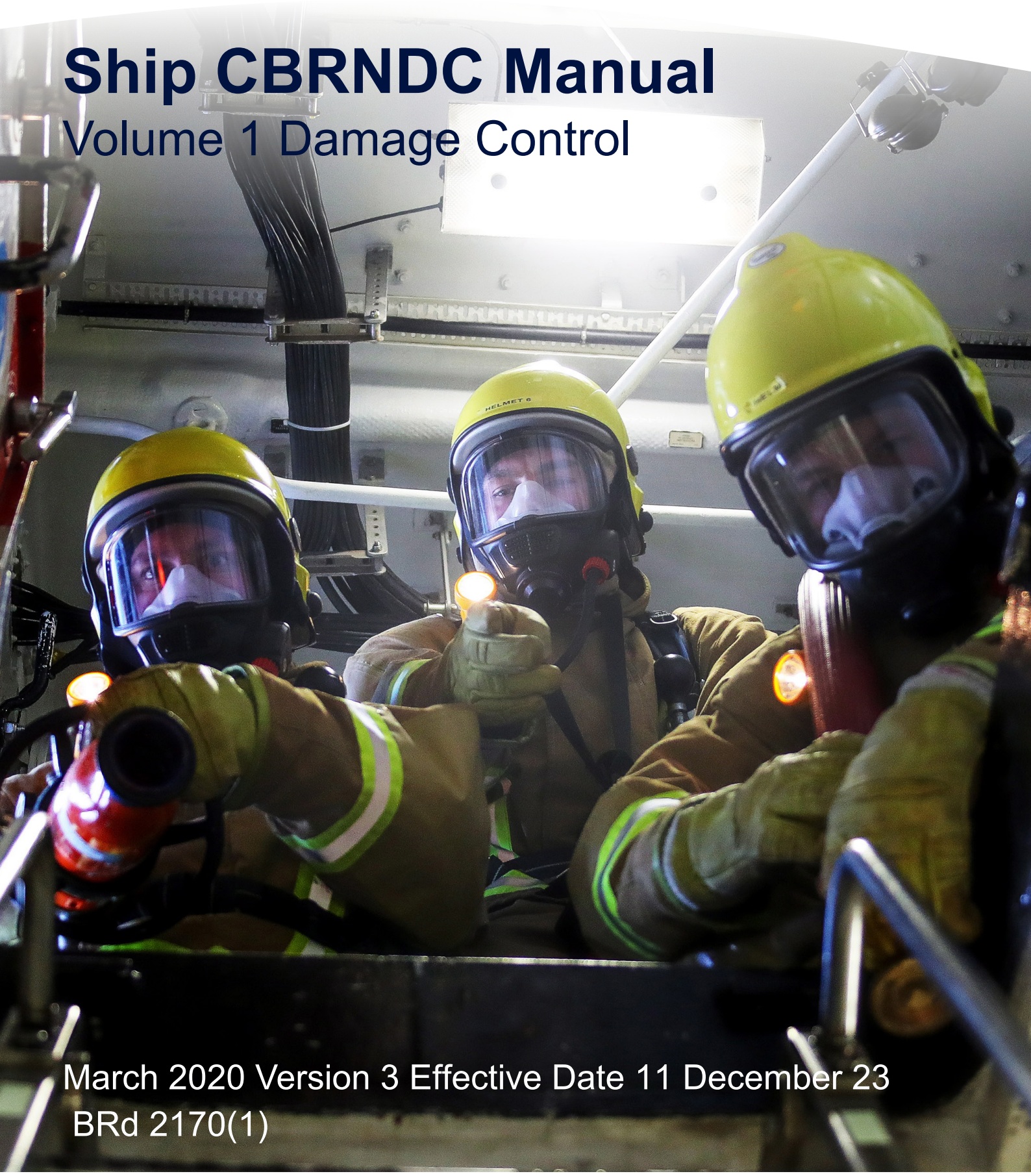
Ship CBRNDC Manual

Volume 1 Damage Control



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BRd 2170(1)

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BRd 2170 SHIP CBRNDC MANUAL VOLUME 1

DAMAGE CONTROL

March 2020 EDITION VERSION 3

1. This edition supersedes the March 2020 Version 2 CBRNDC Orders. The 2020 CBRNDC Orders, approved by Navy Command, enable Flotilla Staff/Naval Command overview of the content of the orders held.

2. Changes to this version are within Chapter 11 inclusive of all annexes, Annex 17B, Annex 17E and Chapter 27.

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4. All future temporary memoranda that specifically affect these orders are to be held in the Master Damage Control Training and Material Assessment Log until the next change.

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DAMAGE CONTROL

2020 EDITION VERSION 3

EFFECTIVE DATE 11 DECEMBER 2023

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PREFACE

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR AND DAMAGE CONTROL (CBRNDC)

CBRN and Damage Control (CBRNDC) concerns every Department and impinges on nearly every aspect of ship life. It directly affects the fighting efficiency of the Fleet and is the responsibility of every member of the Ship's Company.

The Ship CBRN and Damage Control Manual comprises 7 volumes:

Volume 1 Damage Control.

Volume 2 CBRN Defence.

Volume 3 Catalogue Of CBRNDC Stores For HM Surface Ships, Submarines and RFAs.

Volume 4 CBRNDC for HM Submarines.

Volume 5 Embarked Aviation Crash Fire Rescue (CFR).

Volume 6 CBRNDC Incidents.

Volume 7 Platform Type Specific CBRNDC Orders.

CONVENTIONS

The following conventions are used throughout this publication:

Note. *A note is provided when it is essential to emphasise an operating procedure, practice or condition.*

CAUTION

Caution. An operating procedure, practice, or condition that may result in equipment damage if not carefully observed or followed.

WARNING

AN OPERATING PROCEDURE, PRACTICE, OR CONDITION THAT MAY RESULT IN INJURY OR DEATH IF NOT CAREFULLY OBSERVED OR FOLLOWED.

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CHAPTER 1

POLICY

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CHAPTER 1

POLICY

SECTION 1 – INTRODUCTION

0101. Introduction

The potential for RN and RFA vessels to sustain fire or flood damage is a risk which is present both in peace and war and recognised in ARM[1]. as significant risks that pose a serious risk to personnel and equipment. An effective Damage Control capability is fundamental to fulfil the MOD's duty of care to provide Suitably Qualified and Experienced Personnel (SQEP), with the right equipment and training to prevent or minimise the effects of such damage.

0102. Aim

This chapter of BRd 2170(1) describes the Royal Navy Damage Control policy, defining the Navy Command approach to delivering Damage Control capability on RN Ships. Extended policy documentation for RFA Ships and Submarines can be found in the references in the foot notes [2] ,[3]. It provides strategic guidance to Damage Control activities and is a policy-based framework for decision makers and operators involved in conducting Damage Control in the maritime, including capability management and supports the issue of the MoD Shipping Safety Certicate.

0103. Provenance

This policy has been written in support of the revised approach to risk management in defence and the need to separate Damage Control policy from Damage Control doctrine and procedure as written in the current publications. The key outcomes from these decisions were; a 'JSP style' BR where Damage Control policy is written separately from doctrine and procedure but published under the same cover.

0104. The Threat

Threats to ships in harbour will normally be countered by the procedures instituted under the relevant Counter Terrorist Response Level or AWKWARD Alert State. An attack will fall into one of two categories, alerted or Unalerted. In the case of the former, a ship may be alerted to the possibility of a threat before its arrival in port (presuming there is an overriding requirement to enter harbour) or at a subsequent point in its period whilst berthed in port or anchored.

a. When a ship is alerted to the possibility of a threat, the ship will need to tailor its preparations to the likelihood that an attack will be made and to the level of warning that can be expected. This is reflected in the various levels of Counter Terrorist Response Level and AWKWARD alert states. If a ship is alerted prior to entering harbour, as many material preparations as possible should be completed prior to entry, although certain aspects may need to be modified to maintain an impression of normality on the upper deck and in areas used by visitors. When intelligence information is received after arrival that requires an increase in the general alert state, due consideration will need to be given to the limitations imposed by the reduced number of personnel onboard.

[1] The software used to manage and coordinate risks held at ODH level
[2] RN Submarines Damage control and Firefighting policy and procedures is covered in BR2170(4)
[3] RFA Damage control policy is managed by AfSup

Whilst the priority must be to achieve and maintain the required state, Damage Control and/or CBRN Defence preparations for the next higher state should be started early to reduce the impact of manpower shortages. It should be noted that it may not be possible to achieve the full State 1, consideration will need to be given to deployment of the reduced manpower.

b. In the event of an Unalerted attack, the DC response will vary according to the type of attack and damage sustained. In all such situations the DC effort will have to be undertaken without those ratings that are part of the Ship Protection Force (SPF). Additional non-duty personnel will need to be mustered and briefed in an area clear of the upper deck and the area of damage. The OOD may need to delegate his SPO or DC responsibilities to another Officer or Senior Rate.

0105. Language

This Damage Control policy is subordinate to the Ministry of Defence maritime safety regulations and therefore will adopt the language used in the regulatory documents where appropriate.

a. **Orders.** Overarching mandatory instructions detailed in this policy that are to be followed without exception (unless more stringent regulations or orders apply, or waiver/exception has been issued) will use the executive verb **Shall**. Where an Order states that a person “shall” do something, he or she has no choice but to do it. Whenever possible, orders will be written in the positive sense. If this is not feasible then where the provision states that a person “**shall not**” do something, he or she is prohibited from doing a certain act.

b. **Compliance**. Where this policy identifies preferred acceptable means by which compliance of Damage Control orders can be met are written in the permissive sense in order to allow alternative approaches to be considered. As a consequence, Acceptable means of compliance contain the permissive verb **should** (highlighted in bold for visual impact). Regardless of whether published AMC are used, or alternatives are proposed to the Sponsor, the burden of proof that the Order is satisfied rests entirely with the individual conforming to the Order. There can be no presumption of conformity if a published AMC is followed inappropriately. In the event that multiple AMC are published for the same Order which are equally applicable, the commanders may choose which option is to be followed.

c. **Guidance Material.** Guidance material accompanies the acceptable means of compliance in order to provide additional explanation to assist the application of the order. Both Mandatory and Permissive statements can be contained in the GM. These will be enabled through the use of “Must/Will/May/Could”, with the following ‘rules’ associated with their usage:

(1) The word “Must” in the text is used for citing legislative, regulatory, or complimentary Order requirements (e.g. HSWA 1974, DSA RAs, or other Orders e.g. SOLAS, MCA) and has to be complied with. If used to expand on the Order within amplifying instructions for achieving conformity with the Order, it has to be complied with.

(2) The word “Will” in the text denotes an expectation, provision or service, or an intention in connection with a requirement.

(3) Sentences containing the word “May” or “Could” are guidelines; no justification is required if they are not followed.

0106. Out of Scope

This policy does not cover **Counter-CBRN Defence.** The Defence and Royal Navy Counter CBRN defence policies are issued under separate papers.

0107. Applicability

The policy contained within this statement is applicable to all seagoing RN units. This includes all RN ships and submarines, Royal Fleet Auxiliary (RFA) ships, the personnel serving in them, and embarked units of the Fleet Air Arm and Royal Marines. The sub paragraphs below provide further clarification

a. The provisions of this policy are to be applied to vessels already in-service on the effective date to the extent that is practical and cost effective so to do. Any new material requirements which cannot be met from currently allocated resources are to be addressed as potential capability enhancements and the guidance contained in the DSA02-DMR Shipping Regulations concerning the application of safety management systems to in-service equipment is to be followed.

b. Ships of the Royal Fleet Auxiliary (RFA) are constructed to Merchant Navy standards. They are required to comply with the Safety of Life at Sea (SOLAS) regulations, issued by the International Maritime Organisation (IMO). The IMO is a specialist agency of the United Nations that aims to provide cooperation between governments on technical matters affecting international merchant shipping. SOLAS is enforced through the Maritime and Coastguard Agency (MCA), along with other statutory requirements particular to the United Kingdom. Additionally, because of their operational commitments and tasks in company with ships of the Royal Navy, many RFAs are fitted to conform to RN requirements for CBRN collective protection, eg citadel and pre-wetting arrangements.

c. This policy does not cover new vessels prior to PAD or those vessels in upkeep where responsibility for the safety of the vessel has been passed to a contractor. Responsibilities of RN or RFA personnel in these circumstances are to be covered by a negotiated and agreed Safety Plan and the continuing responsibilities of the MOD to its employees falls within the scope of MOD Fire Safety Policy.

d. MOD chartered vessels, Ships taken up from Trade (STUFT) and Unmanned vessels are necessarily excluded from the scope of this policy since the provision of DC&FF capability will be subject to contract negotiations with the supplier. However, those responsible for chartering vessels are to be mindful of the principles of this policy. They are to consider the DC&FF capability required and how it will be provided. Operational circumstances may make it appropriate for Service equipment and manpower to contribute to this capability.

e. This policy does not address ships laid-up or non-seagoing ships used for training. Firefighting ashore is also outside the scope of this policy. For RN establishments firefighting ashore is the responsibility of the Chief Fire Officer, Defence Fire and Rescue Service DFR is also responsible for setting airfield firefighting policy in accordance with the requirements of the MOD Regulations for Aircraft Rescue and Fire Fighting (ARFF), contained within JSP 426 - Fire Safety Manual, to meet the requirements of Joint Regulations; NAVY CSAV-ACOS will implement this policy on RN Air Stations. However, the paper recognises the common approach required for ARFF at sea.

0108. Linkages

Compliance with this policy and the guidance in the Damage Control manual support the issue of the MOD Shipping Certificate issued by the Naval Authority Group;

a. **DSA03-DMR**. Naval Authority Rules for Certification of MOD Shipping.

b. **BRd 857**. Is COMRFA's Quality and Safety Management System meets the requirements of IMO's International Safety Management Code and contains the procedures to be used by the RFA flotilla in respect of Damage Control. Where no procedures exist in BRd 875 the guidelines and procedures detailed in the RN Damage Control manual should be followed. Deviations from these procedures should be detailed in class manuals equivalent to BRd 2170 Vol 7 Series**.**

c. **BRd 2170 Volume 7 Series.** BRd 2170 (7 Series), are a method of formally publishing and distributing mid-level CBRNDC policy procedure and orders and instructions from flotilla organisations. Flotilla commanders are responsible for the delivery of BRd 2170(7) Series for the Platform classes within their AoR, sponsorship of BRd 2170(7) Series is to be delegated by flotilla commanders to a suitable desk authority within the flotilla.

d. **Ships' CBRNDC Standing Orders**. Ships may publish their own CBRNDC orders. They are Low-Level documents that should be used to cascade CBRNDC policy, local orders and instructions set by the ship's Commanding Officer that enables delivery CBRNDC capability.

0109. Deviations, Waivers and Exemptions

Deviations waivers and exemptions will be managed using the duty holder construct. At the tactical level a ships CO will manage deviations from implied and directed tasks and procedures outlined within this policy and the Damage Control guidance manual with risks held on the ships risk register. Waivers of mandatory Damage Control requirements shall be managed and coordinated at flotilla level with risks held on the flotilla Risk register by the delivery duty holder. Exemptions from the direction of this Damage Control policy will be held at ODH level by Director Force Generation (Dir FGen), advice will be provided by Navy Command Ships CDT desk officers via DACOS(Ships) and CSO(E). These exemptions will be managed by the CBRNDC Ships CDT desk officer and recorded as risks within ARM.

0110. Dependencies

Defence does not have a single comprehensive cross service Damage Control policy from which the RN can align its contribution.

0111. Damage Control Governance

The Damage Control governance structure and committees are outlined below.

a. **Damage Control Committee (DCC)**: is the Royal Navy senior Damage Control forum. It meets termly and is chaired by FMEO. It is responsible for providing strategic direction on the balance of effort for delivering capability across the fire safety and survivability[4] certification areas, taking a holistic view of priorities and resources, and analysing and managing strategic risks. After each meeting the chairman, who is accountable to CSO(E), provides a written update.

b. **Capability Governance**. Navy Command CBRNDC CDT have responsibility for the delivery of the in service Royal Naval Damage Control equipment capability. Further information on the following sub-groups may be found in their Terms of Reference (ToR).

(1) **Damage Control Availability Working Group (DCAWG).** The quarterly DCAWG, chaired by DES TL, is responsible for managing in-service Damage Control capability availability and performance.

(2) **CBRNDC Training Working Group (CBRNDC Trg WG).** The Bi-Annual CBRNDC Trg WG, chaired by NAVY OP TRG-MWS TRG CDR VS OC, provides oversight and direction for CBRNDC Training.

0112. International

Navy Command CBRNDC CDT will reach out to international partners and foreign Navies periodically to identify and learn, where appropriate, alternative solutions to Damage Control issues that may have the potential to increase operational capability, and/ or reduce cost in terms of provision of equipment and manpower.

0113. Interoperability and Standardisation

NATO Standardisation Agreements (STANAGs) and Standardisation Recommendation (STANRECs) should be adopted to ensure interoperability with the remainder of the Alliance, unless there is a sovereign or security justification for not doing so.

0114. Capability

The Royal Navy Damage Control capability should be tailored to meet the Key User requirements for maritime design, enabling platforms to complete specific missions successfully in a hostile environment. The following factors should be considered;

a. **Susceptibility.** Avoidance of being hit, which includes platform signatures, and hard and soft kill.

b. **Vulnerability.** Intrinsic robustness to minimise the damage should a hit occur.

c. **Recoverability.** Ability to repair damage and recover capability.

[4] Survivability includes susceptibility, vulnerability and recoverability

0115. Certification

a. **Naval Authority Group.** The Naval Authority Group (NAG) is charged with providing safety and engineering advice and safe to operate assurances, through Naval Authority Group certification, with respect to MoD shipping. The NAG has a key role in managing many areas of the MoD's maritime knowledge base, including sponsorship of standards and guidance publications. In doing so, the NAG works closely with external authorities, notably Lloyd's Register and NATO. The NAG's business covers naval architecture and constructive engineering, and certain specialist areas such as the carriage of munitions, atmosphere control and fire safety for MoD owned and operated ships and submarines.

b. **Naval Authority Group (Fire) Ship Safety Certification.** All Royal Navy ships, submarines and RFAs are to be issued with a MOD Ship Safety Certificate by the Naval Authority. This certificate, which is part of the overall ship safety case, demonstrates that a case for certification and compliance of the rules have been proven, and verifies that the risks of relevant key material state hazard areas have been reduced to a level that is as low as is reasonably practicable (ALARP). The safety of the ship is also dependant on the competence and training of the ships staff and the ongoing routine maintenance of systems and equipment; these are the responsibility of Platform Authority.

c. **IMO**. Under SOLAS Regulations all RFA ships shall have Ship Safety Plans displayed for the guidance of the ships staff. All ships should hold a duplicate set of plans permanently stored in a prominently marked weather-tight enclosure outside the deckhouse for the assistance of shore side firefighting personnel. The information on the plans should show clearly for each deck the control stations, various fire sections enclosed by 'A' and 'B' class divisions (see Para 0417) together with particulars of the fire detection and fire alarm systems, the sprinkler installation and fire extinguishing appliances. A fuller description of the requirements can be found in the consolidated version of SOLAS. Attention is drawn to the requirement for these plans to be kept up to date. For RFAs the plans are produced and supplied by DE&S Platform Authority; any amendments are to be addressed through COMRFA in accordance with CBRN/Damage Control Amendments.

0116. Stability

a. All members of a ships company should have some knowledge of the elementary principles of ship stability both so they can ensure that they can operate safely in peacetime, during normal routine operations as well as understanding the correct actions to take following an incident. In addition, the MEO should be in date for completion of the RN stability exam in accordance with the STCW requirements.

b. Every platform should ensure suitable opportunities are made use of (e.g. pre sailing) to ensure that a suitable base line of the stability condition is established, by the taking of draught marks.

c. The loading of the ship should be in accordance with any limitations in the stability operator guidance. The loading condition should be checked for compliance prior to sailing, correlating the observed and calculated draughts, and also the prospective arrival condition validated. When there are significant changes to payload, loading conditions should be checked for compliance.

d. Capital ships and vessels with unusual stability systems[5] will carry a Command Stability Advisor[6] these personnel are to provide stability advice to the TG Commander, for all vessels within the Task Group or Task Force, as well as the platform on which they are embarked.[7]

e. In addition to the peacetime safety certification, all vessels should carry the stability documentation necessary for transition to war[8] and it should be available to be provided by the relevant SCA to SALMO. The peace time documentation should be held readily available for advice to the Internal Battle Commander (or Officer of the Day) at the primary incident response position (normally HQ1/SCC) and at any alternative HQ within the platform.

0117. Naval Architecture Support

a. In order to formalise the manner in which essential Naval Architecture and Ship Condition information is provided to Platform Project teams the Marine Incident Reporting Form (MIRF) has been developed. This form is to be used in all future incidents where it is necessary to provide information to the relevant DE&S Platform Authority for the purposes of Naval Architecture support. The MIRF replaces the Naval Architecture Incident Information Form (NAIIF) and the Ship Condition Report (SCR) and more closely replicates common commercial practice.

b. This captures essential and other relevant information to allow Duty Holders, SALMO and other authorities to assess the vessel in an incident. It comprises of a Part A for immediate completion and transmitting ashore to allow an initial assessment and advice on ship stability and structure to be given, and a Part B to be completed and transmitted as soon as possible to allow more detailed analysis of the ship's damaged condition.

c. Ship specific MIRF/SERS/ERS form is included in the Stability and Survivability Book held in HQ1. With softcopy held on ModNet and available for immediate use in the event of an incident requiring Naval Architecture support. Paper copies of the MIRF/SERS/ERS should be held in the Bridge File, the Navigation Data Book, the Class book, and the MEO's CBRNDC File for action/emergency situations. Instructions in the use of the form, and guidance on the data/information required is included on the form. The information may be provided to the DE&S Platform Authority by e-mail attachment, FAX, signal, or telephone, as is most suitable in the circumstances, provided that the format of the MIRF is followed.

[5] This currently includes QEC, LPD, the IPS, the Echo Class and HMS Scott.
[6] Who should have completed the ME109 Advanced Stability Course. This is separate from the Salvage Advisor and Naval Architect who during contingent operations will probably be attached to the Maritime Component Commander's staff (see BRd 9962 Part 3).
[7] They should have an understanding of the stability issues likely to impact on STUFT and submarines that may be within the TG as well as the surface RN Vessels. Further, their stability training should cover peacetime intact as well as damage situations and the ability to understand the risks of operating outside the usual safety envelope provided by certification. An individual taking ME109 should therefore already have completed both the basic technical training (i.e. SEMC) and have experience of operating vessels at sea (e.g. have been a DMEO).
[8] This includes both a Jettison Bill and a Scuttling Plan.

d. RN ships whose primary emergency response is provided by Classification Societies will continue to follow the LR SERS or DNV ERS processes as appropriate. SERS and ERS manuals contain the relevant form for reporting ship condition to the service provider. When utilising Emergency response services forms are to be copied to the DES Platform Authority via the DFC/FIRC to allow parallel analysis and planning for future remedial action to be undertaken.

e. RFA vessels predominantly have primary emergency response provided by Lloyds Register Classification Society so will follow the relevant LR SERS process as appropriate with the onboard SERS manuals containing the relevant form for reporting ship condition to LR SERS. When utilising SERS the forms are to be copied to the DES Platform Authority via the DFC/FIRC to allow parallel analysis and planning for future remedial action to be undertaken.

f. MIRFs and SERS/ERS forms should also to be used in accident response exercises[9] to gain experience of their use.

SECTION 2 – UNDERSTAND

0118. Understand

Understanding the Strategic, Operational and Tactical context is an enduring requirement that permeates all Naval Damage Control activity; spanning Damage Control activity at the tactical level to capability development.

0119. Intelligence

Effective Damage Control response can be supported by timely and accurate intelligence and information relating to the nature of weapons and their damaging effects when employed by an aggressor. DI are to provide objective all source intelligence assessments and advice on immediate and strategic threats to RN and RFA ships and submarines at home and overseas to enable operational and contingent planning (including medical), policy formulation, capability and S&T development.

0120. Risk

a. No Risk Control System can ever be absolute, nor can operating procedures fully mitigate risk against every activity that a ship may conduct. Local risk assessment is, therefore, a key part of safety and environmental management at sea. Ships command organisations should empower Damage Control teams to manage risk at the lowest level.

b. Risk assessment comes in many forms but fundamentally involves 4 stages: identification of the hazard; assessment of the impact; assessment of the likelihood and development of mitigation. Further information on risk assessment requirements and process is contained in BRd 167 Chapter 6 for safety risks.

[9] i.e Exercise Purple Quiver

c. Operating Risk is most effectively managed as close to the point of origin or activity as possible. However, when risk cannot be managed locally it must be transferred up the chain of command to ensure effective mitigation, termination or endorsement of tolerability. The CO must be aware of the level of operating risk held across the METS pillars and ensure that it is articulated appropriately and in a timely manner.

0121. Planning

Damage Control risks can present unique challenges that require innovative responses, necessitating flexible application of response. At the tactical level, incidents[10] will occur with little or no warning yet may have significant operational or strategic implications. Task Groups and units must be resourced for the inclusion of authoritative Damage Control advice throughout the planning process: coordinating Damage Control protective measures across appropriate platform areas, predicting potential hazard areas and their consequences following a fire or flood incident, and ensuring that the secondary implications of responding to damage are fully understood.

0122. Staff Advice

a. **Strategic.** At the strategic level it is the responsibility of the Capability Delivery Team (CDT) in Navy Command HQ to provide CBRNDC policy advice and inputs to Strategic Planning Groups (SPG), Current Commitments Teams (CCTs) and CDS Directives.

b. **Operational.** The Flotilla organisations are responsible for the provision of Damage Control advice to Operational planning and on-going operations. In the event that further information is required, they will reach out to the Damage Control team in Navy Command and FOST for advice on recovery or response and second order consequence implications in the first instance and may also request Specialist Damage Control SME augmentation.

c. **Tactical.** Task Group and Task unit Damage Control Officers and CBRNDC Q, supported by Specialist Liaison Officers when available, are responsible for the provision of tactical advice for current incidents and contingency planning where appropriate. Damage Control Officers and CBRNDC Q must be capable of coordinating protective measures, advising on hazard locations and providing SME advice to their chain-of-command. Where further specialist Damage Control advice or information is required, Defence must retain the capability to provide comprehensive and timely specialist Damage Control technical advice. Currently this is provided via FOMO with expert support from Dstl, SALMO and industry as required.

[10] For Example fires and floods.

0123. Training

a. **Individual Training.** Before personnel may be held at readiness, all individuals are to receive sea safety training to safely operate tactically in, or near, a Damage Control incident to enable them to SURVIVE within their given role and environment. Individuals must be capable of understanding the threat they face, identifying an appropriate response, and have familiarity with their personal equipment to be able to confidently PROTECT themselves and execute their chosen course-of-action. Flag Officer Sea Training (FOST) is responsible for delivering and assuring sea safety and Damage Control training.

b. Dir FGen is the nominated Operating Duty Holders (ODHs) for Surface Ships as part of the Navy Command Duty Holder construct and oversee the activities of the Flotillas as the Delivery Duty Holders (DDH). The ODH is responsible for ensuring that MOD managed ships are manned and operated by a requisite number of suitably qualified and experienced personnel while the DDH is to ensure that all Risks to Life are managed to be Tolerable and ALARP. To fulfil these responsibilities, personnel are to be trained and 'in date' for the relevant sea safety training according to the role or position they are assigned to.

c. Sea Safety training is role dependant and is categorised broadly on the function of the embarked personnel. Personnel are normally required to be in date for the Basic, Intermediate Sea Safety Courses (BSSC/ISSC) or Embarked forces Sea safety Course.

d. Service and civilian personnel visiting RN and RFA vessels are not required to undertake mandatory shore training, however as these personnel are exposed to the numerous hazards present onboard they are required to undertake onboard training following embarkation.

e. **Stages of individual Sea Safety Training.** The training of personnel in sea safety and CBRNDC process and procedures is a continual process throughout a service persons career The stages are outlined below.

(1) **Initial training.** Delivered during initial training. Responsibility of FOST. Delivered by MWS Phoenix.

(2) **Pre joining training (PJT).** Delivered prior to sea assignment. Responsibility of FOST. Delivered by MWS Phoenix.

(3) **On job training (OJT).** Delivered on arrival at sea assignment. Responsibility of ships Executive officer, managed and delivered by ships Q organisation.

(4) **Continuation Training.** Delivered throughout an individual's sea assignment period. Responsibility of ships Executive officer, Managed and delivered by ships Q organisation.

f. **Collective Training**. RN and RFA Ships and Submarines must be able to SURVIVE an incident, to do so they must be capable of adopting a balanced posture that enables each individual platform to SURVIVE, coherent command and control to be applied, and incident management conducted sufficient to REHABILITATE. Collective Training will be set by Navy Command CBRNDC CDT using the MORS process and delivered by FOST.

g. **Assessment and Reporting of Organic Collective training.** All CBRNDC Collective training is to be assessed using the CBRNDC Fire or Flood Assessment Form. MWS Phoenix are responsible for providing up to date forms and ensuring its accuracy. Reporting of collective training is to be completed on the CBRNDC Fire or Flood Assessment Form. These Forms are to be retained for 1 calendar month or 2 cycles of an F3 and above and DCX's, these may be held electronically.

0124. Education

Awareness of fires, floods and there specific hazards on RN, RFA Ships and submarines. The knowledge of appropriate individual and collective responses to an incident, should be universal throughout the Royal Navy commensurate to role, rank and service. CBRNDC Education is a ships responsibility.

0125. Science and Technology (S&T)

The range of Damage Control operations, preparedness and planning, across the Understand, Prevent, Protect & Recover functions of the Damage Control Conceptual Framework are underpinned and enabled by S&T. The Royal Navy S&T programme is to provide impartial advice through the generation of scientific evidence and management of knowledge to support operational, current and future capability decision-making. Resilience will be enhanced through MOD Research Programme (MOD RP) or from commercial sources. Available and affordable scientific resources are to be targeted at the broad DC&FF spectrum, including survivability, recoverability and personnel safety issues. MARCAP is responsible for tasking industry to investigate and assess future Damage Control equipment and practices.

0126. Concepts and Doctrine

Navy Command Ships CBRNDC CDT have overall responsibility for development and publication of Damage Control policy and doctrine and will collaborate with other agencies in the delivery of this task. Development of platform level damage control procedures and processes is responsibility of the platforms within a class with procedural assurance provided by the parent flotilla.

0127. CBRNDC Documentation

Navy Command CBRNDC SO2 is the CDT manager for CBRNDC policy doctrine and equipment and is responsible for sponsoring high level CBRNDC documentation[11]. Platform Class CBRNDC orders[12] should be compiled and sponsored by the platforms parent flotilla. NPGO will conduct authoring and publishing tasks for high and mid-level CBRNDC documentation on behalf of the CBRNDC CDT and flotillas. CBRNDC Documentation will be published in electronic format and should be made available across the defence information infrastructure.

[11] BRd 2170 Series, BR4007, BR4008
[12] BRd 2170 (Volume 7 Series)

SECTION 3 – PREVENT

0128. Fire, Flood and Damage Risk

At sea, vessels are isolated from external support and the platform provides the means of survival in a hostile environment. A relatively large number of personnel are concentrated in a restricted space often with difficult access. Furthermore, platforms within the scope of this policy are liable to be subjected to enemy action, the disruptive consequences of which are impossible to accurately predict. Therefore, a significant risk of fire, flood or damage exists. This risk occurs in the following circumstances:

a. **Alongside**. There is a significant and ever-present risk of fire and flood from a number of sources such as, equipment malfunction, hot work, human error (including negligence), criminal activity and the asymmetric threat. System failure or maloperation can cause flooding and, although low, there is also a risk of damage from unforeseen events such as collision. A proportion of personnel are likely to be ashore and, particularly out of working hours, some areas will not be manned. However, much equipment will be shut down. With their very limited reserve of buoyancy, submarines are at risk from any form of flooding.

b. **At Sea.** In addition to sub para a, there is an increased risk from events such as collisions and groundings and, with more equipment operating, of equipment malfunctions. For submerged submarines, these risks are exacerbated by difficulties in evacuating the vessel and the greatly increased flooding rates resulting from the elevated external pressure. However, the increased risk is mitigated for by higher manning levels.

c. **During Operations.** In addition to sub para a. and sub para b, there is a significant risk of fire, flood or damage because of enemy action. Warships and Auxiliaries are to be designed with an acceptance that this risk is an intrinsic part of their primary function.

0129. Damage Control Priorities

The relative priority accorded to safeguarding personnel and minimising damage to equipment will depend on the operational circumstances at the time and will require consideration of the following factors:

a. The operational threat to the vessel and the force.

b. Ability of a vessel to provide life-support for those within it.

c. Whether the safety of an individual may be subordinated to the safety of all or part of the Ship’s Company.

d. The availability of external assistance.

0130. Commanding Officers

They are responsible for determining the balance between saving life, protecting their vessel and projecting military capability but the following principles are to be observed:

a. **Alongside.** Whilst a vessel is alongside and given that evacuation of the vessel is possible and there are no complicating circumstances, the primary aim is to protect life.

The optimum means of protecting life may be to direct the Damage Control effort towards protecting the fabric of the vessel in the first instance. Factors to consider will include but not be limited to the presence (or otherwise) of (and danger to) ammunition or that non-intervention will contravene elements of the nuclear safety case or needlessly endanger other lives and property.

b. **At Sea.** Maintaining a safe, life-sustaining vessel for the Ship's Company is to be the primary aim of Damage Control effort.

c. **On Operations**. The overriding aim on operations is to maintain an effective military capability.

0131. Damage Control States of Readiness and Watertight Integrity

a. **States of Readiness.** Damage Control states of readiness govern the manning requirements, materiel and machinery preparedness and associated arrangements required to control the effects damage and depend on the calculated risk of damage, the expected warning of attack, and the speed with which the highest state can be assumed. Damage Control states do not cover, preservation of watertight or gastight integrity and the special needs in manning, machinery and material solely to counter the CBRN threat.

b. There are three states of readiness, designed to meet all possible situations. These states provide a uniform framework throughout the Surface Flotilla into which each ship must build its own organisation, being guided by the principles outlined in the Damage Control manual. Classes of ships and even ships within a Class differ considerably and it is not possible to define manning, materiel and machinery arrangements to meet the needs of all ships. Therefore, the arrangements given in the Damage Control manual are for guidance only. The Damage Control states of readiness are defined below, and flotillas shall detail class and ship specific arrangements in the appropriate BRd 2170 Volume 7.

(1) **STATE 1 - Attack or Damage Imminent:** Highest state of Damage Control and CBRN preparedness compatible with fighting efficiency. Disregards habitability and wear and tear of machinery. All Damage Control and CBRN positions fully manned, with personnel relaxed for meals, etc, as ordered by the Command.

(2) **STATE 2 - Attack or Damage Possible**: Normal war cruising and harbour state. Skeleton watch system with personnel drawn from all departments. Transition to State 2 should be via State 1.

(3) **STATE 3 - Attack or Damage Unlikely without Adequate Warning**: Normal peacetime cruising and harbour state. In harbour this will afford maximum possible habitability, routine and maintenance.

c. **Responsibility for Setting the State.** When ships are in company, the Officer in Tactical Command (OTC) is responsible for ordering the Damage Control state of readiness, however ships should not wait for such an order if there is a requirement to elevate the state readiness to meet the threat and the Rules of Engagement permit. At all other times the responsibility rests with the CO of the ship.

d. **Choice of State.** The following points must be considered before deciding the state of readiness to be set:

(1) **In War.** Damage Control State 2 is normal at sea and in harbour except for the relatively short periods when State 1 will be necessary.

(2) **In Peace.** The assumption of State 2 or State 1 will rarely be needed, except when ordered for exercise purposes. Commanding officers may impose relaxations or enhancements to the documented Damage Control State 2 or 3 to sustain activity and provide appropriate readiness to counter internal and external threats for short periods. Where a modified Damage Control State[13] is adopted the CO shall be responsible for the management of the operational risk (i.e. due to external threats) and the operating risks (i.e. the hazards endemic to the maritime environment).

(3) **At Any Time.** The Damage Control state of readiness assumed should be no higher than what is required to accomplish the task and safeguard the ship.

(4) **Peacetime Navigational Hazards.** Damage Control State 2 shall not be used during peacetime navigational hazards.

e. **Watertight and Gastight Integrity.** Survival after damage and resistance to flooding and CBR contamination depends on watertight subdivision and gastight integrity respectively. Both depend on disciplined control of openings[14] on the ships structure as well as continuous maintenance and routine checks of watertight and gastight bulkheads, decks and the fittings that penetrate them. The degree of watertight integrity referred to as the ‘condition’ and is detailed in the Damage Control manual. The watertight and gastight condition naming convention detailed in DefStan 07-204 should be adopted during platform design phase. Where platforms have been procured from industry, other nations or built to alternative regulations using an alternative watertight naming convention, the details of the system used should be documented in the BRd 2170 volume 7 series.

f. **Watertight Risk and Control.** The red risk zone is a defined area of a ship that presents increased risk of catastrophic loss of the ship should the area, or compartments within, become flooded. Therefore, there is a need to exercise strict control of openings within the red risk zone. Where ships are designed and built to current defence standards the red risk zone is defined during the design stage. Platforms that have been procured from industry, other nations, or built to alternative regulations, that do not have a method of identifying areas of increased flooding risk shall identify and control the area in accordance with DefStan 02-900 and the Damage Control manual. Where an alternative method or zone is deemed suitable or identified by the certification authorities, the alternative arrangements shall be detailed in the BRd 2170 volume 7 series.

[13] A Damage control state, where personnel, materiel and machinery preparations deviate from the flotilla endorsed requirements in BRd 2170(volume 7)
[14] Doors, hatches, flaps, valves.

g. **Risk and control Markings.** All openings affecting watertight and/or gastight integrity should be identified using guidance in the Damage Control manual and DefStan 07-204. Deviations from this convention should be detailed in the BRd 2170 Volume 7 series.

h. **Application of the watertight/gastight condition**. The watertight condition should be applied to ships in accordance with the process detailed in the Damage Control manual, any approved and authorised deviations should be detailed in the class Damage Control manual.

i. **Responsibility and method of control.** The command is responsible for setting the watertight condition. The condition ordered depends on the calculated risk of damage and, to facilitate ships routine and habitability, should always be the lowest condition possible consistent with the risk. Responsibility for overall control of the watertight or gastight condition, once set, will be dependent on the Damage Control state of readiness and the class of platform, guidance is provided in the Damage Control manual and any class specific arrangements should be detailed in the BRd 2170 Volume 7 series. All changes to the watertight condition should be recorded.

0132. Platforms, Systems, Equipment and Manpower

a. **Design Characteristics.** The design of a seagoing unit, its fitted systems and equipment embarked for operational purposes, are to take into account the risk environment in which they are expected to operate and should seek to minimise the risks from fire, flood and damage to As Low As Reasonably Practicable (ALARP)[15]. Prevention of incidents is to be the first consideration. In the event of an incident, construction characteristics, the choice of materials, system design and automatic and manual operating procedures are to seek to minimise the impact and spread of fire, flood and smoke. Early detection and response will be key elements in achieving this.

b. **Manpower.** Trained manpower is to be provided in support of the ship design and Damage Control and fire fighting equipment provision. Platform design studies are to address the manpower required to achieve the Damage Control capability stated in the System Requirement Document. Any desire to reduce the size of a ship's complement will have to be balanced by increased provision of technical measures to facilitate an effective response in the event of damage.

c. **User and System Requirements.** The User and System Requirements Documents for platforms should refer to this policy and are to articulate fully the Damage Control capability required including a statement on the residual capability expected following damage. Maximising ship survivability is to be considered as part of the overall platform trade-off. Duty Holders are to complete a safety case to demonstrate the overall Damage Control capability provided by the platform design, including its systems and equipment's, and are to comply with the requirements for Key Hazard Certification.

[15] DSA03-DMR Naval Authority Rules for the Certification of MOD Shipping.

d. **Equipment and System Specifications.** Specifications for all systems and equipment require the damage and fire risks to be addressed and appropriate material and operating procedures put in place to reduce the operating risks to ALARP. The equipment delivery team is to provide a safety case for all Damage Control equipment to demonstrate the effectiveness of these measures. Development and maintenance of Damage Control equipment safety cases is the responsibility of the equipment delivery team within DE&S safety cases.

e. **Commonality.** Where practical, common standards are to be set for all equipment and systems[16]. Commonality of equipment between platforms is to be pursued in order to optimise currency of practice and training. This should not preclude the selection of novel designs, enhancements, revised procedures, measures to reduce risks to personnel or improvements in whole life costs in order to achieve the required Damage Control capability. In all cases, full reference is to be made to the Knowledge in Defence for the delivery of new and enhanced Military Capability across all Defence Lines of Development (DLoD). Where appropriate, practicable and cost effective, Damage Control equipment is to be common and interoperable with the equipment of the other Services. As far as it is possible and cost effective to do so, and where required by NATO STANAG, equipment is to be interoperable with NATO partners and other potential allies.

f. **Appropriate Equipment and Systems.** The provision of fixed and portable Damage Control equipment, detection and surveillance systems, stability management systems, and remote, automatic or manual operating systems is to be commensurate with the overall design and purpose of the ship and associated risk, manpower levels and the Damage Control organisation within the unit. Their design is to recognise that smaller complements will require greater use of technological solutions to ensure that residual risk is maintained As Low As Reasonably Practicable (ALARP).

g. **Smoke Management**. Analysis of ships fire reports indicate that smoke inhalation is by far the largest cause of injury in the event of a fire. Effective smoke management and breathing protection for all those likely to be exposed to smoke during any firefighting effort is considered a high priority in reducing casualties.

h. **Environmental Pollution**. Design solutions for systems should account for all applicable and foreseeable regulations which will apply when dealing with Damage Control incidents.

i. **Equipment Holdings**. Vessels are to be equipped with portable and consumable Damage Control equipment for operational and training use as determined through a fire safety assessment. This process must be completed to obtain Key Hazard Certification and to assess foreseeable flood and damage incidents. Navy Command Ships CDT and platform authorities are responsible for setting the scales of equipment for RN ships. Navy Command Submarines ME systems is responsible for setting the scales of equipment in RN Submarines, Navy Command AfSup is responsible for setting the Scales of equipment in RFA. Navy Command-FOST is responsible for procurement setting the scale of Damage Control equipment used for training within the MWS.

[16] In RFAs, DC&FF equipment has to be Type Approved by Lloyds Register of Shipping and the MCA.

0133. Fire Prevention And Firefighting In Upkeep Periods

a. **Reduced Manned Upkeep Periods.** During reduced manned upkeep periods and some specific docking periods, responsibility for Care and Protection may pass to the Upkeep Contractor between the Upkeep Period Start Date and the Ship Staff Move on Board Date.

b. DE&S Platform Authorities are responsible for setting the upkeep contract terms and conditions, including fire fighting and fire prevention arrangements. A contract will be placed containing the specified requirements. The Contract Work Package is presented in the form of a series of work lists held within several volumes. Volume 0 is a foreword that defines the contract terms and conditions and responsibilities of DE&S Platform Authorities, Ships Staff and the Contractor for that particular project. Further guidance can be found in BR 1313 and BR 8593 series.

SECTION 4 – PROTECT

0134. Peacetime Requirements

The primary requirement during peacetime is to maintain a safe, life-sustaining vessel for the Ship's Company:

a. **At Sea.** At sea during peacetime, all ships shall be capable of organically responding to and managing a whole ship event. Flotillas shall ensure contingency plans, whole ship reactions and standard procedures are included in platform Damage Control documentation. It is anticipated that recovery from the event will become the Command Aim. Emergency Stations is a method of bringing a ship to a high state of preparedness when Action Stations is inappropriate. The Damage Control manual provides guidance relating to the manning and materiel preparations that may be conducted, Flotillas should ensure these requirements are included as a standard operating procedure within the platform class CBRNDC documentation.

b. **Harbour**. All ships shall be capable of dealing with one Minor Event from within their own resources. All ships shall have an organisation capable of dealing with one Major Event which may draw on externally available assets. Consideration is to be given to the level of risk from fire, flood or damage when determining the size of the emergency party retained on board. The Commanding Officer may reduce the size of the emergency party below that of the Standard Harbour Fire Emergency Party with the approval of the Delivery Duty Holder (DDH) where an assessment has concluded that the risk of so doing is acceptable and appropriate mitigations are in place to respond to Damage Control incidents. The Emergency clear lower deck procedure is a method of accounting for all personnel and supplementing the emergency party if required. The Damage Control manual provides guidance relating to manning and materiel preparations that may be conducted, Flotillas should detail the emergency clear lower deck requirements as a standard operating procedure in the platform class CBRNDC Documentation.

c. **Dormant Leave.** During dormant leave, strictly controlled measures are to be implemented within a ship to reduce the risk from fire and flood significantly below that normally encountered, even in Harbour. Recognising this lower risk, the Damage Control capability is provided by a host ship. The organisation and resources of the host are to be sufficient to cover the dormant ship. The risk reduction measures are to be approved by the Flotilla DDH before dormant leave is authorised.

0135. Operational Requirements

The primary requirement in conflict or on operations is to contain the effects of damage whilst continuing to meet the Command Aim:

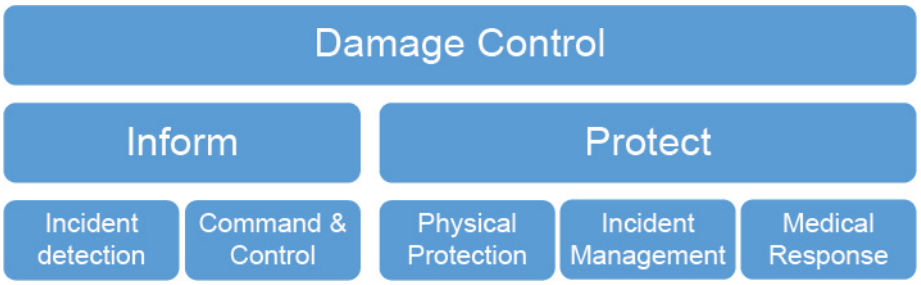
a. **State of Readiness.** The capability of the Damage Control organisation shall be commensurate with the State of Readiness of the ship recognising that the ship will operate under the threat of enemy action in both State 1 and State 2. At the highest State of Readiness (State 1) a ship shall be capable of managing and responding to a whole ship event. It is accepted that a reallocation of personnel from warfare tasks is acceptable to meet the Command Aim.

b. **CBRN Environment.** The Damage Control capability should be maintained when operating[17] in a CBRN threat environment.

0136. Taxonomy

The Royal Navy Damage Control taxonomy is shown at Figure 1-1.

Figure 1-1.



a. **Inform.** Inform refers to the ability to provide timely accurate and relevant Damage Control information of incidents allowing the command and control organisation to make appropriate and timely decisions. It is further resolved into detection and command and control.

b. **Detection.** This refers to the ability to indicate[18], and where required, classify, identify and quantify damage to the platform[19]. Detection methods are dependent on the type of incident and each will present unique challenges. The Royal Navy requires the capability to detect, classify and quantify fire, smoke and floods. It will work with sufficient confidence and timeliness to inform the command and control organisation whilst being of sufficiently low burden in terms of operation and logistical support.

[17] Operating in a CBRN environment is in accordance with the survive and operate concept through hazard avoidance
[18] This is to include the tasks of Incident Warning, Incident Location, Incident Characterisation, Residual Incident Warning and assessment of scale of incident.
[19] I.E Fire, Smoke Flood Etc

c. **Command and Control (C2).** Command and Control refers to the ability to be able to provide timely Damage Control situational awareness to the command to support pre-incident planning, and incident management post occurrence. It is vital to ensure the right decisions are made at the right time. An effective C2 organisation, including robust communications and information systems, is to be provided to control and direct the manpower and systems employed in Damage Control tasks. The C2 Organisation is to include reversionary or secondary command positions. Where practical, Damage Control systems are to be compatible and interoperable with warfare systems.

d. **The C2 Organisation.** Damage Control C2 Organisations shall meet the following requirements:

(1) **Warships of Frigate size or above.** Ships of this size shall have an HQ, and a geographically separated alternative, which can control and direct the work of an appropriate number of outstations. These outstations may be organised in a cascaded structure.

(2) **RFA's**. RFA's shall have a HQ, and a geographically separated alternative, which can control and direct up to 4 outstations, as dictated by the size and class of the vessel, acknowledging that only 2 posts are likely to be manned at any one time.

(3) **Submarines.** Submarines shall have a DCHQ, and a geographically separated alternative, which can control Attack and Support parties forward and aft for firefighting, and mechanical and electrical repair parties for Damage Control.

(4) **Other Platforms.** Remaining vessels shall have an HQ, and where practical an alternative, which can control and direct up to 2 outstations.

e. **DC&FF Organisation.** An organisation shall exist dedicated to responding to and managing Damage Control risks that exist in peace and the additional risk of damage and injury resulting from enemy action. The following shall be provided when establishing platform Damage Control capability:

(1) The ability to establish quickly and accurately the location, extent and effect of an incident or incidents forming part of a whole ship event.

(2) The ability quickly to contain an incident, or incidents forming part of a whole ship event, and to make a vigorous initial attack.

(3) The ability to quickly assess the impact of an incident or incidents on overall ship stability and to take appropriate action.

(4) The ability quickly to assess command priorities and to be able to direct efforts accordingly.

(5) Should it be necessary to change the Command Aim to containing or attacking the event, the ability to quickly and effectively call upon and direct the use of all manpower on board.

(6) Should it be necessary to change the Command Aim the ability to quickly and effectively articulate such a change to all out-stations and the entire ship's company.

f. **Systems and Equipment.** The C2 organisations are to be suitably manned and equipped with:

(1) **Communications.** Comprehensive, damage resilient communications through all DC&FF control nodes and linked to the Command. Redundancy is to be provided for key links.

(2) **Damage Control Management Systems**. The Damage Control management system should provide a comprehensive picture in as near to real-time as practical. The system should enable the Command to monitor the internal battle.

(3) **Weapons and Mechanical Systems Repair.** The organisations to control and repair mechanical, electrical and weapons systems shall be integrated into the Damage Control C2 structure.

(4) **Medical Organisation**. The medical organisation shall be integrated into the Damage Control C2 structure.

(5) **CBRN**. The CBRN organisation and its associated C2 structure shall be integrated with the Damage Control C2 structure.

0137. Protective Measures

Protective Measures refers to the ability to maintain the effectiveness of the platform whilst responding to a Damage Control incident. Damage Control Protective Measures consists of:

a. **Physical Protection.** The purpose of physical protection is to prevent or mitigate against the effects of exposure to individual hazards borne from Damage Control incidents in order to minimise casualties and equipment losses thereby maintaining operational effectiveness.

b. **Personal Protective Equipment (PPE).** The Royal Navy requires a suite of PPE that will enable personnel to be able to operate in close proximity to established fires, to be able to conduct first stage leak stopping in compartments subject to flooding in ambient temperatures less than 10 deg C and conduct expedient repair or reconstitution of critical equipment.

c. **Incident Management.** Incident management refers to activities associated with the immediate and follow on response to a Damage Control incident. The immediate recovery from an incident regardless of scale at the tactical level. Regeneration of critical systems and equipment and personnel required to maintain safe and effective operational capability appropriate to the wider situation and reconstitution of an operationally capable warship and crew capable of delivery of military effect as directed.

d. **Medical Provisions and Casualty Care.** Medical provisions and casualty care refer to the ability of the platforms organisation to be able to provide pre incident analgesia to key personnel[20], immediate first aid to casualties sustained during a Damage Control incident and onward medical interventions and provisions during the recovery phase. Casualty care refers to the provision of care to casualties, the provision of medical resources for casualties and the planning and logistics involved with the movement of casualties to and or between treatment facilities.

[20] Key personnel may include the command organisation, and damage control teams

CHAPTER 2

INTRODUCTION TO DAMAGE CONTROL (DC)

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CHAPTER 2

INTRODUCTION TO DAMAGE CONTROL (DC)

0201. Introduction

Damage control directly affects the fighting efficiency of the fleet and is the responsibility of every member of the ships company. Damage Control refers to the arrangements and procedures associated with firefighting, response to flooding, and repair following damage required to sustain the operational capability of a platform in peace and war. It does not address counter CBRN or CBRN Defence activities. The aim of Damage Control is to limit, control and repair (within the ships resources) material damage, however caused, in peace and war and to protect personnel from the effects of fire and damage generally. The aim of CBRN Defence is to protect personnel from the effects of chemical and biological agents and from the radiological and Nuclear hazards resulting from the operational use of CBRN weapons. All members of the ships company are potential links in the CBRN and Damage Control organisations, and the action taken by them, whether as routine or as an emergency response, may prove decisive to the safety of the ship. Thus every person on board must have a thorough understanding of damage control principles and practices. Battle Damage Repair (BDR) is a standard NATO term for essential repair, which may be improvised, carried out rapidly in a battle environment in order to return damaged or disabled equipment to temporary service. The term is used regularly during Operational Sea Training (OST), where a war environment is simulated, but it is not widely used in this book, as the Damage Control procedures also apply to peacetime incidents. BDR is, therefore, a sub-set of Damage Control and is not an alternative term.

SECTION 1 – DAMAGE

0202. Causes of Damage

a. Like fire, material damage can occur in a ship in peace as in war, though in war the chances are, of course, greater. A collision or a grounding may cause the underwater hull to be ruptured with the consequent flooding of compartments and damage to equipment in the immediate vicinity (Primary Zone damage) with possible additional damage remote from the incident (Secondary and Remote Zones of damage). In peace, explosions can normally be discounted, but if they do occur, they are generally internal. In war, explosions may occur outside and inside the ship. The extent of damage from an explosion cannot be forecast since it will depend on such variables as weight and nature of the explosive, the position of the explosion relative to the ship, the type and size of ship, her subdivision and hull strength. General information regarding the effects of weapon attack on surface ships is provided in CB 8844 - Weapon Effect. Damage posters (Form S.3075 (1)-(6)) show examples of damage sustained by ships in Operation Corporate in 1982. Reports on ship damage are in BR 8362 and CB 8362(2). Whenever damage is sustained in action, collisions or from any other cause, reports must be rendered in accordance with BRd 2.

b. Explosive weapons are classed as conventional or nuclear. The term conventional normally refers to bombs, shells, missiles, rockets, mines or torpedoes that are filled with any type of chemical explosive which does not rely on nuclear reaction to produce its explosive power.

Figure 2-1. Above Waterline Damage Caused by an Anti-Ship Missile

0203. Damage from Conventional Weapons Above Water

Weight for weight, weapons designed to explode on impact carry a larger charge than those designed to pierce structural protection. The explosion of a weapon above the waterline can cause extremely heavy local damage, with widespread secondary damage (by splinters, shock and whip) with probable loss of watertight and gastight integrity. Subsidiary effects of damage can be serious and some examples are:

a. Blast entering funnels and uptakes can cause damage to machinery.

b. Riddling, i.e multiple holes in the freeboard from near-miss splinters, will cause loss of reserve buoyancy.

c. Fires may be started in the vicinity of the explosion and remote from it.

d. Heavy casualties may result from splinters and objects, including personnel being thrown violently by shock and blast.

Figure 2-2. Aircraft Cannon Fire Damage

Figure 2-3. Weapon Entry Hole, Showing Petalling of Plating

0204. Internal Explosions

The explosion of a weapon inside a ship will cause very heavy local damage with complete destruction of structure and services. The venting of explosion gases will create a formidable secondary zone of damage. In addition to the immediate primary and secondary effects, there will most probably be fire, loss of watertight and gastight integrity, failure of pipe systems, electrical and other services in other areas of the ship. Should the weapon explode below the waterline and rupture the outer hull plating, flooding can spread back through the compartments and spaces wrecked by its passage and detonation. The results of any accidental internal explosion will be similar, in type if not in degree, except that there will be no entry path.

Figure 2-4. Damage to Fully Clipped Door Caused by Internal Explosion

0205. Blast Routes

a. **Magazines.** Arrangements are made in magazines to allow for any build-up of pressure, due to a rapid 'burn-off' of a weapon, to be vented off to atmosphere. In the event of a detonation this arrangement is inadequate and will not prevent extensive damage.

b. **During Action.** Deliberately opening up blast venting routes prior to and during Action is not practicable, or advised, for the following reasons:

(1) The position of explosions cannot be predicted before the weapon enters the ship.

(2) Opening doors and hatches in the structure is detrimental to the watertight integrity of the ship and could facilitate the passage and spread of flash, fires, smoke, CBRN contamination and possibly floods.

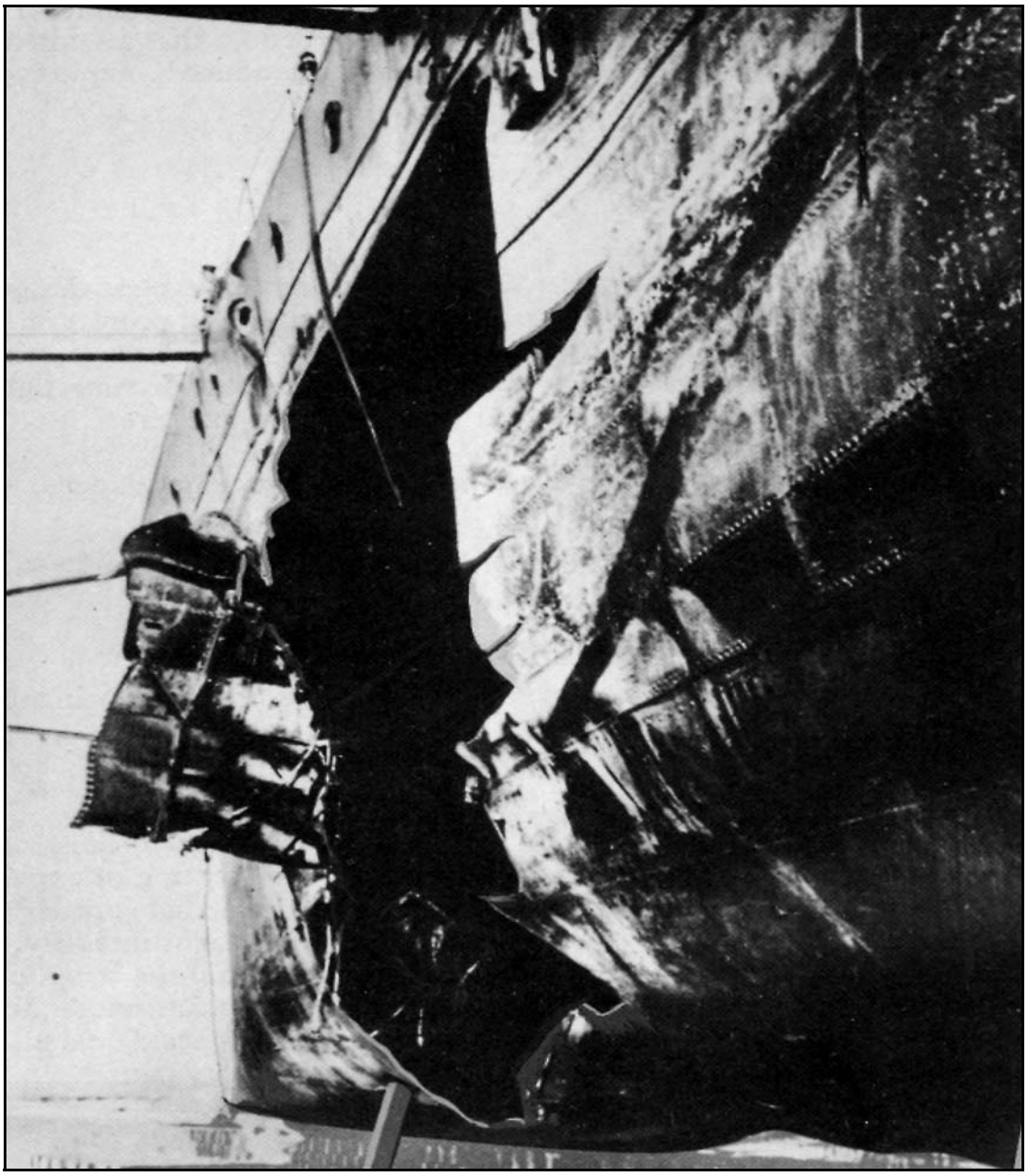
c. **Post Action**. When the presence of unexploded enemy munitions is confirmed in a ship post-action, opening up a blast venting route may be beneficial. While this will have little effect on the degree of damage at the point of an explosion, it may ameliorate the effects as blast spreads through adjacent compartments. In the case of a slower burn-off the opening of a blast route would be beneficial. The blast venting route should be arranged to take the most direct path to the weather deck. However, it should be borne in mind that the passage of the blast may cause damage to structure, systems and fittings as it passes along the venting route. Due account should be taken of any compartments adjacent to the venting route which might present a hazard by reacting adversely to the blast. Personnel are to be kept clear of the blast venting route until the munitions have been dealt with.

d. **Improvised Explosive Devices (IEDs).** IEDs should be treated as unexploded ordnance. The ship should be brought to the highest state of watertight integrity and a blast venting route opened up as described in sub para c above.

0206. Underwater Contact Explosion

The water effectively tamps an underwater explosion and when it happens against the hull of a ship it causes very severe local damage (a charge of just one or two kilograms against the hull is generally enough to penetrate the plating). Outside the radius of severe damage there is normally little effect other than flooding and possible splinter damage. Shock is usually only of minor importance and fire is seldom caused directly by underwater explosion. A contact mine or torpedo exploding against the hull will destroy a large part of the hull structure, the internal structure, fittings and equipment. The resulting flooded area may be extensive. Most of the structure in way of the hole will be seriously weakened and could result in the ship breaking in two. Flooding could result in a serious loss of stability and produce heel (loll or list) and/or trim.

Figure 2-5. Underwater Damage - Contact Torpedo



0207. Underwater Non-Contact Explosion

The pressure pulses from this type of explosion cause damage to an extent depending on the size of charge, its distance from the hull and, to some extent, the depth of water. If the explosion is outside the hull-splitting distance, dimpling or buckling of the plating between frames and distortion of the frames is probable. Successive pressure pulses striking the ship may lead to longitudinal bending, known as ‘whip’, with the possibility of breaking the ships back.

Figure 2-6. Non-Contact Mine Damage

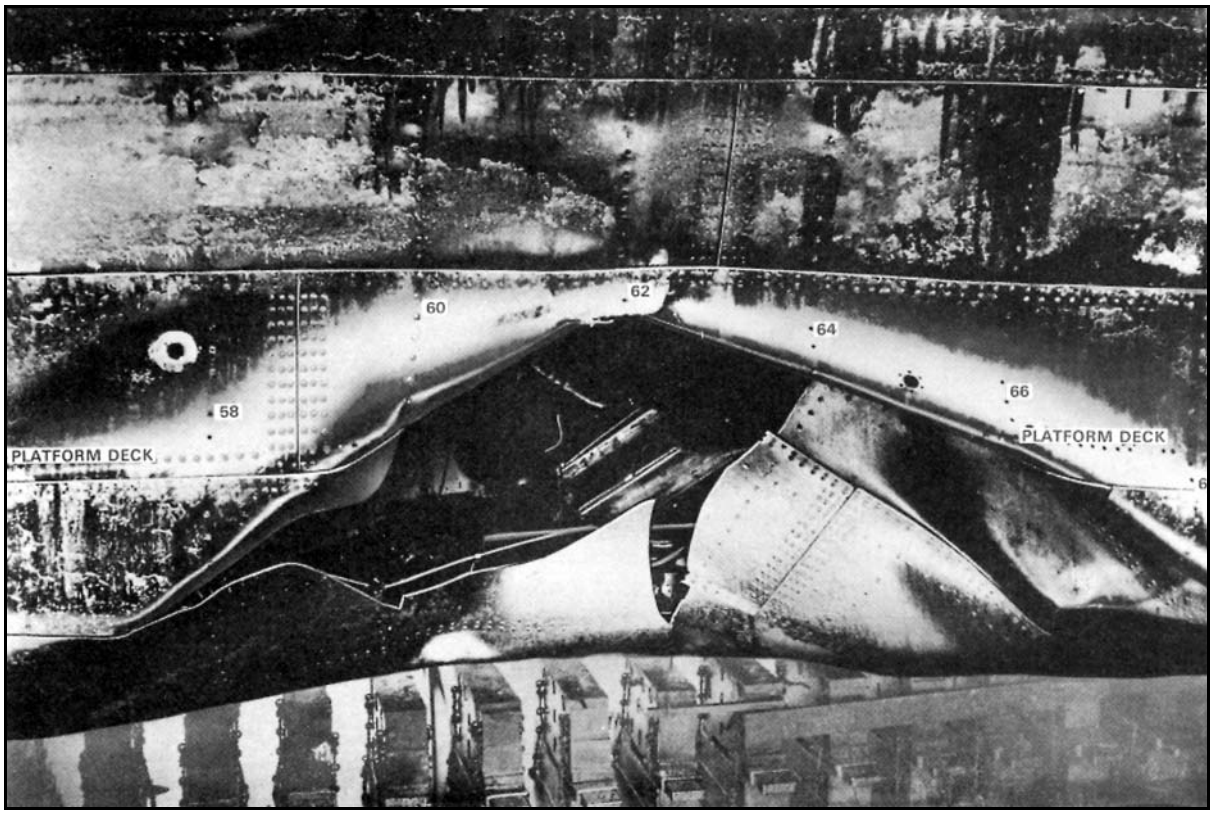
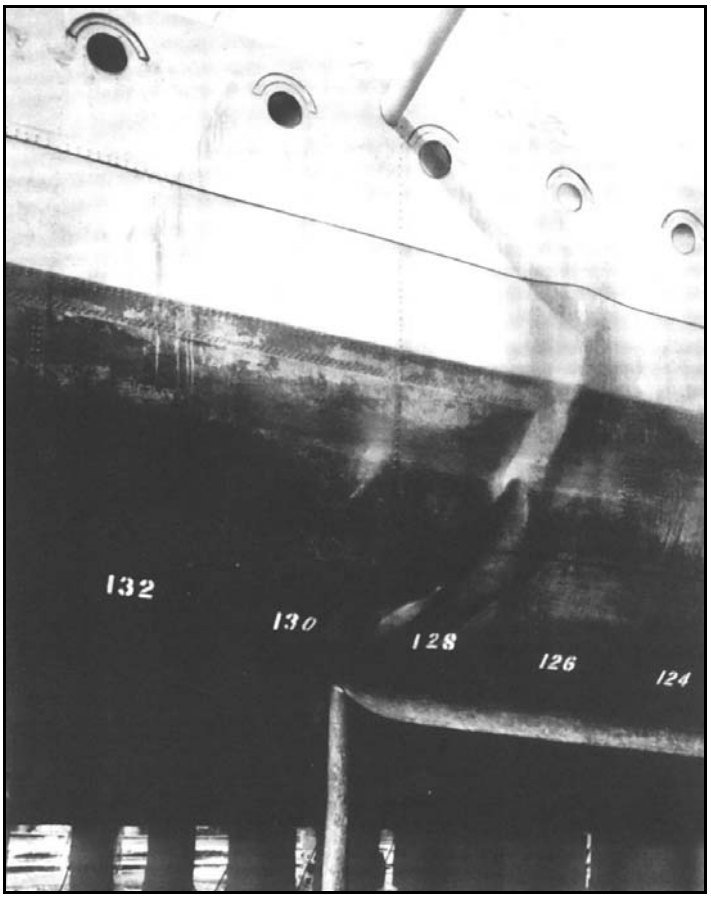


Figure 2-7. Whip Damage

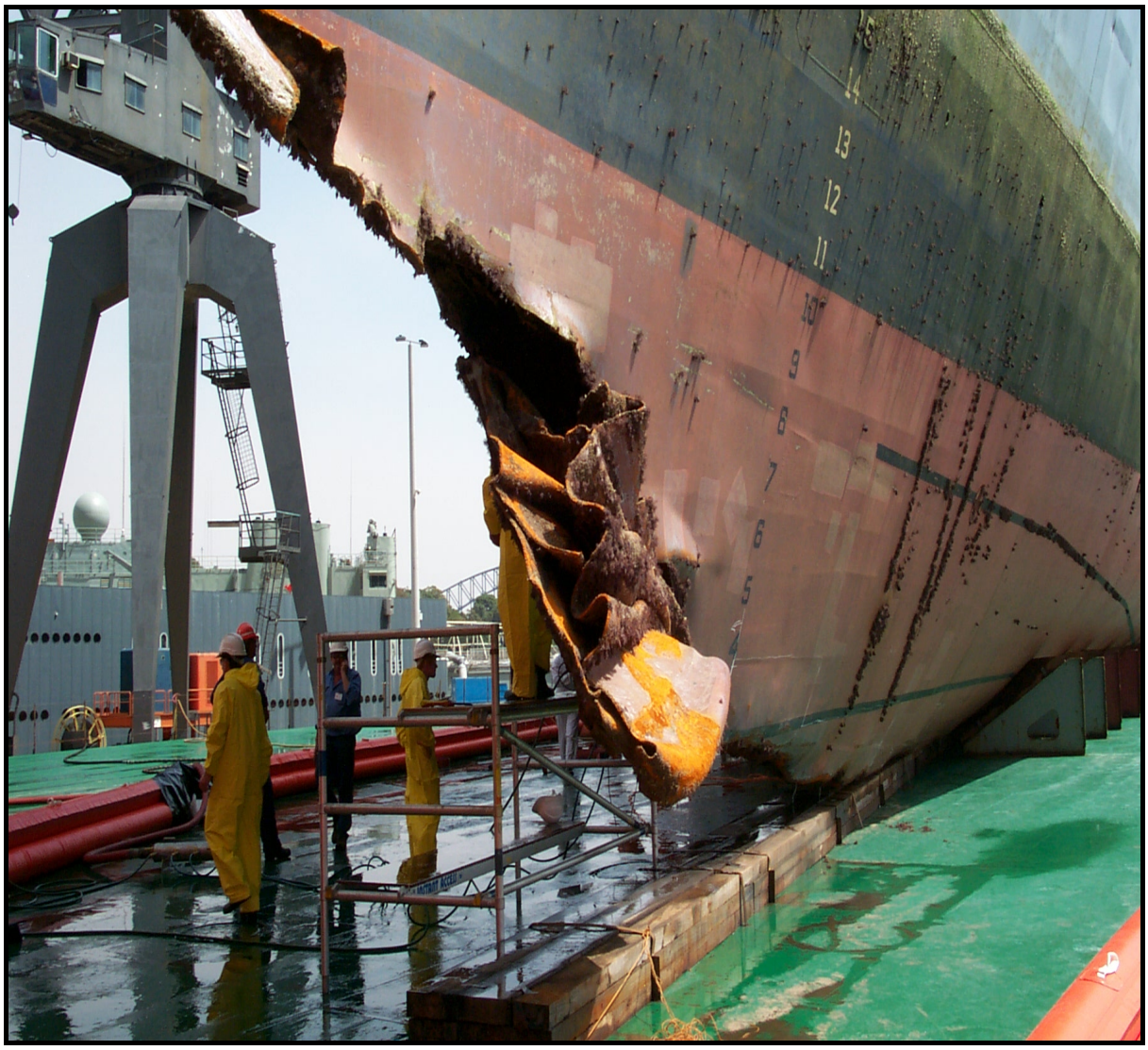


0208. Collision and Grounding

Ships are constantly at risk of damage from navigational incidents, but prompt damage control measures will normally save a ship in these circumstances. Effective Damage Control methods can result in ships being made safe enabling a safe return to port for repairs.

Figure 2-8. Collision Damage

Figure 2-9. Grounding Damage



0209. Nuclear Explosions - Above Surface

Nuclear Weapon yield is explained in BRd 2170(2) and ATP45. Table 2-1 gives a rough approximation of the ranges at which damage of different degrees of severity will be likely for a 20 kT and 10 MT airburst, assuming that the weapons are exploded at the height that gives the greatest blast effect for the weapon yield. The table also gives approximate distances at which exposed combustibles are likely to ignite. Table 2-1 is only a generalisation because blast effect depends on such variables as height of burst, direction of the ships head relative to burst, atmospheric conditions (which modify the effects of heat) and the nature of materials. As used in the table, ‘severe damage’ means that the ship could be sunk, or put out of action with damage enough to require major reconstruction; ‘moderate damage’ means the ship will be immobilised and need much repair, especially to shock sensitive machinery and electronic equipment; ‘light damage’ means that although the ship may be still capable of operating, there will be damage, especially to electronic and other equipment, even though it may be repairable with ships resources.

Table 2-1. Approximate Range of Effects - Nuclear Airburst

Damage Sustained	Range (km)	
	20 kT	10 MT
Severe	0.8	3.2
Moderate	1.2	6.4
Light	2.0	11.2
Damage to aerials and parked aircraft	3.2	12.8-16.0
Exposed combustibles ignited	2.4	24.0

The significant part of the intense heat pulse lasts for about one-and-a-half seconds from a 20 kT weapon and 30 seconds from a 10 MT weapon. As weapon yield increases, the distance at which the heat is effective increases more than the ranges of other effects. The arrival of the heat pulse is virtually instantaneous so that some of the fires caused by it may be extinguished by the following blast. However, the indirect or secondary fires that are almost certain to follow will offset this. A low airburst or surface burst will cause similar damage, but the ranges of effects will be less.

0210. Nuclear Explosions - Underwater

The shock wave from this type of explosion lasts much longer than from a conventional non-contact weapon; long enough, in fact, for the pressure to be exerted all-round the hull at once (crushing or squeezing effect). This will cause widespread damage to the whole of the underwater hull, the amount and severity of which will vary with the yield of the weapon, distance of explosion from the ship, depth of burst, depth of water, strength of structure and the attitude of the ship to the explosion. Water waves developed after an underwater explosion may cause damage to structure, flooding through weather deck openings and loss of external fittings and equipment. Wave formations will vary with the yield and depth of explosion, the depth of water and the topography of the seabed.

0211. Zones of Damage

Damage to a ship can be divided into three zones:

a. **Primary Zone.** This is in the immediate vicinity of the cause of damage (explosion, collision, grounding) and, particularly in the case of explosion, will be the zone of complete destruction. That part of the Primary Zone below the waterline will probably be completely flooded and nothing can be done except to try to contain the floodwater within its original bounds.

b. **Secondary Zone.** The area surrounding the Primary Zone will most probably suffer from split and leaking structure, doors and hatches, fractured pipes, damaged electrical circuits and fittings, fires, smoke and possibly toxic fumes. It is unlikely that this zone will flood immediately, but slow and progressive flooding is probable because of damage to hull and bulkheads/decks surrounding the Primary Zone.

c. **Remote Zone.** Explosion, collision or grounding, particularly explosion, will cause a shock wave to travel through the ships structure and may cause a violent whip, with resultant damage and possibly fire. Whip can cause extensive rippling and distortion of structure, damage to equipment, fittings and services, and often slow flooding over a large area.

0212. Shock

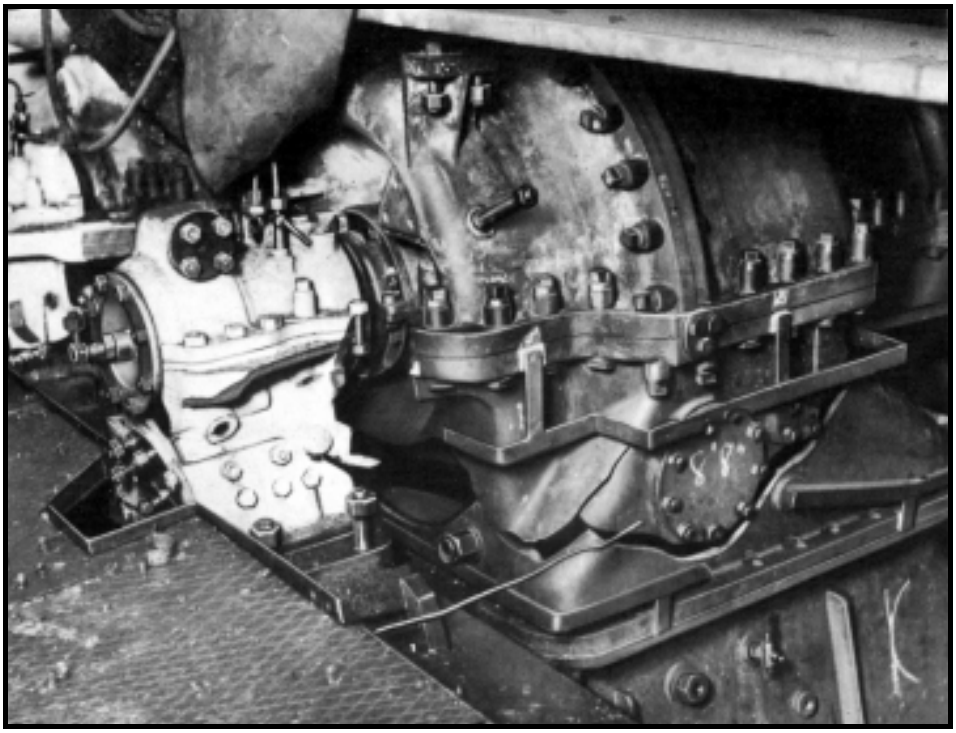
a. The large accelerations and decelerations imparted to equipment directly or indirectly connected to the hull may result in shock damage. Most of the important machinery and equipment in warships is either designed to be shockproof or is fitted with shock-resistant mountings. Even so, the shock forces may overcome these features and cause failure in an item of equipment because of fracture (usually in the securing arrangements). Damage from shock may be caused by:

(1) **Relative Movement between Separate Components.** This may lead to collision between components, failure of mechanisms, opening or closing of contacts. Extensive power failures may result from the accidental opening of switchgear. Damage to electronic equipment and displacement of fuses, telephone handsets and similar fittings may also occur.

(2) **Relative Movement between Different Parts of the Same Item**. Excessive strain caused by large bending moments may result in distortion of fittings that are made of ductile materials or fracture in those which are brittle. This is the most frequent cause of damage to machinery.

(3) **Passage of Stress Wave.** An intense stress wave, with its associated strain, passing through the material may cause failure in its path.

Figure 2-10. Shock Damage to Machinery



b. All portable and semi-portable equipment, fittings, ladders, stores etc must be properly secured or stowed as a precaution against shock or whip effects. Warships incorporate the following design features to reduce the effects of shock or whip:

(1) The use of non-brittle materials.

(2) The support of overhanging masses.

(3) Special securing arrangements to absorb accelerating and decelerating forces.

0213. Destruction

Structure, services and equipment may be completely destroyed by the force of an explosion and may be severely damaged by collision or grounding. In addition, the area of explosion damage may be greatly extended by fragmentation and the projectile effect of debris. Splinters may cause fragments of plating and equipment to act in turn as splinters. The effects of flying debris vary greatly, depending on whether the explosion occurs, how near it is to vital equipment and power supplies and the thickness of interposed structure. The penetration of decks and bulkheads always destroys watertight and/or gastight integrity. The limitation of damage from blast and splinters, and from a bows-on collision is in the first place a matter of design (eg collision bulkhead). Vulnerable equipment is protected as far as possible by structure and other equipment and, in large ships, side and deck protective plating. Whenever possible, alternative power supplies are provided for important machinery and services, and arrangements are made to enable systems to be isolated from damaged areas. According to size and type of ship, main machinery and associated systems are designed as far as practicable to operate as separate units. Provision is made for emergency power to be supplied if alternative supplies fail.

0214. Reduction of Splinter Hazards

The fitting of anti-shatter film to all glass mirrors and the removal of unbacked melamine laminates will reduce the splinter hazard to personnel. Covers for TV and VDU screens should be available to be fitted at State 1.

SECTION 2 – FIRE DAMAGE

0215. Fire Hazards

Fire is an ever-present risk in ships, with the risk being greater in war and upkeep periods. As always, prevention is better than cure and, accepting those caused by enemy action, clean and tidy living, keeping things in their proper places, being fire conscious and obeying the relevant regulations, can prevent most fires on board ship

0216. Additional Hazards in War

Heat from an explosion, including the heat flash from a nuclear weapon, and unspent missile propellant can start ‘primary’ fires. ‘Secondary’ fires, as an indirect consequence of damage, may be caused by:

a. Hot splinters striking combustible materials.

b. Flammable liquid fuels brought into contact with hot surfaces (eg on the surface of rising flood water).

c. Combustible material thrown by blast or shock against a source of heat.

d. Damage to electrical circuits, causing sparks or overheating and ignition of insulation.

0217. Additional Hazards in Upkeep Periods

Fire precautions and firefighting in Upkeep Periods are covered in Chapter 16. The main hazards are:

a. Welding and burning operations, (the safety regulations concerning 'open flame' heating are contained in BR 2000(20).

b. Numerous temporary electrical/air leads passing through doors and hatches.

c. Difficulty in maintaining control of smoking and the use of electrical equipment.

d. The arising's of waste material that would normally not be allowed to accumulate.

e. The use of flammable substances such as adhesives and paints.

f. Civilian personnel who are not familiar with the ship layout.

g. Possible disruption of normal firefighting equipment and communications.

0218. DIY Improvements

Despite general improvements in habitability in ships, there remains a desire to overcome minor deficiencies and provide personal touches, by DIY. However, DIY presents many potential fire risks. All DIY proposals must be processed by the Platform Authority.

0219. Explosives and Fuel

It must always be borne in mind that fire in the vicinity of stowed explosives or fuel (including weapon fuel/propellant) is an immediate and grave risk to the safety of the ship (BR 1754).

0220. Flash Point and Ignition Temperature

a. Warships contain considerable quantities of flammable liquids, so it is important to understand the significance of the terms flash point and ignition temperature.

b. Heat raises the temperature of a combustible substance to the point where fuel in the substance gives off vapour. When enough vapour is formed to support a flame the substance is at its flash point. If the vapour is heated further, it ignites when combined with enough oxygen and the substance is then at ignition temperature. Flash points and ignition temperatures vary with different substances. Fuels such as Dieso and AVCAT are known as high flash point fuels because their flash point is above normal ambient temperature. However, low flash point fuels such as gasoline (petrol) have a flash point below normal ambient temperature, so must be handled with greater care to avoid sources of ignition.

c. Dieso and AVCAT in the form of an atomised spray (eg a ruptured, pressurised system) may ignite below their respective flash points when in contact with a flame.

Figure 2-11. Fire Caused by an Anti-Ship Missile

0221. Toxicity of Smoke

The smoke produced by fires and burning weapon propellant is highly toxic. If inhaled, it will quickly become fatal.

SECTION 3 - FLOODING DAMAGE

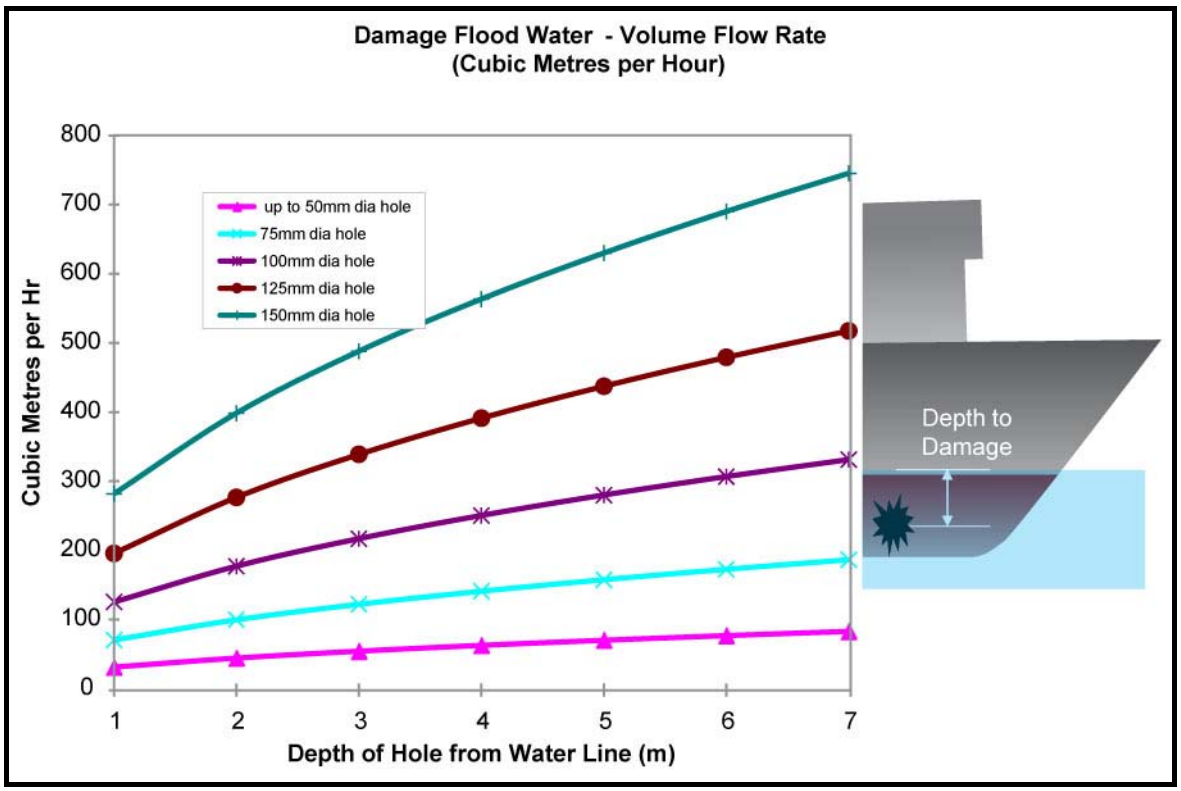
0222. Flooding

Flooding causes loss of buoyancy and the failure of non-watertight equipment in the flooded spaces. It impairs ship stability and may cause heel and/or trim. In a small ship the heel will probably be loll that may lead to capsize, and excessive trim may cause a small ship to plunge. Excessive heel (which may be list or loll) in a large ship gives serious risk of capsize. In all ships, a large heel impairs the operation of weapons and other equipment and has a serious effect on flying operations. Immediate measures are necessary to restore a ship to a stable and upright condition (see Chapter 12, Chapter 13 and Chapter 23). Countermeasures such as leak stopping, pumping and shoring must be promptly applied and the main flooding boundary quickly established. Extension of flooding to large spaces high in the ship has a most adverse effect on stability, and the forming of free surface in any compartment will give a loss of initial stability. As heel and trim increase, it is likely that further holes in the freeboard are brought below water; the effects are cumulative and hence the need for prompt action. Shock or whip damage may cause flooding in spaces removed from the actual incident (Remote Zone) and a careful search must be made after damage, with particular attention given to compartments low in the ship.

0223. Rate of Flooding

The speed with which a compartment will flood can be appreciated from the fact that, for example, a hole 150 mm in diameter and 1.8 m below the waterline will admit about 30m³ of water in 5 mins. In other words, this small hole would lead to the complete filling of a compartment 6 m x 3.7 m x 2.4 m in less than 10 mins. To estimate how much water will enter the ship due to a hole below the waterline. A flooding rate board is available in BRd 2170(3) Chapter 3 can be used to estimate the flooding rate. The size of hole and the depth below the waterline need to be known in order to determine the rate of flooding. This can then be used to assess the number of pumps required to reduce the flood or determine if the ships eductors can cope with the incoming water.

Figure 2-12. Flooding Rates



SECTION 4 - CONTROL OF DAMAGE

0224. Principles of Organisation

a. The overall organisation is founded on Damage Control with CBRN defensive measures superimposed on the organisation when needed. Such flexibility is both necessary and practical since fire and damage are ever-present risks, chemical, biological, radiological and nuclear (CBRN) are primarily a war risk. Success in CBRN and Damage Control depends mainly on:

(1) Being materially prepared.

(2) Having well trained and knowledgeable personnel.

(3) Intelligent prior planning of responses to the most demanding of potential CBRN and Damage Control scenarios.

b. These principles can only offer the chance of success if each is regularly and frequently checked. They will need further review if it is anticipated that the ship will face a specific threat or particularly challenging circumstances, eg operations in a CBRN environment in very hot climatic conditions.

0225. CBRN and Damage Control Priorities

a. The relative priority given to safeguarding personnel and minimising damage to materiel depends on the operational circumstances at the time and requires consideration of the following factors:

(1) The operational threat to the vessel and the Force.

(2) The availability of external assistance.

(3) That the fabric of the vessel provides the means of life support for her company.

(4) That the safety of an individual may be subordinate to the safety of all or part of the ships company.

b. The continuous spectrum of operational intensity between peace and full scale war precludes a simple consideration of one or the other. Commanding Officers are responsible for determining the balance between saving life; protecting their vessel and projecting military capability but the following principles are to be observed:

(1) **Alongside.** With the vessel alongside and given that evacuation of the vessel is possible and there are no complicating circumstances, the primary aim is to protect life. The optimum means of protecting life may be to direct the DC & FF effort towards protecting the fabric of the vessel in the first instance. Factors to consider will include but not be limited to the presence (or otherwise) of (and danger to) ammunition or that non-intervention will contravene elements of the nuclear safety case or needlessly endanger other lives and property.

(2) **At Sea.** Maintaining a safe, life-sustaining vessel for the ships' company is to be the primary aim of the DC&FF effort.

(3) **On Operations.** The overriding aim on operations is maintaining effective military capability.

0226. CBRN and Damage Control Organisation

The CBRN and Damage Control organisation varies with the size and type of ship and, to an extent, with the size of the ships complement, although the basic principles are the same. The organisation must be able to exercise the required degree of control under all the differing circumstances in peace and war, and transition smoothly from one set of conditions to another. The CBRN and Damage Control Command and Control organisation is detailed in Chapter 7.

0227. CBRN and Damage Control Positions

a. The requirement for the allocation of CBRN and Damage Control management positions depends on the size of the ship:

(1) **Single Damage Control Section Ships**. In ships of DD/FF size or smaller, Damage Control Headquarters (HQ1) controls a number of Fire and Repair Parties (FRP), based at Fire and Repair Party Posts (FRPP). An Alternative Damage Control Headquarters (AHQ) is nominated for emergency use in the event of HQ1 becoming untenable.

(2) **Multi Damage Control Section Ships.** Larger ships have a HQ1, but are divided into a number of Damage Control Sections numbered from forward to aft, each controlled by a Damage Control Section Base. Each Damage Control Section has a number of FRPPs. In lieu of an AHQ, these ships have a permanently rigged Secondary Damage Control Headquarters (HQ2). In some ships HQ2 may be combined with one of the Section Bases. In some cases the hangar and flight deck are classed as separate sections that are controlled from the Hangar Control Room (HCR) and Aircraft Control Room (ACR) respectively.

b. Responsibility for immediate countermeasures following action damage lies with the FRPP or the quarters or self-contained position, with coordination by HQ1/SCC (small ship) or Section Base (large ship). As a general rule, damage in machinery spaces, hangars, flight decks, tank decks and in quarters positions, is dealt with by the personnel stationed there, leaving the Damage Control Team to deal with damage between decks. The extent to which quarters, machinery or Air Department crews can contribute to the total ship, post-damage, organisation will depend on whether they are actively engaged in their primary duties. It may be necessary to augment Damage Control teams from these sources in case of serious damage. Conversely, Damage Control teams may be needed to assist them, especially in the event of a large fire, heavy CBRN contamination, or if extensive repairs are required. Rigid rules cannot be applied; the Damage Control organisation must be flexible enough to deal with any form of emergency, all officers and ratings being trained accordingly. CBRN protection and countermeasures are controlled directly from HQ1/SCC, in consultation with the Command in the Operations Room. Monitoring and decontamination parties are drawn from Damage Control teams, self-contained positions or any other source, as circumstances allow.

0228. CBRN and Damage Control Manning

Only in large ships eg (QEC/LPD) are personnel included in the complement primarily for CBRN and Damage Control duties. In the majority of ships, DD/FF, RFAs and MM/PPs, all departments provide ratings required for CBRN and Damage Control duties. The Executive Officer is responsible for nominating their duties on the CBRN and Damage Control Watch and Station Bill (see Chapter 3). The manning requirements for each Damage Control state are detailed in Chapter 5.

0229. The Damage Control Team

The Damage Control team may include the following areas:

a. **Control.** Manning the control positions of HQ1/SCC, and HQ2 in large ships, electrical control positions and the Weapons Section Bases (and Section Bases in large ships).

b. **Fire and Repair.** Manning the Fire and Repair Party Posts.

c. **Special Parties.** These comprise those personnel who man counter flood positions/ manual spray/flood positions (larger ships) and Mobile Repair Parties.

d. **CBRN Parties**. For cleansing station duties, monitoring and decontamination parties.

e. **Self-Contained Sections**. Machinery spaces, hangars in QEC or other larger ships with embarked squadrons and tank decks in LPDs etc.

f. **Weapon Repair Teams**. For repair of weapon equipment.

0230. Control Team

a. In Damage Control State 1, HQ1, SCC will normally be manned as follows platform class CBRNDC orders will provide detailed guidance:

(1) Destroyers and Frigates

(a) The Marine Engineer Officer (MEO): Internal Battle Controller (IBC).

(b) The Damage Control Officer (normally the Logistics Officer): CBRNDCO.

(c) A Weapons Engineering Department senior rating as the CBRN Protection Officers Assistant.

(d) A ET(ME)(L) senior rating as Damage Control Officer (Electrical).

(e) A WOET(ME) as the Propulsion Manager.

(f) An Incident Board Operator.

(g) One or more Communication Numbers.

(2) Large Ships

(a) The MEO.

(b) The CBRNDC Officer (CBRNDCO).

(c) The CBRN Protection Officer (CBRNPO) (normally the DWEO).

(d) A ME Officer and/or ET(ME)(L) senior rating as Damage Control Officer (Electrical).

(e) A ME Officer or WO as Propulsion Manager.

(f) The Hull Section Officer.

(g) One Incident Board Operator for each Damage Control section.

(h) Communication Numbers.

(i) Damage Control Information Boards Operators.

(j) CBRNPO's Assistant.

(k) An Information Number whose duty is to pass to HQ2 and the Operations Room all the information recorded on the various boards in HQ1.

(l) A senior logistics rating to assist the CBRNDCO in all matters pertaining to the arrangement and contents of storerooms, provision of emergency stores and the organisation for keys to locked compartments.

b. In large ships the control team also includes those officers and ratings that man the following:

(1) **HQ2.** HQ2 will be manned by sufficient officers and ratings to mark up the information boards duplicating those in HQ1 and ME personnel for machinery and electrical power supply and distribution purposes. In those ships in which HQ2 is combined with a Section Base, it will be manned by the minimum numbers additional to the Section Base personnel to allow a smooth takeover from HQ1/SCC if needed.

(2) **Section Bases.** Manned in Damage Control State 1 by:

(a) Section Base Officer.

(b) Communication Number.

(c) Incident Board Operator.

(d) An operator to maintain other Damage Control information boards.

(e) A logistics rating.

(f) A ET(ME)(EL) senior rating.

(g) A Communication Number to operate the telephone link to HQ1.

0231. CBRN Parties

Cleansing stations are manned by the Supply Department and as such those ratings selected should be noted on the Watch and Station Bill. Likewise, monitoring and decontamination teams, (which is a whole ship commitment) should also be noted on the Watch and Station Bill.

0232. Quarters

a. The action crew at a quarter must be ready to take immediate CBRN and Damage Control countermeasures at or in the vicinity of their quarters. Their organisation must allow for:

(1) Emergency firefighting and general damage countermeasures when closed up at Action Stations.

(2) Monitoring and decontamination during a lull in or after a CBRN attack.

b. Personnel detailed for these duties should be selected from the quarter's crews and specially trained in their CBRN and Damage Control duties, so that when called upon they form a trained team, adapted and equipped to perform any of the above duties. The following general principles apply:

(1) The primary function of the quarter takes first priority.

(2) CBRN and Damage Control parties at quarters should, where possible, consist of personnel who can most easily be spared from their primary function, so that the quarter can continue to operate, though possibly at reduced efficiency.

c. Quarters CBRN and Damage Control parties must be mobile in the sense that they can be detailed to assist elsewhere in the ship if the situation requires it. The number of personnel available for CBRN and Damage Control duties in a small ship is severely limited. It is therefore of the greatest importance that quarters personnel should be fully trained in all CBRN and Damage Control measures so that they can make an effective contribution to the ships CBRN and Damage Control organisation in an emergency.

0233. Main Machinery Spaces

Where the number of personnel within the ME Department permits, machinery spaces should be manned by 2 ratings to enhance incident reporting, speed of response to damage and dispersal of ME personnel. Where possible one should be a Senior Rate. In some modern very lean manned ships it may not be possible to comply with this guidance. Such ships will normally be equipped with comprehensive machinery and fire/flood surveillance equipment as well as fixed firefighting systems. In these ships, to make the most effective use of available manpower, the machinery spaces may be left unoccupied and the personnel allocated to either the Mobile Repair Party or an adjacent FRPP.

0234. Hangars and Flight Deck

All CBRN and Damage Control measures in hangars and on the flight deck of a QEC or other large ship with an embarked squadron(s) are the responsibility of the Air Department, assistance being given by the CBRN and Damage Control sections and parties whenever needed. These CBRN and Damage Control measures are controlled from the Hangar Control Position (HCP) and Aircraft Control Room (ACR) respectively. These positions are Section Bases, in communication with the ships Damage Control HQ, and have broadcast systems for their respective areas. Both positions have the facility for emergency stopping of aircraft re-fuelling systems and the HCP has control of the fire curtains, spray systems and the hangar ventilation. Personnel manning these positions consist of the aircraft handlers and maintenance teams, the engineering department personnel who operate and maintain flight deck machinery and lifts, and the personnel attached to the embarked squadron(s). The aircraft handlers are divided between the flight deck and hangar handling parties and include hangar CBRN and Damage Control parties, consisting usually of one Petty Officer plus 7 junior rates for each hangar. All hands of the flight deck party should be detailed for fire duties in the vicinity of their flying stations. Monitoring and decontamination requirements must also be met and the parties detailed should be trained not only to deal with contaminated structure or personnel, but also with the contaminated aircraft (see BRd 2170(2)). In a small ship operating aircraft, the few Air Branch ratings borne must be backed up by ratings detailed from the Ship’s Company and trained in aircraft firefighting.

CHAPTER 3

CBRN AND DAMAGE CONTROL RESPONSIBILITIES AND TERMS OF REFERENCE

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CHAPTER 3

CBRN AND DAMAGE CONTROL RESPONSIBILITIES AND TERMS OF REFERENCE

SECTION 1 - DAMAGE CONTROL RESPONSIBILITIES OF KEY PERSONNEL

0301. Executive Officer (XO)

a. These CBRNDC responsibilities below are applicable to an Officer of the Royal Navy appointed to undertake the function of the Executive Officer (XO) and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). The Flotilla organisation may extend or limit these CBRNDC responsibilities and authorisations in the relevant platform class CBRNDC orders. -

b. **Associated Publications and References**

(1) BRd 2 Chapter 9.

(2) BRd 2170 Volume 7 series.

c. **Training Requirements**

(1) CBRNDC 4 (HoD Course).

(2) CBRNDC 4a (HOD Course - MM/PP).

d. **Purpose**

(1) To act as the Warfare Department, Head of Department.

(2) To conduct the administrative duties of the Damage Control Officer (DCO) when no DCO is borne by appointment.

(3) Carrying out the duties of the command rover when required.

e. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	All Officers and Ratings except the Internal Battle controller (IBC)	CO
Training	All Officers & Ratings	CO
Organisation	All Officers & Ratings	CO

f. **Operational Tasks**

(1) To assume the role of the CO if required.

(2) Supervising the CBRNDCO when one is appointed.

(3) At action, being stationed as directed by the Command or rove in conjunction with the EWO, visiting scenes of incidents and all Damage Control Command nodes.

g. **Training Tasks**

(1) Ensuring the Ship's Company is trained in survival and lifesaving. IAW BRd 67 and BR 1329.

(2) Ensuring that the ships company first aid trained personnel is maintained at or above the minimum percentage required in accordance with BRd 2170(1).

(3) Managing the continuation training and manpower allocation of the CBRNDC organisation, ensuring the Watch and Station Bill provides personnel from all departments to meet the CBRNDC requirements of the ship at all states of readiness.

h. **Organisational Tasks**

(1) Carrying out the Damage Control duties of a Head of Department for the Warfare Department.

(2) Conducting the operational and training tasks of Damage Control Officer where a Damage Control Officer is not borne by appointment.

(3) Assuring the command that HQ1, HQ2, AHQ, Section Bases and FRPPs are provided with all necessary equipment and resources required for management of all CBRN and Damage Control incidents.

0302. Marine Engineer Officer (MEO)

a. These CBRNDC responsibilities below are applicable to an Officer or Warrant Officer of the Royal Navy appointed to undertake the function of Marine Engineer Officer (MEO) or Engineering Officer (EO1) and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). The Flotilla organisation may extend, restrict, or refine these CBRNDC responsibilities in the relevant platform class CBRNDC orders.

b. **Associated Publications and References**

(1) BRd 2 Chap 10.

(2) BRd 3001 Para 0103.

(3) BRd 2170 Volume 7 series.

c. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig - MPV).

d. **Purpose**

(1) To undertake the CBRN and damage control tasks of the Marine Engineering Head of Department.

(2) To carry out the duties of the Internal Battle Controller (IBC).

e. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	Whole Ship	CO
Training	All Personnel	CO
Organisation	Fire, Repair and Damage Control Teams	CO

f. **Authorisations:** The MEO or EO1 is authorised to:

(1) Approve deviations from standard operating procedures as required by circumstance.

(2) Is authorised to exercise functional authority over ship's personnel, as well as embarked military and civilian personnel, regardless of rank, in the performance of the duties with which they are charged.

(3) Authorising the use of non-automatic fixed firefighting and flooding systems and coordinating stability countermeasures.

(4) Is authorised to liaise with relevant authorities, achieve the stated purpose of these Terms of Reference.

g. **Operational tasks**

(1) To carry out the role of Internal Battle Controller.

(2) To provide technical advice to the Command in relation to their own departmental aspects of CBRN and Damage Control.

(3) Provision of specialist advice for fixed and portable CBRN and Damage Control equipment which is the responsibility of the ME department.

(4) Recommending to the Command, changes in the Damage Control State of Readiness to deal with peacetime emergencies if the incident is beyond the capability of watchkeepers or the SSEP.

(5) Assignment of a suitably qualified and authorised Officer to undertake the role of I/C of the FRPP furthest from HQ1 in ships where only one Engineer Officer is borne.

h. **Training tasks**

(1) Being a member of the ships CBRN and Damage Control Planning and Training Committee. Assisting in the production and execution of the Whole Ship CBRN and Damage Control training programme.

(2) Managing aspects of Whole Ship CBRN and Damage Control training for which the department is responsible.

i. **Organisational tasks**

(1) Carrying out the Damage Control duties of the Head of Department for the Marine Engineering Department and supervising all other Officers in the department in their Damage Control duties.

(2) The custody of damage control and firefighting equipment iaw BRd 2170(3).

(3) Responsible for ensuring the maintenance and testing of all fixed CBRN and Damage Control Equipment is in accordance with the appropriate maintenance schedule.

0303. Deputy Marine Engineer Officer (DMEO)

a. These CBRNDC responsibilities below are applicable to an Officer, Warrant Officer or Senior Rate of the Royal Navy appointed to undertake the function of Deputy Marine Engineer Officer (DMEO) and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). Where a Warrant Officer or Senior Rate is deputy to the MEO, they are to remain responsible for machinery control. The DMEO is to be the MEO's immediate deputy in all CBRN and Damage Control related matters.

b. **Associated Publication and Reference:** BRd 2170 Volume 7 series

c. **Training Requirements**

(1) CBRNDC 11 (FRPP Team Leader).

(2) CBRNDC 11a (ZCP Team Leader).

d. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	As directed in Local Orders	MEO
Training	As directed in Local Orders	MEO
Organisation	As Directed in Local Orders	MEO

e. **Authorisations:** The Platform class BRd 2170 Volume 7 series shall be used to document where the Flotilla organisation has granted MEO authorisations to the DMEO.

f. **Operational Tasks**

(1) The DMEO is to assume the MEO's action role if the MEO is unable to undertake or continue their duties.

(2) Where practical the DMEO at State 1 should be physically displaced from the MEO as far as practicable.

g. **Training Tasks**

(1) The organisation and training of fire, repair and damage control parties.

(2) Delivery of training all ships personnel in firefighting methods.

0304. Logistics Officer (LO)

a. These CBRNDC responsibilities below are applicable to an Officer, Warrant Officer or Senior Rate of the Royal Navy appointed to undertake the function of Logistics Officer (LO) and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). The Flotilla organisation may extend or limit these CBRNDC responsibilities in the relevant platform class CBRNDC orders.

b. **Associated Publication and Reference:** BRd 2170 Volume 7 series

c. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

d. **Purpose**

(1) To undertake the damage control tasks of the Logistics Head of Department.

(2) To carry out the operational tasks of the Damage Control Officer (DCO) when no specific DCO is borne by appointment.

(3) To complete the non clinical responsibilities of the Medical Officer when no Medical Officer is borne.

e. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	Logistics Department	CO
Training	Cleansing Station Personnel Action Manning Personnel First Aid Personnel CBRN Personal Protection	XO
Organisation	Logistics cell First Aid	CO

f. **Authorisations:** At Action or Emergency Stations, is authorised to exercise functional authority over the Medical Officer/Officer with Medical Responsibilities in the deployment of the First Aid Party personnel.

g. **Operational Tasks**

(1) To carry out the role of the Damage Control Officer (DCO) except where an Officer is appointed specifically for Damage Control duties.

(2) When employed as the DCO, to assist the MEO in the execution of damage control response in the Action State and during Damage Control State 2 and State 3 emergencies.

(3) The special provision of food when the situation precludes normal feeding arrangements.

(4) The custody, provision and re-supply of stores at all states of readiness, including arrangements for emergency supply.

(5) Protection of stores from damage or contamination.

(6) Dispersal of stores.

(7) Stowage of stores to allow access to bulkheads or ships sides and to minimise fire and flooding risks.

(8) Custody and stowage of IPE and CBRN stores except those in the charge of Weapon Engineering or medical staffs.

(9) Issue of IPE and, when required, clean clothing at cleansing stations.

(10) Undertake the role of Officer with Medical Charge when a Medical Officer is not borne.

h. **Training Tasks**

(1) Ensuring Action First Aid Party personnel receive regular continuation training in support of medical staff and the Medical Organisation for Action/Emergency (MOFA/E)

(2) Ensuring cleansing station teams receive regular continuation training.

i. **Organisation Tasks:** Carrying out the Damage Control duties of a Head of Department for the Logistics Department.

0305. Weapon Engineer Officer (WEO)

a. These CBRNDC responsibilities below are applicable to an Officer, Warrant Officer or Senior Rate of the Royal Navy appointed to undertake the function of Weapon Engineer Officer (WEO) and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). The Flotilla organisation may extend or limit these CBRNDC responsibilities in the relevant platform class CBRNDC orders.

b. **Associated Publications and References**

(1) BRd 2 Chap 10.

(2) BRd 300 Para 0105.

c. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

d. **Purpose**

(1) To carry out the duties of the Command Advisor.

(2) To undertake the damage control tasks of the Weapon Engineering Head of Department.

e. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	All Personnel	CO
Training	Monitoring and Decontamination Personnel Weapon Repair Personnel	CO
Organisation	Monitoring and Decontamination Personnel Weapon Repair Personnel	CO

f. **Operational Tasks**

(1) Undertaking the role of the Command Adviser in the Action State and during Damage Control State 2 and State 3 emergencies.

(2) Giving technical advice to the Command on their own departmental aspects of CBRN and Damage Control.

g. **Training Tasks**

(1) Provision of continuation training for personnel with monitoring and decontamination responsibilities.

(2) Provision of continuation training for Weapon Repair Teams.

(3) Directing the departmental CBRNDC Qualified personnel.

(4) Managing departmental CBRN and Damage Control training.

(5) Being a member of the ships CBRN and Damage Control Planning and Training Committee and assisting in the production and execution of the Whole Ship CBRN and Damage Control training programme.

h. **Organisational Tasks**

(1) Carrying out the Damage Control duties of a Head of Department for the Weapon Engineering Department iaw BRd 300.

(2) The custody and provision of maintenance of all fitted and portable CBRN monitoring and decontamination equipment.

(3) The management of the CBRN organisation.

(4) The provision of maintenance, integrity and operation of magazine fixed firefighting systems.

(5) The custody and provision of maintenance for aircraft firefighting equipment, when the Ships Flight is not embarked.

(6) Carrying out the Damage Control duties of an Officer and supervising all other Officers in the department in their Damage Control duties.

0306. Deputy Weapon Engineer Officer or WE Section Officer

a. These CBRNDC responsibilities below are applicable to an Officer, Warrant Officer or Senior Rate of the Royal Navy appointed to undertake the function of Deputy Weapon Engineer Officer (DWEO) and the associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy).

b. **Associated Publication and Reference:** BRd 300(1) Chap 1.

c. **Purpose**

(1) To carry out the duties of the weapon section base Officer.

(2) To carry out the duties of the CBRN Protection Officer (PROTO).

d. **Authority and accountability**

Tasks	Authority Over	Accountable to
Operational	As directed in Local Orders	WEO
Training	As directed in Local Orders	WEO
Organisation	As directed in Local Orders	WEO

e. **Authorisations:** The Platform class BRd 2170 Volume 7 series shall be used to document where the Flotilla organisation has granted WEO authorisations to the DWEO.

f. **Operational Tasks**

(1) The DWEO/Section Officer is the WEO's deputy in all CBRN and Damage Control related matters and is to assume the WEO's action role if WEO is unable to undertake or continue their duties. Otherwise, at State 1 they are based at the Weapon Section Base (WSB) controlling the activities of the Weapon Repair Party (WRP).

(2) The DWEO/Section Officer will be the CBRN Protection Officer (CBRN PO), based in the WSB, receiving information from the CBRNPO Assistant in HQ1, coordinating responses and briefing the WEO as Command Adviser.

g. **Training Tasks.** The organisation and training of the Weapon Repair Parties.

h. **Organisational Tasks.** When the CBRN threat level increases to Medium, DWEO is to delegate technical matters to the WOWEs in the WSB, and act as CBRNPO in HQ1. If a Section Officer is borne, they are to transfer from the Alternative WSB to the WSB to supervise technical matters.

0307. Head of the Air Department

a. These CBRNDC responsibilities below are applicable to an Officer of the Royal Navy appointed to undertake the function of Head of the Air Department and its associated tasks, in a QE Class platform. The Flotilla organisation may extend or limit these CBRNDC responsibilities in the relevant platform class CBRNDC orders. Where a ship operating aircraft has no separate Air Department, CBRN and Damage Control matters remain the responsibility of the XO and the respective HODs.

b. **Associated Publications and References**

(1) BRd 2.

(2) RA 1029.

(3) BRd 766.

c. **Training Requirements.** CBRNDC 4 (HoD Course) if carrying out duties of Command Rover.

d. **Purpose.** To undertake the damage control tasks of the head of the air department.

e. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	Air Department Personnel	XO
Training	Air Department Personnel	XO
Organisation	Air Department Personnel	XO

f. **Authorisations.** The Platform class BRd 2170 Volume 7 series shall be used to document where the Flotilla organisation has delegated authorisations to the head of the air department.

g. **Operational Tasks**

(1) Provision of air department personnel to the ships CBRN and Damage Control organisation when required and as directed by HQ1 (or HQ2).

(2) Carrying out the Damage Control duties of a head of department and supervising all other Officers in the department in their Damage Control duties.

(3) Giving technical advice to the Command on their own departmental aspects of CBRN and Damage Control.

h. **Training.** The continuation training of Air Department personnel in specialised aircraft firefighting techniques, and those CBRN monitoring and decontamination procedures that are peculiar to aircraft.

i. **Organisation**

(1) Preservation of watertight and/or gastight integrity in the Air Department spaces to accord with the ships ordered Damage Control condition.

(2) Ensuring the maintenance of specialised aircraft firefighting equipment is carried out in accordance with the maintenance schedule and technical documentation.

0308. Medical Officer

a. The CBRNDC responsibilities below are applicable to a Medical Officer (MO) of the Royal Navy appointed to undertake the function of the Ships Medical Officer and its associated tasks, in a ship owned or chartered by the Ministry of Defence (Navy). The Flotilla organisation may extend or limit these CBRNDC responsibilities in the relevant platform class CBRNDC orders. The Logistics Officer will normally conduct these tasks where no Medical Officer is borne, specific tasks shall be detailed in the platform class CBRNDC orders.

b. In the event of CBRN operations, the Medical Officer or Senior Medical Branch Rating, with support from the Logistics Officer in the absence of a Medical Officer, has a key role in the command and control organisation. They provide advice to the Command on the pathological effects on the Ship's Company of chemical and biological agents and nuclear radiation. They manage the organisation for immunisation against BW agents and other prophylactic or post-attack medical countermeasures against BW or CW agents. The CBRNDC responsibilities of the MO are detailed in BRd 2170(1) Chapter 2. The Medical Officer should also be responsible for the development of contaminated casualty handling and evacuation plans, as well as quarantine plans in the event of biological agent exposure.

c. **Associated Publications and References**

(1) **BRd 2 –** The Queens Regulations for the Royal Navy.

(2) **BRd 1991 –** Instructions for the Royal Naval Medical Service.

(3) **JTTP 3-61.2 -** Counter CBRN Medical Support.

d. **Training Requirements**

(1) Basic Sea Safety Course.

(2) Intermediate Sea Safety Course.

e. **Purpose.** To undertake the damage control tasks of the head medical department.

f. **Authority and Accountability**

Tasks	Authority Over	Accountable to
Operational	Medical Department Personnel	XO
Training	Medical Department Personnel	LO
Organisation	Medical Department Personnel	XO

g. **Operational Tasks**

(1) The medical treatment of casualties.

(2) The organisation for immunisation of personnel against BW agents and other prophylactic or post-attack medical countermeasures against BW or CW agents.

(3) Assistance to the WEO in evaluating for the Command (regarding future operations) the effects of biological and chemical agents and radiation experienced by the Ship's Company.

(4) Briefing the command of the pathological effects of exposure to sources of radiation, biological and chemical agents.

(5) Undertake the role of Officer with Medical Charge.

h. **Training Tasks**

(1) Provision of First aid training.

(2) Responsible to the Logistics Officer for the execution and coordination of first aid training, in respect of the coordination of Action and Emergency First Aid Party initial and continuation training, upper deck crews and cleansing station personnel.

(3) Being a member of the ships CBRN and Damage Control Planning and Training Committee and assisting in the production and execution of the Whole Ship CBRN and Damage Control training programme.

i. **Organisational Tasks**

(1) Investigating and responding to the CBR contamination of food and fresh water.

(2) The provision of equipment and manning for first aid posts and emergency operating stations, and the distribution and periodical turnover of first aid equipment at quarters.

(3) Interpreting and holding the permanent clinical records of radiation received by the Ship's Company, and records of personnel contaminated by Chemical and Biological agents.

(4) Interpreting and holding the permanent clinical records of radiation exposure received by the Ship's Company.

(5) The custody of CBRN medical countermeasures stores.

0309. Heads of Departments (HODs) – General CBRNDC Duties

a. These generic CBRNDC responsibilities are applicable to all Royal Naval Officers appointed to HOD positions.

b. **Associated Publications and References**

(1) BRd 2.

(2) BRd 9600.

c. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

d. **Purpose.** These generic CBRNDC responsibilities inform Heads of Departments of the mandatory CBRNDC administrative tasks required to maintain the ships CBRNDC capability.

e. **Superiors.** The Heads of Department are accountable to the Commanding Officer.

f. **Authority.** The Heads of department have authority over all personnel assigned to their department, however, are accountable to the Commanding Officer.

g. **Tasks**

(1) Carrying out the Damage Control duties of an Officer and supervising all other Officers in the department in their Damage Control duties.

(2) Giving technical advice to the Command on their own departmental aspects of CBRN and Damage Control.

(3) Production of their departmental section of ships CBRNDC Orders.

(4) Producing Damage Control procedures for any self-contained Damage Control sections that may be allied to the departmental function. (e.g. main machinery spaces, flight decks, hangars, vehicle decks and docks in certain ships).

(5) Providing suitably qualified persons to the Whole Ship CBRN and Damage Control training organisation.

(6) Providing personnel to the CBRN and Damage Control organisation as required by the Watch and Station Bill.

(7) Directing the department as CBRNDC Qualified personnel.

(8) Managing departmental CBRN and Damage Control training.

(9) Managing aspects of Whole Ship CBRN and Damage Control training for which the department is responsible.

(10) Being a member of the ships CBRN and Damage Control Planning and Training Committee and assisting in the production and execution of the Whole Ship CBRN and Damage Control training programme.

(11) Provisioning of specialist advice and maintenance for CBRN and Damage Control equipment which is the responsibility of their department.

(12) Informing other departments of any defects found with CBRN and Damage Control equipment situated in their departmental spaces.

0310. Other Officers General CBRNDC Duties

a. These generic CBRNDC responsibilities are applicable to all Royal Naval Officers not appointed to HoD positions.

b. **Associated Publications and References**

(1) BRd 2.

(2) BRd 9600.

c. **Training Requirements**

(1) Basic Sea Safety Course.

(2) Intermediate Sea Safety Course.

d. **Purpose.** To carry out the damage control tasks detailed in their terms of reference which may include some or all the tasks identified below.

e. **Authority.** Authority over all ratings regarding the performance of the damage control duties with which they are charged, however they are accountable through their chain of command.

f. **Tasks**

All other Officers must be capable of:

(1) Carrying out the CBRN and Damage Control duties of an AB, LH and SR.

(2) Carrying out the CBRN and Damage Control duties of a Divisional Officer.

(3) Checking ratings' personal CBRN and Damage Control equipment.

(4) Monitoring and conducting advancement and ship knowledge training.

(5) Updating divisional CBRN and Damage Control documentation.

(6) Forwarding information for updating the ships CBRNDC Master Training and Material Assessment Log.

(7) Monitoring and counselling of stress casualties.

(8) Informing other departments of any defects found with CBRN and Damage Control equipment situated in their departmental spaces.

(9) Carrying out the duties of an Officer in Charge of a quarter, post, section or living space.

(10) Taking charge of immediate measures to deal with CBRN and Damage Control incidents when required to do so.

SECTION 2 - CBRN AND DAMAGE CONTROL TERMS OF REFERENCE

0311. Internal Battle Controller (IBC)

a. These ToRs are applicable to a suitably qualified and authorised Officer, Warrant Officer or Senior Rate assigned the role of the IBC. This role is normally undertaken by the MEO, however in some vessels it may be more appropriate for the most Senior Engineering Officer or the 1Lt to undertake this role. The BRd 2170 Volume 7 series will detail which UEL position conducts this role.

b. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

c. **Purpose.** The IBC is to coordinate the HQ1/SCC team to achieve cohesive progress towards the Command Aim. It is essential that they keep an overall view of all damage control and firefighting, CBRN, electrical repair and propulsion incidents, while delegating authority to make full use of the specialist personnel.

d. **Superiors.** The IBC is responsible to the Commanding Officer.

e. **Authority.** The IBC has authority over the HQ1/SCC team and their outstations.

f. **Key Tasks**

Reacting to the Command Aim by:

(1) Taking overall charge of the HQ1/SCC, at State 1 and during emergencies in States 2 and 3 as the Internal Battle Controller (IBC).

(2) Coordinating the activities of and giving priorities and direction to the SCC team and outstations.

(3) Giving priorities and direction to Officers in charge of self-contained Damage Control Sections and coordinating their activities with that of the SCC team.

(4) Authorising the use of non-automatic fixed firefighting and flooding systems and coordinating stability countermeasures

(5) Liaising with the Command Advisor on the interface between DC, ME activities, warfare teams, quarters crews, monitoring and decontamination teams, cleansing personnel and the Weapon Repair Party.

(6) Monitoring rover reports from the command rovers and directing their activity. Informing the Command of all matters which effect the availability of the ship capabilities, advising on the implications of incidents and defects, and recommending priorities for repairs in consultation with Command via the Command Advisor.

(7) To ensure all incident evidence is quarantined and retained in safe custody until required for investigation or handed over to the investigating authority.

(8) Maintains a flow of CBRN information to and from the Command Adviser.

0312. Command Advisor

a. These ToRs are applicable to a suitably qualified and authorised Officer, warrant Officer or senior rate assigned the role of Command Advisor. This role is normally undertaken by the WEO, however in some vessels it may be more appropriate for another engineering Officer to undertake this role. The BRd 2170 Volume 7 series will detail what UEL position conducts this role.

b. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

c. **Purpose.** The Command Advisor monitors the internal battle and the tactical situation to pass high priority information quickly to the CO and the warfare team. The Command Advisors briefings to the CO must be appropriately timed within the tactical situation and the format of the brief should be agreed beforehand. Items should be briefed in overall ship priority order using a portable briefing board and must include advice on courses of action, any change to the Command Aim and the priorities derived from it, as well as fall back or reversionary modes of operation of damaged equipment.

d. **Superiors.** The Command Advisor is responsible to the Commanding Officer.

e. **Authority.** The Command Advisor is authorised to deliver the Commanding Officers intent.

f. **Key Tasks**

(1) To determine the Command's equipment, repair priorities and ensure that the appropriate outstations are aware of them and work to them. In consultation with the PWO, they are to recommend changes to these priorities, depending on the tactical situation and the extent and nature of any damage suffered.

(2) To monitor the performance of weapons sensors, communications, data handling systems and all the supporting services whilst considering operator, tactical and material factors. They are to assess the effects of damage, defects and degradation on the ship's ability to fight, establishing estimated time back on line (ETBOL) and alternative modes of operation where possible. Command Advisers are to keep the Command fully informed of all significant changes that may affect the operational ability of the ship.

(3) By consultation with the MEO and the XO, Command Advisers are to monitor the extent of damage to the hull, propulsion and ancillary systems and the effect on the ships ability to meet the Command Aim and to keep the Command informed of all significant changes that may affect the operational capability of the ship.

(4) To integrate the requirements of the Warfare and Engineering Departments for the testing, maintenance and repair of systems and equipment within the existing tactical scenario. They are to particularly assess the extent of damage following an attack (mini-SOCs and blanket search).

(5) To monitor the identity, number and location of casualties and to monitor the requirement to move personnel within the ship to deal with damage control, firefighting and weapon repair. They are to ensure that the Command Aim is being complied with and that the Command is fully informed of all significant personnel matters.

(6) In the event of a CBRN threat, the Command Adviser also takes on the role of Command CBRN Adviser, coordinating the CBRN defence inputs from various sources, relating them to current warfare operations and advising the Command.

0313. Task Group CBRN Advisor (CTG CBRNA)

Further guidance on the function of the CTG CBRNA is provided in BRd 2170(2)

The principle tasks are summarised as follows:

a. To be the focus for all CBRN matters within the Task Group.

b. To liaise with the Land and Air Force Operational Advisers on the coordination of CBRN Warning and Reporting and to input to the theatre threat warning scheme.

c. In conjunction with other CBRN cells, to coordinate joint CBRN policy including distribution and employment of pooled and theatre CBRN equipment.

d. To advise the CTG on CBRN risk management.

e. To determine the Task Group’s collective and individual protection posture, when possible, in concert with shore authorities, and recommend acceptable habitability relaxations.

f. To liaise with:

(1) The Task Group Warfare Staff, with reference to CBRN matters.

(2) The Group Medical Officer on CBRN protective measures, prophylaxis, the management of contaminated casualties and quarantine measures.

(3) The Group Meteorological Officer on fallout and the hazard area prediction.

(4) The Group Logistics Officer on the distribution and consumption of CBRN consumable equipment.

(5) The Group Aviation Authority on CBRN as it affects aircraft operating from ships.

(6) The CBRN Warning and Reporting organisation.

g. To interpret and disseminate to the Task Group, CBRN threat information and changes in CBRN policy, philosophy and procedures from higher authority.

h. To ensure that the Task Group is trained for the CBRN environment.

0314. CBRN Cell Controller (CTG or QEC)

The principle tasks are summarised as follows:

a. Establish two (minimum) subordinate members to act as CBRN Cell staff.

b. Prepare the equipment required to operate a CBRN Cell.

c. Understand role/responsibilities of other CBRN Generalists and Specialists.

d. Execute the supervisory tasks of a CBRN Cell Controller.

e. Manage shift patterns/watch rotation for CBRN Cell staff.

f. Produce manual CBRN predictions.

g. Provide hypothetical data on consequences of accidental release from TIM locations.

h. Provide hypothetical data on consequences of enemy CBRN use (Pre Attack).

i. Assist with tasking of specialist CBRN personnel and resources (Post Attack).

j. Explain the role of the CBRN Cell.

k. Explain the characteristics and effects of:

(1) CW/substances.

(2) Biological.

(3) Radiation and Radiological Weapons.

0315. Command Rover

a. These ToRs are applicable to a suitably qualified and authorised Officer, warrant Officer or senior rate assigned the role of Command Rover. This role is normally undertaken by the XO, EWO and CBM, however in some vessels it may be supplemented by other HoD's or DHoDs where appropriate. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role.

b. **Purpose**

(1) The Command Rovers provide an expert audit of the overall picture and a Command level physical link between the Command Team, the scenes of all incidents and the FRPP/ZCP/Section Bases that control them. They bring to bear a high level of leadership and direction at the scenes of action to overcome communication difficulties or differences in interpretation. The availability of both the XO and EWO to fulfil the Command Roving role offers a ship many opportunities and possibilities, especially at State 1.

(2) In FF/DD the relative strength of a Bridge Team and the experience of an EWO are just two of the factors that the Command Team should consider when deciding how to allocate Command Rovers. If both the XO and the EWO are available to rove they should initially decide how they are going to divide the ship. It is usually better for the XO to cover the fwd half of the ship where he is better placed to update his own tactical awareness. In any case the system must be flexible enough to allow IBC and the Directors to task rovers as required to cover priority incidents. The rovers must be careful not to overload HQ1 with too many visits. If the decision is taken to keep the XO on the bridge, allowing the EWO to rove the whole ship, then consideration should be given as to how tactical information is to be effectively passed around the Damage Control Command nodes.

(3) During single State 3 incidents, when the CO will almost certainly be on the Bridge, the XO may be best employed in the roving role with the EWO, leaving personnel control issues to the RPO or a Warfare senior rate.

c. **Superiors.** The Command rover is responsible to the Commanding Officer.

d. **Key Tasks**

(1) Roving between CBRNDC incidents as directed by the IBC or DCO to act as their 'eyes and ears'.

(2) Extracting the maximum information from each damage scene, particularly incident boundaries.

(3) Assessing the status (winning/holding/losing) of CBRNDC Incidents.

(4) Checking the quality of information flow between all Command nodes (HQ1, Ops Room, Bridge/HQ2, WSB, Section Bases, FRPPs and MHQ) and eliminating confusion.

(5) Monitoring the tactical picture and the Command aim and disseminating this information to all Command nodes and incident managers.

(6) Maintaining impetus and morale throughout the ship.

(7) Contributing to the 'Command huddle' in HQ1 when available.

(8) Maintain constant monitoring of WT integrity and State 1 preparations.

(9) Monitoring Damage Control preparations for action.

(10) Directing the CBM who roves on the upper deck.

0316. Damage Control Officer (DCO)

a. These ToRs are applicable to a suitably qualified and authorised Officer, warrant Officer or senior rate assigned the role of DCO. This role is normally undertaken by the Logistics Officer, however in some vessels it may be undertaken by another suitably qualified Officer, Warrant Officer or Senior Rate. In ships where an Officer is appointed specifically for Damage Control duties they are to be known as the CBRNDCO. They assist the XO and provide professional advice on CBRN and Damage Control matters to other HoDs in the discharge of their CBRN and Damage Control responsibilities. In ships where no Officer is appointed specifically for Damage Control duties, another Officer, normally the Logistics Officer, will be the DCO. They are to be fully conversant with the ships CBRN and Damage Control organisation and ship layout and will direct the employment of damage control and FAP personnel, referring to the MEO for priorities and guidance. The flotilla will provide further details in platform class CBRNDC Orders. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role.

b. **Training Requirements**

(1) CBRNDC 4 (Internal Battle Command Team – HOD's Desig Course).

(2) CBRNDC 4a (XO and MEO Desig – MM/PP).

c. **Purpose.** The DCO provides an assessment for the IBC of the overall damage picture in the ship except in the main machinery spaces. He coordinates the efforts of the Fire and Repair Parties (FRPs) and medical teams. The damage picture is maintained using the main Incident Board and its associated operator (IBO). The DCO is also directly responsible for the management of essential services in support of the DC effort and will need to liaise with the DCO(L) and PM to achieve this. The DCO directs the actions of the FRPs in a management and coordination task, identifying and prioritising incidents and maximising the use of available personnel and material resources, or identifying when resources must be re-allocated.

d. **Superiors.** The damage control Officer is responsible to the IBC.

e. **Authority.** Is authorised to delegate tasks associated with the achievement of their tasks as CBRNDCO, to competent personnel who have the necessary training, experience, and ability. The delegation of any task does not absolve the CBRNDCO of their accountability, they have authority for the following:

(1) The DCO has authority over the I/C Fire Repair Party.

(2) The DCO is authorised to liaise with DCO(L)Propulsion Manager.

f. **Key Tasks When employed as the CBRNDCO**

(1) To produce and review platform CBRN and Damage Control Standing Orders where, directed to do so.

(2) Ensure departmental coordinators maintain accurate departmental Watch Bills.

(3) Coordinating the whole ship CBRN and Damage Control training organisation.

(4) To arrange and supervise all CBRN and Damage Control training programmes and exercises, in support of HODs.

(5) The overall organisation of CBRN and Damage Control personnel and equipment throughout the ship.

(6) To direct the organisation for maintaining watertight and gastight integrity in the different Damage Control conditions, and the arrangements for closing down the ship.

(7) Ensuring SCC watch keepers are trained and competent to undertake the duties of the SCC watchkeeper.

(8) Ensuring the watertight and gastight condition is maintained as directed by the command.

(9) Ensuring CBRN and Damage Control equipment is stored correctly at the appropriate level of readiness.

(10) To direct CBRN and Damage Control preparations by:

(a) Monitoring changes in the watertight condition.

(b) Monitoring changes in the state of readiness.

(11) Delivery of the Damage Control Watch and Station Bill.

(12) Delivery of the Master CBRN and Damage Control Training and Material Assessment Log.

(13) Ensuring paper versions of CBRNDC related publications are accounted for and held at the correct amendment state.

(14) Ensuring digital versions of CBRNDC publications stored on a platforms internal intranet are held at the correct amendment state.

(15) Overseeing the work of Whole Ship CBRNDC Coordinator (WSQ) and monitoring the work of departmental CBRNDC Qualified personnel.

g. **Key Tasks when employed as the DCO**

(1) To be in HQ1 at State 1 and during emergencies at States 2 and 3.

(2) To direct CBRN and Damage Control preparations by:

(a) Monitoring changes in Watertight and Gastight Condition.

(b) Monitoring changes in the State of Readiness.

(c)) The DCO coordinates the integrity of the ship's collective protection (normally a citadel) and liaises closely with the CBRN Protection Officer's Assistant for the entry and exit of personnel. He must monitor the use of the HPSW system for prewetting to ensure that firefighting or educting operations are not disrupted. He controls the deployment and use of Pre-Shelter Parties.

(3) Giving priorities to CBRN and Damage Control incidents and monitoring reactions of Damage Control Section Bases (FRPPs in single Section ships).

(4) Coordinating reaction to CBRN and Damage Control incidents that cut across Section or FRPP area boundaries.

(5) Re-deploying resources between Sections or FRPs when required.

(6) Ensuring that immediate reactions to incidents by quarter's crews etc. are coordinated with the work of the dedicated FRP and First Aid Parties.

(7) Directing the deployment of personnel taken from outside the damage control organisation to reinforce DC parties, including Warfare personnel allocated by the Command at action and 'spare hands' during emergencies.

(8) Redeploying the monitoring and decontamination teams elsewhere within the DC organisation, when approved by the Command, at low CBRN risks.

(9) Managing use of the HPSW system and coordinating its re-configuration following damage.

(10) Acting as the interface between HQ1 and the rest of the SCC by:

(a) Reacting to priorities and directives from the IBC.

(b) Keeping the MEO informed of CBRN and Damage Control incidents and the DC organisations reaction to them.

(c) Requesting priority changes or assistance for DC parties from outside of the DC organisation, from the Command, through the MEO.

(d) Keeping IBC informed of incidents that require coordination between the DC organisation and any self-contained Damage Control Section.

(e) Liaising with the Propulsion Manager.

(f) Liaising with the DCO(L).

(g) Liaising with the CBRNPO's Assistant.

(11) Directing the work of the HQ1 Incident Board Operator, HQ1 panel operators and any HQ1 communication numbers or messengers by:

(a) Ensuring all information coming into HQ1 is properly recorded, re-routed or acted upon.

(b) Ensuring any directives or priorities from the Command and the MEO, and any information generated within HQ1, is passed to all outstations within the DC organisation including HQ1 alarms.

(c) Ensuring that a narrative of events is kept in all Damage Control State 3 incidents.

(12) Broadcast 'SITREPs' to the Ship's Company.

0317. Principle Warfare Officer (PWO)

a. The PWO has a vital role in the ships CBRN defence organisation, as he has access to intelligence reports and the latest tactical situation. He must relate CBRN defensive measures to the current mission or task. He has direct authority over the operation of the prewetting system (see BR2170 Vol(2)) and must take into account its effects on weapons, sensors, radar cross-section (increase), infra-red signature (blurring), flying operations and Minimum Effective Crews. Before ordering prewetting, he must consider the effect on the ships HPSW system, particularly if damage has been suffered or during firefighting, against the repercussions of not prewetting. The PWO (Duty Staff at State 1) is responsible for Warning and Reporting organisation utilising BRACIS.

Table 3-1. Warning and Reporting Organisation

Platform Class	OiC Warning and reporting Organisation	Warning and Reporting Supervisor	BRACIS Operator
QEC	PWO	HM Officer	HM JR
LPD	PWO	POEW	EW
Type 23	PWO	POEW	EW
Type 45	PWO	POEW	EW
HMS Scott	NO	HM Officer	HM JR
SVHO	NO	HM Officer	HM JR
Hunt Class	NO	POMW	MW
Sandown Class	NO	POMW	MW
RFA	OPS OFFICER	OPS OFFICER	OPS OFFICER

Platform classes that are not identified in the table above are to be capable of sending CBRN contact reports iaw ATP45

0318. Navigating Officer (NO)

Although not required to operate BRACIS in FF/DD and above the NO will continue to be trained in manual plotting. For MM/PP and RFA the Navigating Officer will remain the prime user of the BRACIS software package in support of the Command

0319. Damage Control Officer (Electrical) (DCO(L))

a. These ToRs are applicable to a suitably qualified and authorised, warrant Officer or senior rate assigned the role of Damage Control Officer (Electrical) (DCO(L)). This role is normally undertaken by a nominated ME rating, however in some vessels it may be supplemented by other personnel where appropriate. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role. The DCO(L) is normally stationed in the SCC when Damage Control State 1 is ordered.

b. **Training Requirement.** CBRNDC 15. (Prop Man/DCO(L) course).

c. **Purpose.** The DCO(L) is responsible for the integrity of the electrical power system and converted supplies. Their team must quickly build an accurate picture of damage to electrical services and the effect on key systems. DCO(L) then directs the electrical and switchboard teams in their repair efforts. The DCO(L) has a key liaison function, to the WSB and inter-desk within HQ1.

d. **Superiors.** The DCO(L) is responsible to the IBC.

e. **Authority**

(1) The DCO(L) has authority over switchboard teams.

(2) The DCO(L) is authorised to liaise with the Weapon Section Base personnel.

f. **Key Tasks**

(1) Control of the main electrical distribution system and converted supplies, keeping the MEO informed of the current state, limitations and implications of damage repair actions.

(2) Compilation of the damage 'picture' of electrical losses gathered from feedback from 'L' DC teams and WSB reports.

(3) Advising the Propulsion Manager of any electrical problems affecting machinery.

(4) Advising the DCO of any electrical problems affecting the Damage Control efforts under their control.

(5) Maintaining close liaison with the WSB with regards to providing power supplies to weapons and sensors, together with any mechanical problems highlighted by the PM.

(6) Interrogation of the main incident board for incidents that may affect integrity of power supplies or restoration of power supplies.

(7) Ensuring electrical incidents are plotted on the main incident board.

(8) Investigation of electrical defects and implementation of emergency cable runs and electrical repairs in accordance with the Command Aim.

0320. The Propulsion Manager (Prop Man)

a. These ToRs are applicable to a suitably qualified and authorised, Warrant Officer or Senior Rate assigned the role of Propulsion Manager (Prop Man). This role is normally undertaken by a nominated ME rating, however in some vessels it may be supplemented by other personnel where appropriate The BRd 2170 Volume 7 series will detail what UEL positions conduct this role. The Prop Man is normally stationed in the SCC when Damage Control State 1 is ordered.

b. **Training Requirements.** CBRNDC 15. (Prop Man/DCO(L) course).

c. **Purpose.** The Prop Man is responsible for ensuring propulsion and key ships systems are available to the Command by overseeing the actions of watchkeepers and machinery space crews and directing the actions of the Mobile Repair Party (MRP). The Prop Man coordinates the reactions to damage of the propulsion plant and then directs repair efforts to deliver the return of propulsion to the Command in accordance with the priorities set for him by the IBC.

d. **Superiors.** The Prop Man is responsible to the IBC.

e. **Authority**

The Prop Man has authority over:

(1) The engineering watchkeepers.

(2) The mobile repair party.

(3) The machinery space crews.

f. **Key Tasks**

(1) Informing the MEO of damage and limitations affecting the propulsion plant and key mechanical systems and providing an Estimated Time Back On Line (ETBOL) all losses.

(2) Coordinating the reaction to damage to the propulsion plant in accordance with the priorities set by the MEO.

(3) Supervision of the SCC watch and machinery space crews.

(4) Directing the actions of the Mobile Repair Party.

(5) Maintaining a close liaison with the DCO and DCO(L) ensuring the implications of fires, damage and electrical losses on the propulsion plant are understood.

(6) Ensuring incidents in machinery spaces are recorded on the main incident board.

(7) Managing the reconfiguration and repair to mechanical systems.

0321. Hull Section Officer

a. These ToRs are applicable to a suitably qualified and authorised Officer, Warrant Officer or Senior Rate assigned the role of Hull Section Officer. This role is normally undertaken by a nominated ME rating, however in some vessels it may be borne by appointment or satisfied by other personnel where appropriate. The BRd 2170 Volume 7 series will detail which UEL positions conduct this role. The Hull Section Officer is normally stationed in the SCC when Damage Control State 1 is ordered.

b. **Associated publication.** BRd 3000.

c. **Purpose.** The Hull Section Officer is the ships structural specialist. In circumstance of high Damage Control risk, their place of duty is normally HQ1.

d. **Superiors.** The Hull Section Officer is responsible to the MEO.

e. **Tasks**

(1) Delivery of training of all DC personnel in the care and maintenance of watertight openings, leak stopping and shoring.

(2) The distribution and maintenance of all materials for structural repair.

(3) Maintenance of hull structure, fittings and systems.

0322. Main Incident Board Operator (IBO)

a. These ToRs are applicable to a suitably qualified and authorised, rating assigned the role of the Main Incident board operator. The Main IBO is normally stationed in the SCC during Damage Control State 1 or 3 incidents. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role.

b. **Training Requirements**

(1) CBRNDC 7, (Incident Board Operator).

(2) CBRNDC 7a, (T45 DSAC Operator Course).

(3) CBRNDC 7b, (QEC PMS Operator Course).

c. **Purpose.** The Main Incident Board Operator assists the DCO by taking charge of the communications network and managing the FRPP IBOs following up information that is missing and bringing important information to the DCO.

d. **Superiors.** The Main IBO is accountable to the DCO.

e. **Authority.** The Main IBO has authority over all other incident board operators.

f. **Tasks**

(1) Establishing and marking the scenes of incidents and associated information iaw the incident board marking guide.

(2) Maintaining incident narrative during state 3 incidents.

(3) Controlling the CBRNDC communications net and following up missing information.

(4) Drawing the DCO’s attention to new incidents.

(5) Identifying hazards particularly around primary boundaries and drawing it to the attention of the DCO.

0323. Officer of the Watch (OOW)

In a CBRN environment the OOW provides information on visual observations, current weather and temperature, current navigational hazards, course, speed etc. The OOW, and their lookouts may also be able to provide visual clues in a developing CBRN ROE situation, such as visual evidence of spray tanks fitted on aircraft etc. The Bridge Team are also able to monitor chemical detector papers and radiological instruments on the Upperdeck for indications of contamination. They can confirm coverage of some areas of prewetting. The OOW also initiates the main broadcast chemical alarm in accordance with the Chemical Safety Rule.

0324. Officer of the Day (OOD)

These CBRNDC responsibilities are applicable to a Royal Naval Officer appointed to undertake the duties of the Officer of the Day (OOD) in a ship owned or chartered by the Ministry of Defence (Navy).

a. **Associated Publications and References**

(1) BRd 2 chapter 30.

(2) BRd 9467 Chapter 9.

(3) BRd 9600 para 1304.

b. **Training Requirements.** CBRNDC 5 (OOD Course).

c. **Purpose.** To ensure the safety of the ship.

d. **Superiors.** The OOD is accountable to the Commanding Officer.

e. **Authority.** The OOD has authority over every Officer and all Ratings except the Commanding Officer, Executive Officer and Damage Control Officer (when detailed), regarding the performance of the damage control duties with which they are charged.

f. **Tasks**

(1) All Officers and Senior Rates in the OOD roster must be capable of undertaking the following damage control related tasks:

(2) Responsibility for the safety and security of the ship and the Ship's Company in harbour.

(3) Being aware of all hazardous activities being undertaken in the ship.

(4) Controlling the routine tasks of the Duty Watch/Harbour Fire and Emergency Party (HFEP).

(5) Commanding the HFEP during emergencies, whilst assessing the situation and establishing control.

(6) Directing the activities of all emergency parties and specialist personnel.

(7) Clearing ship of all other personnel if necessary and directing them to supplement the HFEP as required.

(8) Liaising with all outside authorities and integrating any offered support with the activities of the HFEP, eg Fire Rescue Service (FRS).

(9) Responding to external incidents in accordance with local orders, e.g. PORTSAFE.

(10) Providing NLIMS fire and flood follow up reports following incidents, consulting or recalling other ships Officers as required.

(11) Ensuring that a narrative of events is kept during incidents.

(12) Conducting Duty Watch safety training in accordance with the Harbour Watch Training Log.

(13) Responding to a CBRN incident in harbour. In the first instance this is likely to involve closing screen doors and hatches, minimising exposed personnel, and deploying sense equipment and IPE. BR2170 Vol(2) contains further advice.

0325. Officer in Charge of the Weapons Section Base (OiCWSB)

a. These ToRs are applicable to a suitably qualified and authorised, Officer, Warrant Officer or Senior Rating assigned the role of the Officer in Charge of the Weapons Section Base (OiCWSB). And are supplementary to any other high level TORS written for this role. The OiC WSB is normally the DWEO but may be an Officer or senior rating nominated by the WEO or senior engineering Officer. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role.

b. **Purpose.** The OiC WSB coordinates and directs the weapon repair teams dispersed at strategic locations throughout the ship. The OiC WSB is assisted in the WSB by a small team normally including the Sensors WE Senior Rate, Weapons WE Senior Rate and the WE Manpower coordinator.

c. **Superiors.** The OiC WSB is accountable to the Command Advisor.

d. **Authority.** The OiC WSB has authority of the weapons repair teams and will liaise with the DCO(L).

e. **Tasks.** Compile and validate the weapon and sensor damage picture for the Command Advisor. Monitor the extent of ongoing incidents and organise efforts to assist establishment of fire and flood boundaries. To monitor the Command Open Line to keep abreast of the tactical situation.

0326. CBRN Protection Officer (CBRNPO)

a. These ToRs are applicable to a suitably qualified and authorised, Officer, warrant Officer or senior rating assigned the role of the CBRNPO. The CBRN Protection Officer is normally the DWEO but may be any suitably qualified Officer or senior rating nominated by the WEO or senior engineering Officer. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role. Detailed guidance on managing a CBRN threat is contained in BR2170 Vol (2). When the CBRN threat is assessed as 'Low', CBRNPO will be in charge of the Weapon Section Base (WSB). When it rises to 'Medium', 'Significant, or 'High' CBRNPO will be stationed in HQ1, so that they can liaise directly with the IBC and DCO.

b. **Training Requirements.** CBRNDC 8 (Protection Officer).

c. **Purpose.** The CBRN Protection Officer provides guidance to the command of the characteristics and effects of CBRN materials and incidents and provides advice relating to the capabilities and limitations of the platform when reacting to a CBRN/Toxic Industrial Material (TIM) incident.

d. **Superiors.** The CBRNPO is accountable to the Command Advisor.

e. **Authority.** The CBRNPO has authority over the CBRN Protection Officers Assistant and the CBRN Monitoring and Decontamination teams. They will also liaise with the Command Team.

f. **Tasks**

(1) Advising the Command on all CBRN Defence matters and incidents and recommending responses and reactions to them.

(2) Assisting the PWO in the interpretation of CBRN related intelligence.

(3) Assisting the warning and reporting organisation in the interpretation CBRN (ATP 45/BRACIS) reports.

(4) Advising the Command, of the appropriate CBRN protection measures.

(5) Advising the Command of monitoring and decontamination procedures and directing the activities of the CBRN Monitoring, Decontamination and Cleansing Station Teams.

(6) Advising the Command of the CBRN risk-taking philosophy.

(7) Supervising the CBRNPO's Assistant (CBRNPOA) and informing them of the Command aim.

(8) Supervising the WSQ for the delivery of Training and exercising the CBRN Monitoring and decontamination Teams.

(9) The production and amendments of the CBRN Protection sections of the ships CBRN Orders.

(10) Advising the Command on CBRN hazard management considerations.

(11) Liaising with DSTL CBRN reach back when authorised to do so.

0327. CBRN Protection Officer's Assistant (CBRNPOA)

a. These ToRs are applicable to a suitably qualified and authorised, Officer, warrant Officer or senior rating assigned the role of the CBRNPOA. The CBRNPO's Assistant is normally a WE senior rating but may be any suitable qualified and experienced Officer or rating. The BRd 2170 Volume 7 series will detail what UEL positions conduct this role. Detailed guidance on managing a CBRN threat is contained in BR2170 Vol (2) CBRNPOA is stationed in HQ1 and supervises the CBRN Monitoring and Decontamination Teams, Cleansing Station Crews, and citadel Airlock Sentries.

b. **Training Requirements.** CBRNDC 8 (Protection Officer).

c. **Purpose.** The CBRNPOA provide CBRN advice and assistance to the CBRN Protection Officer in the delivery of their Duties as the CBRN Protection Officer.

d. **Superiors.** The CBRNPOA is accountable to the Protection Officer

e. **Authority.** The CBRNPOA has authority over the CBRN Monitoring and Decontamination teams. They will also liaise with the SCC team.

f. **Tasks**

(1) Reporting CBRN incidents including alarms, detection, monitoring and decontamination results.

(2) Administering CBRN record keeping.

(3) Assisting in the delivery of CBRN training to Monitoring and Decontamination Teams.

(4) Tasking of ships CBRN Monitoring and decontamination teams.

(5) Tasking airlock sentries when employed.

(6) Providing CBRN advice to the IBC and DCO in the SCC.

(7) Controlling the custody and maintenance of CBRN detection and monitoring equipment for which they are responsible.

(8) When the CBRNPO is stationed at the WSB, the CBRNPOA keeps in contact with him by telephone. They maintain the following records for the CBRNPO:

(a) CBRNPO's Incident Board.

(b) Chemical State Board.

(c) Total Dose Record Board and/or Individual ADM.

(d) Citadel In/Out Log.

0328. I/C Fire and Repair Party Post(FRPP)/Zone Control Party (ZCP)

a. These ToRs are applicable to an Officer, Warrant Officer or senior rate assigned the role of I/C FRPP or zone control party I/C ZCP and are supplementary to any other instructions written for this role. The BRd 2170 Volume 7 series will detail any additional information that is relevant to this role including any differences in methodology or terminology.

b. **Training Requirements**

(1) CBRNDC 11 (FRPP Team Leader Course).

OR

(2) CBRNDC 11a (ZCP Team Leader Course).

c. **Purpose.** The I/C FRPP directs the team of personnel employed at the fire repair party post when responding to incidents. Information will be passed to the DCO to enable to the command team to prioritise incidents and set incident boundaries.

d. **Superiors.** The I/C FRPP is accountable to the DCO.

e. **Authority.** The I/C FRPP has authority over the personnel at their FRPP or ZCP.

f. **Tasks**

(1) Ensure the Manning of their FRPP is in accordance with the Watch and Station Bill.

(2) Ensuring the FRPP is equipped in accordance with the equipment schedule BRd 2170(3) and BRd 2170 Volume 7 series.

(3) Ensuring FRPP document packs are maintained in a serviceable material condition and up to date in accordance with the platforms FRPP document inventory.

(4) Acknowledging the Command Aim, threat warnings and allocated priorities to shape the way incidents within the Section are managed.

(5) Directing incident response from the FRPP, by managing personnel, equipment, fixed firefighting systems and HPSW, seeking authorisation from HQ1 where required.

(6) Controlling the quality of information received and transmitted and questioning the accuracy of information and messages when suspect.

(7) Early consideration of incident smoke clearance in collaboration with the DCO.

(8) Ensuring damage control equipment after use maintenance and checks are conducted on completion of use and prior to re stowing.

(9) Managing the welfare of FRPP personnel during and on completion of incidents.

(10) Restoration and maintenance of the state 1 posture.

SECTION 3 – CBRN AND DAMAGE CONTROL TEAMS

0329. The Bridge Team

a. These responsibilities are applicable to all personnel employed as part of the bridge team and are supplementary to any other instructions written for this role. The BRd 2170 Volume 7 series will detail any additional CBRNDC information that is relevant to this role.

b. **Purpose.** The Bridge team is responsible for the maintenance of navigational safety at all damage control states.

c. **Superiors.** The bridge team is accountable to the Command

d. **Authority.** The bridge team will liaise with the Command Advisor and the IBC

e. **Tasks**

(1) Reacting to damage incidents to maintain navigational safety.

(2) Initiate Mini-SOCs and provide reports to the Weapon Section Base.

(3) Maintaining a running tote of defects affecting navigation.

(4) Liaising with the SCC to ensure the command aim is maintained.

0330. The Fire and Repair Party

a. These ToRs are applicable to any Officer, Warrant Officer or rating assigned to the role of FRP Team Member. The BRd 2170 Volume 7 series will provide detailed information regarding the composition of personnel and allocation of duties of the FRPP's.

b. **Purpose.** The FRP responds to incidents as directed by the I/C FRPP.

c. **Superiors**. The FRP personnel are accountable to the I/C FRPP.

d. **Tasks**

(1) Responding to incidents as directed by the I/C FRPP.

(2) Conducting damage control patrols.

(3) Providing accurate incident information to the I/C FRPP.

(4) Conducting after use maintenance ad checks on damage control equipment when no longer required at the scene of the incident.

(5) Returning all damage control equipment to its stowage's when no longer required.

0331. Mobile Repair Party (MRP)

a. These ToRs are applicable to any Officer, Warrant Officer or rating assigned to the role of MRP Team Member. The MRP will normally lead by a suitably qualified, authorised, and competent Senior rating. The BRd 2170 Volume 7 series will provide detailed information regarding the composition of the MRP and allocation of duties.

b. **Training Requirements.** CBRNDC 29 (LET(ME) QC CBRNDC Course)

c. **Purpose.** The primary objective of the MRP is provide assistance and expertise to the main machinery space teams or other incidents by providing specialist knowledge, equipment or stores.

d. **Superiors.** The MRP is accountable to the Prop Man.

e. **Tasks**

(1) Provide assistance and expertise to the MMS Action Crews.

(2) Provide assistance expertise to incidents remote from MMS as directed by the IBC.

(3) All personnel allocated to the MRP are to be trained in the use of all specialist equipment that is available to them.

(4) Conduct regular continuation training in the application and use of specialist equipment including associated repair techniques.

(5) Conduct regular ship and system knowledge and damage control procedures continuation training.

(6) Conduct all Pre and Post use checks in the specialist equipment used in the application of their duties.

(7) Ensure all specialist equipment is mustered and stowed in accordance with the relevant instructions on completion of use.

0332. Monitoring Teams Internal and External

Monitoring teams should consist of a Monitor to take readings, and a Recorder to record, report, and mark hot spots, etc. Teams should be selected from Damage Control parties, quarter's crews, and personnel in machinery spaces and, where possible, should be assigned to locations they are familiar with or are normally responsible for. As many teams as possible should be trained to provide adequate reliefs, quick/efficient coverage and to minimise individual exposure.

a. **Internal (trained by CBRNDC organisation)**

(1) When there is a possibility of contamination entering the citadel it will be necessary to conduct detailed monitoring of the interior of the ship. In these cases priority should begiven to the citadel boundaries, especially near damage, at cleansing stations, at the entrances to machinery spaces, etc.

(2) Internal monitoring teams will ensure the effectiveness on the AFUs and sub citadels.

(3) As a minimum they must be trained in the use of IPE and GSR as well as the RVD one- and two-man sniff test. They must understand routes they have been given and are normally be made up of personnel taken from the FRPP or ZCP.

b. **External Training - CBRNDC 14. (Consideration should also be given to the training detailed in BR2170 Vol (2) and BR9274)**

(1) Monitoring Teams will be among the first to be exposed to the ship's contamination. They must be well trained in all aspects of monitoring procedures including the following:

(a) They are to be familiar with the full range of instruments appropriate to the Contamination how to use them and to test them before use.

(b) To understand the readings on the equipment used for example be aware of the Maximum Permissible Dose (MPD) in force for a Radiological hazard.

(2) They are to be fully briefed on the types of hazards that may be present and the risks these present, as well as the layout of the vessel, communications and actions to be taken in the event of an emergency.

(3) They must be trained in the wearing of IPE & GSR, all drills required to use the GSR as well as undressing and cleansing procedures.

(4) Each Monitoring Team should have 3 personnel, wearing IPE:

(a) A Monitor, with the monitoring instrument.

(b) A Recorder, with deck plans and documentation for records.

(c) An Assistant, to carry additional equipment, and to mark contaminated and contamination-free areas.

(5) Each monitoring team is to be allocated to a particular area of the ship. For DD/FF size ships, 4 areas are appropriate: for example.

(a) Upper deck structure and fittings.

(b) Ship's sides and underwater structure.

(c) Machinery systems, equipment and compartments subjected to airborne and waterborne contamination.

(d) All other compartments and spaces below decks.

0333. Decontamination Teams (CBRNDC 14 Qualified) Operational Tasks

As with monitoring, the task of decontamination is most effectively accomplished by the users of the equipment. They are more aware of the parts of the equipment that they will need to handle and they have a personal interest in the efficiency of the process. In addition, the users of the equipment are also likely to have been exposed at the time of the attack (ie weapons crews), and to make use of them for decontamination reduces the number of personnel involved in the process and, subsequently, lessens the loading on the cleansing station(s). In a nuclear situation, however, the need to spread the radiation dose evenly among a Ship's Company may require the employment of previously shielded personnel.

a. Decontamination Teams will be exposed to the ship's contamination. They must be well trained in all aspects of decontamination procedures including the following:

(1) They are to be familiar with the full range of instruments appropriate to the Contamination how to use them and to test them before use. To understand the readings on the equipment used for example be aware of the Maximum Permissible Dose (MPD) in force for a Radiological hazard.

(2) They are to be fully briefed on the types of hazards, that may be present and the risks these present, as well as the layout of the vessel, communications and actions to be taken in the event of an emergency.

(3) They must be trained in the wearing of IPE & GSR, all drills required to use the GSR as well as undressing and cleansing procedures.

b. Each decontamination Team should have a minimum of personnel, wearing IPE: to carry out the decontamination required dependent on task.

0334 Cleansing Station Teams (CBRNDC 14A Qualified)

Cleansing is a naval term for personal CBRN decontamination, whereas the term decontamination also refers to the removal of CBRN contamination from structure, fittings, equipment and casualties. When a ship is in a CBRN environment, personnel who have been exposed to contamination, enter the citadel via a cleansing station where they undergo an undressing and cleansing routine. To ensure efficiency, this process is carried out by trained Cleansing Station Teams

a. Cleansing Station Teams will be among the first to be exposed to the ship's contamination. They must be well trained in all aspects of cleansing stations procedures including the following:

(1) They are to be familiar with the full range of instruments required in the Cleansing Station for the Contamination how to use them and to test them before use.

(2) To understand the readings on the equipment used and the background readings

(3) They must be trained in the wearing of IPE & GSR, all drills required to use the GSR as well as undressing and cleansing procedures.

(4) To be trained and understand each type of undressing in the cleansing station as detailed in BR 2170(2)

(5) To understand the theory of decontamination and the movement of hazards as well as how to setup and operate a DDL IAW JSP 925 for mass decontamination

(6) Each Cleansing Station Team should have 2 or 3 personnel depending on platform size.

0335 Airlock Sentries (trained by CBRNDC organisation)

INSTRUCTIONS FOR CITADEL AIRLOCK SENTRIES

a. In Condition ALFA, each citadel airlock is to have a sentry posted. The following generic instructions for airlock sentries are to be adapted, where necessary, to suit an individual ships layout.

b. **Tasks.**
The tasks of the sentry are:

(1) Ensure that incorrect opening of the airlock does not compromise the integrity of the citadel. Only one door may be opened at any time.

(2) Provide details of personnel passing in or out or the airlock to the CBRNPO.

c. **Dress and Equipment.** The sentry is to be in the same CBRN Dress State as the Minimum Effective Crews on the Upperdeck (including one-colour detector papers).

d. **Position.** The sentry is to be stationed in the airlock (ie between the inner and outer doors).

e. **Communications.** The sentry is to have a communication link with the CBRNPO in HQ1. A means of communicating with personnel on the Upperdeck outside the airlock door is to be established; where there is no installed system this may have to be by radio or an agreed system of knocking on the door.

f. **Use of an Airlock.** Sentries are to be given instructions for their individual airlocks by the CBRN Protection Officer.

g. **Relief of Sentries.** The provision of reliefs for sentries is to follow the principles in Para 1006. This means that, in a contaminated environment, the relieved sentry must exit to the Upperdeck and re-enter via the cleansing station.

0336. Pre-Shelter Party (trained by CBRNDC organisation)

In preparation for shelter stations the Pre-Shelter Party will be activated by the order **“PRE-SHELTER PARTY CLOSE UP”**. The Pre-Shelter Party is responsible for preparing the shelter routes by removing all clips, except two, on the selected doors and hatches on the shelter routes. In addition, they will verify that all doors and hatches are properly closed when all personnel have passed through.

SECTION 4 - CBRNDC TRAINING ORGANISATION

0337. Whole Ship CBRNDC Q (WSQ)

a. These responsibilities are applicable to any Warrant Officer or Senior Rate appointed to the Position of the WSQ or when no WSQ is Borne any Senior rating delegated to undertake the responsibilities of the WSQ. The WSQ coordinates and manages the whole ship CBRNDC organisation and training routines.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS.

(3) Previously held position of departmental CBRNDC Q.

c. **Authority and Accountability**

(1) The WSQ is accountable to the head of the CBRNDC organisation (XO or CBRNDCO).

(2) The WSQ has functional authority over departmental CBRNDC Q for coordinating specific CBRNDC activities across departments.

(3) The WSQ has the authority to delegate CBRNDC tasks to departmental CBRNDC Q.

d. **Tasks**

(1) Coordinating Departmental CBRNDCQ planning whole ship CBRNDCQ meetings.

(2) Liaising with the XO/CBRNDCO and external authorities to ensure CBRNDC training serials are included in the ships short and medium programme.

(3) In conjunction with other CBRNDCQs, to arrange training in general CBRNDC responsibilities and for advancement training to the higher rate.

(4) To coordinate the writing and amendment of CBRNDC Orders.

(5) Collate and propose amendments to Chapter 15 of Ships General Orders.

(6) Assist in the preparation and execution of fire exercises, ensuring that CBRNDCQs are available for HOD covered fire exercises.

(7) Ensuring the FRPP lockers are mustered at least once per week or after major CBRNDC exercises and discrepancies made good.

(8) Ensuring that all EDBA are checked iaw Chapter 21 and the checks recorded in the Weekly EDBA Log.

(9) Examine the HQ1 Watchkeepers to a syllabus approved by the MEO before they may stand watches on their own.

(10) To ensure that all relevant CBRN and Damage Control directives are disseminated to the Ship's Company and any actions required by them are actioned.

(11) Administration of the Master CBRN and Damage Control Training and Material Assessment Log (see BRd 2170 Annex 27A).

0338. Marine Engineering Department CBRNDC Q

a. These responsibilities are applicable to any suitably qualified and authorised rating undertaking the role of the Departmental Q of the ME department.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On Job Training under the supervision of the WSQ.

c. **Purpose.** The ME departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the ME Department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The ME departmental CBRNDC Q is accountable to the MEO and the WSQ.

(2) The ME departmental CBRNDC Q has authority over all ME department personnel in the delivery of these terms of reference.

(3) The ME department CBRNDC Q Should liaise with other departmental Q in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) To ensure that the recommended CBRN and Damage Control practices are adhered to (i.e. tidy living, correct stowage of equipment, maintenance of markings and fittings etc).

(2) Train ratings in the delivery of CBRN and Damage Control tasks.

(3) Assist with general and advancement training in that department.

(4) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(5) To assist in the writing and amending of CBRNDC Orders.

(6) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(7) To inform the MEO of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(8) To be conversant with BRd 2170(3) and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(9) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(10) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(11) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the Warfare Branch CBRNDCQ, in their capacity as overall Survival and Damage Control Training Coordinator, informed of training intentions.

(12) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

(13) Under the direction of the MEO, the ME Department CBRNDCQ is to coordinate the organisation and training of fire and repair and Damage Control personnel and the instruction of the whole Ship's Company in firefighting measures.

0339. Weapon Engineering Department CBRNDC Q

a. These responsibilities are applicable to any suitably qualified and authorised rating undertaking the role of the Departmental Q of the WE department. Where the WE Department CBRNDC Q is qualified and authorised, they will normally undertake the role of the CBRN Protection Officers Assistant (CBRN PROTOA).

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On Job Training under the supervision of the WSQ.

c. **Purpose.** The WE departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the WE Department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The WE departmental CBRNDC Q is accountable to the WEO and the WSQ.

(2) The WE departmental CBRNDC Q has authority over all WE department personnel in the delivery of these terms of reference.

(3) The WE department CBRNDC Q should liaise with other departmental Qs in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) To ensure that the recommended CBRN and Damage Control practices are adhered to. (i.e. tidy living, correct stowage of equipment, maintenance of markings and fittings, etc).

(2) Train ratings in the delivery of CBRN and Damage Control tasks.

(3) Assist with general and advancement training in that department.

(4) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(5) To assist in the writing and amending of CBRNDC Orders.

(6) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(7) To inform the MEO of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(8) To be conversant with BRd 2170(3) and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(9) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(10) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(11) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the Warfare Branch CBRNDCQ, in their capacity as overall Survival and Damage Control Training Coordinator, informed of training intentions.

(12) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

0340. Warfare Department CBRNDC Q

a. These responsibilities are applicable any suitably qualified and authorised rating undertaking the role of the departmental Q of the Warfare department.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On Job Training under the supervision of the WSQ.

c. **Purpose.** The Warfare departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the Warfare Department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The Warfare departmental CBRNDC Q is accountable to the XO and the WSQ.

(2) The Warfare departmental CBRNDC Q has authority over all Warfare department personnel in the delivery of these terms of reference.

(3) The Warfare department CBRNDC Q Should liaise with other departmental Q in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) To ensure that the recommended CBRN and Damage Control practices are adhered to. (i.e. tidy living, correct stowage of equipment, maintenance of markings and fittings, etc).

(2) Train ratings in the delivery of CBRN and Damage Control tasks.

(3) Assist with general and advancement training in that department.

(4) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(5) To assist in the writing and amending of CBRNDC Orders.

(6) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(7) To inform the MEO of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(8) To be conversant with BRd 2170(3) and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(9) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(10) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(11) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the Warfare Branch CBRNDCQ, in their capacity as overall Survival and Damage Control Training Coordinator, informed of training intentions.

(12) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

0341. Logistics Department CBRNDC Q

a. These responsibilities are applicable any suitably qualified and authorised rating undertaking the role of the departmental Q of the Logistics department.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On Job Training under the supervision of the WSQ.

c. **Purpose.** The Logistics departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the Logistics Department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The Logistics departmental CBRNDC Q is accountable to the Logistics Officer and the WSQ.

(2) The Logistics departmental CBRNDC Q has authority over all Logistics department personnel in the delivery of these terms of reference.

(3) The Logistics department CBRNDC Q Should liaise with other departmental Q in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) To ensure that the recommended CBRN and Damage Control practices are adhered to. (i.e., tidy living, correct stowage of equipment, maintenance of markings and fittings, etc).

(2) Train ratings in the delivery of CBRN and Damage Control tasks.

(3) Assist with general and advancement training in that department.

(4) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(5) To assist in the writing and amending of CBRNDC Orders.

(6) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(7) To inform the logistics Officer of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(8) To be conversant with BRd 2170(3) - Damage Control Stores Catalogue for HM Surface Ships, HM Submarines and RFA and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(9) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(10) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(11) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the WSQ informed of training intentions.

(12) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

(13) Delivery of training to personnel identified to operate the Cleansing Station.

(14) Delivery of CBRN training iaw MATT4.

(15) To retain custody of all CBRN IPE CBRN collective equipment stores (respirators, suits etc) except those in the specific charge of the CPOET(WE) or medical staff.

(16) To assist in coordination of Action First Aid Parties' training.

0342. Air Department CBRNDC Q

a. These responsibilities are applicable any suitably qualified and authorised rating undertaking the role of the departmental Q of the Air department.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On job training under the supervision of the WSQ.

c. **Purpose.** The Air departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the Air department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The Air departmental CBRNDC Q is accountable to the head of the Air department and the WSQ.

(2) The Air departmental CBRNDC Q has authority over all Air department personnel in the delivery of these terms of reference.

(3) The Air department CBRNDC Q Should liaise with other departmental Q in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) The Air Department CBRNDCQ is to be the lead trainer for Flight Deck incidents.

(2) To ensure that the recommended CBRN and Damage Control practices are adhered to. (i.e. tidy living, correct stowage of equipment, maintenance of markings and fittings, etc).

(3) Train ratings in the delivery of CBRN and Damage Control tasks.

(4) Assist with general and advancement training in that department.

(5) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(6) To assist in the writing and amending of CBRNDC Orders.

(7) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(8) To inform the head of the air department of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(9) To be conversant with BRd 2170(3) - Damage Control Stores Catalogue for HM Surface Ships, HM Submarines and RFA and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(10) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(11) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(12) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the WSQ informed of training intentions.

(13) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

0343. Air Engineering Department CBRNDC Q

a. These responsibilities are applicable any suitably qualified and authorised rating undertaking the role of the departmental Q of the Air department where ships have a dedicated Air Engineering Department.

b. **Training Requirements**

(1) Completed CBRNDC 35 or 35R Course and have the competency recorded on JPA.

(2) Completed CBRNDC On Job Training and achieved OPS or conducting On Job Training under the supervision of the WSQ.

c. **Purpose**: The Air engineering departmental CBRNDC Q coordinates and manages the CBRNDC organisation, training routines and equipment maintenance within the Air engineering Department and departmental allocated spaces.

d. **Authority, Accountability and Liaison**

(1) The Air engineering departmental CBRNDC Q is accountable to the head of the air engineering department and the WSQ.

(2) The air engineering departmental CBRNDC Q has authority over all air engineering department personnel in the delivery of these terms of reference.

(3) The air engineering department CBRNDC Q Should liaise with other departmental Q in the coordination and delivery of cross department CBRNDC training.

e. **Tasks**

(1) The Air engineering Department CBRNDCQ is to be the lead trainer for hanger incidents to ensure that the recommended CBRNDC practices are adhered to. (i.e. tidy living, correct stowage of equipment, maintenance of markings and fittings, etc).

(2) Train ratings in the delivery of CBRN and Damage Control tasks and assist with advancement training in that department.

(4) To undertake specific instruction aspects of Damage Control as directed by the Damage Control Officer (DCO) or their HOD.

(5) To assist in the writing and amending of CBRNDC Orders.

(6) To provide inputs to the CBRNDC Master Training and Material Assessment Log and to bring attention to any amendments that should be made to the CBRNDC Class Book (CB 4538 series).

(7) To inform the head of the air department of shortcomings in the CBRN and Damage Control organisation, the CBRN and Damage Control Watch and Station Bill, and in CBRN and Damage Control material standards.

(8) To be conversant with BRd 2170(3) and to ensure the outfit of stores for which the department is responsible is under constant review, so that the correct stocks are held, and replacements demanded as necessary.

(9) To arrange instruction and exercises for those ratings detailed as plotters and communication numbers in the CBRN and Damage Control organisation, in conjunction with other CBRNDCQs as appropriate.

(10) To coordinate and, where appropriate, conduct training in delegated departmental CBRN and Damage Control and survival topics including those for which the department has a whole-ship training responsibility.

(11) To liaise closely with other departmental CBRNDCQs and departmental coordinators and to keep the WSQ informed of training intentions.

(12) To assist as necessary with coordination of whole ship Damage Control training commitments and exercises.

CHAPTER 4

SHIP STRUCTURE AND LOCATION MARKINGS

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CHAPTER 4

SHIP STRUCTURE AND LOCATION MARKINGS

SECTION 1 - SHIP STRUCTURE

0401. General

The greater part of a warships structure is steel plating, welded and held to shape by steel frames, beams and longitudinals. The structure, whether steel or GRP is designed to provide:

a. Strength to withstand all the forces acting on the ship under all conditions of service.

b. Buoyancy and stability.

c. Space, protection and accommodation for machinery, stores, equipment and personnel.

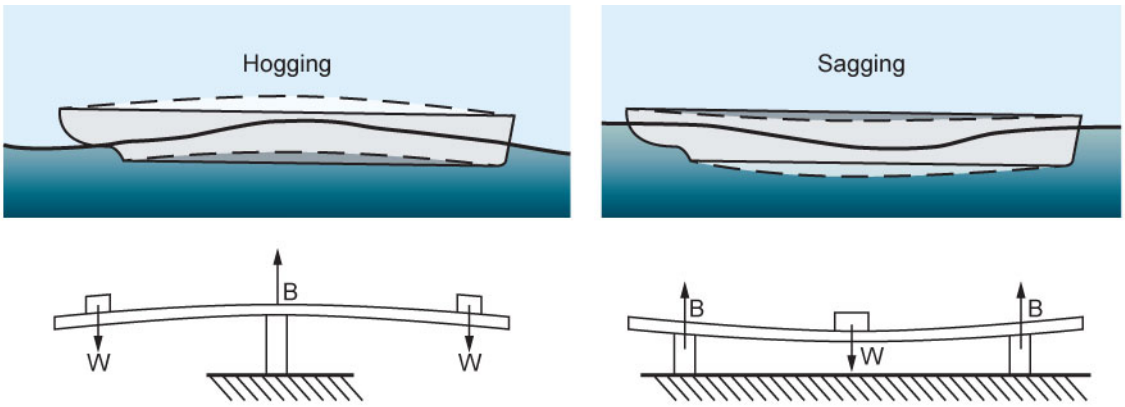
d. Habitability under all conditions of service.

0402. Stresses In Service

The most important stresses met in service by warships are:

a. **Longitudinal.** Stresses in the fore and aft line are caused by the variation in the buoyant forces acting on the ship as a result of the wave action along its length. These cause conditions known as ‘hogging’ and ‘sagging’ (see Figure 4-1). The greatest stresses occur in the topmost continuous deck (usually 1 Deck), the vertical and flat keels and the adjoining strakes of plating (garboard strakes) together with the topmost strakes of shipside plating (sheer strake). The bending stresses are usually greatest in the middle of the ships length.

Figure 4-1. Hogging and Sagging

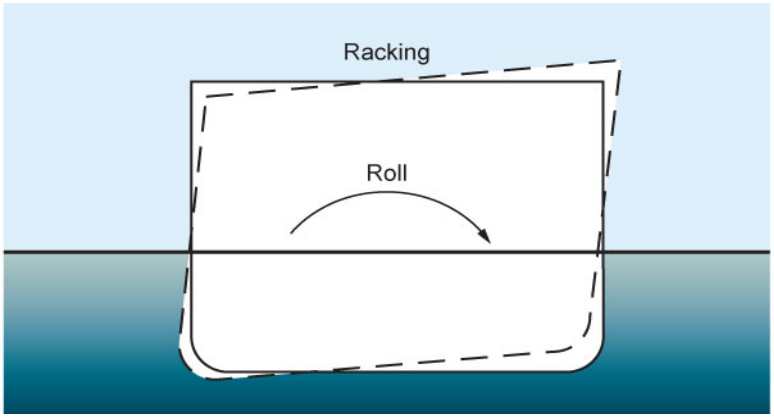


B = Buoyancy **W = Weight**

b. **Racking.** Heavy rolling causes stresses which tend to alter the transverse shape of the ship (Figure 4-2) and are resisted by the main transverse bulkheads and framing.

c. **Local**. Local stresses are imposed by heavy weights eg machinery, weapons, etc, by propeller thrust, the firing of weapons, the landing and movement of aircraft, berthing and docking.

Figure 4-2. Racking



All these stresses are accentuated if the ship is structurally damaged or subject to shock or whip (see Chapter 2).

0403. CBRN and Damage Control (CBRNDC) Design Aspects

There are many features of CBRNDC that influence, or are influenced by, ship design and layout. Among the more important are:

a. Watertight, and gastight, subdivision, openings and fittings.

b. Structural protection and the thickness of plating.

c. Dispersal, siting and layout of equipment, systems and power supplies, and the arrangements for isolation, duplication, and resistance to shock.

d. Ventilation, air-conditioning and air-filtration systems.

e. Nuclear ‘hardening’ of certain electrical systems.

f. Chemical hardening of exposed structure and equipment.

0404. Zoning

Certain RN ships and RFAs incorporate a CBRNDC zoning system. The principles of this system are:

a. Zone end boundaries are coincident with main watertight bulkheads to No 1 Deck and continued up through the superstructure as fire barrier bulkheads.

b. The combined length of any two adjacent zones is not less than 30% nor more than 50% of the waterline length.

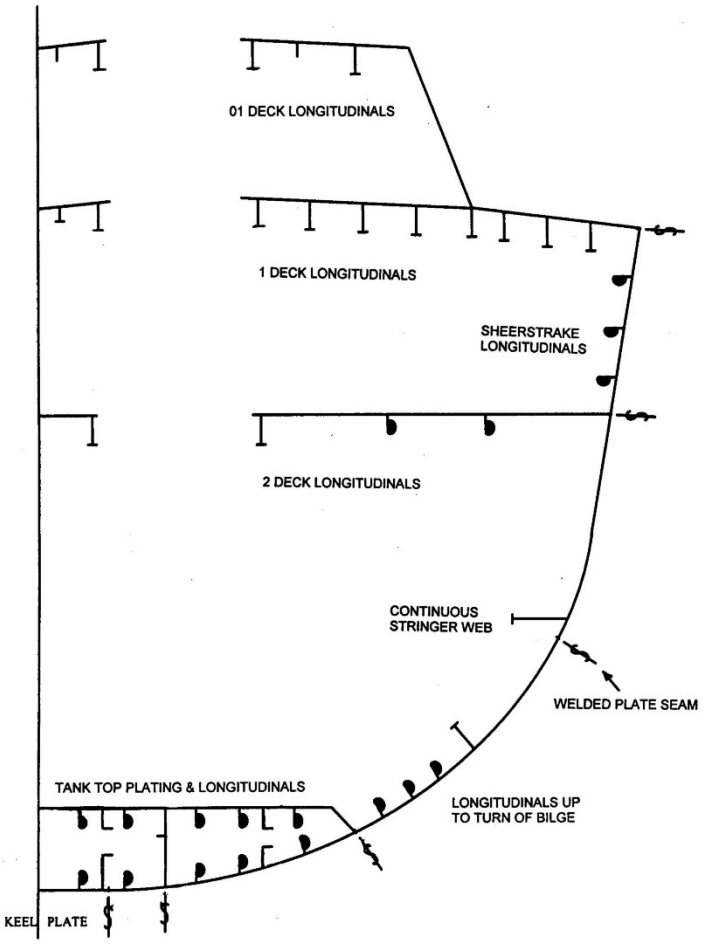
c. If a fire extends over two adjacent zones then essential services (firefighting, sea water, fresh water, chilled water, salvage, electrical power generation and distribution) are maintained in the remaining zones.

d. Each zone has its own CBRN filter units (AFUs) and ventilation/air conditioning systems; any emergency cross connections have closures operable from both sides and are normally to remain shut. Smoke clearance arrangements are provided in each zone, crash stopping of fans (AFUs and ATUs) is on a zone basis with restart of AFUs similarly based.

e. Each zone has at least one HPSW pump and the HPSW main has remotely operable isolating valves at zone boundaries.

f. Sufficient domestic facilities are provided in each zone for it to be occupied for prolonged periods in high DC states.

Figure 4-3. Section of a Typical All Welded Frigate



0405. Subdivision

a. Subdivision can be watertight, gastight or non-watertight, as required by the design. Watertight subdivision makes the greatest contribution to the strength of the ship. It is also gastight, though gastight structure is not necessarily watertight. Watertight subdivision localises flooding (and usually fire), preserves buoyancy and provides protection for equipment and personnel. Gastight subdivision is designed to prevent the entry and dispersion of CBRN agents. The amount of subdivision is limited by various conflicting requirements, such as:

(1) Habitability.

(2) Economy in weight.

(3) Ease of supply of weapons to their firing point(s), stowage of fuel and stores, ease of movement.

(4) The piercing of structure by pipe, electrical and ventilation systems.

(5) The size of equipment to be installed, and the need for adequate space for equipment and machinery removal routes.

b. Subdivision is achieved by the following structures:

(1) **Deck and Flats**. These watertight structures divide the ship in the vertical direction (a flat being a short non-continuous length of deck). Weather decks are built with camber and sheer to assist in the drainage of water. The position of the lowest continuous deck in a ship is usually governed by the height of the machinery spaces.

(2) **Main Transverse Bulkheads**. These are strong, watertight, structures that continue as high up in the ship as possible. They divide the ship lengthwise into a number of main watertight sections. The foremost bulkhead extends from the keel to the weather deck in smaller ships, and to a suitable deck well above the waterline in larger ships, and is called the collision bulkhead.

(3) **Main Longitudinal Bulkheads**. In DD/FF and smaller ships these fore and aft, watertight bulkheads are kept to the minimum possible to reduce the risk of flooding on one side only of the ship. Larger ships have longitudinal bulkheads as detailed by the design requirements, eg where local longitudinal strength is required or where additional protection is needed for magazines etc.

(4) **Hull and Inner Bottom**. The part of the hull below the waterline is called the outer bottom. In some large ships an inner bottom is constructed which extend, normally, over an area covered by the machinery spaces and up the ships side abreast of them. Where an inner bottom is fitted the space between it and the outer bottom is called the double bottom, and this is divided up into suitably sized compartments by welded transverse and longitudinal framing.

(5) **Minor Bulkheads**. These are fitted between decks, usually fore and aft, as required to subdivide the main sections and so provide compartmentation for accommodation, stores, passageways, offices, workshops, etc. These bulkheads may be watertight or non-watertight as required by the design. Figure 4-4 shows typical arrangements of subdivision in HM ships.

0406. Openings

a. Structure must be pierced to allow access to compartments, movement through the ship and passage for ventilation trunking, pipe systems, control systems and electric cables. Watertight and gastight integrity depend on:

(1) The design of the openings, which must include arrangements for making them watertight or gastight.

(2) Maintenance of openings and the preservation of structure and fittings.

(3) Control of openings, as required by the watertight and/or gastight condition set for the ship.

b. In the design of a ship, the piercing of watertight and gastight structure is rigidly controlled, especially in the Red Risk Zone where immediate flooding is likely after underwater damage (see Chapter 5). Within this zone main bulkheads are not usually pierced for access, and trunks are built through decks so that access may be gained to most of the lower compartments. Where ventilation and other systems must pierce main watertight bulkheads these are taken through, wherever possible, above the Red Risk Zone. Wherever watertight or gastight structure is pierced, provision for maintaining integrity is made by fitting:

(1) Watertight (or gastight) doors, hatches, manholes, escape scuttles, fixed windows and sidelights.

(2) Watertight slide valves, closures and gas-flaps in ventilation systems.

(3) Watertight glands to rod gearing, electric cables, propeller shafts and rudderstocks.

(4) Bulkhead pieces and stop valves in pipe systems near decks and main bulkheads.

0407. Access Openings

Access openings are in 2 categories:

a. Those in general or occasional (routine) use, eg watertight doors, hatches and manholes, the opening of which are governed by control markings or a special routine or order (see Chapter 5).

b. Those normally kept closed, eg bolted manhole-covers to tanks and double-bottom compartments and emergency escape exits.

0408. Care of WT Closures

The proper handling of closures to openings helps to maintain safety and efficiency and reduces the maintenance workload. Much useful information is contained in BRd 2203 - Ship Husbandry (Cleaning).

0409. Access Ladders

Sloping steel ladders give access to spaces approached by a hatch and in constant use eg accommodation spaces, workshops, stores etc. Sloping ladders, with hatches beneath them, are constructed such that they can be ‘broken’ and hinged back so that they hang down, clear of the hatch below.

0410. Emergency Escape Ladders

Emergency escape ladders (flexible) are fitted where permanent steel ladders are not fitted. They are attached to eyeplates at their upper and lower ends. Emergency escape ladders are to be in position and rigged, in all states of readiness, (except for those which would impede progress through the ship which, in State 3 only, are to be rolled up and stowed). All ladders are to be rigged in an emergency, or individually when required for use. When ladders are stowed, they are to be secured by 5 mm polyester line and held by a slip knot.

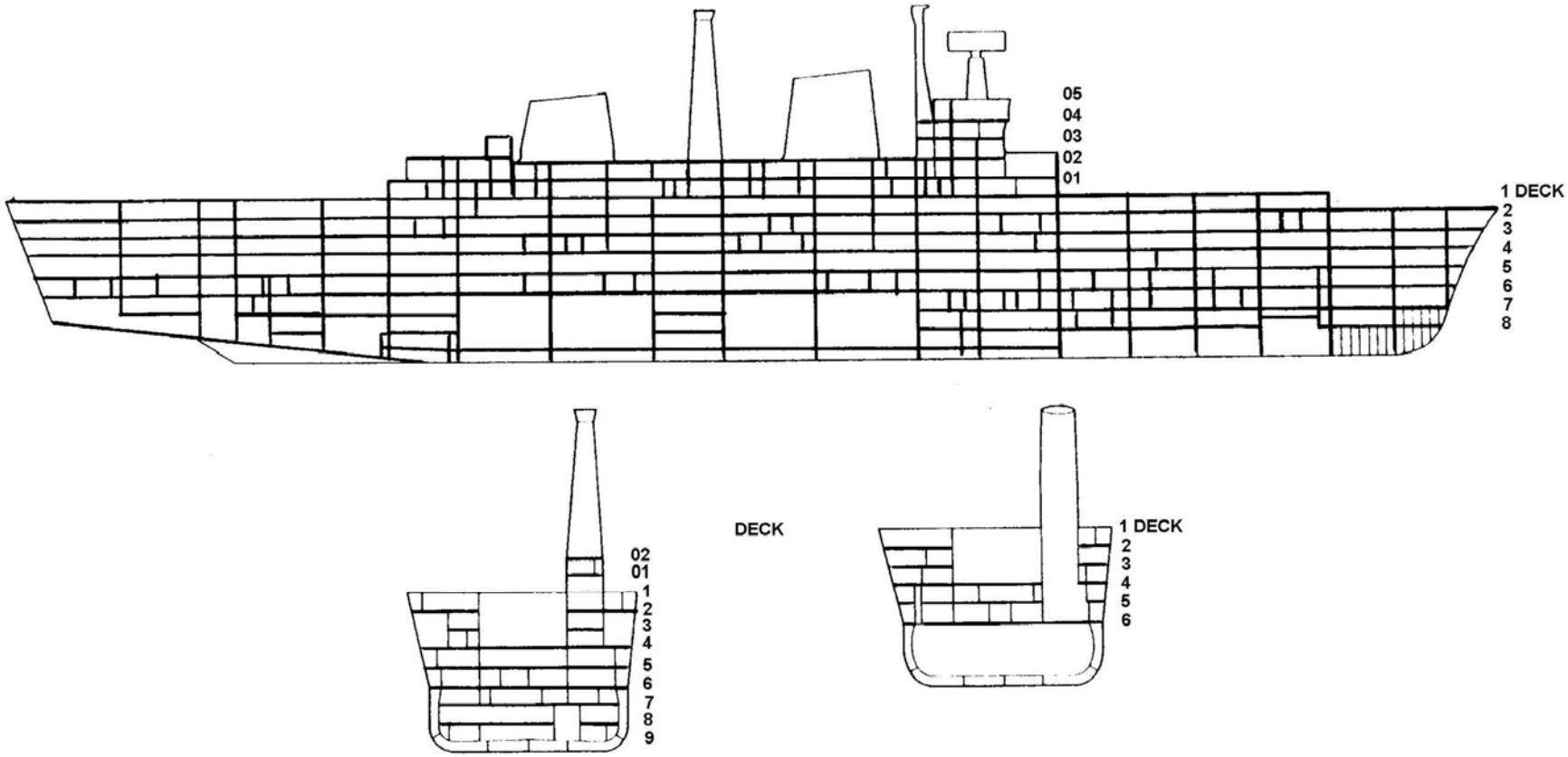
0411. Control of Openings

However efficient the design and maintenance of openings and their closures, water tightness and gas tightness ultimately depends on the strict control over all openings which pose the risk of spread of floodwater or the entry of CBRN agents. The organisation for this control is given in Chapter 5.

0412. Air Escapes

Air escape pipes rise from the crowns of all compartments which contain liquids or are fitted with flooding arrangements; those from adjoining compartments are sometimes grouped together. Air escapes must terminate outside the Red Risk Zone and those from magazines and compartments containing flammables must be fitted with wire gauze filters as a fire precaution. Care must be taken in maintenance to ensure that the perforations at the outboard ends of air escapes are not obstructed, for instance, by paint. As a CBRN precaution, air escapes to freshwater systems and magazines are sited within the citadel. Magazine air escapes have automatic valves that open only when the amount of flood or spray water in the compartment is enough to cause a predetermined increase in pressure.

Figure 4-4. Profile and Sections of Large Warship



0413. Structural Integrity

Watertightness and gastightness can be impaired by:

a. Corrosion.

b. Perished, worn, or painted rubbers on closures to openings.

c. Distorted closures to openings.

d. Defective glands to rod gearing, electric cables and pipes.

e. Unblanked holes such as redundant cable glands, screw and boltholes etc.

0414. Preservation of Structure

The strength, watertightness and gastightness of a ship can be seriously impaired if corrosion is not prevented in its structure. BRd 2203 - Ship Husbandry (Cleaning) gives detailed information on this subject. However, the following points should be borne in mind:

a. Accumulation of water should be prevented, especially where different metals are in contact in the water. Heat accentuates any adverse reaction caused by these conditions.

b. Any liquid flowing from copper pipes must be run clear of aluminium structure and fittings.

c. Strong alkalis, such as caustic soda, must not be used for cleaning structural materials, particularly aluminium.

0415. Structural Protection

The protection afforded by structure depends upon the thickness and composition of the plating. Much of the protection required for equipment is gained by siting it below the waterline, below the superstructure and, in larger ships, behind longitudinal bulkheads. This also applies to the protection of personnel from blast and radiation hazards.

0416. Fire Barrier Insulation

Bulkheads and decks forming the boundaries of high risk compartments have a layer of fire barrier insulation applied to them. Care must be taken to preserve the fire barrier properties of these boundaries throughout the life of a ship. Any insulation that is removed or damaged during refit work, etc, must be reinstated as soon as possible.

0417. Classification of Fire Barriers

In RFAs and other vessels built to comply with Safety of Life at Sea (SOLAS), ANEP77 (Naval Ship Code) and/or Maritime and Coastguard Agency (MCA) requirements, the following definitions are used:

a. **Class A Divisions**. These are bulkheads and decks made of steel or equivalent material capable of preventing the passage of smoke and flame to the end of a set time period. Insulated with an approved non-combustible material, the average temperature on the unexposed surface of the panel will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 180°C above the original temperature within the time interval.

The divisions are classed to indicate this interval, eg an A60 bulkhead will not exceed the stated temperature rise in 60 minutes or an A30 bulkhead will not exceed the stated temperature rise in 30 mins.

b. **Class B Divisions**. These need not be made of steel but must be of non-combustible material (with the exception that combustible veneers may be permitted) and must prevent the passage of flame to the end of the first 30 mins of the standard fire test. They are insulated such that the average temperature on the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225°C above the original temperature within the time interval. The divisions are classed to indicate this interval, eg a B-15 bulkhead will not exceed the stated temperature rise in 15 mins.

c. **Class C Divisions**. These are non-combustible materials. They meet neither requirements for the passage of smoke and flame nor limitations to the temperature rise.

d. **Non-Combustible Material**. A material which neither burns or gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C. This does not mean that the material will not combust if subject to higher temperatures.

0418. A60 Structure - Boundary Monitoring and Cooling (Reference: SOLAS Regulations Consolidated Edition 2009)

a. A60 structures are designed to prevent the passage of smoke or flame for a given period. For the RN this means that a lower containment priority can be given to these boundaries than non-protected or damaged structures. Other insulated boundaries exist (eg B15) however **'A' rated boundaries should be the only boundary where lower containment priorities are applied.**

b. A60 boundaries are to be clearly marked on ship's drawings and general arrangements. A60 boundaries are to be marked on Incident Boards, Kill Cards and within DSAC/PMS systems, however where this is not the case ship's drawings should be readily available within HQ1 and the Containment HQ.

c. Whilst it remains the decision of HQ1 (and Containment HQ) what the priority boundaries are, A60 boundaries may be directly labelled to assist personnel engaged in boundary cooling with their identification. A sticker in the form of a **RED** rectangle containing 22 mm high **WHITE** lettering 'A60' or 'A60 Behind' (where a bulkhead is obscured by equipment mounted directly on it or on the deck adjacent to it) should be applied (see Table 4-1).

d. **A60 Escape Routes**. Where platforms are fitted with A60 protected escape trunks, such as in RCOPV Main Machinery Spaces, it is important that the capabilities and limitations of these facilities are widely understood and regularly exercised. These facilities may also allow a Re-Entry Team to enter low into a compartment (see sub para f below on Vertical Access Trunks).

e. **A and B Class Definitions**. The overarching regulations for A and B class divisions are at Reference. 'A' class divisions are defined as follows (see Reference):

(1) 'A' Class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

(a) They are constructed of steel or other equivalent material.

(b) They are suitably stiffened.

(c) They are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature within the time listed below:

- **Class A-60.** 60 mins (against standard fire test);
- **Class A-30**. 30 mins (against standard fire test);
- **Class A-15**. 15 mins (against standard fire test); and
- **Class A-0**. 0 min.

(d) They are so constructed as to be capable of **preventing the passage of smoke and flame to the end of the one hour standard fire test.**

(e) The Administration (International Maritime Organisation) requires a test of a prototype bulkhead or deck in accordance with the Fire Test Procedures Code to ensure it meets the above requirements for integrity and temperature rise.

***Note**. The principles in this section can be applied to 'A' rated boundaries. Additionally, it should be noted that some A60 doors in service fail to meet these regulations for preventing the passage of smoke (see specific BRd 2170 Vol 7 series for further details).*

(2) 'B' class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following regulations:

(a) They are constructed of approved non-combustible materials and all materials used in the construction and erection of 'B' class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of the Reference.

(b) They have an insulation value such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any point, including any joint, rise more than 225°C above the original temperature, within the time listed below:

- **Class B-15**. 15 mins (against standard fire test); and
- **Class B-0**. 0 mins.

(c) They are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test.

(d) The Administration (International Maritime Organisation) required a test of a prototype division in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise.

Note. *The principles in this section should not be applied to 'B' rated boundaries under any circumstances. 'B' rated boundaries do not provide sufficient mitigation to relax boundary cooling requirements and only offer a notional level of integrity sufficient to give time for the establishment of protection in adjacent compartments.*

f. Procedural Considerations when Dealing with A60 Boundaries

(1) A60 boundaries will be fitted with either an A60 domestic type door or a watertight/gastight door (perhaps also with an A60 rating). An A60 boundary has considerable merit as a point of entry to the incident however the following circumstances might guide boundary selection:

(a) Establishing a boundary on an A60 bulkhead where a more appropriate non 'A' rated bulkhead exists could lead to excessive loss of real estate. This may be a conscious decision if to do otherwise might require excessive resources to undertake containment.

(b) If the smoke hazard generated by the incident is so significant that passing of smoke from within the boundary into the FCP cannot be managed (eg when a domestic type A60 door is the point of entry and is passing excessive smoke) a more suitable smoke tight division (ie watertight or gastight door) should be used. Under extreme circumstances, eg where capability would be placed at risk by a FCP re-location, then it may be acceptable to move the FCP but keep a sentry in BA to monitor the integrity of the A60 boundary. Some platforms may apply mitigation to smoke leakage by domestic type A60 doors, such as taping of seals but in general terms this should be discouraged (this is a particular issue on MCM, P and H vessels and is an accepted practice given the small real estate and the impact of loss).

(2) Modern ship designs, eg RCOPV, QEC and T26 have Vertical Access Trunks (VATs) between decks and these may be used as point of entry to the smoke boundary (an effective airlock if managed correctly) however conditions with the VAT should be closely monitored. In the case of VATs and re-entries from the same level, smoke curtains remain vital even when boundary is not being transited.

(3) A60 doors/bulkheads may be considered as low priority by Containment Parties, but should always at least attract a sentry (roving if necessary); with A60 the emphasis becomes boundary monitoring rather than active boundary cooling. The ability to monitor will allow one person to manage several compartments and dependant on the extent of the A60 boundary, 4 Boundary Coolers could be deployed in the monitoring role (one fwd, one aft, one above, one below). However, as many incidents will still require active boundary cooling this approach, by itself, should not be used as justification to reduce numbers of boundary coolers in the HFEP and SSEP. A60 will delay the commencement of active boundary cooling with water such that it may be possible to defer isolation of electrical supplies to navigationally critical or mission essential equipment.

(4) In the initial stages of any incident good communications between the Containment Party I/C, Deck Managers and the Boundary Coolers is necessary to confirm which boundaries are A60. Despite the fact that A60 markings exist on bulkheads and doors, priorities should be discussed, cross referencing markings, Kill Cards and DSAC/PMS (drawings if appropriate) before priorities are agreed. Until these priorities can be agreed active boundary cooling should be assumed.

(5) Due to the requirement to conduct TMS for some incidents, it may be necessary to cut insulation away from A60 boundaries to establish correct boundary temperatures. It should be noted that the aim of TMS is most often to establish conditions internal to the compartment and unless this insulation is stripped back a false reading could result.

Note. *Some platforms (eg RCOPV) have insulation on the inside of the Main Machinery Spaces and TMS procedures require modification to overcome this (refer to BRd 2170 Vol 7 series for further details).*

SECTION 2 - LOCATION MARKINGS

0419. Location Markings

The Royal Navy and Royal Fleet Auxiliary location marking system consists of a series of numbers and letters displayed on bulkheads, doors, hatches and other fittings to indicate positions in a ship.

0420. Basis of the System

Decks divide the ship horizontally and main transverse bulkheads divide the ship into main sections. Minor transverse bulkheads further divide these main sections. Longitudinal (fore and aft) bulkheads also divide the main sections.

For convenience, a main transverse bulkhead (and hence a main section) is assumed to continue upwards to the top of the structure even though it may actually finish at a lower deck. Similarly, deck levels are in most cases assumed to be continuous throughout the ship.

0421. Compartments and Openings

The basic unit of the location marking system is the COMPARTMENT. Doors, hatches, manholes etc. are then identified by the location of the compartment in which they are located, or to which they give access. The position, and hence the marking of a compartment, is defined by a combination of figures and letters:

a. **Vertical Component**. A large FIGURE (number) for the deck on which the compartment is located.

b. **Horizontal Components:**

(1) A large capital LETTER indicating the main transverse subdivision.

(2) If needed, a suffix LETTER (small capitals) indicating its position, forward or aft, within the main transverse subdivision.

(3) If needed, a small FIGURE indicating the athwartships position in relation to the centre line.

0422. Decks

Decks are numbered consecutively downward to the outer bottom, starting with the forecastle deck as 1 Deck. In aircraft carriers (eg QEC or LPH), 1 Deck is the flightdeck. Decks above 1 deck are numbered 01, 02 and so on consecutively upwards see Figure 4-5.

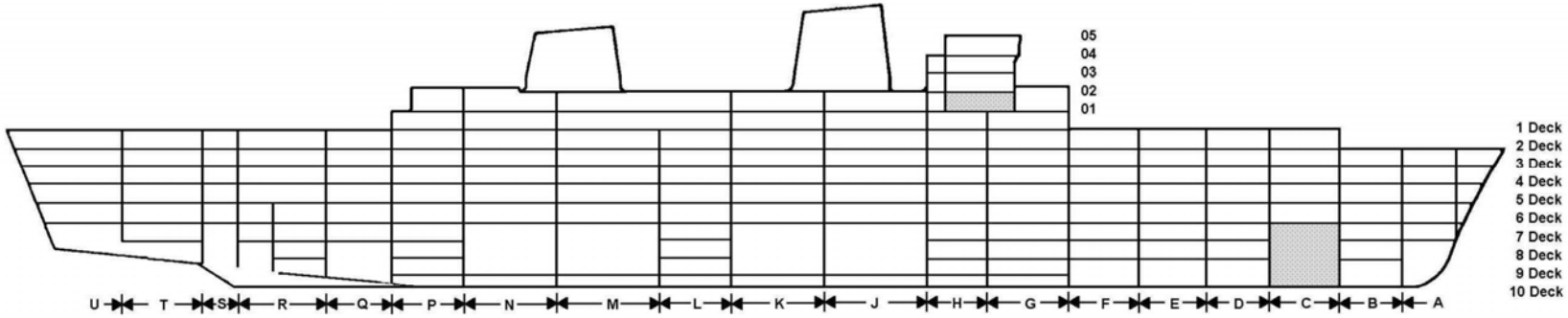
0423. Subdivision Fore and Aft

a. The main sections formed by the main transverse watertight bulkheads are lettered, A, B, C and so on, from forward to aft. The letters O and I are omitted to avoid confusion with deck numbers.

b. Watertight compartments formed by transverse bulkheads within the main sections are given suffixes A, B or C, starting from forward, or Z, Y or X starting from aft, as well as the marking of the main section. In the case of an odd number of watertight compartments within a main section, precedence in the suffix letter is given to the top end of the alphabet eg:

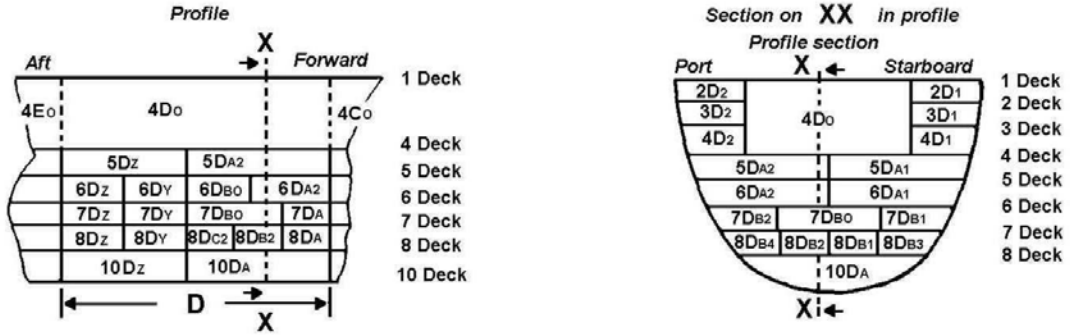
ABC YZ; AB Z; ABCD XYZ.

Figure 4-5. Decks and Main Sections in a Major Warship



Note. *These suffix letters are capitals, but smaller than the main section letters and deck figures (see Figure 4-6).*

Figure 4-6. Compartments



0424. Subdivision Athwartships

Where fore and aft bulkheads divide a main section, forming a number of watertight compartments abreast, small figures are used after the deck number and section letter or letters: 1, 3, 5, 7 and so on to indicate compartments to starboard of the centre line and 2, 4, 6, 8 for those to port of the centre line, in each case numbering outwards from the centre line. Compartments on the centre line are numbered 0 (see Figure 4-6).

0425. Watertight Compartments within Another

When one watertight compartment is contained within another, its marking is that of the larger one, with the addition of -00. If more compartments than one are contained, they are marked -100 and -300 outwards from the centre line if they are on the starboard side of the ship or -200 and -400 if on the port side, eg 8DA-100 and 8DA-200 (see Figure 4-7).

0426. Compartments Extending Beyond a Main Section

Where compartments extend beyond one main section, they bear the letter of the section in which they are mainly situated; this may occur anywhere but is most common on decks above the main watertight subdivision, eg in Figure 4-5, the space on 01 deck running above G and most of H sections will be marked 01H. In aircraft carriers, this system is generally applied to compartments on the upper hangar and gallery decks; the section boundaries are considered as being extended up to 1 deck.

0427. Compartments More than One Deck High

A compartment more than one deck high is marked according to the deck on which it stands (eg: in Figure 4-5, the lowest compartment in C Section would be 10C).

0428. Compartments External to the Ship

An external compartment is marked according to the deck on which it stands with the abbreviation - E added (eg: an external compartment located on 01 Deck H Section would be 01H-E).

0429. Nomenclature of Compartments

Since every watertight compartment is given a marking by this system, (and some non-watertight spaces), it is convenient and desirable to refer to many compartments by the deck number and section letter rather than by any arbitrary number eg:

5C Plant and Pump Space.
4M Aft Auxiliary Machinery Space.
4K General Service Pump.
2N2 Dining Hall.

Fuel tanks can also be identified in this way but with the addition, if required, of a number denoting the position of the tank within the section, from forward to aft, odd to starboard and even to port, eg: 6M2 Dieso tank, 7H1 AVCAT tank. In multi-unit ships such as QEC, it is often more convenient to identify the tanks by a marking that indicates the unit, eg: A3 Dieso tank, but the tank would also bear its location marking that might be 11LA2.

0430. Doors

In general, a door bears the marking of the compartment to which it gives access. Where two or more doors give access to one compartment they are distinguished by the words **PORT** (or **STARBOARD**) and/or **FORWARD** (or **AFT**) in abbreviated form after the marking.

In rare cases of doubt as to which of two adjacent compartments should govern the door marking, the marking of the compartment in which the door is hinged should be used (see Figure 4-8).Doors that pierce main athwartship bulkheads, separating lettered sections of the ship, are designated by the deck number followed by the letters of the two section in alphabetical order, eg 3D/E.

0431. Hatches

A hatch bears the number of the deck in which it is cut followed by the horizontal co-ordinates of the compartment to which it gives access, eg hatch 5DY giving access to compartment 6DY (see Figure 4-8). Where two or more hatches, cut in the same deck, give access to the same compartment they are distinguished by the words **PORT** (or **STARBOARD**) and/or **FORWARD** (or **AFT**), in abbreviated form, after the marking.

Note. *Escape manholes or scuttles do not bear location markings.*

0432. Manholes

A manhole with a bolted or otherwise fixed cover bears the marking of the compartment to which it give access, since this may be from the deck above or through a bulkhead. A manhole in a hatch is not marked but is referred to as ‘Manhole in hatch’, followed by the marking of the hatch in which it is cut.

0433. Trunks

A trunk is marked with the deck number of the top hatch or door and the deck number and compartment letter(s) of the lowest compartment to which the trunk leads. This applies to the whole trunk and is shown in each separate watertight part (eg trunk 5/8DA in Figure 4-7). Each hatch in the trunk, and any intermediate access door, is marked with its own deck number and with the deck number and compartment letter(s) of the bottom of the trunk (eg hatch 5/8DA in Figure 4-7 and Figure 4-8). In addition, the word **TRUNK** is marked on the top hatch (or door) and each intermediate one.

0434. Drawings

On drawings only, code letters D, H and M prefixes the markings of doors, hatches and manholes, respectively, but these letters are not included in the actual markings onboard.

0435. Ventilation Systems

a. Each ventilation system is marked by a number, a large capital letter and a two-figure number. The first number is the number of the deck on which the fan is located, the large capital letter donates the main watertight section containing the fan, and the two-figure number indicates the position of the fan in that main watertight section, eg 11 is the first fan on the starboard side, 13 the second on the starboard side, 12 the first on the port side, 14 the second on the port side and so on. The 2 figure number is used to prevent confusion with deck numbering. The explanation of ventilation system 3C11 is that it is supplied by a fan situated at the starboard forward end of C section on 3 Deck. The whole system (terminals, closures, flaps, valves and trunking) carries the fan marking, with tallies fitted as follows:

(1) At each system component, eg terminal flaps, fan, fan starter, valves, heaters, fire flaps, grease filters, etc.

(2) On trunking serving a compartment, including recirculation trunking.

(3) On trunking passing through an unlined compartment.

(4) At intervals along a trunk within a specific compartment where passing services or complexity of vent systems results in the identification of the system being difficult, eg main machinery spaces supply, air-conditioning supply to Messdeck.

(5) In lined compartments, on portable access panels to vent heaters, valves, etc, in lieu of a tally on the component.

(6) Tallies are not required on trunking in cabins, or on trunking in a compartment where a component is identified (subject to sub para (4) above).

(7) Ventilation flaps to Main Machinery Spaces have an additional sign painted or tallied on both sides of the flaps to enable personnel to quickly identify which flaps need closing in the event of a fire as follows '**CLOSE IN THE EVENT OF FIRE IN ..... (name of compartments)**'.

b. The above markings are in addition to any CBRN/Damage Control risk and control markings on the system and fittings. In group ventilation systems, a subsidiary run from the main system is marked as a separate system if it contains a booster fan. Lengths of trunking and bulkhead flaps provided to promote recirculation but not related to specific ATUs are also to be treated as separate systems and marked accordingly. A natural system, in which no fan is fitted, is treated as if there were a fan in the compartment served and is marked accordingly.

c. The location and system identification (in abbreviated form) of all main machinery space fan starters, closures and flaps are to be clearly marked in white figures and letters on a red background at their control position and outside the compartment in which they are located, eg 01H14 GTR SUP. Ventilation controls are not to be located in compartments, which are normally required to be locked.

d. The location and system identification of all other fan starters are also to be clearly marked at their control position. The system identification is to be in abbreviated form and where grouped compartments are involved, should be restricted to the principle function, eg 2E13 MAG SUP or 2J16 No 4 ATU. Tallies for galley and machinery space fan starters are to be clearly marked in white figures and letters on a red background. Other fan starter tallies are to be marked in black figures and letters as for standard location markings (see Para 0437).

e. All other ventilation outlets, including free breathing ventilation systems, eg diesel crankcase breathers, are to be marked with the system of origin in abbreviated form. Where grouped compartments are involved the marking is to be restricted to the principle function of the ventilation system.

Figure 4-7. Compartments - Plan and Section - Showing Trunk

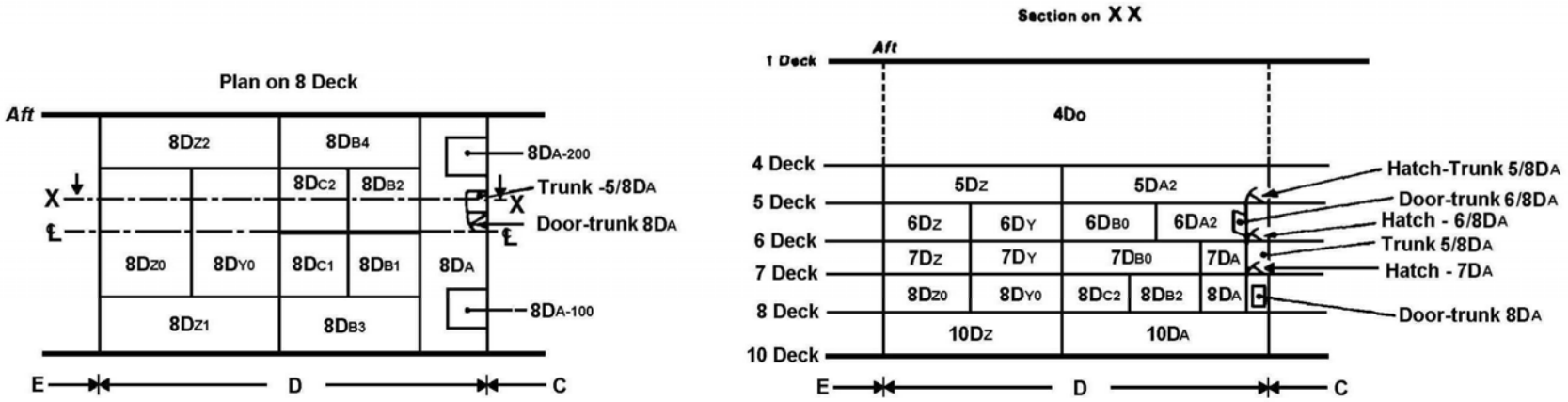
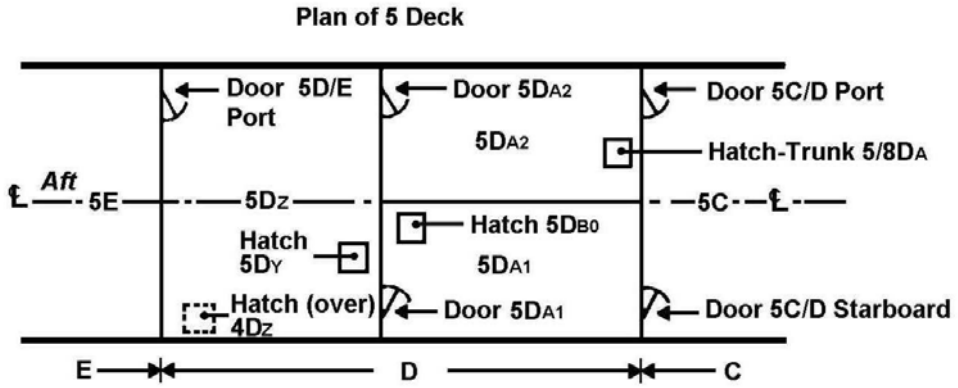


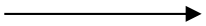
Figure 4-8. Doors and Hatches



0436. Fan Starters

If the starter is remote from the fan, the position of the starter is indicated at the fan.

a. If the starter is in the same watertight section as the fan, the sign is marked on the fan casing in the following form:

STARTER
3 METRES 

b. If the starter is not in the same watertight section, the exact location of the starter is indicated on the fan casing, eg:

STARTER AT 3C, 52½(S)

0437. Seacocks

Seacocks and their controlling mechanisms are marked by the deck number and main section letter of the compartment in which the seacock is fitted, followed by **PORT** (or **STARBOARD**) and/or **FORWARD** (or **AFT**), if there are two on the same deck and within the same section. The only seacocks marked are those that admit water into the hull, either directly or through additional valves, eg floods to magazines. Those that admit water into a closed system, eg pump suctions, are not marked.

0438. Method of Marking

Markings are generally in the form of embossed aluminium tallies, applied with an impact adhesive. Letters and figures on the embossed tallies are painted black with the background the same colour as the surface on which they are located, except for galley and main machinery space ventilation system tallies as referred in Para 0435 sub para c and sub para d. The size of tallies is as follows:

a. **In Compartments**. 75 mm figures and capital letters for the deck number and section letter, and 50 mm capital letters and figures for the remainder. The tallies are placed so that they are visible from all entrances to the compartment, more than one tally being used if necessary.

b. **Doors, Hatches, Manholes and Seacocks**. 25 mm figures and capital letters for the deck number and section letter, and 20 mm capital letters and figures for the remainder. The words PORT, AFT and so on, when needed, are in 25 mm capital letters. Doors and hatches are marked on both sides, doors near the upper corner of the hinged edge.

c. **Ventilation Fans, Systems and Fittings**. 25 mm figures and capital letters for the deck number and section letter, 20 mm capital letters for the remainder. Fan starters are also to be marked **SUPPLY** or **EXHAUST** in 20 mm capitals.

d. **A60 Bulkheads.** See Table 4-1.

0439. Station Numbers

A station number is a means of locating a position in a ship in relation to the nearest transverse frame, eg when reporting the position of an incident of damage to authorities holding drawings of the ship, or for other technical purposes.

Frame stations are numbered consecutively from forward to aft, Station 0 being the forward perpendicular (this numbering system is reversed in ships built to merchant ship standards, where the numbers run from aft to forward). A main transverse bulkhead is marked, in a conspicuous position on the bulkhead at each deck level, with the number of the frame at which it is fitted (see Table 4-1).

0440. Other Side Markings

These are applied to certain bulkheads to indicate the type of compartment on the other side and hence its contents:

a. **In DD/FF and Smaller Ships.** On bulkheads forming the perimeters of dangerous compartments, namely; magazines, machinery spaces, paint and flammable stores.

b. **In Larger Ships.** On all main transverse and longitudinal watertight bulkheads below the lowest communication deck, on bulkheads of dangerous compartments as for smaller ship.

Note. *A communication deck is one on which fore and aft movement through the ship is freely possible.*

c. The markings consist of the name of the compartment followed by the underlined letters OS (see Table 4-1).

0441. Compartments Below Markings

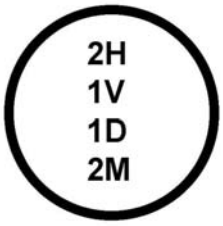
These indicate the names of compartments to which a hatchway gives access and are generally painted on a nearby bulkhead above the hatch, eg:

Compartments Below

SRE Compartment
TV Studio
A/C Machinery Compartment
Sewage Plant

0442. Contents Circles

These indicate, within the Red Risk Zone (see Chapter 5), the number and types of all openings within a watertight compartment or group of compartments to which a watertight door or hatch gives access, for the guidance of personnel responsible for shutting them. Self-evident letters are used, eg:



. . . . . 2 hatches
. . . . . 1 ventilation valve or closure
. . . . . 1 door
. . . . . 2 miscellaneous openings

Only valves or closures that affect flooding boundaries (eg scuppers) are indicated, not system operating valves. An (O) after a V or M indicates that the operating mechanism (eg handwheel) is outside the compartment. An arrow on the contents circle indicates that it refers to the compartment to which the arrow points. These markings are available as transfer waterslides and are listed in BRd 2170(3).

0443. Suction Strainers

The position of a suction strainer is indicated by the letter S enclosed in a square, high up on the bulkhead, with an arrow pointing towards the strainer. This is to enable repair parties, in a flooded compartment being pumped, to locate a strainer that has become choked.

0444. Deck Tubes

a. Deck tubes for the passage of emergency cables from one deck to another are indicated by a green cross on the white-painted cap of the deck tube.

b. Foam tubes for machinery space firefighting are painted red. Adjacent signs, with white lettering on a red background, are to indicate the use of foam tubes.

0445. Traffic Routes

Where necessary or desirable, black arrows are used to indicate routes in passageways or through doors or hatches.

0446. First Aid Posts and Secondary Medical Positions

First Aid Posts and Secondary Medical Positions are indicated by a white cross on a green background, an arrow being added where necessary to indicate direction. The designation of the FAP, eg its number or section letter, or forward/aft, may be added if required.

0447. Cleansing Posts

Cleansing posts are indicated by the words **CLEANSING POST** in orange, an arrow being added where necessary to indicate direction. The cleansing post locker is to be painted white with an orange, upright, cross.

0448. Pipe Systems

Pipe systems, together with ventilation systems and rod gearing, are to be identified with self-adhesive tapes or paints, as specified in BRd 2170(3). Where an identifying system colour is not specified, they are to be painted in the colour of the background surface.

0449. Escape Markings

In all cases, escape routes are to be clearly marked, using the signs listed in BRd 2170(3). These markings are not to be obscured by any doors in the open position.

a. **Escape Routes.** These are to be marked by:

(1) Photo luminescent arrows applied at prominent positions high on bulkheads adjacent to all hatches (except where only a single route is possible), to indicate the direction of escape.

Arrows are also to be applied at intermediate positions on bulkheads in lobbies and passageways leading to the point of escape, particularly when changes of direction occur. These arrows are to be positioned at a nominal height of 1.5 m above the deck in order to remain visible in the event of flooding.

(2) Deck mounted arrow dot markers are to be positioned in the centre of passageways adjacent to high-level bulkhead mounted markings.

(3) In large ships, in large compartments with multiple doors, the escape route door is to be painted emerald green.

b. **Escape Recess Markings**. These markings are to be applied to ships where this type of escape is provided in way of aircraft or ammunition lifts. Escape recesses are to be indicated by the application of a photo luminescent **ESCAPE** marking at prominent positions, on bulkheads, within the recess.

c. **Escape Hatches and Scuttles**

(1) Normally emergency escape hatches and scuttles are painted green on both sides. However, the escape side of hatches sighted on ships weather decks are to be painted in the appropriate deck covering material and the escape side of scuttles on ships screens are to be painted in accordance with the ships overall paint scheme.

(2) In all cases the presence of escape hatches and scuttles must be clearly indicated on adjacent structure in the compartment from which escape is intended to be made, by the application of a photo luminescent **ESCAPE** marking (on a green background). A photo luminescent arrow marking (on a green background) is to be added adjacent to the **ESCAPE** marking to indicate the direction of escape. The word **ESCAPE** may also be painted directly on the emergency escape hatch or scuttle in 40 mm white letters, in addition to the photo luminescent markings on adjacent structure, where this is considered more practical to indicate its position.

(3) With the exception of those which open onto the upper deck, escape hatches which can be open from the non-escape side by means of a T handle are to have these T handles painted in a combination of photo luminescent paint on the centre bar and emerald green on all other parts. Details of the paint are in BRd 2170(3).

0450. Important Valves and Fittings

Thixotropic photo luminescent paint is used to highlight the position of the following important valves and fittings:

a. High pressure sea water system main isolating valves.

b. High and low pressure air machinery space bulkhead isolating valves.

c. BA Charging panel isolating valves.

d. Hydraulic system main isolating valves.

e. Remote diesel engine stops.

f. Remote fuel stops to auxiliary boilers.

g. The fully **CLOSED** position on Leith Cardle WT door handles.

h. Operating levers/handwheels on the underside of escape scuttles.

0451. HPSW System Valve Marking

Hydrants and hose baskets are to be painted **RED**. Valves and hydrants in the high pressure seawater (HPSW) system are marked numerically to assist rapid identification for damage control and firefighting purposes. The ideal marking system to be applied to surface warships and RFAs is as follows:

a. The marking of valves and hydrants involves the complete HPSW system but excludes all other parts of the system ie sprays, cooling and domestic lines etc.

b. Numbering of the main isolating valves begins on the isolating valve closest to the end of the ring main on the forward most spur with the isolating valves numbered consecutively from forward to aft along the ship. Where a spur meets a ring main, the conventional Damage Control numbering of even numbers to the port side and odd numbers to starboard is used, counting from the last number on the spur. When the spur is in the middle of a port or starboard leg, the numbering of the ring main recommences from the last number on the spur. This means that two adjacent isolating valves may not have consecutive numbers.

c. Numbers are only repeated when the main system exists on more than one deck, an example being a QEC. In this instance isolating valves on the higher and lower rings will have either a suffix H or L. Whether at the end of, or in the middle of a port or starboard leg the numbering of the valves is to be from forward to aft.

d. All hydrants are numbered with the numbers of the isolating valves either side of the hydrant take-off; the lower number is first and the higher number is separated with a dash. When the hydrant is supplied from a lower or higher ring main the two numbers are followed by the relevant suffix eg 18-20L. Where more than one hydrant is supplied from the main between the same two isolating valves, they are to have exactly the same number. This defines exactly which hydrants are unavailable when the isolating valves are closed. Figure 4-9 shows a typical arrangement, identifying each valve.

e. The actual marking of the isolating valves is included on the Main Systems Board in HQ1 and AHQ (HQ2) and FRPPs/ZCP's as appropriate. Black indelible markings are used.

f. Marking numbers are applied as follows, using luminous red self-adhesive tape:

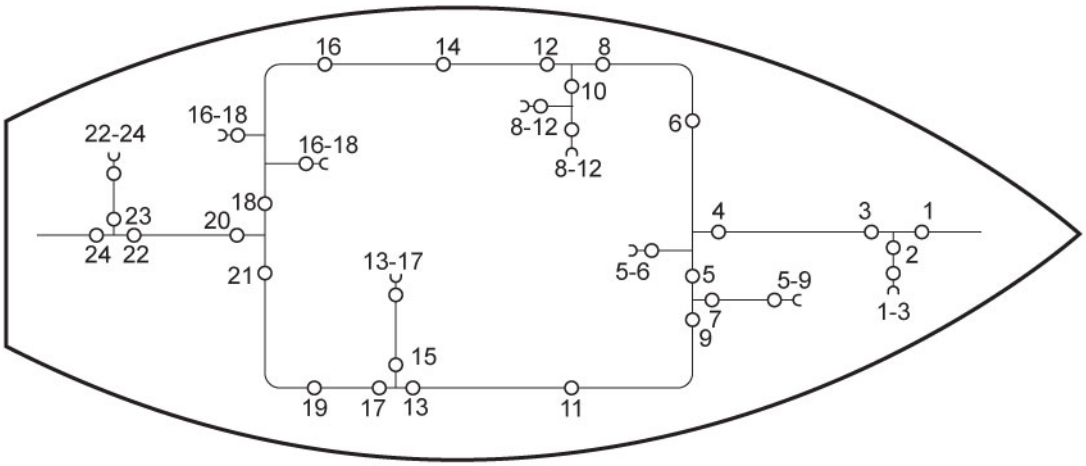
(1) **Isolating Valves.** 25 mm black numbers on a 75 mm square red background on, or close to, the valve.

(2) **Hydrants**. 12 mm black numbers on a 50 mm square red background, on the boss of the instantaneous coupling.

0452. Electrical System Markings

Electrical system markings are detailed in BR 2000(52) - Electrical Power Distribution and Utilisation.

Figure 4-9. HPSW System - Valve Marking



0453. Damage Control Zone Marking

Damage Control zones are numbered from forward to aft. They are marked, numerically, on Damage Control drawings, but the bulkheads that separate zones are only marked by the words **ZONE BOUNDARY.**

0454. Upper Deck Markings for MMS Boundary Cooling

Markings, as shown in Table 4-1, are applied to the inboard edge of the upper deck or adjacent superstructure to aid MMS boundary cooling operations. The marking (in black) consists of a line indicating the position of the transverse bulkhead, with an arrow pointing forward/aft from the bulkhead line in the direction of the MMS compartment. Below this arrow is the space name in 50 mm italic letters. The line indicating the MMS limit is 150 mm long and 15 mm wide and the arrow line is 70 mm long. Where the marking is on superstructure, it should start 100 mm above the deck. Where a transverse bulkhead separates two machinery spaces, the marking should indicate both spaces.

Table 4-1. Summary of Markings

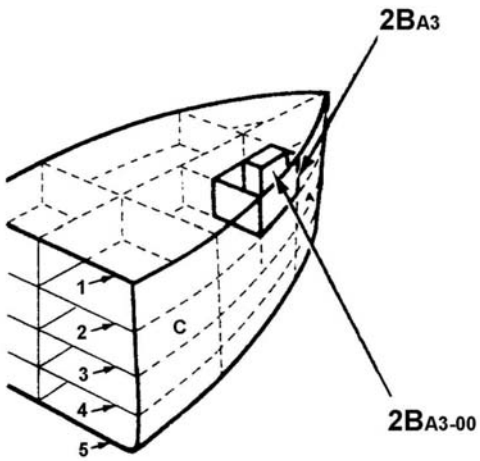
EXAMPLE	APPLICATION	
COMPARTMENTS	**IN A POSITION THAT CAN BE SEEN FROM ALL ENTRANCES**	
2BA3 indicates a compartment on 2 Deck that is situated at the fore end of B Section and is the second compartment to starboard of the centreline.  2BA3-00 indicates a watertight compartment within compartment 2BA3.	**FIRST** (FIGURE)	**DECK**. Numbered 1, 2, 3, etc. downwards from foc'sle or flight deck, and 01, 02, etc, upwards.
	SECOND (LETTER)	**SECTION**. ie Main compartment between main transverse bulkheads lettered A, B, C, etc (not I or O) from forward to aft.
	THIRD (LETTER)	Fore and aft position of compartment within section. Lettered A, B, etc, from forward; Z, Y, etc, from aft.
	FOURTH (FIGURE)	Athwartships position of compartment from centreline, 1, 3, etc, to starboard, 2, 4 to port. Centreline compartment, 0.
	SUFFIX (FIGURES)	Watertight compartment contained in another. Suffix -00. (-100 or -200, etc, where two or more contained compartments, odd to starboard, even to port.)

Table 4-1. Summary of Markings (Cont'd)

EXAMPLE	APPLICATION
DOORS 2PB Door giving access to compartment 2PB. 2D/E Door connecting D and E Sections on 2 Deck.	**BOTH SIDES, UPPER CORNER OR HINGED EDGE.** Doors bears marking of compartment to which it gives access. If two doors give access to same compartment, marking is qualified by **PORT/STBD** or **FWD/AFT**. Doors in main transverse bulkheads separating lettered section have deck number and letters of both sections in alphabetical order.
HATCHES 2DA1 Hatch on 2 Deck giving access to compartment on 3 Deck that has horizontal coordinates DA1.	**NEAR CORNER ON HINGED SIDE. FIRST FIGURE - DECK IN WHICH HATCH IS CUT.** Remaining letters and figures give fore and aft and athwartships position of compartment to which hatch gives access. Where 2 hatches give access to same compartment, markings qualified by PORT/STBD or FWD/AFT.
MANHOLES (Fixed) 6GZ4 manhole gives access to 6GZ4.	Marking of compartment to which manhole gives access. A manhole in a hatch is not marked by referred to as ‘manhole in hatch’.
TRUNKS 1/5DA Trunk running from 1 Deck down to compartment 5DA.	**MARKED ON EACH SEPARATE SECTION OF TRUNK.** Trunk carries deck number of top hatch or door, plus marking of compartment at bottom of trunk. Each hatch in trunk, and any intermediate door, has its own deck number plus marking of compartment at bottom of trunk. Word **TRUNK** on all hatches and doors giving access to trunk.
STATION NUMBER 17 indicates a main transverse bulkhead at the 17th frame station from the foremost frame.	Frame stations at main transverse bulkheads, as needed in conspicuous position on bulkheads.
OTHER SIDE MARKING **MAGAZINE OS**	On bulkheads forming perimeter of dangerous compartments, eg magazines, machinery spaces, flammable stores. Also, in multiple section ships, on main bulkheads below lowest communication deck.
COMPARTMENTS BELOW	As needed above a hatchway to indicate compartments gained thereby. Instead of the heading ‘Compartments Below’, an arrow can be used if desired.

Table 4-1. Summary of Markings (Cont'd)

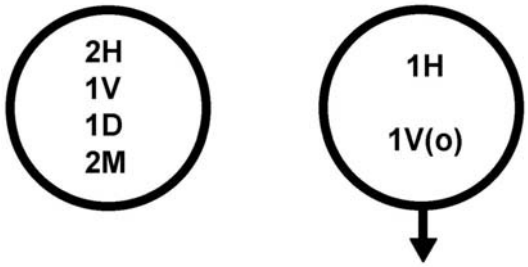
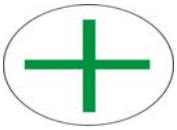
EXAMPLE	APPLICATION
VENTILATION SYSTEMS 3C11 system with fan at starboard forward end of C Section on 3 Deck.	On vent trunking, at regular intervals.
TEMPERATURE MONITORING SIGNS	High risk (fire) compartments external boundaries (see Annex 21D for illustration).
CONTENTS CIRCLES 	WITHOUT ARROW - indicates number and types of openings in that compartment. WITH ARROW indicates number and types of openings in compartment to which arrow points. **H** = hatch; **D** = Door; **V** = ventilation valve; **M** = miscellaneous openings, (**o**) after **V** or **M** indicates that opening mechanism is outside the compartment.
STRAINERS 	Placed high on bulkhead with arrow pointing to position of strainer.
DECK TUBES 	On caps of deck tubes for flexible emergency electrical cables.
TRAFFIC ROUTES 	Where needed in passages or through doors or hatches.
MMS BOUNDARY COOLING 	On deck edge or superstructure to indicate forward/aft limits of machinery spaces.

Table 4-1. Summary of Markings (Cont'd)

EXAMPLE	APPLICATION
FIRST AID POSTS 	To mark FAP or SMP. A white arrow on a green background may be used to indicate direction.
CLEANSING POSTS 	To mark cleansing post, with orange arrow where needed.
ESCAPE ROUTES 	On escape routes, recesses, hatches and scuttles.
HPSW SYSTEM 	On HPSW isolating valves and hydrants.
DAMAGE CONTROL ZONES **ZONE BOUNDARY**	On bulkheads, which separate Damage Control zones.
SHELTER ROUTE 	Alongside doors/hatches on shelter routes.

Table 4-1. Summary of Markings (Cont'd)

EXAMPLE	APPLICATION
A60 BULKHEADS 	For the identification of A60 Fire Retardant doors in RN and RFA vessels (see RNTM 206/13 for demand details). a. 'A60' signs are to be placed on A60 bulkheads on the side of the A60 insulation or 'A60 BEHIND' signs on the opposite side of the bulkhead to the A60 insulation. b. Signs to be fitted approximately 1400 mm above the deck at 3 m intervals. c. Doors within A60 boundaries are to have a sign fitted on either side. d. A60/A60 BEHIND signs are not required in pipe tunnels, cofferdams, voids or places not normally accessed/not accessible. e. A60/A60 BEHIND signs are not required on deckheads, decks or hatches/scuttles within decks.

CHAPTER 5

STATES OF READINESS CONDITIONS, RISK AND CONTROL MARKINGS

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CHAPTER 5

STATES OF READINESS CONDITIONS, RISK AND CONTROL MARKINGS

SECTION 1 - STATES OF READINESS AND CONDITIONS

0501. General

At all times ships must be prepared to limit the extent of damage and to minimise the effects when it occurs. This preparedness before damage is provided by the Damage Control states of readiness, and by watertight and gastight conditions.

0502. Damage Control States of Readiness

Ships must be prepared to limit the extent of damage and to minimise the effects when it occurs. Therefore, there must be some means of ensuring the highest state of ship preparedness compatible with fighting efficiency, habitability, routine and maintenance of structure, machinery and services. It is also necessary that manpower and materials to carry out effective countermeasures are readily available in sufficient numbers and quantity to meet the calculated risk of damage. Damage Control states of readiness are designed to ensure that manning requirements are met, and material arrangements provided in varying degrees appropriate to the threat of attack or risk of damage. Since there is always some element of risk, there is always the need for a state of readiness to be in force. Maintenance of the highest state possible is the best way to limit and control damage. However, the measures that this state imposes take personnel from their normal tasks and adversely affect habitability, routine and maintenance of the ship, its machinery and services. The highest state, therefore, cannot be maintained indefinitely and ships should adopt a state of readiness which will afford reasonable habitability and as much opportunity as possible for normal routine and maintenance, at the same time permitting the highest state to be assumed before the risk of damage becomes imminent.

0503. Typical Arrangements

Typical arrangements governed by Damage Control states of readiness include:

a. Control and operation of machinery.

b. Operation of HP sea water systems and other services.

c. The spraying (and flooding, if applicable) of certain high risk areas.

d. Operation, distribution and isolation of electrical power and services.

e. Availability and stowage of CBRN and Damage Control stores and equipment.

f. Security of and access to locked compartments (locks and keys).

g. Operation of galleys.

h. Organisation of the Secondary Medical Position, Sickbay and first Aid Posts.

i. Securing of stores and gear in other places (including personal gear) to minimise the risk of damage, pump suction blockage and fire.

j. Measures to protect the individual against the effects of damage, eg clothing, anti-flash gear and lifejackets.

k. Damage Control and CBRN manning requirements.

0504. Definition of Damage Control States

There are three states of readiness, designed to meet all possible situations. These states provide a uniform framework throughout the Surface Flotilla into which each ship must build its own organisation, being guided by the principles outlined in this chapter and by the typical arrangements given in Table 5-1. Classes of ships and even ships within a Class differ considerably and it is not possible to define manning, material and machinery arrangements to meet the needs of all ships Therefore, the arrangements given in Table 5-1 are for guidance only. The Damage Control states of readiness are defined as follows:

a. **STATE 1 - Attack or Damage Imminent.** Highest state of Damage Control and CBRN preparedness compatible with fighting efficiency. Disregards habitability and wear and tear of machinery. All Damage Control and CBRN positions fully manned, with personnel relaxed for meals, etc, as ordered by the Command.

b. **STATE 2 - Attack or Damage Possible.** Normal war cruising and harbour state. Skeleton watch system with personnel drawn from all departments.

c. **STATE 3 - Attack or Damage Unlikely without Adequate Warning.** Normal peacetime cruising and harbour state. Large ships provide skeleton watch system as for State 2. In MM/PPs, no Damage Control manning except for the SCC watchkeeper (if applicable) and patrols. In harbour, maximum possible habitability, routine and maintenance.

Notes:

1. Damage Control states of readiness do not necessarily coincide with armament degrees of readiness. Although Damage Control State 1 is always assumed when the armament goes to the first degree of readiness (Action Stations), the converse is not necessarily true, eg when operating in a mine threat area.

2. States and conditions can be altered independently of each other, but when changing one or the other it is advisable to mention both. For instance, when changing from State 2, Condition Yankee to State 3, Condition Yankee, the order should be 'ASSUME DAMAGE CONTROL STATE 3, CONDITION YANKEE'.

0505. Preparation of States of Readiness

Deciding the material conditions of the ship and the organisation of the personnel needed to achieve the different states of readiness is the responsibility of the XO/MEO, who must work in accord with the Heads of Departments concerned. He should consider first the highest state when all safeguards have been applied, since these will affect all departments of the ship to a greater or lesser degree. The relaxations from this state that can be permitted in the lower states should then be considered. When the organisation for all states has then been decided for the ship as a whole, Heads of Departments must formulate the organisation for each state in their departments; for example, the MEO will draw up orders for the working of machinery.

0506. Responsibility for Setting the State

When ships are in company, the Officer in Tactical Command (OTC) is responsible for ordering the Damage Control state of readiness that is to be set. However, in a high threat situation in wartime, the Command should not wait for such an order if to do so would prejudice the achievement of a higher state in time to meet the threat and the Rules of Engagement permit. At all other times the responsibility rests with the CO of the ship.

0507. Choice of State

a. **In War.** Damage Control State 2 is normal at sea and in harbour except for the relatively short periods when State 1 will be necessary.

b. **In Peace.** The assumption of State 2 or State 1 will rarely be needed, except when ordered for exercise purposes. Prolonged periods on peacetime operations may require relaxations or enhancements to Damage Control State 2 or 3 so as to be able to sustain activity but provide appropriate readiness to counter internal and external threats.

c. **At Any Time.** The Damage Control state of readiness assumed should be no higher than that needed to accomplish the task and safeguard the ship in the particular circumstances.

0508. Peacetime Navigational Hazards

Peacetime navigational hazards should be mitigated by employment of Special Sea Dutymen (SSD) rather than change the state of readiness.

0509. Assuming State 2

State 2 would generally be assumed only for long periods. State 1 should be assumed for a thorough check of manpower and material, and that only after this should State2 be ordered.

0510. Manning for Damage Control State 1

The Watch and Station Bill must nominate sufficient personnel to ensure prompt and effective response to all forms of damage and fire. To achieve this it must:

a. Man essential control positions.

b. Provide Fire and Repair Parties, which include teams for pumping and flooding and electrical repair.

c. Provide a Mobile Repair Party, stationed adjacent to HQ1, with access to specialist tools eg Thermal Lance, Ramset Tool and Cutting and Spreading Equipment.

d. Man magazine flood and spray positions (mainly in large ships).

e. In Condition ALFA, man the cleansing station(s) as required and provide monitoring and decontamination parties after contamination.

0511. Manning for Damage Control State 2

In Damage Control State 2, personnel are required to partially man certain positions to ensure the maintenance of the ordered CBRN and Damage Control condition of watertight/gastight integrity and to enable a smooth transition to Damage Control State 1 when ordered. The State 2 Damage Control Command and Control organisation is covered in more detail in Chapter 7. The following requirements are to be covered in State 2:

a. **Control**

(1) **Multi-Section Ships.** An Officer or Senior Rating and 2 Junior Ratings as assistants in HQ1. One communication number in each Section Base.

(2) **Single-Section Ships.** Ships with SCC's to be manned continuously by permanent watchkeepers. In other ships the OOD/OOW should maintain the Watertight Integrity Log.

b. **Patrols**. Two-man patrols to maintain a continuous check on the Damage Control state and condition ordered. Consideration should be given to making the patrol personnel permanent watchkeepers, rotated at approximately 3 monthly intervals. In addition to carrying out Damage Control patrols, their duty is to assist the rating in charge in HQ1/SCC.

c. **Relaxation from Condition ALFA**. One sentry to man each Alpha opening that has been opened, whilst it remains open.

0512. Manning for Damage Control State 3

In State 3, Damage Control requirements are to be covered as follows:

a. **Control**

(1) **Multi-Section Ships.** HQ1 only manned.

(2) **Single-Section Ships.** Ships with SCCs to be manned continuously by permanent watchkeepers. In other ships the OOD/OOW should maintain the Watertight Integrity Log.

b. **Patrols**. As for State 2, except that in single-section ships patrol duties are covered by nominated personnel and ratings on watch. In ships with a permanently manned SCC, some of the Damage Control functions normally carried out by rounds are covered by automatic alarms and warnings displayed in the SCC and are monitored by the watchkeeper. Notwithstanding this, there remains a requirement for Damage Control rounds to be carried out.

0513. Material Condition of a Ship

The material condition of a ship is of vital importance to its Damage Control preparedness. Planned maintenance schedules take care of most of the requirements but constant vigilance is needed for such as the following:

a. Ensuring the continued watertightness and gastightness of structure and fittings by regular air testing, citadel tests, making certain that holes made when equipment (especially electric cable) is moved are efficiently blanked.

b. Frequent and systematic examination of all clips, rubbers, gas flaps, rod gearing, etc, to ensure that no distortion or other deterioration has taken place.

c. The maintenance of location, control and risk markings.

d. The systematic checking, testing and replacement as necessary of Damage Control and CBRN stores equipment and fittings.

e. The suction strainers of fixed and portable pumps can quickly be choked by loose material left lying on decks or displaced there by shock or blast. Particularly, this applies to soft materials, rags and paper, and to such things as paint chippings and rust scale. If a compartment is in darkness and only partly flooded, the difficulty of clearing suction strainers needs no emphasis. Even large gratings such as those fitted to hangar scuppers can be made useless by loose rags and other detritus washed against them.

0514. Stores and Equipment

Storerooms and provision rooms normally have fitted stowages for their contents and keep-battens or wire mesh grills to secure them. The stores should always be properly stowed with all keep-battens in place and secured. Wrapping papers and bags, cardboard cartons and sacks should be removed and discarded in accordance with ships procedures when no longer required In workshops, hangars, messdecks, etc, cleaning cloths should be kept in metal containers when not in use, or removed from the space and properly secured. Throughout the ship, loose clothing or other materials should never be left about and locker doors should not be left unsecured.

0515. Access to Compartments

a. On assuming Damage Control State 1, personnel are to ensure that non-watertight doors are secured in the open position with the following exceptions:

(1) Non-watertight doors classed as fire barriers in accordance with Ch4

(2) Doors giving access to compartments containing highly classified equipment/materials or attractive store items.

(3) Where ships classified as passenger ships under SOLAS Part 1 Chapter II Part A Regulation 2/f and constructed under the rules applicable to a Class 1 Passenger ship, the regulations contained in SOLAS Part 1 Chapter II-2 Regulation 9/4.1.2.2 are to be followed. Any ad-hoc cabin door securing arrangements removed. There is no requirement to secure in the open position at state 1 and 2 is removed.

b. Compartments containing highly classified equipment or materials and those containing attractive stores items (NAAFI store) may be excluded if the door securing mechanisms are left unlocked. If the compartment is required to remain physically secure during Damage Control State 1 the fitting of a hasp and securing the compartment with a soft padlock may achieve this.

c. Compartments containing highly classified material accessed by non-watertight doors secured by combination keypads are to have their locks latched in the open position. If required, a hasp may be fitted and the compartment secured during State 1 with a soft padlock, this **is not applicable to doors that are classified as Fire barriers.**

0516. Accessibility of Ships Side and Bulkheads

Unless there is ready access to the ships side and to bulkheads, the efforts of repair parties, especially in leakstopping and shoring, may be seriously hampered. This is particularly important in storerooms and is dealt with in Chapter 10.

0517. Security of Magazines

Detailed instructions can be found in BRd 862.

a. **Peacetime**. Normally all compartments (including hoists and trunks giving access) and lockers in which ammunition is stowed are kept locked, and this is known as the **'Security'** condition. When on Operational Tasking or Exercise with the ship in either Damage Control State 2 or 3, Command may direct that certain Munition Stowages be in the "**OPERATIONAL ACCESS** (OA) Condition". This allows quick and easy access to munitions for specific armaments or weapon systems in support of directed operational tasks. All other magazines will remain in the security condition.

b. **Wartime**. When rapid access to magazines containing explosives is likely to be required in order to bring armament quickly into action, normally in Damage Control States 1 or 2, the "**ACCESS** Condition" is to be assumed. In this condition magazines are not locked. Doors and hatches are to remain clipped shut These conditions can be ordered in peacetime, for exercise purposes, by the Command.

Notes:

1. Unlocking of compartments does not imply that they may be left open. The door and other openings to magazines affected by the 'Access condition' or 'Operational Access' must conform to the particular watertight or gastight condition that the ship is in, according to their markings.

2. The condition of magazines, ie 'Security', 'Operational Access' or 'Access' should be recorded in the Ships Explosive Log RN Form S285B.

0518. Hatch Guardrails

Hatch guardrails should be removed and stowed at Action (DC State 1), except around those hatches designated and marked 'Open in Action'. Additionally, they should be rigged around hatches left open as part of exercise requirements, eg at OST where some hatches may be designated to be left open for staff access.

If any hatches are to be left open for protracted periods then the person in charge of the area should consider the requirement to rig guardrails, taking into account the ship motion and other hazards.

0519. Ships Company Clothing

Clothing is in accordance with Chapter 20.

0520. Action Carry Bags

The large amount of personal protective and survival equipment that may need to be carried by personnel at Action Stations or Defence Stations can be a significant encumbrance. Action Carry Bags, which are normally kept in Naval Stores, may be issued to the Ship's Company, when authorised by the Command. This will enable personnel to have the items immediately at hand without wearing them about the body. The contents of the action carry bad is dependent on the situation and set by the command

Table 5-1. Damage Control States of Readiness

Guidance for Damage Control and Firefighting preparations. BRd 2170 (7 series) should contain class specific preparations.

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Preparations for War	None.	All preparations for war completed iaw BRd 2170(1) and BRd 2170(7)Series	
Watertight Condition	X (Y for situations of increased risk).	Y	Z
Gastight Condition	None.	None or A.	
Dress	Dress of the day.	As State 1 but with anti-flash hoods down, lifejackets and survival suits to hand.	Full action dress iaw Chapter 25.
Manning	Fire and Emergency Party (in harbour/Standing Sea Fire Party (at sea). Patrols active with SSD. SCC manned.	HQ1 and FRPPs manned iaw Quarter Bill (defence watch manning) patrols active, HFEP/SSEP detailed in each watch.	Full Damage Control teams closed up iaw Quarter Bill, patrols active, dispersal of personnel

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Fire and Repair Equipment	Equipment in normal stowage's. FRPP lockers locked.		At each FRPP dress 1 x Support Party in full firefighting rig, off air, communications equipment to hand. Fire and repair lockers unlocked and contents checked; on completion doors should be closed and secured with a drop-nosed pin but not locked.
	In all states fire hoses with nozzles are to be connected to hydrants.		
Non Watertight Doors (except fire doors)	Normal use.		All cabin doors and doors to unmanned compartments to be secured in the open position
Locked Compartments and Keys (except magazines)	Mortice locks and padlocks locked. Duplicate keys in normal stowage.	As for State 3 but duplicate keys held at FRPPs.	All compartments unlocked, unmanned secure stowages to be re-secured with soft padlocks only.
Magazines	Security condition or access condition.	Access condition.	Access condition.
Escape Ladders	Secured in the useable position (unless this interferes with normal access).		Secured in the useable position.

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Ramset Explosive Power Tool	Explosive charges in small arms magazine.	Ramset Tools to be accessible. Explosive charges to be issued to Mobile Repair Party.	
Thermal Lance	In normal stowage.	Accessible to Mobile Repair Party.	
Cutting and Spreading Equipment	In normal stowage.	Immediately accessible to Mobile Repair Party.	
Smoke Curtains	Stowed.	Stowed.	
Hatch Guardrails	Rigged.	Rigged.	Removed and stowed, except hatches marked: **'OPEN IN ACTION'.**
High Pressure Sea Water (HPSW) System	As ordered, checked on going to sea.	The system may be de-isolated to an extent dictated by the threat. In general, the number of running fire pumps should be reduced and the HPSW main isolated into the same number of sections as there are HPSW pumps running. Main systems board is maintained. In harbour the system is run as ordered. Pump starter override switches to be unlocked.	Divide HPSW main into as many sections as there are serviceable pumps. Run 1 pump to each section. Ensure main and duplicate supplies to magazines are from separate sections. Pump starter override switch to be closed. All CFHR de-isolated.

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR. (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR. (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Magazine Floods and Sprays	**Manual Systems** Main spray isolating valve (**LOCKED OPEN**). Operating valve (**LOCKED SHUT**). **Automatic/Semi-Automatic Systems** Main spray and system isolating valves (**LOCKED OPEN**). Spray shut off valve (**LOCKED OPEN**).	**Manual Systems** Main spray isolating valve (**OPEN***). Operating valve (**SHUT***). **Automatic/Semi-Automatic Systems** Main spray isolating valve (**OPEN***). Spray shut off valve (**OPEN***). *Padlock opened with hasp re-inserted in the valve locking pin/cotter.	
Portable DC/FF pumps (less than 100 kg)	Available consistent with maintenance.	Checked and tested and ready for immediate use.	
Mobile DC/FF pumps (more than 100 kg)			

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Emergency Electrical Equipment	Equipment secured.	Equipment checked. Emergency cables ready for immediate use.	Emergency electrical equipment.
Main Machinery	As ordered, consistent with maintenance.	**Sea:** Full power available. **Harbour:** As ordered.	Full power available.
Auxiliary Machinery	As ordered, consistent with maintenance.	**Sea:** As ordered. **Harbour:** As ordered.	
Fresh Water	Normal use.	Normal use.	Pumps stopped. System isolated.
	Notes. 1. Before the pumps are stopped, plastic jerry cans are to be filled with fresh water and distributed to FAPs and SMPs. 2. Pumps may be restarted at the discretion of the Command to provide essential facilities such as Bridge window washing, cleansing stations and essential domestic services.		
HP Air	Main de-isolated.	Main isolated. Compressors run as necessary (but not from compartments affected by smoke).	
Refrigeration and Air Conditioning	Operating except as required for maintenance.	Operating unmanned.	Operating unmanned.
		In Condition ALFA tested regularly for leaks by personnel in BA.	
	Note. *In condition ALFA tested regularly for leaks by personnel in BA*		

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Main Generators	**Sea:** Sufficient running to ensure adequate power if one fails. **Harbour:** As ordered.	**Sea:** On load as required. All other generators at immediate notice. **Harbour:** As ordered.	All generators running and supplying their own sections.
High Power Electrical Distribution System	As ordered in the BR 6500 series, Main Supply System Handbook, CBRNDC Class Book or BR 2000 series. It is important that interconnecting cables are isolated whenever possible and always in State 1.		
Emergency Generators	At immediate notice except during overhauls.		
Changeover Switches	All automatic COSs to be in the ‘auto’ mode. Both hand and automatic COSs should select the Normal supplies.		
Converted Electrical Supplies	Enough conversion to meet the load, (consistent with maintenance). LP battery floating.	Enough conversion to meet the load. LP battery floating.	All conversion machinery available. LP battery floating.
Hydraulic Ring Main	Pumps running and system pressurised as required.	As for State 1. De-isolated and pressurised if required for use as required by HQ1.	Pumps shut down. System de-pressurised and isolated iaw system BR.
Chilled Water	**Sea:** As for State 2. **Harbour:** As required.	As for State 1 unless maintenance requirements dictate otherwise.	All plant available. System isolated iaw system BR.

Table 5-1. Damage Control States of Readiness (Cont'd)

CONSIDERATIONS	STATE 3 NORMAL PEACETIME STATE AT SEA AND IN HARBOUR (NON ACTION DAMAGE POSSIBLE AT ANY TIME)	STATE 2 NORMAL WAR STATE AT SEA AND IN HARBOUR (ACTION POSSIBLE WITH LITTLE WARNING)	STATE 1 ACTION STATE (ACTION IMMINENT)
Galleys, Bakeries, etc	Normal use.	Normal use, emergency food at hand for action messing (not to be used without Command approval).	Shut down except as ordered for action messing. Galleys, etc. not to be used without Command approval (for Action messing details see BR 93).
Naval Store Rooms	As for State 1 consistent with storing.	Stowed to meet the Damage Control threat (see BR 4).	Naval Store Rooms.
Victualling Store Rooms	As for State 2 consistent with storing and maintenance except stocks of RU provisions not required.	As for State 1 consistent with storing.	As for Naval store rooms. About 7 days provision to be stowed high in the ship (consistent with stability).
Secondary Medical Position (SMP)	Unrigged. Equipment stowed in normal stowage.	Equipped but unrigged, unmanned and gear stowed.	Unmanned. Equipment checked and re-secured. To be rigged and manned as required following triage.
Sickbay	Normal use.	Flammable stores not required moved to the medical store.	Used as medical HQ but not as FAP. Equipment should be made ready as standby
First Aid Posts (FAP)	Unmanned. Gear stowed in lockers. Analgesia in Controlled Drug cupboard.	Posts and contents of first aid lockers checked periodically. Analgesia issued to selected Officers and Senior Rates.	Manned. Analgesia issued. Medical personnel dispersed throughout the ship.

SECTION 2 - RISK AND CONTROL MARKINGS

0521. Introduction

a. Resistance to flooding and CBR contamination depends on watertight integrity.

b. Watertight integrity, is maintained at all times while a ship is water-borne. Gastight integrity is achieved by creating an area of collective protection known as the ‘citadel’. The purpose of establishing the citadel is to prevent the ingress of CBR contamination whilst also providing protection for personnel stationed, or taking cover, between decks so that normal living can be resumed and the ship can recover and sustain as soon as possible after an attack.

0522. Discipline

Although it is vitally important to maintain the watertight structure and fittings in an efficient condition, experience has shown that progressive flooding has almost always been due to inadequate control of openings. All personnel must be fully conversant with the system of markings used to make this control effective, both for watertight and gastight integrity, and a record must be kept of the watertight and gastight condition of the ship at all times. The watertight condition is recorded in the Watertight Integrity Log and any other method directed within local procedures; the gastight condition is recorded on the CBRN Ventilation Board. The requirements of watertight and gastight integrity will conflict with habitability, routine and freedom of movement. The condition of the ship is thus tied in some ways to the states of readiness. The system of markings described in this chapter is intended to meet these conflicting requirements as far as possible and to allow the necessary degree of flexibility.

0523. Watertight Risk

A ship sustaining major underwater damage will probably either sink very quickly (30 mins or so) or, if the first hour is survived and good damage control is exercised, be saved. Realistic estimates can be made of the maximum flooding, attributable to major damage, which would not sink the ship in a short time. This flooding can then be related to the increase in draught, heel and trim for such damage occurring at different places in the ship. These calculations give a zone (called the Red Risk Zone) that extends from the keel to somewhere above the deep waterline, rising higher at the ends and, in a broad ship, at the sides.

0524. Red Risk Markings

Openings to all compartments within the Red Risk Zone are deemed to be, when open, of immediate risk to watertight integrity. These are known as Red Openings, and are marked as follows:

a. **Doors and Hatches**. By a red triangle across the upper corner furthest from the hinges.

b. **Valves and Scuttles**. By a red disc (with or without an arrow) on or near the fitting.

0525. Emergency Control of Red Openings

In an emergency, such as unexpected damage or imminent collision, red openings are to be rapidly closed by broadcasting the order **"CLOSE ALL RED OPENINGS"**. The broadcast of this order indicates an emergency and that speed of response is vital. The order overrides any previous watertight order or concession, such as 'May Be Left Open' tallies or 2 clip markings. When the order is in force, no Red Opening may be opened without specific permission from Damage Control headquarters. The broadcast order may specify openings in one particular part of the ship or may apply to the whole ship. On hearing the broadcast **"CLOSE ALL RED OPENINGS"**, all personnel are to close all red openings in their vicinity. This includes all marked openings in adjacent compartments indicated in Contents Circles.

0526. Watertight Control

The main watertight control markings are:

a. **X (X-Ray)/Y (Yankee).** In black on doors, hatches, drain cocks, valves, some ventilation fans and ventilation openings (including slide valves) that affect watertight integrity. Required generally only in the Red Risk Zone.

b. **Z (Zulu).** In black on similar openings to above. Required generally only outside the Red Risk Zone to give watertight integrity and protection against blast, flash and fire.

0527. May Be Left Open (MBLO) Tallies

a. Watertight control can also be maintained with MBLO tallies. These tallies and their fastenings must be made from a fire resistant material. The number of MBLO tallies allowed in a ship is detailed in the Ships Class Book and also in Ships CBRNDC Orders. In addition to the standard markings, tallies are to be permanently marked **FORWARD** or **AFT** (small ships) or with the section number in a large ship. There are three types of MBLO tallies:

(1) **May Be Left Open.** To be used on certain openings which would normally be shut in a particular watertight condition but which may need to be open for periods without being attended, eg a door which provides passage in almost continuous use by day but which can be shut at night, or a hatch in frequent use during working hours but where it cannot be guaranteed that someone is always on hand to shut it instantly. Tallies should not be left on openings for long periods merely to gain entry to compartments with difficult access. The number of tallies issued must be kept to a minimum and they are not to remain on openings for indefinite periods. The tally should permanently bear the printed words **MAY BE LEFT OPEN**. The location marking of the opening and the condition(s) for which it is authorised are to be added, by marker pen, at the time of issue. It is to be hung over the normal control marking. In conditions other than that or those for which the tally is authorised, the tally must be withdrawn, and the opening controlled by its normal marking. When a tally has been issued, responsibility for the opening rests with HQ1 (normally through its Damage Control patrols).

(2) **May Be Left Open in Action.** Openings (generally only a few) that would normally be shut but may need to be open and possibly remain open for action purposes should have a tally hung or screwed on, not covering the control marking, and bearing the words **MAY BE OPEN IN ACTION.** At all times other than those authorised in the Ships CBRNDC Orders, the opening must be controlled by its normal marking.

(3) **May Be Left Open - Man Below.** Hatches (and some doors) that need to be open during the course of routine rounds (eg gland spaces and plummer block compartments) but which are marked with a watertight control marking X or Y, may remain open for the duration of the rounds inspection by the use of a tally bearing the words **MAY BE LEFT OPEN, MAN BELOW.** The tally is issued to the department concerned and is to be hung on the top hatch (or door) when rounds of the space commences and removed when rounds are complete and the hatch(es)/door(s) are shut.

Note. *See BRd 2170(2) for details of the tally for use on ALFA doors between sub-citadels.*

b. Keeping in mind the control markings of openings and the general routine which the ship works (or is to work), the MEO should examine the actual watertight state of the ship in each of the three watertight conditions (X, Y and Z) making allowance for any MBLO tallies that are authorised and for MBLO - MAN BELOW tallies that have been issued to departments for their rounds. Such an examination should place the ship in the most pessimistic state authorised for each condition. The MEO should then decide how many more openings he can allow to be open in each condition, giving consideration to the need to live and work in the ship.

c. If a routine is laid down for opening the various compartments that have to be visited regularly, the number open at any one time can be kept small. For example:

(1) FORWARD

3C Canteen Store	0945-1015
3D Naval Store	1015-1045, 1400-1430
4E Naval Store	1115-1145, 1500-1530
4G Magazine	0800-0830
4H Magazine	0915-0945
3J Provision Room	0930-0900
4J Beer Store	1045-1115

(2) AFT

4P Magazine	0830-0900
4P Naval Store	1015-1045
4Q Naval Store	0915-0945, 1430-1500
4R Provision Room	0800-0830

d. Such a routine allows all personnel concerned to know that they may receive permission to open their particular compartments at the times stated, but permission to open must still be obtained from HQ1.

In addition to the regular openings as above, allowance must also be made for casual requirements to open compartments. The total number of openings permitted to be open at any one time should be worked out on the basis of at least two intact transverse bulkheads between each applied MBLO tally. Once decided, the allowances should be laid down in the Ships CBRNDC Orders[a], and a copy should be inserted in the Watertight Integrity Log or prominently displayed in HQ1/SCC.

0528. Watertight Control Qualifying Symbols

The only qualifying symbols used in conjunction with watertight control are:

a. **2-Clips.** On doors and hatches where the normal volume of traffic makes full clipping impracticable; it may also be used on openings selected as routes to shelter positions. The openings to be so marked are decided by ships Officers. All clips are to be put on in emergency. Rules for the use of the 2-clip marking are given in later paragraphs.

b. **Vent 2-Clips/Vent No Clips.** Required in some ships on venting routes from magazines. The openings to be so marked are decided by the MOD at the design stage. In wartime the venting condition is ordered when action is imminent (Damage Control State 1). In peacetime it is ordered in ships which are in the proximity of a hostile shoreline, or boat, or where the threat from dissidents/saboteurs creates a potentially dangerous situation. All clips are to be put on in an emergency.

0529. Gastight Control

Gastight control is exercised by the assumption of condition A (ALFA), which is superimposed on the watertight condition (Z or Y) as required. Gastight control markings are letters A, M and R (painted orange) and the following qualifying symbols:

a. **Citadel In/Citadel Out.** On airlock doors/hatches specified for citadel entry/exit in Condition ALFA. They are marked **CITADEL IN** on the outside and **CITADEL OUT** on the inside of the citadel. They may be used for access to and from the citadel prior to contamination, after which they are for exit only and access to the citadel is via the cleansing station only. The markings are painted in orange and the openings so marked are decided by the MOD.

b. **Cleansing Station.** Entry into the citadel after the ship becomes contaminated must be made only through the cleansing station, the outer door of which (leading into the undressing area) is marked **CLEANSING STATION** (painted orange).

c. **Shelter.** An arrow and the word **SHELTER**, both in orange, indicate routes, on and below the weather deck, to shelter positions. A door on the route is thus indicated by signs on the bulkhead on either side pointing to it; the door then has on it only the usual risk and control markings, and possibly the '2-CLIP symbol'. If a hatch on the route has no adjacent bulkhead, the symbol is placed on the hatch cover. The broadcast **"SHELTER SHELTER SHELTER"** is an emergency order allowing any route so marked to be used.

[a] BRd 2170 Volume 7 Series

d. **Sub-Citadel.**

(1) **Airlock Division.** Where passage between sub-citadels is via an airlock, the doors/hatches forming the airlock must bear the appropriate watertight risk and control markings and the words **SUB-CITADEL IN/OUT** on each side. In Condition ALFA the doors/hatches must be shut except for passage. If required to remain open, permission must be obtained from HQ1 and a sentry posted.

(2) **Single Door/Hatch Division.** Where passage between sub-citadels is via a single door/hatch, the door/hatch must bear the appropriate watertight risk and control markings, the gastight marking **'A'** and the words **SUB-CITADEL** on each side. In the sub-citadel condition, the door/hatch will be controlled by the gastight marking **'A'**. In the whole-citadel condition, the **'A'** marking should be covered by a disc bearing the words **OPEN FOR PASSAGE ONLY** and the appropriate location marking of the door/hatch.

e. **Open In ALFA.** Fitted on the supply flaps to CBRN filter units, which are to be open in Condition ALFA.

0530. Citadel and Gas Free Spaces

With regard to gastight integrity, compartments can be placed in 4 categories:

a. **Citadel**. The citadel is defined as the main group, or groups, or interconnecting compartments that can be included together within unbroken gastight boundaries and in which air can be re-circulated. Movement must be possible throughout the citadel without the need to leave its confines. In some ships, large parts of the superstructure are included in the citadel. The citadel is shown in ships' drawings and in the appropriate Ships CBRNDC Class Book, outlined in orange.

b. **Citadel - Risk of Contamination**. Certain compartments included in the citadel can, in some circumstances, become contaminated as a result of failure of structure or equipment, or because temperature rise necessitates ventilating the space. These are chiefly main or auxiliary machinery spaces and are shown in ships' drawings and in the appropriate Ships CBRNDC Class Book, as 'CITADEL, RISK OF CONTAMINATION' within the citadel but indicated by a brown wash.

c. **Gas-Free Compartments**. Isolated compartments from which gas can be excluded but which, owing to the layout of the ship or for some other reason, cannot be included in the citadel are called 'GAS-FREE COMPARTMENTS' or 'GAS-FREE SPACES'. They are shown in ships' drawings and in the appropriate Ships CBRNDC Class Book outlined in purple.

d. **Gas-Free, Contaminated if Used Compartments**. Certain compartments, eg fuel storage tanks, some magazines, workshops, can be kept gas-free if not used but will become contaminated if used or ventilated during an CBRN attack or in a contaminated atmosphere. They are shown in ships' drawings and in the appropriate Ships CBRNDC Class Book as **'GAS FREE, CONTAMINATED IF USED'**, outlined with a broken line in alternating orange and purple.

0531. Rules for Watertight and Gastight Control Markings

Observance of the rules for the control of watertight and gastight openings is the responsibility of all personnel, and they must be continually aware of which watertight and gastight condition is in force and also of the requirements of each condition. The maintenance of the set condition is policed by kept by Damage Control patrols or by frequent rounds by the Watch on Deck or Duty Watch according to the state of readiness, the type and size of ship. The rules for control markings are:

a. **'X': SHUT IN ALL WATERTIGHT CONDITIONS.** To be opened only for transit and fully clipped on gaining access. If required to be kept open, a sentry must be posted or other arrangements made for the opening to be shut instantly on order, or a MBLO tally must be used.

b. **'Y': SHUT IN CONDITIONS Y AND Z.** May be open in Condition X-Ray. When shut may normally be opened for passage or use but must be immediately shut again. If required to be kept open in Conditions Yankee or Zulu the rules as for X-Ray openings apply.

c. **'Z': SHUT IN CONDITION Z.** May be open in Conditions X-Ray and Yankee. When shut, the rules as for Yankee openings apply.

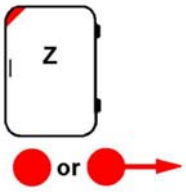
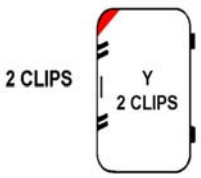
d. **'A': SHUT IN CONDITION A.** When Condition ALFA is in force, openings so marked are not to be opened without specific permission from HQ1.

e. **'M'.** In Condition ALFA only, openings so marked are under the control of the user department. User departments must ensure that the orders regarding their M openings are clear and fully understood by their personnel.

f. **'R'.** Fittings or equipment so marked must continue to run or remain open for recirculation.

***Note**. 'Shut' or 'Closed' means fully clipped, except for openings bearing 2-CLIP or venting symbols (in the venting condition). Such openings are to be fully clipped on assuming that watertight integrity condition but may be relaxed to 2-CLIPs by Command to allow access to high risk compartments (ie machinery compartments) or to facilitate transiting through the ship for specific reasons (action messing, embarkation of troops etc). Additionally, such openings are to be fully clipped in emergency or, on shelter routes, when the last person is through to shelter and when the threat warning is RED. Y 2-CLIP doors (except those on shelter routes) are to be fully clipped, at all times, in Condition Zulu.*

Table 5-2. Risk and Control Markings

EXAMPLE AND COLOUR		SIZE	APPLICATION
RISK MARKINGS		Equal sides 250 mm painted 50 mm Transfer	Red on both sides of door or hatch, upper corner opposite edge to hinges. On or near valve, ventilation closure, flap, fan, etc, scuttle.
CONTROL MARKINGS	Watertight **X Y Z** Gastight A M R	Embossed Aluminium Tallies Door or Hatch; 75 mm	Watertight. Upper centre of door or hatch. Gastight. Immediately below watertight control.
	Watertight **X Y Z** Gastight A M R	Valve, Ventilation Closure, Flap, Fan, Scuttle; 40 mm	As needed on or near fitting
	CLEANSING STATION CITADEL IN/OUT SUB-CITADEL IN/OUT	40 mm Block Letters Embossed Aluminium Tallies	Over or beside outer door of undressing area on selected doors/hatches. At sub-citadel dividing boundaries
MBLO TALLY		150 mm Square OPEN - 40 mm Block Location - 15mm Remainder - 25 mm	Three types: a. Slotted screw hole for hanging over existing marking. b. Screwed on hatch cover. c. With loop for hanging on hatch. May be left OPEN May be left OPEN in Action May be left OPEN, MAN BELOW
QUALIFYING SYMBOLS		40 mm Block Letters Two Parallel Black Lines 125 mm long, 6 mm wide and 15 mm apart - water slide transfer.	Control markings. 'Vent 2 clips' and 'Vent no clips' are similar. On 2 clip doors and hatches the parallel lines to be adjacent to clips to be used and angled to show direction clips should be put on

0532. Designation of Openings

a. Risk and control markings for all ships are mandatory and the requirements are detailed in DefStan 07-204 and the damage control policy. Watertight risk markings and gastight control markings cannot be changed following Naval Authority Group (NAG) certification, but if seagoing experience indicates that a change of certain watertight control markings is considered essential, COs are to submit their proposals to their Platform Authority giving full reasons in support of the proposals. Subject to their agreement, the Platform Authority will forward details of the proposals to NAG for approval before authorising implementation by ships.

b. Within the Red Risk Zone, openings that affect watertight integrity should generally be X-Ray or Yankee. Zulu is acceptable only where there is need for free access at all times, other than in the highest state of readiness, is paramount. Above the Red Risk Zone, openings that need to be shut to prevent ingress or spread of blast, flash or fire should generally be marked Zulu. Doors normally kept locked (eg storerooms) should be marked Zulu since the responsible person can then open them without reference to HQ1. There may be, exceptionally, in some ships, a few doors and hatches high in the ship which are much used, do not immediately affect watertight or gastight integrity, and have little value in the restriction of blast, flash or fire; these may be left unmarked, and if required to be shut for any reason they can be shut by order.

0533. Citadel Boundaries

Principles of application of watertight and gastight markings for openings in the boundaries of citadels and gas-free spaces are:

a. **Doors and Hatches**. X-Ray, Yankee or Zulu markings with an orange ALFA (or M or gastight qualifying symbol) secured immediately below the watertight control marking.

b. **Ventilation**. This must be marked according to the needs of the compartment served. Some ventilation openings, valves and fans can bear the same risk and control markings as the access to the compartment concerned (eg some magazines and storerooms). Other systems must continue in operation in a high watertight condition and would then normally be controlled by a gastight control marking (A, M or R) but should bear in addition the appropriate watertight risk marking. To reduce the chances of spreading fire, flood or contamination through ventilation systems, it is important that non-essential ventilation is so marked as to reduce its use in the high Damage Control and CBRN conditions to a minimum.

c. **Scuppers, Drains and Soil Pipes**

(1) Any scupper, drain or soil pipe that has no opening into the citadel needs no marking other than the watertight risk marking (red) on the screw-down storm valve and its remote handwheel.

(2) In ships with citadels, all scuppers, drains and soil pipes opening into the citadel should be fitted with 150 mm water seals. No gastight marking is then needed but the storm valves and their handwheels should have the appropriate watertight risk marking.

d. **Discharge Overboard Valves**

(1) All discharge overboard valves are to be painted black and require a watertight risk and gastight control marking as necessary.

(2) If the valve is inside a compartment or hidden behind ships side linings then a notice stating **DISCHARGE O/B VV** (50 mm black lettering on the background paint scheme) must be clearly displayed on the door or adjacent structure to the door leading to the compartment, or on the lining panel leading to the valve. Risk and control markings are not required at this position.

0534. Scuttles and Windows

a. All scuttles (including those for emergency escape) and windows in the citadel boundaries are a risk to gastight integrity, and those within the Red Risk Zone are a risk to watertight integrity. Consequently all opening scuttles, windows and deadlights to fixed side scuttles in citadel boundaries should bear the appropriate gastight orange control marking (used to denote risk); it will then be mandatory for them to be shut on assuming Condition ALFA.

b. All opening scuttles on ships' sides or internal within the Red Risk Zone, including deadlights to fixed scuttles, should bear the watertight red risk marking in addition to any gastight control marking. They should not, however, be given a watertight control marking.

c. The opening and closing of scuttles should be under the direct control of the Command through the MEO/DCO. In an emergency, the order **"CLOSE ALL RED OPENINGS"** overrides any permission that may have been given to open scuttles so marked.

d. Light-excluding plates fitted to viewing ports in watertight doors and hatches for darken ship arrangements do not require watertight or gastight markings.

0535. Bolted Manhole Covers

These bear no risk or control markings. They are considered part of the structure in which they are situated. However, should they be removed for any purpose (eg maintenance, inspection, upkeep period, etc) the fact must be reported to and recorded in HQ1 with the times opened and re-secured and the Tag Out procedure must be followed.

0536. Escape Hatches and Scuttles

a. Escape hatches and scuttles do not, normally, bear risk or control markings. Chapter 4 details the identification colours and markings to be used for all escape routes.

b. Escape hatches are not to be covered by carpet or any fittings likely to interfere with their use. Carpets surrounding an escape hatch are to be correctly fitted and secured clear of the hatch cover.

c. With the exception of emergencies, HQ1 is to be informed prior to an escape hatch being left open whilst unattended, and the area is to be cordoned off to prevent accidents.

d. 'T' handles bars for external escape hatches are to be stowed within the nearest upper deck access or airlock and the whereabouts of the stowage to be clearly highlighted adjacent to the escape hatch.

0537. Examples of Typical Markings

The following are typical of the markings that might be found on various accesses, mainly in the red zone:

Table 5-3. Typical Markings

SPACE/AREA	MARKING
Magazines	X or Y (possible use of a **MAY BE LEFT OPEN IN ACTION** tally).
MEO's rounds spaces	X or Y (possible use of a **MAY BE LEFT OPEN - MAN BELOW** tally).
Bathroom in Red Risk Zone	Y door or Y hatch with Z manhole.
Gangway door, Red Risk Zone (see **Note 1**)	Y (2-clips if necessary).
Gangway door, above the Red Risk Zone	Z (2-clips if necessary).
Workshops, hatch access	Y if spring loaded or manhole fitted; Z if no manhole or not able to be opened from below.
Mess spaces and cabin flats with manhole (see **Note 2**)	Y hatch, Z manhole.
Mess spaces and cabin flats without manhole (see **Note 2**)	Z hatch.
Messdeck, small ship (see **Note 2**)	Z (generally).
Messdeck, door access (see **Note 2**)	Y or Z according to traffic.
Main Naval Store (see **Note 2**)	Y hatch, Z manhole. Z if no manhole.
Other stores, working spaces, cable passages, etc (see **Note 2**)	Y or Z.
Main Machinery Space (see **Note 3**)	Where two accesses, one Y, one Z.
Generator Room (see **Note 3**)	X or Y.
Pump Space (see **Note 3**)	X or Y.
Sonar Compartment, manned (see **Note 3**)	Y if can be opened from below; if not, X and **MAY BE LEFT OPEN - MAN BELOW** disc.
Hangar access door	Y or Z with A.

***Notes**:*

1. In some ships, gangway doors in the Red Risk Zone are in such continual use that even Y 2-clip markings are not acceptable. With careful consideration, such doors may be marked Z or, in extreme cases, where frequency and rapid passage is needed even in State 1, Z 2-clip might be more appropriate.

2. In war, it may be necessary to post orders at the entrance to ensure that if the space is in the Red Risk Zone, and occupied, the last person out closes the opening.

3. These openings may need an M in addition. Doors and hatches that give access between machinery spaces and citadels or gas-free spaces, must bear a gastight marking in addition to the watertight marking.

0538. Watertight and Gastight Conditions

Watertight conditions are normally used as shown below, but this does not preclude the Command from ordering a higher condition when it is deemed to be necessary. Watertight conditions govern the watertight integrity of the ship and, since there is always a threat to watertight integrity, there is always a watertight condition in force. The condition ordered depends on the calculated risk of damage and, to facilitate ships routine and habitability, should always be the lowest condition consistent with the risk. Watertight conditions are normally used as follows:

a. **In Peace**

Condition X-Ray	(X openings shut)	Harbour and normal cruising.
Condition Yankee	(X and Y shut)	Dangerous circumstances (eg navigational hazards, exercises).
Condition Zulu	(X, Y and Z shut)	As required for exercise.

b. **In War**

Condition Yankee	(X and Y shut)	Harbour and normal cruising.
Condition Zulu	(X, Y and Z shut)	Action or relaxed action.

The gastight Condition ALFA is superimposed on watertight conditions Zulu and Yankee as required. Condition ALFA is the only gastight condition; it is the fully closed down condition that gives complete collective (citadel) protection against CBRN hazards.

0539. Relaxations to Condition ALFA

In certain circumstances relaxations to Condition ALFA may be permitted. Guidance is given in BRd 2170(2). To improve habitability when Condition ALFA is in force for lengthy periods, certain specific ALFA openings may be opened at the discretion of the Command when the ship is in either Damage Control State 1 or State 2. The openings selected must not form a set gastight condition but, if the operational situation permits, should satisfy only the immediate requirement, eg main galley ventilation to allow the cooking of a main meal, or the heads ventilation as and when possible.

The openings that may be opened may vary depending on the tactical situation and/or the climate. When it is considered that the CBRN threat allows certain relaxations to Condition ALFA, the Command should inform HQ1. HQ1 must then order the required openings to be open specifically by name/location marking, the order being given to the appropriate Fire and Repair Party Post or Section Base (large ship). This routine must be followed on each occasion of allowing relaxations to Condition ALFA. The openings selected must be capable of being shut immediately on order, by a sentry if necessary.

***Note**. When a ship is in Condition ALFA it is vitally important that the citadel pressure remains positive, even when relaxations to the condition are in force and one or more ALFA openings are open. Because firm guide lines cannot be laid down, it is recommended that ships Officers take every opportunity to check citadel pressures with various combinations of ALFA openings open (those most likely to be used in a relaxation of Condition ALFA), supply and exhaust fans running, cleansing station in use, etc, and record the results.*

0540. Relationships Between Damage Control States and Conditions

Damage Control states of readiness used in conjunction with watertight and gastight conditions are the means by which a ship can be prepared to meet all the varying circumstances of service in peace and war. It must be borne in mind that states and conditions are completely separate and must be ordered separately. The following gives practicable relationships between states and conditions and the circumstances under which they would generally apply. They are neither mandatory nor rigid, but are intended as guidance in producing the best working arrangements. The gastight Condition ALFA must never be used alone, but must be superimposed, when needed, on a watertight condition, usually Zulu or Yankee.

a. **Damage Control State 1**

(1) **Action State**. The highest state of Damage Control preparedness, with all Damage Control positions fully manned and relaxations for meals, etc, ordered as necessary and when circumstances permit.

(2) Assumed as far as practicable when **"EMERGENCY STATIONS"** is broadcast.

(3) Normal for Awkward State 1.

(4) Probable watertight condition: Zulu.

(5) Gastight condition: None or ALFA.

b. **Damage Control State 2**

(1) Normal war state at sea and in harbour.

(2) Normally associated with the weapon state Defence Stations (two watches).

(3) Normal for Awkward State 2.

(4) Probable watertight condition: Yankee.

(5) Gastight condition: None or ALFA.

c. **Damage Control State 3**

(1) Normal peace state at sea and in harbour.

(2) Gastight condition: None.

(3) Probable watertight condition:

(a) **Sea.** X-Ray (under circumstances of navigational hazard, eg fog, gale, narrow waters, RAS, entering and leaving harbour, etc, the watertight condition can be upgraded to Yankee with the addition of 'Special Sea Dutymen' who would include any special provision for the particular hazard, for example, HQ1 patrols when entering harbour in very poor visibility).

(b) **Harbour.** X-Ray (with latitude for maintenance, etc).

0541. Method of Control

In all ships in the higher states of CBRN/Damage Control readiness, overall control of the watertight and gastight conditions must be exercised from HQ1. In the lower states, control is exercised from HQ1 through its watchkeepers, from the SCC through its Damage Control watchkeepers, or the OOW/OOD (usually through the Quartermaster), depending on the size and type of ship. Damage Control states and conditions should be set by broadcast or, in harbour; they may be set by routine Daily Orders. Although the state alone, or the condition alone, can be changed at any time, it is better both should be mentioned, eg:

a. **In State 3, Condition X-Ray.** Pipe: **"ASSUME Damage Control STATE 3 CONDITION YANKEE".**

b. **In State 3, Condition Yankee.** Pipe **"ASSUME Damage Control STATE 1 CONDITION YANKEE ALFA".**

c. **In State 2, Condition Yankee ALFA.** Pipe **"REVERT TO Damage Control STATE 2 CONDITION YANKEE"**.

0542. Control of Openings in the Lower Damage Control States

a. The object of controlling watertight openings in the lower states of Damage Control readiness is to maintain as high a degree of watertight integrity as possible, consistent with the working of the ship, and so limit the extent of flooding in the event of sudden damage. Such control serves also to limit the number of openings that need to be shut to achieve Damage Control State 1 Condition Zulu. The Damage Control Door and Hatch Board should be used to show the openings that are opened.

b. The number of MBLO tallies provided corresponds to the number of openings allowed to be open at any one time. When a particular watertight condition is assumed, the watchkeeper in HQ1, or the Quartermaster, is issued with the appropriate number of MBLO tallies. Anyone seeking to open a X-Ray opening, or keep open a Yankee opening in Condition Yankee may be given permission by the watchkeeper, provided that a tally is available to be issued, and at least two intact transverse bulkheads exist between the intended opening and any other approved tallied, opening. The tally should be hung on the opening concerned as an indication to patrols that permission has been obtained for it to be open. The tally must be returned to the watchkeeper as soon as the opening is shut. The OOW/OOD need be approached only if it is thought essential to exceed the number of openings authorised to be open in that condition in that part of ship.

CHAPTER 6

EMERGENCY PROCEDURES AND ALARMS

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CHAPTER 6

EMERGENCY PROCEDURES AND ALARMS

SECTION 1 - EMERGENCY STATIONS

0601. Purpose

Emergency Stations provide a simple standard procedure that will enable a ship to a rapidly adopt a higher state of manning and material preparedness to deal with any hazardous situation in which Action Stations would not be appropriate. Emergency Stations is a rapid and effective countermeasure that will provide the Command with an organisation capable of regaining the initiative in the event of:

a. Fire.

b. Collision or grounding.

c. Aircraft or explosive accident.

d. Flood.

e. Unexpected mine explosion.

0602. Authority

The authority to initiate Emergency Stations rests with the Commanding officer, who may delegate this authority. All delegations of this authority should be detailed in Ships Standing Orders.

0603. Procedure

The pipe **"EMERGENCY STATIONS"** is to be made by an authorised person preceded by the general alarm. Where there is an immediate risk of flooding (eg imminent collision or grounding), The pipe **"CLOSE ALL RED OPENINGS"** may be more appropriate. Care should be taken to broadcast any additional orders or information that will clarify the situation and improve response. The broadcast should include any special instructions for the mustering of spare hands in order to reduce interference with the work of the Damage Control parties. The emergency stations procedures should be detailed in BRd 2170 Vol7 Series and the guidance below may be used.

a. **Manning**

(1) Personnel on watch are to remain closed up until relieved or otherwise ordered.

(2) Personnel engaged in first aid measures to combat the hazard are to continue with their task until relieved by the Damage Control team.

(3) Damage Control teams are to close up as for Damage Control State 1. Firefighters are to dress in full firefighting rig ready for deployment. ME and WE Officers and Senior rates are to close up, as detailed in departmental orders, to provide the fullest control over machinery.

(4) Additional messengers are to close up at the Command position.

(5) Additional internal communication numbers are to close up at positions detailed in the Orders.

(6) First aid parties are to close up.

(7) The remainder of the hands are to act as ordered by the Command, either to remain in their present position or to proceed to stated muster points. The Damage Control teams are not to be impeded. Hands are not to return to their mess decks to collect lifejackets but should carry them if immediately available (all ships have emergency lifejacket stowages on the upper deck).

b. **Material**

(1) Additional electrical power is to be made available from standby generators.

(2) All HPSW service pumps are to be run up, discharging to the HPSW main. System isolation is to be strictly controlled by HQ1.

(3) Fire and repair parties are to carry out the following State 1 preparations if time permits:

(a) Unlock and check damage repair, fire and electrical lockers.

(b) Check compartment locks and keys.

(c) Ensure that there are no suction strainer hazards in the lower compartments.

(d) Check state of openings, including ventilation.

(4) Main machinery is to be controlled from the machinery control position.

0604. Control

Where circumstances arise that dictate Command and HQ1 teams are unable to operate from their primary positions. They must ensure that their locations are known, especially to their subordinates, and that messengers are properly briefed. The spare hands at muster points are to be mustered by divisional officers or senior ratings, and reported to the Officer of the Watch. They are then to be controlled by the XO, normally through the Officer of the Watch.

SECTION 2 - EMERGENCY IN HARBOUR

0605. Purpose

While most of the emergencies listed in Para 0601 could happen in harbour, the use of Emergency Stations would generally be inappropriate as a number of key ratings may be ashore. Therefore, a different system for dealing with emergencies in harbour is required.

0606. Personnel

Initially, the Duty Part of the Watch will be used to deal with any harbour emergency. Should the Duty Part be unable to cope with the situation it will be necessary to muster all personnel hands on board to ensure all personnel are accounted for and identify personnel who may be able to assist with the emergency where required.

0607. Authority

The authority to initiate an emergency clear lower deck rests with the OOD, or the senior officer on board.

0608. Procedure

a. The OOD is to remain in charge of dealing with the emergency until relieved by a more senior officer. The allocation of extra hands is normally to be coordinated by the Officer or Senior rate in charge at the muster point. The pipe **"EMERGENCY, EMERGENCY, EMERGENCY - EMERGENCY CLEAR LOWER DECK"** is to be broadcast. The pipe should always be preceded by the general alarm and followed by the location of the safe area where the hands are to muster[a]. Care should be taken to broadcast any additional orders or information that will clarify the situation and improve response. The emergency clear lower deck procedures should be detailed in ships standing orders, and the following guidance may be used.

b. **Manning**

(1) Duty Part of the Watch remain closed up to deal with the emergency.

(2) Personnel engaged in first aid measures to combat the hazard are to continue with their task until properly relieved.

(3) All remaining hands are to muster at a point stated in the pipe taking the following equipment:

(a) A minimum of 4 sets of firesuits, gloves, firefighters' hoods, boots and socks (usually stowed in the FRP locker).

(b) TIC to be collected and taken to the jetty.

(c) A minimum of 4 sets of BA.

(d) If possible they should take warm clothing with them, particularly at night, but they are not to waste time in returning to their messdecks in order to obtain the clothing.

(4) Damage control and first aid personnel should be mustered apart from the remainder of the hands in order to be more easily detailed to support the Fire and Emergency Party.

c. **Material**. As far as possible and applicable, material arrangements should be as given in Para 0603 sub para b.

[a] the jetty area adjacent to the main gangway should be considered the preferred location for mustering if circumstances permit

SECTION 3 - ALARMS

0609. Audible Alarms

a. **The General Alarm**. The general alarm is **not** to be used for **any** other emergencies, or during any exercises. It may be used during OST when the Safeguard Rule is in force provided that a suitable prefix pipe is made at the start of the serial. A suitable prefix pipe is also to be made prior to system alarm testing. The general alarm is to precede the emergency broadcast on the following occasions of a **REAL** emergency:

(1) Hands to Action Stations (to combat a **real** threat).

(2) Hands to Emergency Stations/Emergency Clear Lower Deck.

(3) Fire/Smoke Alarm.

(4) Flood.

(5) Collision or grounding imminent (Red Openings to be shut).

(6) Emergency landing/crash on deck (but not precautionary landing).

(7) Fire danger.

(8) Casualty.

b. **Chemical Alarm**. The chemical alarm is to be used in an operational CBRN context. It may also be used in a CBRN exercise. It is not to be used for any other purpose. An appropriate pipe should prefix tests.

c. The use of these alarms, as detailed above, is to ensure immediate awareness of all personnel onboard as soon as the alarm is sounded, followed by the swift and correct response by those involved in combating the emergency or taking specific action for personal safety or survival.

0610. Casualty Alarm

a. Upon a casualty being discovered, the following loud vocal alarm (LVA) is to be used: **“CASUALTY, CASUALTY, CASUALTY”**. This is to include the location of the casualty/casualties and is to be repeated until acknowledged.

b. In peacetime it is appropriate to make a Main Broadcast pipe, to include the relevant information. This will ensure that the Medical Branch Rating/Duty First Aider/Standing Sea First Aid Party respond quickly. In the Action State casualties should not be piped. The information should be passed through MHQ.

c. The Casualty Alarm should not detract personnel from their duty to raise a Fire/Flood Alarm (LVAs), but should be included in it.

0611. Smoke Alarm

While it is impossible to provide rigid routines due to differing circumstances, (number of zones sounding, locations, sighted smoke, heat etc.) the guidance issued below should be reflected in BRd 2170 Volume 7 series and adapted as necessary to suit the fitted smoke alarm systems.

a. In the event of a Smoke alarm HQ1 should:

(1) Accept and silence smoke alarm.

(2) Sound General Alarm.

(3) Activate SSEP/HFEP.

(4) Broadcast: "**SMOKE ALARM x3, SMOKE ALARM IN** (compartment name and location marking). **ATTACK PARTY TO INVESTIGATE. SUPPORT PARTY MUSTER AT FRPP** (FRPP location**). CONTAINMENT PARTY MUSTER IN** (compartment name and location marking). **CLOSE ALL SMOKE CURTAINS IN THE VICINITY OF THE INCIDENT. THIS COMPARTMENT HAS NO HV IMPLICATIONS/THIS IS A HV COMPT** (as required)".

(5) Monitor compartment CCTV if fitted.

(6) Use the fire detection network (FDN) to interrogate sensors and other available sensors (If applicable).

b. SSEP/HFEP is to prepare, but should not initiate fixed systems laid down in fire SOPs until the attack party confirms that there is a fire.

c. Attack party are to follow the guidance in BRd 2170(1) para 1705, ensuring they minimise their exposure to smoke.

d. **SMOKE ALARM PROCEDURES TO BE CARRIED OUT ON SMALL SHIPS AND RFA.**

Applicability: MCMV, RCOPV B1&2, P2000, Magpie and all RFA platforms.

(1) In the event of a Smoke alarm HQ1 should:

(a) Accept and silence smoke alarm.

(b) Broadcast: "**SMOKE ALARM x3, SMOKE ALARM IN** (compartment name and location marking). **SSEP/DUTY WATCH TO INVESTIGATE.**

(2) The SSEP or Duty Watch should not implement fire SOPs until the attack party confirms that there is a fire.

(3) Attack party are to follow the guidance in BRd 2170(1) para 1705, ensuring they minimise their exposure to smoke.

CHAPTER 7

ACTION ORGANISATION COMMAND AND CONTROL

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CHAPTER 7

ACTION ORGANISATION COMMAND AND CONTROL

SECTION 1 - ACTION ORGANISATION

0701. General

This chapter describes the Damage Control command and control organisation in a fully manned warship, at sea, in a war environment. The damage control and firefighting aspects are also applicable to peacetime incidents that would require implementation of Emergency Stations. The procedures are based on a ship of DD/FF size, and are to be scaled and adapted for use by other vessels. Guidance on the Damage Control State 2 organisation is provided in Section 3 of this Chapter.

0702. The Command Team

At the top of the Damage Control Command Team, is the CO who is supported by the Command Advisor in the Ops Room (WEO) and the Internal Battle Controller (MEO) in HQ1. These two maintain a liaison using a 'hot line' hardwired communications link, which provides the Internal Battle Controller (IBC) only link with the Command. This link is essential to:

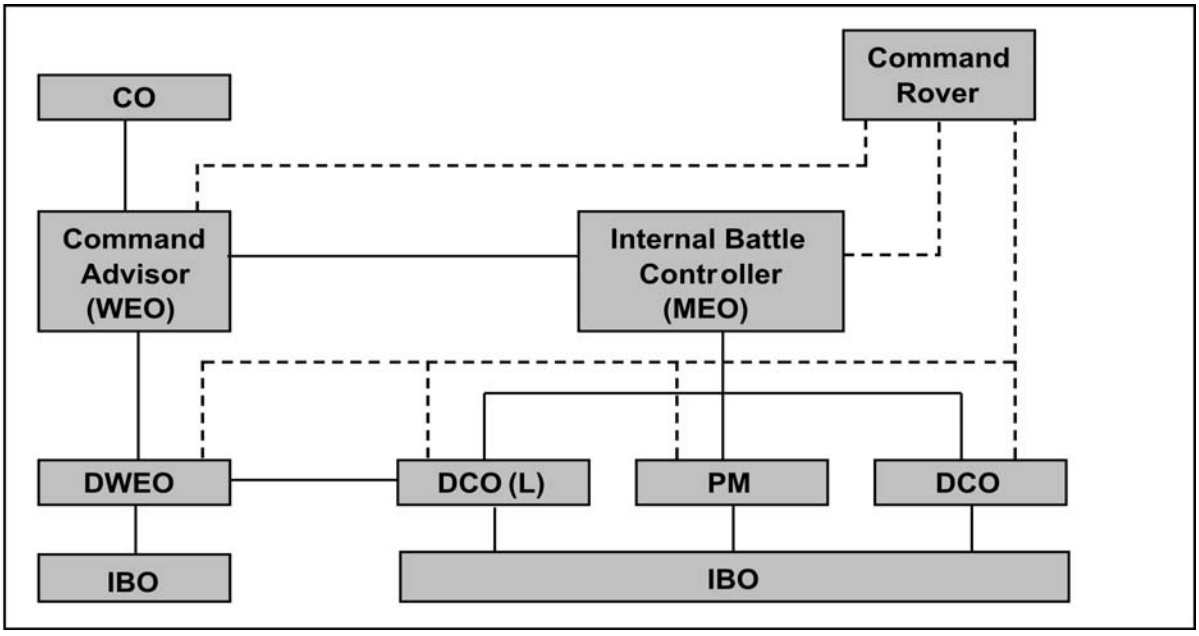
a. Continuously monitor the damage picture and assess the implications.

b. Maintain a close liaison with each other, keeping each other aware of the internal and external picture.

c. Set and review agreed priorities for damage repair teams which will maximise achievement of the Command Aim.

d. Discuss and agree requests for manpower re-allocation, seeking Command approval as required.

Figure 7-1. The Command Team



0703. The Command Aim

The Command Aim is derived from the pre-eminent principle of war, identification and maintenance of the aim. The CO should set the Command Aim to bind together the efforts in all Warfare environments, be they external (ASW, AAW, ASuW) or internal (CBRN, damage control and firefighting). The CO must express his aim in a clearly focused sentence. This should then be transmitted through the command and control chain in two ways: direct to the WEO in the CO/WEO discussions, for onward transmission to the IBC and DWEO; and also by the CO, or PWO, via main broadcast during sitreps to the ships company. Although only one sentence, the Command Aim should contain sufficient information to make incident and equipment priorities readily apparent to members of the Damage Control Command Team. In order to ensure cohesion in the progress toward the Command Aim, each member of the Command Team should give consideration to 'translating' the Aim into plain English for their respective team members identifying individual important compartments and or equipment. For example the following Command Aim may not be readily understood by all: **"TO PROVIDE AAW PROTECTION TO THE HVU WHILST CARRYING OUT ASWC AT SPEEDS OF UP TO 21 KNOTS".** Translating and outlining individual areas of priority will allow a certain level of autonomy and widespread use of 'command by veto', improving leadership efficiency and avoiding overload.

0704. Command Advisor

a. The Command Advisor will normally be based in the Ops Room, and also a node on the DC Telling Line (see Chapter 8), not only to receive information, but also for the input of damage control and firefighting information which may be fed to the Ops Room from other areas such as the bridge, flight deck or weapon crews. The command advisor uses the Command Open Line to monitor the external battle and the tactical situation, and to pass high priority information quickly to the CO and the warfare team. Briefings to the CO must be appropriately timed within the tactical situation and the format of the brief should be agreed beforehand with the CO. Items should be briefed in overall ship priority order using a portable briefing board and must include: advice on courses of action, any change to the Command Aim and the priorities derived from it, as well as fallback or reversionary modes of operation of damaged equipment. While weapon systems are often the highest priority, the brief must include damage control and firefighting, propulsion/systems, casualty and logistics information. An assistant, a junior engineer officer or a senior rating, who has good knowledge of whole-ship mechanical and electrical systems in addition to weapon and sensors, supports the command advisor. The assistant will manage the overall picture and maintain the Command Stateboard, also providing direction to the WSB in accordance with directed aims.

b. To assist them in collating information, the Command Advisor has, at their position in the Ops Room:

(1) A Command State Board, an example of which is at Annex 28B.

(2) An Incident Board, reflecting the board in HQ1.

(3) **A Command Briefing Board.** This is a portable board to allow the WEO to take a concise brief to the Command.

(4) **A Casualty State Board/Proforma.** This is to indicate the name, rate, location, position and type of injury of all casualties. This board should have a cover to protect the information.

0705. Internal Battle Controller (IBC)

a. The IBC coordinates the HQ1/SCC team to achieve cohesive progress towards the Command Aim. It is essential that they keep an overall view of all damage control and firefighting, CBRN, electrical repair and propulsion incidents, while delegating authority to make full use of the specialist personnel.

b. The IBC must decide on movements of personnel from less to more hard pressed areas and give the necessary orders; if necessary, request assistance through the Command from quarters who may have hands to spare. They must advise the Command on any restrictions, eg in speed, which may need to be imposed. If damage is accompanied by CBRN contamination, or the threat of contamination, the situation facing the IBC is more complicated.

0706. Command Rover

a. The Command Rover provides essential support to the IBC, the Directors and the Command Advisor, in providing an expert audit of the overall picture and a Command level physical link between the Command Team, the scenes of all incidents and the FRPP/ZCP/Section Bases that control them. They are able to provide high level leadership and direction at scenes of action to overcome communication difficulties or differences in interpretation

b. The relative strength of a Bridge Team and the experience of an EWO are just two of the factors that the Command Team should consider when deciding how to allocate Command Rovers. If both the XO and the EWO are available to rove they should initially decide how they are going to divide the ship. It is usually better for the XO to cover the fwd half of the ship where he is better placed to update his own tactical awareness. In any case the system must be flexible enough to allow IBC and the Directors to task rovers as required to cover priority incidents. The rovers must be careful not to overload HQ1 with too many visits. If the decision is taken to keep the XO on the bridge, allowing the EWO to rove the whole ship, then consideration should be given as to how tactical information is to be effectively passed around the Damage Control Command nodes.

c. During single State 3 incidents, when the CO will almost certainly be on the Bridge, the XO may be best employed in the roving role with the EWO, leaving manpower control issues to the RPO or a Warfare senior rate.

d. In Capital Ships consideration should be given to using the HODs at State 1 as Rovers in areas which best suit their experience and area of expertise.

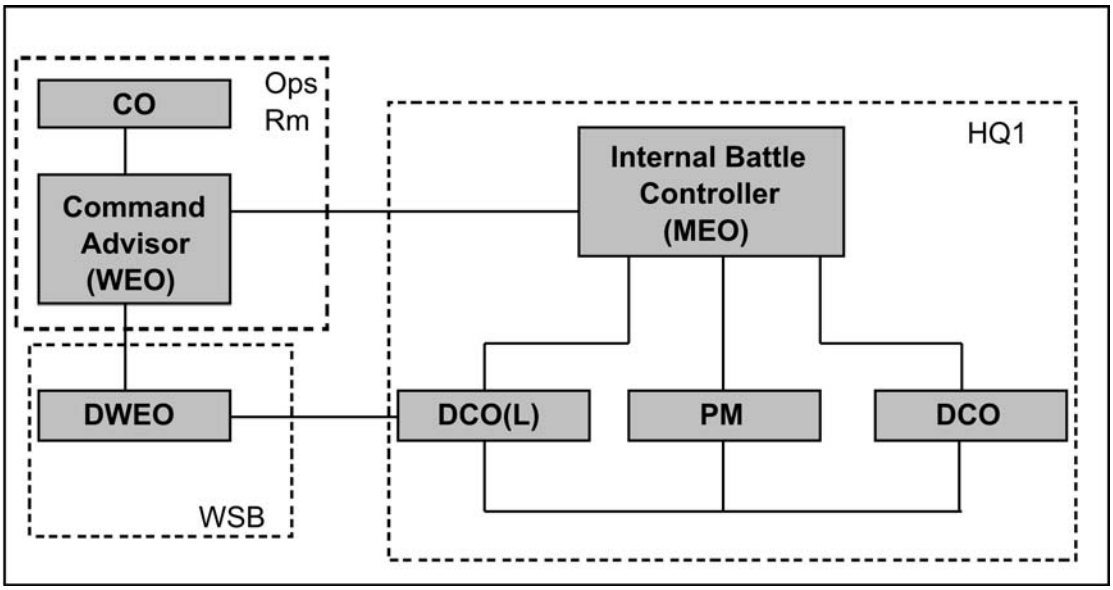
e. At State 3 in Capital Ships rovers should close up at predetermined areas of the incident, again, best utilising their experience eg XO to FCP then to SOTI (if possible) then HQ1 with person who discovered the incident, CDR(L) to above incident, CDR(AE) aft of incident or SOTI for A/C or hangar fires, EWO below incident etc. The Command Rover's tasks are detailed in chapter 3.

f. At State 1, the Command Rover may be on the Bridge or moving around the ship at the time of damage. If on the bridge, the Rover should ensure that the Bridge Team have made an initial damage report and then proceed to HQ1 so that the overall damage picture can be appreciated and incidents prioritised. At State 3 the Rover should proceed direct to the incident to establish a clear picture of events from the incident manager before heading to HQ1 to provide valuable confirmation of the extent of damage, establishing boundaries and actions taken so far. As well as visiting incidents, Section bases, FRPPs, HQ1, WSB and HQ2, periodic visits should be made to the Ops room and bridge to gather a tactical update, not forgetting to update incident boards in these locations. This should allow the XO to assume conduct seamlessly if the CO is incapacitated and allow relevant tactical information to be disseminated to all Command nodes as the Rover moves around the ship. Arrival in HQ1 should be announced **"XO/EWO in HQ1"** and the relevant Director briefed, with the IBC listening, ensuring that the Incident Board Operator (IBO) plots the information. When incidents are under control/complete, the Rover should ensure that the impetus is maintained throughout the regrouping and re-stowing phase.

0707. Directors of the Internal Battle

The next element of the Command Team are those who will actually direct and coordinate the damage repair activity. The directors of the internal battle are the Damage Control Officer (DCO), Damage Control Officer (Electrical) (DCO(L)) and Propulsion Manager (PM) all in HQ1/SCC, and the Weapon Section Base (WSB). Their aim is to achieve an effective recovery from the damage by acting in accordance with the priorities and instructions given to them by the Command Advisor and IBC, ensuring that these priorities are the focus of activity at the scenes of incidents. The tasks of these directors overlap in several areas and therefore it is essential that they communicate with each other. This is achieved by effective inter-desk liaison within HQ1/SCC, often using a 'chit' system, and the 'green line' between the WSB and HQ1/SCC 'L' desk.

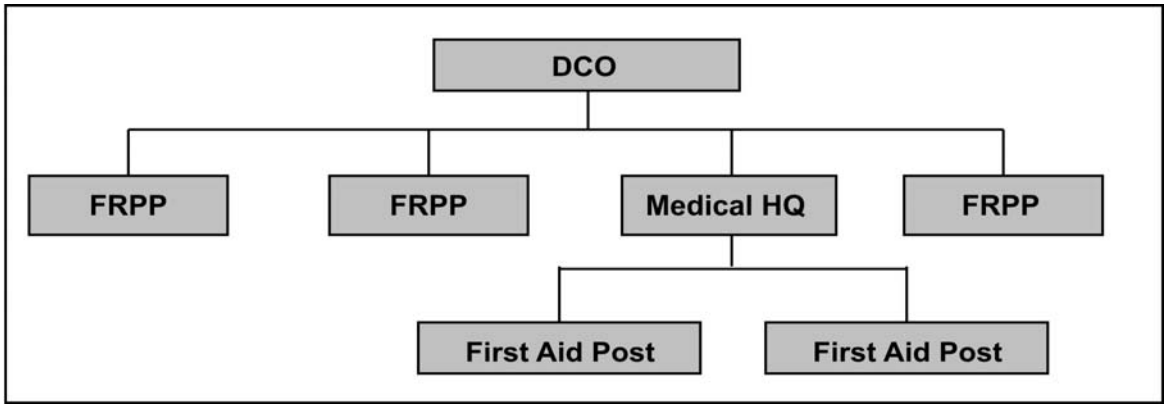
Figure 7-2. Ops Room/HQ1/WSB Liaison



0708. Damage Control Officer (DCO)

The DCO provides an assessment for the IBC of the overall damage picture in the ship except in the main machinery spaces. He coordinates the efforts of the Fire and Repair Parties (FRPs) and medical teams. The damage picture is maintained using the main Incident Board and its associated operator (IBO), who is linked to the incident boards at all the command nodes (both FRPPs, Ops Room, WSB and AHQ) by the DC telling line. DCO is also directly responsible for the management of essential services in support of the DC effort (ventilation, High Pressure Sea Water (HPSW) main, eductors etc) and he will need to liaise with DCO(L) and PM to achieve this. DCO directs the actions of the FRPs in a management and coordination task, identifying and prioritising incidents and maximising the use of his personnel and material resources, or identifying when resources must be re-allocated. His priorities may lie in dealing with incidents, or in incident boundary management, or in containing incidents to allow other damage repair tasks to be carried out. The Logistics Support Cell (see Chapter 10) is under the control of the DCO, but will normally liaise directly with the repair teams. Similarly, the Medical Headquarters (see Chapter 11) will liaise directly with various control positions.

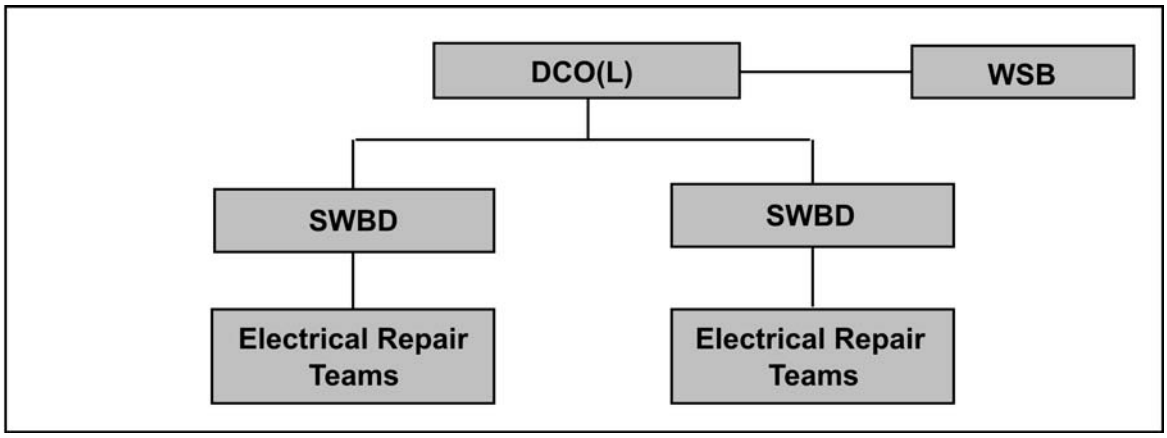
Figure 7-3. Damage Control and Firefighting Incident Management



0709. Damage Control Officer (Electrical) (DCO(L))

The DCO(L) is responsible for the integrity of the electrical power system and converted supplies. Their team must quickly build an accurate picture of damage to electrical services and the effect on key systems. DCO(L) then directs the electrical and switchboard teams in their repair efforts using the dedicated communications net (‘green line’) to the switchboards and the Electrical Repair Teams. DCO(L) has a key liaison function, both to the WSB via the ‘green line’ and inter-desk within HQ1. They must ensure loss of lighting etc is plotted on the main Incident Board in HQ1, as this information needs to reach all command nodes, he must also study the Incident Board to understand how the other incidents influence their own decisions. In QEC an experienced Senior Rating (WE) may be utilised by the DCO(L) to provide detailed information on Weapons systems.

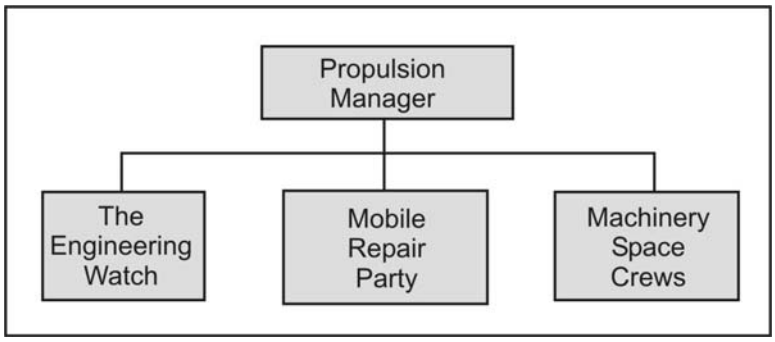
Figure 7-4. Electrical Damage Repair Management



0710. Propulsion Manager (PM)

The PM is located in HQ1/SCC. He must maximise propulsion and key ships systems to the Command by overseeing the actions of watchkeepers and machinery space crews, and directing the actions of the Mobile Repair Party (MRP). The PM coordinates the reactions to damage of the propulsion plant and then directs repair efforts to maximise the return of propulsion to the Command in accordance with the priorities set for him by the IBC. They have broadcast communications with machinery spaces and a dedicated line to the MRP, which is deployed as required by him to assist in machinery space incidents. They must ensure machinery space fire and flood information is plotted on the Main Incident Board in HQ1, as this information needs to reach all command nodes, they must also study the Incident Board to understand how the other incidents influence their own decisions.

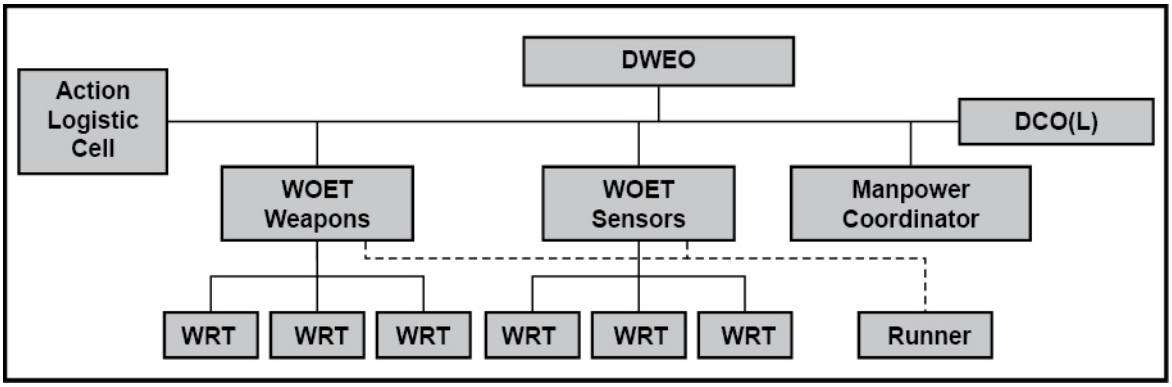
Figure 7-5. Propulsion Management



0711. Officer in Charge of the Weapon Section Base (OIC WSB)

The OIC WSB Coordinates and directs the Weapon Repair Team (WRT) made up of WE personnel, dispersed at strategic locations throughout the ship. To assist the OIC WSB may have a small team allocated. The WSB task is to build and validate the weapon and sensor damage picture and pass it to the command advisor in the Ops Room, with appropriate assessments. The WSB is on the Damage Control Telling Line to monitor fires and floods and allow it to organise efforts to assist establishment of fire and flood boundaries. The WSB also continuously monitors the Command Open Line to keep abreast of the tactical situation.

Figure 7-6. Weapon Section - Base Management



0712. Command Huddles

a. The Command Huddle is an assessment tool that may be used in HQ1 by the IBC and his key advisors. Its purpose is to

(1) determine whether the Command Aim can be sustained.

(2) to assign incident priorities in support of the aim.

(3) focus the management of these priorities.

b. **Command huddle format**

(1) The Huddle should begin with a statement by the IBC of the Command Aim and WEO's top three weapon repair priorities.

(2) Each Director then gives a short brief stating whether they can or can not meet the Command Aim, percentage of Blanket Search complete, then their top 3 priorities, giving their reasons for the priority and offering Estimated Time Back On Line (ETBOL).

(3) This is then followed by a summary from the IBC confirming (or otherwise) the Directors priorities and stating the overall ship priorities and a reminder of the Command Aim. The target time for a Huddle is 2-3 mins; 20 seconds for each Director (and Command Rovers if present) and 30 seconds for the IBC to introduce and conclude.

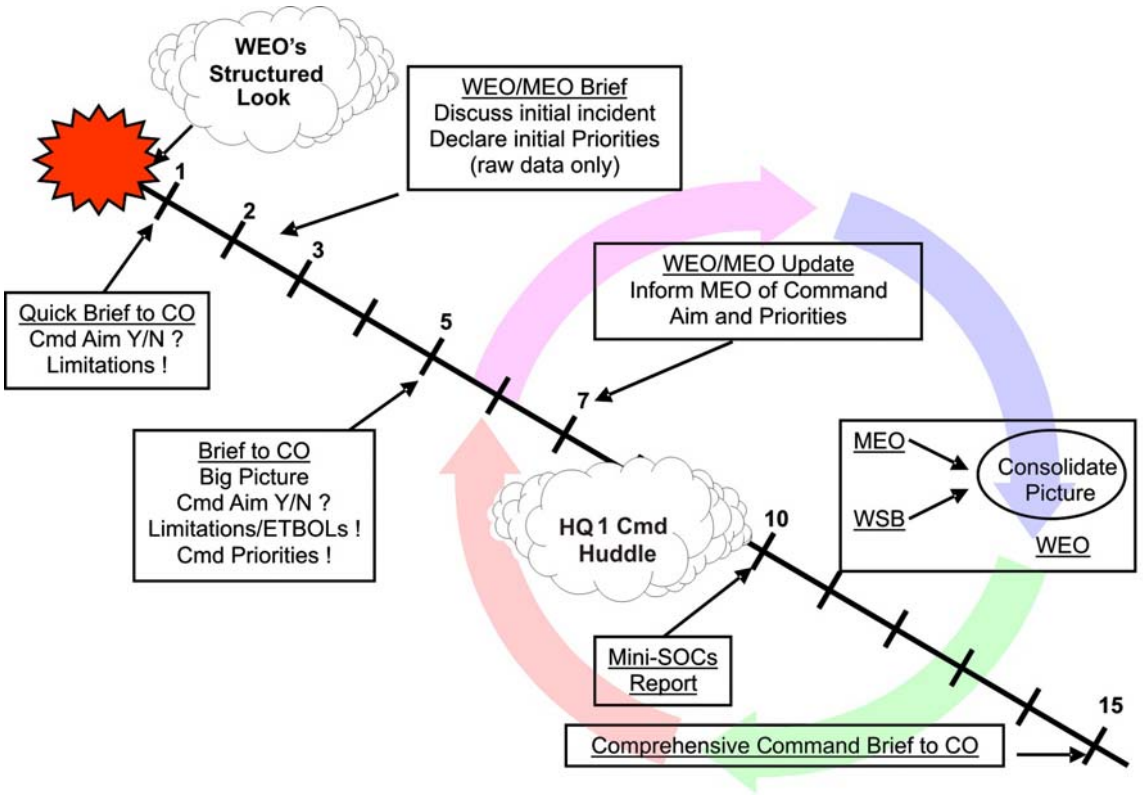
(4) The IBC should give a 2 mins warning for the Huddle, allowing his Directors to chase updates and assess their priorities. The Huddle should only be disturbed by other HQ1/SCC personnel for 'Flash' messages. The Command Rovers may participate in the Huddle if present, interrupting to correct briefs if required and giving an update after the three Directors have completed their briefs. The Command Huddle will invariably dictate where the Rovers should head next.

(5) Command Huddles should take place regularly until all repairable damaged is rectified. On completion of the Command Huddle the Command Advisor and the IBC consolidate the picture.

0713. Estimated Time Back on Line (ETBOL)

Control positions, such as HQ1 and WSB should be given an estimate of the time at which damaged equipment's and services will be back 'on line'. ETBOLs should always be used on Command Stateboards and are always expressed as an absolute time, ie '1145', or 'minute 45', never as the repair duration. If it is difficult to provide an ETBOL, then either a best guess should be given or, if still investigating, then a time to the next Sitrep.

Figure 7-7. Internal Battle Timeline



0714. The Bridge Team

a. The Bridge Team is often in a unique position and indeed may provide the first notice of an attack and make the **"BRACE"** pipe. After damage the bridge can supply vital information on the type of damage and area of impact. In order to do this, someone must be nominated to watch the aircraft/missile/torpedo while others protect their eyes. This information should then be broadcast as soon as possible after **"STAND TO"**, preferably on main broadcast if available, and backed up on the AHQ Incident Board Operators communications line and on Command Open Line. A good description of the incident is essential, to provide guidance to personnel below decks, eg: 'Bomb through foc'sle port side and large explosion/no explosion seen'.

b. Following action damage, initial reactions must concentrate on ship safety. This will invariably mean dealing with any propulsion and steering defects first: the Action OOW must know instinctively the initial actions for steering failures and Emergency Slow/Stop, including the override drill. If a propulsion defect and steering failure are indicated simultaneously, then the Navigating Officer (NO) should be ready to assist by dealing with one of the breakdowns on the OOW's behalf, or detail an appropriate person to help. The level of involvement from the NO in these reactions will depend heavily on the navigational situation.

In open water the NO will be immediately available to take an active role, whereas in constrained waters, such as a swept channel, the needs of navigational safety may prevent the NO from direct involvement. Whatever the case, rapid restoration of propulsion and steering in the highest control state available is essential, particularly when in confined waters, in order to achieve the Command Aim.

c. After any immediate actions, Mini-SOCS must be initiated if not already in progress and all reports are to be made to Command Advisor's assistant in the Operations Room. Engineering defects should be monitored closely. After the immediate actions have been conducted, a concise brief on the problem and estimated time to repair should be obtained. For steering defects, a report on the status of power supplies to each motor and control system should be given. A running tally of defects should be kept, which should include ETBOL, in order to allow the OOW to assist in maintaining the drive to restore capability in line with the Command Aim. There must be frequent liaison between the bridge and SCC to ensure that momentum is not lost, as well as keeping the Ops Room aware of the key points.

0715. Fire and Repair Parties

a. Section Bases and FRPPs are pivotal to the success of Damage Control, and the Officer/Rating in Charge must ensure that the team is fully conversant with their individual responsibilities, and that all equipment and documentation is at a high standard. Manning levels should be in accordance with the Watch and Station Bill (W&SB) to achieve the right balance of expertise. Documentation should include the following as a minimum:

(1) Manning checklist.

(2) Full checklist for State 1 preparations.

(3) A set of Kill Cards for compartments covered by the FRPP.

(4) Full set of smoke clearance plans.

(5) Electrical 'underground maps'.

(6) Set of 'aides memoire'.

(7) FRPP locker layout (BRd 2170(3)) plasticised and stuck to reverse of door.

(8) Clear and accurate set of closing down cards.

(9) Briefing cards for DC Patrols.

(10) Dispersal plan for FRPP Team members.

(11) Briefing cards for Boundary Coolers.

(12) Boundary Search Cards.

b. The role of leading a Fire and Repair Party is a dynamic and responsible position. From here raw information is fed up through the lines of communication so that HQ1 can manage the whole-ship Damage Control effort effectively. The actions to deal directly with fires and floods are normally well known and understood. However the management of boundaries can be critical in maintaining the Command Aim. In addition to the containment of a fire by boundary cooling, limitation of the spread of smoke using well-controlled smoke boundaries is a separate task and can be more vital. The rapid establishment of flood boundaries can be the key factor in indicating to the IBC whether the Command Aim theme needs to switch from Fight to Survive. In establishing boundaries, priority should be given to protecting the command nodes and those compartments linked to the achievement of the Command Aim. Indeed, DCO may allocate a boundary as the top priority for a FRP (eg: 'Prevent the smoke from reaching the Ops Room').

c. The 2 I/C must rove between section incidents and the FRPP, feeding to the IBO and the FRPP Leader the relevant information, incident location, type and size, actions in hand and name of the incident manager, boundary management status, and his opinion on whether the incident is under control. They must physically return to the FRPP at regular intervals to update the OIC, view the incident board and check that the picture is correct.

d. The leader directs operations at the FRPP, controlling the quality of information received and questioning, that which is doubtful. Their specific tasks include the management of his personnel, equipment, fixed firefighting systems and HPSW, seeking authorisation from HQ1 where required. They must use the Command Aim, threat warnings and allocated priorities to shape the way he drives incidents within the Section. This may mean re-entry actions are delayed while weapon or 'L' repair teams carry out tasks, sometimes within a smoke boundary using BA.

e. The tendency to relax must be avoided until post incident actions are complete. There are 4 principal tasks:

(1) **Smoke Clearance.** The clearance of smoke must be thought of early, strictly policed and the plan discussed with, de-conflicted and authorised by HQ1. However, smoke clearance must be carried out within the Command Aim on a priority basis. The smoke route must be known and as with smoke boundaries authorised by the Command via the DCO.

(2) **Re-Stow/Replenish.** Check and re-stow equipment, recharge BA and extinguishers, to ensure everything is ready for immediate use.

(3) **Re-Group.** Account for all team members, re-disperse and provide drinks where required, particularly for firefighting teams.

(4) **Restore.** Restoration of State 1 posture.

0716. Composition of a Fire and Repair Party

Guidance on the composition of an FRP given below and may be scaled dependant on platform. To maximise Damage Control training exposure the OICs of FRPPs are to be DMEO and DLO where borne. In smaller ships it will be necessary to make adjustments to the numbers while retaining the overall concept of the organisation. The tasks given in the 'Recommended Duty' column guide to the manning requirement.

Table 7-1. Example of Composition of a Fire and Repair Party

Manning	Recommended Duty
Officer 1 x MESR 1 x Able Rate	Overall I/C of the Fire and Repair Party 2nd I/C FRP Communications
Senior/Leading Rate 1 x ET (ME) Able Rates x 2 Able Rates x 2 Able Rate	I/C Fire Party 2nd I/C Fire Party; I/C `of Repair Party Firesuitmen/as required for repair Fire back-up/as required for repair BA Controller
Able Rate Able Rate Able Rate Able Rate Able Rate	Pumping and leakstopping/as required Pumping and leakstopping/as required Pumping party/as required Pumping party/as required Pumping party/as required
Switchboard Manning	
MESR ME Leading Rate 1 ME Able Rate + 1 Able Rate (any) 1 ME Able Rate + 1 Able Rate (any)	I/C electrical repair/as required 2nd I/C electrical repair/as required Working pair/as required Working pair/as required

0717. Damage Control and Firefighting Patrols

When a ship is closed up in Damage Control State 1 or 2, personnel are to be nominated from the Fire and Repair Party manpower pool to conduct patrols. Each patrol should be minimum 2 persons whose duties are:

a. To visit all compartments and spaces on their nominated route and report any incidents.

b. Ensuring that watertight and gastight openings conform to the Damage Control condition set.

c. To look for signs of flood, fire, machinery overheating, malfunction or electrical failure and to apply the correct drill for entering compartments in which damage may have occurred.

d. When an incident is discovered one rating must report the fact to the FRPP/Section Base by the quickest possible means, while the other tackles the incident using the material in the patrol bag, or other equipment to hand, aided by the first rating once his report has been made.

e. As soon as the repair or fire party takes the incident in hand, the patrol resumes its patrolling duties, unless ordered otherwise.

f. Patrols members are to conduct patrols with the following equipment.

(1) Patrol bag containing softwood wedges, bungs, and 2 x hammers.

(2) Torch.

(3) PPE, i.e. EEBD (Belt Mode), Hard Hat, gloves.

(4) Specialist tools or equipment required for compartments on patrol route.

0718. Narrative of Events

A full HQ1 narrative of events is to be kept in all Damage Control State 3 incidents, either by the Incident Board Operator on his board or at some other suitable position in HQ1. For further information see Annex 7B.

0719. Incident Assessment by the Command Rover

a. The following questions will help the Command Rover to assess incidents:

AT THE INCIDENT SCENE	
FIRES	**FLOODS**
Where is the seat?	Where is the damage (ships side, deckhead or deck) and what type (splinter holes, fractured pipes etc)?
What type of fire (oil based/carbonaceous)?	What is the level of water? Is it rising/falling/steady?
Which team is attacking it and with what?	Is the flood contaminated?
How long before re-entry (if applicable)?	Has initial leak stopping taken place?
What hazards are in the vicinity?	Are pumping requirements in place?
Are there casualties? Are they being dealt with?	
Is there an incident manager?	
What is the fire/smoke/flood boundary status?	
Which boundaries are priorities?	
Is the incident under control?	

AT THE FRPP
Are incidents shown correctly?
Are boundaries shown correctly?
When are reliefs due in?
What other incidents are there in the section?
Does the OIC have the right priorities?
Does the OIC have things under control?

b. In order to gain this information the Command Rover must get as close as possible to an incident. For a flood this includes sighting the damage. Additional information should be gathered, for example the state of lighting in the ship. There is a lot to take in and good use of pocket size deck plans and 'aides memoire' are essential.

SECTION 2 - DAMAGE CONTROL STATE 2 ORGANISATION

0720. State 2 Considerations

a. DC State 2 should be achieved via State 1 to ensure material and machinery configuration is correct. Reversion to DC State 3 must be via DC State 1. The default state for the release of manpower to deal with large incidents is State 1 Action Stations.

b. Damage Control State 2 may be considered if the operational task requires more personnel on watch than can be generated at State 3 or if the external threat warrants further precaution. When reviewing the State 2 posture, invariably utilising the Command Estimate process, the following may be included:

(1) Likely threat weapon warning time.

(2) Typical reaction time for the ship to assume heightened Damage Control postures, eg State 1 Condition Zulu from State 2 Condition Yankee.

(3) Required response to non-hostile incidents, eg internal fire, collision.

(4) Successful maintenance of the State 2 posture requires strength of leadership and teamwork which in turn relies heavily upon individual knowledge of ship, drills, procedures and systems (including reversionary modes of operation), eg when assuming Condition Zulu in an unfamiliar part of ship.

(5) The psychological importance of being at State 2, as opposed to State 3, should not be underestimated. State 2 provides a whole-ship focus to the task in hand and subconsciously causes people to mentally prepare for combat and damage, however remote that possibility might be. State 3 is synonymous with peacetime cruising and encourages that mind-set. Personnel may require days to mentally adapt to State 2 and the real possibility of combat and trauma.

0721. Sustained Periods at State 2

During a sustained period of State 2 operations, a more loosely and generically applied Command Aim may be appropriate. Where the threat warning time allows sufficient reaction time for the ship to assume Action Stations, Damage Control State 1 Condition Zulu should be adopted to counter battle damage.

0722. Maintenance of Readiness

Where the threat warning time does not allow sufficient reaction time for the ship to assume Action Stations, or closing down to Condition Zulu could interfere with movement of the Ship's Company thereby hampering the ability to deal with a non-hostile incident:

a. State 2 Standard Operating Procedures (SOPs) must be promulgated and understood at all levels.

b. A Defence Watch Emergency Party (DWEP), capable of reacting to a non-hostile incident or battle damage, should be nominated for each Defence Watch. Where practicable, key State 1 personnel should not be allocated a role in the DWEP that is different from their role at State 1.

c. Ships should practise the various scenarios so that key personnel can make the correct broadcast and personnel know the right response for an incident.

d. All personnel, particularly the DWEP, must be prepared to fulfil unfamiliar roles.

e. DWEP briefs, conducted at watch changes, must reinforce individual and team roles, the need to respond instinctively and remain closed up and on task until relieved by State 1 personnel.

f. HQ1 Watchkeepers must be fully conversant with, and endorsed in the use of, HQ1 systems, communications and SOPs.

g. Ship's Company messing and accommodation should be reviewed to ensure personnel are dispersed as close as is practicable to their Action Station thereby reducing movement and therefore time to achieve State 1. Sleeping in full AWD greatly assists individual protection and improves personnel response times. Implications of mine warnings on accommodation are also worthy of consideration.

h. The DWEP must wear surcoats for easy identification.

i. To minimise the time accounting for personnel when assuming State 1, detailed DWEP/State 1 personnel cross-reference muster lists are to be produced and report to HQ1 or Operations Room.

j. Adequate provision must be made to bring up maintenance and discussed during the Battle Rhythm.

Notes:

1. Personnel are to remain dispersed until "STAND TO" is piped. The DWEP should then be piped to muster. Contrary to State 3 practice the DWEP Support teams should muster at the FRPP nearest the incident. There may be a requirement to pipe ***"HANDS TO ACTION STATIONS"*** *but add* ***"STAND FAST, BRACE, BRACE, BRACE"*** *prior to impact.*

2. Where Action Stations are ordered to counter the internal, rather than the external, threat careful consideration should be given to:

a. Remaining at State 1 Condition Y.

b. Employment of Warfare personnel.

Table 7-2. Example of a DWEP

HQ1 TEAM	CONTAINMENT
DCO ME ADVISOR HQ1 WATCHKEEPER COMMS/IBO ME ISOLATIONS	I/C CONTAINMENT 1 CONTAINMENT 2 KEYS/CONTAINMENT 3 PATROL/CONTAINMENT 4 PATROL/CONTAINMENT 5 CONTAINMENT 6
EMERGENCY PARTY	**FIRST AID**
I/C MAIN GROUP ATTACK ATTACK ATTACK BA ATTACK BA SUPPORT PARTY I/C SUPPORT (Firefighter) SUPPORT (Waterwall) SUPPORT (Hose Handler) SUPPORT (Ship Protector) BA CONTROLLER	I/C FA FA1
	OPS ROOM
	IBO

Notes:

1. These positions are to be covered by both Port and Starboard Watches and some positions may have to be split into 1st and 2nd Watches.

2. It is recommended that the Containment Group muster at the nominated WSB and use the WSB Incident Board.

SECTION 3 - CONTROL POSITIONS

0723. HQ1

HQ1 is normally sited in a position near the centre line, co-located with the ships electrical distribution and machinery control centre. This combined space should be designated the Ship Control Centre (SCC). For the purpose of integrated management, the SCC is designed to allow display and dissemination of Damage Control information, in conjunction with other systems, and must enable the IBC to control the various functions from a single position. The following should be provided in HQ1:

a. The communications links specified in Chapter 8.

b. Damage Control information boards and control documentation, as detailed in Annex 7A.

c. A whole-ship Damage Control Incident Board, as detailed in Annex 7B with space for Command Aim, threat warnings and Command Priorities.

d. Emergency lighting.

e. A desk on which documents can be consulted.

f. Fire, flood and CBRN monitoring remote warning equipment.

g. Main broadcast microphone and alarm buttons.

h. Citadel pressure manometer(s), for each sub-citadel.

i. Duplicate key stowage.

j. Heel indicator.

k. HPSW Pump start/stop, pressure gauges for each leg of the HPSW System and operations of main isolating valves.

l. A clock.

m. Stowage for Damage Control documentation and ‘may be left open’ tallies.

n. Individual vent start/stop and single action Crash Stop.

0724. Secondary Damage Control Headquarters (HQ2)

In large ships with a HQ2, it should be separated from HQ1 by at least 2 main transverse bulkheads, and should be fitted with equipment and information boards in a manner similar to HQ1 to allow takeover should HQ1 be put out of action. In addition, it should be fitted with the necessary instruments and repeats to indicate the state of machinery and systems.

0725. Alternative Damage Control Headquarters (AHQ)

An AHQ is identified and is a manned position. In most ships the AHQ position will be on or near the bridge. A whole-ship incident board which may be portable, or fixed if space permits, with a lockable cover, as appropriate, should be fitted at this position and illuminated by low voltage, battery operated lighting. Communications links with HQ1, FRPPs, Ops Room and WSB should be available, along with copies Kill Cards and Smoke Clearance Plans

0726. Section Bases

Section Bases, where used, are sited on the deck that affords fire and repair parties the easiest fore and aft movement. They are normally located remote from the shipside and afforded protection by virtue of the ships structure and their location. Communication with their own outstations and with HQ1 and HQ2 are to be available. Each section base contains or is fitted with the following items.

a. A whole-ship Incident Board with space for Command Aim, threat warnings and Command Priorities.

b. A Section Electrical Information Board.

c. A Section HPSW System Board.

d. A Section Damage Control Door and Hatch Board.

e. A Section Ventilation Board.

f. Kill Cards for compartments in that Section.

g. Blanket Search Cards and tote.

h. Section Keys.

0727. Fire and Repair Party Posts (FRPP)/Zone Control Point (ZCP)

These consist of grouped damage control, fire party and electrical repair party lockers, or combined built-in stowages, sited with communication with HQ1 and a manometer for citadel pressure. The following information boards are required at FRPPs:

a. Whole ship Incident Board.

b. Whole ship HPSW System Board.

c. Whole ship Electrical Information Board.

e. The FRPP documentation.

f. Blanket Search Cards and tote.

0728. Upper Deck Re-Entry Fire Party Post (UDRFPP)

An UDRFPP is located on the upperdeck of all DD/FF sized vessel (T23 and subsequent vessels have a dedicated compartment within the superstructure). The post comprises stowage for sufficient equipment to affect a re-entry into the ship, should it be necessary to withdraw firefighters to the upper deck. Breathing apparatus and the TIC are susceptible to damage from exposure to weather, so they are sighted at sheltered, but easily accessible locations within the superstructure.

0729. Alternative WSB

a. The alternative WSB must be capable of accommodating all WSB personnel with Stateboard. The location of the alternative site will depend on the extent and location of damage or smoke. The final decision has to be made at the time. Two locations should be pre-designated to allow for flexibility. They are to be as far apart as practicable, and should be displaced laterally and vertically from the main WSB and from each other. Ideally, the two space will have the communications indicated in Figure 8-1.

b. Moving the WSB to its alternative location should be a pre-planned SOP. The OICWSB ensures that all personnel are safely evacuated from the compartment, and as much portable equipment as possible is taken with them.

ANNEX 7A

HQ1 INFORMATION BOARDS AND CONTROL DOCUMENTATION

1. To assist the Command and Control team in HQ1 an outfit of information boards should be provided.

a. Damage Control Incident Board (see Annex 7B).

b. Damage Control Command State Board (see Annex 28B).

c. Pumping and Flooding Board (DD/FF and larger ships only).

d. HPSW System Board.

e. Fuel and Fresh Water State Board (Multiple Damage Control section ships only).

f. Damage Control Door and Hatch Board.

g. Damage Control Ventilation Board.

h. CBRN Protection Officers (CBRNPO) Incident and Information Boards.

i. Damage Control Electrical Information Board (see Chapter 15).

2. In newer ships, some of these boards may be replaced by electronic displays.

3. Command State Board

The HQ1 Command State Board, an example of which is at Annex 28B, is identical to the board maintained by the Command Adviser in the Ops Room and by the OICWSB

4. Pumping and Flooding Board

a. This board consists of a series of deck plans up to at least the highest survivable static waterline. On it are shown the watertight subdivision of the ship, and various stability data for each compartment if flooded. Each compartment is bordered as follows:

(1) Green — Watertight compartment.

(2) Orange — AVCAT.

(3) Brown — DIESO.

(4) Blue — Fresh and Sea Water.

(5) Red — Magazines.

(6) Yellow — Storerooms.

(7) Silver grey — Machinery Spaces.

b. Each compartment may contain some of the following information. The effect on the heel and trim of the vessel when the compartment is filled and the capacity of each compartment in tonnes of seawater. In addition the compartment may contain the change in GMF for the worst case scenario, it may also contain information about other pumping and flooding arrangements for that compartment, for example the location of salvage eductors or cross flooding lines.

c. The information provided on the board gives guidance to the operator on the affects of various floods. Hence the board can be used to assess what counter flooding is required to recover from a damage incident and to provide guidance on how counter flooding might affect the available reserve of stability. The board is to be operated by the DCO or Command Stability Advisor (large ships) who must have an intimate knowledge of the pumping and flooding arrangements of the ship.

5. HPSW System Board

This board shows, in broad outline, the ships HPSW system. Red pegs can be inserted in provided holes at the valve positions to indicate the valves are shut. Green pegs can be inserted in provided holes at the pump positions to indicate the pumps are running. Other colour pegs may be used to indicate, say, ‘Pump defective’ or ‘Valve defective’. The board is operated under the supervision of the DCO.

6. Fuel and Fresh Water State Board

The board is in the form of a tabular statement indicating clearly, in the case of fuel, the machinery units for which the tanks are providing. The statement should indicate:

a. 95% capacity of each tank in tonnes and the location of the tank.

b. State of tank at any given time and the time at which the state was last determined.

c. Whether the tank is in use or ‘standby’.

7. Damage Control Door and Hatch Board

This board should include all the deck plans of the ship on which are shown:

a. The position of all watertight and gastight doors, hatches, manholes and access trunks with their location markings.

b. The Damage Control risk and control marking for each opening.

c. The regulations for watertight and gastight openings and the number of openings permitted to be open in each Damage Control condition.

d. Coloured pegs can be inserted to indicate the openings that are open at any given time and those pegs should be the predominant feature of the board.

8. Damage Control Ventilation Board

The Damage Control Ventilation Board (see Figure 7A-1) is an essential aid for firefighting, smoke removal and watertight and gastight control, and is designed to enable use by non-technical personnel. It consists of a series of deck plans showing the areas served by each supply, exhaust and conditioned-air system using colour codes of blue, scarlet and orange respectively. Each system is identified by the number of the fan or ATU serving it with directional arrows, indicating the direction of air flow, adjacent to each fan number. Each compartment served by an ATU has its boundaries delineated by a continuous orange line, and contains the number of the ATU serving it. The related tabular statement (see Table 7A-1) is an integral part of the ventilation board.

9. CBRN Protection Officer's (CBRNPO) Information Boards

These consist of:

a. A scaled down reproduction of the Main Incident Board.

b. A Total Dose Record Board (see BRd 2170(2) Annex 6A).

c. A Dose Rate Graph (see BRd 2170(2) Annex 6B).

d. A Radiological Monitoring and Decontamination Board (see BRd 2170(2) Annex 6C).

e. A Chemical State Board (see BRd 2170(2) Annex 8A).

10. Damage Control Electrical Information Board

This is maintained by the DCO(L), as detailed in Chapter 15.

11. Kill Cards

A full set of compartment Kill Cards are to be readily available in HQ1 (see Annex 17J).

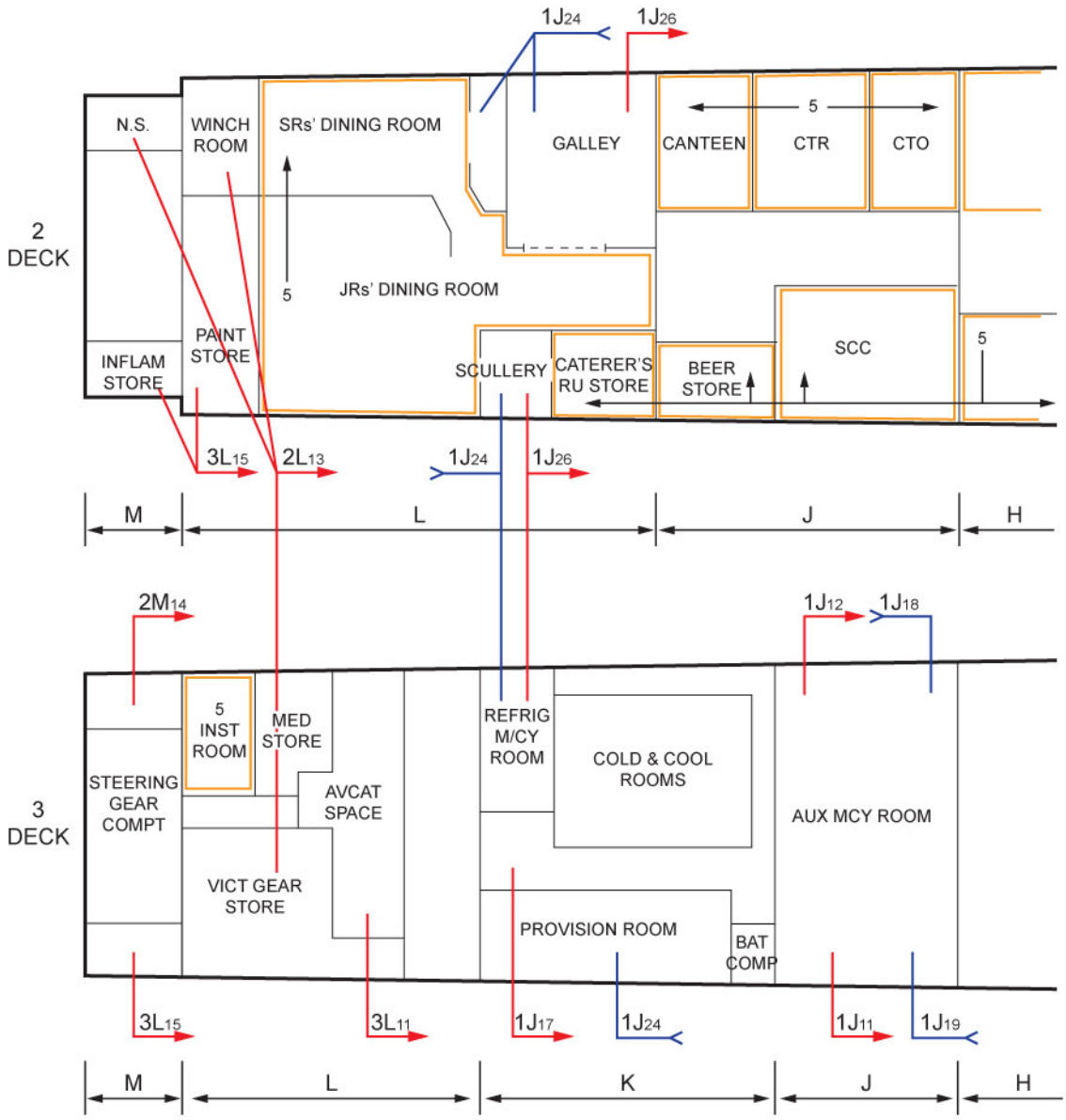
12. Smoke Clearance Plans

A full set of Smoke Clearance Plans are to be readily available in HQ1.

13. CBRNDC Class Book

Survivability Handbook or Platform Statistical Stability Information with Damage Examples is to be readily available in HQ1. Latest platforms, Contractor Logistic Support (CLS) and Commercial Classes of ship will be provided with ‘Hard Copy’ or electronic versions of this information.

Figure 7A-1. Example of Ventilation Board



Markings for ventilation board

BV	- Butterfly valve
QAHWTC	- Quick acting hinged watertight cover
HWTC	- Hinged watertight cover
OIA	- Open in alfa
GTC	- Gastight cover
3	- Air-conditioned areas and A.T.U. number
2C12	- Exhaust vent and system numbers
2C11	- Supply vent and system numbers

Table 7A-1. Ventilation Board - Associated Tabular Statement

SUPPLY						SERVICE	EXHAUST					
EXTERNAL CLOSURE AND CONTROL MARKING		INTERNAL CLOSURE	STARTER POSITION AND CONTROL MARKING		FAN & SYSTEM NUMBER		FAN & SYSTEM NUMBER	STARTER POSITION AND CONTROL MARKING		INTERNAL CLOSURE	EXTERNAL CLOSURE AND CONTROL MARKING	
01 Deck 64:65(P)	A	BV	SL Galley O/S	A	1J24	Rating Galley Servery and Scullery 2L, Fridge Space Provision Room 3K	-	-	-	-	-	-
-	-	-	-	-	-	Rating Galley, Scullery 2L, Fridge Space and Ratings Dining Hall	1J26	2L Galley O/S	A	By Fire Flap	01 Deck 65: P65(P)	A
-	-	-	-	-	-	Hangar 1J	1J15	01G PASSAGE	A	-	01 Deck 58: 59(S)	A
-	-	-	-	-	-	NAAFI Beer and Spirit Store	1J17	3K Flat	A	BV	01 Deck 61: 62(S)	A
-	-	-	-	-	-	Winch Room 2L, Victualling Store, Medical Store 3L and No 5 Naval Store	2L13	2L Lobby Aft	A	Changeover and Shut Off Flap	2 Deck 78: 79(S)	A
-	-	-	-	-	-	Flam Store 2M and Paint Room 2L	3L13	2L Lobby	A	BV	2 Deck 78: 79(S)	A
-	-	-	-	-	-	Steering Gear Compartment	2M14	3K Flat	I	BV	2 Deck 78: 79(P)	A

Table 7A-1. Ventilation Board - Associated Tabular Statement (Cont'd)

SUPPLY						SERVICE	EXHAUST					
EXTERNAL CLOSURE AND CONTROL MARKING		INTERNAL CLOSURE	STARTER POSITION AND CONTROL MARKING		FAN & SYSTEM NUMBER		FAN & SYSTEM NUMBER	STARTER POSITION AND CONTROL MARKING		INTERNAL CLOSURE	EXTERNAL CLOSURE AND CONTROL MARKING	
01 Deck 61:62 (S)	M	BV	5J AAMR (P) Fwd	M	1J19	Aft Aux Machinery Room	1J11	5J AAMR (P) Fwd	M	BV	01 Deck 57:58(S)	M
01 Deck 61:62(P)	M	BV	2H Passage (P) O/S GW Magazine	M	1J18		1J11	2H Passage (P) O/S GW Magazine	M	BV	01 Deck 57:58(P)	M

Table 7A-2. Damage Control Information Boards and Control Documentation

	MULTI SECTION SHIPS				SINGLE SECTION SHIPS			WE	
	HQ1	HQ2	SB	FRPP	HQ1	AHQ	FRPP	WSB	OPS ROOM
Incident Board.	1:150	1:150	1:150	1:200	1:150	1:300	1:200	*	*
Command State Board.	*	*	-	-	*	*	-	*	*
Weapons and Sensors State Boards (600 x 600 mm).	*	-	-	-	-	-	-	*	-
Main Systems Board.	*	*	*	*	*	*	*	-	-
Damage Control 'L' Information Board. (1000 x 600 mm).	*	*	*	*	*	*	*	-	-
Damage Control Door and Hatch Board (1:200 or 1:100).	*	*	*	-	*	-	-	-	-
Damage Control Ventilation Board.	1:200	1:200	1:200	-	1:100	1:100	-	-	-
Pumping and Flooding Board (1:200 Length).	*	*	-	-	*	-	-	-	-
Fuel and Fresh Water State Board.	*	*	-	-	-	-	-	-	-
Total Dose Record Board (750 x 500 mm).	*	*	-	-	*	-	-	-	-
Chemical State Board.	*	-	-	-	*	-	-	-	-
CBRNPO's Incident Board (600 x 600 mm).	*	*	-	-	*	*	*	-	-
Kill Cards (A4).	FF	FF	FF	-	FF	FF	-	WE	-
Closing Down Route Cards.	*	*	*	-	*	-	-	-	-
Safety Plan (RFAs only).	-	-	-	*	-	-	*	-	-

Note. *The scales shown are the minimum requirement.*

ANNEX 7B

INCIDENT BOARDS

1. Incident boards are used for the visual recording of information regarding damage, flood, fire, contamination and Ship Protection issues. Marking is carried out by each Incident Board Operator (IBO) who is constantly in communication with other IBOs to gain the information. The incident board consists of deck plan drawings of all decks, arranged one above the other, on a single board which is covered in clear plastic (Perspex) on which the operators can indicate incidents using marker pens. This is sited such that the Damage Control Command Team can see the complete picture of the ship. Bolts or stud bolts must securely fasten these and other DC information boards to a fixed structure, preferably, in order to minimise the risk of dislocation when subjected to shock loading. All incident boards are prepared in accordance with Naval Engineering Standard (NES) 119, of which Table 7B-1 is a summary. Incident Boards at some command positions will need to be portable in order to facilitate relocation should the area become untenable.

2. Marker Pens

Incident boards are annotated, as detailed in Table 7B-1, using fine-tipped permanent OHP marker pens. These have a finer point than chinagraph markers, resist smudging and accidental removal of information. Markings may be removed by using a normal rubber eraser ensuring that Para 3 below is adhered to.

Table 7B-1. Incident Board Symbology

FEATURE	SYMBOL
Watertight structures, doors, hatches, trunks, etc.	Thick black line.
Non-watertight structure.	Thin black line.
Compartment names.	Abbreviated in fine lettering not over 3 mm high.
Location markings.	Bold type 4 mm for deck and section 3 mm for remainder. No markings for doors hatches or trunks, eg **$5E_A$.**
Fire and Repair Party Posts.	Segmented concentric rings filled equally with red, green and blue enclosing identification, eg **Aft**.
The number of personnel stationed in each compartment at Damage Control State 1.	Indicated by the number contained in a black circle.
Modularised Machinery (with Halon or CO_2 drench).	Black rectangle with symbol **GTM** or **DGM.**
Capacities (in tonnes) of all watertight compartments below 1 Deck (ships without pumping and flooding boards only).	Enclosed in a black rectangle in the compartment.
Aluminium structure.	Bordered blue.
Unbacked Melamine.	Continuous emerald green line (when unbacked MPL is removed then these lines must be deleted).

Table 7B-1. Incident Board Symbology (Cont'd)

FEATURE	SYMBOL
Damage Control Section boundaries.	3 mm blue and white broken line.
Citadel boundaries.	3 mm continuous orange line.
Sub citadel boundaries.	3 mm broken orange line.
Cleansing stations. Citadel In/Out airlocks. CBRN store.	Tinted orange.
Gas Free - Contaminated if used spaces.	Purple/orange dotted line.
Gas free spaces not included in the citadel.	3 mm continuous purple line.
Damage Control, HQ1, HQ2, AHQ Section bases and Command shelter station.	Bordered in red.
Switchboards, EDCs and spaces containing High Voltage HV hazards.	Tinted green.
Magazines, weapon stowages, launchers, all explosive stowages and handling areas and petrol stowages.	Tinted red.
Main machinery spaces and associated trunking.	Pink or blue wash, adjacent spaces alternatively coloured. Common trunking to be dual coloured stripes.
Upperdeck re-entry fire locker.	Red border and symbol **RFL**.
Zonal DC Boxes.	Black box around the letters **DCBZ**.
Weapon Section Bases.	Letters **WSB** inside a pink circle.
Medical Stations.	Red Cross in a circle with annotation **SMP**, **MHQ** or **FAP** beneath.
Air Filtration Units.	To be identified by the letters **AFU** with the location and zone number. Tinted blue.
Ship Protection Incidents.	Incidents identified in green.

3. Recording of Information on the Board

The board principally concerned with the recording of damage is the Incident Board and it is to be marked boldly by marker pens using the colours and methods shown in Figure 7B-1 and Figure 7B-2 and as stated below:

a. **Errors and Erasures**. In all DC States, the Incident Board deck plan must reflect the exact damage picture at that precise moment and the narrative at States 2 and 3 must correctly detail the history of events should there be a need to hand over the incident or should a Board of Enquiry require it as evidence. Therefore:

(1) A significant error in board marking (eg fire identified and marked in the wrong compartment) should be erased and marked correctly.

(2) Incorrect wording in the narrative should be lined through and the correct word inserted.

(3) All other variable conditions including smoke/flooding boundaries, containment markings, FCP/Support party/spare hand movements and BA/foam dump relocation, can be erased and moved to reflect the current status.

(4) Prior to any erasure or amendment the HQ1 IBO must seek permission from the DCO (at sea) or the OOD (alongside). At DC States 2 and 3 the narrative must be annotated with timings and a clarifying note to reflect the reason for change eg 0830: FCP relocated from 2C/D to 2D/E ready for re-entry or 0845: Spare hands moved from Flightdeck to SRDH due to smoke clearance. At DC State 1, all changes to Incident Boards are to be controlled by the HQ1 IBO via the IBO comms net (see sub para t).

(5) Permanent marker can be erased without damage to Incident Boards using a standard pencil eraser or plastic polish. During DC/FF exercises non-permanent markers are used however, the routines detailed above should be followed.

b. **Additional Information.** Should be marked in black in the appropriate space between deck plans (this does not include the timetable of fire, flood or contamination (see sub para d).

c. **Boundaries**. Lines to denote fire/flood boundaries are not to be used unless the deck plan compartment marking does not identify the boundaries sufficiently (eg fire in a cabin area). Marking for contamination is to include boundary lines (see sub-para l).

d. **Marking of Times**. The timetable of a fire, flood or contamination incident should be marked in red, blue or yellow marker respectively as follows:

(1) **Initial Report.** Time is to be marked in the top left hand corner of the compartment/space concerned or, if the space is very small, immediately outside the top left hand corner of the boundary.

(2) **Containment.** The time of containing the incident is to be marked in the top right hand corner of the compartment/space concerned or, if the space is very small, immediately outside the top right hand corner of the boundary.

(3) **Fire Extinguished.** The time when the fire has been extinguished is to be marked in the bottom right hand corner of the compartment/space or, if the space is very small, immediately outside the bottom right hand corner of the boundary (for fires only).

(4) **Completion**. The time when action taken to deal with the incident is completed (compartment is tenable) is to be marked in the bottom left or right hand corner of the compartment/space concerned or, if the space is very small, immediately outside the bottom left or right hand corner of the boundary.

e. **Fire**. Is marked by a red cross in red circle with red hatching. Times are marked in red.

f. **Free Flood, Slow Flood, Free Surface**. Is marked by a blue FF, SF or FS respectively in a blue circle with blue hatching. Times are marked in blue.

g **Double Incident (Fire and Flood) in the Same Compartment.** Fire information is to be marked by a red cross in red circle with red hatching in one direction, times marked in red. Flood information is to be marked by a blue FF, SF or FS respectively in a blue circle with blue hatching in the other direction. Times are marked in blue (see Figure 7B-1).

h. **Protected Decks and Deckheads**. Protected decks and deckheads are to be identified by a black circle and line from the compartment. The black circle is to contain the fire protection rating of that deck or deckhead (see Figure 7B-1).

i. **Protected Bulkheads**. A dashed line against the bulkhead over the length concerned with qualifying text as required (see Figure 7B-1).

j. **Boundary Cooling**. On a deck or deckhead, a blue BC in a blue circle with qualifying wording in black. For bulkheads, a blue wavy line against the bulkhead over the length concerned. The following procedure is to be adopted:

(1) The I/C Containment details the boundary cooling team.

(2) The HQ1 IBO marks up the incident board with straight blue lines (bulkheads) and blue circles (decks/deckheads) denoting that boundary cooling is ‘planned’ in those areas (see Figure 7B-3).

(3) On confirmation of boundary cooling being established wavy lines are added and the letters ‘BC’ is inserted inside the boundary cooling circle (see Figure 7B-2 and Figure 7B-4).

(4) When boundary coolers are removed during re-entry phase, the blue BC in a circle or blue wavy line against the bulkhead will be removed leaving the planned boundary cooling annotated on the Incident Board.

(5) Boundary monitoring is to be marked as planned but not established.

k. **Splinter Holes**. A black V(s) for hull and bulkheads; black dot within a black circle for decks. These markings may be superimposed over other incident markings.

l. **Contamination**

(1) **Vapour.** Contamination from without is marked by yellow circle divided horizontally with CHEM or BIO in black in the top half and chemical agent designator in the lower half. The circle is to be surrounded by hatching within a yellow boundary (which denotes the new citadel boundary). Contamination from within is to be marked by brown hatching within a heavy yellow boundary and qualified by black wording to indicate the nature of the contamination (eg FREON). Times to be marked in yellow.

(2) **Liquid.** A brown circle divided as in Figure 7B-1 showing time of discovery, agent type and CAM reading, if known, with an arrow indicating the point source of the liquid.

(3) **Contaminated Flood.** Is to be marked by brown hatching in one direction and blue hatching in the other direction within a heavy yellow boundary qualified by black wording to indicate the nature of the contamination (eg DIESEL). Times to be marked in yellow (see Figure 7B-1).

m. **Shoring**. A black T(s) either vertically or horizontally against the deck/bulkhead/hull over length concerned.

n. **Distorted Bulkhead**. Marked as a black wavy line through the length of the bulkhead concerned.

o. **Distorted Deck**. Marked by black wording with a black arrow if necessary.

p. **Movement of Hands**. Those movements, especially hands from the Command and their disposition, are recorded on any suitable blank space on the incident board, in black.

q. **Planned Smoke Boundary**

(1) **Bulkheads.** A black short/long dot at the top of the planned bulkhead smoke boundary.

(2) **Hatches.** A small black tail that extends beyond the corners of the hatch (see Figure 7B-1).

r. **Smoke Boundary**

(1) **Doors and Bulkheads.** A solid black line drawn along the line of the bulkhead containing the door and extending beyond the line of the ships side.

(2) **Hatches.** A solid black diagonal line through the hatch extending beyond the line of the corners.

s. **Flooding Boundary**

(1) **Bulkheads.** A solid blue line drawn along the line of the bulkhead containing the door and extending beyond the compartment, both athwartships and fore and aft as appropriate.

(2) **Decks.** A solid blue diagonal line through a hatch extending beyond the line of the corners.

(3) **Updating.** The flooding boundary marking is to be moved (see Para 3) as incidents are dealt with and compartments closer to the primary zone of damage become tenable.

Note. *Hatching (fire, flood or contamination) covering adjacent compartments is to be alternated as illustrated in Figure 7B-2.*

t. **Minimising Incident Boards**. During a lull in action at DC State1 the DCO may order ‘Minimise Incident Boards’. This is to reduce clutter whilst leaving an accurate record of damage. This evolution is to be controlled by the HQ1 IBO, via the IBO comms net, one completed incident at a time. The damage marking is to be replaced with the relevant circular symbol in the correct colour with the time that the incident was completed. All remaining shoring and distorted bulkhead markings are to be retained. The minimised symbol should be small but legible and contained within the compartment where possible. In small compartments the symbol should be placed as near to the compartment as practicable with a similarly coloured arrow to within the damaged compartment.

u. **High Voltage (HV) Compartments.** High voltage decay times must be indicated on individual equipment and recorded on compartment Kill Cards. Where a compartment contains no HV equipment but is transited by HV cables the compartment is to be considered as a HV compartment in the event of a fire within. Kill Cards for such compartments are to have HV cable runs annotated in **RED**.

4. Electronic Damage Control Information Systems

Electronic Damage Control information systems conform as far as practicable with the foregoing colour coding.

5. Ship Protection Incidents

The Ship Protection Organisation in harbour may use the Incident Board. The markings to be used are detailed in BRd 8988 - Royal Navy Manual of Military Training, Operations and Tactics.

Figure 7B-1. Incident Board Markings

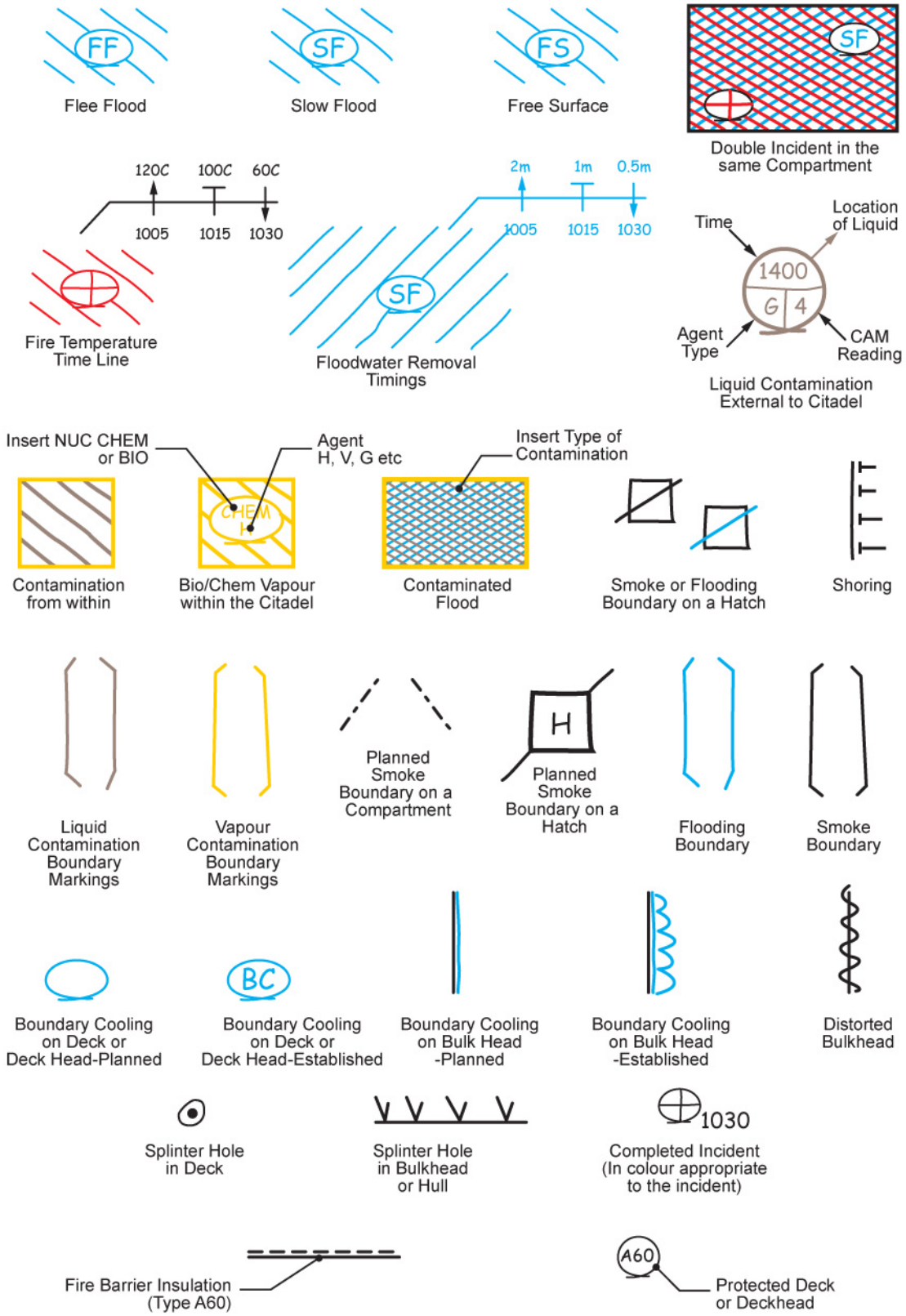


Figure 7B-2. Incident Board Markings (Working Example)

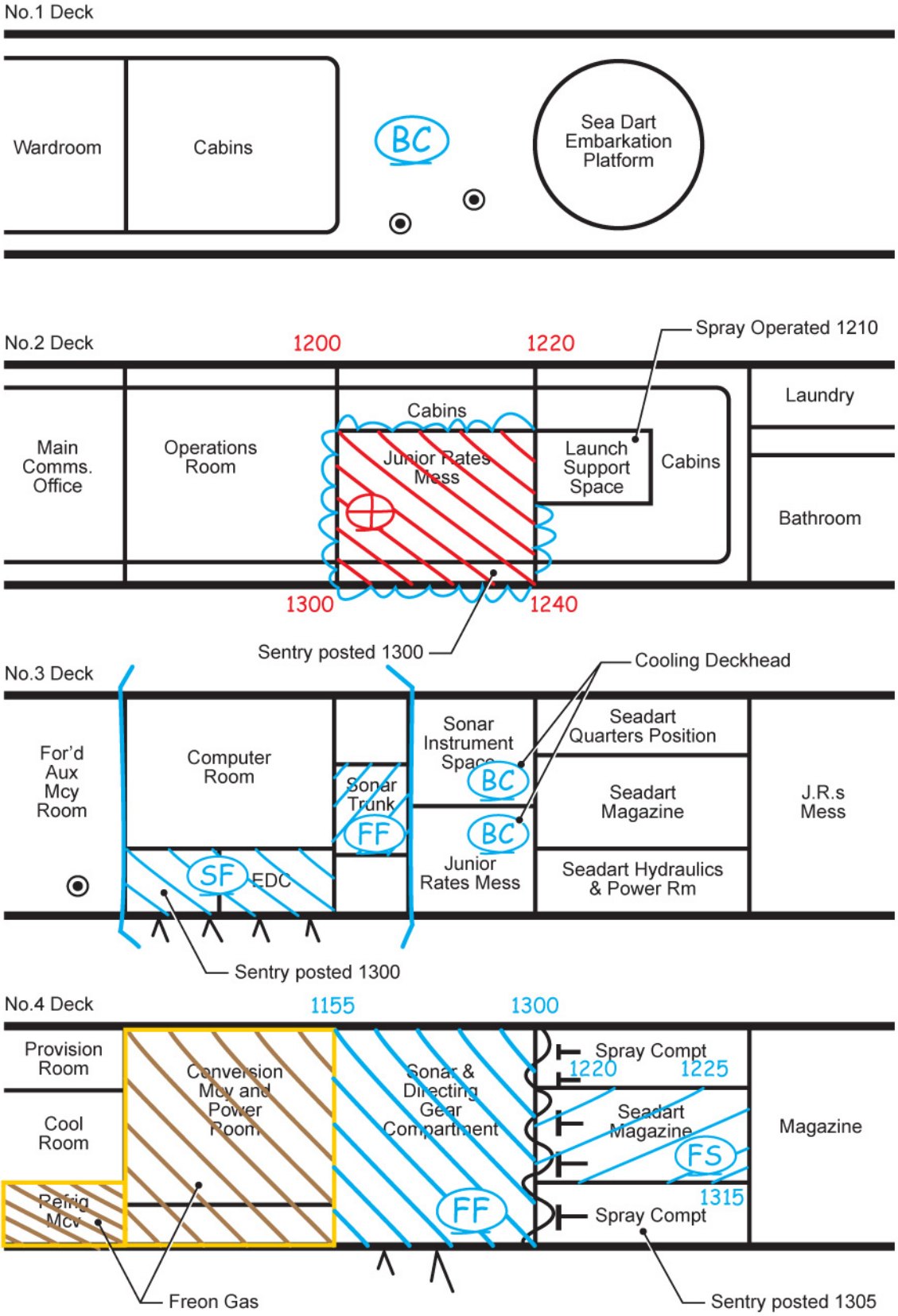


Figure 7B-3. Boundary Cooling Marking - Planned

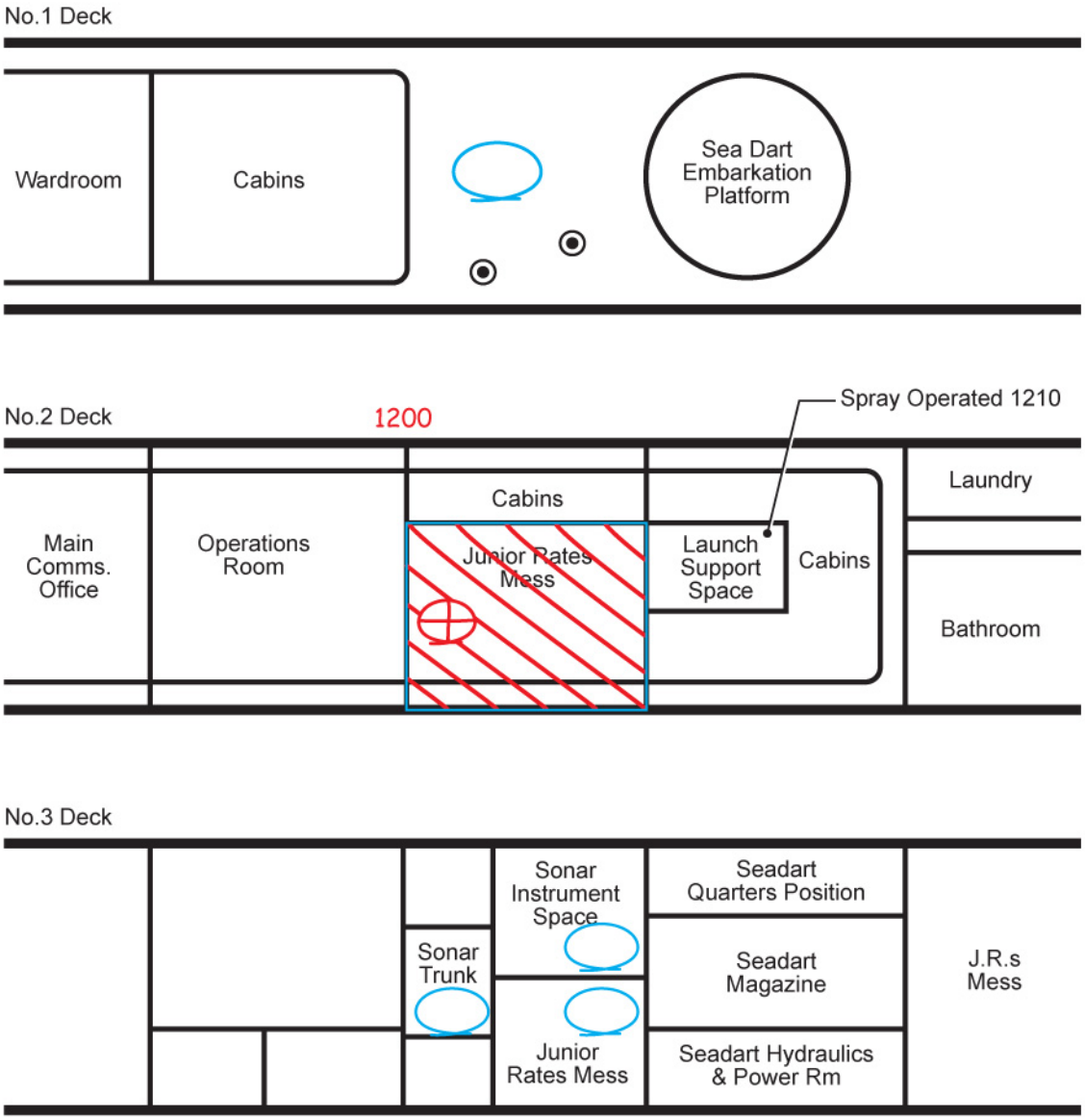
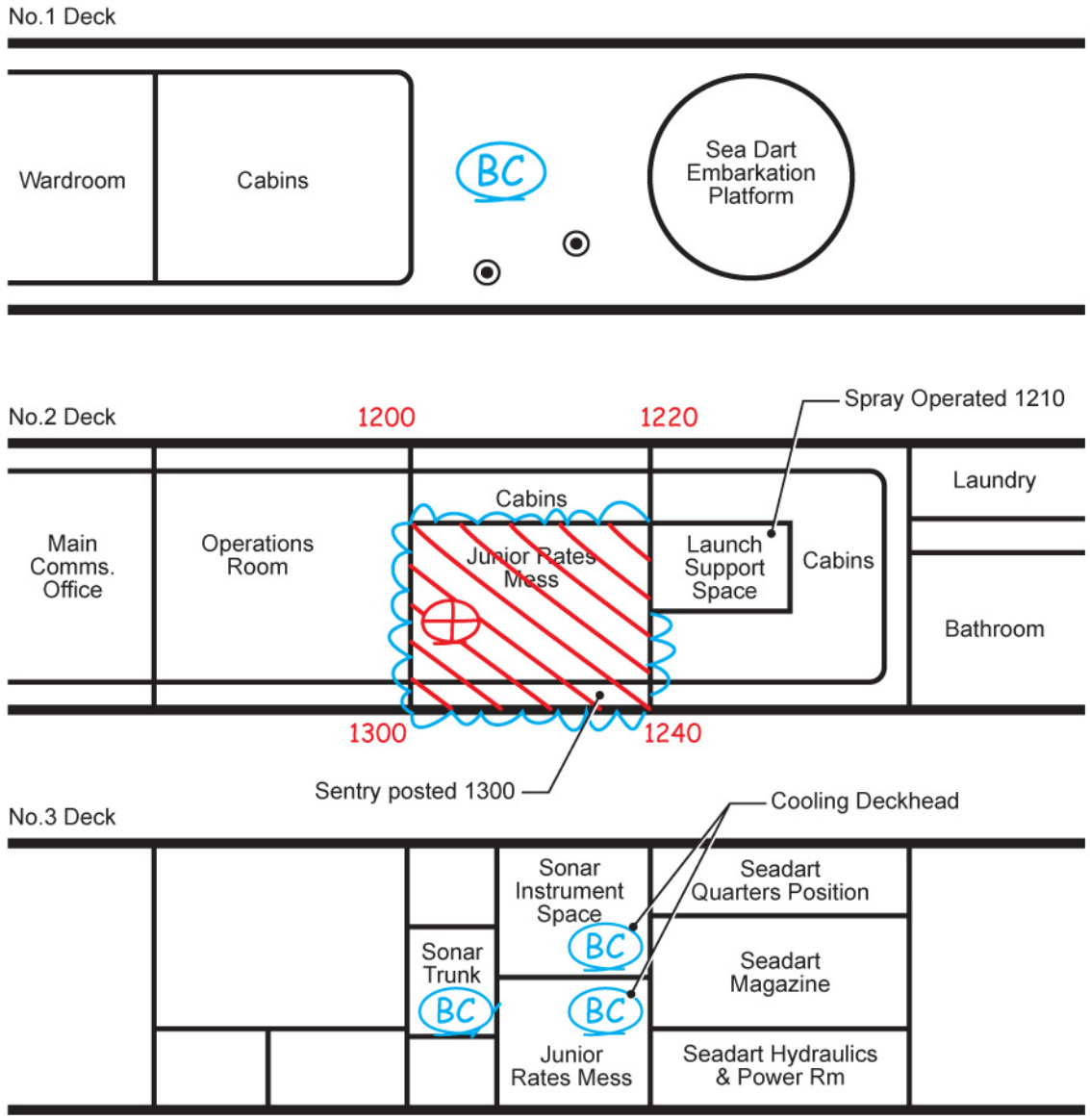


Figure 7B-4. Boundary Cooling Marking - Established



ANNEX 7C

IBC BRIEFING BOARD
(PDF FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 7D

DCO BRIEFING BOARD
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CHAPTER 8

DAMAGE CONTROL COMMUNICATION SYSTEMS

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CHAPTER 8

DAMAGE CONTROL COMMUNICATION SYSTEMS

0801. General

The main form of communication used in the Damage Control (DC) organisation is a mains-operated, battery-maintained, point-to-point interphone system in which the battery operation takes over automatically and immediately if the main power fails. In addition a number of group intercom lines are provided for use between DC outstations, HQ1 and the Command. The communication systems used in a typical DC scenario are as follows and vary dependant on ships class and in some cases platforms within a class.

a. Ships fitted Internal Communication Equipment.

b. Main broadcast system.

c. Ancillary broadcast systems (eg Machinery Broadcast).

d. Main exchange telephones.

e. Messengers (whose value in communications must never be underestimated).

f. individual and team communication sets (i.e firefighter helmet-mounted and hand-held radios).

g. Standard Short Range Portable (SSRP) radios.

h. Sound powered field telephones.

0802. Group Lines

Multi-way group (conference) communications should be available, key positions and personnel are listed below shown schematically at Figure 8-1: this list is not exhaustive and platforms should detail their communications plans in platform level documentation

a. **Command Hot Line.** Permits information exchange between specified officers.

Users: Command (Ops Room).
MEO (HQ1).
WEO (Ops Room).
DMEO (HQ2 in large ships).

b. **Damage Control Hot Line.** Permits information exchange on Damage Control and Firefighting between specified officers. In larger ships additional, dedicated DC Hot Lines are provided between FRPPs and their controlling Section Base.

Users: DCO (HQ1).
All Section Bases OIC (Large ships).
All FRPPs OIC (Small ships).

c. **DC Telling Line.** Enables DC information to be exchanged between Incident Board Operators. In larger ships additional, dedicated DC Telling Lines are provided between FRPPs and their controlling Section Base.

Users:
HQ1 Incident Board Operator(s).
All Section Base/FRPP Incident Board Operators.
Ops Room Incident Board Operator.
Weapon Section Base Incident Board Operators.

d. **'L' Reporting Group ('Green Line').** Permits information exchange on electrical distribution between specified positions.

Users:
SCC Electrical Control Desk.
HQ2 Electrical Control Desk.
All Switchboards and EDCs.
Weapon Section Base WOET(WE).
Alternative Weapon Section Base CPOET(WE).
FRPPs.

e. **Weapon Repair Hot Line.** Provides communication to manage the Weapon Repair Organisation in the Action and Defence states.

Users:
WEO (Ops Room).
DWEO (Weapon Section Base).
OIC/RIC (Alternative Weapon Section Base).

f. **Weapon Repair Group.** Provides communication to co-ordinate Weapon Repair in the Action and Defence state.

Users:
WOET(WE) (Weapon Section Base).
CPOET(WE) (Alternative Weapon Section Base).
All Weapon Repair Outstations.
WEO's Assistant (Ops Room).

g. **Cleansing Station Intercom.** Permits information exchange within individual Cleansing Stations and adjoining citadel entrances.

Users:
Cleansing Station Entrance (Weatherdeck).
Cleansing Station First Stage.
Cleansing Station Second Stage.
Cleansing Station Exit (Citadel).

h. **Command Open Line.** Enables the DC and Weapon Repair Organisation to monitor the tactical situation as required.

Users:
Command.
WEO (Ops Room).
Command Team (Ops Room).
WSB (Loudspeaker watch only).
HQ1 (Loudspeaker watch only).
Alternative WSB (Loudspeaker watch only).

Figure 8-1. Damage Control Communication Requirements

		COMMUNICATION								POSITION/PERSONNEL																		
		HOT LINE	OPEN LINE	DC TELLING LINE	'L' REPORT GROUP	WEAPON REPAIR GROUP	WEAPON REPAIR HOT LINE	DC HOT LINE		WEO - OPS ROOM	WEO ASSISTANT	MEO - HQ1	DCO - HQ1	CBRNPO ASSISTANT	'L' DESK HQ1	DMEO ALT HQ1	DWEO WSB	OIC ALT WSB	WO2ET(WE)	CPOET(WE)	WEAPON REPAIR PERSONNEL	NAVAL STORES	OIC REPAIR POSTS	COMMAND SHELTER	CLEANSING STATION	MONITORING POSITIONS	WEAPON REPAIR WSB 1	WEAPON REPAIR WSB 2
OPS ROOM	COMMAND	X	X							X		X																
	PWO		X							X																		
	WEO	1	X				1			■		X		X		X	X	X										
	WEO'S ASSISTANT					3					■								X	X							X	X
	INCIDENT BOARD			X																								
HQ1	MEO	1										■				X								X				
	DCO							3					■										X					
	CBRN ASSISTANT	1/4												■										X	X	X		
	INCIDENT BOARD			X																								
	'L' DESK				X										■				X	X								
AHQ	OIC	1								X		X				■												
	INCIDENT BOARD			X																								
	'L' BOARD				X										X				X	X								
WSB	DWEO/WO2ET(WE)		2			3	1			X							■	X										
	WO2ET(WE)																		■	X	X	X						
	'L' BOARD				X										X													
	INCIDENT BOARD			X																								
	WPN/SENSORS BOARD					3																					■	X
ALT WSB	OIC		2			3	1			X							X	■										
	CPO/PO ET(WE)																		X	■	X	X						
	'L' BOARD				X										X													
	INCIDENT BOARD			X																								
	WPN/SENSORS BOARD					3																					X	■
WEAPON REPAIR PERSONNEL						3													X	X	■							
NAVAL STORES OFFICE																			X	X		■						
FRPP	OIC												X										■					
	INCIDENT BOARD			X				3																				
	'L' BOARD				X																							
SWITCHBOARD (L)					X																							
COMMAND SHELTER				X								X		X										■				
CLEANSING STATION														X											■			
MONITORING POSITION														X												■		

Key **X** Communication Link.

1 Exclusive person to person interphone line separate from other communications and able to operate without ships supplies.

2 Loud speaker only.

3 A dedicated weapon repair group and a DC hot line, not fitted in older ships.

4 Communication link when under a CBRN threat.

0803. Damage Control Communication Procedures

a. Much confusion is created in action or peacetime incidents through the misinterpretation of common terms, and the failure to recognise that busy internal communications circuits and lines require exactly the same kind of voice discipline as used on radio circuits. The flow of information often relies on a junior rating, of limited experience and possibly in a state of shock, finding a number of defects or incidents and then reporting them accurately to the appropriate outstation. The scope for error is immense during this fast moving initial phase. A mistaken incident or incomplete report can cause incidents to be incorrectly prioritised with potentially catastrophic effects on the fighting and operational efficiency of the ship. The process is further complicated by the sheer volume of information which needs to be assimilated amidst the chaotic environment following a weapon hit or damage incident, Fires, floods, smoke, violent manoeuvring, high pressure system leaks and noise all combine to add confusion and provides a breeding ground for poor communication and flawed decisions. This requires considerable forethought, practice and critical self-analysis by DC Command Team members.

b. When operating under stress, Command and Control discussions can be better focussed if leaders prefix sentences with key descriptive words, to tell the listener the type of message being passed. The most important examples are: ‘Command Aim’, ‘Question’, ‘Order’, ‘Request Sitrep’, ‘Standby Sitrep’, ‘Incident Priorities’. For example:

(1) ‘Question? Status of the 3 Juliet fire?’

(2) ‘Order! send a firefighting team from the Aft FRPP to support fwd.’

(3) ‘Standby Sitrep: .....’

(4) ‘Incident Priorities! Your first priority: fire in 3 Juliet. Your second ..... etc.’

c. All references to ship location letters should be by use of the phonetic alphabet to avoid misunderstanding (eg ‘fire in Two November Galley’).

0804. Initial Contact Report

a. After a Loud Vocal Alarm (LVA) is raised, the first leader at the scene (eg WRT leader, MMS SR, fire/flood team leader) should make an Initial Contact Report (ICR), following the What, Where, Whither and When format; noting that Whither indicates whether the incident status appears to be improving or worsening. The status of an incident should be qualified as follows:

(1) **Minor.** Relatively small scale incident, whose solution is containable within local damage control and firefighting resources.

(2) **Significant.** Larger scale incident, which has the potential to affect key ships fighting and survival systems, but which is presently containable within local damage control and firefighting resources.

(3) **Critical.** Major incident, which already prejudices the survival of the ship or her key fighting systems.

b. Defining the status is initially the role of the local Damage Control team leader, who should take this decision bearing in mind the Command Aim. For example, if the Command Aim is 'to provide goal keeping air defence', then an incident (fire, flood, smoke, power loss, equipment damage) that affects Vertical Launch Sea Wolf could be 'Significant' or 'Critical'. The status will allow those higher up the Command chain, notably DCO and IBC, to prioritise resource allocation. When reported from FRPP/Section Base level to HQ1, these reports may be qualified with an indication of whether extra assistance will be required. If none is requested then it will be assumed that the incident is containable within local resources.

0805. Damage Reports

All reports must be made in the first instance to the Fire and Repair Party Post/Section Base, from where it will be reported to HQ1/SCC (in a large ship, where an officer is in charge of a Section Base, the initial reports must be carefully filtered and a concise report made to HQ1/SCC). Every incident must be reported to HQ1/SCC, but not necessarily all the detail. The types of report required are:

a. First reports from any source (patrols, search parties, Command, machinery control room, electrical control positions, ships company) of incidents discovered, eg structural damage, flood, fire, damage to electrical or other services and casualties.

b. Reports from search parties on the extent of damage and, if possible, more detail regarding loss of services and the aid considered necessary.

c. Reports from fire parties on the nature and extent of fire and, if possible, the location of the seat of fire.

d. Reports of failure or disruption of electrical services.

e. Reports from electrical control positions giving an initial assessment of the effects of damage on electrical power and equipment (electrical damage affecting only weapons may be reported direct to the Command Advisor in the Operations Room).

f. Reports from the Machinery Control Room giving loss or reduction of main and important auxiliary machinery.

g. In a or LPH, from the hangar/flight deck or vehicle deck control positions giving all necessary detail on major incidents.

Table 8-1. Information Required by IBC

(Not in order of priority)

TYPE OF INFORMATION	INFORMATION SUPPLIED BY	METHOD
Type of attack expected, eg current threat.	Command	Telephone or Broadcast
Imminence of attack, eg missile launch, coming within range.	Command/OOW	Telephone or Broadcast
Engaged side (applicable mainly to larger ships).	Command/OOW	Telephone or Broadcast
Information on hits and/or near misses.	OOW and/or OOQ of exposed weapons	Broadcast or via armament communications
Priorities for power or repair.	Command	Telephone
Detection of chemical spray attack.	OOW, MEC and/or fixed systems	Broadcast
Nearby air or surface nuclear burst.	OOW, MEC and/or fixed systems	Broadcast (take cover)
Detection of biological attack.	Medical	Telephone or conning

0806. Follow Up Reports

Early reports should be followed by more detailed reports as soon as the information is available. These follow-up reports may amplify or correct previous reports and/or specify new areas of damage. Brief statements concerning casualties should be included. As soon as the Damage Control parties are working to control or repair damage or to fight fire, HQ1/SCC must be kept informed of the actions being taken, the numbers of hands involved, the progress being made towards the containment of the incident and the flood/fire boundaries that have been established. All this information must be recorded in HQ1/SCC (mainly on the incident board).

Table 8-2. Information Required by the Command

TYPE OF INFORMATION	INFORMATION SUPPLIED BY	METHOD
Restrictions on manoeuvrability or speed imposed by mechanical/electrical damage, structural damage or fire.	HQ1 (IBC)	Telephone
Course to assist damage control operations or reduce smoke nuisance.	HQ1 (IBC)	Telephone
Defects affecting ability to employ countermeasures, eg pumps for prewetting, citadel defects.	HQ1 (IBC)	Telephone

Table 8-2. Information Required by the Command (Cont'd)

TYPE OF INFORMATION	INFORMATION SUPPLIED BY	METHOD
Limitations on ability to employ weapons systems caused by defects, damage or contamination, including delays in reaction caused by contamination.	WSB/Command Advisor	Telephone In person
Power failure to any system.	HQ1 (IBC)	Telephone
Damage affecting any system.	HQ1 (IBC)	Telephone
Serious numbers of casualties or impending radiation casualties among personnel serving any system or main machinery, or in Damage Control parties that may need reinforcement from other quarters.	HQ1 (IBC)	Telephone
Need to shelter or deep shelter.	HQ1 (CBRNPO)	Telephone
Requirement for decontamination and/or cleansing, eg: additional loading of cleansing station.	HQ1 (CBRNPO)	Telephone
Time likely to elapse before restrictions stated above can be lifted, and progress reports as necessary.	HQ1 (CBRNPO)	Telephone
Progress in watch changes and similar movements of personnel across the citadel boundary.	HQ1 (CBRNPO)	Telephone
Amplifying reports on the general situation and casualties.	HQ1 (IBC, XO)	Telephone or in person

0807. Flash Procedure

Flash reports are designed to gain urgent attention of the Command Team. As such they must be used sparingly. All Directors must acknowledge Flash reports; unacknowledged Flash reports are to be repeated. The following occasions are usually the only ones where a Flash report will be appropriate:

a. ICR of a 'Critical' or 'Significant' incident.

b. Sitrep of a 'Critical' or 'Significant' incident, especially where the situation is deteriorating.

c. Change in the Command Aim, or broad incident priorities.

d. Key system or equipment restored or brought back on line.

0808. Message Chits

A chit system should be used to improve inter-desk liaison in HQ1. The 'What, Where, Whither, When' format recommended for ICRs is also ideal for chits. Chits may be made up as a tailored form, but the standard blank 'Post-It' can be just as effective and has the advantage of being self-adhesive.

0809. Secondary Communications Position (SCP) and Emergency Communications Post

a. Platforms should ensure that procedures for establishing a secondary communications position (SCP) or emergency communications post (ECP) are detailed in relevant platform documentation. The following communications capabilities should be available at the SCP or ECP.

(1) 1 x HF Voice.

(2) 1 x UHF Voice.

(3) SCP pack containing current COMPLANs, Callsigns, EMCON, NUCO, Mini-SOCs, Chinagraphs and Signal Pads.

(4) Associated ancillary equipment.

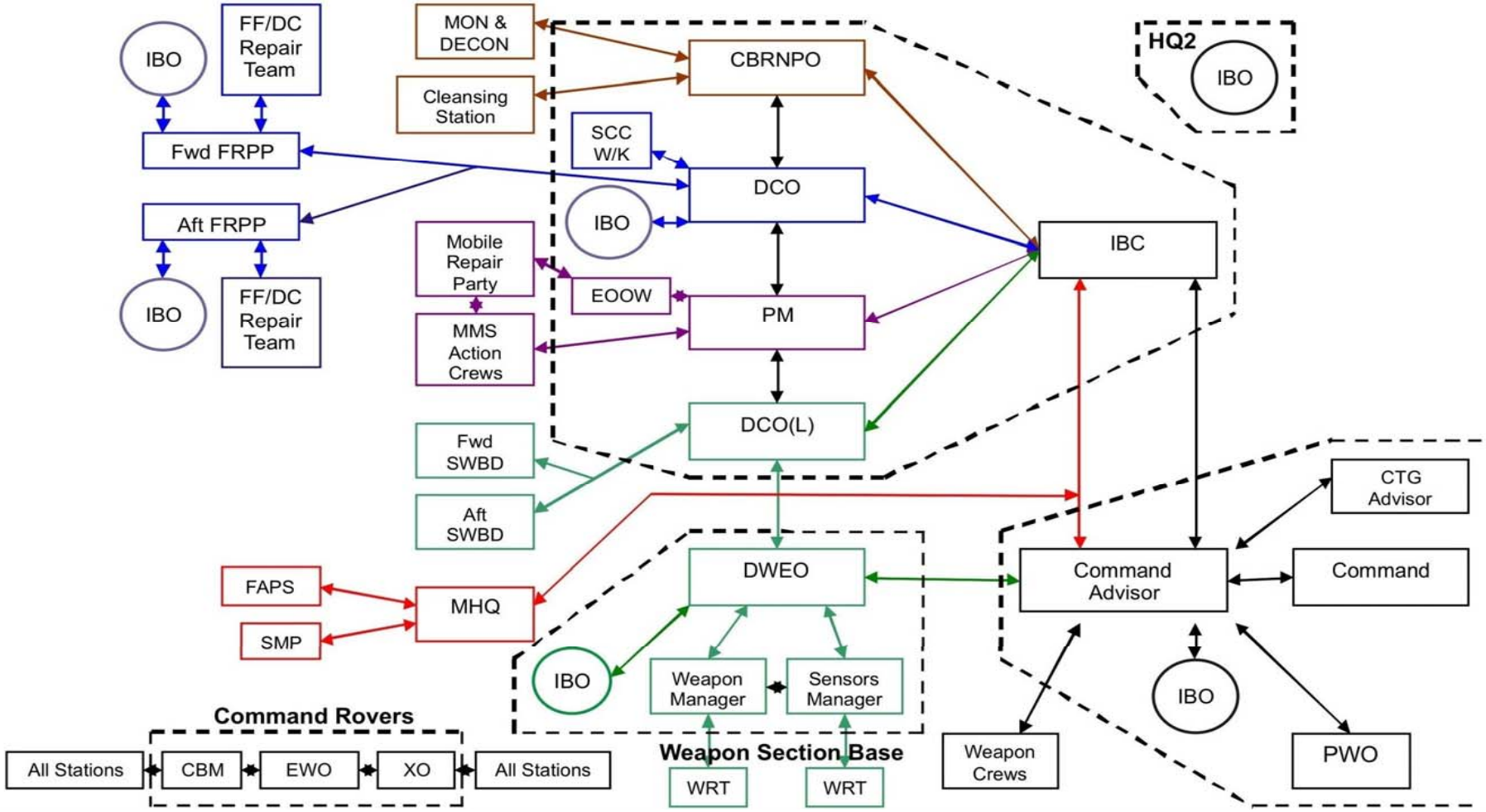
(5) PPE for upper deck working and State 1 posture.

b. Portable VHF communications should be available on the Bridge and deployed as required by the Tactical Support (TCS) operators. Portable equipment on the SCP/ECP should be set to frequencies nominated on the COMPLAN as the Command's highest priorities. These may be amended according to the situational requirements.

c. The SCP/ECP position should be available in the Aft part of the ship with easy access to internal communications. A regular routine for testing the equipment deployed to this position should be in place along with a battery management plan.

d. Activation of the SCP/ECP is to be exercised on a regular basis to ensure all staff can quickly react to an emergency condition and personnel are all fully conversant with the emergency communications arrangements.

Figure 8-2. Damage Control Command Control and Communications Team for a Typical DD/FF



CHAPTER 9

DAMAGE CONTROL PREPARATIONS FOR WAR AND ACTION

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CHAPTER 9

DAMAGE CONTROL PREPARATIONS FOR WAR AND ACTION

0901. Damage Control Preparations for War

a. It is difficult to establish with certainty those actions, which should be taken by ships on or before the outbreak of hostilities in order to improve DC arrangements. The difficulties are:

(1) To establish those actions, which appear desirable from a damage control and firefighting viewpoint and those, which could, over a realistic period of time, prove to have a degrading effect on habitability and morale.

(2) To establish those actions which will take time to complete and which should therefore be started at an early stage in a period of tension, and other actions which, once completed, might prove a distinct source of embarrassment to ships and bases, were tension to be relaxed (this latter category includes actions which could involve financial loss).

b. Guidance on what is desirable and what is considered acceptable under certain broad circumstances should be provided in platform class CBRNDC orders, and ships commanding officers must be free to decide their action according to the prevailing conditions. For example:

(1) The removal of ships side linings was found to be necessary during the Second World War to make easier the control of possible damage to the hull, but their removal in a modern ship could have a marked effect in the Arctic or tropics, as well as possibly depriving the side of lining/lagging provided for the limitation of noise.

(2) Some preparations may be obvious to an outside observer who might interpret them as an escalation of the situation. The rules of engagement in force at the time must therefore be taken into account.

c. Preparations can be undertaken in three stages. The first stage contains those actions that can be carried out covertly and later reversed at little cost. The second stage comprises actions to be taken during a hardening of the situation. The third stage should be put into effect on completion of the second stage preparations if the situation continues to deteriorate and, hopefully, to be completed before the start of hostilities. In some situations (eg operations other than war) it may be necessary to merge or adjust the following staged preparations to ensure that the ships operational posture is fully tailored to the overall situation. This will be decided by the Command, based on guidance from the CTG and from internal ‘table-top’ planning.

0902. First Stage Preparations

a. Conduct ‘table-top’ planning (see Annex 27H) for likely CBRN and damage scenarios and adjust preparations accordingly.

b. Check main and duplicate key boards/drawers.

c. Check holdings and serviceability of CBRN and DC equipment and stores, special attention being paid to BA, firefighting equipment and that CBRN stores are adequate and in date for use.

d. Review conduct planned maintenance on CBRN and DC materiel, and associated, equipment.

e. Review contents of Ships and Departmental CBRNDC Orders.

f. Check all smoke curtains for operation and effectiveness.

g. Check all escape hatches operate correctly.

h. Check all escape ladders function correctly.

i. Consider the requirement to remove of facial hair.

j. Review the Jettison Bill.

k. Review medical arrangements:

(1) Order war stores.

(2) Check that the ships company in date for medical/dental checks.

(3) Check that all blood groups are known.

(4) Accelerate the first aid training programme.

(5) Disperse first aid equipment and stores around the ship.

(6) Check Chemical Field Sets are complete and in date.

l. If at sea, de-fuel all boats except the seaboat(s).

m. Review the arrangements for locking compartments, other than magazines and storerooms (for which other arrangements already exist), to ensure ease of access in the event of damage.

n. Review arrangements for, and identify, compartments and spaces available for the stowage of additional CBRNDC and other equipment and stores.

o. Ensure that a suitable officer whose place of duty is remote from that of the officer normally responsible holds the combinations to security containers.

p. Develop and publish a waste management policy and organisation.

q. Check respirators and haversack contents (JSP 925 and JSP 926).

r. Consider the requirement for identity discs to be worn.

s. Review holdings of CBRN and DC stores.

0903. Second Stage Preparations

a. Ensure that victualing, NAAFI and medical stores are safely and adequately dispersed throughout the ship.

b. Disperse the sleeping and messing arrangements of key personnel as much as possible.

c. Consider fitting new GSR Primary Filter Canisters.

d. The following stores should be issued in accordance with current allowances and as necessary, and indicated by the threat assessment:

(1) Action coveralls.

(2) Once-only suits (Special fit only).

(3) CBRN inner and outer gloves, overboots and suits.

(4) Additional respirator canisters.

(5) Chemical agent detector paper.

(6) DKPs 1 and 2.

(7) RVDs and CAMs.

(8) Dosimeters and radiac instruments to be distributed.

(9) NAPS, BATS and Combopens. Orders for the issue and use of these items will normally be given by the Chief of Joint Operations (CJO), the Joint Task Force Commander (JTFC) or by the CTG.

(10) Action carry bags, when authorised by the Command.

e. Order respirators and lifejackets to be carried.

f. Activate chemical and radiological fixed detection systems (SIC and SIRS) and consider the use of MCAD, if held and relevant to the threat. Confirm portable chemical and radiological sense equipment is serviceable (CAMs, CAM XTR, LCAD) . Equipment activation will need to balance the threat level against the consumption of consumables for some equipment.

g. Prepare Secondary Medical Position (SMP).

h. Land the following, non-essential, items:

(1) Curtains, loose covers and bunk overcases (except those covering foam rubber or plastic material).

(2) All surplus furniture.

(3) Non-fireproofed timber (excluding timber needed for DC and emergency repairs).

(4) Gangway furniture eg screens, lifebelts, stands, covers etc.

(5) Ship and boat name boards and badges.

(6) All awnings and stanchions.

(7) Recreational boats.

(8) Loose carpets.

(9) Glass-fronted pictures, crests and non-essential decorative items.

(10) All trophies, silver and associated cases.

(11) All non-Service items of personal baggage including civilian clothes and shoes.

(12) Reduce holdings of paint (minimum to ‘touch up’ rust patches and external surfaces) and other flammables.

(13) Funnel badges.

(14) Private radios/recording equipment that cannot be securely stowed in lockers. Mobile phones are so small that they can easily be stowed but EMCON/security considerations may require some action to be taken.

i. Remove Perspex/glass fronts to notice boards etc and, where necessary, replace with wire mesh.

j. All books except BRs etc in use, to be kept secured in lockers. Books on bookcases/shelves are to have a method for restraining contents.

k. Ensure, wherever possible, that items of equipment and stores that are normally not secure, and could be accelerated under shock/whip conditions, are adequately secured.

l. Make checks to ensure that the ship is best able to resist shock, as follows:

(1) Check that all shock mounts are free to move and are in good condition.

(2) Check that items, which are shock mounted, have adequate clearance around them and that stores, books etc are not stowed on top of them.

(3) Check that shock mounted items are not 'shorted out' by bights in cable or pipe connections.

(4) Check that all storerooms are stowed correctly with all battens in place and items lashed in position where necessary.

(5) Check that all fire extinguishers, hoses, portable pumps and associated equipment's are in their correct stowage positions and cannot be displaced by shock or whip.

(6) Check that all gas/air bottles are in their correct Stowages and are not free to move.

(7) Check that all equipment secured to benches, bulkheads and other fixed structures are bolted in position.

m. Distribute plastic jerry cans and similar containers, filled with fresh water, around the ship.

Note. *Guidance on the hygiene of containers used for fresh water storage is to be followed as detailed in BRd 820 - Portable Water Management Chapter 6.*

n. Accelerate and intensify the training of CBRN/DC teams.

o. Personnel to be briefed and practised on how best to protect themselves from the effects of weapons.

p. Issue morphine to officers/ratings in charge of First Aid Parties.

0904. Third Stage Preparations

a. Ensure that the Ship's Company have access to CBRNDC and Survival documentation appropriate to role

b. Issue lengths of line for securing bedding, furniture etc in place before going to Damage Control State 1.

c. Consider draining deep fat fryers when not in use.

d. The use of hot water heating urns should be controlled and restricted to reduce 'wild heat' and the risk of scalding.

e. Issue the maximum number of torches.

f. Cabins, messdecks and public areas to be secured (bedding, lockers, drawers, furniture, etc) when not in use.

g. Servery, galley and food or other lift hatches/shutters/doors to be closed when not in use.

h. Rim locked doors to be left unlocked and closed. Where security is necessary hasps, staples and lightweight padlocks should be fitted.

0905. Jettison Bill Preparation

a. A Jettison Bill is to be prepared in accordance with BRd 2 and included as part of the ships CBRNDC Orders. It should list all those items which are comparatively heavy, sited above the centre of gravity (usually superstructure, 1 and 2 Decks only) and which can be removed and jettisoned with reasonable ease. Ideally, the Jettison bill should contain the following information:

(1) The item of equipment.

(2) Its position by location marking and distance from the centreline.

(3) Its weight and mobility.

(4) The tools, if any, needed for its removal.

b. Jettison Bill items must be peculiar to the particular ship, but the types of equipment, which can usually be included, are as follows:

(1) Anchors, but not the cables, which should be dropped into the lockers.

(2) Ships boats, which can be put into the water and secured to the ship.

(3) Aircraft, which can be flown off.

(4) Ready use ammunition lockers (but not the ammunition) and other Weatherdeck lockers.

(5) Equipment such as wires and reels, hawsers, awning gear and canvas, spare gear for weapons, machinery boats, etc, cable working gear.

(6) RAS stump mast.

(7) Potatoes from their Weather deck stowage.

0906. Identity Discs

All RN personnel are to be in possession of 2 identity discs. These discs are engraved with the name, official number, blood group and religion of the owner. They are to be worn around the neck of the owner when ordered.

0907. Damage Control Preparations for Action

a. In applying these recommendations, or before consideration is given to making any or all of them mandatory, account must be taken of the situation(s) in which the particular ship(s) may be involved.

b. In a general war situation a ship is likely to spend a large part of the time in Damage Control State 2 with the majority of the ships company in defence watches. Under such circumstances messdecks and cabins are being lived in and workshops are being used, and will continue to be right up to the moment when DC State 1 is ordered, which may be as a result of:

(1) A change in the overall threat, which probably requires the rapid assumption of action stations in addition to DC State 1.

(2) Sudden and unexpected damage, which could require the immediate assumption of action or emergency stations.

(3) Knowledge that the operations into which the ship is about to enter will mean prolonged periods of action stations and/or DC State 1 with a high possibility of damage.

c. In the types of situation, which give rise to the sudden and unexpected assumption of action stations/emergency stations/DC State 1, it is neither reasonable nor realistic to expect that all desirable precautions will have been taken before personnel close up at their stations. However, when some warning is to be expected, precautions can and must be taken beforehand.

d. It is more probable that a ship will find it necessary to go to DC State 1 from State 2 with no prior warning and that occupants of compartments (messes, workshops, etc) will be unable to complete all the desirable preparations before closing up. The training of the ships company must therefore stress the importance of tidy living at all times and the particular training of the DC teams must emphasise the need to correct any obvious faults in preparations as part of their closing up drill.

e. If the preparations for war have been carried out, preparations for DC State 1 should normally be limited to the following, unless there is special reason for further measures:

(1) Carry out the State 1 preparations listed in the ships CBRNDC Orders.

(2) Empty waste paper baskets and gash buckets.

(3) If the warning time permits, all personnel dress in clean clothing.

(4) Stow away all loose clothing and ensure that doors to kit lockers and drawers in offices and cabins are securely closed.

(5) If towels cannot be safely stowed within kit lockers they should be firmly knotted on the towel rails.

(6) Bundle curtains together and stow them or lash them securely in their positions.

(7) Lash and secure movable furniture except, for example, the wardroom table and fittings where the wardroom is the Secondary Medical Position (SMP).

(8) Check the smaller compartments that are not covered by the normal key regulations.

(9) Switch off unnecessary heaters, heating and electrical circuits.

(10) No hot fat/cooking oil in galleys.

(11) All personnel carry lifejackets and battle bags. Respirators are to be carried when ordered by Command.

(12) Check that plastic, fresh water containers are full, and stowed safely. All water bottles to be filled.

f. The Command should have a clear understanding of the time taken for key personnel to close up from State 2, and the time taken to achieve full State 1. In some situations these times may be crucial in determining whether to order State 1 as a threat materialises or remain at State 2 until after damage is sustained, in order to ensure highest feasible level of damage control integrity as the ‘hit’ is taken.

0908. Sabotage Attack Against Ships - CBRNDC Countermeasures

Reference: BRd 8988 Chapter 22-25

BRd 8988 and Royal Navy Security Guidelines (RNSG) provide guidance to Commanding Officers (CO) on defence against sabotage and terrorist attacks made on their ships both above and below water, giving background information on the factors which have to be considered, the preparations which must be made in advance and on dealing with the threat when it materialises. They also identify a number of possible means of attack ranging from mortar attacks, to car bombs, to underwater swimmers. The potential for ships to be targeted with Chemical, Biological and Radiological (CBR) weapons poses a newer, albeit unlikely, threat in certain operational theatres. Further guidance can be found within the associated publication.

CHAPTER 10

LOGISTICS DEPARTMENT

CONTENTS

Associated publications:

BRd 2002 – Maritime Operational Logistics
JSP 456 – Defence Catering Manual
BR 1754 - Regulations for the Safe Storage and Handling of Petroleum Products in HM Ships and Submarines

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CHAPTER 10

LOGISTICS DEPARTMENT

1001. Introduction

The Logistics Officer (LO) is to consider the problems imposed by an elevated CBRNDC threat in conjunction with the Damage Control Officer (DCO) and the CBRN Protection Officer. They are responsible for ensuring the Logistics Department are able to manage the supply of food and stores before, during and after action. Preparations are to be made to limit the impact of secondary damage to stores from fire and flooding in Logistics related compartments. Therefore, dispersal plans, accessibility and stowage of all stores should be considered for all logistics spaces. Routines for ventilating storerooms must also be established with the DCO.

1002. Stores and Storerooms

Special arrangements are to be made for the stowage of delicate, high value, flammable, provisions, and clothing liable to contamination by CBRN agents or noxious fumes. Detailed information in these respective areas is contained in JSP 456 Vol 1-3 and BR 1754.

1003. Accessibility of Stores

Stores supplied to ships for CBRNDC purposes are drawn from the LO by the MEO or the DCO and stowed in, or near to, FRPP lockers, the CBRN store, or other authorised stowages.

1004. Provisions

When operating under war conditions, ready-use stocks of provisions are to be deployed in secure places as high as practicable within the citadel, so that they are readily available as a reserve against damage to storerooms or for action messing. Any provisions not packed in impermeable containers must be sufficiently covered to protect them from potential contamination.

1005. Action Logistics Cell

When operating in State 1, an efficient logistics support organisation needs to be in place to ensure sustainability issues are correctly addressed in relation to the Command Aim. This is particularly important should the ship suffer secondary damage.

a. **Primary Functions**. The Action Logistics Cell (ALC) should normally be in a compartment that can provide access to good, whole-ship communications (ie adjacent to, or integrated with the Weapon Section Base (WSB)). A Secondary Action Logistics Cell (SALC) will also be identified in the event of having to evacuate the ALC, within or close to the alternative WSB. The position of both Cells and the associated procedures and routines used for retrieving stores should be written within the respective unit's Standing Orders.

b. **Personnel**. With the LO invariably employed as DCO at State 1, responsibility for providing logistics advice and coordination is normally assumed by a Supply Chain Rating , who assumes the role of the Primary Logistics Coordinator (PLC). The PLC may be assisted by a SQEP Logistics rate in the role of Stand-by Logistics Coordinator (SLC).

c. The functions of the PLC and the SLC are:

(1) Provide swift and accurate briefings to personnel tasked to retrieve spares. The PLC should not make the issue(s) personally, as they are to be in a position to provide the wider logistics advice to the Command.

(2) Evaluate the impact of battle damage incidents and be prepared to provide the Command with sustainability information.

The SLC should be employed in a flexible role that will allow them to be released without impacting on the primary role (i.e. AMT and not an IBO).

d. **Store Retrievals**. Efficient stores retrievals are essential and may need to be prioritised, as a number of stores requests may be received simultaneously. The PLC SLC are therefore to be fully aware of the Command Aim and Equipment Repair Priorities in order to determine the priority of issues. A safe transit route should be given to the person retrieving the stores, and this is best achieved through the WSB Incident Board Operator (IBO). Retrievals should form part of CBRNDC circuit training. Stores Retrieval Cards should be used to ensure that all pertinent information is captured in order to facilitate a swift stores retrieval process. On arrival at, and prior to departure from a Store, the retriever is to check in with the ALC and again, on arrival and prior to departure from the point of repair.

e. **Documentation Required**. Both the ALC and SLC should be equipped to fulfil the logistics support function at Action. An Action Logistics Information pack should be held in both cells, and contain the following:

(1) The Ship Plan, highlighting the following locations by colour code:

(a) Naval storerooms.

(b) Provision storerooms.

(c) Medical stores locations.

(d) RAS equipment.

(e) Aircraft Spares (hangar).

(f) CBRN and Damage Control equipment.

(g) NAAFI storerooms.

(h) Ready-use stores.

(i) Safety equipment.

(2) A Command Priorities page (see format at Annex 10A).

(3) ALC Command Huddle Crib (see format at Annex 10B).

(4) Record of CBRNDC incidents (e.g. Ship's plan, incident log, etc).

(5) A configuration breakdown of each storeroom and sustainability implications in the event of losses.

(6) Issues Log pages (see format at Annex 10C).

(7) Stores Retrieval Cards to include contact numbers for the respective ALC and SLC (see format at Annex 10D).

f. An up to date 6 monthly fall-back print, increased to 1 monthly during periods of OST, in times of tension or when directed by the LO. Emergency lighting, communications within and external to the WSB and sufficient writing implements should also be held at each cell. Access to IT via a desk station, Laptop or Tablet and fallback documentation is required at the ALC and the SLC.

g. **Logistics Advice**. The PLC must assess the implications of direct or secondary damage to stores. In order to achieve this, they are to insert details of each incident on the Incident Log page(s), together with any logistical impact. This information should be passed to the Command via the WSB, either before or during Command huddles using the 'Flash' procedure if necessary. The Incident Log page(s) should be used thereafter to monitor the currency of information received and any subsequent updates.

h. **Command Huddles.** It is imperative that the PLC is included within WSB Command Huddles so that logistical implications can be brought to the attention of Command. The PLC's brief at the Command Huddles should include the following as a minimum:

(1) Ability to meet Command Aim.

(2) Incidents impeding stores retrievals and where required logistical implications.

(3) Progress on current stores retrievals.

(4) If required, any other factors affecting stores retrievals, e.g., upper deck access, lack of retrievers, etc.

1006. Action Messing

a. The Policy for action messing is set out in the Defence Catering Manual. Procedures for action messing should be described in class CBRNDC documentation and should include plans for action messing, defence watch messing, emergency messing and fallout messing.

b. The LO should ensure that a dedicated Action Messing Team (AMT) is detailed on the Watch and Quarter Bills for State 1.

c. Action Messing teams should not be automatically deployed to State 1 incidents. However, it is entirely appropriate for the AMT to conduct blanket searches of their immediate areas and to be used as spare hands to assist in the damage control effort when the situation and Command priorities dictate.

d. The pre-deployment of ‘action snacks’ at State 2, and the distribution of hot and cold drinks when State 1 is piped, is the most effective method of ensuring the short-term sustenance of personnel.

e. Prior to OST and during times of tension, ships companies must be educated in the role of the AMT, how to effect re-supply of drinks at State 1, and the routine for Action messing.

ANNEX 10A

ACTION LOGISTICS CELL COMMAND INFORMATION SHEET

ACTION LOGISTICS CELL COMMAND INFORMATION SHEET			
	COMMAND AIM		
	COMMAND PRIORITIES		
1			
2			
3			
	THREAT WARNING		
AIR	**R**	**Y**	**W**
SURFACE	**R**	**Y**	**W**
SUB SURFACE	**R**	**Y**	**W**
MINE	**R**	**Y**	**W**
	WE REPAIR PRIORITIES		
1			
2			
3			
4			
5			
	ME REPAIR PRIORITIES		
1			
2			
3			
4			
5			

ANNEX 10B

EXAMPLE OF A COMMAND HUDDLE CRIB

I CAN / CANNOT MEET THE COMMAND AIM	
INCIDENT	**IMPACT ON STORES RETRIEVALS**
CURRENT STORES RETRIEVALS	
ITEM / REPAIR POINT	**UPDATE (e.g. ETBOL, current location of retriever, etc)**
FURTHER COMMENTS (e.g. Upper Deck Access, lack of retrievers, etc) – N.B. Only use if required!	

ANNEX 10C

EXAMPLE OF AN ISSUES LOG

DATE / TIME	EQUIPMENT AFFECTED / COMMAND PRIORITY	DESCRIPTION	STOCK NUMBER	LOCATION	NAME OF PERSON COLLECTING ITEM	TIME AT STOREROOM	TIME AT REPAIR POINT

ANNEX 10D

ACTION LOGISTICS CELL STORES RETRIEVAL CARD

ME	WE	Command Priority No.
Equipment to be repaired		
Stores Item Description		
NSN (Last 8 digits)		
Store / Location within store		
Delivery Location (inc. Location Marking)		
Person to be delivered to & Ext.		
PHONE THE PLC ON _____: ON ARRIVAL AT STORE, BEFORE LEAVING STORE, AND WHEN STORES ARE DELIVERED TO REPAIR POINT.		

ME	WE	Command Priority No.
Equipment to be repaired		
Stores Item Description		
NSN (Last 8 digits)		
Store / Location within store		
Delivery Location (inc. Location Marking)		
Person to be delivered to & Ext.		
PHONE THE PLC ON _____: ON ARRIVAL AT STORE, BEFORE LEAVING STORE, AND WHEN STORES ARE DELIVERED TO REPAIR POINT.		

CHAPTER 11

EMERGENCY MEDICAL CARE AND ORGANISATION AFLOAT

Sponsor: NAVY MED-SO1 FGEN OPS

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CHAPTER 11

EMERGENCY MEDICAL CARE AND ORGANISATION AFLOAT

1101. General

The Ship's Emergency Medical Organisation is outlined below. The organisation for submarines is laid down in BRd 2170(4) Chapter 6. Any embarked personnel (such as EMF, TAG, PCRF) are to be integrated into the Medical Organisation as per Medical Standing Orders (MedSOs) or as local guidelines dictate. Medical countermeasures and casualty care in a CBRN environment are covered in BRd 2170(2).

1102. Principles

A ship's Emergency Medical Organisation is designed to provide rapid and effective medical care to casualties in peace or war to ensure that personnel efficiency, and hence the ship's efficiency, is maintained at the highest possible level. The immediate treatment of minor injuries may enable personnel to remain at or return to their posts. As such, a continuum of care exists - a casualty should receive immediate life-saving first aid treatment, be removed from danger, be treated by specified First Aid Team (FAT) members and then by the ship's medical staff. At the point of wounding all members of the Ship's Company are members of the Medical Organisation and should be competent at delivering immediate life-saving first aid treatment. Therefore, all RN personnel are to receive basic first aid training through Naval Core Training 2 (NCT2) as well as iaw BRd 9274 Chapter 8 Section 2 Serial 802003.

1103. First Aid Training

a. The CO is responsible for ensuring the correct numbers of first aid trained personnel are onboard iaw the latest policy.

b. The Senior Medical Branch Rating (SMBR) is to provide continuation First Aid Training (Level 2 and 3) to all members of the Duty First Aider (DFA) organisation, Standing Sea First Aid Party (SSFAP) and Emergency/Action First Aid Team (FAT) members. They also have responsibility for conducting first aid training in the specialist areas and to the Ship's Company in accordance with BRd 9274 Chapter 8 Section 2.

c. Ships are to ensure that training is carried out in accordance with the MORS training serials in BRd 9274 Chapter 8 Section 2. Ships are to conduct first aid training at every available opportunity and to ensure that medical aspects of the CBRNDC response are exercised.

d. A record of all training is to be maintained in the Master CBRNDC Training and Material Assessment Log held by the Whole Ship CBRNDC Qualified (WSQ). The SMBR is to maintain the First Aid Training log and to hold the log within the Sickbay. The First Aid Training log is to record the date, subject, duration and names of individual attendees. Over a week, First Aid Team members should undergo a minimum of one hour of theory and one hour of practical training.

e. All personnel involved in First Aid duties onboard (DFA, SSFAP, FATs, Boarding Party First Aider) are to be trained as a minimum to Level 2 First Aid standard (having completed Level 3 Core Competencies). The SMBR is to train all FAT personnel to the Level 3 standard iaw BRd 9274 Chapter 8 Section 2.

f. All DFAs are to have completed the Level 3 training syllabus on portable Oxygen, Oral Transmucosal Fentanyl Citrate and AED prior to undertaking the role of DFA. FAT members are to have completed this within 2 weeks of being assigned to the role in the FAT.

g. All First Aiders are to have a Level 3 taskbook[1] issued and are to have successfully completed the syllabus within 4 months of joining their ship.

1104. The Medical Role

The ship's Medical Officer (MO), QARNNS[2], SMBR and Medical Branch Ratings (MBRs) have specific responsibilities in support of the ship's CBRNDC organisation and in maintaining the operational capability. They are not to be used as members of the First Aid Teams, and they are not to be included in Level 2 and level 3 First Aid numbers, as they are specifically borne to provide SME and clinical interventions as required. Additionally, they are to:

a. Maintain the health of the Ship's Company.

b. Provide advanced medical treatment to casualties to maximise the fighting efficiency of the ship.

c. Support the Command during any peacetime emergency.

d. Provide a Medical Organisation for Action/Emergency (MOFA/E).

e. Provide and maintain all emergency medical equipment within the Sickbay and throughout the ship.

f. Conduct First Aid training to the Ship's Company, SSFAP, FAT and other personnel as detailed in BRd 9274 Chapter 8 Section 2.

g. Provide specialist advice on the medical aspects of CBRN defence.

1105. The Dental Role

Whilst the role of the dental team is to provide primary dental care, during Action and Emergency Stations, they are required to work under the functional authority of the Principal MO/MO/MBR (see BRd 2 Para 1553) and should be appropriately incorporated into the MOFA/E. It is essential that the dental staff are adequately trained for this role.

a. **Dental Officer (DO).** The role of the DO is providing management// Triage officer/medical advisor or CASEVAC support as directed/required by the senior

[1] INM-RNMSS-Portal - 20180612-Task_Book_RNFAL3_V3.6.pdf - AllItems (sharepoint.com)
[2] The Senior Nursing Officer (SNO) is responsible for the management of clinical delivery in the Role One facility providing chronic disease management, medical force protection and routine screening. They are to provide clinical supervision for the Medical Branch Ratings.

clinician onboard or as operationally required. In capital ships, the DO will have a more formal role iaw local ship's instructions.

b. **Dental Nurse.** The Dental Nurse is as an additional member of a FAT. The minimum level of training for this is FA Level 2 but they are to be Level 3 trained within four months of joining.

1106. Duty First Aiders (see also Para 1620)

a. All ships alongside in harbour are to have an in date, First Aid qualified (as per Para 1103 sub para e) member in their Duty Watch organisation. This individual is to be identified on the ship's Daily Orders. The SSFAP delivers First Aid at sea and are to be nominated on the Watch and Station Bill.

b. All DFAs are to have immediate access to correctly stocked first aid bags at all times. This may be their own personally issued FA bag (if they are also members of the SSFAP/FAT) or may be a nominated DFA bag that is handed over at the beginning and end of each duty. They are to be responsible for the bag throughout their duty. The content of each FA bag is to be iaw the current Medical Equipment Table for Service Afloat (METSA) and to include individually issued Eye Protection (EyePro). Fresh water is to be carried in 1 ltr bottles and is to be available at all times. The DFA must wear a red cross surcoat for the duration of their duty and they are not to be assigned to other duties (e.g. BA controller or boundary cooling) that will prevent them from conducting their primary duty. The DFA must remain appropriately dressed to respond to an incident at all times. In DD/FF, AB(MBR)s may undertake the role of DFA in harbour. It is understood that some personnel undertaking DFA responsibilities may have either clinical or food handling responsibilities. These personnel may work with their sleeves rolled up however, upon leaving that immediate area sleeves must be rolled down as for SSEP personnel.

c. Where a ship has a Duty MBR, normally deployed outside of Base port, a DFA is still required.

d. When assuming FA duties in harbour, the DFA is to conduct a formal handover with the SMBR (or in the SMBR/MBRs absence, the DFA from the previous day). The DFA to remain onboard (immediate proximity of the ship) for the duration of their duty.

e. As part of the handover, and in order to ensure familiarity with the emergency medical equipment they may be required to use, the DFA is to conduct daily checks of the emergency medical equipment as detailed at Annex 11A. A log (utilising MOD Form 373) is to be maintained in the Sickbay to record the following:

(1) Item of equipment and the checks required.

(2) Name/Rate of person conducting checks.

(3) Reported defects discovered and corrective action taken.

(4) Monthly signature of the Officer with Medical Responsibility.

1107. Standing Sea First Aid Party (SSFAP)

a. All ships are to have a SSFAP which is to be included within the Standing Sea Emergency Party (SSEP). The SSFAP should consist of the SMBR[3] as overall I/C, a nominated 2I/C (the second MBR if borne) and no less than 4 other Level 3 First Aiders all of whom are to be certificated and in date.

b. All members of the SSFAP should also be in possession of a fully completed Level 3 task book (see Para 1103 sub para e). When the second MBR is not borne, a suitably trained 2I/C should be nominated.

c. SSFAP personnel should be taken from day worker watches and must be correctly dressed and equipped at all times, this includes having sleeves rolled down. All members of the SSFAP are to be issued with foul weather clothing, eye protection and ear protection, which are to be easily accessible in the event of an incident. They are to muster with the Standing Sea Emergency Party (SSEP) as directed.

d. With the workforce constraints on Survey, Hydrographic and Fishery Protection Squadron units, the following is to be adopted as the minimum workforce level for the SSFAP:

(1) **Medical Branch Rating Borne.** MBR, a nominated 2I/C[4] and no less than two other trained First Aiders.

(2) **Medical Branch Rating Not Borne.** A minimum of an I/C[5] and no less than two other trained First Aiders are required to be in the SSFAP.

e. The SSFAP is to muster for all emergencies in accordance with MedSO/LDSO or Ship's General Orders. The SSFAP is to be divided into 2 teams:

(1) **Team A.** Should consist of the 2I/C plus two First Aiders and are to muster at to the Forward Control Point (FCP) reporting to the I/C FCP. They are not to enter any smoke boundaries that have been established. They are to carry their First Aid bags, portable oxygen and are to be easily identifiable by wearing Red Cross surcoats with sleeves rolled down.

(2) **Team B.** Should consist of the I/C plus two First Aiders and are to muster in the Sickbay or other nominated location (e.g. Secondary Medical Position (SMP)) as directed or as the situation dictates. They are to prepare the Sickbay/SMP and standby to deal with incidents. They are to carry their First Aid bags and are to be easily identifiable by wearing Red Cross surcoats with sleeves rolled down.

(3) When borne, the MO reports to the Sickbay with Team B.

(4) On B1OPV, MM/PP ships, the medical responsibility falls to the I/C (Coxswain or P2000 XO) and the FAT muster iaw MedSOs.

[3] This may be the Coxn on vessels that do not carry an MBR
[4] This should be the Coxn/DCoxn
[5] This should be the Coxn in the absence of an MBR

1108. Medical Workforce in the MOFA/E

a. All members of the Ship's Company (SC) have a responsibility to assist casualties to the best of their ability as a part of dealing with the whole incident. It is part of an individual's self-leadership responsibility to remain in date for Naval Core Training (NCT) competences. Units are responsible for ensuring personnel maintain in date for NCT 2 First Aid. Operational priorities will dictate the relative importance given to the treatment of casualties with regard to the repair of damage; the Command Aim will reflect this. Although the priority is the incident at State 1, SC are to do their best not to ignore the casualties and at least reassure. When an opportunity allows, and it is safe to do so SC should conduct DRS ABC as well as basic first aid. Further guidance on this aspect is given in Para 0105. Unless specifically directed by the Command, FAT members are not to be employed in tasks which they cannot be easily and rapidly released from and which are likely to prevent them from conducting their primary duty within the MOFA/E. Irrespectively, **ALL** Ship's Company are required to provide immediate actions to deal with fires and other whole-ship incidents if in their immediate vicinity.

b. **State 1 and State 3 (Action and Emergency Stations).** Each populated FAP (depending on class of ship) is to be a minimum of a team of five; an I/C and two teams of two qualified and in date Level 3 First Aiders (as per Para 1103 sub para c). Medical branch personnel are **NOT** to be included in the numbers of the team. First Aid Teams should be deployed from the FAP in teams of two. Medical Headquarters (MHQ) is to be staffed by a suitably trained coordinator or team depending on the size of the ship. Close liaison is necessary between I/C of FAPs, the SMBR and the Medical Coordinator in MHQ, and between MHQ and Ship Control Centre (SCC) or HQ1, depending on the size of the ship. Maintenance of an accurate casualty state and Damage Control (DC) picture is essential. Knowledge of the location of medical assets is important information for the Command. Liaison between MHQ, SCC/ HQ1 and Command is necessary to coordinate casualty evacuation and relocation of medical positions as required.

c. **State 2.** In the Defence Watch organisation, there is to be a nominated First Aid Party within each watch. Each Defence Watch FA Party (DWFAP) is to consist of a Medical Branch Rating as I/C plus no less than two Level 3 First Aiders. If no MBRs are borne, a suitably qualified I/C should be nominated. The DWFAPs are to be included within the DWEP organisation and are to muster accordingly.

d. **Boarding Parties.** Each Boarding Party is to have a nominated Level 3 First Aider (trained and in date) who is to muster with the Boarding Party iaw BRd 1920 and local orders.

1109. First Aid Boxes

a. First Aid equipment (including eyewash bottles) is to be widely distributed around the ship to ensure flexibility and allow rapid access in case of an emergency. The locations of Clayton First Aid boxes are to be indicated on a ship's plan held within the Sickbay. Each box is to be marked **'FOR EMERGENCY USE ONLY'** and include a list of contents and expiry dates. Replenishment of contents are to be taken from the METSA scaling.

b. The compartment custodian is responsible for ensuring the Clayton First Aid box and Eyewash Bottles within their compartment are checked and in date as part of the weekly CBRNDC checks. They should liaise with the medical department for replacement contents if used or time expired.

1110. Medical Positions

a. During peacetime operations, the Sickbay is the focus of the ship's medical organisation. Its purpose is to maintain the health of the Ship's Company by providing comprehensive primary care, health promotion and public health advice. It must be ready to deal with a medical emergency at any time; therefore, all emergency equipment is to be ready for immediate use, with an easily accessible emergency drug tray stocked iaw with current policy.

b. Alternative medical positions are prepared and maintained during peacetime and war. Information regarding composition of the FAPs and the SMP are detailed in NES 106[6] and ANEP 77[7]. These areas should provide adequate space and emergency medical equipment for treating larger numbers of casualties. They may be used in the event of multiple casualties when the sickbay is untenable, or access prevented. They are usually sited within any citadel.

c. During Action or Emergency Stations, the Sickbay becomes the Medical Headquarters (MHQ) from where the medical effort is coordinated.

d. In Survey Vessel – Hydrographic Oceanographic (SVHO) platforms, there is no requirement for a dedicated SMP. FAT personnel, including the casualty coordinator, are to muster as directed by MedSOs or at an appropriate alternative medical position as directed by the SMBR. During Action or Emergency Stations, the Sickbay complex doubles up as the SMP.

e. The functions and details of MHQ, FAPs and SMP are at Annex 11B, Annex 11C and Annex 11D.

1111. Emergency Medical Equipment

a. All SSFAP, MOFA/E personnel and those nominated with First Aid duties in Boarding/Recce Parties are to be issued with a First Aid bag for which they are responsible. The wearing of EyePro for all SSFAP, MOFA/E personnel and those nominated with First Aid duties is mandatory and is to be issued to personnel iaw METSA. The contents of each FA bag are to be iaw the current METSA. Fresh water is to be carried in 1 ltr bottles and is to be available at all times. These all need to be signed for on a Loan Record Card (MOD Form 3352A).

b. Within the Sickbay, all emergency medical equipment is to be set up for immediate use and located around the resuscitation table. The fixed oxygen with BVM attached, resuscitation equipment including a defibrillator must be positioned so that they reach a casualty lying on the resuscitation table. The table should also be appropriately sited and fixed securely to the deck. Annex 11A details the emergency equipment routine checks.

[6]https://documents.pub/document/nes-106-part-1-requirements-for-medical-and-dental-organization-in-hm-surface.html
[7]https://modgovuk.sharepoint.com/teams/cui6-49/04-Engineering/02/01/01Supplementary_Info/ANEP-77.pdf#search=ANEP%2077

1112. Casualty Handling/Manual Handling

a. The SMBR is to ensure that they conduct routine training for their medical emergency teams (SSFAP/FATs) on casualty handling techniques and the procedures for using any form of stretcher. Routine whole-ship and Fire and Repair Party Post (FRPP) training should also be conducted by the SMBR in casualty handling.

b. During peacetime, the Paraguard Excel stretcher remains the most appropriate for moving casualties around a ship internally when they are incapacitated.

c. During Action, manual handling techniques such as the fore and aft carry or hose lift are more appropriate especially when swift extraction from a compartment is required to allow Damage Control (DC) teams into the space. Paraguard stretchers are not routinely used during action due to the time constraints and workforce required to complete the task. They may be considered when there is either a lull in action or the threat warning level has reduced with any movement of casualties being achievable without jeopardising the safety or efficiency of the ship i.e. maintenance of the DC state.

d. Where a hose lift is conducted, an adequate length must be used to ensure the safe extrication of a casualty. A Size 2 hose is the most appropriate, as long as they are not required for FF/DC, Size 1 for QEC. The brass fittings of the hose should be under full control to prevent further injury.

1113. Stretchers

a. There are 4 main types of stretchers in use on board RN surface vessels; Paraguard Excel; General Service (GS); Aircraft Lightweight (ALW) (if held); and Scoop stretcher.

b. Whilst carrying out all casualty handling involving a stretcher, the casualty must be moved feet first at all times. It is acceptable to take a few steps backwards whilst manoeuvring a casualty but someone else must guide this.

c. **Paraguard Excel Stretcher**

(1) **Introduction.** The Paraguard Excel stretcher and the valise (storage bag) (see Figure 11-1) [8] is designed for the transportation of casualties in difficult or unusual circumstances. The casualty is enveloped in a protective flexible case that takes up as little space as possible and can bend slightly to negotiate difficult routes. These stretchers are dispersed as indicated by the Ship Class Book. They are generally stowed in stretcher cabinets (valise to be removed to be able to fit in current stretcher cabinets) but can be fitted to bulkheads in appropriate positions. Paraguard stretchers exposed to the elements are to be stowed in the Paraguard valise. They may be lifted or lowered with the patient either in the vertical or horizontal attitude and thus can be used for moving casualties up ladders, down from superstructures, through hatches or in fact from any position of difficult access. Maintenance is to be conducted iaw AESP 6530-L-010. [9]

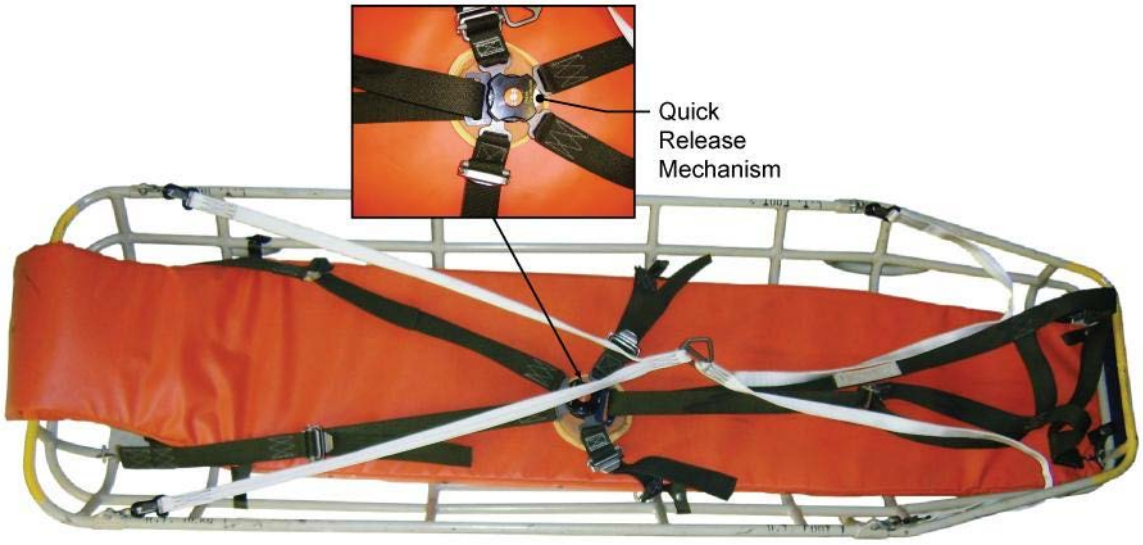
Figure 11-1. Paraguard Excel Stretcher and Valise

d. **General Service.** As a rule, this stretcher is not suitable for use on most RN surface vessels between decks due to the limitations of space. The General Service stretcher is generally used for moving casualties around during operations ashore. When moving casualties around on these stretchers, care must be taken to ensure that the restraining belts are used to prevent the casualty falling off. In Capital ships General Service stretchers are valuable assets for handling flight deck casualties or during amphibious operations.

e. **Aircraft Lightweight (ALW).** These stretchers are specifically designed for helicopter patient transfer. When the ship's flight embarks, they will bring another ALW stretcher with them. Specific training is required in the use of this stretcher, and all Medical Branch Ratings should make themselves aware of the procedures and limitations of these stretchers by consulting with the embarked flight team Senior Maintenance Rating (SMR).

[8] https://plm.web.logis.r.mil.uk/TDOL_LCS_Release/6530-L-010-201-ANNEX_A_%20001-UM_Paraguard_2003-0037_R03_0719_0.pdf
[9] AESP 4240-G-145-522 Maintenance Instructions

Figure 11-4. Aircraft Lightweight (ALW) Stretcher Rigged for Lift



f. **Spinal Board (SB) and Scoop Stretcher.** [10] These are specialist stretchers and should only be used by personnel who have been trained in their use. Whilst they remain an option for use, casualties should only remain on a SB for a short period (<1hr) and should be transferred to another form of stabilisation as soon as practicable. Scoop stretchers present a more viable option where available. All MBRs are to have undertaken training in the use of these stretchers prior to joining their unit and again casualties should be transferred to another form of stabilisation in under <1hr. All maintenance for the Scoop stretcher is to be conducted iaw AESP 4240-G-145-111[11] Equipment Support Policy Directive and AESP 4240-G-145-201[12] Operator & Maintenance Information.

Figure 11-5. Spinal Board

Figure 11-6. FERNO Scoop Stretcher

[10] https://plm.web.logis.r.mil.uk/TDOL_LCS_Release/4240-G-145-201_Scoop_Stretcher_0.pdf
[11] https://plm.web.logis.r.mil.uk/TDOL_LCS_Release/4240-G-145-111_Scoop_Stretcher_2_0.pdf
[12] https://plm.web.logis.r.mil.uk/TDOL_LCS_Release/4240-G-145-201_ANNEX_A_SCOOP_EXL_ATRAUMATIC_STRETCHER_USER_AND_MAINTENANCE_MANUAL_0.pdf

1114. Casualty Documentation

a. When a casualty arrives at a medical position, their injuries and treatments must be reassessed, and a definitive treatment plan put in place. The MO/SMBR/MBR (or I/C of FAP in their absence) is to review and coordinate treatment. Precise written instructions are to be made on each patient's Field Medical Card (FMed 826) and signed on completion. This permits medical staff to question the appropriate person if any queries remain regarding the patient's condition as well as assists with the return of casualties to duty. Recording all casualty details, clinical observations and treatments are important aspects of ongoing care.

b. To aid casualty care an FMed 826 is to be completed in the following coloured ink scheme:

(1) The senior clinical authority writes in **RED** (that is the MO or SNO when borne, otherwise the SMBR).

(2) Medical Branch Ratings write in **BLUE** (except the SMBR writes in red when no MO is borne).

(3) All FAT members write in **BLACK**.

c. An accurate casualty state is to be maintained by the I/C of the position. This information should be passed to MHQ who will in turn ensure the Command nodes are kept abreast with the casualty state. All casualties received within the FAP/SMP are to be debriefed (where possible) and any information regarding the Damage Picture or that may support the Command Aim is to be recorded, passed to the I/C and reported up through MHQ immediately.

1115. Peacetime (State 3) Casualties/Incidents

a. Upon discovering a casualty, the loud vocal alarm **"CASUALTY, CASUALTY, CASUALTY + LOCATION MARKING"** is to be raised and continued until either it is responded to or has been piped over the main broadcast correctly, preceded by the ship's general alarm. The first priority is to remove the casualty from danger. Although this must be done with due care to the casualty's injuries, it is accepted that in certain circumstances, the urgency of the situation may exacerbate the injuries.

b. The main broadcast may be used to hasten medical help to the scene of the incident in peacetime, but it should not be used during Action.

c. Once removed from danger, the casualty is to be assessed promptly and treatment commenced following current protocols.

d. The SMBR (plus MO when borne) and nominated members of the SSFAP will respond to the emergency and attend to the incident at the scene. The MBR and one member of the SSFAP are to proceed directly to the Sickbay. Here they will await instructions such as any additional equipment required at the scene. They will also ensure the Sickbay is prepared to receive a casualty. Ongoing management will proceed as deemed appropriate by the senior medical staff present. The Command is to be kept informed, and a process in place whereby this can be achieved speedily.

e. For stand-alone casualty emergencies all members of the SSFAP are to muster at the scene. The SMBR/MBR will co-ordinate the incident and allocate workforce, equipment retrieval and liaise with Command.

f. Casualties, their injuries, and treatments are to be re-assessed with documentation raised on arrival in either the sickbay, FAP or SMP. All casualties are to be debriefed (where possible) and information obtained reported immediately.

g. Consideration must be given to the possibility that the reported location of a casualty may not be the location at which the injury was sustained. Where possible, and particularly where there are grounds for uncertainty such as exposure to airborne contamination, casualty handlers should seek to confirm this detail and report it to HQ1, ensuring that any hazard and incident boundary is properly understood.

h. Should the incident necessitate the ship progressing to Emergency Stations, all other members of the FATs are to muster at their designated FAPs iaw the Whole Ship Watch and Station Bill (WSWSB) and/or MedSOs. Those FAT members already dealing with casualties are to continue to do so until directed otherwise. Members of the FAT are to maintain a presence at the FCP where practicable as directed by the SMBR or FAP I/C.

i. Where a MA2 (consolidation phase) is borne, they are not to be used as a routine member of the First Aid Team. MA2s are augmented to the ship for consolidation training and whilst capable of providing medical care, they have not completed any medical specific Medical Competencies or Pre-Joining Training (PJT). Therefore, these individuals should not be used to replace permanent ship's gaps. It is accepted that on occasions, a temporary gap may appear (courses/compassionate, etc) when the MA2 may be required to fill the position, this period should not exceed 4 weeks.

j Following a Crash On Deck, FAT personnel may be required to attend casualties in the crashed aircraft. Actions are to be taken iaw BRd 2170(5) Paras 0105, 0221 and personnel dressed in appropriate PPE as laid down in BRd 2170(5) Para 0223 (h).

1116. State 1 Preparations

a. All personnel are to muster as per WSWSB dressed in Action Dress iaw Para 2002, including Eye Protection, Red Cross brassards (attached to the right shoulder) and carrying their personal First Aid bag. MO when Borne and SMBR/MBR should be wearing Emergency Escape Breathing Device (EEBD) carried on a belt in their capacity as Rovers.

b. The material state of all FAPs and the SMP is to be checked and is to include a full muster of the contents of the FAPs and the SMP iaw current METSA scaling. An oxygen cylinder (size ZX with masks) is to be distributed from the medical store to each crewed FAP. All emergency equipment is to be checked and made available for immediate use and must be fully secured for Action.

c. Whilst strict adherence to civilian drug laws and regulations must be maintained in peacetime, at Action Stations immediate access to Controlled Drugs (CD)/strong analgesia must be available to the Medical Branch staff. When the order is given to proceed to Action Stations, the SMBR (when no MO borne) is to obtain the CD keys from the CO to allow access to the cabinets in both the Sickbay and medical store. Fentanyl Lozenges are issued to FAPs, SMP, FAT members and Boarding Party First Aiders as appropriate. They may also be issued to other selected members of the Ship's Company who are trained in its use and can administer under the direction of the senior clinician. In extremis, it is accepted that analgesia may have to be administered as a result of their own judgement. Ideally these persons should also be qualified in First Aid Level 3.

d. All members of the Ship's Company are to carry Emergency Care Bandages (ECBs). Combat Application Tourniquets (CATs) should be issued to all personnel carrying personal firearms including Upper Deck Weapons crews and all members of Boarding Parties. The ECB and CAT are not taped or affixed to either personal weapons or lifejackets when carried but should be placed in a pocket. All personnel must be trained in the use of the CAT due to the potential dangers when misapplied. The CAT must be made ready for immediate use and not remain within its packaging.

e. Each medical position is to inform MHQ when State 1 preparations are completed noting any deficiencies to workforce or equipment. When confirmed as complete, MHQ is to report findings to HQ1.

f. After mustering and completing State 1 preparations, FATs are to be briefed with a plain English translation of the Command Aim and their priority areas. At Threat Warning Red, they are to be dispersed in pairs, to locations nominated by the I/C. The locations of the dispersed personnel are to be recorded. The positioning of the dispersed personnel is to be influenced by the direction of the threat and the availability of suitable locations with means of escape and communications with the I/C of their relevant FAP (Para 0717 provides further details). Where FAT members are already dealing with casualties in the FAP, the I/C must apply discretion as to whether dispersal is appropriate. Generally, those required to manage the casualties must remain within the FAP and not disperse.

g. State 1 preparations should include the following:

(1) Sickbay is to be unlocked.

(2) All personnel are to be correctly dressed (AWD, dog tags, Red Cross Brassards, individual FA Bags, Eye Protection and head torches worn. SMBR/MBR and MO to be carrying EEBD on belts in their capacity as Rovers.

(3) All personnel accounted for, including additional personnel.

(4) Drugs cupboards are to be locked (SMBR to carry keys). If MO borne they carry CD/AC keys, if no MO borne the SMBR is to carry these at State 1.

(5) Medical store to be secure with 1” padlock.

(6) Check all emergency lighting including head torches.

(7) Oxygen ZX cylinder issued to crewed FAPs.

(8) Tempus Pro and AED to be distributed to each FAP and checked for serviceability.

(9) 100% muster of FAPs, SMP, Resuscitation Equipment (AMBU Bags, etc), FA Bags & individual trauma bags.

(10) MHQ are only to be informed when all of the above has been completed.

1117. State 1 Casualties

a. During Action there may be limited opportunity to provide care to casualties and the survival and fighting effectiveness of the ship may take priority. However, casualties should be removed from immediate danger and afforded lifesaving first aid interventions as long as the main FF/DC effort or Command Priority is not affected. As a minimum, the casualty should be removed from danger and moved to place of relative safety. Whilst at State 1, triage categories are unaltered, and treatment is still delivered on the basis of need and resources. However, the Command priority is to maintain the fighting efficiency of the ship. In recognition of this, more lightly injured casualties who can rapidly be returned to duty following simple and immediate treatments are to receive immediate care. This may be delivered by the FATs without reference to the medical staff if the latter are involved in dealing with seriously injured personnel. Alternatively, simple buddy-buddy care delivered at the scene of injury by members of the Ship’s Company without the requirement to involve the FATs, is also effective, as all members of the Ship's Company are trained to NCT 2 and are capable of conducting both a Primary Survey and rendering Basic First Aid. All casualties are to receive definitive assessment and care from the medical staff during a suitable lull in the action.

b. At Action, casualties are not to be piped iaw Para 0610 sub para b. However, ships without a MHQ (MM/PP) can pipe casualty alarms over the main broadcast as the Coxswain/XO may be mobile and not be in a position to respond to casualty information being passed by telephone.

c. First Aid Teams are to be deployed from their position to assist the injured. The casualty is to be removed away from immediate danger to the nearest place of relative safety (which does not impede DC teams or other Command priorities), and treatment directed at saving life or stabilising injuries. This evacuation should always be made with consideration for the overall situation and in consultation with MHQ and/or SCC/HQ1 where necessary. Casualty evacuation must not jeopardise the ship e.g. by opening doors or hatches and breaching smoke boundaries or impeding emergency teams. Where such actions are necessary, the local DC Incident Manager is to be consulted. The MO and MBRs will initially aim to remain within the FAP to assess and direct the care of casualties as they are received, however must be prepared to leave the FAP and go the scene of injury if their presence on site is requested by the First Aiders.

d. FATs deployed from a FAP need to carry their First Aid bags and any specific medical equipment required. They may also be carrying survival equipment but are not required to carry EEBD. They should be aware of the location of this equipment at all times.

e. Other factors that need to be considered during Action are:

(1) The need for accurate debriefing of casualties for information that may assist the DC or firefighting teams.

(2) Returning casualties to duty, even in a limited capacity.

(3) Priorities for evacuation to higher level of medical care should the opportunity present itself.

(4) Maintenance of a State 1 posture in the medical positions.

f. Casualty's injuries and treatments must always be reassessed (with appropriate comments recorded on FMed 826s) on arrival at the FAP, SMP or when in the Sickbay (see Para 1114 for further details).

g. FAP I/Cs are to maintain an accurate casualty state and DC picture for the whole ship. This is important to identify any threats to medical positions, plan safe routes for medical personnel and FATs, plan the relocation of FAPs should this be necessary and inform Command of any key personnel that are injured. At all times there should be a contingency plan for relocation. The exact areas of responsibility will differ in different ships but in general, qualified medical staff should cover distinct areas of the ship and should not congregate in one area unless there are extenuating circumstances. The SMBR should be aware of the overall Command aim, Command priorities, DC picture and casualty state; where no runners are available, casualty reports can be distributed accordingly by the SMBR.

h. During Action, appropriate bracing drills are to be applied by all FATs and casualties. If conscious, casualties with the use of functional limbs, are to be instructed by medical staff and First Aiders to brace themselves as effectively as possible while the FATs brace themselves. If the casualty is unconscious/incapacitated, the FATs can brace the casualty, but the bracing must be effective. If an effective brace cannot be achieved, the medical staff/FAT must brace themselves only.

1118. Casualty Triage

a. When there is more than one casualty, there needs to be a system to prioritise treatment. There are a number of systems for doing this. The RN uses the system outlined in AMedP-1.10[13], applied using the instructions in Clinical Guidelines for Operations (JSP 950 Volume 11[14]). This is summarised below:

(1) **T1 Immediate Treatment**. Consists of those requiring immediate life-saving interventions. One of the principles of triaging patients as T1 is that they may be converted into T2 with appropriate temporary intervention(s) (Colour code Red).

(2) **T2 Urgent Treatment.** Consists of those in need of high priority stabilising treatment, but whose general condition permits delay in surgical or other special medical treatment without unduly endangering life (Colour code Yellow).

(3) **T3 Delayed Treatment.** Consists of those with relatively minor injuries who can effectively care for themselves or who can be helped by first-aid trained personnel (Colour code Green).

(4) **DEAD.** Not breathing after airway opening procedures.

(5) **T4 Expectant Treatment. NOT A ROUTINE CATEGORY**: consists of those who are expected to die given the circumstances of the Major Incident/MASCAL. They will receive appropriate supportive treatment and palliative care.

Dead and T4 Expectant Treatment are defined as those whose injuries give no hope of recovery and if treatment were attempted other casualties who could have been saved may die (this category is not to be used unless directed by Joint Force Command/CTG (Medical)).

b. Triage is an active process and the category awarded will change with variation in the clinical condition of the individual or changes in the numbers of other casualties awaiting treatment. FATs are to be trained in applying the simpler and strictly formatted Triage Sieve process. Medical Staff will supervise the Triage Sort process once the situation has subdued (usually in the FAPs) and will also overlay their clinical judgement and apply more considered triage categories. Whilst at State 1, triage categories are unaltered; however, see Para 1117 sub para a with regards to the relative prioritisation of casualties at action.

[13] https://www.coemed.org/files/stanags/03_AMEDP/AMedP-1.10_EDB_V1_E_2879.pdf
[14] https://modgovuk.sharepoint.com/sites/defnet/JFC/Pages/JSP950ClinicalGuidlinesforOperations.aspx

1119. Safety Critical Medical Requirements (SCMR) for Peacetime Service in UK waters

a. Ships often operate at sea with minor deficiencies in stores, material and trained personnel. This risk is carried by the Commanding Officer who must be able to make an informed judgement of the level of risk they are carrying.

b. The aim of this is to clarify the Safety Critical standards by which a ship's medical department will be judged safe to operate at sea. It mirrors the criteria which, if not met, would result in an UNSAFE assessment at Material Assessment & Safety Check (MASC).

c. It must be emphasised these are the absolute minimum standards to be able to deliver emergency care safely and a medical department may still be assessed as performing 'Below Standard' or receive 'No Assurance' for healthcare governance despite meeting these criteria.

d. Each class of ship's equipment scale is detailed in the METSA. These scales are based on the number of personnel on board, the level of training of the medical staff and the nature of the ship. When included in the scale, the following are deemed the minimum items to operate safely.

e. Ships are to ensure that they meet the METSA SMCRs. A detailed list of METSA SMCRs are identified on the Medical Standardised Management Tool (SMT) and are to be reported on a monthly basis to the respective SURFLOT Medical Team. Where SCMR Pharmaceuticals and equipment stipulated as SCMRs are not held or fall below the minimum holdings, an HRA is to be raised and the associated risk recorded on the Whole Ship Risk Register iaw BRd 11 Leaflet 01.24[15].

f. If quantities fall below 60% of METSA scale, deficiencies are to be reported to WLSG/SURFLOT Medical organisations or RFA Med Tech. All equipment must be in full working order, in date for testing and daily checks, ready for immediate necessary use.

g. In order to move patients safely, stiff neck collars and suitable stretchers must be available. Ships are to have a usable Scoop stretcher, Paraguard stretcher, and Spinal board for man overboard (platforms with sea boats), and appropriate stiff neck collars available for ready use.

h. Members of First Aid Teams must have first aid bags stocked in accordance with METSA Module 004.

i. All members of the medical department must be in date for mandatory competencies (including BATLS and ILS training).

j. There must be sufficient Level 2 First aid trained personnel to provide a first aid team as mandated in Para 1103 and BRd 1991 Annex 5A. [16] These personnel must be employed in roles where they can be immediately released for first aid duties (i.e. not watch keepers, support party etc).

[15] 20230206-BRd11-Leaflet_01.24 - O.pdf (sharepoint.com)
[16] http://web.apps.royalnavy.r.mil.uk/fpgo/BRd_0001_4999/BRd_1991/BRd_1991/01_Homepage.html

k. Any failure to reach these standards must be discussed with the respective SURFLOT Medical Team; if sufficient mitigation is in place, a dispensation or waiver may be exceptionally granted using the HRA process. It must be remembered however that physical risk remains with the platform, regardless of temporary dispensations.

ANNEX 11A

EMERGENCY MEDICAL EQUIPMENT - ROUTINE CHECKS

EQUIPMENT	BY WHOM	NOTES
DAILY		
Sickbay AMBU Box Contents	DFA (alongside) SMBR/MBR/SSFAP (at sea) XO (P2000)	SMBR/Coxswain/XO (P2000) to supervise and check monthly. Contents to be iaw METSA Annex A
Sickbay Fixed Oxygen Cylinder (mask and tubing)	DFA (alongside) SMBR/MBR/SSFAP (at sea)	SMBR/MBR to supervise. Do not open cylinder every time. Charge gauge and shut cylinder.
Electrical Suction Machine	DFA (alongside) SMBR/MBR/SSFAP (at sea)	Under SMBR/MBR supervision.
Penthrox	DFA (alongside) SMBR/MBR/SSFAP (at sea)	Under SMBR/MBR supervision.
'Tempus Pro' Patient Monitor	DFA (alongside) SMBR/MBR/SSFAP (at sea)	Under SMBR/MBR supervision.
DFA Bag	DFA	Contents to be iaw METSA Annex E/Amendments to include changing water on daily basis.
AED	DFA (alongside) SMBR/MBR/SSFAP (at sea)	
WEEKLY		
Outstation AMBU Box Contents.	SMBR/MBR	Contents to be iaw METSA Annex A
First Aid Bags	All holders ie SSFAP/FAT members	Contents to be iaw METSA Annex E to include changing water on weekly basis.
Seaboat First Aid Bag	Coxswain of Boat/Designated First Aider	Oral airways sizes 2/3/4. Hand held suction apparatus. First field dressing. Blanket in protective covering, with one side waterproofed.
Clayton First Aid boxes (100% check within the month)	Compartment Custodian	To be exchanged or items replaced by SMBR.
Eye Wash Bottles	Compartment Custodian	To be exchanged with SMBR.

EMERGENCY MEDICAL EQUIPMENT - ROUTINE CHECKS (CONTINUED)

EQUIPMENT	BY WHOM	NOTES
MONTHLY		
First Aid Posts & SMP Contents and Equipment	SMBR/MBR with assistance from FAT members	iaw METSA Annex B and C to include changing water on monthly basis.
Paraguard stretchers (33% check within the month)	SMBR/MBR/Coxswain (XO on P2000)	UMMS 1 Log UMMS 5 Log.
Chemical Warfare Module, when held)	SMBR/MBR/CoxswainSMBR/MBR/Coxswain (XO on P2000)	METSA Annex D 550 ModuleUMMS 1 Log UMMS 5 Log
Chemical Warfare Module, when held)	SMBR/MBR/Coxswain	METSA Annex D 550 Module

ANNEX 11B

MEDICAL HEADQUARTERS (MHQ)

1. Role

Medical Headquarters (MHQ) is the control and communications centre for the Medical Organisation for Emergency/Action.

2. Functions:

a. Control, coordination and the deployment of medical teams.

b. Maintenance of communication with HQ1 and/or SSC/Ops Room/Bridge depending upon the situation (and location of CO or his Command Adviser) and with medical positions.

c. Maintenance of an accurate casualty state and whole ship damage picture.

d. Provision of advice to Command on casualty numbers and priorities with specific reference to casualties amongst personnel in key positions. This information should be provided orally as soon as the MO/SMBR/MBR knows it and is to be supplemented with a hard copy Using Casualty State Board/Incident Board.

e. Maintenance of accurate information on the location and effectiveness of all medical personnel and FATs.

f. Maintenance of the location of the MO/SMBR/MBR.

g. Input of MISTAT and other casualty details to facilitate 9 Liner message.

3. Essential Requirements/Facilities:

a. Located within the citadel; usually within the Sickbay.

b. Adequate primary and secondary communications with Command nodes and medical positions.

c. Adequate main and emergency lighting (see BRd 2170(3)).

d. Ships DC state board, Casualty state board and Casualty reports forms.

4. Workforce

Crewing will vary with the size of the ship and available workforce during Emergency or Action. The MHQ must be staffed at all times. A runner should be provided as an assistant and to ensure that hard copies of casualty reports are provided for Command positions as the situation dictates. The NAAFI Canteen Manager (CANMAN) traditionally runs MHQ but in ships with no CANMAN or if workforce permits, a member of the Ship's Company (Senior Rate) should control the organisation.

ANNEX 11C

FIRST AID POSTS (FAP)

1. Role

First Aid Posts (FAPs) are the collecting and treatment areas for casualties during Action or Emergency. The FAPs may also be used if there are large numbers of casualties or additional space is needed. FF/DD are to have a minimum of 2 FAPs. Larger ships have more iaw Ships Class Book. MM/PP and SVHO have one FAP that is staffed with a First Aid Team (FAT) and a secondary, unoccupied post.

2. Functions

a. Reception point for casualties at Action or Emergency.

b. First aid treatment of casualties.

c. Triage and reception for large numbers of casualties.

d. Control of first aid teams allocated to FAP.

e. Maintenance of casualty state and ship's damage state boards.

f. Dispersal of emergency medical equipment.

3. Essential Facilities

a. Widely dispersed around the ship, mainly above the waterline and close to FRPPs.

b. Adequate protection.

c. Adequate space for treatments and holding of casualties.

d. Adequate communication with MHQ and HQ1/SCC.

e. Adequate main and emergency lighting (see BRd 2170(3)).

f. Water supply at Action (5 ltr containers x 2 at each FAP and SMP).

g. Easy access for stretchers and non-stretcher casualties.

h. Adequate, secure storage for first aid and emergency equipment.

i. Emergency medical equipment (METSA IAW SCMRs).

j. State boards to show Damage Picture, Smoke Boundaries, Safe Routes and casualty states.

k. Stationery and documentation.

l. Adequate approach and escape markings. All emergency/FAP signs should be white lettering on a green background.

4. Workforce

All FAPs are to include at least an I/C plus 2 teams of 2 first aiders. All FAT personnel are to be in date for Level 2 First Aid and Level 3 First Aid qualified. This allows one team to be deployed and the other team to continue treatment of any casualties in the FAP. The I/C's role is primarily to control the FAP/FATs, to ensure that communications are maintained and to oversee treatment of the casualties.

5. First Aid Post Locker - Standard Layout

First Aid equipment should be stored in FAP lockers or other suitable stowage as space allows. All storage spaces are to be clearly labelled and contain accurate contents lists (including expiry dates as applicable). This locker is to be locked with a padlock when alongside for protracted periods and a frangible cable tie when at sea.

a. **Drawer 1.** Catastrophic Haemorrhage.

b. **Drawer 2.** Basic Airway Equipment.

c. **Drawer 3.** Advanced Airway Equipment.

d. **Drawer 4.** Breathing.

e. **Drawer 5.** Circulation.

f. **Drawer 6.** Fluids.

g. **Drawer 7.** Bandages (Remove Drawer).

h. **Drawer 8.** Splints.

i. **Drawer 9.** Eyes.

j. **Drawer 10.** Burns and Drugs.

k. **Side Compartment.**

l. **Miscellaneous/Other/Under Seat Stowage.**

m. **Nearby.** 5 gallon water container (with 'date of water changed' sticker).

ANNEX 11D

SECONDARY MEDICAL POSITION (SMP)

1. Role

The role of the Secondary Medical Position will vary in different classes of ship. It is identified as a fallback position for the Sickbay/MHQ or one of the FAPs should any of these become untenable during peacetime or war. The SMP may also be utilised as a casualty reception area for example following COD, SALVEX, NEO etc.

2. Functions:

a. Provision of emergency medical treatment and resuscitation in peacetime should the Sickbay be untenable or overwhelmed.

b. Provision of a fallback position for MHQ or FAPs at action should any of these become untenable.

c. Provide triage and reception area for casualties. This may be particularly pertinent in providing assistance to another vessel or non-combatant civilian evacuation operation. It may be appropriate if the SMP is on the same deck level as the casualty embarkation point.

3. Essential Facilities:

a. Located within the citadel.

b. Adequate protection.

c. Adequate space for the treatment and holding of casualties.

d. Adequate communications with MHQ, FAPs and HQ1/SCC and Command positions.

e. State boards to show damage and casualty states.

f. Casualty reporting forms.

g. Adequate main and emergency lighting (see allowances BRd 2170(3)).

h. Water supply (in containers at action) including access to hot water.

i. Easy access for stretchers and non-stretcher casualties.

j. Adequate, secure stowage for first aid and emergency medical equipment.

k. Stationery and documentation.

l. Adequate approach and escape markings.

m. Emergency medical equipment (see scale promulgated in the Medical Equipment Table for Service Afloat (METSA).

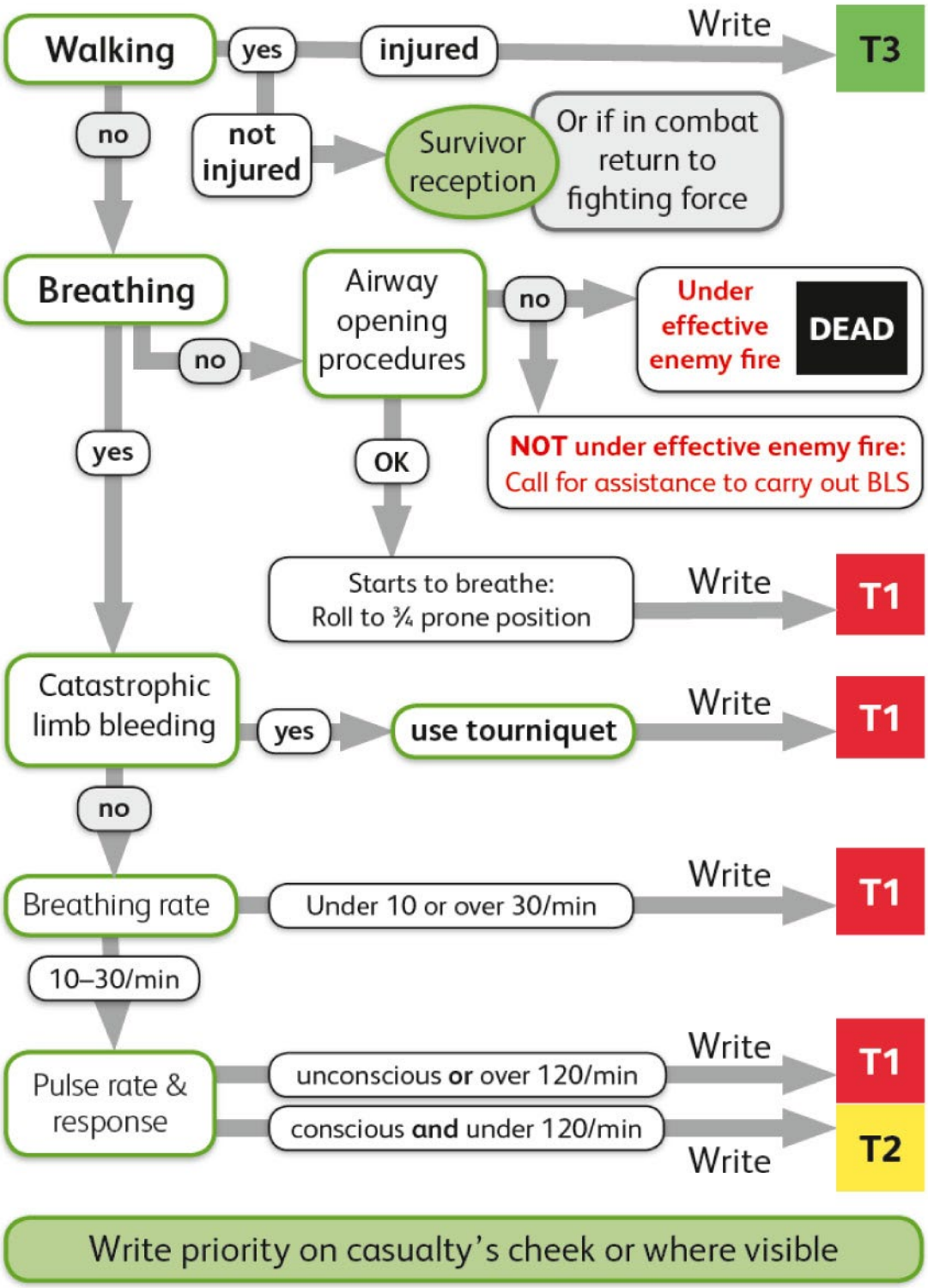
4. Workforce

The SMP is generally unoccupied during peacetime or at action unless it is also being used as a FAP. Members of the Ship's MOFA/E must ensure that the SMP is prepared for use and checked as part of DC State 1 preparations. SMP usage will vary according to its role.

ANNEX 11E

TRIAGE SIEVE AND SORT

1. TRIAGE SIEVE



2. TRIAGE SORT

Step 1: Calculate the Glasgow Coma Score (GCS)

E = Eye Opening:			V = Verbal Response:			M = Motor Response:	
Spontaneous	4		Orientated	5		Obeys commands	6
To voice	3		Confused	4		Localises	5
To pain	2		Inappropriate	3		Pain withdraws	4
None	1		Incomprehensible	2		Pain flexes	3
			No Response	1		Pain extends	2
						No response	1

GCS = E+V+M

Step 2: Calculate the Triage Sort Score

X = GCS			Y = Respiratory Rate			Z = Systolic BP	
13-15	4		10-29	4		90 or more	4
9-12	3		30 or more	3		76-89	3
6-8	2		6-9	2		50-75	2
4-5	1		1-5	1		1-49	1
3	0		0	0		0	0

Triage Sort Score = X + Y + Z

Step 3: Assign a triage PRIORITY

12 = T3
11 = T2
10 or less = T1

Step 4: Upgrade **PRIORITY** at discretion of the Senior clinician dependant on the anatomical injury/working diagnosis.

CHAPTER 12

DAMAGE CONTROL PRACTICE

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Para	
1201.	Immediate Action in HQ1
1202.	Immediate Action at the FRPP
1203.	Hazards
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1211.	Cofferdams
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CHAPTER 12

DAMAGE CONTROL PRACTICE

1201. Immediate Action in HQ1

If flooding from damage results in heel of more than a few degrees, the most urgent task confronting the MEO and the DCO is to restore the ship to a stable and, if possible, upright condition. If the upright condition is impossible, the aim must be to obtain a heel, which is acceptable to the operation of weapons, including aircraft.

1202. Immediate Action at the FRPP

a. In conjunction with the urgent requirements of reporting and passing information, countermeasures must be started. Generally, personnel nearest to an incident, or discovering it, are to start tackling the job. Their priorities are:

(1) Raise the alarm.

(2) Initiate a continuous and aggressive attack on a fire.

(3) Ascertain and limit the extent of damage and flooding.

(4) Carry out first aid repairs.

b. Speed is vital in the early stages of combating damage. Although search and investigation of compartments and spaces must be done thoroughly, it must also be done quickly. Firefighting, leakstopping, clearing away debris etc are immediate actions.

1203. Hazards

WARNING

1. SMOKE MANAGEMENT GUIDANCE (INCLUDING VENTILATION CONTROL) IS PROVIDED IN ANNEX 17C AND SHOULD BE FOLLOWED AT ALL TIMES.

2. WHERE ANY RISK OF A CONTAMINATED INCIDENT OR ENVIRONMENT EXISTS, VENTILATION MUST BE CRASH STOPPED AND BREATHING APPARATUS AND ATMOSPHERE MONITORING DEVICES MUST BE USED. RISK COMPARTMENTS WILL INCLUDE CONFINED SPACES, REFRIGERATION MACHINERY, SEWAGE TREATMENT PLANTS, VOID SPACES AND HULL OUTFITS

a. Damage, particularly fire, is likely to be accompanied by smoke, perhaps dense, or by toxic or combustible gases. Where the risk of a dangerous atmosphere exists or where a flooding incident will be contaminated by sullage, sewage or hazardous contents within a compartment, initial responders and all personnel in the immediate vicinity of the incident must wear breathing apparatus (EDBA) until it has been confirmed the atmosphere is breathable. Additionally, Personal and Confined Space Gas Monitors (PGM/CSM) **MUST** be provided to the FCP immediately to ensure appropriate atmosphere monitoring is conducted. Where compartments are already fitted with fixed atmosphere monitoring systems these are to be checked prior to entry into a compartment.

b. Structural damage is likely to be the cause of further personal danger – sharp broken edges at head height, holes in decks, ladders missing, etc. Such dangers should be roped off and illuminated when possible.

1204. Power Failure

Damage to electrical supplies will probably result in failure of lighting circuits. The restoration of lighting may be delayed because of more urgent work to be undertaken by the Electrical Repair Party. If power to essential equipment and machinery is lost and cannot be restored through alternative supplies, the DCO(L), in consultation with the MEO and DCO, must prioritise the supply of emergency power to equipment reflecting the Command Aim.

1205. Follow Up Action

a. Following the initial countermeasures, the urgent requirement is the establishment of fire/flooding boundaries, leakstopping, pumping, shoring weakened structure and the restoration of services.

b. The repair and control of damage in action is largely a matter of improvising to meet circumstances that cannot be foreseen exactly or in detail. All the resources of a ship is to be made available to deal with the damage. Firefighting accepted, the most urgent need is to combat flooding, ie stop the leaks and pump out floodwater. Speed is of the utmost importance:

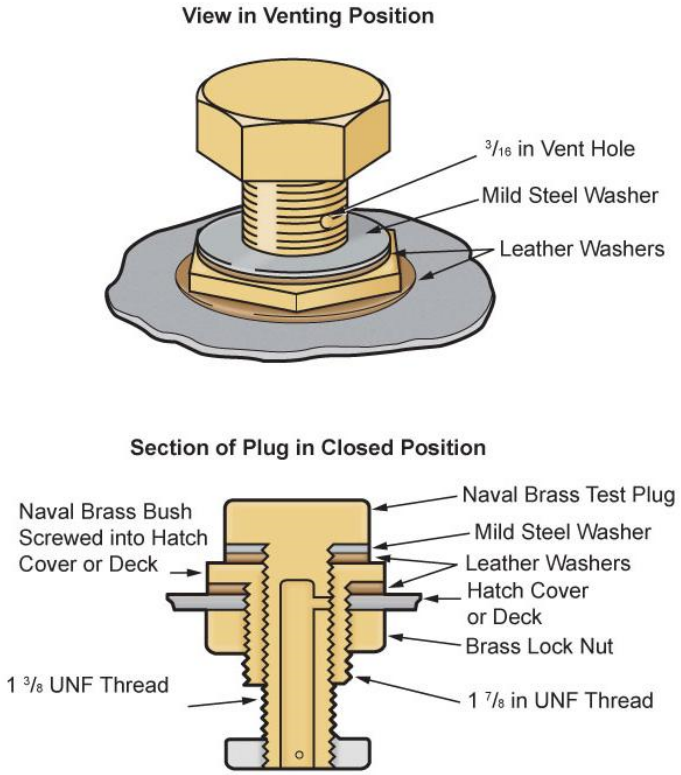
1206. Zones of Damage

An early appreciation of the zones of damage is essential before coordinated action can be taken, therefore blanket search parties must be sent out immediately.

1207. Indicator Test Plugs

When a search is being made great care must be exercised not to spread flooding by the incautious opening of watertight doors and hatches. To enable tests for flooding to be made without opening compartments, indicator test plugs (ITP) are fitted to the crown of every watertight compartment (except those normally containing liquid in bulk) within the Red Risk Zone (see Chapter 5). ITPs are generally fitted to the hatch or manhole giving access to a compartment, but they may be fitted to any suitable and accessible part of the structure. If water spurts out the compartment is obviously full-flooded and the plug should be screwed home If nothing is seen the hatch may be cautiously lifted and the compartment examined. Test plugs to magazines and flammable storerooms have an elongated thread and are fitted with a nut and split pin to prevent complete withdrawal of the plug. Figure 12-1 illustrates a plug in the venting condition and also shows in section a plug fitted with a nut and split pin.

Figure 12-1. Indicator Test Plug



1208. Flooding Boundary

a. When a ship is damaged below water, the need to rapidly establish the flooding boundary cannot be too highly stressed. Initially, the limits of the flooding boundary are the limits of the intact structure surrounding the area of the damage, ie inside the Secondary Zone and probably towards its outer edges. The immediate aims of the Repair Parties must be the reduction and eventual elimination of the slow flooding in the Secondary Zone. The ultimate objective is to reduce the flooding boundary until it coincides as nearly as possible with the Primary Zone. Unless the measures taken are prompt and effective, the Secondary Zone may become completely flooded. In deciding which bulkheads and decks are to form the flooding boundary it is necessary to:

(1) Ascertain which compartments are flooding or flooded as a direct result of damage.

(2) Inspect adjacent compartments to locate progressive flooding, its cause and to make certain what structure is sound.

(3) Decide in which compartment(s) the flooding can be stopped or controlled.

b. When the initial flooding boundary has been decided, prompt action must be taken to establish it and ensure its integrity by:

(1) Stopping leaks in the structure and isolating pipe systems until temporary repairs are carried out.

(2) Concurrently with leakstopping, rigging and working portable pumps and eductors (operating fixed pumping/draining/salvage systems if fitted).

(3) Shoring leaking doors and hatches.

(4) Shutting ventilation systems and drainage systems as necessary.

(5) Supporting strained/weakened/bulging bulkheads and decks with shores.

c. When the initial flooding boundary has been established, the next most urgent task is to reduce the area flooded as much as possible. Stopping leaks to bring the ingress of water to within the capacity of available pumps will allow the eventual reclamation of the compartment.

1209. Leakstopping and Shoring

Details of leakstopping, initial repair and shoring are contained in Chapter 13, Chapter 16 and BR 4008.

1210. Pipe Systems

Damage to the HP Sea Water Main, however, must be dealt with urgently, even if only by temporary measures and these are described in Chapter 13.

1211. Cofferdams

Cofferdams are structures of wood and/or steel built to form temporary watertight barriers. They are generally constructed of tongued and grooved planking between 38 mm and 75 mm thick, secured to a framework of shoring timbers, but they can be made of steel plates suitably stiffened and welded. The usefulness of a cofferdam is mainly restricted to the waterline area and some uses are as follows:

a. To restrict the spread of water from large holes in the ships side at or above the waterline, until repairs are made.

b. As dwarf bulkheads to break up free surface area.

c. To restrict the floodwater that might come up through a damaged deck.

d. To allow access to a partially flooded compartment by blanking off the lower part of the door opening.

1212. Wreckage

When a ship sustains damage to the hull or internal structure it usually means a lot of distorted, torn and loose plating, beams, frames, etc, and before any form of watertight repair can be attempted, eg the fitting of a cofferdam, this torn and loose structure must be cut away or brought reasonably together. To cut the structure away quickly will require the use of a thermal lance cutting equipment. Weakened structure can be strengthened with doubling plates or stiffening angles secured by welding or the use of a Ramset explosive powered tool. Damaged cables, lockers and fittings can be cut away for access, by the cutting and spreading equipment.

1213. Thermal Lance Cutting Equipment

WARNINGS

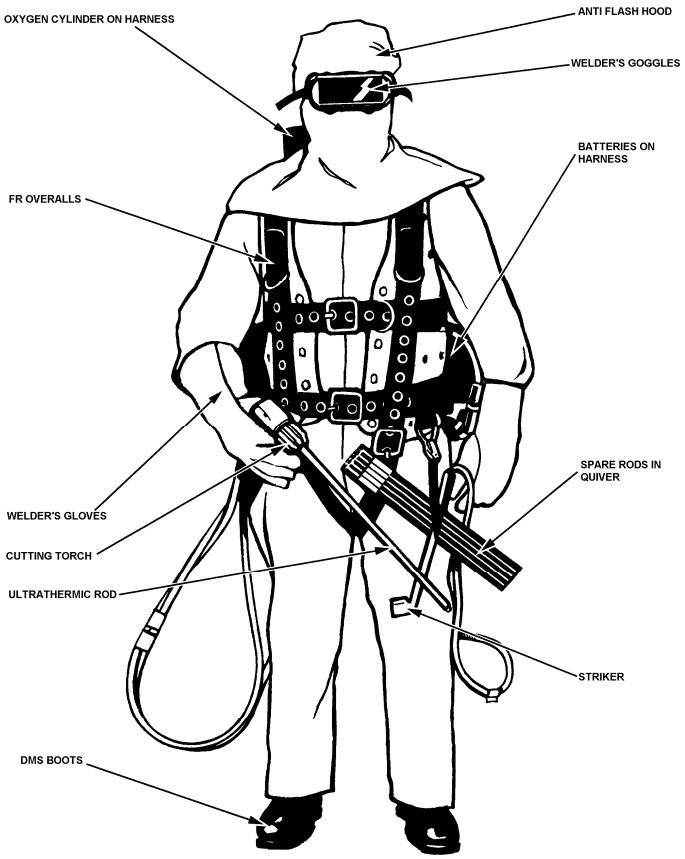
1. THE TEMPERATURE AT THE ROD TIP IS 5000°C. THIS MAKES IT A VERY DANGEROUS PIECE OF EQUIPMENT. EXERCISE GREAT CAUTION AND ALLOW NOBODY WITHIN 3 METRES OF THE OPERATION.

2. THE MIXTURE OF OXYGEN AND ELECTRICITY IS POTENTIALLY LETHAL, UNTRAINED PERSONNEL MUST NOT USE THE THERMAL LANCE.

a. This damage control emergency cutting equipment is portable and allows the operator to cut ferrous, non-ferrous metals and most other material rapidly, with accuracy and control. It uses ultra-thermic cutting rods that are precision mini thermic lances (ie iron wires encased in a tube through which oxygen is fed). Full details are contained in BR(F) 6589(402) - Damage Control Thermal Lance Cutting Equipment

b. Untrained personnel are **NOT** to use the Thermal Lance. Training is carried out on the CBRNDC 35 Course, LET(ME) QC or by special arrangement with the MWS Phoenix Training Group (see Chapter 27).

Figure 12-2. Thermal Lance and Operator

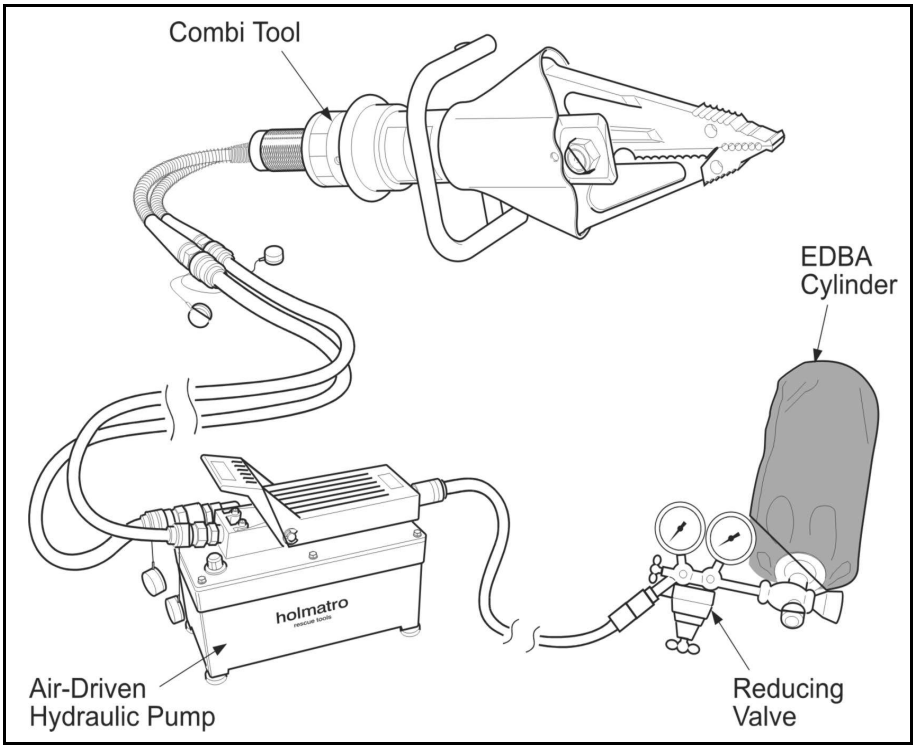


1214. Cutting and Spreading Equipment

a. The hydraulic cutting and spreading equipment (see Figure 12-3) is provided for clearance of wreckage after action damage. It is powered by an air-driven hydraulic pump, air being supplied from EDBA cylinders, or from the ships LP or HP air systems. If compressed air is not available, a hand-operated hydraulic pump may also power the tool.

b. The equipment is only to be used by trained operators. The operator and all personnel involved with, or in the vicinity of the work being undertaken must be wearing overalls, safety helmet with visor or goggles, and heavy duty gloves. If heavy duty leather aprons are available they are to be used for protection purposes. Training is included in all Aircraft Handler Qualifying Courses, CBRNDC 35 Course and given to LET(ME)'s through the CBRNDC 29 Course. Additional training may be arranged with the MWS Phoenix Training Group booking office (see Chapter 27).

Figure 12-3. Cutting and Spreading Equipment



1215 Displacement of Floodwater

The loss of buoyancy due to a free flooded compartment can be considerable. If the ships outer bottom is holed and repair parties cannot reach the damaged area, consideration should be given to displacing the floodwater by:

a. Inflatable fenders or aircraft salvage bags, if the compartment is still accessible.

b. LP air via an improvised connection (eg indicator test plug) on the compartment boundary, or by divers, where available, via the holes in the hull.

1216. Counterflooding to Reduce List

a. Counterflooding to correct adverse list can be undertaken only in ships that have a fair degree of longitudinal subdivision. This will not be found in small ships but ballast tanks incorporated into the structure can be used for a similar effect. The results obtained from filling or emptying such tanks are listed in the CBRNDC Class Book.

b. Counterflooding is generally used only to give an immediate correction to dangerous list or list that nullifies the ships armament. For damage floodwater to cause list it must be off-centre, which is only really possible in ships with longitudinal subdivision. Special arrangements for counterflooding are fitted in aircraft carriers. The ballast system in Assault Ships can be used for counterflooding if necessary.

c. Should the total correction available by counterflooding be insufficient to bring the ship back to an acceptable level, it may become necessary to flood selected watertight compartments at the expense of the equipment they contain. Any form of deliberate flooding results in a loss of reserve buoyancy and though it produces quick and effective corrections to heel and trim it must be regarded as an interim measure only. As soon as it becomes possible to undertake the lengthier process of transferring liquid (fuel and fresh water) the deliberately flooded compartments must be pumped out and the transference and pumping out must be done together to avoid undue changes in the stability condition of the ship. Due regard must be given to the relative leverages of the compartments involved. Counterflooding and the transfer of liquid weight must be restricted to that necessary to restore the operational efficiency of the ship.

1217. Responsibility for Counterflooding

The MEO is wholly responsible up to the limits delegated by the CO. Should they consider more counter flooding to be necessary, permission must be requested from the Command taking in the tactical situation, remaining freeboard, weather conditions, etc. It is important that immediately a compartment has been flooded up to its crown, the valves are shut to prevent extension of flooding, straining of the deckhead or free communication of floodwater. The stability condition of the ship is to be kept under constant review. The DCO is to give any necessary orders for transference of fuel and the working of fuel tanks to ensure an uninterrupted supply to the main engines. He must also issue any orders necessary for the isolation of the HPSW main and the operation of all pumps associated with damage control.

1218. Tactical Considerations

If the ship stops listing before the angle of deck-edge immersion is reached and is not rolling heavily, the danger of capsize is not immediate and counterflooding should be stopped. Great care must be taken to differentiate between list and loll. Generally, if a ship with longitudinal subdivision is heeling, the condition is list. A ship with little or no longitudinal subdivision (transversely constructed) can rarely attain a condition of list if the heel is caused by floodwater, and loll must be assumed (see Chapter 23).

1219. Telescopic Damage Control Ladder

a. **Description.** The ladder is supplied with unique safety stabiliser bars, fitted with large rubber feet in order to protect floor surfaces and give effective grip in all positions. It is only to be opened to the height that is required, therefore giving increased manoeuvrability, particularly in confined spaces. For ease of transportation and protection of the ladder it is supplied with a heavy duty carry bag incorporating a shoulder strap and carry handle.

b. **Concept of Use.** The Telescopic Damage Control Ladder has been introduced to enhance the onboard damage control capability particularly following battle damage and will aid and facilitate in the evacuation of and the access to compartments during emergencies.

c. Although this ladder offers some advantages over the rigid ladder it is not a replacement for it. The telescopic ladder is intended to complement the rigid ladder offering additional flexibility. There remains a requirement for rigid ladders, which serve multiple purposes both onboard and when disembarked.

Figure 12-4. Telescopic Damage Control Ladder

d. **Stowage.** Ladders are to be stored at each FRPP/ZCP or Section Base. Local securing arrangements are to be provided with appropriate consideration given to noise hygiene and securing for action requirements.

e. **Training.** Ship's Staff and in particular CBRNDCQs are to ensure that the written instructions are clearly understood. Consideration should be given to use of this item during CBRNDC circuit training and/or FRPP training as required by ships individual training programmes. All courses at MWS Phoenix Training Group will receive a basic brief on the use of this ladder during Damage Control training.

1220. Blanket Search – SMART

a. **Blanket Search.** Following an incident, where the state of damage to the Ship is unknown (in any State), there is a requirement to conduct a 100% Blanket search of the ship to build a comprehensive damage picture, subsequently providing the DCO with the relevant information to make an informed decision when setting the Command priorities iaw the Command Aim. Ships are expected to be able to provide a full blanket search report to HQ1 within 10 mins of a hit/incident.

b. **Dispersal.** When the Ship is at state 1 the I/C FRPP/ZCP must deliver a comprehensive Blanket search brief to all personnel, Utilising the SMART search method and prioritising compartments within the "red risk zone". To facilitate a quick Blanket search, personnel will be issued a route card and dispersed prior to attack. The positioning of the dispersed personnel is to be influenced by the availability of suitable locations with means of escape and communications with the FRPP. The 5 man firefighting team and the first-aid party within each section should be included in the paired dispersal.

c. **Blanket Search Cards.** The Blanket search card issuing will be prioritised by the I/C FRPP in response to alarms, indications and initial reports. When the order "**STAND TO**" is broadcast by the Command, this should be closely followed by a broadcast from the DCO **"ALL POSITIONS CARRY OUT BLANKET SEARCH"**. The Blanket search card is to have all "red risk zone" compartments highlighted in RED, all normally locked compartments in state 3 marked with a yellow star and a MOD 1 key attached to assist with access to compartments. The card is to be ticked off as compartments are searched to allow the card to be handed over if required and previously searched compartments not being re-visited. Ideally the Blanket search card is to be A5 size and laminated.

d. **SMART Search.** This is the method employed to utilise Ships sensors and visual knowledge of the impact area to direct the Blanket search teams, speeding up the formulation of the damage picture.

e. Tools utilised for SMART searching:

- Smoke Alarms;
- Flood Alarms;
- Heat/Flame detectors;
- CCTV;
- Machinery Control System (MCAS); and
- OOW visual sight of impact zone.

Despite these sensors being utilised to direct the Search efforts, a 100% check of all compartments must be conducted.

Figure 12-5. Example of Blanket Search Card

BLANKET SEARCH CARD 4 (FRPP)		
KEYS ARE REQUIRED FOR COMPARTMENTS HIGHLIGHTED * COMPARTMENTS IN THE RED RISK ZONE ARE HIGHLIGHTED RED #		
DECK	**TANK**	**SEARCH COMPLETE**
3F	RO FLAT #	
3F1	FAN CHAMBER #	
3F0	SHIP'S STORE #	
3F2	CMR #	
3F4	BATTERY CHARGING RM #	
4F	PUMP COMPARTMENT #	
2E	OPERATIONS RM	
2E	OPERATIONS RM ANNEX	
2E	WO & CPO CABIN	
2E	SR'S DINING RM	
2E	MEO'S CABIN	
2E	GALLEY*	
2E	MCO*	
REPORT TO I/C FRPP WHEN COMPLETE		
IF AN INCIDENT IS FOUND RAISE AN LVA AND ATTACK THE INCIDENT USING FIRST AID APPLIANCES		

CHAPTER 13

LEAKSTOPPING AND SHORING

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ANNEX

Annex 13A Procedure For Flooding Incidents

CHAPTER 13

LEAKSTOPPING AND SHORING

SECTION 1 - LEAKSTOPPING

1301. General Considerations

a. The work falls naturally into two stages:

(1) First aid leakstopping, to stop the inflow of water or reduce it to a rate which portable or fixed pumps can contain.

(2) Post damage, semi-permanent repairs, to make the ship sufficiently seaworthy to continue operations or to proceed to a repair facility.

b. Very large holes or serious damage to the hull cannot generally be repaired at either of these stages. Such damage is in the Primary Zone and is dealt with by establishing a flooding boundary. Less extensive damage, such as smaller holes and splits in the hull, bulkheads and decks, damage to pipe systems and strained or damaged doors and hatches can and must be dealt with. There are several ways to deal with these different kinds of damage; usually the simplest is not only the quickest but also the best. In deciding the most suitable type of repair the following must be considered:

(1) The rate of flooding and the size of the compartment.

(2) The kind of hole (eg puncture or split), its size and whether the plating around it is distorted.

(3) The accessibility of the damage and its position relative to the waterline.

(4) The manpower, equipment and pumping capacity available.

(5) The importance of the compartment, as determined by the Command Aim.

1302. Underwater Damage

Holes that are completely underwater obviously constitute the greatest danger and must be tackled immediately to slow the rate of flooding to within the scope of pump capacities. A small compartment will fill more rapidly than a large one with similar damage and leakstopping devices must be applied swiftly to all leaks, starting at the bottom of the compartment, to prevent its total loss due to free flooding. A large compartment will fill slower than a smaller one with the same damage, allowing more time for leakstopping. This, however, should not distract from the urgency of the situation. Some damage will be so severe and flooding so rapid that leakstopping cannot be carried out and pumps will not reduce the level of water. In these cases the compartment must be shut and allowed to free flood, and the boundary structure made watertight. This may require the use of shoring to support weakened or straining structure or fittings.

1303. Waterline Damage

Holes at or just above the waterline should be dealt with as quickly as conditions permit, since they are a great potential danger. The rolling, heeling or trim of the ship, or increase of flooding elsewhere, may bring them underwater, thus increasing the flooding at the waterline. This will cause free-surface flooding, which will impair stability and may hazard the ship.

1304. Leakstopping Devices and Methods

The main difficulty in leakstopping is making a watertight joint between the stopper and the edges of the damaged plate. Around an ‘entry hole’ the inboard surface is usually very ragged and petalled but an ‘exit hole’ may present a fair inboard surface. The principle in both cases is to choke the flow of water by compressing soft material into the hole and against the edges of the plating. Mattresses and bedding material are especially suitable for fairly large holes. Other materials can, of course, be used and some methods of leakstopping are described in the following paragraphs.

1305. Softwood Wedges and bungs

a. Small splinter or bullet holes, and small splits can normally be plugged by hammering in softwood wedges (or bungs for round holes). These have the advantage of swelling when wet, making them grip and seal more firmly. Wedges can be used singly or in bunches, and small gaps can be filled by pieces of wedge (which can be split easily from a whole wedge along the straight grain). Wedges have a tendency to spring back when used on thin plating, GRP or in oily conditions. A recommended remedy is to cover the wedge with wet cloth before driving it in. The cloth fills the gaps between the wedges as well as providing a better grip.

b. When using wedges in a vertical split, multiple splits or splinter holes, the lowest ones must be tackled first; work proceeding upwards. This will ease the problem of obscuring low splits by the wedges already driven in and will, in general, make the task of wedging up easier and more complete. Where splits and holes are obscured by water they can be felt for with the fingers and the wedges guided in accordingly. Wedging up is the only method of leakstopping against seawater pressure that can be carried out single-handed. All other methods will require two or more people.

1306. Large Holes

If holes or splits are too large to be filled by softwood wedges, the following alternative methods of leakstopping are available:

a. GRP Domes.

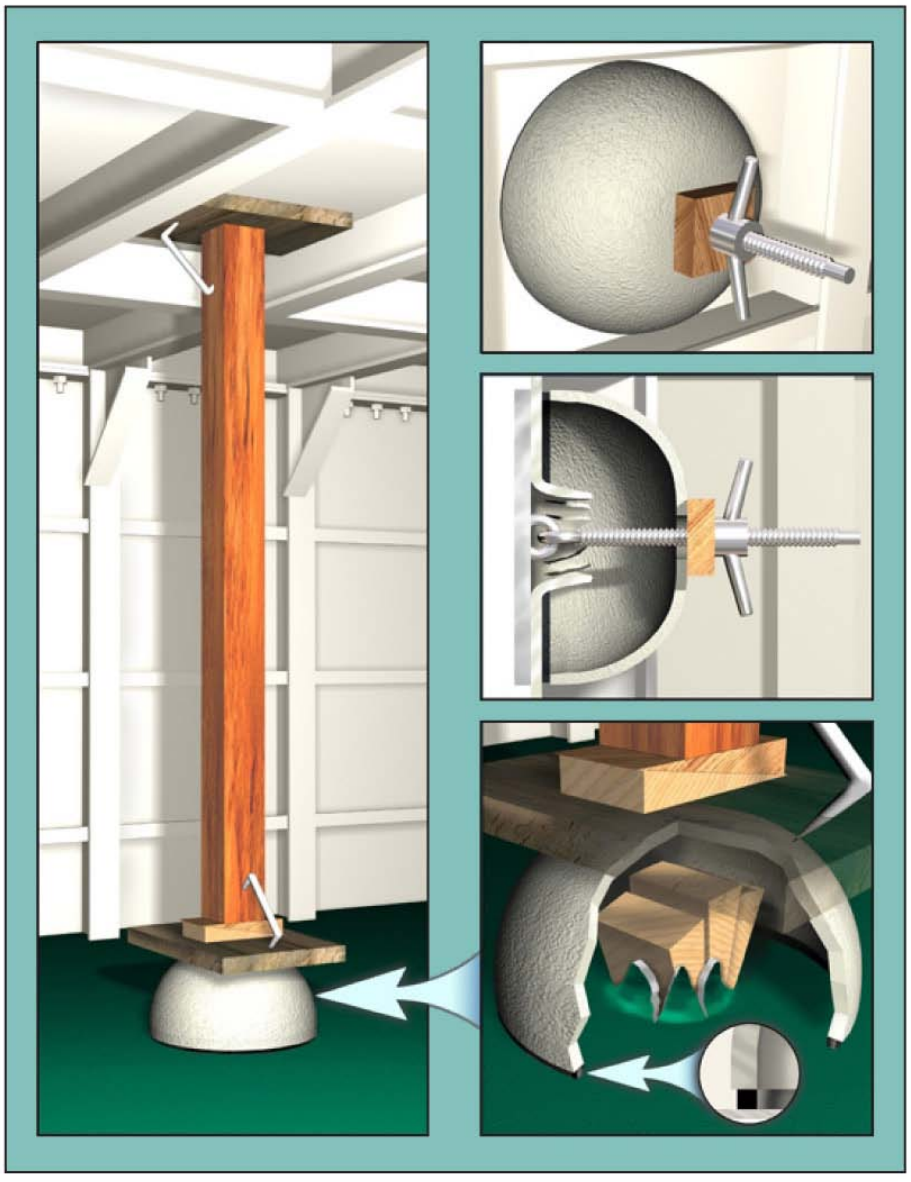
b. Sandwich pack (5mm rubber sheet and 5mm steel plate).

c. Improvised leakstopper.

1307. Glass Reinforced Polymer (GRP) Dome

These are used for patching holes with ragged edges. They are shallow GRP boxes that are available in three sizes, 300 mm diameter x 175 mm deep, 450 mm diameter x 200 mm deep and 600 mm diameter x 225 mm deep. One face is open and has a rubber seal around its edge, the opposite face being closed and with a 15 mm hole in its centre which is blanked off with a bolt, butterfly nut and washers. When used on a tiled deck, tiles and deck cement should be removed to allow a better seal. The box can be held in place by a shore (see Figure 13-1), when the hole is sealed by the foot of the shore or by the wooden wedge. Alternatively it can be secured by removing the bolt, etc. and using a 50 x 50 x 6 mm steel angle strongback fitted with an eyebolt and a 600 x 12 mm ringbolt and butterfly nut with a wooden washer. Allowances are scaled to one set of GRP domes, (one of each size), per FRPP and one per Main Machinery Space. If needed, and the necessary equipment is available, a heavier strongback can be made by bolting or welding an eye (approximately 12 mm) into the throat of a short length of channel bar. In order to maintain a low magnetic signature, GRP structured vessels are to locally manufacture eyebolts and strong backs from aluminium, as detailed in BRd 2170(3).

Figure 13-1. GRP Dome and Shore



1308. Patch Packs

These consist of six 5 mm thick mild steel plates ranging in size from 300 x 200 mm to 900 x 600 mm with a number of eyes welded to one side of each plate. All six plates, complete with strongbacks, hookbolts and wingnuts, are tack-welded together to form one pack for ease of stowage. The plates are intended to be applied to the outside of the damaged shell plating with the 50 mm x 15 mm flat bar strongbacks inboard, held in place by the 12 mm dia. hookbolts and wingnuts, with sheet rubber or other joining material inserted between the patch and the shell plating. Allowances are scaled to one patch pack per FRPP. The 76 x 38 mm steel channel, provided at FRPP lockers can be used if the strongbacks need to be more robust.

1309. Improvised Leakstoppers

a. The shape and extent of holes in the hull may preclude the use of GRP domes or patchpacks, but adequate leakstoppers can be improvised using materials readily to hand. Table tops or similar flat boards may be considered as emergency stopper plates. Sealing between the stopper and the hull can be achieved using bedding, a shot mat or soft furnishings. If entry holes are severely petalled, a ‘sausage’ of rolled material (eg blankets or carpet) should be wrapped around the jagged plating until the pad stands well clear of the edges (see Figure 13-4). This type of leakstopper will normally be held in place by shoring, but an improvised strongback may be appropriate. For holes well above the waterline, where less urgency is needed, it is advisable to cut off the worst of the hull petalling to make the seal more effective.

b. In addition to the allowance of patchpacks, strongbacks and hookbolts in BRd 2170(3), additional devices may be fabricated onboard, as illustrated Figure 13-2 and Figure 13-3.

1310. GRP Emergency Repair Pack

Ships with glass reinforced plastic (GRP) hulls carry an Emergency Repair Pack for making repairs to minor hull damage. The pack includes all materials, personal protective equipment and instructions. The 2-part epoxide based repair material produces best results on clean, dry and well prepared surfaces, but in an emergency it will tolerate slight oil contamination and may be applied underwater. The pack can also be used for making temporary repairs to ruptured pipes, etc. Clamping it to the damaged surface until the epoxy resin cures can enhance the effectiveness of the repair. The minimum temperature for curing is 5°C, but the gel time will reduce considerably at higher temperatures.

Figure 13-2. Leakstopping - Large Hole - Using Strongback

Figure 13-3. Strongback and 'U', 'T' and 'L' Bolts

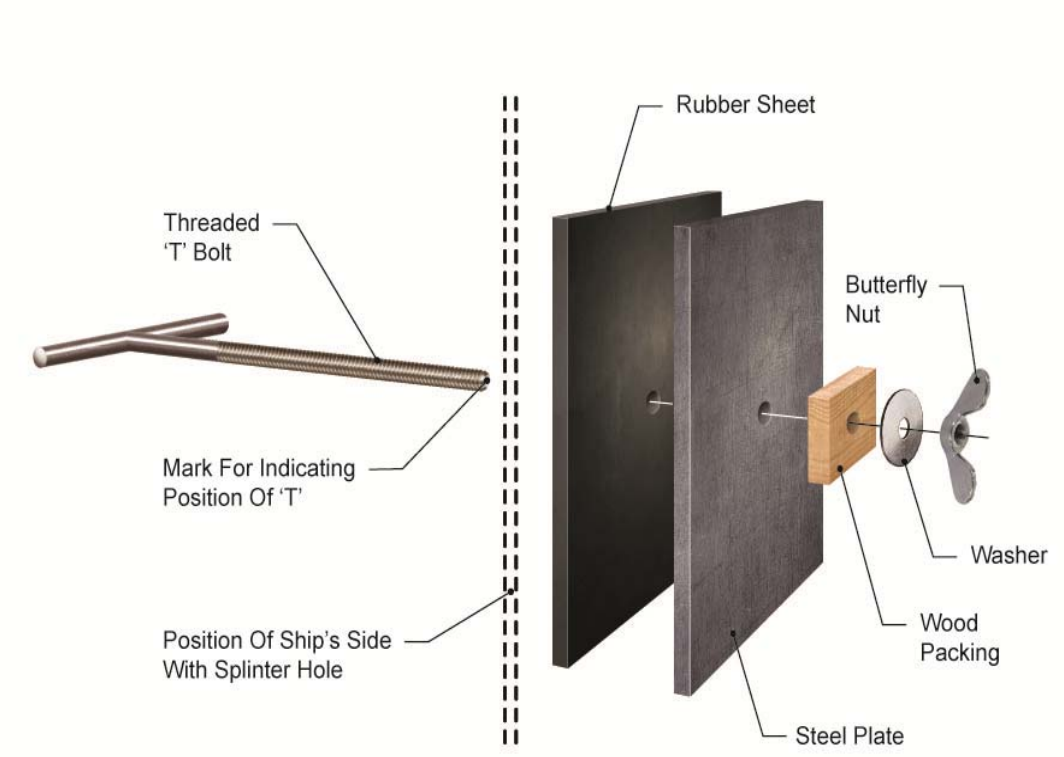
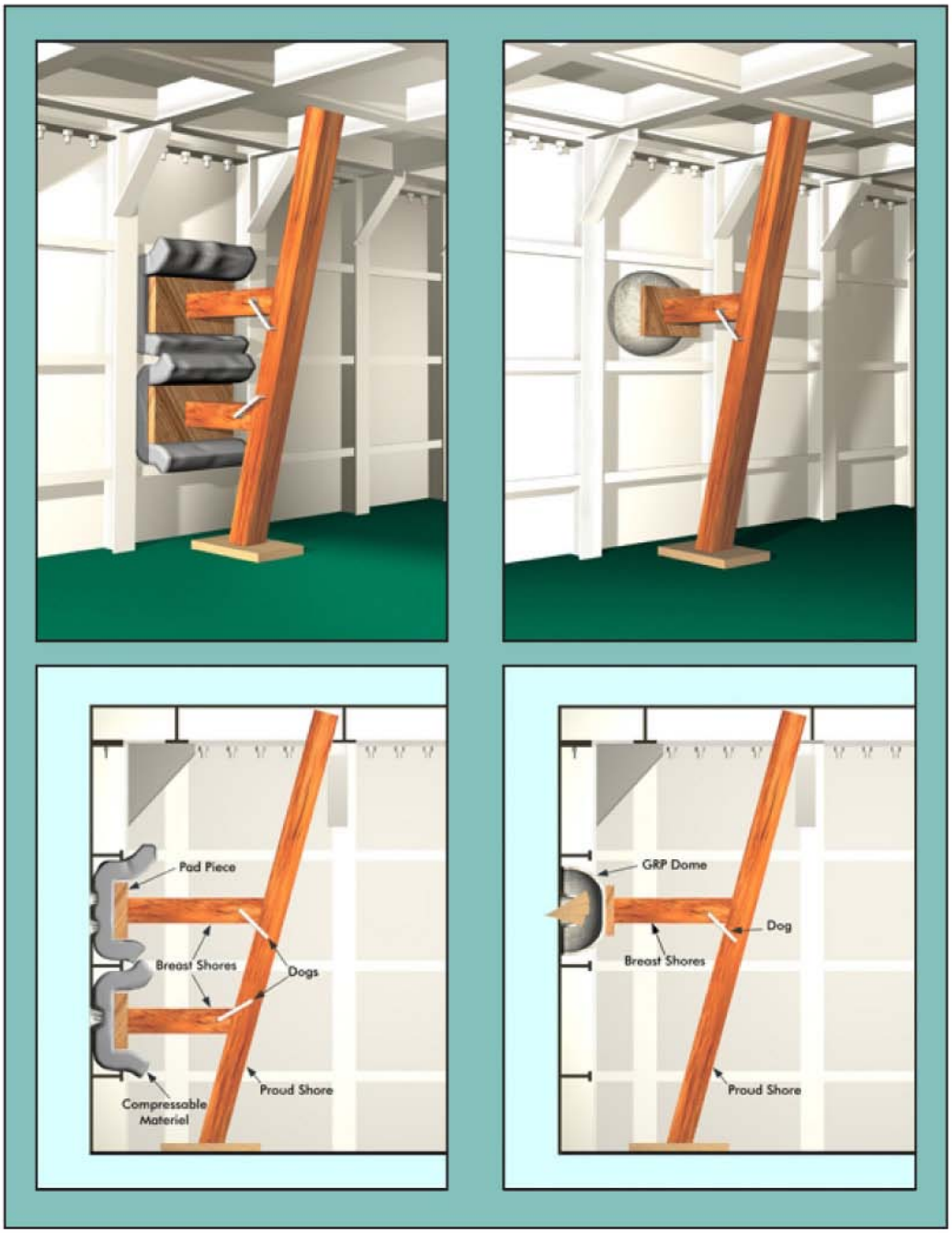


Figure 13-4. Leakstopping - Large Hole - Using Shore



1311. Cement Boxes

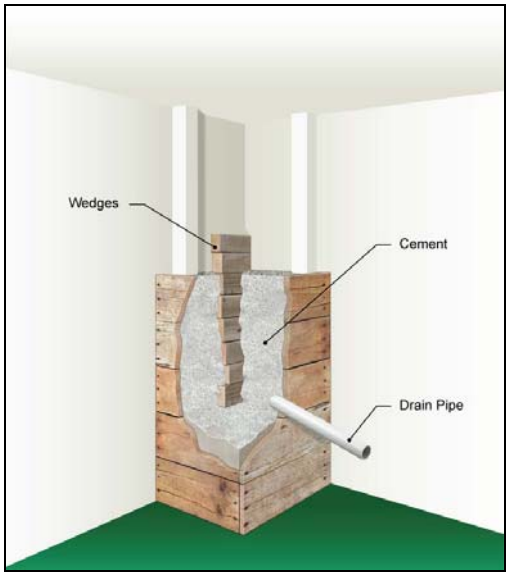
WARNINGS

1. CONTACT WITH THE CEMENT POWDER OR WET MIX CAN CAUSE IRRITATION, DERMATITIS OR BURNS.

2. EYE AND SKIN PROTECTION IS TO BE WORN.

Small holes near boundaries, and in difficult corners, can be dealt with by using a small cement box. The material used as the leakstopper is rapid hardening cement (Ciment Fondu, sometimes called damage control cement), which is a semi-permanent repair material. Unlike ordinary commercial (Portland) cement, which takes some time to harden, the rapid hardening cement sets in five hours, hardens in eight hours and achieves maximum strength in 24 hours. It will also set, providing it is well contained, under static water. The leak must be stopped as much as possible using softwood wedges (or some other form of leakstopping) and the surrounding plating, which is to be covered by cement, must be cleaned of oil, grease, loose paint, etc. (GP detergent is recommended for this purpose, care being taken with its application). The cleaned steel can then be roughened with a cold chisel or similar tool to aid the grip of the cement. A cofferdam or cement box should be built around the leak using, for preference, tongued and grooved timber or heavy plywood boarding. The cement can be mixed with either salt or fresh water to provide a stiff mix. It is sometimes useful (especially if water from the leak is still coming in, or present, to fill sand bags, one third full, with mixed cement before moulding to suit the damaged area. This will reduce washing-away of the cement. The cement placed in the box must always be well tamped down, care being taken to avoid trapping air. If small amounts of running water are present it is recommended that sheet rubber or PVC be placed over the leak and taken to the bottom of the box. This will give the cement a better chance of setting and also greatly reduce the chances of any of it being washed away. A drainpipe should be set into the box at a low level in order that any water that may become trapped inside may ‘bleed off’. When the cement has set this pipe can then be plugged. It should be remembered that 0.1 m3 of mixed cement weighs approximately 40.5 kg and that sufficient should be made to fill the box. Figure 13-5 shows the construction of a cement box.

Figure 13-5. Cement Box



1312. Damaged Pipes

a. Softwood plugs, wrapped with cloth, can be hammered into a severed pipe if the open end is in reasonable shape. Plugs are not to be used in pressurised systems and must be secured into position, to reduce the hazard to personnel in the event of a blowout. If the pipe is distorted, the use of blank flanges is more effective, but takes longer due to the need to isolate the system and remove bolts. Small bore pipes can be repaired by use of rubber hose and 'Jubilee' clips.

b. Splits and small splinter holes in pipes can be repaired by isolating the system and applying the suitable size of pipe repair clamp (see Figure 13-6). This is a temporary solution only, caution to be taken when applying a clamp to a Fuel or Oil system, the rubber will erode. A regular check must be conducted (min once per hour).

Figure 13-6. Pipe Repair Clamp

c. **Rubber Pad and Whipping Repair Method.** This repair is carried out using a rubber patch secured by cord whipping (see Figure 13-7).

(1) Whipping repairs will significantly reduce the amount of fluid leaking from pipe depending on the quality of workmanship however it is unlikely that fluid leakage will be fully stopped.

Note. *If whipping repairs are to be undertaken on systems containing pressurised POL products the risk of atomised POL products leaking on the completion of the repair must be assessed.*

(2) To construct a whipping repair the following procedure is to be followed:

(a) Isolate the system.

(b) Place rubber sheeting over the damaged pipework ensuring that the sheeting is at least 25 mm longer than the split at both ends and is covering ¾ of the pipe work circumference. Secure with tape.

(c) Lay a loop of whipping cord on the opposite side of the pipe work to the split (if practicable) so that at least 15 mm is overhanging the rubber sheeting.

(d) Start to whip the pipe work by starting the coils at the opposite end of the cordage to the loop.

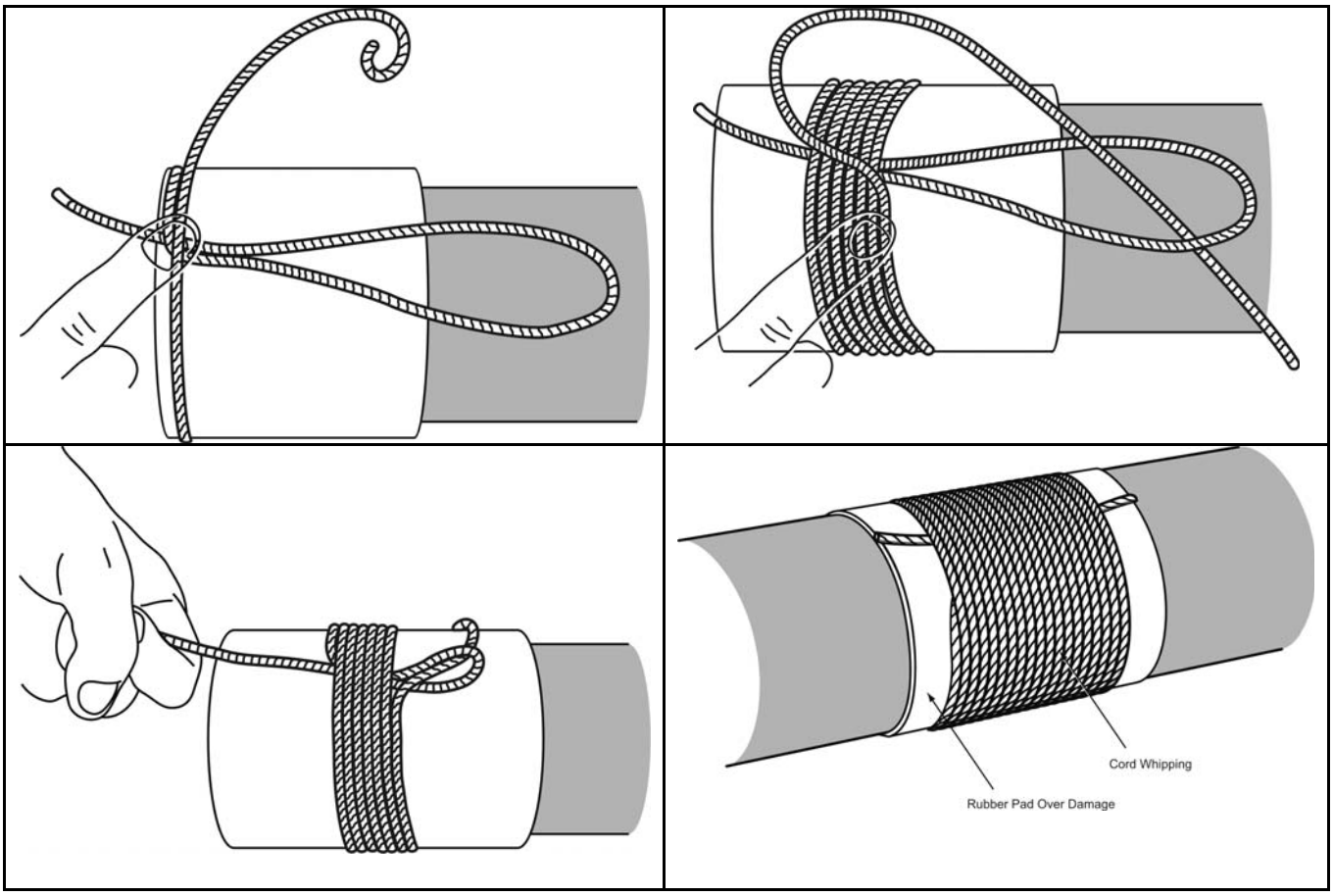
(e) Pull the turns as tight as possible (the integrity of the seal may be increased by use of a bar to pull the whipping tight) and lay each turn directly adjacent to the previous turn.

(f) When all of the rubber sheeting has been covered with whipping pass the end of the cordage through the loop and pull to secure the whipping.

(g) Slowly open the fluid system isolations and check for leaks.

d. Pipe repair tape kits are carried onboard Each kit includes two-part epoxy putty, repair tape, protective gloves and instructions. The resin in the repair tape is activated by contact with water and cures in approximately 30 mins, depending on the temperature.

Figure 13-7. 4 Stages of Rubber Pad and Whipping Repair



SECTION 2 - SHORING

1313. Shoring

a. Many of the leakstopping devices described depend on shoring for their efficiency. Shores also have other very important functions in a damaged ship:

(1) Support of straining bulkheads, decks, doors and hatches against abnormal pressures.

(2) Support for damaged and weakened structure and fittings.

b. In both, the shoring is used to distribute the stress loading of straining or weakened members to sound parts of the structure. The principal watertight bulkheads are built to withstand the stresses that occur when compartments are flooded statically, and compartments are tested during building to ensure that this is so. To conserve timber, therefore, and to avoid wasting valuable time and labour, sound structure should not be shored merely because the compartment on the other side is flooded. However, extensive damage in the vicinity may have weakened the structure and made it incapable of standing up to its designed stresses; it must then be supported. Support is also needed for a bulkhead thrown open to the sea, to prevent its collapse under wave action or under pressure from movement through the water. In this case, if no strain is apparent, only a little support is needed; if strain is apparent, much more shoring is needed.

1314. Symptoms of Strain

a. Straining of structure is usually readily apparent and can be recognised by:

(1) **Panting.** This is the alternate bulging and contraction of plating (often accompanied by a groaning or pinging noise) caused by uneven pressure or locked up stresses. It is difficult to shore panting structure efficiently and a much better job can be done if the ships speed is reduced, or the ships head turned away from the sea, until shoring is completed. If conditions will not permit this, the shores should be fitted to the extreme of the outward movement. Alternatively, if there is a convenient securing point (eg eye plate) or one can be welded on, the plating can be held in by wires or chains and lifting appliances.

(2) **Buckling.** Deck beams or bulkhead stiffeners may buckle; bulkheads or deck plating may bulge when under strain.

(3) **Fracture or Splitting of Plating.** This may occur alongside stiffeners or where bulkheads or decks abut on hull plating. It is often difficult to detect cracks that may be hidden under paint, oil or fittings.

b. Great care is necessary when examining the structure and if strain is apparent shoring must be carried out immediately. It should not be postponed, because flooding may spread, causing an increase in draught with the consequent greater pressure on the structure and a further loss of compartments.

1315. Supporting Weakened Structure

When structure has been weakened by damage, or has lost its normal means of support, shoring provides the best method of giving temporary support until more permanent measures are possible. If structure has been distorted, shoring should be used only to hold it to its new position. No attempt should be made to force if back to its original shape because this would probably induce further stresses and may cause complete rupture.

1316. Timber Shoring

The main and best material for shores is softwood, ie pine or fir. It can be easily handled, cut, fastened and, compared to hardwood, has a higher strength/weight factor. The sizes most used for shores are 100 x 100 mm and 150 x 150 mm. Deal planking of sizes 50 mm and 75 x 225 mm are usual for pad pieces and packing, and the usual size of tongued and grooved planking is 32 x 150 mm. Batten timber, used for tying a system of shores together, is 25 x 75 mm. Softwood wedges are used for setting up shores. Mild steel dogs (staples), and nails are used for securing shores, pad pieces and battens together. When stowed onboard, the shores, planks and battens should be cut to the greatest length that can be moved through the ship. New timber is only to be procured via the authorised supply route.

1317. Acro Props

a. The Acro Prop consists of two telescopic, tubular steel sections, supplied in two sizes, 1.75 m extending to 3.1 m and 1 m extending to 1.68 m. It is fitted with head and base plates and provided with a screw jack, with drop handle, for fine adjustments. The Acro Prop can only take loading along their lengths. Any lateral loading will distort them, so they should only be used as vertical or breast shores, never as proud shores. They must not be hit with hammers or dented, as any distortion to the outer case may prevent the inner part from sliding freely, thus making adjustments difficult or impossible.

b. When Acro Prop are stowed (either vertically or horizontally), the pin should be located through a hole in the inner tube, below the screwed collar, which should be near to the bottom of the thread to allow for maximum adjustment.

c. It is essential that an Acro Prop be carried correctly to avoid hazards to personnel. It must be carried across the body, with the threaded portion uppermost. The pin must be fully inserted just below the rotating collar. To prevent the pin from moving it must be held in place, as shown in Figure 13-8. The other hand should grasp the Acro Prop at a point one third of its length up from the base.

d. Acro Props may be used for permanent shoring during peacetime damage situations, when ship motion is unlikely to displace them, but they must be regularly inspected (min once per hour). They are always to be used in conjunction with wooden pad pieces to:

(1) Reduce the danger of slipping.

(2) Spread loading on the structure.

(3) Prevent damage to GRP domes.

e. After use all moving parts of the Acro Prop should be lightly oiled before stowage, to prevent seizure.

1318. Tools for Shoring

The following tools, required for shoring, are stowed at FRPP lockers:

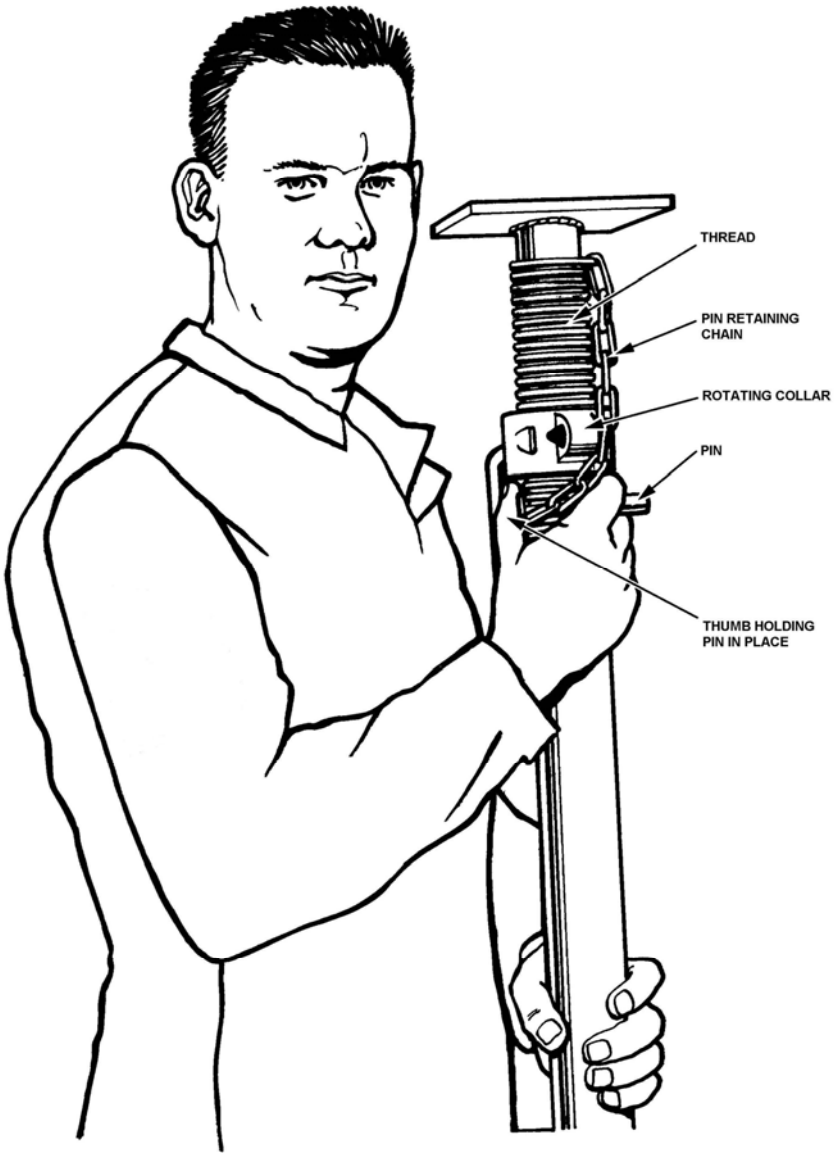
a. 7lb (3.15kg) hammer.

b. 2lb (910g) hammer.

c. Cross cut wood saw.

d. Gunter batten.

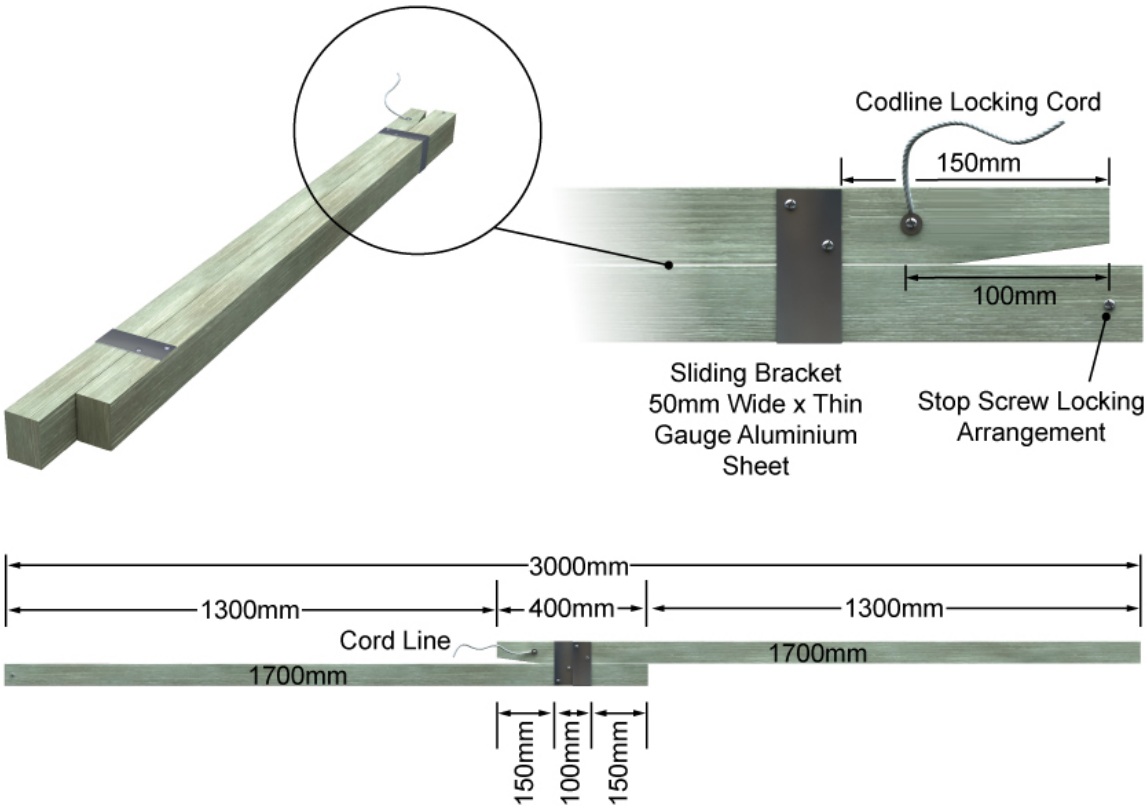
Figure 13-8. Carrying an Acro Prop



1319. Gunter Battens

Gunter battens are used for measuring the length to which shores are to be cut. Guidance for their manufacture and use is given in Figure 13-9 and Figure 13-10. Two standard sizes to be made are, 1700 mm long and 850 mm. An extra-long Gunter batten may be made to facilitate large compartment builds, if the Gunter batten is too long to leave the compartment, the DC timber will be too long to enter the compartment.

Figure 13-9. Gunter Batten - Manufacturing Details



Note. *The Gunter Batten is to be manufactured from 38 x 25 mm straight grained softwood. Manufactured by Ships Staff or WRF.*

1320. Principles of Shoring

a. The essentials for shoring to be effective are:

(1) Strong and rigid anchorage for the shores.

(2) A reasonably complete network of reinforcement.

(3) Distribution of the load over as large an area as possible.

b. The method of shoring to be adopted depends on the extent of damage and the character of the structure in the vicinity. The aim should be to shore to the nearest strong point.

If the nearest structure is not strong enough, the shoring must be continued back, through other compartments if necessary, to end at members of the necessary strength. The shoring assembly must always be kept under observation because if it becomes strained it will itself need support.

1321. General Rules for Shoring

There are certain rules generally applicable to all types of shoring, whether for bulkheads, decks, doors or hatches. They are:

a. A timber shore should never be longer than 30 times its minimum width or thickness.

b. Ideally, the head and heel of a shore should abut on stiffened plating (by a deck beam or bulkhead stiffener). This is not always possible, in which case wooden pad pieces should be used to spread the load.

c. Shores should never be cut in anticipation, for any distortion of structure would make them useless.

d. Shores must never be placed in position before damage occurs; they would transmit shock and make the damage greater.

e. Wedges should be used in opposing pairs. The two wedges should be driven in simultaneously or a heavy weight held against one while the other is driven in.

f. A system of shores should be tied together with battens and dogs or nails.

g. Careful watch must always be kept on shoring and any loosening attended to immediately.

1322. Methods of Shoring

There are 4 methods of shoring:

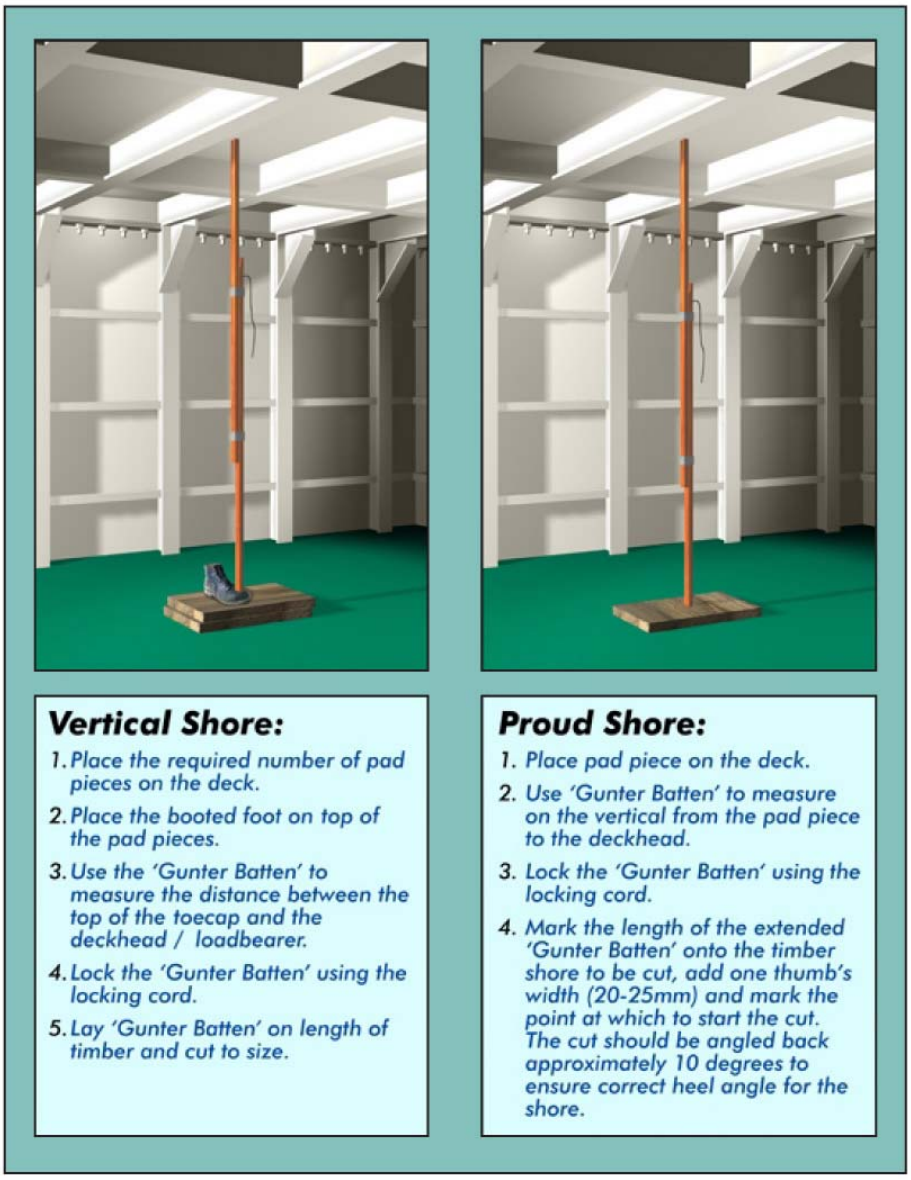
a. **Vertical Shoring**. For hatches and decks and for leakstopping devices on them. (see Figure 13-11, Figure 13-12 and Figure 13-13). A vertical shore must be cut approximately 50 mm shorter than the measurement between the deck pad piece and the deckhead, to allow for the wedges used to ‘harden’ it into position.

b. **V Shoring**. For vertical structures. This is not as simple as square shoring. (see Figure 13-15 and Figure 13-16).

c. **Square Shoring**. For bulkheads, ships side plating, watertight doors and for leakstopping devices on them. A proud shore is sometimes needed to achieve square shoring. A proud shore is a shore cut longer than the height between decks (add 20 mm), the head placed against a girder or a welded-on lug, and the heel jammed on the deck below. A breast shore is then carefully cut to jam down as nearly horizontal as possible between the proud shore and the structure to be supported. With accurate cutting of the shores, wedges are unnecessary. However, should wedges be necessary, they are best used at the heel of the breast shore where it butts against the proud shore. Figure 13-14 illustrates this arrangement.

d. **Cantilever Shoring.** Can be used in lieu of any build type for leak stopping where there is restricted access to the area of damage. This type of shore uses an EMMS clamp as a fulcrum and is **NOT** to be used for reinforcing or shoring up of bulkheads or hatches (see Para 1329).

Figure 13-10. Use of Gunter Batten to Measure Length of Vertical/Proud Shore



1323. Basic Instructions for Shoring

a. Details of more elaborate systems of shoring are given in later paragraphs, but the basic rules are:

(1) **Bulkheads.** The first and most effective shore on an intact but straining bulkhead should be at the centre of the bulge or, if the strain is due to water pressure on the other side, at one-third of the height and at the centre of width of the bulkhead. Full advantage must be taken of beams, pillars and heavy, fixed fittings to anchor the shores.

(2) **Decks.** Pad pieces will always be needed at both ends of a vertical shore. For vertical shores to abut under a beam, pad pieces or shoring material must be laid across under the beams. If a deck is bulging because of pressure underneath, the foot of the shore should be over the distortion if possible. If a number of vertical shores are to be fitted in line, a length of 100 H 100 mm timber should be used as a continuous pad piece.

(3) **Watertight Doors and Hatches.** The first shore should be set up on a pad piece on the door or hatch just clear of the clips along the side remote from the hinges. If needed, a second shore can be similarly set up along the side nearer the hinges. On a very big hatch, it may be necessary to set up four shores (see Figure 13-13) but two will generally be enough. Shores to doors and hatches must not be set up harder than necessary, because undue pressure will only tend to increase the leaking.

b. If a vertical shore is being set up on an oily deck, efforts should first be made to clear the oil away using GP detergents and/or suitable absorbing agents before using rough abrasive cloth/paper (doubled up to present the rough side to the surfaces in contact) or rags, under the pad piece and the heel of the shore, to improve its grip. Wedges should be set under the heel unless floodwater makes it impossible, when they should be set under the head.

Figure 13-11. Vertical Shoring - Decks

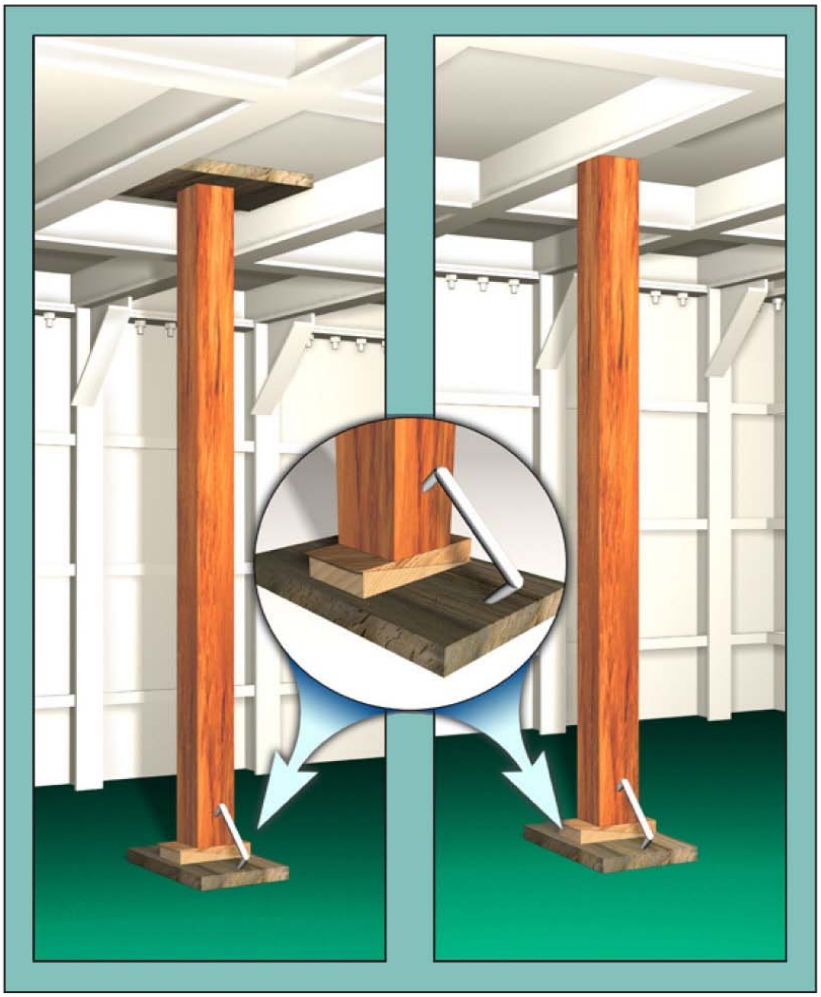


Figure 13-12. Vertical Shoring - Using an Acro Prop

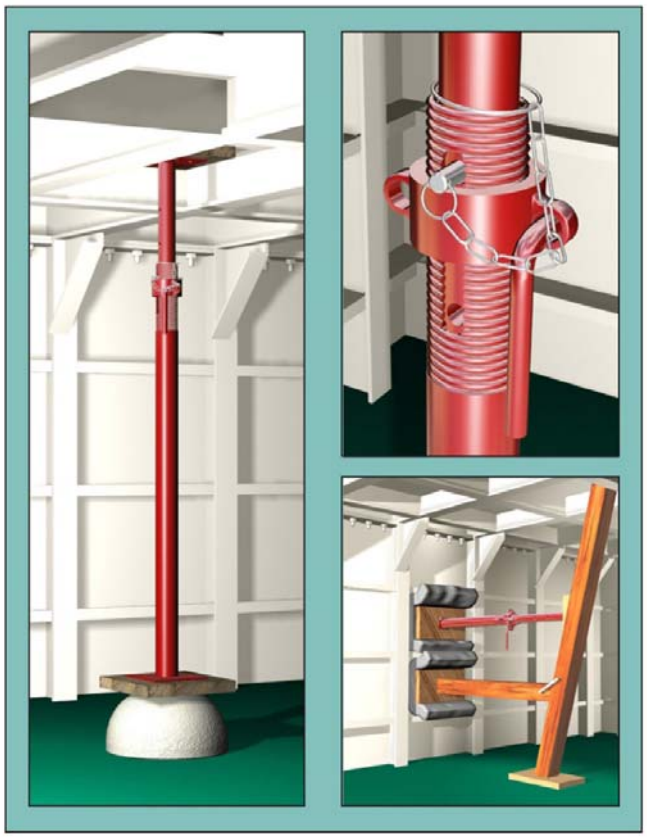


Figure 13-13. Vertical Shoring - Hatch

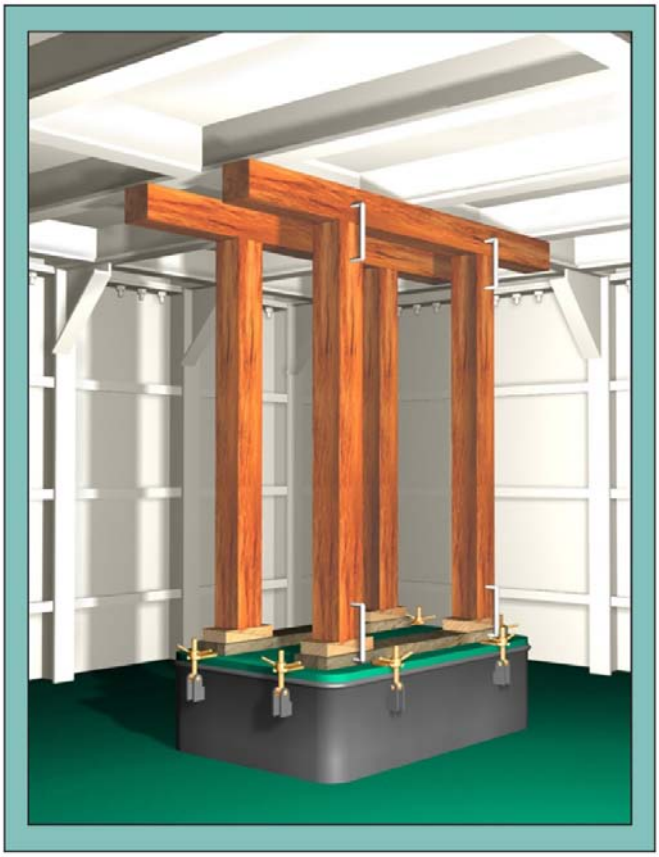
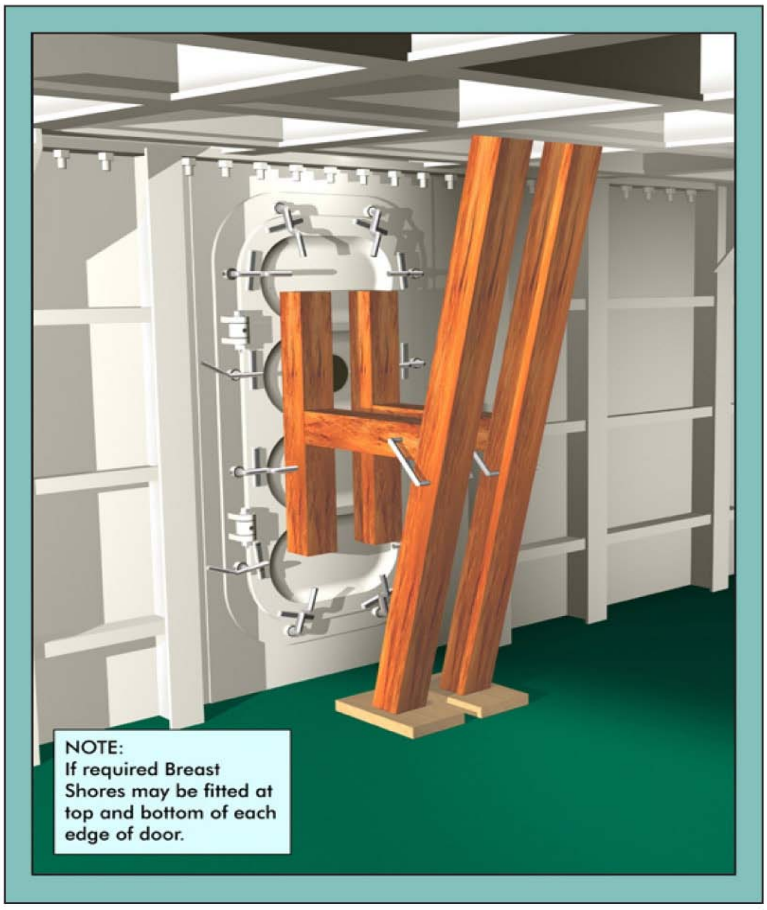


Figure 13-14. Square Shoring - Door



1324. Multiple Shoring of Bulkheads

a. Where no solid structure is available to take the thrust of shoring in the immediate vicinity, a system of multiple shoring must be adopted to take the thrust back to the nearest strength structure. Examples of this shoring are illustrated in Figure 13-17, Figure 13-18, Figure 13-19 and Figure 13-20.

b. Long lengths of shoring timber are unwieldy, difficult to set up and, in addition, may be too long to get through the door or hatch of the compartment in which they are required. With the types of multiple shoring illustrated, comparatively short lengths of timber can fulfil the purpose.

c. Breast shores should be set up to pad pieces against the bulkhead with their heels to a proud shore and be continued back (and up and down if necessary) through other proud and breast shores, or through V shoring, to the nearest strength structure. The whole system must be cross-tied by battens, with shores, pad pieces, cross-ties, packing and wedges secured by staples and nails. Supporting chocks under the heads and heels of breast shores give additional security against falling. Distance pieces between the heel of the proud shore and the nearest strength structure help prevent the possibility of slide back.

d. If slackening is observed, wedges and breast shores should be hardened up and re-secured with staples or nails.

Figure 13-15. V Shoring - Bulkhead (Elevation)

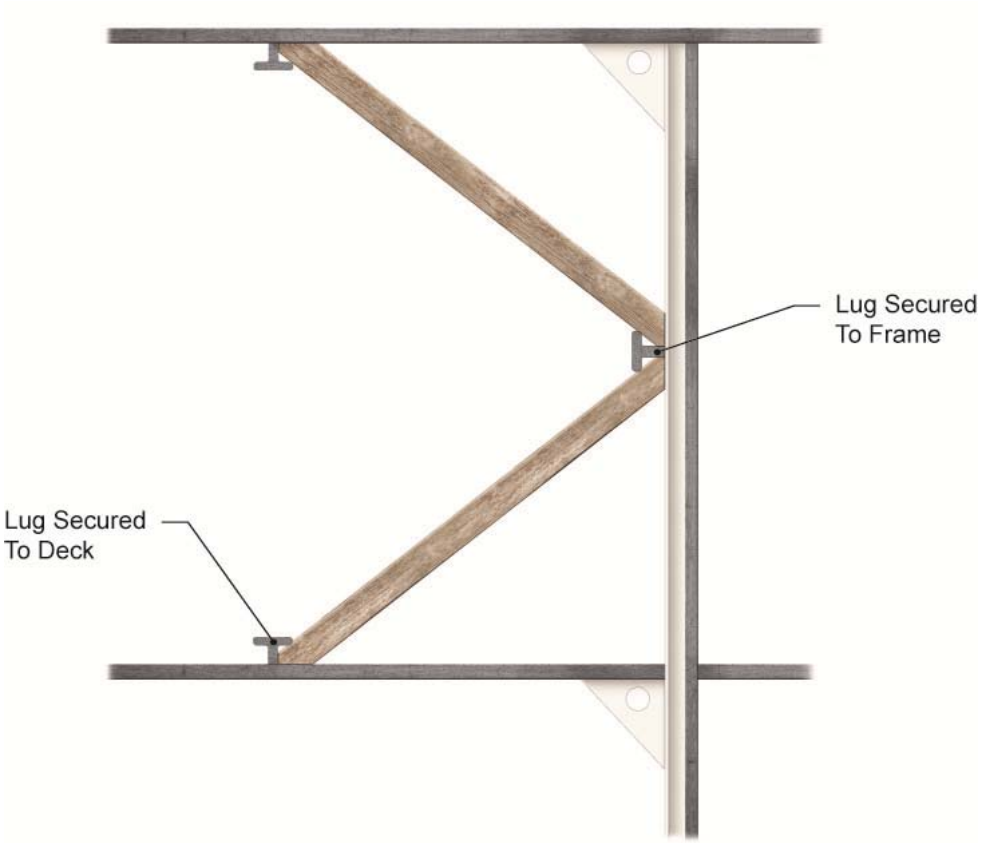


Figure 13-16. V Shoring - Bulkhead (Plan)

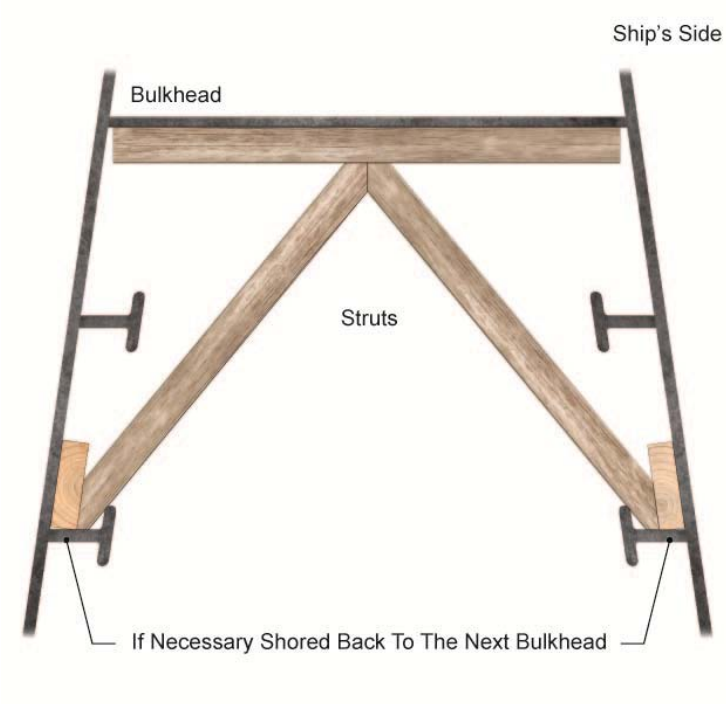


Figure 13-17. Multiple Square Shoring

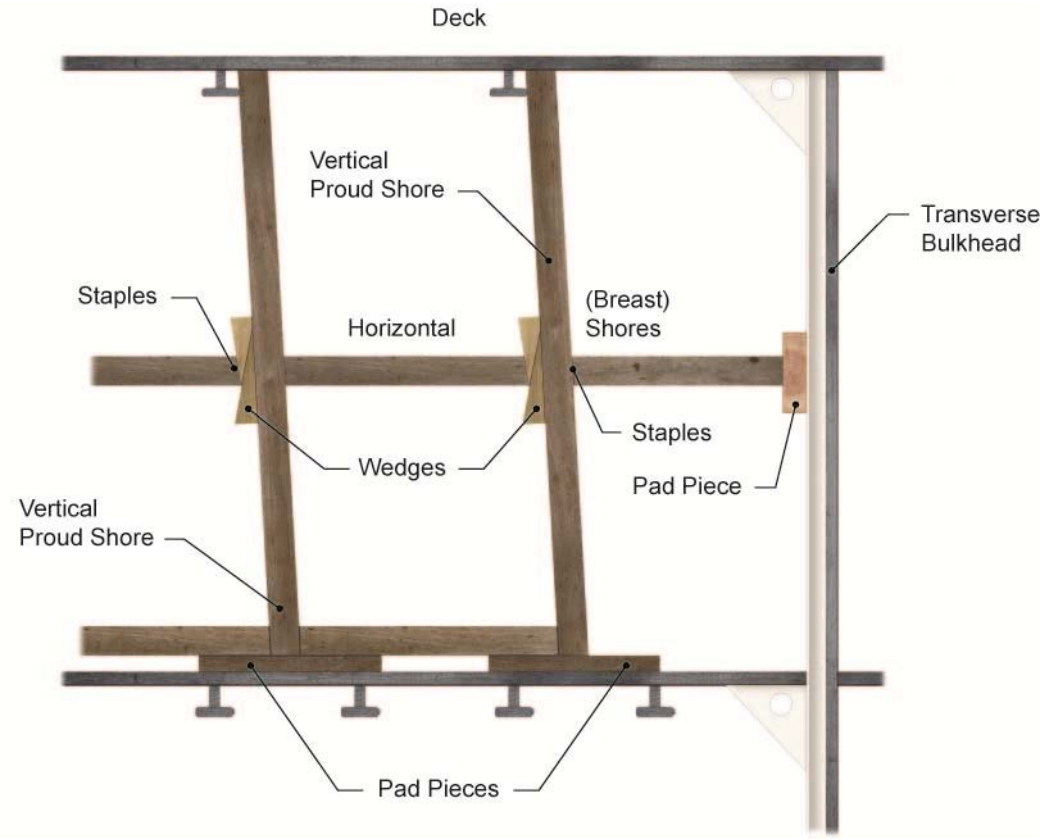


Figure 13-18. Multiple Square and V Shoring

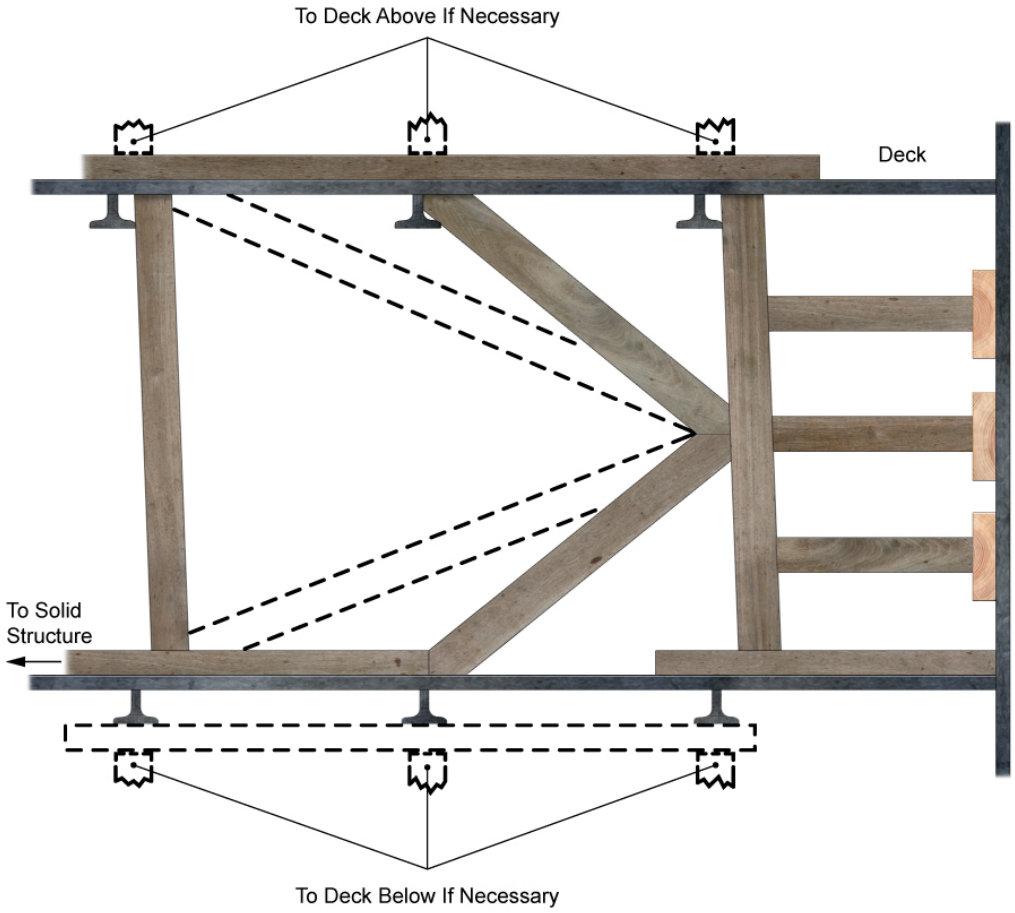


Figure 13-19. Multiple Square and V Shoring

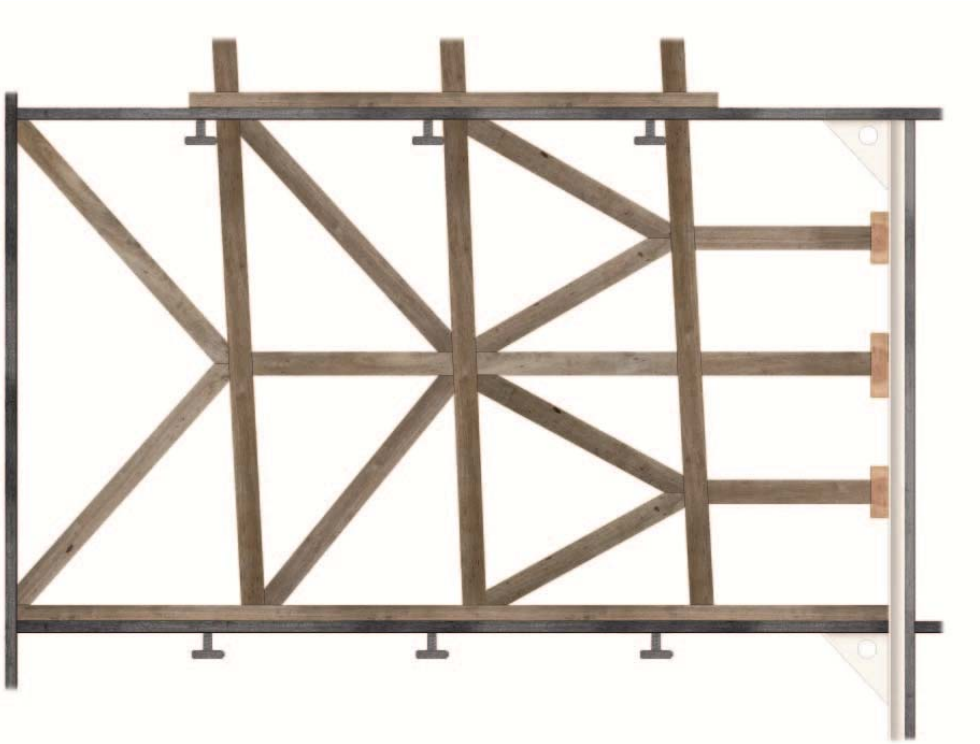
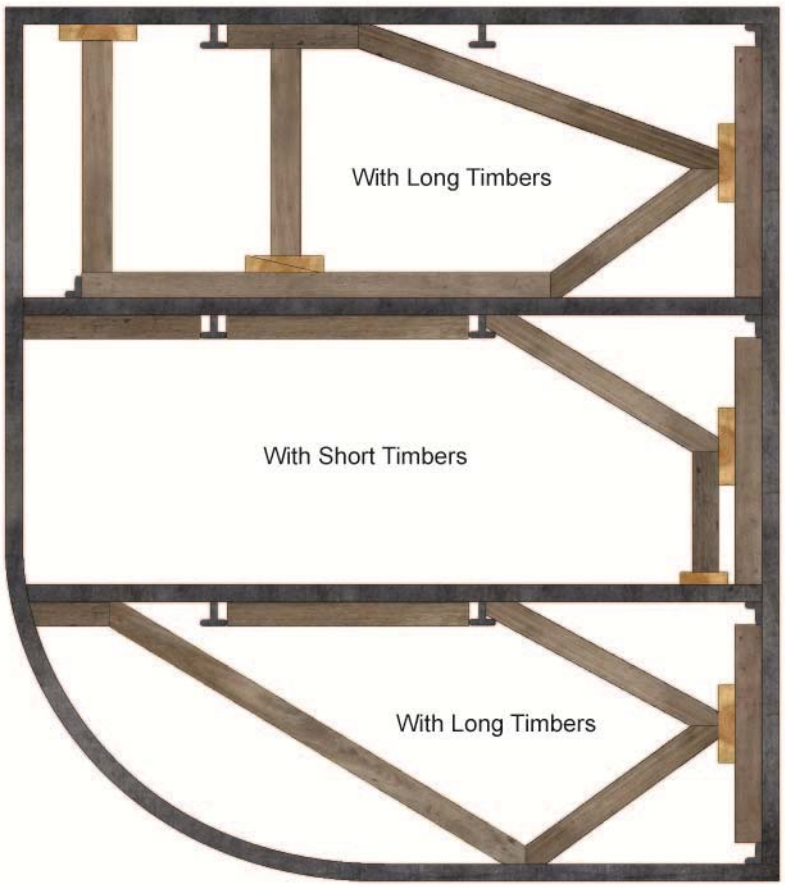


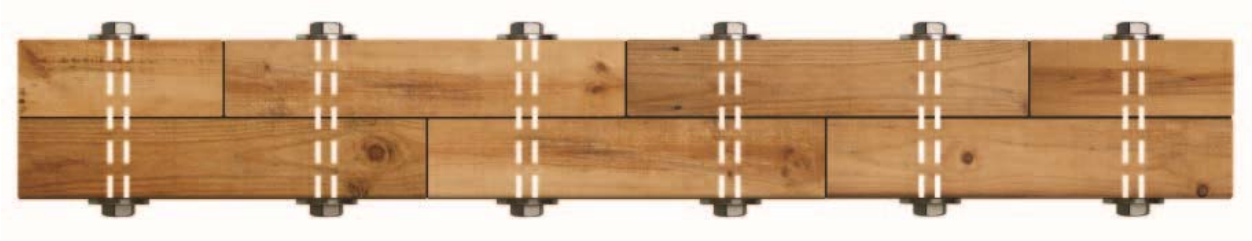
Figure 13-20. Shoring a Longitudinal Bulkhead (Various Methods)



1325. Fabricated Shore

Should it be necessary to use a long single shore in a compartment that has only a small access opening because machinery and fittings make the erection of multiple shoring impossible, a shore can be fabricated from short lengths of timber bolted together as illustrated in Figure 13-21. Each length used should be the longest length that can be passed through the access opening and the fabrication of the shore must be carried out in the compartment. Understandably, the use of a fabricated shore cannot be a first aid measure as the cutting, drilling and bolting together of the pieces will take time. A fabricated shore is not as strong as solid timber of the same dimensions.

Figure 13-21. Fabricated Shore



1326. Shoring Training Allowance

The allowance of 100 x 100 mm shoring timber held at FRP Posts includes a 20% enhancement for training purposes.

1327. Machinery Spaces

The erection of shoring in machinery spaces is difficult, and is almost impossible to achieve quickly, due to the large deck heights, and machinery and pipe systems that impede such work. Structures which require to be supported need to be shored from nearby, sound structures, while patches to the ships side, and some bulkheads, can be supported by using Emms clamps.

1328. Emms Damage Repair Clamp

a. This item is designed to be used in pairs and can replace proud shoring systems when supporting patching or other leakstopping devices. Its use alleviates the problems of access and stowage associated with providing long lengths of shoring timber in such spaces, and allows shoring to be cut to shorter lengths as required.

b. Three types of Emms clamp are provided:

(1) **Standard Small.** For use with 100 x 100 mm shoring.

(2) **Standard Large.** For use with 150 x 150 mm shoring or double 100 x 100 mm shoring, (in large ships only).

(3) **Universal.** For use with 100 x 100 mm shoring in ships with offset bulb ('P' section) frames.

c. The damage repair clamps for main machinery spaces (MMS) form part of the contents of the damage repair tool box, which is held in these spaces, or they may be secured to ships' frames high up in the MMS, near to the access hatch or air lock. The damage repair clamps for the FRPP form part of the contents of the damage control locker. Full details of allowances for RN and RFA ships are in BRd 2170(3).

d. The standard Emms clamp is made in two parts, each with an end shaped to fit over the flanges of either 'T' bar or bulb frames. One part is welded to a box section, and the other free section is secured to it by means of a captive, double start threaded bolt and wingnut. The two parts of the clamp can be secured to 'T' bars by fitting the shaped ends over the flange and then tightening up on the wingnut. For fitting over bulb angle the free part should be reversed and the wingnut tightened. The box section is designed to hold standard damage repair shores that are held in position with opposed wedges and, if necessary, nails.

e. The clamps are secured to ships' frames or longitudinal either side of the damaged area. Once in position and secured, a suitable length of shoring timber can be passed through the box sections welded to each clamp, thus providing a strongback close to the damaged area against which a GRP dome or patch can be shored, wedged, dogged and nailed, using a pad piece if necessary (see Figure 13-24). Two clamps can be used in tandem to extend the distance of the strongback from the damaged area.

f. These repair clamps are not proof tested and therefore must not be used as beam clamps for lifting purposes. Consequently a tally marked **'FOR DAMAGE CONTROL PURPOSES ONLY'** is fitted to each clamp.

g. The standard Emms Clamp was designed to fit on 'T' section frames. It will not fit offset bulb frames (eg in Type 23, LPH, HMS SCOTT and RFAs). The Universal Emms Clamp (see Figure 13-22) is used in these ships. It is attached to the frame by a screwed clamp and the box section swivels to give versatility in the orientation of the shoring.

h. The small standard clamp may be clamped onto the universal clamp, in tandem. The universal clamp cannot be clamped onto either of the standard clamps.

Figure 13-22. Universal Emms Clamp

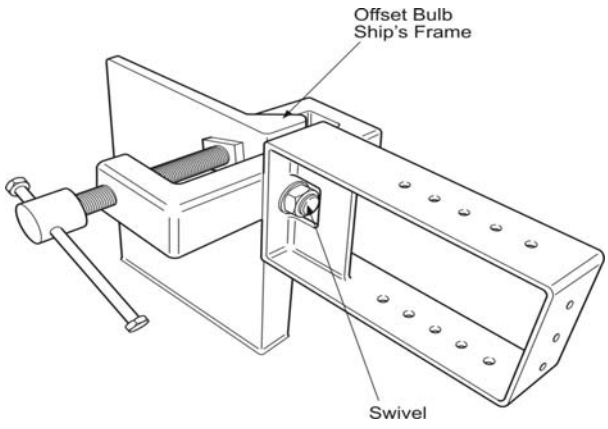
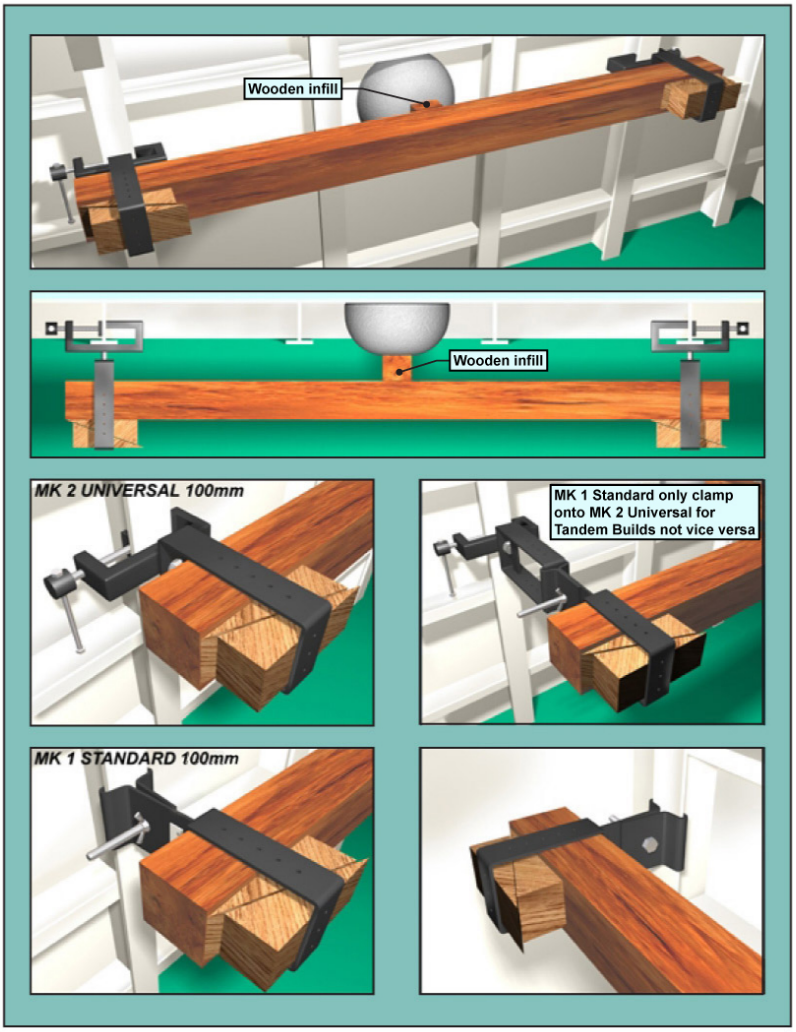


Figure 13-23. Emms Clamp Shoring



1329. Confined Access Shoring

a. The traditional shoring builds outlined in this chapter and BR 4008 are widely understood and accepted as best practice for general DC incidents requiring secondary shoring to provide both flood protection and in some cases bulkhead strengthening. However, primarily horizontally fitted, Emms clamp builds are not suitable where the damage sustained is in the first section of plating adjacent to transverse bulkheads, where there are stiffeners of differing sizes, machinery bedplates restricting access or with cable runs or pipe systems fouling the stiffeners.

b. Enclosed are examples of alternative Emms Clamp shoring builds that can be adapted in many areas where traditional builds cannot be achieved.

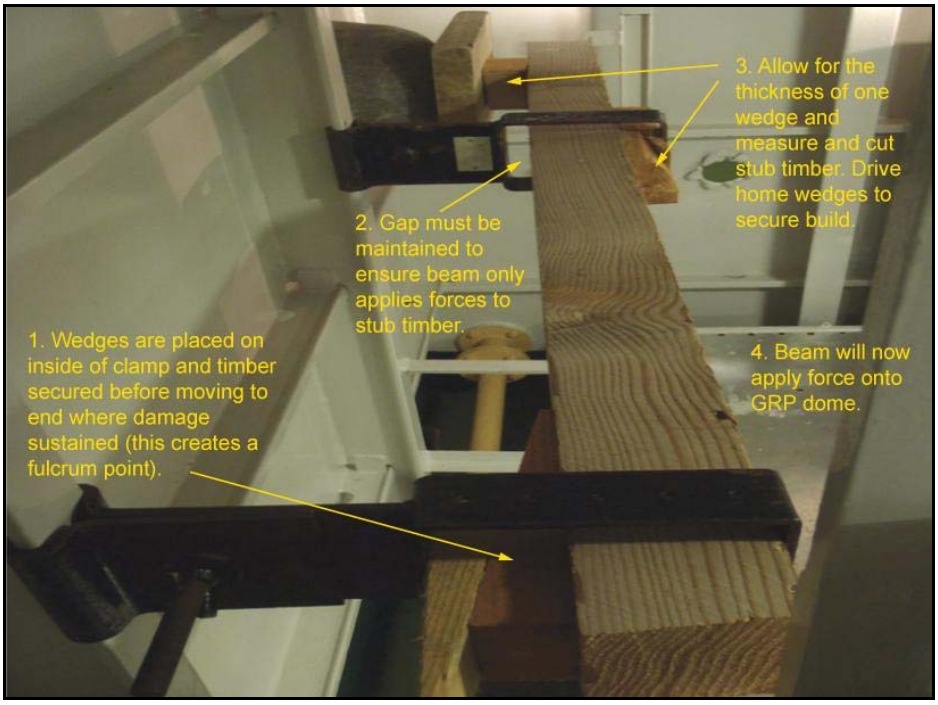
c. **Method**

(1) Figure 13-24a and Figure 13-24b illustrates 2 modified Emms clamp builds where access to or the ship's hull construction prevents the clamps being fitted either side of the area of damage.

The two Emms clamps are fitted as normal and careful consideration made to ensure the adjustment butterfly nut is situated correctly as this may compromise access to the area of damage. In this build the ‘free-end’ (ie the clamp furthest away from damage) is secured with wedges on the inside face of the DC timber thus creating a datum pivot point to facilitate a bending moment acting on the GRP dome/repair. The rest of the build is fitted as normal ensuring that the stub piece of wood acting on the pad piece is measured to provide a gap on the inside of the Emms clamp allowing the external wedges to act; the action of these wedges creates the moment that is required to secure the repair.

Figure 13-24a. Emms Clamp Shoring Methods

Figure 13-24b. Emms Clamp Shoring Methods



(2) Figure 13-25a and Figure 13-25b show 3 examples of the cantilever build. This is utilised where there is very limited access to the hull stiffeners to construct the conventional Emms clamp build; all that is required is one accessible stiffener. In this build, 2 Emms clamps are connected together that enable the DC timber build to be projected from the hull plating. The floating 'proud' shore locates through the Emms clamp and is not secured in place with any wedges therefore allowing the timber to pivot when load is applied. The most effective measurement of the breast shores is to have the one acting on the damage to be half of the length of the one used at the non-damage end. Following the steps illustrated in Figure 13-24a will create a very rigid secondary build equally as capable as the standard proud and breast method. The advantage of this build is that the proud shore is totally 'free standing' and therefore can be utilised where there is no supporting deck of deckhead structure present.

(3) As in all cases with secondary builds the most effective repair is achieved with careful measurement and cutting of accurate angles on the breast shores.

Figure 13-25a. Emms Clamp Shoring - Cantilever Method

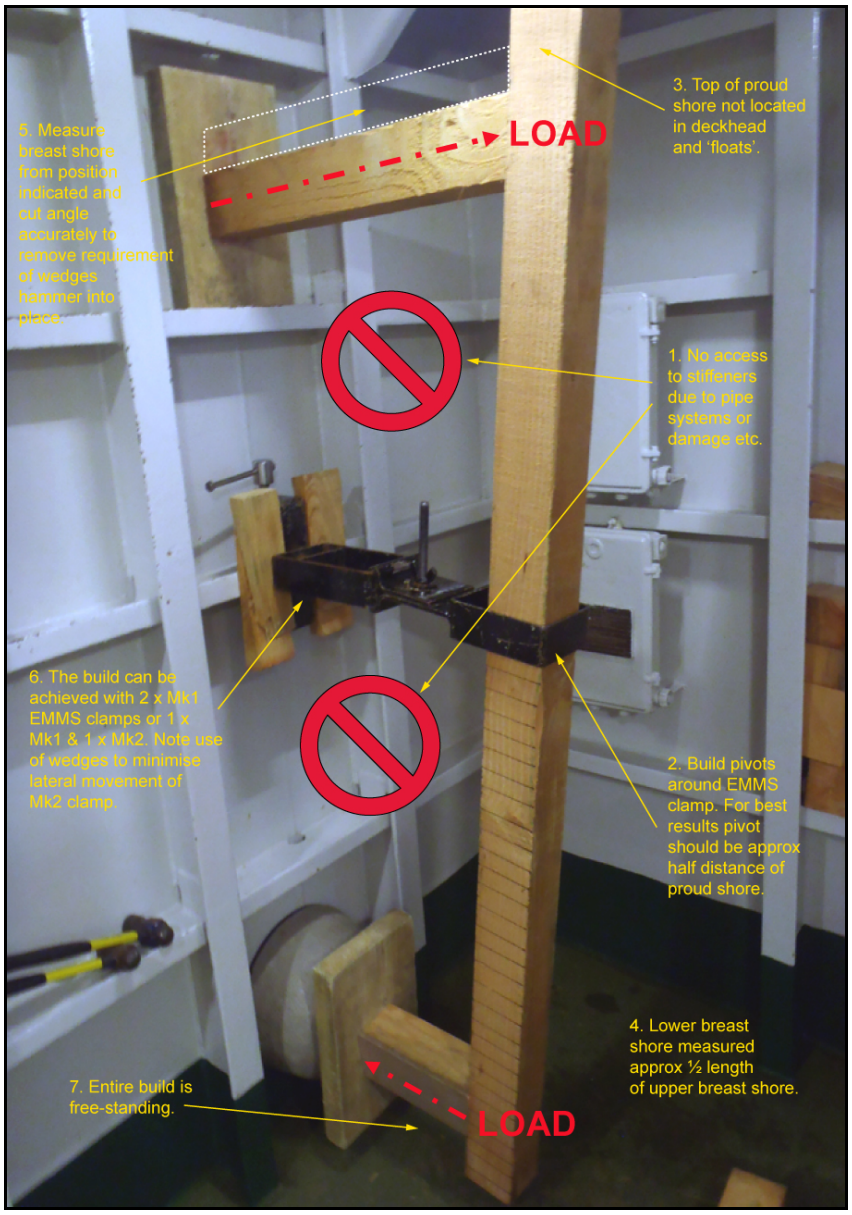
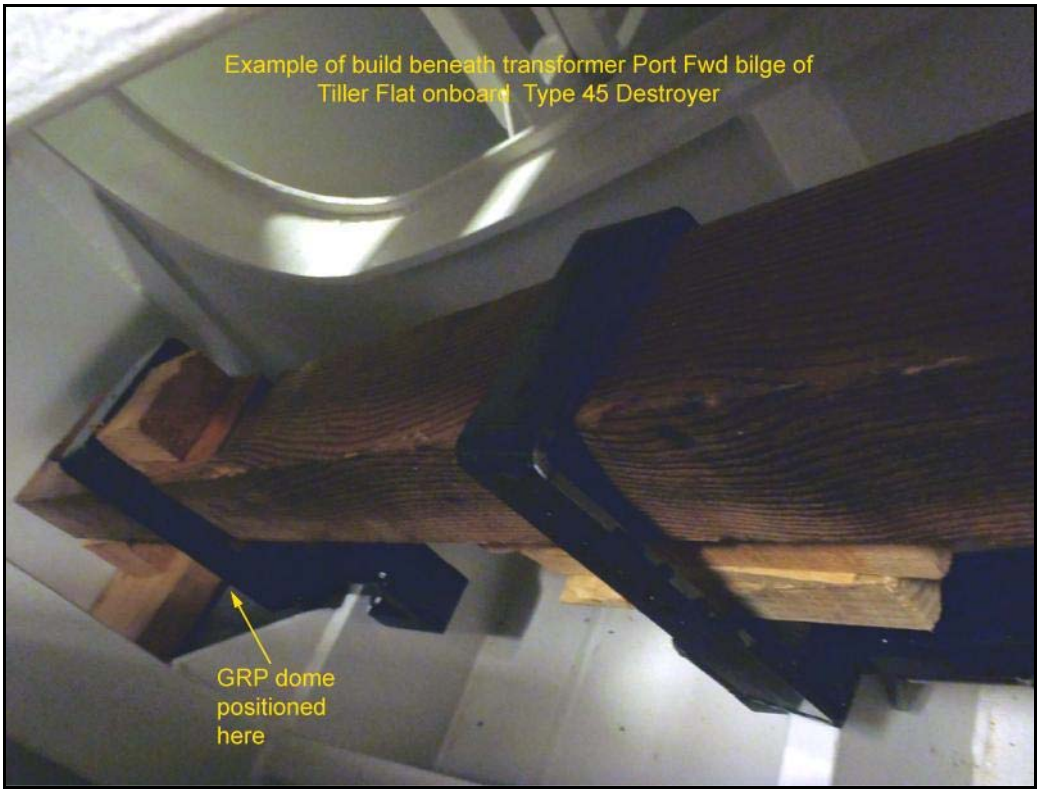


Figure 13-25b. Emms Clamp Shoring - Cantilever Methods



ANNEX 13A

PROCEDURE FOR FLOODING INCIDENTS

1. General

In the same manner as dealing with any fire situation a quick response to flooding incidents is required to stop or contain the flood. The following points are a guideline for flood responses both in harbour or at sea during peacetime.

2. I/C Main Group

The I/C Main Group is to have a thorough knowledge of the compartments within the Red Risk Zone and throughout the ship and be aware of the inherent dangers within these compartments. On hearing the flood pipe the I/C Main group:

a. Is to proceed to the scene of the reported incident and establish the FCP informing the OOD/DCO of its location.

b. Debrief the person reporting the incident and assimilate the information from other sources and pass the information to HQ1 keeping the OOD/DCO regularly updated as the situation develops. The person finding the incident is to report to HQ1.

c. Is to ensure sufficient measures are taken to safeguard the safety of both the ship and personnel whilst dealing with incident.

d. Is to implement any flooding boundaries as directed by the I/C containment of OOD/DCO.

3. Attack Party

All members of the Attack Party are to be aware of the possible dangers from fumes from within the compartments. Fumes can be emitted from fuel/oil tanks or gas fumes released from sewage treatment or refrigeration plants. If a gas or fume danger is suspected the Confined Space Monitor is to be provided to the Attack Party prior to entry to the compartment. Should gas or fumes be detected all personnel entering the compartment are to wear BA. On hearing the flood pipe the non-BA wearing members of the Attack Party are to proceed immediately to the SOTI collecting leak stopping equipment en-route. Prior to entering any suspected flooded compartment the Indicator Test Plug (ITP) is to be used to ascertain the state of the compartment. Once access is gained to the compartment the flood is to be aggressively attacked using any first aid leakstopping material available. The two nominated BA wearing members of the Attack Party are to collect but not don BA in this instance and are to proceed to the SOTI via the closest FRPP to collect first aid leak stopping bags. On arrival at the SOTI they are to join in with the aggressive attack on the flood as directed by either I/C Attack or Main Group. If no gas of fume hazards exist within the compartment the BA sets are to remain at the FCP. Whilst BA is not in use the BA Controller can be also be utilised as a member of the attack team. The Attack Party is to continue the attack on the flood until either:

a. The situation becomes uncontrollable and to maintain the attack would endanger personnel or the ship.

b. They are relieved by other personnel detailed by the I/C Main Group.

4. Support Party

The members of the Support Party nominated as firefighter and waterwall operators are to proceed to the FRPP closest to the incident and are to dress in multi-fab immersion coveralls. Once dressed they are to proceed to the FCP, with additional leak stopping bags and are to report to the I/C Main Group prior to relieving members of the Attack Party at the SOTI. The remaining members of the Support Party are to collect the largest capacity pump available, test the pump and deliver it to the SOTI. On completion they are to carry out tasks as detailed by the I/C Main Group.

5. Containment

As a priority in harbour, the DWETR is to detail off members of the Containment Party to provide a portable pump to the SOTI, (if no Support Party within the Duty Watch). He is then to proceed to HQ1 to inform OOD of all WE hazards within the vicinity of the incident They are then to proceed to the containment control position and is to instigate the setting up of flooding boundaries in conjunction with the I/C Main Group. The DWETR is to ensure that the sentries are fully briefed.

6. BA Party

The nominated BA Party are to remove all BA sets in the vicinity of the incident to a safe area and establish a dump. The use of these sets is to be controlled in the same manner as for a fire incident.

7. DMESR/Propulsion Manager

The DMESR is to proceed to HQ1 to advise the OOD/DCO and carry out isolations as required:

a. Crash stopping of ventilation (see **Note 2**).

b. Isolating electrical supplies within the flooded area and boundary as required.

c. The availability of ships services and the effect the flood will have on these services.

d. Ensuring systems within the flooded area are depressurised as soon as it is safe to do so.

e. Provide HPSW to enable the removal of floodwater/fluids.

f. The removal of floodwater/fluids and the effects on ships stability.

g. Advising the OOD/DCO on MARPOL considerations.

h. The presence of gases within the flooded area.

i. The estimated final level of the floodwater with reference to the waterline.

j. Checking for the possibility of any further damage above the waterline through propagation and/or capillary action.

k. Coordinating the recovery of systems and services within the flooded area when required and providing alternatives as necessary.

Notes:

1. At sea the role of the WE specialist advisor to HQ1 is to be undertaken by the DWEO and is a separate task to I/C Containment.

2. It is highly likely that the incident will be discovered by alarm in HQ1/SCC and the ventilation crash stopped as a precaution. The ITP is always to be used prior to entry and should the compartment appear pressurised it can be assumed that the compartment is flooding. Crash stopping of ventilation will also reduce the spread of noxious fumes and gases around the ship.

CHAPTER 14

DAMAGE CONTROL ARRANGEMENTS IN ICY CONDITIONS

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CHAPTER 14

DAMAGE CONTROL ARRANGEMENTS IN ICY CONDITIONS

1401. General

ATP 17 - Naval Arctic Manual, contains information on operating in ice. Certain aspects of Damage Control can be affected by icy conditions and the following paragraphs are intended as information for ships officers on the design arrangements called for by the MOD(Navy) in dealing with these conditions, and the ways in which a ship can deal with them.

1402. High Pressure Sea Water (HPSW) Service

a. All mains and branches which are exposed to the weather, or which supply hydrant valves in exposed positions, are fitted with drain down arrangements.

b. Whenever possible, hydrants and magazine locker flood pipes in exposed positions have an additional valve in the branch supply well inside the main structure, so arranged that the exposed length of supply pipe can be drained and left empty. PVC or polythene covers should be used to cover hydrants. Hoses and nozzles in exposed positions should be as dry as possible internally or re-located between decks.

c. Attention is given to the insulation of all supply pipes, including flanges which, although not in exposed positions, are likely to be subjected to very low temperatures, eg those near lift openings in aircraft carriers. Similar precautions are made for the spraying arrangements to any magazines or magazine lockers in exposed positions, but some difficulty may be experienced where the spray piping is ‘dead end’ and has no flow-through. The main supplies to hangar spray systems are insulated as far as the control valves.

d. Where the extreme fore and aft ends of the HP sea water system are in exposed positions, leak-offs are fitted to ensure a continuous circulation of water. The leak-offs should be 12 mm diameter, well insulated and so arranged to discharge either directly overboard or into a scupper with a warmed storm valve.

e. Hoses and nozzles will perform satisfactorily at freezing temperatures, if the water is kept flowing and a good pressure is maintained. After use, they should be drained, taken between decks for drying and replaced by dry hoses and nozzles.

1403. Prewetting

The arrangement of prewetting systems is such that the supply pipes drain down after use. If difficulty is experienced with the complete draining of any pipe, it should be blown through with LP air. Nozzles should be cleared of ice by seawater hosing or manually.

1404. Scuppers and Drains

Decks and platforms are equipped with sufficient drains to eliminate the formation of pools of water. Arrangements are made to prevent, as far as possible, the ingress of water to exposed deck equipment, or ready drainage is fitted.

1405. Fresh Water Systems

Piping in exposed positions or in positions likely to be subjected to low temperatures is insulated and steam or electrically heated. Frost plugs are fitted in positions of ready access. Care should be taken that insulation does not interfere with any working parts of the system.

1406. Ventilation

Heating systems are designed to maintain a minimum temperature of 18.3°C in living and working spaces. Low humidity is avoided by limiting fresh air intake. Thermal insulation is fitted to cold surfaces inside the ship to reduce heat transfer losses and prevent condensation. Insulation is fitted to the weather boundaries in all living, working and other spaces where condensation must be avoided, and to all fresh air trunking where it passes through such spaces.

1407. Weatherdeck Terminals

The hinges and clips of all weatherdeck ventilation terminals should be treated with a de-icing compound.

1408. Portable Firefighting Appliances in Exposed Positions

Whenever possible, portable firefighting appliances that are likely to freeze should be stowed in sheltered positions. Diesel fuel systems in portable pumps are liable to blockage by waxing at very low temperatures. AFFF drums and AFFF extinguishers should be stowed in their heated lockers (where provided). On no account should anti-freeze be added to AFFF extinguishers because of the danger of AFFF losing its fire extinguishing properties. For freeze protection of exposed AFFF drums in exceptional conditions, refer to Chapter 19. CO_2 and dry powder extinguishers are unaffected by cold weather.

1409. Stability

Heavy icing on the weatherdeck, superstructure and weatherdeck, fittings and equipment will adversely affect the stability of the ship due to the additional top weight refer to Chapter 23. Every effort must be made to prevent the information of ice and to remove it as quickly as possible when it has formed. The methods used for ice prevention and removal is contained in ATP 17.

1410. Citadel Openings

Careful attention must be given to keeping the jointing portion of the door rubbers dry in order that they will not freeze to their seatings on the door coamings.

1411. Door and Hatch Clips and Hinges

All grease nipples should be charged, and clip barrels and hinges should be smeared with de-icing compound.

1412. Batteries

Low temperature reduces the output of all types of batteries, so those required for damage control purposes must be kept in a warm area.

CHAPTER 15

ELECTRICAL ASPECTS OF DAMAGE CONTROL

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CHAPTER 15

ELECTRICAL ASPECTS OF DAMAGE CONTROL

SECTION 1 - ELECTRICAL SYSTEMS AND EQUIPMENT

1501. General

In warships, the continued supply of electrical power under all conditions is essential for maximum fighting efficiency and may well be a deciding factor in a ships survival. Some of the important services and equipment that depend on electrical power are:

a. Control and operation of weapons and sensors.

b. Internal and external communications.

c. Steering gear.

d. Aids to navigation.

e. Ventilation and lighting.

f. HPSW and salvage pumps.

g. Lubricating oil and controlled pitch propeller pumps.

h. Ships propulsion.

i. Chilled water.

j. HP and LP air.

1502. Main Supply System

a. Many important main-engine auxiliaries, ancillary equipment and ventilation fans are electrically driven. Several features in the electrical system of a ship are designed to limit the effects of damage on essential power supplies and to enable supplies to be restored with minimum delay. They include:

(1) Enough generator capacity to allow for possible failure of some generators.

(2) Dispersal of generators to obviate the risk of complete failure of electrical power from one hit.

(3) Secondary generation of power from diesel generators when primary generators are steam driven.

(4) Alternative supplies, and in some cases emergency supplies, immediately available to important services.

(5) Fuses and overcurrent protection in switchgear to isolate circuits and prevent damage to generators and equipment in the event of a short circuit.

(6) Shock-tested mountings and fittings to prevent the displacement of equipment, switchgear, fuses, etc, by underwater shock.

(7) Duplication of conversion machinery.

(8) Provision of an emergency generator in certain classes of ship.

b. Main electrical supplies in ships are generally derived from diesel driven generators, however some older classes of ship may have steam driven generators, or a combination of both. The type of generator prime mover, generator output, and the number of generators are determined by the functions, general characteristics and operational role of the ship. The generators will meet the maximum ships load (usually the action load) with an adequate margin to allow for generator damage, defects and maintenance. A reserve of generation capacity is also allowed for, to meet any growth in electrical demands during the life of the ship.

c. In the majority of warships, electrical power is generated at 440 volts, 3 phase, 60 Hertz AC. However, certain classes of ship generate a higher system voltage to supply the propulsion motors. Conversion machinery is employed to convert the higher voltage to the normal 440V working level. Detailed information regarding the generation and distribution of the main supply system can be found in the CBRNDC Class Book for the particular ship, or in the main electrical system BRs.

1503. Distribution Systems

There are 3 different types of power and distribution systems commonly fitted in ships:

a. A simple system in which all the generators supply a common switchboard.

b. An extension of the above system, whereby the switchboard is divided, with each generator supplying its own independent switchboard section. A DD/FF normally has two such switchboards, each board having two sections. Breakers interconnect all the switchboards and sections.

c. In modern warships, major services are no longer supplied directly from a switchboard section. Equipment’s located in a particular section of the ship, and fitted for a particular purpose are grouped together and supplied from either an electrical distribution centre (EDC), or an electrical distribution panel (EDP). Services are fed from these EDCs/EDPs via moulded case circuit breakers (MCCBs). Hence these may be considered to be sub-switchboards.

1504. Circuit Breakers

Each generator is connected to its associated switchboard or switchboard section through a supply breaker contained in the switchboard. A breaker is fundamentally a hand-operated or electrically operated switch. The difference between switches and breakers is that breakers incorporate protection and safety devices that enable them to open automatically should a fault condition arise. Breakers are therefore normally fitted for the protection of main generators, for all main interconnections between switchboards, and all major feeders, where switch and fuse units cannot be used. In modern ships, each EDC/EDP consists of a number of MCCBs.

1505. Main Switchboards

A ships main switchboard provides facilities for controlling the voltage and frequency of generators, and their synchronisation when needed for parallel running. In ships with remote machinery control from an MCR or SCC the switchboard is normally located in the MCR/SCC. In some instances where the main switchboard is remote from the generator, local control panels (LCPs) are provided. Secondary switchboards are also normally provided. All switchboards are ‘dead-fronted’ to prevent any exposure to the system voltage.

1506. Supplies to Services

All services are supplied through breakers or, for more lightly loaded circuits, by switch and fuse units. These breakers and switches are known as feeder breakers and feeder switches, and the circuits are feeder circuits.

1507. Alternative Supplies

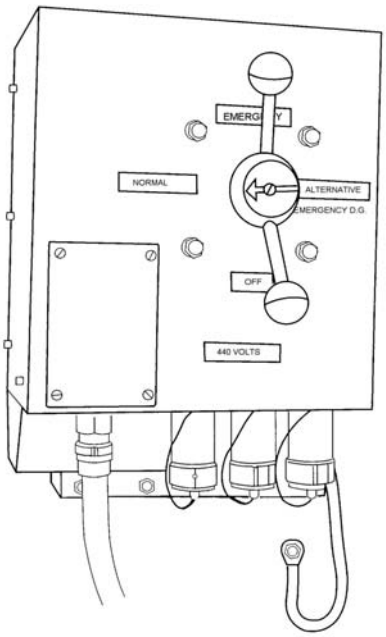
Some electrically driven equipment in HM ships is considered to be of sufficient importance to justify the provision of 2 or more power supplies. These are fed via changeover switches to allow the connection of an alternative supply if the normal supply should fail. Changeover switches are sited as close to the equipment as possible to minimise the risk of power failure due to local circuit damage:

a. **Automatic Changeover Switch (ACOS).** These are provided for equipment considered vital to the safety of the ship. They will automatically change the incoming supply from normal to alternative should the normal voltage drop to 80% of nominal, and will revert automatically to the normal supply should the normal supply be restored.

b. **Hand Changeover Switch (HCOS).** Automatic changeover switches must be limited in number otherwise remaining generators could be loaded beyond their capacity. If a short delay in restoring power to particular equipment is acceptable, then a hand changeover switch is fitted (see Figure 15-1). Examples of equipment’s fitted with changeover switches are:

AUTOMATIC	HAND
Forced lubrication pumps	Ventilation
Conversion machinery	HPSW pumps

Figure 15-1. Hand Changeover Switch



c. **Electrical Distribution Panel (EDP).** EDPs that are fitted in certain classes of ships are divided into three different types:

(1) **Remotely Operated Changeover Switch (ROCOS).** This type is remotely controlled and allows an operator to select the Normal or Alternative supply from a remote position (normally the SCC), or locally at the EDP.

(2) **Automatic Changeover Switch (ACOS).** In this mode, the EDP operates as a normal ACOS.

(3) **Sheddable.** These EDPs are operated, either automatically as part of machinery operation, or manually from a remote position (SCC), forward or after switchboards or locally at the EDP.

Note. *ROCOS and ACOS EDPs have input and output emergency sockets, whereas Sheddable panels have emergency output sockets only.*

1508. Converted Supplies

Lighting and small power services, including portable apparatus, lower voltage supplies at 115V, 3 phase and single phase, are provided by transformer conversion from the 440V system. Various services, eg radar and weapon control systems, need ac and dc supplies at voltages and frequencies different from those of the main supply. These are provided by conversion machinery, ie motor-driven generators, static frequency changers, transformers/rectifiers and batteries, as appropriate. Where the converted supply is peculiar to specific equipment the necessary conversion machinery is often sited nearby. It is usual to provide a common conversion machinery room at the load centre of all services concerned.

1509. System Operation

a. The distribution system should not normally be arranged so that the normal and alternative supplies are taken from the same generator, or generators sited in the same compartment.

b. Generators may fail at any time without warning. When this happens, all services being supported by a failing generator, through automatic changeover switches, will be transferred automatically to the generator providing the appropriate alternative supply. Therefore, each individual generator must not be fully loaded; a margin must be left to allow each generator to accept the load thrown over when automatic changeover switches operate as a result of the failure of another generator.

c. At higher states of Damage Control readiness, the main supply system must be manned and operated such that sudden failure of a generator does not hazard the ship.

1510. Breaker Colour Codes

In older ships switchboard switches and breaker controls are colour coded to indicate the importance of the service supplied by the switches and breakers, and to assist the watchkeeper in selecting priorities when load shedding. In modern ships with MCCBs and ECDs feeding multiple services, major services should be listed at the primary and secondary control positions adjacent to feeder breaker operating switches. Colour coding should be employed against each major service. The colours are:

a. **BLUE (Seagoing Efficiency).** Steering, gyro, machinery space lighting and power, navigation radar, etc.

b. **RED (Fighting Efficiency).** Turret/mounting/launcher supplies, magazine lighting, ammunition hoists, sensors, etc.

c. **GREEN (Damage Control Supplies).** HPSW/hangar spray/salvage pumps, air conditioning units and ventilation, etc.

d. **WHITE (Less Important Supplies).** Refrigerators, galley equipment, etc.

e. **YELLOW (Unimportant Supplies).** Unimportant lighting and ventilation, heaters, etc.

1511. Control of the Electrical System

The complexity of the ships electrical system requires a high degree of central control, so that the general state of supplies throughout the ship can be assessed and the supplies handled quickly and easily. This becomes increasingly important when damage is sustained and only limited supplies are available. In such circumstances the function of control is:

a. The even distribution of load among intact generators by the control of switchgear and the shedding of less important services.

b. The isolation of damage and the redirection of supplies to important services.

c. The cooperation of electricity supply and repair parties in the restoration of power to damaged areas.

1512. Switchboard Primary Control

In most modern warships the voltage and frequency of generators and the operation of supply, feeder, busbar linking and interconnecting breakers, are remotely controlled at a console in the MCR/SCC; this console is known as the Primary Control Position (PCP). In ships where more than one switchboard exists, communications are available between each switchboard, this communication usually being a combination of Rationalised Internal Communications Equipment (RICE), machinery space broadcast and telephone.

1513. Switchboard Secondary Control

In large ships with a second Damage Control headquarters (HQ2), a Secondary Control Position (SCP) is also fitted. Its function is to assume control if the PCP is out of action. The SCP is not necessarily provided with automatic indication or remote control arrangements but the state of the main supply system may be recorded, on a hand worked mimic diagram, from information received from the PCP while active, or otherwise from outlying stations. This information enables the SCP to coordinate the remaining switchboards and outlying electrical positions to direct and maintain power supplies. In more modern warships SCPs are situated adjacent to each main switchboard. From these positions local main switchboards can be operated in the event of failure of the PCP.

1514. Operation of the Main Supply System

Instructions for the operation of the Main and Emergency supply systems of the ship are outlined in the associated CBRNDC Control Class book, and are detailed in BR 2000(52) - Electrical Power, Distribution and Utilisation, BRd 300 - Fleet Weapons Engineering Manual and relevant main power supply system BRs. The electrical state of readiness should conform to the ships DC State. At DC State 1, all generators are to be proved by placing on load. Generators that are running should be independently supplying their own switchboard sections via supply breakers and/or bus bar linking breakers. The sub-division of the main supply system in this way minimises the effect of any damage to the system. Switchboard operations should be kept to a minimum. Where it is required to parallel generators to transfer load, then the operation should be completed as quickly as possible. Care must be taken during the transfer to ensure that the generator frequencies do not deviate to a level likely to affect frequency conscious equipment. Consideration should be given to opening MCCBs/breakers that supply non-important services as part of State 1 preparations. This removes unnecessary 440V from compartments, thus reducing the risk of electrical shock to firefighters and faults to the primary electrical distribution system.

1515. Action Paralleling

In the event of a generator or its prime mover becoming damaged necessitating the quick removal of its load, then ‘action paralleling’ should be employed. This is where the affected generator is paralleled with an unaffected generator that has sufficient spare load capacity, such that it is able to accept the load from the failing generator. Once the 2 generators are in parallel, the off-going generators supply breaker is opened, this immediately transfers the load and allows for the immediate shut down of the affected generator.

1516. Electrical Supplies to HPSW Pumps

a. HPSW pumps are provided with both normal and alternative supplies; some classes of ship are capable of providing a third supply from an emergency generator. Under standard operating conditions the HPSW pumps should be fed from their normal supply to ensure maximum diversity of supplies. Every effort must be made to ensure electrical supplies are maintained to the HPSW pumps. In the event of possible interruptions to these supplies due to load transfer, battle damage etc it is essential that the DCO(L), via the DCO, keep the FRPPs informed of any possible interruptions. For peacetime emergencies the Senior Rating I/C of the firefighting team will be kept informed by the DCO. In the event of a fire that requires re-configuration of the main supply system, care must be taken to ensure that, wherever possible, HPSW pumps in use are fed from separate generators or supplies.

b. All HPSW pump starters are fitted with a lockable switch known as the ‘Battle Override’ switch. The purpose of this switch is to prevent the operation of the electrical safety devices fitted within the starter and thus prevents the pump from tripping under fault conditions. This switch is to be unlocked in DC State 2 and made in DC State 1.

1517. Ships Lighting

Almost without exception, some lighting will fail when action damage is sustained. General lighting is not provided with alternative supplies but, to prevent a complete blackout:

a. In important spaces, and in gangways, two electrically separate and widely dispersed sources each supply half the lighting.

b. In some generator and switchboard rooms, a proportion of the lighting is supplied directly from the live side of generator supply breakers.

c. Switchboard rooms, radar offices, HQ1/SCC and other operational spaces may also be provided with battery-operated secondary lighting. This is in addition to the automatic emergency lights.

1518. Automatic Emergency Lights (AEL)

AELs are normally fitted adjacent to doorways and hatchways to indicate their position in the event of a power loss affecting lighting. AELs are also sited adjacent to some machinery controls, in hazardous areas such as galleys and on escape routes. They are battery fed and are operated by relays connected to the main supply system. They switch on automatically if power in the space fails but give only enough illumination for movement between decks. AELs are fitted with a special battery which is trickle charged, thus ensuring the emergency lighting is available at all times. A neon lamp indicates the charging supply.

1519. Emergency Lighting for Repair Parties

a. When normal lighting fails, the provision of emergency lighting for repair parties and others to carry out their duties is of paramount importance. Various items of equipment, details of which are in BRd 2170(3), are provided for this purpose. The principal items are:

(1) Moulded strip lighting circuits (DC 'necklaces') which can be connected to a source of 115V emergency supplies.

(2) LED gangway lighting equipment which is available in 16, 26 and 50 m lengths complete with power packs.

(3) Portable, battery-operated equipment comprising:

(a) Lanterns for general use of repair parties. This equipment is splash proof but not watertight.

(b) Safety torches.

(c) Lamps for repair parties and medical parties.

(d) Right angle torches.

(4) Cyalume chemical illuminators.

Note. *In areas that are suspected or known to contain flammable or explosive vapours, only safety torches or cyalume illuminators may be used.*

b. When emergency lighting is being rigged, care must be taken to ensure that the cables do not breach watertight integrity. The closing of doors and hatches forming smoke or watertight boundaries should not be impeded by allowing cables to pass through them.

1520. Emergency Supply Arrangements

a. Emergency supplies are distributed in two ways. Either via portable, flexible, cables, normally run along the communications deck, thus giving relatively free fore-and-aft access for repair parties, or by a hard wired system supplied from an emergency (salvage) generator via an emergency switchboard to a number of ships vital services eg HPSW pumps, steering gear and emergency portable pump sockets. In some classes of ships it can be a combination of these two methods. These cables are never to be rigged until required in an action/damage situation, unless ordered by HQ1 or their designate. In some ships, where there are passageways on both sides of the communication deck, facilities are provided for port and starboard systems.

b. In some ships with a large number of decks, provision is made for emergency supply systems to be run on two deck levels; the communication deck and one other. Permanent cables are run to these decks from generators and switchboards. Where emergency cable runs are required to pass through watertight bulkheads, special through-bulkhead connection boxes are provided.

1521. Permanent Risers

Where it is necessary to transfer emergency power from one deck to another, two methods are used:

a. Short vertical lengths of cable are fitted permanently through watertight deck glands (where watertight or gastight integrity must be maintained). These permanent cables are called risers.

b. Deck tubes with removable caps are fitted for the passage of cables (where watertight or gastight integrity is not a prime consideration). The caps are painted white with a green cross.

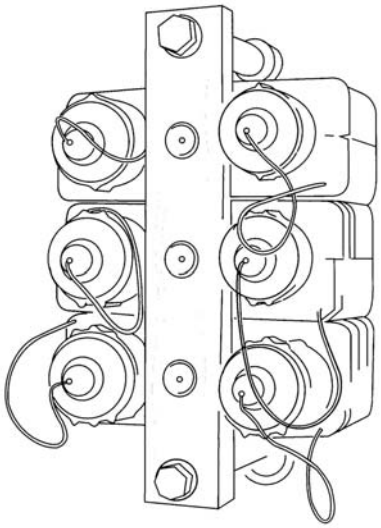
1522. Emergency Supply to Fuse Panels

Some fuse panels supplying important services are fitted with normal/emergency changeover switches and emergency connections. In earlier ships the first fuse panels supplied from the switchboard breaker/switches were fitted with these arrangements. In later ships the panels fitted with emergency arrangements have been limited to those supplying important services. Only the necessary panels, which may not be the first after the switchboard breaker/switch, are so fitted.

1523. Emergency Connections

Facilities for obtaining emergency power are provided at all main switchboards or generator LCPs in the form of emergency socket connections fed from the bus-bars through switch and fuse units. All ends of permanent risers are terminated by emergency connection boxes (ECBs) and so, by means of flexible cables having suitable connectors at each end, the main emergency run can be energised from available power sources. Similarly, at all important services there are facilities for accepting emergency power. The facilities comprise either an emergency switch and connection box fitted in the supply to the service or emergency socket connections in a fuse panel supplying a group of important services. Each type of facility includes a changeover switch to enable changeover from ‘normal’ to ‘emergency’ supply. Distribution for these services is by portable emergency link boxes or portable fused distribution boxes, normally bolted to bulkheads at positions near the main emergency run. They can easily be made portable but when so used they must be earthed to the ships structure by connection to the earthing terminal provided.

Figure 15-2. Emergency Through-Bulkhead Terminal



1524. Emergency 440V Cables

a. Ships cables are pre-positioned, with fitted connectors, cables are manufactured, as required, from rolls of colour coded cables (red, yellow and blue phases) and crimped onto tails that have connector plugs fitted. The crimped butt connectors should be insulated by wrapping insulating tape around them. The connectors and sockets have standard phase colouring and, to assist phase identification by touch, a number (one, two or three) of raised rings are moulded on the shroud of each cable connector and a corresponding number of raised lobes are on each socket. In addition, to make doubly sure, shrouds are moulded with one, two or three keyways to fit corresponding numbers of keys in the sockets. Cable connectors are shown in(Figure 15-3). Emergency cables are stowed on special brackets or reels, where they make small targets for splinters. They should not be rigged in position until required. To enable certain important items of equipment to be connected to permanent risers, or to the main emergency run, they are provided with lengths of flexible cable that are stowed near the equipment. If long lengths of emergency cable are damaged and unusable, short lengths may be joined together by use of muff couplings (Figure 15-4) and the contents of the cable lockers are detailed in BR 4500(120) - Emergency and Converted Electrical Supply Systems Type 23 Frigates.

b. The stowages for all emergency cables are to be clearly marked, preferably with an embossed tally. Cables should be neatly stowed in their correct stowages with the connectors clear of the deck. The cables should be maintained strictly in accordance with the relevant MMS schedule.

Figure 15-3. Emergency Cable Connectors

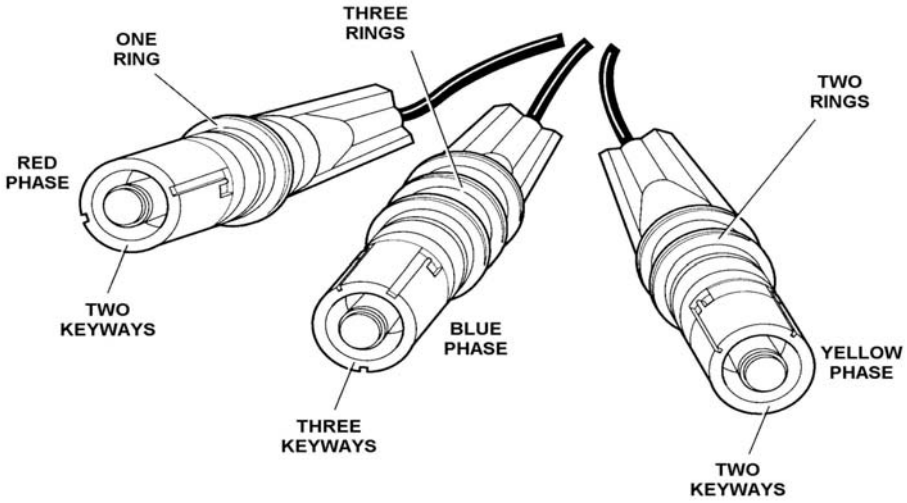
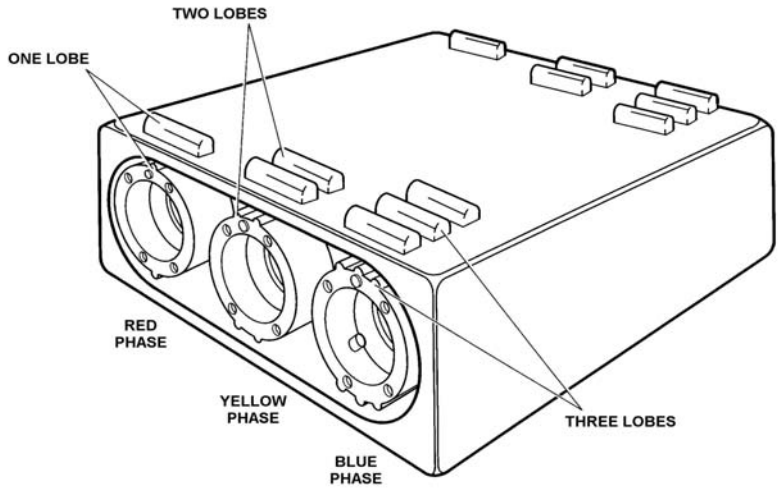


Figure 15-4. Muff Coupling



1525. Electrical Supplies to Portable Pumps

a. Switched sockets are provided at strategic positions throughout ships, for normal 440V 3 phase supplies to portable pumps (see Figure 15-5). The socket boxes are painted yellow and numbered in black. For connection to an emergency supply, a special switched adaptor cable (‘rats tail’) is provided in ERP lockers (see Figure 15-6).

b. T23, LPD, Tide Class, Bay Class, Wave Class, and QE, Echo, Enterprise and Protector all have WEDAs with the 239 406, plug earth orientated in the 6 o’clock position.

c. OPVs have 239 403 plug, (non patt) earth orientated in the 3 o’clock position.

d. T45 have 239 407 plug, earth orientated in the 7 o’clock position.

Figure 15-5. Switched Portable Pump Supply Socket

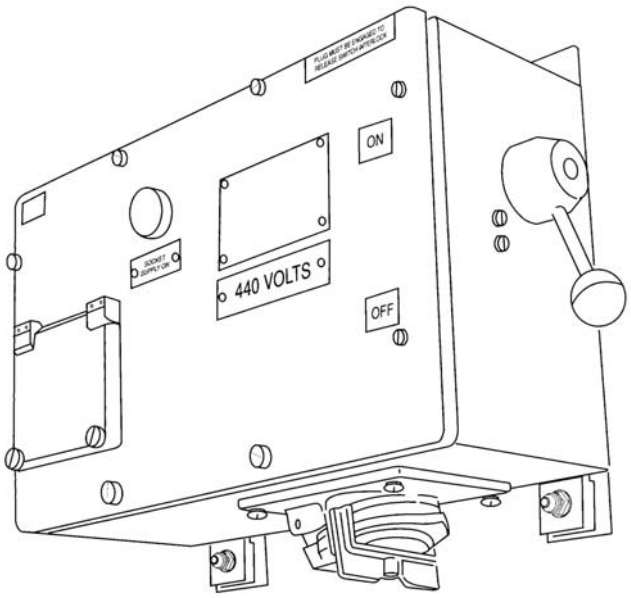
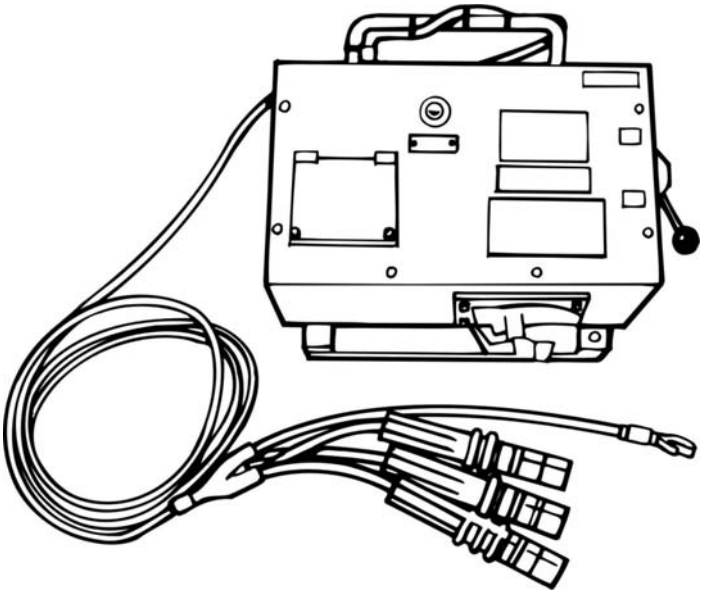


Figure 15-6. Switched Rat's Tail



1526. Battery Operated Lanterns

The allocation of battery-operated lanterns (see Figure 15-7) is three to each FRPP, plus one each to sickbays, secondary medical positions and dental surgeries. Those allocated to these medical stations are to be clearly marked as such. They are to be held by the appropriate marine engineering section for issue when assuming DC State 1. Lantern maintenance is limited to replacement of the lamp or lens gasket and recharging the two batteries using either the BC2 (2 way) or BC10 (10 way) charger. The charging system is self-regulating, and the lantern may be left on the charger until required for use. Lamps indicate state of charge as follows:

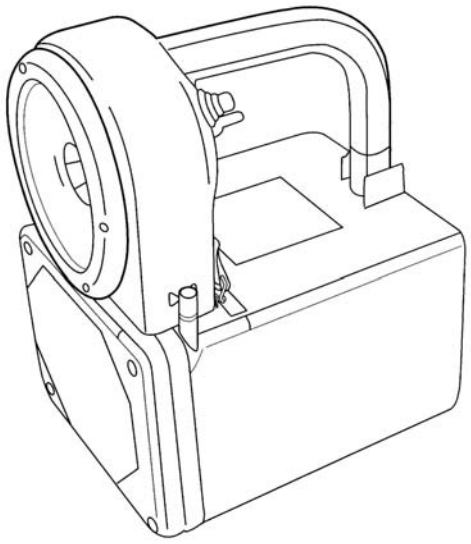
a. **Red Lamp.** Charging.

b. **Green or Green and Red.** Charged.

CAUTION

Lantern end casings or batteries must not be removed and battery seals are not to be removed during recharging.

Figure 15-7. Battery Operated Lantern



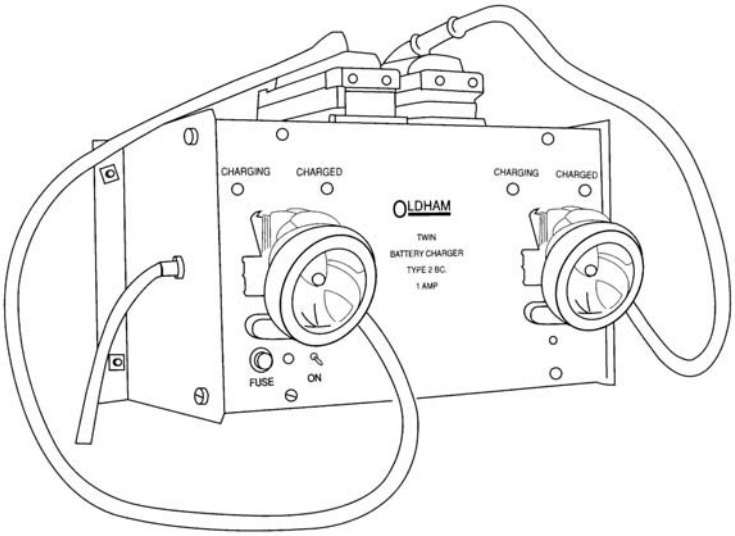
1527. Battery Operated Headlamps (Caplamps)

The allocation of headlamps is nine per FRPP. Also one each to the sickbay, SMP and dental space and three to each First Aid Party, to be stowed in the sickbay. Headlamp maintenance is limited to:

a. Recharging of the battery using the BC10 and BC2 chargers (see Figure 15-8). The charging indications are as for the lanterns in Para 1526. Headlamp batteries are sealed during manufacture and are not to be topped up. Battery seals are not to be displaced or removed.

b. Replacement of defective lamp filaments.

Figure 15-8. Headlamp Battery Charger



SECTION 2 - LOW VOLTAGE ELECTRICAL DAMAGE CONTROL PRACTICE

1528. Damage Control Officer (Electrical)(DCO(L))

a. At State 1, the DCO(L), in HQ1 they are responsible for the integrity of the Main Electrical Supply System, including Converted Supplies. Where the ships main generators form part of the Propulsion System, the demarcation of ownership is to lie at either the Generator or the HV/LV Transformer, dependant on the ships equipment fit (the Prime Movers are owned by the Propulsion Manager/MEOOW1). In the case of a ship with Electrical Propulsion Motors the Propulsion Manager/MEOOW1 is responsible for the operation of the Propulsion Motors and associated control equipment.

b. DCO(L)s specific responsibilities for Electrical Damage Control (Electrical DC) are listed in Chapter 3.The Electrical DC Organisation should, where possible, be structured around the organisation detailed in Chapter 7. Later classes of ship may have to adapt to this around this guidance dependant on their manning state and advances in technology.

1529. Electrical Repair Party Posts (FF/DD)

The Electrical Repair Party Posts on DD/FF operate from the Fwd and Aft switchboards, with the switchboard operator acting as the I/C Electrical Repair Party Post. Each party is to be made up of an I/C (who is to hold a Switchboard Operating Certificate) and at least 2 electrically competent ratings, identified with green brassards or surcoats. Only under exceptional circumstances should electrical team members be used in other DC organisations (eg firefighting) due to their limited numbers. Only the DCO(L) can issue ‘Underground Maps’ (authorising live electrical DC cable runs), except for LPH/LPD where subtly different procedures apply due to their larger size of electrical distribution system. The Electrical DC Teams have the following areas of responsibility:

a. Electrical State 1 Preparation.

b. Blanket Searching.

c. Electrical Damage Repairs.

d. Emergency Cable Running.

1530. The Role of the DCO(L) Assistant

The DCO(L)'s Assistant has a key position within the Electrical DC organisation. Their primary task is to permanently man the 'Green Line' acting directly on behalf of the DCO(L) and as such is 'in charge' of the Green Line, regardless of rank. Instructions passed to the Electrical Repair Party Posts and the Weapon Section Base should be acted upon as if given directly by the DCO(L). Following damage, the assistant is to control the flow of information from the Electrical Repair Party Posts to ensure vital information is not missed. Details should be written or marked in a legible format utilising the Electrical Incident Board and the Essential Supply Availability Board, so that the DCO(L) can easily assimilate the information. The assistant should regularly update the electrical incident boards with all losses, BDR (including fires and floods) and equipment failures. An ideal opportunity is during the Command Huddle where communications are minimised allowing a limited time to update each board. This information should then be passed to the I/C Electrical Repair Party Posts. The flash procedure is only to be used if the information affects the Command Aim either by the loss of a supply/equipment or its subsequent restoration.

1531. BDR Electrical Information and Stateboards

a. The DCO(L) is to have electrical information Stateboard(s) detailing the Main LV Electrical Power System and the Emergency Supply System for use in the event of damage. These boards are to be of a standard design across each class of ship with only slight differences due to the current state of each ships enhancement/A&A fit. General guidance for typical information to be included on the stateboards comprises:

(1) A main electrical supply system line diagram from ships generators (or HV/LV transformers) to EDCEDP/EDR detailing all major components. A facility for annotating generator and emergency supply loading (KW or Amps) must be available.

(2) An emergency supply system line diagram ('Underground Map') overlaid onto a BDR plan of the ship. This is to include:

(a) Permanent risers.

(b) Through bulkhead connectors.

(c) EDCs/EDPs.

(d) Equipment capable of accepting emergency cables.

(e) Deck/bulkhead glands.

(f) Sequentially numbered Portable Pump sockets including normal supply details.

(g) All sources of emergency electrical supply eg Main and Emergency Switchboard Emergency Supply Units (ESUs) and Electrical Distribution Centres (EDCs) outlet socket connections (if fitted).

(h) Location of portable transformers, fuse panels and link boxes.

(i) Location of major items of electrical equipment.

(3) An electrical incident board used to list all the electrical defects requiring repair action including ETBOL. This board is to be used in support of the electrical ‘tote board’.

(4) A common electrical tote board with a priority numbering system is to be used at all positions (1,2,3,4,5,6, etc). This will enable each defect authorised for repair, to be given a unique priority with the top 3 aligning with the Command Aim. If the priority subsequently changes, then the numbering system can be altered accordingly. Other information to be detailed is the nature of the defect and the related ETBOL.

(5) An essential supply availability diagram - ‘ban the bomb’ or its equivalent.

(6) A comprehensive list of EDC/EDP MCCBs including the fuse ratings and location of spare circuits.

(7) Details of main supply cable routes are to be held and include interconnector cables between switchboards and feeder cables to EDCs/EDPs.

(8) A list of all key WE weapon and sensor supplies that align with the Weapon Section Base Weapons and Sensors state boards.

(9) Details of Converted Supplies including Control and Communication Switchboards, Transformer Rectifier Units, Static Frequency Changers, Motor Generators, and Low Power batteries for ME and WE equipment.

(10) Copies of the Underground Map for all sections split into relevant electrical zones as required. The details of each electrical section should overlap its neighbour by at least one ship section to prevent inadvertent connection of 2 separate sources of supply.

(11) A list of pre-made emergency cables detailing its number, rating, length and location.

(12) A list of manpower available for Electrical DC including their dispersal station.

(13) A Blanket Search check off list to enable confirmation of completed routes.

(14) A list of State 1 preparations for each section.

(15) An area detailing the Command Aim, IBC's priorities and threat levels - Air, Surface, Sub-Surface, Mine and CBRNDC.

b. All documentation should be positively secured for action, yet portable in the event of HQ1 being evacuated. If this is not practical due to the sizes and number of boards, then a duplicate set must be held at HQ2 and information transferred to it from the Electrical Repair Party Posts.

1532. Damage Control State 1 Preparation

On closing down to Damage Control State 1 Condition Zulu the material state of important electrical equipment is to be checked and made ready. The following preparations are given as guidance and may differ between classes of ship:

a. All compartments are to be secured for action.

b. Major equipment Tagged Out and/or Out Of Action (including OPDEFs) is to be noted on the electrical Stateboard.

c. Blanket search cards are to be annotated with the state of any MCCB already open on assuming State 1 and the current state of the distribution system.

d. Personnel are to be mustered and manning levels reported to DCO(L).

e. Electrical DC lockers are to be mustered and any deficiencies noted. For the contents of the lockers see BRd 2170(3) Chapter 2.

f. Personnel are to have available or carry:

(1) Torch/miners headlamp.

(2) Voltage Unitesters.

(3) DC Rubber Gloves (checked and serviceable).

(4) Electrical rates Rationalised Tool System (RATs) toolbox or similar equipment.

(5) Waterproof wax or permanent pens and blanket search route cards.

(6) All electrical safety rescue hooks located and available for use by personnel acting as a safety numbers for workers engaged in ‘live’ electrical work.

(7) Field Back Packs for DC(L) personnel to carry tools and equipment.

g. Portable pump sockets are to be checked for 440V 3 phase supplies.

h. The LV Electrical Distribution System is to be configured correctly for State 1 and emergency generators run up and proved on load. When an attack is imminent, all available generators should be running and on load to reduce supply losses.

i. Check for 440V output from the Switchboard Emergency Supply Units and EDC/EDP Emergency Outlet Terminal Sockets.

j. All Battle Override switches (if fitted) are to be unlocked with the switch put to the override position (only unlocked for exercise purposes).

k. Ensure the following tools/General Purpose Testing and Measuring Equipment (GPTME) is available in each section:

(1) MIT 420.

(2) Clip on/Fluke Ammeter.

(3) Flukes.

(4) Unitesters.

(5) Cable repair equipment and consumables.

(6) RATS toolkits.

l. Check emergency/contingency lighting is operable.

m. All equipment is to be re-secured for action on completion of State 1 preparation.

n. Test all primary and back-up methods of communication.

1533. Blanket Searching

a. When a blanket search (automatic response to the order **"STAND TO"**), is initiated the search is to include inspections of the electrical distribution system and equipment in accordance with Blanket Search route cards. These cards must be comprehensive and include a set route to follow and indicate equipment to be checked. They must also provide an area for annotating defects to enable details to be passed to the I/C Electrical Repair Party Post without omission. If possible, serviceability checks are to be made as part of the blanket search. This will allow for prompt and accurate repair actions to be developed. The blanket searchers should be suitably trained to recognise fault conditions and be fully conversant with electrical safety. If an incident is discovered during the blanket search one person is to deal with the incident whilst the other contacts the relevant switchboard and then continues with the blanket search. The following is a general guide on items to be checked but is not an exhaustive list:

(1) **Electrical Distribution Centre (EDC)**

(a) Check the compartment or immediate vicinity for obvious signs of damage.

(b) Check that the busbar supply lamp is illuminated.

(c) Check that the Earth Percentage Meter indicates zero, if not make a note.

(d) Open the MCCB cubicle door and check for the following:

- Damage to EDC;
- Unusual smells or burning;
- Tripped breakers. Reset once, if further trip occurs note as defective; and
- Check fuses for signs of rupture (red pop-out).

(e) Check the integrity and condition of the electrical cables going into and coming from the EDC.

(2) PECP/SECP and Main Switchboards

(a) Carry out full earth check, if not automatic within the MEPS.

(b) Carry out a discrepancy switch lamp test.

(c) Check the voltage, frequency and load of the running generators are within tolerance and stable.

(d) Check the condition of all switchboard Main Breakers and MCCBs supplying EDCs or equipment (eg compressors, fire pumps, Radar 997) where fitted.

(e) Check that a 440V output is still present from the Emergency Supply Units if in use.

(3) Conversion Machinery

(a) Check the condition of both static and rotating electrical conversion machinery if located within a CMR. Conversion machinery associated with individual equipment's and in its vicinity should be checked by the end user eg Sea Wolf SFC.

(b) Check the Control and Communication switchboard parameters and indications are correct, including a full earth check.

(4) General Equipment Checks

(a) Check Normal and Alternative supplies are available, where indicated.

(b) Check for signs of single phasing of motors, damage to equipment casings, electrical cables, shock mounts, pipe work and pump bellows as appropriate. Obvious indications of mechanical damage should also be noted.

(c) Reports on serviceability should be passed to DCO(L) at the earliest opportunity.

(d) Check indication lamps/instrumentation are within the required parameters.

b. Where EDCs are located in MMS, it may be more efficient to arrange for MMS crews to conduct blanket searches in those areas, passing electrical defects and 'blanket search complete' reports to DCO(L) via the MEOOW1. Similarly in ships where the large geographical separation of some EDCs and lean manning precludes a rapid blanket search, electrical blanket searches may be conducted by suitably trained FRPP or WE personnel, and reports passed to DCO(L) via the Weapon Section Base (WSB) or Switchboard 'Green Line'. In both cases, the responsibility for training of personnel lies with DCO(L), as does the provision of blanket search route cards.

1534. Incident Reporting

Following a comprehensive blanket search, compilation of the electrical defects is to be carried out by the I/C Electrical Repair Party Post, prior to information being passed to DCO(L). This will ease the task of prioritising defects enabling an accurate picture to be established prior to the Command Huddle. To aid the DCO(L), essential equipment supply losses that affect the Command Aim should be passed in full; eg **"M1-35 MCCB is tripped and will not reset - Normal supply to Goalkeeper".** Losses should be supported with serviceability checks and ETBOL's where possible. Verbal transmission on the 'Green Line' should be orderly and controlled by the DCO(L) Assistant. Whilst one switchboard I/C is passing information through to DCO(L), the other should annotate defects on his electrical Stateboard for information.

1535. DCO(L) Management of Electrical Losses

a. The Command Aim and IBC's priorities drawn from the Command Aim is pivotal in allowing DCO(L) to formulate his priorities. The Command Aim and IBC's priorities should be passed to all Electrical Repair Party Posts on each occasion that it changes and written in a prominent position on the electrical Stateboard for all to see. Reported losses should be marked up, on the Essential Supply Availability Diagram so picture compilation can be established. All electrical defects are to be annotated on the electrical incident board so that a long-term plan for rectification of lesser important defects can be established once priority defects have been dealt with. Information regarding losses which directly affect other key directors should be passed to them at the earliest opportunity, either verbally or using a method such as the 'post-it' routine. A list of the top 3 defects affecting the Command Aim, subsequent repair actions and ETBOLs should be compiled in readiness for the command huddle and subsequently passed to the Electrical Repair Party Posts. Repair actions issued should then be placed on the 'tote board' alongside the nominated Electrical Repair Party Post, its allocated priority and ETBOL. The 'tote board' is used to list all types of defects being dealt with and not just cable runs. Only when the repair or cable run is complete can the defect be removed from the 'tote board'. On completion of restoration of supplies or defect repair, the Command and the end user must be informed of its availability.

b. Losses affecting the Command Aim should be passed to the IBC; and if associated to weapons and sensors passed to the Weapon Section Base as a matter of urgency. Equipment losses reported to DCO(L) from the Weapon Section Base or via one of the other key directors in the SCC/HQ1 should be passed on to each Electrical Repair Party Post by the DCO(L) Assistant. Likewise, details of whole ship BDR incidents should be passed out to the Electrical' Repair Party Posts at a convenient point for annotation to their Stateboard.

1536. Electrical Incident Board Marking

a. Should events dictate, anyone suitable, qualified and experienced might be called upon to take over the position of DCO(L), I/C Electrical Repair Party or the DCO(L) Assistant. It is therefore essential that incident boards be marked in a format using standard Symbology. Incident boards are to be marked using coloured permanent marker pens; non-permanent marker pens or dry-wipe board markers are not to be used. Ink from permanent marker pens can effectively be removed using a standard pencil eraser or medical methylated spirit swabs. Standard markings for different classes of ship for the Essential Supply Availability Board are detailed at Figure 15-9.

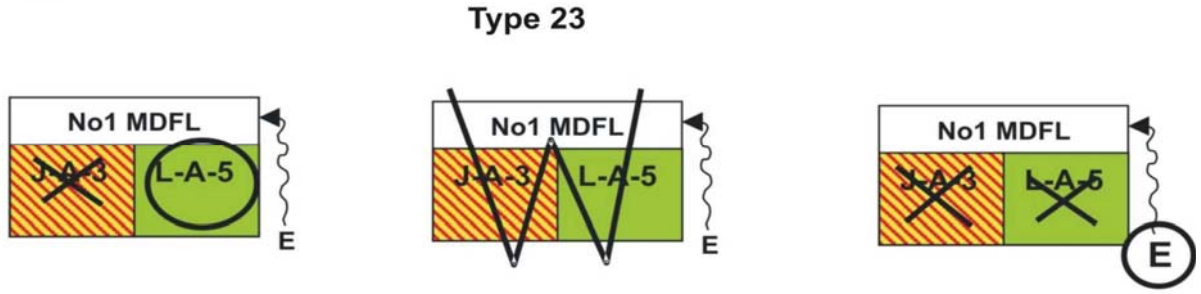
(1) Lost supplies should be marked with a 'X'.

(2) Equipment running in Alternative should have a 'ring' around the supply details to indicate that it is being supplied from its alternative supply.

(3) Wrecked equipment should be marked with a 'W'.

(4) Equipment running from Emergency Cables should be marked with an 'E' and circled to indicate that it is being supplied from emergency cables.

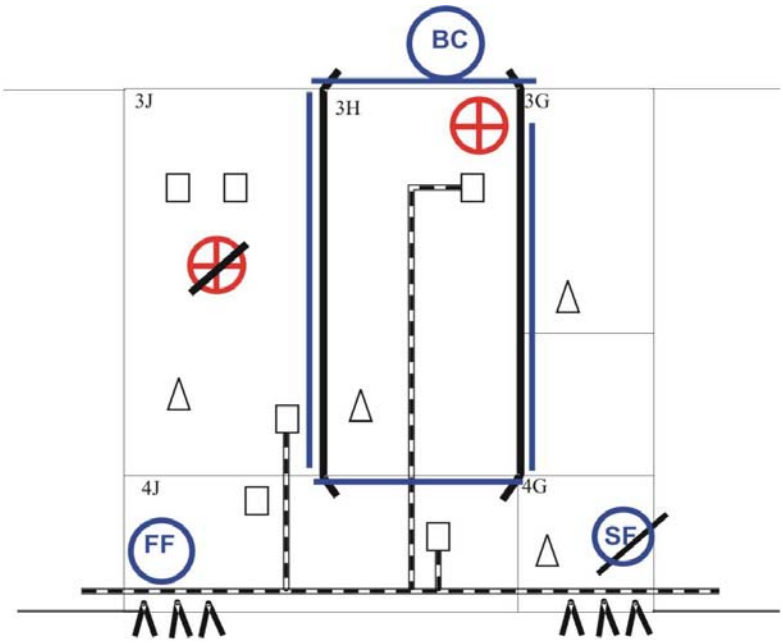
Figure 15-9. General Markings on the Essential Supply Availability Board



Note. *Due to the number of variants of the Essential Supply Availability Boards, marking of electrical losses should follow as far as possible the convention detailed above. If significant differences exist then a standard workable routine should be adopted at all positions.*

b. Whole ship damage incidents are to be marked on DCO(L)s and the I/C Electrical Repair Party Posts Emergency Supply Diagram (‘Underground Map’) to enable electrical incidents to be managed safely and to appreciate potential damage to electrical equipment and personnel. Incident markings are to follow the standard Annex 7B Symbology. Due to the limited space available, the symbols should be reduced so that they do not obstruct the marking up of electrical incidents. Completed incidents are not to be erased from the Stateboard but minimised and have a black line scored through as a reminder that electrical checks are required on electrical DC equipment. Once these checks have been carried out, the incident can then be removed from the board. Examples of damage control incidents marked on the ‘Underground Map’ are detailed at Figure 15-10.

Figure 15-10. BDR Symbology Minimised on the ‘Underground Map’



1537. Emergency Cable Run Diagrams

The DCO(L) is responsible for the issue of hand held cable run diagrams (‘Underground Maps’). It is vital that these remain under the strict control of the DCO(L) due to the dangers prevalent from unauthorised cable runs (electric shock and/or inadvertent paralleling between switchboards). Initial information on individual cable runs may be passed verbally over the ‘Green Line’ to allow prompt action to re-supply equipment until the map is issued. The cable run diagram is then used to back up the verbal instruction and is authorisation to apply power. It should be noted that on larger ships the issue of the cable run diagrams is delegated to the I/C of the Electrical Repair Party Post. On all other ships fitted with an Emergency Cable capability the cable run diagram must be issued by DCO(L) from HQ1 and not delegated to the Electrical Repair Party Posts/Switchboards. The only exception to this directive is when an evacuation of HQ1 is in progress and DCO(L) is relocating to AHQ. Prior to evacuation, where possible, DCO(L) is to issue verbal authorisation via the ‘Green Line’ to the Electrical Repair Party Posts/Switchboards supervisors to conduct necessary cable runs without further authorisation. Once relocated DCO(L) is to conduct a verbal handover of responsibilities via the ‘Green Line’, ensuring that he is fully briefed of any actions taken in his absence. The following procedures and guidelines are to be followed when compiling cable run diagrams:

a. The equipment is to be confirmed serviceable prior to issue of a ‘Underground Map’.

b. Normal and Alternative electrical supplies must have been lost prior to ordering an emergency cable run.

c. Cable run diagrams are to be used as the primary method of authorising the running and powering up of emergency cables. Failure to receive a cable run diagram due to whole ship incidents should not prevent power from being turned on provided the I/C of the Electrical Repair Party Post is content that the run has been completed safely. Verbal authorisation to apply power must be sought from DCO(L).

d. Cable runs are to be indicated on DCO(L)s and the I/C Electrical Repair Party Posts Emergency Supply System diagram by broken lines until the run is complete, after which the line is made continuous once power has been proved present at the equipment. Individual cables which are complete may be indicated with a tick until the whole run is completed. Lines are to be coloured green, using a permanent marker.

e. The cable run must identify from the service to the source of supply. Any connection to a point already energised with power must be clearly marked **‘LIVE’**.

f. Cables marked on diagrams issued to cable running teams are to be indicated on the cable run diagram using green continuous lines (not broken), together with the following information:

(1) The time of issue.

(2) An ETBOL. Real time four digit term eg 1405 (pronounced one-four-oh-five).

(3) A unique priority.

(4) The equipment or service to be supplied.

(5) Priority MCCBs to be closed if re-supplying an EDC from an adjacent EDC.

(6) Any DC incident (eg fire or flood) which may impede the cable running activity or passage to a particular section.

g. Cable run diagrams are to be dispatched from HQ1 to Electrical Repair Party Posts in plastic envelopes for protection. Laminated cable run diagrams may be used as long as details are marked with permanent marker pens.

h. On completion of a cable run, the I/C Electrical Repair Party Post is to ensure the cable run diagram is returned to the DCO(L)(DD/FF). Verbal acknowledgement to DCO(L) is sufficient once the diagram has been returned to the I/C Electrical Repair Party Post.

i. Electrical sections or zones should be marked on the DCO(L)'s Emergency Supply Diagram and 'Underground Maps' to highlight points of demarcation preventing inadvertent paralleling of generators.

1538. Emergency Cable Running Procedures. (BR 2000(52)(1) Para 0318 refers)

Prior to commencing the cable run, the electrical ratings undertaking the required cable run are to receive a comprehensive safety brief from the I/C of the Electrical Repair Party Post on the specifics of the run and any possible associated hazards. Emergency cables are not to be pre-run in anticipation of action damage. The following procedures are to be strictly adhered to when running cables:

a. Whenever possible, personnel should work in pairs.

b. Personnel **MUST** wear electrically insulated rubber gloves whether power is applied or not.

c. Emergency equipment previously exposed to fires or floods must be checked for earth faults and short circuits with GPTME prior to use.

d. Cable runs must be from the service equipment to the source of supply. If 2 teams are undertaking the run, then a 'leapfrogging' technique may be adopted but must be closely supervised by the I/C cable running team.

e. Emergency cable spill ends must be kept clear of the deck at all times. Where possible the whole cable should be kept clear of the deck to prevent water contamination and abrasive damage.

f. Care must be taken to ensure that the running of emergency cables does not breach watertight/gastight (WT/GT) integrity and the effectiveness of smoke boundaries are not compromised. If they have to breech WT/GT integrity the permission of the respective FRPP Officer must be sought.

g. Cables are to be run in such a manner as to allow them to be moved quickly in the event of further damage in the vicinity.

h. Emergency cables should not obstruct operating mechanisms such as rod gearing.

i. Cables can be hung from any structure solidly mounted to the ship's hull with certain exceptions. The cables weight should be secured and supported using 'S' hooks (sky hooks) where possible. Examples of structures **NOT** to be used to support emergency cables are:

(1) Any pressurised small bore pipe work such as HP air, hydraulics and pneumatics.

(2) Existing electrical cables to prevent damage to their insulation.

(3) Non-robust installations that may fail due to excess weight.

(4) Doors or hatchways that may impede firefighting teams or personnel carrying out other duties.

j. Cables should not be coiled around fixtures and fittings to take up extra length. This could lead to induced currents, overheating and subsequent fire.

k. Prior to connecting cables to any HCOS, the switch should be set to the off position. Prior to switching to Emergency, the Normal and Alternative supplies are to be confirmed as isolated and the 3 phase emergency supply confirmed as present but not energised (eg emergency generator, switchboard ESU or EDC is serviceable).

l. 440V warning tallies must be secured adjacent to all **LIVE** connection points. For long cable runs, 440V warning tallies should be placed at regular intervals along the cable length.

m. The emergency cable run must be inspected by a competent rating before the electrical supply is energised ensuring all connections are sound, warning tallies are in place and it conforms to the instructions of the cable run diagram. Once power has been applied, 3 phase voltage must be confirmed as present at the nearest point to the service being supplied.

n. On completion of the emergency cable run and when power has been applied, the emergency supply is not to be interrupted without prior permission from DCO(L). Generator and ESU loadings are to be monitored and readings passed to HQ1 and FRPPs every 15 mins or when large load changes occur.

o. During a lull in the action, consideration should be given to securing the cables more permanently using cable ties, rope or other suitable material to allow the ‘sky hooks’ to be returned to the electrical DC lockers.

p. ESU loadings must be measured when power is first applied to the emergency cable run; this must be repeated, and recorded, every 15 mins whilst the cable is live.

1539. Equipment Isolation

Details of equipment isolations is provided in Annex 17E.

1540. Use of Rubber Gloves

a. Rubber gloves are to be carried by all members of the Electrical Repair Party at all times. They are to be manufactured to BS EN 60903 which have a maximum working voltage of 1000V AC and will be marked with the words ‘Class 0’ or a red colour code marking. The gloves are to be correctly stowed in the electrical DC lockers when not in use, ensuring that they are not compressed, folded, exposed to any source of heat or prolonged periods of sunlight or artificial lighting. Prior to use, each glove should be checked for perishing and be inflated to check for air leaks. Under no circumstances should voltages in excess of 1000V AC be touched wearing rubber gloves.

b. Rubber gloves should be worn at all times when running emergency cables. When investigating cable damage in trunks or channelling, they should be worn until all damaged cables have been electrically isolated, after which they can be removed for ease of cable repair. Damaged equipment should initially be investigated with rubber gloves worn until isolations have been confirmed, after which they can be removed.

c. Anti-flash gloves may be relaxed for ease of repair following approval from DCO(L). They must be readily to hand for quick replacement on the order of **"Brace, Brace, Brace".** One or two additional sets of gloves should be carried to allow for torn gloves or to enable extra manpower such as a WE maintainer to assist with the run.

1541. Defect Repair

Components required to repair equipment are normally drawn from naval stores. If Naval stores do not carry the required component then DCO(L) and the Electrical Repair Party Post I/C's should look for non-essential equipment that they can remove the component from. Alternatively wrecked equipment with similar components can be used.

1542. Cable Repair Techniques

The ability to undertake a variety of cable repairs is essential to maintain the Operational Capability and fighting effectiveness of the ship, however cable repairs to High Voltage power cables are not to be undertaken (1000V AC or 1500V DC). It is therefore essential that all members of the Electrical Repair Party Post are capable of carrying out repairs safely and competently. Before instigating repair action, the DCO(L) should ascertain the full extent of the damage and determine the following points:

a. **Does the defect affect the Command Aim?** There is little point carrying out a repair if it is not in support of the Command Aim unless time, manpower and resources are available. Due consideration should be given to ensure that any repair required relates to the restoration of electrical supplies to equipment that is essential and the use of alternative equipment does not provide a safer solution.

b. **Is it safe to carry out the repair?** Can the cable be electrically isolated and the area made safe. Is the cable repair within the capability of the repair team because of the size and nature of the cable (eg generator main supply cables probably not).

c. **Are the correct tools and equipment available?** The preferred method of cable repair is with use of proper inline crimps and splices using an appropriate tool. Electrical repair teams should ensure that a variety of crimps and splices are held along with the correct tools and die sets including insulating self-amalgamating tape. A basic cable repair kit made up by ships staff should consist of the following:

(1) An item of GPTME suitable for measuring voltage and resistance. The voltage range should be 24 to 1000V and 0 to 1MΩ.

(2) Insulated rubber gloves.

(3) A sharp knife.

(4) A small hacksaw.

(5) Pliers, side cutters (snips) and cable strippers.

(6) Self-amalgamating tape.

(7) Phase identification tape (red, yellow and blue).

(8) A selection of different sized terminal blocks with the appropriate screwdriver.

(9) A sufficient quantity of crimps and splices to make a repair connecting a minimum of 4 separate cores.

(10) A selection of different sized, separately bagged, groups of 4 bolts each fitted with 2 plate washers and nut.

(11) A selection of cable ties.

(12) Water-displacing silicone gel.

(13) A permanent marker.

(14) Pen and pencil.

(15) Cardboard identification tags for cable marking.

d. For guidance regarding cable selection, jointing and repair, refer to the following publications:

(1) BR 2000(51)(4A) - Workshop Technology Electrical Practices.

(2) Def Stan 02-512 Part 8 - Guide to Cables, Electrical and Associated Items.

(3) BR 4603(1) - Electrical Installation Manual Volume 1 Installation Practices.

SECTION 3 - DAMAGE CONTROL AND FIREFIGHTING IN A HIGH VOLTAGE (HV) ENVIRONMENT

1543. Introduction

a. The following guidance for damage control and firefighting within HV compartments has been derived from best Naval practice and commercial experience. Guidance within this section must be modified and endorsed by platform class CBRNDC orders to reflect the specific design of any HV system.

b. The policy and procedures to be adopted in a State 1 environment are detailed in the class specific BRd 2170 Vol 7 and if appropriate Departmental Standing Orders.

1544. Definitions

a. **High Voltage Environment.** A HV environment is said to exist if voltages present within the compartment or equipment exceed 1000 volts AC (1KV) or 1500 volts DC (1.5KV) under normal working conditions. Where a compartment contains no HV equipment but is transited by HV cables the compartment is to be considered as a HV compartment in the event of a fire within. Kill Cards for such compartments are to have HV cable runs annotated in **RED**.

b. **The Authorising Engineer.** The Authorising Engineer (AE) is to comply with the regulations in BRd 3000 and BR 2000(52)(1).

c. **HV Live.** This term is used to inform personnel that the ship is either generating HV, is capable of generating HV or is connected to an external HV Shore Supply.

d. **HV Disconnect/HV Disconnected.** This term is used as a request to, or order from, the Command for competent ME personnel to disconnect a particular equipment or compartment from the HV power system but not secure individual breakers (eg HV Disconnect the FAMR). HV breakers feeding the relevant equipment/compartment will be opened (but not racked out).

e. **HV Isolation.** This term is used to inform personnel that an equipment or compartment has been disconnected and separated from the source of electrical energy in a secure fashion (eg HV Breaker Open and Racked Out).

f. **HV Safe.** This term is used to inform personnel that a particular compartment/area is safe to enter with all forms of HV power source disconnected, and the appropriate HV decay periods have elapsed. This term must only be used in conjunction with the clearly identified compartment/area.

g. **HV Dead.** This term is used to inform personnel that the ship is no longer capable of generating HV and all sources of HV supply are to be disconnected and isolated with circuit main earths applied.

Note. *There is a clear requirement to utilise the terms* ***HV ISOLATION*** *and* ***HV DISCONNECT/DISCONNECTED*** *within the SCC/MCR to ensure that operators are in no doubt over the state of HV systems. However, the only terms which should be used over the main broadcast are* ***HV SAFE*** *and* ***HV LIVE.***

1545. HV Hazards

Damage control and firefighting within a **LIVE** HV environment can expose personnel to a number of additional hazards including:

a. Massive electric shock from **LIVE** equipment.

b. Blast effects resulting from an internal arc caused by either battle damage, damage control and firefighting activity in the vicinity or the development of an initial electrical fault.

c. Exposure to dangerous arc products.

d. Increased exposure to the fire hazard due to the restrictions placed on firefighting.

e. Increased fire propagation resulting from the initial delay in using more effective firefighting equipment until such time that HV equipment is made safe.

1546. HV Fires

WARNING

IT IS IMPORTANT TO NOTE THAT WATER (EVEN IN THE FORM OF SPRAY OR AFFF FOAM) AND DIRECT INJECTION OF CO_2 ARE TOTALLY UNSUITABLE FOR FIGHTING FIRES ON LIVE HV EQUIPMENT.

a. Electrical fires are so called because they are usually caused by some fault to a live electrical circuit, which has generated sufficient heat to ignite insulation, paint or some other combustible material close to it. The fault is often caused by:

(1) A breakdown in insulation resistance of an electrical component or cabling.

(2) Water ingress.

(3) Action damage.

(4) A breakdown of clearance distances eg introduction of conducting foreign bodies.

b. The heat generated by an unprotected HV electrical fault can in extreme cases be sufficient to instantaneously vaporise the conductors in the fault region resulting in rapid expanding flame front that will seek an escape route from the cabinet and into the compartment. The extent of the flame front or blast effect will depend on the design of the equipment and only last momentarily whilst the residual fire will depend on the amount of combustible material in the vicinity of the equipment.

c. Due to the high fault energy inherent within the high voltage system, HV fires will not be extinguished until electrical power is first **DISCONNECTED** and this is more than likely to occur either through the correct operation of the safety protection devices fitted (eg circuit breaker trip) or due to the high energy discharged through the fault region resulting in an open circuit.

1547. Ingress Protection Codes and Categories of Enclosure

a. Ingress Protection (IP) codes are a commercial standard laid down in British Standards whereas Categories of Enclosure are a military requirement described in Defence Standards (see Table 15-1).

b. With the introduction of HV equipment their existence and importance has been brought into focus regarding RN firefighting policy. The specification defines the environmental protection performance of the enclosure. The first figure of the code identifies the degree of protection against the ingress of solid objects. The second figure indicates the resistance offered by the enclosure to water penetration.

c. Therefore an IP65 rating means that the unit is protected against access with a wire (1 mm), is dust tight and withstand jetting water from all directions.

d. HV compartments will contain IP rating tallies on all electrical equipment, however, it must be noted that that the IP ratings for equipment can and do degrade over time, particularly if maintenance or defect rectification has been undertaken incorrectly.

e. **Categories of Enclosure.** Although the IP Code is used in the specification of Naval equipment it supplements, but not replaces, the enclosure category. The general categories are as follows:

(1) **Category 1**. Normal drip proof.

(2) **Category 2**. Totally enclosed and spray proof.

(3) **Category 3.** Watertight to 0.1 bar.

(4) **Category 4**. Watertight at 0.4 bar.

(5) **Category 5**. Watertight to pressures above 0.4 Bar.

f. The majority of electro technical equipment will fall into Category 1. However, equipment intended for installation in machinery spaces with fixed firefighting spray systems must be enclosed at least to Category 2.

g. IP ratings are mainly dependent on the type of ventilation required for the equipment and the quality of the cable glands. Additionally poor maintenance, such as not replacing doors and panels correctly, or not changing damaged seals, will degrade ingress protection, but not change the equipment rating.

Table 15-1. Ingress Protection Codes

PROTECTION AGAINST ACCESS TO HAZARDOUS PARTS FIRST NUMERAL	
Number	**Description**
0	Non - Protected
1	Protected against access with back of hand (50 mm)
2	Protected against access with jointed finger (12 mm)
3	Protected against access with a tool (2.5 mm)
4, 5, 6	Protected against access with a wire (1 mm)
PROTECTION AGAINST INGRESS OF SOLID FOREIGN OBJECTS FIRST NUMERAL	
Number	**Description**
0	Non - Protected
1	Objects equal or greater than 50 mm
2	Objects equal or greater than 12.5 mm
3	Objects equal or greater than 2.5 mm
4	Objects equal or greater than 1 mm
5	Dust Protected
6	Dust Tight

INGRESS PROTECTION CODE - SECOND NUMERAL		
IP Code	**Protection Against Ingress of Solids**	**Meaning For Protection From Ingress of Liquids**
0	No protection	No protection provided.
1	Protected against vertically falling drops of water. Limited ingress permitted.	Vertically dripping.
2	Protection against vertically falling drops of water with enclosure tilted 15° from the vertical. Limited ingress permitted.	Dripping up to 15° from the vertical (equivalent to CO_2 and Dry Powder Fire Extinguishers).
3	Protected against sprays to 60° from the vertical. Limited ingress permitted.	Limited spraying.
4	Protected against water splashed from all directions. Limited ingress permitted.	Splashing from all directions.
5	Protected against low pressure jets of water from all directions. Limited ingress permitted.	Hosing jets from all directions.

Table 15-1. Ingress Protection Codes (Cont'd)

INGRESS PROTECTION CODE - SECOND NUMERAL (Cont'd)		
IP Code	**Protection Against Ingress of Solids**	**Meaning For Protection From Ingress of Liquids**
6	Protected against strong jets of water.	Strong hosing jets from all directions (equivalent to a Centre Fed Hose Reel (CFHR)).
7	Protected against the effects of immersion between 15 cm and 1 m.	Temporary immersion (equivalent to a Size 2 Hose and F/F Nozzle).
8	Protected against longer periods of immersion under pressure.	Immersion.

COMBINED CATEGORY AND IP RATINGS				
Enclosure Category	**Description**	**Minimum Acceptable IP Rating**	**IP Protection Against Solids**	**IP Protection Against Liquids**
1	Normal Drip Proof	IP32	>2.5 mm	Dripping
2	Totally Enclosed and Spray Proof	IP54	Dust Protected	Splashing
3, 4, 5	Watertight	IP68	Dust Tight	Continuous immersion up to 1 m

1548. Real Time Risk Assessment

WARNING

WHILST PROVIDING GUIDELINES FOR DAMAGE CONTROL AND FIREFIGHTING, EACH INCIDENT MUST BE EVALUATED IN REAL TIME AND THE APPROPRIATE ACTIONS TAKEN, BALANCING THE DANGER TO THE SHIP POSED BY THE FIRE AGAINST THE RISK TO PERSONNEL FROM LIVE HV EQUIPMENT.

a. It is important to emphasise that the initial response to incidents (fire and floods) within compartments containing correctly functioning LIVE HV equipment must be rapid, instinctive and safely undertaken within the guidelines detailed in this Section.

b. It is a general principle that where the HV equipment has sustained damage or is malfunctioning, power must be **DISCONNECTED** before committing personnel into the compartment.

c. At increased levels of operational intensity it must also be borne in mind that damage control and firefighting activities may compromise the integrity of the power and propulsion plant, degrading fighting capability and subsequently jeopardising the mission aim. Hence, operational posture and the tactical environment will undoubtedly impact on the decision whether to HV **DISCONNECT** or contain an incident without disconnecting to maintain the fighting capability for as long as practicable under battle conditions.

d. At increased levels of operational intensity, if an incident or the response to an incident is likely to result in water or FF media impinging on live HV equipment a dynamic risk assessment must be undertaken by the Authorising Engineer to inform command and justify the increased risk to personnel against the broader mission aim.

Note. *Where fire has ignited on the low voltage elements of high voltage equipment (control circuitry in addition to LV windings of link transformers), it may cause damage to the control; monitoring and/or safety devices fitted and could subsequently lead to a HV fault.*

1549. Fires Within a Live HV Compartment

a. Where all HV equipment within the compartment has ingress protection (IP) of IP56 or greater (generally RN Main Machinery Spaces) and the integrity of the HV equipment is not endangered by the fire, then manual firefighting is permitted using dry powder, CO_2 extinguishers, AFFF SPE and CFHRs. Where any HV equipment within the compartment has an IP rating of less than IP56 (generally HV and LV switchboards and RFA Main Machinery Spaces), then manual firefighting is limited to CO_2 and dry powder extinguishers. Manual injection ports for CO_2 extinguishers must **NOT BE** used on HV equipment until it has been **DISCONNECTED** and reported as HV **SAFE** over main broadcast.

b. CFHRs may be deployed and used in compartments with live HV equipment where the ingress protection of all the HV equipment is IP56 or above, although HV equipment should not be intentionally sprayed. Power should be **DISCONNECTED** and reported as HV **SAFE** over main broadcast as soon as operationally practicable. In compartments where the ingress protection of the HV equipment is less than IP56, then CFHRs should remain stowed and isolated until the affected space is **DISCONNECTED** and reported as HV **SAFE** over the main broadcast.

c. Lay flat hoses must neither be deployed nor charged within any HV compartment where the ingress protection rating of the HV equipment is less than IP 57 (submersible) until such time that it has been confirmed that all HV equipment in the affected space has been **DISCONNECTED** and reported as HV **SAFE** over the main broadcast. Normal RN firefighting procedures are then to be followed.

Note. *Manual firefighting using AFFF SPEs and CFHR is permitted in compartments with an IP rating of less than IP56 ONLY when concessions are formally documented following agreement by the Naval Authority, Material Duty Holder and Operating Authority Duty Holder. Where concessions are held, SOPs should be amended accordingly.*

1550. Fixed Firefighting Systems

The following operating restrictions are applicable to current fixed fire suppression systems:

a. Fixed 2 shot CO2 drench systems are to be operated as follows:

(1) The first shot may be used without disconnecting power although where the fire has been initiated by a HV fault, then power should be **DISCONNECTED** as soon as practicable.

(2) The second shot should only be used after HV **DISCONNECTION**.

b. Fixed water/AFFF spray systems may only be operated over live HV equipment in extreme cases where the risk to the ship outweighs personnel safety. This normally, but not necessarily, refers to State 1 scenarios where an especially aggressive response to the fire is warranted. In such situations all personnel should be evacuated from the compartment and the operation shall only be authorised personally by the Authorising Engineer.

c. Fixed water/AFFF spray systems normally operated for compartment cooling should only be used when it has been confirmed that power to all HV equipment within the compartment has been **DISCONNECTED**. It is noted that in extremis where the ingress protection of all HV equipment within the compartment is IP56 or greater and operational constraints prevent the rapid disconnection of power then high level spray systems may be operated as soon as the compartment has been evacuated of all personnel. Fixed low level water/AFFF spray systems, normally fitted for bilge protection may be used without **DISCONNECTION** of HV supplies when the equipment within the compartment is IP56 or greater.

Note. *Equipment with an IP rating of 56 or less has no protection against the effects of immersion.*

1551. Portable Firefighting Equipment

The following operating restrictions are applicable to current portable firefighting equipment:

a. The CO_2 SPE may be used in the vicinity of live HV equipment up to 12 kV where the ingress protection is greater than IP22; however, CO_2 may not be allowed to directly impinge on live HV conductors due to the risk of ice forming on critical components degrading clearance distances. For this reason it is important that CO_2 is **NEVER** injected into **LIVE** HV equipment even though the fitted ports contain a deflector nozzle to mitigate the risk of direct discharge onto live conductors. CO_2 is an inert gas and will not support combustion or life at concentrations above 35%. It is heavier than air and displaces oxygen by forming a temporary blanket providing limited post fire protection, but no cooling effect. Carbon Dioxide will cause limited obscuration in use, however, its effectiveness can be significantly degraded by even weak ventilation, due to the reduction of CO_2 concentration levels.

b. Manual CO_2 injection ports fitted to HV equipment should only be used to extinguish any residual fire once the power has been **DISCONNECTED** to the defective equipment. However, CO_2 may be manually injected into the low voltage side of any HV equipment before disconnecting power where it is clearly marked safe to do so.

Note. *All panels containing CO_2 injection ports must be clearly marked with the maximum operating voltage of the cubicle.*

c. Dry powder may be used in the vicinity of live HV voltage equipment up to 12 kV, where the ingress protection rating is greater than IP22. Dry powder is a quick and effective smothering agent but has limited post fire protection and no cooling effect; it will also cause rapid obscuration and is significantly degraded by strong ventilation. The residual powder has been proved to be conductive but will absorb moisture and should be removed from electrical equipment as soon as reasonably practicable.

d. AFFF fire extinguishers should only be used in the vicinity of live HV voltage equipment if all the high voltage equipment within that compartment is protected by an ingress rating of IP56 or higher.

1552. Electrical Disconnection and Isolation

In all fire and flood situations in an HV compartment, permission for HV **DISCONNECTION** must be swiftly sought from the Command and, where necessary, achieved and maintained by the most appropriate means that ensures that the system cannot be inadvertently re-energised. All HV equipment in the affected space must have **HV ISOLATIONS** effected prior to firefighting teams conducting a full re-entry. The Officer in charge of firefighting and damage control (DCO at Sea and the OOD in Harbour) is to make a pipe on General Broadcast informing all personnel as soon as the compartment has been made **HV SAFE**. The following pipes are to be made:

a. **Smoke Alarm**

"SMOKE ALARM, SMOKE ALARM, SMOKE ALARM, SMOKE ALARM IN (Compartment Name, Location Marking and Fire Zone). THIS IS A HV COMPARTMENT. ATTACK PARTY (AND ME(ET)OW) TO INVESTIGATE".

b. **Fire**

"FIRE, FIRE, FIRE, FIRE IN (Compartment Name, Location Marking and Fire Zone). THIS IS A HV COMPARTMENT. ATTACK PARTY MUSTER AT THE SCENE. SUPPORT PARTY MUSTER AT (FRPP1, FRPP2, FWD FRPP, AFT FRPP). CONTAINMENT PARTY MUSTER IN HQ1/EMR. DROP ALL SMOKE CURTAINS AND CLOSE FIRE DOORS IN THE VICINITY OF THE FIRE".

c. Once HV is Confirmed **DISCONNECTED** and the decay time has elapsed:

(1) Pass and repeat HV **SAFE** to I/C Main Group.

(2) Make the following pipe x 2.

"THIS IS THE DCO/OOD, THE (Compartment Name and Location Marking) IS NOW HV SAFE. ALL FIREFIGHTING EQUIPMENT MAY NOW BE USED IN THE (Compartment Name and Location Marking)".

1553. Decay Times

HV decay times must be indicated on individual equipment and recorded on compartment Kill Cards. Local standing orders and standard operating procedures must be amended to reflect the additional hazard represented by decay times in excess of 20 seconds to decay to below 440V.

1554. Firefighting Procedures

The adopted firefighting procedures will depend on the design of the installed HV system as well as the operational state of the vessel and nature of the incident. Clear guidance must be provided in local standing orders and the ships firefighting teams (HFEP (Harbour)/SSEP (State 3)/FRPPs and Mobile Repair Parties (State 1)) must all be familiar with the procedures, layout and hazards within all HV compartments. The following generalised guidance is provided:

a. **Small Fires within a HV Compartment.** Small fires should be attacked, without waiting for electrical disconnections, using the most appropriate first aid firefighting equipment designated as safe for use within the compartment. Once power to the HV equipment has been **DISCONNECTED**, standard RN firefighting procedures may be applied, noting that the excessive use of water may cause significant damage to the HV equipment, putting it beyond operational use. If the fire is not easily contained then the early evacuation of personnel from the compartment should be considered and fixed suppression systems deployed in accordance with the local operating procedures.

b. **Small Fires on Low Voltage Equipment within a HV Compartment.** Standard RN firefighting procedures apply and a CO_2 extinguisher should be used either with a discharge horn or a bayonet connection for electrical cabinets; all electrical power to the affected equipment should be isolated as soon as reasonably practicable. If the affected low voltage circuits/equipment is integral to HV parent equipment, this equipment is to be HV **DISCONNECTED** as soon as practicable.

c. **Major Fires within a HV Compartment.** The compartment should be evacuated of all personnel and fixed fire suppression system deployed in accordance with the local operating procedures. Unless it is operationally essential all HV equipment should be **DISCONNECTED** as soon as reasonably practicable.

d. **HV Fires.** HV power must be **DISCONNECTED** as soon as practicable and where fitted the fixed fire suppression systems deployed in accordance with local operating procedures. Where there is no fixed suppression system, a controlled re-entry should be made once all HV equipment, low voltage equipment and other mechanical hazards within the effected compartment have been **ISOLATED** in accordance with accepted RN practice.

e. **Fire Danger within a HV Compartment**. Where immediate action is required or HV power cannot be **DISCONNECTED**, a localised fire danger may be made safe where the risk of not taking action outweighs the risk of exposure to high voltage.

This will depend on the location and ingress protection of the installed HV equipment. However, HV power should be **DISCONNECTED** as soon as operationally practicable as a precautionary measure and before applying any form of foam blanket where the ingress protection of the HV equipment within the compartment is less than IP56.

f. **Fire Alarm within a HV Compartment**. Members of the Attack Party should carry out investigating a fire alarm inside a closed HV compartment once all other means of evaluating the compartment state have been exhausted (eg CCTV/viewing port).

g. **HV Compartment Re-Entry.** Having **ISOLATED** the compartment, the method of re-entry and recovery will depend on the individual circumstances of the incident and operational state of the vessel; noting that the excessive use of water could cause significant damage to the HV equipment within the compartment and prevent the full recovery of that equipment. Where a fixed gaseous suppression system has been deployed or significant smoke and toxic gases have accumulated then a waterwall seal or closed door must be maintained at the containment boundary.

(1) Main machinery space re-entry is to be carried out in accordance with current firefighting procedures as detailed in Annex 17F and the ships specific CBRNDC Orders, once it has been confirmed that all HV equipment has been effectively **ISOLATED**. However, where a fixed fire suppression system has been deployed quickly and there has been minimal rise in the overall compartment temperature, consideration should be given to limiting the extent of water damage within the compartment with the careful choice of entry point and local risk assessment made on the amount of compartment cooling required.

(2) Dedicated high voltage compartments with fixed fire suppression systems and dedicated ventilation/purging arrangements (eg Gas Turbine Alternator) should be recovered using the re-entry principles outlined in Annex 17M, once all HV equipment has been effectively **ISOLATED** and the compartment temperature (monitored using the TMS) is below 60°C (see Annex 17A for re-entry notes).

h. **Boundary Monitoring/Cooling.** Boundary Monitoring may be carried out within **LIVE** HV compartments **ONLY** under the supervision of a Competent Person. However, should it become necessary to use water for cooling then power should be **DISCONNECTED** as soon as operationally practicable and plastic sheeting used to cover the HV equipment, noting the principles laid down in Annex 17D.

1555. Damage Repair Procedures

The appropriate HV safety procedures must be followed before undertaking damage repair on/or adjacent to HV equipment until such time that the operational tempo or Command aim require a more direct approach. Once HV power has been **DISCONNECTED**, standard Damage Control procedures should be followed. The following generalised guidance is provided for recovery under action or emergency conditions, noting that incidents can rapidly deteriorate with little warning:

a. **Pumping and Flooding.** Small floods remote from HV equipment may be contained without disrupting power to the Command and fixed pumping equipment deployed at the earliest opportunity. Major flooding is likely to cause significant damage to HV equipment and where it is non-submersible and in immediate danger from floodwater, power must be **DISCONNECTED** not only to safeguard the equipment and personnel, but also wider system integrity. Only portable electrical submersible pumps and fixed eductors should be used to remove floodwater in HV compartments; **portable routine eductors should not be used.**

b. **System Repair**. The repair of minor fluid leaks remote to HV equipment may be carried out following standard procedures without disrupting power to Command. Where appropriate, consideration should be given to covering HV electrical equipment with plastic sheeting to minimise risk to equipment and personnel. Major leaks from fluid systems that represent a serious risk and a danger of spray contamination of HV equipment are to be dealt with immediately. In such cases, HV equipment must be **DISCONNECTED** as soon as practicable until the fluid system has been isolated or repaired.

c. **Shoring.** Shoring must be carried out in live HV environments **ONLY** under the supervision of a HV Competent Person, and the risk of man-handled timber and steel shores adjacent to live HV equipment must be assessed against the Command's priorities and where possible power should be **DISCONNECTED**. If operationally essential, HV equipment may be re-energised post shoring at the discretion of the Authorised Engineer.

d. Extreme caution must be exercised in re-energising HV equipment and systems previously affected by action damage. Integrity testing and inspections should be undertaken in accordance with BR 2000(52)(2). Deviations from this procedure requires the authority of the Authorising Engineer as determined by operating regulations.

1556. Manning of Firefighting and Damage Control Parties (HFEP/SSEP/State 1)

All firefighting and damage control teams entering compartments containing live HV equipment are to comprise of sufficient HV Competent Persons to ensure the safety of both personnel and equipment. Therefore, provision must be made to ensure that there are sufficient personnel within the DC organisation with adequate electrical training. The following specific training and qualification standards for onboard personnel should apply:

a. The I/C of both the Attack Party and the Support Party of firefighting parties must be HV Competent.

b. All personnel within the Damage Control organisation must be HV aware.

c. All personnel proceeding into HV compartments to undertake firefighting, containment or damage control activities must be accompanied by at least 1 HV Competent person.

d. The OOD or DCO in charge of firefighting and DC in a HV compartment must be HV Competent, and they must be advised on the implications of HV hazards within that compartment by a HV Competent ME Officer or ME Senior Rating.

1557. Training

Onboard firefighting and damage control training must be conducted in such a manner within HV spaces to ensure that personnel are competent and familiar with the local procedures and HV hazards.

a. For strictly controlled training serials (ie during OST) lay flat hoses may be charged, isolated and then pressure relieved at the nozzle prior to deploying into compartments containing HV equipment of IP rating 54 or greater under strict supervision.

b. Appropriately qualified safety numbers or trained staff, locally endorsed by the Authorising Engineer, must be present to closely monitor any damage control and firefighting training within compartments containing HV equipment.

c. Mechanical smoke generators may be used within HV compartments under the direct supervision of appropriately qualified training staff, locally endorsed by the Authorising Engineer.

1558. High Voltage Authorised Person's Logbook and Diary

A High Voltage Authorised Person's Logbook and Diary (RNS 3284) is issued to all personnel attending the appropriate training module at HMS SULTAN. The purpose of the logbook is to allow Authorised personnel to maintain their own record of HV switching operations and practical work. This will also assist the Authorising Engineers in monitoring and auditing their platforms procedures. Any HV qualified engineers currently in date within the Surface Flotilla who wish to receive a logbook are to contact HMS SULTAN by e-mail: SULTAN-ctec@nrta.mod.uk for a copy.

CHAPTER 16

FIRE AND EMERGENCY ORGANISATION

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CHAPTER 16

FIRE AND EMERGENCY ORGANISATION

1601. Terminology

a. Since the Harbour Fire and Emergency Party (HFEP) and the Standing Sea Emergency Party (SSEP) deal with a variety of incidents such as fire, flood and structural damage the terminology describing the control points for an incident are:

(1) **Scene of the Incident (SOTI).** The actual location of the incident. This will be under the immediate control of the I/C Attack Party.

(2) **Forward Control Point (FCP).** The elected control point of the I/C Main Group. By definition this will be the single entry control point for entry to the SOTI. It should be located at the established smoke boundary for a fire situation, ie a watertight door or hatch.

b. The Duty Watch is the smallest unit capable of fighting, or at least containing, an incident. It must be organised to provide suitably, qualified and experienced trained personnel to maintain overall control of the incident and safety of the ship.

1602. Duty Watch Organisations

Two duty watch organisations are available to FF/DD in Fleet Time, unless otherwise specified within own platform Volume 7.

a. **Full HFEP**. Detailed at Annex 16D. Should be adopted when berthed at any location that is not the platforms nominated base port.

b. **Minimum HFEP**. Detailed at Annex 16C May be used when base ported in HM Naval Bases Portsmouth and Devonport to provide greater flexibility in manpower management and should consider the factors at Para 1623 sub para b. Ships intending to use a Minimum HFEP should ensure that the base port Emergency fire focal point representative informed.

1603. Identification of HFEP Personnel

In order to facilitate the easy recognition of Fire and Emergency Party personnel, coloured surcoats(Brassards) should be worn as follows:

a. **Red, with a white stripe** (Red):I/C Main Group.

b. **Red** (Red):Main Group with the exception of the BA Controller.

c. **Yellow** (Orange): Breathing Apparatus Party plus Attack and Support Parties' BA Controllers.

d. **Green** (Green): Technical (Vent, Electrical etc).

e. **Blue** (Pink): Containment Party.

f. **Brown** (White): Key Personnel (IBO DPO etc).

g. **Red with white cross** (white with red cross): First Aid Party.

1604. Guidance for Adopting a Shared HFEP Alongside at Naval Bases

To reduce the Duty Watch burden when alongside in a Naval Base, Ships may share a HFEP if the following constraints can be met: these considerations refer to the response to fires and emergency's only

a. Ships are of the same class and they are either rafted together or berthed in such a way that access between them can be guaranteed by ship-to-ship brow.

b. If the ships are alongside in a UK HM Naval Base with Fire Rescue Service (FRS) available, the resultant capability must provide no less than the Minimum HFEP in accordance with Para 1624.

c. Ships should provide an XTM detailing the procedures and responsibilities during the rafting period.

d. A shared system guaranteeing provision of the remaining capability of Containment and Support is agreed between the ships and endorsed by the DDH.

e. All personnel are to be familiar with and trained in their roles, and the combined HFEP is to be mustered and exercised in accordance with standard operating procedures. Particular emphasis must be placed on the strict adherence to correct rounds routines and procedures.

f. A single Quartermasters position should be used, with communications and main broadcast to both ships. A direct telephone is to be set up between HQ1s/SCCs of the ships. HQ1s/SCCs of the ships must be permanently manned by an HQ1 watchkeeper.

g. The participating ships are to Emergency Clear Lower Deck immediately it becomes apparent that an incident cannot be dealt with by initial attack.

h. Where rafted ships sharing a HFEP are required to release personnel to assist other ships, the command organisation should ensure enough personnel are retained on the rafted platforms to react to an incident in either ship.

SECTION 1 - FULL HARBOUR FIRE AND EMERGENCY PARTY ORGANISATION

1605. Introduction

a. This section sets out a flexible organisation for the composition of the Full Fire and Emergency Party of all ships in harbour, whether at anchor or alongside for Fire Fighting and Damage Control (FF/DC). The numbers of personnel forming each of the groups detailed in the following paragraphs are the recommended minimum (based on the capability of a fully manned frigate) and if they cannot be met, the risk of ineffective firefighting will be increased. However, it will be necessary in some ships to make some adjustments to the numbers, and under these circumstances it is important that the overall concept of the organisation is retained.

b. Ship knowledge, teamwork, speed and effective use of FF/DC techniques, and well maintained equipment are essential for successful firefighting. To further enhance the effectiveness of the HFEP the following actions are recommended:

(1) At the forenoon muster of the HFEP, on taking over the duty, personnel are to be detailed for their specific FF/DC duties and all junior ratings are to be fully briefed on their individual tasks and responsibilities by group leaders.

(2) Daily Orders is to include the names of all members of the HFEP and specify their individual roles within the organisation.

(3) The HFEP should include a First Aid (Level 2 qualified rating (non-RF and not a Main Group member).

1606. First Aid Firefighters

These personnel are not necessarily duty or specifically detailed personnel. They are the person(s) discovering the fire and those in the vicinity who hear and respond to the loud vocal alarm of **"FIRE, FIRE, FIRE"** (it is most important that when a fire is discovered HQ1/SCC is informed immediately). First aid firefighters must use equipment to hand in an attempt to extinguish or contain the fire. If unsuccessful in their attempt, the person who found the fire and who has vital information about the location, seat and type of fire etc, must remain at the SOTI and report to the person in charge of the Attack Party and of the Main Group as they arrive to take charge of the incident. The OOD and Officer in Charge of the FRS, if attending, may also require debriefing by the person who discovered the fire. The name of the person finding the incident is to be reported to HQ1 by the I/C Main Group and the person is to be escorted to HQ1 for debrief as soon as he can be spared or when ordered by the OOD.

1607. Main Group

The precise function of the Main Group may alter, depending upon the situation and nature of the incident, but the basic philosophy remains the same, the Attack Party must always be prepared to attack a fire immediately, and the remainder of the group then maintains this attack continuously and aggressively.

1608. I/C Main Group

a. The I/C Main Group should:

(1) Have a thorough knowledge of the ships layout, which includes all routes of entry and exit from major compartments and those fitted with fixed firefighting installations.

(2) Have a thorough knowledge of the harbour fire organisation contained in this Chapter and be familiar with:

(a) Chapter 12, 13 and Chapter 17.

(b) Ships General Orders Chapter 15.

(c) Ships CBRNDC Orders (BRd 2170 Volume 7 - Ship Specific CBRNDC Orders).

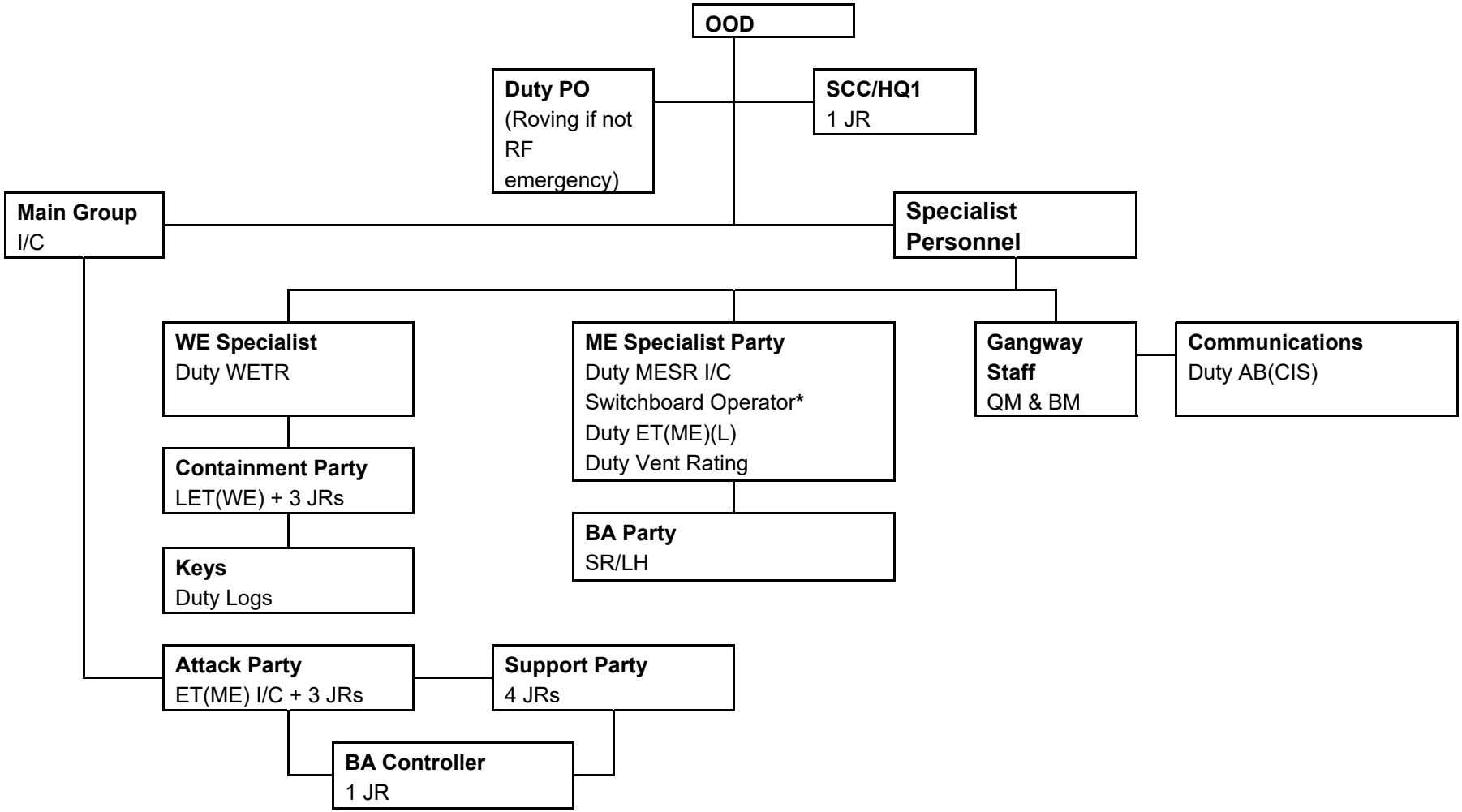
(d) Harbour Fire/Flood Exercise Assessment Form (paying particular attention to Umpire 1 section).

b. On taking up the duty they are to brief the Main Group to ensure that they are aware of their tasks and responsibilities within the fire and emergency organisation.

c. On hearing the alarm they should proceed immediately to a safe position as close as possible to the scene of the incident, in order to assess the situation and to ensure that an effective initial attack is being made on the incident. With this first-hand knowledge, and after debriefing the person who discovered the incident, they will be able to decide where to position the FCP and where, if necessary and after consultation with the DWETR, to establish the smoke boundary.

d. They must operate the fixed firefighting systems, when ordered by HQ1, and confirm their operation to HQ1.

Figure 16-1. Full Harbour Fire and Emergency Party



e. They must also bear in mind that the attack BA personnel:

(1) Should be dressed in overalls/PCS dress with sleeves rolled down.

(2) Should carry out a BA face seal check before entering any controlled areas.

(3) Will not necessarily be relieved by the firefighting team provided by the Support Party, may have either extinguished the fire, run out of air or been beaten back by the fire.

(4) Will have been nominated at the Duty Watch muster so that the BA Controllers' boards can be made up in advance. In making up the boards it is to be assumed that the pressure in each BA is 160 bar, and the time started to breath is taken as time the incident was piped.

(5) May be compelled, for any of a variety of reasons, to withdraw from their attack on the fire. Should this happen the I/C main group must determine the configuration of the compartment hatch or door . Consideration may also be given to holding the hatch or door on a waterwall. In deciding which of these methods should be adopted, consideration must be given to the problem of free surface water, which can build up should the sealing hose be in prolonged use, compared to the flash over dangers involved in a full hatch/door re-entry procedure.

f. The I/C Main Group must ascertain if there are any personnel trapped within the incident and if there are any casualties who require assistance.

g. On the withdrawal of the Attack BA personnel, the I/C Main Group must ensure that the expended firefighting appliances are moved out of the area from which the next attack is to be mounted.

h. They must request, from HQ1, information on any specific hazards existing in the compartment on fire or in adjacent compartments. This information is included on compartment firefighting Kill Cards, which are held at HQ1.

i. They must supervise hose running, detailing the lengths of hoses required and the type of nozzles to be used, and should be guided by the following principles:

(1) Firefighting hoses should be run from separate hydrants, although it is acceptable to use a controllable 'Y' piece to supply a boundary cooling hose and a firefighting hose from the same hydrant.

(2) Sufficient hose should be provided to allow the firefighters to reach all parts of the compartment.

(3) The firefighter nozzle has a considerably lower discharge rate than the waterwall nozzle and is the nozzle used for firefighting between decks.

(4) Waterwall nozzles are only to be used to provide the waterwall, and the firefighter nozzle for fighting carbonaceous fires.

j. They must establish the nature of the fire and if there is a possibility that it is a fuel/oil fire, must ensure:

(1) The firefighting medium is AFFF.

(2) A FB5X branchpipe is used, in conjunction with an inline inductor where appropriate.

(3) Sufficient quantities of replenishment AFFF are provided for the Support Party. **A 20 ltr drum lasts approximately 60 secs when supplying an FB5X branchpipe through a No 2 hose.**

(4) Where ships have foam inlet tubes, The number of drums to adequately blanket a compartment is shown adjacent to the foam inlet tube. Further guidance for the use and limitations of foam inlet tubes will be in the platform BR 2170 Vol 7.

(5) If a hatch re-entry is to be made, a third hose incorporating an inline inductor and fitted with a FB5X foam making branchpipe must be used to provide AFFF. Before the FB5X is directed at a fire it is essential that foam is being produced (also see Annex 17A).

k. If it is a Continuous Aggressive Attack CAA then the first two fully dressed members of the Support Party arrive at the FCP on air . The I/C at the FCP then has the flexibility to use them in pursuing an aggressive attack, if circumstances dictate, or holding them to await the remainder of the Support Party if a full re-entry is to be made. The I/C at the FCP is to make every effort to inform HQ1/SCC and/or the Support Party dressing area whether the first two dressed are required or not.

l. If a CAA is not achievable and the door has been closed then the team should arrive at the FCP “off air” and then the I/C at the FCP must brief them on the nature, location and size of the fire, together with any other information available. This can be taken from Kill Cards and should include positions of hazardous items such as gas cylinders, batteries etc. This briefing should take place in a suitable clean air environment. They must ensure that each team member is conversant with his task within the team.

m. The I/C Main Group must ensure that all personnel not involved with a re-entry procedure are kept well clear of the door or hatch to be used. He must ensure that all those remaining in this area are fully protected in Full Firefighting rig and BA (see Para 2002) and keep low to avoid any fireball.

n. As soon as the Support Party has been deployed to fight the fire (and if a second Support Party cannot be supplied from ‘Emergency Clear Lower Deck’ (ECLD) personnel), the I/C Main Group is to ensure that the Attack Party is prepared to form a second Support Party to be ready for briefing, well before the team tackling the fire is due out.

o. The I/C main group will debrief all firefighting teams on their exit from the incident.

p. Must keep the Command team informed on the current situation, especially when it is changing, for better or for worse. In the latter situation, requests for additional manpower should be made early.

q. The I/C Main Group must keep HQ1 informed of the amount of time any BA wearers having remaining on task until reliefs are due in. This time must be passed in minutes rather than actual time ie ‘reliefs due in 20 mins’.

1609. Attack Party

The Attack Party, should consist of 4 JR’s of any branch under the leadership of an ET(ME). They are organised such, that the ET(ME) I/C plus one attack the fire and other 2 are BA wearers. They, and the BA Controller, are to be dressed in Tier 1 (Enhanced) firefighting rig ie PCS/overalls with sleeves rolled down and natural fibre socks, DMS boots. Their aim is to attack the fire as quickly as possible.

a. On the alarm being raised the ET(ME) plus one other junior rate are to attack the fire, collecting SPE(AFFF) and CO_2 fire extinguishers en route. They should establish the seat and nature of the fire using the thermal imaging camera (TIC) if available upon arrival at the scene of the incident.

b. The attack BA wearers, on hearing the alarm, are to act independently of one another and everyone else on board. They are to proceed to the nearest BA locker, don the BA (plus firefighters hood and anti-flash gloves), conduct a face seal check and remaining on air proceed to the SOTI collecting SPE(AFFF) en route. On arrival at the SOTI they are to attack the fire, whether or not the Attack BA Controller is present. On arrival the BA ‘set number’ tally should be left at the entrance to the SOTI to identify that the BA wearer is within. The men being relieved (first aid attack firefighters or attack Non BA) who are not wearing BA must then withdraw (see sub Para d).

c. The Attack Non BA are to report to the Sickbay immediately after debriefing the OOD. The Attack BA are to report to the I/C Main Group for redeployment when relieved, beaten back or their attack on the fire has to cease.

Notes:

1. ***Thermal Imaging Camera (TIC).*** *The prime use of the TIC is to locate the seat of the fire through smoke. It is also useful in search and rescue, identifying fuel leaks feeding a fire, locating firefighting equipment and spotting unexpected hazards in smoke logged areas. Until the arrival and involvement of the Support Party, the TIC is a valuable tool to the I/C of the Attack Party. Initially, if possible, the TIC is to be given to the ET(ME) I/C of the Attack party by a member of the Containment Party. Subsequently, its use will be controlled by the I/C Main Group. In most circumstances, where the TIC is needed, the user will be wearing BA. The user should be aware of the TIC limitations described in Chapter 19.*

2. ***Large Compartments with More than One Access Point.*** *. Provision is to be made in for a standard muster point for each major space detailed in the in standard operating procedures contained within the BRd2170 Volume 7 series. Simplicity is vital; therefore choice of port or starboard passage access to all compartments may be appropriate as standard operational procedures.*

1610. Support Party

a. On the alarm being raised, the Support Party is to muster, at the designated FRPP/ZCP. They have two main tasks:

(1) To provide personnel dressed in full firefighting rig, (see Chapter 20), to the scene of the incident as soon as possible.

(2) To coordinate and collect all necessary equipment required to sustain a continuous attack on the fire (hoses, nozzles, inline inductors, AFFF, etc) at the SOTI. Manpower for rigging hoses is normally provided from members of the retiring Attack Party, from supplementary personnel onboard when the alarm is raised, or from Emergency Clear Lower Deck.

b. Support Party personnel are to be dressed in Tier 1 (Enhanced) firefighting rig (see Chapter 20) with surcoats throughout the period of their duty.

c. To ensure a continuous and aggressive attack on a fire, the Support Party is to be deployed as follows:

(1) Alarm raised, initial attack made by Attack Party/Attack BA.

(2) Support party muster at the designated FRPP/ZCP (BA Controller at the FCP).

(3) The first 2 members of the initial Support Party are to don FFHBC and proceed to the FCP on air. They are not required to carry out the standard communications check, as this will delay their arrival at the FCP.

(4) Once the first 2 members arrive at the FCP, the I/C then has the flexibility to use them, if needed, to maintain a continuous and aggressive attack or, if the door to the compartment has been shut, keep them there to prepare for a full re-entry, come off air and wait for the remainder of the Support Party to arrive.

(5) The remainder of the Support Party are to carry out a communications check before reporting to the I/C Main Group '*on air*'. The Team Leader of the Support Party is ensure their FFHBC is in TL mode before donning the helmet.

(6) If no message or information is received at the Support Party dressing area, with regard to the state of the door/hatch to the compartment on fire, then it is to be assumed that the door/hatch is open.

(7) The relief Support Party is to use Channel 2 on their FFHBC helmet radios, so that they do not interfere with communications at the SOTI. The I/C at the FCP is to change to Channel 2 once the second Support Party has taken over at the SOTI.

1611. BA Controller

When BA is used operationally a BA Controller should be tasked.

a. The BA Controller is to be suitable, qualified and experienced in the use of the apparatus and understand the safety implications associated with the role.

b. The duties BA Controller are as follows:

(1) The BA Controller should only control 10 BA wearers.

(2) They must always be in possession of a reliable timepiece (mobile phones should **NOT** be used) and a water resistant marker pen for the Control Board.

(3) Smart watches may be used by BA controllers providing they can be assured by the owner to be reliable. consistently good in quality and/or performance and is dependable, trustworthy & safe. If a smart watch is unable to self-update or be manually adjusted to display the time in relation to the current time zone it is therefore not dependable and thus unreliable and must not be used for controlling personnel using breathing apparatus.

(4) On assumption of the duty, they are to enter the names of the Attack BA/Support Party wearers onto a BA Control Board (Column A) and also a cylinder pressure of 160 bar (Column B) for the Attack Party and ensure that the partially filled BA Control Board is kept with them at all times.

(5) On hearing the **"Fire Pipe"** they are to annotate the time of the pipe into Column C of the BA Control Board for the Attack BA wearers and proceed to the nominated FCP. They must remain at the FCP and should not be tasked with any other duties.

(6) If the BA Controller sees the Attack BA team prior to entry they are to take the actual cylinder pressure and update the BA Control Board (Column B and C) accordingly.

(7) When acting as Controller for the Support Party they are to:

(a) Assist the wearer, when plausible, to don and adjust the BA, and to carry out functional and face seal checks. Clip the set number tally to the Control Board.

(b) Mark up the BA Control Board iaw Para 2110.

(8) Additionally, for Search and Rescue operations they are to ensure that the tail of the guideline is secured to an anchorage point at the incident entry point.

(9) Be alert for any signals from distress alarms.

(10) Ensure that the I/C Main Group is kept informed of the time that a relief team should be committed to relieve the previous team ie 'time relief due in'(in minutes).

(11) Inform the Officer in Charge of firefighting if a BA wearer has not emerged by the 'due time out' (in minutes).

(12) When BA wearers exit:

(a) Identify the BA wearer once they are 'off' air.

(b) Remove the 'set number' tally and replace it on the original BA set.

(c) Erase the wearers details from the Control Board.

(d) Ensure the wearer is debriefed by the I/C Main Group at the FCP, and then is to report to the BA Controller for the removal of the BA set.

(e) Where personal injury has been sustained or suspected to have been sustained to an operator wearing EDBA during response to an incident or during exercise, the BA control Board and BA controllers watch should be quarantined as evidence until completion of any investigation.

1612. WE Technical Rate

On the alarm being raised, the Duty WE Technical Rate is to close up in HQ1/SCC. They are responsible for:

a. Ensuring firefighting teams have access to magazines in the vicinity of the fire.

b. Advising the OOD on the following:

(1) Magazine and explosive safety.

(2) Movement of ammunition.

(3) Magazine firefighting arrangements, spray systems and fitted pumping arrangements.

(4) Electronic and electrical equipment safety.

(5) Internal and external communications.

c. Coordinate containment, liaising between the 2 I/C of the Containment Party, specialist parties and the OOD, in order to establish priorities for the containment task and to ensure that the duties listed in Para 1613 are effectively executed.

1613. Containment Party

a. The containment Party, in harbour, should comprise the following personnel.

(1) LET(WE) (I/C).

(2) 3 x Junior Rates.

(3) The Containment Party may utilise all other duty personnel who have not been detailed for other specific fire and emergency party tasks, plus all available non-specified Duty Watch and non-duty personnel.

b. When the alarm is raised, members of the Containment Party are to muster, as quickly as possible, as directed by the fire ‘pipe’, collecting their containment bags. A rating is to be pre-designated to provide a TIC at the SOTI. The I/C should work closely with HQ1 and provide regular updates on the status of containment. In harbour, the 2 I/C’s primary role is to brief boundary monitors/coolers on where they are required to monitor/cool and hazards in the vicinity of where they are monitoring/cooling, and to confirm that boundary cooling has been established where directed. They should also check on the wellbeing of personnel, particularly on the upperdeck and rove regularly to ensure boundary monitors/cooling efforts are proving effective. Planned containment details may be marked on incident boards by means of a solid blue line but the location must be checked by the 2 I/C prior to passing the boundary as contained to HQ1. Guidance on boundary monitoring/cooling and the temperature monitoring system (TMS) is at Annex 17D. Guidance on flooding boundary monitoring is at Para 1207, Para 1208 and Para 1315.

c. All personnel involved in containment should receive a detailed brief on their roles and responsibilities when assigned to boundary monitor/cool a compartment. The use of diagrams and containment Kill Cards, particularly in high risk areas such as magazines, will help considerably in ensuring boundary cooling/monitoring is effectively conducted. The use of comprehensive aide memoirs with boundary cooling and flooding boundary instructions given to all personnel will provide confidence in their task and ensure all actions are carried out and reported.

1614. The Duty LET(WE)

The Duty LET(WE), as I/C of the Containment Party, is to be briefed by the Duty WETR on the location of all the adjacent compartments and to be made aware of those compartments presenting the greatest hazard, eg magazines, gas cylinder stowages, fuels, flammables etc. They should constantly check the boundaries to ensure that his team has contained the incident and is to keep the OOD informed through direct liaison with the DWESR. They are to provide first hand guidance on the safety of electronic and electrical equipment and personnel. Smoke control measures initiated by the Attack Party become the responsibility of the Containment Party once it has closed up. They may initiate local smoke control measures, using ventilation, as directed by HQ1/SCC, reporting back on their effectiveness and the location of smoke boundaries. They are to initiate action to remove or drain down free surface water.

1615. Keys Rating

Normally the Duty Logs fulfils the role of the Duty Keys Rating and musters at containment control on the alarm being raised. they are responsible for obtaining the keys to the duplicate keyboard from the OOD, and then providing to the ratings in charge of both Main Group and Containment Party with the necessary keys to enable firefighters and boundary monitors to gain access to all compartments in the vicinity of the fire.

1616. ME Specialist Party

This party is responsible for:

a. Maintaining the integrity of the ships electrical power supplies and safeguarding those to electrical services, if necessary by shedding load and/or putting additional generators on load. Where possible, normal and alternative power supplies to the HPSW pumps should be established and maintained during firefighting operations.

b. Crash stopping ventilation if only operable from the switchboard, or ensuring it has been stopped. Shutting upper deck vent flaps on systems serving the compartment on fire, and subsequent operation of other vent systems for smoke clearance.

c. Checking all HPSW pumps and starting additional pumps to maintain the HPSW system pressure. If necessary, this is to be achieved by shutting off seawater to non-essential services.

d. Isolating electrical power supplies in and around the area of the incident to minimise the danger to firefighters and equipment’s.

e. Checking and safeguarding those systems essential to the firefighting effort (Hi Fog, HP air, etc) and isolating those systems containing hazardous fluids (fuel, lub oil, hydraulics, etc) to prevent them from feeding the fire.

f. Making contact and liaising with the shore electrical supply authority.

g. Advising the OOD:

(1) On fixed firefighting installations.

(2) The technical aspects of firefighting.

(3) Pumping and salvage arrangements.

(4) Ventilation and smoke clearance.

(5) Ship stability and MARPOL implications.

(6) The presence of compressed gases or pressure vessels in the vicinity of the fire, including HP air, refrigerant gases, oxygen and acetylene gases and the discharging of the contents of HP air cylinders, where possible.

(7) The nature of the ships structure, ie aluminium or steel on the area of the fire.

1617. Breathing Apparatus Party

The Breathing Apparatus Party is led by a S/R or L/H BA Coordinator who must be specifically trained in this task and must be familiar with BA control as well as recharging techniques. This party is supplemented by members of the HFEP not tasked, or by spare personnel identified during the ECLD On the alarm being raised the BA Coordinator organises his party to collect BA and spare cylinders (excluding the 4 designated for the upper deck re-entry locker) to form a dump in a position allowing room to work and being free from smoke. This location is to be broadcast. Once the necessary BA has been collected, the BA Coordinator is responsible for:

a. The BA Tote Board**.** This provides a method of accounting for all BA and associated equipment and shows the quantity, identity number and location of all BA sets and spare cylinders held onboard.

b. Provision of BA to required user locations.

c. Recharging used BA cylinders.

d. Informing the OOD of the BA availability state.

e. Coordinating optimum use of BA procured from outside sources (other ships etc).

f. Briefing all BA Controllers in their duties at the start of their period of duty, noting that BA Controllers in the Main Group are not members of the BA party.

g. Provision and briefing of BA Controllers, other than BA Controllers pre-designated as members of the Main Groups.

1618. Gangway Staff

On receipt of a report of an incident, from whatever source, a pipe is to be made by the Gangway Staff or HQ1/SCC Watchkeeper, as appropriate, informing the Ship's Company of the existence of an incident, its location and where various members of the Fire and Emergency Party are to muster. **This pipe is to be repeated**. When available, the main broadcast alarm is to be used prior to making this initial emergency broadcast. Thereafter, the Gangway Staff or the HQ1 Watchkeeper (depending on access to shore telephone) is to carry out the following:

a. Inform the (FRS) and maintain a 7.5 m clear area at the foot of the brow for FRS access.

b. Inform shore authorities and adjacent ships.

c. If the FRS has arrived and once the appropriate route to the SOTI from the 'on' brow has been agreed between the Officer responsible for ship safety and the FRS officer, the BM can be instructed to leave the gangway to identify the route by running a combined guide and sound powered telephone line.

d. Mark up the incident board on the gangway with location and any other relevant information on the fire.

e. Control entry to and exit from the ship, and account for personnel using the 'peg board'.

f. Prepare to meet the FRS Officers and escort them to HQ1/OOD, ensuring that they have filled in Annex 16A and Annex 16B.

g. ensure a red flag (daytime) and red light (after dark) are available to identify the 'on' brow.

1619. Communications Rating

On the alarm being raised, a Duty AB(CIS) is to carry out the following tasks:

a. If required rig a sound powered telephone between HQ1 (or other control position) and the FCP.

b. Man emergency communications nets to outside authorities.

1620. Medical First Aid

Whilst in Harbour, a Duty Watch First Aider is to be nominated on Daily Orders. They are to be qualified and in date to Level 2 standard, having also completed the 'core' Level 3 training competencies (AMBU use; AED and Entonox use). They are not to be part of the Reaction Force or Main Group. Their role and the role of the Ship's Company when dealing with a fire involving casualties is as follows:

a. Ships with reduced manning/harbour duty watches may use the DFA to deliver the TIC or keys to the I/C at the SOTI but they must be relieved of those responsibilities to deal with any immediate casualties. If there are no immediate casualties they are to remain at the SOTI, with adequate equipment.

b. On assuming the duty, the DFA is to draw a specific first aid bag from the Senior Medical Branch Rating (SMBR)/Medical Branch Rating (MBR) or previous DFA (although can use their own bag if a member of the SSFAP or Action FA Teams), be briefed and perform daily equipment checks as detailed in Annex 11A.

c. On discovering a casualty, a Loud Vocal Alarm (LVA) is to be conducted and continued until the general alarm sounds and a main broadcast pipe is made. The DFA is to attend the scene with his First Aid Bag and AMBU box as a minimum.

d. The casualty is to be moved to clear air, beyond the smoke boundary and clear of any traffic, and passed into the care of the DFA who should receive the following information about the casualty:

(1) Nature of injuries if known.

(2) Whether or not exposed to inhalation of smoke and any loss of consciousness.

(3) Whether or not a key member of the firefighting organisation.

(4) Location/compartment rescued from, and whether or not any other casualties exist so that search and rescue is not implemented unnecessarily.

e. All information is to be passed immediately to the OOD/HQ1. The DFA is then to liaise with the QM and await arrival of professional medical assistance.

f. The DFA must be afforded assistance when dealing with isolated injured personnel.

g. On completion of the duty, the DFA is to return the First Aid bag and debrief the SMBR/MBR/incoming DFA as required.

1621. Emergencies

As soon as it is apparent that a fire is more than a minor incident, the OOD should declare a full scale emergency as detailed in Chapter 6 Section 2. This will ensure that all uninvolved personnel are brought out of the ship, clear of danger, and provide a ready pool of spare hands for extra firefighting and containment tasks.

SECTION 2 - MINIMUM HARBOUR FIRE AND EMERGENCY PARTY ORGANISATION

1622. General

a. It is mandatory to maintain a harbour Duty Watch roster of not less than 1 in 4 in HM Naval Bases outside of leave periods. the composition of Harbour Fire and Emergency Parties (HFEP) may be reviewed in order to provide the Commanding Officer (CO) with greater flexibility in manpower management. The following paragraphs provide COs with guidance on the options of HFEP size required and mandates the minimum NCHQ endorsed organisation that can be operated. It does not include the arrangements for:

(1) Ships in Upkeep.

(2) QEC, HM, MM and PP.

(3) RFA.

(4) Ships outside HM Naval Bases.

b. Ships operating HFEP that deviate from this should detail local procedures within their own SGO's or local orders.

1623. Risk

a. CO's retain care and protection of their personnel in all circumstances and a prime role of the Duty Watch are to safeguard those personnel living on board. In HM Naval Bases, where a degree of support can be guaranteed, there is potential to reduce the numbers of HFEP personnel commensurate with the level of potential support and the degree of risk of a major fire/flood occurring. The decision regarding the size of HFEP required should only be made after careful assessment of the relevant risks.

b. COs considering reducing to the Minimum HFEP will need to balance the above factors against their manpower constraints and their knowledge of the experience and competence of their personnel. In some situations it may be necessary to review the composition of certain duty rosters to ensure that the required experience and competence is available. Flotilla advice should be sought and taken into account. A risk assessment should be conducted and documented before any decision is taken to adopt the minimum HFEP.

(1) The five basic principles of risk assessment are

- Identification of hazards;
- identification of who may be harmed and how;
- evaluation of the risks and identification of the associated precautions;
- recording of findings and associated implementation; and
- review and update as required.

(2) In the case of adopting a minimum HFEP the risk assessment process should include the following considerations

- what activities are required during the period of the minimum HFEP;
- the hazards that may be present when hazardous activities are being undertaken;
- the likelihood of Fire, flood or injury to personnel occurring and the severity which may result from the planned activities; and
- what control measures are available to reduce the risk of occurrence to a level that is as low as reasonable practicable and tolerable

c. Examples of Control measures that may be used to mitigate against the occurrence of a fire flood or injury and reduce the risk to as low as reasonable practicable and tolerable and adopt the minimum HFEP are provide below. This list is not exhaustive

(1) **Level of Experience.** Ships that have not achieved a formally recognised level of training in the past year ('Satisfactory' or better assessment in OST) would normally need to operate a full HFEP although, in the intervening periods (and after additional training if a 'Satisfactory' assessment was not achieved at OST) assessment can be conducted by Flotilla Staff. COs will need to pay close attention to the impact of the turnover of large numbers of personnel, or key personnel such as OODs, on standards previously achieved.

(2) **Prior Training.** Ships planning to change from one size of HFEP to another should ensure that all Duty Watches are fully briefed and exercised prior to undertaking a duty in the new organisation.

(3) **Fire Rescue Service (FRS).** The FRS serving HM Naval Bases Portsmouth, Devonport and Clyde . Can be expected to arrive in about 7 minutes. However, COs should be aware that a further significant period of time (perhaps 10-15 mins) might elapse before FRS firefighters are able to commence tackling an incident. Industrial action by FRS (either actual or forecast) would normally preclude use of the Minimum HFEP.

(4) **Ship's Status.** Is the ship fuelled/ammunitioned/stored? What machinery and electrical equipment is operating? What nature of work is being undertaken onboard? The amount of burning/welding taking place during a maintenance period significantly increases the risk of fire. COs may wish to consider utilising a larger Duty Watch during the day until such work has completed and then revert to a smaller HFEP, noting that thorough re-briefing of personnel would be required at the transition. An enhanced rounds routine could also be considered.

(5) **Mutual Support from Other Units.** When a ship is berthed in close proximity to other RN warships it can normally be assumed that adjacent ships will be able to provide additional manpower and equipment, should an emergency occur. However, if they too are working a Minimum HFEP the numbers of personnel they will be able to provide will be significantly reduced. Ships should also consider what support they themselves can safely provide to an adjacent ship if it requests assistance to deal with an emergency.

(6) **Risk Assessment.** Risk assessments, when conducted, need to be undertaken by competent persons, i.e. those who have an understanding of the activities being carried out, and are able to make an assessment of the risks that arise from these activities. it may be appropriate to convene a risk assessment panel that may include the ships HOD's, WSQ, contractors, flotilla representatives and the dockyard EFFP. Further guidance for conducting risk assessments can be found in JSP 375 part 2 Vol 1. All decisions to reduce to the Minimum HFEP should be recorded on the Whole Ship Risk Register.

1624. Minimum HFEP

The NCHQ endorsed minimum Harbour fire and emergency party addresses the requirement for a fire and emergency party only. The variances from the full HFEP are summarised below and shown in Figure 16-1 and Figure 16-2

a. The Main Group should be under the overall command of the I/C Main Group who must have completed CBRNDC 29 or 35 course

b. The Attack Party, should contain 4 personnel.

c. There is no Support Party within a Minimum HFEP.

d. The BA Controller is to act as Controller for all members of the Attack Party.

e. DWETR commands the containment party and also provides guidance on electronic and electrical safety.

f. The Containment Party should contain all other duty personnel who have not been detailed for other specific fire and emergency party tasks, plus all available non-specified Duty Watch and non-duty personnel.

g. The on watch Bosun's Mate is to act as one of the members of the Containment Party, after running out the guideline from the gangway to the FCP (this can only be carried out if he is not carrying a weapon).

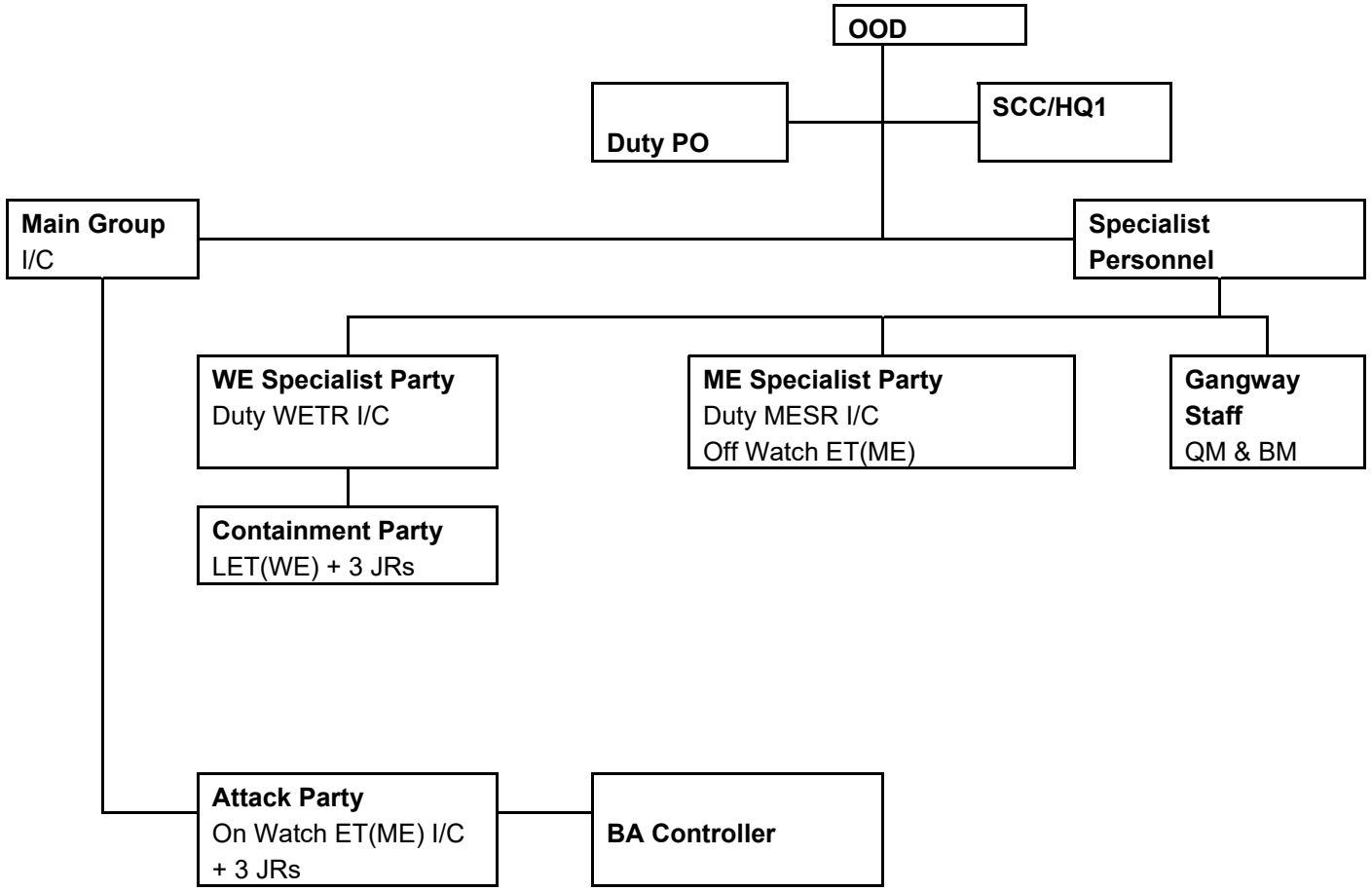
h. The duty Logistic rating is to act as a member of the containment group once he has obtained keys for all the compartments in the fire area.

i. Provided he is suitably qualified, the duty ME Senior Rate may, in ships where the main switchboard and HQ1 are co-located, also undertake the duties of the Switchboard Operator.

j. The Minimum HFEP, shown in Figure 16-2, identifies the positions for the key roles required within a DD/FF construct of a Minimum HFEP.

k. No dedicated First Aid Party is available in this organisation. Ships should ensure that one non-Main Group member of the HFEP is suitably trained or an adjacent ship can provide that adequate cover.

Figure 16-2. Minimum Harbour Fire and Emergency Party



SECTION 3 - FIREFIGHTING IN CONJUNCTION WITH THE FIRE RESCUE SERVICE (FRS)

1625. Liaison with the Fire Rescue Service (FRS)

A good liaison with FRS is essential if efficient use is to be made of their service in the event of fire. This liaison is vital when a ship is in harbour for any length of time and/or the Ship's Company is depleted (eg by leave or training).

a. All ships should contact the local FRS on arrival at a port away from their home base, in the UK. The objective is to alert the local FRS of the presence RN or RFA vessel in their area and invite the FRS to attend for an acquaint visit. the visit should include information associated with the ships layout, firefighting practices, firefighting organisation and installed firefighting equipment.

b. Ships may contact the local FRS when visiting ports outside of the UK, this decision is at the discretion of the CO and should consider, security implications, perceived competence of the local organisation, duration of visit.

c. Contact with the FRS in Portsmouth, Plymouth and Clyde Naval Bases should be made, in the first instance, through the naval base Emergency fire focal point representative EFFP. The EFFP should be kept up-to-date with any significant changes that might affect the ships firefighting capability, eg docking, leave period, supply of additional pumps etc.

d. The EFFP or one of his representatives may attend ship fires during normal working hours, but this attendance may be delayed during silent hours.

e. For ships in Upkeep Periods it is essential that the FRS and EFFP be kept fully informed by the CO or Senior Naval Officer (SNO) of any increased risk of fire

1626. FRS/OOD Liaison

a. Ships General Orders are to contain instructions for calling the FRS as an automatic response to the discovery of a suspected or known fire when a ship or submarine is berthed in a Naval Base, commercial port or shipyard. This is particularly important during the vessels upkeep periods where there are deviations to the normal standard procedures. Standard briefing forms are to be used and completed by the ship staff if the FRS is called to assist with an emergency onboard the ship. The system consists of 2 forms, the Fire Rescue Service Information Form (see Annex 20A) for completion on arrival in port and the Fire Rescue Service Incident Briefing Form (see Annex 20B) to be completed in the event of an emergency. Additionally, a separate Ships Incident Board is to be retained at the QM's desk to provide the FRS with essential ships layout information. When the FRS is in attendance the Incident Board is to be presented to the OIC for use during briefings. During exercises the FRS emergency call is to be a touch drill only. At anchor or at a buoy, due regard must be given to the FRS problem of getting out to the ship.

b. Upon arrival of the FRS the Senior Fire Officer attending the incident is to be met at the brow and escorted directly to the OOD responsible for the safety of the ship. At this stage in Portsmouth, Plymouth and Clyde the FRS may establish their own Control Point (CP), Forward Control Point (FCP), and Breathing Apparatus (BA) and firefighting equipment dump in the most appropriate locations. Should the FRS subsequently become involved in the incident; communications are to be established between the Officer responsible for ship safety and the FRS CP. Whenever possible a Liaison Officer or Senior Rating should be stationed at the FRS CP.

c. The OOD responsible for the safety of the ship is to fully brief the Senior Fire Officer on the situation, and then, after consultation with him, decide whether to ask the FRS to standby or carry out firefighting actions. The OOD responsible for the safety of the ship may request the FRS to undertake some, or indeed all, aspects of the operation. The appropriate strategy will be dependent on the nature of the incident and the ships manpower and equipment available. Any request for assistance should be clearly recorded. If FRS assistance is accepted, control of the firefighting aspects of the incident is to be given to the Senior FRS Officer. A main broadcast pipe advising personnel that the FRS are assuming control of firefighting is to be made.

d. The level of involvement of the FRS will be determined by the operational state of the vessel and the ships complement. As a general rule, frigates and above that are operational may require less assistance than MM/PP or submarines. Due to the limited manpower resources, RFAs and ships in refit or repair and ships adopting the minimum HFEP will generally require major assistance from the FRS. The initial level of attendance is predetermined by individual local authorities and is usually in the order of two appliances with others later.

1627. Ship Safety

Notwithstanding the involvement of the FRS in some or all aspects of the operation, the officer responsible for ship safety retains full overall responsibility and safety of the ship, but not the control of the FRS personnel if they are committed to the firefighting task. It is imperative that no matter what firefighting strategy is adopted, until such time that a fire is extinguished, a continuous attack on the fire is maintained.

1628. Brows

When a ship has more than one brow, a clear indication is to be given as to which one should be used by the FRS to come aboard. A red flag, or a red lamp by night, should be placed in a prominent position to mark the ‘on’ brow.

1629. Missing Personnel

The FRS may arrive before an accurate check of personnel has been made. During the initial consultations between the FRS and the OOD, a decision whether search and rescue operations by the FRS are required in preference to firefighting assistance may have to be made.

1630. Electrical Supplies

The FRS normally expects all electrical supplies to an installation on fire to be isolated. This is seldom practicable in a warship fire. However, when there is a risk of voltages in excess of 440V, the equipment is to be isolated. It must be noted that attempts at maintaining a 'keep alive' policy may be counter-productive when compared with the savings in damage through quick extinction of the fire.

1631. Route to Fire

Once the appropriate safe route to the Forward Control Point (FCP) from the 'on' brow has been agreed between the OOD and FRS Officer, an appropriate safe route is to be identified by Ships Staff to guide the FRS.

1632. Control of Personnel

a. Strict control over the combined numbers of personnel involved in the firefighting operation will need to be exercised, and the FRS will normally require all RN/RFA personnel not directly involved to clear the ship. This will be achieved by sounding the main broadcast alarm and making a pipe to clear lower deck (see Chapter 6 Section 2).

b. Entry to and egress from the ship is to be controlled by the gangway staff at the brow(s).

c. FRS personnel will at all times act under the direction of Fire Officers. Ships Staff will act under the direction of the OOD or his representative.

1633. Employment of Ships Staff in collaboration with the FRS

Ships firefighters, will only be required to act as guides assisting the FRS in locating the incident they have been tasked with. Close collaboration between the rating in charge of the ships main group and the FRS Officer at the FCP is essential. The rating in charge of the ships main group, once relieved by the FRS at the FCP, is to remain there. His duties will be:

a. To liaise with the FRS Officer in charge at that position.

b. To keep HQ1/SCC informed of all actions being taken.

c. To maintain command of all the Ships Staff employed at the scene of the incident.

1634. Evacuation of HQ1/SCC

Should HQ1/SCC and AHQ need to be evacuated for any reason, it is recommended that the ships control team move to the brow. If this is not practicable, any other location in clear air with good ships internal communications should be selected.

1635. Communications

The ship is to provide a communication link from HQ1/SCC or AHQ to the FCP, and from the brow to the FCP, manned by ships staff at both ends. FRS officers will normally use their own communications system, but these may prove inadequate in a warship environment and, in some cases, the associated SHIPHAZ may prohibit their use. Regulations in place preclude the use of any portable communications equipment in RFAs unless the equipment is intrinsically safe.

1636. Disposition of Ships Staff/FRS

a. FRS firefighters normally 'mask up' within the ship at their FCP. The rating I/C of the Main Group will operate from the agreed FCP.

HQ1/SCC (Gangway in RFA)	FCP	CONTROL POINT (Jetty/Brow)
OOD Senior Fire Officer Specialist Personnel	Junior Fire Officer I/C Main Group FRS BA Ships BA Controller	2FO 2nd OOD Quartermaster Bosun's Mate

b. Ships staff BA Controllers should continue to control ships personnel using BA at the same time maintaining the closest possible liaison with the FRS Controllers. Should firefighting measures be assigned to the FRS, overall coordination of all BA wearers is to be exercised by the FRS officer in charge of the firefighting operations. The endorsement of the combined RN/FRS FCP adjacent to the scene of the incident depends on the Fire Officer classifying the area 'clean air'. The rating I/C of the Main Group and the RN BA Controller will be required to relocate to the FRS FCP if control of firefighting operations passes to the FRS.

SECTION 4 - FIREFIGHTING AT SEA

1637. Standing Sea Emergency Party (SSEP)

a. In all ships at sea there must be a party of specifically detailed firefighters under the charge of a suitable senior rating, which is available at all times and ready for an immediate response to a fire. In Damage Control State 1 the Fire and Repair Parties meet this requirement. For States 2 and 3 a Standing Sea Emergency Party (SSEP) is to be formed. The SSEP should be made up from day work personnel for the State 3 situation and 'on call' personnel for State 2. The SSEP members are to be briefed on their duties prior to the ship sailing.

b. If the SSEP is unable to cope with an incident, either due to lack of personnel or shortage of material resources, it is important that the ship be piped to Emergency Stations in good time. This will get the right people to the right places quickly and bring the ships FRPP's/ZCP's to State 1. It will also clear the area of unnecessary personnel, allow off-watch watchkeepers to be accounted for and provide back up where necessary. The actual stage at which the ship should be piped to Emergency Stations will vary depending upon the size of the SSEP and the rate of escalation of the incident.

c. In order to facilitate the identification of SSEP personnel, coloured surcoats should be worn.

1638. SSEP Organisation

An SSEP comprises all the personnel. required for the main, containment and specialist party's ie medical, engineering logistics

a. **SSEP Team**. In order to achieve continuity and a well-trained, worked-up team, all members of the SSEP should be drawn from day work or on-call personnel. The following additional requirements are to be met

b. Members of the SSEP should not be special Sea Dutymen.

c. The I/C Main Group should be CBRNDC 35 Course qualified and also have completed their OPS.

d. Specialist parties are to be made up from daywork personnel from the relevant departments.

e. The remainder of the Attack, Support and Containment parties are to be made up from personnel from **ALL** departments

f. Embarked force personnel should not be employed in the attack, or support parties and be mustered with the spare hands.

SECTION 5 - FIRE PREVENTION AND FIREFIGHTING IN UPKEEP PERIODS

Associated Publications
JSP 426
BRd 1313
BR 8593 series

1639. Introduction

a. Under commercially managed Upkeep Periods DES Ships will place with a Contractor, a project contract containing specified requirements. The Contract Work Package is presented in the form of a series of worklists held within several volumes. Volume 0 is a foreword that defines the contract terms and conditions and responsibilities of DES Ships, Ships Staff and the Contractor for that particular project contract.

b. An Upkeep Period (UP) is defined as a maintenance period conducted alongside at an appropriate facility and outside of Fleet Time, i.e. the Scheduling Authority transfers from Navy Commend to the DE&S Strategic Class Authority (SCA). The SCA is accountable for compiling the Work Package, gaining the necessary approvals, negotiating contracts, engaging a prime contractor and overseeing the work with many of these activities being delegated to the industry led Class Output Management (COM) team under the appropriate support contract framework. An UP extends from Non Fleet Date (NFD) to Fleet. The manning profile for Surface Ships during Upkeep will be agreed between the SCA and NCHQ prior NFD in order to manage any Service considerations arising from a displaced UP, and to agree the roles and responsibilities of the Ship Staff during the upkeep.

1640. Division of Responsibility

In all cases, the division of responsibility between the CO and the Contractor with respect to care, protection and security will be clearly defined in the Upkeep Contract documentation. General guidance can be found in BR 8593(4) - Guidance on the Roles, Responsibilities and Activities of Ships Staff during Upkeep Periods. Details specific to a ship upkeep period will be laid down in Volume 0 of the Work Specification and the Project Safety Plan.

1641. Considerations Peculiar to Ships in Upkeep

Ships in Upkeep face a number of different problems associated with fire prevention and firefighting. Tasks involving the use of open flames (burning, cutting, welding and grinding) together with an increased amount of combustible material, flammable liquids and gases on board as part of work package activities increase the probability of fire. This increase in risk is further compounded by changes in the state of systems and structural integrity with pipework, valves, doors and hatches removed and holes cut in tanks and superstructure. The presence of dockyard workers and ‘outside’ contractors, who may be unfamiliar with the ship, adds to the risk. For these reasons, regulations require that in the event of a confirmed fire, no matter how small, the Fire Rescue Service (FRS) shall be called. A number of criteria must be borne in mind in support of FRS operations.

1642. Establishment Fire Focal Point

All Naval establishment commanding officers are to appoint an Establishment Fire Focal point (EFFP) in accordance with JSP 426. They are responsible for the oversight of and advice to management for the day-to-day upkeep of fire safety measures throughout the establishment. Further details of the duties of the EFFP are provided in JSP 426. They also act as the link between ships and the local fire authorities. The EFFP or their representative will normally make it their business to visit upkeep ships within the area. commercial ports should liaise with the NCHQ Safety Centre fire officer for local liaison advice. Ships staff and local DES Ships Project Managers are to ensure that EFFPs (and thus the FRS) are kept aware of all circumstances surrounding the ship that change the risk of fire or have a bearing on firefighting actions.

1643. Liaison with the Fire Rescue Service (FRS)

It is important that liaison with the FRS be established, through the EFFP, at the start of an Upkeep Period and that a good relationship is fostered throughout the period through regular visits and involvement in fire exercises, as appropriate. The EFFP will be able to facilitate attendance of the FRS at exercises and will attend himself to assist with conduct and debriefing.

1644. Fire Prevention in Ships in Upkeep

The risk of fire during an upkeep period can be reduced by the application of common sense, the adoption of best practice and adherence to strict rounds routines, coupled with a disciplined approach to fire safety and the reduction of fire hazards on board. Ships staff is to report any shortcomings in fire prevention measures to the Superintendent Fleet Maintenance/DLO Project Managers and the Upkeep Contractor without delay.

1645. Fire Rounds

When the responsibility for care and protection rests with the CO, regular rounds (not necessarily at fixed times) must be carried out by responsible officers and ratings, as follows:

a. **During Working Hours.** All spaces where work is underway; to ensure that fire risks are minimised, that welding/burning/hot work is not being undertaken without proper authorisation, that hot work sentries are carrying out their duties correctly and that all firefighting equipment is distributed and stowed correctly.

b. **At the End if the Working Day.** All spaces affected by work; to ensure that they have been left in a safe state and that flammable arising (oily waste, paint containers, adhesives, aerosol sprays etc) have not been allowed to accumulate. The rounds must be timed to occur at least ***one hour after the cessation of hot work for the day.***

1646. Control Centre

The position of HQ1 in a ship is chosen to meet the requirements of damage control in the Action State and to be the control point situated to best deal with peace time incidents in an intact condition. During an Upkeep Period there may be times when, due to the amount of work being undertaken, an alternative position may be more suitable. If this is the case, reliable communications are to be provided and, if feasible, alarms and warnings remoted to this position. A portacabin adjacent to the ship or on the flight deck has proven to be suitable. The Upkeep Contractor will put an access control and accounting system in place eg the 'T-card' system. Ships staff is to comply with the system in use at the upkeep venue.

1647. Fire and Emergency Party Organisation

a. The composition of and requirement for a Fire and Emergency Party is dependent on a number of factors:

(1) **The Authority with Responsibility for Care and Protection.** When care and protection is passed to the Upkeep Contractor, the requirement for fire and emergency cover and access security is articulated in Volume 0 of the work specification. A dedicated contractor First Aid Firefighting (FAFF) party normally undertakes this, with no input from ships staff.

(2) When care and protection rests with the CO, a fire and emergency party should be provided, the size and composition of which will vary with the type of ship.

(3) Outside this period a ship is to provide a fire and emergency party in accordance with Chapter 16. Where this is not possible approval to employ bespoke fire and emergency party should be obtained via the Flotilla organisation

b. **The Current Phase of the Upkeep Period.** The amount of fire cover necessary to keep risks as low as reasonably practicable (ALARP) will vary through an Upkeep Period eg whilst a ship is docked down with systems and equipment removed and the ability to close down and contain a fire restricted by services passing through doors and hatches etc. In this case the only effective way to fight a fire, beyond first aid appliances, is to evacuate the ship and attack the fire progressively from the gangway. In this situation, the advantage that a dedicated FAFF brings is diminished, particularly when each hot work operation on board has a fire sentry ready to deal with any immediate incident.

c. Any fire not extinguished by first aid appliances would probably escalate such that it would need more intensive action and FRS involvement. Therefore it is reasonable to accept that the FAFF could be stood down for this period.

Obviously, the risk changes at Flood Up date when the probability of flooding has to be taken into account. Volume 0 of the work specification instructs that a contractor conducts a risk assessment for each phase of the Upkeep period to determine the level of fire and emergency cover required. It also charges contractors to consider all methods to mitigate the risk of fire.

d. **The State of Systems and Equipment.** Clearly as systems and equipment are brought back into service the level of fire and emergency cover should be increased proportionally. This includes the commissioning of fixed firefighting systems prior to operating machinery and equipment.

e. **The Accommodation State.** If personnel are living on board a full Duty Watch must be provided.

f. **The Upkeep Venue.** The reduction in fire and emergency cover is mitigated by the fact that FRSs can get to the dockside within 8 mins of receiving a call. If this cannot be achieved, the requirement for FAFF/Duty Watch should be reviewed and, if necessary, guidance sought from Fleet Waterfront Staff.

1648. Proximity of Duty Watch Accommodation

For ships in which the CO retains responsibility for care and protection, the Duty Watch should must be accommodated as close as possible to the ship to allow quick access to the ship in an emergency. BR 8593(20) - Shore Support of Ship’s Staff Standing-by Vessels in Upkeep provides full guidance.

1649. Firefighting in a Ship in Upkeep - General Advice

Whilst the hazards caused by fire are the same in a ship in upkeep, fighting fires presents different challenges for firefighters. This paragraph identifies some specifics to be considered when dealing with fire in an upkeep ship and is offered as general guidance. It does not detract from the requirement to conduct exercises and ‘table-top tactics’.

a. **First Actions.** The general actions to be taken on discovering a fire are standard practice and are no different for ships in upkeep. The main emphasis is to safeguard life rather than to preserve systems and equipment. To this end, when a fire is discovered and the alarm raised, all personnel (uniformed, dockyard and civilian) who are not part of an Emergency Party are to evacuate the ship and muster in a safe position.

The highest priority at this point is to determine if there are any missing personnel. A robust and infallible system must be in place for identifying missing personnel so that rescue action can be initiated promptly, in conjunction with the FRS.

b. **Smoke.** Smoke, one of the greatest hazards in ship firefighting, is particularly perilous in an upkeep ship as many doors/hatches will not be available to shut to contain the spread of smoke. Smoke curtains, too, are likely to have been removed.

c. The Control Centre must be aware of the doors and hatches that are out of action and the incident board marked accordingly. Incident boards should be audited regular for accuracy of information. For ships responsible for firefighting, it is essential that breathing apparatus is maintained correctly and charging arrangements provided. Alternative sources of safe breathing air may have to be considered.

d. **Ship Alongside or in Dry Dock.** In some circumstances an approach from the jetty or dockside may provide the best and quickest means to deal with a fire.

e. **Ventilation.** For the majority of Upkeep period ventilation will rarely be running in its normal state. The Control Centre must be aware of the ventilation that is running, any portable ventilation equipment in operation and the actual state of vent systems. In addition to crash stopping ventilation, different measures, in discussion with the FRS, may have to be taken to minimise airflow to a fire.

f. **HP Sea Water Main (HPSW).** It is essential that an adequate number of points from which major firefighting equipment can be operated be maintained throughout the ship. If, due to the nature/scope of the work being undertaken, the ships fitted system is unavailable a temporary main is to be established. The detail of this alternative arrangement is to be described in the Ships Safety Plan.

g. **Portable Equipment.** Portable firefighting equipment will inevitably be subjected to the rigours of upkeep. It is therefore essential that a robust plan be in place that checks more frequently than normal that this equipment remains ready for use. Hoses and nozzles are particularly susceptible to increased wear and tear during upkeep periods.

1650. Escape Routes

Escape routes for all positions within the ship must be clearly marked, ensuring that they are unambiguous to a workforce that may be unfamiliar with the ships layout. Escape routes must be regularly checked to ensure that work does not obstruct egress from the ship.

1651. Brows

Sufficient brows must be provided to ensure that evacuation from the ship is not impeded. As a minimum, brows should be provided forward and aft on each side of the ship whilst in dock, dependant on the size of ship. The ships safety plan will give full details of the requirement. To maintain security, there should be one main brow, with the remainder locked but capable of being opened from the inboard side without a key.

ANNEX 16A

FIRE RESCUE SERVICE INFORMATION FORM

Ships Name: .....Tonnage.....	Nationality: .....
Berth:	Phone Number: .....
Liaison Officer:	**HV SHIP: YES / NO**
Visit Duration: From:	To: .....

Ships Point of Contact:

Date	Duty Officer Name/Rank	Duty Medical Personnel Name/Rank

Ships Complement:	Number in Duty Watch:.....

Fixed Firefighting Systems:

Location	Type of Compartment	Size of Compartment	Type of Fixed System

Fuel held onboard: ..... (m^3)
Aviation fuel held on Board: ……(m^3)

Fixed system fitted to Ship. ……

Location of Ammunition Stowages will be briefed upon attendance for an incident.

Notes:

ANNEX 16B

FIRE RESCUE SERVICE INCIDENT BRIEFING FORM

Ships Name: .....

Number of personnel onboard: ……

Personnel Safety

- Are all personnel accounted for: Yes / No
- Number of missing personnel: .....
- Last known location of missing personnel: …….
- Number of casualties: ……
- Location of casualties: ……

Brief Incident Summary

- Location of the fire: .....
- Type of fire: ……..
  (Electrical / Carbonaceous / Oil based)
- Door / Hatch: Open / Closed
- Source of fire: …….. (If Known)
- Fixed systems within compartment: ……
- HV Status (Live / Save / Dead)…….
- Current actions of the HFEP……..

  ……
- Hazards within the Compartment (Ammunition/Fuel etc):

  (Information from Kill Card)

  a. .....

  b. .....

  c. .....

FRS Notes: The OOD will provide a full and comprehensive Brief on the incident.

QM Notes: Hand this Briefing form and the Extra IBO board to the FRS. Ensure the lead FRS officer is escorted to HQ1/SCC.

ANNEX 16C

18 PERSON HARBOUR DUTY WATCH
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 16D

26 PERSON HARBOUR DUTY WATCH
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 16E

SSEP MANNING
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 16F

Sponsor: NAVYOP TRG-MWS EXC OIC

FIRE AIDE MEMOIRE
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 16G

Sponsor: NAVYOP TRG-MWS EXC OIC

FLOOD AIDE MEMOIRE
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

CHAPTER 17

FIREFIGHTING PROCEDURES

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CHAPTER 17

FIREFIGHTING PROCEDURES

1701. Preparations

Damage through fire can generally be attributed to late discovery, faulty technique (including misuse of appliances), or the rapid growth of fire following explosion:

a. Early discovery of a fire can be helped by conscientious regard of all automatic warnings and by diligent patrols/rounds personnel who frequently visit all compartments, including storerooms.

b. Faulty technique can be eliminated by good training, which starts at the firefighting schools and must continue in the ship. Every opportunity must be taken to carry out realistic and imaginative exercises and all personnel should know where to find and how to use all firefighting appliances/equipment and breathing apparatus with confidence.

c. The possibility of rapid growth of fire (from any cause) calls for a carefully prepared organisation, the strategic stowage of appliances and the ability to concentrate appliances and firefighters rapidly in adequate but not excessive numbers. Complex situations may arise when more than one compartment and/or a variety of materials are involved or threatened. Explosives, combustibles, gas cylinders, etc, are possible complications. Structural damage, which might include jammed doors and hatches, will make the firefighting task more difficult. These situations can be met with confidence if the officers and key ratings likely to be called upon to direct operations have used imagination in assessing the risks before the fire occurs and if they have a thorough knowledge of their ship and the firefighting procedures.

1702. Management of Firefighting Equipment and Personnel

The limited amount of firefighting equipment and personnel in a ship necessitate careful management of resources. In particular:

a. When firefighting, positive efforts are required to salvage firefighting appliances from teams being relieved. Personnel must be trained to ensure that all equipment is kept under control and not needlessly lost.

b. With the possibility of firefighters in EDBA working for nearly an hour, the signs and symptoms of heat stress and physical exhaustion must be understood. An organised system of feeding/watering firefighting teams is essential. Supplies of drinking water must be easily available to all manpower containing the incident and those working in spaces where temperature has risen due to the fire.

c. Accurate identification of compartments can save wasted effort. A combination of location markings and compartment name should be used.

d. Running portable diesel or gas turbine pumps for long periods requires good fuel supply management.

1703. Sources of Compartment Information

Detailed information about compartments can be made available to firefighting teams from the following sources:

a. Firefighting Kill Cards (see Annex 17J).

b. the Damage Control Data Retrieval System (DCDRS). Electronic management systems eg Machinery Control and Surveillance (MCAS) and Damage Surveillance and Control (DSAC).

c. Departmental specialists and compartment custodians

1704. Smoke Alarm - Reaction

Guidance on the reaction of personnel in the event of a smoke alarm is given in Chapter 6.

1705. First Report and Action

a. The person discovering a fire may not necessarily be on duty or a member of the ships firefighting team. They are known as a first aid firefighter and their immediate action must be to shout a loud vocal alarm and, together with those personnel in the vicinity who respond to his alarm, use the equipment at hand to extinguish or contain the fire. If the attempt is unsuccessful, the first aid firefighter with the vital information about location, seat of fire, type of fire, etc, must report to the person who arrives to take charge of the incident and remain with him until ordered otherwise. After debriefing, they are to be escorted to HQ1 for further debriefing prior to being escorted to the sickbay for medical examination.

b. Correct and prompt action by the person discovering a fire can make the difference between the fire causing minor damage and becoming a major conflagration. The action depends on whether the fire is in an open or closed compartment.

(1) **If Smoke is seen.** Suspect fire raise the alarm by shouting **“FIRE, FIRE, FIRE”** and inform HQ1/SCC/Quartermaster, pass a clear accurate message stating the location of the fire. If the smoke is seen venting from a compartment door then **DO NOT** open, return to the scene of the incident (SOTI) and rig hoses for containment/re-entry.

(2) **If the Door is Open or the Fire is not Behind a Door.** If a fire is discovered in an open compartment, raise a loud vocal alarm by shouting **“FIRE, FIRE, FIRE”** and try to extinguish it with the equipment to hand. The command must be informed by the quickest method (if a second person is present he must attend to this). If the finder is doubtful of his ability to extinguish the fire, he should shut all openings to the compartment, rig hoses for containment/re-entry, ensure the Command is informed and report to the person who arrives to take charge of the incident. If the retreating personnel have time, it may be possible to remove the blanking cap from a through-bulkhead HPSW connector. This would aid subsequent survey of the closed compartment.

1706. Continuous and Aggressive Attack

a. Fires will usually spread quickly if the firefighting effort is interrupted, so it is essential that a continuous and aggressive attack (CAA) is maintained from the moment of discovery. If First Aid Firefighters are unable to extinguish a fire, they should attempt to maintain the CAA until the Attack Party take over. To maintain the CAA firefighting equipment should be supplied to firefighters in accordance with Para 1723. The rules regarding the use of lay flat hoses within HV compartments (see Chapter 15) must be strictly adhered to. If the compartment becomes untenable the First Aid Firefighters may have to retreat to the door or hatch to maintain the CAA consider the use of a waterwall nozzle or Fixed Hatch Waterwall (FHWW) With their use left to the discretion of the I/C but if operated HQ1 must be immediately informed; HQ1 retain the option to veto their use. This will obviate the need for a compartment full re-entry. Once a door or hatch is closed, the waterwall nozzle or FHWW must be shut off until it is either required for re-entry or, cooling down entry point prior to re-entry.

b. The same applies to the Support Party relieving the Attack Party. The standard time, within which the Attack BA should arrive at the Scene Of The Incident (SOTI), is 2 mins. The Support Party should report to the I/C Main Group at the FCP within 8 mins of the alarm being raised.

c. The CAA must not be allowed to endanger the ship or personnel. If firefighters are inadequately protected or equipped, they may be beaten back (eg while waiting for a waterwall nozzle). If this happens, the compartment door or hatch should be closed and preparations made for a full re-entry. The decision to shut the door or hatch must be taken by the person at the scene of the incident.

1707. Questions to be asked at the Scene of a Fire

a. The initial concerns of the person taking charge at the Forward Control Point (FCP) must be to find out:

(1) What is it? (Oil, Carbonaceous, Electrical)

(2) Where is it? (SOTI, Seat of the Fire within the compartment)

(3) Who discovered it?

(4) When did it start if known? How did it start?

(5) What is being done about it? (CAA, Reported, Fire-Fighting medium, Door/Hatch open/closed)

(6) What is the casualty count?

b. Additional information to be considered by I/C Main Group at the FCP

(1) Have the boundaries of the fire been established and is monitoring/cooling under way.

(2) What are the immediate dangers? (eg fuel tanks/magazines, structural damage).

(3) Has communication been established to HQ1/SCC and correct pipe been made? (Safe route to the FCP piped)

***Note**. These initial questions must be asked, within the first 2 mins. The discoverer of the fire, if there is one, may well be able to answer most of these.*

(4) Have all the Attack Party arrived and are they using the right equipment?

(5) Has effective control over smoke been achieved, with smoke boundaries identified? (see Annex 17C)

(6) Has ventilation been crash stopped?

(7) Has the FCP been established in the right area, affording the best entry into the scene of the incident?

(8) Has the Command Aim been given? (In Damage Control States 1 and 2)

(9) Are any more appliances required from other parts of the ship? Will more personnel be required?

(10) Is smoke present in such a manner as to give false impression of the seat of the fire?

(11) Are Support Party personnel available and getting dressed?

(12) Have all relevant isolations been made?

(13) Are HQ1/SCC aware of the water levels?

(14) Consideration for use of Fixed Systems authorised by DCO/OOD.

c. When the fire appears to be extinguished, the following questions remain:

(1) Is it really extinguished? Have charred solids been broken up and wetted? Is any insulation still smouldering?

(2) Is there any danger of spontaneous re-ignition? Can the danger be prevented? Has a sentry been posted?

(3) What damage is there to electrical apparatus? Has HQ1/SCC been consulted about the precautions that might be necessary?

(4) Are all personnel accounted for?

(5) How is smoke and water clearance going to be achieved?

1708. Control of Firefighting Operations

A fire cannot be effectively controlled unless there is well co-ordinated control of the firefighters (see Chapter 16). The direction of all firefighters in a single fire zone must be unified and remain so. Takeover of control must be carried out with the greatest of care and only after they have assessed the situation. Inopportune taking over, contradictory orders from different sources and overcrowding of a FCP constitute serious hindrances to firefighting. While the first actions at a fire are with the person who discovers it, hands should not join in the fighting of an established fire except as directed by the person in charge at the FCP. Spare hands should be mustered, (Emergency Stations at sea or Emergency Clear Lower Deck in harbour) clear of the fire, where they will be immediately available when needed. Sentries, may be posted if manpower is available to maintain the fire boundaries.

1709. Choice of Firefighting Method

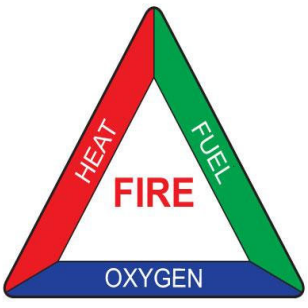
Having assessed the situation, the person in charge at the FCP must choose the most suitable technique and call for appliances, some of which may have to come from other parts of the ship. Speed is essential in the initial stages, however if the first measure fails to extinguish/contain the fire, a careful assessment of the situation is as important as speed. The right action in good time is better than the wrong action too quickly. Since fire depends upon a reaction between two substances and is sustained by self-generated heat, there are three ways of extinguishing a fire:

a. Take away the heat faster than it is generated.

b. Separate the substances.

c. Interfere with the chemical reaction that takes place between the fuel and the oxygen.

Figure 17-1. The Fire Triangle



Note. *The fire triangle is explained in simple terms in BR 4007 - Guide to Ship Firefighting.*

1710. Principle of Extinction

If a fuel is burning in oxygen drawn from the air, two methods of separating the substances may be possible. Either air or fuel may be prevented from reaching the fire. Consequently, the firefighter has three aims:

a. To starve the fire by removing solid combustibles or by cutting off the supply of fuel either in its liquid or gaseous state.

b. To cool the fire and its surroundings to a temperature at which it dies through lack of heat.

c. To smother the fuel by preventing air from reaching it, or by diluting the air with some form of inert gas.

d. These aims are the principles of firefighting and self-descriptive names can be given to them: **STARVING, COOLING** and **SMOTHERING.**

1711. Application of the Principles

a. Firefighters should keep all three principles in mind when attacking a fire. They should use the structure of the ship itself and the various installations, to assist the fire appliances they are using. The closing of watertight doors and hatches or the shutting down of appropriate valves on fuel supply lines and ventilation systems may prove as important as the use of any fire appliance. In fighting significant fires, a change in the course of the ship may be warranted to prevent fires from being fanned and to assist in smoke clearance.

b. More than one principle is brought into effect from most firefighting appliances even though a single principle dominates the extinguishing process. If this is understood, firefighters may safely classify their appliances according to their major function.

1712. Starving

By taking combustibles away from a fire, the fire will not burn as long. With uncontrolled fires, removing combustible solids from the immediate vicinity will limit the spread of the fire. If a fire is fed by liquid fuel flowing from a burst pipe, isolation by the appropriate control valve is an essential precaution. If a fire can be completely isolated it will eventually die from lack of fuel. Allowing a fire to burnout in this way is justifiable in some cases when the burning substance contains or produces oxygen, however this means of extinguishing a fire is hazardous and slow.

1713. Cooling

a. Heat is a form of energy, and cannot be destroyed. Cooling is the alteration of this energy from a destructive force into innocuous energy. Water is an excellent cooling agent. Projected on to a fire it takes a certain amount of heat to bring it to boiling point and about six times as much to turn it to steam. The firefighter must initially seek to remove the heat energy by cooling the flame and not the fuel. In an open area, steam carries the heat away. In a partially closed compartment, both the heat and the steam may fail to escape entirely, but the heat will be distributed and the temperature of the fuel will be reduced. The steam will also produce a smothering effect.

b. The absence of flame does not necessarily mean that the fire has been extinguished. Transfer of heat within the fuel may lead to the renewal of flame (this may occur hours or even days afterward). Therefore, when the flames disappear, solids must be separated and broken up so that the insides, as well as the outside, are cooled. A metal compartment in which a fire has been burning may have parts hot enough to re-ignite the contents. Hence, the whole fire zone must be cooled to a temperature well below that at which flames disappear. The decrease in temperature of hot substances, and the prevention of cool substances from getting hotter, is closely related in the processes of fire extinction. Both ideas are inherent in the principle of cooling.

c. Water is available in a plentiful supply from the sea, so there is a temptation to be extravagant with its use and this can be almost as dangerous as the fire itself. Water should therefore always be used as a spray except when it is necessary to break up and drench masses after the flames are extinguished. The following facts about water must always be remembered:

(1) It is heavy where 1 ltr of water weights 1 kg. Water partially filling any compartment, has a free surface that will degrade the stability of the ship. The higher in the ship or the further from the centre line, the greater the detrimental effect.

(2) Most liquid fuels are lighter than water so they will float and may continue to burn while doing so. This may become a serious hazard in bilges, tanks etc. If water is introduced to a burning liquid that is at such a temperature, the water will boil and turn to steam. The expansion will cast the burning liquid out violently.

(3) Sea water is liable to cause permanent damage to electrical equipment and temporary damage to most machinery. It may cause lethal shock when used as a jet on live electrical equipment.

(4) Application of water will prevent the transfer of heat from bulkheads, etc or from one explosive charge to another, and thus prevent ignition. It will not necessarily stop an explosive charge from burning once it has become ignited. Oxygen continues to be evolved by the explosive even when it is drowned in water.

(5) Water, a very stable compound, is composed of oxygen and the flammable gas hydrogen; it can react chemically with some substances:

(a) Even when cold, it reacts violently with some substances to produce flammable gas. Potassium, sodium and calcium, which are found in some medical stores, react producing hydrogen.

(b) When very hot, certain light metals used in the construction of aircraft react with water. These metals can burn in air. If water is applied at a slow rate, the generation of hydrogen may cause an intensification of the fire but, providing that the metals are not present in great quantities and the rate of water applied is high, the cooling effect outweighs any danger from hydrogen generation.

(c) Iron will not burn in air, but at 700°C it can burn in the presence of steam with the generation of hydrogen.

(d) When limited quantities of either water or steam contact hot carbon, a result is ‘water gas’, a flammable mixture of both hydrogen and carbon monoxide.

d. With these facts in mind, the most efficient use of water must be made to extinguish fires. For most situations a spray will be used. Water broken up into the fine particles that form a spray has a larger surface area than the same volume of water projected in the form of a continuous jet. In contact with a large hot surface, the transfer of heat to the water particles is very rapid. Hence, the cooling effect is very rapid, and spray is particularly suitable for cooling large surfaces. The jet is most effective in dealing with structural fires and other fires involving metals.

1714. Smothering. All relevant Fixed Systems to be added.

a. Smothering is the process of preventing oxygen from reaching a fire. Applying a wetted, or even dry cloth over a chip pan on fire, can smother it. Shutting all doors and hatches to a compartment and crash-stopping ventilation is another way to smother a fire. But, because many combustibles contain oxygen, the process can be slow. As mentioned earlier, the discoverer of a fire must raise the alarm to summon help. If the fire is obviously beyond the capabilities of the discoverer to extinguish or even control, he must contain it by shutting all openings to the compartment, to prevent air (oxygen) from getting to the fire.

b. AFFF is the most effective and readily available smothering agent, especially against burning hydrocarbon liquid fuels that are not miscible. It rapidly produces an air (oxygen) excluding film of water over the surface of the burning liquid and even when that film is disturbed, it will quickly reform. AFFF is also effective against paper, wood rags, etc, because it improves the penetration of water to extinguish deep-seated fires.

c. Dry powder is a quick and effective smothering agent, but the extinction is often only temporary. Its most effective use is against low flash point liquid fuel fires. Its swift ‘knock down’ effect on the flames is very effective in preventing further fire spread, allowing firefighters access to burning aircraft etc. However, dry powder does not form a permanent seal or remove heat, so AFFF must be used immediately as back up.

d. Carbon dioxide (CO_2) is an inert gas and will neither burn nor support combustion. It is heavier than air and displaces oxygen by forming a temporary blanket. It is mainly used for electrical fires, but some ships have CO_2 drench (smothering) systems fitted to machinery spaces. Consideration must be made in relation to the volumetric size of the compartment when discharging CO_2. It must be remembered that CO_2 will not support life in concentrations over 17% in the atmosphere.

e. Halon 1301 (BTM) has some minimal smothering qualities, but its main extinguishing method is by chemically interfering with the reaction that takes place between the fuel and the oxygen. It is normally used in machinery spaces.

1715. Precautions and Limitations of Smothering

Ships' staffs are to ensure that relevant closing down and evacuation procedures relevant to them are clearly laid down in BRd 2170 Volume 7 series or within Ships SGO's and understood. The following points must be considered:

a. Trying to smother a fire where all the oxygen required to complete the combustion process is mixed with the fuel, as with explosives, would be ineffective. Such an attempt would interfere with the venting of the products of combustion and increase the rate of flame generation and pressure. Consequently, explosives burning comparatively slowly might explode.

b. Smothering methods are slow and unpredictable if some of the oxygen required for combustion is held within the body of the combustibles (eg textiles, wood and other organic substances).

c. Hydrocarbon liquid fuels do not liberate oxygen so require an independent source of oxygen if they are to burn.

1716. Flashover

A flashover occurs in fires when there is no shortage of oxygen. In any compartment fire there may be a stage where the radiated heat from fire and hot gases at deckhead level are enough to ignite much of the remaining combustible material in the compartment. This transition from a localised fire to total compartment fire can be very rapid.

1717. Backdraught

A backdraught can only occur in fires where there has been a period of oxygen starvation (ie a compartment closed down). The heat in a compartment will still decompose the materials within, producing flammable gases but due to the lack of oxygen they will not ignite. The introduction of new fresh air results in these gases igniting, possibly explosively. This backdraught can take place immediately or when a new source of ignition is introduced, such as firefighters exposing smouldering material. Gases produced in a fire may well escape the compartment via cable runs, vent trunking, etc and build up in another compartment away from the initial fire source. These gases in turn could ignite with the introduction of a separate ignition source such as sparking from electrical equipment.

1718. Firefighting - Ventilation Control Standard Procedure

a. The aim of this procedure is to reduce the flow of air to a compartment and limit the spread of smoke, in the shortest possible time, after the discovery of a fire. It is easily understood and can be applied in all Damage Control states, and conditions, at sea and in harbour, namely by:

(1) Crash stopping all ventilation fans as soon as the alarm is raised. This action contributes significantly towards the aim and produces a known state of ventilation, which is essential for subsequent control procedures (the various minor disadvantages, which will result from a complete crash stop of ventilation in some ships, must be identified and overcome by good training, and discipline, in the standard procedure).

(2) Closing smoke curtains in the ship section containing the fire and in adjacent sections.

(3) Restoring power to all ventilation systems so that they may be restarted (under the control of HQ1/SCC or OOD) in order to:

(a) Supply ventilation to essential systems.

(b) Supply ventilation to areas of the ship not affected by the fire.

(c) Contain the smoke within the desired boundary.

(d) Reduce the supply of air to the fire.

(e) Remove smoke from areas adjacent to the fire.

(f) Remove all smoke and fumes after extinction.

b. BRd 2170 Volume 7 series are to consider the following paragraphs concerning ventilation control for SOPs. Larger ships are to adapt these instructions to suit their ventilation design features, possibly on a damage control section basis. In all ships the Officer in Charge of firefighting operations has the authority to modify the instructions if required.

1719. Stage 1 - Crash Stop Ventilation

Upon activation of a smoke alarm or confirmation of a fire the following actions are to be taken:

a. Open all main machinery and general ventilation breakers at the switchboard or HQ1/SCC central crash-stop panel. After a pause for five seconds, re-close the breakers to restore the electrical supply to local fan starters. However, those ships with in-line switches fitted to some general ventilation fans (ie 5-inch fans in MMs) must ensure that these switches are opened before their respective breakers are re-closed, otherwise these fans will restart automatically.

Note. *In Condition ALFA a balance must be struck between the need to prevent the spread of smoke and the risk of contaminating the citadel. When the BRACE pipe is made, AFUs are to remain running in the crash stopping of ventilation. Where AFUs are connected to the crash stop circuit they are to be restarted immediately after any precautionary crash stop of ventilation.*

b. Trip the local starters of general ventilation fans, which are not controlled, from the ventilation breaker (see **Note 1** below).

c. Re-set ventilation moulded case circuit breakers (MCCBs) tripped when breakers were opened.

Notes:

1. The following fans should not be stopped because they will not spread smoke to other areas, and their continuous operation is required. If affected by fire, the electrical supplies to the system or unit should be isolated in conjunction with other equipment in the compartment.

a. ACUs fitted in individual compartments to re-circulate cooled air in that compartment only.

b. Full re-circulation ATU systems serving only unmanned spaces for equipment cooling purposes.

c. Closed-circuit equipment cooling systems that are independent on the ships ventilation system.

2. The effectiveness of this procedure depends on regular and thorough briefing of the personnel nominated for the various tasks, and their practice in the drill.

1720. Stage 2 - Restart Selected Ventilation Systems

Electrical supplies must be made available to all ventilation systems as soon as possible after crash stopping so that systems essential to the ships function and which do not interfere with the firefighting operations, or the establishment of a smoke boundary etc, can be restarted. The following guidelines are to be used by personnel tasked with using the ventilation systems to control contain or remove smoke during and after a fire:

a. The spread of smoke is a major factor in preventing a clear appreciation of the source and extent of a fire and in preventing the adoption of effective firefighting measures., always bearing in mind that cold smoke does not always behave in the same manner as hot smoke.

b. It is vital that, in the earliest stages of a fire, efforts are made to isolate the smoke into the smallest area that is consistent with the need to gain access to the fire.

c. Early consideration must also be given to the removal of smoke in order to assist with containment (compartment may still not be tenable). In almost all cases this can be done effectively by selective use of the ventilation systems, (the Ramfan can assist in this removal, but consideration must be given to the effects on the HPSW main) but this requires great care since forced smoke removal may encourage the fire. When planning smoke clearance routes, the effect of smoke in previously uncontaminated spaces must be considered.

d. In general, ventilation systems should not be used to remove smoke from a compartment in which a fire is burning, and care is necessary in removing smoke from a compartment adjacent to the fire and through which the firefighting team will have to pass in order to reach the fire. Withdrawing smoke by means of an exhaust fan which is sited at some distance from the scene of the fire may fill previously clear compartments with toxic smoke and become a hazard to unprotected members of the firefighting and containment teams.

e. The most effective fans for the clearance of smoke are those in the main machinery spaces and the galley, and dedicated smoke clearance fans.

f. Care must be taken that smoke is not picked up by the suctions of the HP air compressors, or systems supplying habitable compartments.

g. When using main exhaust fans, a route to atmosphere must be opened up to allow make-up air into the ship.

h. Should the ship suffer major structural damage above the waterline, the use of the newly created opening should be considered for blowing smoke through to the atmosphere.

i. Smoke may be removed by blowing or sucking. Except in the simplest cases, eg where the fire area is adjacent to an upper deck opening or, in action, a hole in the ships structure, sucking is to be preferred because it gives much better control of the smoke. It is not possible to predict where smoke will go when it is blown.

j. Consideration should be given to altering the ships course relative to the wind in order to blow exhausted smoke away from ventilation inlets or areas in use on the upper deck.

k. The air supply from AFUs can be effective to blow the smoke out through a machinery space in Condition ALFA.

1721. Stage 3 - Prepare to Shut Down Machinery Space

If the fire is in a machinery space, immediately following the crash stop, all supply and exhaust ventilation flaps are to be closed to seal a main machinery space on fire. This will ensure the compartment is configured for the use of fixed system if the first aid firefighting measures fail, and the fixed firefighting installation has to be used at short notice.

Notes:

1. When using CO_2 fixed firefighting systems, one pre-designated exhaust ventilation flap is to be left closed but unclipped to prevent over pressurisation when the system is used. When the system has been discharged, and the pressure relieved, this flap is to be clipped shut (Personnel to be on BA). This requirement does not apply to compartments fitted with BCF or BTM gaseous fixed firefighting systems where all ventilation flaps should be shut and clipped before use.

2. Detailed procedures for Main Machinery Space fires are at Annex 17F.

1722. Stage 4 - Restore Essential Ventilation

As soon as possible after the crash stop, the Officer in Charge of the firefighting operation must assess the fire situation, and with the aid of reports from the scene of the incident, and the ventilation information held in HQ1/SCC, ensure that smoke boundaries to the affected areas have been established. They should then issue the necessary instructions to restore essential ventilation, in accordance with the Command Aim (having ensured that smoke will not be drawn back into the ship from the weather deck terminals of any exhaust fans used by the ships firefighters). A record of the smoke boundary established, and subsequent restoration of essential ventilation, should be kept in HQ1/SCC. Thorough training and exercises are necessary to ensure that the time taken to restore ventilation is minimised, and that it is restored without further spread of smoke.

1723. Rigging of Hoses and Nozzles for Fire Incidents

WARNING

FIREFIGHTERS MUST BE AWARE OF THE HAZARD OF ELECTRIC SHOCK IF WATER IS SPRAYED ON LIVE EQUIPMENT DURING THE INITIAL ATTACK PHASE.

Each fire incident must be individually assessed, generic guidance for the rigging of hoses and nozzles is as follows:

a. During the initial attack phase for a carbonaceous fire, if the initial attack with extinguishers proves ineffective, the early deployment of a firefighter nozzle, used in ragged spray or CFHR in foam, may well extinguish the fire. All hose baskets are fitted with firefighter nozzles. They can be safely operated by one person and can also be used for boundary cooling and in personal protection mode should it be necessary to withdraw from the compartment.

b. If heat or smoke forces the initial attack personnel to withdraw to the compartment door/hatch, consideration should be given to rigging a waterwall nozzle or fixed hatch waterwall (FHWW). If either is operated HQ1 is to be informed immediately due to the possible hazard of electric shock and the large amount of water (over 10 ton/hr) that can be discharged into a compartment. This will allow the door/hatch to remain open for the Attack BA wearers or first two dressed Support Party members to continue the attack on the fire. Note however, that extinguishers and CFHR's do not have the force to effectively penetrate a waterwall. The Waterwall Operator must also be backed up when operating the nozzle through its full range.

c. When rigging for a 3 hose re-entry, the Ship Protector hose should be rigged first, underneath the firefighter and waterwall hoses. This will help to minimise the problems of hoses snagging against each other during the re-entry.

d. Before opening the door or hatch to a compartment containing a fire, the following preparations must be made:

(1) Rig hoses of enough length to reach the furthest part of the compartment. Water supply to each hose should be from separate hydrants. A 'Y' piece should not be used to supply a team's waterwall and firefighter hoses.

(2) All hoses should be fitted with the correct nozzle (and fully charged where possible) prior to the support party ‘going on air’.

(3) When using a FB5X foam making branchpipe, consideration should be given to use of a FBU5X inline inductor adjacent to the hydrant. This can be outside the smoke boundary, allowing easier tending of the foam drums.

(4) If the entry door opens away from the firefighters, a lanyard should be attached to the handle so that the door can be pulled shut if necessary.

(5) If the re-entry is from below, a waterwall mounting pole will be required.

1724. Firefighting Techniques

a. Re-entry firefighting techniques are detailed in Annex 17A and illustrated in BR 4007. The techniques are based on easily accessible doors and hatches, but in battle conditions the Team Leader, may have to modify them. Very few hatches in a ship have enough space around them for the full team to get into ideal positions before re-entry.

b. Flame, smoke, heat, darkness and structural damage may hinder access to the seat of a fire. Protection from flame-lick is achieved by a waterwall. When fighting a fire without the aid of a BA, the firefighter should crouch on one knee, because at this level there is usually a layer of clear and cooler air. Once firefighters start to tackle the fire using first aid appliances, the steam produced may force the smoke layer down, rendering the compartment untenable.

c. If damage to the structure prevents a direct approach to the seat of a fire, it may be necessary to use portable cutting equipment, but only on the orders of HQ1/SCC. A hole just large enough to take a firefighter nozzle may be all that is necessary. Before cutting a hole, the following points should be considered:

(1) If possible, the pressure in the compartment should be tested, using an indicator test plug.

(2) Signs of blistering or charring may be useful in choosing the best location for a hole.

(3) The effect on watertight or gastight integrity may not be acceptable.

(4) The admission of air though the hole may increase the fire.

(5) Damage to essential services on the other side of the bulkhead may be minimised if the hole is cut in a known clear area.

1725. 4 Man Firefighting Team

For a relatively simple re-entry into a compartment containing a fire, a 4 man team, such as the HFEP Support Party, can be used:

a. **Team Leader.** Leads the team and carries a TIC and opens hatches.

b. **Waterwall Operator.** Operates the waterwall nozzle.

c. **Firefighter.** Operates the firefighter nozzle or FB5X foam making branchpipe and opens doors.

d. **Hydrant Operator.** Operates the hydrants and handles the hoses

1726. 5 Man Firefighting Team

For a more complicated re-entry, a 5 person team can be used:

a. **Team Leader.** Leads the team, carries the TIC and opens hatches.

b. **Waterwall Operator.** Operates the waterwall nozzle.

c. **Firefighter.** Operates the firefighter nozzle or FB5X foam making branchpipe and opens doors.

d. **Ship Protector.** Operates the ship protector waterwall nozzle.

e. **Hydrant Operator.** Operates the hydrants and handles the hoses.

Note. *Any number of additional Hose Handler may be necessary.*

1727. Actions to be Taken when a BA Whistle Sounds

a. The overriding principle upon a whistle sounding is a safe withdrawal of the team, consolidating their attack on the fire wherever possible. This should be accomplished by withdrawing the team to the door or hatch, shutting the door or hatch, leaving whichever member of the team has the highest pressure as a sentry with a controllable source of water and to withdraw the remainder of the team back to the FCP.

b. Alternatively, in order to maintain contact with the fire, if only one team member's whistle is sounding the Team Leader may, providing it is not his own whistle, use his discretion to decide if the position of the person whose whistle is sounding can safely be taken by another member of the team and that the loss will not compromise either the firefighting effort or the safety of the remaining members of the team. Depending upon the circumstances this may be conducted within the compartment or by withdrawing the team back to the door/hatch. If this action is taken, the person whose whistle is sounding should be sent back to the FCP, with an escort if possible. In making this decision, the Team Leader will need to consider the condition of the rest of his team and the remaining EDBA pressure.

1728. Cyalumes for Firefighting Team Identification

In circumstances of low visibility, eg a smoke-logged compartment, the delay caused by firefighters trying to identify who they are to relieve may result in the initial re-entry team being relieved after their whistles have sounded. To alleviate this problem, personnel involved in firefighting management are to employ the following guidelines for identification of key firefighting re-entry team members:

a. A coloured cyalume, dependent on the re-entry team member's function is to be connected to the rear of the team member's BA bellyband by a cable tie. Activation and fitting of the cyalumes should be completed just prior to the re-entry brief.

b. The following colour coding is to be used:

(1) **Team Leader** - Green.

(2) **Firefighter** - Red.

(3) **Waterwall Operator -** Blue.

(4) **Hydrant Operator** - Green (may wear 2 if considered necessary).

c. Cyalumes are only to be used by a re-entry team following the complete closure and containment of a compartment and their provision must not interfere with the efficiency of a continuous and aggressive attack on the fire.

d. A minimum of 6 green, 3 red, and 3 blue are to be stored in each fire locker and upper deck re-entry locker (see BRd 2170(3) for stock numbers).

1729. Boundary Monitoring and Cooling

Guidance on monitoring and cooling the boundaries of ship fires is at Annex 17D. Intact bulkheads and decks lined with fire barrier insulation (eg A60 bulkheads, fully described in Chapter 4) will effectively contain a fire for a limited period without cooling. In such situations, priority should be given to temperature monitoring, rather than cooling.

1730. Ship Stability and Firefighting

Ship stability is dealt with in Chapter 23. The officer/rating in charge of firefighting operations may not be in a position to judge the effect of firefighting water on ship stability, so guidance must be given by HQ1/SCC. It is advisable to remove water as quickly as it is introduced to a fire, by pumping out or draining down/out. In newer ships, drain plugs are fitted in some decks for this purpose. A ship could be in more danger from ‘free surface’ water than it is from the fire.

1731. Aluminium Structure and Fire

Unless aluminium structure is suitably protected by insulation (lagging) or by the cooling effect of water when involved in fire it will, in simple language, melt. Aluminium is non-combustible and will neither contribute fuel to, nor assist in, the spread of fire. However, at temperatures above about 250°C the load carrying capacity of aluminium is seriously reduced. It melts at about 650°C. Therefore, in that respect, if an aluminium structure is involved in a ship fire, it can materially assist in the spread of fire by no longer acting as a fire boundary. Fallen cables and other services that had been secured to the deckhead/bulkhead by aluminium hangers, which are destroyed in fire, may seriously hamper firefighting measures.

1732. Glass Reinforced Plastic (GRP) and Fire

a. Use of Glass Reinforced Plastic (GRP) for construction of ships poses two problems in respect of fire:

(1) Dense smoke is evolved from burning of the surface resin.

(2) There may be a marked reduction in strength of GRP with increase of temperature.

b. The GRP beneath the layer of surface resin is very resistant to penetration by fire and the structure is an effective insulator. A fire in one compartment will not create a localised ‘hot-spot’ in an adjacent space. However, heat will be transferred laterally across the GRP laminate and can cause remote hot spots in through bulkhead pipework, cabling, securing bolts, etc. When the surface resin is heated it produces a strong pungent smell before ignition, thus providing an effective early warning of potential fire. Boundary coolers must be extremely vigilant and ensure that likely heat-soaks are regularly monitored, and prompt action taken, should secondary fires occur. Notwithstanding the excellent insulation properties associated with GRP, the basic principles of boundary cooling still apply, ie a minimum of a CFHR or a charged hose with a firefighter nozzle (nozzle turned off until required).

1733. Fires Involving Hazardous Stores

Details of the chemical constituents of codified hazardous stores are available on the Hazardous Stores Information System (HSIS), which is held on CD by Naval Stores. As the hazard from such stores may be increased in a fire, it is important that this information is readily available. BRd 2170(5) - Embarked Aviation Crash Fire Rescue (CFR) 2013 Edition contains specific information on materials used in aircraft, their associated hazards and the resultant firefighting procedures.

1734. Fuel and Lubricating Oil Tanks

a. Fuels and lubricating oils can present a considerable hazard in the vicinity of a fire. However, cold liquid fuel in a full tank is safer than fuel vapour in a partially filled tank. The following questions should be considered by the MEOOW/MEOOD when advising the MEO/OOD and by the MEO in State 1:

(1) Is there associated action damage or is it solely a fire incident?

(2) If there is action/heat damage, is a ready-use tank or associated pipe work ruptured, and therefore supplying fuel to the fire in that space?

(3) Are emergency dump or rundown facilities fitted to the tank? Compartment Kill Cards should state this information. If this is so:

(a) Would dumping reduce the amount of fuel and so assist the extinction of the fire?

(b) Would pressing the fuel tank full cause further supplies of fuel to reach the fire via damaged fuel transfer pipes?

(4) Where does the dumped fuel go? If to an adjacent overflow tank or bilge, have they enough receiving capacity, and would this promote further hazards?

(5) Would vital power supplies still be available if the tank contents were dumped?

(6) Is it possible to fill the tank 100% full, ie does it have a float operated inlet valve and does it have an overflow? If it has an overflow, where does it overflow?

b. Bulk storage tanks pose additional questions:

If the tank is structurally sound and the systems are intact, is fuel likely to escape from dip tubes or air escapes when it is pressed full? If so, take precautions to ensure that the fuel is not allowed to overflow via these openings.

1735. Machinery Space Fires

Guidance on fighting machinery space fires is given at Annex 17F.

1736. Galley Fires

a. Fire in a galley is usually the result of spillage and/or the overheating of trays and utensils in ovens or on hot plates, particularly when the equipment is left unattended. Deep fat fryers present a serious hazard because of the quantity of fat or oil they contain. In common with all other galley equipment, deep fryers should never be left unattended when they are switched on.

b. in the event of a galley fire the immediate local action must be:

(1) Switch off power to the equipment locally, stop the galley vent and raise the alarm.

(2) Shut the fire baffle locally.

(3) If the fire is in the deep fryer, attack the fire with a 6 ltr Wet Chemical Extinguisher (Fry Fighter) or 9 ltr SPE(AFFF). On completion shut the lid.

c. If the fire is not extinguished by the above immediate local action:

(1) Switch off power at master switches sited outside the galley door.

(2) If local closing of the fire baffle is not possible shut it by remote operation at the galley door, stop the galley vent and raise the alarm.

(3) Shut the weather deck terminal to the galley exhaust trunking. Cooling the trunking with water spray may help to prevent the spread of fire.

d. A fire that is beyond fighting with first aid measures should be attacked with a FB5X foam making branchpipe, used under close supervision because of the dangers inherent in a fat fire. Fire parties must be exercised regularly in the correct drill to deal with a galley fire. Water must never be used except for boundary cooling, and CO_2 is not recommended because it has insufficient cooling effect and re-ignition is most likely once the CO_2 has dispersed.

e. An SOP for dealing with Galley Fires should be documented held in each specific Class CBRNDC Orders.

1737. Danger from Oxygen Enrichment

Normal air contains 21% of oxygen. In air which contains more than that (oxygen-enriched), flammability, ie ease of ignition, combustion rates and combustion temperatures all increase. Materials such as clothing, which do not burn readily in air, burn much more actively in an atmosphere that is enriched with oxygen. An oxygen content increase of only 4% gives rise to a particularly dangerous situation. A further hazard is that, under pressure, and in the presence of heat (such as can be generated by opening the valve of an oxygen cylinder too rapidly), oxygen will react to oil and grease with a violent explosive force. The utmost care must be exercised whenever oxygen is being used onboard ship, particularly if within a confined space. Oxygen cylinders must be turned off and the reducing valve removed whenever they are unattended.

1738. Electrical Fires

a. Electrical fires are usually caused by an electrical fault generating enough heat to ignite insulation, paint, or some other combustible substance close to it. Giving the name electrical to this type of fire serves to inform the firefighters of the precautions they must take and enables the correct firefighting technique to be employed. A fire that may start with solids or liquid fuels and subsequently involves live electrical equipment or circuits becomes, in effect, an electrical fire. It is important, therefore, to switch off all electrical circuits in the vicinity of a fire, if it can be done without detriment to essential services, eg firefighting pumps. When power is off, what was an electrical fire is a straightforward fire of the combustibles present and should be attacked with the appropriate equipment. In the event of minor fire symptoms, e.g., a small smoke emission from within an electronic cabinet or switchboard, these may all disappear once all power supplies are removed. Some discretion is therefore necessary in the initial firefighting action.

b. The actions, which should be taken, are:

(1) **Fire in Electrical Equipment.** Isolate the power supply and attack the fire with CO_2. The use of CO_2 should not be delayed if power cannot be removed. However, re-ignition is likely until isolation is achieved. If this action does not extinguish the fire it should be treated as an ordinary fire and attacked with water. If the power cannot be switched off, it is possible, at voltages up to 440V AC or 800V DC to use water in the form of a spray, provided that the nozzle is not nearer than 1.8 m to any live equipment, irrespective of the type of water (fresh or sea) being used.

(2) **Fire in High Voltage (HV) Equipment.** Due to the energy inherent within a HV system (above 1000V AC or 1500V DC), high voltage electrical fires will not be extinguished until electrical power has been disconnected. Therefore, manual injection of CO_2 should only be undertaken once power has been disconnected; however, fixed CO_2 systems may be operated prior to disconnection. Although electrical disconnection is likely to occur either through the correct operation of the safety protection devices or due to high energy discharge through the fault region resulting in an open circuit, firefighting action must only be taken once disconnection has been confirmed. Water, even in the form of spray or AFFF foam, must not be used for firefighting on live HV equipment (see Chapter 15).

(3) **Fire Within a Live HV Compartment.** Where all HV equipment within the compartment has ingress protection (IP) of IP56 or greater and the integrity of the HV equipment is not endangered by the fire, then manual firefighting is permitted using dry powder and CO_2 extinguishers or CFHRs. Where any HV equipment within the compartment has an ingress protection of less than IP56, then manual firefighting is limited to CO_2 and dry powder extinguishers. For other than strictly controlled training serials, lay-flat hoses are not to be deployed and used within any HV compartment where the ingress protection of the HV equipment is less than IP57 (submersible) until such time that it has been confirmed that power to all HV equipment has been disconnected. Once disconnection has been confirmed, normal RN firefighting procedures are to be followed. Fixed water and AFFF spray systems may only be operated on live HV equipment in an extreme case and where the ingress protection of all the HV equipment is IP56 and all personnel have been evacuated from the compartment. Detailed guidance is given in BR 2000(52)(1) - Operating Guidance for High Voltage Systems in HM Ships, Submarines and the Royal Fleet Auxiliary (also see Chapter 15).

(4) **Fire in Electronic Cabinets.** Isolate power if the local switch is accessible, and attack with CO_2 through the injection nozzle when fitted, or where practicable by opening doors/covers when not. Switch off and remove fuses from all power sources (including alternatives) to the equipment. If these actions do not extinguish the fire it should be treated as an ordinary fire and attacked with water, observing the precautions regarding voltages given above. When the fire has been apparently extinguished, all drawers or sections of complex equipment should be opened to confirm that the fire is extinguished.

(5) **Sting Ray Torpedo Battery Fire.** This battery contains (amongst other substances) magnesium, and the fire is to be fought using copious amounts of water (see Annex 17G for fires in air weapons magazines). It is most important that the firefighters must wear BA and, should their clothing become contaminated with thallium effluent, it must be thoroughly washed after removal (see BR 8680(A)(2)(5(1)).

1739. Explosives and Pyrotechnics

Firefighting in magazines and the behaviour of explosives and pyrotechnics is discussed at Annex 17G. The effects of fire on aircraft armaments and pyrotechnics are covered in BRd 2170(5).

1740. Fires in Aircraft Hangars

a. Large Aircraft Hangars (CVF) are divided into sections that can be isolated from each other by closing fireproof curtains. The whole hangar is regarded as a DC section. The Hangar Control Position (HCP), from which the Hangar Control Officer (HCO) supervises safety arrangements and the movement of aircraft in the hangar, is equipped as a Damage Control Section Base and has communications with fuelling positions and HQ1. The fire curtains can be operated from the HCP, inside the hangar on either side of each curtain and in the access lobbies. Each hangar section has one access lobby to port and starboard. If the event of a fire in the hangar, ventilation should be crash stopped, but it is recommended that the trunking is not closed because, if spraying is started, the sudden drop in pressure may damage the fire curtains. On the first instance the fire must be attacked with 9 ltr foam (AFFF) extinguishers, CO_2 (if appropriate) and, possibly, main foam appliances. As soon as it becomes obvious that the first aid firefighting measures are having no effect, the Command/HCO should consider the use of fixed installations (hangar sprays), for FF/DD Command approval must be authorised prior to their use. Preparation to activate the fixed installation must be made from onset of the fire and very early action must be taken to drain back any aviation fuel from charged systems.

b. The danger from composite fibre materials in a fire (see BRd 2170(5)) will be compounded in an enclosed area such as a hangar, so early use of breathing apparatus will be essential. After a fire in a hanger, involving composite fibres, great caution must be exercised to contain contamination and to establish a safe working environment. Access is to be strictly controlled; protective clothing and BA will be necessary until it can be ascertained that no fibre dust is present. This may require the removal and cleaning of all equipment in the hangar.

1741. Floating Oil or Fuel

This hazard is sometimes met in harbours and basins. If ignited it could cause a ship fire. Alternatively, with a ship on fire, floating oil or gasoline in the basin, or discharged from the ship, might result in a ship-to-ship fire. Floating burning fuel should be attacked with AFFF, although high flash point fuel can usually be broken up with water jet and then isolated portions cooled and quenched with water spray. A patch of burning fuel can be prevented from spreading by using the wash from ships' boats.

1742. Firefighting in a Chemical Environment

a. The citadel entry procedures after firefighting in a chemical environment are detailed in BRd 2170(2). The protective clothing for these operations is detailed in Chapter 20. The BA procedures, including changes between EDBA and General Service respirator, are detailed at Annex 17K.

b. Before committing firefighters to an incident where contamination is suspected, the following points should be considered to reduce the risk of contamination to personnel and equipment:

(1) If fixed firefighting systems have been used and all indications are that the fire is extinguished, consider delaying re-entry to allow purging of the compartment to help disperse the contaminant. Once re-entry by minimum number of personnel has confirmed that the fire is extinguished, withdraw firefighters and carry out monitoring and then decontamination if required.

(2) Consider all entry/exit routes to/from compartment, including escape routes. Machinery spaces may, for example, be entered via a pressurised airlock and exited via escape route to the upper deck. Contaminated personnel can then re-enter the citadel via normal cleansing stations. If contamination of equipment is suspected, contaminated equipment is to be contained within CBRN contaminated equipment containment bags[a]. Advice on decontamination and reconstitution should be sought from DSTL PortonDown via CBRN Reachback.

(3) If liquid contamination is suspected, firefighters are to dress in full IPE. This gives minimal heat protection, and they must therefore stay behind a waterwall until fire is confirmed extinguished.

(4) Always have a relief team standing by but consider minimising the number of personnel exposed by using only one team for the firefighting effort. The team maybe briefed to consolidate and withdraw to the airlock/entry for a rest and cylinder change at a pre-determined BA pressure.

1743. Search and Rescue

Search and Rescue operations in a fire environment are detailed at Annex 17H.

1744. Post Fire Precautions - Fire Sentry

A sentry should be posted at the scene of the fire after it has been extinguished to report and respond to any re-ignition. Initially, the sentry may be provided by one of the withdrawing Support Party, if his BA has sufficient air remaining. Guidance on the requirement for follow on fire sentries is:

a. Sourced from the pool of spare personnel, not from the Firefighting Team, who will need rest.

b. A BA Controller will be required if dressed in full firefighting rig.

[a] Currently MIZZY Small.

c. To remain in communication, with the FCP, the FRPP or HQ1/SCC using suitable method.

d. To be provided with a charged hose fitted with a firefighter nozzle, or centre feed hose reel of sufficient length to reach all areas of the compartment under surveillance.

e. if required to patrol several compartments, if they are to be on the same deck and it is practicable to do so. If there is requirement to patrol on different decks, then further sentries must be posted.

f. A sentry will be required until the person in charge of firefighting is satisfied that there is no possibility of re-ignition.

ANNEX 17A

FIREFIGHTER/WATERWALL NOZZLES TACTICS, TECHNIQUES AND PROCEDURES

1. Clarification of Re-Entry Techniques

WARNING

CURRENT EQUIPMENT AND FIREFIGHTING TRAINING PROCEDURES SUPPORT 'WET' RE-ENTRY TECHNIQUES ONLY AND ANY DEVIATION FROM CURRENT TECHNIQUES IS CONSIDERED UNSAFE.

a. Recent reports and ships investigations show an increase in the number of ships conducting the use of 'dry re-entries'. It is appreciated that a 'dry re-entry' reduces the amount of water damage to the affected compartment, however, employing this technique increases the likelihood of an explosive re-ignition, **exposing the ship and its crew to unnecessary and avoidable additional danger.** This remains the case for MMS even if the TMS limit of 60°C has been reached (see Annex 17E).

b. Ships Staffs are highly trained to fight fires at sea but there is limited knowledge of how a fire develops and the subsequent predictability and behaviour of fire gases. During a fire various material start to pyrolyse with a wide variation of flammable ranges. The current practice of closing down the compartment prevents the fire gases dispersing throughout the ship and starves the fire of oxygen, unfortunately this creates an ideal environment for a backdraught. Ships staff are unable to establish the composition of the fire gases within a closed compartment; it is this unknown condition that can lead to a backdraught scenario, making dry re-entry inherently dangerous.

c. When the fire is reduced or extinguished, the temperature in the compartment will eventually drop below 60°C nevertheless the pyrolysed gases will remain within the compartment. While re-entry at 60°C significantly reduces the risk of re-ignition **it does not eliminate the risk.** When conducting a re-entry, opening a door or hatch to allow firefighters access to the compartment also introduces oxygen which mixes with the rich gases. If a source of ignition is still present eg residual embers or small flame, the mixture of gases will create an explosive re-ignition.

d. The re-entry techniques trained and employed as detailed in this Annex and illustrated in BR 4007 are the only safe method to make a re-entry into a compartment which has been exposed to fire, whilst affording maximum protection to firefighting teams. The use of the waterwall protects both the firefighting teams and the ship from any explosive re-ignition that may occur.

2. Hose Charging

Prior to the following re-entry techniques, which are illustrated in BR 4007, the hoses are to be charged, unless otherwise stated. The Team Leader must ensure that the Hydrant Operator has identified which hydrant supplies the Waterwall Operator and which supplies the Firefighter. They can then take up their position behind the waterwall to back-up/support, this is to be done whenever an order is given in regards to operation of hoses. Both the firefighter and waterwall nozzles are to be shut initially.

The Team Leader then gives the order **“HYDRANT OPERATOR, ON FIREFIGHTER AT THE HYDRANT”**. The Hydrant Operator repeats the order, and then carries it out. They then inform the Team Leader **“FIREFIGHTER ON AT THE HYDRANT”**. The Team Leader then gives the order **“HYDRANT OPERATOR, ON WATERWALL AT THE HYDRANT”.** The Hydrant Operator repeats the order, and then carries it out. They then inform the Team Leader **“WATERWALL ON AT THE HYDRANT”**.

3. Re-Entry on the Same Level - Carbonaceous Fire

a. The Waterwall Operator crouches on one knee and positions himself, either in front or to the side of the door, depending on which way the door opens:

(1) If the door opens towards the Team (**hinges can be seen**), then the Waterwall Operator positions himself on the opposite side of the door to the hinges, just to the side of the door so that they will not impede the opening of the door.

(2) If the door opens away (**hinges cannot be seen**), they then positions themselves on the side of the door opposite the hinges, with the nozzle in position against the door frame.

b. The Team Leader remains behind the Waterwall Operator and backs them up. The Firefighter positions themselves adjacent to the Team Leader crouching on one knee. The Team Leader then gives the order **“FIREFIGHTER, ON PERSONAL PROTECTION”**. The Firefighter operates the nozzle one eighth of a turn to the right to produce a 2 m flat disc of water for personal protection. Once this is confirmed to the TL, the Firefighter is ordered to **“Stand up and release all door clips except one”** and holds the last clip on the door at arm’s length. The Team Leader first ensures that they are backing up the Waterwall Operator, and then gives the order **“ON WATERWALL”**. The Waterwall Operator rotates the nozzle swiftly through its full range to the left, to produce a 10 m flat disc of water. If the door opens away from the Team, the Waterwall Operator now places the nozzle inside the door frame.

c. When both the firefighter and waterwall nozzles have been operated, the Team Leader orders the Firefighter to **“OPEN THE DOOR”**.

(1) **If the door opens towards the Team.** The Firefighter opens the last clip on the door (usually in the centre, opposite the hinges), and opens the door to 45°. At the same time, the Waterwall Operator moves across to place their nozzle in the opening, against the door frame.

(2) **If the door opens away from the Team.** A chain or rope must be secured to the door and held by the Team Leader, to enable him to close the door if necessary. The Firefighter opens the last clip, turns his back and pushes the door open with his boot. The waterwall, already in position, has sealed the door.

d. Once the door is fully open, the Firefighter crouches on one knee adjacent to the Team Leader. When ordered by the Team Leader, the Firefighter adjusts the nozzle a further 1/8 to ¼ of a turn to the right to a ragged spray. **If the fire can be seen** the Team Leader orders the Firefighter to fight the fire.

e. If the fire cannot be seen the Team Leader orders the Firefighter to direct the ragged spray towards the deckhead to cool the compartment down. The Team Leader uses the TIC to scan around the compartment, looking for the seat of the fire, and indicates its position to the team. When the Team Leader is confident that the compartment has been sufficiently cooled, he orders the Team to **"STAND UP and ADVANCE"** ensuring that the waterwall is not breached by the remainder of the team into the compartment, cooling and extinguishing the fires. The Hydrant Operator now acts as a Hose Handler, helping the team to move forward.

f. Once the fire is extinguished the TL retreats the team to a safe area and directs the team down on one knee and the orders **"FIREFIGHTER, ON PERSONAL PROTECTION"**. Once this action is complete, the TL, ensuring the waterwall is not facing the seat of the fire, orders **"WATERWALL OPERATOR OFF WW"**. When complete, TL orders **"FIREFIGHTER OFF FF"** and stands up the Firefighter and proceeds to conduct a boundary search (see Para 9).

4. Re-Entry on the Same Level - Oil Fire

a. The Team position themselves by the door, as previously described for a carbonaceous fire. **THE TEAM LEADER POSITIONS HIMSELF BEHIND THE WATERWALL OPERATOR, BACKING HIM UP.**

b. After ensuring that the Firefighter is aiming the FB5X in a safe direction away from the door, the Team Leader orders **"PROVE FOAM"**. The Firefighter moves the switch on the FB5X to the **open** position and proves foam, using the fingertip method (putting the tip of his firefighting glove into the flow of the foam, then wiping it on the extreme edge of their BA visor. Foam will stick to his visor; water will run off). Once the Firefighter has proved foam, they move the switch on the FB5X to the **shut** position. Once the foam has been proved the Firefighter is ordered to **"Stand up and release all door clips except one"** and holds the last clip on the door at arms length.

c. The Team Leader, backing up the Waterwall Operator, orders **"ON WATERWALL"**. The Waterwall Operator rotates the nozzle swiftly through its full range to the left, to produce a 10 m flat disc of water.

d. The Team Leader orders the Firefighter to **"OPEN THE DOOR"** (as previously described). Once the door is fully open, the Firefighter gets into position, alongside the Team Leader, (behind the Waterwall Operator); they crouch on one knee, always keeping the FB5X pointing away from the fire into a safe corner. The Team Leader orders the Firefighter **"PROVE FOAM IN A SAFE DIRECTION".** Once foam has been proved, the Team Leader orders the Firefighter to **"IN FB5X, FIGHT THE FIRE"**.

e. The Team Leader, using the TIC, orders the Firefighter to direct the foam above the fire. Once the fire is extinguished, the Team Leader orders the Firefighter **"OUT FB5X"**. The Firefighter directs the FB5X into a safe direction, then the Team Leader orders **"OFF FB5X"**. The Team Leader confirms that all fires are extinguished then, ensuring the WW is facing away from the seat of the fire, orders **"Off Waterwall"**. If the fire cannot be extinguished from the door the Team Leader is to order the Firefighter **"OUT FB5X"** followed by **"IN A SAFE DIRECTION OFF FB5X"**.

They are then to reposition their team by advancing the WW to an area they deem better to fight the fire. The Team Leader is then to bring the Firefighter to a position behind the WW, prove foam once more and fight the fire as described above.

Note. *Consideration should be given to using a Ship Protector if the Team Waterwall leaves the access route unprotected. The 3 hose technique described in Para 6 may be adapted to achieve this.*

5. Re-Entry From Above - Carbonaceous Fire

a. The Waterwall Operator and Firefighter each takes up position, crouched on one knee with the hose over the shoulder, one hand on the hose banding behind the coupling, and one hand on the nozzle. The hoses are positioned on the opposite side of the hatch to the hinges with the WW adjacent to the ladder. The nozzles are to be positioned below the level of the hatch opening.

b. The Team Leader remains standing to back up the Waterwall Operator, holding the hose with one hand and backing themselves up with the other. The Team Leader then gives the order **"FIREFIGHTER, ON PERSONAL PROTECTION"**. The Firefighter turns the nozzle 1/8th of a turn to the right to provide a 2 m flat disc of personal protection waterwall. Then, backing up the Waterwall Operator, the Team Leader orders **"ON WATERWALL"**. The Waterwall Operator turns the nozzle swiftly through its full range to the left, to form a 10 m flat disc of water for team protection.

c. The Team Leader moves to the end of the hatch and stands with their back to the hatch. They indicate to the Waterwall Operator and the Firefighter that they intend to open the hatch; both of them acknowledge this. The Team Leader reaches down, takes hold of the hatch and stands up, so that the hatch is at an angle of 45°. The Waterwall Operator and Firefighter immediately position their nozzles with the release lugs of the hose couplings resting across the corners inside the hatch coaming. The Team Leader looks over their shoulder to check that both nozzles are in place and then opens the hatch, making sure that the retaining clip secures it in the fully open position. With the hatch fully open, the Waterwall Operator and Firefighter are now sealing the hatch, preventing the smoke and flame from escaping from the compartment.

d. The Firefighter confirms the nozzle is still set to provide a 2 m flat disc for personal protection. The TL orders the Firefighter to lower the firefighter nozzle 2 m into the compartment (see BR 4007 Figure 7-14). The Firefighter then aggressively swings the hose to gain maximum cooling coverage in the compartment. When the TL is satisfied that adequate cooling has taken place, they order the Firefighter to raise the nozzle out of the compartment. The Firefighter raises the nozzle, assisted by the Hose Handler, checks that it is still set to personal protection, and then returns it to the corner of the hatch coaming to seal the opening.

e. The Team Leader takes over the waterwall from the Waterwall Operator, who makes their way down the ladder until their shoulder is level with the hatch coaming. The Waterwall Operator lifts his arm nearest to the waterwall nozzle and forms a clenched fist. The Team Leader lifts the nozzle from the hatch coaming and positions it underneath the arm of the Waterwall Operator, pulling it up so that it is tight under their arm, locking the nozzle in place.

The nozzle protects the Waterwall Operator as he descends the ladder. On reaching the bottom of the ladder, the Waterwall Operator turns around, bringing the hose back under the right arm, checks the position of the nozzle, then reports **"LADDER CLEAR"**.

f. The Waterwall Operator moves to a pre-determined position away from the ladder and crouches on one knee. The Firefighter uses the same procedure to descend the ladder. On reaching the bottom they turn around, grips the hose under their right arm and reports **"LADDER CLEAR".** They then move to a position behind the Waterwall Operator.

g. The Team Leader descends the ladder, reports **"LADDER CLEAR"** and positions himself behind the Waterwall Operator, alongside the Firefighter. They survey the compartment, using the TIC, and then directs the Firefighter to project a ragged spray towards the fire. If required, the Team Leader gives the order to advance on the fire, keeping control of the Team always.

h. Once the fire is extinguished the TL retreats the team to a safe area, directs the team down on one knee and the orders **"FIREFIGHTER, ON PERSONAL PROTECTION"**. Once this action is complete, the TL, ensuring the waterwall is not facing the seat of the fire, orders **"WATERWALL OFF WW"**. When complete, TL orders **"FIREFIGHTER OFF FF"** and stands up the Firefighter and proceeds to conduct a boundary search (see Para 9).

6. Re-Entry From Above - Oil Fire (Three Hose Technique)

a. An oil fire re-entry from above, using the three hose technique, requires a 5-man Support Party; the extra man being the Ship Protector. Both the Waterwall Operator and the Ship Protector position themselves, with waterwall nozzles, on the side of the hatch opposite to the hinges. The Firefighter has a FB5X to produce foam to fight the fire. When ready, the Team Leader orders the Firefighter **"PROVE FOAM IN A SAFE DIRECTION".** The Firefighter proves foam (as detailed in Para 4 sub para b) and confirms this to the Team Leader.

b. The Team Leader, while backing up the Waterwall Operator, orders **"ON WATERWALL"**, then they back up the Ship Protector and orders **"ON SHIP PROTECTOR"**. The Team Leader then opens the hatch, making sure that it is firmly clipped open. Both the Waterwall Operator and the Ship Protector seal the hatch with their waterwalls.

c. The Team Leader orders the Firefighter to **"PROVE FOAM IN A SAFE DIRECTION"** again. When the Firefighter has proved foam, they direct the foam down into the compartment. After the contents of at least 2 drums of AFFF have been projected into the compartment, the Team Leader orders **"OUT FB5X"** then when clear of the compartment **"OFF FB5X"**. The Firefighter moves the FB5X from the compartment and shuts it by pulling the switch to the shut position.

d. The Waterwall Operator descends into the compartment (as described in Para 5 sub para e). The Firefighter moves onto the ladder until their shoulder is level with the hatch coaming, raises their arm nearest to the nozzle and makes a clenched fist.

The Team Leader lowers the FB5X hose, parallel to the Firefighters body, until the FB5X is at waist height. The Firefighter places the FB5X hose under their arm and descends into the compartment.

e. The Team Leader follows and takes up position behind the WW operator, using the TIC to survey the compartment to find the seat of the fire. They direct the Firefighter away from the fire and orders **"PROVE FOAM IN A SAFE DIRECTION"**. Once foam has been proved the TL orders the firefighter **"FIGHT THE FIRE"**. The Firefighter then directs foam above the fire allowing the foam to smother **and** cool the fire. If the fire cannot be extinguished from the bottom of the ladder the TL is to order the Firefighter **"OUT FB5X"** and in a safe direction **"OFF FB5X"**. They then to reposition his team by advancing the WW to an area he deems better to fight the fire. The TL is then to bring the FF to a position behind the WW, prove foam once more and fight the fire as described above.

7. Re-Entry From Above - Oil Fire (Fixed Hatch Waterwall)

a. This technique allows the use of a 4 man Support Party, yet still protects the ship. The use of FHWW is to be closely controlled by HQ1 due to the large amount of water (approximately 10 ton/hr) that it can put into a compartment.

b. The Team take up positions, with the Waterwall Operator crouching to the side of the hatch opposite to the hinges, and the Firefighter standing. After the Firefighter has proved foam, the Team Leader orders **"ON WATER AT THE HYDRANT, TO THE FIXED HATCH WATERWALL".** The Team Leader backs up the Waterwall Operator and orders **"ON WATERWALL"**. The Team Leader opens the hatch to 45°. The Waterwall Operator moves his nozzle into position inside the hatch coaming. When the Team Leader is satisfied that the Team Protection waterwall nozzle is in position, they open the hatch fully, ensuring that the hatch retaining clip is engaged.

c. Once the hatch is fully opened, the Team Leader takes up position on his knees and orders the Waterwall Operator to **"LOWER YOUR WATERWALL TO JUST BELOW THE FIXED HATCH WATERWALL"**. When the waterwall nozzle is in position below the fixed hatch waterwall, the Team Leader checks that the fixed hatch waterwall is still sealing the hatch opening. If it is, they order the Waterwall Operator to move their nozzle back to the hatch coaming. The Team then carry on, as described for a 5 man team.

d. If the fixed hatch waterwall is not sealing the hatch opening correctly, then a controlled closure of the hatch must be made. The Team Leader orders the Waterwall Operator to move the waterwall nozzle back to the hatch coaming. The Team Leader releases the hatch retaining clip and lowers the hatch to 45°, then orders the Waterwall Operator to remove the waterwall from within the coaming. Once the waterwall has been removed, the Team Leader lowers the hatch, backs up the Waterwall Operator, and orders **"OFF WATERWALL"**. When the waterwall nozzle is shut, the Team Leader orders **"OFF WATER AT THE HYDRANT, TO THE FIXED HATCH WATERWALL"**.

e. A 5-man team, using a ship protector must then be used for re-entry.

8. Re-Entry From Below - Oil Based Fire

a. The Hydrant Operator is positioned at the hydrant. The Firefighter stands to one side of the ladder, holding the FB5X in a pistol grip fashion, right hand on the spill pick up connection, left hand on the ring guard, ensuring that the nozzle is shut.

b. The Waterwall Operator crouches on one knee and positions themselves at the base of the ladder ensuring that waterwall nozzle is fully closed.

c. The Team Leader, from behind the Waterwall Operator, gives the order **"HYDRANT OPERATOR, ON FIREFIGHTER AT THE HYDRANT"**. The Hydrant Operator repeats and then carries out the order. Once he has carried out the order, they will inform the Team Leader **"FIREFIGHTER ON AT THE HYDRANT"**. The Team Leader then gives the order **"FIREFIGHTER PROVE FOAM IN A SAFE DIRECTION"**. The Firefighter then proves foam and once he has proved foam, he shuts off the FB5X.

d. The Waterwall Operator fully opens the waterwall nozzle and then inserts it in the mounting pole. The Waterwall Operator then takes up position on the ladder with their nozzle in the mounting pole and positions it to seal the hatch. The Team Leader uses the support pole to support the mounting pole. Once the Team Leader has confirmed that the waterwall is in the correct position he gives the order **"HYDRANT OPERATOR, ON WATERWALL AT THE HYDRANT"**. The Hydrant Operator repeats and then carries out the order. Once he has carried out the order, they inform the Team Leader **"WATERWALL ON AT THE HYDRANT"**. The Team Leader now opens the hatch.

e. The opening of the hatch is a coordinated effort between the Team Leader and the Waterwall Operator. The Team Leader removes his pole from the mounting pole and pushes open the hatch. Once they have opened the hatch, they return their pole to the waterwall mounting pole. The Team Leader and Hose Handler then assist the Waterwall Operator in manoeuvring the mounting pole to the hatch coaming. If the seat of the fire is known the waterwall should be positioned in the hatch coaming to give a safe area for the firefighter to step in to behind waterwall protection.

f. The Team Leader gives the order **"FIREFIGHTER, PROVE FOAM IN A SAFE DIRECTION AND PUT A LAYER OF FOAM IN THE COMPARTMENT ABOVE"** (minimum 2 drums of foam). Once the firefighter has projected the layer of foam, the Team Leader gives the order **"FIREFIGHTER OUT FB5X"** followed by **"IN A SAFE DIRECTION OFF FB5X"**. The Team Leader takes the FB5X from the Firefighter. The Firefighter then climbs the ladder. The Team Leader passes up the FB5X to the Firefighter. The Firefighter positions himself behind the waterwall, proves foam in a safe direction away from the seat of the fire and, once he has proved foam, they bring the FB5X round in a sweeping motion and fights the fire.

9. Boundary Search

a. Once all fires have been extinguished within the compartment a thorough boundary search is to be conducted including a check of all firefighting equipment by the TL and FF.

b. In the case of a carbonaceous fire this is to be conducted using the firefighter with the hose charged but with the nozzle **OFF**.

c. In the case of an oil fire the boundary search is to be conducted using a CFHR charged, foam proved and the nozzle in the **OFF** position. If a CFHR is not available, the search is to conducted with a AFFF SPE available to extinguish any minor fires or re-ignition discovered.

d. The WW operator is to remain in a safe area with his nozzle off ready to provide immediate protection to the remainder of the team.

e. If major re-ignition occurs during this phase the team is to return to safety behind the WW, open the WW and continue to fight the fire in the previously described manner.

f. Whilst conducting the boundary search any carbonaceous material discovered is to be doused **AND** broken up ensuring that, in the case of an oil based fire, the foam blanket is not disturbed.

g. Any ‘hot spots’ discovered are to be immediately reported to the FCP.

h. On completion of the boundary search the actions detailed for provision of a sentry in Para 1744 are to be taken.

10. Compartment Withdrawal

a. During firefighting operations, it may become necessary for the firefighting team to withdraw. Reasons may include:

(1) Injury.

(2) BA whistle operation (see Para 1727).

(3) Operation of team members BA Bypass Valve.

(4) Tactical withdrawal.

Before any withdrawal commences the TL is to inform the remainder of the team of the requirement to withdraw. Team Leaders are to withdraw their team as safely and swiftly as possible using the following the routines at sub para b and sub para c as a guideline.

b. Withdrawal On The Same Level Through a Watertight Door

(1) Order **“FIREFIGHTER, ON PERSONAL PROTECTION”** or **“OFF FB5X”**.

(2) Stand up the whole team and withdraw backwards to an area adjacent to the door keeping the waterwall between the team and the fire. It is essential at this stage that Hose Handlers and Hydrant operators assist the team to ensure a safe exit.

(3) When at the door, TL passes through the door and checks the door integrity.

(4) When TL has confirmed the integrity of the door, they order the Firefighter back through the door and directs them to take control of the door and prepare to close it.

(5) Once in position TL orders Waterwall Operator back through the door.

(6) When whole team is in position TL orders the Waterwall Operator to get down on one knee adjacent to the non-hinge side of the door in the same position for opening with nozzle on the door frame.

(7) When satisfied that door is sealed TL orders **"FIREFIGHTER CLOSE DOOR TO 45°"**.

(8) When satisfied the TL Orders **"FIREFIGHTER CLOSE THE DOOR"**. At this point Waterwall Operator withdraws his nozzle, Firefighter closes the door and ensures that a minimum of 1 clip is closed to ensure the door is secure. The Firefighter is to retain control of this clip until the WW nozzle is shut.

(9) TL, whilst backing up the Waterwall Operator, now orders **"OFF WW"** and on completion orders **"FIREFIGHTER DOWN ON ONE KNEE".** When the Firefighter is in position TL orders **"OFF FF"**.

(10) When nozzles are shut TL checks team air supply and if safe to do so orders the person with the highest pressure to establish BC with either FF nozzle or CFHR on the door whilst TL, backing up the Waterwall Operator, isolates and drains down the hoses not in use.

(11) TL then either withdraws the remainder of the team to the FCP or acts as ordered by I/C Main Group/HQ1.

c. **Withdrawal Upwards Through A Hatch**

(1) Order **"FIREFIGHTER, ON PERSONAL PROTECTION"** or **"OFF FB5X"**.

(2) Stand up the whole team and withdraw backwards to an area adjacent to the ladder keeping the waterwall between the team and the fire.

(3) If a fire is still burning all nozzles are to remain open throughout the ladder phase of the withdrawal to afford maximum protection to the team and ship.

(4) TL now proceeds up the ladder, through the hatch and takes up position to supervise the ladder accent of the remainder of the team.

(5) Once in position they give the ladder clear and orders **"FIREFIGHTER UP THE LADDER"**. The nozzle is positioned to afford maximum protection to the Firefighter as he ascends the ladder. As the Firefighter approaches the top of the hatch TL takes control of the FF nozzle and hose and places it in the hatch combing before ordering the Firefighter to exit the ladder and take control of his nozzle.

(6) When FF has control of his nozzle and has confirmed the nozzle is still in personal protection, TL gives the ladder clear and orders **“WATERWALL UP THE LADDER”**. The nozzle is positioned to afford maximum protection to the Waterwall Operator as he ascends the ladder. As the Waterwall approaches the top of the hatch TL takes control of the WW nozzle and hose and places it in the hatch combing before ordering Waterwall to exit the ladder and take control of his nozzle.

(7) When Waterwall has control of their nozzle TL prepares to close the hatch.

(8) When ready TL closes the hatch by 45°.

(9) The TL Orders **“OUT WW AND OUT FF”** nozzles whist simultaneously closing the hatch and secures it by at least 1 clip.

(10) TL, whilst backing up the Waterwall Operator, now orders **“OFF WW”** and on completion orders **“FIREFIGHTER DOWN ON ONE KNEE”**. When the Firefighter is in position TL orders **“OFF FF”.**

(11) When nozzles are shut, TL checks team air supply and if safe to do so orders the person with the highest pressure to establish BC with either FF nozzle or CFHR on the hatch whilst TL, backing up the Waterwall, isolates and drains down the hoses not in use.

(12) TL then either withdraws the remainder of the team to the FCP or acts as ordered by I/C Main Group/HQ1.

ANNEX 17E

COMPARTMENT ISOLATIONS

1. Primary Isolations

Primary isolations are large sized isolations key to quick closing down of the space and may affect parts of a system remote from the incident. These should be achieved within 10 mins of the alarm being raised and must be complete prior to operating the second shot of Gaseous drench systems. The cards are to provide the following details:

a. Ventilation isolation cards to include all machinery space accesses, escape routes and flaps essential for the operation of the fixed firefighting system.

b. Mechanical isolation cards contain details of all flammable fluids and air systems.

c. All voltages above 230V AC.

d. To speed up identification, valves and flaps that are to be operated are to be clearly identified. Valves are to be painted using luminescent paint. Vent flaps are to be marked with their specific vent marking and the machinery space they supply.

2. Secondary Isolations

a. Secondary isolations are to be undertaken on completion of primary isolations in order to safely isolate or re-configure a system more locally to the incident. This will allow important systems, remote from the incident to be re-instated and less hazardous or non-essential systems to be isolated. Secondary isolations may take up to 30 mins to achieve and are to be completed prior to authorisation for a re-entry. Secondary isolations are NOT to be confused with boundary isolations.

b. Voltages above 50V AC and 120V DC pose an increased Risk to Life and MUST be isolated unless the consequent loss of equipment/capability (e.g. loss of Integrated Platform Management System in QEC) incurs a greater Risk to Life or significant risk to mission failure or platform capability. Such a decision must be dynamically risk assessed by an appropriate Competent Person and the Command advised with regard to the operational imperative.

c. It is an unacceptable risk for any extra low voltage circuits (including battery back-up) to remain live on any damaged equipment or system unnecessarily where damage repair is required. These supplies MUST be isolated, wherever possible, prior to any repair activities being undertaken. If these supplies cannot be isolated safely then the situation must be dynamically risk assessed and the work completed according to a Safe System of Work by a suitably Competent Person.

3. Electrical Re-Entry Isolations

In areas considered at a high risk from fire such as main machinery spaces re-entry isolation cards are to be produced covering electrical isolations in passageways and lobbies where re-entry hoses will be rigged and operated. These isolations are to be carried out when setting up and must be complete for a re-entry and must be completed prior to hoses being charged.

4. Conducting Mechanical and Electrical Isolations during CBRNDC Incidents

a. The LOTO system is the mandated Safe System of Work (SSOW)[a] for conducting electrical isolations. However, it is a lengthy process. There are occasions, such as during CBRNDC incidents or at war where the time to implement increases the exposure of personnel to other hazards and therefore increases the risk to life. For example, if it is not possible to complete a LOTO within the 10 minutes required for primary isolations. Therefore, an alternative and less rigorous SSOW may be adopted.

b. As soon as practicable, full LOTO MUST be instated. The two alternative SSOW available are Emergency and Action Isolations, which are described below.

5. Emergency Isolations

a. The Emergency Isolations SSOW can be used in State 2 or 3 for all emergencies, whether alongside or at sea, for all isolations to equipment or systems in order to protect personnel undertaking CBRNDC activities. This includes primary, secondary, boundary and re-entry isolations. The purpose of the Emergency Isolations SSOW is to provide a trackable method for making isolations onboard and that the isolations are clearly visible locally. **It is NOT to be used for conducting equipment repairs or maintenance.**

b. This SSOW is to be achieved using dedicated, numbered 'EMERGENCY ISOLATION' tags with an associated tote board (see Figure 17 E-1). Where valves or breakers are operated by IPMS/PMS, these are to be marked as 'Out of Service'. It is to be controlled by the DTSR/DMESR/DCO(L) or other platform specific equivalent and is to form part of their LOTO endorsement process.

c. As soon as reasonably practicable, these isolations MUST be replaced with a full LOTO.

[a] Policy in BRd 167 Chapter 13.

Figure 17E-1 – Emergency/Action Isolation

EMERGENCY/ACTION ISOLATION

Tag No: _____

DO NOT OPERATE BREAKER / VALVE

Equipment / System

_____

Name

_____

EMERGENCY/ACTION ISOLATION

DO NOT OPERATE BREAKER / VALVE

Note. *Specific S-Forms for Emergency/Action Tags are still being finalised and will be promulgated by RNTM when available. In the interim laminated LOTO tags (S3027(L)) are to be used.*

6. Action Isolations

a. The Action Isolation SSOW is to be used for conducting vital repairs on equipment or systems at sea to restore capability in a State 1 environment, in support of the Command Priorities. It is automatically authorised for use when a ship is at State 1.

b. This SSOW is to be achieved using dedicated, numbered 'ACTION ISOLATION' tags and a dedicated tote board. Where this is not achievable or practical a sentry can be left, if this is not possible and the relevant valves and/or control panel starter is within eyesight of the person conducting the repair then the starter is to be taken into local and switched to the 'OFF' position. Repairs can then be carried out without the removal of the circuit fuses or the tagging of a valve. Where valves or breakers are operated by IPMS/PMS, these are to be marked as 'Out of Service'. Regardless of environment the emphasis must always be to reduce the risk to life to as low as reasonably practicable.

c. In extremis, there may be situations at State 2 or 3 which necessitate the use of this less rigorous SSOW to reduce the risk to life of personnel, such as in support of critical navigational, medical or CBRNDC incidents. In these situations, the IBC is to explicitly authorise the Action Isolation SSOW to be used, limited to a specific equipment or system. This may be for ME, WE or AE equipment, and should involve discussion with the Command Advisor (WEO) over the criticality of the equipment and the potential risk to life incurred by not using the Action Isolation SSOW. The authorisation of the Action Isolation SSOW at State 2 or 3 must be recorded in the Ship's Log.

d. If a repair is required to the electrical control panel starter then the isolation is not to be at the starter but further back up the supply such as a HCOS or MCCB. Once the isolation has been made, all exposed conductors or damaged equipment must be checked using appropriate electrical test equipment to ensure all electrical supplies are isolated. Whilst undertaking this task, personnel must wear DC rubber gloves and use insulated tools. Test equipment must be checked prior to and after use on a known electrical supply. Should the site be vacated at any time prior to the repair being completed then full precautions and tests on the electrical cables are to be repeated. A check for electrical power should include phase to phase and phase to earth checks.

e. As soon as reasonably practicable, these isolations MUST be replaced with a full LOTO.

f. All technical personnel should be briefed and made fully conversant with this SSOW as part of Transition to War preparations.

7. Primary and Secondary Isolation Cards

a. Due to the number of isolations involved when closing down a main machinery space in the event of a fire or flood, ships are to have individual isolation cards for mechanical, electrical and ventilation systems. These are to be used to isolate a space in preference to the standard - Kill Card (see Annex 17J). However, the Kill Card should still be used to advise the MEO/DCO/OOD as to the hazards within the machinery space and enable cross-reference with the isolation cards as required.

b. Command approval must be sought prior to carrying out any isolation, which may affect power to command at sea. The issue and control of isolation cards should be strictly controlled by the MEOOW1/Propulsion Manager/DCO(L) at sea and the DMESR in harbour.

c. Master copies are to be held in HQ1/SCC in easily accessible stowages and clearly identifiable. A second copy should be held in each FRPP for use in the event of HQ1/SCC being evacuated. Duplicate A5 sized cards are to be issued to personnel carrying out the isolations thus speeding up the closing down process.

d. The HQ1/SCC Master Card and A5 card for issue are to be identical and to include:

(1) A pictorial map detailing a logical clear route.

(2) Clear identification of the required isolation/closure eg FL2000 valve, J1-24 MCCB, 01L18 ventilation flap etc.

(3) Location of isolation eg AER port fwd adjacent to the Fram filter, J1 EDC, Stbd waste adjacent to port RAS winch (thumbnail digital photos recommended).

(4) A tick box to allow isolations to be checked.

(5) Card number identified as Master or for issue.

(6) Issued to:……..

(7) Time out:……...

(8) Time completed:……..

e. Isolation cards are to be divided into 3 sub-systems with primary cards issued in the following priority order:

(1) Ventilation (1).

(2) Mechanical (2).

(3) Electrical (3).

8. Electrical Boundary Isolation Cards

To allow boundary cooling to take place safely boundary isolation cards are to be produced to identify electrical supplies to equipment sited on adjacent bulkheads. These isolations need only be carried out as the situation dictates and allow individual equipment's to be selected from a tabulated list. The layout of these cards should follow the basic format of isolation cards and include a method for equipment selection such as a check box. As appropriate, each sub-system should be separated into 'Primary' and 'Secondary' isolations. **This is only used within MMS all other incidents are to be classed as "Electrical Isolations" only.**

ANNEX 17B

MULTI-PURPOSE NOZZLE TACTICS, TECHNIQUES AND PROCEDURES

1. General

a. Prior to conducting re-entry techniques using multi-purpose nozzles, the following points are to be noted:

(1) There are no changes to team member titles[1].

(2) The multi-purpose nozzle is used in conjunction with Size 1 lay flat hoses for all types of fires.

(3) For oil based fires the multi-purpose nozzle and paired inline inductor is to be used to produce foam. A 20 ltr drum of AFFF will last approximately 90 secs, when this equipment is used.

(4) During firefighting, nozzle operating positions to be used are Waterwall and Ragged Spray only, indicated on and selected by the pattern selector ring (ring on front of nozzle). The flush position is used to flush the nozzle on completion of fire fighting with AFFF and is selected by rotating the pattern selector ring fully to the left.

b. Prior to any nozzle operation, the (TL) must obtain confirmation from their team members that the nozzle is set to the **230 ltrs/min SETTING AND CONFIGURED IN THE WATERWALL MODE OF OPERATION** by checking the flow rate selector.

2. Hose Charging

For all re-entry techniques hoses will be charged. The TL must ensure the HO has identified which hydrant supplies the WW and which supplies the FF. They can then take up position behind the WW, there is no longer a requirement to back up the WW operator, but support may be given to either the WW or FF operators as required. Both the FF and WW nozzles are to be shut initially. The TL then gives the order: **"HYDRANT OPERATOR - ON FIREFIGHTER AT THE HYDRANT"**. The HO repeats the order and then carries it out. They then informs the TL: **"FIREFIGHTER ON AT THE HYDRANT"**. The TL then gives the order: **"HYDRANT OPERATOR - ON WATERWALL AT THE HYDRANT"**. The HO repeats the order and then carries it out. They then inform the TL: **"WATERWALL ON AT THE HYDRANT".**

[1] Team Leader (TL), Firefighter (FF), Waterwall Operator (WW), Hydrant Operator (HO), Hose Handler (HH), Ships Protector (SP).

Figure 17B-1. Multi Purpose Nozzle

3. Re-Entry on the Same Level - Carbonaceous Fire

a. The WW operator crouches on one knee and positions themself, either in front, or to the side of the door opposite the hinges, depending on which way the door opens.

(1) **If the door opens towards the team (hinges can be seen):** The WW positions themselves just to the side of the door so that they will not impede the opening of the door.

(2) **If the door opens away from the team (hinges cannot be seen):** The WW will position themselves with the nozzle in position approximately 30 cm back from the door frame to achieve a seal[2] (due to the 170° angle of the cone).

b. The TL remains behind the WW. The FF remains standing and positions themself adjacent to TL. The TL then gives the order: **"FIREFIGHTER - ON WATERWALL"**. The FF operator opens the nozzle ensuring it remains in the waterwall mode of operation and then holds the last clip on the door at arm's length. The TL then orders: **"WATERWALL - ON WATERWALL"**. The WW operator opens the nozzle ensuring it remains in the waterwall mode of operation.

c. When TL has confirmed the WW positioning they order: "**FIREFIGHTER - OPEN THE DOOR"**.

(1) **If the door opens towards the team**: FF removes the last clip on the door and opens the door to 45°. At the same time, the WW moves across to place the nozzle approx. 30 cm[3] the opening, behind the door frame.

(2) **If the door opens away from the team**: Then a chain lanyard[4] with spring clip must be secured to the door and held by the TL, to enable the door to be quickly closed if necessary. TL confirms that the door is sealed correctly by the WW. The FF removes the last clip, turns their back and pushes the door open with their boot. The WW, already in position, ensures the door has been sealed.

d. Once the door is fully open the FF crouches on one knee adjacent to the WW. The TL confirms that the door is sealed correctly and directs the FF to aim their nozzle towards the bottom of the door to enhance the sealing effect. If the fire can be seen the TL can fight the fire by giving the order: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**.

e. **If the fire cannot be seen** the TL orders the FF: **"FIREFIGHTER - ON RAGGED SPRAY, COOL DECKHEAD"**. When the TL is confident that the compartment has been sufficiently cooled by use of the TIC[5], the order is given: **"FIREFIGHTER - SET TO WATERWALL"** this will enhance the team protection until the seat of the fire has been identified. The TL uses the TIC to scan around the compartment, looking for the seat of the fire, and indicates its position to the team. The TL will then guide the WW to a more suitable position within the compartment, to be able to safely fight the fire. Once happy with the WW positioning, the TL will guide the FF into position adjacent to the WW. The TL then orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**. If needed the TL will order the team to **"STAND UP"** and **"ADVANCE"** towards the fire ensuring they control the advancement so that the WW is not breached by the remainder of the team. The HO now acts as the Hose Handler (HH) helping the team to move forward, by ensuring the hoses do not become tangled or snagged.

[2] The multi-purpose nozzle produces a cone of water at 170° as opposed to the brass waterwall producing a 180° disc.
[3] This is an approximate distance.
[4] Lanyards should be at least 2m in length.
[5] Thermal Imaging Camera.

f. When the fire has been extinguished the TL withdraws the team to a safe area, directs the team down on one knee and orders: **"FIREFIGHTER - SET NOZZLE TO WATERWALL, OFF NOZZLE"**. Once this action is complete TL confirms the fire is extinguished and orders: **"WATERWALL - OFF NOZZLE"**. When complete, TL stands up the FF and proceeds to conduct a Boundary Search (see Para 10).

4. Re-Entry on the Same Level - Oil Fire

a. The team position themselves by the door, as previously described for a carbonaceous fire, with the TL positioned behind the WW.

b. TL orders: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. The FF opens their nozzle ensuring it remains in the WW mode of operation and proves foam using the fingertip method[6]. Once foam has been proved the FF shuts off the nozzle.

c. The TL then orders: **"WATERWALL - ON WATERWALL"**. The WW operator opens the nozzle.

d. The TL orders the FF to: **"FIREFIGHTER - OPEN THE DOOR[7]"**. Once the door is fully open, the FF gets into position, alongside the WW, keeping the nozzle pointing in the direction of the fire. The TL orders: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. Once foam has been proved and confirmed again, while ensuring the nozzle remains in the WW mode of operation, the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**.

e. The TL, using the TIC, directs the FF to ensure foam is laid above the fire. Once the fire is extinguished, the TL orders: **"FIREFIGHTER - SET TO WATERWALL, OFF NOZZLE"**. The TL then confirms that all fires are extinguished, and then orders: **"WATERWALL - OFF NOZZLE"**.

f. If the fire cannot be extinguished from the door the TL is to order **"FIREFIGHTER - SET TO WATERWALL"**. They are then to reposition their team by moving the WW to an area they deem better to fight the fire. The TL is then to bring FF to a position behind the WW, and fight the fire as described above.

Note. *Consideration should be given to using a Ship Protector if the team waterwall leaves the access route unprotected. The 3 hose technique described at Para 6 may be adapted to achieve this.*

5. Re-Entry From Above - Carbonaceous Fire

a. The WW and FF each take up position, crouched on one knee with the hose over the shoulder, one hand on the hose banding behind the coupling, and one hand on the nozzle pistol grip. The hoses are positioned on the opposite side of the hatch to the hinges with the WW adjacent to the ladder. The nozzles are to be positioned below the level of the hatch opening.

[6] By putting the tip of their fire fighting glove into the flow of the foam, then wiping it on the extreme edge of the breathing apparatus visor. Foam will stick to their visor; water will run off.
[7] Using the procedure at Para 3c.

b. The TL then gives the order: **“FIREFIGHTER - ON WATERWALL”**. Once the FF nozzle is open ensuring it remains in the WW mode of operation, the TL orders **“WATERWALL - ON WATERWALL”**.

c. The TL moves to the end of the hatch and stands with their back to the hatch. The TL indicates to the team that they intend to open the hatch, both nozzle operators are to acknowledge this. The TL reaches down, takes hold of the hatch and stands up, so that the hatch is at an angle of 45°. The nozzle operators immediately position their nozzles with the Pistol Grip of the nozzle resting across the corners of the hatch coaming. The TL looks over their shoulder to check that both nozzles are in place and then opens the hatch, making sure that the retaining clip secures it in the fully open position. With the hatch fully open, the TL, checks that the nozzles are sealing the hatch, if necessary adjusting the position to give full sealing, preventing smoke and flames from escaping from the compartment.

d. The TL orders the FF to lower their nozzle 2 m into the compartment (dependant on compartment layout). The FF vigorously swings the hose to gain maximum cooling coverage in the compartment. When the TL is satisfied that adequate cooling has taken place, they order the FF to raise the nozzle back out of the compartment. The FF raises the nozzle, assisted by the HH, checks that it is still set to the WW mode of operation and fully open, then returns it to the corner of the hatch coaming to seal the opening.

e. The TL takes over the WW nozzle from the WW Operator, who then proceeds down the ladder until their shoulder is level with the hatch coaming. The WW Operator lifts their arm nearest to the WW nozzle and forms a clenched fist. The TL lifts the nozzle from the hatch coaming and positions it underneath the arm of the WW operator, pulling it up so that it is tight under their arm, locking the nozzle in place. The nozzle protects the WW operator during the descent of the ladder. On reaching the bottom of the ladder, the WW operator turns round, bringing the hose back under the arm, checks the position of the nozzle, then reports **“LADDER CLEAR”.**

f. The WW operator moves to a pre-determined position away from the ladder and crouches on one knee. The FF uses the same procedure to descend the ladder. On reaching the bottom they turn around, grips the hose under the right arm and reports **“LADDER CLEAR”**. They then move to a position behind the WW operator.

g. The TL descends the ladder, reports **“LADDER CLEAR”** and positions themself behind the WW Operator, alongside the FF. TL then surveys the compartment, using the TIC, and orders **“FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE”** the TL directs the FF to project a ragged spray towards the fire. If required, the TL gives the order to advance on the fire, keeping control of the team at all times.

h. Once the fire is extinguished the TL withdraws the team to a safe distance and directs the team down on to one knee. They then order: **“FIREFIGHTER - SET TO WATERWALL, OFF NOZZLE”**. Once this action is complete, the TL confirms the fire is extinguished and orders: **“WATERWALL - OFF NOZZLE”**. When complete, TL stands up the FF and proceeds to conduct a Boundary Search.

6. Re-Entry From Above - Oil Fire (Three Hose Technique)

a. An oil fire re-entry from above, using the 3 hose technique, requires a 5-Person Support Party; the extra person being the Ship Protector (SP). Both WW operator and the SP position themselves on the side of the hatch opposite to the hinges. The TL positions the FF in a safe area away from the vicinity of the hatch. When ready the TL orders: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. The FF's nozzle is then opened ensuring it remains in the WW mode of operation and proves foam[8] and confirms this to the TL.

b. The TL takes up position to open the hatch and orders: **"SHIP PROTECTOR – WATERWALL"**, then orders**: "WATERWALL - ON WATERWALL"**. On both occasions the nozzle operator is to ensure the nozzle is in the WW mode of operation. The TL then opens the hatch[9], making sure that it is firmly clipped open. Both the WW and the SP seal the hatch with their nozzles.

c. The TL then orders: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. When the FF has proved, and confirmed foam again, the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, LAY FOAM"** the FF then aims the nozzle into the compartment. After the contents of at least 2 drums of AFFF have been discharged into the compartment, the TL orders: **"FIREFIGHTER - OUT NOZZLE"**, then when clear of the compartment: **"FIREFIGHTER - SET TO WATERWALL, OFF NOZZLE"**.

d. The WW descends into the compartment[10]. Once the WW operator is clear of the ladder the FF descends the ladder in the same way but their nozzle remains shut. At the bottom of the ladder the FF confirms the nozzle is still shut, confirms ladder clear and positions themself next to the WW with their nozzle facing in the direction of the fire.

e. The TL follows and takes up position, using the TIC to survey the compartment to find the seat of the fire. The TL orders: **"FIREFIGHTER- CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. Once foam has been proved the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**. The FF then directs foam above the fire allowing the foam to smother and cool the fire. If the fire cannot be extinguished from the position at the bottom of the ladder the TL is to order: **"FIREFIGHTER - SET TO WATERWALL"**. They are then to reposition their team by moving the WW to an area they deem better to fight the fire. The TL is then to bring the FF to a position behind the WW and orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"** as described above.

7. Re-Entry from Above - Oil Fire Fixed Hatch Waterwall

a. This technique allows the use of a 4 person Support Party, yet still protects the ship. The use of fixed hatch waterwall is to be closely controlled by HQ1 due to the large amount of water that it can discharge into a compartment.

[8] By putting the tip of their firefighting glove into the flow of the foam, then wiping it on the extreme edge of the breathing apparatus visor**.** Foam will stick to their visor; water will run off**.**
[9] Using the procedure detailed in Para 5b.
[10] Using the procedure detailed in Para 5b.

b. The Support Party take up positions, with the WW operator crouching to the side of the hatch opposite to the hinges and the FF in an adjacent area away from the hatch. After the FF has proved foam the team Leader (TL) orders: **"HYDRANT OPERATOR - ON FHWW AT THE HYDRANT"**. Once the FHWW is fully open TL takes up position behind the WW and orders**: "WATERWALL - ON WATERWALL"**. The TL indicates to the team that they intend to open the hatch; the whole team is to acknowledge this. The TL reaches down, removes the last clip, takes hold of the hatch and stands up, so that the hatch is at an angle of 45°. The WW operator moves the nozzle into position inside the hatch coaming. When the TL is satisfied that the nozzle is in position, they open the hatch fully, ensuring that the hatch retaining clip is engaged.

c. Once the hatch is fully opened, the TL takes up position on their knees and orders **"WATERWALL - LOWER NOZZLE"**. When the nozzle is in position below the FHWW, the TL checks that the FHWW is still sealing the hatch opening. If it is, they order: **"WATERWALL - RAISE NOZZLE"**, the WW operator returns their nozzle to the hatch coaming. The team then carry on with the remainder of the re-entry, as described for a 5 person team.

d. If the FHWW is not sealing the hatch opening correctly, then a controlled closure of the hatch must be made. The TL orders: **"WATERWALL - RAISE NOZZLE"**, the WW operator returns their nozzle to the hatch coaming. The TL releases the hatch retaining clip and lowers the hatch to 45°, then orders: **"WATERWALL - OUT NOZZLE"**. Once the nozzle has been removed, the TL lowers the hatch, and orders: **"WATERWALL - OFF NOZZLE"**. When the nozzle is shut, the TL orders: **"OFF WATER AT THE HYDRANT, TO THE FHWW"**.

e. A 5-person team, using a Ship Protector, must then be used for re-entry.

8. Re-Entry From Below - Oil Based Fire - Vertical Ladder

Notes:

1. The following routine is to be used as a guide and adapted accordingly for carbonaceous fires. Certain steps may need to be modified dependant on platform layout and, if necessary, detailed in BRd 2170 Volume 7 series.

2. There is no nozzle mounting pole available for the multi-purpose nozzle.

3. Prior to any attempt to conduct a re-entry from below, the team leader is to ensure that the hatch is down to 'one clip' and a Support Pole is available to assist in opening and lifting the hatch from below. Pre-determined positions inside the compartment are also to be known by all team members.

4. If the seat of the fire is known then the multi-purpose nozzle is to be held in the hand closest to the base of the fire i.e. if the fire is situated on the left-hand side of the hatch, the Waterwall and Firefighter operators are to hold the multi-purpose nozzle in their left hand.

a. WW and FF each take up position, crouched on one knee, one hand on the pistol grip and one hand on the nozzle. The hoses are positioned on opposite sides of the base of the ladder.

b. The TL will order**: "FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. The FF opens their nozzle ensuring it remains in the WW mode of operation and proves foam and confirms this to the TL.

c. The TL will check the temperature of the hatch and top of the ladder, using the TIC, and if required, will order: **"WATERWALL - ON RAGGED SPRAY, COOL DOWN HATCH AND LADDER"**. Once the hatch and ladder has cooled sufficiently, TL will order: **"WATERWALL - SET TO WATERWALL, OFF NOZZLE"**.

d. The TL will then position the WW onto the top of the ladder under the hinged side of the hatch. Whilst the WW is ascending the ladder a HH is to support the weight of the hose. The WW will then raise the nozzle above their head and hook the nozzle pistol grip handle over the top rung of the ladder. They will then wrap their hand around the ladder and hold onto the nozzle pistol grip, securing the nozzle and themselves onto the ladder.

e. The TL will then order: **"WATERWALL - ON WATERWALL"**, to seal the hatch. The TL will then order the WW: **"REDUCE TO ONE CLIP".**

f. The opening of the hatch is a coordinated effort between the TL and the HH. The TL will order the WW: **"REMOVE THE LAST CLIP"**. Once the WW has confirmed that the last clip has been removed the TL and the HH will position the support pole below the hatch handle and open the hatch, ensuring that once open the hatch is securely held in place by the retaining clip.

g. The TL will then order: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. Once foam has been proven the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY COOL DOWN THE COMPARTMENT"**. The FF will direct foam from the base of the ladder into the compartment above, ensuring care is taken not to hit the WW operator, still positioned on the hinged side of the ladder, with the foam. A minimum of 2 drums of AFFF are to be used to cool the compartment. When the TL is confident that the compartment has been sufficiently cooled by use of the TIC, the order is given**: "FIREFIGHTER - SET TO WATERWALL, OFF NOZZLE"**.

h. The TL orders the WW to advance up the ladder into the compartment to the pre-arranged position, trying to keep the output of the nozzle between them and the fire at all times. If the compartment is still too hot, then the WW will inform the TL. In this case the TL would then order the FF forward to cool down the compartment again. Once the WW is in position inside the compartment, the TL orders the FF to ascend the ladder to their pre-determined position within the compartment with the HH supporting the weight of the hose as before. Once the FF is in position the TL will ascend the ladder and take position behind the WW.

i. The TL orders: **"FIREFIGHTER – CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. Once foam is proven the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**.

j. When the fire is extinguished the TL orders: **"FIREFIGHTER - SET TO WATERWALL"**. Once this action is complete, the TL confirms the fire is extinguished and orders the FF and WW: **"OFF NOZZLES"**. When completed, the TL stands up the FF and proceeds to conduct a Boundary Search.

9. Re-Entry From Below - Oil Based Fire - Sloping Ladder

Notes:

1. The following routine is to be used as a guide and adapted accordingly for carbonaceous fires. Certain steps may need to be modified dependant on platform layout and, if necessary, detailed in BRd 2170 Volume 7 series.

2. There is no nozzle mounting pole available for the multi-purpose nozzle.

3. Prior to any attempt to conduct a re-entry from below, the team leader is to ensure that the hatch is down to 'one clip' and a Support Pole is available to assist in opening and lifting the hatch from below. Pre-determined positions inside the compartment are also to be known by all team members.

4. If the seat of the fire is known then the multi-purpose nozzle is to be held in the hand closest to the base of the fire i.e. if the fire is situated on the left-hand side of the hatch, the Waterwall and Firefighter operators are to hold the multi-purpose nozzle in their left hand.

a. WW and FF operators each take up position. The hoses are positioned on opposite sides of the base of the ladder.

b. The TL will order: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. The FF opens their nozzle ensuring it remains in the WW mode of operation and proves foam.

c. The TL will check the temperature of the hatch and top of the ladder, using the TIC, and if required will order: **"WATERWALL - ON RAGGED SPRAY, COOL DOWN HATCH AND LADDER"**. Once the hatch and ladder has cooled sufficiently, TL will order: **"WATERWALL - SET TO WATERWALL, OFF NOZZLE"**.

d. The TL will then position the WW onto the ladder. The WW will then raise the nozzle above their head, with the HH supporting the hose from the base of the ladder. The TL then orders: **"WATERWALL, ON NOZZLE"**, to seal the hatch. Once the WW has sealed the hatch, the TL orders: **"REDUCE TO ONE CLIP"**.

e. The opening of the hatch is a coordinated effort between the TL and the HH. The TL will order the WW: **"REMOVE THE LAST CLIP"**. Once the WW has confirmed that the last clip has been removed the TL and the HH will position the support pole below the hatch handle and open the hatch, ensuring that once open the hatch is securely held in place by the retaining clip.

f. The TL will then order: **"FIREFIGHTER - PROVE FOAM"**. Once foam has been proven the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, COOL DOWN THE COMPARTMENT"**. The FF will direct foam from the base of the ladder into the compartment above, ensuring care is taken not to hit the WW operator, still positioned on the ladder, with the foam. A minimum of 2 drums of AFFF are to be used to cool the compartment. When the TL is confident that the compartment has been sufficiently cooled, by use of the TIC, the order is given: **"FIREFIGHTER - SET TO WATERWALL, OFF NOZZLE".**

g. The TL orders the WW to advance up the ladder into the compartment to the pre-arranged position, ensuring the output of the nozzle is between the operator and the fire at all times. If the compartment is still too hot, then the WW will inform the TL. In this case the TL would then order the FF forward to cool down the compartment again. Once the WW is in position inside the compartment, the TL orders the FF to ascend the ladder to their pre-determined position within the compartment with the HH supporting the weight of the hose, as before. Once the FF is in position the TL will ascend the ladder and position them behind the WW.

h. The TL orders: **"FIREFIGHTER - CONFIRM NOZZLE IN WATERWALL, PROVE FOAM"**. Once foam is proven the TL orders: **"FIREFIGHTER - ON RAGGED SPRAY, FIGHT THE FIRE"**.

i. When the fire is extinguished the TL orders: **"FIREFIGHTER - SET TO WATERWALL"**. Once this action is complete, the TL confirms the fire is extinguished and orders the FF and WW: **"OFF NOZZLES"**. When complete, TL stands up the FF and proceeds to conduct a boundary search.

10. Boundary Search

a. Once all fires have been extinguished within the compartment a thorough boundary search is to be conducted, including a check of all firefighting equipment by the TL and FF, with the hose charged and nozzle shut.

b. The WW is to remain in a safe area with the nozzle off ready to provide immediate protection to the remainder of the Team.

c. If major re-ignition occurs during this phase the team is to adopt a safe position behind the waterwall, open the firefighter nozzle to ragged spray and fight the fire[11][12].

d. Whilst conducting the boundary search, any carbonaceous material discovered is to be doused and broken up ensuring that, in the case of an oil based fire, the foam blanket is not disturbed.

e. Any 'hot spots' discovered are to be immediately reported to the FCP.

f. As in any firefighting situation, a sentry is to be posted at the scene of the fire after it has been extinguished to report and attack any re-ignition. Initially, the sentry may be provided by a member of the withdrawing support party, if their breathing apparatus has sufficient air remaining.

11. Compartment Withdrawal

During firefighting operations, it may become necessary for the fire fighting team to withdraw for various reasons such as injury, operation of breathing apparatus whistle, operation of team members breathing apparatus bypass valve or tactical withdrawal. Before any withdrawal commences the TL is to inform the remainder of the team of the requirement to withdraw. The TL should then withdraw their team as safely and swiftly as possible using the following routines as a guide.

[11] Team Leaders are to be fully aware of the situation when conducting boundary searches and must be ready to react and order the team as appropriate in the event of a major re-ignition.
[12] In the event of major re-ignition, the waterwall operator should immediately operate the nozzle (checking for waterwall mode prior to operation).

a. **Withdrawal From A Compartment On The Same Level**

(1) TL orders: **“FIREFIGHTER - SET TO WATERWALL”**.

(2) Stand up the whole team and withdraw backwards to an area adjacent to the door, keeping the output from both nozzles between the team and the fire.

(3) When at the door the TL passes through the door and checks the door integrity.

(4) When the TL has confirmed the integrity of the door they take up position at the door and orders the FF to withdraw, take control of the door and prepare to close it.

(5) Once in position, the TL orders the WW back through the door.

(6) When the whole team is in position, TL orders the WW to get down on one knee adjacent to the non-hinge side of the door, in the same position they would adopt for opening the door with the nozzle behind the door frame sealing the door.

(7) When satisfied the door is sealed the TL orders: **“FIREFIGHTER - CLOSE THE DOOR TO 45°”**.

(8) When satisfied, the TL orders: **“FIREFIGHTER - CLOSE THE DOOR”**. At this point the WW withdraws their nozzle; the FF closes the door and ensures that the minimum of 1 clip or latch is closed to ensure the door is secure. The FF is to retain control of this clip until the WW nozzle is shut.

(9) The TL then orders: “**WATERWALL - OFF NOZZLE. FIREFIGHTER - OFF NOZZLE”**.

(10) When the nozzles are shut, the TL checks the teams’ air supply, and if safe to do so, orders the person with the highest pressure to relieve the FF operator and establish boundary cooling using ragged spray. For an oil based fire, the hydrant operator is to ensure at this point, that the spill pickup is removed from the AFFF drum; the FF can then boundary cool using water instead of foam. The WW is then to be isolated and drained down.

(11) The TL then either withdraws the rest of the team to the Forward Control Point (FCP) or acts as ordered by the I/C Main Group/HQ1.

b. **Withdrawal From A Compartment Upwards Through A Hatch:**

(1) Order: **“FIREFIGHTER - SET TO WATERWALL”**.

(2) Stand up the whole team and withdraw backwards to an area adjacent to the ladder, keeping the output from both nozzles between the team and the fire.

(3) If a fire is still burning, all nozzles are to remain open throughout the ladder phase of the withdrawal to afford maximum protection to the team and ship.

(4) The TL now proceeds up the ladder, through the hatch and takes up position to supervise the ladder ascent of the remainder of the team.

(5) Once in position the TL gives the report: **“LADDER CLEAR”** and orders **“FIREFIGHTER - UP THE LADDER”**. The FF places the hose under their arm to afford maximum protection to the FF as they ascend the ladder. As the FF approaches the top of the ladder, the TL, with assistance of the HH will recover the FF hose and seal the hatch by placing the nozzle in position, with the pistol grip resting across the corner of the hatch coaming.

(6) The FF exits the hatch and positions themself next to the TL and takes control of the nozzle and continues sealing the hatch.

(7) When the FF has sealed the hatch, the TL gives the ladder clear and orders: **“WATERWALL - UP THE LADDER”**. The WW places the hose under their arm, ensuring it is on the side of the body that will exit the ladder first, ascends the ladder. The TL, with assistance of the HH, will recover the hose at the same rate of ascent as the WW operator.

(8) As the WW approaches the top of the ladder the TL will remove the hose and place the nozzle in position with the pistol grip resting on the hatch coaming. The WW operator exits the hatch and takes control of the nozzle and slides it into the corner of the hatch coaming ensuring the pistol grip remains in contact with the coaming at all times to enhance the sealing of the hatch.

(9) When content that both nozzles are in position, the TL closes the hatch by 45°.

(10) The TL then orders: **“OUT NOZZLES”**, whilst simultaneously closing the hatch and securing by at least one clip.

(11) The TL then orders: **“OFF NOZZLES”.**

(12) When the nozzles are shut, the TL checks the team’s air supply and if safe to do so, orders the person with the highest pressure to relieve the FF operator and establish boundary cooling. For an oil based fire the hydrant operator is to ensure at this point, that the spill pickup is removed from the AFFF drum, the FF can then boundary cool using water instead of foam. The WW is to then be isolated and drained down.

(13) The TL then either withdraws the rest of the team to the FCP or acts as ordered by the I/C Main Group/HQ1.

ANNEX 17C

SMOKE MANAGEMENT

ASSOCIATED PUBLICATIONS:
A. CONFINED SPACES REGULATIONS 1997
B. DSA02-DMR

1. During the initial attack on a fire the person discovering the fire, those in the immediate vicinity responding to the Loud Vocal Alarm and the Attack Party are expected to commence a continuous, aggressive attack on the fire, initially without the respiratory protection provided by BA. There is a clear risk to these personnel of smoke inhalation, and this must be balanced against the consequences of a minor fire developing into a significant incident.

2. To contain and prevent the spread of smoke through the ship, smoke boundaries should be established quickly by the person in control of the FCP. These should be at the periphery of the smoke-logged compartment(s) and the closest tenable area to the scene of the SOTI. Only when all non-BA wearing personnel known to be within the boundary have withdrawn should the final boundary be established; this will normally be directly between the FCP and the SOTI. ‘Controlled Access’ into the smoke boundary zone must be strictly controlled at the FCP. To this end, HQ1 must pipe the location of all smoke boundaries and the location of the FCP. All other doors and hatches forming part of the boundary should be indicated by a boundary light or manned to prevent unauthorised personnel entering the smoke affected area and jeopardising additional areas of the ship.

3. Smoke boundaries must be established by shutting, watertight doors, hatches ventilation closures and A and B rated doors. Whilst non-watertight doors and smoke curtains can be used to reduce the spread of smoke, especially in the early attack on the fire, they are less effective and should not be considered as physical boundaries. In ships with limited watertight sub divisions it may not always be practicable, or desirable, to establish all smoke boundaries at watertight closures. In some circumstances, non-watertight doors, hatches or smoke curtains may need to be utilised. In this way, vital areas of the ship may remain more readily accessible and the FCP and key positions remain as close as practicable to the SOTI. Therefore personnel in charge of incidents must remain alert to their vulnerability and increased risks in the event of any sudden escalation of the fire. Fixed hatch water wall will not stop the passage of smoke and is not effective in creating a smoke boundary

4. Doors installed in a protected structure such as an A rated bulkhead will adopt the fire rating of that structure ie will have an A rated door equivalent to the rating of the structure. These rated doors are not watertight but are designed to prevent the passage of smoke or flame. Para 0418 provides the definition and further information along with guidance relating to A and B rated sub divisions. Therefore, A and B rated doors may be considered as a physical boundary for smoke boundary management in the same manner as watertight doors up to the end of their time rating. **PERSONNEL IN CHARGE OF INCIDENTS MUST REMAIN ALERT TO NON-WATERTIGHT DOOR VULNERABILITY ESPECIALLY INADVERTENT OPENING OF DOORS PRIOR TO RE-ENTRY.**

5. Guidance for Smoke Clearance and Ventilation Process In Surface Vessels

a. It has long been recognised that most fire deaths are due exposure to toxic smoke products, oxygen deprivation and other effects loosely termed smoke inhalation. Smoke kills by a combination of thermal damage, poisoning and pulmonary irritation caused by carbon monoxide, hydrogen cyanide and other by-products of combustion.

b. When considering smoke clearance, ship's staff should be aware that as well as being toxic, smoke is unburnt gas and is therefore flammable. The flammability of this smoke should not be underestimated, and this means that sensible precautions should be taken to ensure that the process of smoke clearance does not provide any ignition sources. Also, in most ships, the ventilation system will allow smoke to pass to other compartments that may be remote from the scene of the incident and therefore personnel need to be informed of the potential hazards with any smoke emanating from ventilation system, however remote from the incident. Therefore, the following precautions should be observed, as far as reasonably practicable:

(1) When using an exhaust fan to smoke clear, all reasonable precautions should be taken to ensure its electrical integrity before it is utilised to smoke clear.

(2) If smoke is to be exhausted through a compartment, or passageway, the electrical integrity of all equipment within that compartment should be confirmed before smoke is exhausted through it.

(3) If the compartment to be smoke cleared does not have a fresh air inlet, then a Ramfan may be used to feed fresh air in while an exhaust fan is used to exhaust the smoke.

(4) Supply fans may be used to move smoke, but the possibility of the smoke (toxic and unburnt fuel) being forced into compartments remote from the scene should be carefully considered and precautions taken to minimise this.

(5) The OOD or IBC/Command Team should carefully consider what equipment/fans will be used to smoke clear, the route the smoke will take (as well as the route it may take) and therefore which areas need to be clear of personnel or have personnel in breathing apparatus. They should also be aware where the smoke will go once it has left the ship, eg if alongside the shore authorities/other ships need to be informed.

(6) Diesel driven emergency generators are not to be used to move smoke. Whilst they have a big effect on air movement throughout the ship, moving un-burnt gasses over a hot engine could introduce the right conditions to cause further fires.

6. Guidance For Assuring Smoke Clearance

a. **Introduction:** After an incident involving fires of any size the atmosphere in the compartments affected could be toxic, oxygen enriched/ depleted or explosive, they may therefore be categorised under Health and Safety regulations as a confined space. All RN personnel are trained in the dangers of smoke following a fire and the mitigations in place to minimise these dangers.

b. **Aim**: The aim of this handrail is to provide a safe system of work which gives guidance and direction to Ships Command Teams to assure as far as reasonably practical, with available resources, the tenability of a compartment(s) following an incident.

7. Exposure of Personnel to Smoke or a Dangerous Environment

a. Low levels of toxic or non-life sustaining gases can be incapacitating or lethal, personnel in a compartment containing smoke and not wearing EDBA and not part of the initial response are to evacuate at the earliest possible opportunity. First responders and personnel who have been nominated as attack Non BA should maintain a Continuous Aggressive Attack (CAA) until relieved or unable to maintain a (CAA).

b. All personnel who have been exposed, or think they have been exposed, to smoke are to report to Sickbay at the earliest practicable opportunity for medical assessment. Medical records are to be updated accordingly. First responders and Attack Non BA personnel who have been relieved from the incident are to be escorted to HQ1 for debrief and then escorted to the Sickbay.

8. Smoke Clearance and Removal of a Toxic Atmosphere

a. On completion of the response phase a sentry will be posted to report occurrences and provide initial actions in the event of a reoccurrence.

b. The incident recovery phase will likely present a requirement to remove toxic particulates in the form of non-life supporting gasses and unburnt fuel that would have been generated during combustion. Commonly referred to as ‘Smoke’.

c. Ships are to allow enough time for smoke clearance. This is dependent on the scale of the affected compartments and the effectiveness of equipment used to ventilate the affected area. The approved smoke clearance routes are detailed in compartment kill cards and use various methods to move the smoke. Smoke removal procedures using ships fixed ventilation systems are detailed in Para 5.

9. Post Incident Assurance whilst Alongside

During peacetime operations tenability assurance should be completed by a suitably qualified port support authority where available who will assess the affected area and provide advice for further action, or issue a certificate assuring the compartments are tenable.

a. HMNB Devonport contact Occupational Hygienist 9375 67844 only available Mon – Fri 0800-1600.

b. HMNB Portsmouth contact Emergency Response Team 9380 2532.

c. HMNB Clyde do not have a post fire monitoring capability and a Risk Assessment should be conducted iaw Para 13.

10. Post Incident Assurance whilst at Sea or when Support Authority is not available during Operational timescales.

The preferred course of action to assure tenability of a compartment(s) is to proceed alongside and task a suitable authority to declare the area tenable and issue the appropriate certificate. Operational imperative or circumstances may dictate that access to compartments post incident is required before a suitable authority can issue the required assurances. Under these circumstances, or where there is restricted access to a suitable authority, the Commanding Officer or suitably empowered delegate is required to carry out an assessment considering the urgency of the requirement to regain operational use of the affected compartment(s), balancing this requirement against the potential for increase in effectiveness, once access has been regained.

11. If the requirement to regain an affected compartment(s) has been acknowledged a Risk Assessment is to be carried out. Guidance for conducting Risk Assessments can be found in Para 1623.

12. Where the hazards to health are identified and mitigations are put in place to reduce the hazards to personnel. These actions take place in the recovery phase of the incident and decision is to be documented on a MOD Form 5010 for scrutinising at subsequent investigations.

13. Mitigations available to Commanding Officer for assessing tenability of a compartment post incident are detailed below:

a. Scale of the incident?

b. What materials were on fire?

c. **Degree of Contamination** – Is the compartment affected the scene of the incident or part of the smoke extraction route?

d. How long has ventilation taken place for, what is the volume of the affected compartments and what is the capacity of the smoke clearance fans used? (A DD/FF sized cleansing station final airlock will change the air 5 times in 4 minutes which is sufficient to remove residual chemical agent vapours).

e. Has a recovery party assessed the degree of damage sustained? Have any additional hazards been identified?

14. Where a Commanding Officer has assessed the level of damage and contamination to be minimal and is content that current in place mitigations reduce the hazard to the health of personnel to ALARP and Tolerable, restrictions to affected compartments may be removed. Documentary evidence of this decision is to be completed and retained to support any future investigations.

15. **Confined Space Entry, Precautions and Procedures**.

MOD policy, and the framework for work in confined spaces is in accordance with JSP 375. BRd 167 supplements this guidance providing further information to encompass the dynamic risk often presented by ships. In all instances the guidance published in these higher-level documents should be followed as far as possible. Any deviations are to be recorded, mitigated to reduce the risk to ALARP and held by a suitably empowered person.

16. Personal Protection Equipment during Smoke Clearance

a. Due to the possibility of firefighting water or flood water encountering other substances, smoke clearance teams must be provided with adequate protection to prevent exposure to acids, contaminated flooding (fuel or sewage) and decomposing materials.

b. Initially the sentry will be in full Firefighting Rig and EDBA or immersion suits with EDBA if the atmosphere is deemed un-breathable. All relief sentries must be dressed the same, until the hazard has been reduced to a point where it is known that there is no risk of re-ignition or flooding.

c. The minimum requirement will be Tier 2 clothing, eye protection and disposable gloves. Disposable Overalls may be worn if available.

d. After smoke clearance has been completed and the need for EDBA has been removed, personnel entering the effected compartment may still require some form of Respiratory Protection Equipment (RPE) to protect individuals from residual particulates post combustion. Ships Command Teams are to formally risk assess any residual hazard that may exist before allowing personnel without RPE to re-enter previously smoke logged compartments.

ANNEX 17D

BOUNDARY MONITORING AND COOLING

1. Fire Boundary

The fire must be contained within the smallest possible area by forming a fire boundary, which is the bulkheads and decks surrounding the compartment or space on fire. The temperature of these bulkheads and decks must be monitored to establish the requirement for cooling with a water spray. The priority boundary is that directly above the fire unless another boundary poses a hazard eg magazines, compressed gas etc. Particular note should be taken of uptakes and downtakes.

2. Boundary Cooling

The purpose of boundary cooling is to contain a fire within the smallest possible area by keeping the adjoining decks, bulkheads and deckheads cooled with water spray. Boundary cooling must be carefully controlled because indiscriminate spraying may cause unnecessary damage to electrical equipment, and may degrade ships stability. If a deck or bulkhead is cool enough to touch it does not require the application of water spray. When the use of water does become necessary the amount used must be kept to the absolute minimum required. The Containment Group should plan boundary cooling in the very early stages of a fire. The following points will assist in the management of boundary cooling:

a. Boundary cooling should be established on the Primary boundaries initially and on high risk/high value compartments (see Para 1). Once this has been correctly prioritised there is then a requirement to monitor and cool secondary and remote boundaries. This can only be effectively achieved within MMS and these high-risk compartments with comprehensive, pictorial guides being made available to all boundary coolers. The provision of these guides does not negate the requirement for a comprehensive initial brief. Information contained on these cards should include a pictorial guide highlighting the specific area that is to be boundary cooled. The reverse of the card should hold a written brief, instructing the monitor and cooler on how to carry out their duty. It should also cover aspects associated with:

(1) Keys required.

(2) Equipment to be used.

(3) Hazards associated with spraying ‘live’ electrical equipment.

(4) The correct method of covering electrical equipment. Identifying the location of the nearest plastic sheeting, when and where applicable.

(5) The requirement to remove obstructions such as panelling should the need arise, and the location of the necessary tools. Containment bags are to be issued.

(6) The requirement to remove and break up free surface water.

(7) The requirement to use the minimal water necessary and to use the back of the hand to check the temperature of surfaces.

(8) The removal of flammable objects in the immediate area.

(9) The requirement to be fully aware of the location of the smoke boundaries and the procedures to be followed for entering a smoke boundary if required.

(10) The requirement to record and pass on the Temperature Monitoring System (TMS) data when asked.

(11) Have the telephone number of the nominated Containment HQ available.

b. To further assist in the marking up of incident boards and the tracking of boundary coolers, units are to adopt the routine at Annex 7B if their organisational and manning structures permit. This method allows the DCO/OOD to validate/interrogate the areas planned for containment ensuring all areas are covered. Any areas that are incorrect or missed can be identified quickly and remedial action taken.

c. I/C Containment should move between the nominated Containment HQ and HQ1/SCC at regular intervals, ensuring consistency between the containment incident board and the main incident board in HQ1/SCC. Deck managers are to regularly visit all boundary coolers to check on their welfare and ensure that they are going about their task correctly. The 2 I/C should remain at the nominated Containment HQ and be responsible for the deployment of the boundary cooling personnel. In addition, they should also detail and control all Deck Managers including the coordination of TMS data.

d. Deck managers are allocated a deck/zone as their area of responsibility. When used correctly, they are an asset to the containment organisation especially when used for Main Machinery Space Fires (MMSFs) that require boundary cooling on several decks and compartments. It may be necessary to have more than one deck manager per deck subject to the location of smoke boundaries. They are responsible to the 2 I/C Containment for ensuring boundary coolers are deployed in the correct areas with the correct equipment and are monitoring the correct fire boundary.

e. Deck Managers should report to the 2I/C as soon as boundary cooling is established and when a set of steady TMS temperatures is achieved. Further TMS readings are taken and reported as required.

f. On hearing the fire pipe all Officer of the Quarters (OOQs) should listen out for the location and know whether it is adjacent to their magazines or not. If the fire is adjacent to their area of responsibility they should inform the I/C Containment at the HQ and proceed directly to the magazine. The I/C Containment can then allocate manpower accordingly.

g. Boundary coolers should carry out their duties after receiving a comprehensive verbal brief and having been given a Boundary Cooling card as previously stated. They are to cool the designated areas if they are hot to touch with the back of the hand and carry out temperature monitoring in their immediate area when TMS has been employed.

h. A number should be assigned to each boundary cooler and noted on the containment incident board with their name and where they are cooling.

i. Mark on the containment board the position of smoke boundaries and the FCP. Ensure HQ1 provides updates as boundaries move.

j. Consider early provision of BA and BA Controller to those coolers who will be inside a smoke boundary.

k. If re-entry is liable to affect the safety of a boundary cooler, the I/C Containment must ensure the I/C Main Group at the FCP is aware of their positions and make plans for their removal/safety.

l. Electrical aspects:

(1) Electrical equipment ideally should be isolated providing such action does not jeopardise the firefighting effort.

(2) Where possible whole units or units within assembly racks are to be removed well clear of the area.

(3) Electrical equipment that cannot be isolated is to be covered with polyamide sheeting and securely taped (boundary coolers should then monitor equipment for signs of overheating).

(4) Avoid spraying directly onto any electrical equipment. Spray onto a deckhead or top of bulkhead and allow water to run down the surface.

(5) Boundary cooling is not to be commenced within an HV compartment until it is HV dead.

m. Any obstructions eg panelling should be removed prior to cooling taking place. It may not be necessary to do so immediately, in which case the panelling/insulation should be monitored closely for signs of blistering paintwork, peeling or heat transfer. Ensure containment bags have been issued and correctly stocked with tools to remove the panelling and insulation.

n. Remove flammable material, such as carpets, stores, bedding etc from the fire boundary.

o. Bathrooms, heads, sculleries and galley decks will not readily transfer heat but brackets welded to the deck, deck drains and pipes passing through the deck will.

p. If the structure is cool enough to touch it does not require cooling.

q. The minimum requirement for boundary cooling inside the ship is a CFHR or a size 2 hose with a firefighter nozzle. Cloths, mops and extinguishers are unsuitable. Water from the deck can be applied by bucket but consideration must be given to how hot the structure is and the amount of physical effort required. **NOZZLES AND CHARGED HOSES SHOULD NOT BE LEFT UNATTENDED**.

r. Ensure the boundary coolers know how to break up free-surface using material to hand.

s. If the fire involves aluminium structure it is most important that early boundary cooling is applied as it may collapse or melt without warning.

t. Boundary coolers should be briefed to contact Containment Party when boundary cooling in their area has been established.

u. Should there be a need to go to Emergency Stations it is recommended that consideration be given to detailing available spare hands to proceed to the nominated Containment HQ in order to augment the containment effort.

3. Fire Boundary Temperature Monitoring

The Temperature Monitoring System (TMS) is designed for use in Main Machinery Spaces and other high-risk compartments to give the MEO, DCO and OOD the ability to assess conditions within a compartment prior to planning or committing a re-entry team. In an emergency the principles of TMS can be adapted to suit any compartment with a fire, however the inevitable delay in identifying, accessing and establishing suitable monitoring points may restrict its overall value and divert effort from the task of extinguishing the fire. Use of Thermal Mapping is to be utilised also eg. Smoke heads/cameras/TIC.

4. Material Preparations for TMS

The following are required:

a. **HQ1 Record Sheet**. A record sheet copied from the format at Figure 17D-2. This allows HQ1 to record temperatures from up to eight points, transferred from the Recorders' cards. By studying temperature trends and peaks, the HQ1 team can predict events and plan actions. The information contained on these cards should be retained for any subsequent investigation.

b. **Recorders Card**. These are a 200 x 125 mm (to fit plastic JIC wallets) card matrix copied from the format at Figure 17D-3. Each card shows the location of pre-planned temperature monitoring points covering machinery spaces fitted with fixed firefighting systems and other high risk compartments. Cards are to be indexed and tagged together, and a marker pen attached. A blank recorders card is to be included for the ad-hoc use of TMS for any compartment without pre-planned temperature monitoring points. The cards are to be retained in the Containment Pack until required.

c. **Pre-planned Monitoring Points**. These are points on the outside of the perimeter bulkheads, decks and deckheads of the machinery space or high risk compartment being considered, which are suitable for monitoring temperatures of the space. These are to be identified by ships staff taking into account:

(1) Access to the location, once smoke boundaries are established.

(2) The thermal conductivity of the bulkhead material allowing accurate measurement of temperature within the compartment. Thermal conductivity through bulkheads protected by fire barrier insulation will be considerably reduced. Monitoring points on these bulkheads should be at positions with a direct heat path from the other side, eg on metal door frames.

d. **'Doughnut' Signs**. Standard 'doughnut' signs, as illustrated at Figure 17D-1 are available from Naval Stores (see BRd 2170(3)). The blank centre of the circle should be cut out to improve conductivity and thus the recording of true boundary temperature. The line at the bottom of the sign is for identifying the monitoring point.

e. **Kill Cards**. HQ1 and AHQ/HQ2 copies of Kill Cards for compartments with pre-planned monitoring points are to be annotated to indicate that TMS could be activated if required.

f. **Temperature Monitoring Devices**. These are:

(1) Magnetic dial thermometers, held in HQ1/FRPP lockers, or

(2) Digital probe kit held in HQ1 of GRP vessels.

Note. *Difficulty may be experienced with cosmetically lined bulkheads, however, this can be overcome by installing hinged access points in bulkhead linings abutting Main Machinery Spaces and high-risk compartments. The identifying 'doughnut' is to be on the hinged door.*

5. Personnel Requirements for TMS

To ensure timely implementation, one rating should be nominated from the Containment Party to be responsible for recording temperatures from all the monitoring points. The nominated person should report to HQ1 after each set of readings and complete the HQ1 record sheet.

6. TMS Activation

TMS is activated when it is established that access into the compartment has been lost, ie Attack BA party beaten back and access closed, fixed firefighting systems have been used or no other means can be used to monitor the internal temperatures in a compartment prior to re-entry.

7. TMS Procedure

a. The procedure for activation and implementation is:

(1) When activated from HQ1, the nominated TMS rating (the Monitor) collects the India tagged Recorders Cards for the compartment on fire and the thermometers (or probe kit) from HQ1. The Monitor then proceeds to the locations identified on the Recorders Cards and affixes the magnetic thermometers or takes a reading with the digital probe.

(2) When all the magnetic thermometers are in place and have had time to settle, the Monitor takes a set of readings and records them on the Recorders Card. When all possible locations have been covered, the Monitor returns to HQ1 and transcribes the individual temperatures and the reference time onto the HQ1 Record Sheet, briefing the IBC, DCO or OOD on any specific points noted during the round.

(3) When all the temperatures have been transcribed from the Recorders Card, it is wiped clean and the reference time for the next set of temperatures written in. Readings should be taken every 15 to 20 mins depending size and complexity of the route. The monitoring cycle is repeated until ordered to cease by the IBC/DCO/OOD.

b. Care must be taken not to breach established smoke boundaries. Any pre-determined monitoring point that is inaccessible because of a smoke boundary is to have a line drawn through the relevant column on the Recorders Card and a note to that effect marked on the Record Sheet.

c. Although the Monitor will be entering compartments where boundary cooling is established, he must not be employed on that task. The priority is to attach all thermometers and record temperatures. The Monitor may, however, relay messages from the Boundary Cooler to HQ1 and should take appropriate action on discovering secondary fires or casualties.

Figure 17D-1. The 'Doughnut' Sign

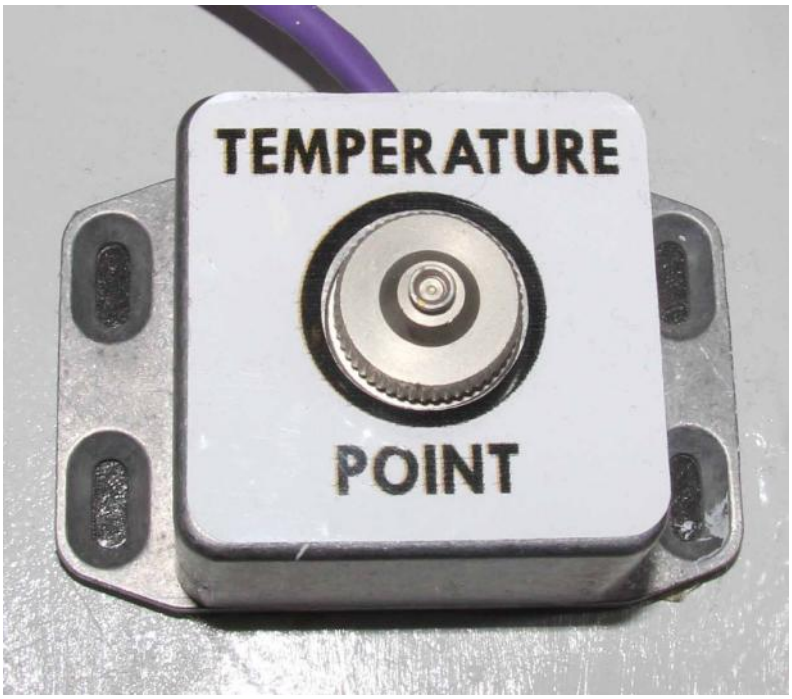


Figure 17D-2. Temperature Monitoring System - HQ1 Record Sheet

Date:

Sheet of
TEMPERATURE MONITORING SYSTEM - HQ1 RECORD SHEET

Compartment: Fixed Firefighting System Used: Yes/No

Time of First shot: Time of Second Shot:

TIME											
POINT	**LOCATION**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**	**TEMP**
1											
2											
3											
4											
5											
6											
7											
8											
9											

Figure 17D-3. Temperature Monitoring System - Recorders Card

TEMPERATURE MONITORING SYSTEM

RECORDERS CARD

Time:

Point	Location	Temp
1		
2		
3		
4		
5		
6		
7		
8		

ANNEX 17F

MACHINERY SPACE FIRES

1. The Hazards

Machinery spaces present a high risk of initiation of fire and a great danger that, once started, the fire will develop into a major conflagration. Fuel leaks, oil spray or mist from defective joints, and oil-soaked lagging are possible sources of outbreaks.

2. Physical Nature of Machinery Spaces

Machinery spaces in warships are usually highly congested, with access generally through hatches. This configuration itself is a most daunting one to approach, and enter, with a major fire burning below. Movement about the spaces is via catwalks at levels appropriate to the machinery, with short connecting ladders as necessary. Catwalks and ladders are generally narrow, making movement of personnel with firefighting equipment difficult. Catwalks and floorplates are often manufactured in chequered plating which effectively degrades high-level spray systems and restricts vision and attack on the seat of the fire.

3. First Aid Portable Appliances (see Chapter 15)

These must always be tried first unless the fire is clearly of such major proportions when discovered that their use would be pointless. Portable extinguishers are supplied for the instant reaction and their use will, quite often, ‘knock down’ apparently large fires. They will certainly have some effect, not the least of which is to gain time for the firefighting teams to prepare themselves and for fixed installations to be made ready.

4. Water and Water/AFFF High/Low Level Spray Systems

Some water spray systems have an AFFF foam spray capability but the AFFF storage tank capacity allows only a limited period of continuous running. The system should be used in the following manner:

a. AFFF usage is recommended to be restricted to 50% tank capacity - either continuous spraying or sporadic bursts. This holds 50% in reserve for possible use at a later stage.

b. The decision to spray foam continuously or in burst rests with the IBC/OOD.

c. There is no need for the compartment to be evacuated before the system is operated, if personnel inside are wearing breathing apparatus, ensuring Primary Electrical Isolations have been completed. This type of situation could arise if an attempt to deal with the fire by a firefighting team inside the compartment was abandoned and the system was activated while they were vacating.

d. The continued use of water spray after foam induction has little effect on the foam blanket already laid. Total spraying time should be restricted to no more than 10 minutes it is unlikely that longer spraying will be effective.

5. Gaseous Firefighting Systems

WARNING

ALL PERSONNEL ASSOCIATED WITH FIREFIGHTING SHOULD BE MADE AWARE OF THE POTENTIALLY LETHAL PRODUCTS OF PYROLYSED HALON, THE DECOMPOSITION PRODUCTS OF THE FIRE ITSELF AND THE DANGER OF RE-IGNITION FROM INCOMPLETELY CLOSED DOWN COMPARTMENTS. COMPARTMENT EVACUATION FOLLOWING DRENCH IS ESSENTIAL WITH EEBD BEING USED WHERE AVAILABLE.

These systems that are single or multi-shot (Carbon Dioxide (CO_2), Halon 1211 (BCF) or Halon 1301 (BTM)), Inergen are fitted in the main and auxiliary machinery spaces, and their use is authorised by the officer in charge of firefighting (IBC/OOD).

Notes:

1. There are several types of HALON gas including BCF and BTM. To avoid confusion it is essential that personnel are fully aware of the appropriate system and closely follow the respective operating procedure. It is important to understand that HALONS have virtually no cooling effect.

2. Inergen is fitted within the QE class and details of this are held within BRd 2170(7A)

a. CO_2 drench systems require concentration of 35% by volume to extinguish fire and, when the compartment is closed down, all ventilation flaps to it should be clipped shut, with the exception of one (which has been pre-designated), which is closed but not clipped (to prevent excessive build-up of pressure when the CO_2 gas is released). This atmosphere is lethal if inhaled for even a short period. Compartments in which CO_2, is to be used should be vacated and fully closed down before the system is operated.

b. BCF requires only about 5% concentration by volume to effectively extinguish most fires. At these concentrations BCF is quite toxic and 1-minute exposures will bring about the onset of first stage anaesthesia, ie a feeling of detachment and a tingling in the fingers. The compartment should be completely closed down; all WT doors, hatches and vent flaps being closed and clipped. BCF installations are normally only found on gas turbine or diesel engine modules and in MM/PP machinery spaces. Compartments in which BCF is to be used should be vacated and fully closed down before the system is operated.

c. BTM requires the same concentrations as BCF to be effective but is less toxic and medical tests have proved that people may inhale concentrations of up to 7% by volume without any risk to health. For single shot systems the compartment should be completely closed down; all WT doors, hatches and vent flaps being closed and clipped. For multi-shot systems the first shot is not to be delayed by compartment isolations or evacuation of personnel. BTM works chemically to stop the combustion process itself. In the process of extinguishing a fire the BTM decomposes to produce highly toxic and corrosive acids, namely hydrogen fluoride (HF) and hydrogen bromide (HBr).

The amount of acids produced is minimised by injecting the required 5% concentration into the space in 10 secs or less. With dual shot systems the first shot of BTM may be used when vent fans have been stopped but the flaps open and when personnel are still inside the compartment.

Notes:

1. In addition to systems being designed so that full discharge is achieved within 10 seconds of initiation to ensure optimum fire suppression, initiation should take place as soon as possible and within 5 mins of fire discovery. In the event that initiation is delayed, the system will still be effective but there will be more breakdown products produced, more fire damage and more subsequent clean up required. It is therefore important to initiate compartment drench as early as possible.

2. Where a BTM 2-shot system is fitted, the operation of the first shot may be authorised by the MEOOW at sea. This will preclude a delay while waiting for the IBC's permission.

d. Where available, fixed water/foam sprinkler systems may be used for up to 5 mins, before re-entry is attempted, in order to cool closed down compartments. This will significantly reduce the chance of re-ignition and permit re-entry much earlier after the use of gaseous systems, under the direction of the DCO, however this may affect the future operation of the equipment.

e. Whenever locally operating a gaseous drench system or checking bottles have discharged within a dedicated Halon/CO_2 bottle stowage/compartment, there is a possibility of dangerously high concentrations of gas in the compartment. Therefore, EDBA is to be worn 'on air' by anyone entering the compartment/stowage. A BA Controller must be nominated. EDBA is also to be worn 'on air' whenever investigating gaseous drench system leakage/discharge alarms.

f. The diesel generator acoustic enclosures in Type 23 Frigates are not hermetically sealed and there is a risk to personnel entering the machinery space after remote operation of a module BCF system. BA is therefore to be worn 'on air', when entering the FAMR after such an incident.

6. Standard Operating Procedures for Machinery Space BTM/BCF/CO_2 Systems

a. The guidance given in the following paragraphs is aimed at assisting IBC/OOD in dealing with main Machinery Space fires in ships fitted with either:

(1) CO_2/BCF - Single and two-shot system.

(2) BTM - Single-shot system.

(3) BTM - Two-shot system.

b. Due to variations within these systems ships will need to 'tailor' the instructions when compiling individual aide memoire and procedures. Ships fitted with common gas drench/water spray pipework are to note the precautions detailed at Para 8.

The procedures are not intended to cover every eventuality. Each Main Machinery Space fire will behave differently, however, by understanding the principles, success is more likely. Whilst the chronological order of events may vary it is essential that a continuous and aggressive attack is maintained on the fire. This includes dressing and deploying a Support Party as quickly as possible whilst the space remains occupied by the Initial Attack/Attack BA Team. The Support Party will relieve the Attack Team and continue to deal with the incident. This may mean tackling minor fires or carrying out a compartment search following a successful first operation of the gas drench system. Should the second shot become necessary in vessels fitted with a 2-shot gaseous system, the Support Party will evacuate the compartment prior to the second shot.

7. Ships are to adopt procedures IAW platform specific CBRNDC Orders for the CO_2/Halon/Inergen Single and Two Shot System Procedure. The following notes should be considered when operating gaseous fixed fire fighting systems.

Notes:

1. For ships operating a Reduced HFEP system the forming of the Support Party from the spare hands is to receive high priority.

2. Isolations for each space are to be identified on the Kill Card as Primary or Secondary. Primary Isolations are to include all fuel, air, lub oil, 440V and HV systems in the compartment. In most cases it should be possible to make Primary Isolations within 10 mins but Secondary Isolations may take up to 30 mins to complete. The making of isolations, giving priority to the Primary Isolations, should commence as soon as the alarm is raised, however their completion should not delay use of the first shot of the gas drench system. In vessels fitted with a 2 shot system all Primary Isolations should whenever possible be completed before authorisation of the second shot. In 1 and 2 shot systems all Primary and Secondary Isolations should whenever possible be completed before authorising a re-entry to the compartment concerned. If for any reason isolations cannot be achieved the OIC must make a risk management decision when to authorise operation of the gas drench system or make a re-entry.

*3. Confirm all personnel have been evacuated from the compartment. Before the order 'Operate **CO_2/BCF Gas Drench'** is given the OIC is to have considered to man below boards and last known location of any missing service or civilian personnel. This process must not unduly delay operation of the gas drench system and the OIC must be prepared to make a risk management decision when authorising operation of a toxic gaseous system. Once the order 'Operate CO_2/BCF Gas Drench' is given cabinet doors are to be opened as a coordinated action in the process of operating the gas drench. No more than 1 min is to elapse from opening doors to operating the gas drench system.*

Notes: (Cont'd)

4. In ships fitted with common pipework for gas drench and water/AFFF sprays there is a risk that the cooling effect of the expanding gas will cause water trapped in the pipework to freeze. If a sequence of Gas/Water (AFFF)/Gas is used, a second operation of the gas system may freeze any remaining water and prevent a successful second gas drench. The risk is greatly reduced if a Gas/Gas/Water (AFFF) sequence is used.

*5. High-level spraying quickly reduces compartment temperatures and minimises heat damage. Most high level spray systems are fitted with non-aspirating nozzles - foam is **NOT** produced when AFFF and water is used. Water spray with AFFF greatly improves the cooling effect by reducing the surface tension of the water thereby increasing the wetted area. 'Water only spraying' does not adversely affect bilge foam introduced through the foam tubes. Excessive spraying of any description will increase equipment damage.*

6. Positioning of spray heads varies; therefore, spraying will not necessarily cool the machinery space deckhead. Deckhead temperatures may therefore remain high due to latent/trapped heat.

7. During State 3 incidents, personnel safety is a higher priority and there is no Operational or Safety related requirement to regain the effected compartment as quick as possible, consideration should be given to delaying the re-entry until the compartment temperature has dropped to:

a. Ambient temperature

OR

b. Below the open flash point temperature for POL substances within the compartment. In MMS this temperature can be taken as 60°C for F76.

*8. Confirm all personnel have been evacuated from the compartment. On the order **"BTM GAS DRENCH",** Cabinet doors are to be opened as a coordinated action in the process of operating the gas drench. No more than 60 secs is to elapse from opening doors to operating the gas drench system.*

9. The Attack Party fighting the fire without BA are at risk from the toxic effects of smoke. The BTM introduced into the space is between 5-7% concentration and is not in itself toxic. However, when BTM is in contact with extremely hot surfaces this will add to the toxicity of the smoke. Firefighters without BA are therefore to evacuate the space as soon as the BTM drench alarm sounds. BTM drench cabinet doors are to be opened as a coordinated action in the process of operating the gas drench. No more than 60 seconds is to elapse from opening doors to operating the gas drench system.

ANNEX 17G

EXPLOSIVES AND PYROTECHNICS

SPONSOR: NAVY SHIPS EXP SO2

1. Ships Explosives Organisation

For any incident involving Explosive Stores, advice should be taken from the ERO and members of the Ship's Explosive Organisation.

2. Definitions

A magazine is defined as a compartment or locker specially designed to be safe for the permanent or temporary stowage of explosives or explosive stores, ie all weapons, missiles or stores containing substances used to produce an explosive, incendiary or pyrotechnic effect.

3. Firefighting

A small fire in a magazine should be first tackled with the 9 ltr foam (AFFF) extinguisher provided. A fire that has progressed beyond the use of portable equipment will normally be dealt with by the activation of a fitted spray system. Some spray systems are manually operated, but in most ships, they are automatically operated at a specific rise in temperature. Flooding arrangements, as fitted to some magazine, RU magazine and pyrotechnic lockers are manually operated.

4. Floods and Sprays

With a manual system, the decision whether to spray and/or flood a magazine must be made in good time. The responsibility to do so rests with the MEO or OOD who, if time permits, must consult the Command and the Ship's Explosive Organisation. In cases of extreme emergency, the decision must be made by the officer/rating of the appropriate Fire and Repair Party or, in the case of RU magazines or lockers on the weather deck, by the officer/rating closed up in the vicinity. The MEO or OOD should be informed immediately.

5. Adjacent Compartments

To meet the hazard of fire in a compartment adjacent to a magazine, the bulkhead/deck/deckhead of the magazine should be sprayed with water (boundary cooled) from within the magazine, using either a firefighter nozzle supplied with water from the nearest hydrant or CFHR by running a hose through the door or hatch. The decision to boundary cool rests with the officer/rating in charge of the firefighting team or, in extreme emergency, with the officer/rating that may be stationed in the magazine.

6. Air Weapons Magazines

a. If the air weapons magazine smoke alarm activates (and if torpedoes are carried), the OOQ is to inhibit the sprays or, if the sprays are already activated, isolate the HPSW supply. Using both indicator test plug and 'fish eye' viewer, he is to attempt to ascertain the situation in the magazine:

(1) If the cause of the smoke alarm is a non-self-sustaining torpedo battery fire, the sprays are not to be re-activated. Once all battery activity has ceased and the smoke has been cleared, a controlled re-entry into the magazine is to be made by the Support Party, backed up by the WE Hazard Team.

(2) If the cause of the smoke alarm is confirmed as a self-sustaining battery fire, a major magazine fire, or if there is any doubt, the sprays should be activated and/or the HPSW supply de-isolated. The magazine should then be sprayed for a minimum period of 30 mins. On completion, provided all battery activity has ceased and other fires are extinguished, a full re-entry is to be made by the Support Party, backed up by the WE Hazard Team.

b. If no Sting Ray warshot torpedoes are held in the magazine, the policy for spraying remains the same as for any other magazine.

7. Boundary Cooling

If boundary cooling is being carried out in a magazine fitted with an automatic (quartzoid bulb) spray system and a high proportion of the spray heads are suddenly activated, the person(s) carrying out the boundary cooling, unless wearing breathing apparatus, should vacate the magazine immediately, as it is considered that the volume of fine spray water will make the compartment uninhabitable.

8. Regulations

The regulations applying in each ship should be contained in Ships General Orders (SGOs).

9. Incendiary Weapons

These are generally thermite, or a similar substance, in a magnesium alloy casing. The filling produces its own oxygen and, once ignited, cannot be extinguished. While it is burning the outer case ignites and generally explodes, so that pieces of burning magnesium alloy can be thrown a considerable distance. These weapons should be cooled with large quantities of water spray. Burning magnesium should be attacked with large quantities of water. Water on burning magnesium causes intense reaction and increases the burning rate, so vast quantities must be used. CO_2 should not be used because it increases the burning rate without producing any cooling effect. Firefighters must make full use of any available protective cover when tackling this type of fire.

10. Ammunition with Phosphorus Content

Phosphorus is air reactive and, when on fire, should be fought with copious amounts of water. At about 250°C, encased white phosphorus changes its chemical form, with the resultant considerable release of heat, and is likely to explode.

11. Risk Reduction Measures

a. The need for rapid and efficient firefighting is vital. The risk of explosion makes it necessary for the firefighters to protect themselves as much as possible by shielding behind any structure or fitting which may be close to their required firefighting position. The possible loss of all or part of the firefighting team and their equipment as the result of an explosion must be considered, and back-up crews and their equipment must be available in a suitably sheltered position. Ships General Orders are to contain suitable procedures for dealing with this situation. The requirement to ditch weapons, or loaded or crashed aircraft, must also form part of the contingency plan and detailed regulations are contained in BRd 862 Parts 1, 2 and Addendum - MOD Maritime Explosive Regulations - Surface Ships, Submarines and MAPS.

Ditching must be considered immediately it is known that a fire involving explosives has developed; it may be the only way to avert a major disaster. Regular fire exercises are to be arranged so that Ships' Company's are thoroughly conversant with the requirements of these Orders.

b. The chance of explosives becoming involved in a fuel fire is greatest when the explosive is out of its normal stowage, for instance, on a flight deck. Every precaution must be taken, every order implicitly obeyed. The danger from explosives on flight decks arises from either those loaded on aircraft or from those held in weapon parks. BRd 862 should be consulted for detailed regulations for handling and care of air weapons. The amount of explosive stores on flight decks must be carefully controlled and should never exceed that required for immediate operational requirements. The Ships Explosive Organisation will have detailed knowledge of the methods and official routes for the disposal of explosives iaw BRd 862 Part 1 Chapter 8.

12. Cooking Off

a. The time factor for ammunition to 'cook off' (ie premature explosion due to excessive heat) in a fire situation depends on many variables, eg the nature of the explosive and the propellant, the thickness of the case, the temperature of the fire and the proximity of the explosive to the source of heat. BRd 862 addendum contains Ships Explosive Store Safety Instructions (SEXSSI) which state the hazard times and risk times of weapons when they are involved in fire, and officers/ratings who may be responsible for such firefighting operations are to familiarise themselves with the relevant SEXSSIs.

b. When the flames surrounding a weapon have been extinguished, the internal temperature of the weapon may continue to rise and cause 'cook off' some considerable time later. The cooling of weapons exposed to fire must continue for at least 30 mins after the fire is extinguished.

13. Weapons and Pyrotechnics on Aircraft

BRd 2170(5) - Embarked Aviation Crash Fire Rescue (CFR) 2013 Edition gives guidance on the effect of fire on weapons and pyrotechnics associated with embarked aircraft.

ANNEX 17H

SEARCH AND RESCUE (SAR) PROCEDURES

1. Command Considerations - Implementing Search and Rescue (SAR) Operations

a. If personnel are known, or suspected of being in a smoke logged area and there is a high possibility that they are overcome or trapped, the Command must decide on whether a SAR operation is practicable. Normally SAR should only be considered when all fires are under control or confirmed extinguished; as it is then that sufficient CBRNDC equipment and manpower will be available for dedicated SAR operations. Once the decision to conduct this type of operation is made, the saving of life becomes the priority.

b. When the Command consider a SAR operation may be necessary, (eg Support Team overdue) direction should be given to muster all equipment and prepare the teams. Concurrent to this, all hands should be accounted for, so that the number of potential casualties can be determined prior to the SAR operation. If a SAR operation is carried out during aid to another ship, passenger lists and crew check-off lists should be used.

c. When selecting personnel for SAR teams, it is beneficial to identify individuals with knowledge of the area or compartments to be searched, but this must be weighed against their knowledge and experience of SAR techniques.

d. Additionally, consideration should be given to:

(1) Location of the area where personnel were last seen or known to be.

(2) Details/locations of casualties (if known).

(3) Dangerous areas (eg positions where guardrails, ladders or decks etc are missing in way of work or damage).

(4) Difficult search areas and trap points (under machinery and small compartments).

(5) Little used exit points such as emergency exits, escape hatches etc.

2. FCP and I/C SAR Team Considerations

a. **Safety Precautions**

The safety of the SAR teams is as important as the efforts to rescue trapped personnel. The person in charge of the incident should be guided by the following:

(1) Make sure teams are well briefed on how to search a compartment and laying a guideline, if necessary.

(2) Make sure teams know how to use SAR equipment, especially breathing apparatus.

(3) Have the area to be searched clearly defined utilising ships plans (if available).

(4) Always work in teams of at least two (pathfinders, search, and rescue).

3. Equipment

The following equipment is available for SAR teams:

a. A 37 m guideline in a pouch (Figure 17H-1) for searching compartments or for use on an unfamiliar vessel. The standing end is knotted to prevent it from being pulled out of the pouch. Four guidelines are supplied to each FRPP and UDREL. In addition, BA lockers that contain guidelines are to be identified by a tally **'GUIDELINE WITHIN'** applied beneath the EDBA tally or a 2 inch white line around the top of the locker.

b. A personal line with a knurled spring clip (8 per FRPP and UDREL). The spliced eye of the line is attached to the lower 'D' ring of the kidney protector on the EDBA backplate. When the EDBA is not being used for SAR, the personal lines are to be stowed in FRPP lockers, these are made locally from Ship's staff.

c. Breathing Apparatus (EDBA).

d. FFHBC for the search team and a hand-held radio for the I/C at the FCP.

e. A 2 m BA extension hose and rescue mask. This is to be supplied to one member of each team (including pathfinders) committed to the search area in the event of a casualty is found. This is to be connected to the waist rectus coupling.

f. A 15 m BA extension hose (2 x 15 m may be joined to give a 30 m hose - this is the maximum length that can be used). When connecting the extension hose to the EDBA, the shoulder rectus coupling must be used as the integrity of this connection has already been proven. It will require the removal of the EDBA facemask. This equipment must have a dedicated BA Controller to monitor air pressure when it is committed to the search area, and a face seal check conducted prior to use. This EDBA is to be positioned at the FCP outside the smoke boundary. A standby BA set must be readily available for use should the pressure on the 'in use' set diminish to the level of the warning whistle sounding.

g. Lightweight stretcher.

h. Thermal Imaging Camera (TIC) to be used in the grey scale (WH).

i. Torches.

j. **EEBD.** One belt worn EEBD per team for casualty use.

k. Full Fire Fighting rig to be worn, gloves tucked in to EDBA waistband.

l. Cyalumes.

4. EDBA Extension Equipment in the SAR Role

a. Carry out full pre-use and user checks on all equipment prior to entry. The 2 m extension hose and mask is connected to a search team members rescue mask connection, allowing provision of an air supply to a casualty.

Figure 17H-1. Guide Line (Indicator Route Line)

b. Carry out a full face seal check on the EDBA, remove mask and connect the 2 m extension mask to rectus coupling, on the left hand kidney protector. Carry out a further face seal check on the rescue mask. Replace EDBA mask and carry out a face seal check.

5. Precautions

SAR teams must utilise effective methods of personal protection when moving through vessels with reduced visibility, to ensure that any hazards, encountered are identified and avoided. It should be noted that SAR Team Leaders (TL) must identify the potential for penetrating too far into a vessel (particularly if the layout is unfamiliar eg a merchant ship). It can become increasingly difficult to maintain orientation and therefore safety, as well as the quality of any searching and the subsequent debrief, may be compromised. In addition, the SAR TL must remain mindful of any predetermined turn around cylinder pressure.

6. Air Management by the SAR Team

a. It is the responsibility of the SAR TL to ensure that every BA wearer reports back to the FCP before their BA whistle sounds. This can only be achieved, and wearers will only obtain the maximum working duration of the BA set, if every wearer fully understands the importance of air management and regular gauge readings. The SAR TL should prompt other team members for regular gauge readings and ensure the FCP is updated. In turn, if the FCP does not receive regular gauge readings, the SAR TL must be prompted accordingly.

b. During the SAR team briefing, the I/C Main Group may wish to determine a Turn-Around Pressure in advance of deploying the SAR team. Each wearer will consume air at a different rate. The difference will be determined by a number of factors including; body mass, individual levels of fitness, work rate, environmental conditions and the wearer's reaction to the situation. It is for these reasons that each wearer must read their own gauge, make their own calculations, and take responsibility for informing the SAR TL of the pressure at which the team will need to start exiting the search area.

c. Reaching easily identifiable locations eg a change of level or direction, doorways and large obstacles such as furniture and fittings can act as a prompt and waypoint. Checking gauge pressure at these waypoints on the return journey will guide the team as to the pace required in exiting the search area. By doing this at regular intervals, any unexpectedly high air consumption or loss should be identified.

d. Air use must be monitored on the way out of the search area, and as previously mentioned, in all normal circumstances, wearers must be back at FCP before a low pressure warning whistle sounds.

e. As indicated in sub para f if a team fully understands gauge reading and by making calculations, it is permissible to use some of the safety margin if a team needs to exit with a casualty. This extreme measure will only be employed in a highly calculated and controlled manner and the FCP must be advised of the decision made. In addition, the SAR team must remain in communication with the FCP, so that I/C Main Group may introduce appropriate support and additional risk control measures.

f. Where a SAR team has to exit with a casualty, it is essential that unless they are extremely close to an exit, a gauge reading is taken and a calculation is made on the air required to leave the incident. Having commenced the journey out, and on reaching the points where gauge readings were taken on the way in, they must take further gauge readings and by reference to their earlier calculations work out by how much their air consumption has increased. From this the team will be able to determine if they can leave the incident with the casualty or progress as far as possible before having to leave the casualty for another SAR team. Again, the SAR team must remain in communication with the FCP, so that appropriate support and additional risk control measures may be introduced where necessary.

g. It is each wearer's responsibility to make the SAR TL aware of their gauge readings regularly so that work can be shared out evenly amongst the Team in order to maximise air remaining. Subject to the requirement for the SAR TL to maintain a leadership role and ensure awareness with the correct exit route, this might involve the wearers with the most air carrying the casualty, where possible. To facilitate this, the team should be rotated regularly to conserve air. However, it must be emphasised that this should **NOT** be attempted if doing so might compromise the safety of the SAR team.

7. SAR Control at the Entry Point

The I/C of the Main Group will normally control SAR teams and is to keep HQ1/SCC informed of progress. The I/C will also:

a. Establish a casualty handling area.

b. Ensure proper BA control.

c. Arrange for a Rescue Team to stand-by, with BA pre-wear checks completed.

d. Arrange for 30 m (2 x 15 m) BA extension equipment to be laid out and proved.

8. SAR Compartment Search Procedures

a. **Left/Right Hand Orientation**. Search procedures will employ a left or right hand orientation, in that the SAR TL will use and follow the left or right hand bulkhead as their fixed reference point to ensure that the search is orientated and systematic. This left or right hand orientation applies at all times a SAR team is within the search area, after passing through the Forward Control Point (FCP) into the structure.

b. **SAR Technique**

(1) The search is to begin at the nearest point to the scene of the incident and then work away from it towards fresh air and safety. This ensures that if a casualty is found before the team reaches the limit of their endurance they are as near to fresh air as possible. **To this end, priority is given to a 2 man Pathfinder team who can lay a guideline to the Scene Of The Incident (SOTI).**

(2) Pathfinders enter the smoke boundary ensuring that the guideline is secured at the entry point, in fresh air, to a secure fitting. A 2 m BA extension hose is to be carried by one member of the team (ideally No 2). The guideline should be laid by the most direct route, if possible at waist height and always to secure fittings. This will allow search teams to follow with ease. Personal lines are to be attached to the guideline with the knurled edge of the clip facing the entry point. The guideline should, where possible, be laid above doorways to leave access for later search teams and indicate that the compartment has not yet been searched. When the Pathfinders arrive at the SOTI the guideline is to be secured to a fixed position, by the BA Controller.

Note. *The guideline secured to a fixed position will indicate there is another guideline attached to continue further into the compartment. Guideline canvas bag on the deck indicates this is the SOTI.*

(3) The fundamental principle of this procedure is that a search team will attempt to fully search each compartment they enter before moving on to the next compartment. On receiving and confirming their brief (which should include the use of ship's plans), the search team will move to the Point of Entry and enter the search area. The search may start at the point of entry or from a designated point, as per the brief given at the FCP. Within the search area the team will maintain a left or right hand orientation and use the corresponding wall as their fixed reference point at all times. At the point designated in the brief they will commence a Compartment Search procedure.

Note. *Personal lines are to be attached so that on entry the line is across the front of the body therefore keeping the searcher close to the guideline on the way to the search area. At the pre-determined search start point the team is to turn 180° therefore allowing maximum extension of the personal line to aid compartment coverage. The knurled face of the personnel line hook is always to face the point of entry thus allowing the wearer to know the direction of travel to FCP if they become disorientated.*

(4) When any team has been committed including pathfinders, an Emergency Rescue Team (ERT) should always be ready, standing by, with all pre-wear checks completed. Once the guideline has been laid, SAR teams can be committed after being given a full brief on what areas they are to search, and search technique (boundary, quarter, diagonal). The SAR teams must clip onto the guideline in fresh air, at the entry point, with the knurled side of the personal line spring clip pointing towards the entry/exit point.

(5) When the pathfinders have completed their task, they debrief the I/C SAR and the search teams. Once briefed the Search Team must attach their Personal Line to the guideline ensuring the knurled edge is towards the exit point. The team then proceed to the SOTI (the point where the guideline is tied off); this is where the search begins, a cylinder pressure check must be made before the team work back towards the FCP. When proceeding along the guideline and through the search area continually test the area ahead by moving a hand ahead with the palm toward the face ensuring you tread gently and cautiously before committing weight to the lead foot.

(6) On entry into the first (primary) compartment to be searched, the perimeter and in the case of all compartments, the centre of the compartment, are searched at the same time. At no time should all members of the team unhook themselves from the guideline. If a lightweight stretcher is to be used, a 4 man team should be considered. First aid should be given only when it is safe to do so.

(7) At the SOTI, one member of the team detailed by the TL always remains on the guideline to act as a datum for the search. The remaining members of the team search out into the centre of the compartment ensuring there are attached to each other by use of their personal lines.

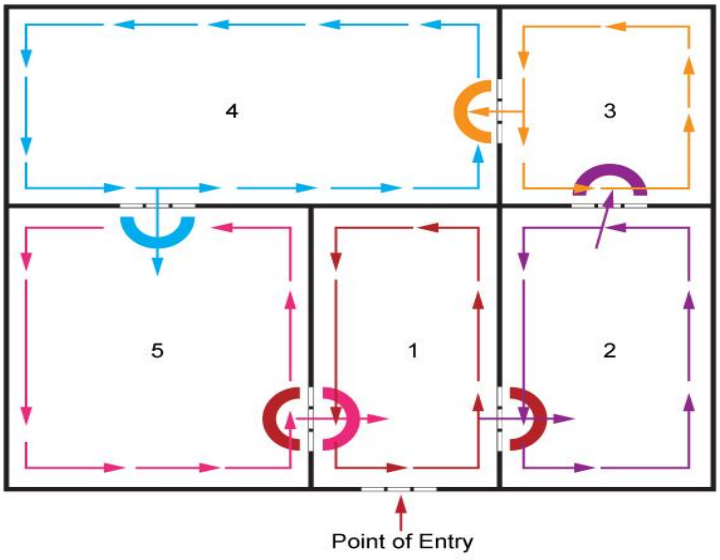
As the team progress through the compartment, they should carry out a sweep around any doors encountered and then continue around the compartment. If open doors are encountered during this phase of the search the compartment (secondary compartment) should be entered informing I/C SAR of the action, leaving a further Team member as a datum at the entrance point, the remaining team members enter and search the secondary compartment. If proved clear, the door is to be closed and marked (by placing a cyalume on the door or the guideline across it) informing I/C SAR. The original compartment search is then to be completed.

(8) If open hatches are encountered the TL is to inform I/C SAR but is not to proceed through the hatch until the original compartment search is complete unless ordered to do so by I/C SAR. When searching through a hatch a team member is left at the bottom of the ladder as a datum, the team then search that compartment, once complete the hatch is to be closed to preserve watertight integrity and a cyalume is placed on the hatch.

(9) Once the original compartment search is completed the Search Team are to progress to the next compartment by maintaining a left or right hand bulkhead search pattern, as briefed at the I/C SAR. The same procedure will then be repeated for that and any subsequent compartments.

(10) On completion of the search, or at the pre-planned turn-around pressure, or at any point during the search as the SAR TL determines, the SAR TL must ensure that orientation with the bulkhead is maintained, albeit the direction of travel reversed in order that the team may exit the structure.

Figure 17H-2. Diagrammatic Representation of the Principles of Compartment Search Procedure (Example shown - Right Hand Orientation in a 5 Compartment Structure)



Note. *This illustrates the basic principle of the procedure. It does not cover all possible compartment configurations and is not to any specific scale.*

9. Precautions when Searching

a. **When negotiating a hatch and ladder**:

(1) Ensure that the hatch retaining clip is secure.

(2) Test rungs/treads before committing full weight.

(3) Feel below for the next rung/tread. Never assume that deck level has been reached. SAR TL to inform rest of team the number of rungs/treads to expect during transit.

(4) Never jump from a ladder to a deck.

(5) One searcher at a time on a ladder, the other stood clear.

(6) Use the 'ladder clear' drill.

b. **When passing through a doorway or access:**

(1) Enter cautiously, as the door could lead to a ladder, a trunk or shaft, or an unsafe/damaged deck.

(2) If the access is restricted, do not remove BA.

(3) Ensure that there is sufficient room to turn around.

c. **When moving through the ship:**

(1) Tread gently and cautiously before committing weight to the lead foot, (shuffle, rather than walk).

(2) Never put weight on guardrails.

(3) Avoid touching metal items with bare hands as they may be hot from fire or electrically live.

(4) Continually test the area ahead by moving a hand ahead, with the palm towards the face.

10. Locating Missing Personnel

a. Personnel trapped by smoke or fire often retreat into unexpected places to protect themselves, so all areas of compartments must be methodically searched. Possible hiding places are:

(1) In or behind bunks.

(2) In or behind lockers.

(3) Under tables or chairs.

(4) Adjacent to compartment exits.

(5) In bilges or under deck plates.

b. Casualties who are conscious will probably be suffering from shock and may present a danger to the search team. Teams must be prepared to restrain casualties and keep their own air supplies out of reach.

11. Actions on Locating Casualties

a. Upon locating a casualty, an LVA is to be raised, the Search Team Leader should relay this information to the FCP as soon as possible. The other members of the team should carry out a proximity search around the casualty to ensure there are no further casualties close by.

b. At this stage the SAR team members must take a gauge check to ensure effective air management is maintained. Confirmation of this information with the TL should take place and where possible, the FCP notified of SAR team members' air supplies and the rescue and withdrawal decisions of the SAR Team Leader, accordingly.

c. **On discovering a conscious casualty:**

(1) As long as able to don an EEBD is preferred to be used as this will preserve search team air supply if this is not possible then;

(2) Open the by-pass valve on the extension mask and offer the mask to the casualty at arms length.

(3) Close the by-pass valve once the casualty is breathing comfortably.

(4) If the casualty is able, escort to the entry point immediately.

(5) If the casualty cannot be safely moved, provide an EEBD. Inform I/C who will arrange for a relief team member with extension equipment (30 m maximum) to provide a more permanent air supply.

(6) Only personnel trained in the use of an EEBD are to be given one. (Add warning box to stipulate the risk involved in non-trained personnel using)

d. **On discovering an unconscious casualty:**

(1) Open the by-pass valve on the extension mask, place on the casualty and purge the mask.

(2) Leave the by-pass valve open.

(3) Remove casualty to the point of entry immediately.

(4) If the casualty cannot be safely moved or is trapped. Inform I/C who will arrange for a relief team member with extension equipment (30 m maximum) to provide a more permanent air supply.

Note. *As soon as 2 people are breathing from the same set, endurance is significantly reduced therefore cannot be positively controlled.*

12. Entrapped Procedure

a. When BA wearers cannot retrace their exit route they should consider going into entrapped procedure. No provision exists for conserving the air supply in compressed air BA other than by the wearer moderating demand by exerting the least possible energy. By conscious effort and self-control, the wearer can reduce demand considerably.

b. When a BA Wearer becomes aware that it is not possible to escape the search area the following actions should be taken:

(1) Contact the FCP by radio (if possible).

(2) Operate the BA distress alarm.

(3) Relax as much as possible in the circumstances by assuming a reclined or seated posture.

(4) Breathe calmly and gently to minimise air usage.

c. The cylinder valve should not be adjusted, other than to check that it is fully open. Once the safety margin has been reached the low pressure warning device will operate. In the case of an air-operated low pressure warning whistle device, the air consumed is minimal.

13. Deployment of an Emergency Rescue Team (ERT)

The I/C Main Group is responsible for the instigation of emergency procedures and/or the deployment of an ERT. The I/C Main Group is also responsible for all other elements of ERT deployment, including briefing and debriefing ERT/s and maintaining a suitable record of all relevant operational and risk information, decisions made, tasks given to ERTs and any other relevant information. Following the deployment of any Rescue Team, arrangements must be immediately made for the provision of replacement Rescue Team.

14. Actions of a BA Wearer in Distress

a. BA wearers should indicate that they are in distress by operating the BA distress alarm (horn). Such action should be taken if there is a risk to life or severe injury to any BA wearers in the SAR team, or if the SAR team feel they cannot evacuate safely from the incident by their own unaided efforts, or if they are unable to trace their route to their exit point. In the unlikely event of a BA distress alarm failing to operate, the warning device of another team member should be operated. In such circumstances, the BA wearer, or their SAR TL or colleague, should consider the following actions:

(1) Inform the FCP immediately.

(2) Operate the BA distress alarm of any persons affected (in the unlikely event that a BA distress alarm fails to operate, the alarm of another member should be operated).

(3) Establish communications with the FCP and inform them of the situation, current location and intentions.

(4) Carry out gauge checks and inform FCP of cylinder pressures.

(5) Carry out a dynamic risk assessment and decide whether appropriate to remain at current location or to locate a safe waiting area.

(6) Where possible, retrace steps to the FCP.

(7) If unable to retrace steps to the exit, locate an alternative exit eg hatch/door, in immediate vicinity and attempt to attract attention.

(8) Where appropriate, adopt ‘entrapped procedures’ to conserve air whilst awaiting rescue.

b. Actions of SAR Team/s in a search area on hearing a BA distress alarm:

(1) Contact should be made with the FCP to inform them that a BA distress alarm is audible.

(2) On hearing the BA distress alarm from another team within a search area, SAR TL should instigate a gauge check to determine if sufficient air reserves exist within the team to investigate the source and render assistance.

(3) Rendering assistance to a SAR team in distress should take precedence over existing tasks, unless it is determined that their activities are risk critical and if uncompleted may compromise the safety of other BA wearers within the search area.

(4) FCP should be informed of the intentions of the SAR Team.

(5) The SAR team must not take unnecessary risks, such as entering large or complex areas without the means to retrace their steps.

c. Actions of an ERT on locating distressed BA Wearer/s:

(1) Cease operation of the BA distress alarm to improve communications.

(2) Obtain verbal confirmation from distressed wearer/s into the nature of the emergency (if possible).

(3) Inform FCP that the distressed wearer/s have been located and request further ERTs for assistance as required.

(4) Take gauge readings of distressed wearer/s.

(5) Take gauge readings of ERT.

(6) Render any on scene emergency assistance as required.

(7) Following an assessment of risk, determine and implement a safe action plan to remove distressed wearer/s from the search area.

ANNEX 17I

FIRES INVOLVING CYLINDERS

References:

A. BR1754 Pt2 Chp 3 Hazards, Regulations and Precautions for Compressed Flammable Gases.

B. JSP 319 Joint Services Regulations for the Storage, Handling and Use of Gases.

1. Introduction

a. All UN class 2 compressed gas cylinders represent a potential hazard if directly involved in a fire. Cylinders are pressure vessels designed to withstand high internal pressure but if that pressure increases with heat they may fail. This is particularly important if compressed gas cylinders experience the direct application of heat via a flame, in addition to the increase in internal pressure, the cylinder shell itself could start to lose its strength as a result of excessive heat. This may eventually cause the cylinder to burst or fail in a violent manner resulting in the release of a considerable amount of energy. Subsequent events will depend upon the gas type. If compressed gas cylinders, including acetylene, have not been heated then they do not represent a hazard.

b. Personnel discovering cylinders exposed to fire or on fire are to make every effort, without exposing themselves to unnecessary risk, to identify the type, contents, location and number of any cylinders involved. This will determine the appropriate course of action. If firefighters (attack BA, Support Party) encounter cylinders that have been fully involved in a severe fire for an unknown period, they should treat them with extreme caution. Cylinders should, if possible, be removed from the scene of the incident. For inert gases no further action is required. Cylinders containing acetylene will undergo a self-sustaining internal decomposition reaction, producing heat which may continue after the fire has been extinguished.

c. If a cylinder is alight at the valve group, it should be ascertained whether it is alight around the cylinder neck (from the base of the valve group where it enters the cylinder) or from where the hoses attach to the valve group itself. If it is safe to do so, the cylinder can be shut off. Where the cylinder is alight at the neck (i.e. the base of the valve group) this indicates that the valve group or cylinder neck is damaged and potentially will not be able to be shut off.

d. In most cases, non-acetylene cylinders which have not failed can be made safe by the application of cooling water. Once water has been applied and the cylinder wall temperature reduced, the cylinder is very unlikely to fail.

e. Prompt action is to be taken to extinguish any fire directly affecting the cylinder and apply cooling sprays or fixed systems directly on to any affected cylinders. This applies to cylinders suffering direct flame contact and those affected by radiant heat.

2. Acetylene Cylinders

a. Acetylene cylinders that have been significantly heated or damaged by fire are not be moved under any circumstance.

b. Water cooling should be continued for at least one hour. After a minimum of one hour of water cooling the cylinder's temperature should be checked to see if it has been effectively cooled.

Notes:

1. "effectively cooled" means bringing the cylinder shell temperature down to ambient temperature. The "wetting test" and/or thermal imaging equipment should be used to do this.

2. The 'wetting test' involves:

a. Getting a clear view of the cylinders from a safe and preferably shielded location.

b. Briefly spraying water on to the cylinder surface.

c. Stopping spraying and looking for signs of steam rising from the surface of the cylinder.

d. If steam is not seen rising, checking to see whether the wetted cylinder surface dries out quickly (ie one – two minutes).

3. During the process of combustion tars and oils may be released and deposited on the cylinder surfaces. The oil and tar deposits may make the 'drying out' part of the test difficult to interpret due to the reaction between oil and water.

4. If either check is failed, i.e steam is rising, and/ or surface drying quickly (under 2 mins), then water cooling must be re-applied for one hour before testing again.

5. If both tests are passed then the "monitoring phase" should start.

6. Use of thermal imaging equipment and remote temperature measuring equipment gives additional confidence and should be used whenever possible.

c. **Cylinder Monitoring:**

(1) Stop water cooling.

(2) Do not move cylinder.

(3) Maintain scene of the incident.

(4) Reapply wetting test and monitor temperature trend with thermal imaging device at 15 Minute intervals.

(5) If re heating occurs – restart water cooling for one hour.

(6) After one-hour water cooling restart cylinder monitoring.

d. When effective cooling of the cylinder shell has been achieved, water cooling should be stopped. The cylinder should still not be moved for a further one hour and an appropriate cordon should be maintained. This is required due to the possibility of internal decomposition occurring.

Note. *Leaking acetylene cylinders have a higher risk of decomposition occurring.*

e. When the cylinder remains effectively cooled (i.e. the shell temperature remains at ambient temperature for one hour without being water cooled and is not leaking) there is no risk of cylinder failure.

f. A cylinder which is leaking significantly, but not alight should not be moved and should be allowed to vent safely. I/C Main Group should assess any fire or explosion risks caused by the escaping gas and continue cylinder shell temperature monitoring.

g. Where multiple cylinders are very closely packed, and/or concealed/buried by debris, there may be a risk that the cooling water may not come into contact with a substantial proportion of the cylinder shell, therefore limiting the effect of cooling. If the I/C Main Group considers that significant areas of the cylinder(s) are ‘dry’ then cooling should be extended beyond one hour.

ANNEX 17J

FIREFIGHTING KILL CARDS

1. Application of Kill Cards

Ships should raise Kill Cards for 'High Fire Risk', 'Explosive Risk', 'Electronic and Operational Spaces of High Value' and 'High-Voltage(HV)' Compartments. The MEO/EO1 is responsible for the composition and review of Compartment Kill Cards, custodians are to ensure that Kill cards are updated after every major maintenance period, if an A&A effects the compartment or every 4 years. This update must include updating DCDRS/PMS/IPM/DSAC Compartments and spaces should be classified according to the risk inherent in their function, ie:

a. **High Fire Risk**. Main and auxiliary machinery spaces, generator compartments, uptakes and downtakes, ventilation trunks from the machinery spaces up to the fire flaps, machinery removal and escape trunks to the above compartments, fuel pump spaces, hangars and galleys.

b. **Explosive Risk**. Magazines, lockers, RU stores and designated danger areas as defined in BRd 862(1).

c. **Electronic and Operational Spaces of High Value**. Operations room, computer rooms, designated communications and weapon equipment compartments, ship control centres, navigation equipment compartments, switchboard rooms, electrical distribution centres, telephone exchanges, conversion equipment rooms, EW spaces, main cable and wiring spaces.

d. **High Voltage (HV) Compartments.** High voltage decay times must be indicated on individual equipment and recorded on compartment Kill Cards. Where a compartment contains no HV equipment but is transited by HV cables the compartment is to be considered as a HV compartment in the event of a fire within. Kill Cards for such compartments are to have HV cable runs annotated in **RED**.

2. Disposition of Kill Cards

A Blank Kill Card is held within the forms section of this BR. They can be bound together to form a loose-leaf book that can be indexed. The completed Kill Card pack(s) should be available at the following locations:

a. HQ1 (and HQ2) - full sets.

b. Section Bases/FRPPs/ZCPs - cards for compartments within the responsibility of the Section Base/FRPP/ZCPs.

c. An additional card is to be secured adjacent to the outside of the compartment door.

3. Information

a. Kill Cards should include the following information where applicable:

(1) Recommended minimum time of operation of each gaseous drench or foam/water spray system.

(2) Equipment's, stores, services etc contained within the compartment with items of extra high risk being identified, and their position in the compartment stated (a fuel line, hydraulic service pipe or air service pipe could add appreciably to the hazard of the fire if ruptured).

(3) Any other relevant information, displayed on a simple diagram of the compartment layout to assist firefighters entering the compartment. The diagram should also include positions of obstructions and passageways.

(4) The presence of any structure other than mild steel, eg aluminium or melamine plastic laminate.

(5) The presence and details i.e. timings of any Fire Barrier Insulation (FBI) fitted should be indicated by a broken black line with the notation 'Fire Barrier Insulation', followed by the type of material in brackets, refer to Chapter 4 for a breakdown of A and B rated sub-divisions.

(6) Boundary temperature monitoring points.

(7) The presence of beryllium within the compartment should be annotated on the kill card to prevent fire fighting without being on BA. **"Beryllium Within"**

(8) A concentration of 20 or more EEBDs within the compartment must be annotated due to the quantity of oxygen held within each unit.

b. A generic example of a completed Firefighting Kill Card is at Figure 17J-1 (front) and Figure 17J-2 (back). A blank Kill Card is provided for use within the forms part of this BR.

4. Smoke Clearance Plans

A space is provided on the Kill Card for smoke clearance action. If this space is too small to contain the information, a separate Smoke Clearance Plan should be populated, with a cross-reference to the associated Kill Card. An example of a Smoke clearance Plan is at Figure 17J-3. A blank Smoke Clearance plan is provided within the forms part of this BR.

BLANK KILL CARD AND SMOKE CLEARANCE PLANS
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

Figure 17J-1. Example of a Kill Card (Front)

Firefighting Kill Card No. 209

RN Form S3021 (Revised 11/12)

Ventilation Control

	Fan	Starter at	Flaps/Slides at
Supply	ACU 17 3E 1S RECIRC FAN	3E STBD	1E
Exhaust	01 F19 EF 10	01F STBD	01F HWTC

Natural Ventilation

SUPPLY FROM No1S&16 ACU 3E1

VALVE IN No1S & 16 ACU 3E1

Danger Hazards

Within the Compartment	External to the Compartment
440V R 22 GAS LUBOIL(IN CW PLANT)	HP& LP AIR (3/4F FAMR) DIESO FUEL (3/4F FAMR) LUBOIL (3/4F FAMR) 600 V (3/4F FAMR) 440 V (ALL COMPTS)

Compartment
CHILLED WATER PLANT RM

Location Mark
4E

Frame Station Numbers
64 - 72 ZONE 1B

Nearest F & RP Post
FWD 2D

Firefighting Installations

Within the Compartment		External to the Compartment	
Fixed	Portable	Fixed	Portable
SMOKE DETECTORS 2 HYDRANTS 2 DOUBLE HOSE BASKETS	1 AFFF EXT 2 No HOSE 6M 2 No HOSE 12M 1 CO_2 EXT 2 FF NOZZLES	1 HYDRANT 1 DOUBLE HOSE BASKETS 1 No2 HOSE 6M 1 No 2 HOSE 12M (3E LOBBY)	1 CFHR 1 INDUCTOR 1 AFFF EXT. (3E LOBBY)

Issue:

Dated:

Smoke Clearance Action

OPEN HWTC AT 01F STBD FOR EXHAUST FAN 01F19. OPEN 1E2 AIRLOCK DOORS FWD. OPEN 1/2 E HATCH FWD. OPEN 2/3E HATCH AFT.

OPEN 3/4E HATCH AFT. SHUT ALL OTHER DOORS/HATCHES IN E SECTION.

RUN EXHAUST FAN 01F19. RUN ACU17.

SMOKE COMMS: 3E ADJ GYRO ROOM.

Pumping Out Arrangements

ONE 75 $M^3/_{HR}$ SALVAGE EDUCTOR

NEAREST OVER BOARD DISCHARGE AT 2E2 SR PANTRY.

Electrical Supplies to be Isolated

ACP1: BKRS F-16(N). H-16 (A)
ACP2: BKRS H-15(N). F-15 (A)
HPSW: PUMP: MCCB E-R1-07
ACP PUMPS: MCCB E-R2-6, E-R2-7

Hazardous Systems to be Isolated

SHUT LP AIR VALVE A1S 2007 IN 3/4F FAMR

Figure 17J-2. Example of a Kill Card (Back)

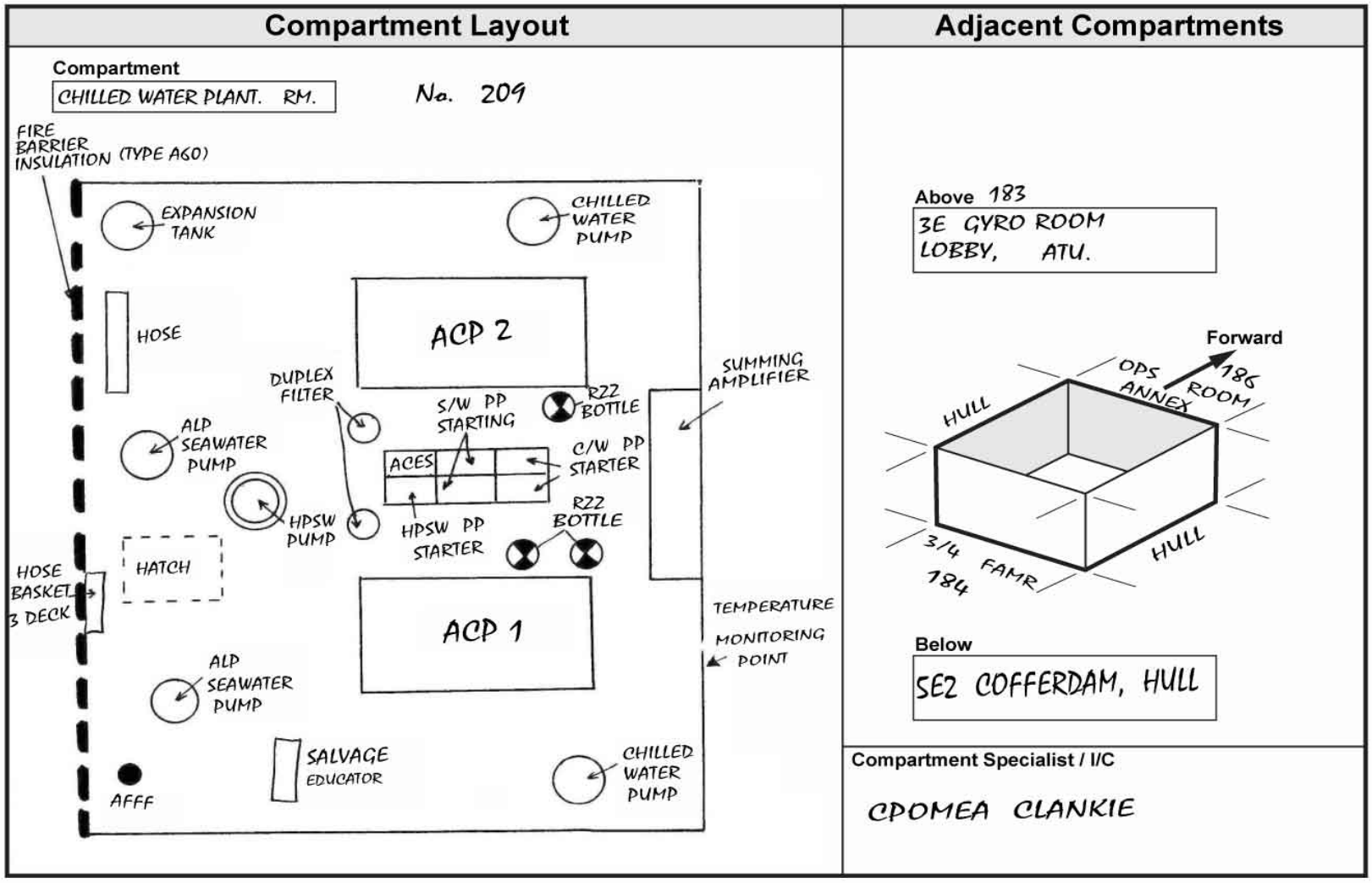


Figure 17J-3. Example of a Smoke Clearance Plan

<table>
<tr><th colspan="3">SMOKE CLEARANCE PLAN</th></tr>
<tr><td>2P
2Q
2R
Smoke logged compartment doors open
Non-smoke logged closed</td><td colspan="2">1. Sentries to be placed on <u>ALL</u> open doors and hatches.
2. Briefed to shut openings on “BRACE” Command.
3. HQ1 informed at end of smoke clearance.
4. Do not start ATUs unless fan is in smoke free area.
5. Smoke Curtains to be tied back.</td><td>K</td></tr>
<tr><th>OPEN DOORS AND HATCHES</th><th>CLOSED DOORS AND HATCHES</th><th>ADDITIONAL EXHAUST FANS</th></tr>
<tr><td>Doors: 2K/M, 2M/P, 2P/Q, 2Q/R and 2R/2S1 (Aft Airlock)

If fire in JRs Bathroom $2R_1$, DC Store $2R_{z1}$ of Undressing Area $2S_z$, open appropriate doors to atmosphere and close airlock 2R/2S.</td><td>Door: 2IJ/K
Hatches: 2N, 2P, 2Q, 2S, 1K and 1M.

AER Hydraulic Hatch.
FER Hydraulic Hatch.
FAMR Hydraulic Hatch.</td><td>Exhaust No 8 Starter in AFU No 5.
Exhaust No 17 2R Starter in Laundry.
Exhaust No 18 2S Starter in 2R Lobby.
ATUs (See Note 4 above)
ATU No 14 2R.

AFU No 5 1N.

Supply Fans: Supply No 6 1P Starter in Trans and MG Compartment, Supply No 8 2R Starter in Laundry and Supply No 9 2R Starter in Drying Room.</td></tr>
<tr><th colspan="2">BLOW</th></tr>
<tr><td colspan="2">Machinery Vent Running: FER Supply Port & Stbd, AER Supply Port & Stbd and AAMR Supply Port & Stbd.

Machinery Vent Stopped: FER Exhaust Port & Stbd, AER Exhaust Port & Stbd and AAMR Exhaust Port & Stbd.</td></tr>
</table>

ANNEX 17K

FIREFIGHTING IN A CHEMICAL ENVIRONMENT - BA PROCEDURES

1. General

Guidance for protective clothing when firefighting in various CBRN environments is detailed in Chapter 16. When a ships firefighting team is required to leave the citadel to fight a fire in a chemical environment (liquid or vapour) the following BA procedures should be adopted.

2. Before Leaving the Citadel

a. The BA Controller is to carry the teams' respirators (in their haversacks).

b. The Firefighting Team is to remain in the citadel, 'off air', until informed that all hoses are rigged.

c. The Team is to be briefed before they go 'on air'.

d. The Team and BA Controller are to exit the citadel under the control of HQ1/SCC.

If the ship is free from contamination within the citadel, then it may be possible for the team to exit the ship 'on air' (after undertaking the normal face seal check) and proceed directly to the fire (endurance of the BA set should be considered). However, if those inside the citadel are wearing respirators when the team is required to exit the citadel, then the following routines for changing from respirators to EDBA should be followed.

3. Changing from General Service Respirator to EDBA

The firefighter should change from respirator to EDBA in the following manner:

a. Select a sheltered position (if on the upper deck).

b. Put on the EDBA set, check the Demand Valve (DV) bypass valve is in the closed position and opens the bottle fully. ensuring that the facemask neck strap is placed out of the way of the facemask. Firefighting gloves are placed, open end down, under the EDBA waist strap.

c. Decontaminate the EDBA facemask and straps using Fullers Earth (DKP1).

d. Remove headgear and anti-flash hood (firefighting hood remains in place around the neck) in a vapour environment. IPE suit hood is to be removed if in a liquid environment.

e. Using the 'buddy system', open the EDBA DV bypass valve, take a deep breath and shut the eyes. The BA Controller then removes the Firefighters respirator and the Firefighter, bending forward, dons the firefighters hood and the EDBA facemask

f. Ease the top of the facemask away from the forehead momentarily to allow the air to purge out of the mask. Tighten the head harness straps, open the eyes and continue to breathe. Take a deep breath to operate the first-breath positive pressure mechanism and then turn off the by-pass.

g. Carry out a face seal check.

h. Pull up the firefighters hood, don FFHBC and, if in a vapour environment, put on firefighting gloves. Using the ‘buddy system’ check each others dress.

i. The BA Controller, on completion of filling out the control board, decontaminates the respirators, placing them in their haversacks and keeps them available for future use.

4. Changing from EDBA to General Service Respirator

a. The four-man Firefighting Team should change from EDBA to respirators in the following manner.

(1) If dressed as required for a vapour hazard environment:

(a) Select a sheltered position on the upper deck.

(b) Remove FFHBC. The BA Controller then removes the firefighting gloves and rolls the firefighters hood down around the Firefighters neck.

(c) The BA Controller opens the Firefighters haversack and presents the respirator and DKP1 to the firefighter, who removes these items.

(d) The Firefighters decontaminate their respirators and the BA Controller decontaminates his gloves with Fullers Earth (DKP1).

(e) The Firefighter takes a deep breath and shuts his eyes. The BA Controller removes the EDBA facemask and the Firefighter dons his respirator in the normal manner, breathing out hard to clear any contamination inside.

(f) When the BA Controller has removed the EDBA facemask from the firefighter, he presses the DV re-set button.

(g) If necessary, the Firefighter, using the ‘buddy system’ carries out the personal decontamination drill (see BRd 2170(2)).

(h) The Firefighter replaces his firefighters hood and firefighting gloves and takes his haversack from the BA Controller.

(i) The Firefighter collects all items of firefighting clothing and equipment and proceeds to the weathering point on the upperdeck.

(j) EDBAs and firefighters’ helmets etc are then hung up to weather.

(k) Firefighters (wearing the fire suit and respirator) then proceed to the Cleansing Station to enter the ship.

(2) If dressed as required for a liquid environment:

(a) Select a sheltered position on the upper deck.

(b) Decontaminate CBRN gloves using Fullers Earth (DKP1).

(c) Loosen and pull back the hood of the CBRN suit.

(d) The BA Controller opens the Firefighters haversack and presents the respirator and DKP1 to the Firefighter, who removes these items.

(e) The Firefighters decontaminate their respirators and the BA Controller decontaminates their gloves with Fullers Earth (DKP1).

(f) The Firefighter takes a deep breath and shuts his eyes. The BA Controller removes the EDBA facemask and the Firefighter dons their respirator in the normal manner, breathing out hard to clear any contamination inside.

(g) When the BA Controller has removed the EDBA facemask from the Firefighter, they pressed the DV re-set button.

(h) Using the ‘buddy system’, the Firefighter carries out the personal decontamination drill (see BRd 2170(2)).

(i) The Firefighter replaces their CBRN hood and takes his haversack from the BA Controller.

(j) The Firefighter collects all items of firefighting clothing and equipment and proceeds to the weathering point on the upperdeck.

(k) Once an EDBA has been used in a confirmed chemical liquid or vapour hazard, they are to be put in CBRN containment bags and sealed using the authorised method.

(l) Firefighters then proceed to the Cleansing Station to enter the ship.

b. The procedure for undressing and cleansing from a fire suit is detailed in BRd 2170(2).

ANNEX 17L

FIREFIGHTING ASSISTANCE TO OTHER SHIPS

Associated Publications:
Emergency Response Guidebook (ERG)

1. Initial Assessment and Planning

The following points are to be considered during the initial assessment of an incident in another ship at sea, before committing firefighting or search and rescue teams:

a. Accounting for personnel and casualties.

b. Establishing an incident boundary and checks of adjacent compartments.

c. Assessment of the hazards to firefighting or search and rescue (SAR) operations (eg hazardous cargo, fuel, live electrical systems, pressurised systems, smoke-logging, restricted access, sea state).

d. Informing shore authorities and other ships in the area.

e. Availability of ships boats for transfer of personnel and stores.

f. The establishment of a stability datum and the effects of firefighting operations on stability.

g. The availability of ship systems (eg fire pumps, electrical supplies, ventilation, emergency lighting, fixed firefighting systems, portable equipment, BA).

h. Compatibility of hose connections ie availability of the International shore connection.

i. The hazards associated with cargoes containing Toxic Industrial Materials.

j. Prior agreement of the assistance to be provided.

k. Prioritisation of actions and agreement of the plan (SAR, CASEVAC, containment and firefighting).

2. Information Sources

The following information sources may be available to assist with the initial assessment and incident planning:

a. **Fire Control Plans**. These should be available in either English or French in all merchant ships conforming to IMO conventions. They are usually kept, usually in a red container, either on the bridge or at gangway positions. They contain detailed information on ship firefighting equipment, fire lockers, fixed systems, ventilation plans, etc. They may be very complex, requiring assistance from the ship's crew to interpret them.

b. **Dangerous Goods Declaration**. Dangerous cargoes are identified by IMDG Codes, which are detailed in the Emergency response Guidebook (ERG). In some ships these may not be very accurate, therefore all cargo should be treated as hazardous until confirmed otherwise.

c. **Cargo Plan/Manifest**. The Manifest gives details of cargo locations and the order in which it has been stowed for unloading. This may also be a complex document, requiring assistance to decode and interpret.

d. **Stability Data**. The nominated Stability Officer is to monitor and update stability information, using a portable stability board. If normal RN firefighting techniques are used in ships with large deck areas, free surface water could quickly pose a threat to stability. For further stability guidance see Chapter 23.

3. Nomination of Responsible Officers

Personnel should be nominated as Responsible Officers for the following:

a. Stability.

b. Logistics.

c. Communications.

d. Safety.

e. BA Control.

f. BA Coordination.

g. Firefighting water supply.

h. Firefighting operations.

i. SAR operations.

j. Casualty handling.

k. Damage Control.

ANNEX 17M

GUIDANCE FOR ACTIONS IN RESPONSE TO FIRES IN GAS TURBINE MODULES

1. Introduction

a. These guidelines provide the basis for all gas turbine fire fighting and module recovery procedures. The fundamental principles are to maintain the module integrity while extinguishing the fire, cooling, purging and safely regaining access to the module, without re-ignition.

b. The purge times are not statutory; management of this aspect will require careful consideration of risk balanced against the operational imperatives, to ensure safe progress is made. The procedures assume that the module integrity has not been compromised. Where integrity has been breached, a more flexible approach will be required, dependent upon the effectiveness of the fixed firefighting systems and the degree of egress of combustion products.

c. Ships staff is to use this generic guidance to develop and practice installation specific procedures, to include all gastight gas turbine modules fitted within the vessel. The methods outlined may be slightly adapted if necessary, to take account of variations in module design.

Firefighting Actions and Recovery of GT Modules at State 3 (Peacetime)

Phase A - Initial/Watchkeeper Actions

2. Containment

Unless the module has been breached the operation of fire suppression systems should extinguish a fire within the module. Uptakes and downtakes within the machinery space, associated ventilation trunking and all sides of the module require monitoring and, if necessary, cooling using available hoses from within the compartment. As modules are constructed from steel and are double skinned with an insulation material between the two skins, only minimal cooling effect is gained by wetting the whole module. The effort should therefore be concentrated on the area's most likely to breach and allow BCF/BTM to be lost to the Main Machinery Space (MMS). The most susceptible areas are the flexible gussets between the module and the intakes/uptakes; 2 personnel can only effectively cool these areas, each using a minimum of a centre fed hose reel (CFHR). Primary checks are to be carried out as a priority. Continual checks via module windows and all fitted/portable thermometers should confirm that temperatures are stabilising, and no re-ignition has occurred. Secondary checks are then to be carried out to ensure full isolation of the module. If considered safe, machinery space ventilation may be used to clear any fumes from the machinery space and provide fresh air for personnel within the compartment. Module temperature will continue to rise initially due to a lack of cooling air. To give some additional indication of module temperature Rototherms may be placed on the module door and other suitably conductive areas.

a. **Fire not Extinguished**. If the fire is not extinguished by the first shot of the two shot fixed firefighting system, the second shot is to be operated locally. If this fails to extinguish the fire or if the fire has not been extinguished on a single shot system, containment is to continue, and boundaries are to be re-established prior to a full re-entry being conducted on the module with nozzles open. Re-entry to the module is to be conducted without going through the purge stage in this case.

b. **Fire Extinguished**. For single shot module fixed firefighting systems, and for two shot module fixed firefighting systems where one or both shots have been operated, used bottles are to be replaced prior to purging and preparation of re-entry firefighting equipment.

Phase B: - Re-Entry and Recovery

3. Module Re-Entry Preparations

A full firefighting team in full firefighting rig is to be dressed and two hoses, 1 x Size 2 hose with firefighter nozzle for personal protection and 1 x FB5X, are to be used. Hoses previously tasked for boundary cooling may be used for the re-entry team once temperatures have reduced. In machinery spaces without hydrants then 2 x CFHR are to be used with one selected to water and one selected to foam.

4. Module Purge

a. **Preparations**. The module fixed system BCF/BTM bottles must be renewed prior to commencing the module purge. Before starting the purge, consideration is to be given to the exit location of the purge gases. If necessary, the upperdeck in the vicinity of the module ventilation outlet is to be cleared and ships course relative to wind direction altered. The machinery space ventilation supply fans are to be started, and the exhaust fans are to be stopped, therefore pressurising the machinery space. A positive pressure must be confirmed by checking and reporting the machinery space manometers. Transit to/from the machinery space requires strict airlock discipline in order to maintain a positive machinery space pressure. The fixed hatch waterwall hose (if rigged) will have to be removed to achieve this. At least Tier 1 enhanced (cotton underwear, PCS/overalls, firefighters hood, anti-flash gloves and BA) is to be worn by all personnel that will be in the machinery space during the purge. BA facemasks must be worn during the initial opening of the purge valve and until the purge is complete.

b. **Execution**. After confirmation that it is safe to purge (module temperature check, observation via module window, all non-involved personnel clear of the machinery space) the ventilation flaps are to be carefully opened whilst the module interior is checked for signs of re-ignition. If no re-ignition occurs the purge may proceed. The purge team are to go ‘on air’, and one man is to crack open the purge valve, taking care to ensure the airflow direction is correct and no re-ignition takes place. If at any stage re-ignition occurs, the purge process is to be stopped immediately, the purge valve shut, module ventilation flaps closed, and the module fixed system operated. A sentry with a minimum of an AFFF SPE is to remain in the vicinity of the purge valve throughout the purging operation. The purge must be continued for a minimum of 10 mins and until the module temperature has reduced to an acceptable level. To cease purging at this point, and after a (possibly protracted) delay conduct a module re-entry, would reintroduce risk to an otherwise minimal risk situation; for that reason, purging is to continue throughout the re-entry and recovery phase.

If at any stage re-ignition occurs, the purge process is to be stopped immediately, the purge valve shut, module ventilation flaps closed and the module fixed BCF/BTM system operated.

Notes:

1. Purging using module ventilation fan (No current RN vessels fitted - other NATO only).

2. Module purging is achieved using the installed module ventilation fan. This is a fully contained method with the least risk to personnel in the machinery space. After opening the ventilation flaps the module fan is started and the module interior purged. Personnel require no additional protection except Intermediate Firefighting Rig (PCS/overalls, fire fighter's hood, anti-flash gloves, BA). If at any stage re-ignition occurs, the purge process is to be stopped immediately, the module vent fan stopped, module ventilation flaps closed, and the module fixed system operated.

5. Module Re-Entry

Strict air lock discipline is to be employed when transiting to and from the machinery space. When purging is assessed as effective (minimum 10 mins) and the module temperature has reduced to an acceptable level, all personnel not wearing full firefighting rig are to exit the machinery space, all accesses are to be closed and sentries posted. The module is to be unlocked and BTM/BCF re-armed prior to re-entry. Module re-entry by the firefighting team is to be authorised by the IBC and conducted 'on air' with hoses charged but nozzles shut.

6. Machinery Assessment and Recovery

Once re-entry has been achieved all machinery space ventilation is to remain running to clear any products of combustion from the machinery space. During this period the module door is to be left open and the machinery space access to remain closed. When the atmosphere is clear, the re-entry team may come off air and non-BA wearers may have normal access to the machinery space. An assessment of damage to the internal aspects of the module and engine unit is to be completed and if possible, rectification action conducted to return the engine to a serviceable condition.

Note. *When BCF/BTM is discharged it leaves a harmful acidic residue. PPE is to be worn by all personnel to prevent contact with skin and eyes.*

Module Recovery at Action (State 1/2)

7. Introduction

a. The principles of module recovery in the Action State are to be driven by the stipulated Command Aim and Priorities. Strong and effective management is essential and may require taking certain calculated risks and decisions to formulate a plan of action to achieve speedy recovery of the affected engine.

b. The drill reactions and module checks will share much with the State 3 (Peacetime) procedure, which Action personnel are to be fully conversant with. However, the imperatives of the Command Aim may necessitate more rapid entry into the module to assess serviceability and identify the relevant actions and the possible logistic/technical support required. An example algorithm is provided which should be used to develop installation specific aide-memoires and check lists.

8. Containment

a. Unless the module has been breached, the operation of fire suppression systems should extinguish a fire within the module. Uptakes and downtakes within the machinery space, associated ventilation trunking and all sides of the module require monitoring and, if necessary, cooling using available hoses from within the compartment. As modules are constructed from steel and are double skinned with an insulation material between the two skins, only minimal cooling effect is gained by wetting the whole module. The effort should therefore be concentrated on the area's most likely to breach and allow BCF/BTM to be lost to the Main Machinery Space (MMS). The most susceptible areas are the flexible gussets between the module and the intakes/uptakes; it may be necessary to cool these areas with only 1 person, using a CFHR. Should the Command veto tripping of the engine, high priority must be given to containing the fire within the module.

b. In the event of module breach, initial leak stopping should be actioned and full containment established with the aim of containing the fire to the module. The use of BA will be required in this instance.

c. To give some additional indication of module temperature, a Rototherm may be placed on the module door.

9. Firefighting Equipment Preparation

Driven by the Command Aim, the urgency to recover the module will dictate the level of fire fighting equipment deployed and whether the fixed gaseous drench bottles should be changed. The potential exposure to higher than normal temperatures and the possibility of re-ignition must be considered. A minimum of 2 CFHRs are to be used to conduct the re-entry with one on water and one on foam. Personnel involved in other urgent tasks such as blanket searching, leak stopping, etc may continue however they must carry an EEBD and should have an adjacent escape route.

10. Module Purge and Recovery

a. The Action crew should assess the situation at the scene and request permission to 'conduct action re-entry', taking account of the module temperature and timescales involved. The order from HQ1 to conduct an action re-entry authorises the Action crew to start MMS vent, purge and enter the module without further reference to the SCC/HQ1. It is therefore imperative that all factors are considered before ordering recovery. The IBC is to authorise the re-entry.

b. I/C of the space should risk assess actions in line with ship priorities, including the situation regarding personnel remaining in the space, access to EEBD or breathing apparatus and an adjacent escape route. Any personnel remaining within the space are to be informed that the re-entry is to be conducted.

Action crews must then ensure that any ratings entering or leaving the MMS are aware of the re-entry. Personnel must be nominated to start the MMS supply fans and act as sentries on the MMS access points (external assistance may be required to achieve this).

c. The method of purging recommended in order to ensure that the quickest possible recovery can be achieved is as follows: Module vent flaps should be opened, and module checked for re-ignition. If no re-ignition, then the MMS supply fans should be started. The Action crew or the mobile repair team, with the necessary fire fighting equipment and wearing AWD with BA (on air), should then crack open the module door sufficiently to establish a purging airflow. The purging time should be at the discretion of the I/C of the space considering the circumstances that prevail, and the priority placed on recovery. Once purged the module door is to be fully opened and re-entry undertaken. On completion of re-entry and subsequent smoke clearance, the propulsion manager is to be informed in order that GT recovery may commence.

11. Fire Not Extinguished After Use of Fixed System

If the module fire is not extinguished after operation of first or second shot of BTM/BCF, the module is to be treated as a closed compartment and re-entered using recognised techniques for an oil-based fire. In this instance there is no requirement to carry out a module purge routine. Personnel not involved in the re-entry must be evacuated from the compartment. If any there are any other personnel involved in urgent repairs within the space, they must be wearing BA.

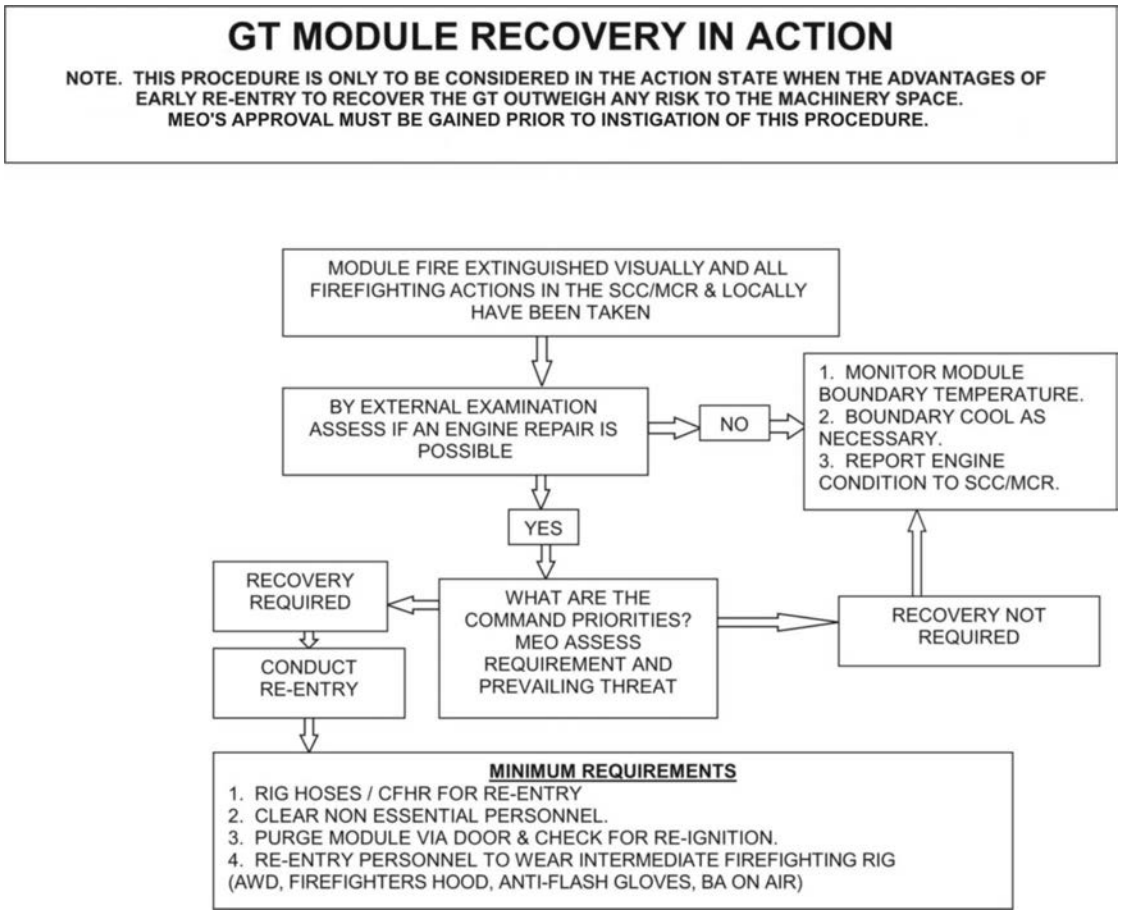
Gas Turbine Module State 3 (Peacetime) Recovery Procedures

PHASE A	PHASE A
SCC Actions	**Local Actions**
Operate BCF/BTM system and confirm operation of automatic system (from local position).	Watchkeeper to local to investigate carrying AFFF SPE.
Carry out EMERGENCY SLOW on affected shaft. Request OOW permission to trip affected engine and select alternative drive state. Carry out actions when approved.	Carry out PRIMARY CHECKS: 1. Ensure BCF/BTM has operated. 2. Ensure module vent flaps shut. 3. Switch off module lights, check state of fire (Extinguished/Not Extinguished). If 2 shot system and fire not extinguished, operate second shot and notify MEOOW. 4. Check module for gastight integrity (module intact).
Crash stop all vents and conduct Fire SOPs.	Report: **“Primary Checks Complete, Fire Extinguished/Not Extinguished”** (see Phase B).

Broadcast **"Fire in Port/Stbd ..... module in the.....(location). SSEP to muster....."** Report to OOW **"Ready to obey telegraphs on affected shaft."** Give revised limitations.	
	On completion carry out SECONDARY CHECKS: 1. Once engine tripped from remote, trip from local position also. 2. Ensure HPSOC indicates shut. 3. Ensure LP fuel valve is shut. 4. Ensure HP air to engine start system isolated. 5. Ensure module drains shut. 6. Ensure module purge valve shut. 7. Check uptakes and downtakes in machinery space only.
	Report – **"Secondary Checks Complete"** Rig containment hoses on both sides of the enclosure (2 x CFHR) and continue to monitor enclosure temperature. Report to I/C of Attack Party**: "Primary and Secondary checks complete, Fire Extinguished/Not Extinguished"**. Handover control at the scene of the incident.
	On completion proceed directly to I/C Main Group for debrief, then to be escorted to DCO/IBC in HQ1 as person finding the fire.
↓	↓
PHASE B	**PHASE B**
Fire Extinguished	**Fire Not Extinguished**
Conduct BCF/BTM bottle change and prepare to purge module.	Contain the fire within the module.

Wait for significant drop in module temperature. This may take some time due to lack of cooling air.	Re-establish smoke boundaries with sentries. Clear all non-essential personnel from within the smoke boundary.
Reduce personnel in the compartment to minimum. Ensure all are wearing Intermediate firefighting rig (PCS/overalls, firefighter's hood, anti-flash gloves, BA). .	Conduct module re-entry with 2 x Size 2 hoses, one with firefighter nozzle and one with FB5X using the support party, on air, nozzles open (for T23; 2 x CFHR are to be used).
Request Command turn the ship across the wind and make a warning pipe reference module venting.	
With module lights off, open module vent flaps and check viewing ports for re-ignition.	
No Re-Ignition	**Re-Ignition**
Pressurise MMS using supply fans.	Crash stop all vent and shut module vent flaps and purge valve (if open).
With IBC's permission open module purge valve and purge module for minimum of 10 mins (one man at purge valve, in Intermediate FF rig, on air, with an AFFF SPE).	Operate BCF/BTM and repeat Phase B.
Rig hoses and prepare for re-entry.	
Support party in full FF rig to be in Main Machinery Space.	
Clear all non-essential personnel from within the smoke boundary.	
Re-establish smoke boundaries with sentries.	
Unlock module door and re-arm BCF/BTM system.	
Obtain Command approval and conduct re-entry of module with charged hoses (nozzles shut).	

Figure 17M-1. GT Module Recovery In Action



ANNEX 17N

SSEP FIREFIGHTING PROCEDURES

1. Procedure.

In DD/FF and larger ships, where the SSEP comprises all the firefighting groups and parties of the full harbour organisation, the procedure to be followed is much the same as when the ship is in harbour:

a. When the alarm is raised the Attack Party should proceed directly to the SOTI. They are to collect portable first-aid firefighting appliances en route, and join up with such firefighters as there may be. Having established the seat and nature of the fire, they are to fight it with the appropriate appliances. Two ratings (previously detailed) should arrive at the SOTI wearing BA, and carrying portable firefighting appliances. The BA Controller, proceeds directly to the FCP, ready to prepare the ratings wearing BA for entry as quickly as possible. The BA Attack Party, using portable appliances or hoses as appropriate, is to commence firefighting immediately. All members of the Attack Party are to be fully experienced in dressing and wearing BA as well as being capable of using a BA control board.

b. As soon as the initial alarm is raised, HQ1 should be manned by the IBC, the DCO, an incident board operator, a communications number and the DWEO to advise on WE aspects; switchboards should be manned by qualified switchboard operators to crash-stop ventilation and to safeguard electrical supplies; SCC/ER watchkeepers should put all available HPSW pumps on to the HPSW system. The first task of the communications number is to rig a sound powered telephone between HQ1 and the FCP.

c. The XO should briefly visit the FCP and HQ1 in the early stages, in order to gain an up-to-the-minute appreciation of the situation so that he will be able to give advice to the Command on whether there is a need for the ship to go to Emergency Stations.

2. First Aid Firefighting During Silent Hours

It is recommended that the following on-watch ratings be detailed to undertake first aid firefighting until relieved by the SSEP: an ET(ME), AB(CIS), AB(WAR), ET(WE).

3. Containment Party

a. To contain primary boundaries quickly, it is important that a Containment Party is provided immediately following the emergency pipe. These personnel are an integral part of the SSEP and are identified by the wearing of blue surcoats. It is advantageous to have a WE senior rating as I/C Containment Party, so that he can advise Deck Managers on electrical equipment and magazine hazards at the boundaries. Should the ship subsequently go to Emergency Stations, then personnel nominated from spare hands would augment the Party. In capital ships, there is normally sufficient manpower available to deal with all primary boundaries, adding extra personnel from Emergency Stations. The minimum containment organisation for a typical DD/FF at sea is normally as follows:

(1) **DWEO/CISE.** Technical advice to the DCO.

(2) **WO/CPO/PO.** I/C Containment Party.

(3) **CPO/PO/LH.** 2 I/C Containment.

(4) **Four CPO/PO/LH.** Deck Managers (from any department).

(5) **All Officers of Quarters (OOQ).**

b. The I/C Containment Party has a roving role, visiting HQ1, WSB, the Containment HQ and containment operations as necessary. They are responsible to, and briefs, the DWEO/CISE in HQ1. They ensure consistency between the respective incident boards.

c. The 2 I/C Containment is normally stationed at the nominated Containment HQ and is responsible to the I/C Containment Party. They detail and control the Deck Managers and Boundary Coolers, and coordinates TMS data from the Deck Managers (see Annex 17D).

d. Deck Managers are each allocated a deck as their area of responsibility. They are particularly valuable for MMS fires, which require boundary monitoring/cooling on several decks and compartments. They are responsible to the 2 I/C Containment for ensuring that boundary monitors/coolers are in the correct location with the correct equipment to monitor/cool the designated areas of the boundary. The use of diagrams and Kill Cards, particularly in high risk areas, will help to ensure that boundary cooling is effective. They are to report to the 2 I/C Containment when the monitors/coolers are in position and undertaking their tasks. Deck Managers are then to constantly monitor their areas, briefing the 2 I/C on progress, including TMS data.

e. OOQs are to report to the 2 I/C Containment with their magazine keys. Should a fire be adjacent to a magazine or ready-use locker, the relevant OOQ should then report to the FCP to take charge of the boundary monitors/coolers in the vicinity of their quarter.

f. Boundary Monitors Coolers are to carry out their duties as detailed by their Deck Manager. They are to cool designated areas, if they are hot to the touch, and carry out temperature monitoring in accordance with the procedures in Annex 17D.

4. SSEP - Command and Control Aide-Memoire

a. Continuous Aggressive Attack - (DCO)

(1) Check the pipe is correct (General Alarm), re-pipe as necessary, check vent crash stopped, HPSW pressure and HV implications if relevant.

(2) DCO to pipe arrival in HQ1 and hasten reports, receive report from HQ1 watchkeeper and ensure IBO narrative begins.

(3) DCO makes contact as soon as possible with the FCP and establish its location, status of the fire (Type of fire? carbonaceous, oil based, etc. minor, significant, critical (see **Note 1**), winning/holding/losing) and priority (status of door/hatch, CAA or containment while rigging for re-entry), smoke boundaries (if established) (see **Note 2**) and if there are any casualties.

Notes:
*1. **Minor:** Small/Containable, **Significant:** Potential to effect ship capability and **Critical:** Prejudices survival of ship or fighting capability.*

2. Smoke must be controlled effectively, although the establishment of smoke boundaries too early can hinder the CAA

(4) The location of the FCP and smoke boundaries should always be piped when known and if moved (Annex 17C).

(5) If casualties, then correct pipe to be made.

(6) If any hazards in the compartment - pipe what the hazard is and the implications to the SSEP.

(7) Consider the use of fixed systems (Annex 17F for MMS).

b. **Command Adviser/IBC**

(1) **Command Aim (CA)** - Does it change?

(2) **Whole ship priorities eg:**

(a) CAA.

(b) Account for personnel.

(c) Prepare for CASEVAC.

(3) If complex incident, consider Bridge Command Huddle. Brief CO as follows:

(a) CA achievable - Yes/No.

(b) Status of speed, steering and stability.

(c) Command Top 3 Priorities.

(d) Status of Emergency Stations if not already briefed.

(e) Status of blanket searches - if applicable.

(f) Mini SOCs called on aviation facilities to assess potential impact on flying.

(g) Casualty Status in the approved triage format.

(h) End with repeat of CA achievable Yes/No.

c. **DCO**

(1) Pipe when electrical isolations made, if attack/support party are still attacking the fire.

(2) Consider Emergency Stations early, but after 2 mins to allow Attack BA to proceed to the scene unimpeded. Precede pipe with General alarm (Para 0704), stating reasons for ES, where to muster and safe route. Make sure all personnel accounted for, using a Rover if necessary. What is the process? Is there a manpower coordination cell on the Bridge/XO Cabin?

(3) Ensure the person finding the fire reports to HQ1. DCO is to debrief this person at the incident board establishing: type of fire, location of fire, actions carried out, type of extinguishers used and status of the door/hatch.

(4) Check containment being carried out and establish priorities (Annex 17D), including TMS.

(5) Employ Rovers, providing leadership and direction at the scene as required and providing DCO with first hand picture.

(6) Check that the picture makes sense and that all resources are marked ie FCP, 5 man teams, casualties, spare hands also if any resources have re-located, noting all this information on the Incident Board (IB).

(7) Discuss with the Propulsion Manager (PM) if any stability or MARPOL implications.

(8) Report from FCP - Winning/holding/losing.

d. **Containment**

(1) If door/hatch closed, then new priority must be piped (containment while rigging for re-entry, unless it is a MMS, when it is containment only while fixed systems are being used and the compartment is cooling).

(2) At this stage a Command Huddle may be considered appropriate if the situation is unclear, or people are missing, and priorities are to be allocated. A similar format to the State 1 Command Huddle should be used, but reports should be more SITREP focussed than ‘Top 3’ focussed, although priorities should be allocated.

(3) CA may also call a Command Huddle on the Bridge. Format as follows:

(a) CA brief to CO.

(b) XO (internal battle report, morale etc).

(c) NO with navigation update/safety/weather.

(d) Ops Officer to cover external factors (requests for assistance, updates to shore authorities, NLIMS etc).

(e) PR Officer deals with media.

(f) Final update by CA, then hand over to CO.

e. **Re-Entry**

(1) DCO and I/C Main Group agree how re-entry will be conducted ie the route to fresh air, where smoke boundaries will be established, where FCP will re-locate to, clean/dirty air Re-entry and the location of foam dump.

(2) Once the I/C Main Group is satisfied that the Support Party has been briefed and in position off air, the correct hoses are rigged and charged and that a plan for re-location and smoke boundaries is in place, permission is to be sought to make a re-entry from the DCO.

(3) The DCO must satisfy himself that all isolations to the compartment have been completed (including re-entry isolations if required), vent has been re-crash stopped and that HPSW pressure is adequate before he can give permission for the re-entry (Command approval is required) or less than 60°C for MMS. They then gives the I/C Main Group a direct order to conduct the re-entry over the main broadcast **AND** secondary communication.

(4) A relief team should be considered from a FRPP. This team should be fully prepared and ready to relieve the initial firefighting team before they are due out.

(5) The DCO then pipes the new location of FCP, smoke boundaries and time to relief for Support Party once informed by I/C Main Group.

(6) Consider medical attention and drinks for support party.

f. **Recovery**

(1) Once the fire is extinguished and boundary search complete, then pipe name of the sentry and the time to relief To avoid injury of sentry from heat stress, consider two sentries if available.

(2) Obtain smoke clearance plan from PM. Pipe outline plan, where ship’s company should keep clear of and where smoke will exhaust. It is important to have an alternate plan. Smoke clearance must be closely managed due to the dangers it presents and the unpredictability of where smoke may end up (see Annex 17C).

(3) Consider removal of firefighting water.

(4) Once incident is complete, regain material and personnel posture as quickly as possible.

(5) Draft and send NLIMS signal.

(6) Consider Trim for personnel engaged in firefighting effort.

ANNEX 17O

OOD HFEP PROCEDURES

1. OOD Firefighting Command and Control

The OOD's primary consideration during peacetime incidents is the safety and security (S&S) of the ship's company and the ship. OODs must use an aide memoire to ensure that all issues have been considered throughout the incident. During an incident the OOD's position is in HQ1 from where Command and Control should be exercised. To ensure effective control is achieved the OOD must consider:

a. Continuous Aggressive Attack - First 15 mins

(1) Check the pipe is correct, re-pipe as necessary, check vent crash stopped, HPSW pressure and HV implications if relevant.

(2) Pipe arrival in HQ1 and hasten reports, receive report from HQ1 watchkeeper and ensure IBO begins narrative.

(3) As soon as possible make contact with the FCP and establish its location with a safe route, status of the fire (Type of fire? carbonaceous, oil based, etc.) and priority (status of door/hatch, CAA or containment while rigging for re-entry), smoke boundaries (if established) (see ***Note***) and if there are any casualties.

> ***Note.*** *Smoke must be controlled effectively, although the establishment of smoke boundaries too early can hinder the CAA*

(4) The location of the FCP and smoke boundaries should always be piped when known and if moved (Annex 17C).

(5) If casualties, then correct pipe to be made.

(6) If there are any hazards in the compartment pipe what the hazard is and the implications to the HFEP.

(7) Consider the use of fixed systems (see Annex 17F for MMS).

(8) Pipe when electrical isolations made, if Attack/Support party are still attacking the fire.

(9) Consider Emergency Clear Lower Deck (ECLD) early, but after 2 mins to allow Attack BA to proceed to the scene unimpeded (**Mandatory requirement with Minimum Duty Watch**). Precede pipe with general alarm, stating reasons for ECLD, where to muster and safe route. Ensure all personnel are accounted for (use the Duty PO (DPO) if necessary).

(10) Ensure person discovering the fire reports to OOD in HQ1. OOD to debrief person finding the fire establishing: - type of fire, location of fire, actions carried out, type of extinguishers used and status of the door/hatch.

(11) Check that containment is being carried out and establish priorities (Annex 17D), including TMS if MMS.

(12) Check QM/BM has closed the gangway, informed FRS and adjacent ships.

(13) Use DPO as Rover, providing leadership and direction at the scene as required and providing OOD with first hand picture.

(14) Discuss with DMESR stability and MARPOL implications.

(15) Check location of BA Dump.

(16) OOD is to continually check the incident board to ensure that it is annotated correctly and is an accurate representation of the situation on the ground.

b. **Containment**

(1) If door/hatch closed, then a new priority must be piped (containment while rigging for re-entry, unless it is an MMS, when it is containment only while fixed systems are being used and the compartment is cooling).

(2) At this stage a Command Huddle may be considered appropriate if the situation is unclear, or people are missing, and priorities are to be allocated. A similar format to the State 1 Command Huddle should be used, but reports should be more SITREP focussed than ‘Top 3’ focussed.

(3) OOD and I/C Main Group should agree how re-entry will be conducted, ie the route to fresh air, where smoke boundaries will be established and where FCP will re-locate to.

(4) Once the I/C Main Group is satisfied that the Support Party has been briefed and are at their positions off air, the correct hoses are rigged and charged and that a plan for re-location and smoke boundaries has been agreed then they are to seek permission to make a re-entry from the OOD.

(5) The OOD must satisfy themselves that all isolations to the compartment have been completed, including re-entry isolations vent has been re-crash stopped and that HPSW pressure is adequate before they can give permission for the re-entry. They then give the I/C Main Group a direct order to conduct the re-entry over the main broadcast **AND** secondary communication, reiterating the checks stated above.

(6) A relief team should be considered and if no spare hands available may be formed by using the Attack Party. This team should be ready well before the team tackling the fire is due out.

(7) The OOD to pipe the new location of the FCP, smoke boundaries and time to relief for the Support Party once informed by I/C Main Group.

(8) Consider medical attention and drinks for the Support Party.

(9) Do not stall CAA while waiting for FRS. Once on the scene consider using FRS for search and rescue if people missing, firefighting if beyond ship resources or containment if that will free up hands for the ship firefighting effort. The OOD does not relinquish responsibility for S&S of the ship, but handover of the task must be clear and piped over main broadcast so that HFEP and Ship's Company are aware (see Annex 16A and Annex 16B).

c. **Permission to Enter Compartments with Support Teams.** There are 2 scenarios when a compartment which has sustained a fire or has had an alarm raised on it requires re-entry through a closed door or hatch:

(1) **Clean Air Re-entry:** The initial attack was beaten out and the CAA has been lost or the access has remained closed throughout. The I/C main group has rigged for the re-entry phase outside the compartment in a clean atmosphere ie the re-entry point is outside the smoke boundary. In this situation the following routine is to be adopted prior to the re-entry commencing:

(a) I/C Main Group is to seek permission to commence re-entry confirming that the Support Party have been fully briefed and are waiting off air, all hoses are rigged and charged with FF medium proved.

(b) HQ1 carry out the following checks:

- ventilation crash stopped;
- all isolations are complete (compartment and any re-entry isolations);
- HPSW ringmain is (***class specific***) pressure; and
- confirm standby support team available/being dressed.

(c) I/C Main Group obtains permission from OOD (or IBC obtains permission from Command at sea). OOD (or DCO at sea) then authorises the re-entry to I/C Main Group via main broadcast **AND** secondary communication.

(d) On receipt of the order to enter the compartment I/C Main Group carries out the following:

- ensures the pre-determined smoke boundary is established and sentries in place;
- remove all personnel not in Full Firefighting rig from inside the new smoke boundary;
- put Support Team on air; and
- relocate FCP as directed by HQ1.

(e) Once FCP re-established I/C Main Group is to order I/C Support Party to carry out the re-entry.

(f) When I/C Support acknowledges order I/C Main Group is to inform HQ1 of:

- location of FCP;
- location of smoke boundaries;
- that entry has commenced; and
- time relief party is required.

(2) **Dirty Air Re-entry:** The re-entry to the fire is required to be made from a contaminated area (ie within the smoke boundary) and the team rigging for the re-entry has needed to be on air to do so. In this scenario the following routine is to be adopted:

(a) I/C Support Team seeks permission to re-enter the compartment confirming that all hoses are rigged and charged with FF medium proved. They will also pass the minimum BA pressure of the team ie 250 bar to I/C Main Group.

(b) I/C Main Group then passes this pressure and **TIME FOR RELIEF** to HQ1 whilst seeking permission to re-enter the fire.

(c) HQ1 carry out the routine in Scenario 1 sub para (b) and sub para (c) including considering re-locating the FCP to enable future Support Teams to enter from fresh air. This may also require the relocation of smoke boundaries.

(d) For subsequent re-entries through closed doors or hatches, TL of the Support Party is to confirm that actions at sub para (a) above to I/C Main Group.

(e) **If the BA pressure is above 160 bar:** I/C Main Group will order the re-entry to commence and informs HQ1 that the subsequent re-entry has commenced and any other actions that have been taken eg re-locating FCP/re-establishing/moving of smoke boundary etc.

(f) **If the BA pressure is below 160 bar:** The re-entry is **NOT** to commence without the OOD (Command at sea) approval. In this situation, consideration should be given to tasking a new Support Team to carry out the re-entry.

(g) On receipt of permission to re-enter, the I/C Main Group is to order the I/C Support Team to commence the re-entry.

d. **Re-Entry/Recovery**

(1) Once fire extinguished and boundary search complete, then pipe name of sentry and time to relief.

(2) Obtain smoke clearance plan from DMESR and pipe outline plan, where Ship's Company should keep clear of and where smoke will exhaust. It is important to have an alternate plan.

Smoke clearance must be closely managed due to the dangers it presents and the unpredictability of where smoke may end up (see Annex 17C).

(3) Once incident complete, regain material and personnel posture as quickly as possible.

(4) Retain data and information from the incident for input to the Navy Safety Occurrence Report (NSOR)

(5) Consider Trim for personnel engaged in firefighting effort.

CHAPTER 18

HIGH PRESSURE SEA WATER SYSTEMS AND ASSOCIATED FIREFIGHTING EQUIPMENT

Para

1801. General
1802. Intermediate Pressure and Low Pressure Sea Water Systems
1803. HPSW Pumps
1804. Domestic Services
1805. HPSW Main
1806. Pressure Gauges
1807. Shore Connections
1808. Hydrants
1809. Hoses
1810. Hose Couplings
1811. Stowage of Hoses
1812. Nozzles
1813. Fixed Hatch Waterwall Nozzle
1814. Waterwall Nozzle Mounting Pole
1815. Foam Making Branchpipes
1816. FB5X Mk 2 Foam Making Branchpipe
1817. FB10/10 Foam Making Branchpipe
1818. Characteristics of Foam Making Branchpipes
1819. Portable Inline Inductor FBU5X
1820. Controllable Y Piece
1821. Inline Controllable Coupling Piece
1822. Double Ended Hose Adaptor
1823. Flange Adaptors
1824. Emergency Bulkhead Hose Connections
1825. Centre Feed Hose Reel
1826. CFHR Standby Condition
1827. CFHR Operating Instructions
1828. Ramfan
1829. Flooding and Spraying Systems
1830. Manually Operated Spray Systems
1831. Automatic Spray Systems
1832. Pressurised Reservoir Systems
1833. Rapid Reaction Spray Systems (RRSS)
1834. Metron Activated Spray Systems (MASS)
1835. RRSS and MASS Operating Procedure Whilst Conducting Exercise Serials
1836. Hangar Spray Systems
1837. Dry Risers
1838. Dutch Rolling of Hoses
1839. Flight Deck Monitor

CHAPTER 18

HIGH PRESSURE SEA WATER SYSTEMS AND ASSOCIATED FIREFIGHTING EQUIPMENT

1801. General

a. The high pressure sea water (HPSW) system supplies seawater throughout the ship, usually by means of a ring main, to supply the following services:

(1) Firefighting installations including spray systems in machinery spaces, magazines, flammable stowages and other high risk areas.

(2) Prewetting systems.

(3) Domestic and sanitary services.

(4) Ballasting and de-ballasting water-compensated fuel tanks and other tanks used for stability purposes.

(5) Eductors for salvage and general drainage.

(6) Hangar spraying systems in aircraft carriers.

(7) Flight deck firefighting systems in aircraft carriers.

(8) Cooling of essential machinery and equipment.

b. Pumping, flooding and draining are dealt with in Chapter 22. Portable and mobile firefighting equipment, and fixed firefighting installations (other than those supplied from the HPSW system) are dealt with in Chapter 19. This chapter contains a general description of the HPSW installations and their associated firefighting equipment. For detailed information concerning specific ships, reference should be made to the appropriate CBRNDC Class Book.

1802. Intermediate Pressure and Low Pressure Sea Water Systems

Cooling for electrical and other equipment and emergency cooling for certain other items of machinery can be supplied by seawater, at reduced pressure, from the HPSW system.

1803. HPSW Pumps

Electrically driven pumps supply the HP sea water main with a capacity of 72-200 m^3/h according to the size of ship. They are designed to produce about 7 bar pressure in the system and are dispersed throughout the ship, inside and outside the machinery spaces. The number of pumps fitted in any ship is based on the water requirement for firefighting, de-ballasting or pre-wetting, whichever is the greatest, together with any essential service such as emergency cooling water for important equipment, plus allowance for breakdowns. The sole duty of these pumps is to supply the HPSW main.

They normally take suction directly from the sea although one or more of the pumps can also take suction from the discharge side of the diesel generator heat exchanger, or some other hot discharge, so that warmed water can be delivered to the system in arctic conditions. This facility is not fitted in all ships.

1804. Domestic Services

If it is possible, domestic services such as supplies to bathroom eductors, sanitary services, garbage disposal, sewage plants, refrigerating plant and other similar services, are generally grouped together so that supplies can readily be isolated to enable adequate pressure to be maintained in the system in an emergency.

1805. HPSW Main

a. This can be a ring main, a single line of piping, or cross-connected double lines, running fore and aft with extensions and branches as necessary to carry seawater under pressure to all parts of the ship. Bands of green tape, marked 'SEA', around the piping, identify it. Branches for firefighting and spray systems are painted bright red throughout their length. The main usually runs fairly high in the ship above the waterline. It is intended to work at about 7 bar but damage (or other causes) may cause the pressure to drop below this and most appliances for use on the main are designed to work at pressures as low as 2.4 bar.

b. The pumps discharge through vertical pipes called rising mains, which lead into the HPSW main. The numbering system for HPSW main valves is detailed in Chapter 4. To prevent flooding from, or loss of pressure in, a damaged main, isolating valves are fitted:

(1) On each side of the junction of the rising main with the HPSW main.

(2) In the rising main below its junction with the HPSW main.

(3) On each side of branches leading to spraying installations.

(4) At each watertight bulkhead (transverse or longitudinal) if there is no other isolating valve in that section.

(5) On each side of a cross connection junction with the main.

1806. Pressure Gauges

Direct reading pressure gauges are fitted in the HPSW main adjacent to each riser. For single spot helicopter decks a direct reading gauge is fitted in the branch from the main immediately upstream of the monitors and hangar spray system. In ships with between deck hangars pressure gauges are fitted in each hangar access lobby to indicate upper main pressure. The remote pressure information in each zone is displayed in the SCC/HQ1, HQ2 and/or AHQ and Section Bases. Where the main is fitted on port and starboard sides of the ship, as a ring main, they are treated as separate mains and each is fitted with pressure gauges.

1807. Shore Connections

Connections into the HPSW main are provided normally fore and aft port and starboard to enable shore-supply water to be used for firefighting purposes while the ship is in dock. These can also be used for rigging emergency fore-aft breeching hoses in the event of damage to the system. In ships with flooding systems, water can be supplied up to the sea inlet valves through flooding bonnets.

1808. Hydrants

These are fitted to the HPSW main throughout the ship, each consisting of a screw-down or single-action lever operated control valve controlling one or two outlets which should be blanked by caps when not fitted with ready-use hoses or required for use. The screw-down valve should be shut **HAND TIGHT** only, as over tightening will cause damage to the valve seat. The single action lever operated control valve should, when required to be operated, be opened slowly to avoid the possible displacement of the seal.

1809. Hoses

Impermeable lay-flat delivery hoses are supplied for use with the HPSW main, and they vary in length from 2 to 18 m in the following 3 sizes:

a. **No 1 Size**. For use with Multi-Purpose nozzles.

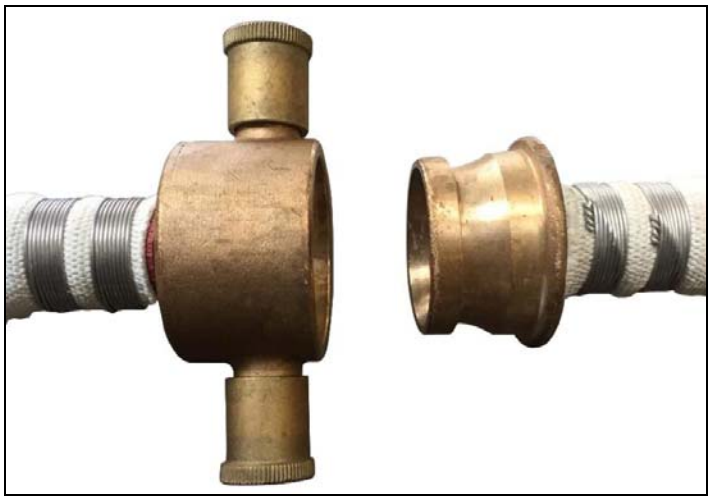
b. **No 2 Size**. For general use, located at all hydrants throughout the ship (except those fitted with No 3 hoses as sub-para c below), 50 mm in diameter.

c. **No 3 Size.** For use with FB10X foam branchpipes and fixed inline inductors on flight decks and in hangar positions of some aircraft carriers, 70 mm in diameter. An allowance of No 3 hoses is also stowed at each Fire and Repair Party Post for use as a temporary HPSW main, as discharge hoses from portable pumps, discharge from Ramfans also on the inlet side of the controllable Y piece.

1810. Hose Couplings

Firefighting hoses are joined together and connected to the HPSW main by instantaneous couplings (Figure 18-1). Each coupling has a male and a female half. All hydrants have female connections so that when coupling a hose, **THE MALE END MUST BE TAKEN TO THE HYDRANT AND THE FEMALE END TOWARDS THE FIRE.** The marrying parts of the couplings are of one standard size but the tails are of a size to suit the hoses concerned. The female half of each coupling has a rubber seal that should be inspected regularly and maintained in good order.

Figure 18-1. Instantaneous Coupling



1811. Stowage of Hoses

WARNING

WITH THE EXCEPTION OF LPDs, HV SHIPS ARE TO DISCONNECT HOSES FROM HYDRANTS IN HV COMPARTMENTS AND ENSURE THE HYDRANT BLANKING CAPS ARE FITTED.

a. Ships equipped with brass nozzles should ensure a fire fighter nozzle is coupled to the faked 12m hose whilst in the stowed configuration.

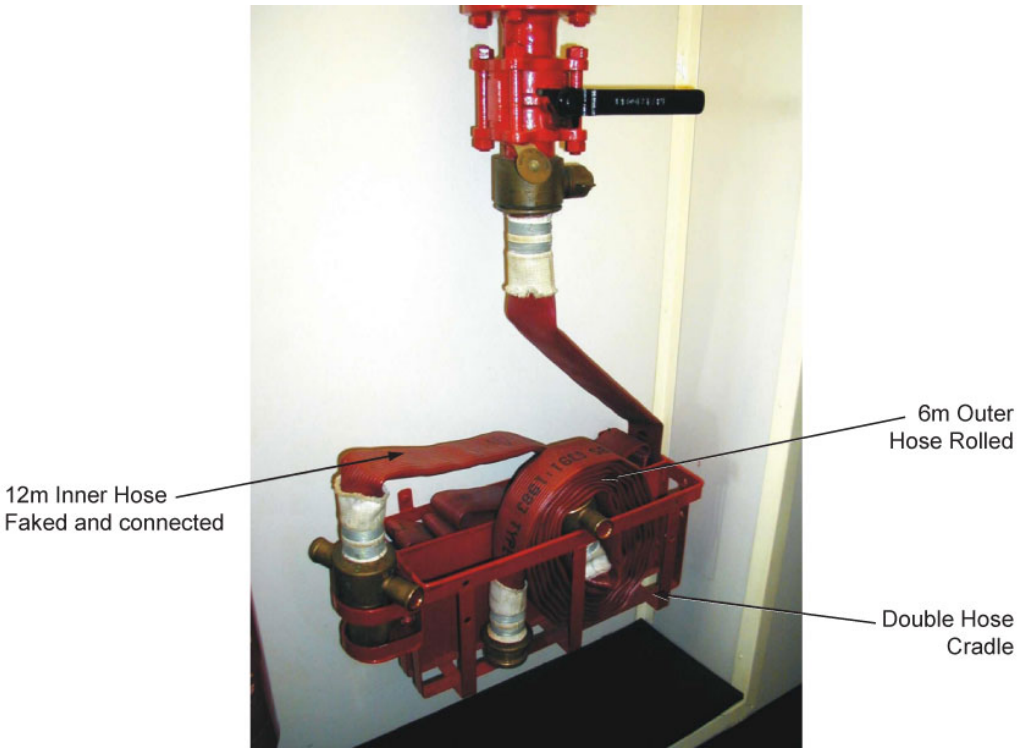
(1) For ships that have been converted to multipurpose nozzles, the nozzle is to remain disconnected and stowed adjacent to the hose basket and adequately secured for sea whilst in the stowed configuration.

(2) Although fairly robust, hoses need care if they are to be kept in good order, and the following instructions must be observed.

b. Hoses are to be faked down in their stowages ready for running out. Where double-hose baskets are fitted, the hose in the section of the basket closest to the bulkhead contains a faked 12 m hose which is connected to the hydrant. The basket furthest from the bulkhead has a rolled 6 m hose. Where single baskets are fitted the 12 m hose is to be faked, connected to the hydrant.

c. Hoses should not be left faked in their stowages for periods exceeding 4 months without being removed and run out for inspection. The position of the folds should be shifted when re-stowing.

Figure 18-2. Stowage of Fire Hose



d. To avoid subjecting the hose to sudden shock or strain, and to avoid possible displacement of the seal, hydrants and pump delivery valves should always be opened slowly, and sudden closure of the nozzle should be avoided.

e. Hoses must be drained and wiped down before being stowed. To expel water, hoses should not be walked along the deck but should be under-run at shoulder height.

f. Hoses and couplings must not be painted.

g. Hoses should be washed and flushed through after contamination with fuels, oils and greases, and after use with AFFF.

h. Hoses, which are not filled with water, catch fire or melt when in contact with excessive heat or fire and must be stowed away from hot pipes or structure.

i. Sea lashings may be fitted to upperdeck hose baskets in all vessels to prevent loss or damage to the rolled and faked hoses during rough weather and high sea states. However, they must not inhibit access to, and the operation of, the hoses during an emergency.

1812. Nozzles

Three types of hand-held nozzle are in service in HM ships:

a. **Firefighter Nozzle (Figure 18-3).** The Firefighter nozzle is provided at all between deck fire and Weatherdeck hydrants already connected to a 12 m faked hose. It is stowed in the shut position. To operate the nozzle turn it one eighth of a turn to the right to provide a 2 m flat disc for personal protection. A further turn of one eighth of a turn to the right produces a 60° ragged spray, which is used for fighting fires. The output from a firefighter nozzle ranges from 10 - 17m³/hr (see Table 18-1).

b. **Waterwall Nozzle (Figure 18-4).** Waterwall nozzles are stowed adjacent to flightdeck hydrants to cover all flying activities, within upperdeck re-entry lockers (UDRL) and 5 in number provided in each FRPP and outside, dependant on local orders, high risk compartments ie galleys and machinery spaces. These nozzles are used to provide waterwall protection to firefighters. They are stowed in the shut position, which is achieved by turning the rotating sleeve fully to the right. Opening the nozzle by rotating the sleeve to the left produces, initially, a jet, but the nozzle must be opened fully to produce the desired waterwall. Water discharge capacities are given in Table 18-1.

Note. *The waterwall nozzles incorporated in flightdeck fire hydrant layouts ie hydrants adjacent to or on the flight deck are to remain in place to provide a spray waterwall or water snake if necessary.*

Figure 18-3. Firefighter Nozzle

Figure 18-4. Waterwall Nozzle

c. **Multi-Purpose Nozzle (Figure 18-5)**. The Multi-Purpose nozzle has recently been introduced into service, initially for use on the QEC Class only.

Figure 18-5. Multi-Purpose Nozzle

WARNING

THE TEAM LEADER MUST ALWAYS BACK UP THE WATERWALL OPERATOR BEFORE ANY NOZZLE OR HYDRANT OPERATION.THIS IS NOT REQUIRED WHEN USING DELTA NOZZLES

Table 18-1. Water Capacities of Nozzles in m^3/h

Pressure	Waterwall			Firefighter			Hatch Waterwall
(bar)	Spray 110°	Spray 90°	Jet	Spray 45°	Spray 90°	Jet	
2.4	23.9	22.9	15.5	8.3	5.4	9.7	
3.5	28.7	27.4	18.3	10.2	6.4	11.5	
4.5	32.5	30.7	21.1	11.5	7.4	13.1	
5.5	36.4	34.0	23.9	12.7	8.1	14.7	
6.9	40.4	37.8	26.4	14.2	9.3	16.3	
7.0							10
8.3	44.3	42.2	28.7	15.7	10.2	17.8	

Note. *To convert m^3/h into litres/min (approximately) multiply m^3/h by 17.*

Table 18-2. Foam Producing Characteristics of Branchpipes

	FB5X Mk 2	FB10/10
Water pressure in bar	5.5	not less than 4.1
AFFF consumption in ltrs/min	13.5	25
Foam delivery in ltrs/min	2,250	4,540

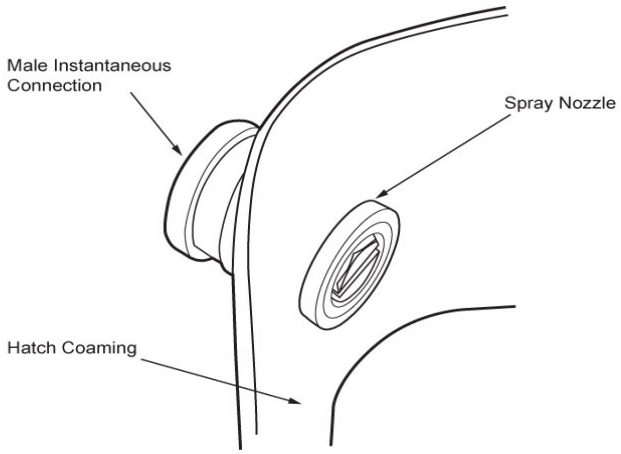
Table 18-3. Water Capacities of Branchpipes in m^3/h

Water Pressure in Bar	FB5X Mk 2	FB10/10
2.4	9.1	22.4
3.4	10.4	26.9
4.8	12.1	30.5
5.5	13.4	34.0
6.9	14.9	38.1
8.3	16.5	41.1

1813. Fixed Hatch Waterwall Nozzle

Fixed hatch waterwall nozzles are fitted primarily in the corners of all hatches leading to high fire risk compartments to facilitate re-entry when firefighting by providing a more effective sealing waterwall and possibly reducing the number of personnel near the hatch. Where the fitting of these nozzles obstructs guardrail stanchions then the stanchions must be re-sited and their chains adjusted to length accordingly. The nozzle blanking cap is to bear the same watertight and gastight control marking as the hatch and is to be fitted when the nozzle is not in use. The use of the FHWW is to be closely controlled by HQ1 due to the possible hazards of electrical shock and the large amount of water that can be discharged into a compartment. The FHWW will not stop the passage of smoke and is not effective in creating a smoke boundary.

Figure 18-6. Fixed Hatch Waterwall Nozzle



1814. Waterwall Nozzle Mounting Pole

The procedure, detailed in Annex 17A and in BR 4007, for fighting surface ship fires from below requires an operating waterwall nozzle to be raised through a hatchway from below. This is achieved by mounting the nozzle on a special, 1 m long, pole (see Figure 18-7). A separate, 2 m long, support pole (see Figure 18-8) is used for pushing the hatch open from the deck below. The V shaped cradle on this pole is used to assist in positioning the waterwall nozzle mounting pole in the hatchway. A lug on the waterwall mounting pole allows it to be located on the hatch coaming. This can only be utilised on brass waterwall nozzles as illustrated in Figure 18-7.

Figure 18-7. Waterwall Nozzle Mounting Pole

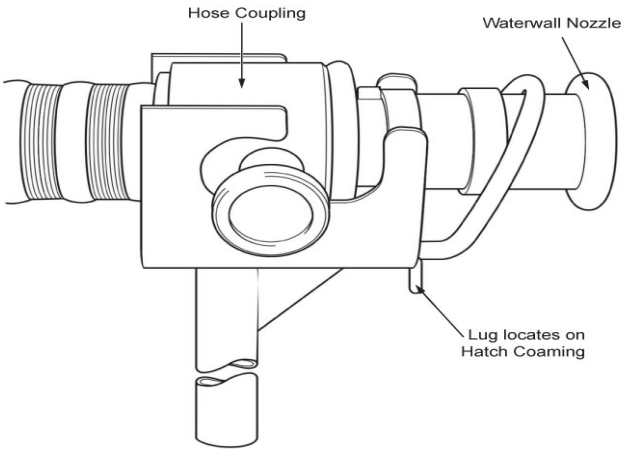
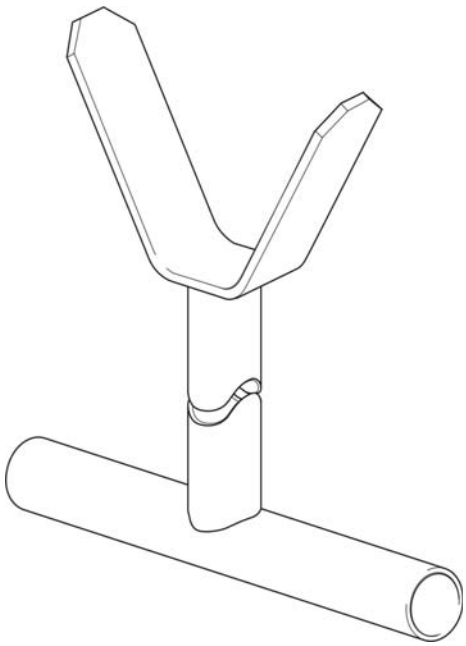


Figure 18-8. Support Pole



1815. Foam Making Branchpipes

The two types of foam making branchpipe used in ships are the FB5X Mk 2 and the FB10/10.

1816. FB5X Mk 2 Foam Making Branchpipe

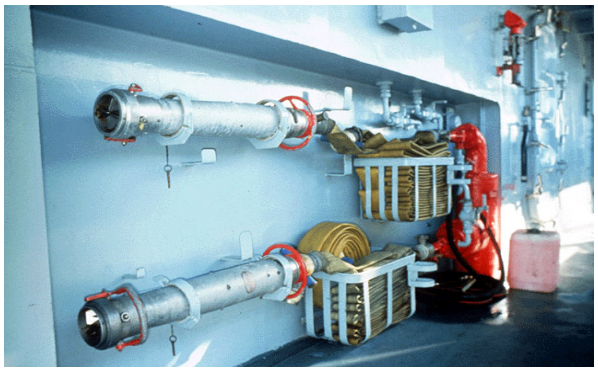
The FB5X Mk 2 is a lightweight branchpipe for general use against liquid fires in ships. It is only to be used with size 2 hoses. Using size 2 hoses, the consumption rate for a 20 ltr container of AFFF is approx 60 seconds with a water pressure of 6.9 bar. A good backup supply of AFFF containers is therefore essential. The FB5X Mk 2 is fitted with an open/shut facility that enables the operator to control the foam discharge. It is also fitted with a foam mix selector that for RN application must always be pinned at the 6% AFFF position. The pick-up assembly (suction hose and spill) are attached to the branchpipe by a quick-release coupling. **The FB5X is to be stowed with the pick-up assembly attached.** To induce AFFF, the cap of the AFFF container must be removed and the spill pickup inserted.

Figure 18-9. Foam Branchpipe FB5X Mk 2

1817. FB10/10 Foam Making Branchpipe

This is a high-output branchpipe used only on flight decks and aircraft carriers. Each of the hydrants in these positions has an FBU10 inline inductor bolted to the flange before the instantaneous coupling. The pick-up assembly is attached to the inductor and has a shut-off cock that is to remain in the open position. The inductor passes a mixture of AFFF and water through a No 3 hose to the branchpipe that aerates and delivers the foam at the rate of about 4540 ltrs/min. The branchpipe needs a HPSW main pressure of not less than 4.1 bar at the branchpipe to produce foam of good quality, and will consume about 25 ltrs of AFFF per minute. A handle at the output end of the branchpipe operates a swirl-vane selector that enables foam to be delivered to a distance like a jet or less forcibly as a spray. (A waterwall nozzle is stowed at each hydrant and can be attached to the hose in place of the branchpipe, with the pick-up shut off, to produce a waterwall spray protection).

Figure 18-10. Foam Branchpipe FB10(X) or FB10/10



1818. Characteristics of Foam Making Branchpipes

The foam-producing characteristics of the branchpipes are given in Table 18-2 and the water capacities in m^3/h of the branchpipes are given in Table 18-3.

1819. Portable Inline Inductor FBU5X

This inductor is designed for use with the FB5X and **is to be stowed with the pick-up assembly attached.** Its purpose is to allow AFFF to be introduced into the hose line at or near the hydrant position and not directly into the branchpipe. This allows the operator much greater mobility in that he is no longer encumbered by AFFF containers and the pickup assembly when passing through doorways, hatches and when using ladders. The inline inductor comes complete with stowage bracket and a 2 m length of No 2 hose (for use between the hydrant and the inductor).

The inline inductor is fitted with a quick release coupling which incorporates a non-return valve, this prevents the AFFF container being pressurised when the FB5X control valve is shut off. When the inline inductor is in use the branchpipe pick-up spill is not required (the spill connecting point on the branchpipes need not be blanked off). The number of inductors onboard are small and they are best kept for use with firefighting hoses which are being moved around by operators, as opposed to static hoses.

Note. *When using the FB5X with its spill pickup assembly, the portable inline inductor should not be connected into the hose line, as this will induce air and prevent foam induction at the branchpipe.*

Figure 18-11. Portable Inline Inductor FBU5X

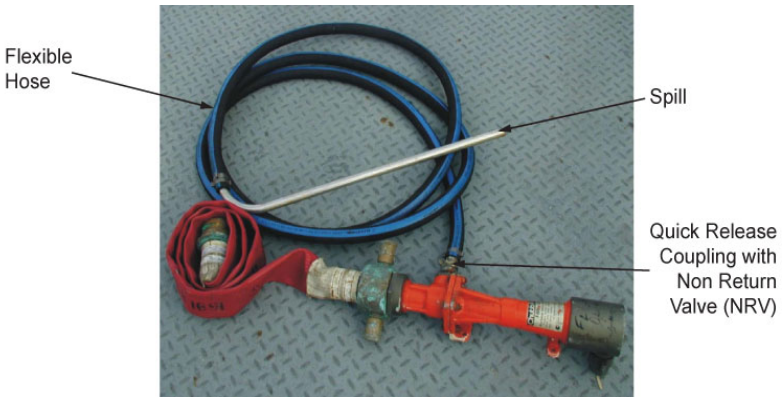


Figure 18-12 Spill Pickup Assembly In Use

1820. Controllable Y Piece

WARNING

'Y' PIECES ARE NOT TO BE USED TO PROVIDE A WATERWALL AND A FIREFIGHTING HOSE TO THE SAME TEAM OF FIREFIGHTERS. THE WATERWALL AND FIREFIGHTING HOSE MUST COME FROM DIFFERENT HYDRANTS.

The controllable Y piece, shown in Figure 18-13. It is carried in ships in order that two hoses may be run from a single hose or hydrant. It is particularly useful in:

a. Boundary cooling.

b. Allowing the extension of a hose in either leg.

c. Isolating burst hoses.

Figure 18-13. Couplings and Adaptors

Controllable 'Y' Piece

Controllable Coupling

CAUTION

These aluminium Y pieces are only to be connected to hydrants using the 2 m length of No 3 hose provided. Connecting directly to the hydrant will cause the aluminium to fracture, therefore IS NOT to be done

1821. Inline Controllable Coupling Piece

This coupling piece is shown in Figure 18-13. It can be used:

a. To connect onto through-bulkhead connectors to facilitate zone isolation.

b. On long hose runs to enable the hose handler to turn off and extend the run without going back to the hydrant.

1822. Double Ended Hose Adaptors

The double male and double female instantaneous adaptors, shown below, are provided to permit hose runs dependant on orientation of through bulk head connectors.

Figure 18-14A. Double Female

Figure 18-14B. Double Male Ended Adaptors

1823. Flange Adaptors

A range of flange adaptors is provided to allow the HPSW main or firefighting pumps to be connected to other NATO ships or merchant ships. The adaptors are detailed in Chapter 22 and ship allowances are listed in BRd 2170(3).

1824. Emergency Bulkhead Hose Connections

The purpose of these connections is to allow a run of hoses, between adjoining watertight subdivisions without compromising watertight integrity by opening doors. They may also be used to help contain smoke when firefighting by allowing watertight doors on smoke boundaries to be kept closed. Connections are fitted in selected bulkheads, usually where the HPSW main is not duplicated and not adequately protected by structure, ie generally in the fore and after parts of the ship. Normally, the instantaneous coupling on the forward side of the bulkhead is female, and the after side is male. Where 2 connections are fitted in the same bulkhead, one will be male-aft and female-forward and one will be female-aft and male-forward. The blanking caps must always be kept fitted to bulkhead hose connections except when the connections are in use, to preserve watertight integrity, and they should bear the same WT and GT control marking as the adjacent door.

1825. Centre Feed Hose Reel

The Centre Feed Hose Reel (CFHR) is a first aid firefighting appliance, normally used in the FOAM mode, but with the facility to be used in the WATER mode for boundary cooling. The Mk 2 CFHR layout is shown at Figure 18-15.

1826. CFHR Standby Condition

a. The normal ‘STANDBY CONDITION’ for the 3 way selector valves is summarised as follows:

(1) Two HPSW Isolating Valves Fitted:

(a) HPSW isolating valve **PINNED OPEN.**

(b) HPSW valve adjacent to the inductor panel **SHUT.**

(c) Foam/Water selection lever set to **FOAM.**

(d) Nozzle valve **SHUT.**

(2) One HPSW Isolating Valve Fitted Adjacent to the Inductor Panel:

(a) HPSW valve adjacent to the inductor panel **SHUT.**

(b) Foam/Water selection lever set to **FOAM.**

(c) Nozzle valve **SHUT.**

b. At DC State 1, centre feed hose reels are to be de-isolated and pressurised up to the nozzle control valve. After use or when reverting to DC State 2 or 3 the hose reels are to be isolated and drained down.

c. After use in the foam mode the CFHR is to be flushed to remove any residue AFFF.

Figure 18-15. Centre Feed (Foam/Water) Hose Reel Unit (Mk 2)

1827. CFHR Operating Instructions

Operating instructions and a deck plan showing compartments served by that CFHR are to be displayed adjacent to each CFHR. The CFHR is operated as follows:

a. **First Aid Firefighters**

(1) Take hold of the pistol grip in the hand and place hose under the arm (left or right as preferred)(see Figure 18-16).

(2) Pull an adequate length of hose off the reel to manoeuvre.

(3) Check operating lever is in the off position.

(4) Check nozzle is in spray.

(5) De-isolate CFHR from the HPSW main.

(6) Check foam mode is selected on the induction panel (inductor handle pointing towards you).

(7) Place spill pick up into a drum of foam.

(8) Open nozzle in a safe direction to prove foam/CFHR works in spray.

(9) Once foam is produced dress the hose over the opposite shoulder then either:

(a) If CFHR is adjacent to the fire, get into position to fight the fire down on one knee. Turn the nozzle to provide a 30° cone of foam and fight the fire.

OR

(b) Isolate the nozzle, proceed to an area adjacent to the compartment of the fire. In a safe direction prove the foam in spray. When foam is produced continue into the compartment, down on one knee. Turn the nozzle to provide a 30° cone of foam and fight the fire.

(10) The next person on the scene is to check AFFF levels.

b. **Boundary Cooling**

(1) Take hold of the pistol grip in the hand and place hose under the arm (left or right as preferred).

(2) Pull an adequate length of hose off the reel to manoeuvre.

(3) Check the operating handle is in the off position.

(4) Check nozzle is in spray.

(5) De-isolate CFHR from the HPSW main.

(6) Check water mode is selected on the induction panel (handle against the wall).

(7) Open nozzle in a safe direction to prove CFHR works in spray.

(8) Turn of the nozzle.

(9) Dress the hose over the opposite shoulder and make your way to the compartment to boundary cool.

(10) Boundary cool using the minimum amount of water.

c. **In Use.** When operating the CFHR it is always important to have control of the nozzle. The technique of ‘dressing’ the CFHR may be adopted to provide greater nozzle control when advancing into a fire/boundary cooling situation with a CFHR illustrated in Figure 18-16. This technique has an advantage in that there is no strain on the hose/nozzle connection when the CFHR is in use and aids control of the nozzle.

d. **After Use**. Following the use of the CFHR in the foam mode, the CFHR is to be flushed through with water. Check the water mode is selected on the induction panel (handle against the wall). Operate the nozzle in the ‘flush mode’ in a safe direction, close the nozzle, isolate HPSW main, drain hose and turn the nozzle to the ‘off’ position. Re-select foam mode, stow hose on the reel taking care to rewind the hose in the correct direction to avoid kinking at the exit to the drum and stow spill pick up.

Figure 18-16. Dressing Technique Using the CFHR

1828. Ramfan

a. The Ramfan illustrated in Figure 18-17 is a water driven turbine, one-man portable, fan. Its purpose is smoke clearance or double bottom venting. It is driven from the HPSW main and will accept any pressure from 2.75 to 12.4 bar (40 to 180 psi) via a male instantaneous inlet coupling. Water discharge is from a female outlet coupling to be connected, via a Size 2 or 3 hose, to any discharge overboard. Airflow is through 5 m lengths of 300 mm diameter hose. This hose is rigid across its diameter but collapsible along its length into metre high bags, two of which can be carried by one person. A fan set comprises one fan and four lengths of hose. One set is kept at each FRPP.

b. Where there is a requirement over and above the capability of the ships ventilation system, to remove smoke from areas adjacent to a fire or remove smoke or fumes after the extinction of a fire, the Ramfan with its associated flexible ducting may be used in the Negative Pressure Ventilation (NPV) mode, ie fan suction, from the vented space. After use, the water turbine should be flushed through with fresh water to inhibit corrosion.

Figure 18-17. Ramfan and Ducting

1829. Flooding and Spraying Systems

Flooding systems are no longer fitted in main magazines but they are fitted to some magazine lockers on the upper deck of ships. A variety of fixed water spray systems are fitted in ships, mainly in magazines, machinery spaces, flammable stowages and aircraft hangars.

1830. Manually Operated Spray Systems

Each manually operated spray system is supplied with seawater from the HPSW system via an isolating valve, a strainer and a spray valve. The spray valve can be operated from two locations. Open ended sprinklers are normally fitted, although some explosive lockers have a perforated pipe instead. Some machinery space systems can also be used to spray foam.

1831. Automatic Spray Systems

Magazine automatic spray systems are permanently charged with fresh water, pressurised by the HPSW system. The spray valve and HPSW isolating valve are both locked open when a magazine contains ammunition. Each spray head incorporates a quartzoid bulb that bursts at a predetermined temperature to release the fresh water, followed by seawater from the HPSW system. A water flow alarm with remote indication is fitted to give warning when the system has operated automatically.

Figure 18-18. Sprinkler Head

1832. Pressurised Reservoir Systems

Magazines that contain a large amount of propellant and high explosive require an automatic system with an instant high flow rate of water. A pressurised fresh water reservoir is therefore fitted to give the initial flow, allowing time for extra HPSW pumps to be started. When one or more of the quartzoid bulbs bursts, water is expelled from the fresh water reservoir by compressed air pressure acting on a rubber diaphragm bag in the reservoir.

1833. Rapid Reaction Spray Systems (RRSS)

The magazine rapid reaction spray system is a pressurised reservoir system, activated by smoke detection. The pneumatically operated spray valve is opened automatically by a control system. When the spray valve opens, the ships HPSW pumps are automatically started sequentially to provide the required flow.

1834. Metron Activated Spray Systems (MASS)

The Metron activated spray system has quartzoid bulb spray heads in a pressurised system similar to that described in Para 1831. In addition to the normal activation by temperature, the quartzoid bulbs can also be burst by small charges, initiated by smoke detectors, via a control system. The control system can be switched to manual mode but it is normally left in automatic mode when ammunition is embarked.

1835. RRSS and MASS Operating Procedure Whilst Conducting Exercise Serials

a. With the introduction of optical and heat detectors replacing optical only detectors to RRSS and MASS systems concern has been raised that in the interim that there is a slight possibility that training smoke could inadvertently activate legacy, smoke detector systems when in the automatic mode of operation during Operational Sea Training (OST) and exercise serials (either in OST or day-to-day training plans).

b. To mitigate erroneous operation of MASS and RRSS, ships fitted with smoke detectors are to change the operating mode to manual prior to any serials where training smoke is likely to be used in support of the training serial in the vicinity of magazines. Whilst it is acknowledged that this reduces the overall effectiveness of these fire protection systems, the change of operating mode must be closely managed by the Explosive Responsible Officer to ensure that the safety of the magazine is not compromised. The routine to be carried out whilst conducting exercise serials is that all:

(1) Platforms fitted with RRSS and MASS systems with smoke and heat detectors are always to be left in automatic mode, except in the following instances when false activation is likely:

(a) T23 Gunbay system during Medium Range Gun firings.

(b) When undergoing routine maintenance.

(2) Platforms fitted with RRSS and MASS systems with smoke detectors are always to be left in automatic mode, except in the following instances when inadvertent activation is likely:

(a) Conducting CBRNDC training serials where training smoke is to be employed.

(b) T23 Gunbay system during Medium Range Gun firings.

(c) When undergoing routine maintenance.

1836. Hangar Spray Systems

Manually operated HPSW spray systems are fitted to aircraft hangars in ships. In larger hangars, the system is divided into separate grids, each with its own spray valve. Great care must be taken to prevent the accumulation of free surface water from hangar spray systems. Hangar scuppers must always be kept clear and they must be constantly checked when sprays are operated.

1837. Dry Risers

In some ships, minor compartments such as messdecks are fitted with dry HPSW or foam spray systems. Each system is terminated, outside the protected compartment, in a male instantaneous hose connection protected by a female blanking cap. If no isolating valve is fitted, the blanking cap is to bear the same watertight and gastight control marking as any adjacent door/hatch in the bulkhead/deck through which the system passes.

1838. Dutch Rolling of Hoses

On flight decks manned by aircraft handlers, ie on multi-spot decks, spare fire hoses may be stowed using the Dutch rolled method. Stowage and deployment of Dutch rolled hoses is achieved as follows:

a. **Stowing the Hose**. Lay the hose out flat. Draw the female coupling back along the hose length to 10 cms short of the male coupling. Once the upper layer has been aligned precisely over the lower layer the hose can be rolled up from the bight with the couplings coming together on the outside of the roll.

b. **Deploying the Hose**. To deploy the hose after removing it from its stowage, it should be held in front of the couplings with one hand supporting the roll of the hose. The hose is then rolled away so that it uncoils itself leaving a loop of hose on the deck. The male coupling can then be attached to the pump/hydrant/hose and the female coupling taken towards the fire.

c. **Stowing Dutch Rolled Hose**. The Dutch rolled hose is to be stowed as shown in Figure 18-19.

Note. *The Dutch rolled hose method is only to be used on flight decks and also in hangars of QEC, LPD, and RFA ARGUS. Its use between decks, in any ship, is prohibited.*

Figure 18-19. Dutch Rolled Hose

1839. Flight Deck Monitor

a. The flight deck monitor is used to project foam onto the area of an aircraft landing spot. The type of monitor varies between ship classes; the automatic oscillating type is illustrated at Figure 18-21. In this type, a Pelton wheel water motor, using a small amount of HPSW, provides the power for oscillation. The frequency of oscillation is dependent on HPSW supply pressure, but it is typically eight cycles per second at 7 bar. The range of oscillation and nozzle elevation are set during installation but must be confirmed by a full functional check if adjusted during maintenance work. When not in use, the monitor is to be set in the automatic oscillating mode, with the nozzle centred. Monitors that do not have the automatic oscillating mode must be traversed and elevated manually. **Monitors are supplied with 1% AFFF, the concentrate being stored in a dedicated tank.**

b. **AFFF Storage Tanks**. These tanks are to be marked with 20 mm white letters on a red background stating: ‘Time’ in minutes (total capacity of AFFF), the % concentration of AFFF and the AFFF LIFEX date as shown in Figure 18-20.

Figure 18-20. Marking of Bulk AFFF Storage Tank

AFFF BULK STORAGE TANK

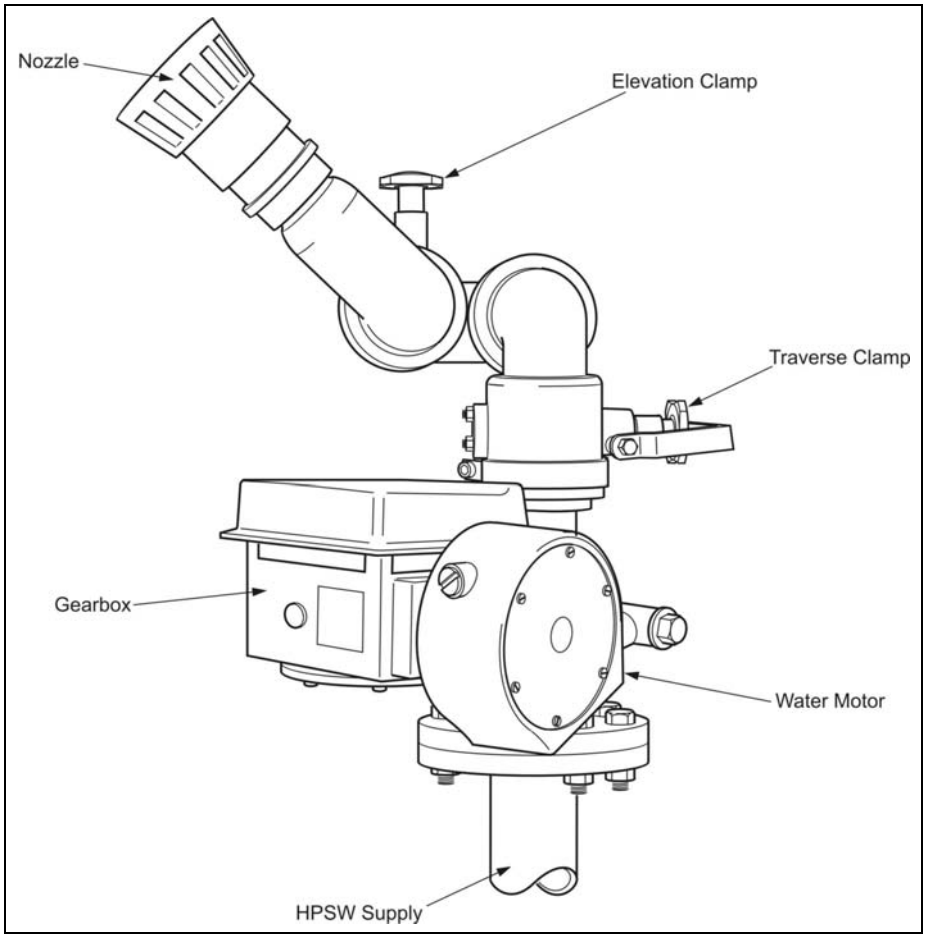
X MINUTES TOTAL CAPACITY OF AFFF

Y% CONCENTRATION

LIFEX XX(DAY)XXX (MONTH) XXXX (YEAR)

Note. *Time in minutes (X), percentage concentration (Y%) and date for each tank onboard to be added using Figure 18-20 as a template.*

Figure 18-21. Automatic Oscillating Monitor



CHAPTER 19

FIREFIGHTING APPLIANCES AND INSTALLATIONS

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CHAPTER 19

FIREFIGHTING, APPLIANCES AND INSTALLATIONS

1901. Portable and Mobile Equipment

a. This chapter deals with portable and mobile appliances and equipment, and fixed firefighting appliances and installations other than those associated with the HP sea water system. The latter are dealt with in Chapter 18.

b. There are several types of portable (first aid) appliances for hand use, provided for attacking fire in its early stages. If tackled promptly, such appliances can extinguish most fires, but it is important to realise their limitations and to prepare adequate back up should they fail. It should be noted that whenever a gas or solid (eg CO_2 or dry powder) is expelled under pressure from an extinguisher, electrostatic charges might be generated. The occasions when such charges assume the capability of causing electric shock to the user are rare; they vary according to circumstances and, in any case, are usually only of a minor nature.

EVERYONE MUST KNOW WHERE TO FIND AND HOW TO USE THE RIGHT TYPE OF EXTINGUISHER FOR ANY SORT OF FIRE.

1902. 9 ltr Stored Pressure Extinguisher (AFFF)

WARNING

THE 9 ltr STORED PRESSURE (SPE AFFF) EXTINGUISHER IS NOT TO BE USED TO FIGHT ELECTRICAL FIRES.

The 9 ltr SPE (AFFF) can be recognised by a **red painted shell** and a **cream coloured band** to indicate the foam contents. It is used on solid or liquid fires. It has a working charge pressure of 15 bar, so it can only be charged by the portable air charging assembly or from the LP air system, not by a foot pump. When fully charged to 15 bar it has a throw of approx 6 m and a discharge time of approx 38 seconds. There are two versions: standard and non-magnetic. The extinguishers are supplied fully charged ie filled with water, Chubb Aerospray Premix Foam and pressurised to 15 bar and are ready for use onboard. There is no requirement for ships staff to discharge and refill. If during the extinguishers life it requires refilling it is to be filled using Chubb Aerospray Premix Foam. Should all spare Chubb Aerospray Premix foam charges be used up, AFFF extinguishers can still be charged with 6% AFFF 3M or Solberg AS held onboard. Chubb Aerospray Premix foam is not to be used in any fixed system AFFF tanks. For ships allowances of Chubb Aerospray Premix Foam see BRd 2170(3). To operate the 9 ltr SPE(AFFF):

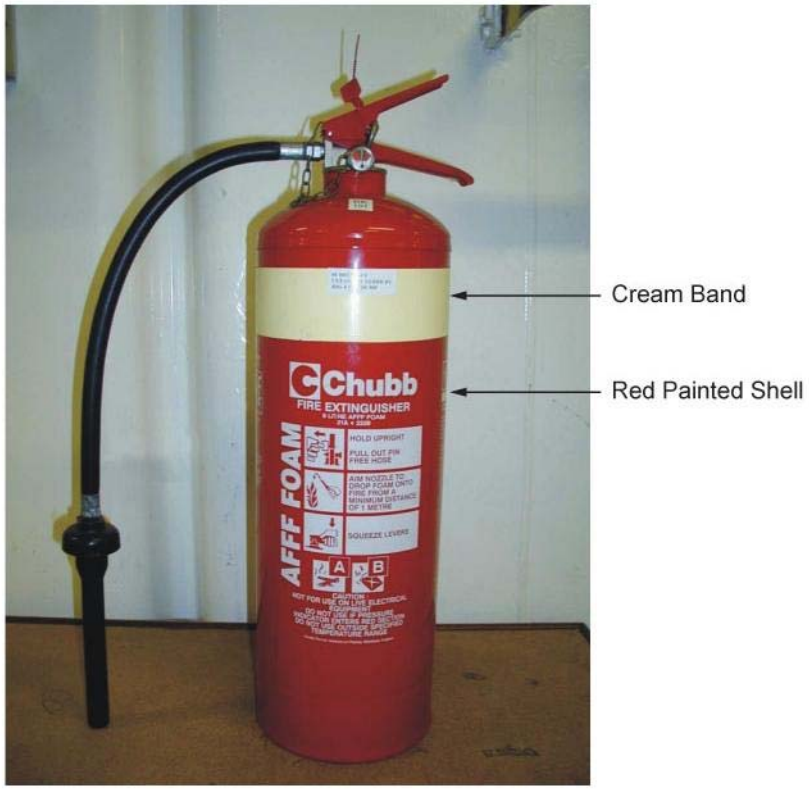
a. Hold the extinguisher upright.

b. Pull out the safety pin (the anti-tamper tally) will break).

c. Free the discharge hose and aim the nozzle to drop foam onto the fire from a minimum distance of 1 m.

d. Squeeze the levers.

Figure 19-1. 9 ltr SPE (AFFF)



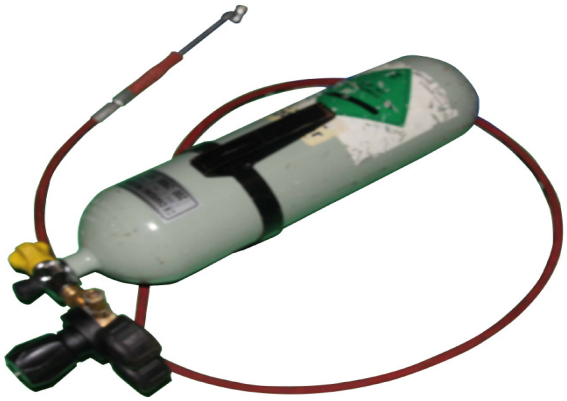
1903. SPE(AFFF) Extinguisher Air Charging

WARNING

GOGGLES AND EAR DEFENDERS ARE TO BE WORN WHEN CHARGING SPE WITH COMPRESSED AIR.

The Portable Air Charging Assembly illustrated in Figure 19-2 consists of a high pressure air bottle fitted with a regulator valve and pressure gauges. A discharge hose terminates in a connection that will mate with the air charging connection on the SPE. The assembly is also fitted with a carrying handle. The air bottle is charged to 207 bar with clean, dry air from the ships breathing air charging panel, and will charge the SPE to 15 bar.

Figure 19-2. Portable Air Charging Assembly



1904. 9 ltr SPE (AFFF): - Refilling and Recharging

a. Remove the safety pin. Invert the extinguisher and squeeze the operating levers to vent any residual pressure.

b. Slacken the head cap by rotating it two complete turns and listen for any residual pressure.

c. Remove the head and siphon tube assembly.

d. Empty the residual contents and rinse out the extinguisher with fresh water.

e. Fill the extinguisher with fresh water to the ‘F’ line level indicator on the siphon tube.

f. Top up with Chubb Aerospray Premix Foam charge. Do not overfill or mix Chubb Aerospray Premix Foam charge with other foam types.

g. Check the actuation of all moving parts of the head and the condition of the neck ring. Check that the siphon tube is clear of obstruction.

h. Lightly grease the ‘O’ seals, moving parts and neck threads with petroleum jelly.

i. Screw on the head assembly and tighten it hand tight.

j. Fit the safety pin and insert a plastic dart through the end.

k. Pressurise the extinguisher with air to 15 bar (the white line on the gauge), using the portable air charging assembly or the LP air system and a tyre inflator. Replace the dust cap on the Schrader valve.

1905. Recharging the SPE Portable Air Charging Assembly

WARNING

THE SPE AIR CHARGING ASSEMBLY USES A BASCCA BOTTLE WHICH MUST NOT BE CHARGED TO MORE THAN 207 BAR.

The compressed air bottle is to be recharged from a 207 bar air charging panel, if fitted, or from the ships usual charging facilities ashore. To fill the compressed air bottle from the BA panel the following procedure should be adopted:

a. Ensure that all valves on the charging panel are shut.

b. Open the charging panel pressure gauge stop valve on the 207 bar charging line to vent any pressure that might be remaining in the circuit.

c. Remove the blanking cap from the charging panel 207 bar outlet.

d. Open the main air supply valve and crack open the 207 bar outlet valve to blow any dirt out of the line.

e. Remove the regulator and hose assembly from the air charging bottle, first ensuring that the bottle valve is shut.

f. Connect the compressed air bottle, through the charging hose and adaptor, to the charging panel 207 bar outlet.

g. Open the bottle valve and then open the charging panel 207 bar outlet valve enough to charge the bottle to 207 bar at a comparatively slow rate. This avoids overheating the air passing into the bottle.

h. When charging is complete, shut the bottle valve, shut the charging outlet valve and shut the main supply valve.

i. Disconnect the bottle, charging hose and adaptor from the charging panel.

j. Replace the blanking cap on the 207 bar outlet connection.

k. Replace the regulator and hose assembly on the air charging bottle.

Note. *In ships without a 207 bar charging panel, the 205 bar SABA diving BA panel should be used.*

1906. 9 kg Stored Pressure Extinguisher (Dry Powder) (SPE (DP))

WARNING

THE 9kg SPE (DP) IS SUPPLIED WITH A 15 BAR NITROGEN CHARGE AND IS NOT TO BE RECHARGED BY SHIPS/UNITS.

The 9 kg SPE (DP) can be recognised by a **red painted shell** and a **blue coloured band** to indicate the powder contents. It is used on solid or liquid fires and is particularly effective for liquid fuel pressure spray fires. It may be used on low voltage electrical fires (up to 440V AC or 800V DC) but **must not be used on live HV systems.** It has a throw of approx 6 m and a discharge time of approx15 seconds. There are two versions: standard and non-magnetic. To operate the 9 kg SPE (DP):

a. Hold the extinguisher upright.

b. Pull out the safety pin (the plastic dart will break).

c. Free the discharge hose and aim at the base of the fire, from a minimum distance of 1 m.

d. Squeeze the levers.

Figure 19-3. 9 kg SPE (DP)

1907. Marinised 2 kg Dry Powder Extinguisher

WARNING

ALTHOUGH THE DRY POWDER IS NON-TOXIC THIS EXTINGUISHER IS NOT TO BE DIRECTED AT PERSONNEL.

The Marinised 2 kg dry powder extinguisher illustrated in Figure 23-4 is supplied for use in small craft using outboard motors. The extinguisher, which has a dedicated mounting bracket, has a 2 kg charge of dry powder and is pressurised by nitrogen at 15 bar. This Marinised version of the extinguisher is manufactured from corrosion resistant materials and should not be confused with the 2 kg dry powder extinguisher supplied for use ashore. It cannot be recharged onboard but must be returned through Naval Stores if partially or fully discharged. To operate the extinguisher:

a. Hold upright. Pull out the pin.

b. Aim at the base of the fire, from a distance of at least 1 m.

c. Squeeze the levers.

Figure 19-4. Marinised 2 kg Dry Powder Extinguisher

1908. 2 kg CO_2 Extinguisher

WARNINGS

1. DO NOT GRIP THE HORN OR THE BOTTLE DURING USE IT WILL FREEZE THE HAND AND MAY CAUSE BURNS.

2. CO_2 IS HARMFUL, CAUTION SHOULD BE OBSERVED WHEN DISCHARGIN CO2. ONCE CO_2 HAS BEEN OPERATED PERSONNEL ARE TO RETREAT TO A CLEAN ATMOSPHERE.

a. The 2 kg CO_2 extinguishers are coloured red with a black identifying band around the bottle. It consists of a bottle containing 2 kg of liquefied CO_2 at a pressure of 58 bar at 20°C and is normally fitted with a rigid discharge horn. There are two versions: normal and non-magnetic. To operate the extinguisher, remove the safety pin, (the plastic dart will break), hold the extinguisher by the squeeze-grip release valve and press the trigger of the grip very firmly to ensure a full discharge and to avoid the risk of freeze up at the orifice. The discharge time is about eight seconds. The horn should be directed at the base of the fire from at least 1 metre initially.

b. CO_2 extinguishers provided in compartments containing electrical equipment eg radar cabinets, are fitted with a flexible hose and bayonet plug illustrated in Figure 19-5b. The plug fits into inlet sockets on electronic cabinets. The socket has a breakable membrane that ruptures when the plug on the extinguisher hose is inserted. For use on open equipment and elsewhere in the compartment the hose is fitted with a detachable hand applicator, which fits over the plug, designed to prevent hand contact with the end of the hose. The extinguisher is normally stowed with the hand applicator fitted.

c. No attempt must be made by any individual or ship/unit representative to remove the discharge valve from the extinguisher. If the safety pin is missing, or the plastic dart is missing or broken, the weight must be checked. The 2 kg CO_2 extinguisher must be returned and replaced if any of the following conditions occur:

(1) Partial or complete discharge.

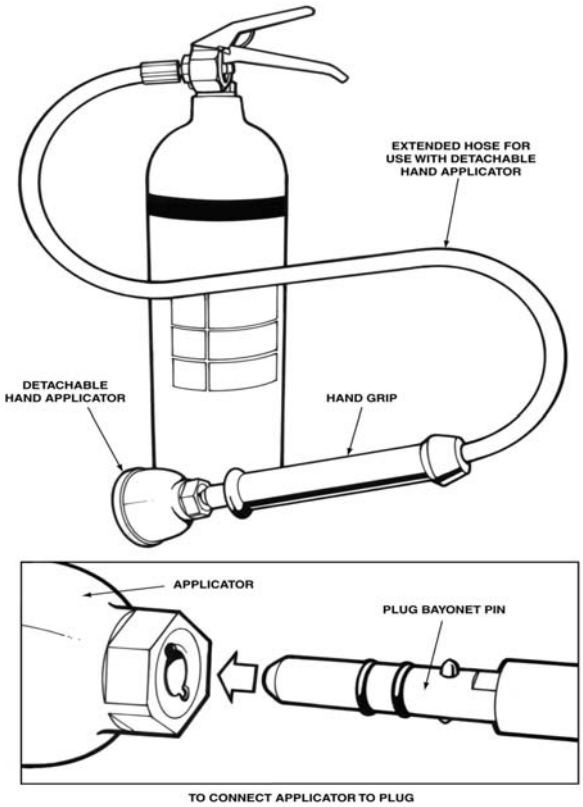
(2) Damage to the gauge or any part of the extinguisher that renders it unserviceable.

(3) Significant signs of corrosion.

(4) 10 years after Date of Manufacture (DOM) (see Para 1912).

Figure 19-5a. 2 kg CO_2 Extinguisher With Discharge Horn

Figure 19-5b. 2 kg CO_2 Extinguisher With Flexible Hose



1909. 6 ltr Wet Chemical Extinguisher (Fry Fighter)

WARNING

AFTER FRY FIGHTER ACTIVATION RE-ENTRY TEAMS ARE NOT TO TRAIN HOSE NOZZLES DIRECTLY AT THE DEEP FAT FRYER IN ORDER TO PREVENT THE REMOVAL OF THE PROTECTIVE CRUST AND TO AVOID THE RISK OF RE-IGNITION.

The Fry Fighter extinguisher illustrated in Figure 19-6 is provided in galley compartments specifically to deal with deep fat fryer fires. The extinguisher contains a wet chemical that reacts with the burning fat or oil. When applied it cools and emulsifies the burning liquid forming a crust over the surface It has a discharge time of approx. 45 seconds. The spray initially knocks down the flames and the crust completes the extinction. The crust formed on the surface also prevents re-ignition by stopping contact with oxygen in the air. The fry fighter can be recognised by a **red painted shell** and a **46 mm wide yellow label** to indicate the contents. It cannot be recharged onboard but must be returned through Naval stores if partially or fully discharged. There are two versions: standard and non-magnetic. To operate the extinguisher:

a. Pull out the safety pin and detach the applicator.

b. Hold the nozzle directly above the fire at a distance of 1 m.

c. Squeeze the levers and apply the entire contents to the total area of the fire.

Figure 19-6. 6 ltr Wet Chemical Extinguisher (Fry Fighter)

1910. Misuse of Stored Pressure Extinguishers

Fire extinguishers are only provided to attack and extinguish fires and in no circumstances are they to be used for any other purpose.

1911. Marking of Portable Fire Extinguishers

a. **Extinguishers**. All extinguishers are to be marked with 25 mm (1 inch) Black numbers using a permanent marker (see Figures 19-7a and 19-7b). These markings can be removed, without causing abrasive damage, using Propanol Ampex, (see BRd 2170(3)) applied with a soft cloth. **ALL THESE POSITIONAL MARKINGS MUST BE REMOVED PRIOR TO THE EXTINGUISHER BEING RETURNED TO STORES.**

Figure 19-7a. Stored Pressure Extinguisher

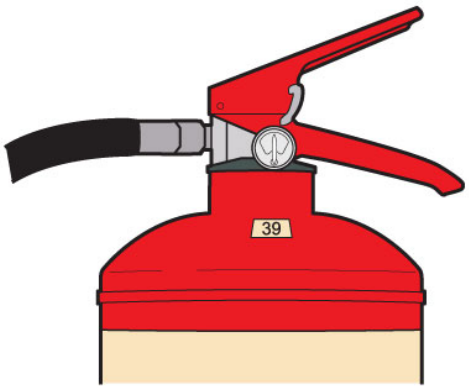
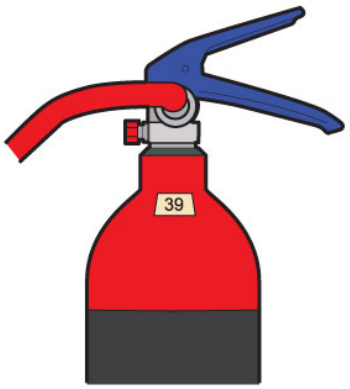


Figure 19-7b. 2 kg CO_2 Extinguisher

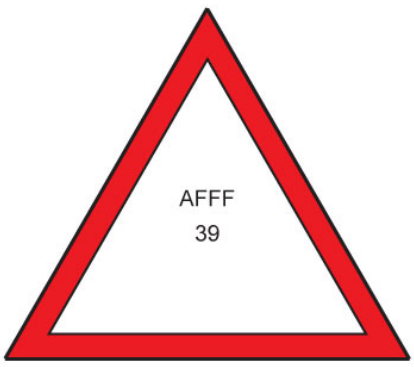


b. **Stowages**

(1) All extinguisher stowages are to be identified by a red triangle on the structure directly above the stowage position. These can be painted or are available from Naval Stores (NSN listed in BRd 2170(3)).

(2) The triangles should have outside dimensions of 115 mm (4.5 inch) per side and a 7 mm (¼ inch) border. Corresponding type and number of the associated extinguisher is to be painted or marked in the triangle with 13 mm (½ inch) black lettering, as example below.

Figure 19-7c. Fire Extinguisher Stowage



1912. Extinguisher LIFEX

a. The LIFEX for AFFF, Dry Powder and Fry Fighter extinguishers is defined as 5 years. This is determined from either the date of manufacture (DOM), or refurbishment date (whichever is most recent). The DOM will be printed on the extinguisher body adjacent to the 'ship's wheel'. If the extinguisher has been refurbished a label will be attached to the lower part of the unit, which should state 'Refurbished by Name + Date'. It should be noted that the original printed DOM will not be amended when an extinguisher is refurbished and will remain visible.

b. The LIFEX of CO_2 extinguishers, including those contained within the operating cabinets of gaseous drench systems, is defined as 10 years. This is determined from the test date stamped on the bottle neck.

c. The discharge of AFFF SPEs and subsequent on-board recharging has no effect on the stated 5 year LIFEX. The AFFF SPE is to be replaced within 5 years regardless of use.

d. On receipt of SPEs from stores, the DOM, refurbishment date or test date is to be checked and recorded by the maintainer. This will enable ships staff to check that SPEs are in date on receipt and enable a calculation to be made on the remaining life. To assist in this process maintainers are to generate electronic history sheets, recording the manufacture, refurbish, test and LIFEX dates against local numbers. An example history sheet for SPEs is detailed at Table 19-1. A copy of the history sheet is to be held within the vessels Master CBRNDC Training and Material Assessment Log to enable the maintainer to plan and record the exchange of extinguishers and facilitate any audit of the equipment.

e. The maintainer is to plan a rolling exchange programme for extinguishers as their LIFEX point approaches. AFFF, Dry Powder, Fry Fighter and CO_2 extinguishers are supplied fully charged from stores and if unused should be returned through the stores system intact and not discharged locally.

Table 19-1. Example of SPE Extinguisher History Sheet

SPE NO	SPE TYPE	LOCATION	DOM/REFURBISH/TEST DATE	LIFEX DATE (see Note)
23	CO_2	Bridge 02H	Jun 05	Jun 15
24	AFFF	Chart House	Mar 06	Mar 11

Note. *AFFF, Dry Powder and Fry Fighter extinguishers have a 5 year life from DOM/ Refurbish Date. CO2 extinguishers have a 10 year life from bottle test date.*

1913. Mobile Foam Unit SF90

WARNINGS

1. DO NOT REMOVE ANY FITTINGS UNTIL ALL INTERNAL PRESSURE HAS BEEN RELEASED FROM THE STORAGE CONTAINER.

2. MAXIMUM WORKING PRESSURE OF THE AIR BOTTLE IS 200 BAR.

3. IF A DEDICATED CHARGING SUPPLY IS NOT AVAILABLE, GREAT CARE MUST BE TAKEN TO AVOID OVER PRESSURISATION OF THE AIR BOTTLE.

a. This is for use against flightdeck or hangar fuel fires in some ships. It is designed for rapid action to gain time while the main firefighting system is being brought into operation. The unit carries 90 ltrs of foam premix (fresh water/6% firefighting foam solution), mounted on a trolley. It has a hose and a branchpipe with an on/off control valve. An air bottle mounted on the foam tank provides discharge pressure. Older designs of the unit will have the discharge hoses 'Dutch rolled' in a stowage basket. Newer designs have a small bore hose coiled on hooks. The unit discharges in 1 min and has a throw of 15 to 18 m. To operate the unit:

(1) Roll out the hose towards the fire.

(2) Open the valve on the air bottle to pressurise the foam tank.

(3) Open the nozzle control valve and direct the jet to fall lightly on to the burning material.

Note. *The SF90-AS (a static version of the SF90 unit) is fitted in the machinery spaces of some RFAs and submarines (see BRd 2170(4)).*

b. The SF90-AW and SFU 90-AS extinguishers are re-charged after use as follows:

(1) Ensure the air bottle valve is shut.

(2) De-pressurise the premix foam container tank via the pressure release valve.

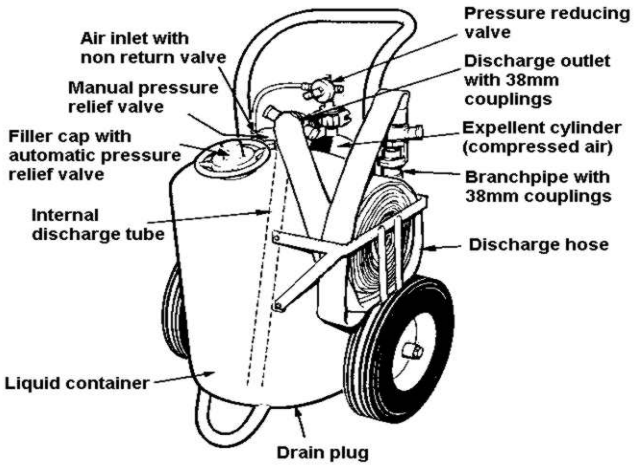
(3) Disconnect the foam discharge hose from the premix foam container and flush with fresh water.

(4) Re-connect the foam discharge hose to the premix foam container.

(5) Stow the foam discharge hose.

(6) Unscrew the filler cap assembly and remove.

Figure 19-8. Mobile Foam Unit SF90-AW



(7) If completely discharged, fill the container with clean fresh water to within 150 mm of the filling hole sealing face. Slowly add 5 ltrs of 6% AFFF liquid concentrate and stir to ensure a constant mix. Top up with fresh water to 100 mm from the sealing face.

(8) If the unit has been partially discharged, top up with a prepared premix of 85 ltrs of clean fresh water and 5 ltrs of 6% AFFF liquid concentrate, to within 100 mm of the filling hole sealing face.

(9) Check the filler cap gasket is not damaged and in place and replace the filler cap hand tight.

(10) Disconnect the air bottle from the pressure regulator, release the bottle retaining strap and remove the air bottle.

(11) Charge the air bottle to 124 bar (minimum) to 200 bar (maximum) pressure.

(12) Replace the air bottle, secure the retaining strap and re-connect the pressure regulator to the air bottle.

(13) Check all connections are tight.

Notes:

1. In an emergency, when fresh water is not available the unit can be recharged using seawater to enable it to be prepared for immediate use. At the earliest opportunity after being charged with seawater the unit is to be emptied and the storage container and hoses flushed with clean fresh water to prevent corrosion and salt deposit build up.

2. The unit is not to be left charged with seawater for long periods.

1914. 10 kg CO_2 Extinguisher

WARNING

AFTER DISCHARGE, THE APPLICATOR EXTENSION TUBE WILL BE EXTREMELY COLD AND SHOULD NOT BE DIRECTLY HANDLED.

a. The trolley-mounted 10 kg CO_2 extinguisher (see Figure 19-11) is provided for dealing with fire during the starting of aircraft engines. The apparatus comprises a trolley-mounted bottle, containing 10 kg of liquefied CO_2, connected by flexible hose to a telescopic applicator. The applicator may be extended up to 3.6 m and the length set by turning the knurled locking collar. A horn is normally fitted over the discharge nozzle for use in the open, but this is unscrewed and removed if the nozzle is to be inserted into an engine access panel. Discharge of a fully charged bottle lasts between 30 and 40 seconds.

b. To operate the extinguisher:

(1) Place the trolley in the upright position.

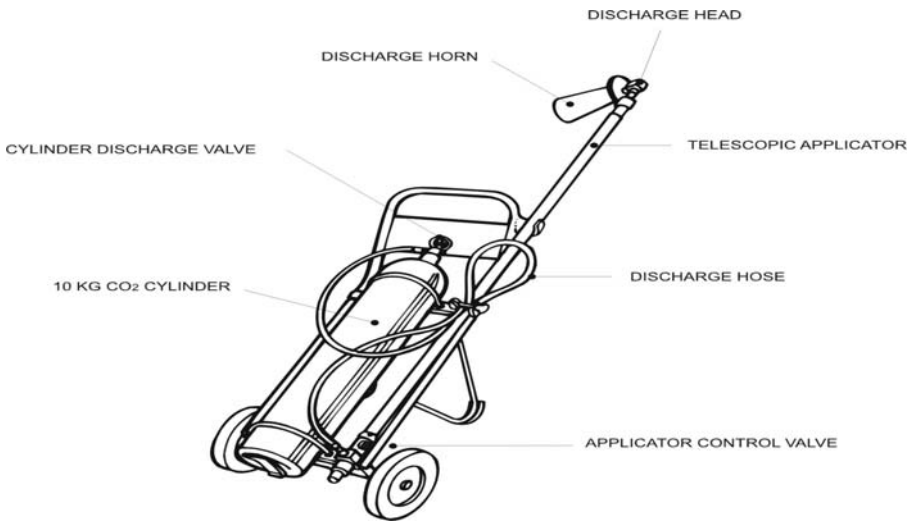
(2) Open the bottle discharge valve.

(3) Remove the applicator from the trolley and extend to the required length. Lock the applicator adjustment to prevent it extending under gas pressure.

(4) Position the discharge nozzle through an engine bay fire access panel, etc.

(5) Squeeze the applicator control valve to release the gas. The operator should be prepared for jet reaction on discharge, especially if the applicator is fully extended.

Figure 19-9. 10 kg CO_2 Extinguisher



1915. Aqueous Film Forming Foam (AFFF)

a. AFFF is a synthetic, non-toxic, foam-forming liquid based on fluoro-chemical wetting agents designed for use with fresh or seawater. It produces an aqueous film to float out over the surface of a burning fuel, forming a vapour seal that extinguishes fire and prevents re-flash. This sealing action will also take place on fuel spillages, thus securing them from ignition. AFFF can be used in conjunction with other firefighting agents used in HM ships, without impairment of its efficiency. It is as effective against solid fuel fires as it is against liquid fuel fires and, in each case, should be sprayed directly over the fire to achieve complete coverage as quickly as possible. Firefighting systems using AFFF should only be supplied with undiluted (neat) AFFF (except when freeze protection is added; see Para 1917).

b. There are two types of AFFF used in HM ships, 6% and 1%. These figures indicate the percentage of AFFF concentrate that is mixed with water at the inductor. The 1% AFFF is therefore a stronger concentrate than the 6% AFFF. The two types are used as follows:

(1) 6% AFFF is used in 9 ltr stored pressure extinguishers, SF90 and SFU90 extinguishers, FBU5X and FB10/10 branchpipes. This is supplied in 20 ltr drums.

(2) 1% AFFF is used in flight deck monitors and in some hangar and vehicle deck spray systems (see specification for individual ships). This is also supplied in 20 ltr drums.

c. On receipt of the AFFF drums, the caps should be eased so that when required for use they may be opened by hand. Extreme care should be taken to prevent breaking of the anti-tamper tag. If necessary, the red plastic security seals, listed in BRd 2170(3), may be used.

d. Do not mix AFFF 6% 3M or Solberg AS with Chubb Aerospray Premix Foam. Chubb Aerospray Premix Foam is not to be used in any fixed system AFFF tanks.

1916. AFFF LIFEX

a. Sealed 20 ltr drums of AFFF have 20 year life from (DOM). This date can be found on the drums label. An anti-tamper tag is to be fitted to all drums. LIFEX date is also to be written on the drum in permanent marker to guard against illegibility or loss of the drums label over its 20 year life.

b. AFFF used in spray system tanks has a 10 year life from DOM. The quality and strength is to be checked annually in accordance with relevant maintenance schedules. The unit must permanently record the DOM of decanted AFFF and the LIFEX date annotated on the tank. Units who suspect the quality of AFFF contained in storage tanks are to contact Abbey wood 9375 39602 for guidance on testing.

c. AFFF once mixed with fresh or salt water has a 5 year life (pre-mix).

d. The storage life of Chubb Aerospray Premix Foam is 10 years in an unopened bottle and 5 years premixed.

1917. Freeze Protection of 6% AFFF

a. 6% AFFF concentrate is liable to temporary thickening when exposed to temperatures below 2°C. This could affect the pick-up of the concentrate by an inductor. AFFF stowed in exposed positions in cold climates, eg unheated stowage on jetties, on upper decks of ships or on submarine casings, may be freeze protected by the addition of 24% ethylene glycol, which will give protection down to -10°C. Drums of AFFF which have been thus treated must be clearly marked: **'Freeze protected by 24% ethylene glycol'** to avoid confusion with untreated AFFF, and are not to be put in between-deck stowages. Freeze protected 6% AFFF down to -16°C is available if required.

b. Dilution by ethylene glycol will affect the performance of AFFF, so it is only to be added in exceptional climatic conditions, eg Upkeep Periods, when no heated stowages are available.

1918. Thermal Imaging Camera (TIC)

These are issued to HM Ships, Submarines and RFAs to the scale of allowances given in BRd 2170(3) for Surface ships, Submarines and RFA.

a. **Purpose**. For use as an aid to firefighting and search and rescue operations by providing thermal pictures through dense smoke where normal vision is impossible. The TIC will provide:

(1) The operator with a clear vision through dense smoke and darkness.

(2) Locate the source and spread of the fire.

(3) Improve the safety and mobility of the firefighters by making obstacles and other hazards visible.

(4) Reduce the time taken in search and rescue operations.

(5) Detect and display the relative temperatures within the fire scene.

b. Other features include:

(1) Capture of up to 100 images.

(2) Direct and Ambient Temperature Measurement.

(3) 2 x Zoom.

(4) Removable Handle.

(5) Date and Time.

c. **Description**. The TIC is a battery operated, hand-held, self-contained camera which has a fully automatic operation with no control or adjustment required in use. No routine maintenance is required for the camera. If it is not in regular use, it should be switched on for a period of 10 mins every month to check correct operation. After use and prior to stowing, the camera should be cleaned using a cloth soaked with warm soapy water. The TIC is fully illustrated in Figures 19-10a, 19-10b and 19-10c.

d. **Initial Operation**

(1) The rechargeable batteries should be fully charged before use.

(2) Fit the battery into the compartment on the top of the camera and push down until a click is heard. To remove the battery, press the battery release button and the battery will eject and can be removed.

(3) Turn on the camera using the middle red button on the rear. A **RED** light will be illuminated to show the camera is powered. A long (3 sec) press is required to switch the camera off.

(4) After the camera is switched on and for approximately 5 secs afterwards, a start-up screen will be displayed on the camera screen while the system performs a self-test routine. This start-up screen is configurable by the operator.

(5) The thermal image, with battery status display, training bar, time and date and ambient and spot temperature and spot target markings, will appear.

(6) When the TIC is in operation, the camera has to recalibrate to maintain its performance and image quality. This is achieved by an internal shutter that ‘freezes’ the image; this in turn allows the electronics to recalibrate and redisplay the image. This recalibration will only occur when necessary due to a change in scene or internal temperatures. The freezing of the image will last for less than 0.2 seconds.

(7) The camera can be used with or without the handle. To remove the handle, spin the large thumbwheel anti-clockwise until the handle detaches from the camera body. Refitting is the reverse of this, initially making sure that the locating pip is positioned correctly.

Figure 19-10a. Thermal Imaging Camera

Figure 19-10b. Thermal Imaging Camera (Rear View)

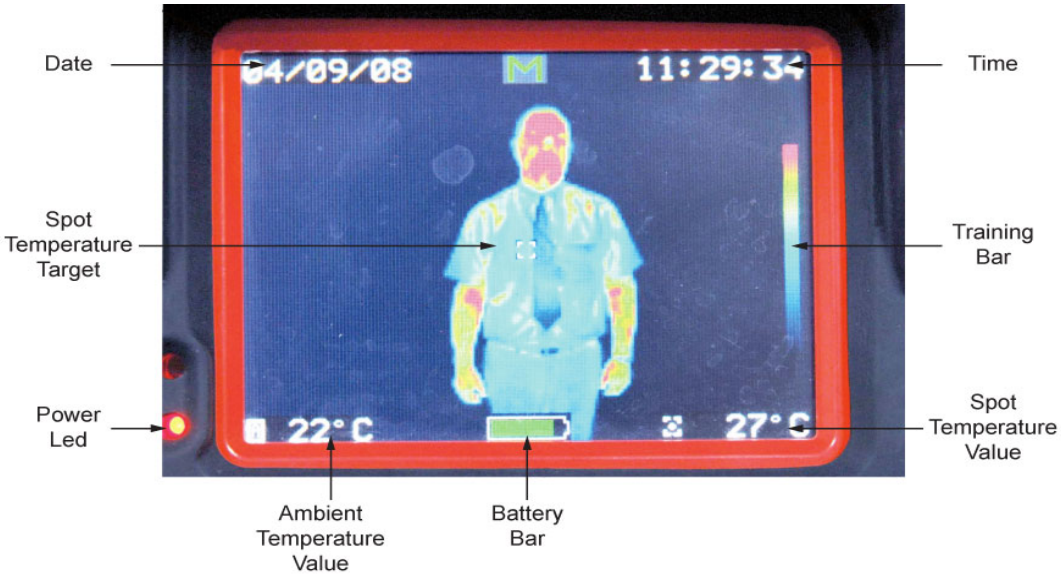


Figure 19-10c. Thermal Imaging Camera (Front View)

e. **Operating Modes**. The two modes to be utilised for firefighting and Search and Rescue (SAR) operations are as follows:

(1) **Firefighting.** 'Heat finder soft red' (to remain in this mode unless SAR operations have been authorised).

(2) **Search and Rescue**. 'Grey Scale (WH)'.

Note. *The operating modes can be changed using the remote unit (supplied with each TIC).*

f. **Camera Features**

(1) **Dynamic Scene Colourisation (DSC).** The TIC provides the end-user with a selection of colour palettes, which colourises the thermal image to allow the user to pinpoint the hottest areas within the fire scene.

(2) **Direct Temperature Measurement**

(a) The TIC allows the operator to view the average temperature of the centre spot of the scene (defined by the target markings). The temperature reading is displayed in the bottom right-hand corner of the display. This system is intended to give the operator the ability to detect possible hazards such as hot gas bottles or tanks.

(b) The camera can be configured to give a reading in degrees Celsius or degrees Fahrenheit by using the user software or the remote control. Scene temperatures between -40°C (-30°F) and 800°C (1480°F) can be displayed. This feature can be turned off if not required by using the software provided.

Notes:

1. If the object in the scene does not fully fill the target marks then a false reading may be obtained.

2. Different materials have differing surface emissivities, which will produce variations in the temperature readings. Variations can also be caused by the distance from the object. This temperature measurement must be regarded as an indication and not a guaranteed reading.

3. If the temperature falls outside the maximum value, the display will show '+++'.

(3) **Image Capture**

(a) Up to 100 images can be captured and stored in the TIC. These images can then be viewed or deleted using the remote control or software provided. Using the software provided, captured images can be downloaded to a suitable laptop/PC in several formats.

(b) To capture an image, press the left-hand button. The image capture symbol appears for a short time above the ambient temperature reading and the number of the image out of 100 will also be indicated on the display.

(c) If the image capture button is pressed and the camera already has 100 images stored, a **'CAMERA FULL'** warning will appear. Before further images can be captured, unwanted images will need to be deleted using the remote control or software.

(4) **Tri-Mode Sensitivity**. The TIC has three levels of sensitivity: High, Low and Extended Low. These levels provide the user with a thermal image over the widest possible temperature range. The TIC will switch to the optimum level of sensitivity automatically and will indicate which mode the camera is using by a coloured 'M' symbol at the top of the display as follows:

(a) **High Sensitivity Mode.** The TIC will operate in High Sensitivity mode under normal operating conditions and is indicated by a green **'M'** symbol. The image that is produced is clearer and will show more detail. The temperature range for this mode is between –40°C and 150°C (-40°F and 300°F).

(b) **Low Sensitivity Mode.** The TIC will automatically switch to Low Sensitivity mode when higher temperatures have been detected. It is indicated by an orange **'M'** symbol. The image that is produced loses some clarity, but will still show a significant amount of detail. The temperature range for this mode is up to 400°C (750°F).

(c) **Extended Low Sensitivity Mode.** If the scene has extreme temperatures, the TIC will automatically switch to Extended Low Sensitivity mode, indicated by a red **'M'** symbol, and allows an image to be produced that is clear and will show some detail. The temperature range for this mode is up to around 800°C (1480 °F).

(5) **Zoom.** A short press on the right-hand button operates the zoom function. The zoom symbol will appear to the right of the display above the spot temperature reading and is indicated by the magnifying glass icon on the screen. The temperature measurement sample window is also expanded to suit. The zoom feature can be turned off if not required by using the software provided.

(6) **Ambient Temperature.** The ambient temperature sensor is fitted to the front of the camera and the ambient temperature is displayed on the bottom left-hand side of the display. The range for ambient temperature measurement is –15°C (5°F) to 150°C (302°F). If ambient temperature measurement is not required, it can be turned off using the software and the reading will be removed from the display. The ambient temperature will be shown with any image captured.

Note. *The ambient temperature is an indication only. If the temperature falls outside the minimum value, the display will show '---'. If the temperature falls outside the maximum value, the display will show '+++'.*

(7) **Time and Date.** Time and date are displayed at the top of the screen in the format: dd/mm/yy and hh:mm:ss. The date and time can be adjusted using the remote control or software provided and will be shown on any image captured.

g. **Display Warning Graphics.** The TIC is equipped with an advanced microprocessor based control and user warning system. In addition to controlling the automatic operation of the camera to ensure the best possible picture at all times, the control system provides graphics on the display to alert the user to certain conditions as follows:

(1) **Over Temperature Warning.** As the circuitry within the camera approaches its maximum internal operating temperature, a warning symbol in the shape of a thermometer will appear to the left of the battery display. The camera will continue to operate at this temperature, but the user may see some degradation of the image quality. If the user ignores this warning and continues to operate the camera in very high temperatures, the warning symbol will flash.

Note. *When the flashing temperature warning is present, the camera is very close to its absolute operating limit and the image will start to degrade considerably. The user must remove the unit from the high ambient temperature at this time; failure to comply may result in permanent damage to the unit. Failure to act upon this level of warning may result in serious damage to the system and may invalidate the warranty.*

(2) **General System Failure Warning.** As part of the operation of the system, the microprocessor monitors certain functions and displays an internationally recognised warning symbol if it detects a fault. The warning, which takes the form of an exclamation mark within a triangle, will appear to the left of the battery status indicator. If the warning appears and if appropriate, turn the camera off and leave for 5 mins. Turn the camera on and check if the warning symbol has disappeared. If the warning symbol is still present, or the symptoms return the camera is not to be used.

h. **Operating Notes.** The following information relates to a ‘white-hot’ image.

(1) **Interpreting The Image - Relative Temperatures**. The image displayed is simply a black and white picture of the infrared energy entering the lens. The camera displays relative temperature differences between individual objects and their surroundings irrespective of overall ambient temperature. The camera is set up to display objects at various shades between black for cooler items and white for hotter bodies, eg in a room at 20°C a cold drink would appear black whilst a hot radiator would appear white. However, in a room at 250°C, it is possible that the same hot radiator may appear darker than, for example, burning materials.

(2) **Identification of Fire and Hotspots.** The camera will represent zones of very high temperature as white zones within the picture. When sufficient heat has been detected, eg a large area of fire, the camera will automatically enter low sensitivity mode. This will extend the dynamic range of the camera and allow the image of surrounding objects to remain clearly visible.

(3) **Hidden Fires.** It is possible that fires may be burning or smouldering behind doors, in trunking or in bulkhead or deck cavities. In such circumstances, the operator should look for areas that appear whiter when compared with the surroundings. For example, a fire behind a door will cause the door to appear whiter against the background. Similarly, a white area on an otherwise dark wall could indicate an area of fire behind the structure.

(4) **Search and Rescue**. The camera can be used by search and rescue teams to search for casualties and to seek out dangerous items such as fuel tanks or gas bottles.

(5) **Image Clarity.** The sharpness and clarity of the image provided is related to the temperature of the scene and objects in view. A cold room provides little infrared energy and less detail is detected than in a warm environment where objects give off significant energy. In general, the warmer the scene, the more thermal contrast and hence the greater detail in the picture.

(6) **Heat Layers in Closed Spaces.** In a major fire, a layer of hot gases may build up in the upper region of the closed space. Attempting to use the camera in this hot layer will cause the image to become featureless. By bringing the camera down beneath this layer, the unit is able to provide the firefighter with a clearer picture of the scene ahead.

(7) **Windows and Polished Surfaces.** Glass is not transparent to long wavelength infrared energy and it is not possible for the operator to use the camera to look through a window. A white window would indicate that the window itself is relatively warm and may be being heated by a fire behind it. Just as we see reflections in glass under normal circumstances, it is possible that the camera can detect infrared reflections in glass, mirrors and polished or painted surfaces. Care must be taken to ensure that the image seen is not simply a reflection. Training and experience will give the operator the required added confidence.

(8) **Control of Water Streams/Jets.** When viewed through the camera, water streams from hoses will appear black against the background scene. The control and direction of a water flow can be monitored by viewing its flow and effect on the fire through the camera. It may be necessary, if employing a waterwall, to drop the wall momentarily to view the effects of the extinguishing stream.

(9) **Lens Cleaning During Operation.** The camera lens, like the BA visor, may become obscured during use. The lens may be cleaned with a glove or cloth if necessary.

1919. TIC Battery Charging

a. The rechargeable battery system supplied with the TIC has been specifically designed to fast-charge the Ni-MH rechargeable batteries. The charger is to be used with the charging shoe and is mains powered. The charger is a fully automatic 'smart charger', monitoring voltage, time and temperature and ensures optimum charge for the battery. In addition:

(1) The charger has a built-in start timer that eliminates early termination of charging when a battery is first connected to it. This prevents batteries that have not been used for some time, or are completely discharged, from showing a fully charged status incorrectly.

(2) If the battery temperature is too low, the charger will start with a trickle charge until the correct operating temperature has been reached.

(3) If the battery temperature is too high, the charger will reduce the charge rate until the normal operating temperature has been reached.

b. Once the battery has reached full charge, the charger will go into top-up charge mode and the LED will turn green and flash intermittently yellow. Once the top-up has been completed, the charger will go into maintenance mode and the LED will show green. The battery is to be removed from the charging shoe once charged. Before fitting another battery into the charger, allow at least 30 seconds so the battery charger can reset; the LED turning to yellow indicates that the charger has reset.

LED COLOURS DURING NORMAL OPERATION	
LED	**MODE**
Orange	No battery fitted, initial power applied
Yellow	No battery fitted, charger ready for use
Yellow	Battery fitted, start-up trickle charging
Orange	Battery fitted, fast charging
Green with intermittent yellow flash	Top up charge
Green	Charge complete, maintenance mode
LED COLOURS DURING FAULT CONDITIONS	
LED	**MODE**
Green while flashing yellow	Battery or charger out of operating range
Flashing between orange and green	Battery or charger has a fault. Remove battery and disconnect the power.

Note. *On some models the 'orange' LED may appear to have a red tint. This is normal.*

1920. TIC Rechargeable Battery Pack

The TIC is supplied with two rechargeable battery packs which are designed to power the unit for 4 hours from a full charge and use Nickel Metal Hydride (Ni-MH) cells. The battery pack contains circuitry that monitors the cell's temperature to ensure that maximum performance is provided and that correct charging is performed.

The pack also has a recoverable short-circuit protection. The battery pack provides an output to the 'battery status bar' on the camera display illustrated in Figure 23-10b. This battery status bar provides a continuous colour indication of the remaining charge, allowing the firefighter to avoid unpredicted power loss. With a fully charged battery, the battery bar will show full and be coloured green. The battery bar will then progressively decrease as the battery capacity is consumed. When the battery status bar has reached a quarter full, the battery bar will turn orange and there is approximately one (1) hour of battery life remaining. As the battery capacity is consumed further, the battery bar will turn red and there is approximately 30 min of battery life remaining. When the battery is low, the battery status bar border will turn red and flash to alert the operator. The time remaining will typically be 10 mins.

Note. *To maintain the accuracy of the battery charge indicator, it is recommended that batteries are occasionally fully discharged in a camera before charging.*

Figure 19-11. TIC Battery Charger

1921. Gaseous Firefighting Systems

See Chapter 17 for details.

1922. Smoke Containment Curtains

a. Smoke curtains are fitted at main watertight doors to sub-divide passageways to enable smoke boundaries to be maintained in the event of distortion of doors/structure or for the passage of personnel. They are manufactured from Temprotech TPT3200-2-SS flame retardant fabric. Canopy arrangements are provided at doors to form a mini airlock about 1 x 1 m on the non-door side of the bulkhead. A pelmet curtain rail, with well rounded corners to allow easy curtain movement, follows the form of the airlock. Curtains are fitted in two parts with an overlap. Reflective tape is fitted to the edges of the smoke curtains to allow the access to be rapidly identified, thus reducing the time taken to pass through. Curtains must be checked to ensure that:

(1) Temprotech curtains have an overlap of between 600 and 700 mm and Columbus 300 curtains have a minimum overlap of 505 mm.

Note. *Type 45 curtains have been designed with a nominal 550 mm overlap (±5%) closed by full length Velcro tapes to provide a continuous seal along the length of the curtain (minimum acceptable overlap of 522.5 mm).*

(2) Pelmets fitted for the sub division of passageways hang both sides of the curtain to a depth of 225 mm.

(3) Curtains have lead weight strips sewn in 50 mm from the deck.

(4) Curtains touch the deck to form a smoke tight seal that will be maintained while the ship is pitching and rolling within its design parameters.

(5) Internal and external edges of curtains have reflective tape fitted.

b. Smoke containment curtains are susceptible to considerable wear, chaffing and snagging from the passage of personnel and equipment's when left in the rigged position. In order to retain the effectiveness and integrity of the curtains the following procedures are to be adopted:

(1) **State 1** - Curtains are to be fully rigged and checked for defects; they are then to be re-stowed using only one tieback. Defects are to be rectified as soon as possible.

(2) **States 2 and 3** - Curtains are to remain stowed.

(3) In the event of a real fire or smoke generated for exercise purposes the curtains are to be rigged as soon as possible to hinder the spread of smoke.

Notes:

1. Temprotech TPT3200-2-SS flame retardant fabric is available from Naval stores (see BRd 2170(3) Chapter 3) to allow for curtain repair or the manufacture of ad-hoc smoke curtains.

2. It is entirely acceptable for units to be fitted with a mixture of Temprotech TPT3200-2-SS and Columbus 300 smoke curtains and any remaining stock of Columbus 300 may be used for the repair of existing Columbus 300 curtains.

1923. Boundary Light

The Boundary Light has been introduced to replace sentries when indicating the extent of an incident boundary. The light is lightweight, robust, magnetic and fully portable it may be used to indicate the boundary of any type of incident. It is powered by 4 AA alkaline batteries with 26 super-bright red LED lights providing 22 hours of light in the static mode and between 24-40 hours in the flashing mode before the brightness starts to decline. When using the light to indicate a boundary opening, it should be set to the 'Flash' mode. Boundary lights that are not functioning, may have depleted the battery in this instance, they should be assumed to be functioning in the flashing mode, and treated as such.

Figure 19-12. Boundary Light

1924. Smoke Generating Training Devices

There are 2 smoke generating machines in use in the RN, the RN Colt 4 Turbo Basic and the Spirit 900A Smoke System available for firefighting/search and rescue team training aids. Both these units operate on a 115V 60 Hz electrical supply via transformers, with the colt coming in a 240V version also, producing smoke from a pressurised canister containing smoke fluid and a pressurising agent. They allow realistic exercise of breathing apparatus, TICs and DC communications techniques and enhances training in smoke control and clearance. Although simple to use, these devices require operator training and is delivered to all CBRNDCQs on the CBRNDC 35 Course, as well as LET(ME)'s during CBRNDC 29 Course.

A quick reference guide for the use of these units is as follows:

a. **RN Colt 4 Turbo Basic**

(1) **Preparation and Operation**

(a) Connect unit to a suitable 115V/240V supply and put the Red Power switch to **ON**.

(b) After approx 5 mins the Green Ready Indicator will light. **For the best performance wait a further 5-10 mins before operating** (the unit is thermostatically controlled and can be left heating indefinitely if required).

(c) Screw a full Colt 4 canister into the machine.

(d) Ensure Flow Regulator valve is fully anticlockwise (fully open).

(e) To produce smoke depress the black smoke button.

(f) To stop producing smoke release the black smoke button.

(2) **Off Power Use**

(a) This unit incorporates a high mass steel heater block. Once pre-heated this will hold sufficient energy to produce a considerable quantity of smoke ‘off power’ allowing the operator to carry the unit, making smoke as required, without a trailing lead.

(b) If using the smoke ‘off power’, the operator should monitor the smoke quality being produced. When the smoke thins and becomes ‘bluish’ in appearance stop producing smoke and re-heat the machine until the Green Ready light comes on again.

(3) **Shut Down**

(a) When finished with smoke production the Colt 4 aerosol can be removed. The can re-seals for later use.

(b) If the Colt 4 was last used in the ‘off power’ mode, it is recommended that the unit is connected to the power supply for 2-3 mins before the unit is switched off this helps vaporise any residual chemical left in the heat exchanger chamber and once this has been done it can then be stored.

(4) **General Information**

(a) Colt smoke machines are designed for use only with the appropriate Colt aerosols. Damage will occur if any other aerosol is used.

(b) Do not cover or obstruct louvers’ in any way. Only use the unit in well ventilated areas.

(c) When smoke is required to be hosed away from the machine, a ducting adaptor must be used. This acts as an adaptor for the flexible hose and also serves to remove any large droplets of fluid from the smoke that would otherwise collect in the hose.

(d) Normal precautions should be observed regarding the storage and use of aerosols ie protect from sunlight and do not expose to temperatures exceeding 50°C. Do not pierce or burn after use. Do not spray on a naked flame or any incandescent material. Store aerosols with valve downwards.

b. **Spirit 900A Smoke System**

(1) Fill the unit with Spirit Smoke Fluid A. Do not overfill. Ensure that the transit cap (underneath the red reservoir cover) is removed when making smoke.

(2) Connect unit to a suitable 110V AC supply and put the red power switch to ON. The digital display will light and the temperature of the unit (red display) will begin to increase. The green 335 figure is the target temperature.

(3) After approx 5 mins the green ready indicator will light. **For best performance wait a further 5 mins before operating** (the unit is electronically temperature controlled and can be left heating indefinitely if required).

(4) Ensure Flow Regulator Valve (FRV) is fully anti-clockwise (fully open). If continuous smoke is required this can be achieved by closing the FRV until that is achieved.

(5) To produce smoke put the black smoke switch to On (1). Alternatively, with the remote switch fitted, put the remote switch to On (1).

(6) To stop producing put the black smoke switch to Off (0). Alternatively, if the remote switch is being used, put the remote switch to Off (0).

Notes:

1. To ensure optimum performance clean out the nozzle of the heat exchanger block with the 2 mm twist drill provided after every 2 hours of use. This operation takes 10 secs.

2. When finished with smoke production, disconnect the machine from the power supply, re-fit the transit cap under the red reservoir cover to prevent liquid spill.

3. For detailed information on the units maintenance, health and safety and fault finding refer to the manufacturers full instructions supplied with the unit.

CHAPTER 20

PERSONAL PROTECTION

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CHAPTER 20

PERSONAL PROTECTION

2001. General

This chapter defines how personal protective clothing for action, damage control and firefighting shall be employed. Breathing apparatus is covered in Chapter 21 and individual protective equipment (IPE) for CBRN hazards is covered in BRd 2170(2).

Associated publications

This chapter is associated with the following publications;

- BRd 2170(1) Policy Document;
- BRd 2170(2) CBRN manual;
- BRd 2170(3) DC equipment allowances;
- JSP 539 heat illness and cold injury: prevention & Management;
- BRd 3 Naval Personal Management;
- BRd 1277 The Laundry Manual; and
- A Commanders guide to climatic injury.

2002. Ship Firefighting Clothing

Firefighting protective clothing is designed to give the wearer protection against radiant heat and flame, but only for limited periods. It will not protect from the effects of exposure to great heat for long periods. The protective clothing also reduces heat loss from the body and, therefore, heat stress increases, possibly leading to heat exhaustion and collapse. The safety of personnel working in heat depends on the correct approach to the problem, good training, discipline and careful supervision. Personnel who are to wear protective clothing must be regularly practised in its use. Protective clothing must be examined regularly and maintained in good order. There are 3 levels of ship firefighting rig which use, as a base, the Action Clothing Tier as seen in Table 20-1.

Table 20-1. Action Clothing Tiers

	TIER 1	TIER 1 (Enhanced)	TIER 2	TIER 3
Current BRd 2170 Definition	-	Basic Firefighting Rig and the basis of Intermediate Firefighting Rig	-	Action Dress
Clothing	No 4 (PCS) (See Note 1)	No 4 (PCS) with sleeves rolled down & cotton underwear (inc cotton T-shirt/Thermal Layer) worn. (see Note 2).	No 4 (PCS) + Coverall GS (see Note 2 and Note 3).	No 4 (PCS) + Coverall GS (see Note 2, Note 3 and Note 4).
CBRNDC State	3	3/2	1	2/1
Example When Worn	At Sea	SSEP/HFEP and Defence Watches.	Benign operations at State 1. **To be worn for OST training serials iaw BRd 9275.**	Operations where a direct threat to platform is deemed realistically possible.
Physiological Burden	Low	Low	Awareness required.	High

Notes:

1. In Tier 1 protection No 4 (PCS) may be substituted for Coveralls GS.

2. When new, Coveralls GS will provide some additional protection as the top FR layer in the tiered Action Clothing system however it will not prevent burns in the event of a direct flame exposure lasting 4 seconds or greater. Prolonged wear, damage to the fabric and contamination with oils and greases may compromise the limited protection afforded by the garment. Action Coveralls are held in Naval Stores and are issued only in times of tension or war. Their 2 layer design mitigates the fact that the outer layer may perish when exposed to long duration flames and in all cases they will provide enhanced protection over the Coverall GS worn with the Tier 2 Action Dress.

***Notes**.(Continued):*

*3. **Action Coveralls.** Despite instructions authorising the use of Action Coveralls alone with cotton underwear, trials suggest that the garment does not provide sufficient protection to meet the 4 second challenge when worn without a undergarment. Therefore, if the threat dictates that Action Coveralls are be used then they should be worn as an over garment to No 4 (PCS) uniform or Coveralls GS. Despite that they provide 2 layers of material.*

4. **Unapproved or Non authorised clothing** *The wearing of Unapproved or Non-Authorised Clothing/ PPE. represents a hazard to the individual. CBRNDC Clothing and PPE Policy is controlled by NAVY SHIPS - CBRNDSC SO2. BRd 3 and BRd 2170(3) provide details of authorised clothing..*

2003. Immersion Coveralls

Are provided for personnel working in partially flooded compartments. The three sizes are generously cut, to be worn over action dress, including DMS boots. Extended wearing of the coveralls should be avoided due to the risk of heat stress. The wearing of action coveralls is not necessary when immersion coveralls are worn, although the double layer could provide additional insulation in exceptionally cold conditions.

2004. Additional Layers vs. Climatic Conditions

The balance between clothing protection, work rates and the working environment should be carefully considered. Detailed instructions for heat stress monitoring are contained in JSP 539. It is acceptable to wear the Firefighting Suit directly over underwear if time and decency permits. Unit Command should take note when considering the decision to permit this relaxation that the flexibility for role changing is diminished. Care should be taken if there is a potential external threat.

2005. Firefighting Personal Protection Ensembles

Figure 20-1.

Basic Firefighting Rig	Intermediate Firefighting Rig	Full Firefighting Rig
Action Clothing Tier 1 Enhanced	Action Clothing Tier 1 Enhanced	Firefighting Suit
PCS or cotton overalls, cotton underwear and T-shirt DMS boots, cotton/woollen socks	PCS) or cotton overalls, cotton underwear and T-shirt DMS boots, cotton/woollen socks Breathing Apparatus Firefighters Hood Anti-Flash Gloves	PCS, cotton overalls, Chefs Whites firefighters hood firefighters helmet with built in communications (FFHBC) firefighters gloves woollen socks firefighting boots EDBA TIC (as Required)
When engaged in firefighting operations, collars should be buttoned up and the sleeves rolled down with cuffs buttoned.		When dressed in full firefighting rig the following clothing substitution is authorised: Firefighters boots for DMS boots. Firefighters gloves for anti-flash gloves. Firefighting suit for action coverall if PCS or overalls are being worn.

2006. Protecting the Body from Injury

When an explosion occurs in, or near, a ship there is a danger to personnel from blast, flying debris and the whipping action of the hull. This may also occur during a collision. In order to minimise injuries to personnel caused by these effects the following precautions are to be taken:

a. For prolonged periods under threat at DC State 1, personnel not directly involved with fighting the ship are to be dispersed in pairs, or small groups, throughout the ship, avoiding potential blast routes and covering all decks and all sections if possible. This will provide the facility to conduct an immediate, and more effective, blanket search after action damage, and minimise casualties in any one place.

b. When an attack is imminent, the order **"BRACE, BRACE, BRACE"** is to be broadcast by the Command.

2007. Brace Drill

On hearing the command **"BRACE, BRACE, BRACE"**:

a. All personnel not directly involved in fighting the ship or in the most protected positions, ie a bunk or a fixed chair, are to stand, face away from any loose material, bend knees, lift heels off the deck and, with bent arms, take a firm grip from beneath a fixed object at waist height. The head, neck and back should remain in a straight vertical line to absorb the effect of shock from the deck. For accelerations athwartships, personnel should face forward or aft. For longitudinal accelerations, personnel should face athwartships.

b. Personnel who are seated during periods of attack are to carry out the following procedures:

(1) Personnel sitting in front of a VDU, unless directly repulsing an attack, should swivel their chair so that lower limbs are not trapped between the chair and the console.

(2) Seated personnel whose chairs cannot swivel should not twist their necks to avert the face from the VDUs. In these circumstances stand as in Para a.

(3) Close the eyes and extend anti-flash hoods to cover the face. Firmly grip the sides of the chair seat with both hands (all seats that are required for action are to be securely fitted to the deck).

(4) Seated personnel should sit in an erect position, with a slight concave bend in small of the back, feet tucked beneath the seat, heels off the deck. Head, neck and back to be in a vertical line.

Figure 20-2. Brace Position (Seated)

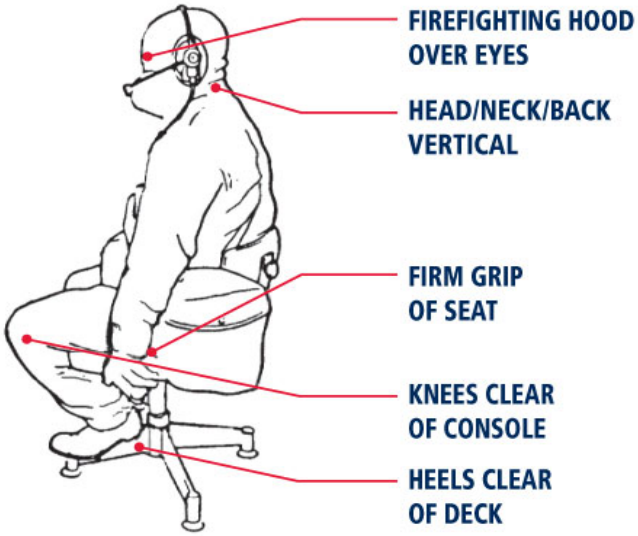
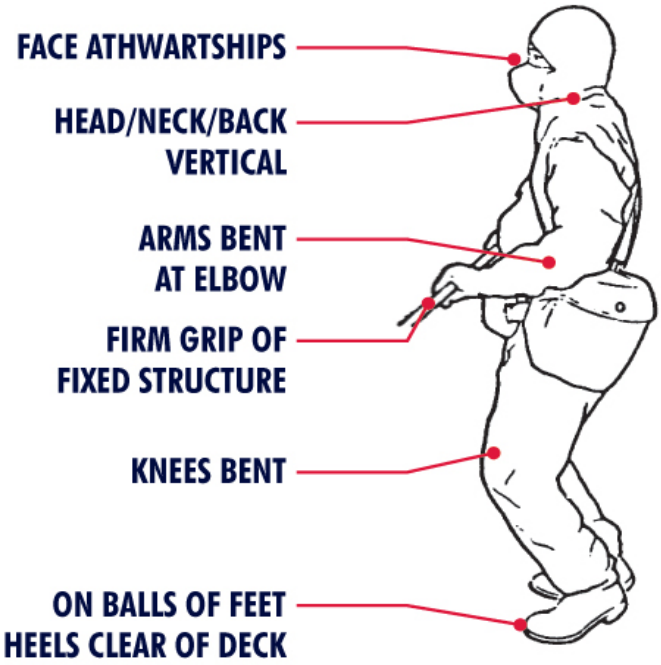


Figure 20.3. Brace Position (Standing)



2008. Action Dress

a. At Action and Defence Stations all personnel are to wear Action Clothing Tier 2 or 3 dependant on the level of threat and climatic conditions(see Table 20-1). The basic Action Dress is as follows:

(1) **Cotton Underwear.** Personnel are advised to avoid wearing undergarments made from nylon, thermoplastics and polyester, even in peacetime. The most practical material for undergarments is plain cotton although wool and materials derived from cellulose (eg rayon) are also melt hazard free.

(2) Thick wool rich black socks and issued DMS boots.

(3) Use of the action coverall as a 3rd protective layer should be balanced against the increased risk of heat stress illness.

(4) Flame retardant anti-flash gloves and hood (gloves are to be worn over the coverall sleeve). The hood bib is to be tucked into the neck of the coverall. At Defence Stations the hood may be relaxed around the neck at the discretion of the Command.

b. Selected items from the following list may be worn/carried in addition to Action Dress, when appropriate:

(1) Rank/rate shoulder badges.

(2) Lifejacket.

(3) Survival suit.

(4) General Service Respirator.

(5) Brassard, for identification. (As required).

(6) EEBD (only if ordered for a specific function, eg patrols).

(7) Identity discs (stainless steel). (As required).

(8) CBRN protective suit, gloves and overboots (IPE).

(9) CBRN decontamination suit.

(10) Foul weather clothing.

(11) Flight deck clothing.

(12) Immersion coverall.

(13) Protective helmet.

2009. Keyboard Operator (KO) Anti-Flash Gloves

a. These gloves are **NOT TO BE STOWED** in EDBA lockers where one size gloves are more appropriate, or for issue to EMF. At no instance should KO gloves be used for firefighting. The flame retardant (FR) treatment will last for the serviceable life of the gloves. Gloves must not, however, become badly soiled or permanently stained since such deposits/defects reduce the FR properties and decrease the protection afforded.

b. **Cleaning Instructions.** The gloves may be cleaned by careful hand washing.

2010. Action Coverall

a. The action coverall is a double-layered flame retardant garment that is to be worn when directed by the command. The coverall may be marked in felt tip, for the identification of personnel, on the left breast pocket flap only. For exercise purposes blue or white FR overalls over PCS trousers and lightweight jacket are to be worn to simulate the action coverall.

b. Personnel employed on duties in support of firefighting teams may be dressed in an action coverall ensemble at the discretion of the DCO although any person required to transit the ship protector waterwall to gain access to a compartment/scene of the fire must be in full firefighting rig. The action coverall firefighting ensemble includes the following additional items:

(1) Cotton underwear and cotton T-shirt.

(2) Woollen socks.

(3) Firefighters hood.

(4) Firefighting gloves.

(5) Firefighters helmet.

(6) Leather firefighting boots.

(7) Breathing apparatus.

(8) PCS, Chefs Whites or FR overalls.

(9) Action Coverall.

c. Due to the limited space available in FRPP lockers and the requirement that only clean oil free action coveralls are used for firefighting, they are to be drawn from Naval stores.

2011. Brassards

Brassards are to be worn on the right upper arm, over action coveralls, to denote the following functions:

a. **Red**. Damage control personnel (except heavy ‘L’).

b. **Green**. Heavy ‘L’ personnel.

c. **Orange**. (BA Controllers).

d. **Pink**. Weapon Repair Teams.

e. **Red Cross on White**. First Aid Teams.

f. **White**. Marked to indicate key personnel (XO,EWO, etc).

Figure 20-4. Action Coverall in Action Dress

2012. Action Dress for Embarked Military Forces

Multi Terrain Pattern (MTP) Personnel Clothing System worn by Embarked Military Forces (EMF) is not Flame Retardant (FR) and may not protect the wearer from burn injury if exposed to flame. To provide protection appropriate to risks when in the Action State, and to correspond with the protection provided afforded to RN personnel, all EMF personnel are to be issued with one Action Coverall, one anti-flash hood and one pair of anti-flash gloves as soon as practicable to cover any contingencies which may arise. These are to be worn when prescribed by the Command in accordance with the guideline below. The action coveralls are environmentally sealed, and the packages should not be opened until required:

a. The table below provides guidance on the EMF dress state relevant to the perceived threat to the ship.

Table 20-2. EMF Guidance

RISK	SHIP STATE	DRESS
Low	State 3 (Cruising Watches)	MTP/PCS
Medium 1	State 2 (Defence Watches)	MTP/PCS (Anti-flash hood and gloves carried)
Medium 2	State 2 (Defence Watches) and a credible risk to the ship exists	MTP/PCS Action coverall, anti-flash worn (Hood down)
High	State 1 (Action Stations) and a credible risk to the ship exists	MTP/PCS Action coverall, anti-flash worn (Hood up)

b. Where possible underwear and other garments worn under action coveralls should, be made from natural fibres (eg cotton).

c. It is recognised that EMF personnel will have to change back into MTP perhaps many hours before disembarkation (when the ship might be at greatest risk). However, personnel should try to delay changing until as late as possible and wear anti-flash hood and gloves, if possible, with MTP until disembarked. Ships will need to exercise the wearing of different levels of protection at Assault Stations and develop SOPs to minimise the impact any changes in dress states will have upon operations.

2013. Firefighting Protection in a CBRN Environment

a. Protection for firefighters in a CBRN environment varies according to the hazard and appropriate PPE should be considered on a case by case basis in consultation with the PROTO and DSTL CBRN Reachback, As a guide the following should be considered.

(1) **Firefighting Between Decks in a CBRN Environment.** Firefighters should wear normal action working dress with/without a fire suit. IPE clothing (ie suit and rubber gloves) should not be worn under the fire suit and firefighters gloves. All Firesuitmen personnel must, however, have access to BA and General Service respirator, and be well practised in the procedures for changing over from one to the other, as detailed in Annex 17K.

(2) **Firefighting on the Upper Deck in a CBRN Environment (Vapour Hazard).** If the CBRN hazard is from vapour alone, then firefighters dressed as in Para 2013 a sub para (1) above and wearing BA may[a] have adequate short term protection for the duration of their firefighting task. A GSR must be readily available (with the BA Controller) and firefighters must be practised in the procedures for changing to and from BA, as detailed in Annex 17K.

(3) **Firefighting on the Upper Deck in a CBRN Environment (Liquid Hazard).** In the unlikely event of having to fight a fire on the upper deck, in a CBRN liquid environment, then all firefighting is to be conducted from behind a waterwall. The type of PPE used, i.e Full Firefighting rig vs. CBRN IPE, will be dependent upon the nature of the incident and will be at the discretion of the Command with advice provided by the PROTO and DSTL Reachback

(4) **Firefighting in a Radiological Hazard Environment.** Full firefighting rig with BA will provide protection to the wearer against particulates emitting alpha and Beta Radiation. Like CBRN IPE, the full firefighting rig will not provide protection to the operator against Gamma Radiation. The CBRN Protection Officer will need to consider stay times for personnel exposed to Gamma radiation.

b. The procedures for undressing and cleansing after firefighting in a CBR environment are detailed in BRd 2170(2) Chapter 14 Annexes A-G.

[a] Dependant on type of vapour hazard

2014. Chemical Threat - Wearing of Anti-Flash

When the Chemical Safety Rule is in force, upper deck crews are to wear IPE at a dress state appropriate to the threat and as directed by the command. In Dress States Zero, One, Two and Three anti-flash is to be worn. CBRN Dress States are defined in BRd 2170(2). The use of anti-flash with CBRN IPE whilst inside the citadel is at the discretion of the command and will be based on the type of threat associated hazard. Anti-flash should not be worn with CBRN IPE in dress state 4R.

CHAPTER 21

BREATHING APPARATUS

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Annex 21A Weekly EDBA Log

CHAPTER 21

BREATHING APPARATUS

2101. Introduction

Extended Duration Breathing Apparatus (EDBA) has a low magnetic signature and is suitable for use in all RN ships, submarines and RFAs. Full details are contained in BR 8223(1).

2102. Categories of Breathing Apparatus

There are 2 categories of breathing apparatus used in Royal Navy surface vessels and Royal Fleet Auxiliaries for firefighting purposes and for use in emergency escape situations as described below:

a. **Breathing Apparatus (Damage Control)**. This is the generic term used to describe the breathing apparatus (BA) used by damage repair parties and firefighters. Extended Duration Breathing Apparatus (EDBA) is the current BA (Damage Control).

b. **Emergency Escape Breathing Device (EEBD)**. It provides respiratory protection for personnel escaping from a toxic or smoke filled atmosphere. It is not suitable for firefighting, rescue or repair work.

SECTION 1 - EXTENDED DURATION BREATHING APPARATUS

2103. Description

EDBA is a positive pressure, first-breath activated, lightweight, low maintenance set, fitted with a 9 ltr air cylinder (free air capacity 2430 ltrs) capable of being charged to 300 bar. The set comprises a one-size facemask with a net head harness (see Figure 26-2), an ergonomically designed backplate with a comfortable flame-retardant harness (see Figure 26-3), a lightweight composite air cylinder, a high-pressure reducing valve, a warning whistle and a pressure gauge. The facemask assembly is fitted with an oro-nasal mask, an exhalation valve incorporating a speech diaphragm, and an automatic first-breath operated positive pressure demand valve. The demand valve is designed to be re-set by pressing the black rubber re-set button (on the demand valve). This closes off air to the facemask, enabling it to be removed. The demand valve is also fitted with a manually operated by-pass valve, which allows a free flow of air into the facemask, in case the wearer gets into difficulty. A bulb horn distress alarm is to be attached to the left shoulder strap of the EDBA set.

2104. Stowage

EDBA is stowed in lockers, ready for immediate use, with all straps fully extended. A tally, detailing the functional and face seal checks, is attached inside the locker door. Control boards are stowed in selected lockers, which are identified by a 50 mm wide white band on the front and sides, 50 mm from the base of the locker. The distribution of control boards is to be detailed in ships CBRNDC Orders. The ‘set number’ tally is attached to the D ring on the left shoulder strap of a stowed EDBA.

2105. Duration

To maximise duration, EDBA should be charged to the highest pressure available from the HP air system, up to a maximum of 300 bar. However, most ships do not have a HP air system that is capable of achieving this pressure and are therefore to charge EDBA to the maximum working pressure of their system up to the maximum of 300 bar. To allow a tolerance for EDBA checks, cylinder pressures in stowed sets may be allowed to fall to 10 bar below the full charge, eg if the HP air ringmain delivers 270 bar, stowed EDBA sets are to be charged to 270 bar but may be allowed to fall to 260 bar before recharging. When EDBA checks are carried out the ship is to ensure that the HP air ringmain is at maximum pressure. The duration varies with air pressure, as follows:

a. **300 bar**: 48 min working duration + 12 min whistle = 60 min.

b. **240 bar**: 39 min working duration + 12 min whistle = 51 min.

c. **207 bar**: 33 min working duration + 12 min whistle = 45 min.

d. **200 bar**: 32 min working duration + 12 min whistle = 44 min.

e. **160 bar**: 24 min working duration + 12 min whistle = 36 min.

Notes:

1. The warning period will be 12 min only if the whistle is correctly set at 55 bar and will depend on the individual wearer and the task being carried out.

2. These times exceed the work periods for action coveralls or No 4s and PBI Gold in Chapter 20, so heat stress will normally limit operations before BA endurance.

Figure 21-1. Extended Duration Breathing Apparatus (EDBA)

Figure 21-2. Facemask Assembly

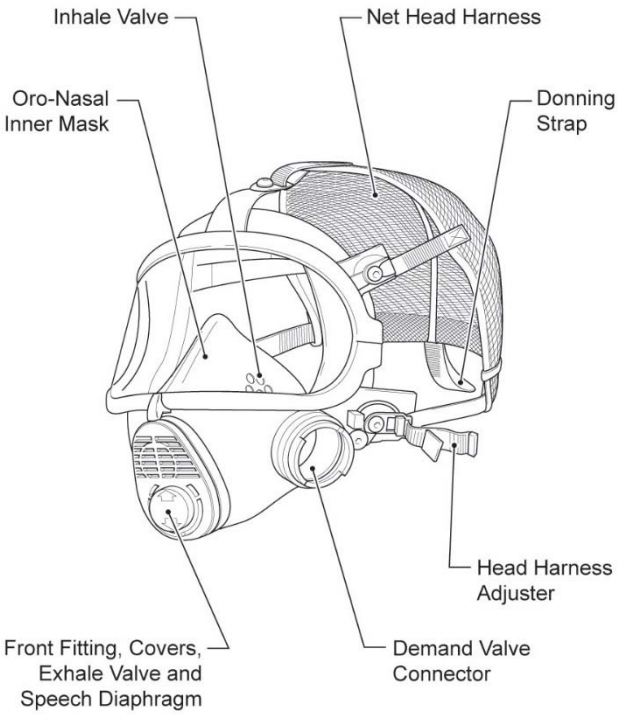
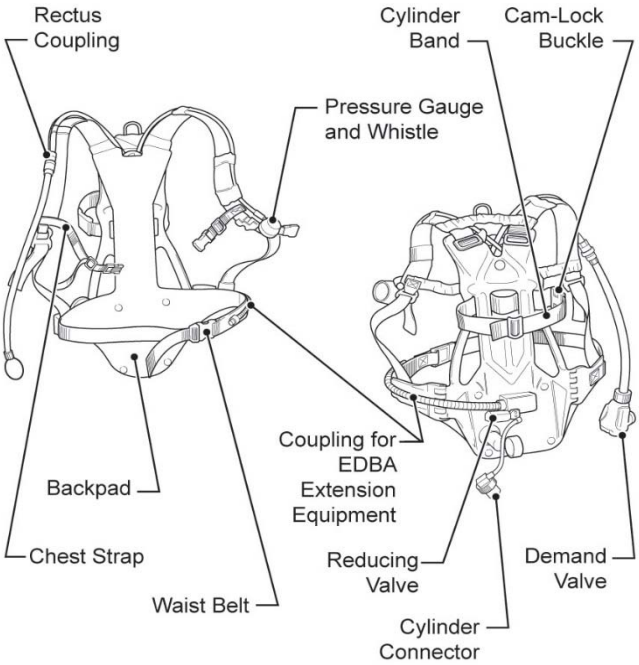


Figure 21-3. Back Plate and Harness



2106. Donning and Functional Checks

a. While stowed in its locker, the EDBA must be maintained in a state of readiness for immediate use, with the air cylinder fully charged to the correct working pressure (within 10 bar of ships declared ringmain pressure). Approval must be obtained from the officer in charge of firefighting (DCO or OOD), prior to using a set if the pressure is below the minimum approved operating pressure of 160 bar.

b. With assistance from the BA Controller, the wearer dons the set as follows:

(1) Remove the facemask from the stowage clip. Place the facemask neck strap over the head and allow the facemask to hang on the chest. The neck strap must be worn under the firefighters hood.

(2) Release the bands securing the set in its locker and pass the right arm through the right shoulder strap. Lift the set clear of the locker and pass the left arm through the left shoulder strap.

(3) Adjust the shoulder straps by pulling them down and towards the rear. Fasten the waist belt and chest strap, taking care not to over tighten.

(4) Check that the bypass valve is in the closed position and the demand valve (DV) reset button is pressed.

(5) Open the cylinder valve fully and check that the warning whistle sounds briefly (in the 0-55 bar range). If the whistle is not heard to operate when the cylinder valve is opened:

(a) Shut the cylinder valve. Open the bypass valve to reduce pressure to 55 bar, at which point the whistle should sound.

(b) Close the bypass valve. If the whistle still does not operate, it is defective, and the set must not be used. The BA Coordinator must be informed.

(6) On completion of the test, open the cylinder valve fully.

2107. Face Seal Check

When the wearer is required to commence a task, the following routine is to be carried out:

a. Place the chin in the chin cup, pull the head harness back over the head and tighten the head harness straps.

b. Inhale sharply to activate the DV first-breath mechanism and then breathe normally.

c. Twist the DV gently to confirm that the locking catch is fully engaged.

d. Open the DV bypass valve and check that there is a free flow of air into the mask. Set the bypass valve to the closed position.

e. Shut the cylinder valve and then quickly open it one quarter of a turn. Take a deep breath. Shut the cylinder valve and check that there is no sound of escaping air, and that the pressure gauge reading does not fall by more than 10 bar (one division on the dial) in 10 secs.

f. Open the cylinder valve fully, breathe normally and check that the gauge reading is steady. If it is not, check that the cylinder valve is fully open. If the gauge fluctuates when the cylinder valve is fully open, do not use the set.

g. Test the distress alarm.

h. On completion of a successful face seal check the BA controller removes and retains the 'set number' tally, enters the wearers name and cylinder pressure on the control board.

i. Pull up the firefighters hood, check protective clothing and proceed on task.

Notes:

1.If the wearer is not required immediately, take a deep breath and press the black rubber reset button on the DV to close off air to the facemask. Remove the facemask and allow it to hang on the chest.

2. The face seal check must be performed each time a wearer dons the facemask for operational purposes.

3. On completion of the face seal check, the BA Controller must enter, on the control board, the time at which the wearer starts to breathe from the set

2108. Extension Equipment

Extension equipment for EDBA illustrated in Figure 21-1 comprises a Rescue Mask (RM) assembly with head harness, a 2 m extension hose and a 15 m extension hose. These items are stowed in a red locker, which has a drop-down door. A tally on the inside of the door gives the operating instructions for EDBA extension equipment. Two 15 m extension hoses can be connected to give a maximum length of 30 m. The 2 m hose is not to be added to this 30 m length. Instructions in the use of EDBA extension equipment is as follows:

a. Remove equipment and check condition of hoses and couplings.

b. Connect 2 m/15 m hose and mask ensuring connections are fitted correctly and tight.

c. Obtain EDBA and carry out full wearer checks.

d. Check the extension mask by-pass valve is closed; connect extension hose to EDBA and lock.

e. Carry out face seal check on extension mask.

f. Once 'on air' place full details on the EDBA control board. A nominated person is to control both the set and board.

Notes:

1. On each occasion the extension facemask is worn a full face seal check must be carried out.

2. For instructions for the use of EDBA extension equipment in the SAR role see Annex 17H.

2109. BA Control

When EDBA sets are used operationally, a BA Controller should be nominated. The duties of a BA Controller are detailed in Chapter 16.

2110. Completion of the Control Board

The BA Controller is to carry out the following entry instructions after the firefighting team has been briefed and tasked by the Officer/Rating I/C of firefighting:

a. Confirm a face seal check.

b. Remove the 'set number' tally from the BA and clip it onto the Control Board illustrated at Figure 21-4.

c. Check that the wearers dress is correct.

d. Check the wearers personal distress device is functional.

e. Before the wearer enters, complete his details in columns A, B and C. The abbreviations to be used in the task column are **FF** for all members of firefighting teams, **BC** for boundary coolers, **SAR** for search and rescue teams and **DC** for any other use.

f. Turn the dial to set the cylinder pressure (B) window over the minute of start time (from column C).

g. Read off and enter times in columns D, E and F.

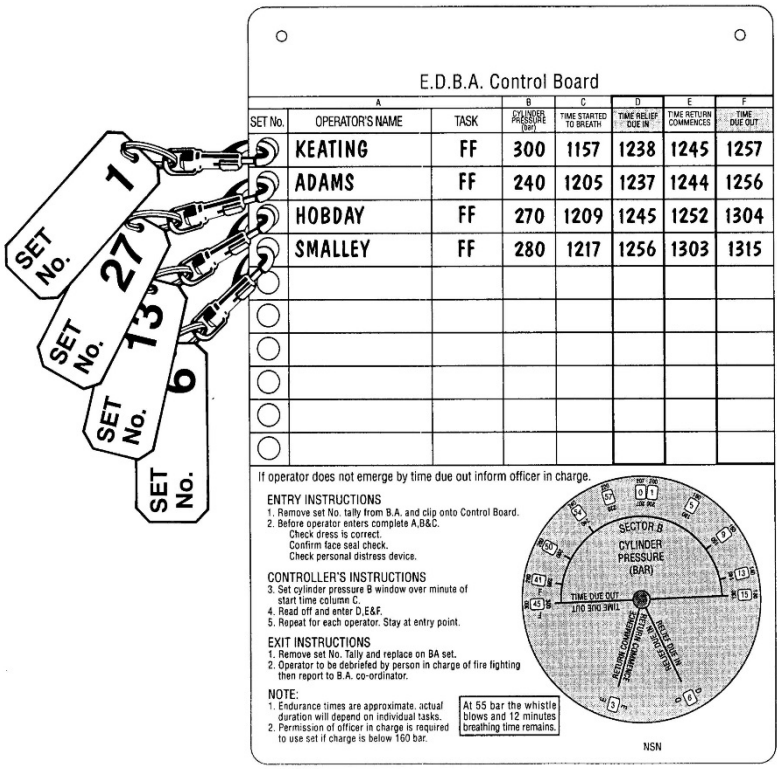
h. Repeat for each BA wearer. Stay at the entry point.

Note. *When acting as BA Controller for the Attack BA, the Controller is to obtain a BA control board and enter on it the time of the fire alarm as the 'time started to breathe'. The BA Controller may not see the Attack BA Team prior to their entry and must assume that their initial BA pressure, as entered on the control board, is 160 bar (for EDBA).*

2111. BA Tote Board

The BA Coordinators Tote Board is illustrated at Figure 21-5. It is used by the BA Coordinator to keep a running record of the location and state of all BA sets and spare air cylinders available for Damage Control.

Figure 21-4. EDBA Control Board



2112. Breathing Apparatus Dump

a. **Forming The Dump**. The location of the BA dump should take into consideration:

(1) Location of the fire.

(2) Proximity to the Flight Deck (flying ops), weapons, sensors and areas where guardrails have been ‘struck’.

(3) Access to charging facilities.

(4) Weather conditions (rain, etc).

(5) Location of gangway(s) and potential Fire Rescue Service BA Dump/Forward Control Point.

(6) Availability of communications with HQ1/SCC/OOD.

Note. *If, after the initial location of the BA dump has been piped, the BA Coordinator considers that a move to another, more suitable, location is appropriate he should inform HQ1/OOD and re-locate the dump.*

b. **Setting Up The Dump**

(1) In forming the dump, all BA and associated equipment must be collected where possible.

(2) The collection of BA and associated equipment should start in areas adjacent to the scene of the fire to minimise possible loss of equipment should the fire escalate.

(3) When sets are collected from lockers all associated items should be removed and taken to the dump, ie control boards, board markers, hoods and gloves, etc.

(4) As BA and other items arrive at the dump they should be placed in separate areas as designated by the BA Coordinator, ie useable sets, spare cylinders (full), spare cylinders (empty), extension sets.

(5) All sets should be checked on arrival at the dump to ensure that they:

(a) Are not defective.

(b) Are fully charged.

(c) Have all straps fully extended.

(d) Are recorded, along with all associated items on the Tote Board.

2113. Procedure for use of Cylinder Indicator Tabs

The cylinder covers have a Velcro tab that may be used to indicate the state of charge and should be used in accordance with the procedures below:

a. **Cylinders not connected to EDBA Sets.** The Velcro tab should only be used to indicate the status of cylinders not connected to an EDBA set. The tab is to indicate ‘FULL’ if the cylinder is within 10 Bar of the declared HP air Ringmain pressure otherwise it should indicate ‘M.T’.

b. **Cylinders connected to EDBA Sets**. If the cylinder is connected to an EDBA set the Velcro tab should be located against the harness back plate and not clearly visible, therefore the pressure gauge is to be used to determine the status of the cylinder.

c. **Cylinders stored in cylinder stowages**. Only Cylinders charged to within 10 Bar of the declared HP air Ringmain should be stored in cylinder stowages, thus there is no requirement to display the indicator tab. Cylinders stored in cylinder stowages are to be orientated to display reflective stripe.

2114. EDBA - Periodicity of Checks and Controls

In order to maximise EDBA reliability and reduce unnecessary work EDBA checks are to be carried out weekly when the following routine has been adopted and briefed:

a. **Check Routine.** Weekly and after each occasion of use EDBA sponsors/nominated personnel are to conduct EDBA checks paying particular attention to ensuring that the set is fully charged (ie 300 bar maximum or within 10 bar of the ships declared ringmain pressure). Most units already manage EDBA and other safety equipment checks by planning an 'EDBA Day' or a 'Safety Day' - this approach facilitates QA as well as acknowledging the importance of these checks and this approach is strongly recommended. On completion of satisfactory checks a tamper proof tag is to be fitted to the securing arrangement on each EDBA locker door in such a way that the door cannot be opened without breaking the tag. The date checked and the cylinder pressure is to be annotated on the door and the EDBA log signed. The date checked is also to be annotated on the tamper proof tag in permanent ink. The 'sealed' EDBA contained within will normally require no further checks for 1 week providing the tamper proof tag remains intact. If ships staff discovers a locker with a damaged or missing tag, HQ1/SCC is to be informed and action is to be taken to re-check the BA set before a replacement tag is fitted. RFAs already implementing a weekly routine, apart from fitting a tag, are to revise onboard routines and comply with these changes. Under certain circumstances, there may be a requirement to reduce the periodicity of the EDBA checks eg the EDBA sets dedicated for flight deck use. As part of Standard Operating Procedures prior to flying stations the EDBA locker tamper proof tag is to be checked intact and the date of test/cylinder pressure is to be checked in-date and correct iaw BRd 766 - Embarked Aviation Operating Handbook.

b. **EDBA Log.** Annex 21A details the EDBA log sheet to be locally reproduced and adopted uniformly across the Fleet. Planning routine exercises in different areas of the ship will clearly reduce the requirement to use more than one set of forms per week.

c. **Training.** Tamper proof tags are designed for single use only and are designed to break easily on opening EDBA locked doors. These tags can be obtained from Naval Stores via BRd 2170(3) and are the only tags to be used.(NSN 4210-99-5008659).

d. **Maintenance.** The cylinder is to be cool before stowage and all locker contents accounted for. Environmental factors affect the cylinder pressure and to allow for this a 10 bar drop in cylinder pressure is permissible over the period of a week. A pressure drop in excess of this will require investigation by the maintainer.

Figure 21-5. BA Coordinators Tote Board (not to size)

BA Co-ordinators Tote Board

Breathing Apparatus						Cylinders				
IDENT NO	Stowage Location	Serviceable	Defective	In Use	At BA Dump	IDENT NO	Stowage Location	Charged	Empty	At BA Dump
1						1				
2						2				
3						3				
4						4				
5						5				
6						6				
7						7				
8						8				
9						9				
10						10				
11						11				
12						12				
13						13				
14						14				
15						15				
16						16				
17						17				
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23						23				
24						24				
25						25				
26						26				
27						27				
28						28				
29						29				
30						30				
31						31				
32						32				
33						33				
34						34				
35						35				
36						36				
Total From Ship						Total From Ship				
Total From Other Sources						Total From Other Sources				
Total						Total				

* Re-entry BA - Not To Be Removed To BA Dump

BA Controller	Task Of Team

BA Charging Points

	Location	Available	Operator Name
1			
2			
3			
4			
5			
6			

SECTION 2 - EMERGENCY ESCAPE BREATHING DEVICE

2115. Purpose and Function

The Emergency Escape Breathing Device (EEBD) is a one-shot, short duration re-breathing set that provides respiratory protection for personnel escaping from a toxic or smoke-filled atmosphere. It is not suitable for heavy use (such as firefighting, rescue or repair work). EEBD is automatically activated when it is withdrawn from the base of its container and has a minimum working duration of 10 mins (at a hard working rate) from the time of activation. It is normally stowed in racks located in compartments containing personnel, but it can also be worn on a belt. The unit fits into existing stowages however modification of the securing strap is required. EEBD is approved for use within magazines provided that there is no more than 1 unit per 1 m³ compartment volume. Should a person wearing respiratory protection that does not support life in an oxygen deficient environment, ie General Service Respirator (GSR), encounter a toxic or smoke filed environment they should immediately remove that device and don EEBD.

Figure 21-6. Emergency Escape Breathing Device (EEBD)

2116. Description

The EEBD is fully described in BR 9322. The device, illustrated at Figure 21-6, is stowed in an orange coloured plastic case and comprises of:

a. A mouthpiece.

b. A nose clip, permanently attached to the mouthpiece.

c. A neck strap.

d. An oxygen cylinder, gauge and regulator.

e. A scrubber to remove carbon dioxide from exhaled air.

f. A breathing bag, which receives oxygen from the regulator and exhaled air from the user.

g. A face shield to provide head and eye protection from smoke. This is not part of the breathing circuit.

h. A plastic cover and base which encapsulate the device until it is used.

2117. Operating Instructions

To use an EEBD, proceed as follows:

a. Remove EEBD from the orange stowage case.

b. Lift the yellow lever and discard the cover.

c. Remove the unit from the base by pulling the yellow neck strap upwards.

d. Insert the yellow mouthpiece, so that the flange seals between the lips and gums. Gently bite on the mouthpiece.

e. Inhale through the mouth.

f. Fit the yellow nose clip.

g. Adjust the yellow neck strap, if necessary, by pulling upwards on the O-ring.

h. Don the face shield and pull outwards on the O-rings to tighten it around the neck.

i. Escape.

j. If vision is impaired by condensation, rub the inside of the face shield against the face to clear it.

2118. EEBD In-Service Life

EEBD has a 15 year in-service life from the date of manufacture when retained within the storage case. A 5 year limit is imposed when EEBD is belt worn or stowed outside the storage case. After 5 years the unit must be returned to its storage case for the remaining 10 years of life. Each EEBD and its stowage are to be given a local number for identification purposes and tracking of belt worn units (3M self-adhesive labels are ideal). For ease of maintenance and control, wearing an EEBD in the belt mode for a day does not need to be recorded against the 5 year period. Only when a unit is worn for a continuous period in excess of 30 days is it to be recorded as part of the 5 year limit. When belt worn the EEBD is subject to user checks and must be regularly checked. A more comprehensive description is contained within BR 9322.

2119. EEBD - Operations Room Use

The routines currently used within the operations room at States 1 or 2 are to be adapted for EEBD. If insufficient stowage racks exist within the operations room nominated sets are to be removed from adjacent flats, attached to a belt and placed at the operators chair as dictated by the readiness state.

2120. Maintenance

EEBD is a one-shot device that requires no maintenance other than a regular visual check. The inspections described below are to be carried out before use or at the beginning of each watch if belt worn. If stored, the following visual inspection should be carried out annually:

a. Check the presence of the tamper proof ball.

b. The gauge needle should be in the green zone. If it is in the red zone or on the white zero pressure mark, the unit is not to be used. Should the view of the gauge be obscured the unit is to be withdrawn from service.

c. Visually inspect for indications of high force impacts checking for:

(1) Cracks, burns, or deformation of case.

(2) Excessive gaps between the cover and base.

(3) Damage to the latch or cover band.

(4) Dirt, debris or moisture visible through the gauge window.

(5) Damaged or broken belt loops.

d. Check that the unit has not exceeded the life date.

CAUTION

Should the EEBD fail any of the above inspections the unit should be removed immediately from service. The replacement procedure is detailed in BR 9322.

2121. Training Model

To avoid expensive use of operational EEBDs during training, a special reusable training model is provided in a distinctive blue case. It has the same dimensions as the operational EEBD but contains dummy oxygen and scrubber system components. The mouthpiece simulates breathing resistance and should be disinfected after each use. All ships staff are required to don a training model at 6 monthly intervals as a minimum qualification period. Successful completion of EEBD training is to be recorded by the WSQ in the CBRNDC Training and Material Assessment Log. CBRNDCQs are to incorporate EEBD training into damage control circuit training and Harbour Fire and Emergency Party (HFEP) briefs. Live units are used during BSSC, CBRNDC 35 and OST and their use is to be recorded as counting towards an individual's training requirement. To facilitate onboard EEBD training a lecture plan is provided at Annex 27B, an example of the recording of onboard training see Table 21-1 and a blank Training Record Form provided at Table 21-2.

Table 21-1. Example EEBD Training Record Form

NAME	SERVICE NUMBER	RANK/ RATE	LAST TRAINED	LIVE/ TRAINER	TRAINING METHOD (SHIP/FOST)
BLOGGS	D128371D	ET(ME)	06/01/09	TRAINER	SHIP
JONES	D123123T	LET(ME)	13/01/09	LIVE	FOST

Table 21-2. EEBD Training Record Form

NAME	SERVICE NUMBER	RANK/ RATE	LAST TRAINED	LIVE/ TRAINER	TRAINING METHOD (SHIP/FOST)

ANNEX 21A

WEEKLY EDBA LOG

GUIDANCE NOTES

1. A full check of all EDBA is to be carried out weekly on ‘EDBA Day’ by nominated personnel from the HFEP/SSEP/HQ1.

2. After the initial weekly check detailed above and on a separate day a 10% check of all EDBA is to be carried out each week by a nominated Senior Rate/ Department CBRNDC Q at sea and in harbour. They are to sight and sign the log ensuring all defects are rectified.

3. The DMESR (in harbour) or the /I/C Main Group (at sea) are to sight the log daily and initial to that effect in order to pick up defects resulting from exercises or compromised EDBA lockers (ie tags broken).

4. A 100% check of all EDBA spare bottles is to be carried out weekly by: (ship to nominate). The log is to be signed on completion.

5. On ‘EDBA Day’ this log is to be completed by 0930 (Sea) or 1 hour after the Duty Watch handover. Defects to be reported to: (ship to nominate).

6. This log is to be completed 1 hour after every fire exercise (defects are to be reported and actioned immediately). Columns headed ‘Pressure’ and ‘Signature’ are to be completed on each occasion for sets used during exercises.

7. SSEP/HFEP to enter relevant code letter in column marked ‘code’ and sign.

8. An additional section is provided to enable individual sets to be checked or used for training.

9. The following items are to be mustered with any deficiencies reported to DMESR (in harbour) or the I/C Main Group (at sea):

a. EDBA set.

b. Fire fighting hood.

c. Anti flash gloves.

d. Set number tally.

e. Control board (as required).

f. Marking pen/chinagraph.

g. User checks and face seal check instructions.

h. Guideline (as required).

WEEKLY EDBA LOG

WEEKLY EDBA LOG									WEEK COMMENCING				
SET PRESSURES					Code: A=SSEP, B=HFEP, C=HQ1				SIGNATURE				DEFECTS/COMMENTS
SET	DATE 1	DATE 2	DATE 3	DATE 4	1	2	3	4	1	2	3	4	

WEEKLY EDBA LOG (Cont'd)

WEEK COMMENCING: USE THIS SECTION TO RECORD INDIVIDUAL SET DEFECTS/MISSING TAGS/TRAINING				
DATE	**SET NO**	**REASON FOR CHECK**	**NAME**	**SIGNATURE**
DAILY QA CHECKS TO BE COMPLETED BY: DMESR (IN HARBOUR) OR THE I/C MAIN GROUP AS SEA				
WEEKLY QA CHECKS				
DATE	**PERSONAL DETAILED**	**ACTION**	**NAME**	**SIGNATURE**

CHAPTER 22

PUMPING, DRAINING AND BALLASTING

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2203.	Ballasting Arrangements
2204.	Suction Lift and Discharge Head
2205.	Pump Performance
2206.	Portable and Mobile Pumps
2207.	Firefighting Pumps
2208.	Mobile Pump
2209.	Portable Diesel Pump
2210.	Portable Submersible Pumps
2211.	Eductors
2212.	Overboard Discharge Connections
2213.	Electric Submersible Pump Power Sockets
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Annex 22A	WEDA Electrical Submersible Pump
Annex 22B	Diesel Driven Emergency Fire Pumps

CHAPTER 22

PUMPING, DRAINING AND BALLASTING

2201. General

Pumping, draining and ballasting arrangements are provided in ships for the following main purposes:

a. To pressurise the HP seawater system for firefighting, domestic use, etc, and to provide water via the LP seawater system for machinery cooling, etc.

b. To remove water that has been let into the ship either deliberately or as a result of damage or firefighting.

c. To introduce seawater into specified compartments to correct adverse heel and/or trim to improve stability.

2202. Drainage Arrangements

a. Weather decks and tops of superstructures are fitted with scuppers to drain loose water overboard. Pipes from the scuppers are led directly to ships side outlets and are not usually fitted with storm valves (simple flap valves). Drains from internal compartments are either led to drain tanks or sumps, or directly overboard. If the latter, they are fitted with storm valves which can be shut. Shutting the storm valve prevents flooding back into the compartment if the ship heels or trims after damage. Storm valves are usually operated from a higher deck through rod gearing. Drain tanks and sumps are pumped out by fixed or portable pumps or eductors. Scuppers and drains are not to be interconnected because of the risk of spreading flooding between compartments and of spreading contamination if prewetting is being operated in an CBRN environment. In ships with pressurised citadels, all drains serving compartments inside the citadel must be fitted with 150 mm ‘U’ water seals or closed to achieve Citadel pressure.

b. Some classes of Ship have screwed plugs are fitted in some decks to allow excessive water, due to firefighting, to be drained down to lower compartments which are fitted with fixed eductors. Permission to drain down water through these plugs must be given by HQ1 prior to use. Drain down plugs within or adjacent to the red risk zone are to be marked with red dots to indicate the need to ensure they are closed at the order **“Close all red openings”**.

2203. Ballasting Arrangements

The method used to fill a compartment with seawater is through fixed or portable connections from the HP seawater system to the designated compartments for either:

a. Ballast tanks to compensate for consumed stores.

b. To improve the ships attitude after collision or action damage.

c. In Assault ships, a number of ballast tanks are fitted for flooding and pumping to enable the ship to be used as a floating dock. The considerations that govern counterflooding action are referred to in Chapter 12.

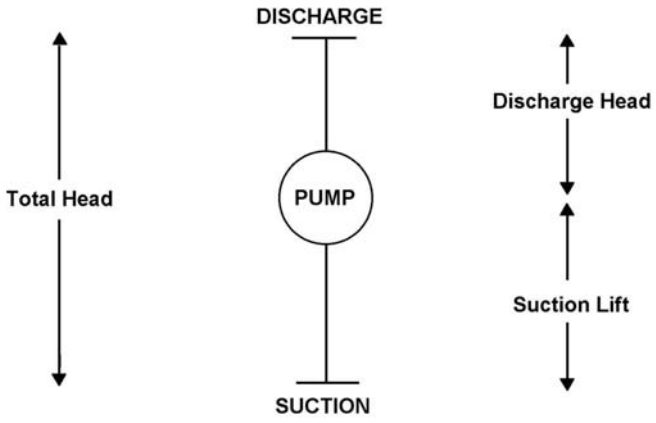
2204. Suction Lift and Discharge Head

Suction lift refers to the ability of a pump to lift water from below. In the ideal situation, with a perfect vacuum, water can be raised 10 m. In practice the pumps used in the RN will lift water through two decks If the lift required is more than 5-6 m then a submersible pump must be selected. The head to which a pump will discharge depends on the pump discharge capacity.

2205. Pump Performance

The capacity of a centrifugal pump is related to 'total head' which is the suction lift plus the discharge head (see Figure 22-1). Pumping capacity is affected by system head losses due to fittings in the pipework such as valves, bends etc, friction in the associated pipework and the difference in height between the suction point and the discharge point. Thus, when rigging a pump the shorter the suction hose, and hence suction lift, the better the pump performance for firefighting and pumping out (see Annex 22A and Annex 22B for pump capacities).

Figure 22-1. Pump Head



2206. Portable and Mobile Pumps

These pumps are defined by as follows:

a. **Portable Pump**. A pump, generally weighing less than 100 kg, which can easily and quickly be moved without mechanical aids, between compartments and decks of a ship.

b. **Mobile Pump**. A pump, that can be moved between compartments and decks of a ship falling outside the definition of a portable pump.

2207. Firefighting Pumps

A Mobile independently driven, diesel pump (Desmi S100 LDW 2004) is provided for firefighting duties when normal HPSW main and electrical power supplies are damaged or destroyed. Additional Portable independently driven, diesel pumps (Desmi mk 2, Desmi mk 3 and GN 500) should never be connected to a pressurised HPSW main and should always be used independently unless all other internal HPSW pumps have failed on the Ships ring main These pumps will also provide emergency standby firefighting capability for ships in dock, or alongside when ships generating capacity is not available and shore facilities are limited. See BRd 2170 Volume 7 series for further platform specific operation configurations.

2208. Mobile Pump

The mobile diesel pump is to be semi-permanently installed in its working position adjacent, and connected by the portable hoses, to a sea suction standpipe and also the exhaust outlet. The two pump discharges are to be connected by two No 3 delivery hoses to the HPSW system via two hydrants sited in close proximity to the pump position, and two double male instantaneous coupling adaptors provided for this purpose.

Note. *The mobile diesel pump is too heavy for normal mobility, as defined in Para 2206 sub para b. In ships where a common working and storage position cannot be achieved a mobile gas turbine pump is provided.*

2209. Portable Diesel Pump

a. This pump is to be stowed in a readily accessible and sheltered position off the Weatherdeck complete with suction, delivery and exhaust accessories. It may also be used for pumping out and for the assistance of other ships or services in distress.

b. When diesel pumps are used outside the ship (or inside for pumping out free water), the suction hoses are to be fitted with a suction strainer at the free end. When used inside the ship for firefighting, the suction hose is to be coupled to a sea suction standpipe and flexible exhaust hoses (maximum 4 x 3 m lengths) are to be provided to carry the exhaust fumes to the open air through doors, hatches or the special exhaust outlets provided in the ships structure.

2210. Portable Submersible Pumps

Portable, electrically driven, submersible pumps are provided for damage control duties. They are normally classified as drainage pumps rather than salvage pumps in order to differentiate between the damage control pumps used on warships for pumping out and the pumps used by specialised ships for salvage operations. The submersible electrically driven pumps are provided, primarily, for damage control duties but they can also, if needed, be used for firefighting subject to their limitations and the availability of electrical power. See Annex 27A for series connection of WEDA pumps for firefighting.

2211. Eductors

There are two types of Eductor, both using HPSW flow through a venturi to create a suction:

a. **Fixed Eductors**. These are fitted in machinery spaces, cable lockers and other compartments, low down in the ship, with a high probability of water ingress.

b. **Portable Eductors**. These are normally stowed at FRPP lockers and can quickly be rigged and supplied by hose from the HPSW main. They are supplied with non-collapsible suction hoses, clamps and a strainer. The discharge is led, by a No 3 hose, to an overboard discharge connection or to the upper deck.

2212. Overboard Discharge Connections

Overboard discharges are provided for use with portable pumps, in conjunction with collecting head adaptors, (twin female instantaneous connections) to enable a single or twin run of discharge hoses to be connected from a pump.

Overboard discharges are fitted at readily accessible positions to a minimum of one in each watertight section along the lowest communication deck, and sited alternately on port and starboard sides of the ship. In larger ships, or where access is not available across the ship, two discharges are fitted in each watertight sub-division, one port and one starboard. Where discharges are sited in an enclosed compartment a tally plate worded **PORTABLE PUMP OVERBOARD DISCHARGE INSIDE COMPARTMENT** in black letters on a white background is to be sited adjacent to the door of the compartment, (and not obscured by it when it is open). Some Classes of Ship require special discharge overboard adaptors.

Figure 22-2. Portable Eductor

2213. Electric Submersible Pump Power Sockets

Power sockets for portable pumps are sited on, or near, the centre line of the ship on the lowest commuting deck.

2214. Pump Stowages

Stowages for portable pumps and their accessories are sited on the lowest commuting deck adjacent to the FRPP/ZCP lockers. Covers are provided for pumps that are not stowed within a locker. Securing arrangements are provided for all pumps.

2215. NATO Standard Flange Adaptors

A range of adaptors, is carried by NATO ships to facilitate interchangeability of damage control and firefighting hose connections. This allows for the transfer of independently driven portable pumps between ships of different nations. One end of each adaptor has the appropriate national connection, but the common features are the standard NATO flanges at the other end. Refer to BRd 2170(3).

ANNEX 22A

WEDA ELECTRICAL SUBMERSIBLE PUMP

1. Description

The WEDA, electrically driven, portable pump operates submerged in the water to be pumped. This pump is provided primarily for pumping out loose water. When two pumps are used in tandem (or series) they provide a very useful emergency firefighting system. In the latter case suction can be taken from overboard or from a flooded compartment/tank onboard. The pump must be lifted or lowered using the handle (with rope attached), and not by the electrical cable. The cable is to be whipped to the lowering rope at 450 mm intervals. When using a WEDA pump during a flooding incident, consideration should be given to leaving the pump unsecured. If secured, the likelihood of being unable to retrieve the pump should the situation in the compartment deteriorate should be weighed up against the safety of personnel, especially if the ship is in State 1 and further action damage could occur. When the ship is conducting training the WEDA pump may be lashed in position for safe operation.

Figure 22A-1. WEDA Electric Submersible Pump

2. Pumping Out

When used for pumping out loose water, the WEDA pump is to be fitted with the twin discharge piece, which has two female instantaneous couplings. One size 3 hose is sufficient for the pump discharge. If only one hose is used, the unused connection on the twin discharge piece must have a blanking plug fitted. Alternatively, two hoses may be used.

3. Emergency Firefighting

Two WEDA pumps, connected in series, can be used in the firefighting mode. The first pump (which is taking suction) is fitted with a 100 mm discharge adaptor (as supplied) and a 100 mm discharge hose to the second pump that has the series coupling conversion kit on its suction side. The second pump is fitted with a twin discharge piece, supplying two hoses for firefighting. A total of four hoses may be supplied, by fitting Y pieces, but only in extreme emergency due to the reliance on a single source.

4. Pump Accessories

a. A switched emergency ‘rat tail’ connector.

b. A 10 m length of 100 mm discharge hose.

c. A twin 60 mm instantaneous female discharge piece.

d. 2 x 100 mm hose connectors.

e. One series coupling conversion kit per two pumps.

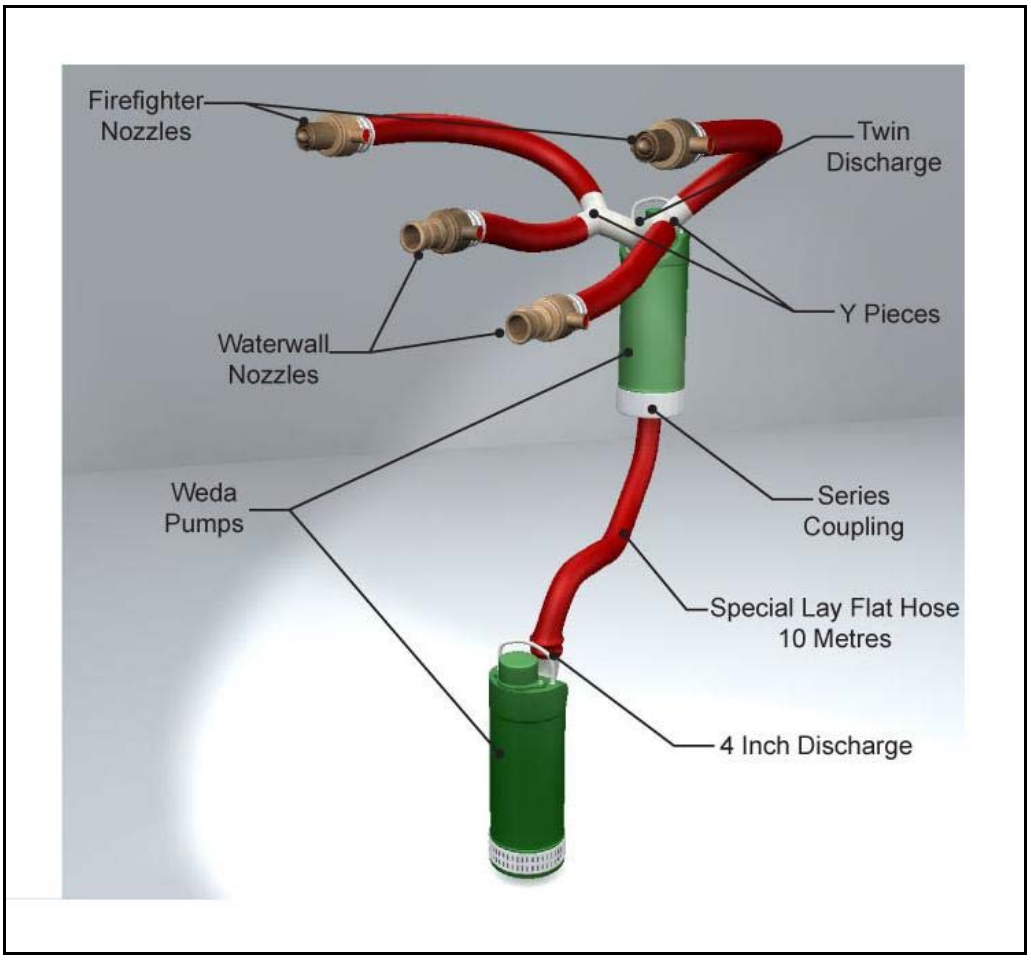
f. One electrical adaptor lead per pump.

(1) Type A – Hunt class only.

(2) Type B -all other platforms.

g. A trolley and stowage bracket is provided one per pump.

Figure 22A-2. WEDA Pumps in Series



5. Pump Particulars

a. **Weight (dry):** 59 kg.

b. **Performance:** 100 m³/hr at 1.8 bar.

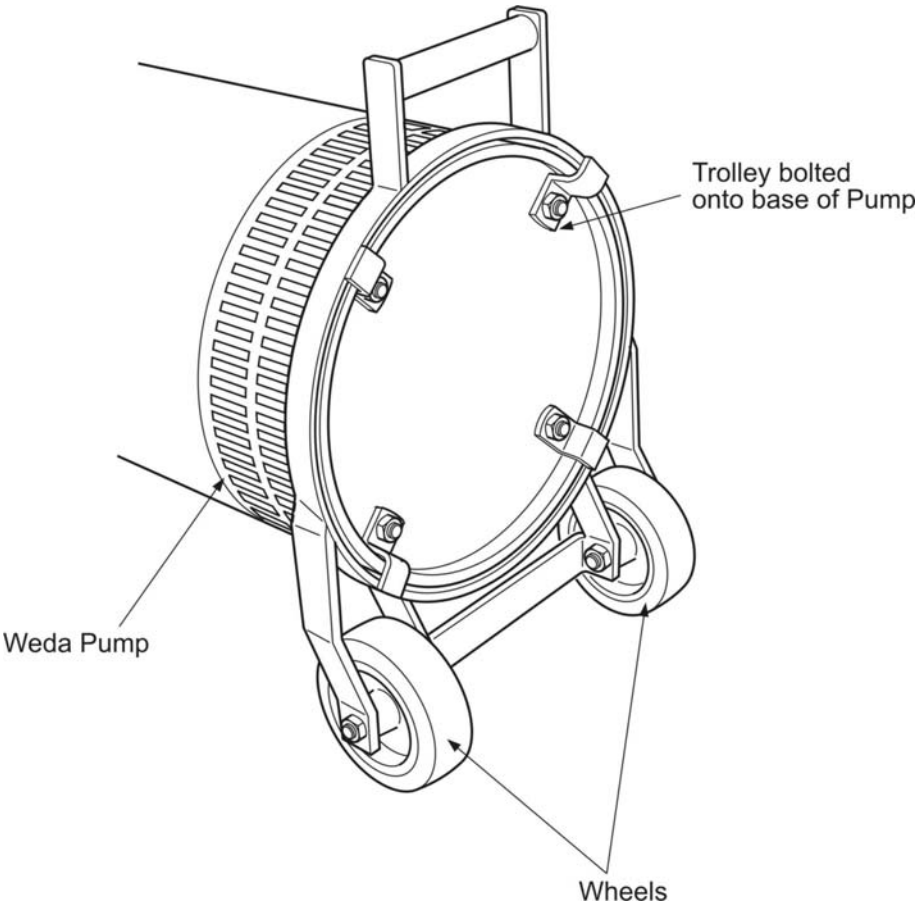
c. **Size:** 762mm tall, 277 mm wide.

d. **Power supplies:** 440 V 3-phase 60 Hz (full load 13.5 amps).

6. Handbook

Full details are published in DBR 6570(662).

Figure 22A-3. WEDA Pump Trolley



ANNEX 22B

DIESEL DRIVEN EMERGENCY FIRE PUMPS

1. Overview

The RN currently utilise several different Diesel driven emergency fire pumps in support of pumping and flooding efforts onboard our vessels or when providing aid to merchant shipping. Additionally the Diesel driven emergency fire pumps can be utilised to supplement the HPSW ring main in the event of a Total electrical failure (TLF) or utilised as a standalone pump for firefighting efforts.

2. Godiva GN 500

A Portable pump with a static suction height of 3.5M, capable of supplying two hoses. It is 2 person portable and can be “wheelbarrowed’ by one person. It will fit through a 610mm hatchway. Ideally this pump should be stowed in a dry stowage close to the upper deck and run weekly. Full details are published in BR 6570(620).

Pump Particulars:

- weight (dry without fuel tanks): 113 kg;
- fuel (diesel) F76: 5.1 ltr tank; and
- performance: 33 m³/hr at 2.75 bar.

Figure 22B-1. Godiva GN 500, Diesel-Driven, Portable Firefighting Pump

3. DESMI SP D3-2 Mk 2 & Mk 3

A Portable pump with a static suction height of 6M, capable of supplying two hoses. It is 2 person portable and can be “wheelbarrowed’ by one person. Ideally this pump should be stowed in a dry stowage close to the upper deck and run weekly. Full details are published in DBR 7830(93).

Pump Particulars:

- weight (dry without fuel tanks): 113 kg;
- fuel (diesel) F76: 4.1 ltr tank; and
- performance: 40 m³/hr at 6 bar.

The DESMI is supplied in two variations, the Mk 2 has a curved frame at the discharge end and no fixed lifting points. The Mk 3 has a square frame with fixed lifting points.

The DESMI Mk 3 **MUST** be fitted with a lagging pad around the exhaust to prevent damage to the fuel tank.

Figure 22B-2. DESMI SP D3-2, Diesel-Driven, Portable Firefighting Pumps

Mk 2

Mk3

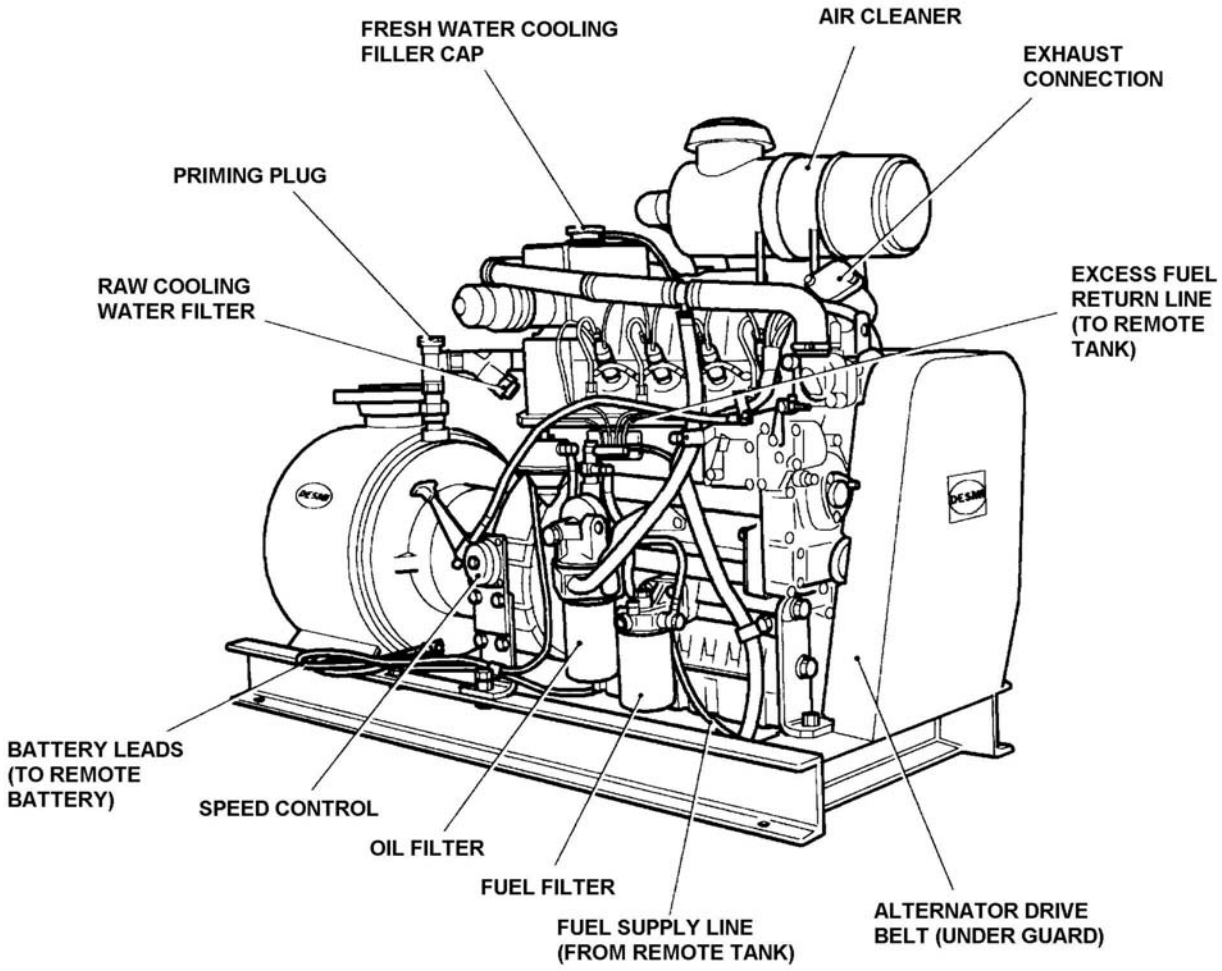
4. DESMI S100 LDW 2004

A Mobile pump with a static suction height of 3.5M, to be run for one hour per week on load, either supplying the HPSW ring main or discharging overboard. NOT to be run against an already pressurised HPSW ring main, this will effect secondary cooling to the exhaust, resulting in damage. Full details are published in BRF 6570(629).

Pump Particulars:

- weight (dry without fuel tanks): 375 kg;
- fuel (diesel) F76: 2 X 25 ltr containers; and
- performance: 100 m³/hr at 7 bar.

Figure 22B-3. DESMI S100 LDW 2004 Diesel Fire Pump



CHAPTER 23

GUIDANCE FOR STABILITY CALCULATIONS

Sponsor: DSMarE Hull

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CHAPTER 23

GUIDANCE FOR STABILITY CALCULATIONS

SECTION 1 - BASIC SHIP STABILITY

2301. Stability Knowledge Requirements

All members of a ships company should have some knowledge of the elementary principles of ship stability. This chapter provides, in easily understood terms, a basic explanation of those principles and the associated terminology. This chapter provides the underpinning mathematical knowledge expected of all those personnel who are required to undertake the stability examination prior to their roles at sea.

2302. Terminology

It is Naval convention to use a lowercase letter when referring to a compartment and an uppercase letter when referring to a ship. Thus, ‘A’ would be the waterplane area of a ship, and ‘a’ would be the waterplane area of a compartment being considered.

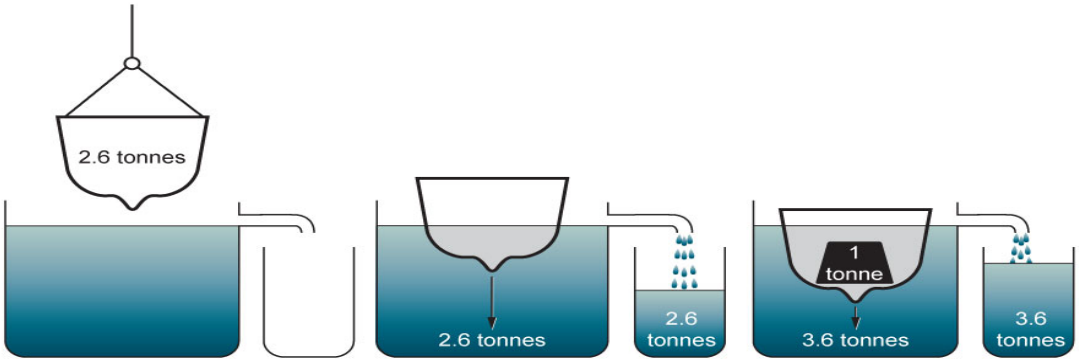
2303. Flotation

A flat sheet of metal placed in a tank of water will sink to the bottom, and the volume of water displaced by it will be equal to the volume of the sheet of metal. If the sheet of metal is moulded into the form of a watertight box it will float on the surface of the water; the volume of water then displaced will be equal to the volume of the immersed part of the box, and its weight will be equal to the weight of the box.

2304. Displacement

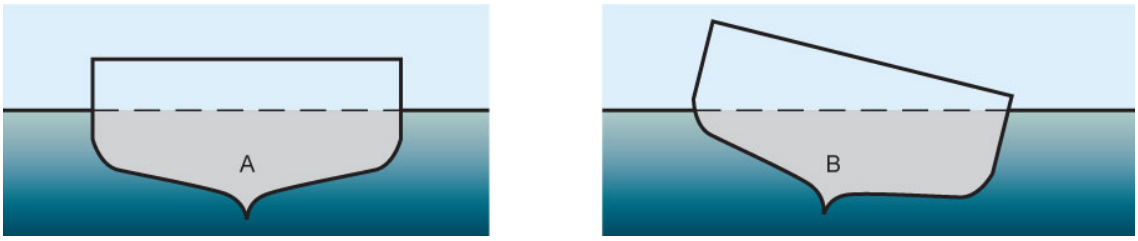
a. The facts are illustrated in Figure 23-1, which represents a boat weighing 2.6 tonnes lowered into a tank of water. When the boat is waterborne, 2.6 tonnes of water are displaced, the volume of which is equal to the immersed volume (shown shaded) of the boat. If a weight of one tonne is placed in the boat she will sink down into the water until 3.6 tonnes of water are displaced, and the volume of water displaced will again be equal to the volume (shown shaded) of the immersed part of the boat. The weight of water displaced always equals the weight of the floating object and is referred to as her displacement.

Figure 23-1. Flotation and Displacement



b. If the boat heels to one side the shape of the immersed part of her hull will alter, but the volume will remain the same. In Figure 23-2 the volume of the shaded portion A equals that of the shaded portion B, and the weight of water displaced is the same in each instance.

Figure 23-2. Heel and Immersed Section Contour

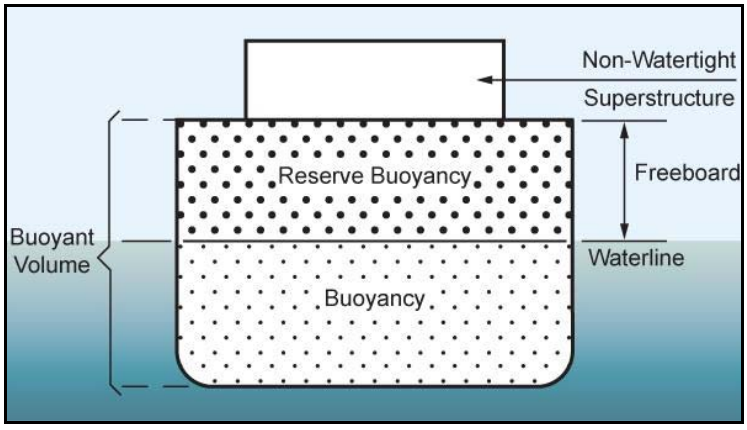


Volume of the shaded Portion A equals that of the shaded Portion B

2305. Buoyant Volume

a. The buoyant volume of a ship is the volume of the entire watertight part of the hull. That part of the buoyant volume below the waterline is called her buoyancy, and that part above the waterline is called her reserve of buoyancy (Figure 23-3).

Figure 23-3. Buoyant Volume



b. Additional loading or flooding after damage will sink a ship lower into the water. Part of the reserve buoyancy then becomes the buoyancy. It is the reserve of buoyancy that largely determines the ships ability to float after flooding damage.

c. The freeboard is the height above the waterline, at the ships side, of the highest continuous watertight deck. As most ships are nearly wall sided ie perpendicular above the waterline the freeboard gives an approximate measure of the reserve of buoyancy.

2306. Centre of Gravity and Buoyancy

A ships ability to float depends upon two factors – her total weight (or displacement) and her buoyancy.

Figure 23-4. Centre of Gravity

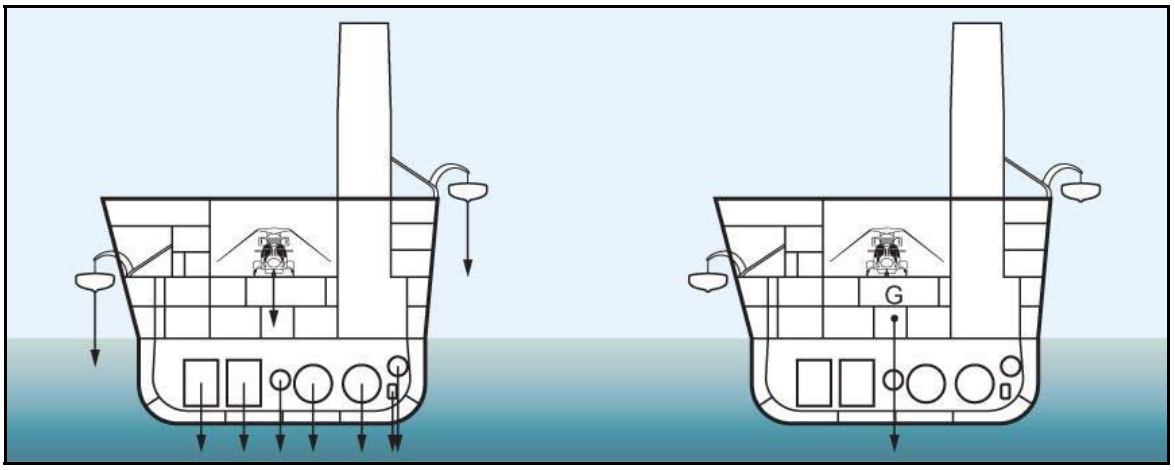
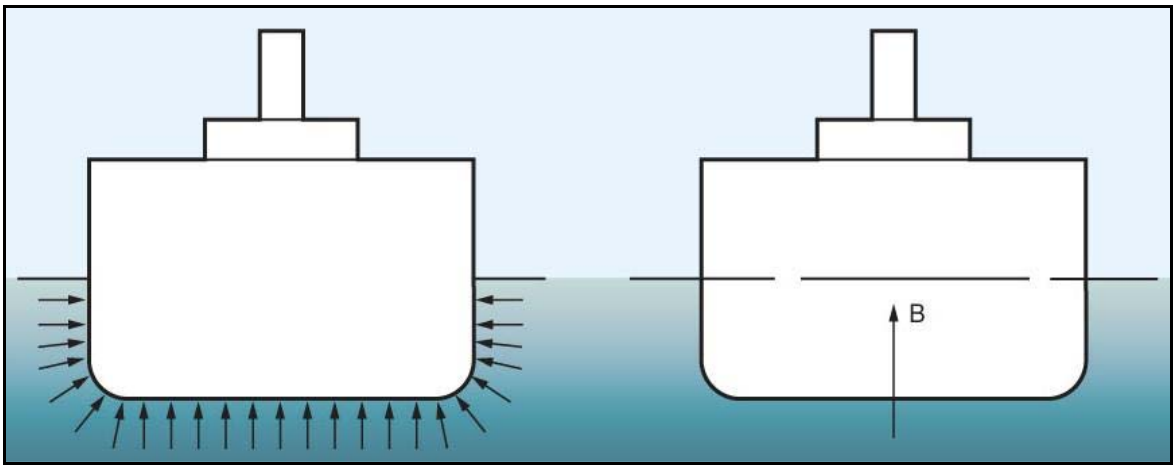


Figure 23-5. Centre of Buoyancy



a. The total weight is the sum of the weights of everything in the ship, including that of all the structure, machinery, armament, fittings, stores, fuel and ships company, and it can be visualised as the effect of exerting a single force through a central point which is called the centre of gravity (usually indicated by the letter G, see Figure 23-4).

b. Buoyancy is the upward force exerted on the ship's hull by the water when she is floating, and it is equal to the weight of water she displaces. Although this force is distributed over all the underwater surface of the ship's hull it also can be resolved into a single force exerted through a central point which is called the centre of buoyancy (usually indicated by the letter B, see Figure 23-5).

c. A ship's hull is symmetrical about a fore-and-aft vertical plane, so B is on the middle line when the ship is floating upright; as the weight in this condition must be distributed symmetrically about this plane, G is also on the middle line.

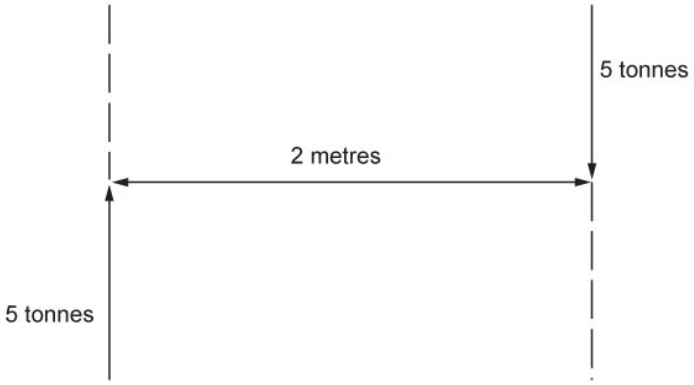
2307. Conditions for Equilibrium

a. For a ship to float in equilibrium the buoyancy force pushing upward on the underwater part of the hull must be equal to the total weight of the ship, and as these two forces balance one another they must be acting in the same straight line Figure 23-7(a).

b. When two equal and opposite forces acting on the same object are not in line these are known as a ‘couple’ and produce a moment tending to rotate the object; this moment is found by multiplying the perpendicular distance between the lines of action of the forces by the force of one of them. This is illustrated by the example at Figure 23-6.

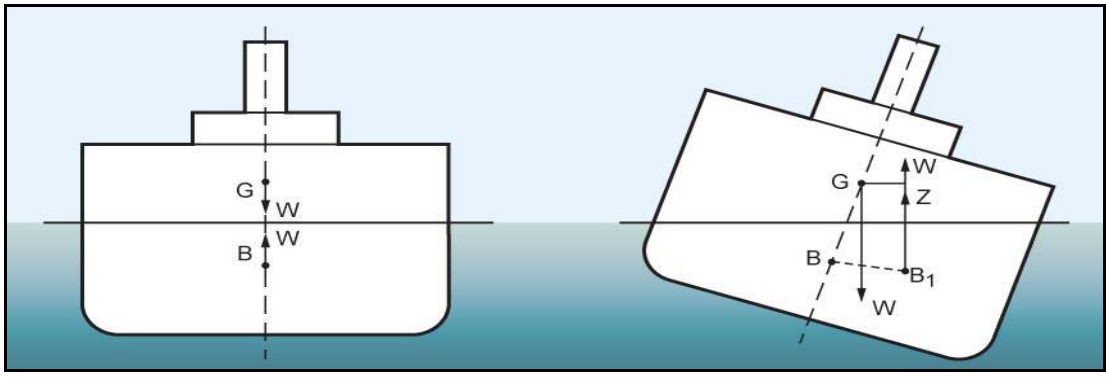
Moment = 5 tonnes x 2 m = 10 tonnes-m

Figure 23-6. Couple and Moment



c. If a ship is heeled over by some external force such as wind or wave, the weight, and hence the position of the centre of gravity, will, for all practical purposes, remain unaltered; but as the shape of the submerged part of the hull will be changed, the centre of buoyancy, B, will move from the middle line towards the lower side of the ship to B_1, as shown in Figure 23-7(b). Hence the forces of weight and buoyancy are out of line and therefore produce a moment tending to return the vessel to an upright position and she is said to be in stable equilibrium.

Figure 23-7. Stable Equilibrium



(a) **(b)**

2308. Righting Moment and Righting Lever

a. In Figure 23-7(b) the righting moment acting on the ship is calculated by multiplying the displacement, W, by the horizontal distance between the resolved forces of weight and buoyancy, GZ. This horizontal distance GZ, which separates the forces of weight and buoyancy as the ship heels, is called the righting lever.

b. The stability of a ship (ie her resistance to heeling forces) at any angle of heel is given by her righting moment, which depends on the size and shape of the submerged part of the hull (which determines the position of B) and also on the distribution of the weights of stores, fuel, weapons, machinery, etc (which determines the position of G). As the weight and the centre of gravity of a ship remain unaltered (apart from small differences due to free liquids) when she is heeled by an external force, her stability can be judged by the length of the righting lever GZ at the particular displacement.

c. Thus it will be seen that the stability of a ship depends on three factors:

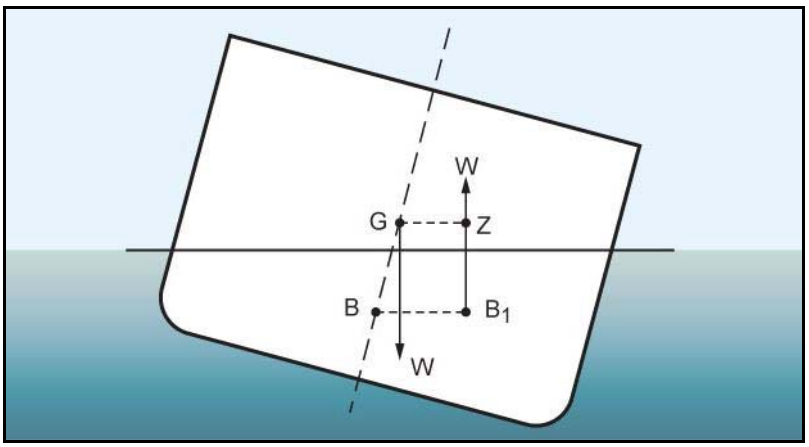
(1) The shape of her hull (both of the part normally underwater and the part liable to be submerged as the ship rolls) which determines the position and movement of the centre of buoyancy.

(2) The arrangement of all weights such as the hull, machinery, stores, weapons and fuel, etc, which determines the position of the centre of gravity.

(3) The positions of the centres of gravity and buoyancy in relation to each other and to the ship.

d. In designing a ship's hull, a compromise must be reached between the requirements of speed, capacity and stability. Too much weight above the centre of gravity, due to superstructures, weapons, radar equipment, etc, may raise the centre of gravity enough to make her top heavy and endanger her stability. Again, a ship whose beam is unduly narrow may not have a sufficiently large righting lever (and thus righting moment) to enable her to recover from a heavy roll. A warship, also, must be designed with enough margin of stability to keep her stable when damaged and partly flooded.

Figure 23-8. Period of Roll



2309. Period of Roll

a. When a ship is rolling, the righting moment produced depends upon the severity of the roll, ie how far the ship rolls from the upright. This righting moment (W x GZ in Figure 23-8) will oppose the roll away from the upright position and hasten the roll back to it.

b. A ship with a large righting moment (ie good stability) will usually roll rapidly. Conversely, a ship with a small righting moment (ie poor stability) will usually roll sluggishly. The period of a ships rolling can thus give an indication of her stability.

c. A ship that is too lively will be uncomfortable; her violent movements may even cause upper deck fittings to be detach themselves from the ship, and, if a warship, will make it difficult to use the weapons effectively or operate aircraft. If too sluggish, however, she will be unsafe in heavy weather, so a compromise in these respects has to be achieved by the designer.

2310. Heel and Trim

a. **Heel**. This is the athwartships inclination of a ship to either side from the vertical however caused; a sailing vessel, for example, may be heeled by the wind to her leeward side.

b. **List**. This is a heel caused by off-centre loading, ie G is not on the middle line.

c. **Trim**. This is the inclination of the ships designed horizontal fore and aft plane with the surface of the water in which she floats. It is the difference between the draughts forward and aft. Warships are generally trimmed (down) by the stern.

2311. Effects of Loading

a. The effects on her stability of adding a weight to a ship will depend on the size and position of the weight, but it will always result in the mean draught of the ship being increased and in her centre of gravity being moved towards the added weight. The latter effect can be illustrated by the simple example given in Figure 23-9 and Figure 23-10.

b. If two equal weights are hung equidistantly from the middle point of a metal bar it will balance about that point because that is the centre of gravity of the whole Figure 23-9.

Figure 23-9. Centre of Gravity

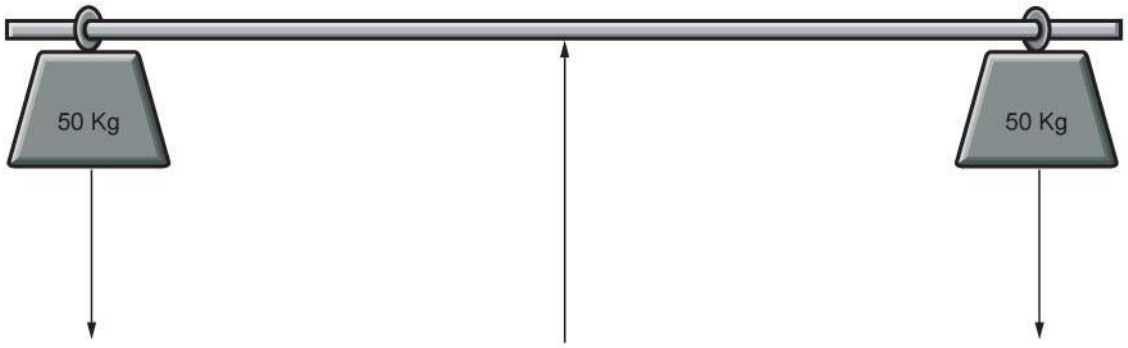
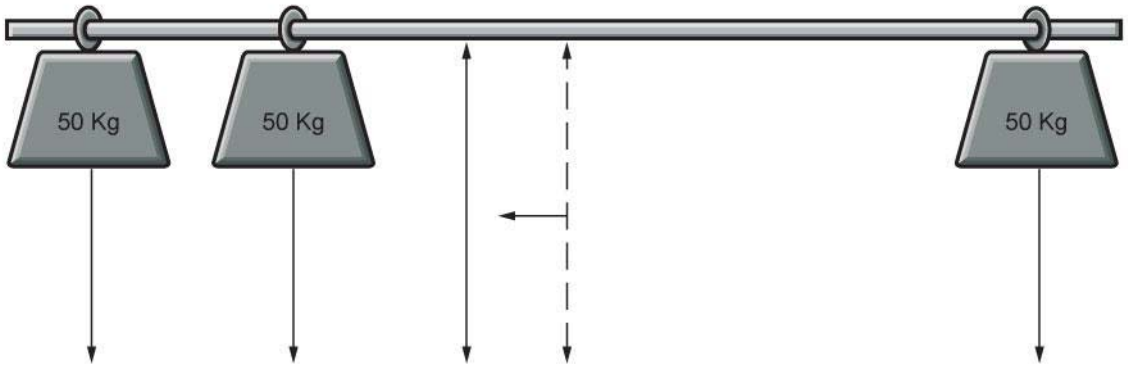


Figure 23-10. Movement of Centre of Gravity

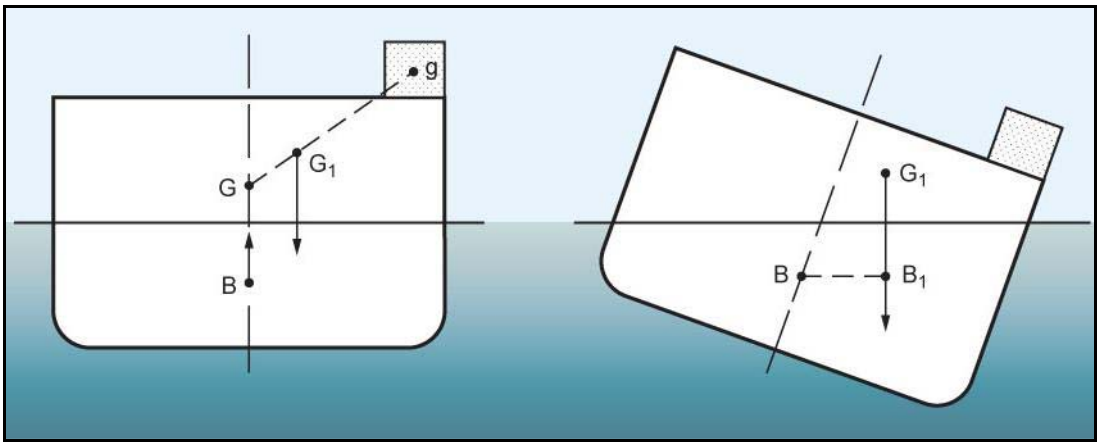


c. If another weight is added on one side of the support (as shown in Figure 23-10), the support will have to be moved from the middle towards the heavier end in order to preserve the balance of the whole. In other words, the centre of gravity of the whole has moved towards the added weight.

2312. Off Centre Loading

When a heavy weight is added on either side of a ship, her centre of gravity moves towards that of the added weight, ie from G to G_1 in Figure 23-11(a). The weight and buoyancy forces are no longer in the same vertical line and so they produce a moment that will list the ship towards the side on which the weight was added. As the ship lists, so B moves towards the low side until it reaches position B_1 vertically below G_1 as shown in Figure 23-11(b). Then, with the centres of buoyancy and gravity once more in the same vertical line, the ship will float in equilibrium in the inclined or listed position. Removing a weight causes the opposite effect, ie the centre of gravity moves away from the centre of gravity of the removed weight and the ship will list away.

Figure 23-11. Effect of Off-Centre Loading

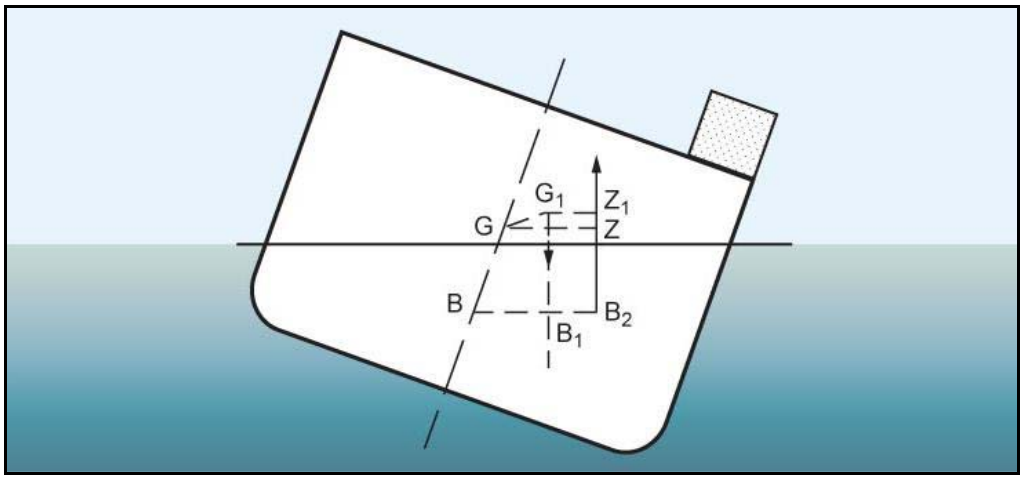


(a) **(b)**

2313. Effect of List on Stability

It may be said that the stability of a ship is reduced by a list because G has moved off the middle line (in Figure 29-12, G has moved to G_1 and B has moved to B_1). Any further heel by an external force in the same direction as the list will produce a smaller righting lever at the particular angle of heel than it would if G were still on the middle line; in Figure 23-12, for example, G_1Z_1 is less than GZ.

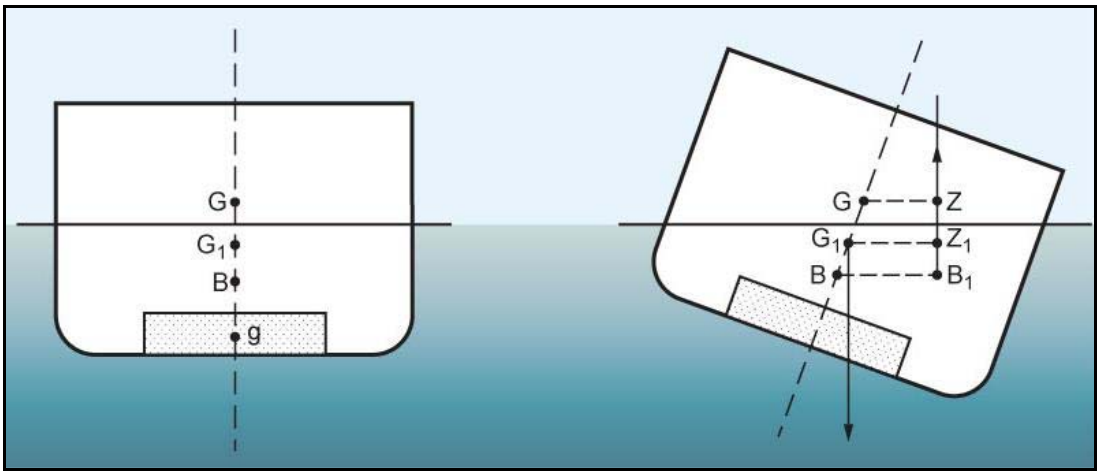
Figure 23-12. Effect of List on Stability



2314. Effect of Ballast

If ballast is added low down in a ship, the position of the centre of gravity will be lowered and stability will be increased. In Figure 23-13, G has moved to G_1 making G_1Z_1 greater than GZ.

Figure 23-13. Effect of Ballast

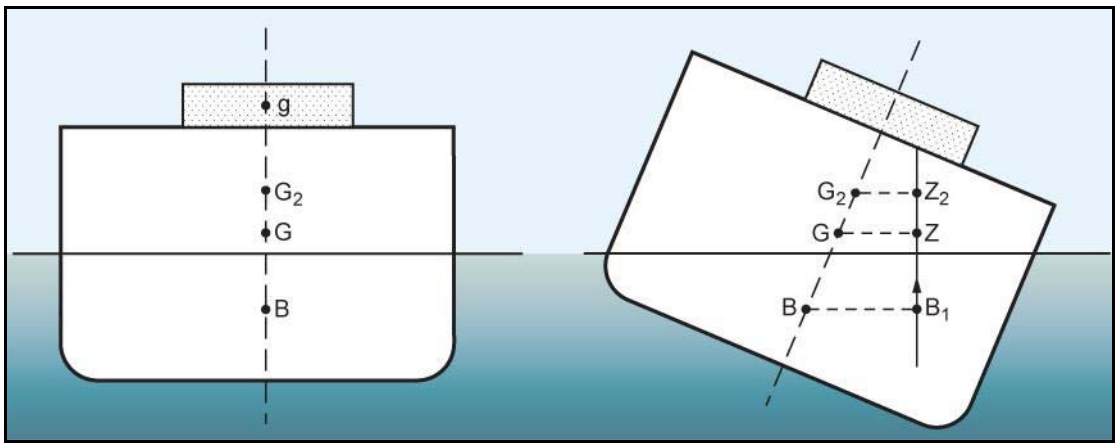


(a) **(b)**

2315. Topweight

If a weight is added high in the ship the centre of gravity will be raised, eg from G to G_2 in Figure 23-14(a), and the stability will then be reduced. In Figure 23-14(b), for example, G_2Z_2 is less than GZ. Top weight is therefore dangerous and must be kept to the essential minimum. A similar effect results from raising weight vertically in a ship. Removal of top-weight, however, lowers G and improves stability. Increase in top weight can arise from such diverse causes as unauthorised additions (to structure or fittings), unnecessary accumulations of paint coatings, equipment and obsolete fittings, and severe icing of topsides. Ships operating in or near the Arctic or Antarctic may experience heavy icing of superstructure, weather decks and exposed equipment. Apart from the loss of stability caused by Topweight, the ice may be asymmetrical (lopsided) and will then cause list. Other evils are overloading of decks, masts and aerials; slippery decks, interference with the handling and operation of topside weapons and equipment. Information on ice prevention and removal is given in Chapter 14.

Figure 23-14. Effect of Topweight



(a) **(b)**

2316. Effects of Flooding

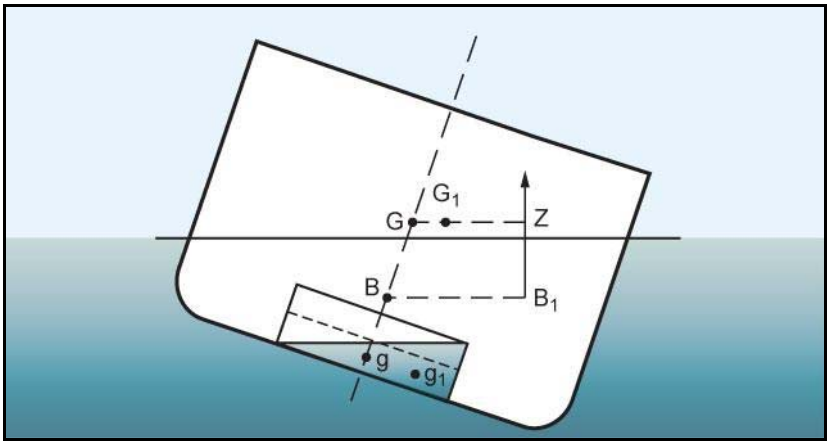
Completely flooding a compartment will have exactly the same effect on the stability of a ship as adding a solid substance of equal weight at the centre of gravity of the floodwater, Figure 23-13. For example, completely filling a centre line fuel tank would ballast the ship and so improve her stability.

2317. Free Surface Liquids

a. If a fuel or other tank is only partly filled, however, the liquid in it has what is called a ***free surface***, being free to run across to the low side as the ship heels or rolls. This will have the effect of moving the centre of gravity of the ship towards the low side, thus reducing the righting lever, so that in the example in Figure 23-15, G_1Z is less than GZ.

b. Free surface liquid therefore reduces stability. The ***free surface effect*** (ie reduction of stability) depends on the area (mainly width) of the free surface liquid but not on the quantity. If liquid with a free surface is added to compartments high up in the ship, during firefighting for example, it will have a more adverse effect on the ships stability than if it were added low down, because it will combine the bad effects of free surface and topweight.

Figure 23-15. Effect of Free Surface Liquid

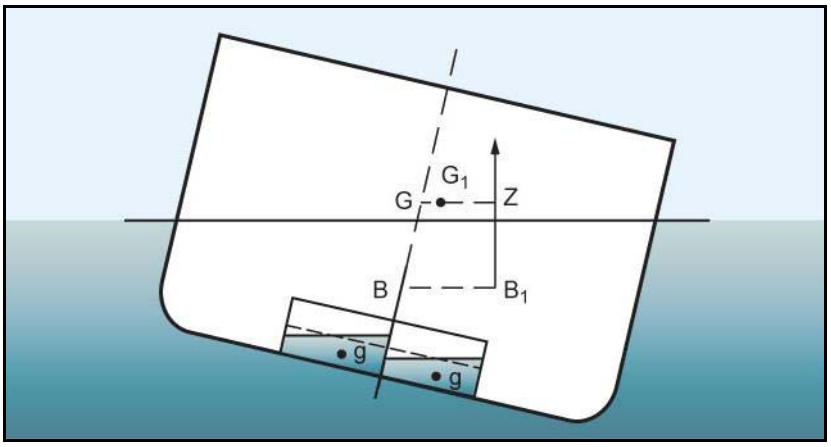


2318. Subdivision of Free Surface Liquids

a. If the tank in the example above were fitted with a middle line bulkhead, Figure 23-16. The centre of gravity of the liquid in it, will not move so far from the middle line when the ship heels or rolls, because the two smaller volumes of liquid will move through shorter distances; the loss of righting lever and stability will therefore not then be so great.

b. For this reason, longitudinal bulkheads may be fitted in fuel and water tanks to break up the free surface and so reduce its effect on the ships stability. For the same reason, and excepting hangars, large areas of unbroken deck space are avoided in warship design as far as possible.

Figure 23-16. Subdivision of Free Surface Liquid



2319. Correction of List

a. Unless caused by damage, list is usually easy to correct. All that is required is to balance the ship and so bring the centre of gravity back to the middle line. There are three ways of doing this:

(1) By removing the off-centre loading, or an equivalent weight on the low side.

(2) By adding an equivalent weight on the high side.

(3) By shifting weights from the low side to the high side.

b. For a damaged ship with off-centre flooding causing a list (that is, generally, a large ship) the first method is usually impracticable because flood water cannot be removed from compartments which are open to the sea, and the weight of this water is so great that there is nothing that can be removed from the low side heavy enough to compensate it.

c. The second method usually affords the quickest way to correct list because, in big ships, the equivalent weight can be added by admitting sea water to wing compartments on the high side as counterflooding. In such ships, valves are usually fitted low down in wing watertight compartments so that they can be flooded direct from the sea.

d. The third method is theoretically the best because it avoids the increase of the ships displacement produced by method (2) (adding weight). In practice, however, it usually means transferring fuel or other liquids across the ship, which is a slow process and not suited to the rapid correction of list. However, when the list has been reduced to a safe angle by counterflooding, pumping across of liquids is undertaken and, concurrently, pumping out counterflood water.

e. List caused by flooding is unusual in DD/FF and smaller ships because there is little or no longitudinal subdivision.

2320. Loll

a. The term loll is applied to the state of a ship that is unstable when in an upright position and therefore floats at an angle or heel to one side or the other indifferently. If disturbed by some external force, such as wind or waves, the ship will lurch to the same angle of loll on the opposite side. Loll is quite different from list, being caused by different circumstances and requiring different countermeasures to correct it, and it is therefore most important that sea going personnel should be able to distinguish between the two.

b. Loll may be caused either by a large area (especially breadth) of free-surface liquid inside the hull or by a large addition of topweight; the following example shows how it may be caused by free surface liquid.

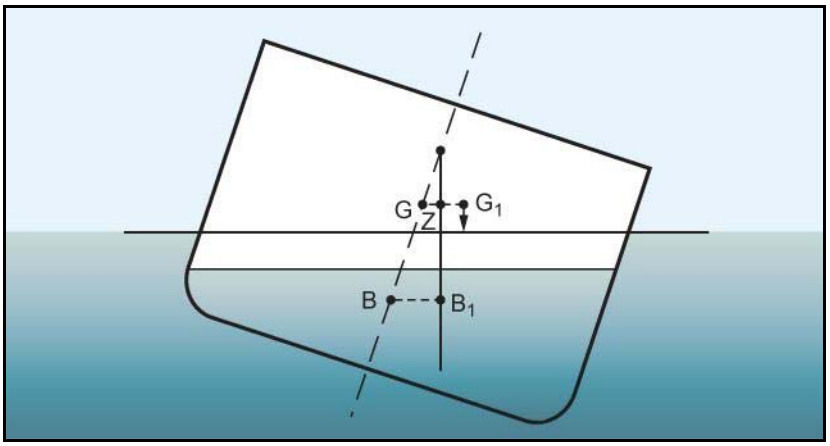
c. In the description of free surface it was shown that the effect of free-surface liquid was to reduce the righting lever by shifting G towards Z. The greater the extent of flooding by free-surface water the further G will move away from the middle line when the ship heels.

d. Consider a frigate with free flooded main-compartments extending right across the ship. If the ship heels to starboard, for example, as shown in an exaggerated form in Figure 23-17, the water in the flooded compartments will run across to starboard and shift G so far that it may well pass beyond B_1 to the position G_1.

e. The centre of gravity G_1 of the flooded ship is now beyond the centre of buoyancy B_1 and these two forces are tending to heel the ship still more instead of returning her to the upright position.

f. As the ship heels over further, however, the centre of buoyancy will also move further to starboard and the ship will come to rest at an angle of heel at which the centres of gravity and buoyancy, G_1 and B_1, are again in line as shown in Figure 23-18. The cross-sectional shape of the hull determines the extent to which the centre of buoyancy can move, and if G_1 is still beyond B_1 when the latter has reached the limit of its travel, the ship will capsize.

Figure 23-17. Free Surface Liquid Effect on G



g. If, due to a change of course or to action by wind or waves, the ship heels over to port, the water in the flooded compartments will flow across the ship from starboard to port, and she will come to rest heeled to port at an angle equal to that of her previous heel to starboard illustrated in Figure 23-19.

Figure 23-18. Loll to Starboard

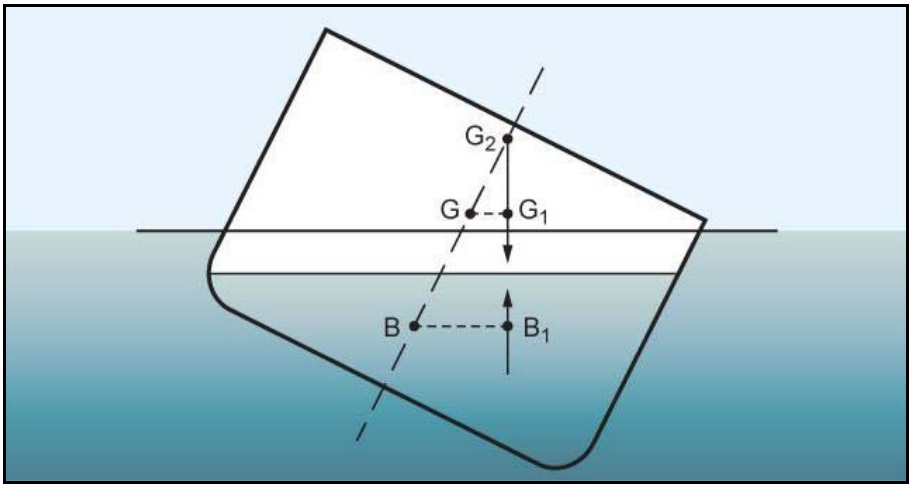
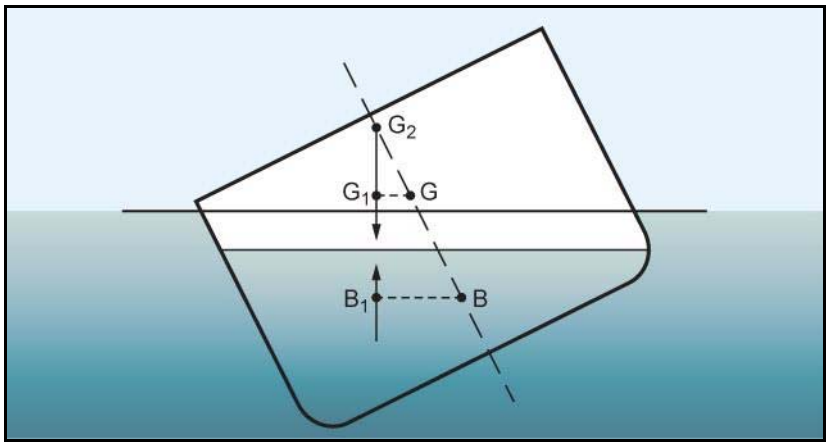


Figure 23-19. Loll to Port



h. An exactly similar effect would be caused by an excessive amount of top weight being placed in the ship, thereby raising the centre of gravity to a dangerous extent. This is illustrated in Figure 29-18 and Figure 29-19, in which G_2 represents the raised centre of gravity caused by top weight. It will be seen that the vertical line of action of the force exerted by the weight of the ship passes through both G_2 and G_1. In this case the centre of gravity is fixed and does not move from one side to the other with the heel of the ship, but the effect is the same as that caused by free-surface liquid.

i. In each case the ship is unstable when upright and also when heeled to port or starboard up to the angle where B and G are in the same vertical plane.

2321. Reduction of Loll

a. There are 4 ways to reduce loll:

(1) Remove weights from high up in the ship.

(2) Reduce the area, especially the breadth, of free-surface liquid.

(3) Add weight low down in the ship.

(4) Shift weights from high in the ship to lower levels.

b. The choice of method or methods to be used depends on the causes of the loll and the means available in the ship for correcting it.

c. The first method is probably the most practicable, especially in small ships, and produces a double improvement because it lightens the ship, increasing her reserve of buoyancy, and also lowers her centre of gravity. It is affected by jettisoning movable gear from the upper decks, but care must be taken to do this evenly each side of the middle line, and not to jettison damage control, firefighting or lifesaving equipment, or ready-use ammunition if further attack seems probable. Lists of suitable equipment should be prepared in the order in which they may be jettisoned so that this method can be used quickly and correctly should the need ever arise. Such items as boats (which should be tied up aft), torpedoes, helicopters and anchors may be included. Some guidance on preparing a Jettison Bill for the ship is given in Chapter 9, and platform details held within BRd 2170 Volume 7 series.

d. The second method is to plug leaks and pump out water; drain to lower and, if possible, narrower compartments; use longitudinal dwarf bulkheads – which may be quite temporary arrangements – to break up the free-surface area; or completely empty (or fill) tanks which contain liquid, according to whether they are high or low in the ship.

e. The third method is to flood compartments or tanks low down in the ship to their full capacity and thus ballast the ship. It is effective in lowering the centre of gravity, but has the disadvantage of loading the ship still further and thereby reducing her reserve of buoyancy. If this method is employed it is important that the flooding should be carried out evenly each side of the middle line of the ship to avoid introducing a list in addition to the existing loll.

f. Apart from draining down of floodwater, the fourth method is usually impracticable because movable objects small enough to be lowered through hatches are not usually of sufficient weight to appreciably affect the centre of gravity. If they were heavy enough, they would then be difficult to shift, particularly if the ship was lolling to a large angle.

2322. Use of Fin Stabilisers After Damage

a. Fin type stabilisers are fitted to warships to minimise roll and assist in weapon operation. They should not be used for heel correction after damage for 2 reasons:

(1) Ships with fin stabilisers are designed so that list after damage is slight, if any. If the ship has a large angle of heel after damage, she is almost certainly lolling. Any attempt to correct loll by applying heeling moments, using the stabilisers, could result in the ship lolling to a greater and possibly dangerous angle on the side remote from the original loll.

(2) Conventional methods of heel correction after damage restore to the ship a capacity to withstand further damage, which does not depend on maintenance of ship speed. Should initial heel correction be obtained by the use of stabilisers, and further damage cause serious loss of mobility, the resulting heeling moments and/or loss of stability from both incidents would be cumulative, possibly with serious consequences.

b. If enough speed can be maintained after damage to make the stabilisers effective, they may be used to minimise roll, thus effectively augmenting the inherent ship stability remaining after heel correction and damage control action have been taken.

2323. Summary of list/loll actions

The information above can be summarised by the following two tables

Table 23-1 – List/Loll Correction

Negative Metacentric Height			
Cause	**Recognition**	**Correction**	**Purpose**
Removal of low weight.	Vessel lists either to port or starboard.	Add low weight or remove high weight symmetrically about the centreline.	To move the centre of gravity below the transverse metacentre.
Addition of high weight.	Vessel lolls from one side to the other at the same angle.	Move weights downward.	
Upward movement of weight.	Vessel has a long slow roll.	Move weights downward.	
Free surface.	Vessel has a long slow roll.	Pump overboard, or drain down to a lower confined space.	
Off-centre weight			
Cause	**Recognition**	**Correction**	**Purpose**
Weight distributed unevenly about the centreline.	Vessel lists to one side.	Eliminate off-centre weight.	To return the centre of gravity to the centreline. Correct only when absolutely sure an off-centre weight exists.
Transverse weight moves.	Roll is normal about the angle of list.		
Addition or removal of weight to one side of centreline.	GM is known to be positive.		
	Off-centre weights are known to exist.		
Combination			
Cause	**Recognition**	**Correction**	**Purpose**
A combination of off-centre weight and negative metacentric height.	A permanent list to one side without lolling.	Eliminate free surface.	To move the centre of gravity onto the centreline and below the metacentre.
	Very slow rolling about this angle.	Eliminate off-centre weight.	
	List is out of proportion to off-centre weight.	Add low weight or remove high weight with due consideration for off-centre weights.	

Table 23-2 – Spill Mitigation

Condition	Spill Mechanism	Mitigation Procedure
Above the waterline damage to a wing tank.	Fuel under the influence of gravity flows out of the hole until the surface of the fuel is below the level of the bottom of the hole.	a) With the fuel main pump the oil out of the tank to a lower level of as rapidly as possible. If the fuel main system cannot be used, rig a syphon to move the oil from the damaged tank to other fuel, ballast tank or void space. b) Ballast to list the ship to the side opposite the hole to bring the hole higher above the waterline.
Hole in the side below the waterline and above the tank top.	a) Oil flows out of the hole until the hydrostatic heads inside and outside balance. Water flows into the hole and drops to bottom of tank. Oil flows out and water flows in the hole simultaneously. b) The oil in the tank floats on the water. It rises and re-establishes a hydrostatic condition where oil flows out of the hole. c) The process continues and oil continues to flow until the water level reaches the top of the damage. d) Current, tide, and seas affect the amount and rate of discharge.	The strategy depends upon the location of the damage; a) If the damage is low in the ship; increase the external head by increasing draught by ballasting or transferring the fuel. b) If the damage is near the waterline; raise the hole by listing and trimming the ship with fuel and ballast. Attempting to remove fuel is worthwhile but are likely to meet with only moderate success because the water flooding into the hole will soon cover the suction. Portable pumps taking suction near the top of the tank can be effective through the spill period.
Damage to a wing tank near bottom.	This is a special case of side damage because the full hydrostatic head forces fuel out until the level drops low enough to re-establish hydrostatic balance. Very little water flows into the tank. Less total loss of fuel may occur than with damage farther up the tank.	a) Lower hydrostatic pressure in the tank by removing fuel from the tank. b) Raise the external hydrostatic pressure by putting the hole deeper in the water by ballasting or transferring fuel.
Bottom shell damage.	a) **Single hull ship:** Fuel flows out under hydrostatic pressure until hydrostatic balance is reached. There will be some minor exchange with the motion of the platform. b) **Double hull ships:** No spillage because fuel containment is not breached.	a) **Single hull ship:** • Lower hydrostatic pressure in the tank by removing fuel from the tank. • Raise the external hydrostatic pressure by putting the hole deeper in to the water by ballasting or transferring fuel. b) **Double hull ship:** No mitigation is required.

Table 23-2 – Spill Mitigation (Cont'd)

Condition	Spill Mechanism	Mitigation Procedure
Shell and tank top damage.	Fuel floods the double bottom and flows out under hydrostatic pressure of the cargo until hydrostatic balance is reached. No water flows in.	a) Lower hydrostatic pressure in the tank by removing cargo from the tank. b) Raise the external hydrostatic pressure by putting the hole deeper in to the water by ballasting or transferring fuel.
Double Bottom damage	Main auxiliary engine room double bottom tanks when flooded the high external hydrostatic pressure forces fuel out of the sounding pipes on the tank top contaminating the ER spaces. Other double bottoms when flooded the significantly high external head will force fuel up the vent and sounding pipes with the potential of causing a spill on deck.	a) Divert the fuel to other tanks through any piping system. This action may contaminate the piping system. b) Decrease the external hydrostatic head by raising the ship out of the water as far as possible.

2324. Effect of Heel and Trim on Fighting Efficiency

a. Excessive heel from any cause will reduce the fighting efficiency of the ship in a number of ways, of which the following are examples.

(1) It is difficult for personnel to get about the ship and carry out their duties properly when the ship is heeled.

(2) Heel may restrict the effectiveness of weapons. It also entails increased effort to move any manually trained equipment. 6° is about the largest angle of heel at which a ships armament can be effectively fought.

(3) Speed and manoeuvrability are reduced by heel.

(4) The efficiency of some machinery, such as fixed pumps, which depend for their operation on the maintenance of a steady liquid level, is reduced if the ship is much heeled.

(5) The ability to, and operation of aircraft and helicopters (for details refer to BRd 766 – Aircraft Operating Handbook).

b. Trim has a much less appreciable effect on fighting efficiency or stability unless it is so large that the freeboard at the low end is reduced to the point where the seaworthiness of the ship is endangered, or the forecastle or quarterdeck is under water. It does affect aspects of ship manoeuvre.

2325. Stability Information

a. All RN ships are supplied with a Ship Stability and Survivability Book in the CB 9500 Series. This contains the following:

(1) Notes to the Command.

(2) Stability statement.

(3) Hydrostatic Particulars.

(4) Watertight Subdivision.

(5) Tank Information.

(6) Damage Stability & Structural Carpet Plots.

(7) Compliant Floodable Length.

(8) Damage Stability and Structural Information.

(9) Pumping and Flooding Board.

(10) Firefighting Water Examples.

(11) Estimating Stability after Damage.

(12) Marine Incident Response Form.

(13) Docking and Grounding.

b. All RN surface ships and RFAs have a CBRNDC Class Book (CB 4538 Series), Chapter 2 refers to the Ship Stability and Survivability Book for RN Ships and the Stability Information Books for RFAs.

2326. Notes to the Command

This gives information on the ship particulars, design standards, watertight integrity, HVAC, open systems and guidance on the response to flooding, survivability, stability during firefighting, salvage arrangements, methods to reduce the hazard of flooding, docking and grounding, stability with ice accretion, cargo stowage, Jettison Bill, number of persons to be carried in an emergency and shaft tunnels.

2327. Stability Statement

This gives Mandatory Operating Restrictions, Loading Conditions usually in the light, average action and deep conditions (or deep, light seagoing and light harbour conditions) containing draught, metacentric height, angle of maximum stability and range. It also contains the Curves of Statical Stability, generally called ‘GZ curves’, are usually given for the same conditions of loading as the stability statement. They show the length of the righting lever at all angles of heel, up to the angle at which the ship loses all transverse stability in the condition and indicate the angle at which the deck edge will be immersed and the angle at which the righting lever is greatest. It is a placeholder for Naval Authority Certification and provides details of the amendments made to the SSB.

SECTION 2 - STABILITY OF THE INTACT SHIP

2328. Determination of Stability Characteristics

a. Two things determine the stability characteristics of a ship:

(1) The geometry of the underwater form of the hull.

(2) The loading of the ship.

Of these, the former is determined by the Naval Architect and cannot be altered by the operator. This information is provided by means of hydrostatic data. The latter is planned by the Naval Architect, however its control is the predominate concern of the operator both on a daily and longer term basis.

b. To fully understand the implications of the operator's actions on the stability of the ship it is first important to appreciate the mechanics and principles of ship stability.

2329. Operating Forces

When a ship is floating in water there are three forces operating on the structure.

a. The total weight of all the constituent parts of the ship and contents, which exerts a force vertically downwards through the centre of gravity.

b. The buoyancy force created by the underwater form of the hull displacing water, which exerts a force vertically upwards through the centre of buoyancy.

c. Other forces which cause the ship to move as a result of their action, such as propulsive forces, resistance, wind, waves and changes in loading.

The primary concern of ship stability is to ensure that the first two forces act together in such a way as to provide a stable platform that can cope with the last group of forces without capsize.

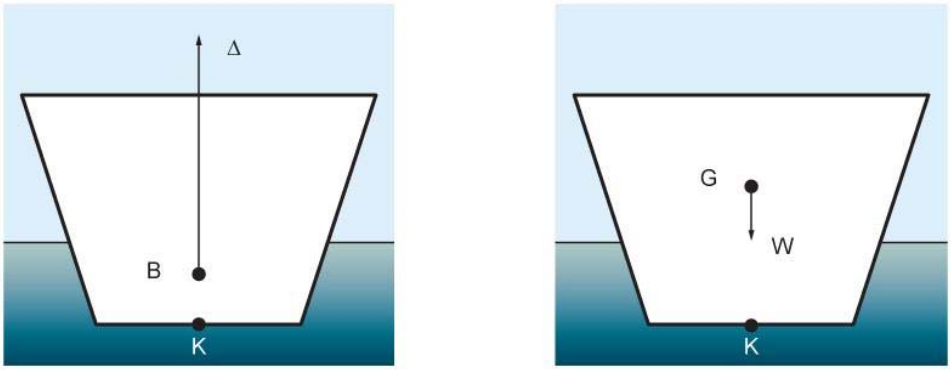
2330. Buoyancy

Archimedes' Principle states that: **"A body fully or partially immersed in a fluid will experience an up thrust equal to the weight of fluid displaced"**.
This up thrust is called the buoyancy force. In order to calculate the magnitude of this force the Volume Displacement of the ship (∇) and the density of the sea (ρ) must be multiplied to give a value for the Mass Displacement of the ship (Δ).

$$\Delta=\nabla\rho$$

The value of Δ is most easily found from the hydrostatic data for the ship where it is given for various mean draughts (T) in standard seawater of density 1.025 tonnes/m³. The buoyancy force, which is equal to Δ, will act vertically up through the centre of buoyancy (B) that is the centroid of the underwater volume of the hull. Again its position is provided in the ships hydrostatic data for different values of T and expressed as a distance (KB) above the ships keel (K). The buoyant volume of a ship is the volume of the entire watertight part of the hull. That part of the buoyant volume above the waterline is called the **reserve of buoyancy**.

Figure 23-20. Buoyancy and Weight



2331. Weight

The weight (W) of a ship is difficult to measure due to the size of the structure. It is possible to calculate this during the design stage by summing all the individual components, but this is impractical for the operator. Instead, finding the total weight relies on the condition of equilibrium the ship adopts when it is freely floating. The weight of the ship acts vertically down through the centre of gravity (G) that again is difficult to find as it depends on the position and weight of all the individual components of the ship. The position of G is found by conducting an Inclining Experiment, the results of which are provided to the operator in the form of the Stability Statement whereby its vertical distance (KG) above the keel (K) is stated for various standard loading conditions. Alterations to these standard conditions to find the position of G for specific loading conditions are relatively simple.

2332. Standard Loading Conditions

Generally ships have three standard loading conditions:

a. **Deep Condition**. The ship is in all respects complete; fully complemented, ammunitioned, fuelled, stored and provisioned.

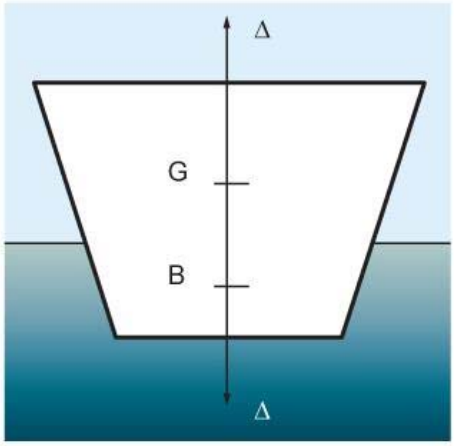
b. **Light Seagoing Condition**. The lightest condition of a ship at sea including any liquid loading restrictions required to meet the minimum stability criteria.

c. **Light Harbour Condition**. The lightest condition of a ship in harbour including any liquid loading restrictions required to meet the minimum stability criteria.

2333. Equilibrium

Under normal circumstances a surface ship would be in a condition whereby it will sink until such time as it reaches a draught great enough to provide an underwater volume displacing enough weight of water to produce a buoyancy force equal to the weight of the ship. Generally, this is expressed by describing both the weight of the ship and the buoyancy force produced as being equal to the **Mass Displacement** of the ship (Δ).Although mass displacement is measured in tonnes it is treated as a force neglecting the gravitational constant in all further expressions.

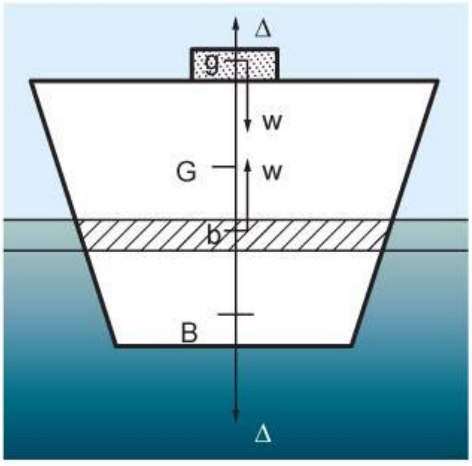
Figure 23-21. Equilibrium



2334. Addition of Weight

The Centre of Flotation (CF) is the centroid of the waterplane at which the ship is currently floating; the ship will trim and heel about this point, which is generally on the centreline and abaft midships. If a weight (w) is added to the ship so that its centre of gravity (g) is above CF, so that there is no heeling or trimming moment, the ship will sink until the increase in draught produces an increase in volume displacement, producing and additional buoyancy force equal to the added weight. An increase of draught in this way, where there is no heeling or trimming moment induced, is called **Parallel Sinkage(s).**

Figure 23-22. Addition of Weight



It can be seen from Figure 23-22 that the buoyancy force created by the additional layer of displaced volume acts through a point (b) and must be equal to the added weight, (w).

2335. Tonnes Per Centimetre Immersion (TPC)

a. For reasonably small additions of weight warships can be assumed to be wall-sided (having vertical side plating). This assumption allows the calculation of parallel Sinkage produced by a known addition of weight to be greatly simplified. The weight (in tonnes) required to sink the ship by 1 cm can be found and plotted against the original draught of the ship, this figure is known as the **Tonnes Per Centimetre Immersion (TPC),** and is presented in the ships hydrostatic data for values of mean draught.

b. Given that the TPC for the original draught of the ship is known, the parallel Sinkage (s) caused by any addition of weight (W) can be calculated such that:

$$S = \frac{w}{TPC} \text{ (cm)}$$

c. Particular care should be taken using this expression for large additions of weight, especially where the value for TPC changes considerably in the area of the parallel Sinkage. In this case it is prudent to calculate the parallel Sinkage using both the TPC at the original draught and the TPC at the new draught and averaging them.

2336. Movement of Centres of Buoyancy and Gravity due to Changes in Loading

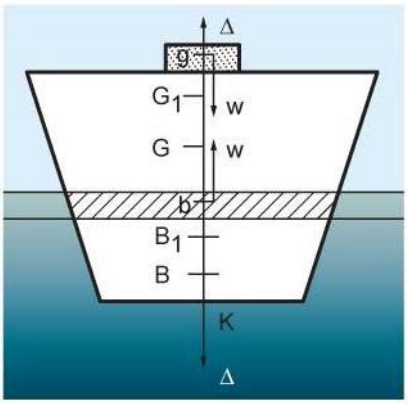
An alteration to the loading of the ship will affect the positions of B and G:

a. B will always move upwards due to the addition of weight, ie towards the centroid of the new slice of displaced volume (b).

b. G will always move towards the centre of gravity of the added weight (g). The opposite is true if the weight is removed.

The new positions of the centre of buoyancy (B_1) and gravity (G_1) can be found by taking 1st moments, multiplying the force by its lever arm, about the keel and dividing by the total mass displacement.

Figure 23-23. Movement of Centres of Buoyance (B) and Gravity (G)



$$KB_1 = \frac{KB.\Delta + Kb.w}{\Delta + w}$$

where: Kb = T + 0.5 x s

T = original draught

s = parallel sinkage

$$KG1 = \frac{KG.\Delta + Kg.w}{\Delta + w}$$

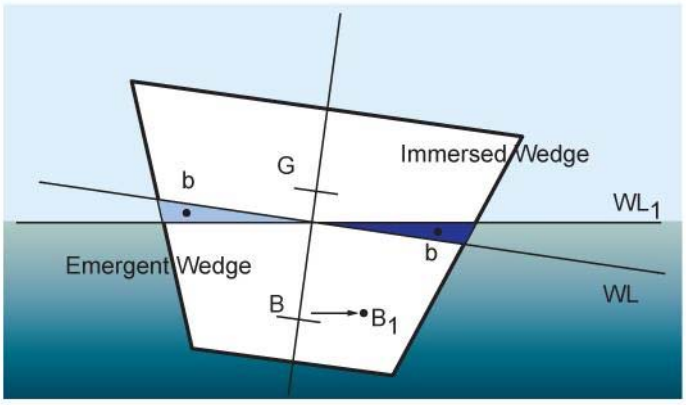
2337. Reserve of Buoyancy

When a surface ship is floating some of its hull is normally above the surface of the sea. If a weight is added the ship will sink further into the sea so that Δ increases. Weight could continue to be added to the ship until such time as its uppermost watertight deck is underwater resulting in the ship sinking. The portion of the ships watertight hull above the waterline is known as the **Reserve of Buoyancy**, and is expressed as a proportion or percentage of the immersed volume. The reserve of buoyancy of a surface warship is of the order of 100% or more and therefore loss of ships by bodily sinking is very unusual.

2338. Transverse Stability

When a ship heels over due to an internal movement of weight or as a reaction to an external force there is no increase in the weight of the ship and hence no increase in Δ. So long as none of the weights making up the total weight of the ship move, ie the ship is secured for sea, G will not move, irrespective of the angle of heel. The weight of the ship, equal to Δ will continue to act vertically down through G. The position of B, however, depends on the shape of the underwater volume of the ship and will move as the ship heels over. As the ship heels over a wedge of additional buoyancy is formed on the lower side and a corresponding wedge emerges from the other side to keep the buoyancy force the same. These wedges have their own centroids and by taking moments it can be seen that the ships centre of buoyancy will move towards the Immersed Wedge illustrated in Figure 23-24.

Figure 23-24. Movement of Centre of Buoyancy (B)

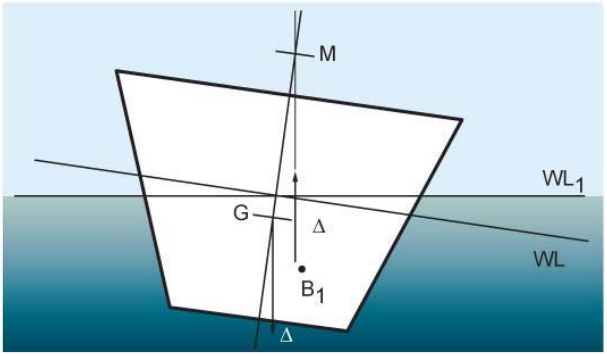


The buoyancy force (Δ) continues to act vertically upwards through the centre of buoyancy that has a new position B_1, but now buoyancy and weight forces are separated and under normal circumstances will attempt to return the ship to the upright position.

2339. Metacentre

The point at which the line of action of the buoyancy force intersects the original vertical centreline of the ship is known as the **Metacentre (M**), as shown in Figure 23-25. The buoyancy force and the weight under these circumstances continue to be equal to the mass displacement of the ship, as no weight has been added, but now act as a moment couple that will try to bring the ship upright.

Figure 23-25. Metacentre (M)



It can therefore be seen that the ability of the ship to return itself to the upright position is dependent on this moment couple, formed by the movement of the centre of buoyancy, being positive. This moment couple will remain positive whilst the metacentre is above the centre of gravity. The position of M can be found from the ships hydrostatic data at various mean draughts, as a distance (KM) from the keel of the ship.

2340. Righting Moment

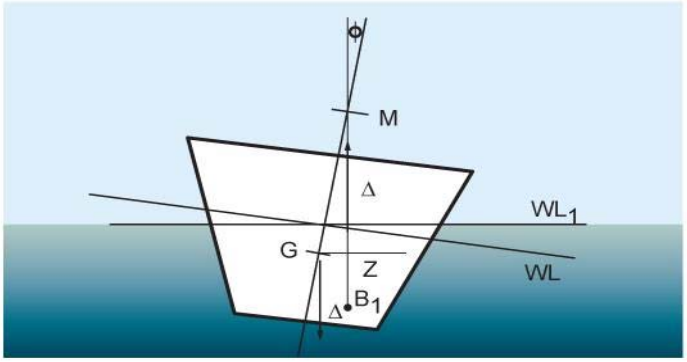
By taking moments about the keel illustrated in Figure 23-26, it can be seen that the moment acting to return the ship to the upright position is given by:

Righting Moment = GZ x Δ

now: GZ = GM sinφ

so: Righting Moment = ΔGMsinφ

Figure 23-26. Righting Moment



The distance GM therefore provides a measurement of the stability of the ship. It is known as the **Metacentric Height.**

2341. Metacentric Height

a. By examination of the metacentric height and Figure 23-26 it can be seen that three states of stability exist.

(1) **Positive Stability.** If the metacentric height is positive the ship will be stable.

(2) **Neutral Stability.** If the metacentric height reduces to zero, ie G and M coincide then the ship becomes neutrally stable.

(3) **Negative Stability.** If the metacentric height is negative then the ship is negatively stable and will tend to heel to a greater angle.

b. The size of the metacentric height also indicates the amount of stability a ship possesses; a large positive metacentric height will provide a large righting lever and consequently the ship will be very stable. Conversely a small metacentric height will provide a small righting lever and the ship will be less stable. A ship with a large metacentric height is said to be **stiff** and one with a small metacentric height is known as **tender.**

c. The metacentric height of a ship depends on two things:

(1) The position of G.

(2) The position of M.

d. The position of G is found by adjusting the value for KG given in the Stability Statement for a standard loading condition, by using the equation at Para 2337 for movements of weights away from this standard condition. The complete method is provided at Para 2349. The position of M is dependent on the position of B as it moves with the angle of heel. The distance of M above B relies on the volume displacement of the ship and the second moment of area of the waterplane of the ship. Calculation of this second moment of area is time consuming and impractical for the operator requiring quick answers to concerns over the ships stability. It is enough to appreciate that the dominant factor in producing a high position for M and thus generally increasing GM is the breadth of the ship and is thus outside the control of the operator. In practice the position of M when the ship is in an upright condition is gained by reference to the ships hydrostatic data for the draught at which the ship is floating. The metacentric height can therefore be found as:

$$GM = KM - KG$$

2342. Stability at Small Angles of Heel

The movement of the centre of buoyancy as the ship heels over is dependent on the shape of the underwater form of the ship and this in turn determines the position of the metacentre and hence the magnitude of the metacentric height. The shape of the ship's hull as it heels is not regular and so B cannot be generally expected to move in a regular pattern therefore the position of M will change with heel angle.

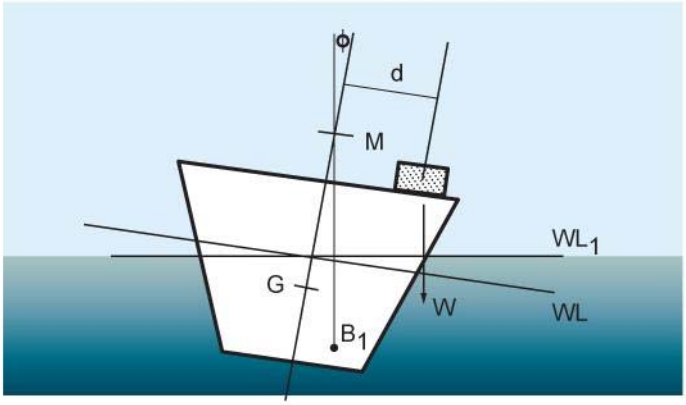
However, the shape of a ship can be thought of as regular for angles up to 10°, therefore the position of M can be assumed to be fixed for angles of heel within this range. The metacentric height found for the ship in an upright position in Para 2341 sub para b can therefore be used for all angles of heel up to 10°.

2343. Finding the Angle of Heel for Small Movements of Weight

The heeling moment acting as a ship caused by the horizontal movement of a weight is given by:

Heeling Moment = $wd\cos\varphi$

Figure 23-27. Angle of Heel for Small Movement of Weight



Therefore, to find the angle of heel the heeling and righting moments can be equated to give:

Heeling Moment = Righting Moment

$wd\cos\varphi = \Delta GM\sin\varphi$

So $\tan\varphi = \frac{wd}{\Delta GM}$

This equation can now be solved by assuming that GM remains constant for angles of heel up to 10°.

2344. Free Surface Effects

a. Liquid in any compartment, anywhere in the ship, which does not entirely fill the compartment has an adverse effect on the stability of the ship. Such liquid is said to have free surface. As the ship heels, the centre of gravity of the liquid shifts to the low (inclined) side. The result of this can be viewed as either an increasing heeling moment, or a reduction in the righting lever. In practice we normally regard the effect as equivalent to raising the centre of gravity, which has the effect of reducing the metacentric height and hence the righting lever.

b. It can be shown that for small angles of heel the reduction in GM is given by:

$$\text{Loss of GM} = \frac{i\rho_l}{\nabla\rho_s}$$

where:

i_L = the second moment of area of the liquid surface area about a principal axis parallel to the axis of rotation of the ship.
ρ_l = the density of the liquid concerned.
ρ_s = the density of the seawater.
∇ = the volume displacement of the ship.

The righting lever for the ship can now be assumed to be dependent on this reduced GM, often termed the GMfluid, which is given by:

GMfluid = GM - loss in GM

Calculation of the second moment of area for an irregular shape is time consuming. However many compartments in a ship are rectangular or close to being so and the second moment of area of a rectangle length a (longitudinally) and breadth b (transversely), is:

$I = ab^3/12$

c. This loss of initial stability is entirely dependent on the Second Moment of Area of the free surface, and in particular, the breadth. The depth, volume or weight of liquid present plays no part in the formula. Also the loss of GM occurs irrespective of the position of the free surface in the ship. However the position of G is also affected by weight: low down the weight serves as ballast; high up is to topweight, and to port or starboard it is off-centre weight. It can be seen that the worst combination is of a free surfaced liquid high up in a ship causing loss of GM by topweight and free surface effect. This rise in the G can quickly result in a state of loll with the associated loss in stability and requires rapid and correct reactions to be taken to avoid putting the ship in danger of capsize. High free surface effects can easily be caused by water used in firefighting and boundary cooling, many ships have capsized because firefighting water was not pumped out, drained overboard, or drained down. The free surface can rapidly become more dangerous than the fire itself. If the free surface cannot be removed, every effort should be made to divide its breadth. The division need not even be completely watertight to be effective, and mess tables on edge can be most successful. Dividing the compartment into two units of equal breadth reduces the loss in GM by four (division by three would reduce loss by nine, and so on). Conversely, if a free surface area is doubled in breadth, the loss in GM becomes eight times as great. The complete method for assessing stability with a free surface effect is given at Para 2327.

2345. Stability at Larger Angles of Heel

Fundamentally the mechanics involved with stability at larger angles of heel are identical to those previously discussed with the exception that GM can no longer be assumed to remain constant. It was shown in Para 2313 that:

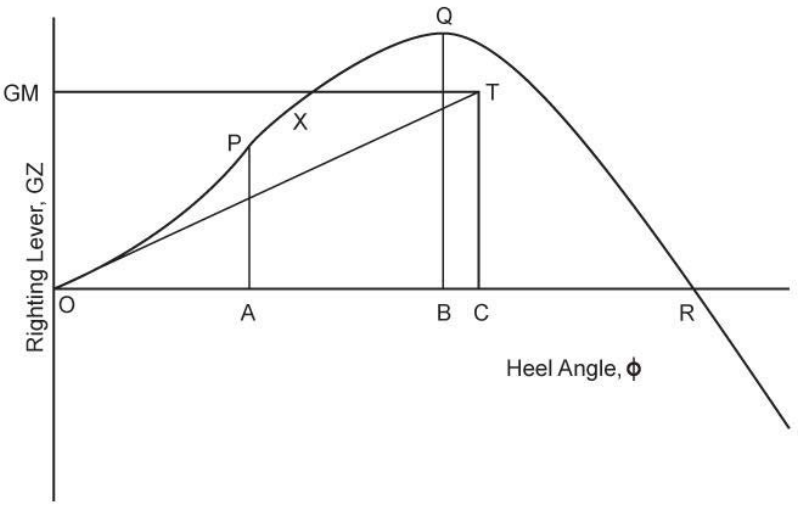
Righting Moment = ΔGZ

This equation still holds for all angles larger than 10° but now account must be taken of the changing underwater form of the hull, which will change the magnitude of GZ for different angles of heel; the metacentre can no longer be thought to be stationary. Determination of the magnitude of GZ involves complicated calculations far beyond the abilities of the average operator. To this end values of GZ are provided for the ship in the form of a **Curve of Statical Stability.**

2346. Curves of Statical Stability

Curves of Statical Stability are provided to the ship as part of the Stability Statement. Normally three curves are presented, one each for the standard loading conditions. The curve shows the value of the righting lever for angles of heel throughout the range of stability of the ship; the righting moment at any angle of heel can therefore be found by multiplying GZ by Δ. The GZ curve for a conventional ship in a normal condition will appear as shown in Figure 23-28.

Figure 23-28. Curve of Statical Stability



Several points and lines have been marked on this figure. They have the following significance:

a. At any angle of heel OA, the ship has a right moment of Δ x PA. It requires a steady inclining moment, such as wind pressure or an off centre weight, of this magnitude to hold her over at this angle.

b. At small angles of heel, the righting lever depends on the metacentric height. This is confirmed in the diagram by the coincidence of the tangent to the curve at the origin 0, and the curve for a few degrees of heel.

c. As the angle of heel increases (about say 10°), the curve shows positive curvature, ie the steepness of the curve increases. At the point X the curvature changes and the steepness decreases. The point of inflexion at X reflects the immersion of the edge of the main Weatherdeck.

d. As the heel increases further, the curve becomes horizontal at the angle B of maximum lever Q.

e. Thereafter the curve descends, at first with increasing steepness, then more steadily. It crosses the base line at a point R called the point of vanishing stability, at which there is no righting lever, and beyond which a capsizing lever is set up. This point defines the range of stability of the ship for her particular condition of loading and the angle OR is generally known as the range.

f. Since the greatest righting moment that the ship can exert is Δ x QB, corresponding to the maximum lever QB, it follows that this is the greatest steady upsetting moment that the ship can resist. The angle of maximum righting lever, therefore is the greatest angle of steady heel the ship can take up without capsizing when inclined by a steady heeling moment. Some of these points on the curve, particularly at higher angles of heel, are somewhat academic as the point at which non-watertight openings are immersed represents a more realistic range of stability for the ship. Generally the non-watertight openings of most concern are the engine downtakes and their angle of immersion will be marked on the GZ curve provided to the ship. Angles of heel past this angle will usually result in unrestricted flooding of large compartments of the ship therefore seriously compromising the stability of the ship.

2347. Adjustment of the GZ Curve for Loading Conditions

It should be appreciated that the value of GZ presented on the curve is dependent on the position of the centre of gravity; this is why the curves are provided for the three standard loading conditions. In practice a ship is unlikely to be operating at a standard loading condition and so alterations have to be made to the curves to ascertain the true behaviour of the ship.

2348. Horizontal Movement of Weights

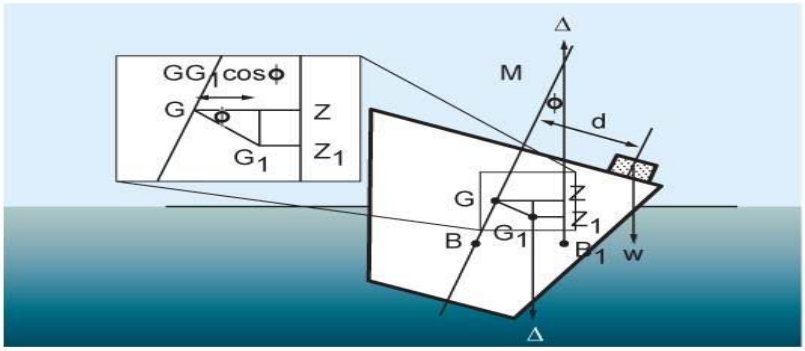
The movement of any weight that constitutes a part of the whole displacement of a ship in a horizontal direction will cause G to move in the same direction. By taking moments about original centre of gravity (G) the distance to the new centre of gravity (G_1) can be found such that:

$$GG_1 = \frac{wd}{\Delta}$$

By referring to Figure 23-29, below, it can be seen that this movement of G will have an effect on the righting lever so that:

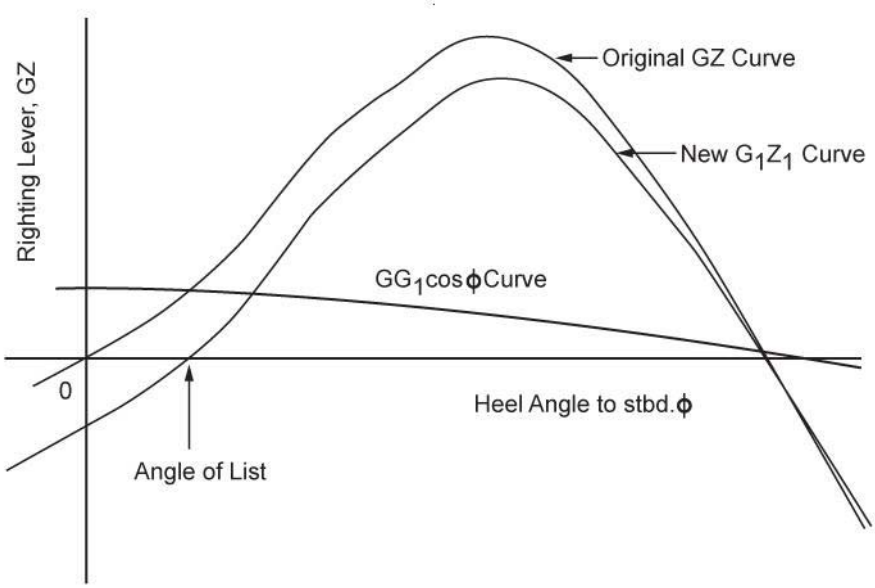
$$G_1Z_1 = GZ - GG_1\cos\varphi$$

Figure 23-29. Horizontal Movement of Weight



Consequently, the modified GZ curve over the range of heel angles can be redrawn by subtracting the curve $GG_1\cos\varphi$ from the original GZ curve. The resulting GZ curve is shown as the 'net righting lever' in Figure 23-30.

Figure 23-30. Net Righting Lever



The movement of the ships centre of gravity away from the centreline will result in the weight force and buoyancy force not being collinear, they will not, therefore, be in equilibrium and the ship will heel over until the 2 points are aligned vertically. The angle of heel will be steady and, so long as the metacentre remains above the centre of gravity, the ship will be stable. This condition of heel is known as **List,** and can be found as the intersection of the net righting lever curve with the x-axis on the curve in Figure 23-30.

2349. Vertical Movement of Weights

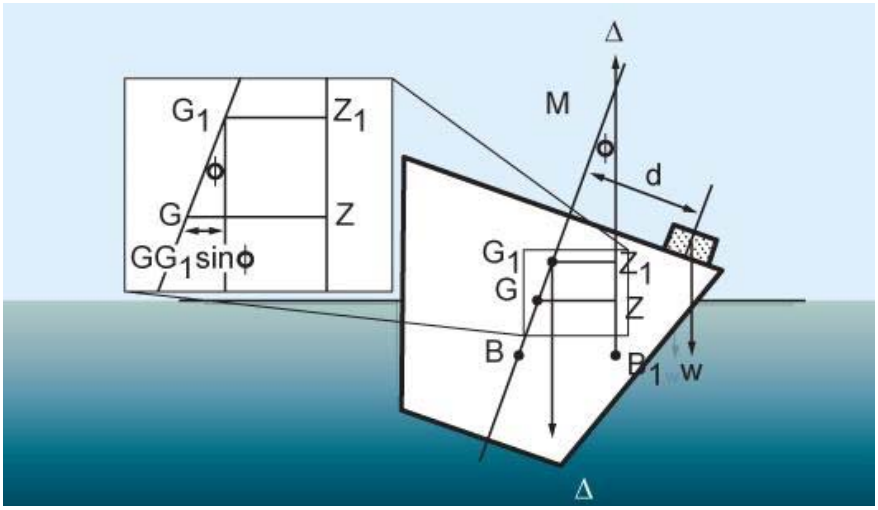
The movement of any weight that constitutes a part of the whole displacement of a ship in a vertical direction will cause G to move in the same direction. By taking moments about the original centre of gravity (G) the distance to the new centre of gravity (G_1) can be found, such that:

$$GG_1 = \frac{wd}{\Delta}$$

By referring to Figure 23-31, it can be seen that this movement of G will have an effect on the righting lever so that:

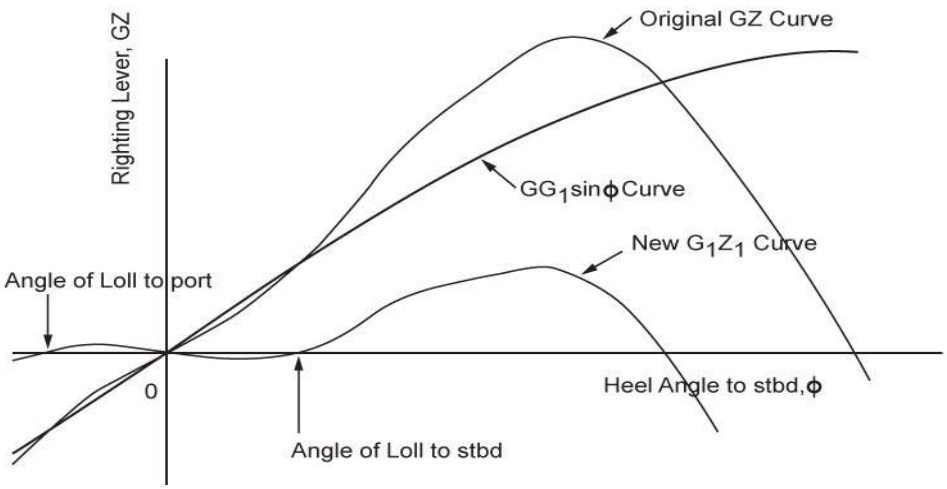
$$G_1Z_1 = GZ - GG_1\sin\varphi$$

Figure 23-31. Effect of Vertical Movement of Weight



Consequently, the modified GZ curve can be drawn over the range of heel angles by subtracting the curve $GG_1\sin\varphi$ from the original GZ curve. The resulting GZ curve is shown as the 'net righting lever' in Figure 23-32.

Figure 23-32. Effect of Rise of G



The general effect of the centre of gravity rising in the ship is to reduce the maximum righting lever and range of stability of the ship. However, an interesting case occurs when GG_1 is sufficiently large to take G above M, so that in the upright condition GM is negative. Rather than causing the ship to capsize, which might be expected, depending on the precise hull shape of the ship and the magnitude of the negative GM, a real situation can be reached where the ship will lurch to one side but recover a measure of stability. This is illustrated in Figure 23-32. The angle of heel is known as the angle of **Loll.** While the diagram shows that because of the nature of the GZ curve, the ship should loll to either side, in practice it would have a slight preference to one side (slightly off-centre G, wind direction, etc). Having lolled over to one side a further heeling moment in that direction will be met by a righting lever that rises to a maximum and then tails off to the angle of vanishing stability. The same is not true in the reverse direction; if from an angle of loll a moment is applied to bring the ship upright, this will initially be met with a moment trying to restore the angle of loll. A point is reached before the ship becomes upright where this restoring moment reaches a maximum and the ship will then lurch through the upright and over to the angle of loll on the other side plus a further heel angle brought about by the moment which has been applied. When a ship is in a state of loll, its GZ curve will have become relatively flat, and consequently the effects of this additional moment could be catastrophic. Loll is a very dangerous situation and to be avoided at all costs and if encountered reacted to rapidly. The method for calculating the GZ curve for a more general movement of weight in both a horizontal and vertical direction is given at Para 2356.

2350. Causes Of and Reactions To List and Loll

a. List is caused by an upsetting moment that causes a heeling moment, such as:

(1) An off centre weight.

(2) Any other external force causing an upsetting moment.

b. In order to correct an angle of list:

(1) Remove the off centre weight or moment.

(2) Counter balance the off centre weight or moment with an equal and opposite one.

c. A state of loll is caused by a high centre of gravity. This may be due to one of three causes:

(1) Excessive weight high up, eg flood water in the superstructure, unusual loading.

(2) Insufficient weight low down, eg fuel, other liquids run down too far.

(3) Free surface effects.

d. The correct response is to take measures to:

(1) Reduce topweight.

(2) Increase weight low down.

(3) Reduce free surface effects.

2351. Longitudinal Stability

The mechanics involved in longitudinal stability are fundamentally the same as for transverse stability. However, there are several differences that should be noted:

a. The second moment of area of the waterplane is far greater longitudinally than transversely. Consequently, the height of the longitudinal metacentre is far greater than the transverse metacentre, in fact approximately 100 times as large.

b. Unlike the transverse case, where the ship is symmetrical about the middle line, there is no axis of symmetry longitudinally and it is necessary to take account of the longitudinal position of the Centre of Flotation, LCF.

c. Angles of trim are generally much smaller than those of heel therefore trim is normally described in terms of the difference between the draughts at the perpendiculars and measured in metres.

In looking at the longitudinal stability of a ship, the main concern is in controlling trim because although the ship is extremely 'stiff' longitudinally, it is exposed to much greater moments, due to the large lever arms, when transferring weights fore and aft rather than athwartships. As a consequence of the longitudinal metacentric height being so large the effect of vertical movements of the centre of gravity are insignificant, therefore allowing the assumption that it is constant at each draught. By considering the balance of righting moment and trimming moment in the longitudinal case a simplified formula can be found giving the trimming moment required to cause a change of trim of 1 m between the perpendiculars (BP), such that:

$$\text{Moment to Change Trim 1m BP} = \Delta GM_1 \left[\frac{1}{L_{BP}} \right]$$

The accepted convention is to calculate Change of Trim in centimetres so:

$$\text{Moment to Change Trim 1cm BP} = \frac{\Delta \, GML}{100 \times L_{BP}}$$

This formula, therefore, provides a simple solution comparable to that for TPC for parallel Sinkage. The Moment to Change Trim 1cm BP (MCT1cmBP) is dependent wholly on the draught of the ship and is provided in the ships hydrostatic data. Now given a moment causing the ship to trim the change in trim of the ship between the perpendiculars can be found as:

$$\text{Change in Trim BP} = \frac{\text{Trimming Moment}}{\text{MCT1cmBP}}$$

Having found the trim change between the perpendiculars the rule of similar triangles can be applied to find the trim change caused at any point along the ships length by:

$$\text{Change in Trim} = \text{Change in Trim BP} \times \left[\frac{\text{(Distance from LCF)}}{L_{BP}} \right]$$

This is particularly useful for calculating the new draught extreme at the propellers or predicting draught mark values. The method for calculating the change in trim at any point along the ship is given at Para 2357.

2352. Stability Methods

The following give clear logical methods for solving common stability problems using the information available to the ship.

2353. Addition of Weight and Daily Stability Assessment

In order to assess the stability of the ship on a daily basis (or after changing the loading condition), thus providing a valid datum point prior to further incidents, it is necessary to find GM and Δ for the actual loading condition.

a. Compare actual loading state (tank states, stores, aircraft etc) with a standard loading condition or known datum point. For this example assumes that a weight w_1 has been added Kg_1 above the keel, a weight w_2 has been removed Kg_2 above the keel and a weight w_3 has been moved vertically upwards a distance d_3, compared to the Deep condition.

b. Calculate the actual displacement:

$$\Delta_1 = \Delta_{Deep} + W_1 - W_2$$

c. Find the parallel Sinkage caused by the additional weight:

$$s = \frac{W1 - W2}{TPC\ Deep}$$

d. Find the actual draught for Δ_1:

$$T1 = T + \frac{s}{100}$$

e. Find the metacentre from the hydrostatic data at this draught T1: KM1

f. Calculate the actual position of G:

$$KG_1 = \frac{KG\ Deep \times \Delta\ Deep + Kg1 \times w1 - Kg2 \times w2 + d3 \times w3}{\Delta\ Deep + w1 - w2}$$

g. Calculate the metacentric height:

$$G_1M_1 = KM_1 - KG_1$$

2354. Addition of Liquids

In order to assess the effect of adding a liquid to a ship currently floating at draught T with a centre of gravity KG, both the effect of the added weight and the effect of any free surface must be taken into account:

a. Find the total weight added:

$w = \text{volume} \times \text{density}$.

b. From hydrostatic data find Δ and TPC at the original draught T.

c. Find the parallel Sinkage:

$$s = \frac{w}{TPC}$$

d. Find the new draught:

$$T_1 = T + \frac{s}{100}$$

e. At the new draught T_1 find KM_1 from the hydrostatic data.

f. Calculate the movement of the centre of gravity due to the addition of weight:

$$KG_1 = \frac{KG \times \Delta + Kg \times w}{\Delta + w}$$

g. Calculate the metacentric height after the weight is added:

$$GMsolid = KM_1 - KG_1$$

h. Take account of the free surface effects reducing the metacentric height assuming a rectangular compartment; length a, breadth b and the seawater in it of standard density:

$$\text{Loss of GM} = \frac{ab^3 \times 1.025}{12 \times \Delta}$$

i. Calculate the effective metacentric height:

$GMfluid = GMsolid - \text{Loss of GM}$

2355. Adjusting the GZ Curve for Movements of Weight

To find the effect on the stability of the ship over the whole range of heel angles due to a large movement of weight, w, and to determine whether the ship is suffering from list or loll the following method should be used to adjust the GZ curve:

a. Resolve the movement of weight compared to a standard loading condition into horizontal (dhorz) and vertical (dvert) movements.

b. Find the movement of G in a vertical direction:

$$GG_1 = \frac{w \times dvert}{\Delta}$$

c. Find the movement of G1 in a horizontal direction:

$$G_1G_2 = \frac{w \times dhorz}{\Delta}$$

d. Select suitable increments from the original GZ curve (eg 10°) and find values for GZ at each of these angles.

e. Calculate the values of $GG_1\sin\varphi$ and $G_1G_2\cos\varphi$ at each of the selected angles above.

f. Subtract $GG_1\sin\varphi$ and $G_1G_2\cos\varphi$ from the original values of GZ at each selected angle of heel to give a value for G_2Z_2:

$$G_2Z_2 = GZ - GG_1\sin\varphi - G_1G_2\cos\varphi$$

g. Re-plot the curve for G_2Z_2 against angle of heel.

2356. Change in Trim Due to Movement of Weight Longitudinally

To find the change in trim at any point along the ship due to a movement of weight longitudinally:

a. Find LCF and MCT1cmBP from the hydrostatic data for the mean draught of the ship.

b. Calculate the trimming moment, the distance the weight has moved multiplied by its weight; if the weight has been added this is the distance from the LCF.

c. Calculate the change in trim between perpendiculars:

$$\text{trim change BP} = \frac{\text{trimming moment}}{\text{MCT1cmBP}}$$

d. Calculate the trim change at any point:

$$\text{trim change BP} = \frac{\text{trim change BP} \times \text{distance from LCF}}{\text{LBP}}$$

SECTION 3 - STABILITY OF THE DAMAGED SHIP

Sponsor: SDA-NAG-ShipStab

2357. General

a. Complete assessment of a ships overall stability after damage involves very complicated mathematical calculations, which take a lot of time and are therefore impractical during the immediate period after an incident. The ships CBRNDC Class Book provides a number of examples for typical damage that can be consulted to give a quick and sure answer in these circumstances. However, in practice the actual extent of damage is unlikely to conveniently match one of these examples exactly and so knowledge of how to predict the stability of the ship in situations other than those provided is necessary.

b. The paragraphs that follow are intended to provide the background knowledge required to carry out calculations to predict stability after damage. It should be remembered that completing these calculations accurately is a lengthy process and requires a large amount of concentration and this should be taken into account before attempting to start them in the noisy environment of HQ1 at State 1. In order to reduce the time required to carry out these calculations and to provide quicker indications of the state of the ships stability, carpet plots are often provided with the ships stability information and these are discussed in this section.

2358. Estimating Stability after Damage

a. When a ship is damaged to the extent that some length of her is open to the sea, and as far as watertight bulkheads permit, she is flooded to the waterline, there will be resulting Sinkage and probably trim and heel. Chapter 30 explained how to carry out some useful calculations for the effects of modest loadings on heel and trim. This is largely possible because under normal loadings the changes in heel and trim can often be assumed to be ‘small’ and:

(1) Hydrostatics can be assumed unchanged through small angles of heel or trim.

(2) Cross-coupling effects on hydrostatics between heel and trim can be ignored.

When extensive flooding occurs in a ship the effects are often so substantial that these assumptions would give a false analysis.

b. There are two methods by which damage stability may be calculated:

(1) The added weight method.

(2) The lost buoyancy method.

The first method is the more simple and logical method and draws very much on the principles discussed within this Chapter. The floodwater is treated as an added weight and any free surface effects taken account of by an effective reduction in GM.

This method is particularly useful for compartments below the waterline that will free flood and present only small free surface effects. The problem with this method is that it involves a lot of iteration if the compartment is large and cuts the waterline of the ship, because the level of water in the compartment will only rise to the waterline and as it does the ship will sink further until an equilibrium is reached. In these circumstances the second method that relies on calculating the loss of buoyancy due to the flood provides a better answer, however, it is a lengthy calculation.

2359. Permeability

If a compartment is filled with water and an attempt to estimate the weight of water within it is made, an allowance must be made for the volume of the compartment that is occupied by such things as fittings, equipment, stores and machinery. This allowance is called the permeability of the compartment and is expressed as a percentage of the gross volume of the compartment. The exact value of permeability will obviously change from compartment to compartment and from day to day and therefore a good approximation is required in order to carry out damage stability calculations. The following figures are given as a guide and adjustments should be made based on ships knowledge, experience and loading conditions:

- Watertight compartments 97%;
- Accommodation Spaces 95%;
- Machinery Spaces 85%; and
- Stores 60%.

2360. The Added Weight Method

The added weight method is the simplest to understand but can be quite lengthy, particularly if the flood is large, because of the iterations required. It is fundamentally the same as the methods described in Chapter 30 for adding a liquid weight to the ship and involves a parallel Sinkage and adjustment to the centre of gravity and metacentre and then an allowance for free surface effects. The method is as follows; refer to Chapter 30 for further explanation.

a. Estimate the volume of water in the compartment to the waterline. An allowance should be made for permeability (the percentage of the compartment not occupied by fittings, equipment's, stores, etc). For this the added weight of floodwater can be estimated.

b. Knowing the added weight calculate the parallel Sinkage, using TPC for hydrostatic data at the original draught.

c. From the new draught a second iteration can then be made of the weight of floodwater up to this level (it will be more than the first iteration), and again the parallel Sinkage calculated and the new draught found.

d. At this new draught find the position of the metacentre (KM_1) from the hydrostatic data and calculate the new position of the centre of gravity (KG_1).

e. The metacentric height can then be calculated as if the floodwater was a solid weight:

$$GM = KM_1 - KG_1$$

f. Now make an adjustment to the GM for any free surface effects, assuming the compartment is rectangular:

$$GM_{Fluid} = \frac{GM - ab^3 \times 1.025}{(12 \times \Delta)}$$

g. It is quite possible under severe cases of damage that the GM will become negative and the ship will loll. Because the shipside is free flooding, as the ship rolls there is likely to be a change in the weight of floodwater and so further iterations will be required. Ultimately an accurate result can be obtained by this method. In spite of the tedium of the iterations required it has its merit in that at each iteration an accurate assessment of the changing weight of flood water can be made, in particular allowing for watertight decks overhead which may be able to restrict flooding vertically.

2361. The Lost Buoyancy Method

a. The alternative approach is to consider that as a result of damage the volume of the hull and area of the waterplane that contribute to the buoyancy and hydrostatics of the ship have been modified. The method involves transferring the buoyancy previously provided by the new flooded compartment to a new layer of buoyancy above the original waterline and reducing the waterplane area. These have the effects of:

(1) Altering transverse and longitudinal GMs.

(2) Sinking the ship lower in the water.

(3) Heeling the ship.

(4) Trimming the ship.

b. The analysis of the results of damage can be calculated in three distinct stages:

(1) Estimate Sinkage.

(2) Estimate damaged transverse metacentre and heel.

(3) Estimate damaged longitudinal metacentre and trim.

2362. Sinkage

a. As with the added weight method, first an estimate of the weight of floodwater must be made, this is also the loss of buoyancy (w), also the position and the size of the compartment must be estimated.

b. Estimate the area of the waterplane lost by assuming the compartment is a rectangle (length - l, breadth - b):

Lost WPA = a = l x b

c. Find the remaining TPC from the formula that transforms the lost WPA to a weight of seawater 1 cm thick:

$$\text{Remaining TPC} = \text{TPC} - \frac{\text{lost WPA}}{97.5}$$

d. Calculate the parallel Sinkage (s) in cm:

$$s = \frac{w}{\text{remaining TPC}}$$

2363. Heel

a. Estimate the shift of the centre of flotation off the centreline caused by the loss of waterplane area:

$$FF1 = \frac{a \times fF}{A - a}$$

where:

A = original WPA (TPC x 97.5)

a = lost WPA (l x b)

fF = distance from the centreline of the middle of the flooded compartment.

b. Calculate the second moment of area of the lost waterplane area from the fore and aft axis through the new centre of flotation. For a rectangular compartment (length l, breadth b) a distance d from the new centre of flotation's axis:

$$i = l \times b \times d^2 + \frac{(l + b^3)}{12}$$

c. Find the fall in the transverse metacentre (MT) due to the lost waterplane area:

$$\text{Fall of } M_T = \frac{i \times \rho}{\Delta}$$

d. Find the rise of the centre of buoyancy due to the parallel Sinkage:

$$\text{Rise of B} = \frac{w \times Bb}{\nabla}$$

where: Bb = distance from the original centre of buoyancy (found from hydrostatic data) to the centre of the parallel Sinkage $\left[\frac{T + s}{200}\right]$

e. The centre of gravity is unchanged so the transverse metacentric height is only changed by the fall in metacentre and rise in centre of buoyancy:

$$GM_T(\text{damaged}) = GM_{original} - \text{fall of } M_T + \text{rise of B}$$

f. The angle of heel can now be found. The heeling moment is given by the loss of buoyancy, w, multiplied by the distance from the centre of the lost waterplane area to the fore and after axis of the centre of flotation:

$$\tan\varphi = \frac{\text{heeling moment}}{\Delta x\ GM_T\ (\text{damaged})}$$

2364. Trim

a. Calculation of trim is similar to calculation of heel:

(1) Estimate the fore or aft shift of the centre of flotation due to the lost waterplane area shown in Para 2363 sub para a.

(2) Calculate the loss of second moment of area of the waterplane where the centre of the compartment is a distance, e, from the athwartships axis through the new centre of flotation. The formula in Para 2363 sub para b becomes:

$$i = a \times b \times e^2 + \frac{(b \times a^3)}{12}$$

(3) Find the fall in longitudinal metacentre due to the loss of waterplane area:

$$\text{Fall of } M_L = \frac{i \times \rho}{\Delta}$$

(4) The rise in centre of buoyancy due to parallel Sinkage is the same as in the transverse case therefore:

$$GML(\text{damaged}) = GMoriginal - \text{fall of ML} + \text{rise of B}$$

where:

GML original can be found from:

$$\text{GML original} = \frac{MCT1cmBPoriginal \times LBP}{\Delta}$$

(5) Now the MCT1cmBP for the damaged ship can be calculated:

$$MCT1cmBPdamaged = \frac{\Delta \times GM\ L\ damaged}{LBP}$$

(6) The trimming moment is found by multiplying the lost buoyancy by the longitudinal distance between the centre of the flooded compartment and the new centre of flotation. Therefore:

$$\text{Change of Trim} = \frac{\text{trimming moment}}{\text{MCT1cmBPdamaged}}$$

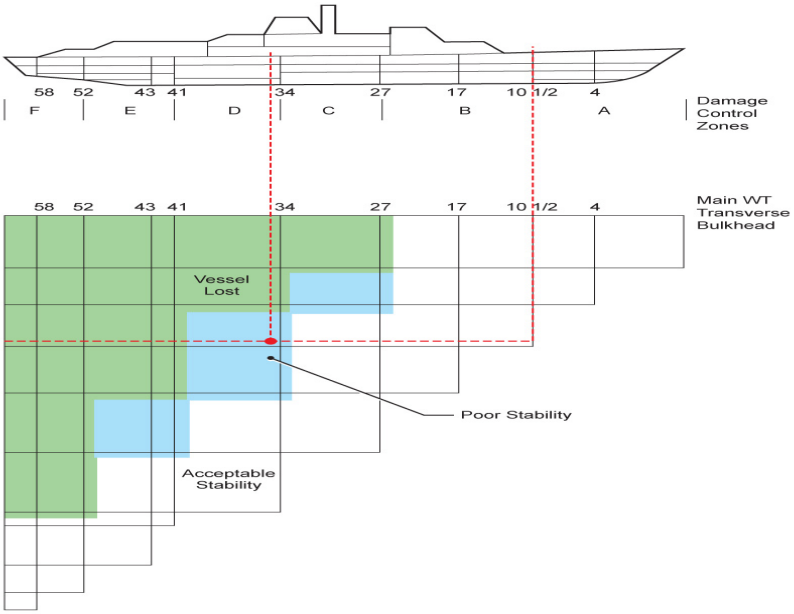
b. Both of these methods will allow prediction of ship stability with reasonable accuracy up to approximately 15° of heel. At greater angles of heel or at large angles of trim, particularly if the deck edge is immersed or large areas of weather deck are submerged forward or aft, improvement of stability must be of prime importance and reference should be made to the damage examples given in the CBRNDC Class Book.

c. As can be seen above both of these methods are extremely long and tedious and fraught with the risk of calculation errors particularly during the stress of State 1. Therefore every attempt should be made by the officers responsible to fully familiarise themselves with the examples in the CBRNDC Class Book and attain a suitable level of ships stability knowledge to recognise when an incident may start to present a stability problem and should be studied more closely.

2365. Carpet Plots

To make the task of assessing the effect of flooding on ships stability very much quicker and less likely to create an error, carpet plots are often issued to ships to aid the HQ1 team. These plots provide a quick visual guide to the state of the ships stability dependent on the length of the flood. These diagrams give a worst case scenario, with all flooding adjacent and unrestricted vertically between the forward and after flooding boundary. They will only tell you whether the ship is lost, has poor stability or acceptable stability. With reference to Figure 23-33 to use the diagram, mark on the forward flooding boundary and follow the line down to the bottom of the diagram. Trace this line across to the other side of the diagram. Mark on the after flooding boundary and follow this line down. At the point where the lines cross read off stability condition.

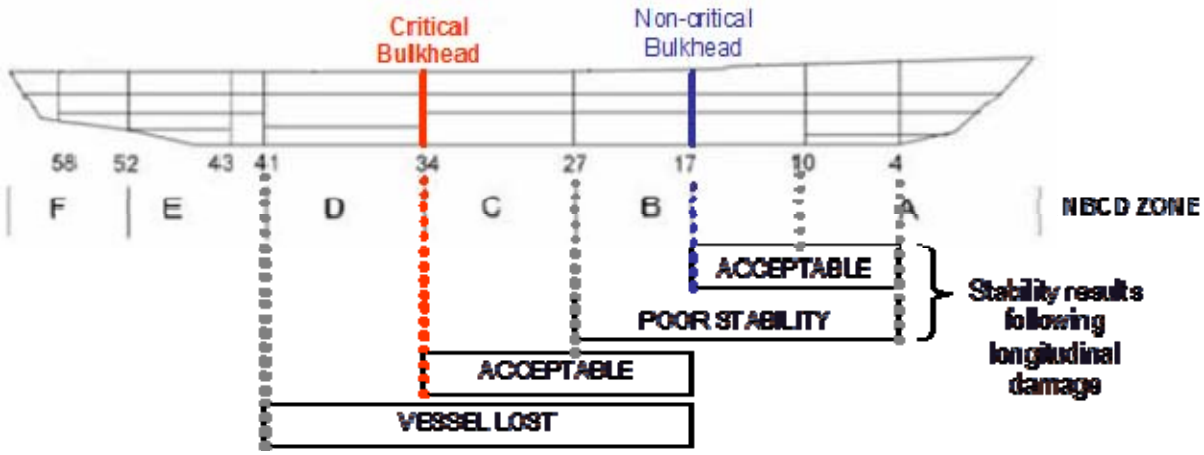
Figure 23-33. Carpet Plot



2366. Critical Bulkheads

The Ship Survivability Book will provide guidance on Critical Bulkheads. Warships may have some reserve of buoyancy and stability beyond their stability standard should the integrity of watertight subdivision be maintained. In some instances, this is not the case. If the damage suffered is the same as the ship was designed to survive, and flooding progresses through a watertight bulkhead there are cases where ship will transition from being able to survive to being lost. This watertight bulkhead is categorised as a Critical Bulkhead and should be a priority for damage control. This is illustrated below in Figure 23-34 for a ship that is designed to survive damage to 2 adjacent compartments. Critical Bulkheads are indicated on the Ships Carpet Plots.

Figure 23-34 Critical Bulkheads



2367. Measurements

a. For the shore-based Emergency Response Naval Architect to support the on-board recovery decision making process for residual stability and buoyancy, measurements of the ship attitude and condition will be necessary.

b. The method employed by the Emergency Response Naval Architect (ER NA) to arrive at situational diagnosis of adequate fidelity relies upon the differential comparison of the attitude with respect to draught, trim and list simulated using the computer model and actual measured attitude of the casualty.

c. For the diagnostic process to work effectively the measured attitude should be associated with the reported internal status, as such they should, as close as practically possible, represent the same particular point in time, i.e. within approximately 30 minutes.

"If you don't measure it, you can't know it. If you don't know it, you can't control it. If you can't control it, you are at the mercy of chance" Dr Mikel Harry.

d. It is probable during the diagnosis phase that repeat measurements will be required in order to achieve a prognosis and advice to the ship. Once a prognosis of the situation has been reached it will be important to continue measurements in order to monitor the success of controlling actions.

SECTION 4 - DOCKING AND GROUNDING

Sponsor: SDA-NAG-ShipStab

2368. General

a. A ship may be docked for normal maintenance or for repair work and may be grounded by accident or to prevent her total loss after damage. The stability problems associated with either of these situations are similar except that docking is a more controlled evolution with the hands on experience of a dockmaster to ensure the necessary precautions are taken. This section examines the forces developed during docking or grounding and discusses the impact these can have on the stability of the ship.

b. Grounding and docking introduce an external force, the reaction between the floating body and the block or ground, consequentially buoyancy will not equal weight. The hydrostatic data for the positions of LCF, centre of buoyancy and the metacentres will all remain appropriate for the draught of the ship. However, the weight of the ship will not be equal to the mass displacement given for that draught in the hydrostatic data, rather this figure will represent the buoyancy force and to find the weight of the ship the reaction force has to be added to it. Since the body will be in equilibrium under 3 forces, weight, buoyancy and the reaction; buoyancy and weight will not necessarily act in the same straight line - B will not necessarily be under G.

2369. Free-Floating Incidents

a. For incidents where the casualty remains free-floating the appropriate methodology for determining it's attitude will depend upon the severity of the resultant structural damage. This can be defined as follows;

(1) Is **Limited** when:

- LLSS < 6% LWL;
- VLSS ≥ D_{max}; and
- TPH < 20% Bwl_{max}.

(2) Is **Moderate** when:

- 6% LWL < LLSS < 15% LWL;
- VLSS ≥ D_{max}; and
- 20% Bwl_{max} < TPH < 50% Bwl_{max}.

(3) Is **Significant** when:

- LLSS ≥ 15% LWL;
- VLSS ≥ D_{max}; and
- TPH ≥ 50% Bwl_{max}.

(4) Where;

- LLSS is the longitudinal extent of loss of structural integrity in the side shell;
- VLSS is the vertical extent of loss of structural integrity in the side shell;
- TPH is the transverse penetration into the hull;
- LWL is the load waterline length;
- D_{max} is the maximum weather deck height and; and
- Bwl_{max} is the maximum waterline beam.

b. The methodology applied will depend upon the following;

(1) The structural damage severity, as defined above, is as follows:

(a) **Limited:** either of the following;

(i) Where a fully integrated IPMS[2] is fitted and functioning; an averaged draught at a single stated location and the averaged displayed list and trim angles.

(ii) For older platforms or when the IPMS is not functioning; the averaged fore and aft indicator[3] draughts and the averaged angle of list from the heel indicator.

(iii) Averaged freeboard measurement from a single stated location and averaged angle of list from the heel indicator and the average angle of trim from an improvised measurement system[4].

(b) **Moderate**: averaged freeboard measurement from 8 stated locations around the casualty, 4 portside and 4 starboard, as shown in Figure 23-34.

- When list exceeds 10° the averaged list angle should be provided from either the IPMS or heel indicator.

(c) **Significant:** Averaged freeboard measurement from 16 stated locations around the casualty, 8 portside and 8 starboard, as shown in Figure 23-35.

- When list exceeds 10° the averaged list angle should be provided from either the IPMS or heel indicator.

(2) Where the prevailing conditions and resultant motion of the casualty prevents the undertaking of those measurements specified for **Moderate** and **Significant** categories then the default shall be that specified for **Limited** damage.

[2] Such systems will incorporate both heel and trim inclinometers and draught sensors, the readings from which should be able to be displayed on screen.
[3] Older platforms will usually be fitted with heel and draught indicators in HQ1/SCC and Machinery Control Room (MCR).
[4] This may take the form of a pendulum, a digital level or even a smart phone app.

- When conditions abate one should revert to the original measurement requirement.

(3) When the battle rhythm of the damage control activity prevents the undertaking of those measurements specified for **Moderate** and **Significant** categories then the default shall be that specified for **Limited** damage.

- When the tempo of the damage control activity levels off, one should revert to the original measurement requirement.

c. The preferred method for determining the casualty's actual response in the case of incidents that have **Moderate** to **Significant** structural damage is to take freeboard measurements. The reason for this approach is three fold;

(1) A casualty having suffered **Moderate** to **Significant** structural damage will be at risk of further structural failure, the freeboard method allows the ER NA to determine the longitudinal and transverse structural deformation which would not be possible by just taking draughts.

(2) Taking draught readings in many circumstances will not only be impractical but will also expose personnel to an unacceptable risk of injury.

(3) Determining the casualty's draught trim and list from freeboards, for the following reasons, is far more accurate than taking draughts;

- freeboards are measured as opposed to being sighted;

- many freeboard measurements can be made and averaged in a short period of time;

- freeboard measurements can be taken at more locations around the casualty's deck edge than the six standard draught locations; and

- freeboard measurements will be markedly more accurate and robust with respect to determining the list, trim and draught than the traditional draught based measurement.

d. Freeboards should be measured[5] from the top of the bulwark or spurn water to the water surface from locations that can be clearly referenced on the reporting pro forma. Readings to be averaged over 4-6 measurements and time logged. The need for further reporting of the external response will be driven by both positive and negative situational changes that may occur, be they further battle action damage, material deterioration or the result of the actions of the damage control team.

[5] Freeboard and depth sounding measurements can be undertaken using a dip-tape, the addition of a divers belt weight would assist.

2370. Grounding Incidents

a. In the case of grounding incidents of any severity the recommended procedure would be to take a total of 18 freeboard and sounding measurements around the casualty, (8 portside, 8 starboard, 1 forward, 1 aft) as shown in Figure 23-37. The sounding measurements will allow the Emergency Response Naval Architect (ER NA) to develop a representation of the seabed topography for the full length and beam of the casualty. This will allow the grounded situation associated with a change in tide height or weight and buoyancy distributions to be determined with respect to the following;

(1) The change in ground reaction magnitude and distribution.

(2) The change in embedment.

(3) The potential for severe list and even capsize.

(4) The likelihood of appendages such as rudders and propellers contacting the seabed and the magnitude of the ground reaction acting upon them.

(5) The associated grounded shear force and bending moment.

b. Freeboards and soundings should be measured from the top of the bulwark or spurn water to the water surface from locations that can be clearly referenced on the reporting pro forma. Readings to be averaged over 4-6 measurements and time logged.

c. The need for further reporting of the external response will be driven by both positive and negative situational changes that may occur, be they further battle action damage**,** material deterioration or the result of the actions of the damage control team.

d. The appropriate methodology for further monitoring measurements will depend upon the following;

(1) Where the grounding incident is considered to be a **Low** energy event and any previously received damage has been determined to be **Limited** the casualty's grounded attitude may be determined as follows;

(a) Where a fully integrated IPMS is fitted and functioning; an averaged draught at a single stated location and the averaged displayed list and trim angles.

(b) For older platforms or when the IPMS is not functioning; the averaged fore and aft indicator draughts and the averaged angle of list from the heel indicator.

(c) Averaged freeboard measurement from a single stated location and averaged angle of list from the heel indicator and the average angle of trim from an improvised measurement system.

(2) Where the grounding incident is considered to be a **Low** energy event and any previously received damage has been determined to be **Moderate or Significant** the casualty's grounded attitude may be determined as follows;

- Averaged freeboard measurement from 14 stated locations around the casualty, 7 portside and 7 starboard, as shown in Figure 23-36.

- When list exceeds 10° the averaged list angle should be provided from either the IPMS or heel indicator.

(3) Where the grounding incident is considered to be a **Moderate** or **High** energy event the casualty's grounded attitude may be determined as follows;

- Averaged freeboard measurement from 14 stated locations around the casualty, 7 portside and 7 starboard, as shown in Figure 23-36.

- When list exceeds 10° the averaged list angle should be provided from either the IPMS or heel indicator.

(4) When and if it has been established that the casualty is not suffering significant structural deformation or excessive loading the casualty's grounded attitude may be determined as described at Para 2370.d.(1).

Figure 23-35 Freeboard Measurements for Moderate Structural Damage

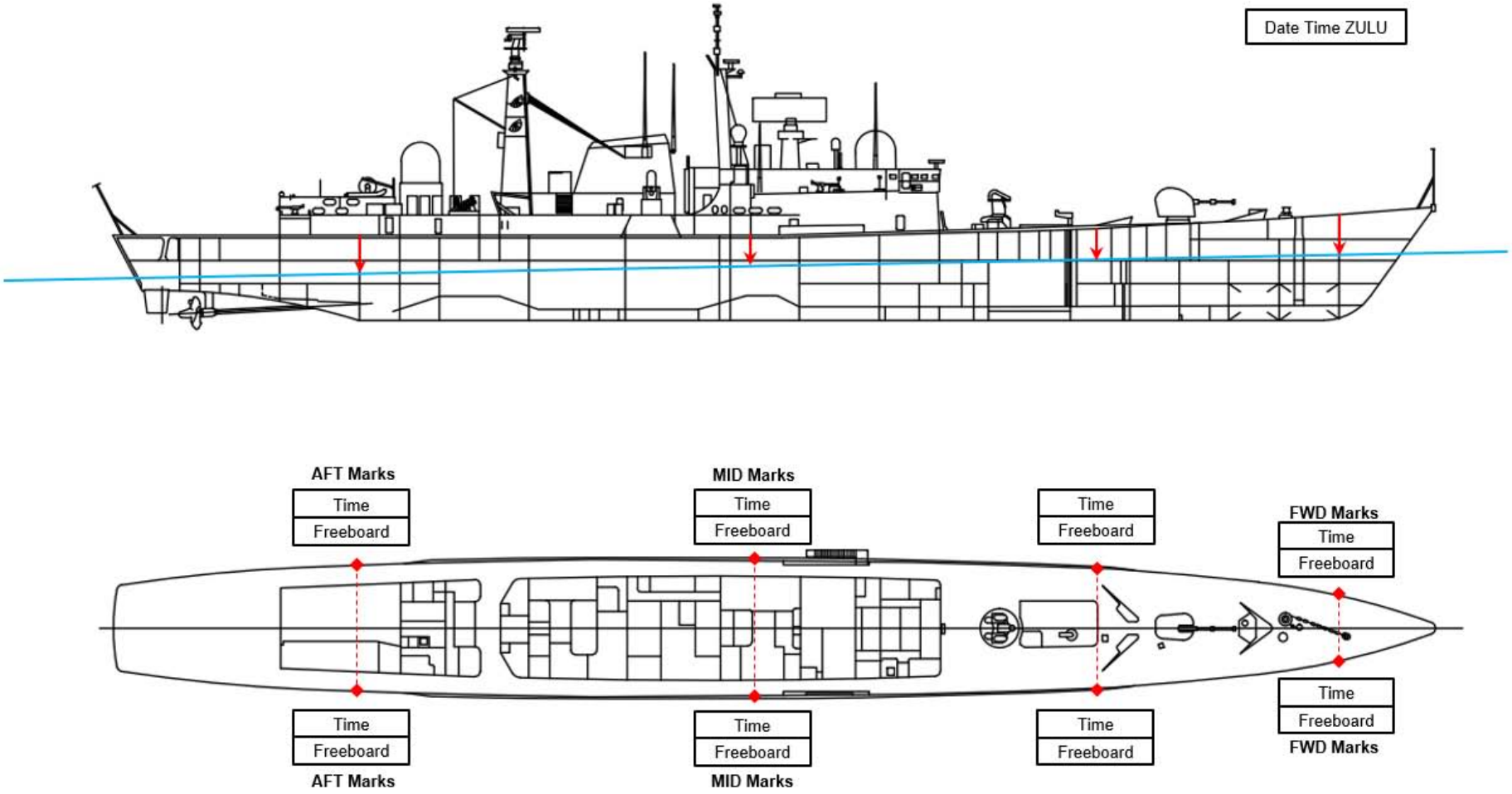


Figure 23-36 Freeboard Measurements for Significant Structural Damage

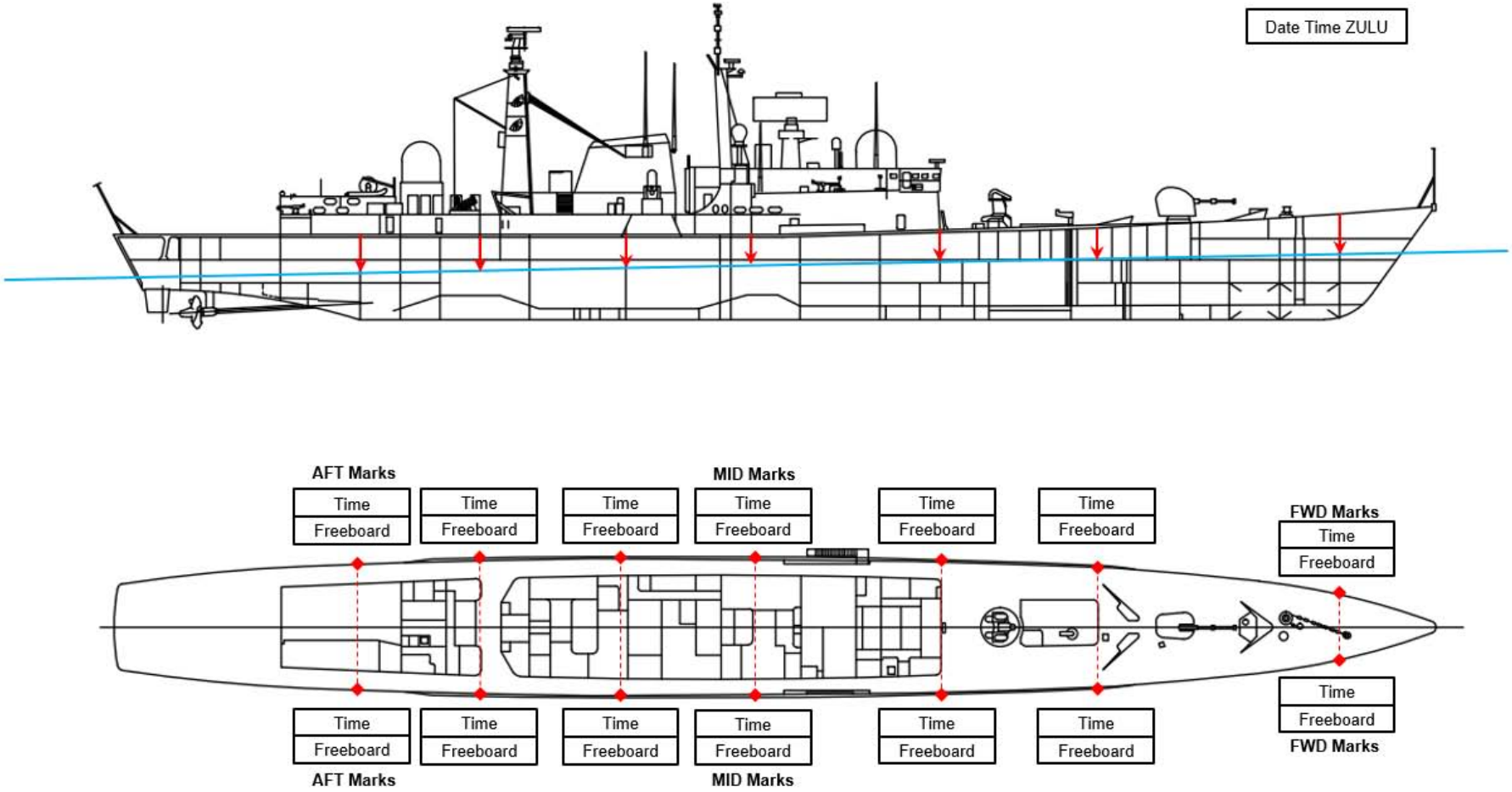
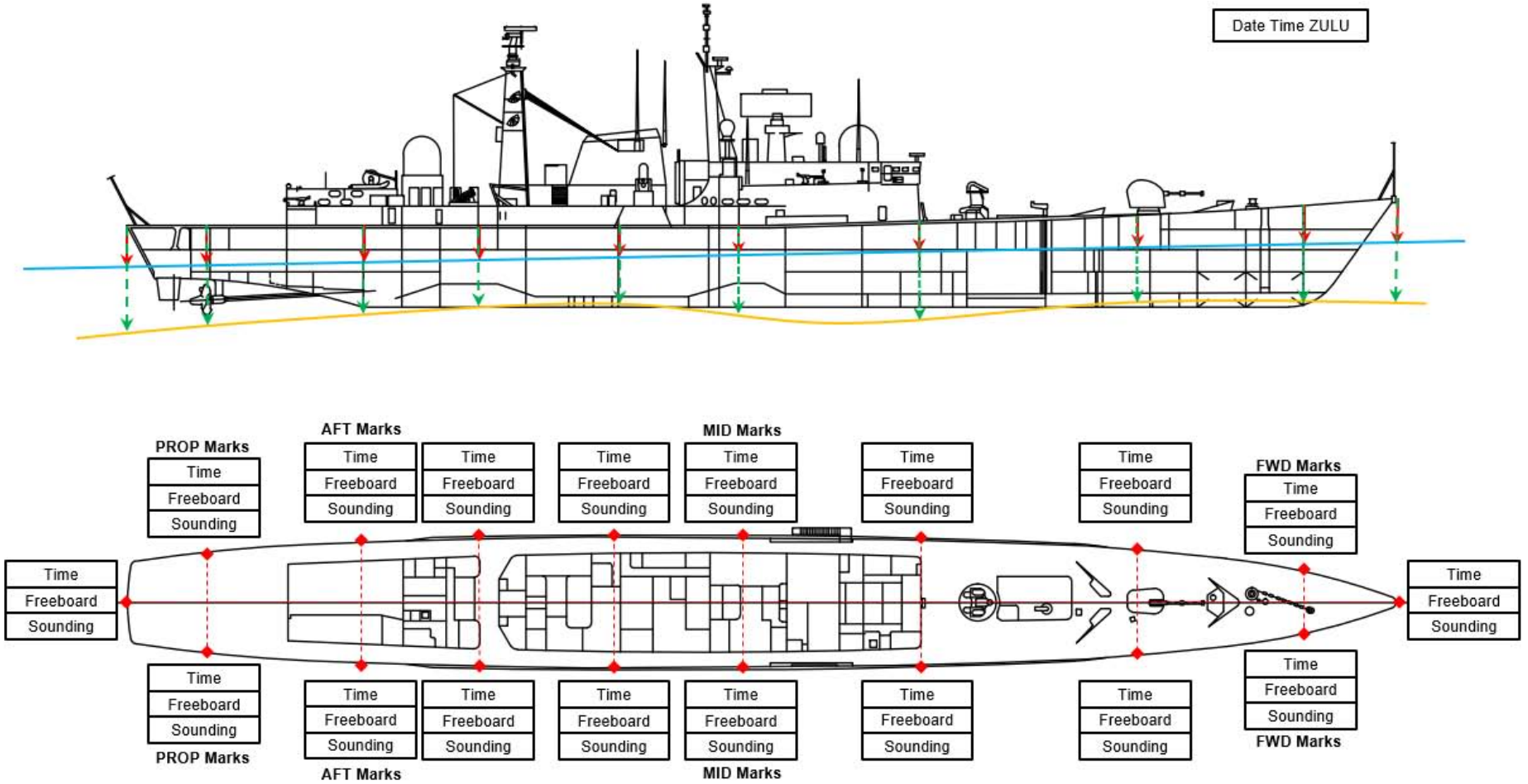


Figure 23-37 Grounded Freeboard and Sounding Measurements



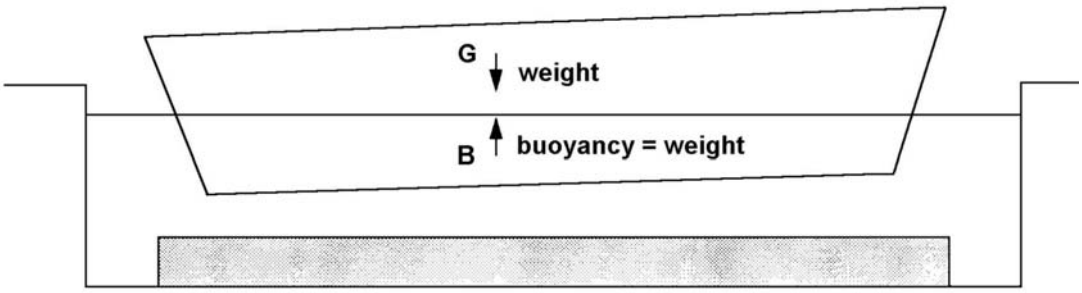
2371. Docking

During the docking procedure, as the water level in the dock falls, it can be difficult to keep the position of the ship accurately above the dock blocks she will rest on, especially if there is any wind. To minimise the risk of docking skew to the blocks, with consequential problems for the stability of the blocks and indeed the ship, and the possibility of excessive forces being produced, the normal practice is first to concentrate on centring one end of the keel on the blocks. Then, as the water level falls, the weight taken anchors that point and closer attention can be given to the other end. Most ships are designed to trim by the stern and the 'after cut up' (ACU) is made of sufficient width and strength to take the normal docking loads without undue damage to dock blocks. Hence it is usual before docking to arrange the draughts so that the ship is trimmed by the stern to ensure the 'after cut up' sues first.

2372. Flotation During Docking

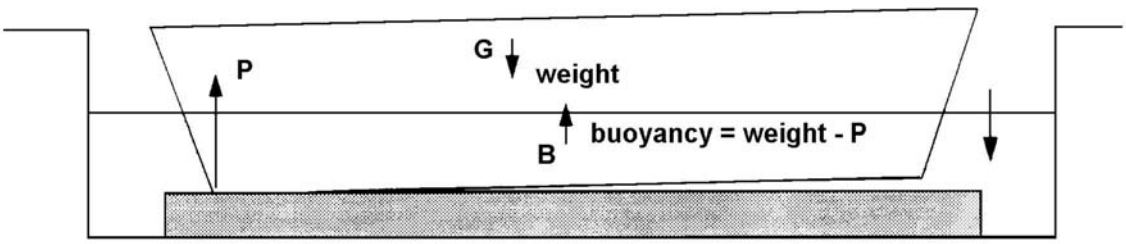
Assuming that the vessel is trimming by the stern relative to the blocks so that it sues first at the 'after cut up'.

Figure 23-38. Afloat in Dock



In Figure 23-38 until the keel touches aft the situation will be normal, ie buoyancy = weight. Once the keel touches and the water in the dock falls relative to the ship, a force P will be created. Being aft of the LCF, P will cause the ship to trim forward, thus moving B forward to regain equilibrium as shown in Figure 23-39.

Figure 23-39. Keel Touching the Dock Blocks



The conditions of equilibrium are now:

a. Weight = buoyancy + reaction P.

b. The moment of the three forces about any axis is zero.

If the ship is symmetrical and remains upright, the three forces will lie in the centre plane of the ship and only the longitudinal moments need to be considered. As a result of the trimming effect of the force P, the ship will eventually touch the dock blocks all along. Thereafter the reaction force will be distributed along the length of the keel and further considerations of the combined moments of the forces should become academic.

2373. Magnitude of Reaction when a Vessel Sues All Along the Blocks

The reaction force, P, will reach its maximum just prior to the keel touching all the way along its length. At this time the blocks and the keel structure at the after cut up must be capable of withstanding this force without crushing or tripping. Apart from structural concerns the magnitude of P at this time is also important for transverse stability. As P increases, draught reduces, the LCF will, in general, change position and MCT will change, though for small initial trims the effect of their change can be ignored. Thus, a first estimate of P is made as:

Pj = (trim change required to align keel with blocks) x MCT1cmBP

where: j is the separation of the ACU from CF
trim change required = trim by stern - declivity of dock blocks

$$P = \frac{\text{(trim change required to align keel with blocks)} \times \text{MCT1cmBP}}{j}$$

The resulting draught reduction at LCF will be P/TPC. This will provide a new mean draught from which new hydrostatic data for the position of LCF, TPC and MCT $1m_{BP}$ can be found. Using these new figures a second iteration of the above calculations can be made to find a more accurate answer for P.

Note. *Most Naval dockyards no longer have any dock block declivity, however this maybe experienced in some areas of the world.*

2374. Transverse Stability During Docking

The introduction of a force p at the keel reduces the righting moment generated when the ship is disturbed from the upright condition. From Fig 23-40 it can be seen that by taking moments about the keel (K) the net righting moment allowing for the effects of the reaction force P is:

Righting Moment = $(\Delta - P)\,KM \sin\varphi - \Delta KG \sin\varphi$

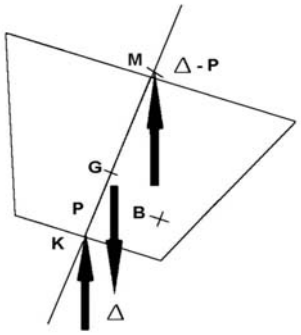
$= (\Delta KM - \Delta KG - P.KM) \sin\varphi$

$= (\Delta GM - P.KM) \sin\varphi$

$= \Delta \left(GM - KM.\frac{P}{\Delta}\right) \sin\varphi$

This parallels the normal afloat relationship (righting couple = $\Delta GM\sin\varphi$ and so the expression (GM - KM.P/Δ) is sometimes referred to as the 'effective GM'. However, it must be remembered that the GM in this expression changes as the ship sues because as the water level falls away from the ship the position of M will move.

Figure 23-40. Transverse Stability During Docking



The ship will remain stable so long as (KM.P/Δ)<GM. It will be seen that this condition will be threatened if either GM is low, or if the reaction force P is high. As we have seen the magnitude of P is determined by the trim change required to align the keel with the blocks, the distance of the point the keel first touches (usually the ACU) from the LCF, and the ship MCT 1 m at the docking draught. Assuming MCT 1 m is outside control, to minimise the risk of instability during suing, the following conditions should be sought:

a. Maximum GM practical (this may sometimes demand ballasting, and may be stipulated in the Stability Statement). As usual, free surfaces must be kept to a minimum.

b. The change in trim required to sue all along should be the minimum consistent with the requirements for the docking procedure (no more than about 0.6 m should be necessary). There may however be occasions when in a light condition the ship has a very large trim, in which case ballasting may be necessary to reduce P - not just for stability but also to protect the dock blocks.

c. The point at which the ship first touches should be as far as possible from the LCF. Although the LCF is usually abaft midships for surface warships, and the ACU is well forward of the stern, as stated above it is normal to use the ACU for this purpose rather than the forefoot as it presents less problems when strengthening the local structure in this area.

2375. Grounding

With the exception of the special cases of docking or amphibious landings, grounding is a condition to be avoided in ships such as warships that are not designed with grounding in view. Ships so designed have flat bottoms and ground on mud or soft sand which equalises the bearing pressures. Analysis of the reaction force apparent after grounding requires the following information:

a. The point at which the ship has grounded.

b. The state of the tide relative to that at which the ship grounded:

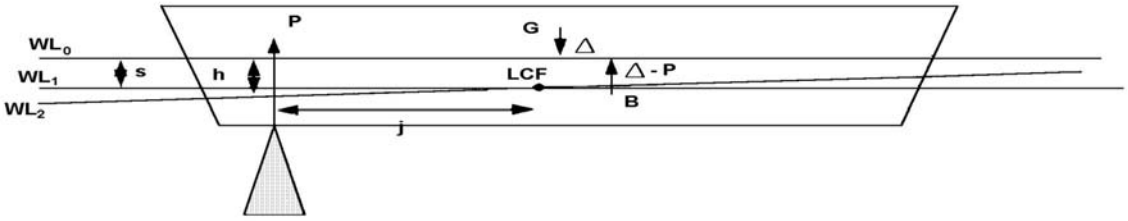
(1) If the tide rises the vessel will be able to float off providing there has been no increase of weight and no flooding has resulted from the grounding.

(2) If the tide falls the reaction between ship and ground will increase. The additional upward force will reduce the buoyancy and hence the volume of displacement. For equilibrium, the centre of buoyancy will move longitudinally away from the point of grounding as in docking and the vessel will take up a heel or trim away from the point of grounding to accomplish this.

The condition to apply is that the reduction in draught at the point of grounding due to the parallel rise, the change in trim, and effects of heel, must be equal to the fall in tide. There are two situations of grounding that are best examined separately centreline grounding when heel effects can be ignored and grounding off the centreline when all three effects must be considered.

2376. Analysis for Grounding On the Centreline

Figure 23-41. Grounding On the Centreline



Referring to Figure 23-41, with no heeling moment let:

s = parallel rise
h = the fall in tide
j = the distance from the CF of the point of grounding
t = the change in trim between perpendiculars caused by the moment of the grounding force P

then, the reaction force P will cause parallel Sinkage s given by:

$$s = \frac{P}{TPC} \text{ (in cms)}$$

and the change in trim caused by the reaction force P will be:

$$t = \frac{P \times j}{MCT1cmBP} \text{ (in cms)}$$

(j and MCT 1 cm being the respective figures for the waterline after parallel rise s (WL_1))
The effect of parallel rise and trim at the point of grounding must equal the fall in tide. Hence:

$$h = s + \left[t \times \frac{j}{L_{BP}} \right]$$

These 3 equations can now be solved to give P.

Note. *Using the TPC and position of LCF between WL_0 and WL_1 an improvement in accuracy can be made, but it should be appreciated that when a ship is grounded, precise calculations will rarely be necessary.*

2377. Grounding Countermeasures

In considering countermeasures to grounding, the moment of P x j (Figure 23-42) gives an indication of the moment required by:

a. Counterflooding.

b. The removal of weights from the grounded end.

c. The transfer of weights to the free end.

While counterflooding may have the advantage of being the quickest of the three methods, it will incur an element of parallel Sinkage and in practice there is a limit to the number of tanks available for this purpose. The removal of weights from the area of impact will reduce pounding at this point, thereby limiting the degree of structural damage, and the transfer of liquid and solid weight to the free end, if sufficiently large, will trim the ship to the point where it can be pulled free. In most ships the limited capacity for each of these procedures may necessitate a combination of all three to be effective. The removal and transfer of solid weights and liquids, combined with counterflooding may be insufficient to release the ship. Therefore early consideration should be given to the flooding of other compartments in addition to tanks and void spaces.

2378. Transverse Stability after Grounding On the Centreline

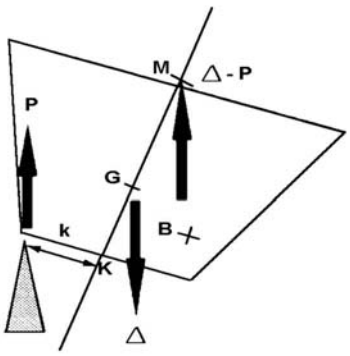
It will be evident that if grounding occurs towards either end the point of contact will be approximately on the middle line. Under these circumstances transverse stability will be affected similarly to stability after docking, such that the ship has an effective GM:

Effective GM = GM - KM x (P/Δ)

2379. Grounding Off the Centreline

Grounding away from the centreline presents more problems, as the reaction force will also result in the ship heeling.

Figure 23-42. Grounding Off the Centreline



With reference to Figure 23-41, if the grounding force P acts a distance 'k' off the centreline, it will cause a heeling moment P x k(cosφ) which will be resisted by the righting moment Δ x (GM – (P/Δ)KM) sinφ

$$Pk(\cos\varphi) = \Delta(GM - (P/\Delta)KM)\sin\varphi$$

$$\tan\varphi = \frac{Pk}{\Delta(GM - (P/\Delta)KM)}$$

The result of the angle of heel is to cause the draught at the point of grounding to fall by an amount, say f:

Therefore $\tan\varphi = f/k$

It can be said that:

$$f = \frac{Pk^2}{\Delta(GM - (P/\Delta)KM)}$$

Hence it can be seen that the effect of an upward force P at any point will cause the draught to decrease at that point by an amount due to parallel Sinkage, an amount due to trim, and an amount due to heel. A first approximation to that total, which will equal the fall in tide, will following the earlier analysis be:

$$h = \frac{P}{(100TPC)} + \frac{Pj^2}{MCT1cmBPL_{BP}} + \frac{Pk^2}{\Delta(GM - (P/\Delta)KM)}$$

2380. Transverse Stability after Grounding Off the Centreline

Assessment of the transverse stability of a ship grounding off the centreline is somewhat more difficult than before. Essentially, the righting moment itself is the same as for the centreline grounding case but the ship has already adopted an angle of heel due to the grounding reaction force and any additional movement of weight will act about this angle not the upright. It is important to note that this analysis of stability after grounding relies on small angle theory and angles of heel due to off centreline grounding will quickly exceed 10° so that this theory is invalid. This situation is exceptionally dangerous and difficult to predict, particularly if the range of tide experience is high, resulting in angles of heel approaching the angle of downtake immersion. Earlier advice to increase GM, so increasing the ships stability, by ballasting low in the ship still holds except that obviously ballasting on the centreline will in this case increase the angle of heel, this problem could be eased by ballasting low in the ship on the same side as the grounding point.

CHAPTER 24

DAMAGE CONTROL AND FIREFIGHTING STORES

CONTENTS

Para

2401. General
2402. Stowage
2403. Custody
2404. Responsibilities for the Maintenance of CBRNDC Equipment
2405. Marking
2406. Arrangements in War
2407. Access to Equipment Lockers at Fire and Repair Posts
2408. FRPP Locker Contents and Contents Lists
2409. Defective Damage Control Equipment

CHAPTER 24

DAMAGE CONTROL AND FIREFIGHTING STORES

2401. General

a. Damage repair stores are supplied initially as either permanent or consumable Naval stores, with some supplied as armament stores eg charges for the Ramset explosive powered fastening tool. A guide to the allowances for ships is given in BRd 2170(3) - CBRNDC Stores Catalogue for HM Surface Ships, HM Submarines and RFAs.

b. Generally, stores used for damage repair consist of the following:

(1) Materials for shoring and the necessary tools for cutting and setting up shores.

(2) Leakstopping materials such as wedges, splinter boxes, patches and patch packs for the prevention of flooding through splinter holes and damaged structure.

(3) Equipment and tools for effecting pipe repairs.

(4) Electrical equipment such as floodlights, lamps, fuses for effecting emergency repairs to the electrical system and for supplying light and power to areas being repaired.

(5) Equipment for wreckage clearance such as heavy and portable cutting apparatus and lifting gear.

(6) Portable lighting such as torches, caplamps, battery operated floodlights and Cyalume chemical illuminators which, when needed, provide emergency lighting for damage control and first aid parties.

2402. Stowage

In most ships much of the different equipment required for damage repair is contained in built-in lockers sited at each Fire and Repair Party Post. Material such as shoring timber, softwood planks, adjustable steel shores, etc, which are too large to fit in the stowages should be distributed throughout the ship, with attention being given to accessibility under possible damage conditions. Damage repair stores should not be stowed so low in the ship as to be inaccessible should the compartment be flooded.

2403. Custody

It is not easy to ensure the safe custody of equipment in open stowages throughout the ship, but the loss of damage repair or firefighting equipment might have very serious consequences in an emergency. The responsibilities of officers regarding Damage Control equipment are given in Chapter 2, and as follows:

a. Damage repair stores are initially taken on to charge by the Logistics Officer and the Armament Stores Accounting Officer (for explosive items).

b. Damage repair stores (except explosive stores) are to be issued to the MEO and placed around the ship as shown in the CBRNDC Class Book. The MEO is responsible for ensuring that these stores are periodically mustered and kept in a sound, workable, condition.

c. Firefighting stores, including breathing apparatus, are to be issued to the MEO and placed around the ship in authorised stowages as shown in the CBRNDC Class Book. They should be marked as suggested in Para 2405, and issued by the MEO to the officers in whose departmental spaces they are normally stowed. Day to day care of the equipment is to be managed by the officer responsible for the compartment. The MEO is responsible for the periodical testing, maintenance and replenishment, as necessary, of all the issued equipment in accordance with the relevant maintenance schedules.

d. The few stores items needed for the maintenance and upkeep of the damage repair and firefighting equipment should be stowed in the MEOs ready-use store.

2404. Responsibilities for the Maintenance of CBRNDC Equipment

Maintainers, Compartment Custodians and the Whole Ship CBRNDC Qualified Rating (WSQ) all have a role to play in ensuring that CBRNDC equipment is fit for purpose and available for immediate use in an emergency as follows:

a. **Maintenance.** The maintenance of CBRNDC equipment is the responsibility of the equipment maintainer. The branch of the maintainer will normally be ME or WE and may vary from ship to ship. A maintainer must be allocated, by the ship, to each item of equipment either via an electronic maintenance schedule (eg UMMS) or another maintenance scheduling tool. The maintenance will include the monitoring and recording, inspection and replacement of all CBRNDC equipment containing components that are subject to Life Expiry (LIFEX).

b. **Compartment Custodians**. Compartment custodians are responsible for ensuring that the correct CBRNDC equipment is stowed in their compartment and for recording any defects in the relevant defect log. Weekly Departmental DC checks will ensure the right equipment is in the right place, marked correctly and is ready for use in all respects.

Note. *Any maintenance operations including the monitoring of test and LIFEX dates are the responsibility of the designated equipment maintainer.*

c. **WSQ.** The WSQ is responsible for the administration of the Master CBRNDC Training and Material Assessment Log, in which the compartment custodian checks are recorded. The WSQ is not responsible for the maintenance of any CBRNDC equipment, unless specifically designated as an equipment maintainer as described in Para 2404 sub para a. The WSQ is to periodically (at least once every three months) carry out random spot checks around the ship to ensure that the system of inspection and maintenance is being carried out correctly and conscientiously.

d. Any item of CBRNDC equipment removed from its normal location during a CBRNDC incident or exercise is to be returned to that compartment in a serviceable condition. OOD (in harbour)/XO (at sea) are to ensure that compartment checks are carried out on completion of exercises and incidents. Should a defect be identified the faulty equipment is to be quarantined and returned to the maintainer and (wherever possible) a serviceable replacement provided to the compartment concerned.

2405. Marking

A standard method of marking all damage repair and firefighting equipment should be used to establish ownership and responsibility, deter personnel from unauthorised removal (or help in subsequent tracing) and facilitate mustering and maintenance. Suitable identification tallies can be made by ships staff and secured to all such portable equipment except hoses and nozzles.

2406. Arrangements in War

In peacetime much of the personal issue DC equipment is held in the Logistics Officers stores. In war this will be issued to individuals as directed and arranged by the MEO. The items then become the personal responsibility of the recipients for inspection and testing. In war, as in peace, medical stores for first aid purposes are to be placed around the ship by the Medical Officer in the first aid stowages at quarters and first aid posts. The Medical Officer is responsible for their periodical mustering and turnover.

2407. Access to Equipment Lockers at Fire and Repair Posts

Quick access to fire lockers in an emergency is ensured by the provision of a duplicate key in a glass-fronted key box secured to these lockers. The remaining keys of the fire lockers and damage control lockers are held in HQ1/SCC for distribution when required. It is possible that a physical barrier, caused by smoke, fire or damage, might delay the delivery of keys from HQ1/SCC to the fire and repair party post needing them. Therefore, duplicate keys of damage control lockers are to be clearly tallied and placed in a small box or bag and stowed within the appropriate fire locker.

2408. FRPP Locker Contents and Contents Lists

HM Ships are provided with Fire and Repair Party Post lockers containing an allowance of Damage Control stores in dedicated stowages. Large items are stowed near the lockers. These lockers are combined for damage control, electrical repair and fire party stores. Dedicated ‘M’ and ‘L’ toolkits can be taken to the scene of an incident by maintainers, enabling simple repairs without constant recourse to the tools in the FRPP locker. A list of locker contents and a diagram of locker layout is published in BRd 2170(3). A copy, together with a list of the larger items stowed nearby should be displayed on the inside of the locker doors.

2409. Defective Damage Control Equipment

Reports of defective material or design in DC equipment are to be forwarded on Form S.2022, in accordance with BRd 1313 - Maintenance Management in Surface Ships. The procedure for reporting defective DC clothing is detailed in MOD Form 1197.

CHAPTER 25

CBRNDC ORDERS

Para
2501. Introduction
2502. Associated Publications
2503. Regulatory Governance
2504. Platform Class CBRNDC Orders allocation of responsibilities
2505. Classes based in more than one base port
2506. Structure
2507. Content
2508. Issue, Review, Amendment and Withdrawal

CHAPTER 25

CBRNDC ORDERS

2501. Introduction

a. Platform class CBRNDC Orders, BRd 2170 Volume 7 series are a method of formally publishing and distributing the Flotillas' CBRNDC orders. It is a Mid-Level document and promulgates CBRNDC policy, orders and instructions from the Flotilla to their Force Elements.

b. Ships CBRNDC Standing Orders are a method of formally publishing and distributing a Ship's Commanding Officer's CBRNDC Orders. They are Low-Level documents that should be used to cascade CBRNDC policy, local orders and instructions set by the ship's Commanding Officer that enables delivery CBRNDC capability.

c. This instruction describes the linkages, purpose, scope, layout and format of the Mid- and Low-Level CBRNDC instructions and defines how they are to be issued and reviewed.

2502. Associated publications

This document is associated with the following publications:

a. DSA02-DMR.

b. BR2170(1) Damage Control Manual.

c. BR2170(2) CBRN Defence Manual.

2503. Regulatory Governance

These requirements are written in support of the following regulations:

a. DSA02-DMR Regulation 401 – Documentation of policies and procedures.

b. DSA02-DMR Regulation 406 – Emergency Preparedness.

2504. Platform Class CBRNDC Orders allocation of responsibilities

a. High level policy **shall** direct the format of the BRd 2170 Volume 7 series.

b. Flotillas will develop, Mid-Level CBRNDC orders for their platform classes within the bounds of this instruction and by adhering the arrangement in Table 1. These orders **should** be derived from the High-Level publications and are to provide additional and specific detail accounting for class-specific capabilities and limitations.

c. Ships may issue their own Low-Level CBRNDC orders in the form of Ships CBRNDC Standing Orders[1] using the chapter arrangement in Table 25-1.

[1] i.e HMS NonSuch CBRNDC Standing Orders

d. Flotillas and Ships may issue Executive Temporary Memoranda (XTM) to facilitate the addition of detail to high or mid-level instructions to account for environmental, local, or ship specific equipment or circumstances. These memoranda are temporary in nature and should remain extant for the duration of the temporary requirement only. Validity should be no longer than one year before review, when they are to be cancelled or noted for inclusion into the appropriate CBRNDC orders at the next scheduled review.

e. The review schedule of the BRd 2170 Volume 7 series of publications will be controlled by the NCHQ CBRNDC desk officers in collaboration with the NPGO CBRNDC author and Flotilla organisations.

f. The NPGO CBRNDC author is responsible for authoring all BRd 2170 Volumes, BR 4007 and BR 4008.

2505. Classes based in more than one base port

Where a platform class is split between base ports, Platform CBRNDC orders are to be authored by the lead base port but should not be specific to the lead base port[2].

2506. Structure

BRd 2170 Volume 7 series is to follow the format in Table 25-1. It will consist of 1 volume per class, each volume will contain 1 cover with chapters arranged in in accordance with the information detailed in Table 25-1.

[2] HMNB Devonport is the Lead Base Port for T23 Frigate.

Table 25-1. BRd 2170 Volume 7 series chapter arrangement

Header	Content	Notes
Preliminary Pages	Title page	These pages will be populated by NPGO in accordance with current NPGO procedures.
	Sponsor Details	
	Equality Analysis	
	Configuration Control	
	Amendment Procedures	
	Authoring Conventions	
	Introduction	
	Preface	
	Contents	
Chapter 1	CBRNDC Responsibilities and terms of reference for CBRNDC roles.	Each role responsibility should have the following sub headings • Authority and Accountability – with a table identifying who the position is accountable to and for what. • operational tasks/ responsibilities; • training tasks/ responsibilities; and • organisational tasks/ responsibilities. Only responsibilities in addition to those documented in BR2170(1) should be documented.
Chapter 2	Command and Control Organisation	This chapter should include the following information as a minimum • details of the Command and Control Organisation; • details of the SSEP Organisation; • details of the HFEP Organisation; and • Logistic Dept processes and procedures.
Chapter 3	States of Readiness	This chapter should provide information and guidance associated with controlling a ships watertight integrity when the design differs from current defence standards and is therefore controlled using different terminology.

Table 25-1. BRd 2170 Volume 7 series chapter arrangement (Cont'd)

Header	Content	Notes
Chapter 4	Control of Damage	This chapter is to provide information relating to equipment and procedures associated with controlling and limiting the extent of damage.
Chapter 5	Firefighting doctrine	This chapter is to provide information and guidance relating to equipment and procedures associated with firefighting.
Chapter 6	CBRN Defence	Chapter 6 is to be sub divided into 5 sections following the enabling components of CBRN Defence taxonomy, detailed below.
Chapter 6 section 1	Sense	Details and procedures associated with the platform class Chemical and Radiation (CR) sensors.
Chapter 6 Section 2	Knowledge Management	Details and procedures associated with the platform class CBRN knowledge management organisation.
Chapter 6 Section 3	Physical Protection	Details and procedures covering individual and collective protection.
Chapter 6 Section 4	Hazard Management	Details and procedures associated with decontamination and cleansing and management of CBR waste.
Chapter 6 Section 5	Medical countermeasures including CBR casualty care.	Details and procedures for managing personal issue Med CM and ships policy for the care of CBR casualties
Chapter 7	Standard Operating Procedures	All template SOP's should be in this chapter with a working copy held in SGO's

2507. Content

a. Class CBRNDC orders and procedures are Mid-level orders and add detail to High-Level policy whilst considering the capabilities and limitations of the platform class they are written for.

b. They may refer to procedures published in additional documents i.e. firefighting or damage control manuals but are not to duplicate or be used to replace any high-level procedure detailed within the manuals. Where local orders and procedures do refer to the manuals they must state the amendment state of the referenced document. A list of reference publications must be maintained so that when reference publications are amended, the local orders or procedures that refer may be reviewed for continued accuracy and amended as appropriate.

c. Low-Level orders and procedures are not to be used to locally amend firefighting or damage control policy/ manuals; the appropriate method for correction is to be used. In all cases Mid- and Low-level orders are not to countermand policy set out in BR2170(1) or BR2170(2) without written approval of the Operating Duty Holder (ODH)[3]. Approved waivers, concessions or exemptions are to be reviewed and included in Mid-Level instructions during the scheduled review cycle or terminated once no longer valid.

2508. Issue, Review, Amendment and Withdrawal

The Flotillas' DDH organisation is responsible for the review and amendment of the BRd 2170 Volume 7 series for the platform types within their organisation. Issue will be coordinated by NCHQ Ships CDT desk officers on behalf of the ODH and released by NPGO. First of class platforms are to develop the first issue Volume 7 in collaboration with the lead Flotilla and publish chapters 1-5 and 7 before Ship's Staff Move on Board (SSMOB). NCHQ is responsible for setting the review schedule on an annual basis looking out 3 years. Flotilla organisations will conduct reviews and amendments in accordance with the review schedule. Withdrawal will be managed by NCHQ.

[3] ACNS (A&C) for CVF and LPD. ACNS(Ships) for all other platforms.

CHAPTER 26

INSPECTIONS, TESTS AND TRIALS

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CHAPTER 26

INSPECTIONS, TESTS AND TRIALS

ASSOCIATED PUBLICATIONS: BRd 9274, BR1313 and BRd 9463

2601. General

a. Effective CBRN and Damage Control capability is reliant upon largely upon the efficiency of the ships watertight structure, including doors, hatches and fittings and associated damage Control equipment and materiel. To ensure this efficiency, numerous inspections, trials and tests and must be carried out to provide assurances that a ship and her crew are safe to operate.

b. The SARC process comprises a series of checks and controls designed to give the CO/SNO confidence and assurance that the ship and her Company are safe to proceed to the next milestone or stage of training. The process recognises the importance of safety training, organisational and administrative arrangements and equipment readiness using a simple pass or fail criteria. SARC training serials are to be conducted by all Ship's Company including Flight and embarked personnel where applicable. Whilst some checks will be mandatory, guidance is given regarding the inclusion and timing of others that will be undertaken at the discretion of the CO.

c. It is not the intention of the SARC activities to alter the acceptance process. However, beyond the mainly engineering checks, there is no consolidated checklist that covers all safety and organisational issues. For new build ships, SARC serials coupled with elements of Preliminary Safety Training (PST) checks provide a consolidated list that together, form the fundamental body of evidence required prior to declaration of System Acceptance.

d. Full details of the SARC process and allocation of responsibilities are set out in BRd 9274.

2602. Harbour Acceptance Trial (CBRNDC)

a. A HAT (CBRNDC) is to be carried out towards the end of an upkeep period, using Check Lists copied from the annexes. The administrative procedures are detailed in BRd 3001 - Fleet Engineering Orders, including the auditing of completed Check Lists by the Fleet Base Port Waterfront Organisation (FWO). The three stages of a HAT (CBRNDC) are:

(1) **HAT (CBRNDC) Part 1**. Pre-SSMOB Checks, as part of SARC 1.

(2) **HAT (CBRNDC) Surface Ship Material State Verification Inspection (MSVI)** Check Form for Issue of Certificate of Safety (Fire)(CS(F)), as part of SARC 2 - conducted by MCTA.

(3) **HAT (CBRNDC) Part 2B.** Pre-Ready for Sea Date (RFSD) Checks to be completed prior to Fleet Date Inspection (FDI) - Part III, as part of SARC 3.

b. A ships officer is to be appointed HAT (CBRNDC) Coordinator and is to be responsible for:

(1) Overall coordination of the HAT (CBRNDC) inspections, ensuring full compliance with the HAT documentation.

(2) Devising and implementing personnel and whole ship CBRN and Damage Control training serials in accordance with SARC requirements. These are to be achieved prior to:

(a) **SSMOB.** SARC 1.

(b) **RFSD.** SARC 2.

(c) **FDI**. SARC 3.

(3) Compilation of a HAT(CBRNDC) report for each Part (ie Part 1, 2A or 2B), detailing items outstanding, emphasising any ‘starred’ items outstanding that affect achievement of a successful HAT(CBRNDC).

(4) Presentation of the completed HAT (CBRNDC) documentation to the Commanding Officer (CO) via XO/CBRNDCO for approval.

(5) Drafting the achievement signal for each Part of the HAT(CBRNDC) for the CO, in accordance with the SARC DIN and BRd 9274 - Maintenance of Operational Capability (Surface Ships).

(6) Arranging for the Base Part FWO, Local FWO or FOST to audit the completed HAT(CBRNDC) Check List for each Part.

(7) Presentation of completed HAT(CBRNDC) documentation to the FDI inspecting authority.

c. The Whole Ship CBRNDC Qualified (WSQ), as directed by the HAT(CBRNDC) Coordinating Officer, is responsible for the conduct of the HAT(CBRNDC) inspection and for:

(1) Ensuring that personnel undertaking the HAT(CBRNDC) inspections are in possession of the correct documentation and are made aware of their duties.

(2) Correlating the results of Parts 1, Surface Ship Material State Verification Inspection and 2B of the HAT(CBRNDC) inspections and presenting the results to the HAT(CBRNDC) Coordinating Officer.

(3) Ensuring that any discrepancies or deficiencies are dealt with in a timely manner, paying particular attention to ‘starred’ items which must be completed to achieve the HAT(CBRNDC) Parts 1, Surface Ship Material State Verification Inspection and 2B standards.

d. Ships staff are to note the following when preparing for a HAT(CBRNDC).

(1) The date chosen for the inspections must be discussed and agreed by all parties involved with the ships upkeep period. Careful coordination is required to ensure that equipment/lockers/sign writing/communications facilities are in place prior to the Ships staff inspections for each HAT (CBRNDC) Part. Possible constraints/limitations which may affect the conduct of, or the ability to achieve, a satisfactory HAT (CBRNDC) standard are to be discussed with the appropriate FWO (or Squadron for MM/PP) staff and PCM.

(2) Certificates of compliance (clean air certificate) must be current and available for inspection by FWO/Squadron staff during the audit.

2603. Harbour Acceptance Trial (Citadel)

Ships being built or undergoing upkeep periods are to be given a HAT (Citadel) before entering service or fleet time. For ships under construction, the HAT (Citadel) is to be undertaken by the shipbuilder. In other instances the trial will be the responsibility of the Upkeep Authority and carried out by them with the assistance, if necessary, of the ships staff. The trial is to be included in the completion programme and is not to be undertaken until all fitting-out or repair work affecting the citadel is complete.

2604. Sea Acceptance Trial (Citadel)

To prove the operational material state of the citadel, a pressure test is to be conducted at sea during post-upkeep trials.

ANNEX 26A

HAT (CBRNDC) Part 1 - PRE-SSMOB CHECKS

HMS……..

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Escape Routes	**MANDATORY for SSMOB/CS(F)**		
1. Are all escape hatches/panels clearly identified with '**ESCAPE**' on both sides and also adjacent structure with direction arrows?		Navy Command Support	
2. Are all escape hatches/panels operable from all positions, with openings/routes free from obstruction?			
3. Are portable wire ladders correctly fitted with appropriate rungs and securely connected to the deckhead?			
4. Are escape hatch handwheels fitted with extension bars? (MM/PPs only).			
5. Is there a routine for regularly proving all escape hatches?			
6. Are escape routes marked correctly and logically throughout the ship?			
7. Are handwheels, ladder rungs, operating levers and T bar operating handles painted with photoluminescent paint or marked with photoluminescent tape?			
Escape BA (EEBD)	**MANDATORY for SSMOB/CS(F)**		
1. Are holdings in accordance with the allowances in BRd 2170(3)?		Navy Command Support	
2. Are they distributed and stowed correctly iaw the **LSA Key Plan**?			
3. Are stowages and EEBD's numbered?			
4. Are belt worn EEBD's available for use by Command rovers?			
5. Are 'ESCAPE BA' signs posted on all EEBD stowages?			
6. Are custody, accounting and maintenance procedures correct?			
7. Have EEBD stowage straps been modified and/or centre clip broken out of the buckle?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Watertight Integrity Organisation	**MANDATORY for SSMOB**		
1. Is there an established watertight integrity organisation?		Navy Command Support	
2. Is the Watertight Integrity Log maintained correctly?			
3. Are ship specific instructions for the issue of **'MAY BE LEFT OPEN'** tallies included inside the front cover?			
4. Are the instructions in accordance with the ships SGO/CBRNDC Orders?			
5. Are the correct numbers and types of MBLO tallies held in HQ1?			
Master CBRNDC Training and Material Assessment Log	**MANDATORY for SSMOB**		
1. Do the contents comply with the instructions in Annex 27A?		Navy Command Support	
2. Has the log been weeded to dispose of unwanted records?			
Harbour Watch Training Log	**MANDATORY for SSMOB**		
1. Do the contents comply with the instructions in Annex 27A?		Navy Command Support	
2. Has the log been weeded to dispose of unwanted records?			
3. Is the Harbour Watch Training Plan sound and up to date?			
4. Are the full range of lecture plans contained within Annex 27B available to Duty Watches?			
CBRNDC Organisation	**MANDATORY for SSMOB**		
1. Is the number and employment of key DC personnel in accordance with Chapter 3?		Navy Command Support	
2. Do they all have the appropriate CBRNDC qualifications?			
3. Is there an effective system for accounting for all personnel in the event of a harbour fire?			
4. Is HFEP training carried out daily, using the lesson plans in Annex 27B?		MCTA/Navy Command Support	
5. Have HFEP personnel been training in ‘the actions to be taken in the event of a fire in a main machinery space’? Are personnel competent in conducting main machinery space isolations iaw Annex 17E?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
CBRNDC Command and Control Facilities	**MANDATORY for SSMOB/CS(F)**		
1. Where applicable are the HQ1 (and HQ2) information boards in place as detailed at Annex 7A and are they in good condition?		MCTA	
2. Where applicable are the incident boards as large as practicable and is the symbology in accordance with Annex 7B?			
3. Are all boards and/or DSAC terminals adequately secured?			
4. Does incident board and/DSAC terminal emergency lighting work effectively?			
5. Where boards are fitted, are there sufficient pegs, marker pens etc?			
6. Are class specific master copies of closing down cards for X, Y, Z, A and M openings held in HQ1?		Navy Command Support	
7. Is a full set of Kill Cards available in HQ1? Is there a full set of validated Main Machinery Space Isolation cards available in HQ1/SCC? Are copies held at the FRPPs? Are the cards iaw Annex 17E?		MCTA/Navy Command Support	
8. Are class specific smoke clearance plans held and are they available in HQ1 for the OOD?		MCTA	
9. Are all headsets and/or handsets in position and have DC comms been fully checked between HQ1 and all outstations (AHQ1, WSB, AWSB and FRPPs)?			
10. Do the main broadcast microphone and alarm push operate correctly?			
11. Is the duplicate key stowage in good order and is an organisation in place for the distribution of duplicate key boxes?		Navy Command Support	
12. Is an aide memoire readily available for the OOD to cover fire/flood incidents?			
13. Is the 999 telephone system working?			
14. Is there a fluids stateboard?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Petrol Stowages	**MANDATORY (Once Fuelled)**		
1. Are fuel tanks painted grey and contents identified with 25 mm red lettering?		MCTA	
2. Are stowages marked '**PETROL STOWAGE NO SMOKING**' in white letters on a red background?			
3. Is the remote release at least 5 m from the stowage? Is the quick release handle clearly identified?			
4. Does the mechanism appear operable? Is it in date for annual functional test?			
Flammable Gas Bottle Stowages	**MANDATORY (Once Stocked)**		
1. Are all bottles correctly stowed?		MCTA	
2. Are the stowages correctly marked identifying the gas?			
3. Are the spray operating valves clearly marked and operable?			
4. Are the valves locked, with the keys available (in frangible keybox) nearby?			
Smoke Curtains	**HIGH PRIORITY for SSMOB/CS(F)**		
1. Do the curtains meet the specification at Para 1923?		MCTA	
2. Do they appear to be smoke tight?			
3. Is the fabric in good condition?			
4. Can they be easily deployed and tied back?			
Galley(s)/Emergency Feeding Stations	**MANDATORY (Once Operational)**		
1. Can the power switches be locked **OFF** only?		MCTA	
2. Are the switches painted red and marked **'SWITCH OFF IN THE EVENT OF A GALLEY FIRE'**?			
3. Is the exhaust vent flap operable from outside the galley and are all operating positions clearly marked?			
4. Is a Kill Card, highlighting the position of the deep fat fryer displayed outside the door?			
5. Are Fry Fighter extinguishers sited correctly? (see Para 1911). Are AFFF extinguishers available at each galley door?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Galley(s)/Emergency Feeding Stations (Cont'd)	**MANDATORY (Once Operational)**		
6. Are viewing ports/spy holes fitted to doors and shutters giving a view of the deep fat fryer?		MCTA	
7. Are food/provision lift doors marked **'KEEP SHUT WHEN NOT IN USE'**? Fixed FF system working if fitted?			
8. Are galley vent flaps fitted, functional and clearly marked?			
9. Are galley fan starters identified in accordance with BRd 2170(1) Chapter 4?			
10. Where applicable are fixed fire suppression system operating points located outside the galley clearly marked?			
Breathing Apparatus (Damage Control)	**MANDATORY for SSMOB/CS(F)**		
1. Are BA holdings in accordance with the Fire Plan?		MCTA	
2. Are BA lockers and spare cylinder stowages sited in accordance with the latest Fire Plan?			
3. Is there a qualified BA maintainer? Is the correct PMS held?		Navy Command Support	
4. Are all cylinders numbered correctly?		MCTA	
5. Do charged spare cylinders have the connection/caps taped over?			
6. Do nominated, correctly marked BA lockers contain SAR guidelines in accordance with Annex 17H?			
7. Does each locker contain a self-adhesive pre-wear checklist?			
8. Does each BA have a distress alarm (horn) fitted?			
9. Does each BA have a 'set number' tally attached?			
10. Are BA control boards stowed in nominated and correctly marked BA lockers? Is a marker pen fitted?			
11. Does each locker contain a firefighters hood and anti-flash gloves and are they in good condition?			
12. Are all sets fully charged? (minimum 10 bar below max HP air system operating pressure).			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
BA Extension Equipment	**MANDATORY for SSMOB/CS(F)**		
1. Are the holdings in accordance with the Fire Plan?		MCTA	
2. Are the lockers correctly stowed with one 2 m extension fitted to a rescue mask and one separate 15 m extension?			
3. Are the correct instructions displayed on the inside of the locker door? (see Para 2108).			
4. Are the rescue masks clean and the hoses in good condition?			
5. Are the lockers portable?			
BA Charging Panels	**MANDATORY for SSMOB/CS(F)**		
1. Is there a minimum of 1 onboard fully functional BA charging point? (remaining points to be correctly tagged out).		MCTA	
2. Has the air at each functional charging point been tested and does it meet the specification for breathing air? (clean air purity certificate posted and available).			
3. Are all charging panel gauges in date for test and correctly zoned? (6 monthly starred item).			
4. Are relief valves on dedicated charging panels set correctly for the ships system? (test tally/certificate available).			
5. Are ear defenders and goggles available at each charging panel? (2 pairs of each).			
6. Is the charging hose restraining wire attached to the hose and clipped to the panel?			
7. Are detailed charging instructions and warnings displayed?			
8. Are the cylinder stowages used for recharging marked **'ONLY TO BE USED FOR RECHARGING CYLINDERS'**?			
9. Is HQ1/OOD aware of current status of all BA charging points?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
HPSW Hydrants and Softwall Hoses	**MANDATORY for SSMOB/CS(F)**		
1. Are all hoses the correct size and in good condition?		MCTA	
2. Where single hose baskets are fitted, are hoses correctly stowed (12 m hose faked in basket connected to hydrant and correct nozzle fitted)? Where twin baskets are fitted, are hoses correctly stowed? (6 m outer hose rolled ready for running. 12 m inner hose faked in basket connected to hydrant and correct nozzle fitted).			
3. Are the rubber seals in all female hose connections in good condition?			
4. Are valves and hydrants on the HPSW main identified in accordance with Para 0450?			
5. Are through bulkhead connections painted red, fitted with rubber seals and blanking caps?			
6. Is there a hose basket adjacent to all hydrants?			
7. Are the correct hose types/lengths iaw the Fire Plan?			
Nozzles	**MANDATORY for SSMOB/CS(F)**		
1. Are all nozzles operable through the full range of travel?		MCTA	
2. Are all nozzles stowed in the closed position?			
3. Are fixed hatch waterwall nozzles set at the correct angle and clear of obstruction?			
4. Are all FHWW fitted with operable instantaneous blanking caps bearing the same watertight and gastight markings as the parent hatches?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Centre Feed Hose Reel (CFHR)(Where fitted and operational)	**MANDATORY for SSMOB/CS(F)**		
	Note. *If a CFHR is OOA, all compartments served by it must be capable of being reached by lay flat hoses.*		
1. Are all CFHR set up in accordance with Para 1825?		MCTA	
2 x HPSW valves fitted:			
HPSW isolating valve padlocked open.			
HPSW valve adjacent to the inductor panel shut.			
Three position selector valve set to FOAM (Mk 1) or foam/water selection lever set to FOAM (Mk 2).			
Nozzle valve shut.			
1 x HPSW isolating valve not adjacent to the inductor panel (not applicable to Mk 2):			
HPSW valve pinned open.			
Three position selector valve shut.			
Nozzle valve shut.			
2. Are all CFHR hoses, nozzles and pick up spills in good condition?			
3. Are operating instructions displayed adjacent to each CFHR?			
4. Are shaded deck plans, indicating the compartments served, displayed adjacent to each CFHR?			
5. Is the foam position clearly marked using photo luminescent tape?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Foam Making Equipment	**MANDATORY for SSMOB/CS(F)**		
1. Are FB5X branchpipes sited only between decks and in the UDRFPP with the spill pick ups fitted?		MCTA	
2. Are only Mk 2 FB5X branchpipes held and checked as follows:			
Pick-up suction holes clear?			
Rubber hoses not cracked, perished or distorted?			
Strainer clear?			
Pick-up spill connected to branchpipe?			
Foam mix selector set to 6%?			
Non-return valve fitted in spill pick-up coupling?			
3. Are FB10/10 branchpipes located only at the hangar/flightdeck in accordance with the FCP and checked as follows:			
Are the control vanes greased and free?			
Are they stowed under cover unless at Flying Stations?			
4. Are the caps on all AFFF drums only hand tight with an unbroken security seal?			
5. Are the holdings of AFFF drums in accordance with the allowance? Has the AFFF LIFEX date been written on the drum in indelible ink? (20 years from Date of Manufacture (DOM).			
6. Have all FBU5X inductors been stowed with a 2 m hose?			
7. Are the holdings of FBU5X inductors and associated 2 m hoses correct?			
8. Are FBU5X inductors stowed adjacent to machinery spaces?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Foam Making Equipment (Cont'd)	**MANDATORY for SSMOB/CS(F)**		
9. Where fitted, are AFFF storage tanks marked with 20 mm white letters on a red background stating: 'Time' **MINUTES**, **TOTAL CAPACITY OF AFFF**, the '%' **CONCENTRATION** of AFFF and the AFFF LIFEX date?		MCTA	
10. Are AFFF drums of the correct concentration in the correct location iaw the Fire Plan?			
Foam Tubes	**MANDATORY for SSMOB/CS(F)**		
1. Are the caps free and fitted with sealing washers? (to include retaining chains where applicable).		MCTA	
2. Are notices posted, stating the compartment served and the number of AFFF drums required for full bilge coverage?			
3. Are the caps engraved or notices posted to indicate the compartment served?			
4. Where deck caps are fitted, are keys sited adjacent to each one?			
5. Are AFFF drums stowed adjacent to all foam tubes?			
Portable Fire Extinguishers	**MANDATORY for SSMOB/CS(F)**		
1. Is the number of AFFF, dry powder, Fry Fighter and CO_2 extinguishers in accordance with the Fire Plan and are they in date for test?		MCTA	
2. Does each extinguisher and stowage have a clearly marked, unique identification mark/number? Can this number be referenced to the SPEs LIFEX date?			
3. In compartments fitted with CO_2 injection points, is the correct type of diffuser fitted to CO_2 extinguishers?			
4. Are portable extinguishers fitted with safety pins, anti-tamper tags, fully charged, serviceable and in date for test?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Portable Fire Extinguishers (Cont'd)	**MANDATORY for SSMOB/CS(F)**		
5. Is there adequate provision of bulk AFFF for recharging extinguishers, stored separately from AFFF drum stowages?		MCTA	
6. Is the SPE recharging cylinder in date for test? (Pressurex Re-Charging cylinder).			
Fixed Firefighting Systems	**MANDATORY for SSMOB/CS(F)**		
1. Are system valves, etc clearly identified?		MCTA	
2. In the event of fire can the compartments be closed down in accordance with the SOPs?			
3. Are operating instructions displayed and correct?			
4. Are keys/operating handles available at all operating positions?			
5. Are the visual and audible warning alarm systems functional?			
6. Are all operating positions functional?			
Gaseous Drenching Systems	**MANDATORY for SSMOB/CS(F)**		
1. Is the gaseous drenching system functional and intact?		MCTA	
2. In the event of fire can the compartments be closed down iaw the SOPs?			
3. Has all maintenance been carried out and records updated?			
4. Are system cylinders in date for test (8A out to maximum of 10 years).			
5. Are all manifold hoses in date for test? (BR 2000(53)(2) - 8A).			
6. Are overboard discharge and air blowthrough valves padlocked in the closed position?	**If fitted, relief valve to be in date for test**		
7. Does the compartment isolating valve(s) manually rotate to the open position?			
8. Are discharge nozzles clear and free from debris?			
9. Are the visual and audible warning alarm systems functional?			
10. Are warning signs posted at the entrance to compartments denoting gas used? (including gas bottle stowages).			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Gaseous Drenching Systems (Cont'd)	**MANDATORY for SSMOB/CS(F)**		
11. In compartments fitted with CO_2 drench, is one ventilation flap marked 'TO BE SHUT BUT NOT CLIPPED WHEN CO_2 DRENCHING'?		MCTA	
12. Where applicable is the back up system correct? eg water/AFFF back up to gas drench.			
13. Does the operating CO_2 bottle have its pin out and available?			
14. Is the Halon/CO_2 bottle store correctly identified?			
Fire Detection System	**MANDATORY for SSMOB/CS(F)**		
Do visual and audible warning alarms operate on activation of detectors?		MCTA	
Flood Detection System	**MANDATORY for SSMOB**		
Do visual and audible warning alarms operate on activation of detectors?		Navy Command Support	
FRPP Firefighters Clothing	**MANDATORY for SSMOB**		
1. Are the holdings iaw the Fire Plan?		MCTA	
2. Are the firefighting suits, boots and socks in good condition?			
3. Do all BA lockers contain one firefighter's hood and one pair of anti-flash gloves? Are they in good condition?			
FRPP Firefighters Helmets	**MANDATORY for SSMOB**		
1. Are the holdings of helmets in accordance with the Fire Plan?		MCTA	
2. Do the built-in radios and hand-held radios provide clear communications?			
Thermal Imaging Camera (TIC)	**MANDATORY for SSMOB**		
1. Are all TICs stowed with a spare charged battery?		MCTA	
2. Are all TIC regularly proved by a functional test?			
3. Are spare batteries readily available in either the TIC box or at the FRPPs?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Portable and Fixed Diesel and Gas Turbine Driven Pumps	**MANDATORY for SSMOB/CS(F)**		
1. Is the full outfit of accessories held in accordance with the pump BR, Annex 22A and Annex 22B?		MCTA	
2. Is a functional test regularly completed?			
3. Do all suction hoses have good coupling seals?			
Portable Eductors	**MANDATORY for SSMOB**		
1. Are the holdings of eductors and associated accessories at each FRPP/ZCP in accordance with BRd 2170(3)?		Navy Command Support	
2. Is a functional test regularly completed?			
3. Do the suction hoses have good coupling seals?			
Indicator Test Plugs (ITP)	**MANDATORY for SSMOB**		
1. Are ITPs easily workable by hand and unpainted?		Navy Command Support	
2. Are leather/fibre and metal washers fitted?			
3. Do those fitted to magazines and flammable stores have a split pin fitted preventing removal?			
Electric Submersible Pumps	**MANDATORY for SSMOB/CS(F)**		
1. Is a 12 mm diameter lowering line spliced to each pump?		Navy Command Support	
2. Are the power cables whipped to the lowering lines?			
3. Are the WEDA pump accessories held iaw Annex 22A?			
4. Are the pumps secured properly?			
5. Is a functional test regularly completed?			
6. Are the power sockets painted yellow and numbered in black?			
7. Are the socket interlocks effective?			
8. Are Type A or Type B adaptor leads held iaw Annex 22A?			
9. Are all pumps in date for electrical testing in accordance with MMS? (4 monthly).			
Damage Control and Firefighting Equipment	**MANDATORY for SSMOB**		
1. Are the contents of FRPP lockers in accordance with BRd 2170(3)? Do the lockers have a contents list displayed and are both the lockers and lists in good condition?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Damage Control and Firefighting Equipment (Cont'd)	**MANDATORY for SSMOB**		
2. Is the DC equipment stowed adjacent to FRPPs in good condition and at dispersed positions in accordance with BRd 2170(3)?		Navy Command Support	
3. Is the equipment at the UDRFPP in good condition and in accordance with BRd 2170(3)?			
4. Is all electrical equipment in date for electrical testing? (Periodicity - 4 monthly motorised/6 monthly the remainder).			
5. Is the DC open line working?			
Main and Auxiliary Machinery Space Ventilation Systems	**MANDATORY for SSMOB**		
1. Are all MMS ventilation starters identified as per Para 0434?		Navy Command Support	
2. Are all machinery space HWTC/dampers and their operating mechanisms kept free from obstruction and functional?		MCTA	
3. Are all machinery space HWTC/dampers identified as per Para 0434?			

CHECKLIST COMPLETION BY SHIPS STAFF	
Signature	
Print Name	
Rank/Rate	
Post	
AUDITED BY FLEET WATERFRONT STAFF	
Signature	
Print Name	
Rank/Rate	
Post	

ANNEX 26B

HAT (CBRNDC) Part 2B - PRE-READY FOR SEA DATE (RFSD) CHECKS

HMS……..

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Damage Control and Identification Markings			
1. Do the following openings have the correct risk, control and location markings in accordance with BRd 2170 Chapter 4/the ships CBRNDC Class Book/Fire Plan?		Fleet Upkeep	
Doors.			
Hatches.			
Vent terminals and trunking.			
Scuttles and deadlights.			
Opening bridge windows.			
Electrical connectors, sockets and deck tubes.			
2. Are the following systems and fittings correctly identified in accordance with Chapter 4?		Fleet Upkeep	
Pipe systems.			
Gas boxes.			
Discharge overboard valves.			
Drains and discharges.			
Watertight slide valves.			
Trunks.			
Foam tubes		Audited by MCTA during MSVI	
Through bulkhead hose connections.			
3. Are the following marked with photoluminescent paint?		Audited by MCTA during MSVI	
HPSW system main isolating valves			
Machinery space fire isolation valves.		Fleet Upkeep	

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Damage Control and Identification Markings (Cont'd)			
BA charging panel isolating valves.		Audited by MCTA during MSVI	
Remote diesel engine stops.		Fleet Upkeep	
Remote fuel stops for auxiliary boilers.			
The fully closed position on all WT door handles.			
Operating levers and/or handwheels on escape scuttles.			
4. Are valves and hydrants on the HPSW main identified in accordance with Para 0450?		Fleet Upkeep	
Miscellaneous Markings			
Are the following signs in accordance with Chapter 4?		Fleet Upkeep	
Other side markings.			
Sub citadel boundaries.			
Damage Control zone boundaries.			
Compartment Contents circles.			
Two clip markings.			
Compartment below signs			
Shelter routes.			
Upperdeck MMS boundary cooling markings.			
Incinerator Compartments			
1. Is the remote fuel drain valve clearly marked?		Fleet Upkeep	
2. Are clear operating instructions, including clinker and ash removal?			
3. Is there a SPE (AFFF) in the vicinity?		Audited by MCTA during MSVI	
Citadel Airlocks			
1. Are the insides of both doors marked **'CITADEL OUT'** and the outsides marked **'CITADEL IN'**?		Fleet Upkeep	
2. Are light exclusion plates fitted to the viewing ports?			
3. Are air bleed valves (where fitted) in good condition?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Seat Covers and DIY Additions			
1. Are all seat units fitted with removable, flame retardant covers?		Fleet Upkeep	
2. Are seat locker lids securable?			
3. Are DIY additions in messes:			
Made of flame retardant materials?			
Readily removable?			
Clear of any Damage Control arrangements?			
Mobile Repair Party Post			
1. Are immersion suits available?		Fleet Upkeep	
2. Are 2 fully stocked leak stopping bags available?			
3. Is there a dedicated and functional communication line between the MRP and the MCR/SCC?			
Thermal Lance Cutting Equipment			
1. Is the holding of cutting equipment and oxygen cylinders in accordance with the allowance?		Fleet Upkeep	
2. Is a regular functional test carried out?			
3. Are there sufficient trained operators?			
4. Is a set stowed in the superstructure, within reach of a hatch leading between decks?			
5. Are the batteries recharged at least every 8 weeks?			
6. Is a copy of the operating instructions included in the case?			
7. Are the oxygen cylinders stowed in a correct location as near as practicable to the set?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Cutting and Spreading Equipment			
1. Is the holding in accordance with the allowance? Is the equipment in date for test?		Fleet Upkeep	
2. Is a functional test of all components regularly carried out?			
3. Are there sufficient trained operators? (completed CBRNDC 35 course).			
4. Is the equipment stowage readily accessible to the MRP?			
5. Is a copy of the operating instructions stowed with it?			
6. Are visor/goggles and heavy duty gloves stowed with it?			
Emergency Electrical Supplies			
1. Are cables and stowages correctly marked?		Fleet Upkeep	
2. Are cables and connectors in good condition?			
3. Are portable transformers and fuse panels in good condition?			
HP Air/Hydraulic Hose Repair Kits			
1. Is the correct outfit held in accordance with BRd 2170(3)? Is the equipment in date for test?		Fleet Upkeep	
2. Is the stowage accessible to the MRP?			
Magazine Spray Systems			
1. Are manual spray valves locked and the keys available adjacent to the valves?		Fleet Upkeep	
2. Are automatic spray systems correctly set up in accordance with the operating instructions?			
3. Are spray systems identified and operating instructions clearly displayed? (white on red).			
Hangar Spray System			
1. Is the spray operating valve (or pneumatic control) locked and the key available nearby?		Audited by MCTA during MSVI	
2. Is the spray system identified and operating instructions clearly displayed? (white on red).			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
SF90 Mobile Foam Unit			
1. Is the holding of SF90s for the aviation facilities in accordance with the allowance?		Audited by MCTA during MSVI	
2. Is the foam tank correctly filled with a 6% AFFF/fresh water solution?			
3. Is the air cylinder charged to 123 bar?			
10 kg CO_2 Extinguisher			
1. Is the holding in accordance with the allowance for the aviation facilities?		Audited by MCTA during MSVI	
2. Is the flexible hose, extending lance and removable discharge horn in good condition?			
3. Is the CO_2 cylinder fully charged?			
Hangar Firefighting Locker			
Are the contents of the locker in accordance with BRd 2170(3)? (single spot ships).		Audited by MCTA during MSVI	
Fire and Repair Party Posts			
1. Are the locker contents and adjacent equipment itemised on checklists?		Audited by MCTA during MSVI	
2. Are locker drawers marked to show contents?			
3. Are locker keys available in a glass fronted frangible keybox?			
4. Is the whole ship incident board stowed securely and in accordance with its classification when not in use but portable when rigged? For DSAC systems; are the terminals functional?		Fleet Upkeep	
5. Does the incident board emergency lighting work?			
6. Does the incident board/DSAC systems show personnel locations at State 1?			
7. Are the following held at each post?			
Personnel muster cards.			
State 1 preparation check lists.			
State 1 dispersal plan.			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Fire and Repair Party Posts (Cont'd)			
Patrol route cards.		Fleet Upkeep	
Kill cards for compartments covered by that FRPP.			
Closing down cards for Yankee, Zulu, Alfa and Mike openings.			
8. Is there a whole ship electrical board?			
9. Is there an electrical 'underground map'?			
10. Is there a 'green line' to HQ1 (and Section Base)?			
11. Is there a working clock?			
12. Are there stowage arrangements for duplicate key boxes?			
13. Is there a visual representation of the whole ship HPSW system board?			
14. Are the patrol, leakstopping and shoring bags held in accordance with BRd 2170(3)?			
Machinery Space Damage Control (DC) Equipment			
1. Are the DC boxes and bags in accordance with BRd 2170(3)?		Fleet Upkeep	
2. Are the boxes properly secured, fully stocked iaw BRd 2170(3) and the contents available for immediate use?			
3. Are the shoring materials in accordance with BRd 2170(3), properly secured and available for immediate use?			
4. Are all eductors functional and ready for use?			
5. Where fitted, are all MMS manometers filled with water coloured with methyl orange? Where fitted, are digital manometers functional?			
6. Are signs posted at accesses detailing length of hoses required to reach extremities of compartment?			
7. Are the following held in each DC box?			
State 1 preparation cards.			
Blanket search cards.			
Fire isolation cards for adjoining main machinery spaces.			
Muster list for DC box.			
8. Is DC equipment available for use in the Tiller Flat?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
HQ2			
1. Is the location separated from HQ1 by at least 2 main transverse bulkheads?		Audited by MCTA during MSVI	
2. Are the equipment and documentation as specified for HQ1?			
Section Bases			
Are the facilities in accordance with Para 0726?		Audited by MCTA during MSVI	
Alternative HQ (AHQ)			
1. Does the location give easy access to fresh air?		Audited by MCTA during MSVI	
2. Is a whole ship incident board available, with a stowage and emergency lighting? For DSAC systems, is there network connectivity?			
3. Is a full set of Kill Cards and smoke clearance plans available? (see Annex 17J).			
4. Is a HPSW system board available?			
5. Is a Damage Control ventilation board available?			
6. Is a Damage Control electrical information board available?			
7. Are the following communications available?			
Damage Control open line to HQ1, FRPPs and Ops Room.			
'Green line'.			
Main broadcast.			
Exchange telephone.			
Field telephone and cable (may be stowed in UDREL).			
Weapon Section Base			
1. Are WSB facilities available in accordance with Para 2818?		Fleet Upkeep	
2. Is an alternative WSB available in accordance with Para 0729?			
Orders and Publications			
1. Is the CBRNDC section of Ships General Orders in accordance with BRd 9600 series?		Fleet Upkeep	
2. Is a copy of the Ships CBRNDC Orders held?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Orders and Publications (Cont'd)			
3. Are Volumes 1, 2, 3, 5 and 6 of BRd 2170 held and at the latest change state? (for the current change state, visit the Navy Publications and Graphics Organisation (NPGO) site on the Defence Intranet).		Fleet Upkeep	
4. Are the holding and custody of the CBRNDC Class Book in accordance with the CB Register?			
5. Where applicable, is the holding and custody of the Ship Stability and Survivability Book in accordance with the CB Register?			
6. Are the Stability Statement, Curves of Statical Stability and Hydrostatic Particulars up to date?			
7. Are Damage Control and CBRN posters, selected from BRd 2170(3) Para 0106, displayed around the ship?			
8. Is ATP 45 Volume 1 held, and at the latest change state?			
9. Is the BRACIS software held and available for use?			
Damage Control Organisation and Logs			
1. Is BRd 9274 being used as a basis for Damage Control training? (see Annex 27B for CBRNDC Lecture Plans).		Fleet Upkeep	
2. Do the signatories regularly inspect the logs?			
3. Are recorded shortcomings being actioned by XO/MEO?			
4. Are the HFEP and SSEP organisations in accordance with Chapter 16?			
5. Are daily duty watch lists, detailing HFEP duties, displayed effectively?			
6. Has a Jettison Bill been produced?			
7. Are there any outstanding A&As or major defects affecting the DC and CBRN capability?			
8. Are regular HOD covered fire exercises being conducted and recorded?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
Emergency Medical Facilities			
1. Are first aid posts and Secondary Medical Positions provided and clearly identified?		Fleet Upkeep	
2. Are sufficient first aid trained personnel in accordance with Chapter 11?			
Citadel			
1. Has a satisfactory HAT (Citadel) been completed?		Fleet Upkeep	
2. Where fitted, are all manometers filled with water coloured with Methyl Orange? Where fitted, are digital manometers functional?			
3. Are all manometers marked to show the differential pressure being measured? (eg Zone 1/Atmosphere).			
4. Is a portable digital manometer held?			
5. Are all AFUs in date for test and filter life?			
Collective Protection (COLPRO) in Non-Citadel Ships			
1. Are the COLPRO arrangements clearly defined in Ships Standing Orders? (UCPS Winterbourne or sanctuary).		Fleet Upkeep	
2. Are the material arrangements available and proven?			
3. Can the CBRNPO be accommodated in or adjacent to HQ1?			
4. Does the CBRNPO have easy access to the following: Communication to the Command Adviser, the SIRS indicating unit and the Main Broadcast?			

CHECKS TO BE MADE	NOTES	AUDITED BY/REPORTED TO	ACHIEVED Y/N
CBRN Protection Officer (CBRNPO) Facilities			
Is the following documentation available to the CBRNPO?		Fleet Upkeep	
Total Dose Record Board.			
Log/Log Graph Paper.			
Stay-Time Table.			
Monitoring Route Cards (in splashproof covers).			
Radiological Monitoring and Decontamination Boards.			
Chemical State Board.			
Citadel In/Out Log.			
CBRNPO's Incident Board.			

CHECKLIST COMPLETION BY SHIPS STAFF	
Signature	
Print Name	
Rank/Rate	
Post	

AUDITED BY FLEET WATERFRONT STAFF	
Signature	
Print Name	
Rank/Rate	
Post	

CHAPTER 27

CBRNDC AND SEA SAFETY TRAINING

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CHAPTER 27

CBRNDC AND SEA SAFETY TRAINING

SECTION 1 - CBRNDC TRAINING REQUIREMENTS

2701. General

Chemical, Biological, Radiological and Nuclear (CBRN) and Damage Control (including firefighting) (CBRNDC) is the responsibility of everyone, regardless of branch, rank or gender. All personnel at sea must have a full understanding of CBRNDC appropriate to their rank or rate, and more importantly, is in a position to use that knowledge correctly given little or no warning. It should never be forgotten that a state of war or period of tension does not need to exist for a large number of CBRNDC skills to be unexpectedly called into use.

2702. Categories of Personnel

All personnel proceeding to sea in Naval service vessels unit fall into one of the following categories:

a. **Category 1 (Ship's Companies)(see Note).** This category covers personnel assigned to a complement position in a seagoing unit, where they would reasonably be expected to form part of the Standing Sea Emergency Party (SSEP) or the Harbour Fire and Emergency Party (HFEP) (Duty watch in RFA). Personnel in this category will normally be assigned to a post where the Unit Establishment List (UEL) requires the ISSC/BSSC competency (in some cases persons in nominated seagoing billets ashore will be in this category).

***Note**. This category includes ASRM and ship's permanent flights.*

b. **Category 2 (Personnel Attached to the Ship's Company).** This category covers Service personnel that are assigned to a maritime platform as an Embarked Military Force or other body temporarily assigned to the platform (this category may also be applicable to some Civilian personnel embedded within staff organisations, eg Maritime Battle Staff). These personnel will NOT be required to contribute towards the Damage Control and Firefighting (DC&FF) organisation but may be called upon to assist if an emergency occurs and will be trained to conduct first aid actions to protect themselves and the platform in an emergency. This category will also include LC RM permanently assigned to a RM Unit (Shore; Non-ASRM) who will be trained to respond to platform emergencies.

c. **Category 2a.** All NATO and Foreign Military Staff will be required to undertake and provide evidence of completion of own nation SST (or equivalent) or an IMO or MCA approved STCW[1] course when they embark in an RN platform[2]. All personnel in this category are also to receive a Sea Safety Brief within 4 hours of embarkation and a Comprehensive Sea Safety Brief within 48 hours of embarkation, to ensure knowledge of safe abandonment and familiarity with platform incident initial actions and firefighting first aid appliances.

d. **Category 2b.** All UK Service personnel attached to QEC as an Embarked Military Force or other body temporarily assigned to the platform (e.g. Lighting Force Squadrons or Maritime Battle Staff). These personnel will be required to undertake course CBRNDC 1F QEC EFSSC covering Safety Familiarisation Training. All personnel in this category are also to receive a Sea Safety Brief within 4 hours of embarkation and a Comprehensive Sea Safety Brief within 48 hours of embarkation, to ensure knowledge of safe abandonment and familiarity with platform incident initial actions and firefighting first aid appliances.

e. **Category 3 (All Other Personnel).** Category 3 personnel have no requirement to conduct shore based pre-embarkation training however should receive onboard training according to the following conditions:

(1) **Service[3] and Civilian Personnel on Duty (aka Special Personnel[4]).** These personnel include those who will be transported to an area of operations to conduct military tasking and also those Service, MOD civilian and other civilian personnel required to embark for short periods specifically to deliver support to maritime activities. These persons, referred to in BRd 9467 as 'special personnel', will have no liability to contribute towards the DC&FF organisation however Service Personnel in this category may be used in extremis to accomplish simple tasks in support of whole ship reactions to an incident that otherwise would challenge the Ships Company and Embarked Military Force[5].

(2) **Civilian Passengers.** These personnel are those that are not serving members of the UK Armed Forces[6] (or RFA) and are not employed when onboard. Under no circumstances are they to be used to contribute to DC&FF activities.

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[1] Basic Training for Seafarers as defined in The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 2010 Resolution 2, Manila Amendments) Section A-VI/1, Chapter VI.
[2] This policy will not apply to any NATO or Foreign Military personnel that has been assigned to a complement role (in accordance with the Unit Position List) and has already completed RN SST as described in BRd 2170(1) Chapter 27.
[3] This includes members of the Reserve Forces who are conducting authorised individual training or who are mobilised.
[4] BRd 9467 - Fleet Administrative and General Orders.
[5] The employment of CAT 3 Service Personnel in extremis recognises the generic skills possessed by all service persons. Due care should be given to not exposing these personnel to excessive risk, particularly in the unfamiliar confines of a ship. Close supervision by a member of the Ship's Company should be an immediate consideration.
[6] Civilians who are also members of the Reserve Forces fall into this category unless they are on authorised individual training or mobilised.

2703. Sea Safety Training Requirements - Aviation Units

Due to the unique operational commitments of Aviation Units it has been necessary to provide specific guidance which is detailed below, although this does not override existing guidance for non-aviation units or individual assignments. Aviation Units that embark in RN/RFA vessels have been categorised depending on the level of sea safety training they require, the units and their relevant categories are detailed below:

a. **Category 1:** All Wildcat, Merlin, 800X Sea Flight personnel attached to or embarked in DD, FF, OPV, PRTR and single spot RFA28. 1700 squadron personnel employed as Permanent Royal Navy (PRN) on RFA platforms.

b. **Category 2:** All fixed and rotary wing personnel attached to QEC and LPD. Personnel attached to flights or squadrons embarking on RFA's as part of an embarked force.

c. **Category 3 (Persons on Duty):** Personnel in SHORE assignments who would not normally be expected to embark from any of the above units but also the following NAS/units – 700X, 750, 744, 736, 727, 705, 703, NFSF (FW) and HTU.

2704. Pre-Joining Training (PJT)

Royal Navy Officers and Ratings shall receive pre joining sea safety and CBRNDC training at the career points detailed below and based on their sea safety training category.

a. **Category 1 Personnel**

(1) Category 1 Officers and Ratings should complete the Basic Sea Safety Course (BSSC) (valid for 5 years) no more than 6 months before proceeding to sea for the first time.

OR

(2) Category 1 Officers and Ratings should complete the intermediate Sea Safety Course (ISSC) Prior to any subsequent appointment with sea liability whose BSSC 5 year qualification has expired.

OR

(3) All Officers and Ratings should complete the intermediate Sea Safety Course (ISSC) during any appointment with sea liability where a previously in date[7] BSSC or ISSC qualification has expired.

OR

(4) Category 1 Officers and Ratings assigned to CBRNDC Q Position ID's as identified in the unit establishment list should complete the CBRNDC 35 Course or CBRNDC 35R course. The CBRNDC 35 Course is valid for 5 years and may be extended for further 5 year periods by completion of the CRNDC 35R course.

[7] Valid for 5 years from date of completion

b. **Category 2 Personnel.**

(1) Category 2a officers and ratings should complete the Embarked Forces Sea Safety Course (EFSSC) valid for 5 years.

(2) Category 2b officers and ratings should complete course CBRNDC 1F QEC EFSSC covering Safety Familiarisation Training valid for 5 years. All personnel in this category are also to receive a Sea Safety Brief within 4 hours of embarkation and a Comprehensive Sea Safety Brief within 48 hours of embarkation, to ensure knowledge of safe abandonment and familiarity with platform incident initial actions and firefighting first aid appliances.

c. **Category 3 Personnel.** For each occasion of embarkation, the ship being visited should provide an initial Sea Safety Brief (SSB) within 4 hours of embarkation, which is to follow the format of the SOLAS[8] minimum requirement at Annex 27E. For Service and Civilian Personnel on Duty this is to be followed by a Comprehensive Sea Safety Brief (CSSB) within 48 hours of embarkation to ensure knowledge of safe abandonment and first aid actions in the event of a discovery of an incident; this is not required if the embarkation period is less than 48 hours. Details of the minimum content of the CSSB can be found at Annex 27E.

(1) **Commanding Officers:** Commanding Officers should complete CBRNDC 2s course and are not required to complete ISSC, with the exception of Commanding Officers of MM/PP's who should complete CBRNDC 2A course and ISSC.

(2) **Heads of Department on QEC and LPD** – Officers appointed to OF4 HoD appointments[9] on QE and LPD class platforms should complete the CBRNDC 2 course providing they have previously completed CBRNDC 4s course.

(3) Specific SST requirements for Aviation Units can be found at Para 2703. Units unsure of their liability or category should contact NAVY FGen-Ships Eng CBRNDC SO2 for guidance.

[8] Safety of Life at Sea - Statutory Instrument 1999 2722 Art 5 (8) (b) & (c) and Art 9 (5) (a), (b) & (c).
[9] CBRNDC 4 course is a prerequisite for OF4 officers appointed to HoD appointments that are required to conduct the role of Command Rover as identified in the whole ship watch and station bill.

Table 27-1. Categorisation Of Personnel And Training Requirement

	JOINER					
Description	Ship's Company[10]	Personnel Attached to the Ship's Company[11]	NATO or Foreign Military personnel	All UK Service personnel attached to QEC as an Embarked Military Force or other body temporarily assigned to the platform	Service and Civilian Personnel ON DUTY. Includes those supporting maritime operations or being transported during an Exercise/Operation	Civilian Passengers
Training Requirement	**Category 1**	**Category 2**	**Category 2a**	**Category 2b**	**Category 3**	
					Personnel on Duty (FLAGOs Special Personnel)	Civilian Passengers
BSSC	X[12]	-			-	-
ISSC	X[13]	-			-	-
EFSSC	-	X			-	-
QEC EFSSC (CRBNDC 1F)				X		
Comprehensive Sea Safety Brief (CSSB)	-	-	X - (Must be received within first 48 hours embarked: not required if embarkation is less than 48 hours)		X - (Must be received within first 48 hours embarked: not required if embarkation is less than 48 hours)	-

[10] Includes DD, FF, OPV and PRTR Ship's Flight (see Para 2703 for further details).
[11] Includes NAAFI, World Wide Laundry Services, Joint elements of Air Group (see Para 2703) and Embarked Military Forces
[12] First sea assignment only.
[13] This is the normal method of requalification for personnel who undertook BSSC for a first sea draft

Table 27-1. Categorisation Of Personnel And Training Requirement (Continued)

JOINER						
Description	Ship's Company	Personnel Attached to the Ship's Company	NATO or Foreign Military personnel	All UK Service personnel attached to QEC as an Embarked Military Force or other body temporarily assigned to the platform	Service and Civilian Personnel ON DUTY. Includes those supporting maritime operations or being transported during an Exercise/Operation	Civilian Passengers
Training Requirement	**Category 1**	**Category 2**	**Category 2a**	**Category 2b**	**Category 3**	
Sea Safety Brief (SSB)	X (On joining)	X (On first embarkation)	X	X	X	X
DC&FF, Sea Survival Liability	May be employed in SSEP, HFEP	May not be employed as part of the SSEP. May be employed as part of the whole ship reaction to an emergency at sea and the HFEP[14].	Are not to be employed in emergencies alongside or at sea, except in extremis. May not be employed in SSEP or HFEP.	May not be employed as part of the SSEP. May be employed as part of whole ship reaction to an emergency at sea and the HFEP[15].	Are not to be employed in emergencies alongside or at sea, except in extremis. May not be employed in SSEP or HFEP.	Are not to be employed in emergencies alongside or at sea. Must be escorted at all times.

[14] Employment within the HFEP limited to specialist trade or contingent tasks.
[15] Employment within the HFEP limited to specialist trade or contingent tasks.

2705. Pre Joining Sea Safety Training (SST) Competency Shortfalls

All competency shortfalls for RN/RM/RFA SST are to be managed by ships in consultation with the SURFLOT Delivery Duty Holder in accordance with BRd 10[16] Flotilla are authorised to conduct SQEP concession management on behalf of the Operating Duty Holder (ODH).

2706. Competency Shortfall Management Process

If a Service Person (SP) is required to join a Unit without a Sea Safety competence, the following process is to be followed:

a. Examples of initiating actions are:

(1) Career Manager (CM) intends to assign an SP to a unit who will arrive without valid SST competency. Assignment Order sent to ship highlighting missing competency.

(2) An existing SST competency expires during time onboard.

(3) EMF personnel intend to embark without a valid SST competency.

b. Ship's EWO/DepCo to recognise missing competency as Risk to Life (RtL) and ship is to complete Risk Assessment and due process as described in BRd 10[17].

2707. On Job Training (OJT)

OJT of Royal Navy Officers and Ratings in CBRNDC is achieved as follows:

- Sea Safety Brief and Comprehensive Sea Safety Brief, refer to Annex 27E.

2708. CBRNDC Task Book

The applicability of the CBRNDC Task Book is not a pre-advancement requirement, however, Divisional Officers are to monitor the progress of CBRNDC Task Books of the personnel in their division. Task Books are to be checked monthly and progress recorded within the TMAL. If the Task Book is misplaced and there is no other record of the tasks completed, they will be required to start again. The task book is to be issued upon a person's first sea assignment (Category 1 personnel), irrelevant of the Rate/Rank and should be completed within 6 months, considerations of a ships maintenance period can be taken into consideration. Failure to complete the Task book within 6 months, requires the divisional warning system to be utilised iaw BR3. The Task Book is produced by MWS Phoenix TG and is available for download on the MWS Phoenix website.

[16] BRd 10 Supplement 1, Leaflet 1.20 (Process for Escalation of Safety Risk to Duty Holders) and Leaflet 1.21 (Competency Shortfall Management in Surface Ships)
[17] Op cit.

2709. CBRNDCQ On Job Training (OJT)

a. In order to progress from TPS (on completion of CBRNDC 35 Course) to OPS, a period of OJT is required to provide assurance to Command that the CBRNDCQ has been fully integrated into the wholeship CBRNDC training organisation and that the CBRNDCQ has undergone a minimum level of platform-specific familiarisation. Careful consideration by the XO and WSQ is to be given to how a newly qualified CBRNDCQ is utilised onboard prior to their OPS endorsement.

b. **To Reach OPS.** A newly qualified CBRNDCQ should compete a CBRNDCQ task book ideally within 3 months, but not exceeding 6 months of joining allowing for Maintenance Periods/Operational Tasking. Failure to complete the Task book within 6 months, requires the divisional warning system to be utilised iaw BRd3. The Task Book is produced by MWS Phoenix TG and is available for download on the MWS Phoenix website.

c. The CBRNDC Q task book is to be retained by the individual and taken to the next unit.

d. **To Remain OPS.** To remain at OPS and to prevent skill-fade, CBRNDCQs must continue to be active members of their ship's CBRNDC training organisation. This must include, but is not limited to:

(1) Twice per term plan, conduce and evaluate a SSEP exercise or HOD covered HFEP exercise as CBRNDCQ.

(2) Twice a year plan, conduct and evaluate a whole ship CBRNDC exercise as lead CBRNDCQ.

(3) Attend CBRNDC Planning Meetings.

(4) At least once per year carry out GSR testing

(5) Fulfil the role as I/C Main Group (including for an exercise)

e. Recording OJT Progress and OPS Status

f. The decision to remove OPS status from a CBRNDCQ is at the discretion of the CBRNDCO (if borne) and the Executive Officer (XO). Any CBRNDCQ whose OPS status is removed, for any reason, should repeat the OJT.

g. **Exemption.** To reach and remain at OPS the Q will have to be a member of a Ship's Company on a sea going ship. Where CBRNDC 35 qualified personnel are fulfilling a 'Q role' but not serving on a sea going ship, eg in organisations such as Flotilla's, FOST, MWS Phoenix and NCHQ, the internal staff training and assurance processes will mitigate the inability to complete the OJT in its entirety and should be used as evidence to enable OPS to be recorded and kept in the unit training log.

2710. Scaling of CBRNDCQ Per Platform

The quantity of CBRNDCQ qualified personnel will be governed by the Unit Position List (UPL). The Table below details the minimum number of personnel required by platform class to hold the CBRNDC35 qualification; a minimum of 2 of these MUST be at OPS (to meet WSQ and SSEP I/C Main Group requirements). Platforms falling below the guideline within Table 27-3 are to raise a PERREQ.

Table 27-3. Minimum Number of CBRNDCQ's Per Platform

Platform Class	Minimum Number of CBRNDC Q
Queen Elizabeth	10
Albion	10
Type 23	6
Type 45	6
Scott	2
Echo	2
Protector	2
Hunt	2
Sandown	2
River Batch 1	2
River Batch 2	2

2711. Responsibilities of RN and RFA Units Line Managers and Career Managers

The following personnel have responsibilities for maintaining individual and collective SST in RN and RFA ships:

a. **The Executive Officer (XO).** As the head of the CBRNDC training organisation, the XO is responsible to the CO for ensuring that all personnel and new joiners are in date for SST and that only suitably qualified personnel can proceed to sea.

(1) For RN units BSSC/ISSC qualifications are recorded in the Master CBRNDC Training and Material Assessment Log, Volume 1, Part 2, which as a monthly book will ensure scrutiny of training status.

(2) The XO is responsible for delivering the SSB over the Main Broadcast or any other suitable method in accordance with the relevant SOLAS requirement to Category 3 personnel.

(3) For RFA units this information will be captured on Magellan and the LSO must notify the XO of non-compliance.

b. **The Executive Warrant Officer (EWO).** The EWO, as the whole ship POC for personnel training, is to pass the ship requirement to the Course Booking Cell, primarily via the Separated Service Planning Tool (SSPT) supported by e-mail as required.

c. **Whole Ship CBRNDC Qualified Personnel (WSQ).** The WSQ is to deliver a robust system of monitoring BSSC/ISSC qualifications of personnel onboard, informing the EWO in plenty of time (at least 12 months in advance) of any requirement for personnel to re-qualify; paying attention to periods when the ships programme will have a severe impact on training opportunities (eg deployments).

d. **Chief Bosun's Mate (CBM).** The CBM is responsible for coordinating the delivery of the CSSB in accordance with the guidance at Annex 27E; this shall include delivery of the sea safety aspects either in person or by a suitably qualified member of the seamanship department and DC&FF aspects by a CBRNDCQ.

e. **Divisional Officers**. It is a Divisional Officer's responsibility to check JPA (prior to the joining interview) to ascertain future SST re-qualifying dates. Timely notification will allow the WSQ/EWO to ensure training is booked prior to the current training LIFEX date. Divisional Officers are to ensure that an individual attending a SST course has read and understood the joining instructions

f. **Individuals.** It is an individual's responsibility to check JPA to ensure the correct SST competency is recorded after the successful completion of a course; allow 10 working days for the competency to be recorded on JPA. If JPA has not been updated to reflect your correct competence, after this period, email NAVY OP TRG-MWS ITSC TSTP P16 (93825 3537) with full details of course(s) attended.

g. **Career Managers**. Career Managers are responsible for ensuring that all Category 1 personnel are in date for SST prior to assigning them to a seagoing unit. Career Managers are also responsible for identifying an individual's training requirement and booking the relevant SST, ensuring there is time for an Officer or Rating to complete that course prior to joining a Unit.

2712. Training Failures

Sea Safety Training contains activities that are arduous and/or stressful for some however failure to achieve all training objectives (other than where that objective is unachievable through circumstances beyond their or the school's control) will result in a course failure. The relevant training school with dictate whether a Return To Unit (RTU) is appropriate, or whether a student will continue on the course. In any case the course competence will not be awarded. Course failures (other than Medical) will have any existing JPA competency stopped on the date of failure and are not permitted to proceed to sea pending successful completion of the relevant sea safety course. As these courses are related to **MANDATORY** competencies, administrative action by the parent unit may be taken against the individual. Where the individual has been retained on course only those modules failed will need to be repeated.

SECTION 2 - CONTINUATION TRAINING

2713. Continuation Training (CT)

Continuation CBRN and Damage Control training is achieved as follows:

a. Ship Team Training at shore facilities.

b. Ship Operational Sea Training (see BRd 9275(1) Chapter 17).

c. Internal ship training, such as duty watch lectures, duty watch exercises and whole-ship exercises.

2714 Operational Sea Training (OST)

FOST is the authority responsible for all aspects of operational sea training for all Fleet units. SARC and Continuation Training, under the direction of FOST, provide the focus to develop individual, team and whole ship skills in CBRNDC. Prior to OST, ships are expected to complete the comprehensive, structured programme of training laid down in BRd 9275 Volume 1 - Operational Sea Training Guide (OSTG). This stage may be conducted using internal resources within individual units or by visiting outside authorities. Stages are closely aligned to BRd 9274 - and their completion plays an important part in gradual progression of ability, as well as providing for the continued exposure to often little used skills.

2715. Staff Covered Weapon Training (SCWT)

Whilst formal OST packages are pre-designated, there is scope for units conducting Staff Covered Weapon Training (SCWT) to request cover for specific exercises. Bids are programmed through the FOST planning cell and cover will be dependent on Staff loading.

2716. FOST (MPV)

a. Based at HMNB Clyde, FOST (MPV) provides Operational Sea Training (OST) for all Minewarfare and Patrol Vessels (MM/PPs). This training normally takes place in the West Coast of Scotland exercise areas. The Gibraltar and Falkland Islands Patrol Vessels receive OST in their respective areas.

b. Guidance for MM/PPs undergoing ‘work up’ is contained in BRd 9275 Volume 2 - Additionally, BRd 9274 (MW Supplement) - is provided to supplement BRd 9274 Chapter 3 Section 4 to provide the necessary instructions for all MCM authorities and Commanding Officers involved in the planning and execution of UK MCM Training and Training Exercises.

2717. Aims and Objectives of CBRN and Damage Control Training Exercises

The aims and objectives of CBRN and Damage Control training serials are detailed below. They do not cover HAT (CBRNDC) (see Chapter 26 for details), FOST Staff Sea Checks or Circuit Training as these areas are ordered separately and detailed in other documentation. Table Top Tactics (TTT) discussions are similarly not covered, as specific serials should be planned and requested as part of an overall training package. When planning and requesting a CBRN and Damage Control training programme, permutations of Circuit Training, TTTs and practical exercises need to be carefully considered. When using outside authorities, early discussion is essential to ensure that a structured and balanced programme is produced, which best fits the needs of the ship.

2718. Exercise Designators

a. For ease of use, training is split into 2 areas. Exercise designators are to be used when planning or requesting CBRN and Damage Control training:

(1) Peacetime CBRNDC Training (see Annex 27C).

(2) Wartime CBRNDC Training Sea (see Annex 27D).

ANNEX 27A

SPONSOR: NAVY OP TRG-MWS EXC CBRNDC OIC

CBRNDC TRAINING LOGS

1. Master CBRNDC Training and Material Assessment Log (TMAL)

a. The Master CBRNDC Training and Material Assessment Log (TMAL) is to be kept by all ships in either hard copy or electronic copy (providing the system is robust and backed up regularly. The Executive Officer (XO), who is responsible for overall CBRNDC training coordination, is responsible for its upkeep. If a specialist CBRNDC Officer is borne he is to assume responsibility for its compilation. In those ships in which no dedicated CBRNDC Officer is borne the log keeping task can be delegated by the XO to the Whole Ship CBRNDC Qualified (WSQ) Coordinator.

b. The Log is to be divided into Parts, separated by spacers. Each spacer should be headed with the title of the Part. The following list of headings should be used as the basis of the Log. This may be added to at the CBRNDCO's/WSQ's discretion:

(1) **PART 1 - Signature and Comment Sheets**

(a) TMAL inspection sheets:

- Commanding Officer (CO) quarterly;
- XO monthly; and
- MEO monthly

(b) CBRNDCO/WSQ comments from the weekly FOCAS report which should include the following:

- an assessment of progress towards achieving the training objectives which have been set iaw BRd 9274/MORS (OC) and CBRNDC Task Books;
- steps taken or planned to be taken to rectify shortfalls with respect to training. Any penalties, which may have to be incurred in other areas as a result of these steps, should also be included;
- which have been highlighted in either CBRNDC practice or as a result of or in preparation for inspections by outside authorities, eg HAT (CBRNDC). This should include mention of stores related problems or difficulties;

- CBRNDC Material shortfalls or OPDEFs and planned rectification. To include material shortfalls identified during outside authority inspections, eg HAT CBRNDC, FOST inspection and weekly onboard inspections; and

- targets and priorities for CBRNDC training for the coming week/near future.

(2) **PART 2 - CBRN and DC Organisation and List of Personnel**

(a) The first sheet is to consist of a list of Key Personnel in the CBRNDC Organisation under headings as:

NAME RANK/RATE CBRNDC DUTY CBRNDC QUALIFICATION DATE

Note. *'CBRNDC Qualification' refers to any CBRNDC courses completed, including First Aid.*

(b) A list of the Ship's Company qualifying and expiry dates.

(c) OPS Record Cards for all CBRNDCQ 35 personnel.

(3) **PART 3 - Team and Whole Ship Training.** This constitutes a record of the whole ship CBRNDC training. BRd 9274/MORS(OC) should form the basis of this part. Any temporary memoranda produced in support of this programme is also to be included for future reference.

(4) **PART 4 - Exercises**. This contains comments arising from ship CBRNDC exercises pertinent to the future conduct of exercises and training. Key strengths and weakness to be noted. All CBRNDC and whole ship exercise reports (including SSEP) is to be held in this Part.

(5) **PART 5 - Material Assessment**. Subdivided into:

(a) **Section A**. HQ1 Daily Checks.

(b) **Section B**. Weekly equipment check sheets detailing:

- equipment for which each department is responsible. To include details of all CBRNDC equipment held;

- person in the department responsible for each compartment;

- weekly signature for compartment owners once all equipment checks detailed in the log have been completed;

- departmental CBRNDCQ's signature;

- post Exercise Check offs; and

- defect pages by department. Use defect log format as detailed in BRd 3000 as a guide.

(c) **Section C**. EDBA weekly signature and comment sheets.

(d) **Section D**. EEBD monthly signature and comment sheets.

(e) **Section E**. Contains 'life' details of CBRN equipment to include, but not limited to: EEBD and all SPE.

Note. *Section E can be held electronically but its location must be specified within the TMAL. EDBA cylinder dates are held with the pressure vessel register.*

(6) **PART 6** - **References**. This contains CBRNDC references, including Forms S2022a, DINs, RNTM and letters where appropriate. Master equipment checklists, master and spare log sheets and the previous months log sheets are also to be retained. It is recommended that copies of all material less than 12 months old and copies of older material, at the log keeper's discretion, be included.

Note. *Ships conducting RIP must ensure Volume 1 of the CBRNDC Material and Assessment log and Harbour Training log is retained by the crew Volume 2 is specific to the hull and must remain with the hull at all times.*

2. Master TMAL - Method of Use

a. Equipment checks are to be carried out weekly and after DC exercises by the compartment custodian and signed for in the Master TMAL. The compartment custodian is responsible for ensuring equipment checks are carried out and all equipment has been returned to its correct stowage and it is readily available for use. Equipment located in communal areas is to be divided between departments in accordance with that units extant communal responsibility. CBRNDCQs are to be responsible for their relevant departments.

b. Post exercises checks should be initiated by an appropriate pipe; on hearing the pipe all compartment custodians are to check and re-sign for their equipment within 30 mins of the pipe being made. Defects are to be given prompt attention and rectified by the compartment custodians at the earliest opportunity in order to protect personnel, equipment and systems.

c. The ME personnel responsible for maintaining the DC equipment are to scrutinise defect sheets daily. All Short-term defects to be entered in the DC Defect Log and managed accordingly by MEO/XO. All long-term defects to be raised in UMMS.

d. When each departmental section within the Master TMAL has been completed and signed, the CBRNDCQ of that department is to carry out random quality control checks and sign to that effect. The WSQ should also carry out spot checks around the ship periodically to ensure that the system of inspection is being carried out correctly and conscientiously.

Messdecks and cabins become the responsibility of the President/LHOM and weekly checks are to be signed for directly in the Master TMAL. An example section of a ME departmental CBRNDC equipment check off sheet is shown at Table 27A-1

Table 27A-1. Weekly ME Departmental CBRNDC Equipment Checks

COMPARTMENT LOCATION and NOMINATED CUSTODIAN	DC/FF and ESCAPE EQUIPMENT FITTED								CUSTODIANS CHECKS and CONTROLS	
	AFFF SPE Nos	CO_2 SPE Nos	DP Nos	Lay Flat Hoses	WW/FF Nozzles	EEBD Nos	CFHR	Escape Hatch	Post WS Exercise Checks (Date and Initial)	Weekly Signature and Date
UAMR 1H M2	51 52	86 98	4	N/A	N/A	46 47	YES x 2	YES	FF 6/4 TT 8/4	
HULL W/S 1G M3H	102	100	N/A	N/A	N/A	22 23	NO	NO	JB 6/4 JB 8/4	

***Note**. This checklist is not exhaustive, and Units may add other items of DC or CBRN equipment that must be checked within compartments.*

3. Harbour Watch Training Log

a. The Harbour training log is formulated by the WSQ with the aim of completing all BRd 9274/MORS tasks within the required timeframe, to aid CBRNDC task book completion and training personnel.

b. **Harbour Watch Training Log Inspections.** The Log Keeper is to weed the Harbour Watch Training Log regularly and keep it in accordance with the following instructions:

(1) **Parts 1A, 1B, and 1C.** The Harbour Watch Training Log should be inspected by the CO quarterly, MEO monthly, and by the XO daily (as part of the OOD handover routine). Signature sheets are to be included to record these inspections.

(2) **Part 2. Marine Engineer Officers Monthly Comments.** The MEO's comments should provide a brief overview of progress of firefighting training, both at sea and in harbour, to the XO. The following information should provide the basis of his report:

(a) Significant weaknesses or trends in firefighting practice that have been highlighted as a result of exercises during the previous month and the steps that are being taken as a result.

(b) An indication of any significant factors that have contributed either to weaknesses in firefighting practice or failure to complete a satisfactory training programme, eg material deficiencies, lack of availability of manpower or programming difficulties.

(c) Significant achievements.

(d) Aims for the coming month.

c. **Part 3 - Harbour Watch Training Plan.** The plan is to comprise a forecast harbour training programme produced by the Whole Ship CBRNDC Qualified (WSQ). When putting together the programme the WSQ should also include requirements for other serials such as the Reaction Force, First Aid, Pollution Control, Conventional Weapons Incident etc. The plan should be agreed with the MEO and approved by the XO on a monthly basis. The plan should specify what form the training will take each day and who will be responsible for its execution eg OOD (Harbour Fire and Emergency Party/Reaction Force Training), Head of Department (Major Harbour Fire Exercises) and non-CBRNDC expertise which may be required for other serials. In addition to using the Lecture Plans provided at Annex 27B as a basis for training, other training serials from BRd 9274/MORS(OC) should also be included, eg Harbour Fire Exercise with the local Fire and Rescue Service (FRS). A column is to be included in the plan such that the Action Officer may sign to certify completion of the serial. A copy of the ship's Longcast is to be included as an aid to exercise planning. The recommended format for the plan is as follows:

DATE	LECTURE/EXERCISE	LECTURE PLAN OR BRd 9274 SERIAL NO	ACTION: COMPLETED/ CANCELLED	SIGNATURE

d. **Part 4 - OOD Daily Comments.** It is essential that OODs provide full details of the daily training serials in order that shortcomings can be addressed. Failings of lectures and weak areas of exercises should be highlighted with recommended remedial actions. Reasons for non-completion of the serials should also be included, as should any material defects (cross referenced to any defect serial number) discovered during training serials. This Part should be read and signed by the Log Keeper daily.

e. **Part 5 - Completed Harbour Fire and Flood Exercise Assessment Forms**.

4. Duty Watch Lecture Plans

The Damage Control Lecture Plans for ships Duty Watches are at Annex 27B.

5. Stability Lecture

A stability lecture, based on the Lecture Plan is to be delivered by the MEO/DMEO at 6 monthly intervals to all OOD, DMESR, DWETR and DPO. Whilst there is no requirement for these key personnel to develop a deep technical knowledge of stability theory, it is essential that they have a good understanding of the practical problems involved with the management of firefighting and boundary cooling water.

ANNEX 27B

Sponsor: NAVYOP TRG-MWS EXC OIC

CBRNDC LECTURE PLANS

LECTURE PLAN	SUBJECT
1	Firefighting Elementary 1
2	Firefighting Elementary 2
3	Firefighting Clothing and Communications
4	Practical Team Training
5	Containment
6	5 Man Team (Revision)
7	Ventilation, Smoke Control and Smoke Clearance
8	Search and Rescue
9	Leakstopping and Shoring
10	Cantilever Build
11	Second Stage Damage Repair
12	Portable Pumps
13	WEDA Pump Series Coupling Kit
14	Incident Board Marking
15	Ramfan
16	Kill Cards
17	Thermal Lance Cutting Equipment
18	Keys Organisation
19	Emergency Escape Breathing Apparatus (EEBD)
20	DC Equipment Checks

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	1. Firefighting Elementary 1	
Fire Triangle: Describe components	Air/Oxygen - smother it/Heat - cool it/Fuel - remove source of combustion.	BRd 2170(1) Chapter 17 BR 4007
Firefighting Media: Uses	When to use: Water, 9 ltr AFFF, Dry powder, CO_2, Fry Fighter and Fixed firefighting systems.	BRd 2170(1) Chapter 19
Firefighting Equipment: Describe its use	2 kg CO_2 extinguisher, 9 ltr dry powder SPE, 9 ltr AFFF SPE, Fry Fighter, Size 1, 2 and 3 hoses, Firefighter nozzle, Waterwall nozzle, Delta Nozzle (If applicable), Centre feed hose reel (CFHR), FB 10/10 branchpipe and FB5X Mk 2 branch pipe (set to 6%), AFFF and Thermal Imaging Camera (TIC).	BRd 2170(1) Chapter 18 and Chapter 19
Describe the Basic Firefighting Techniques	1. Value of the waterwall. 2. Problems with fighting fires between decks. 3. Smoke and associated problems. 4. Door technique. 5. Hatch technique. 6. 3 hose technique. 7. Oil fire from above. 8. Importance of getting to the seat of the fire. 9. Sentry with charged hose complete with F/F nozzle or centre feed hose reel. 10. Importance of breaking up carbonaceous fires to prevent re-ignition. 11. Fixed hatch waterwall (FHWW) - use and testing.	BRd 2170(1) Chapter 17 BR 4007

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	2. Firefighting Elementary 2	
Define initial action on discovering a fire	1. Raise the alarm. 2. If behind closed doors leave closed. 3. If door open fight fire/rescue casualties (depends on circumstances and size of fire). 4. Contain spread. 5. Do not get trapped. 6. If beaten back close door or seal with waterwall. 7. Stay in vicinity to brief Attack Team and I/C Main Group, then escorted to HQ1 to brief OOD.	BRd 2170(1) Chapter 17 BR 4007
Define boundary cooling procedures	1. Aim to remove conducted heat. Priorities are hazardous compartments above, then others. (Include the lack of heat penetration through GRP) 2. Minimum of water to keep decks and bulkheads wet. 3. Pump/bale out excess water. Drain water using fitted ships drains. 4. Protect electrical equipment. 5. Boundary starving and remove combustible material. 6. Searching boundaries. 7. I/C to visit boundary coolers regularly and inform HQ1 of water level in compartments cooled.	BRd 2170(1) Chapter 17 BR 4007
Define actions for dealing with electrical fires	1. Switch off power if possible. 2. CO_2 effective, clean but does not support life (no cooling effect).	BRd 2170(1) Chapter17

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	2. Firefighting Elementary 2 (Cont'd)	
Duties of a Fire Sentry	1. Muster correct equipment. 2. Use correct equipment - FF nozzle and charged hose or CFHR if fitted. 3. Hose length sufficient to reach all compartments. 4. One sentry for each deck level (minimum). 5. BA may be required. 6. Action in event of re-ignition.	BRd 2170(1) Chapter 17 BR 4007
	3. Firefighting Clothing and Communications	
State the varying resistance of materials to fire	1. Man-made fibres - minimal. 2. Cotton - some. 3. Wool - better than cotton. 4. PBI Gold. 5. Action Coveralls. 6. Firefighters gloves 7. Why not to wear Chef whites or Foul weather clothing.	BRd 2170(1) Chapter 20 BR 4007
Basic Firefighting Rig	Outline various elements in the rigs/Outline when and how to be worn/Mention surcoats.	BRd 2170(1) Chapter 20 BR 4007
Intermediate Firefighting Rig	Basic firefighting rig, FF hood, BA and anti-flash gloves. Hood and gloves in BA locker. Worn by Attack BA Team.	BRd 2170(1) Chapter 20 BR 4007

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	3. Firefighting Clothing and Communications (Cont'd)	
Full Firefighting Rig	1. **Outline elements of the full firefighting rig.** a. Firefighting suit (PPI Gold), gloves, firefighting boots and woollen socks. b. Firefighters hood c. Firefighters Helmet with Built-in Communications (FFHBC). d. Thermal Imaging Camera (TIC) (Team Leader only). 2. **Additional Points**. a. Dressing time 8 mins. b. Ensure flesh and hair covered. c. Avoid radiated heat through visor. d. Heat can penetrate elbows, knees and BA straps. Keep body moving to allow air circulation and stay on feet not knees.	BRd 2170(1) Chapter 20 BR 4007
Demonstrate how to use FFHBC	1. Radio operating procedures (channels and voice procedure). 2. Radio limitations (not intrinsically safe, not used in magazines). 3. Capabilities of helmet. 4. Pre-wear checks.	BRd 2170(1) Chapter 8 BR 4007 FFHBC

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	4. Practical Team Training	
Demonstrate and practise correct use of the 5 person firefighting team	1. Correct dressing of support team. 2. Deployment of team on running hoses. 3. Re-entering compartments (door and hatch). 4. Practise relieving support teams. 5. Practise extending hose runs.	BRd 2170(1) Chapter 17 and Chapter 20 BR 4007 4 BA (Damage Control) 4 PBI Gold 2 x 12 m hoses (No 2) 1 FF and 1 WW nozzle
Demonstrate and practise correct use of the 3 hose technique firefighting team	1. Correct dressing of support team. 2. Deployment of team on running hoses. 3. Re-entering compartment to fight oil fire from above. 4. Practise relieving 3 hose team. 5. Practise extending hose runs. 6. Team numbers will depend on where fire is.	BRd 2170(1) Chapter 17 and Chapter 20 BR 4007 BA (Damage Control) Firefighting Suit/3 x 12 m hoses (No 2)/2 x waterwall nozzles/1 x FB5X Mk2/1 x inline inductor/4 x 20 ltr AFFF drums

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	5. Containment	
To: Search, Starve Cool The Fire Boundary	1. Priorities - dangerous, above and other compartments. 2. Apply minimum water to maintain wet plates. 3. Boundary cooling area become untenable, BA required. It may be possible to re-start selective fans to assist in the removal of smoke, only with the permission of HQ1. 4. Remove false deckheads and bulkheads as necessary to enable cooling and/or monitoring of actual deckheads and bulkheads. 5. Electrical cabinets and components to be covered where practicable with waterproof material. 6. Temperature Monitoring System (TMS). 7. Use of Deck Managers.	BRd 2170(1) Chapter 17 FF Nozzle No 2 hoses BA Magnetic thermometer Thermal Imaging Camera (TIC)
	6. 5 Person Team (Revision)	
Define the duties of: 5 person Support Team and 3 Hose Technique Firefighting Team	**5 Person Support Team State:** The composition of the team, the individual duties of the team members and demonstrate the operation of the team for door/hatch entry procedures. **3 Hose Technique Support Team State:** The composition of the team, the individual duties of the team, demonstrate the operation of the team for door/hatch entry procedures and when the 3 hose technique is to be used.	BRd 2170(1) Chapter 17 BR 4007
	7. Ventilation, Smoke Control and Smoke Clearance	
Define the need for Ventilation Control	1. To reduce flow of air to a compartment in which a fire is situated. 2. To limit the spread of smoke.	BRd 2170(1) Chapter 17

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	7. Ventilation, Smoke Control and Smoke Clearance (Cont'd)	
Ventilation Control Procedure(s)	1. **Crash Stopping Ventilation.** Ships CBRNDC Orders should define set procedures for stopping ventilation and remaking breaker(s) immediately a fire is detected. Describe procedures as defined. ***Note.*** *Some fans not controlled from ventilation breakers will need to be stopped at their local control positions.* 2. **Ventilation Systems.** Restart selected ventilation systems only as directed by the OOD in HQ1/SCC. ***Note.*** *This will involve systems essential to the ships function and which do not interfere with firefighting operations or the establishment of a smoke boundary. Particular ventilation systems may be used for smoke clearance operations but only as directed by OOD.* 3. **Machinery Space Firefighting.** Prior to use of either CO_2 or BCF fixed firefighting systems, machinery space to be fully closed down. This will include shutting all ventilation supply and exhaust flaps. Ensure all personnel are aware of position of flaps and that flaps are unimpeded and free to move. 4. **BTM Systems.** Before operating the first shot of BTM, the vent is to be crash stopped. Before operating the second shot of BTM, the compartment vent is to be fully closed down. All vent flaps shut.	

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
7. Ventilation, Smoke Control and Smoke Clearance (Cont'd)		
Smoke Control and Clearance	1. **Effects of Smoke** a. Spread of smoke is a major factor in preventing clear appreciation of the source and extent of a fire and in preventing the adoption of effective firefighting measures. b. Toxic nature of smoke is highly debilitating to personnel and just a small concentration may be lethal. 2. **Smoke Control** a. Effective immediate ventilation crash stop procedures will help to limit the spread of smoke. b. Control of all ventilation systems by the OOD will ensure good smoke control discipline. c. Early use of smoke curtains and/or door/hatches will help to isolate smoke into the smallest area consistent with the need to gain access to the fire. 3. Smoke clearance Guidance for the relevant base port.	BRd 2170(1) Chapter 17 BR 4007 High Risk Compartment Kill Cards.
8. Search and Rescue		
Assess situation and organise search parties	Obtain permission from I/C in HQ1, number of persons missing, last known location, what BA sets are available?, decide search routes and detail personnel in pairs.	BRd 2170(1) Chapter 17
Carry out correct search procedure	Contact is to be maintained, lay guidelines correctly and indicate compartment has been searched on completion.	BRd 2170(1) Chapter 17
Carry out correct procedure on discovering a casualty	Let casualty know who you are, what you are doing and going to do, give casualty a fresh source of air, never leave casualty alone and SITREP to I/C. Request assistance if necessary.	BRd 2170(1) Chapter 17 and Chapter 22. BR 8223(1)
Select best transportation and remove casualty safely	1. If mobile on 2 m extension. 2. If stretcher required, BA is to be removed. 15 m extension to be used. 3. 15 m extension to have separate supplying set and controller outside point of entry.	BRd 2170(1) Chapter 17 and Chapter 22. BR 8223(1)

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring	
Principal of First Aid Leakstopping	1. **First Aid Leakstopping.** a. Explain effect of wedging. b. Explain when and where softwood wedges are used. c. Describe 'petalling' effect and importance to Command and Control (inboard or outboard 'petalling' indicating direction of attack. d. Assess the number of wedges required for area of damage (1 wedge per 25 mm of damage). e. Describe arrangement of wedges when attacking damage (arrow head formation). f. Aggressive attack on damage required to minimise ingress of water 70% effective). g. Describe the splitting of whole wedges, using ships framework for maximum leakstopping effect around whole wedges (90% effective). h. Describe that on attacking multi splinter damage, wedging to commence at lowest level. i. State that DC bags stowed in machinery spaces have bungs in 3 sizes to aid leakstopping teams.	BRd 2170(1) Chapter 12 and Chapter 13 BR 4008

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring (Cont'd)	
Principal of First Aid Leakstopping (Cont'd)	2. **Preparation to Continue to Second Stage.** a. If required, wedges and/or bungs to be cut back in order for domes to fit over damaged area. b. Ensure second stage equipment is at hand before removing wedges. 3. **GRP Domes.** a. Describe different sizes of GRP Domes; identify the rubber seal and stowages. b. Explain the use of strongbacks, wooden washer and securing wing nut. c. Pass strongback through damage, then position GRP dome over threaded spindle. Secure in position using wooden washer and securing the wing nut.	-
Explain the types of shoring available	4. **Types of Shoring Available.** a. **Timber.** (100 x 100 mm and 150 x 150 mm). (30 Min width) b. **Acroprop.** Main advantages of steel shores are speed and ease of use. Cannot be used as a proud shore. Large Acroprop 1.75 m - 3 m. Small Acroprop 1 m - 1.6 m. Major parts - locking pin, rotating collar, fixed feet. Course and fine adjustments (130 mm). No problem with weak points.	BRd 2170(1) Chapter 13 and BR 4008 Timber Shore Steel Shore **Acroprops should always be carried with threaded end uppermost. Pin through cut out below rotating collar, thumb on chain end, two fingers around prop and pin.**

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring (Cont'd)	
Explain different methods of shoring	1. **Vertical Shoring.** a. Used for decks, hatches and GRP domes. b. Pad piece required for deck, pad piece **OR** opposing wedges required for deckhead. c. Stapled on completion. d. Sentry. 2. **Proud and Breast Shoring.** a. Used for watertight doors, bulkheads and GRP domes. b. Proud measured from pad piece, shore is cut 25 mm (one thumb width) longer than required. c. No wedges. d. Pad pieces as required. e. Breast cut ½ width of proud shore longer. f. If on a bulkhead, breast ⅓ way up compartment. g. Stapled on completion. h. Sentry posted.	BRd 2170(1) Chapter 12 and Chapter 13 BR 4008
State the principle rules of shoring	**Shoring:** Shores must have a strong rigid anchorage and complete network of reinforcement essential.	BRd 2170(1) Chapter 12 and Chapter 13. BR 4008

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring (Cont'd)	
State the principle rules of shoring (Cont'd)	**General Rules.** a. Maximum length of timber shores is 30 x min width (eg 100 x 100 mm = 3 m and 150 x 150 mm = 4.5 m). b. The top and bottom of the shores are mounted on pad pieces or opposing wedges if required. c. Never cut timbers in anticipation. d. Do not erect shoring before damage occurs. e. When wedges are used in pairs they should be in opposing pairs - driven in simultaneously, one person, two hammers. f. A system of shores should be tied together with staples. g. Sentry posted on completion, with hammers.	
Demonstrate the method of measuring timber for shoring	1. **Measuring Length of Vertical Shore using Gunter Batten**. a. Place the required number of pad pieces on deck (sheet of rubber/metal plate or GRP dome if required). b. Place the booted foot on top of pad piece (s). c. Use the Gunter Batten to measure the distance between the top of toecap and deckhead/beam. d. Lock Gunter Batten using locking cord.	Gunter Batten BRd 2170(1) Chapter 13 and BR 4008

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring (Cont'd)	
Demonstrate the method of measuring timber for shoring (Cont'd)	e. The person measuring the shore cuts the timber **REMEMBER: MEASURE TWICE - CUT ONCE.** f. Lay the Gutter Batten on length of timber and cut to size. 2. **Measure the Length of Proud Shore.** a. Place pad piece on deck. b. Use Gunter Batten, measure vertical distance between pad piece and deckhead/beam. c. Lock Gunter Batten using locking cord. d. Lay the Gutter Batten on length of timber to be cut, add one thumb width, mark and cut. The cut should be angled back approximately 10°.	Pad Piece example
State the uses of Pad Pieces	**Pad Pieces.** a. Explain the use of a pad piece. b. Not required where shore butts up to beam. c. Pad pieces must be used with metal shores to prevent slipping.	
Explain types and uses of Emms Clamps	**Emms Clamps.** 2 sizes of standard clamp: a. 180 x 140 mm (for use with 100 mm² shoring). b. 230 x 190 mm (for use with 150 mm or double 100 mm shoring should additional support be necessary).	

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	9. Leakstopping and Shoring (Cont'd)	
Explain types and uses of Emms Clamps (Cont'd)	Supplied to HM ships as follows: ***Note.*** *2 clamps can be used in tandem to extend the distance of the 'strongback' from the damaged area.* Universal clamp is for use in ships with offset bulb frames and can be extended by using additional standard Emms clamps.	BRd 2170(1) Chapter 13 and BR 4008 Demonstration Emms clamps (1 standard and 1 large) Demonstration Universal Emms clamp in ships with offset bulb frames
Explain Cantilever methods	**Cantilever.** **CBRNDC Q to deliver only** **On occasions where damage is received and traditional shoring methods are not achievable due to confined access, alternative build such as cantilever shoring using Emms CLAMPS should be considered.**	BR 4008

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	10. Cantilever Build	
Identify suitable area for demonstration, ensuring accessible framing and suitable space either side on the Bulkhead to allow the build.	**1. Second Stage Repair on split/splinter holes on a bulkhead. Using a Cantilever Build utilising an EMMS Clamp (Mk1 or 2), Gunter batten, pad pieces, wedges, a Spar and a medium size GRP dome.** a. Leave first aid leak stopping wedges in situ. b. Fit EMMS Clamp to frame with working parts away from the damage. c. Site GRP dome box over wedges and damage. d. Place one pad piece on GRP dome and one on Bulkhead opposite side of the EMMS Clamp to the damage. Explain use of pad pieces in all shoring. e. Measure for a Spar between the two Pad Pieces, cut and then slide into place so the EMMS Clamp is the pivot. f. Measure for a Breast Shore between the pad piece and the Spar opposite the damage to allow load to be placed upon the pad piece and GRP Dome. g. Wedges can then be utilised, by inserting between the pad pieces and spar at both ends to ensure maximum load applied to the GRP Dome. h Additional wedges can be inserted into the EMMS Clamp behind the Spar to lock it into place and provide a fulcrum point for the cantilever. i. If needed staples can be utilised to add additional strength.	BRd 2170(1) BR 4008 Demonstration

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	10. Cantilever Build (Cont'd)	
Identify suitable area for demonstration, ensuring accessible framing and suitable space either side on the Bulkhead to allow the build. (Cont'd)	**2. Second stage repair split/splinter holes in a bulkhead with a Cantilever Build utilising an EMMS Clamp (Mk 1 or 2) , Gunter batten, pad pieces, wedges, spar, patch pack and rubber sheet (Cont'd)** a. Remove first aid leak stopping wedges to simulate cutting flush. b. Fit EMMS Clamp to frame with working parts away from the damaged area. c. Site patch pack and rubber sheet over damage. d. Place one pad piece onto the patch pack/rubber sandwich and one onto the Bulkhead on the opposite side of the EMMS Clamp. Explain use of pad pieces in all shoring. e. Measure for a Spar between the two Pad Pieces, cut and then slide into place so the EMMS Clamp becomes the pivot point. f. Measure for a Breast Shore between the pad piece and the Spar opposite the damage to allow load to be placed upon the pad piece patch pack/rubber sandwich. g. Wedges can then be utilised, by insertion between the pad pieces and spar at both ends to ensure maximum load applied to the sandwich build. h. Additional wedges can also be inserted into the EMMS Clamp behind the Spar to lock it into place and provide a fulcrum point for the cantilever. i. If needed staples can be utilised to add additional strength.	BRd 2170(1) BR 4008 Demonstration

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	11. Second Stage Damage Repair	
Practical demonstration of shoring techniques	**1. Second Stage Repair on splinter holes in decks or bulkheads. Using an Acroprop, 2 pad pieces and medium size GRP dome.** a. Leave first aid leak stopping wedges in situ. b. Site GRP dome box over wedges and damage. c. Place 2 pad pieces on GRP dome. Explain use of pad pieces in all shoring. d. Place Acroprop on top of GRP dome and one pad piece. One person remove safety pin from below rotating collar and raise up inner section of Acroprop until approx. 2 ins away from deckhead, reposition safety pin above rotating collar. Second person place remaining pad piece in position between deckhead and Acroprop. Lock Acroprop in position using operating handle on rotating collar. Ensure Acroprop is vertical. **2. Second stage repair splinter hole in deck (passing through compartment) using 100 x 100 mm timber shore, Gunter batten, pad pieces, wedges, patch pack and rubber sheet.** a. Explain where to use pad pieces with vertical timber shores (deckhead and support beam). b. Place rubber sheet and steel plate over damaged area on sound frames. Explain that wedges must be removed. Place pad piece on top. c. Describe the construction of the Gunter batten and explain how to operate. d. Place boot on pad piece and measure from toecap of the boot the length of shore required.	BRd 2170(1) Chapter 13 and BR 4008 Demonstration **Observe all safety precautions when handling and transferring Acroprops**. BRd 2170(1) Chapter 13 and BR 4008 Demonstration

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	11. Second Stage Damage Repair (Cont'd)	
Practical demonstration of shoring techniques (Cont'd)	e. Cut timber to length and take to incident. f. Lock shore into position by inserting opposing wedges (top or bottom) ensuring shore is vertical. (A further pad piece may be required if shore butts up to deckhead). g. Vertical timber shore length is not to exceed 30 times its width. **3. Second stage repair on multi-split EMMS clamps, compressible material, pad piece, timber infill's, timber shore and wedges.** a. Position EMMS clamps either side of damaged area on sound frames. Clamps to be central to damage and level with each other. Wing nuts facing away from damaged area. b. Explain that, if required the protruding length of wedges/bungs to be cut off. c. Place compressible material over damage. d. Position pad piece over compressible material. Place timber infills over pad piece. Locate timber shore between EMMS clamps. Lock/build into position using opposing wedges (Infills and EMMS clamps).	BRd 2170(1) Chapter 13 and BR 4008 Demonstration

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	11. Second Stage Damage Repair (Cont'd)	
Practical demonstration of shoring techniques (Cont'd)	**4. Second stage repair on multi-split proud and double breast shore using pad piece, Gunter batten, small Acroprop, 100 x 100 mm timber proud and breast shores.** a. Position pad piece on the deck central to damaged area. b. Use Gunter batten to measure from pad piece to deckhead. c. Add 25 mm (one thumbs width) to the measurement. d. Cut and position timber central to damage. e. Measure from compressible material and pad piece over damaged area on lower breast shore to the front face of proud shore using Gunter batten. f. Extend length of Gunter batten by half of the width of proud shore. g. Cut and position breast shore. h. Place footplate of small Acroprop against compressible material and pad piece. i. Extend Acroprop until top plate touches proud shore, insert wedge between Acroprop top plate and proud shore to counteract proud shore angle. j. Tighten and lock into position using operating handle.	BRd 2170(1) Chapter 13 and BR 4008

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	11. Second Stage Damage Repair (Cont'd)	
Practical demonstration of shoring techniques (Cont'd)	**5. Second stage repair on buckled hatch using Acroprop and pad pieces.** a. Apply pressure to top of hatch (stand on it). b. Apply hatch retaining clips and tighten using hatch clip spanner/lever. c. Shore hatch using Acroprop and 2 pad pieces on affected area. Replace with 100 x 100 mm vertical timber shoring when action/sea state allows. ***Note.*** *During peacetime conditions, Acroprops are considered to be a semi-permanent arrangement. However, in a wartime condition they are only for temporary use and must be replaced with timber shores as soon as conditions allow.*	BRd 2170(1) Chapter 13 and BR 4008 Demonstration
	12. Portable Pumps	
Define the types of pumps available in your ship and where they are located.	Each FRPP has WEDA pumps and 1 portable Eductor. Describe, rig each pump and demonstrate its operation.	BRd 2170(1) Chapter 22 BR 4008
	13. WEDA Pump Series Coupling Kit	
Define WEDA pump capability to produce firefighting water pressure	1. 1 pump does not produce sufficient pressure for firefighting. 2. When 2 pumps are run in tandem the will produce sufficient pressure to supply up to 4 hoses for **EMERGENCY** firefighting.	BRd 2170(1) Chapter 22 BR 4008
Explain tandem connection of 2 pumps	1. The first pump (which is taking suction) is fitted with a 4" discharge adaptor (as supplied) and a 4" discharge hose. 2. The second pump is connected to the first pump discharge hose using the coupling kit connection. This is fitted to the bottom of the second pump strainer.	2 pumps and connections rigged for demonstration

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
13. WEDA Pump Series Coupling Kit (Cont'd)		
Explain rigging of firefighting hoses and nozzles	Two in number 'Y' pieces are connected to the discharge side of the second pump; size 2 hoses are then rigged to the required length from the pump to the firefighting nozzles. If only 2 hoses are used for firefighting, the other 2 should be run to separate discharge overboard valves to provide maximum flow rate.	'Y' pieces, hoses and nozzles rigged for demonstration
Carry out practical demonstration	If the situation allows the demonstration should be rigged on the upper deck and the first pump lowered overboard until its suction is covered by water. The pumps can then be started to prove the system.	At least 6 personnel are required to man the hoses and suction pump
14. Incident Board Marking		
Interpret an Incident Board	The requirement for whole ship Incident boards is to record all Damage Control incidents in a pictorial manner that can be understood at a glance. Explain the following: Layout of Decks, Half Decks, Watertight and non-watertight bulkheads, Doors, Hatches, Manholes, Hoists and trunks, Compartment water capacities, Fire and Repair posts, CBRN markings, Dispersal stations numbers, Tank Layout and Colour wash for machinery spaces.	Large incident board. Individual incident boards marker pens. BRd 2170(1) Chapter 7
Define the notations for marking an Incident board	Explain the following symbols: Fire, Free Flood, Slow Flood, Free Surface Flood, Boundary cooling, Smoke boundaries, Flooding boundaries, Shoring, Contamination from within, External contamination, Additional information, Splinter holes, Distorted bulkheads, Adjacent incidents and Duel incidents. ***Notes:*** *1. Where a significant error has been made, eg fire in wrong compartment, this may be erased and corrected, having first obtained OOD permission to do so.* *2. Emphasise importance of IBO.* *3. The Symbology for marking Ship Protection incidents in harbour is detailed in BRd 8988 - Royal Navy Manual of Military Training, Operations and Tactics.*	Large incident board. Individual incident boards marker pens. BRd 2170(1) Chapter 7 Using individual Incident board get Duty Watch to mark boards up using correct Symbology.

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	15. Ramfan	
Describe the Ramfan and its uses **To identify the equipment and know how it is set up** **Describe the operation of the Ramfan**	1 man portable fan. HPSW driven turbine. 2.75 to 12.4 bar (40 to 180 psi). Used for smoke clearance or tank venting. Set comprises of 1 fan and 4 lengths of 300 mm ducting. a. Connect size 3 hose from discharge side of pump to a discharge overboard. b. Connect size 2 hose from HPSW to inlet of Ramfan. c. Fan must be earthed using earthing lead. d. Attach required length of ducting on suction and discharge. e. To operate open supply for Ramfan (obtain permission from HQ1 before operating). f. On completion flush with fresh water.	BRd 2170(1) Chapter 18 Ramfan and hoses

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
	16. Kill Cards	
Explain what a Kill Card is and where it is found **Define what information is found on the Kill card**	Firefighting Kill Cards are used for High Fire Risk, Explosive Risk and High Value compartments. Kill Cards may be raised for other compartments at the discretion of ships officers. **Front side:** Ventilation, Danger hazards within and external to compartment, Firefighting installations within fixed/portable and external fixed/portable, Smoke clearance action, Pumping out arrangements, Electrical supplies to be isolated and Fuel supplies to be isolated. **Reverse side:** Compartment layout and Adjacent compartments. **Locations to find Kill Cards**: At entrance to compartments, HQ1/HQ2/SCC, FRPPs/ZCPs and WSB.	BRd 2170(1) Annex 17J Photocopied examples of ships Kill Cards

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
17. Thermal Lance Cutting Equipment		
Explain what the Thermal Lance Cutting Equipment is and its uses	It is oxygen cutting equipment: Portable, Uses ultra-thermic cutting rods, How it uses oxygen, How the rod is ignited. Up to 1 m in water and Personnel rescue and battle damage. (CBRNDC Q or CBRNDC 29 trained personnel only)	BRd 2170(1) Chapter 12 and BR 4008 Thermal Lance
Describe each component	Aluminium box, Body harness, Oxygen cylinder, Batteries and cable assembly, Cutting torch and striker late and Ultra thermic rods.	Thermal Lance disassembled. Show each individual part
Procedure: Explain safety aspects and demonstrate how the Thermal Lance Cutting Equipment is used.	Correct clothing: Overalls over PCS and cotton underwear, anti-flash hood and welder's goggles, leather gauntlets. Be aware of what you are cutting: What is behind it?, minimum distance for other personnel (3 m), never point the torch at anyone, keep clear of flammable materials, positive and negative side of the batteries **SHOULD NEVER TOUCH.**	Show objects
Preparation for work.	Inspect all components, check batteries and oxygen cylinder for charge, set regulator 90 - 120 psi, connect batteries to harness, cutting tool and striker, check area, check ventilation and ensure correct safety clothing is worn.	-
Commencing work.	Open Cylinder with gloves warn, open collet nut, insert rod and tighten/point rod away from body/bring rod into contact with striker/when sparking commences add oxygen/move to the top of work and move striker away from work area.	-
Cutting.	Angle rods towards cut and drag along line.	-

WARNINGS

1. THE TEMPERATURE OF THE ROD IS 5000°C.

2. TEMPERATURE MIXTURE OF OXYGEN AND ELECTRICITY IS POTENTIALLY LETHAL.

3. THERMAL LANCE CUTTING EQUIPMENT IS ONLY TO BE OPERATED BY PERSONNEL TRAINED ON COURSE AT THE MWS PHOENIX TRAINING GROUP. THIS LECTURE DOES NOT QUALIFY OPERATORS.

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
18. Keys Organisation		
Explain keys organisation onboard your ship **Explain duty of Keys rating**	Point out importance of key tanks. Correct keys are stowed in key tanks for **ALL** compartments. If locks or padlocks are changed then keys must be replaced in key tanks. Must be mustered periodically. Point out location of key tanks. When the alarm is raised the Key rating is to provide keys from key tank to I/C of Main Group and I/C of Containment Party to allow access to all compartments in the vicinity of the fire. Then rating must return to containment control point.	BRd 2170(1) Chapter 16 BR 4007 Ships CBRNDC Orders

ENABLING OBJECTIVES	KEY POINTS	METHODS AND AIDS
19. Emergency Escape Breathing Apparatus (EEBD)		
Explain what an EEBD is and where they can be found.	1. The Emergency Escape Breathing Device (EEBD) is a one-shot, short duration re-breathing set that provides respiratory protection for personnel escaping from a toxic or smoke filled atmosphere. 2. Normally stowed in racks located in compartments containing personnel, but can also be worn on a belt.	BRd 2170(1) Chapter 21 OCENCO training video.
Identify and Locate the individual components of the EEBD.	1. Mouthpiece. 2. Nose clip. 3. Neck strap. 4. Oxygen cylinder, gauge and regulator. 5. Scrubber to remove carbon dioxide from exhaled air. 6. Breathing bag, which receives oxygen from the regulator and exhaled air from the user. 7. Face shield. 8. Plastic cover.	BRd 2170(1) Chapter 21 OCENCO training DVD.
Demonstrate and practice correct EEBD donning procedure.	1. Don training EEBD iaw case instructions (see ***Note***). 2. Ensure set is fully removed from all packaging and the re-breather is activated. 3. Wear the training EEBD for a minimum of 10 mins. ***Note.*** *Emphasis should be placed on the importance of inserting the mouthpiece first as essential for a successful escape.*	Blue EEBD BRd 2170(1) Chapter 21.

20. DC Equipment Checks

a. CO_2 SPE

(1) Full yellow/red/blue anti-tamper tag in position, pin fitted with collar.

(2) Local number marked on extinguisher.

(3) Red triangle on bulkhead with corresponding local number.

(4) Stowage and securing strap in good condition.

(5) Horn is not loose in movement and securing nut is immoveable.

(6) Check for dents and corrosion on extinguisher.

b. AFFF SPE

(1) Correct pressure (15 Bar - in the green sector).

(2) Check safety pin free to turn and plastic dart is inserted in the pin with anti-tamper tag in position.

(3) Local number marked on extinguisher.

(4) Red triangle on bulkhead with corresponding local number.

(5) Stowage and securing strap in good condition.

(6) Check nozzle assembly and hose connection joints for condition and ensure that joints are tight.

(7) Check for dents and corrosion on extinguisher.

c. Dry Powder Extinguisher

(1) Correct pressure (15 Bar - centre of green sector).

(2) Check safety pin free to turn and plastic dart is inserted in the end of the pin with anti-tamper tag in position.

(3) Local number marked on extinguisher.

(4) Red triangle on bulkhead with corresponding local number.

(5) Stowage and securing strap in good condition.

(6) Shake extinguisher to keep powder inside free.

(7) Check nozzle assembly and hose connection joints for condition and ensure that joints are tight.

(8) Check for dents and corrosion on extinguisher.

(9) Check dust cap is in place on charging connection.

d. **Escape Scuttles**

(1) Test escape scuttles from **BELOW** ensuring ease of operation of the locking mechanism and that the scuttle moves freely.

(2) Test escape scuttles from **ABOVE** ensuring ease of operation of the locking mechanism and that the scuttle moves freely.

(3) Are escape arrows and signage appertaining to the escape scuttle in place, legible and correct?

e. **Firefighting Hoses 20 ft and 40 ft (6 m/12 m)**

(1) Connections clean and lightly greased with XG 274.

(2) Hoses in good repair and marked with location at ends.

(3) Stowed correctly (40 ft faked to the inside, 20 ft rolled to outside).

(4) The hydrant identification number is to be marked on a red painted square adjacent to the hydrant.

(5) Hose basket clean on inside (under hose and nozzle).

f. **Centre Feed Hose Reels**

(1) HPSW valve adjacent to inductor panel **SHUT**.

(2) Position selector valve set to foam and hoses/nozzles and spill pick-ups in good condition.

(3) Pressure in hose released - as indicated on pressure gauge.

(4) Ensure non-return valve ball moves freely.

(5) No saltwater deposits on nozzle.

(6) Operating instructions posted adjacent.

(7) Shaded deck plans indicating compartments covered adjacent.

g. **Firefighting Nozzles FF/WW**

(1) Clean and free of corrosion.

(2) Lightly grease working parts with XG 274.

(3) Easy to operate through the full range of movement.

(4) Stowed in the **CLOSED** position.

h. **Emergency Escape Breathing Device (EEBD)**

(1) Pressure within green zone. Gauge and casing of unit not cracked.

(2) Stowage cabinet in good condition with sets numbered.

(3) ESCAPE BA sign on cabinet.

(4) Securing strap in good condition with Velcro extension.

Notes:

1. Defects are to be entered into the defect log. This checklist is not exhaustive and units may add other items of DC equipment that must be checked within compartments. The checklist may also be adapted to record items of CBRN equipment, including periodical checks to be carried out and details of the custodian.

2. Any maintenance operations including the monitoring of test and LIFEX dates of SPE are the responsibility of the designated equipment maintainer.

ANNEX 27C

Sponsor: NAVYOP TRG-MWS EXC OIC

PEACETIME CBRNDC TRAINING SERIALS

Training serials are given an abbreviated designator for easy of understanding. The requirement for the exercises are laid down in BRd 9274, this includes timings for the exercise and periodicity of when it must be conducted. The objectives for the exercise should be determined from previously identified training shortfalls.

1. Peacetime Harbour

a. **Harbour Fire 1 (HF 1).** A Harbour Fire Exercise intended to train the Duty Watch only in all aspects of a Main Machinery Space Fire (MMSF) without the benefit of immediate outside assistance.

b. **Harbour Fire 2 (HF 2).** A Harbour Fire Exercise at any time, to exercise the Duty Watch and any available additional expertise onboard (stand fast Heads of Departments (HODs) in all aspects of a Main Machinery Space Fire. Use can be made of any immediate outside assistance to increase training value. Secondary fires may occur dependant upon trainee's reactions.

c. **Harbour Fire 3 (HF 3).** A Harbour Fire Exercise at any time, outside of a MMS or compartment fitted with a fixed firefighting system, to exercise the Duty Watch and any available additional expertise onboard (stand fast HODs) in all aspects of a fire in any compartment onboard. Use can be made of any immediate outside assistance to increase training value.

d. **HFEP Exercise 4 (HF 4).** A Major Harbour Fire exercise at any time to exercise the Duty Watch, additional onboard expertise if available (Stand fast HODs) and practical assistance from the local Fire Rescue Service (FRS).

2. Peacetime Sea

a. **SSEP Exercise 1 (F1).** An Unalerted minor fire/flood during another ‘Whole Ship Serial’ to test the integrity and reactions of the Standing Sea Emergency Party (SSEP) up to and including the Support Party.

b. **SSEP Exercise 2 (F2).** An Unalerted minor fire during, and in conjunction with, Machinery Drills to train on-watch personnel and the SSEP in aspects of a fire in a running Machinery Space up to and including the Support Party.

c. **SSEP Exercise 3 (F3).** An Unalerted major fire, outside of a Main Machinery Space or compartment fitted with a fixed system (eg the Galley), during working hours to exercise the SSEP and Support Party; it may include an escalation requiring Emergency Stations.

d. **SSEP Exercise 4 (F4).** A pre-alerted Main Machinery Space Fire (MMSF) intended to train personnel in all aspects of fighting a major conflagration at sea without the benefit of immediate assistance. Aspects of Emergency Stations and casualty evacuation (CASEVAC) will also be exercised.

e. **SSEP Exercise 5 (F5).** A pre-alerted MMSF intended to train personnel in all aspects of fighting a major conflagration at sea without the benefit of immediate assistance during which a further incident, normally a collision separated from the area of MMSF, will be exercised. Aspects of Emergency Stations and CASEVAC will also be practised.

f. **SSEP Exercise 6 (F6).** An Unalerted Flight Deck/Hangar fire during a FLYEX in order to train the Flight Deck personnel, SSEP and Support Teams. Emergency Stations will be exercised.

g. **SSEP Exercise 7 (F7).** A major flooding incident following collision or grounding: to include Emergency Stations.

h. **SSEP Exercise 8 (F8).** An IED onboard at sea and subsequent procedures following its detonation.

i. **SSEP Exercise 9 (F9).** An alerted Vehicle Deck fire to exercise the Control Party, Flight Deck personnel, SSEP and Support Teams: Emergency Stations will be exercised.

ANNEX 27D

Sponsor: NAVYOP TRG-MWS EXC OIC

WARTIME SEA SERIALS

Training serials are given an abbreviated designator for easy of understanding. The requirement for the exercises are laid down in BRd 9274, this includes the periodicity of when it must be conducted. The objectives for the exercise should be determined from previously identified training shortfalls and the laid down requirements.

1. DCX 1

Allow 1 hour for closing down and State 1 preparations. Damage from conventional air, surface or sub-surface attack, resulting in fire, flooding, structural and equipment damage/failure, casualties, etc.

2. DCX 1-1 (Duration 3 hours to include 2 x 45 min incidents)

a. **Aim.** To exercise personnel in basic Damage Control, firefighting, machinery, electrical, weapon repair and first aid aspects of conventional damage.

b. **Objectives.** To train personnel, in the Action State, in the basic aspects of:

(1) Securing for Action and State 1 preparations in all departments.

(2) Damage Control management and decision making at Operation Room, HQ1, Ship Control Centre (SCC)/Machinery Control Room (MCR), Fire and Repair Party Post (FRPP), Weapon Section Base (WSB) and Mobile levels.

(3) Brace Drills.

(4) Dispersal and patrolling prior to damage, and conduct of blanket searches and mini SOCs once damage has been sustained.

(5) Damage Control skills at incident scenes to include establishment of smoke/flood boundaries (FRPP/Mobile Party will be exercised only to the level of their organic capability).

(6) Leadership at incident scenes.

(7) SCC/MCR responses to mechanical, electrical and weapon system Action Damage and associated reconfiguration/repair of vital services.

(8) Information flow from scenes to control nodes, particularly HQ1 and Operations Room, associated decision making and broadcasting of Command Aim, priorities and directives including use of messengers and Rovers.

(9) Control and restoration of HPSW main, chilled water, power, ventilation and stability.

(10) WSB and Repair Team responses to weapon and sensor Action Damage, standards of weapon defect reporting and associated reconfiguration/repair of vital services.

(11) First Aid, both at ships company and First Aid Team (FAT) level.

(12) Evacuation of a manned compartment using EEBD.

(13) Command and Control by Senior Management of 'Whole Ship Aspects' of DCX.

(14) Smoke control, clearance and associated restoration of ventilation.

3. DCX 1-2 (Duration 1½ hours)

a. **Aim.** In addition to aspects exercised in the DCX 1-1 to exercise the ability of HQ1, FRPPs, WSB, Mobile and First Aid to deal with more complex damage and to observe the management of Damage Control manpower.

b. **Objectives.** To train personnel, in the Action State, in the basic aspects of:

(1) DCX 1-1 Serial.

(2) Controlling 2 incidents of a similar nature within the area of control of one FRPP.

(3) Transferring the control of personnel between FRPPs/Mobile Party.

(4) Reconfiguration of HPSW, chilled water and power systems to compensate for Action Damage.

(5) Demanding and controlling extra manpower from non-firefighting DC specialist parties.

(6) Dealing with more complex machinery and electrical damage.

(7) Advice to the Command on unexploded ordnance.

(8) Weapon Repair Team practical repairs.

4. BDX (Duration 2 x 45 mins)

a. **Aim.** To exercise all aspects of a DCX 1-2 in an operational environment created by the 'Thursday War' with real surface, sub-surface and air targets.

b. **Objectives.** To train personnel the basic aspects of DCX 1-2 serial in a Thursday War environment, in the Action State.

5. DCX 1-3 (Duration 2 hours)

a. **Aim.** In addition to aspects exercised in a DCX 1-2 to exercise the ability of the ship to deal with a complicated damage scenario.

b. **Objectives.** To train personnel, in the Action State, in the basic aspects of:

(1) DCX 1-2 Serial.

(2) Flexibility of response to the loss of 'vital areas' of the ship including extensive re-allocation of manpower and use of non-specialist parties to best advantage in order to maintain/recover the fighting ability of the ship.

(3) Consideration of the Commands priorities.

(4) Ad hoc arrangements and alternative methods of communications in order to enable the recovery of large areas of the ship lost to sudden and catastrophic damage and subsequent restoration of essential services.

6. DCX 1-3A (Duration 2-3 hours)

a. **Aim.** In addition to aspects exercised in a DCX 1-3, to exercise the ability to deal with a complicated damage scenario including severe damage to 2 to 3 Sections of the ship.

b. **Objectives.** To train personnel, in the Action State, in the basic aspects of:

(1) DCX 1-3.

(2) Flexibility of response to the loss of 'vital areas' of the ship including extensive relocation of manpower and the use of non-specialist parties to best advantage in order to recover the fighting ability of the ship.

(3) Exercise will require careful consideration of the Command Aim, Command and BDR priorities.

(4) Ad-hoc arrangements and alternative methods of communications in order to enable the recovery of large areas of the ship lost to sudden and catastrophic damage and subsequent restoration of essential services.

7. CBRNX 2

Chemical defence exercise involving the contamination of exposed surfaces only.

8. CBRNX 2-1 (Duration 2 hours)(plus 1 hour to close down)

a. **Aim.** To exercise the procedures for dealing with a chemical attack during which the citadel remains intact, thus exercising the ships Collective Protection (COLPRO) and dedicated CBRN teams in the conduct of their specific duties.

b. **Objectives.** To train personnel, in a Chemical environment, in the basic aspects of:

(1) Preparations for transit of an area with a high CBRN threat.

(2) Testing the citadel and prewetting systems.

(3) Use of the prewetting in an operational environment.

(4) General service respirator (GSR) drills.

(5) Ability to detect, identify and classify chemical contamination.

(6) Internal and external monitoring techniques.

(7) Personal and Operational decontamination.

(8) Use of the Cleansing Station.

(9) Casualty handling in a chemical environment.

(10) Chemical Safety Rule, recognition of symptoms and use of Combopen.

(11) Detection and rectification of citadel leaks including recovery of failed AFUs.

(12) Response to machinery failure, repair techniques, restoration of equipment and personnel protection.

(13) Temperature monitoring of critical compartments both inside and outside the citadel.

(14) Command and Control during a chemical transit to include advice to the Command from the CBRNPO, presenting of information to the Ship's Company, timely use of prewetting and reliefs for Minimum Effective Crews (MECs) etc.

(15) Operation/use of the BRACIS system.

9. CBRNX 3

Nuclear defence exercise including fallout transit with consequent contamination of exposed surfaces.

10. CBRNX 3-1 (Duration 1½ hours)

a. **Aim.** To exercise the procedures for dealing with a nuclear transit during which the citadel remains intact, thus exercising the ships Collective Protection and dedicated CBRN teams in the conduct of their specific duties.

b. **Objectives.** To train personnel, during a Nuclear Transit, in the basic aspect of:

(1) Preparations for transit of an area with a nuclear threat.

(2) Testing the citadel and prewetting systems.

(3) Use of prewetting in an operational environment.

(4) General service respirator (GSR) drills.

(5) Ability to predict and detect nuclear contamination.

(6) Internal and external monitoring techniques, including establishing the maximum permissible dose.

(7) The recording and assessment of the effects of a transit dose.

(8) Use of the Cleansing Station.

(9) Casualty handling in a nuclear environment.

(10) Use of Deep Shelter Stations, including use of Pre-shelter Parties.

(11) Detection and rectification of citadel leaks including recovery of failed AFUs.

(12) Response to machinery failure, repair techniques, restoration of equipment and personal protection.

(13) Temperature monitoring of critical compartments both inside and outside the citadel.

(14) Command and Control during a nuclear transit to include advice to the Command from the CBRNPO, prediction of Downwind Hazard Area by the Navigation Officer (NO), presentation of information to the ships company, timely use of prewetting and reliefs for MECs, etc.

11. CBRNDCX 4

CBRN and Damage Control exercise involving contamination of exposed surfaces and the breaching of the citadel by damage. The breach may occur during or after the chemical attack.

12. CBRNDCX 4-1 (Tailored to circumstances)

a. **Aim.** To exercise the procedures for dealing with a chemical attack during which the citadel is damaged thus exercising the ships Collective Protection and dedicated CBRN teams in the conduct of their specific duties.

b. **Objectives.** To train personnel, in a Chemical environment, in the basic aspects of:

(1) CBRNX 2-1 Serial.

(2) FRPs and Mobiles ability to deal with action damage in chemical environment.

(3) Re-establishing sub-citadel and citadel boundaries, including access to damaged areas to restore essential services.

13. CBRNDCX 5

Nuclear defence and DC exercise involving the near sub-surface burst of a weapon, shock damage and the passage of the base surge. Very high dose rates during the passage but little or no residual contamination.

14. CBRNDCX 5-1 (Tailored to Circumstances)

a. **Aim.** To exercise the procedures for dealing with a nuclear transit during which the citadel is damaged, thus exercising the ships Collective Protection and dedicated CBRN teams in the conduct of their specific duties.

b. **Objectives.** To train personnel, during a Nuclear Transit, in the basic aspects of:

(1) CBRNX 3-1 Serial.

(2) Response to structural damage whilst maintaining the provision of essential services.

(3) Re-establishing boundaries of COLPRO including access to damaged areas for essential repairs.

ANNEX 27E

SEA SAFETY BRIEF

1. SEA SAFETY TRAINING REQUIREMENTS – ONBOARD TRAINING MINIMUM REQUIREMENTS

Sea Safety Brief (SSB). The following bullets are to be considered as the minimum SOLAS[1] compliant SSB that should be conducted by Ship Staff (SS) for all Category 3 (Persons on Duty/FLAGOs Special Personnel), forming the initial part of their training, and Category 3 (Civilian Passengers). The training is to be delivered verbally within 4 hours of sailing, augmented by written instructions to be available to all embarked persons and displayed at their assembly or muster stations.

a. **Written instructions are to include:**

(1) Clear instructions in English to be followed in the event of an emergency, provided for every person carried as a passenger.

(2) Assembly or muster stations.

(3) Essential actions to be taken in the event of an emergency.

(4) How to don life jackets (dependant on type issued or available).

(5) Emergency contact numbers.

b. **Verbal training to include:**

(1) Clear instructions to be followed in the event of an emergency.

(2) Assembly or muster stations.

(3) Essential actions to be taken in the event of an emergency.

(4) How to don life jackets (dependant on type issued or available).

(5) Emergency contact numbers.

2. In addition to these instructions, Category 3 (Civilian Passengers) persons are always to be escorted by a member of the ship's crew, who will have received an escort briefing from either the XO, CBM or nominated CBRNDCQ.

3. Comprehensive Sea Safety Brief (CSSB)

The following bullets are to be considered as the minimum training that should be conducted by SS for all Category 3 personnel (Persons on Duty/FLAGOs Special Personnel) embarked to support, or be transported by, RN or RFA vessels when embarking for periods more than 48 hours. The training is to be conducted within 48 hours of embarkation and should be conducted by the CBM or a suitably qualified CBRNDCQ.

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[1] Safety of Life at Sea – statutory instrument 1999 2722 article 5 (8) (b) & (c) and article 9 (5) (a), (b) & (c).

a. **Sea Survival − Ship Abandonment**

(1) Describe the route to exit the ship in an emergency.

(2) Identify useful items for ship abandonment (i.e. SART and EPIRB).

(3) Locate components of sea survival equipment.

(4) Demonstrate the actions to don a lifejacket.

(5) Demonstrate the actions to don a once only survival suit (where sufficient quantities are carried for passengers).

(6) Describe evacuation systems (as fitted).

(7) Explain the method for abandoning ship.

(8) Using appropriate available visual aids, demonstrate immediate, secondary and subsequent actions upon entering a life raft after abandonment.

(9) Describe likely medical problems associated with abandonment.

b. **Sea Survival − Man Overboard**

(1) Describe the actions to take in the event of a witnessed Man Overboard.

(2) Show locations and types of markers and Perry Buoys available for deployment.

c. **Fire prevention and First Aid actions**

(1) Describe the maintenance of Fire hygiene particularly within mess decks.

(2) Describe the actions required of the person finding a fire to include:

(a) Loud Vocal Alarm.

(b) Communicating the emergency to the SCC or any other SS as soon as possible using telephone or other communication systems available.

(c) Use of first aid FF equipment, where applicable and safe to do so.

(d) Reporting to a member of SS to be escorted to SCC.

d. **Escape from a smoke-filled compartment**

(1) Demonstrate the use of EEDB.

(2) Understand the signage indicating safe escape routes.

e. **Damage Control – Prevention**

(1) Describe the requirement for stowing for sea.

(2) Understand the significance of DC markings and CBRNDC pipes.

f. **Damage Control – Response**

(1) Understand the Brace Drill.

(2) Do not open watertight compartments – seek assistance from SS.

g. **Damage Control – Actions**

(1) Loud Vocal Alarm.

(2) Communicating the emergency to the SCC/HQ1 or any other SS as soon as possible using telephone or other communication systems available.

(3) Identify extent of damage if safe to do so and close hatches/doors if necessary.

(4) Reporting to a member of SS to be escorted to SCC.

ANNEX 27F

Sponsor: NAVYOP TRG-MWS EXC OIC

FIRE EXERCISE ASSESSMENT FORM (WORD)
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 27G

Sponsor: NAVYOP TRG-MWS EXC OIC

FLOOD EXERCISE ASSESSMENT FORM (WORD)
(WORD FILE AVAILABLE FROM HOME PAGE BUTTON: FORMS)

ANNEX 27H

Sponsor: NAVYOP TRG-MWS EXC OIC

GUIDANCE TO DAMAGE CONTROL TABLE TOP TACTICS

1. Aim

To formulate optimum response plans for a Damage Control incident or exercise whilst improving individual/team knowledge and effectiveness.

2. Objective

To train personnel to deal safely with an incident in any Damage Control State at sea or in harbour.

3. Preparations

The following areas are to be considered prior to conducting a Table Top Tactic (TTT) exercise:

a. Decide the scenario to be exercised and the qualified personnel suitable to lead the tabletop. The TTT should be planned and promulgated well in advance to de-conflict with ship's programme and ensure maximum attendance.

b. Arrange a suitable quiet venue in order to conduct the table top (wardroom, dining hall or any suitable briefing room).

c. Decide who is required to attend; ideally all the key players depending on the type of incident eg CO, HODs, CBRNDCQs, HQ1/SCC C2 Team, I/C Fire and Repair Party Post, I/C Weapon Section Base, I/C Mobile Team, I/C Standing Sea Fire Party, I/C Containment, OODs, and Incident Board Operators (IBO).

d. Ensure an incident board is available for the IBO to mark up as the scenario develops.

e. Ensure the relevant documentation is available to validate the decisions made eg SOPs, RNTMs, XTMs, aide memoires, killcards, smoke clearance plans, standing orders, the BRd 2170 series, BR 4007 and BR 4008.

4. Execution

The person leading the table top session is to:

a. Set the scenario and the TTT objectives.

b. Set a time scale and ensure that the session is completed within time.

c. Discuss each element of the incident, as you would expect it to develop from the initial incident report, referring to the I/C of the appropriate group to comment. Those present are to be encouraged to inject various options and comments in dealing with the incident. The final decisions and conclusions are to be compared with SOP's with a view to improving these routines where appropriate.

5. Subject Areas

Suggested areas for discussion:

a. **Single Incident at State 3**

(1) Initial pipe and muster locations.

(2) FCP location.

(3) Use of fixed systems.

(4) Initial priorities including continuous aggressive attack and containment.

(5) Emergency Stations or Emergency Clear Lower Deck.

(6) Containment priorities.

(7) Primary isolations.

(8) Ship and personnel safety.

(9) Re-Entry brief.

b. **State 1**

(1) Command aim.

(2) Fire and flood effect on fighting capability.

(3) ME system failure effect on fighting capability.

(4) The effect on fighting capability after loss of electrical systems.

(5) WE defects and the assistance provided by the internal battle directors.

(6) Priorities in line with the Command aim.

(7) Estimated Time Back on Line (ETBOL) considerations.

c. Validate conclusions against the SOP's and documentation.

d. Look at alternative methods of dealing with the incidents taking into account that the most obvious methods may not work in all cases depending on the situation.

e. Ensure the Whole Ship CBRNDC Qualified (WSQ) takes notes from the TTT exercise in order to update SOP's if required.

6. A well-structured tabletop exercise will prove invaluable to a Ship’s Company. It provides a forum during which methods to deal with any future practical exercises conducted at sea or in harbour, for any Damage Control state, can be planned effectively. The CBRNDCQ's organisation can ensure that the training of personnel can be tailored to enable them to deal with any incident.

CHAPTER 28

WEAPON REPAIR ORGANISATION (WRO)

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CHAPTER 28

WEAPON REPAIR ORGANISATION (WRO)

SECTION 1 - OVERVIEW

2801. Weapon Repair Organisation (WRO)

a. **Introduction.** An efficient WRO requires good organisation and careful preparation as well as the education and training of weapon repair personnel and operators. The objectives of the organisation are to:

(1) Advise the Command on the material state of the ship's equipment and the ship's ability to survive and fight before and after action damage.

(2) Monitor, maintain and repair Weapon, Sensor and Command Info equipment in all CBRNDC states.

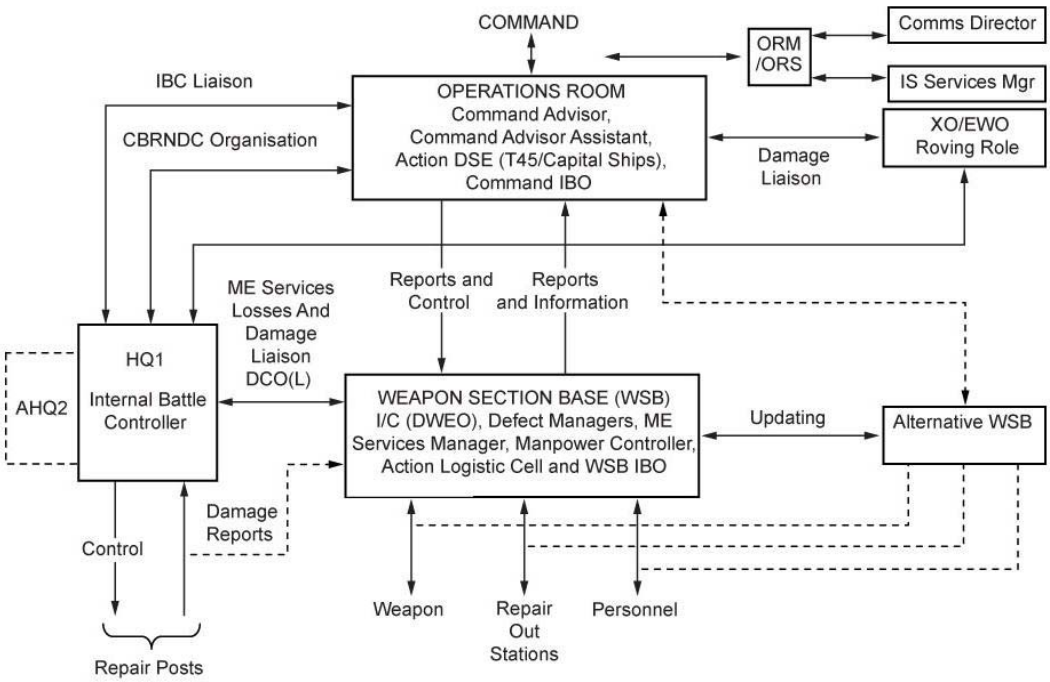
(3) Combat battle damage as an integral part of the Damage Control organisation.

b. WE Departments are encouraged to continually monitor the Best Practice Database, found on the Captain South Homepage and to consider implementing these observed practices where applicable. WEOs should note, however, that not all practices will achieve the same results cross platform or even across the same class of Ship.

2802. The Weapon Section Base

The organisation of weapon repair is illustrated in Figure 28-1.

Figure 28-1. Weapon Repair Organisation



2803. Management of Weapon Repair

The WRO must function effectively under all ship operating states and conditions. The stationing and duties of key WE personnel vary between Action Stations, Defence Watch, Cruising Watch and Emergency Situations and are summarised at Table 28-1. In particular the role of the WEO/SNRWE in each state is as follows:

a. **Action Stations (State 1).** As the Command Advisor (CA), the WEO/Snr WE is to close up in the Ops Room where they are responsible for advising the Command on the ship's ability to meet the Command Aim under varying conditions of threat, environment and battle damage, which in turn will drive repair priorities. They must therefore be fully integrated into the Command Team and have a sound appreciation of the tactical situation as well as up to date, accurate knowledge of the extent and nature of any damage/degradation to weapons, sensors, machinery and ship's structure. A full list of WEO/Snr WE duties is given in Para 2806. A Section Officer is to undertake the duties of PROTO in accordance with BRd 2170(1) Chapter 3. If circumstances dictate that CBRN hazards take priority over weapon repair activities and when directed by the WEO/Snr WE. The Section Officer is to delegate matters as appropriate to a suitable alternative in the WSB and close up in the SCC/HQ1 as the CBRN situation dictates.

b. **Defence Watches.** Normally the Ship's Company will be in 2 watches with certain key maintainers on call. The WEO/Snr WE is to maintain a sustainable routine agreed with the Command. When the WEO/Snr WE is absent from the Ops Room, the DSE is to carry out the tasks listed in BRd 300 Para 0114. For the on watch DSE to provide comprehensive advice to the Command in State 2 as the WEO/Snr WE's representative, they will need to monitor and have displayed the status of WE equipment and CBRNDC incidents in the ship. In the event of an internal incident occurring such as a fire, flood or battle damage, the Ops Room team is to be enhanced by the provision of a CBRNDC IBO and a Command Advisor's Assistant. These personnel are to be previously identified and their nomination recorded on the W&SB. Their closing up is to be initiated by the announcement of an internal emergency, or as called for by the DSE when they decide that the situation dictates.

c. **Cruising Watches.** This is the normal peacetime running state. A DSE, nominated by the WEO/Snr WE, is to be in attendance in the Ops Room for all major serials conducted during normal operational running conditions and during Operational Sea Training. The name of the 'on watch' DSE is to be displayed clearly in the Ops Room and they are to be easily identifiable by wearing a suitable brassard or surcoat. A manpower coordinator is to be nominated to assist the DSE. The WEO/Snr WE is also to visit the Ops Room frequently to familiarise themselves with the operating techniques, tactical scenarios equipment configuration and performance.

d. **Alternative Postures.** At times the operational tempo may be such that the posture adopted by the ship exceeds that required during Cruising Watches but does not reach the level achieved by Defence Watch manning. WEO/Snr WE must ensure that guidance is in place to reflect this requirement giving due consideration to direct WE support to the Command and the Ops Room, ensuring the provision of a flexible and enduring capability to conduct Weapon Repair rapidly at any time. Prior to periods of such operations, early liaison with the Command Team is required to agree the WE Department posture.

e. **Peacetime Emergencies.** As Command Advisor the WEO/Snr WE is to close up at the same time as the Standing Sea Emergency Party (SSEP) and position themselves close to the CO. They are to carry out those tasks listed in Para 2806. which are relevant to the situation. When Emergency Stations is required for a peacetime emergency, the State 3 WRO is to close up to manage WE defects and provide a level of equipment repair capability to meet the Command Aim. Consideration should be given to providing an immediate State 3/SSEP Weapon Repair Capability to safeguard critical C2 (External Communications, Internal Communications, and Main Broadcast), systems impacting on Navigational Safety (navigational radar, WECDIS, and Echo Sounder), and Aviation Services.

2804. Manning

The manning of the WRO must be commensurate with the task. The reduced staff available during defence watches must be capable of advising the Command, monitoring and maintaining weapon engineering equipment whilst initiating repair action, calling out the appropriate section senior rating as required. Specialist maintainers are not to keep formal watches but remain as day workers, available at any time, unless:

a. There are duplicate experts for equipment.

b. The maintainers have an operator function.

Note. *Weapon repair personnel, allowing for their tasks, are to be dispersed as widely as possible to reduce the vulnerability of the organisation to action injuries.*

2805. Key Personnel

The manning of key positions is shown in Table 28-1.

Table 28-1. Deployment of Key Personnel

	STATE 1	STATE 2	STATE 3	EMERGENCY STATIONS
OPS ROOM	Command Advisor (see **Note 1**) Command Advisor Assistant Action DSE (if applicable) Command IBO (if applicable)	DSE	DSE as required.	Command Advisor will close up with the Command, usually on the Bridge, DSE as required in the Ops Room.
WSB/ WMC	WSB/WMC I/C Defect Managers 'L' line/WE Services Manager (WESM) Action Logistics Coordinator WSB IBO (if applicable)	Nominated WE Ratings iaw W&SB.	Not normally manned.	Warrant Officer. State 3 Weapon Repair Team iaw W&SB.

Table 28-1. Deployment of Key Personnel (Cont'd)

	STATE 1	STATE 2	STATE 3	EMERGENCY STATIONS
SCC/HQ1	PROTO in high threat CBRN environment Section Officer (Capital Ship)	N/A	N/A	Section Officer (may relocate to WSB as the situation allows).
Containment HQ	N/A	N/A	N/A	DEPCO as Manpower I/C Containment I/C and 2 I/C Deck Managers (including OOQ).
CIS	Ops Room: Comms Director IS Services Manager (see **Note 2**) MCO iaw W&SB	MCO iaw State 2 W&SB	MCO iaw State 3 W&SB	As per State 3
	Messenger (if available) Manpower Controller.			

Notes:

1. The Command Advisor is to remain with the Command if they choose to locate themselves at a position other than the Operations Room. For example, the Bridge during FIAC.

2. The IS Services Manager will be best positioned next to key IS equipment (for example T23 OPS Room Annexe for access to RNCSS and MTE support in OPS Room).

SECTION 2 - STATE 1

2806. Tasks of the Command Advisor (CA)

For WEO/Snr WE to operate effectively as CA, they must establish a sound rapport with the CO, the XO/EWO (as Command Rovers), MEO (as Internal Battle Controller), and Warfare Officers (OPS Officer at State 3, Command PWO, AAWO, and Duty Staff). Brevity is key in all discussions focusing on the impact on the Command Aim. To give sound advice and formulate Command priorities the CA must have a detailed knowledge of their Combat System as well as an understanding of the critical equipment in other departments, this should include propulsion configurations, steering, stability and key ME services (Electrical Services, Chilled Water, HP/LP Air etc).

The CA must remain aware of the tactical situation at all times and routinely monitor Command Open Line, however, this is not to prevent movement around the Operations Room. The CAs main tasks are:

a. To assist the Command in fighting the external and internal battle.

b. To follow the Command Aim in order to determine the Command and equipment repair priorities. They are to ensure that all appropriate outstations are aware of, and work to, the Command Aim and these priorities. Command Advisor can recommend changes to those priorities depending upon the tactical situation and the extent and nature of any damage sustained. They are to deliver the internal battle picture to Command by regular structured briefings, post hit and by contributions to the Operations Room via the Environmental Sitrep.

c. To monitor the performance of weapons, sensors, communications, data handling systems and their supporting services, considering operator, tactical and material factors. They are to assess the effects of damage, defects and degradation upon the ship's ability to fight, establish estimated times to repair and alternative modes of operation where possible (this should also include options for battle override where available). They are to keep the Command fully informed of all significant changes that may affect the Operational Capability of the ship.

d. To monitor the extent of damage to the hull, propulsion and ancillary systems, the effect on the ship's ability to meet the Command Aim, the alternative modes of ship control based on the specialist advice of the MEO (as IBC), XO (as Command Rover) and LO (as DCO). The Command Advisor is to keep the Command informed of all significant changes that may affect the operational capability of the ship.

e. To integrate the requirements of the ship's warfare and engineering departments for the testing, maintenance and repair of systems and equipment within the existing tactical scenario and particularly to assess the extent of damage following an attack (Mini-SOCs and Blanket Searches).

f. To monitor casualties in order to establish the impact on OC and keep the Command informed of all significant personnel matters.

g. The Command Advisor is also to monitor the movement of personnel on the upperdeck, as well as dealing with smoke clearance approval within the ship (against the current external battle) to assist damage control, firefighting, weapon repair and recovery of State 1 posture.

h. To liaise with, and advise Command Rovers on:

(1) Command Priorities for fighting internal battle including internal incidents impacting restoration of Operational Capability. For example, reduction in ship speed to support primary leak stopping in key compartments.

(2) Explosive hazards including 'whole-ship' reactions to a CWI, also to include a discussion in reduction in speed to support stabilisation of explosive hazards.

(3) Casualties.

(4) Smoke Clearance and personnel access to the upperdeck.

(5) Domestic matters such as action snacks, action messing, the opening of heads, etc.

i. To carry out the duties of Command CBRN Advisor as the CBRN threat dictates.

j. Lead State 3 Bridge/Ops Room Command Huddles and support State 1 Ops Room Command Huddles.

k. **State 3.** All the above points are still applicable; however, without a specific external threat, focus is on the safeguarding of navigation and personnel.

2807. The Weapon Section Base/Weapon Management Centre (WSB)(WMC)

The tasks of the WSB/WMC are:

a. Interpreting the Command Aim to set and deliver WE priorities for weapon repair, informing the Command Advisor as required.

b. Providing an information centre, holding information on equipment, supplies, critical routines and present conditions and advising the Command Advisor as required.

c. Receiving and recording reports from the Operations Room, SCC (ME Services), information from IBO Net, repair posts and weapon repair personnel. The WSB/WMC is to provide a central point for the control of WE department manpower and progress of WE Blanket Searches post incident. This should also include providing weapon repair personnel with safe routes when transiting through the ship.

d. Organising weapon repair personnel at action, during defence watches and State 3 emergencies.

e. Maintaining internal communications with weapon repair personnel and understanding reversionary modes of communication.

f. Interpreting equipment state reports in terms of their effect on the Ship’s fighting characteristics and advising the Command Advisor.

g. Interpreting necessary changes to reversionary or emergency modes of operation in terms of the effect on the Ship’s fighting characteristics and advising the Command Advisor.

h. Initiating weapon repair as the need arises and weapon maintenance as the opportunity occurs.

i. Informing the Command Advisor of any deterioration in weapon equipment performance.

j. Informing the Command Advisor when an essential check or routine is overdue and weapon performance standards can no longer be guaranteed.

k. Informing the Command Advisor of the options for repair and any associated penalty after the failure of, or damage to, weapon systems.

l. Advising the Command Advisor on explosive risks, including Conventional Weapon Incidents.

m. Providing technical advice and back-up as the need arises.

n. Liaising with the Logistics Department to provide spares as required.

o. Liaising with the SCC/HQ1 to ensure:

(1) An accurate WE Top 3 is passed into the SCC/HQ1 Command Huddle.

(2) The effects of damage on weapon systems or their supplies are identified quickly (electrical services, chilled water, LP/HP Air etc).

(3) SCC/HQ1 receives damage reports from weapon repair personnel.

(4) SCC/HQ1 is aware of damage to weapon system supplies and support services and the actions required to meet the Command priorities.

(5) The deployment and use of weapon repair personnel in meeting the Command priorities allowing for the current damage state.

(6) The Machinery Stateboard in the WSB (Weapons Management Software (WMS) on T45) is kept up to date.

p. Hold all WE department spare keys and back-up software.

q. Work with the Command Advisor (Comms Director and IS Services Manager) to coordinate the repair of key external communications and IS systems.

r. Updating the alternative WSB to allow for the easy transfer of control when required.

s. Advising weapon repair personnel of damage and incidents that could affect them or their equipment.

t. To provide a dedicated link at action to pass information on electrical losses (‘L’ Desk/Green Line/WESM). In State 2 this duty will be performed by the on watch WSB/WMC I/C acting under the guidance of the DSE.

2808. Tasks of Weapon Section Base (WSB) I/C

a. The Weapon Repair Organisation is led by the DWEO in a non CBRN environment, normally located in the designated Weapon Section Base (WSB) or Weapon Management Centre (WMC). For the repair organisation to be effective, an accurate defect picture must be established. There are 2 facets to this: Operators must conduct accurate Mini-SOCs quickly, passing the results in duplicate to both WSB/WMC and the CAA, and weapon repair personnel must provide clear and accurate details of all defects, performance degradation and loss of supplies or essential services.

b. The DWEO must drive their team to obtain this picture and they will be aided by Defect managers, Manpower controller, 'L' line/WESM and an IBO.

c. The Command Huddle is an essential and often under-utilised component in building the damage picture and recovering key capabilities, allowing the WSB/WMC a shared understanding of Command and WE priorities and effort. Commencement of a Command Huddle should be piped over Main Broadcast to inform outstations with a 2 min pre-warning given to allow outstations to update reports on Priority repairs. During the Command Huddle, each of the positions within the WSB/WMC should be given the opportunity to brief. The use of individual Command Huddle Aide Memoire briefing cards is recommended to ensure brevity and clarity of information. It is vital that all the other positions listen to and understand the information provided. Comms links should not be answered, and no discussion should take place during the Command Huddle unless 'Flash' or high priority reports are required. It is important that the Command Huddle is brief (2-3 mins) and avoids repetition, whilst still achieving the aim.

d. On completion of the Command Huddle, DWEO should clearly reiterate the Command Aim and his priorities. If required, they should direct action required in each area of the WSB/WMC. Plans should be kept simple. It should be noted that several Command Huddles may be required before the damage is fully resolved.

e. WSB I/Cs are to utilise a 5 point brief card for concentrated incidents such as a CWI, Bridge Hit, or a concentrated area of damage in one area. This will enable the team to better closed loop manage and rectify the incident, aiding resource control and picture compilation. This will aid in prompting the team for blanket searching, damage assessment and capability restoration, especially when briefing updates to Command.

2809. Defect Managers (DM)

a. The Defect Managers will be the 2 Warrant Officers on non-REMS ships (Weapons and Sensors) or 1 Warrant Officer and a Group head on REMS ships (Major and Minor). They are to assist the DWEO in compiling the picture, suggesting plausible top 3 defects and manage all ETBOLS.

b. In order to achieve this, Railex card holders (MOD Form 607) and cards are recommended to monitor defect repair. It is suggested that at least 4 cardholders are used and are marked up as 'Top 3', 'Weapons', 'Sensors' and 'Wrecked'. Additional holders may be used if found necessary, e.g. for 'L' defects.

Card holders should also be adapted to enable the whole of the 5 point brief card to be viewed without touching it. Cards should be marked such that they contain relevant information and should be plasticised so that they can be re-used.

c. Within each area, cards should be individually prioritised i.e. the highest priority defect placed in the top slot of the Railex card holder. ETBOLs must be used and closely monitored by Defect Managers to ensure they are realistic and accurate, with changes briefed as appropriate. Next Time To Report (NTTR) times should only be used where a repair time is genuinely not known, i.e. investigating defect identified during Structured Look; only one NTTR time should be required on each defect before an ETBOL can reasonably be expected. If a low priority defect has no manpower allocated, due to higher priority commitments, then a Zulu + time can be noted. This is a 2 figure time to retain the engineering assessment of repair; as soon as manpower is allocated this must translate in to an ETBOL or NTTR. Pre-printed cards can be made up to show the effects of losing a switchboard or EDC. Zulu + times should not be passed to operators.

d The Railex system should be run and updated by the Defect Managers and DWEO should position themselves so that they can monitor all WSB/WMC boards including the Railex cards.

e. In T45 the DSAC WMS system is used, this allows Defect Managers to input defects onto a computer system using ‘text speak’. Once the defects have been entered, priorities can be assigned as required. A top 5 priorities can be set, allowing the top 3 to be maintained once defects are rectified. The defect details and the priorities can be viewed in the Ops Room by the CAA team and by the SCC team in real time, removing the need for all details to be passed verbally between outstations.

f. Additionally, in T45, the Alternate WMC (AWMC) act as a second hub for receiving defect reports which do not affect the Command Aim (categorised as Minor defects) and are responsible for entering these into WMS. This allows the WMC to focus on the defects affecting the Command Aim (Critical and Significant defects), whilst also giving all outstations visibility of the complete damage picture.

g. The DWEO should ensure Command Priority and Threat Warning changes are implemented and that the Railex system/DSAC agrees with the Command Stateboard.

2810. Manpower Controller (MC)

The whereabouts and condition of all WE personnel must always be known. Weapon Repair personnel should be instructed to check in at least every 20 mins to report their equipment state and location. Weapon Repair personnel must contact the WSB/WMC/MC to obtain a safe route before moving from one compartment to another. A report should also be made when they reach their destination. The MC is to also work with the DMs to account for personnel calling through them; with a pre-organised process in place, full manpower accounted for can be achieved rapidly post hit. The MC should utilise a laminated control board detailing location, contact (and reversionary) numbers and personnel names. The name of their WRT I/C should also be recorded on REMS units.

2811. ME Services ('L' Desk) Liaison

a. Effective ME Services liaison is vital to the success of the Weapon Repair Organisation. A direct communication line must be available between the SCC/MCR and the WSB/WMC. Communications must be 2-way with both parties informing each other of known services losses as soon as practically possible after damage has been sustained. In T45, the proximity of MESM-WESM within the SCC allows voice primary to be used for conveying information. It is vital that the roles and responsibilities of the 'L' Desk or WESM are fully understood and the impact on WE equipment when the loss of electrical supplies, Chilled Water and HP/LP air occurs.

b. WSB/WMC personnel should be aware that the Command priority will invariably be to retain some form of fighting capability and, therefore, emergency cable runs to weapon equipment may need to be given priority over everything else. Consideration must be given to dressing cable runners in BA where appropriate. If electrical supplies are lost, consideration should be given to prioritisation of breakers, noting the load capacity of emergency cable runs.

2812. Incident Board Operator (IBO)

a. The IBO has a critical role as part of the WSB and the Ops Room. The IBO should monitor the net for all incidents marking up the board, concentrating on the following:

(1) All incidents affecting safe routes and Blanket Searches.

(2) All incidents in proximity to key WE compartments and affecting electrical supplies for key capabilities.

(3) The position and status of weapon parks and force protection mounts.

b. The IBO should aim to share all pertinent information with the WSB team and, where appropriate, utilise the FLASH procedure to do so. IBO should utilise minimum effective communications in order to limit speaking time and maximise efficiency. His briefs should follow the format in Table 28-2.

c. The IBO does not necessarily have to be WE, but, if not should endeavour to conduct a series of WE rounds to familiarise himself with WE compartments, capabilities, supplies, services and terminology. It is advisable to create a 'L' supplies aides memoir to affix to the board to hasten reports until it becomes instinctive during training.

d. The IBO should obtain the critical flood depths for each WE compartment (and an appreciation of their impact on OC) and annotate on their boards to assist FLASH routines.

Table 28-2. IBO Reporting

	FLASH? TO WHOM?	WHAT?	LOCATION	WHY?	WINNING/ HOLDING/ LOSING	ETBOL/TTNR
T23 Example	FLASH	Fire	1AB flat	Impacting MFUs	WINNING	No info; chasing
T45 Example	Logs/ WPNS	Flood	4K Naval Stores	Impacting stores retrievals	HOLDING	1110

2813. Weapon Section Base Positions

The recommended positions of the main WSB/WMC is given in Table 28-3. Consideration should be given to the action required if the main WSB/WMC is no longer tenable. The location of any alternative site must depend on the extent and location of damage or smoke. The final decision must, therefore, be made at the time of evacuation, however, in order to plan and still give the necessary flexibility, a space is to be designated beforehand. The space, as far as practicable, is to be displaced laterally and vertically from the main WSB/WMC and have the necessary internal communications. A WSB/WMC evacuation brief is to be given on closing up at State 1 with emphasis to new members of the team and the requirement for the IBO or nominated person to provide a safe route.

Table 28-3. Positions of Weapon Section Bases

POSITION IN SHIP	T23	T45	LPD	QEC
WSB	EMR	HQ1/SCC	OPS Room Annex	HQ1/SCC
Alt WSB	Combined Radar Office (see **Note**)	04E RT1045 Radar Office	Aft Radar Office	EMR

Note. *The AWSB may also be located on 1E/02E Flat.*

2814. Tasks of Weapon Repair Personnel

Weapon Repair Teams must develop a working knowledge of all equipment within their area of responsibility, this also needs to include all essential supplies (electrical, chilled water, LP/HP air etc.) for equipment on their Blanket Search Cards. They must also ensure they maintain suitably stocked Battle Bags and have an unambiguous State 1 Preparations card. The tasks of Weapon Repair Personnel deployed in direct support of weapon systems and equipment under the direction of the WSB/WMC are:

a. Maintaining regular communication with the WSB and ensuring the WSB is aware of their movements and contact details.

b. Monitoring the performance standards of their equipment.

c. Monitoring the availability of all forms of normal, alternative and emergency supplies and support services.

d. Advising operators and the WSB of any changes in equipment performance standard.

e. Advising operators on the need to carry out SOCs/Mini-SOCs, assisting them as required, i.e. periodically, when the ship has been subject to shock or damage, and when equipment has been returned from repair or when performance is suspect.

f. Advising or assisting operators on any adjustment required to meet changing environmental conditions.

g. Carrying out routine maintenance when due, and when the opportunity or the threat allows subject to Command approval (or pre-approved delegation by CTM).

h. Carrying out repairs under the direction of the WSB, informing the WSB of progress and of any limitations imposed by the defect or the repair.

i. Call for technical support from the WSB when required.

j. Checking the equipment areas for CBRNDC conditions as directed by the WSB.

k. Locating damage control facilities and support stores in their equipment area.

l. Assist the WSB in compiling an accurate defect picture by conducting timely Blanket Searches and providing reports in the 5 Point Brief format.

m. Identifying hazardous materials or conditions in the equipment areas and taking or advising on the appropriate safety measures when damage control actions or repairs are in hand.

n. Act in support of the damage control organisation as directed by the WSB.

o. Carrying out rounds in the action and defence states as required by the WSB.

Table 28-4. 5 Point Brief Format

POINT	TITLE	NOTES
1	Line No. and Equipment	Clearly state the line number as listed on Command State boards and which equipment is affected, e.g. *Line No. 2, Radar 997*.
2	Nature of defect	Briefly describe the nature of the defect, e.g. *440v power supply loss, loss of radar transmitter.*
3	What needs to be done?	Describe the actions required to rectify or investigate the defect. If more personnel/stores/tools are required ensure this is reported, e.g. *Run emergency cable from TRMG space, 1 additional hand required.*
4	Capability statement	Provide a clear statement of what, if any, capability remains, or brief on fallback or reversionary modes/configurations where applicable, e.g. *Loss of medium range air surveillance radar, fallback - , link 16.*
5	ETBOL/TTNR	Estimated Time Back On Line or Time To Next Report must be provided in 4 figure format, e.g. *ETBOL 1035*. Two figure times may only be used if it is impossible to progress defect due to lack of access/manpower/equipment, then an estimate of time to repair may be given. This must be converted to a 4 figure ETBOL once the missing criterion has been fulfilled. ETBOLs must be realistic, achievable and include the time to run up equipment post repair and conduct Mini Socs.

2815. WRT Outstations

a. Whilst closed up, outstations must critically monitor the performance of their equipment, paying particular attention to the availability of supplies and services. On closing up, a Blanket Search should be considered to establish the baseline and configuration of equipment. Outstations must maintain regular contact with the WSB/WMC manpower controller, advising them of their location and any movement, ensuring that a safe route is always obtained before moving between compartments.

b. Following damage, outstations should conduct Blanket Searches as directed by the WSB/WMC. These should be conducted in accordance with a pre-produced Blanket Search card, detailing the areas to be searched and any specific requirements for those compartments. As the search is progressed, reports on priority defects should be provided to the WSB/WMC (via the WRT I/C for REMS units) in accordance with the 5 point brief. Reports should convey the effect on the Command Aim. Where directed by the WSB/WMC, the risk may be taken to repair ‘Quick Win’ defects before the Blanket Search is completed but priority must be given to defects which affect the Command Aim; giving rise to ‘Smart’ Blanket Searches.

c. On completion of the Blanket Search, repairs should be conducted as directed by the WSB/WMC. Personnel must be flexible and should appreciate that the WSB/WMC will be allocating resources to defects on a priority basis. Personnel should note that they may be tasked to repair equipment outside their immediate area of expertise.

d. Defects that do **NOT** affect the Command Aim should be noted and the Blanket Search completed prior to calling in all defects found. On T45s, all defects that do **NOT** affect the Command Aim are to be correlated by the WRT I/C and passed to the AWMC for processing.

e. When conducting practical repairs, it is important that personnel are focussed on the restoration of the capability to Command and apply lateral thought whilst maintaining basic personal safety and balancing the engineering risk against the operational imperative.

f. Safe Isolations (electrical, hydraulic and pneumatic) of equipment must always be conducted prior to commencing practical repairs and relevant Action Isolation notices attached (iaw BRd 2170 Chapter 17).

2816. Information Systems Services Manager (ISSM) at State 1

The ISSM Is responsible for the management of all IS services, as part of the Weapon Repair Organisation, their role includes:

a. Close up in iaw WSB requirements at State 1 with the location to be determined by platform.

b. Competent in the conduct of blanket searches and Mini-SOCs in respective State 1 areas of responsibility.

c. To respond to compartment faults/indications iaw State 1 requirements - to be detailed by WSB.

d. To be tasked by the WSB for all IS/CIS related faults and defects iaw their current skill set; this does not extend to low level repairs outside of their JPA competencies.

e. To be tasked for any high priority MCO related issues/defects i.e. electrical supply or loss of SCOT services.

2817. Ops Room Material Requirements

a. The Command Advisor and their assistant will be based in the Operations Room and should have easy access to the Command for briefing, be able to monitor equipment performance (e.g. TACS), have access to an incident board and be able to liaise with the CMD/PWO/ORS/ORM Action DSE and Comms manager. The following communications will be required.

(1) **CA/IBC Hotline to HQ1.** ‘Bleep’ phone, internal telephone, RICE/FICS comms or equivalent.

(2) **Command Open Line**. (single ear piece headset with Press to Talk switch and extension lead are recommended). Weapon Repair Hotline to I/C in WSB/WMC and to AWSB - (‘Bleep’ phone, WE Man Gp Line for T45s).

(3) **CBRN Protection Officer Line.** (may be combined with '(1)').

(4) **HQ2/AHQ Line.** (may be combined with '(1)').

b. **Command Stateboard**. The Command Stateboard is an important tool to enable the Command Advisor to build the damage picture in consultation with IBC and XO, formulate repair priorities and present them to the Command. Therefore, it is important that it is tuned to the manner in which all parties communicate within this organisation. A direct copy of the Command Stateboard is also to be held in the SCC/HQ1 (for use by the IBC in action) and both the main and alternative WSB. At Action this board is invariably manned by the Command Advisors Assistant/Action DSE, with a smaller, personalised version used by the CA to brief Command and aid minimum effective communication with the IBC by use of an identical briefing board held by IBC. An example of a Command Stateboard board is included are at Annex 28B. It is by no means comprehensive and may include additional information, as Ship’s Staff feel fit. It is intended to be an aid to the BDR process not a burden to it. Guidance on the component parts and their use is detailed below:

(1) It is readily accessible to the Command.

(2) Information is legible and of a size that can be easily read.

(3) It is portable, in the event of having to evacuate the compartment.

(4) Adequate emergency lighting arrangements are available.

(5) All weapons, sensors and communications equipment are listed, in a logical order (e.g. by directors, threat etc) and with space alongside for notes on the condition of equipment.

(6) The current Weapon Repair Priority and Command Top 3 can be clearly marked.

(7) The current Command Aim can be clearly shown.

(8) The current threat warnings can be clearly shown. This section should include Air, Surface, Sub-Surface and Mine threat warnings Red, Yellow and White.

(9) A diagrammatic representation of main machinery is included, along with major ancillary equipment such as Steering Gear, Fire Pumps, Chilled Water Plants etc. Space should be sufficient to permit notes on the state of equipment.

(10) Any steering and/or machinery limitations can be clearly shown.

(11) A diagrammatic representation of the ship's main power generation and distribution system is provided, along with space to permit notes on the state of equipment.

(12) Casualty status.

(13) Space for additional notes or comments.

c. **Personalised Command Briefing board (to include):**

(1) Command Aim.

(2) **BDR Prioritisation Table.** The Command Top 3, the Top 3 incidents from WE, ME, Damage Control Organisation (DCO) and DCO(Electrical) (DCO(L)) that have the greatest impact on the Command Aim. Prioritised in discussion between IBC and the CA, with the CA having veto. To compile the defect picture:

(a) The Top 3 WE incidents, prioritised by the WSB received and amended by veto by CA, or, if he is SQEP, the CA's Assistant.

(b) The Top 3 ME, DCO and DCO(L) incidents briefed by IBC. When CA/IBC confer the IBC is to download to the CA then receive the WE and Command Top 3 from CA. Always state if the Command Aim is or is not achievable.

(3) Warfare Environment Threat Levels.

(4) CBRN Threat Level.

(5) **CBRN Threat and Citadel Pressure.** A brief note of citadel pressures and CBRN threat in a CBRN Environment. BRACIS can be used to brief the Command on CBRN incidents and detail such as exposure times and chemical agents.

(6) Table of casualty triage category against number.

(7) ME Status for Speed, Steering and Stability.

(8) Next Time on Top.

(9) Percentage of wholeship and WE Blanket Searches completed.

(10) **Triage Categories.** A reminder of Triage categories. This is to be provided on a separate sheet by MHQ ensuring confidentiality of casualties is maintained to the Command level (to avoid any associated negative impact on morale).

(11) **Engine Configuration vs. Speed Comparison.** A simple table to remind CA of the engine configuration vs. speed implications and the inherent impact on Command Aim.

(12) **Steering Implication Table.** Enables the CA to digest a simple instruction from IBC or OOW/NO via Command Open Line, the impact of loss of steering modes.

(13) **ME Machinery Availability.** A simple block diagram of the propulsion layout to give a quick pictorial representation of lost equipment. The IBC may require an equivalent of the WE Equipment so that he can keep track of defects, but he will normally focus on those to which he has an impact i.e. electrical losses and CW supplies. The level and use of both diagrams will depend on the experience and knowledge of the user; it can be expanded to include generation and DC support equipment (i.e. HPSW pumps). However, if it grows too big it will become cumbersome and difficult to maintain.

(14) **Stability Table.** A simple indicator of the stability status, where MEO can advise the CA of the GM with a simple descriptor on which he can advise the Command. If red/amber/green states used, an explanation should be provided.

2818. WSB/WMC Material Requirements

The following communications, stateboards and documentation will be required[1]:

a. Command Open Line - (a loudspeaker, no speech facility necessary).

b. Weapon Repair Hotline from I/C WSB/WMC's position to CAA and AWSB/AWMC ('Bleep Phone').

c. Weapon Repair Group Line from Command Stateboard markers position to CAA and AWSB/AWMC - (Headset).

d. CBRN and DC IBO net from CBRN Incident Board marker's position to HQ1, HQ2/AHQ, Bridge, Ops Room, AWSB and Section Bases - (Headset).

e. Electrical Repair Hotline ('L' or 'Green' Line) to 'L' desks in HQ1 and HQ2/AHQ.

f. **Communications with Weapon Repair personnel**. These should extend to a comprehensive RICE/FICS network including all major WE outstations, however a (working) telephone is the bare minimum.

g. A Command Stateboard that is a duplicate of the one in the OPS Room.

h. A Weapon and Sensor Stateboard which should contain the following information (examples can be found at Annex 28C and 28D):

(1) Equipment is grouped in a similar way to the grouping used on the Command Stateboard.

(2) Quantity, type and source of all supplies and services supporting each equipment are listed.

[1] WSB Handbook DBR 9442 (3E) and System Engineers handbook (3D) refer.

(3) Equipment sharing the same source of supply should be highlighted in the same colour.

(4) Details of reversionary and emergency modes of operation are listed.

(5) Other details, such as run up times, critical temperatures, and limits without cooling/ventilation/air etc. are given.

i. A Command Huddle aide memoire is available.

j. A CBRNDC incident board is available.

k. A manpower control board is available, considering the following information:

(1) Information is legible and of a size that can easily be read.

(2) Adequate emergency lighting arrangements are included.

(3) It is easily portable in the event of having to evacuate the compartment.

(4) The names, locations and method(s) of contacting Weapon Repair Personnel are included.

(5) Times personnel last checked in, where they go if they leave their designated station.

(6) Status of Blanket Searches can be annotated.

(7) Status of spare manpower can be annotated.

l. An adequate system of defect recording will be required, however the method of recording will depend on the class of ship (Railex cards or DSAC/WMS). Sufficient defect card-holders must be available for use by the DWEO/Defect Managers to accurately display a valid defect picture and there should be a clear method for indicating equipment that has been called for Mini-SOCs. Whichever method is used, the recorded defects should reflect information accurately and include:

(1) Line Number/Equipment.

(2) Time equipment will be back on line (ETBOL) or time of next SITREP (NTTR). In certain circumstances a Z+ time is acceptable (awaiting stores/manpower etc) but should be updated as soon as an ETBOL is available.

Note. *Four figure time including time for run up and Mini-SOCs.*

(3) Adequate space for description of the defect and action being taken.

(4) List any reversionary modes available.

(5) Operational limitation posed by defect - Remaining Capability.

(6) Means of identifying personnel allocated to defect.

m. As a minimum the following additional information should be readily available within the WSB/WMC:

(1) Individual equipment supplies and services (HP and LP air/chilled water/hydraulics/main and converted power supplies).

(2) Emergency supplies and possible alternative sources of supply, particularly domestic supplies. These should include current and power requirements/limitations.

(3) Expected battery performance in the event of power losses.

(4) Expected running times of equipment in the event of loss of chilled water and/or air cooling.

(5) Effects of running equipment in ‘Battle Override’.

(6) Reversionary modes of operation (if any) of weapons and sensors equipment.

(7) Block diagrams of data distribution and communications networks showing locations of DDUs, DBs, Nodes etc.

(8) Lists of known Symptom to Defect Correlations.

(9) Standard Operating Procedures (SOPs) for recovery from expected or common equipment failures (CMCDS, RICE 10 and FICS etc).

(10) Layout of magazine floods and spray systems including valve types and numbers and their locations.

(11) Layout of Chilled Water systems relevant to weapons and sensors including valve types and numbers and their locations.

(12) Misfire/hangfire/stoppage procedures for all weapon systems.

Figure 28-2. Weapon Repair Monitoring Card

Line No.	EQUIPMENT	ETBOL/TTNR* (4 Figure Time)
EXACT NATURE OF DEFECT		
WHAT IS BEING DONE		
REMAINING CAPABILITY, REVERSIONARY/FALL BACK MODES		

*Estimated Time Back On Line/Time To Next Report

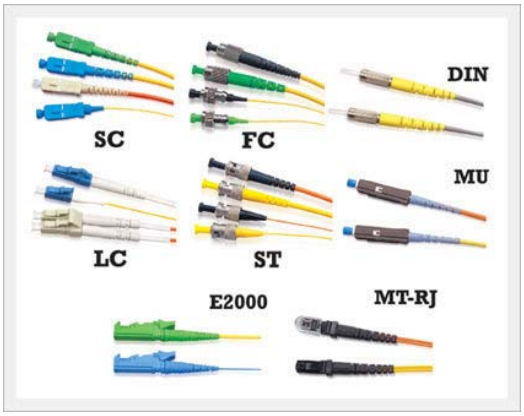
2819. Fibre Optic Aspects of Damage Control

a. **General.** Beyond the statements with regards to the importance of the continued supply of electrical power under all conditions, there is an ever-increasing reliance on network system functionality and data transfer via Ethernet and/or Fibre Optics that directly enables the ship to maintain maximum fighting efficiency in peace and war. The spectrum of systems and equipment that rely on this network functionality are ever increasing, as such the RN needs to have the onboard knowledge, skills and tools to be able to maintain, diagnose and repair the network system.

b. **Levels of Fibre Optic Repair.** As with all systems and equipment there is a level of repair that is both dependant on the operating environment (be it peace, war, State 1, 2 or 3), the ability to access shore support and the technical skill (in terms of underpinning knowledge, skill of hand and onboard tooling) that dictates what we require in terms of OMDR from the onboard maintainer and also where that support purely sits within the shore support environment.

c. **FO Patch Cord/Cable.** A fibre optic patch cord/cable is capped at either end with connectors that allow it to be rapidly and conveniently connected to enable restoration of connectivity of the network, system and equipment. The advantage of this type of repair is that it is quick and requires minimal skill of hand; however, this type of repair is limited based on the need to have access to the required connections points and the physical separation between those connection points, either by distance and/or watertight boundaries. Patch cords can be provided with a spectrum of end connection types (FC, SC, ST, LC, MFM, MTRJ, MPO, MU, SMA, FDDI, E2000, DIN4, and D4) to support the spectrum of network, system and equipment fits. The majority of RN fibre networks are fitted with FC, SC, ST, LC, MFM, MTRJ and SMA connector types, as such ships staff need to be provided with sufficient patch cords (at various lengths) with the requisite spectrum of connector types.

Figure 28-3. Various Connector Types



d. **FO Mechanical Splice.** A mechanical splice is a junction of 2 or more optical fibres that are aligned and held in place by a self-contained assembly. The fibres are not permanently joined, just precisely held together so that light can pass from one to another.

Where the option to utilise a patch cord is not viable the mechanical splice provides a quick and effective method of fibre repair, re-connection. There are a number of mechanical splice methods on the market, ship's staff will need to be provided with sufficient quantities of the agreed mechanical splice products to support mechanical splicing of the fibre network, system and equipment.

Figure 28-4. Mechanical Splice

e. **FO Fusion Splicing.** Fusion splicing is the act of joining 2 optical fibres end-to-end using heat. The goal is to fuse the 2 fibres together in such a way that light passing through the fibres is not scattered or reflected back by the splice, and so that the splice and the region surrounding it are almost as strong as the virgin fibre itself. Where the option to utilise a patch cord is not available and/or where a more permanent repair can be provided (beyond what the mechanical splice can deliver) there may/will be a need to conduct a fusion splice. The conduct of fusion splicing requires a greater degree of knowledge, skill of hand and onboard tooling to that for mechanical splicing, onboard engineers need to be equipped with the requisite toolkit and fibre pig tails to support fusion splicing of fibre network, systems and equipment.

Figure 28-5. Fibre Optic Repair Kit

SECTION 3 - STATE 2

2820. WE Department at State 2

a. The WE Department has 2 major functions at State 2:

(1) To support the Ops Room and the 'fight' capability via the DSE in the Ops Room and appropriate WSB/WMC/maintainer support.

(2) To support the Command via WEO acting as Command Advisor.

b. The support offered by the WE Department at State 2 should be sustainable throughout long-term high intensity operations both in terms of material and personnel. Care should be taken, particularly in lean manned ships, to ensure that the most effective use is made of available manpower. Maintenance requirements, configurations and loading states for equipment should be carefully considered within the requirements of Operational Notice and Command intentions.

c. In addition to Support to Warfare, careful consideration should be given to the WE input to the Defence Watch Emergency Party (DWEP) where used. Sufficient cover should be provided by the WE Department to deal with emergent small-scale incidents that would not normally require the ship to be called to State 1.

2821. Command Advisor Routine

The WEO should work the same routine as the CO. A second Command Advisor may be used to provide support to XO when the CO and WEO off watch. The training provided to the second Command Advisor should be carefully considered to allow them to function in this role, although it is accepted that a second Command Advisor will not be required to undertake the full range of activities that the WEO is expected to perform at State 1.

2822. DSE Routine

A DSE should be present in the Ops Room whenever a Warfare Officer is closed up. Care should be taken to ensure that the DSE roster is sustainable whilst allowing the WE Management Team to continue to function effectively. The DSE should coordinate WSB effort in rectifying defects and provide elements of Command Advice to the on-watch Warfare Officer. It should be noted that the scope of the advice provided to the on-watch Warfare Officer should be expanded from that provided during State 3 Warfare serials, to encompass whole ship DC/FF and ME aspects where these are required. WEO should ensure DSEs used in State 2 have received suitable training in the whole ship aspects of Command Advice and this training recorded in the Training Log.

2823. Weapon Repair Organisation (WRO)

a. The WSB/WMC should be set up as for State 1, but with reduced manning to meet the perceived threat in accordance with the Command Estimate. As a minimum, manning should consist of an IBO who may also conduct WE Rounds and an I/C who is responsible for liaising with the DSE to coordinate WE call out and defect repair. In the event that no Command Estimate process has been conducted, manning of the WSB/WMC should be in accordance with the Watch and Station Bill. The Alternative WSB/WMC should also be set up for State 1, but left unmanned.

b. Personnel manning the WSB/WMC should be familiar with the roles they are required to undertake and should have received suitable training.

c. Sufficient WE personnel should be available outside the WSB/WMC to ensure correct operation of equipment (where operation is a WE responsibility) and to ensure that all equipment achieves the required operational availability. Personnel should be allocated and trained in advance so that there is a secondary/back up/team worked maintainer for all WE Systems in each watch as required by BRd 300. Care should be taken to ensure that the WE Department commitment to the DWEP can be met.

2824. Incidents at State 2

a. Small DC/FF incidents should be handled ‘on the watch’ by the DWEP. Where the DWEP is unable to deal with the incident or if a clear picture of the scale of the incident cannot be formed, then the ship will be called to State 1.

b. Irrespective of the whole-ship reactions to an incident, the DSE and WSB should consider initiating Mini-SOCs and Blanket Search, concentrating the available resource into the area’s most likely to be affected by the incident. It should be noted that initial DC/FF reactions must not be compromised by Mini-SOCs or Blanket Search and that these activities may need to be delayed until manpower becomes available.

c. Defects noted during Mini-SOCs/Blanket Search should be reported/prioritised and actioned as for State 1. Care should be taken over prioritisation of manpower and call out of additional manpower, particularly where damage has affected key equipment.

2825. Equipment Considerations

A Command Estimate process should be conducted in advance of prolonged high intensity State 2 operations to define the Command requirements for Operational Notice and ammunition loading. The WE Department must ensure that the Command requirements are realistic and can be met for the perceived duration. Appropriate representation should be made to the CO if they are unrealistic. Particular note should be made of the effects of weather on ammunition and systems, and the requirements for essential (not only mandatory and safety) preventative maintenance. Systems should also be prepared for firing on a rolling wartime process as defined by Command, striving for maximum system availability and minimum loss of capability always Where Operational Notice requirements cannot be met as a result of defects or routine maintenance, the DSE must liaise closely with the on watch Warfare Officer to minimise impact.

SECTION 4 - STATE 3

2826. Incidents at State 3

a. In the event of an emergency sufficient enough to warrant Emergency Stations, the WRO is run and managed from WSB/WMC or AWSB/AWMC and is run along a similar format as the WSB/WMC at State 1 with much of the same documentation, procedures and communications. WE Personnel involved in Containment Party duties are to be relieved by the Emergency Stations Spare Hands as the situation dictates. This will enable the specialist maintainers to be better utilised in the WRO.

b. Once the WRO has stood up, a minimum of 2 WRO Blanket Search Teams complete with WRO Battle Bags, will each conduct a set of comprehensive rounds commencing from as close to the internal incident as possible. Working their way forward and aft simultaneously, following the stipulated WE rounds route, ensuring 100% coverage of WE compartments.

c. The status of these rounds is reported back to the WSB regularly to update progress and to maintain regular contact with the WE Rounds teams. The I/C of the WRO then reports updates to the CAA who then feeds this information to the both the CA and the DWEO in the SCC who will advise the DCO.

d. Any defects discovered are reported to the WSB using the 5 point brief format. The I/C will then prioritise the defects in line with the Command Aim and advise whether the team should attempt repair or continue their rounds. Should equipment be required to be taken offline or made unavailable to Command for defect repair, the I/C will seek permission from the Command Advisor before any further reduction in capability is removed from the Command.

e. Mini-SOCs are to be conducted as directed by either the PWO, if closed up, or the Command Advisor. Completed Mini-SOCs forms are to be given to the I/C to ensure correlation with the Defect Board in the CRO and that no defects have been missed.

f. All members of the WRO are to keep abreast of the developing internal/tactical situation to ensure that any weapon repair efforts are focussed correctly. By knowing the Command Aim, Blanket Search teams will be able to prioritise defects that they find and know which ones are to be flashed back to the I/C as a priority. For example, a defect affecting a navigational aid will take priority over a defect found on the primary weapon system, when the ship is at State 3 (Smart Blanket Searching).

ANNEX 28A
EXAMPLE OF COMMAND BRIEFING BOARD

CMD AIM			Speed	PRIO
				AAW
				ASuW
				ASW
				MINE

ENV SIT ACHIEVE CMD AIM; TOP 3; LOST CAPABILITY; REMAINING CAPABILITY; ETBOL Speed/Steering/stability/Top 3 DC/Top 3 WE

WE		ETBOL

AIR	AIR	AIR
SUR	SUR	SUR
SUB	SUB	SUB
MINE	MINE	MINE

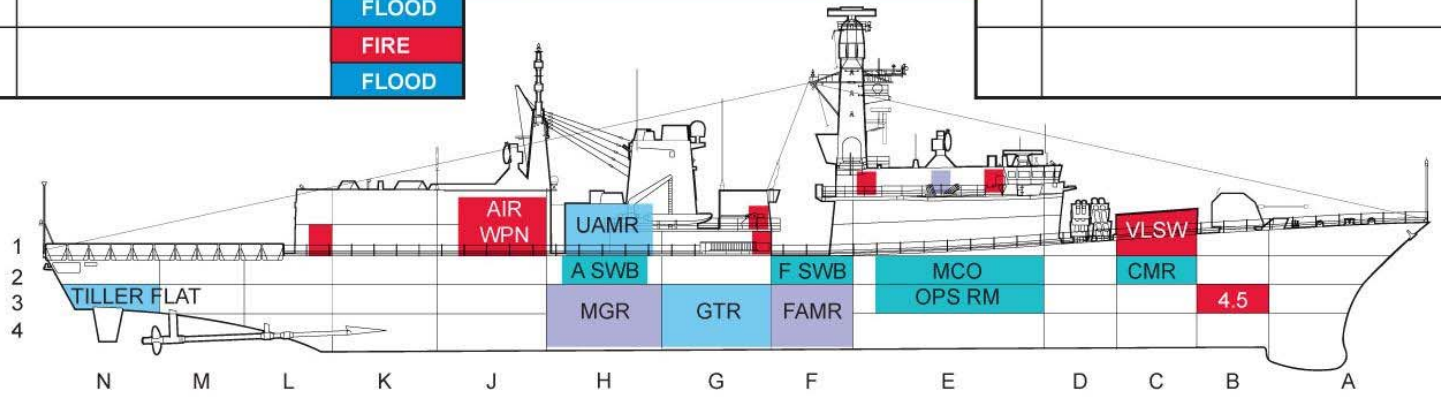
TOT

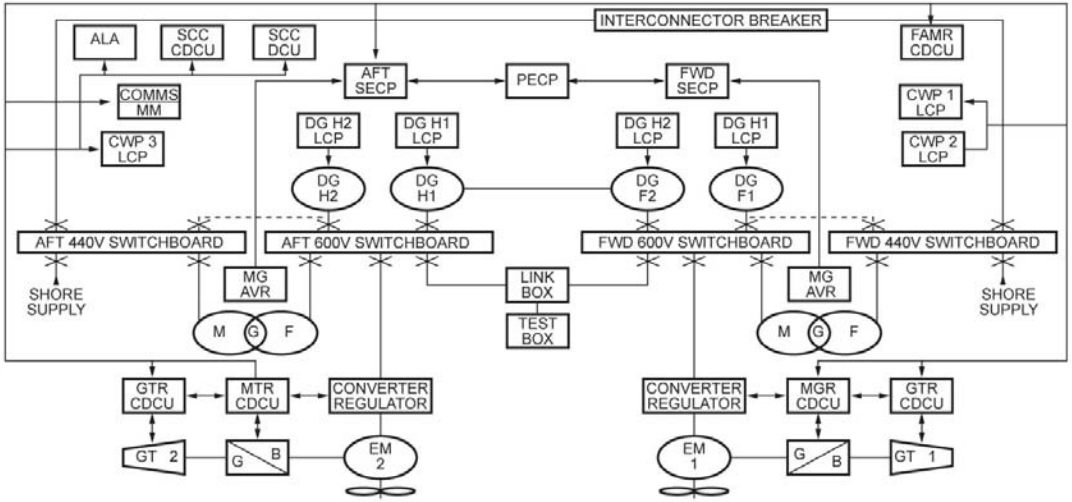
TOP 3		ETBOL

ME		ETBOL

DCO		
		FIRE
		FLOOD
		FIRE
		FLOOD
		FIRE
		FLOOD

L		ETBOL





STABILITY		CASUALTIES			
GOOD	No Implications	**PEACE**		**WA**	
		T1	Minor	T3	
		T2	Serious: Will survive	T2	
MODERATE	No major implications. Monitor situation closely.	T3	V Serious: may die	T1	
		T4	Dead	T4	

SPEED			STEERING	
2 SHAFTS			**PRIMARY**: Bridge A or B	No implications
CODLAG	28		**SECONDARY** Conning to Tiller Flat	Slightly delayed response
SIDED	21		**MANUAL** Manual Control of pumps in Tiller Flat	Slow sluggish response
4 DG	16		**HAND**: Hand Pump	Very slow response Max wheel: 10 < 10 kts. 5 > 10 kts. Min rudder, steer by engines
3 DG	14			
2 DG	12			
1 DG	6			
1 SHAFT	**1 Trail**	**1 Lock**		
1 GT	20	16		
4 DG	12	10		
3 DG	10	8	**BLOCK and TACKLE** Centralise Rudders.	Centralise rudders Steer by engines. Manpower. **CMD AIM**
2 DG	8	6		
1 DG	4	4		

CRITICAL	Within 1 section of loss of ship. Priority stable platform. Max wheel 5°. Course and Speed to minimise effect of sea. **CMD AIM**
UNSAFE	Capsize imminent. Commence abandon ship. Flash signal to OPCON.

ANNEX 28B

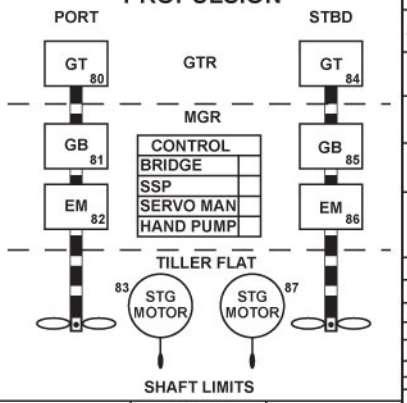
EXAMPLE OF COMMAND STATE BOARD

COMMAND STATEBOARD

COMMAND AIM

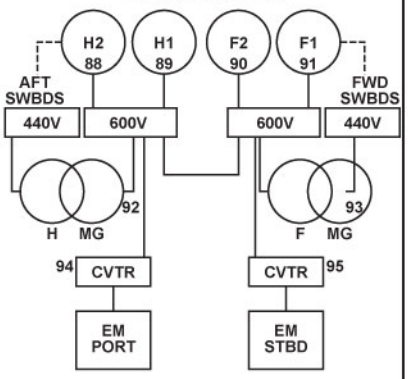
No		EQUIPMENT	Status	ETBOL	REMARKS
1	AIO (ORS)	996 / LFA			
2		1007 / LFC			
3		1008			
4		RRB			
5		JUF / JQA / CTD			
6		1010 / 1011			
7		SNAPS			
8		CSH			
9		DNA 1			
10		ROLE			
11		PDT			
12		COMMS / MISC			
13	EW (EWD)	UAF / T			
14		DLB (P & S)			
15		CRE			
16		DLF			
17		COMMS / MISC			
18	AWW (MD)	911 (FWD)			
19		911 (AFT)			
20		VLSS			
21		GWS 60			
22		GSA 8			
23		GPEOD			
24		4.5 MK8			
25		TDS (P & S)			
26		30mm/GPMG's (P&S)			
27		COMMS / MISC			
28	UWW (ASWD)	2031 / 2067			
29		2050			
30		2013 / 2080 / SEPADS			
31		162 / 182			
32		2008 / 2009			
33		MTLS			
34		AW HE			
35		HVME			
36		COMMS / MISC			
37	COMMS (RS)	SCOT			
38		INMARSAT			
39		VHF / UHF			
40		MF / HF			
41		KMY / BIDS			
42		DIMPS			
43		SECURE SPEECH			
44		TELEX			
45		VIS SIG			
46		COMMS / MISC			
47	BRIDGE (OOW)	NCS 1 (A & B)			
48		PDM 2			
49		AGILOG			
50		WS & D			
51		NAVAIDS			
52		SNAPS			
53		778			
54		DG			
55		COMMS / MISC			
56	AIR (FDO/MC)	HELO			
57		AV FACS			
58		HANDLING			
59		COMMS / MISC			
60	CBRN	SICS / SIRS			
61		COMMS / MISC			
62	ENHANCEMENTS	JOTS			
63		ASMA			
64		NSTN (MHS)			
65		CHIRPSOUNDER			
66		TACSAT			
67		CLANSMAN			
68		1254 / DAMA			

PROPULSION



AHEAD	
ASTERN	

GENERATION



EMERGENCY SALVAGE GENERATOR 96	RUN	S/BY

HPSW

97 CW PLANT	98 FAMR	99 GTR	100 MGR	101 AVCAT PUMP
4E	4F	4G	4H	4K
RUN	RUN	RUN	RUN	RUN
S/BY	S/BY	S/BY	S/BY	S/BY

HATHAWAY EMERGENCY 102		GODIVA FWD-2B STBD 103		GODIVA AFT-2M STBD 104	
RUN	S/BY	RUN	S/BY	RUN	S/BY

CHILLED WATER PLANTS

1. CWP 4E 105		2. CWP 4E 106		3. CWP 1H 107	
RUN	S/BY	RUN	S/BY	RUN	S/BY
1. PUMP 4E 108		2. PUMP 4E 109		3. PUMP 3H 110	
RUN	S/BY	RUN	S/BY	RUN	S/BY

HP AIR COMPRESSORS

1.GTR 111		4G	2. UAMR 112		1H
RUN		S/BY	RUN		S/BY

LP AIR COMPRESSORS

1.01F 113		2. UAMR 114		3.01J 115	
RUN	S/BY	RUN	S/BY	RUN	S/BY

THREAT WARNING

AIR	R	Y	W
SURFACE	R	Y	W
SUBMARINE	R	Y	W
MINE	R	Y	W

CBRN THREAT	LOW	MED	HIGH

EMCON	RSI

CITADEL PRESSURE

FWD		AFT	
1A		3	
1B		4	
2			

NOTES / CASUALTIES

ANNEX 28C

EXAMPLE OF WEAPONS STATE BOARD

THREAT WARNING			
AIR	R	Y	W
SURFACE	R	Y	W
SUBMARINE	R	Y	W
MINE	R	Y	W

WEAPONS

COMMAND AIM

		EQUIPMENT	STATE	EDC	CONVERTED SUPPLIES	VENT ATU No	OTHER SERVICES	RUN UP TIME	SURVIVAL TIMES WITHOUT WATER	SURVIVAL TIMES WITHOUT AIR	HAZARDS	REMARKS
GWS 26	18	911(F) / DBF		E-A-4 / C-A-1 & 4	115 / 400 - FP5 (01E) 200 / 400 - FP5 (CMR)	1	DDU 2, CSH, LP Air, 996, Chilled Water	10 min	1 Hr*	LOSE RADAR A	Radhaz Panacide M Berylilum High Voltage	Supplied from Sw & FP in O.R.A. DBF EITHER Fwd or Aft. DICOLL fed from E-R2-5-1. DICOLL fed from J-R-3-5 at 2H. Loss of MDE - System will not fire - P 1 both Trackers. (*x Battle override).
	19	911(A) / DBF		J-A-1, 2 & 4	115 / 400 - FP 10 (2J) 200 / 400 - SFC (CER)	11 & 12		10 min	1 Hr*	LOSE RADAR A		
	20	VLSS / MFU's		E-A-7			911(F) / (A), MDE	0 min			MISSILES	
		MDE		E-A-8	115 / 400 C & C SWBD			10 sec				
SURFACE WEAPONS	21	GWS 60		E-A-7	MK 42 SFC 28V 115/400 C & C SWBD	1	DDU 1	10 min			Ammunition Eflux	Loss of ECH will necessitate EMERGENCY RE-SUPPLY.
	22	GSA 8		C-A-1 / C-R-3	115 / 400 - FP1 (CMR) 24v - FP2 (CMR)	6 & 16	DDU 2, INA (Ops)	10 sec				
	23	GPEOD					GSA 8, INA (CMR)	THIM 5 min			Movement Laser	
	24	4.5" Mk 8		C-R-1, 4, 10 & 11.		6	GSA 8	15 sec	20 min		Movement, Ammunition Nothrogen Bottle, OEP 8, Anti-Freeze,Rust Veto.	
	25	TDS (P&S)		C-R-3	24v - FP11 at 2H 115 / 400 - PDM 2		Harpoon (ITV)					
	26	30 mm (Port)		G-A-4	Battery Charge 115 / 60			7 sec			Ammunition Movement	Emergency Batteries re-charge from F-05 in 30 mins.
		30 mm (Stbd)		G-A-4	Battery Charge 115 / 60			7 sec				
		GPMG PORT FWD / AFT									Ammunition	
		GPMG STBD FWD / AFT										
UW WEAPONS	33	MTLS		C-A-7 / L-A-3 / J-A-2	115 / 400 - FP 1 24v - FP14 at 2L	4	HP Air, CSH, DDU2	0 min			HP Air,Thallium, Torpedoes.	Max. No of firings if breeches fully charged.
	34	A.W.H.E.					HP Air	0 min		INOP	Movement, HP Air, Ammunition.	Finish movement manually (V-Slow).
	54	Degaussing		C-A-7,8 & 10		11 & 12	DDU3				High DC Current	Controlled via CCU (Bridge) - Power loss alarms at SC.
	56	HELO									AVCAT, Rotors, Ammunition	
	57	AVFAC 28V TRU		L-A		4		5 sec			High Current	
		AVFAC Lights						0 min				
		AVFAC MG Set		K-R				2 sec			High Current	
		AVFAC Door/Fuel						0 min			AVCAT	
	58	HELO HANDLER		H-R-1				10 sec			OX40, Movement	
NAVIGATION	47	NCS 1 GYRO A		E-A	115 / 400 - SFC In Gyro Room. Emerg. Batteries (30 mins)		LOG	2.5 Hr				1. Gyro B, DDU B, SFC B, DDU's 1 & 2 can be supplied in EMERGENCY with cables via HCOS in Gyro Rm. 2. DDU's A & B, SFC's A & B and EP's A & B have internal battery life of 30 minutes. 3. When DDU A & B on batteries, Ship's heading in Synchro form only passed to major Navigation aids. 4. DDU 1 alternative from G-A via HCOS in Gyro Rm.
		NCS 1 GYRO B		G-A			LOG	2.5 Hr				
	48	PDM (2) DDU'S A GYRO Room		E-A	All DDU's 155V 400Hz From MK 34 SFC's In GYRO Room	17	NCS 1					
		PDM (2) DDU'S B GYRO Room		G-A			NCS 1					
		PDM (2) DDU'S 1 GYRO Room		E-A			NCS 1					
		PDM (2) DDU'S 2 Ops Room		G-A		16	NCS 1/LOG/WS&D					
		PDM (2) DDU'S 3 Bridge		E-A		1	NCS 1					
		PDM (2) DDU'S 4 Bridge					NCS 1					
	49	AGILOG		C-A-1	115 / 400 - FP1 (CMR)			3 sec				EM Log readout on Bridge fed from E-A-1.
	50	Wind S & D		C-A-2	115 / 400 - FP1&13 (CMR)		DDU2	3 sec				
		Mag Compass		C-R	24v - FP 11 at 2H							
ENHANCEMENTS	62	JOTS				16	SCOT					
	63	ASMA				15	SCOT					
	64	NSTN (MHS)				15	SCOT					
	65	CHIRPSOUNDER		E-R1-4		15	AVK					
	66	TACSAT				16					RADHAZ	
	67	CLANSMAN				16					RADHAZ	
	68	1254 / DAMA				15					RADHAZ	

Note. This is only a generic example, not to size. Each board is to be made up to represent the individual ship, at least A3 size

ANNEX 28D

EXAMPLE OF SENSORS STATE BOARD

THREAT WARNING			
AIR	R	Y	W
SURFACE	R	Y	W
SUBMARINE	R	Y	W
MINE	R	Y	W

SENSORS

COMMAND AIM

		EQUIPMENT	STATE	EDC	CONVERTED SUPPLIES	VENT ATU No	OTHER SERVICES	RUN UP TIME	SURVIVAL TIMES WITHOUT WATER	SURVIVAL TIMES WITHOUT AIR	HAZARDS	REMARKS
AIO	1	996		ACOS N-F-02 A-H-03	115 / 400 - FP6 at 01E 24v - FP4 at 01G & Ops Room	1	CW, LP Air, CSH, DDU's 1 & 2	10 min	0	TIN Trip	Radio Active (ADQ) EHT (TWT)	Battle override bypass CW fail. 996 will work without LP Air until Ae VSWR Trip operates - can be Battle overridden.
		LFA							0	TIN Trip		
	2	1007			115 / 400 - FP5 at 01E		DDU 2	3 min			Viton Cadmium Batteries and Plating Tantalum Beryllium Radhaz	
		LFC										
	3	1008										
	4	RRB			115 / 400 - FP5 at 01E	1	1007 AAD Rotation					
	5	JUF / JQA			115 / 400 - FP5 at 01E	1 & 16						
	6	1010 / 11			115 / 400 - FP6 at 01E 24v - FP6 in Ops Rm	1	996 ADQ Rotation					
	7	SNAPS		E-A-2 & 6	115 / 400 - PDM2 24v - FP7 in Ops Rm	16	NCS, SFC(A), DDUS	5 min				
	8	CSH	F / A	C-A-7 / J-A-2		6 / 12						
	9	DNA1		E-A-6	24v SW & FP in Ops Rm Annex	16		15 min	30 min	1 Hr	Beryllium, EHT, CRT, Cadmium, Tantalum	Fibre Optic Hazard
	10	ROLE					NCS1, LOG, DDU1, UHF/HF COMMS	1 min				
	11	PDT					HF RX	3 min				
	5	CTD									EHT	
EW	13	UAF (1)		E-A-2 & 7	115 / 400 - FP5 at 01E	1 & 16	DDU2, LP Air, CW	5 min			EHT	UAF(1) will run without water when battle override selected. Will run indefinately but system accuracy degraded. Fed from DLB P8U.
	14	DLB (P & S)		ACOS NmF2 / AmH3		1					Radio-Active Ind Lights (LCP)	
		DLB (I / F Unit)			24v - FP7 in Ops Rm	16	DDU1					
	15	CRE		E-A-1		15						
	16	DLF										
SONAR	28	2031		E-A-3 / L-A-3	24v C SW & FP in Ops Rm Annex	16	DDU2	2 min			Kerosone Gel	Can run without cooling, must be monitored. Cabinet: Temp at 55C Warning Cabinet: Temp at 70C Auto shutdown.
		WINCH		L-A-5 / K-R-3			SW Cooling	10 sec			OX 40, Movement	
	29	2050 (TX 1) (TX 2)		J-A-3 / C-A-3	115 / 400 - FP1 (CMR) (SIG PRO CAB)	6	DDU2, CW	5 min	20 min	<70°	Beryllium, Tantalum EHT	
	30	2013 / 2090		C-A-7		16		0 min				
	31	162			24v - FP OPS Rm Anx	6		0 min				
	32	2006 / 2009				16		0 min				
	53	778		E-A-2		1		0 min				
EXT COMMS	37	SCOT		E-R1-1 / E-R2	115 / 400 - SFC In CMR (1 & 2)	1	DDU 1, CW	20 min	15 min		EHT, Cadmium	Clanaman UHF/HF Emergency. 2 in No. HF broadband wire Ae fed by either Port/Stbd Ae. Emergency Ae Runs - Changeover time 30 mins.
	38	INMARSAT		E-R1-4		15	GYRO VP					
	39	V / UHF		E-R1-1							Beryllilum, Cadmium, High Voltage	
	40	HF		E-R1-1 & 2	CCR (LP) SW & FP CCR (HP) SW & FP			5 min				
	41	KMY		E-R1	C & C SWBD			2 min				
	42	DIMPS (MFP A) (MFP B)		E-R1 / E-R2				15 min				
	43	SECURE SPEECH		E-R1				2 min				
	51	GPS Navstar QYF		E-A-1								
		MNS 2000			FP3 BRIDGE LOBBY	1	DDU 4	0 min				
		SQB		E-R1	115v / 400Hz 24V CCR	15		0 min				
		NAVTEX		C-R-3 / E-A-2	115V TRU 1 C & C SWBD							
	60	SICS / SIRS		E-A-1 / L-A-3 / J-A-2 / J-S-3								
INT COMMS		Main B'cast Fwd		C-A-2	115/60	12						Battery Backup (1 Hr each Broadcast)
		Main B'cast Aft		J-A-2								
	44	TELEX		C-A-2	24v - C & C SW 17	8						
		TRU 1 / FDB 1 (CRO)		ACOS NmF2 / AmH3	24v DC, 10 Amp Output	1					High Current Batteries	TRU Emergency battery (duration 1 hr.)
		TRU 2 / FDB 2 (CER)		J-R		12						
		TRU 3 / FCC (OPS Rm Annex)		E-A-6		16						
		TRU 4 / FDB 3 (CMR)		C-A-3		11 & 12						
	45	VIS. SIG		E-A-2	15° = 440v 5° & 10° = 115v						Heat & Light	

Note. This is only a generic example, not to size. Each board is to be made up to represent the individual ship, at least A3 size

ANNEX 28E

RECOMMENDED BATTLE BAG CONTENTS

ITEM	STORES NUMBER
Tool Bag Canvas	0275 99 923 6244 8465 99 130 9326
Crimping Tool	Local Purchase
Cable 5 amp (10 m)	0561521 8346
Cable 15 amp (10 m)	0561521 8349
Hose Clamp M51-M70 x 2	0241 533 2968
Hose Clamp M44-M60 x 2	0241 99 533 2967
Hose Clamp M27-M40 x 2	0241 533-2963
Hose Clamp M22-M30 x 2	0241 533-2961
Hose Clamp M13-M20 x 4	0241 533-2958
Hose Clamp MII-MI6 x 4	0241 533-2957
Hose Clamp M09-M12 x 4	0241 533-2956
Hose PVC (12")	0237972-2672
Hose PVC (12")	0237972-2674
Hose PVC Tubing (24")	0237525- 7843
PVC Tape Yellow	0425 99 923 9663
Insulated Crimps (Pink/Yellow)	0559100-7061/0559 105-0363
Equipment Wire (Pink) x 3 m	0561 891-9573
Container small x 2 (1 for above crimps, 1 x for fuses)	0264 437-1946
Self Amalgamating Tape	0559 522-9819
Cyalume 10" x 2	6260 01 315 1029
Cyalume 8" x 2	6260 01 074 4230
Magnetic Base Holder	6260 01 901 6998
Terminal Block x 2	5940 99 940 0450
UK4AA Waterproof Torch	0583 01 428 7464
Rubber Soundproofing (small strips and squares	0455 537-4759
Cable Ties x 10 (Large)	0262 746-8555
Cable Ties x 10 (Medium)	0559 99 746 8553
Cable Ties x 10 (Small)	0262 746-8552
Miners Headlamp	6230 99 549 7783
Fluke	-
Aluminium Foil Tape	0425 99 923 2847
Insulated Rubber Gloves	8415 99 975 7239
Screwdriver flat head large	0273 99 923 2847
Screwdriver flat head small/instrument	5120 -99 136- 5594
Screwdriver Posi drive	5120-99-910-5866
Spanner adjustable	5120 99 910 5963
Wire strippers	5110-99-943-7819
Sharp knife/Stanley knife	5110- 99-601-8200
Fuse Key	0273 99 923 9856
Suitable strong backs	6515 99 210 3035
Fuses, various to suit Battle Bags normal location	-
Soldering Iron	-
Solder	-

ANNEX 28F

COMMAND ADVISOR SCENARIOS

1. Task A

TO DETERMINE PRIORITIES FOR REPAIR OF WEAPONS, SENSORS, PROPULSION MACHINERY, ELECTRICAL SUPPLIES, HULL STRUCTURE, SHIP SERVICES AND DAMAGE CONTROL; ENSURING THAT THESE SUPPORT THE COMMAND AIM.

a. This means WEO/Snr WE must ensure all outstations are aware of the Command Aim and priorities and are working to them. They are to recommend changes to the Command priorities depending on the tactical situation and the extent and nature of any damage incurred. CA must use threat warnings and their knowledge of the tactical situation to put all defects and damage in priority order for repair. If, for example, a Type 23 has been strafed by an FBA/FGA and suffered the following losses and damage: Steering gear out of action, Stbd gas turbine stopped, Aft SeaCeptor, RT997, LINK 16 all inoperative, a fire in the galley and a flood in the tiller flat. CA might set priorities as follows:

(1) To the WSB:

(a) RT997.

(b) Aft SeaCeptor.

(c) LINK 16.

(2) To IBC:

(a) Steering gear.

(b) Stbd Gas Turbine.

(3) To DCO (via IBC):

(a) Flood in Tiller Flat.

(b) Fire in the Galley.

b. Once CA has set these priorities, they must brief the CO, ensure agreement, and then demand Estimated Times Back On Line (ETBOLs) for all DC/FF, ME and WE incidents and pursue these times vigorously. CA must also ensure that the priorities have been passed to all outstations (HQ1, WSB, FRPP) and that they are being acted upon.

2. Task B

TO MONITOR THE PERFORMANCE OF ALL WE EQUIPMENT AND SUPPORTING SERVICES, TAKING INTO ACCOUNT OPERATOR, TACTICAL AND MATERIAL FACTORS. TO ASSESS THE EFFECTS OF DAMAGE, DEFECTS AND DEGRADATION ON THE SHIP'S ABILITY TO FIGHT, ESTABLISH ESTIMATED TIMES BACK ON LINE AND ALTERNATIVE MODES OF OPERATION WHERE THESE ARE FEASIBLE. AND TO BRIEF THE COMMAND ON ALL SIGNIFICANT CHANGES THAT MAY AFFECT THE OPERATIONAL ABILITY OF THE SHIP.

a. This task is very much a team effort for all members of the WE and Warfare Departments.

b. **Before Damage:**

(1) The CA and assistant are to monitor the Ops Room as thoroughly as possible checking that equipment is working correctly and that the results obtained are as expected in view of the environment and other factors.

(2) DWEO should ensure that the WSB/WMC maintain a proactive stance, ensuring emergent defects are dealt with efficiently and prioritised in line with the Command Aim. The WSB/WMC is to monitor Command Open Line, Main Broadcast pipes and liaise closely with the CAA to maintain an accurate picture of the tactical situation. If the Threat Warning States allow and restoration of capability can be expedited, Defect Managers may visit outstations, but must return to the WSB/WMC immediately if the Threat Level rises.

(3) Maintainers at outstations should remain critical of equipment performance and liaise closely with relevant operators.

c. **After Damage:**

(1) The CA is to re-assess equipment performance as far as possible utilising a Structured Look and other aides (TACS), although initially he will be tied to the Command position. He is to highlight system degradations to the Command and PWOs using the 'Flash' procedure using voice primary and on CoL where appropriate. For example: "**FLASH, COMMAND - CA, RT997 LOSS OF LFE TRACKS, LOSS OF AUTO TI AND AUTO TRACK EXTRACTION"**. CA should have an instinctive knowledge of reversionary modes and be able to advise on their usage. "Manual TI modes and manual track extraction remains".

(2) CAs should aim to give an initial brief to the Command as soon as the damage picture begins to stabilise, not more than 4 - 5 mins after the hit. CA must endeavour to précis the information into a structured brief starting with the highest priority defects and working through the list in priority order. The priority order should reflect the current Command Aim and briefings should be given at the CO's position. The use of a portable Command Briefing Board will aid this process.

Only information that affects the Command Aim should be passed at this stage. CA is to keep the Command updated at regular intervals iaw the C2 BDR Timeline, tailoring the content of the brief to the prevailing circumstances. If the tactical situation allows it may be appropriate for the CO to come to the Command Stateboard for a comprehensive brief. The brief should be capability based and not a defect list.

(3) The CAA is key in filtering information. In addition to using the Command Stateboard to record defects, he is to assess priorities for CA's approval and pass information to the WSB/WMC. He is to demand ETBOLs from the WSB/WMC and information on reversionary modes or implications for each important defect. He should expect a '5 point Brief' from the WSB/WMC on all key defects, taking particular care to closely track the 'Top 3' priority defects.

(4) DWEO and the WSB/WMC team are required to provide CA with information on equipment defects and degradations that affect the ship's ability to fight. They should ensure ETBOLs are provided along with alternative modes of operation. DWEO should also monitor the WSB/WMC Incident Board with the aim of highlighting to CA and DCO any DC incidents which threaten WE equipment. Essential service losses should be reported to both CA and the ME 'L' Desk.

(5) Maintainers are to conduct thorough and effective Smart Blanket Searches, reporting defects and degradations to the WSB/WMC promptly, giving information on the nature of the problem, the ETBOL and reversionary modes available in 5-Point brief format.

3. Task C

MONITOR DAMAGE TO THE HULL, PROPULSION AND ANCILLARY SYSTEMS TO DETERMINE THE EFFECT ON THE SHIP'S ABILITY TO FIGHT AND SURVIVE. TO BE AWARE OF ALTERNATIVE MODES OF SHIP CONTROL AVAILABLE. CA IS TO BRIEF THE COMMAND ON ALL SIGNIFICANT CHANGES THAT MAY AFFECT THE OPERATIONAL CAPABILITY OF THE SHIP.

a. **Before Damage.** The CA should develop a good knowledge of the ship, its propulsion systems and the production of all essential services. He should know the physical layout of all machinery rooms and be aware of the location of important machines, particularly the height of critical equipment above bilges. This requires application and can be helped by a consolidation period with the MEO soon after joining.

b. **After Damage:**

(1) CA should expect the following reports from IBC:

(a) Propulsion and manoeuvring losses and limitations with ETBOLs.

(b) Essential service losses with ETBOLs.

(c) Alternatives available.

(d) DC incidents that will affect the Command Aim.

(e) Requests for additional manpower to deal with incidents as necessary.

(2) CA should pass IBC the following: Priority WE defects and highlighting the need for ME or DC/FF support.

(3) And agree:

(a) The 'Command Top 3' priorities across all BDR disciplines.

(b) The priorities for electrical/service restorations.

(c) The priorities for DC Incidents.

(d) The priorities for Propulsion/Manoeuvring restorations.

c. A lot of information needs to be passed from CA to IBC and vice versa (push-pull). It is essential that an effective reporting procedure is agreed which concentrates on getting information across both accurately and concisely. The more aware they are of each other's environments the better.

d. The timeline for the exchange of information will be dependent upon the scale of damage sustained and the underlying scenario, however, a typical timeline for IBC and CA briefings is:

TIME	ACTION
As Required	CA passes Flash reports to Ops Room/CO on key WE losses.
Z + (2-3)	IBC uploads key propulsion losses, major fires, major floods, and an assessment of stability to CA.
Z + (3-4)	CA briefs CO (Big Picture)/CO reviews situation and sets priorities.
Z + (5-7)	CA updates IBC on Command intentions and downloads key elements of WE picture, taking care to highlight supply and service losses affecting priority defects. IBC updates CA on platform picture. Agree overall priorities as required.
Z + (7-10)	HQ1 Command Huddle (2-3 mins). CA briefs CO as necessary.
O/C	IBC updates CA. O/C CA briefs CO as necessary.
Z + 15	Full and comprehensive Command Brief to CO.

e. The cycle of updates and huddles will be dictated by the extent of the damage, the developing situation and the battle rhythm. The above timings will clearly vary depending on circumstance. However, the Command Huddle in HQ1 should act as a trigger for updates to Command. A pipe should be made when the Command Huddle in HQ1 is called (backed up across telling lines). CA will then know that, in 3 min, he will be called by IBC and from that they can produce a full Command brief.

4. Task D

RAPIDLY ASSESS THE EXTENT OF DAMAGE FOLLOWING ATTACK. ENSURE OPERATORS CARRY OUT MINI-SOCS WHILST OTHER PERSONNEL COMPLETE BLANKET SEARCHES AND, WHEN THE TACTICAL SITUATION ALLOWS, HE SHOULD COORDINATE THE RELEASE OF EQUIPMENT FOR ROUTINE MAINTENANCE.

a. Although the conduct of Mini-SOCs is the responsibility of the Warfare Department, this is another area where WE teamwork is paramount. Firstly, there are no formal checks laid down for Mini-SOCs, therefore maintainers should assist operators to produce check lists. They should ensure that the checks are concise and operate on the top down principle. DWEO and Defect Managers should assist Warfare Senior Rates in the production of suitable reporting chits.

b. Teamwork is also the key to effective Blanket Searching. A routine should be set up and practised well before it is needed in anger. Maintainers must know exactly what areas to search (Blanket Search Route Cards) and what indicators to check in each area. Reports to the WSB/WMC should be concise and prompt and iaw the 5-Point Brief format.

5. Task E

IT IS THE CA'S TASK TO MONITOR THE IDENTITY, NUMBER AND LOCATION OF CASUALTIES AND TO REQUEST RELEASE OF PERSONNEL TO DEAL WITH DAMAGE CONTROL, FIREFIGHTING AND EQUIPMENT REPAIR. HE IS TO ENSURE COMMAND PRIORITIES ARE BEING COMPLIED WITH AND THAT THE COMMAND IS FULLY INFORMED OF ALL SIGNIFICANT PERSONNEL MATTERS.

a. With regard to casualties, a formal reporting system using chits should be established (T format) so that the Command can be advised through CA of the name, extent of injury, and disposition of each casualty; casualty names should not be passed over incident reporting lines or main broadcast, nor should they be recorded on stateboards. Obviously, if anyone is aware of significant casualties they can be reported to CA by parallel means.

b. IBC may request extra manpower to deal with DC incidents. CA is to coordinate release of personnel from the Ops Room to assist, taking account of the tactical situation and severity of ship damage. For example, if the Sub surface threat warning were 'White' UWW ratings could be released to assist firefighters. Or indeed if the Sub Surface threat was 'Red' and the Sonar Instrument Space was flooding it may be reasonable to release UWW personnel to contain the flood and prevent the loss of Sonar. However, it is a fundamental requirement that the release of manpower is controlled, and that they can be returned to their posts easily. Within the Ops Room it is usual to delegate the control of manpower to the ORS.

6. Task F

LIAISE WITH THE XO

a. He is to maintain an effective liaison with the XO/EWO with particular attention to the following:

(1) Casualties

(2) Domestic matters such as Action Messing/snacks, the opening of heads etc.

(3) Explosives and explosive hazards.

(4) Ship's signature.

(5) Overall Command Priorities, particularly where XO and EWO can add direct focus and leadership to the defect rectification effort.

b. It is worth underlining the important part XO and EWO play as Command Rovers. XO and EWO can give CA valuable information on the severity of damage, and the implications to the ship, as well as ensuring that incidents are being afforded the right priority. The deployment of XO and EWO should not be limited to only DC/FF incidents; CA should deploy them where necessary to focus effort in accordance with the overall Command Priorities.

7. Task G

TO CARRY OUT THE DUTIES OF COMMAND CBRN ADVISOR.

DWEO is usually the CBRN Protection Officer and is assisted by a suitably qualified Senior Rate. They must ensure that CA is given accurate and timely information so that he can assess the situation and advise the Command accordingly.

8. Task H

TO LEAD STATE 3 BRIDGE/OPS ROOM COMMAND HUDDLES.

ROLE	BRIEF
WEO	Command Aim Yes/No. If No, why not and what we can do.
WEO	Speed Steering Stability, Top 3.
WEO	Incident Brief.
IBO/CAA	Any updates heard over IBO net.
Navs/PWO	Situation/Navigation/Tactical Update.
OPS	Update on external actions and reporting.
XO/ Command Rover	Update from SOI.
CO	Info Required and confirm Top 3.
WEO	Confirm Top 3, Command Aim, Yes/No, End huddle.

ANNEX 28G

WEAPON SECTION BASE/WEAPON MANAGEMENT CENTRE STATE 1 PREPARATIONS

		YES/NO √	NOTES
1	Check Communications: WSB - Ops Room, Outstations/WRTs, HQ1/'L' Line DWEO - WEO. **Type 45 Only:** WMC - Weapon Repair line, WE Sensors line, WE Weapons line, WE Management, Outstations PABX (A) & (F) & (VUU).		
2	Muster spare software (held in safe); ensure software is laid out to enable quick location and distribution.		
3	Muster spare equipment keys; ensure keys are laid out to enable quick location and distribution.		
4	Muster spare SHIPHAZ keys; ensure keys are laid out to enable quick location and distribution.		
5	Check emergency lighting operational.		
6	Check/Update State Boards: Manpower Control. Ammunition Holdings (obtain from outstations). Equipment Command Priorities. Air Weapon Park (obtain from outstations). Battle Rhythm Timelines. Command Huddle Aide Memoire.		
7	Check Defect Log held and up to date following SOCs.		
8	Ensure command Aim is recorded and legible to all WSB/WMC personnel (T45 - displayed on PMS).		
9	Conduct time check and update WSB/WMC clock. (T45 - Synchronise CAA/WMC/AWMC/WRTs watches to Weapon Management software system time).		
10	DWEO to conduct threat brief to WSB/WMC personnel.		
11	Ensure sufficient EEBD equipment located and adequately secured in the WSB/WMC.		
12	Check the IBO has Hangar weapons park recorded positions of: Guardrails that are struck (WO Weapons in T45). Hangar door position. Helo position. Weapons fitted to helicopter. Ammunition holdings.		

WEAPON SECTION BASE/WEAPON MANAGEMENT CENTRE STATE 1 PREPARATIONS (Cont'd)

		YES/NO √	NOTES
13	DMs to Quality Control outstations State 1 preps utilising WE State 1 check cards.		
14	Check WSB/WMC documentation is available: WSB/WMC Bible. CWI Pack. Duplicate State 1 Cards Duplicate BS cards. Duplicate Mag State1 Cards. JSP 862. JSP 862 Addendum.		
15	Initiate manpower control and check Manpower Control Board is correct.		
16	Ensure Preps for Firing is completed and in date, record earliest expiry time/weapon (Certificate in Ops Room).		
17	Ensure a WSB/WMC relocation plan is in place and all personnel are aware of it. The following items are required to be taken when relocating; WSB/WMC Bible (if spare not held in AWSB/AWMC). CWI Pack (if spare not held in AWSB/AWMC). JSP 862. JSP 862 Addendum. Railex Cards. Laminated State Boards. EEBDs. Relocation Rucksacks. Spare software. Spare SHIPHAZ keys. Spare Equipment keys.		