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Boat Safety Scheme

Technical manual

Part 1
ADMINISTRATION & ORGANISATION

ADMINISTRATION & ORGANISATION

Part 1 of this manual covers :

- an introduction to the Boat Safety Scheme and its Scope
- the Examiner Training Course
- administration of the Boat Safety Scheme
- the conduct of the Boat Safety Scheme Examination

INTRODUCTION TO THE BOAT SAFETY SCHEME

The Boat Safety Scheme (BSS) is a joint initiative launched by British Waterways (BW) and the Environment Agency (EA) in the interests of public safety for people using and visiting their waterways.

There are an estimated 120,000 boats on the navigable waterways of which 56,000 come under the jurisdiction of either BW or the EA.

The Boat Safety Scheme has been developed to make boat owners, boat builders, boat repairers and others in the inland waterway marine market aware that there are certain fundamental safety rules that apply.

These rules are published in the BSS Guide which is available to all boat owners, members of the boating industry and other interested parties. A charge may be made.

The Scheme does not apply to boats based on the coast, although the technical principles are equally valid for these boats.

RELEVANT LEGISLATION

Implementation The BSS Standards are implemented by Byelaw or Statute, including:

- British Waterways - British Waterways Act 1995
- Environment Agency - The Thames Navigation Licensing and General Byelaws 1993

Licensing arrangements

Boats used on waterways under the control of a navigation authority need to be licensed and/or registered. Many navigation authorities have adopted the Boat Safety Scheme.

In order to renew a licence or licence for the first time, the boat owner will normally need to provide a Boat Safety Scheme Certificate (BSSC). As navigation authorities are implementing the Scheme progressively, boat owners should contact their navigation authority for the up to date information.

It is a condition of issue of a licence and/or registration that the boat is maintained to the BSS Standards in between examinations.

Dangerous boats

Navigation authorities may have measures in place to assess the condition of craft using or visiting their waters and where they believe there is an immediate risk to public safety, may take urgent enforcement action under their primary legislation or Byelaws.

This condition could be caused by:

- leaking fuel or gas with an immediate risk of fire or explosion
- taking in water with a danger of capsize or sinking
- fuel, oils, or chemicals leaking into the waterway

Waterway community

Waterway users, towpath users or trade are encouraged to report boats in a dangerous condition to the relevant navigation authority. All information received via the Boat Safety Scheme office will be forwarded to the relevant navigation authority by the quickest means available.

SCOPE OF THE BOAT SAFETY SCHEME

The Boat Safety Scheme applies to

- all powered vessels
- all vessels let out for hire or reward (except those stated in Standard 10.8)
- all vessels carrying fuel or fitted with cooking, heating, refrigerating, or lighting appliances, whether powered or not.

A BSSC is not required for any privately owned open vessel which does not carry nor is fitted with cooking, heating, refrigerating, or lighting appliances, and is propelled solely by an outboard engine installation - provided that the engine installation complies with Parts 3 and 4 in respect of electrical installations and Part 5 in respect of internal combustion engines.

NOTE: Fire extinguishers are considered to be an essential safety item in any vessel which carries fuel. It is strongly recommended that boats not requiring a Boat Safety Certificate under Standard 1.3 should carry a fire extinguisher(s) in accordance with Standard 6.1

Open vessels

An open vessel is a vessel in which all the accommodation is completely open to the elements.
A vessel which has any form of enclosed accommodation or which is decked over for the greater part of the hull is NOT regarded as an open vessel for the purposes of the requirement for BSSC.

Outboard-engined boats with cabins

An outboard engined boat with a cabin closed to the elements requires a BSSC.

Existing boats

For the purpose of the Boat Safety Scheme Standards an existing boat is any boat manufactured prior to 16 June 1998 that does not carry a CE mark.

Boats with navigation lights

Any boat fitted with navigation lights requires a BSSC whether powered or not.

Canoes, kayaks and dinghies

The Boat Safety Scheme does not apply to canoes, kayaks and dinghies which carry self-contained portable camping appliances as they are not "fitted with" appliances as defined in the Scope of the Scheme, Standard 1.1. Owners of such boats will be advised of the risks of carrying self contained fuelled appliances.

Vessels which do not require a certificate

Examiners are not involved in the licensing arrangements for vessels which do not require a BSSC as specified in these Standards.

Owners of such vessels will apply directly to the navigation authority for a licence under existing arrangements and they do not require any certification of any kind from an Examiner.

Boats with Dept of Transport Certificates

A number of boats on inland waterways are used as trip boats or for carrying passengers. The Maritime and Coastguard Agency which has authority over these boats requires that boats which carry more than 12 people (excluding crew) must have obtained a Passenger Certificate for a Class V Vessel.

As far as these boats are concerned, where there is in force a valid Passenger Certificate issued under the Merchant Shipping Regulations, the boat shall not be required to comply with the Boat Safety Scheme Standards where the Regulations specify different requirements.

Boats with other official certificates

There are a number of other official certificates that are, at present, acceptable to BW and EA.

Since 16 June 1998 all craft placed on to the market, or put into service for the first time, have had to comply with the European Recreational Craft Directive (RCD) through the Recreational Craft Regulations 1996.

'CE' marked boats, covered by the RCD, having a Declaration of Conformity may use the Declaration in lieu of a BSC for the first 4 years from the point of sale. Part completed boats may use the Partial Declaration issued by the hull constructor for a period of 1 year.

The required details of the Declaration of Conformity are proscribed in Annex XV of the RCD or for part completed boats, in Annex III.

In addition there are certificates issued under the Maritime and Coastguard Agency (MCA) Codes of Practice 'The Safety of Small Commercial Sailing Vessels' and 'The Safety of Small Commercial Motor Vessels'.

These certificates cover small charter service craft, carrying 12 or less passengers. The certificate must be issued by one of the MCA's authorised Certifying Authorities in order to be acceptable.

Boats in passage on certain waterways

A valid BSSC may not be required to accompany applications for licences or certificates with a validity of up to 28 days which permit the passage of the vessel on certain waterways.

These boats may be checked against any criteria used by participating navigation authorities to identify dangerous boats.

Commercial Vessels

All commercial vessels on cruising and remainder waterways shall comply with the BSS Standards Parts 1 - 9 inclusive. It is recommended that requirements set out in Part 10 be adopted wherever practical.

Navigation authorities maintenance craft

Navigation authority maintenance craft must comply with the BSS Standards except:

- where it is not practicable to provide a second means of escape (Standard 6.7 refers), cooking, heating or fuel burning appliances shall be situated at the end of the cabin furthest from the exit;

- that the provision of guard-rails around the perimeter of the deck (Standard 10.2 refers) may not be required due to the nature of the work undertaken by such vessels.

BOAT SAFETY SCHEME CERTIFICATES (BSSC) - AUTHORITY TO ISSUE

Independent surveyors & examiners

Boat Safety Scheme Certificates will be issued by **independent** professional marine surveyors or by **independent** examiners participating in the Boat Safety Scheme and whose name appears on the current "Marine surveyor/examiner listing".

For the purpose of this manual, authorised marine surveyors and examiners are referred to as "examiners" except where the context requires a distinction to be made.

Professional marine surveyors

The minimum criteria for BSS registration are:

- have no interest in the ownership or management of the boat being examined;
- continued membership of a professional institution as detailed in the BSS Information Pack;
- valid professional indemnity (PI) insurance;
- successful completion of the BSS Examiner Training Course and any subsequent continuation/refresher courses;
- continued annual registration to the BSS;
- compliance with the BSS Code of Conduct.

BSS Examiners

The minimum criteria for BSS registration are:

- have no interest in the ownership or management of the boat being examined;
- successful completion of the BSS Examiner Training Course;
- have passed the final Independent course assessment;
- have attended any subsequent continuation/refresher courses;
- valid professional indemnity (PI) insurance;
- continued annual registration to the BSS;
- compliance with the BSS Code of Conduct.

Applications for registration

Potential examiners who satisfy the requirements detailed above may apply to the Manager of the BSS for registration.

Marine surveyor/examiner listing

Once approval has been given and the registration procedure has been completed, the names of successful applicants will be published in the "Marine surveyor/examiner listing".

The list is revised from time to time and is available from navigation authorities Customer Services.

THE EXAMINER TRAINING COURSE

The Boat Safety Scheme has developed a training course for potential Examiners and has approved a training organisations to deliver the courses and carry out the necessary assessments of competence.

On satisfactory completion of the training course, which includes a final independent assessment, it will be the responsibility of the individual student to apply to the Manager of the Boat Safety Scheme for formal registration.

The training course is intended to familiarise students with the technical content and interpretation of the Boat Safety Scheme Standards, so that when they have successfully completed the course they will have sufficient knowledge and the competence to examine any inland waterways boat subject to the BSS Standards and assess its compliance.

Course content

The training course comprises 5 modules:

- General (Administration & Organisation; role of BSS examiners; conduct of BSS examinations and documentation)
- Engines and fuel systems
- Electrical Installations
- LPG Installation and Appliances
- Fire Prevention, Pollution, Hire Boats

Modular assessments

During the course, each module will be assessed under arrangements to be decided by the training provider.

Students are permitted 3 attempts at any assessment where they have not reached the required standard.

Anyone who fails at the third attempt will be required to repeat the course for the module in question, or they may withdraw from the training programme.

Final assessment

On successful completion of the training course, students will need to pass a final independent course assessment under arrangements to be decided by and agreed with the training provider.

The Final Assessment includes both Practical and Written Assessments which may be supplemented by oral or further written questions as determined by the Assessor.

During the practical phase candidates will be required to undertake a complete examination of at least one boat presented to them by the Assessor, under arrangements decided by the Assessor.

The results of these assessments will be notified to the BSS Manager by training providers and assessors.

Students who do not reach the required standard are permitted 3 attempts at the final assessment under these arrangements made directly between the assessor and the candidate. The Assessor may charge an additional assessment fee for the second and third attempts.

Anyone who fails at the third attempt will be required to repeat the whole of the training course, or they may withdraw from the training programme.

Registration of successful students

Students who achieve the required standard may apply to the BSS Manager for formal registration.

Applications will be processed within 2 working days of BSS receiving all documentation from the applicant, the training provider, and the final assessor, including the results of all modular and final assessments.

Unless there are exceptional circumstances, it is expected that a successful student will register with the BSS shortly after completing the training. Failure to do so may compromise their application for registration.

On-going quality assurance

Quality assurance assessments will be arranged from time to time and may be without notice.

Examiners must also attend any continuation or refresher trainers courses which will be arranged from time to time. Adequate notice will be given and any costs will be kept to a minimum.

ADMINISTRATION OF THE BOAT SAFETY SCHEME

British Waterways and the Environment Agency are responsible for the Boat Safety Scheme initiative and are therefore responsible for the policy, direction, and the technical content of the scheme.

They have appointed a Manager to undertake the day-to-day management and administration of the Scheme.

The Manager's main areas of responsibility are set out below - not in order of priority .

Liaison & co-ordination
- User Groups - Standards & Boat Safety Scheme;
- Surveyor/Examiner groups
- Trade bodies
- Other Marine Safety Organisations - safety issues;
- Navigation authorities - technical issues & causes of failure.

Boat Safety Scheme
- Marketing and Promotion;
- Maintaining register of examiners;
- Quality control of examiners;
- Provision and maintenance of documentation;
- Complaints procedure.

Examiner Training Scheme
- Appointment of training providers;
- Liaison with training providers;
- Quality control of training providers;
- Monitoring student progress.

MANAGEMENT OF THE BOAT SAFETY SCHEME

The management structure consists of 3 main committees:

- Boat Safety Scheme Management Committee (BSSMC);
- Boat Safety Scheme Advisory Committee (BSSAC);
- Boat Safety Scheme Technical Committee (BSSTC).

Boat Safety Scheme Management Committee
The Boat Safety Scheme Management Committee is the joint committee between British Waterways and Environment Agency as owners of the Scheme under the Terms of a Memorandum of Understanding signed by both Chief Executives.

Boat Safety Scheme Advisory Committee
A group of user, surveyor/examiner and trade representatives who advise the Management Committee on all matters relating to the operation of the Boat Safety Scheme .

Boat Safety Scheme Technical Committee
A small team through which all technical matters including proposals to modify, change or add new standards are considered.

The Boat Safety Scheme & the navigation authorities
The owners of the Boat Safety Scheme are British Waterways and the Environment Agency. Other navigation authorities promoting their participation in the Boat Safety Scheme include:

- Basingstoke Canal Company;
- Broads Authority (From 2005);
- Cam Conservators;
- Lower Avon Navigation Trust;
- Manchester Ship Canal Company;
- River Wey (National Trust);
- Upper Avon Navigation Trust.

Boat Safety Scheme Certificates are being issued to boats that navigate other waters, including coastal waters, and this is to be encouraged and promoted. The Boat Safety Scheme addresses safety and it is therefore in the boat owner's interest to comply.

The navigation authorities continue to discharge their duties and responsibilities in connection with the waterways under their control and the possession of a BSSC does not place any vessel outside their jurisdiction.

THE BOAT SAFETY SCHEME EXAMINATION

Once the examiner has been formally registered, and his/her name is published and made available on the list of those participating in the Boat Safety Scheme, it is the responsibility of the individual examiner to market their services and secure commissions from individual boat owners to examine their boats.

The first contact will therefore be from the owner or the owner's representative who wishes to have his/her boat examined.

Customer care

Examiners must ensure that they exercise the utmost care and sensitivity in all their dealings with boat owners.

The Boat Safety Scheme was developed in co-operation with boat-user representatives and is supported by responsible boat owners, and it is essential that the examination reflects this partnership.

Owners - even those who feel certain that their vessels meet the requirements in every respect - may approach the examination with some apprehension and examiners need to recognise this.

The basic objective is to confirm that the vessel does meet the requirements and the examiner and the owner, acting together, will identify any items where the standards are not met so that remedial action can be taken.

Boat Safety Scheme responsibilities

The Boat Safety Scheme has no responsibility to either the boat owner or to examiners for anything that is done before, during, or after the BSS Examination.

In addition, the Boat Safety Scheme has no responsibilities of any kind in connection with the place where the examination is carried out.

It will be the responsibility of boat owners to make arrangements for the examination of their boats directly with an examiner of their choice from the "Marine surveyor/examiner listing".

Health & Safety

The Boat Safety Scheme has no responsibility for any matters concerning Health & Safety associated with the examination of the boat.

Examiners are personally responsible for all matters concerning their health and safety and for ensuring that they comply with all the relevant requirements of Health & Safety legislation.

The boat owner must take due care to present the boat for examination in a condition which does not place the examiner at risk.

CONDUCT DURING THE EXAMINATION

During the examination it is essential that examiners adopt a professional approach. This includes arriving properly prepared and equipped to undertake the examination and complete the necessary documentation.

All reference documents (Technical Manual, BSS Guide, Examination Checking Procedures) should be to hand and examiners must not hesitate to consult them when necessary.

This is particularly important in achieving the objective of giving value-for-money - the examination needs to be conducted in the shortest possible time necessary to complete all the checks in a conscientious manner.

Examiners also need to approach each examination with resolve and determination. Some physical effort or even discomfort may be required to achieve some of the checks. There is also a strong possibility that they will get their hands dirty and overalls are almost certainly necessary.

If the owner or the owner's representative is present it is very important that they are kept informed - in a constructive and sympathetic manner - of any faults found during the course of the examination.

Technical advice - examiners

It is essential that examiners offer technical advice only on those issues which are within their competence, especially as there are many instances where a fault condition will have been identified but the precise cause of the fault will not.

They can, and should, explain why they have recorded a fault but they should not as part of the BSS Examination give advice on what needs to be done to put things right. If invited to do so they must make it absolutely clear that any advice of this kind is outside the scope of the examination and is, in effect, the subject of a separate agreement or contract (see below).

Technical advice - surveyors

Surveyors should conduct the examination according to their normal terms of business but they should also make it clear that any technical advice given is outside the scope of the examination.

Examination kit

Examiners are responsible for assembling their own examination kits to include all the necessary test equipment, examination aids, and any equipment and materials for those checks which require comparison with samples of known construction and value (see Appendix A).

PRE-EXAMINATION PROCEDURE

Agree with owner:

- date for examination;
- cost and method of payment;
- cost and arrangements for any re-examination if required;
- steps to be taken to prepare boat for examination;
- it is the owner's responsibility to ensure that the boat is in a condition which does not place the examiner at risk;
- the need for the owner to secure any necessary permissions for the examiner to enter the place where the examination is to be carried out and to carry out the examination.

Obtain the following information :

- name, address, telephone number (day/evening);
- name and type of boat;
- whether the boat is a hire boat or a place of residence
- index number or registration number (if any);
- place for examination;
- type of engine installed;
- type of fuel;
- presence of LPG installation;
- presence of consumer electrical services.

Confirm that:

- any manufacturer's documentation, statements or certificates which the owner wishes to use to demonstrate compliance where it cannot be determined by the checking procedures prescribed will be available for examination;
- water, gas, and electrical systems will be in working order;
- anything which the examiner needs to see that requires the removal with tools of any panel, hatches or structure, or that is normally kept in locked lockers, boxes, or compartments, is exposed for examination;
- for electric boats - the charging lead is available for examination;
- for steam powered engines - the inspection certificate and current insurance policy or certificate are available for examination.

LPG fuelled engines

Examiners invited to examine vessels with LPG fuelled internal combustion engines (other than portable generators) are to inform the owner that special arrangements are made for the examination of these vessels and the owner must contact the Manager of the Boat Safety Scheme for details.

These arrangements include the complete Boat Safety Scheme examination and examiners must not enter into any contract to carry out a part- or incomplete examination.

Permissions

Neither the BSS or the navigation authorities have any powers to insist that site owners permit examiners to enter their premises to carry out examinations.

It is the boat owner's responsibility to secure the necessary permission and the examiner should make certain that this has been done as detailed above.

Boat details not available

The examiner cannot issue a BSSC unless there is either a boat name or number. If for any reason full details are not available (or cannot be checked because the boat has not previously been registered or licensed), the information given by the owner should be recorded as appropriate. If no number is available the space should be left blank.

The BSS will take any necessary action on receipt of the documentation.

Preparation of boat

Owners are responsible for preparing their boats for the examination and it is in their interests to do this as diligently as possible so as to reduce the amount of time the examination takes.

Owners will have to remove whatever is necessary for the examiner to see what they have to see and this should be made clear to them during pre-examination discussions.

Owners can obtain guidance from the BSS Guide and also in the Checking section for each fault in the Technical Manual.

Examiners can enter into separate arrangements to prepare the boat for the owner but it should be made absolutely clear that this is outside the scope of the examination.

Pre-examination preparation and repairs or modifications

It is possible for examiners to contract with the owner to:

- prepare the boat for the Boat Safety Scheme examination;
- secure the boat at the end of the examination;
- carry out any work required to be done if the boat does not pass.

Such arrangements are always to be the subject of separate contracts or agreements and are never to be included as part of the contract between the owner and the examiner to carry out a Boat Safety Scheme examination.

Examiners must confirm all the agreements in writing to the owner as deemed necessary. This is necessary so that there is no doubt that anything done before or after the actual examination is in no way connected with the examination or the Boat Safety Scheme.

THE DAY OF THE EXAMINATION

The examiner must identify himself, if necessary, to the owner by producing his Identity Card for the owner's inspection.

Confirm that the boat has been prepared for the examination and the boat owner has determined that it is in a condition which does not place the examiner at risk.

Boat in dangerous condition before examination

If upon arrival at the place for the examination it is apparent the boat is in a dangerous condition as described above in the section "Relevant Legislation" (see page 1) the examiner should not proceed with the examination.

Examiner actions

Where it is evident that the vessel is in a dangerous condition before the start of the examination the examiner must take the following actions:

- explain the gravity of the situation to the owner or owner's representative, and state that the vessel constitutes an immediate danger to persons or property;
- where the boat is located at any mooring, marina, or basin operated by a third party, notify the person responsible for those moorings of the situation, and the action taken, by the quickest means available;
- notify the Manager of the Boat Safety Scheme by the quickest means available;
- if the person responsible for the moorings OR the Manager of the Boat Safety Scheme could not be contacted, then contact the relevant navigation authority by the quickest means available. If necessary by using emergency contact telephone numbers.

CARRYING OUT THE EXAMINATION

Having satisfied himself that the boat is not in a dangerous condition, the examiner will proceed with the examination.

Dangerous situations identified during the examination

During the examination the examiner may record a fault which indicates that the fuel, gas or electrical system <u>cannot be used without constituting a danger</u> to persons or property.

This condition could be caused by:

- leaking fuel as determined following a visual or manual examination of the vessel's fuel hoses, pipes, pipework connections, fuel tanks or fuel system components;
- leaking gas as determined by the LPG soundness test;
- continuous smoke spillage at the time the flue spillage test is conducted on existing open-flued appliances;
- heat damaged cables as determined by a visual examination of cables and cable connections.

Examiner actions – dangerous situations

Examiners should take the action described above in the section "Boat in dangerous condition before examination".

In the case of leaking gas or serious flue defects, they should take the action described in Part 7 of this manual.

Boat Safety Scheme action

On being notified by an examiner that a dangerous situation exists, the Manager of the BSS, will decide what further action is necessary.

Navigation authority action

A navigation authority may act upon information received from BSS.

Risk situations identified during the examination

During the examination the examiner may record a fault which indicates that the item in question poses a risk and has the potential to become dangerous.

Examiner actions – risk situations

Examiners will need to use their judgement based on their knowledge and experience, taking into account the specific circumstances, to decide what further action, if any, to take.

For faults concerning the LPG installation and gas and fuel-burning appliances, further guidance is given in Parts 7 and 8 of these Standards.

GENERAL CONSIDERATIONS IN THE CONDUCT OF THE EXAMINATION

Check list

The BSS Check List is published as part of the BSS Guide. The list is presented in the same order as the Standards so that cross-references are easily made.
In carrying out the examination, examiners are free to adopt any order of checking that suits their method of working and it is not necessary for them to follow the published format.

If they wish to adopt their own system, they should produce their own working document in any form or media they choose.

Owner's documentation Where the Checking procedure permits it and the owner has produced documentation to support compliance with any part of a standard this must be recorded in the examiner's own records.

Owners should be advised that it is their responsibility to retain and keep safe any such documents if it is likely they will be required for any subsequent examination.

The documentation should be in any form which confirms the item in question is fit for the purpose intended and meets or exceeds the requirements of the BSS when installed in accordance with manufacturers instructions.

Technical advice for examiners Examiners requiring advice or assistance should contact the BSS by telephone, fax or email.. Outside normal working hours, the phones are connected to an answering machine.

Exemptions Where exemptions have been granted, it is important that the owner is aware of the need to bring the vessel up to the standard required whenever any repairs, replacements, and modifications are carried out to the item(s) in question.

DOCUMENTATION

Boat Safety Scheme Certificate Boat Safety Scheme Certificates are used in numerical sequence and completed in accordance with the Guidance Notes issued with each pad of certificates.

A copy of the Guidance Notes is at Appendix B.

Unexpired certificates A new certificate (following a full examination) can be issued at any time before the expiry of the previous certificate. If the owner or prospective owner wishes to obtain a full 4-year certificate then the BSS Examination may be held up to two months before the expiry of the previous certificate.

Partly-built boats Short term BSSC are not available for partly-built or unfinished boats at the present time. A full 4-year certificate is issued in these cases and surveyors /examiners should make a note in their own records of what they have seen.

No BSSC is to be issued to any part completed boat which is intended to be CE marked and boat builders must be advised to contact the relevant navigation authority when such boats are required to be put on the water for completion. A BSSC may be issued to a CE marked boat only when all work is completed and the CE mark is affixed.

Any alterations or modifications made to the boat after the date of issue of a BSSC may invalidate that certificate. It is the boat owner's responsibility to comply with the Boat Safety Scheme technical requirements at all times as a licensing condition.

Owners are therefore recommended to enter into an agreement with an examiner to examine the boat at appropriate intervals as the construction and fitting out proceeds.

As a BSSC cannot be endorsed to record the stage of completion it is not necessary for a new certificate to be issued but it is essential that the examiner in question updates their own records where appropriate.

If the vessel is not re-examined by the original examiner, a complete examination and a new BSSC will almost certainly be necessary.

Appliance Record

An Appliance Record must be issued with every BSSC. This record details results of the testing on the LPG system, appliances installed and ventilation assessments. The relevant copy of the Appliance Record is returned by the Examiner with the Monthly Return.

Status Reports

The Status Report forms a record that a complete examination has been held on each boat prior to the issue of a BSS Certificate and is a valuable tool in the BSS Quality Assurance system.

Status Reports:

- assist the navigation authorities in monitoring the failure criteria most frequently encountered;
- assist in the quality control procedures required to maintain a consistent standard of training and the application of the Standards by surveyors and examiners;

Status reports must carry an individual number taken from a range issued by the BSS Office when the pad of reports is dispatched to the Examiner. Status Reports are to be completed in accordance with the relevant Guidance Notes.

A copy of the Guidance Notes is included at Appendix B

The relevant copy of the Status Report is returned by the examiner to the BSS Office with the Monthly Return

Monthly Return

Each month, examiners are to complete a monthly return to the Manager, BSS and completed in accordance with the Guidance Notes issued.

A copy of the Guidance Notes is at Appendix B.

The purpose of this return is to :

- provide the navigation authorities with the names and details of those boats which have been issued with a BSSC and may, on application by the owner, be issued with a licence to use the waterways in question;

- provide a record of the serial number of the BSSC issued to each individual boat;

- act as source of information for issuing duplicate certificates should that become necessary;

- in the case of blank certificates, to minimise the risk of certificates going astray and fraudulent activity.

The embosser

The Personal Authentication Stamp (Embosser) is the property of the BSS and is issued to all examiners formally registered as participating in the Boat Safety Scheme.

It is unique to the individual and includes the examiner's personal identity number (PIN).

It should be kept in a safe place at all times separately from the certificates and the BSS Monthly Return and on no account must anyone other than the examiner to whom it is issued be allowed to use it.

Should the Embosser be lost or stolen, the examiner must notify the Manager, BSS immediately who will then cancel it and issue a replacement which will bear a different serial number.

The original serial number will be invalidated and certificates bearing that number and issued after the date and time of reporting its loss will not be accepted by the navigation authorities.

NOTE: The examiner remains responsible for all certificates issued up to the date and time of reporting the loss of BSSCs or the Embosser.

THE COMPLAINTS AND APPEALS PROCEDURE

Boat owners who have any complaints about the Scheme or think their boat should not have failed, should send all relevant details to the Manager, Boat Safety Scheme.

Action by Boat Safety Scheme Manager

The Manager, BSS will:

- acknowledge the complaint or appeal on receipt

- investigate the matter

- provide the boat owner with a full written response, upon completion of the investigation, usually within 21 working days

If a response is not possible within 21 days, the boat owner will be kept informed about progress.

Reference to Appeals Panel

If the boat owner is still not satisfied and is unable to obtain a licence because the boat has failed, the matter will be referred to the Boat Safety Scheme Appeals Panel. Its decision is final and binding on all parties.

Action pending adjudication

Where a case goes to appeal, normally no action will be taken until the Appeals Panel reaches a decision unless the boat is thought to pose a serious risk to people or property.

Complaints against surveyors & examiners

If there is a complaint against a professional marine surveyor or examiner participating in the Scheme, the Manager BSS will investigate the complaint in accordance with the relevant published procedure.:

Further details on complaints and appeals are available in the BSS Publication 'Complaints and Appeals'

APPENDIX A

Some suggestions for examiner kit

Documentation

- Examination Checking Procedures;
- Laminated Check List;
- BSS certificates
- BSS Status Reports;
- Embosser.

Personal effects

- wipes;
- gloves;
- overalls;
- footwear;
- first aid kit.

Examination aids

- torch;
- extending mirror;
- ruler/tape;
- callipers (external/internal).

Test equipment & specimen materials

- manometer (u-gauge);
- leak detection fluid;
- tools to open test point (e.g. screwdriver, spanners);
- smoke match holder.

- electric cables & terminations to specifications in manual (inc. solid conductor samples).
- hose samples to BS 3212 type 1 & 2;
- hose samples to BS EN ISO 7840;
- hose samples – armoured.
- flame arrester & gauze.

APPENDIX B

Notes for issuing Boat Safety Scheme Certificates (BSSC)

All sections of the BSSC must be completed. The information required to complete BSSC is largely self-explanatory however the following instructions are intended to add clarity.

Date of Examination

This is the date the examination took place and not necessarily the date the paperwork was completed.

Location of Examination

Briefly describe the location where the examination took place and indicate whether it was at a marina or boatyard, or private or towpath mooring.

Date of Expiry

In ordinary circumstances the date of expiry will be the day before the date of examination 4 years hence. For example, if a BSSC is issued on the 15/8/2002 the expiry date is 14/8/2006.

Boat owners are encouraged to renew BSSC on time by the provision of the facility for forward dating of certificates. In circumstances where a valid certificate is held *and* the boat passes the current examination, the start date of a renewal (though not a replacement) BSSC may be forward dated by up to two calendar months. For example, in circumstances where a current certificate expires on 15/9/02, and the date of a successful examination is 1/8/02, the expiry date on the renewal BSSC is 14/9/06 and *not* 31/7/06.

Boat Name

It is important to insert accurately the full boat name, inclusive of any numbers after the name. Recording the full name will help identify the craft examined to the navigation authorities. Craft on some waterways are registered by boat name and therefore it is essential to differentiate between, for example, KINGFISHER XXIII and KINGFISHER XXVI.

Index/Registration Number

Insert the British Waterways (BW) Craft Index Number; or in the case of boats registered by the Environment Agency (EA), the Registration Number. For River Thames based craft the Registration Number is found on the boat owner's Thames Registration Certificate or on the craft licence plate – take care not to insert the licence number.

In order to properly identify the boat the BSSC must record either the Boat Name, or the Index/Registration Number or the HIN. In circumstances where the craft cannot be properly identified a BSSC must not be issued until guidance is sought from the BSS office.

Year of Construction

Insert the year of construction date as provided by the owner or included on the HIN or builders plate, do not use approximations or guesses.

Length and Beam

Insert the length and beam of the craft as provided by the owner, do not use approximations or guesses.

HIN if applicable

In the event the craft is CE marked, insert the Hull Identification Number which is a unique code fixed to the hull.

Hull Material

Indicate the type of hull material, for example, steel, FRP, wood, aluminium.

Engine Make/Type

Insert the engine manufacturer or mariniser e.g. BMC, Yanmar etc, and add other useful information indicating type, e.g. model, 3-cyl, or outboard or outdrive.

Engine Fuel

Insert the type of propulsion fuel used. Select from the following:- Diesel / Petrol / Petroil / Electric / LPG / Steam / None

Number of Engines

Insert the number of propulsion engines.

Manufacturer's or Builder's Name

Insert the manufacturer's name as provided by the owner or indicated on the builder's plate.

Manufacturer's or Builder's Name for Fit Out if Different

Insert the manufacturer's name as provided by the owner or indicated on the builder's plate.

Previous BSS Certificate Number

Note the number of the last BSSC issued to this craft. Should this be the first certificate issued, insert N/A.

Latest Status Report Number

Insert the number of the latest Status Report issued. If the craft has not previously been examined by you this will be the one issued with the BSSC.

CE Marked

If the boat carries a CE mark tick the YES box: if not tick the NO box.

All Advisory Check List items complied with

If all advisory Check List items are complied with YES box if not, tick the NO box and list the Check List item numbers in the space provided.

Note, only those advisory Check List items as identified on the Status Reports by the initials (ad) should be listed. Exemptions and other Check List items not checked, need not be recorded.

BSS Warning Notice issued or current

If a BSS Warning Notice is issued or has been previously issued and remains applicable tick the YES box and list the appropriate Check List item numbers in the space provided. If not, tick the NO box.

Navigation Authority Code

This relates to the navigation authority with whom the boat is usually licensed. If the owner licences with two authorities regularly then note the authority the boat is normally moored on when not in use. If further Navigation Authority Codes are required, please contact the BSS office for allocation. The current Navigation Authority Codes are listed separately.

Examiner Name, Address, Phone Number

Write clearly your name address and phone number.

Distribution

Give the top two copies (the grey and the blue) of the BSSC to the customer. Keep the bottom (yellow) copy for your own records.

Signature of Examiner

Upon signing the BSSC you certify that at the date of examination the boat complied with the navigation authorities nominated mandatory safety requirements.

Date

This is the date the BSSC is signed and not necessarily the date of the examination.

Authentication Stamp

The completed BSSC must be validated it by using the Authentication Stamp (Embosser) in the marked area. The embosser is exclusive to each examiner and carries a personal identification number (PIN) and must not be used by anyone else.

Appliance Record

An Appliance Record must be completed and issued with each BSSC. The number of the BSSC must be inserted into the relevant box on the Appliance Record form. The middle copy of the Appliance Record must be sent to the BSS office along with the Monthly Return.

BSS Monthly Returns

Every BSSC issued must be entered on the BSS Monthly Return to record each certificate issued. At the end of each month a BSS Monthly Return must be returned to the BSS office.

Errors in completing Boat Safety Scheme Certificates

If you make a mistake in completing the BSSC you may correct it and use your embosser and initials to validate the correction. However, navigation authorities may reject an amended certificate and in this case you must invalidate it by clearly putting 2 parallel lines diagonally across the certificate and writing VOID in between the 2 lines. Void certificates must be retained and returned with the BSS Monthly Return.

Notes for completing the BSS Monthly Return

Monthly Returns

At the end of each month you must complete a BSS Monthly Return recording all Boat Safety Scheme Certificates (BSSC) and Status Reports issued during the month.

Monthly Returns are required because:

- they provide timely information that BSSC or Status Reports have been issued;
- BSSC are accountable items and the Monthly Return provides evidence of the regulation of their use;
- Information from the box sections of the Status Reports returned with the Monthly Returns is used to monitor the type of failures which boats are experiencing;
- the Status Reports returned with the Monthly Returns form an integral part of the BSS Examiner Quality Assurance monitoring.

Completing the BSS Monthly Return

Enter the month and year that the Monthly Return relates to, how many sheets are being returned (and which number page of those sheets if there is more than one being returned). Then note your name and PIN (Personal Identity Number, as marked on your embosser).

An entry for each BSSC or Status Report issued during the month must be listed on the table. Each page contains room for 12 entries. Most of the columns are self explanatory, but further guidance is offered for others.

Insert the Index/Reg no, HIN, and boat name as recorded on the BSSC or Status Report

For each BSSC entry, insert the BSS Certificate number and Navigation Authority Code as recorded on the BSSC.

For each Status Report entry, insert the Status Report number as recorded in the report no box on the Status Report.

For all entries insert the date of examination in the box provided. For BSSC and Status Reports this is the date the examination took place and not necessarily the date the paperwork was completed.

Complete the details in the declaration box by listing the range of numbers of the BSSC retained but unused and the range of unused dedicated Status Report control numbers.

Note the number of spoilt `void' certificates (if any) in the box and ensure that they are attached to the back of the BSS Monthly Return.

Sign the declaration and return the top (white) copy to the BSS General Manager.

Nil returns

If no examinations are done in any month then a `Nil' return must be done. Forms for this can be provided if you wish or any form of note from you is acceptable. Should you wish you may report a `Nil' return over the phone, fax or email. Should you fall more than 3 months behind on your returns, you may have your BSS authorisation suspended or withdrawn.

Notes for completing Status Reports

Status Reports are intended to provide a record for the owner, examiner and BSS office that a complete examination of the boat has taken place. Status Reports will also be analysed and the data collected may influence future policy initiatives.

A complete Status Report, comprising of status report forms a – d, must be issued at the time of the initial examination of any boat by an examiner. However, it is not necessary to complete a Status Report for any subsequent examination before the issue of a Boat Safety Scheme Certificate (BSSC) by the same examiner because the BSSC would provide evidence that mandatory faults had been addressed.

Examiners must not place reliance upon any Status Report issued by any other examiner

All sections of the Status Reports must be completed in accordance with the following instructions.

Boat name, Index number

It is important to properly identify the boat on the Status Report form a by recording either, the boat name or the Index Number. Note that for EA based craft the Registration Number must be recorded. Also note that in the absence of an index/registration number the HIN may be recorded. In circumstances where the craft cannot be properly identified a Status Report should not be issued and guidance must be sought from the BSS office.

The boat name must also be inserted on Status Report forms b-d in the appropriate box.

Hull material

Indicate the type of hull material, for example, steel, FRP, wood, aluminium.

Engine I/B, O/B

Insert I/B (inboard) or O/B (outboard) or O/D (outdrive) as appropriate to the propulsion engine. If there is more than one engine indicate ‘x2’ as appropriate.

Fuel type

Insert the type of propulsion fuel used. Select from the following:- Diesel / Petrol / Petroil / Electric / LPG / Steam / None

Examiner’s signature

Place your initials in the space provided on Status Report forms a-d..

Date of examination

This is the date the examination took place and not necessarily the date the paperwork was completed.

Examiner’s PIN

Insert your personal identification number (PIN) in the space provided.

Report no.

A batch of dedicated control numbers will be issued when pads of Status Reports are dispatched. The four forms make up the Status Report so the same number must be inserted on each of the report forms a – d in the box provided. Use the allocated numbers in sequence. If you make a mistake in completing any of the forms a - d simply cross through the mistake and ensure the correction is clear.

Completing the box sections

As the Status Reports are to be analysed it is critical that the boxes are marked with a clearly defined diagonal line from corner to corner of each box. Please take care not to mark the box sections in any other way.

The general rule is that **for each Check List item** the status of what was found at the time of the examination must be clearly represented by mark(s) recorded in the box(es). It is equally important to record what was not there at the time of the examination by way of a mark against the Check List item in the N/A column.

It may be that a complete section is not applicable, for example, Status Report ‘form a’ concerning Part 2 would not be applicable to a small cabin cruiser propelled by an outboard motor. In these circumstances a mark must be inserted in the box in the Part’s title line next to the text, **‘Inboard Engine installation not present’** and no other marks need be inserted on the form concerning Part 2.

Each column of boxes is representative of the status of **each** Check List item:

E (1st column). Mark the box in the E column if an exemption was applied. For example at Check List item 8.5.1 a mark would be made in the E column box where an existing hob did not have a FSD facility.

• (2nd column). Mark the box in the • column if the particular Check List item was not applicable. For example at Check List item 2.17.5, concerning petrol cocks on gravity feed installations, a mark would be made in the • column box where the boat was diesel fuelled.

 (3rd column) Mark the box in the column if the particular Check List item passes. Note that in the FSD example described above, in addition to the mark in the E column box a mark would also be made in the column box where an existing hob did not have a FSD facility.

 (4th column) Mark the box in the column if the particular Check List item fails.

Note that the Status Report forms also include other information aimed at informing the boat owners and reminding examiners. Check List items marked with an '*' indicate that an exemption is available. Check List items ending in (ad) indicate that the item is advisory for craft licensing purposes.

Check List items marked with a '+' indicate that for the purposes of completing the Status Reports, more than one Check List item is covered. For example at Check List item 2.3.2+ the precise deck connection label(s) missing cannot be identified from the Status Report and will need to be communicated to the boat owner by some other means.

BSS Warning Notice

Reference Status Report forms c & d, If a BSS Warning Notice was issued mark the YES box and list the Check List item numbers in the box provided. If not, mark the NO box.

Distribution

Give the middle copies to the customer, Keep the bottom copies for your own records and forward the top copies to the BSS office with your BSS Monthly Return.

BSS Monthly Returns

Details of every Status Report issued must be entered on the BSS Monthly Return.

Boat Safety Scheme
Willow Grange
Church Road
Watford WD17 4QA
Telephone 01923 201278
Facsimile 01923 201420
Email bss.office@britishwaterways.co.uk

Boat Safety Scheme
Technical manual

Part 2

Inboard Engines and Fuel Systems

PART 2
FUEL SYSTEMS

INTRODUCTION

The interval between the first edition of this section and this update has seen the publication of the following British European and International Standards:
BS EN ISO 10088 Small Craft - Permanently installed fuel systems and fixed fuel tanks,
BS EN ISO 15584 Small Craft - Inboard petrol engines – engine-mounted fuel and electrical components,
prEN ISO 16147 Small Craft - Inboard diesel engines – engine-mounted fuel and electrical components.

This edition reflects some changes to longstanding UK recommended practice and updates the text relating to the Standards.

The BSS Technical Manual is not intended to be a comprehensive guide to building or fitting out boats. Readers who are interested in these activities are invited to consult the latest version of the relevant internationally agreed standards.

IMPORTANT NOTE

At points in this section the text will be found to be at variance with the relevant BSS Standard. This reflects the desire to make available alternative compliance options offered by the International Standards, or other means of agreed equivalence, at the earliest opportunity. In general there is a discrepancy between a measurement or dimension quoted in the Standard and that quoted in the text or Checking Procedure. In all cases this later text supersedes the Standard text.

These variances can be found at: 2.2.1, 2.2.2, 2.4.3, 2.4.4, 2.6.5 (test pressure), 2.7.1. Other important changes relate to the use of tubular fuel sight gauges on diesel tanks, the extended use of flexible hose in fuel systems, and the use of hose clips and clamps in fuel systems.

In case of doubt readers can obtain clarification from the BSS Office.

HOSE SPECIFICATIONS

In some instances, the standards require hoses to be “suitable for use” without specifying a particular standard e.g. filling pipes and vent pipes.

It would be good practice to use a hose complying with an appropriate international standard and compliance can easily be determined by the presence of the appropriate marking e.g. BS EN ISO 7840 or DIN 4798

Where this is not done, suitability can be determined by the presence of marking indicating that the hose is suitable for the fuel in use, or a manufacturer's statement of suitability or compliance with an appropriate standard. In all cases, the physical condition of the hose must also be taken into account.

BS EN ISO 7840

Small craft. Fire resistant fuel hoses

This international standard specifies general requirements and physical tests for fire-resistant hoses for conveying petrol and diesel at low pressure.

Fire Resistance Hoses to this standard can withstand a fire test, during which the temperature one inch from the component reaches 648°C, for a period of 2½ minutes.

Marking Hoses to this standard are marked at least every 0.3 m with the name or trademark of the manufacturer or supplier, the last 2 figures of the year of manufacture and the hose specification i.e. “ISO 7840-A1” or “ISO 7840-A2”

Designation The letter "A" after the ISO number indicates a fire resistant fuel hose. The numbers "1" and "2" indicate the permeation rate (loss of fuel through the hose wall) where “1” denotes permeation up to 4 grams per square metre per hour (g/(m^2h) and “2” over 4 g/(m^2h) up to and including 12 g/(m^2h)

OTHER HOSE STANDARDS

BS ISO 15540 This is a marine fuel hose standard which incorporates a fire resistance of 30 minutes at 850 °C .

DIN 4798 DIN 4798 is a German standard for hose pipes used for EL (extra light) fuel oils and specifies the safety requirements, testing and marking of these hoses. Hoses to this standard are fire resistant to a temperature of between 625-825°C for a period of 5 minutes.

Hoses to this standard are marked with: manufacturer’s name or trade mark; nominal diameter; pressure class (A or B); year of manufacture (last 2 digits); DIN number; DIN test mark and applicable registration number.

BS MA 102 BS MA 102 was replaced by BS EN ISO 7840 which is currently identical in every respect and hoses marked with BS MA 102 are acceptable providing they are in good condition.

SAE J 1527 ISO 7840 was derived from SAE J 1527 and hoses marked SAE J 1527 are acceptable providing they are in good condition.

ARMOURED HOSES The presence of armouring or external braiding on flexible hoses, is no indication of their fire resisting qualities. If documentary evidence can be provided to support their use then this will be acceptable. However, it is not easy to verify the condition of the hose wall material with the braiding or armouring in place and any indications of damage will lead to rejection.

HOSE REPLACEMENTS BS EN ISO 7840 is the internationally accepted standard for fire resistant fuel hoses for small craft and when hoses are replaced on existing vessels the opportunity must be taken to use hoses to this standard as a minimum.

FLEXIBLE CONNECTIONS Flexible tubing or hose of a type specified in Standard 2.14 may be used for any part of the fuel system to accommodate relative movement or vibration where the boat owner or installer considers this necessary.

Worm-drive clamps

Where worm-drive clamps are used to secure flexible hoses it is recommended that they comply with BS 5315. They must be properly fitted i.e. ensuring that:

- the worm is always fully engaged with the rack
- there is no sign of damage or corrosion to the clamp
- the clamp is not over-tightened
- the exterior of the pipe at the point of application is not damaged in any way by the clamp
- the pipe is securely connected to the fitting and incapable of movement

Where flexible filling pipe is used for petrol tanks, double clamps are recommended.

Copper coils

Copper coils introduced into copper fuel feed lines to link the system to the engine are not flexible connections within the meaning of these Standards and there is no requirement for copper feed pipes to be installed with anti-vibration coils.

If a coil is to be fitted, it would be good practice to: install it in the vertical axis, and re-anneal the coil before installation

STANDARD 2.1 : FILLING PIPES

Filling pipes shall be taken to deck level or so arranged as to ensure that any fuel overflowing will not be discharged into any part of the vessel including the bilges.

FIG 2.1

OBJECTIVE

The objective of this standard is to avoid any accumulation of fuel inside a boat as a result of overfilling a fuel tank.

INSTALLATION & DESIGN

This objective, which is particularly pertinent when tanks are out of sight of the person carrying out the filling operation, can be achieved if the filler cap is positioned so that:

- the camber of the deck will cause any overflow to discharge overboard
- a coaming high enough to prevent spillages reaching the interior of the vessel is fitted
- a diverter arrangement is fitted around the cap

The position of the filling connection and the camber (slope) of the deck may be such that fuel overflowing can still be discharged into the vessel even though the filler pipe is taken to deck level, therefore installing the filler pipe to deck level is not, by itself, sufficient. Preventing overflowing fuel entering any part of the vessel takes precedence over the installation of the filling pipe to deck level.

Unseen Spillage

The design must ensure that there is no risk of unseen spillage during fuelling operations.

Historic narrowboats

For the purposes of this Standard a historic narrowboat is interpreted to be an original traditional working boat with its original fuel tanks and filling arrangements and where alteration would detract from its historical authenticity and interest.

For historic narrowboats it is acceptable for:

- the filling and vent pipes to terminate below deck level
- the filling point to be inside the engine room.

Owners need to be aware of the dangers of unseen spillage during re-fuelling and the need to comply with the other requirements of the Standards

Sailing craft

For the purpose of this standard a sailing craft with a filling point in a position where any overflow is directed overboard e.g. located in a self-draining cockpit will be acceptable.

Close coupled and auxiliary diesel tanks

A close-coupled or auxiliary diesel tank of up to 13.5 litres capacity need not be connected to a deck filler providing that no modifications have been made to the tank as supplied by the manufacturer and there is no risk of unseen spillage. It may be necessary to install a drip tray underneath small auxiliary tanks.

CHECKING If the vessel has a deck, or part-deck with fuel tank(s) installed below it, visually check that the filler pipe is taken to deck level.

Exceptions Identify:

- existing historic narrowboats
- existing diesel engined sea-going sailing craft
- close-coupled diesel tanks
- outboard powered open vessels with no accommodation with a continuous deck or sole which is fuel tight to the hull interior and bilge spaces, containing engines, electrical components and batteries (diesel or petrol)
- diesel fuel fillers on craft with self draining cockpits with a continuous deck or sole that is fuel tight to the hull interior, and bilge spaces, containing engines, electrical components and batteries

FAULT		
Filling Pipe	Not taken to deck level (advisory for private boats)	2.1.1

CHECKING Visually check that fuel overflowing from filling points will not enter any part of the vessel.

Exceptions Identify:

- existing historic narrowboats
- existing diesel engined sea-going sailing craft
- close-coupled diesel tanks
- outboard powered open vessels with no accommodation with a continuous deck or sole which is fuel tight to the hull interior and bilge spaces, containing engines, electrical components and batteries (diesel or petrol)
- diesel fuel fillers on craft with self draining cockpits with a continuous deck or sole that is fuel tight to the hull interior, and bilge spaces, containing engines, electrical components and batteries

FAULTS		
Filling Pipe	Not arranged to prevent fuel entering any part of vessel	2.1.2

STANDARD 2.2 : FUEL FILLING INSTALLATIONS
The filling pipe shall have an internal diameter of at least 38mm (1½"), and any flexible hose shall be of non-kinking material suitable for the fuel used, and must be connected with leak-proof joints between the top of the tank and a screwcap or plate forming the filling connection. Deck filling connections shall be outside the coaming. All flexible hoses shall be adequately supported and of minimum practicable length, with all joints or connections readily accessible. [see Exemption 11.1]

OBJECTIVE

The objective of this standard is to ensure that fuel can be safely loaded onto the boat without blowback and spillage and that the fuel filling system is free of leaks.

ACCESSIBILITY

It is good installation practice that all joints and connections are readily accessible. However, for the purposes of this standard, joints and connections which are accessible will be acceptable.

This means that they must be capable of being reached for inspection, removal or maintenance without the removal of permanent craft structure but it may be necessary to use tools or remove any items of portable equipment stowed in places intended for storage of portable equipment in order to gain access.

FILLING PIPE - Internal Diameter

The internal diameter of the fuel pipe shall be at least 31.5 mm throughout its length but any flexible sections must have an internal diameter of 38 mm.

The outside diameter of a 38mm internal diameter flexible pipe would be approximately 51mm.

If the pipe has a diameter less than this "blowback" of fuel can occur or the filling nozzle may not enter properly

The design of the fuel filler fitting may reduce the internal diameter of the pipe which is attached to it but must not reduce it below the required diameter.

CHECKING

Measure the internal diameter of the filling pipe (38.5mm for hose, 31.5mm for rigid) or if the internal diameter cannot be measured measure the external diameter and estimate whether the internal diameter meets the requirement.

FAULTS		
*Filling Pipe	Not of prescribed minimum internal diameter	2.2.1

EXEMPTION 11.1

Vessels manufactured prior to 16 June 1998 and having a fuel filling pipe of an internal diameter of at least 32mm (1¼") are not required to comply with that part of Standard 2.2 which requires that a fuel filling pipe shall have an internal diameter of at least 38mm (1½")

CHECKING

Measure the internal diameter of the filling pipe (minimum 31.5mm 1… in). If internal diameter cannot be measured make an estimate from the outside diameter.

FAULTS		
	*EXEMPTION APPLIED	2.2.2

NON-KINKING PIPES

It is important that the bore of the pipe cannot become restricted either by design or by accident.

A non-kinking pipe will prevent the walls of the pipe from collapsing and thus restricting the bore when it is necessary for the pipe to be bent at an angle or any object comes into accidental contact with the pipe

CHECKING

Visually check filling pipe, where accessible, for kinks, damage and deterioration, particularly at any bends or connections.

Check that the flexible filling pipe cannot be compressed by squeezing it by hand.

FAULTS		
Filling Pipe	Not of non-kinking material	2.2.3

FILLING PIPES - Suitability For Fuel

The material of the pipe must not be unduly permeable to the fuel used or react chemically with the fuel leading to deterioration and leaks.

In use, the material must be resistant to damage and deterioration resulting in corrosion, hardening, brittleness, shrinkage and cracking. Any localised or undue softening of flexible hoses may be a sign of an adverse reaction affecting the inner wall which has not yet reached the outer layers.

Flexible hose - marking

Hoses marked by the manufacturer as being suitable for fuel applications e.g. petrol, diesel, gasoline etc are acceptable.

Examples of suitable materials would be those conforming to the standards detailed in the introduction.

Unmarked flexible hoses

Hoses which are not marked but are supported by a declaration of suitability from the manufacturer, supplier or boat builder are acceptable. Examiners may also accept hose which they recognise as being compliant.

Fire resistance

It is not a requirement for material used for filler hoses to be fire resistant but this is strongly recommended.

CHECKING Visually check that flexible hoses are marked as suitable for the fuel used or their use is supported by an appropriate declaration.
Visually and manually check for any signs of :
- corrosion
- decay
- damage or deterioration
- leaks

Metal filling pipes must be examined carefully to ensure that the pipe and its connections shown no signs cracking or slackness etc caused by metal fatigue due to vibration.

FAULTS		
Filling Pipe	Not of material suitable for use with petrol	2.2.4
Filling Pipe	Not of material suitable for use with fuel oil	2.2.5

FILLING PIPE LEAK PROOF JOINTS

Connection to top of tank The filling pipe must be connected to the top of the tank with leak-proof joints.

Connection to a balance pipe A filling pipe may be connected to a balance pipe in diesel system provided that the balance pipe is fully compliant with the relevant requirements to fit isolation valves.
Where flexible hose is used in this configuration it must meet the fire resistance requirement for hoses permanently charged with fuel.

CHECKING Visually and manually check:

- connection of filling pipe to top of tank
- presence of leaking fuel at joints
- that the pipe is securely connected

FAULTS		
Filling Pipe	Not connected with leak proof joints to the top of the tank	2.2.6
Filling Pipe	Not connected with leak proof joints to the screwcap or plate	2.2.7

FILLING CONNECTION OUTSIDE COAMING

CHECKING Visually check deck filling connection is outside coaming

Exceptions:
- outboard powered open vessels with no accommodation with a continuous deck or sole which is fuel tight to the hull interior and bilge spaces, containing engines, electrical components and batteries (diesel or petrol)
- diesel fuel fillers on craft with self draining cockpits with a continuous deck or sole that is fuel tight to the hull interior, and bilge spaces, containing engines, electrical components and batteries

FAULTS		
Filling Pipe	Deck filling connection not outside coaming (advisory for private	2.2.8

	boats)	

FILLING PIPES Flexible hoses are to be adequately supported by means of pipe clips or similar fastenings.

- Support of flexible hose It is recommended that clips or fastenings are spaced at approximately 500mm intervals and they must be of the correct size for the pipe used

CHECKING Visually and manually check the pipe for any movement which would bring it into contact with anything likely to damage it.

FAULTS		
Filling Pipe	Not adequately supported	2.2.9

FILLING PIPES

Length of flexible hoses Flexible hoses are to be of minimum practicable length avoiding any unnecessary loops in which fuel can lie. However, the route taken by the flexible filling pipe is to take account of anything which may damage the pipe e.g. heat sources and the need for access to the connections.

Filling pipes All filling pipes must fall continuously to the tank so that fuel is not permanently retained in the pipe after fuelling.

CHECKING Visually check that filling pipe continuously falls from filling point to tank.

FAULTS		
Filling Pipe	Not of minimum practicable length	2.2.10

FILLING PIPES

Joints & Connections All joints and connections are a potential source of fuel leaks, and need to be inspected at frequent intervals to ensure that the system remains leak-proof. It is recommended that the length of the pipe engaging the spigot of the connector is at least 25mm for hose of 25mm internal diameter, and 35mm for larger hose.

It is good installation practice that all joints and connections are readily accessible but for the purpose of this standard, it is acceptable for joints and connections to be accessible .

CHECKING Visually and physically check all joints and connections in filling pipe are accessible. The use of inspection aids e.g. a torch or mirror is permitted.

FAULTS		
Filling Pipe	Joints/connections not readily accessible	2.2.11

STANDARD 2.3 : DECK & FUEL FILLING CONNECTIONS
All deck and fuel filling connections shall be situated so as to minimise the risk of cross-contamination and shall be clearly marked on the deck fittings or immediately beside then indicating the purpose of each connection and, in the case of fuel connections, the exact type of fuel.

OBJECTIVE

The objective of this standard is to prevent fuels being incorrectly loaded and contacting systems and components which are not suitable.

CROSS-CONTAMINATION

Cross-contamination may be prevented by:

- separating the connections by approximately 250mm (10").
- camber of a deck carrying any overflow overboard
- installing a diverting arrangement around the connection
- use of deck fitting caps which require different keys to open them

Use of screwed fittings

Filling connections which have screw threads to permit the use of bunkering lines are permitted.

CHECKING

Visually check that risk of cross-contamination is minimised.

FAULTS		
Deck connections	Not minimising risk of cross contamination (advisory for private boats)	2.3.1

MARKING OF DECK CONNECTIONS

The purpose of each deck connection shall be clearly marked. This marking is to be either on the fitting, or cap, or immediately beside it

Fuel connections must be marked with the exact type of fuel used. The label can be made of plastic, but not ‘embossed’ tape (e.g. “Dymo” tape), and can be painted on.

Connections marked only with the word "FUEL" or “GAS” (for gasoline) are not acceptable .

Filling and discharge points may be marked with the internationally accepted symbol (e.g. ISO 11192 and ISO 8099).

Clearly marked

Clearly marked means that the marking is in direct view of any person using the connection.

It is recommended that lettering is :

- a minimum of 5mm high
- clearly distinguishable from its background
- not removable by abrasion or contact
- cannot become illegible through cleaning or normal use

CHECKING

Visually inspect all deck connections to ensure they are correctly and clearly marked.

This is not a failure point providing the connection is marked immediately beside it.

FAULTS		
Deck connections	Not clearly marked 'PETROL'	2.3.2
Deck connections	Not clearly marked 'PETROIL'	2.3.3
Deck connections	Not clearly marked 'PARAFFIN'	2.3.4
Deck connections	Not clearly marked 'DIESEL'	2.3.5
Deck connections	Not clearly marked 'LPG BUTANE/PROPANE' as appropriate	2.3.6
Deck connections	Not clearly marked 'WATER'	2.3.7
Deck connections	Not clearly marked 'PUMP OUT'	2.3.8
Deck connections	Not clearly marked 'RINSE OUT'	2.3.9

UNUSED CONNECTIONS

Connections used for purposes other than shown above must be marked to minimize the risk of misuse and if a connection is not used it is important that it is clearly marked to indicate this.

CHECKING

Visually check deck connections, filling or discharge points other than those specified in 2.3.2 – 2.3.9 are correctly and clearly marked. Unused connections or points must be marked appropriately.

FAULTS		
Deck connections	Marking not on deck fitting nor immediately beside deck connections	2.3.10

STANDARD 2.4 : VENT PIPES
A vent pipe of minimum practicable length with an internal diameter of not less than 12mm (½") shall be fitted at the highest point of every fuel tank and connected with leak proof joints. The material used shall be non-kinking and suitable for use with the fuel concerned. [see Exemption 11.2]

OBJECTIVE

The objective of this standard is to ensure that fuel tanks are effectively vented to prevent over- and under-pressure and blowback during filling operations.

MINIMUM PRACTICAL LENGTH

The vent pipe is required to extend to a height equal to or greater than the level of the filling connection.

It may be necessary to incorporate an inverted "U" bend or swan's neck in the pipe to prevent ingress of water and debris which could result in contamination of the fuel or blockage of the vent pipe.

If fuel were retained in the pipe it would no longer act as a vent pipe as there would be no clear passage for the air venting from the tank. The category would also change to that of a fuel pipe permanently charged with fuel.

The route taken by a flexible vent pipe is to take account of anything which may damage the pipe e.g. heat sources and the need for access to the connections

CHECKING

Visually check that flexible vent pipe follows shortest practicable route or continuously falls to tank

FAULTS		
Vent Pipe	Not of minimum practicable length	2.4.1

VENT PIPE INSTALLATION

In general, every fuel tank must have an individual and separate vent line. However, a vent is not required where day tanks are fitted with an overflow pipe which returns fuel back to the main storage tank.

Existing small capacity (i.e. those less than 27 litres/6 galls) petrol tanks as fitted to Stuart Turner engines are permitted to use the small vent hole in the filler cap provided that a flame arrester gauze is fitted.

CHECKING

Visually check that a vent pipe is fitted to each fuel tank (except day tanks with overflow arrangements).

FAULTS		
*Vent Pipe	Not fitted	2.4.2

EXEMPTION 11.2 (sentence 2)

In the case of vessels manufactured prior to 16 June 1998 having no vent pipe, a vent in the screw cap or filling pipe above deck level may be fitted provided that there is a flame arrester complying with the requirements of Standard 2.5. The flame arrester shall have a minimum diameter 12mm.

Note The international standard refers to vent lines having a minimum cross sectional area of 95 mm^2 which equates to an internal diameter of 11.5mm.

CHECKING

If a vent pipe not fitted to a fuel tank, visually check for the presence of a vent in the screw cap or filling pipe.

If present, visually check that vent is:

- above filling point level, and
- provided with a flame arrester: which complies with 2.5.3 and has a minimum internal diameter of 11.5 mm

FAULTS		
	*EXEMPTION APPLIED	2.4.3

INTERNAL DIAMETER

The minimum internal diameter is to be 11.5 mm (½").

It is not a requirement of the Standards that the internal diameter of the vent pipe is larger than that of the filling pipe.

An estimate of the internal diameter can be made by measuring the external diameter. This will depend on the material from which the pipe is made but the following are an approximate indication for materials commonly used:

- copper 14mm
- aluminium 15mm
- steel 15mm
- flexible hose 18 to 20mm

CHECKING

Measure the internal diameter of the vent pipe (minimum 11.5mm)

Where it is not possible or practical to measure the internal diameter, an estimate can be made by measuring the external diameter.

FAULTS		
*Vent Pipe	Less than prescribed minimum internal diameter	2.4.4

EXEMPTION 11.2 (sentence 1)

Vessels manufactured prior to 16 June 1998 and having a vent pipe of an internal diameter of at least 9.5mm (3/8") are not required to comply with that part of Standard 2.4 which requires that a vent pipe shall have an internal diameter of at least 12mm (½").

CHECKING Existing boat - Measure the internal diameter of the vent pipe (minimum 9.5 mm)

Where it is not possible or practical to measure it, an estimate of the internal diameter can be obtained by measuring the external diameter.

Note The following are an approximate indication of the outside diameter for internal diameter 9.5mm for materials commonly used:

- copper - 11.5mm
- aluminium - 12.5mm
- steel - 12.5mm
- flexible hoses - 15.5 to 17.5mm

FAULTS		
	*EXEMPTION APPLIED	2.4.5

LOCATION OF VENT PIPE The vent pipe is to be fitted at the highest point of the fuel tank to minimise the risk of creating a space at the top of the tank where fuel vapour could accumulate.

CHECKING Visually check that the vent pipe is connected to the top of the tank.

FAULTS		
Vent Pipe	Not fitted at highest point of fuel tank	2.4.6

LEAK-PROOF JOINTS

CHECKING Visually and manually check vent pipes for leaking fuel at joints.

FAULTS		
Vent Pipe	Not connected with leak proof joints	2.4.7

FLEXIBLE HOSE USED AS A VENT PIPE

Non-Kinking Pipes It is important that the bore of the pipe cannot become restricted either by design or by accident.

A non-kinking pipe will prevent the walls of the pipe from collapsing and thus restricting the bore when hose is bent or any object comes into accidental contact with the pipe

CHECKING Visually check vent pipe for kinks, damage and deterioration, particularly at any bends or connections.

Check that the pipe cannot be compressed by squeezing it by hand.

FAULTS		
Vent Pipe	Not of non-kinking material	2.4.8

VENT PIPES - Suitability for fuel used	For the purpose of this standard, suitability is determined by the long-term performance of the pipe and its condition in use. The material of the pipe must not be unduly permeable to the fuel used nor react chemically with the fuel leading to deterioration and leaks In use, the material must be resistant to damage and deterioration resulting in corrosion, hardening, brittleness, shrinkage and cracking. Any localised or undue softening of flexible hoses may be a sign of an adverse reaction affecting the inner wall which has not yet reached the outer layers.
Use of soldered joints	As vent pipes are not permanently charged with fuel, soldered joints may be used but their use is not encouraged.
Marking	Pipes marked by the manufacturer as being suitable for fuel applications e.g. petrol, diesel, gasoline etc are acceptable.
Unmarked pipes	Pipes which are not marked but supported by a declaration of suitability from the manufacturer, supplier or boat builder are acceptable. Examiners may also accept hose which they recognise as being compliant.
CHECKING	Visually check that the pipe is marked as suitable for the fuel used or its use is supported by an appropriate declaration. Visually and manually check for any signs of : • corrosion • decay • damage or deterioration • leaks Metal vent pipes must be examined carefully to ensure that the pipe and its connections shown no signs of deterioration or slackness

FAULTS		
Vent Pipe	Not of suitable material for use with petrol	2.4.9
Vent Pipe	Not of suitable material for use with fuel oil	2.4.10

STANDARD 2.5 : VENT PIPE INSTALLATION

A vent pipe shall extend to a height equal to or greater than that of the deck filling connection and the open end of a vent pipe shall be fitted in a position where no danger will be incurred from escaping fuel or vapour.

Each opening shall be furnished with an effective wire gauze diaphragm flame arrester of non-corrosive material.

The flame arrester shall be fitted with gauze of mesh not less than 11 to the linear centimetre (28 to the linear in.) and the total area of the clear openings of the gauze shall not be less than the cross-sectional area of the air pipe.

OBJECTIVE

The objective of this standard is to ensure that a fuel tank vent is effective regardless of the level of the fuel in the tank and that any vapours emerging from the vent opening do not give rise to an explosion hazard.

HEIGHT OF VENT PIPE

The vent pipe is to be taken to a height equal to or greater than the height of the deck filling connection and be of minimum practicable length (see Section 2.4.1)

The recommended height is 100mm above the filling connection.

Use of a swan's neck

It is good practice to form the end into a bend or swan's neck to prevent water and debris entering the pipe.

The outlet of a vent pipe incorporating a swan's neck may be below the level of the deck filling connection providing the height of the top of the swan neck bend is equal to or above the level of the filler.

For the purpose of determining the height of the deck filler, the thickness of the deck or gunwale at the location of the filler may be discounted providing it is not more than 25mm (approx.).

This would allow the vent pipe or swan's neck to be taken to the underside of the deck adjacent to the deck filling connection and there would be no need to make a hole in the deck at that point.

CHECKING

Visually check height of vent pipe outlet or swan's neck in relation to the height of the filling point.

FAULTS		
Vent Pipe	Not extended to a height equal to or greater than that of the deck filling connection	2.5.1

DANGER FROM ESCAPING FUEL OR VAPOUR

It is important, and good safety practice, to ensure that the vent pipe terminal is not in a position where there is a risk of danger. The international standard recommends that vent pipe terminals be in the open air and at least 400mm from any ventilation openings where vapour may enter enclosed cabin spaces. Vent pipe terminals must also be clear of any potential source of ignition and 400mm is an appropriate guideline for a minimum separation.

CHECKING

Visually check that the vent pipe terminal is clear of any potential source of ignition in a position where no danger will be incurred.

FAULTS		
Vent Pipe	Open end not fitted in a position where no danger will be incurred from escaping fuel or vapour	2.5.2

FLAME ARRESTERS

It is fundamental marine engineering practice to install a flame arrester on the outlet of all vent pipes. This device prevents the passage of flame by means of small openings, convoluted flame paths or by ensuring that the temperature of the side which is not exposed to flame does not reach a high enough temperature to ignite a flammable vapour mix.

In the UK it has been historically recommended practice to install a copper or brass gauze with a mesh size of 28 wires per inch. However, the ISO does not have any recommendation for gauze size and requires only that an 'effective' flame arrester is fitted. For the purpose of the BSS therefore any proprietary flame arrester will be accepted.

Whatever type of flame arrester is used it is important to ensure that the openings in the flame arrester body do not restrict the passage of air either by design or by blockage with dirt or corrosion etc.

CHECKING

Visually check for presence of proprietary flame arrester or gauze of 11/cm mesh. Flame arresters not recognised must be provided with satisfactory documentation.

Visually check that openings in the flame arrester are of the same area as the cross-sectional area of the vent pipe and for the presence of any dirt or debris restricting the passage of air and vapour through the flame arrester.

FAULTS		
Vent Pipe	Not fitted with an effective prescribed flame arrester	2.5.3

FAULTS		
	Not used	2.5.4

FAULTS		
	Not used	2.5.5

STANDARD 2.6 : FUEL TANKS
Fuel tanks shall be properly secured and be installed as low as practicable and shall be constructed of a suitable non-corrosive material. Materials used in the construction of fuel tanks shall have a fire resistance of 30 minutes in accordance with BS 476: Part 20. Tanks shall have sustained a pressure test of 0.25kgf/cm^2 (3.5lbf/in^2) before installation and be marked to indicate this. All joints and seams of tanks shall be efficiently welded, brazed or close rivetted to sustain a pressure test of 0.25kgf/cm^2 (3.5lbf/in^2). [see Exemption 11.3]

OBJECTIVE

The objective of this standard is to ensure that fuel tanks are manufactured to give adequate protection to their contents in normal use or in the event of accident.

SECURITY

Fuel tanks which are not an integral part of the hull must be properly secured to prevent any movement which could result in:

- damage to the structure of the tank
- damage to associated pipe work and fittings

Tanks may be secured by: metal framework; brackets; straps; welding to the hull; or collision chocks

JOINTS & SEAMS

Soft soldered fillers must not be used since they would inevitably fail when exposed to excessive heat e.g. in a fire situation.

CHECKING

At present there is no check for the presence of a securing mechanism but all tanks are to be visually and manually checked for movement or any signs that movement has occurred.

FAULTS		
Fuel Tank	Not properly secured	2.6.1

INSTALLATION HEIGHT

Practicability

If the fuel tank is installed in the position determined by the boat builder it will be accepted that it complies with this standard. This also applies if the boat was built by the owner.

There must be no obvious signs that any modifications have been carried out. The main indications that this may have occurred are that the additions and/or alterations do not match the manufacturer's specifications for:

- colour

- construction and grade
- marking (name, model, consumer information etc)
- mismatch of name, materials and connections

CHECKING Visually check that the fuel tank(s) as fitted is installed as low as practicable.

FAULTS		
Fuel Tank	Not as low as practicable (advisory for private boats)	2.6.2

MATERIALS Suitable materials must be used for the construction of fuel tanks since fuel tanks must be resistant to corrosion.

Diesel fuel - suitable materials

The following are suitable materials for diesel tanks:

- untreated mild steel
- mild steel (hot dip zinc coated after fabrication)
- aluminium alloy (containing not more than 0.1% copper)
- GRP
- stainless steel

Diesel tanks may be constructed of GRP in any vessel and its use is not restricted to GRP hulls.

Diesel fuel - unsuitable materials

The following must not be used for diesel tanks:

- lead coated steel
- copper
- internally galvanised steel

Copper is not a suitable material because it acts as a catalyst and reacts with acidic compounds in the diesel to form soap-like organic compounds which can block the fuel system.

Petrol - suitable materials

The following are suitable materials for petrol tanks:

- aluminium alloy (containing not more than 0.1% copper)
- lead-coated steel
- brass
- copper (tin coated internally)
- internally galvanised mild steel
- stainless steel

Petrol – unsuitable materials

The following must not be used for petrol tanks:

- untreated mild steel
- interior painted tanks
- GRP

Plastic tanks ‘CE’ marked plastic tanks are accepted provided they are used within any restrictions placed on their use by the manufacturer. The requirements for marking of the fuel and the test pressure apply to these tanks. A separate information sheet is included as an annex to this section and is available on application to the BSS office.

Identification If it is not possible to identify the material from which any tank is made, the tank must be carefully examined for any signs of material failure.

CHECKING Visually and manually check material of tank for suitability. Visually and manually check all tanks for any signs of material failure such as:

- corrosion
- heavy flaking
- deep pitting
- fuel seepage

Where accessible pay particular attention to areas under dipsticks/sounding pipes

FAULTS		
Fuel Tank	Not of a suitable non-corrosive material	2.6.3

BS 476: PART 20 - Fire Resistance

The international standard BS EN ISO 10088 does not make any recommendation for fire resistance of fuel tanks with the exception of non-metallic petrol tanks which must meet a fire test of 2½ minutes followed by a pressure test.

Close rivetted joints & seams Joints and seams made by close rivetting must be suitably sealed by hard-soldering or brazing or other means to make the joint fuel-tight and fire resistant.

CHECKING If there is no marking or other indication that the material meets the fire resistance requirements, visually check tank for any signs of overheating or heat damage.

FAULTS		
Fuel Tank	Not sufficiently fire resistant (BS476 Part 20)	2.6.4

TANK PRESSURE TEST

TEST PRESSURE BS EN ISO 10088 The international standard lowers the required tank test pressure from the previous UK recommendation of 0.25 kgf/cm^2 to 0.2. kgf/cm^2

CHECKING Visually check for any form of marking which states that the tank has been tested and the pressure to which it was tested (minimum 20kPA/2.9 psi/0.2bar).

FAULTS		
*Fuel Tank	Not marked to indicate pressure test (0.25kgf/cm^2)	2.6.5

EXEMPTION 11.3

Vessels manufactured prior to 16 June 1998 are not required to comply with that part of Standard 2.6 which requires that fuel tanks must have sustained a pressure test of 0.25kgf/cm^2 (3.5lbf/in^2) before installation and be marked to indicate this.

This exemption only applies to the pressure test and not to any other requirements for fuel tanks e.g. non-corrosive material or fire resistance.

FAULTS		
	*EXEMPTION APPLIED	2.6.6

JOINTS & SEAMS

The marking to indicate that the tank has been pressure tested indicates that, at the time of the test, the joints and seams met the pressure test requirements.

Close rivetted joints & seams

Joints and seams made by close rivetting must be suitably sealed by hard-soldering or brazing or other means to make the joint fuel-tight.

CHECKING

Visually and manually check seams of tank for any signs of material failure such as:

- corrosion
- heavy flaking
- deep pitting
- fuel seepage

FAULTS		
Fuel Tank	Joints/seams not efficiently made to sustain pressure test	2.6.7

STANDARD 2.7 : PETROL and PARAFFIN TANK INSTALLATION
No petrol or paraffin tank of more than 2.5 litres (½ gallon) shall be installed within 1 metre (39½") of any engine or heating appliance unless it is insulated and protected by an efficient baffle of fire resistant material.

OBJECTIVE

The objective of this standard is to ensure that petrol and paraffin tanks are protected against the effects of overheating and the production of excessive amounts of vapour.

Heat Shield Baffles

The purpose of a baffle in this context is to protect the fuel tank from directly radiated heat. They may be constructed from any material which is inherently fire resistant or which has been treated to be fire resistant.

Suitable materials would have a fire resistance of 30 minutes in accordance with BS 476: Part 20 such as: sheet metal of minimum thickness 0.9 mm; or Fibre Reinforced Plastic (FRP) of approx 5 mm thickness

If timber or ply was used it must be faced with metal or treated in such a way that it would provide the same degree of fire resistance.

Modifications

The baffle may be modified to allow for the routing of pipes and cables etc providing the baffle, cables and pipes meet all the requirements of the Standards.

BS EN ISO 10088

The international standard has changed previous UK recommended practice for separation between a petrol tank and an engine from 1metre to 100mm (4") and this latter distance will be accepted for the purposes of the BSS. However, maximum separation between any petrol tank and a source of heat is considered to be best practice.

The international standard does remove the lower limit on tank size and this change has also been adopted.

CHECKING

Measure the distance between the petrol or paraffin tank and the engine or heating appliance.

If less than 100 mm visually check for the presence of a baffle of fire resistant material.

Visually check the side of baffle facing the heat source for signs of over-heating.

FAULTS		
Fuel Tank	Petrol/paraffin tank of more than 2.5 litres and less than 1 metre from engine/heating appliance and not insulated by an efficient fireproof baffle	2.7.1

STANDARD 2.8 : FUEL LEVEL INDICATORS

Glass or plastic fuel sight tube gauges shall not be used.

Fuel level indicators, if fitted, shall be of a type which does not allow escape of fuel or vapour in the event of damage to the indicator.

Dipsticks when fitted shall be calibrated and only used via gas-tight fittings.

Where a dipstick is used it must be made so it cannot strike the bottom of the tank.

[see Exemption 11.4]

OBJECTIVE

The objective of this standard is to ensure that fuel level indicators are properly installed so as to minimise the risk of the loss of the contents of the fuel tank in the event of damage.

FUEL GAUGES - COLUMN SIGHT TUBE

For many years the use of glass or plastic fuel sight tube gauges was not recommended practice in the UK as they were felt to be breakable, required a joint at or near the base of the tank, were exposed to physical damage and breached the fire resistance requirements of the tank

This applied to all gauges of this type including those which are not permanently charged with fuel i.e. fuel is only admitted to the sight tube by means of a cock or valve for the purpose of taking a reading.

However, BS EN ISO 10088 allows their use **on diesel tanks only** provided that they are protected against physical damage and that damage does not lead to the loss of the contents of the tank. This is achieved by the use of shields or cages, or by robust design, and by the incorporation of self-closing valves which means that the gauge is only open to the tank when the operator is in attendance at the gauge.

Disconnection

Where a sight tube gauge has been disconnected to comply with this standard, the tank outlet must be fitted with a plug which:

- is connected to the tank by a leak proof connection
- cannot be opened accidentally
- cannot be removed without the use of tools

CHECKING Clear tube or strip type gauge glasses are not permitted on petrol tanks

Visually check for presence of glass or plastic tube gauge – diesel tanks only.

Where fitted check that the gauge is:
- protected against physical damage; and
- closely coupled (connected) to the tank; and,
- fitted with self-closing valves at top and bottom (note that the self-closing valve at the top is not required if the gauge connection is made to the top of the tank)

FAULTS		
*Tube Sight Gauge	Glass/plastic used	2.8.1

ESCAPE OF FUEL OR VAPOUR

Transparent Covers Gauges covered with a transparent cover for the purpose of reading a dial or indicator are only acceptable if no fuel has leaked into the space behind the cover.

If fuel can be seen behind the cover, the gauge becomes a glass or plastic sight tube gauge which is not permitted.

This condition applies even if no fuel has leaked to the outside of the gauge.

CHECKING Visually check for presence of fuel level indicator and if present check for:

- fuel leaks
- damaged or missing components and fixings
- damage to any glass or other transparent cover
- fuel behind transparent cover

FAULTS		
*Fitted Fuel Level Indicator	Can allow escape of fuel or vapour if damaged	2.8.2

DIPSTICKS Fitted dipsticks may be attached to the fuel filler cap, or a separate fitting, providing they comply with these standards.

Calibration Dipsticks, when fitted, shall be calibrated by means of marks, numbers, or letters etched or engraved into the surface.

CHECKING Visually check for presence of dipstick(s) and if present check for calibration

FAULTS		
*Fitted Dipstick	Not calibrated (advisory for private boats)	2.8.3

LIQUID TIGHT Where dipsticks are used the entry point must be through a fitting

FITTINGS which is normally liquid tight

CHECKING Visually check type of liquid tight fitting

Visually check for any sign of fuel leaks at the point of entry

FAULTS		
*Fitted Dipstick	Fitting not gas tight	2.8.4

LENGTH OF DIPSTICKS Dipsticks, whether fitted or not, must not come into contact with the bottom of the tank either when used or fully seated (fitted dipsticks).

Any arrangement e.g. cross-pinning which prevents the dipstick from striking the bottom of the tank is acceptable.

CHECKING Manually check that dipstick(s) does not strike bottom of tank.

FAULTS		
*Dipstick	Can strike bottom of tank (advisory for private boats)	2.8.5

EXEMPTION 11.4 Any diesel fuelled vessel formerly used for the commercial carriage of freight or passengers or as a tug or as an icebreaker and which is to be licensed for use as a pleasure boat, commercial carrying vessel or registered for use as a houseboat unless used for purposes of hire or reward shall not be required to comply with Standard 2.8.

Form of documentation Owners of these vessels are almost always aware of their history and have often collected a variety of records or registration documents associated with them. Any form of documentation (including photographs) which clearly indicates the original use of the vessel is acceptable.

Copies and facsimiles are acceptable.

CHECKING Check owner's documentation to confirm both the original use of the vessel and its current use.

Where this is not available for examination, or the validity cannot be determined, application for exemption will have to be made to the Manager of the Boat Safety Scheme.

FAULTS		
	*EXEMPTION APPLIED	2.8.6

STANDARD 2.9
ACCESSIBILITY OF FUEL TANKS & CONNECTIONS

Fuel tanks shall be accessible and all connections shall be readily accessible for inspection.

OBJECTIVE

The objective of this standard is to ensure that fuel tanks all connections of pipes to tanks are readily accessible for routine checking of condition.

FUEL TANK ACCESSIBILITY

It is not necessary for the tank to be accessible for removal or maintenance but it is necessary for at least part of the tank to be capable of being reached for inspection.

Tanks totally enclosed

For separate tanks not integral to the structure of the hull, some part of the tank must be accessible for inspection. It would be a failure if a separate tank(s) was totally enclosed and access could not be gained, even if the connections to the tank were accessible.

CHECKING

Check that fuel tanks are accessible enough to make a general assessment of their condition. Note that condition of tank is checked under 2.6.3

FAULTS		
Fuel Tank	Not accessible for inspection	2.9.1

ACCESSIBILITY OF TANK CONNECTIONS

It is a requirement of this standard and it is also good installation practice that all connections are readily accessible for inspection.

However it is acceptable for connections to be accessible and not readily accessible as defined in the Glossary to these standards.

This means that they must be capable of being reached for inspection without the removal of permanent craft structure but it may be necessary to use tools or remove any items of portable equipment stowed in places intended for storage of portable equipment in order to gain access.

It is not necessary for the fuel tank connections to be accessible for operation or maintenance as defined in BS EN ISO 10088.

The principal connections to fuel tanks are: filling pipes; fuel take-off pipe; fuel return pipe; vent pipes; drain plugs or cocks; fuel level indicators; balance pipes (diesel engines only)

CHECKING

Identify all tank connections and visually check that the point of connection to the tank(s) is accessible.

The use of inspection aids e.g. a torch or mirror is permitted

FAULTS		
Fuel Tank	Connections not readily accessible for inspection	2.9.2

STANDARD 2.10 : BONDING OF FUEL TANKS

Tanks shall be effectively bonded by low resistance metallic conductors of adequate strength to their deck filling connections, and in the case of a non-conducting deck or hull, tanks shall also be electrically bonded to an earth point in direct electrical contact with the surrounding water, for the discharge of static electricity.

OBJECTIVE

The objective of this standard is to ensure that petrol filling and tank systems are electrically bonded to prevent the build-up of static charge which may lead to an ignition hazard.

Note The international standard restricts this requirement to petrol, systems against the wish of the UK to see it retained for all fuel systems. Bonding of diesel systems is therefore recommended as good practice.

BONDING TO DECK FILLING CONNECTIONS

The bonding to the deck filling connection must be: effective and by a low resistance metallic conductors of adequate strength. An effective bond is made when a conductor of the correct grade is securely fitted between the tank and the deck connection. **FIG 2.2**

The recommended grade is a heavy duty cable with a conductor of at least $2.5mm^2$.

Where the filling pipe is made of conducting material it is not necessary to provide an additional metallic conductor between the tank and the filling connection.

CHECKING

Applies to petrol fuel filling system.

Visually check for low resistance bond between tank and deck filling connection

There must be:
- no movement at any of the connections
- no sign of damage, deterioration, or corrosion in the cable or its connections

FAULTS		
Fuel Tank	Not effectively bonded to deck filling connection	2.10.1

BONDING TO AN EARTH POINT

- The Standard does not specify the size of this earthing point and the BMEA Code of Practice recommends that the resistance to ground be less than 10 ohms.
-

Minimum size No minimum size is specified for the cable connecting the fuel tank to an earthing point but note the recommended size ($2.5mm^2$) for the cable used for bonding the tank to a deck filling connection.

CHECKING Applies to petrol fuel tank

Identify non-conducting deck or hull and visually check that fuel tank is electrically bonded to an earth point in direct electrical contact with the surrounding water.

FAULTS		
Fuel Tank	Not effectively bonded to an earth point	2.10.2

STANDARD 2.11 : FUEL TANK DRAINAGE

Tanks may be drained only by a suitable drain valve fitted with a plug on the outlet.

[see Exemption 11.5]

OBJECTIVE

The objective of this standard is to ensure that fuel tanks can be drained in a controlled way and that drains are protected against unintended operation.

Drain valves – fitting

It is not a requirement that a drain valve must be fitted and it is not a fault if there is no valve. However, if a valve is fitted it must be suitable.

Drain valves - suitability

If a drain valve is fitted it must be connected to the tank by a leak proof connection and fitted with a plug which:

- cannot be opened accidentally
- cannot be removed without the use of tools

If a drain tap or cock is used, the outlet must be sealed with a plug which cannot be removed without the use of a tool.

CHECKING

Visually check for presence of a drain valve on a fuel tank and confirm connections are leak-free and a 'tools to remove' plug is fitted to the drain valve outlet.

FAULTS		
*Fuel Tank	Drain valve not suitable	2.11.1

EXEMPTION 11.5

Vessels manufactured prior to 16 June 1998 and having a fuel tank drain without a valve are not required to comply with that part of Standard 2.11 which requires that fuel tanks shall have a suitable drain valve fitted with a plug on the outlet.

FAULTS		
	*EXEMPTION APPLIED	2.11.2

STANDARD 2.12 : FUEL SUPPLY

The fuel supply shall be drawn through the top of the tank or as near to the top of the tank as is practicable by means of an internal pipe extending to near the bottom of the tank.

In the case only of gravity feed systems a feed from a cock or valve directly screwed in near the bottom of the tank is permitted.

Any return fuel line required to be connected to the fuel tank shall be connected through the top of the tank or as near to the top as is practicable.

[see Exemption 11.6]

OBJECTIVE

The objective of this standard is to ensure that the risk of the loss of the contents of a fuel tank is minimised in the event that any fuel pipe is damaged.

CONNECTION OF FUEL SUPPLY LINE

It has previously been UK recommended practice to ensure that all connections to fuel tanks are made at the top of the tank. The intention behind this recommendation was to minimize the risk of the loss of the contents of the tank in the event that the fuel pipe was damaged downstream. This is particularly hazardous in the case of petrol tanks.

However, BS EN ISO 10088 gives further options in the case of diesel fuel systems. In these types of installations the connection of the fuel feed can be made below the top of the tank or the highest point on the sides or end of the tank provided that:

- either the connection is protected by a valve
- or the connection is welded to the tank and the feed pipe reaches a point above the top of the tank.

Connections to petrol tanks must be made at the top of the tank.

For gravity fed systems, petrol or diesel, where the fuel supply has to be drawn through the bottom of the tank it must be drawn through a cock or valve screwed directly attached to the tank.

Practicability

Providing it is installed as near the top of the tank as possible, the fuel supply may be drawn through the side of the tank if there is insufficient room to install a take-off fitting and associated pipe work at the top of the tank.

CHECKING

Identify type of fuel feed and if it is not an existing gravity fed system, visually check position of connection of fuel supply lines to tank.

If the fuel feed connection is below the top or the highest point of the sides or ends of the diesel tank check that the connection is either protected by a valve or, if welded, by the feed pipe reaching above the top of the tank

FAULTS		
*Fuel Supply Lines	Connections not through top or as near as practicable to top of tank	2.12.1

GRAVITY FEED TANKS

A gravity feed system is one in which there is no pump between the tank and the inlet to the injection pump.

The fuel feed is to be taken from a cock or valve screwed directly into the tank at or near the bottom of the tank. The cock/valve must not be connected to the tank by an extension pipe or through any other fitting or component.

CHECKING

Identify gravity feed tank. If present, visually check presence of cock/valve screwed or attached directly to the tank.

FAULTS		
Gravity Fuel Supply	Gravity feed system cock/valve not fitted to tank	2.12.2

RETURN FUEL LINES

The purpose of fitting the return fuel pipe into the top of the tank is to avoid the loss of the tank contents if the return pipe or its fittings and connections develop a leak or are damaged. Therefore the options that apply to fuel feed systems apply here.

This check only applies to installations where the return fuel line is connected to the tank. It does not apply to systems where it returns fuel to some other part of the fuel installation e.g. it is connected to the fuel filter.

Return fuel lines must not discharge direct into the engine compartment or bilge. Return fuel lines are only found on diesel engine vessels and petrol engines with fuel injection systems.

Practicability

Providing it is installed as near the top of the tank as possible, the return fuel line may be connected through the side of the tank if there is insufficient room to install a fitting and associated pipe work at the top of the tank.

CHECKING

Visually check for connection of return pipe to fuel tank.

If the fuel return connection is below the top or the highest point of the sides or ends of the diesel tank check that the connection is either protected by a valve or, if welded, by the return pipe reaching above the top of the tank

FAULTS		

*Return Fuel Line	Connections not through top or as near as practicable to top of tank	2.12.3

Exemption 11.6 Diesel fuelled vessels manufactured prior to 16 June 1998 are not required to comply with that part of Standard 2.12 which requires that the fuel supply and return pipes shall be taken through the top of the tank or as near to the top of the tank as is practicable.

For these vessels, checks 2.12.1 and 2.12.3 do not apply.

CHECKING Identify diesel fuelled vessel.

FAULTS		
	*EXEMPTION APPLIED	2.12.4

STANDARD 2.13 : FUEL PIPES, BALANCE PIPES & VALVES

All fixed fuel feeds and pipes permanently charged with fuel shall be made of softened copper, stainless steel, aluminium alloy, or (for diesel installations only) mild steel of suitable size, fixed clear of exhaust systems and heating apparatus and adequately supported to minimise vibration and strain.

Balance pipes are only permitted in diesel fuelled installations.

Any balance pipe between fuel tanks must comply with the requirements of this standard and must in addition be fitted with valves directly attached to the tank and so constructed that the valves will not become slack when operated.

[see Exemption 11.7]

OBJECTIVE

The objective of this standard is to ensure that fuel pipes and hoses are manufactured of appropriate materials and are installed to prevent damage in normal use. It is also intended to specify particular requirements for balance pipes in diesel systems to minimise the risk of the loss of the contents of tanks in the event of damage.

FUEL PIPES - MATERIALS

All fixed fuel feeds and fuel pipes permanently charged with fuel are to be made of the materials listed above as:

- they do not react with the fuel
- the risk of damage and deterioration to fuel pipes is minimised

Softened copper pipe is solid drawn copper pipe which has been annealed (heated) after the drawing process which makes it more suitable for bending and working than hard drawn pipes.

FLEXIBLE TUBING

Flexible tubing is more vulnerable to damage and the effects of heat than rigid pipework and its use for pipes permanently charged with fuel is a balance between convenience and replacement cost. It must be expected that a flexible hose will need replacement a number of times through the lifetime of a boat.

Flexible hose is widely used for connections to engines in order to mitigate the effects of vibration when the engine is running, and to take account of relative movement between different parts of the boat's structure.

Existing engines may be fitted with hose to BS MA 102 which is acceptable providing the hose is in good condition. If the condition of the hose is suspect, they must be replaced with hoses which meet at least the fire resisting quality of BS EN ISO 7840.

Balance pipes in diesel installations Flexible balance pipes are allowed providing the installation meets the requirements of Standards 2.14 and 2.15.

Spill Racks (Injector leak-off pipes) Spill racks must comply with Standard 2.13 and flexible hose used in this context must comply with the fire resisting quality requirements of BS EN ISO 7840 and be connected with efficient joints.

Soft soldered connections and unclipped push-on joints must not be used.

This requirement is consistent with the international standard for marine diesel engines for small craft ISO 16147.

Armoured flexible hoses The presence of armouring or external braiding on flexible hoses, is no indication of their fire resisting qualities. If documentary evidence can be provided to support their use then this will be acceptable. However, it is not easy to verify the condition of the hose wall material with the braiding or armouring in place and any indications of damage will lead to rejection.

CHECKING Identify pipes and hoses permanently charged with fuel and visually and manually check for signs of:

- damage
- corrosion or deterioration

FAULTS		
Fixed Fuel Pipe	Not copper/stainless steel/aluminium alloy or for diesel only mild steel	2.13.1

PROECTION OF FUEL PIPES

Sources of heat Fuel pipes are to be fixed clear of exhaust systems and heating apparatus.

The recommended clearance is 125mm but where this cannot be achieved, a clearance of 75mm is considered the absolute minimum.

Routing In routing pipes clear of sources of heat, care must be taken to ensure that they are not exposed to risk of mechanical damage.

It may be necessary to provide shielding or protection if both risks cannot be eliminated.

CHECKING Visually check routing of pipes and hoses for clearance from unshielded or unlagged exhaust systems. Where clearance is less than 75mm check for damage to fuel system. Note that the failure point is on damage not distance.

FAULTS		
Fuel Pipe	Not fixed clear of exhaust system	2.13.2

CHECKING Visually check routing of fuel pipes and hoses for clearance from unshielded or unlagged heating apparatus. Where clearance is less than 75mm check for damage to fuel system. Note that the failure point is on damage not distance.

FAULTS		
Fuel Pipe	Not fixed clear of heating apparatus	2.13.3

FUEL PIPES
- Support

All fixed fuel feeds and pipes permanently charged with fuel are to be adequately supported to minimise strain and vibration. It is particularly important to ensure that fuel system joints and connections are adequately supported to resist the effects of vibration and movement and consequent leakage. BS EN ISO recommends that all joints are supported within 100mm.

They must be fixed directly to the permanent structure of the boat by suitable fixings, or to a support fixed to the permanent structure.

Clips, fastenings, and supports must be: placed at approximately 500mm (20") centres, and in physical contact with the pipe or fitting.

CHECKING

Manually check that fuel pipes including connectors and fittings are adequately secured against damage from vibration i.e. no movement under gentle hand manipulation.

FAULTS		
Fuel Pipe	Not adequately supported	2.13.4

BALANCE PIPES
- Installation

Balance pipes may only be fitted in diesel fuelled vessels.

They are required to comply with Standard 2.13 for :

- material used
- clearance from sources of heat
- adequate support

If the connection between the fuel tanks is made of the same material as the tanks and is permanently connected to the tanks by welded or brazed joints it is treated as an integral part of the tank and not as a balance pipe. Balance pipes which feature a screwed or threaded connection for assembly purposes will be treated in this way.

CHECKING

Identify type of fuel in tanks and check for presence of balance pipe. Balance pipes not permitted in petrol systems

FAULTS		
Balance Pipe	Fitted in non diesel fuelled installation	2.13.5

BALANCE PIPES
- Material

Balance pipes are permanently charged with fuel and need to be constructed from the same materials as other fixed fuel feeds and fuel pipes permanently charged with fuel as listed in 2.13.1.

Use of flexible hose

Flexible hose may be used for balance pipes in diesel installations providing the hose:

- meets the requirements of Standards 2.14 and 2.15
- is fitted with a valve at each end
-

CHECKING Identify flexible balance pipe and check compliance with Standard 2.14 and 2.15.

Visually and manually check balance pipe(s) for signs of:
- damage
- corrosion or deterioration

FAULTS		
Balance Pipe	Not of suitable material	2.13.6

BALANCE PIPES - Valves Valves fitted to balance pipes must be installed as close to the tank as is reasonably practicable – direct attachment is the requirement although it is recognized that this may not always be possible due to space or installation constraints.

CHECKING Visually check that the valves are directly attached to each tank so that there is no pipe work between the tank and the valve.

FAULTS		
*Balance Pipe	Not fitted with valves attached to tank	2.13.7

EXEMPTION 11.7 Diesel fuelled vessels manufactured prior to 16 June 1998 vessels and fitted with a balance pipe between close coupled tanks are not required to comply with that part of Standard 2.13 which requires valves to be fitted where it is not practicable to do so.

Practicality It would not be practicable to fit valves to an existing balance pipe where the pipe:
- was not long enough to take the valves, or
- could not be removed and then replaced with the valves in position

FAULTS		
	*EXEMPTION APPLIED	2.13.8

BALANCE PIPE VALVES - Construction These valves are to be constructed so that no part of the valve which incorporates a threaded joint or connection can become unscrewed or loose when the valve is opened or closed.

If a screwed connection is included, it is recommended that it be provided with some means of preventing it from becoming slack when operated.

CHECKING Visually and manually check balance pipe valves valve for slackness and signs of leaking fuel.

FAULTS		
Balance Pipe Valves	Not constructed to remain leakproof when operated	2.13.9

STANDARD 2.14 : FLEXIBLE TUBING
Flexible tubing may only be used in the engine compartment and shall be suitable for the fuel used. It shall be of minimum practicable length, be reinforced and have an internal diameter of not more than half its external diameter and shall have a fire resisting quality as required by BS EN ISO 7840 or DIN 4798.

OBJECTIVE

The objective of this standard is to ensure that any flexible hose used in the fuel feed and return system is of the correct specification.

Use of flexible tubing

The use of large amounts of flexible tubing in fuel systems has not, historically, been recommended practice in the UK. However, the emergence of the ISO has led to extended use including outside engine room spaces.

Flexible hose is less resistant to fire, abrasion and environmental effects than rigid metallic pipework but does have advantages in other respects. The choice to use flexible hose must acknowledge that it will normally require replacement several times in the lifetime of a boat and need regular inspection to assure its condition.

FAULTS		
	Not checked	2.14.1

FLEXIBLE TUBING Suitability For Fuel

The material of any hose must not be unduly permeable to the fuel used and must not react chemically with the fuel leading to deterioration and leaks. In use, the material must be resistant to damage and deterioration resulting in corrosion, hardening, brittleness, shrinkage and cracking.

The standard for marine fuel hoses in small craft, BS EN ISO 7840 does assure that these requirements are met. However, other standards exist which may be equally acceptable provided that suitable documentary evidence is supplied.

CHECKING

Visually check that the fuel hose is marked as suitable for the fuel used or its use is supported by an appropriate declaration.

Visually and manually check for any signs of :

- damage or deterioration
- leaks
- any restriction of the bore due to collapse of the walls
- "soft" spots

FAULTS		
Flexible Tubing	Not suitable for the fuel used	2.14.2

MINIMUM PRACTICABLE ROUTE It is considered poor practice to install excessive amounts of flexible hose i.e. where connection between two points could have been made with a shorter length.

CHECKING Check that flexible fuel supply hose follows minimum practicable route

FAULTS		
Flexible Tubing	Not of a minimum practicable length (advisory for private boats)	2.14.3

FLEXIBLE TUBING - Internal Diameter Prior to the emergence of BS EN ISO 7840 a check was required to ensure that a flexible hose was likely to provide resistance to internal pressure, kinking and external damage. This check is now out of date and has been withdrawn.

FAULTS		
	Not checked	2.14.4

FLEXIBLE TUBING BS EN ISO 7840 is the international standard for fire resistant fuel hoses (see Introduction).

All flexible tubing deteriorates with time and needs to be replaced at intervals specified by the manufacturer or when it shows any signs of damage or degradation.

BS EN ISO 8469 Tubes marked BS EN ISO 8469 "Non-fire-resistant fuel hoses" are not acceptable except in special circumstances detailed in BS EN ISO 10088.

CHECKING Visually check that flexible hose is marked to BS EN ISO 7840 or an equivalent or higher standard.

FAULTS		
Flexible Tubing	Not of reinforced/fire resisting quality (BS EN ISO 7840/DIN 4798)	2.14.5

STANDARD 2.15 : FUEL PIPE JOINTS & CONNECTIONS
All connections permanently charged with fuel shall be made with efficient screwed, compression, cone, brazed or flanged joints. Soft soldered joints shall not be used.

FIG 2.3

OBJECTIVE

The objective of this standard is to ensure that connections in fuel systems are efficiently made.

JOINTS – RIGID PIPEWORK

Screwed joints generally require a jointing compound or tape between the mating threads. Flanged joints require a gasket etc between the flanges.

Soft soldered joints may not be used as the melting point of solder is too low to pass the fire resistance test described under Fault 2.14.5.

JOINTS – FLEXIBLE HOSE

Joints made with swaged ferrules can only be produced as part of complete hose assemblies by machines made for the purpose. They cannot be "home made" with pliers etc. The ferrule is often marked with the manufacturer's name.

Whilst the use of hose clamps within the fuel feed and return system has not, historically, been recommended practice in the UK, BS EN ISO 10088 for fuel systems does permit their use provided that the clamps are of a minimum width of 8mm and that the ends of the pipes used have been properly prepared by the use of nozzles, beads, flaring or annular grooves.

CHECKING

Visually identify use of approved connection in rigid fuel pipes.
Manually and visually check for signs of fuel leaks at the joint or connection.

Check flexible hose connections which use hose clips or clamps for:

- appropriate clip/clamp size (minimum band width of 8mm on fuel supply and return systems but clamps fitted on small bore hose on engines may be smaller)
- appropriate clip/clamp tightness
- damage or deterioration to clip/clamp
- damage or deterioration to hose

FAULTS		
Fuel Pipe	Connections permanently charged with fuel not efficient screwed/compression/cone/brazed/flanged joints	2.15.1

STANDARD 2.16 : FUEL FILTERS
All fuel filters shall be suitable for marine use and shall be of fire resistant quality.

OBJECTIVE

The objective of this standard is to ensure that filters used in boats are of 'marine' quality and suitable for use.

SUITABILITY

Suitable marine filters are non-corrodible, non-breakable, and impact resistant

Clear bowl, glass or plastic filters meeting the above criteria are acceptable providing they are made for the type of fuel being used. There are a number of clear bowl marine fuel filters on the market and these are often listed as having been tested and certificated by UL (Underwriters Laboratories) and usually have a metal heat shield fitted at the bottom of the bowl.

Some manufacturers who normally supply filters with glass bodies produce a metal-bodied version for marine use. The use of plastic drain plugs is not acceptable since these can compromise the fire resistance of the filter.

Use of filters outside engine spaces

The ISO permits the use of non-fire resistant filters outside engine spaces albeit that the hoses connecting them must be fire resistant.
It is recommended that filters used outside engine spaces meet the requirements of this standard.

CHECKING

Visually examine fuel filter for signs of corrosion or impact damage to any part of the filter body and its connections.

If the filter is not marked, or is not recognized as suitable for marine use, the owner will need to provide evidence that the filter complies with this Standard.

FAULTS		
Fuel Filters	Not suitable for marine use	2.16.1

FIRE RESISTANCE

The fire resistance requirements are exactly the same as any other component in the fuel supply system i.e. 2½ minutes as described in BS EN ISO 10088.

CHECKING

Visually examine any fuel filter located inside an engine compartment.

If the filter is not marked, or is not recognized as a fire resistant filter, the owner will need to provide evidence that the filter complies with this Standard.

FAULTS		
Fuel Filters	Not of fire resistant quality	2.16.2

STANDARD 2.17 : FUEL COCKS
A cock or valve shall be fitted in the fuel feed pipe as near as possible to the fuel tank in a position where it is readily accessible. If it is not visible the position shall be clearly marked. In all petrol engine installations where the steering position is remote from the fuel tank a second cock or means of operating the main cock or valve close to the tank shall be fitted immediately accessible from the steering position.

OBJECTIVE

The objective of this Standard is to ensure that there is a means of closing the fuel supply to the engine in the event of fuel siphoning out of the tank when the fuel supply line is damaged. The standard also specifies extra safety provisions for emergency shutoff controls in gravity fed fuel systems for petrol engines.

FUEL COCKS

Installation

The installation of a readily accessible fuel cock in the fuel feed line as close to the tank as practicable has been recommended practice in the UK for many years. BS EN ISO 10088 has made further compliance options available to reflect what has been standard practice in other parts of the world and these will be acceptable for the BSS.

The alternatives now available are found in the checking procedure below. It is recommended that all valves or cocks in fuel systems are operable from outside the engine space.

CHECKING

Visually check for presence of fuel cock or valve in the fuel feed pipe from every fuel tank.

If not present check for:

- either,
  all fuel lines, including those on the engine, being above the level of the top of the tank;
- or,
  an anti-siphon valve at the tank;
- or,
  a valve or cock in a position in the fuel line which is self-draining from valve to tank (valve to be capable of being closed from an indicated readily accessible position outside the engine compartment);
- or,
  an electrically operated valve at the tank, activated to open only during engine starting or running. Check that a manual emergency operating or bypassing device is provided.

FAULTS		

Fuel Cock	Not fitted	2.17.1

FUEL COCKS

Location Where a fuel cock has been fitted it is acceptable for it to be connected with a longer piece of pipe than strictly necessary if this makes it more readily accessible providing:

- the connecting pipe was of the same material as the tank
- there were no joints in the pipe itself
- it was permanently installed

CHECKING Visually check location of cocks or valves in relation to fuel tanks. Ready accessibility takes precedence over need to be as near as possible to the fuel tank.

FAULTS		
Fuel Cock	Not fitted as near as possible to the fuel tank	2.17.2

FUEL COCKS

Accessibility The fuel cock is to be readily accessible as defined in the Glossary to the Boat Safety Standards.

CHECKING Visually check fuel cocks and valves are readily accessible.

FAULTS		
Fuel Cock	Not readily accessible	2.17.3

FUEL COCKS

Visibility If the fuel cock is below deck or in a compartment, locker, cupboard etc, the location must be clearly marked at the point where access to it is gained.

CHECKING Check that fuel cocks or valves are visible. If not, visually check that the location of the valve or cock is clearly marked and in open view.

FAULTS		
Fuel Cock	Location not clearly marked	2.17.4

PETROL COCK

Accessibility In petrol engine installations where the fuel tanks are remote from the steering position and the fuel is gravity fed to the engine, a second valve or cock, or a means of operating the main cock or valve, must be immediately accessible from the steering position.

Safety If a fracture or disconnection of the fuel supply line occurs at or near the engine in a gravity-fed system the entire contents of the tank would be lost if there was no means of shutting off the fuel supply from the steering position.

Means of Remote operation of the main fuel cock may be achieved:

operation

- mechanically (solid linkages or wire)
- electrically with the use of a solenoid valve
- hydraulically

CHECKING For gravity-fed petrol installations visually check that a second cock, or a means of operating the main cock, is within approximately 1 metre or arms length of every steering position.

FAULTS		
Petrol Cock	Not immediately accessible from steering position nor is there means of operating main cock from steering position	2.17.5

FAULTS		
	Not used	2.17.6

STANDARD 2.18 : FUEL PIPE INSTALLATION
Fuel pipes shall be installed above bilge water level.

OBJECTIVE *The objective of this standard is to ensure that fuel pipes are not installed in a position where exposure to bilge water and consequent accelerated corrosion can be reasonably foreseen.*

BILGE WATER LEVEL

The bilge water level can be determined by:
- the presence of a "tidemark"
- the position of the bilge pump
- the level at which the float switch is set

Installation It is good practice to run fuel pipes as high as possible and where they are run under the cabin floor or sole as close to the underside of the floor as possible.

CHECKING

Visually check that any fuel pipes in the bilge area are above bilge water level.

FAULTS		
Fuel Pipes	Not installed above bilge water level	2.18.1

STANDARD 2.19 - CARBURETTORS & AIR INTAKES

Carburettors (other than of the down draught type) shall be fitted so as to allow any overflow there from to drain into a spirit-tight metal drip tray the top of which shall be covered with copper or brass gauze of flame arresting mesh soldered to the tray all round.

The tray shall be removable or be fitted with a cock for emptying.

A flame trap or air filter must be fitted to the air intake of petrol, petroil and paraffin engines.

FIG 2.4

OBJECTIVE

The objective of this standard is to ensure that any overflow from a carburettor is not discharged into the interior of the boat or is caught and held in an appropriate drip tray. This standard also addresses back-fire control of petrol engines.

Down draught carburettors

Some down draught carburettors (e.g. some Zenith carburettors on some Ford engines) are fitted with an overflow pipe. In the properly marinised versions of these engines the take-off point for this pipe is provided with a raised vent tube as it is not possible to fit drip trays to these carburettors.

There are engines in boats where this has not been done and any overflowing petrol falls straight into the bilge.

These installations are extremely dangerous and surveyors and examiners will take action under the dangerous boat procedure and will also record a fault at 2.15.1.

Practicality

It is not necessary for surveyors/examiners to assess whether it is practical or not to fit a drip tray if one is required. If one is required and it is not fitted they will record a fault.

CHECKING

Visually check presence of an effective drip tray for non down-draught type of carburettor.

FAULTS		
Carburettor	Not fitted with drip tray	2.19.1

SPIRIT TIGHTNESS

CHECKING

Visually check for signs of fuel leaking from the drip tray.

FAULTS		
Carburettor Drip Tray	Not spirit tight	2.19.2

DRIP TRAY COVERS

CHECKING Visually compare gauze covering drip tray with sample of copper or brass gauze.

FAULTS		
Carburettor Drip Tray	Not covered with copper/brass gauze	2.19.3

FLAME ARRESTING MESH - Suitability

CHECKING Visually compare gauze with sample of gauze of correct mesh
Visually check the gauze for holes or signs of damage.

FAULTS		
Carburettor Drip Tray	Not of flame arresting mesh	2.19.4

FLAME ARRESTING MESH - Installation

CHECKING Visually check that there are no gaps or defects in the soldered seams.

FAULTS		
Carburettor Drip Tray	Mesh not soldered to the tray all around	2.19.5

DRIP TRAY - Draining

CHECKING Visually check that the drip tray is removable or fitted with an emptying cock.

FAULTS		
Carburettor Drip Tray	Not removable nor fitted with emptying cock	2.19.6

AIR INTAKES There is no requirement for surveyors/examiners to dismantle the air filter to determine the nature of the filter element, if any.

CHECKING For petrol, petroil and paraffin engines, visually check location of air intake and presence of flame trap or air filter.

FAULTS		
Air Intake	Not fitted with flame trap nor air filter	2.19.7

STANDARD 2.20 - ENGINE INSTALLATION

The engine shall be securely installed.

OBJECTIVE

The objective of this standard is to ensure that engines are securely installed to prevent excessive vibration, movement and consequent damage to fittings and connections.

Security

Secure installation is determined by:

- the use of appropriate fastenings
- the condition of the engine bearers, mountings, and engine beds

ENGINE MOUNTINGS

Engines may be fixed to the bearers in two ways: **FIG 2.5**

- solid mounting
- flexible mounting

Typical arrangements are shown in Figure 2.5.

Holding Down Bolts

The heads and nuts of holding down bolts must be properly landed in the fully tightened position and the nuts provided with suitable locking arrangements.

Screw fastenings such as coach screws are not recommended.

CHECKING

Visually check all parts of the engine mounting system for:

- fractured engine mounting brackets
- loose, missing or fractured bolts or nuts
- evidence of breakdown of flexible mounts

Manually check that the engine is not capable of movement in any direction other than the movement allowed by the use of any flexible mounts.

FAULTS		
Engine	Not securely installed	2.20.1

STANDARD 2.21 - REVERSING & STOPPING
Every vessel shall have effective means of reversing operable from the steering position. The engine stop control shall be located as near to the steering position as is practicable. [see Exemption 11.8]

OBJECTIVE

The objective of this standard is to ensure that boats are provided with effective minimum stopping controls.

Effectiveness Effectiveness is not being checked and surveyors/examiners must not attempt to start the engine or move the boat. It is sufficient for them to identify the presence of a means of reversing and stopping.

CHECKING Visually check presence of a reverse gear selector and that it is connected to the gear changing mechanism.
Visually check that it can be operated from every steering position.

FAULTS		
*Engine	No means of reversing operable from steering position	2.21.1

EXEMPTION 11.8 Vessels manufactured prior to 16 June 1998 are not required to comply with that part of Standard 2.21 which requires effective means of reversing.

FAULTS		
	*EXEMPTION APPLIED	2.21.2

ENGINE STOP CONTROL The engine stop control is to be located as near the steering position as practicable. It is recommended that it is located within 1 metre or arms length of the steering position.

Practicality It may not be possible to mount it within reach of the helmsman as:

- the control may be an integral part of the engine
- there may not be a suitable mounting point
- the steering position may be at some distance from the engine e.g. forward and amidships steering positions

CHECKING Visually check that the stop control is located as near to every steering position as practicable.

FAULTS		
Engine	Stop control not located as near to steering position as practicable (advisory for private boats)	2.21.3

STANDARD 2.22 : ENGINE TRAYS & OIL-TIGHT AREAS

An oil-tight tray made of metal or other suitable material, the sides of which must be carried up as high as practicable, shall be fitted beneath every engine and gearbox so as to prevent leakage of oil escaping into any part of the vessel or overboard.

A tray is not required if oil-tight structural members are fitted fore and aft of the engine.

No fixed bilge pump is to draw from the oil-tight area.

[see Exemption 11.9]

OBJECTIVE

The objective of this standard is to ensure that any fuel or lubricating oil from engines and gearboxes is effectively collected in an effective tray or an oil-tight area which is separated from any fixed bilge pump suction.

Oil-tight area

A tray is not required if it is possible to create an oil-tight area beneath every engine and gear box.

ENGINE TRAY
- Material

The tray must be made of metal or other suitable material which is to be:

- non-porous
- non-corrodible
- oil resistant

If the tray is constructed of GRP, it is recommended that an extra gel coat be applied.

CHECKING

Visually check for presence of oil tray or other means of containing oil leaks from engines and gearboxes and check for signs of oil outside the tray or oil-tight area.

FAULTS		
Engine Tray	Not made of a suitable material	2.22.1

ENGINE TRAY - height of sides

The sides of the tray are to be as high as practicable in order to help ensure the effective collection of the sump contents.

The sides must not:

- come into contact with any part of the engine or other piece of equipment
- interfere with the operation and maintenance of the engine or other piece of equipment

The height of the sides is not to be determined by the need to remove the tray for any purpose. The recommended minimum height is 100mm.

CHECKING

Visually check that the sides of the engine tray or oil-tight area tray are carried as high as practicable (recommended minimum 100mm).

FAULTS		
*Engine Tray	Sides not carried as high as practicable	2.22.2

EXEMPTION 11.9 Exemption now expired.

ENGINE TRAY - Location

Trays or oil tight areas are to be fitted beneath every engine and gearbox. The tray is to be longer than the combined length of the engine and reverse-reduction gearbox unit.

It is recommended that the tray is positioned so that it does not catch any leakage from the stern gland.

CHECKING

Visually check that any oil leaking from the engine or gearbox will be collected in the engine tray or oil-tight area.

FAULTS		
Engine Tray	Not fitted beneath engine/gearbox	2.22.4

ENGINE TRAY - Containing Oil Leaks

CHECKING

Visually check for presence of oil outside the engine tray or oil-tight area.

Visually check the engine tray or oil-tight area, including joints and seams, for signs of corrosion, damage and deterioration.

FAULTS		
Engine Tray	Does not prevent oil escaping into vessel or overboard	2.22.5

ENGINE TRAYS - Fixed Bilge Pumps

The reason for providing an oil-tight area for the collection of any oil leaking from the engine or gearbox is to:

- contain a potential fire risk

- prevent oil being discharged overboard and provide for its safe disposal on-shore.

Fixed bilge pumps must not be allowed, therefore, to draw from the oil-tight area.

CHECKING

Visually check for presence of a fixed bilge pump or fixed suction pipe in engine tray or oil-tight area.

FAULTS		
Engine Tray	Fixed bilge pump fitted in oil tight area	2.22.6

STANDARD 2.23 - ENGINE and EXHAUST COOLING

The cylinders and exhaust system shall be effectively cooled and shall allow for the dissipation of heat.

In the case of air-cooled engines or where water is not passed through the exhaust system the exhaust pipe silencer and flanges shall be effectively lagged or shielded.

OBJECTIVE *The objective of this standard is to ensure that engines are protected from overheating and that engine exhaust systems do not form an ignition hazard.*

Effectiveness The checks under this Standard do not require surveyors/examiners to start or run the engine to determine compliance.

ENGINE COOLING The basic engine cooling systems and their components are shown in Figures 2.6 to 2.8. **FIGS 2.6 - 2.8**

CHECKING Visually check for the presence of an appropriate method of engine cooling which must be a complete installation with all joints and connections made and in good condition.

The engine and its components must be carefully examined for any signs of overheating such as:

- blistered paintwork
- cracks or heat damage to rubber or flexible hoses
- melted or burnt insulation on cables

FAULTS		
Engine	Cylinders not effectively cooled (advisory for private boats)	2.23.1

EXHAUST SYSTEM Cooling The basic exhaust cooling systems and their components are shown in Figures 2.9 and 2.10. **FIGS 2.9 & 2.10**

CHECKING Visually check for the presence of an appropriate method of exhaust system cooling which must be a complete installation with all joints and connections made and in good condition.
Visually check the route of the exhaust system for any signs of heat damage.

FAULTS		
Exhaust System	Not effectively cooled	2.23.2

EXHAUST SYSTEM - Shielding/Lagging The exhaust manifold is not regarded as part of the exhaust pipe for purposes of this Standard.

Lagging Exhaust pipes are usually lagged with asbestos-substitute flexible tapes. The pipe is "bandaged" with the tape generously over-lapped and secured with metal or heat resistant fastenings.

Shielding Shields are usually metal and made of perforated plate to allow the dissipation of heat. They are normally secured to the permanent structure of the vessel.

CHECKING

Identify presence of air cooled engine or exhaust system not cooled by water and visually check presence of lagging or shielding.

Visually check lagging for:

- signs of damage and deterioration
- complete coverage of exhaust pipe
- securing with appropriate fastenings

Visually check shielding for damage and deterioration.
Visually examine all adjacent structures for signs of heat damage from the exhaust.

FAULTS		
Exhaust Pipe	Not effectively lagged or shielded	2.23.3

STANDARD 2.24 : EXHAUST NOISE

Exhaust noise shall be effectively suppressed and no form of exhaust silencer cut-out shall be used.

OBJECTIVE

The objective of this standard is to ensure that inboard engine exhaust noise is controlled.

Effectiveness The checks under this Standard do not require surveyors/examiners to start or run the engine to determine compliance.

Noise suppression It is not possible to give figures for unacceptable noise levels for boat exhaust systems but guidance can be found in Health & Safety at Work legislation which states that employees may not be exposed for prolonged periods to any noise level of 80 decibels or above without approved ear protectors.

Exhaust systems which are not silenced or have defective silencers can easily exceed this limit.

Water-cooled exhausts Water-cooled exhausts do not need a silencer as the action of injecting water into the exhaust gas flow provides the necessary noise suppression.

Expansion boxes On older traditional boats expansion boxes may be found. These are acceptable providing they are to the original design and are in good condition.

CHECKING

Visually check for presence of a silencer cut-out (diverter valve) in the exhaust pipe before it enters the silencer.

Noise levels will not be checked at present during the Boat Safety Examination but surveyors/examiners must satisfy themselves that:

- an exhaust system, including a silencer/expansion box, is installed, and that all elements are properly connected
- there are no signs of excessive damage or corrosion, or leaks of exhaust gases

FAULTS		
Silencer	Exhaust noise not effectively suppressed (advisory for private boats)	2.24.1

STANDARD 2.25 - STEAM POWERED ENGINE INSTALLATIONS

In any steam powered engine installation:

i) pressure systems shall have a current inspection certificate issued by a Recognised Competent Person and shall be covered for third party risks by a current insurance policy.

ii) where the boiler is fuelled by liquefied petroleum gas, the gas installation shall comply with Part 7 of these Standards as applicable.

iii) where the boiler is fuelled by diesel, paraffin or similar fuels, the fuel installation shall comply with the appropriate requirements of Part 2 of these Standards as applicable.

iv) in the case of a duel fuel system no flame failure device is required so long as the boiler when in use is constantly attended.

OBJECTIVE

The objective of this Standard is to ensure that the particular hazards associated with steam engines and their associated fuel systems are effectively controlled.

Note The text of this section has been reviewed by the Steam Boat Association of Great Britain.

PRESSURE SYSTEM INSPECTION CERTIFICATE

The inspection certificate is actually a detailed report of an examination of a pressure system which may involve a number of stages and tests and the report may be issued in two parts. **FIG 2.11**

There is no set format for the report although HSE does publish a model form (see Figure 2.11).

The reports are issued by organisations (often an insurance company) and professional independent competent persons.

In all cases the reports will be signed by a person with a title such as:

- Tester
- Examiner
- Inspector
- Surveyor
- Engineer Surveyor

A report will be issued whatever the state of the boiler as its purpose is to tell the owner what is wrong as well as what is right. The existence of a report does not mean, therefore, that the boiler is in a satisfactory state to be used, so it must be read carefully.

Report The points to be assessed are:

Assessment

- has the examination been carried out by a competent person
- does the report indicate satisfactory condition

Competent Person

Any person issuing a report on behalf of one of the following may be accepted as competent:

- Insurance companies
- Plant examination firms
- SBA Services Ltd
- Northern or Southern Federations of Model Engineering Societies

In the case of other organisations or persons the report is signed by a person of the appropriate designation.

In cases of doubt it may be necessary to refer to the Manager of the Boat Safety Scheme .

Satisfactory Condition

The indications of satisfactory condition to look for in the report are as follows:

- the examination was carried out in two stages
- the report applies to the boat in question
- date of examination(s)
- terminology

Two Stage Examination

The boiler must first be examined cold before it is examined under steam at normal working pressure.

The two examinations may have been done on the same date or they may have been done on separate dates, and they may be reported on a single form or on two - one for each examination.

It is essential to establish that both examinations have been carried out.

Name of Boat

The name of the boat in question must appear on the report.

Some boilers are examined out of the boat and the boat name can be omitted by the examiner.

Date of Examination

Reports are only valid for 14 months following the date of the latest examination.

The only exception is where the report states a "run-out" date in which case it is valid up to that date.

Where the examination has been done in two parts the examinations must not be separated by too long a period. There is no maximum but it is recommended that the examinations are done within 3 months of each other.

Where the separation is longer, the examiner must seek an explanation.

Terminology The report must be carefully checked for words or statements such as:

- satisfactory/unsatisfactory
- in order/not in order
- repairs required

If repairs have been required there is usually documentary evidence that they have been carried out satisfactorily. If not, the owner must be asked to supply the necessary information.

CHECKING Visually check validity of current inspection certificate and confirm that the details recorded on the certificate are those of the vessel being examined.

FAULTS		
Pressure System	No current Pressure System Certificate	2.25.1

PRESSURE SYSTEM INSURANCE POLICY

CHECKING Visually check validity of current insurance policy or certificate and confirm that the details recorded are those of the vessel being examined.

FAULTS		
Boiler	No current Pressure System Insurance Policy (advisory for private boats)	2.25.2

BOILERS FUELLED BY LIQUEFIED PETROLEUM GAS

Where the boiler is fuelled by LPG, the gas installation is to comply with Part 7 of the standards as applicable:

The LPG installation must be checked under Part 7 and if any fault recorded concerns the LPG supply to the engine, a fault is also to be recorded at 2.25.3

FAULTS		
Boiler	LPG installation does not comply with Part 7 of these Standards	2.25.3

BOILERS FUELLED BY DIESEL, PARAFFIN OR SIMILAR FUELS

Where the boiler is fuelled by diesel, paraffin or similar fuels, the fuel installation is to comply with Part 2 of the Boat Safety Standards.

The fuel installation will be checked under Standards 2.1 to 2.19 and if any fault recorded under those Standards concerns the fuel supply to the engine, a fault is also recorded at 2.25.4

CHECKING Where the boiler is fuelled by liquid fuel visually identify type of fuel used and apply relevant parts of Part 2 of the standards

FAULTS		
Boiler	Fuel system does not comply with Part 2 of these standards	2.25.4

STANDARD 2.26
ENGINES FUELLED BY LIQUEFIED PETROLEUM GAS

All vessels with internal combustion engines fuelled by Liquefied Petroleum Gas (LPG) must comply with the Liquefied Petroleum Gas Association (LPGA) Code of Practice No.18 except that engine installations shall not be constructed to allow the use of a dual fuel system where LPG constitutes one of the fuels employed.

OBJECTIVE *The objective of this Standard is to ensure that the particular hazards associated with are controlled.*

EXAMINATION OF VESSELS WITH LPG FUELLED ENGINES

Special arrangements are made for the examination of these vessels and owners will have been advised to contact the Manager of the Boat Safety Scheme for details and to arrange for their vessels to be examined.

These arrangements include the complete Boat Safety examination so there is no requirement for surveyors/examiners to carry out a part- or incomplete examination.

The following information is therefore included for guidance only and is not intended to form the basis for an examination of these vessels.

LPG fuelled outboard engines The arrangements referred to above also apply to LPG fuelled outboard engines (see 5.5.1)

LPG fuelled generators & other equipment Surveyors/examiners may determine the compliance of portable LPG fuelled generators but every other piece of equipment fuelled by LPG is to be referred to the Manager of the BSS as described above.

LPG CONTAINERS FOR LPG FUELLED ENGINES

Design pressure The design pressure shall be not less than 22 bar.

Security The container(s) must be securely attached to the craft by means of:

- fixed lugs welded to the container during manufacture
- provision of cradles, metal straps, or bonds attached to the craft

Exterior protection The exterior of the container(s) must be protected from corrosion by an adequate surface treatment.

Marking A data plate shall be permanently attached to the tank giving - as a minimum the following information:

- specification or code to which the tank is manufactured
- manufacturer's name or identification mark and test mark
- the tank serial number
- water capacity in litres (gallons)
- design test pressure in bar (lbf/in^2)
- year of manufacture
- date of test, mark of testing authority and space for re-tests

Stowage Container(s) must be stowed in accordance with Part 7.

COMPARTMENTS & LOCKERS
Compartments and lockers for the storage of containers must be constructed in accordance with Part 7.

CONNECTIONS & FITTINGS
All connections and fittings must be:
- protected against physical damage and tampering
- readily accessible

ENGINE SYSTEM - Control Equipment
The engine system shall incorporate the following control equipment:

- a filter to remove matter from the LPG fuel
- an automatic lock-off valve after the filter and upstream of the pressure reducing regulator(s)
- a pressure regulator(s) which may be combined with a vaporiser
- a vaporiser
- an automatic control to shut-off the gas supply if the engine stops for any reason
- a second independent shut-off valve which need not be automatic
- a carburettor

PIPE WORK - material
Pipe lines shall be of high pressure hydraulic grade stainless steel, copper or copper alloy suitable for a minimum service pressure rating of not less than 75 bar (1100 lbf/in^2).

PIPE WORK - installation
Where high pressure pipe lines are installed within the hull or superstructure, all joints and connections shall be enclosed in a vapour-tight sleeve and vented to the outside of the hull or superstructure.

Every section of a pipe line between positive shut-off or lock-off valves shall be fitted with a hydrostatic relief valve whose vent is piped away to the open air or a safe place.

The start to discharge pressure of the relief valve shall be not less than 1 bar above the relief valve setting of the container and not more than 50 bar.

Low pressure LPG flexible connectors shall be permitted for connection between the engine carburettor and the second stage regulator.

CONTROL EQUIPMENT - installation
Control equipment shall be installed in a vapour-tight compartment in accordance with Standard 7.2.

The engine intake air shall be supplied via remote trunking from a source outside the hull or superstructure.

EMERGENCY PROCEDURES - instructions
All hire craft shall have written emergency instructions which detail the action to be taken in the event of a gas leak and/or fire on board.

CHECKING Checking of LPG fuelled engines is currently performed by special arrangement with the BSS office.

FAULTS		
LPG Engines	Installation not in compliance with LPGA Code of Practice 18	2.26.1

DUAL FUEL SYSTEMS Where LPG is used as one of the fuels in a dual fuel installation, there is a danger of damage to carburettors and mechanical fuel pumps while the engine is operating on LPG as there is the potential for periods of "dry running". For this reason, the use of LPG is not permitted.

The fuel tanks must be examined to determine the two fuels in use.

CHECKING Visually identify dual fuel installation and refer to BSS office for acceptability.

FAULTS		
LPG Engines	Dual fuel system not allowed	2.26.2

Boat Safety Scheme

Information Sheet No. 1A

15 December 1999

Set out below is updated BSS information concerning permanently installed plastic fuel tanks which supercedes Information Sheet No 1 dated 21 July 1998.

Please read this information carefully.

All fuel tanks, intended for use in recreational craft within the scope of the Recreational Craft Directive, (voluntary from 16 June 1996 and mandatory from 16 June 1998), which are placed on the Community/EEA market, must meet the essential requirements of that Directive and must bear the CE marking of conformity. It should be noted that 'CE' marked products and components enjoy free circulation within Europe given the intended purpose, restrictions on the use and installation requirements provided by the manufacturer.

PERMANENTLY INSTALLED PLASTIC FUEL TANKS

1. In the case of plastic fuel tanks, 'CE' marking to the Recreational Craft Directive (RCD) (94/25/EC) indicates that the product complies with the essential safety requirements of that Directive and accordingly the product has had the 'CE' marking affixed by the manufacturer or his authorised representative.

Note 1 CE marking of fuel tanks may be affixed to the tanks, or on its packaging, or on both.

2. Plastic fuel tanks, including 'CE' marked tanks, may also be marked by the manufacturer with the standard or code to which it was constructed provided that this does not mislead third parties with regard to the meaning or form of the CE marking (or reduce its visibility and legibility), although construction to a standard or code is not the only method whereby a manufacturer might demonstrate compliance of the product with the RCD.

Note 2 *Most standards or codes relating to fuel tanks include a clause requiring the product to be marked with the manufacturer's details, fuel type(s) for which the tank is suitable, design capacity, test pressure and the standard or code number.*

For example: The US Coast Guard Code of Federal Regulations (CFR) Part 183.510 of 33 CFR, subpart J is one such code. Conformity with this code can be determined by a visual inspection of the tank manufacturer's plate that should make reference to the CFR Part 183.510 or any of the following voluntary codes:

American Boat and Yacht Council (ABYC) H24 and H33. (N.B. H33 refers to diesel systems and stipulates the same procedures as for petrol systems).

American National Standards Institute/Underwriters Laboratories (ANSI/UL) 1102.1991.

National Fire Protection Association (NFPA) fire protection standard for pleasure and commercial motor craft - NFPA 302.

National Marine Manufacturers Association (NMMA) specification.

3. Where there is no 'CE' marking or other markings or documentation providing guidance to the tanks suitability for the fuel used, or where there is an indication that the 'CE' marking relates to a Directive other than the RCD, then advice should be sought from the manufacturer or distributor as to its suitability for the intended purpose.

Note 3 *Alternatively, the Boat Safety Scheme may already have such information and advice can be sought from the BSS office particularly as new appropriate standards or codes are published from time to time.*

4. All plastic fuel tanks outside the scope of the RCD, which are not manufactured to an appropriate standard or code, constitutes a failure to meet Boat Safety Scheme requirements.

5. Plastic fuel tanks should be installed in accordance with the manufacturer's instructions and requirements. Manufacturers may specify the intended purpose of the product and should draw attention to any restrictions on the use of the product. Plastic fuel tanks not used in accordance with the intended purpose or not installed in accordance with the manufacturer's instructions may pose a serious risk to public safety.

Note 4 *Restrictions placed on the intended use by manufacturers may include specifying the type of fuel to be stored and/or excluding other types of fuel.*

Note 5 *Manufacturer's installation instructions may also include requirements for the plastic fuel tank to be installed, for example:*

with the smooth base surfaces of the tank supported and secured;
in a ventilated area;
above deck or open cockpit locations only;
outside of accommodation spaces;
away from sources of heat, or protected from heat or fire;
away from direct sunlight;

In the absence of the manufacturer's installation instructions such information may be available from the distributor of the tank. Alternatively information may be available from the Boat Safety Scheme office.

6. Where plastic fuel tanks have been installed in any way other than in accordance with their intended use and manufacturer's installation requirements, this may constitute a failure to meet Boat Safety Scheme requirements under Standard 2.6 and/or Standard 2.7 as appropriate

7. If there are any signs of:

   - fuel leakage from the fuel tank material;
   - physical damage (such as significant chafing or puncture);
   - signs of corrosive attack (such as softening or environmental stress cracking)

the condition of the plastic fuel tank must be considered unsafe and it must be urgently replaced.

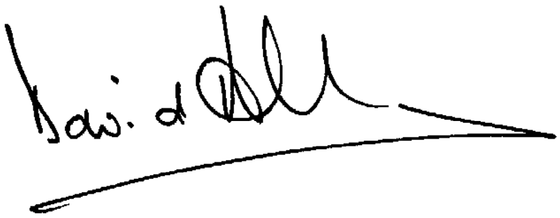
Note 7 *Chafing may potentially occur next to the restraining points on the tank. Chafing may lead to fuel leaks.*

Softening indicates corrosive attack by the fuel causing the fuel to permeate the plastic or tank gasket material. The physical properties of the material will progressively degrade and may ultimately lead to tank failure or fuel leaks. The presence of softening would indicate that the tank is not being used in accordance with its intended purpose.

Environmental stress cracking may develop should the tank be subject to tension or bending stress beyond its design tolerance and over prolonged periods. Environmental stress cracks may cause fuel leaks. Potential areas of stress cracking can be:

- *Adjacent to a tank spigot;*
- *Next to a means to restrain the tank;*
- *Around a tight radius in the moulded tank surface*

8. In all cases, suspected non-compliance with the RCD should be reported to the relevant Local Authority Trading Standards Department in Great Britain or District Councils in Northern Ireland.



David Allison
General Manager
Boat Safety Scheme

WARNING

Leaking fuel may present an immediate danger to public safety, property and the environment.

WARNING

Work on fuel tanks can be dangerous to you and others nearby.
Seek professional advice if you are not sure what to do.

Boat Safety Scheme
Willow Grange
Church Road
Watford WD1 3QA
Telephone 01923 201278
Facsimile 01923 201420

Boat Safety

Boat Safety Scheme
Technical manual

Part 3

ELECTRICAL INSTALLATIONS

British Waterways

Environment Agency

The Boat Safety Scheme is a joint initiative between BW and the EA

PART 3 ELECTRICAL INSTALLATIONS - NOTES

BMEA CODE OF PRACTICE FOR ELECTRICAL INSTALLATIONS

In addition to the Boat Safety Standards, there is also a Code of Practice produced by the British Marine Electronics Association (BMEA) which embodies a number of other standards.

It also includes good installation practice for which, at present, there are no suitable standards. It was prepared for implementation in new-build boats but is a source of valuable information and guidance for those wishing to repair, maintain or modify their electrical installations.

ELECTRIC SHOCK - Effect On The Body

The effects of electric currents on the human body varies greatly and the dangers from even very small currents are often not appreciated.

The International Electrotechnical Commission publication 479 "Effects of current passing through the human body" shows that a current of only 10-30 milliamps passing continuously from one hand to another (or to the feet) can cause heart fibrillation and death.

ELECTRIC SHOCK - Causes

The most obvious source of an electric shock is an exposed live conductor.

A less obvious source is an exposed metal object which becomes connected to a live conductor. This can be caused by:

- faulty or incorrect installations
- accidents such as driving screws into hidden cables
- breakdown in conductor insulation due to damage and deterioration

PLUGS & SOCKETS

At present, there is no check on the type of plugs and sockets used for on-board electrical supplies but it is not good practice to use the same types for supplies of different voltages.

The BMEA Code of Practice states that sockets for one voltage or supply should be incompatible with the plugs for any other voltage.

RESIDUAL CURRENT DEVICE (RCD)

RCDs should always be installed on boats with a 240V supply to disconnect the supply before a dangerous situation is reached.

These are automatic switches which rely on the principle that in a fault-free system there are no leakages to earth and all the current leaving the RCD through one live conductor returns to it by the other.

If a leakage does occur, all the current does not return through the neutral conductor and the RCD detects the leakage (known as the residual current) and "trips" within a few milli-seconds to shut off the current and prevent an electric shock.

The "leakage" the RCD can detect is pre-set, usually at 30 milliamps.

They can be mounted in a separate enclosure or combined with the fuse or circuit breaker installation, and comply with BS 4293.

They are marked RCD or RCCD on the faceplate.

STANDARD 3.1 : BATTERIES

All batteries shall be securely installed so as to prevent movement and damage.

All battery compartments shall be adequately ventilated and covered with insulating and non-corrosive material.

No battery may be fitted beneath or adjacent to any petrol or LPG tank, cylinder, cock, pipe or filter.

Definition

A battery compartment is an enclosure specifically designed to contain the batteries only.

BATTERY INSTALLATION - Security

Batteries and battery compartments may be secured by attaching them to the permanent structure of the vessel by means of:

- clamps
- straps
- cradles or framework

The method used should ensure that the batteries remain secure under any condition up to 45° to the horizontal.

Batteries should be installed with insulating material between them and the hull.

Where batteries are fitted in accommodation areas they should be enclosed in gas tight compartments (see Fault 3.1.2)

CHECKING

Visually check presence of battery securing system.
Manually check for movement that must not exceed 10mm in any direction.

FAULTS		
Battery	Not securely installed	3.1.1

VENTILATION OF BATTERY COMPARTMENTS

All battery compartments are to be adequately ventilated to ensure the dispersal of hydrogen gas produced during battery charging.

Hydrogen is lighter than air and the simplest way of providing ventilation is by means of holes, slots or louvres at or near the top of the compartment.

Where the compartment is fitted with a lid, this must also be provided with holes or slots to ensure that an unventilated pockets is not created beneath it where hydrogen could accumulate.

Batteries Installed in Engine Bays

Where batteries are installed in engine compartments it should not be necessary to provide battery ventilation providing the engine compartment is ventilated to the outside air.

Batteries In Accommodation Areas

Where batteries are fitted in accommodation areas they should be enclosed in gas tight compartments which are ventilated to the outside air.

Where battery compartment ventilation ducts are installed, the IEE Regulations Section 14.12 state that:

- no part of the ducting is to be inclined at an angle more than 45^o from the vertical
- where this cannot be achieved, a fan is to be incorporated in the ducting to provide forced ventilation

CALCULATION OF VENTILATION REQUIREMENTS

For each battery, the area of the ventilation openings required is found by the formula:

no.cells x capacity in amp.hrs (Ah) x 1.935 = area in sq.mm

Where it is not possible to do the calculation for any reason, the following table provides a guide for a range of typical batteries.

The dimensions are taken from manufacturers data and are reasonably consistent across the range of batteries normally used in pleasure craft.A 25mm diameter hole has an area of approx. 490 mm^2.

Where there is more than one battery, multiply the ventilation requirements for one battery by the number of batteries installed.

Ah	L	W	H	NO. CELLS	AREA mm^2	NO. HOLES
6V BATTERY						
105	293	169	222	3	609	2
160	245	169	330	3	929	2
12V BATTERY						
63	381	169	222	6	731	2
105	486	199	222	6	1219	3
160	477	169	330	6	1857	4
24V BATTERY						
63	381	169	222	12	1462	3
105	486	199	222	12	2438	5

160	477	169	330	12	3714	8

CHECKING

Calculate the ventilation requirements for the battery compartment from the following formula:

Ventilation (mm^2) = no. of cells x capacity in Ah x 1.935

Visually check ventilation provision. (See appendix for ready reckoner)

FAULTS		
Battery	Compartment not adequately ventilated	3.1.2

BATTERY COVERS

The top of the battery is to be protected by insulating and non-corrosive material.

Where the top of the battery(s) is sealed so that only the +ve and -ve terminals are exposed, insulated terminal covers are acceptable. This applies also to batteries contained in compartments.

For the traditional type of battery top where the inter-cell connectors are also exposed, a cover needs to be provided to protect the whole of the top surface of the battery.

Where this type of battery(s) is contained in a compartment, a cover for the compartment is acceptable.

Protection

Protection may be achieved in two ways:

- batteries not in compartments - fit protective cover
- batteries in compartments :
  - fit protective cover
  - provide lid for compartment

In all cases, the presence of a cover or compartment must not impede the ventilation of the surface of the batteries so that battery gas emissions can be dispersed.

Suitable materials are wood, plastics, vulcanised rubber.

Metallic covers are not acceptable.

Use of deck boards as covers

If batteries are installed below deck, the deck board over them is acceptable as an insulated cover providing it does not have to be lifted or removed for any purpose other than access to the batteries.

CHECKING

Visually check presence of a battery cover or terminal covers and identify material used.
Visually check that no part of any metal terminal or any metal connection is exposed.

FAULTS		
Battery	Not covered with insulating and non corrosive material	3.1.3

BATTERY LOCATION

For the purpose of this Standard:

- the term "battery" includes any part of a battery
- there should be a separation of approximately 0.5m in any direction between the batteries and the petrol or LPG installation

BENEATH/ADJACENT PETROL/LPG TANK

CHECKING Visually check that no part of any battery is fitted beneath or within 0.5m of any petrol or LPG tank.

FAULTS		
Battery	Fitted beneath/adjacent PETROL/LPG tank	3.1.4

BENEATH/ADJACENT PETROL/LPG CYLINDER

CHECKING Visually check that no part of any battery is fitted beneath or within 0.5m of any petrol or LPG cylinder.

FAULTS		
Battery	Fitted beneath/adjacent PETROL/LPG cylinder	3.1.5

BENEATH/ADJACENT PETROL/LPG COCK

CHECKING Visually check that no part of any battery is fitted beneath or within 0.5m of any petrol or LPG cock.

FAULTS		
Battery	Fitted beneath/adjacent PETROL/LPG cock	3.1.6

BENEATH/ADJACENT PETROL/LPG PIPE

CHECKING Visually check that no part of any battery is fitted beneath or within 0.5m of any petrol or LPG pipe.

FAULTS		
Battery	Fitted beneath/adjacent PETROL/LPG pipe	3.1.7

BENEATH/ADJACENT PETROL/LPG FILTER

CHECKING Visually check that no part of any battery is fitted beneath or within 0.5m of any petrol or LPG filter.

FAULTS		
Battery	Fitted beneath/adjacent PETROL/LPG filter	3.1.8

STANDARD 3.2 : ELECTRIC CABLES

Cables shall be of adequate current carrying capacity and of suitable construction and grade.

They shall be insulated and/or sheathed so as to be impervious to attack by fuel or water.

They shall be adequately supported or run in adequately supported suitable conduit.

CABLE - Definition

For the purpose of this Standard, the term "cable" also includes the cable terminations and connectors.

In some cases, however, terminations or connectors could not be insulated or sheathed otherwise they would not be able to make metal-to-metal electrical contact.

OUTBOARD & PORTABLE ENGINES

Engine covers are not to be removed as part of the examination as there is no requirement to check any part of the electrical installation inside the engine cover.

For this purpose, the engine cover is that supplied by the engine manufacturer as an integral part of the engine.

'Hush' covers

'Hush' covers do not count as engine covers and owners (or their representatives) should remove them as part of the preparation for the examination if tools are needed for their removal.

Cables to be checked

It is not possible within the scope of the Boat Safety Scheme to carry out meter testing of the electrical circuits but a reliable assessment can be made by checking the physical size of the cables described in the tables below by comparison with sample cables of known current rating. **FIGS 3.1 & 3.2**

The designated cables are also shown in Figures 3.1 and 3.2.

Master Switch in the Positive Wire

The cables to be checked are as follows (minimum cable sizes for the duties indicated assume a cable run of approx. 2m).

CABLE	MIN. SIZE
master switch (1) to starter battery	$25mm^2$
master switch (1) to starter solenoid	$25mm^2$
starter battery to engine negative post	$25mm^2$
engine negative post to alternator	$10mm^2$
alternator to blocking diode	$10mm^2$
blocking diode to batteries	$10mm^2$
master switch (2) to services battery	$25mm^2$
master switch (2) to blocking diode	$10mm^2$
master switch (2) to distribution box	$10mm^2$
services negative post to services battery	$10mm^2$

Master Switch in the Negative Wire

The cables to be checked are as follows (minimum cable sizes for the duties indicated assume a cable run of approx. 2m).

CABLE	MIN. SIZE
master switch to starter battery	25mm^2
master switch to engine negative post	25mm^2
starter solenoid to starter battery	25mm^2
engine negative post to alternator	10mm^2
alternator to blocking diode	10mm^2
blocking diode to batteries	10mm^2
services battery to master switch	25mm^2
master switch to services negative post	10mm^2
services battery to distribution box	10mm^2

Battery to Battery Connections

All battery to battery connections are to be at least 25mm^2 .

Cable Rating

10mm^2 cable has a rating of 60 Amps
25mm^2 cable has a rating of 110 Amps

Distribution Cables

Cables to electrical equipment are not likely to be visible for checking but providing the circuits are properly protected by fuses or circuit breakers of the correct rating this is not likely to be a problem in a sound installation.

Any cable terminations that can be seen in the distribution box or panel must be VISUALLY examined and their rating assessed by comparison with samples of known size and rating.

The rating of the fuse or circuit breaker in the circuit in question must then be determined by VISUAL examination and compared with the rating of the cable. The rating of the protective device must always be LESS than the cable it is protecting.

Lucas alternators

Some Lucas alternators were supplied with 8.5mm cabling and this is acceptable providing all other requirements of the Standards are met.

CHECKING

Verify that following cables are of minimum size:
Battery to master switch 25mm^2
Battery to starter motor 25mm^2
Battery/Battery 25mm^2
Other cables between battery and fuse/distribution box suitable current carrying capacity for the installation.

FIGS 3.1 & 3.2

Note that outboard engines, which have the engine manufacturer's original loom, are not required to meet these dimensions.

FAULTS		
Electric Cables	Not of adequate current carrying capacity	3.2.1

CABLES - CONSTRUCTION

Multi-strand cables

The specifications for multi-strand cables (construction, number of strands, diameter etc) are given in the BMEA Code of Practice (see Introduction to Part 3).

Solid Conductors

Solid conductors are acceptable for existing boats i.e. non-CE marked boats manufactured prior to 16 June 1998, providing no faults are recorded at 3.2.1, 3.2.3 to 3.2.5.

When any cable with solid conductors is repaired or replaced multi-strand cables must be used, and any modifications or additions to the installation must be made with multi-strand cables.

Types of Terminals

There are 3 main types of terminal:

- pillar terminal - conductor inserted into a hole or cavity where it is clamped under the shank of a screw
- screw terminal - conductor is clamped under the head of a screw
- stud terminal - conductor clamped under a nut

Connections to terminals

It is good practice for all conductors to be fitted with suitable terminations for connection to terminals.

Except for pillar terminals, bare wires should not be used to connect to terminals and the use of ring or captive spade connectors is recommended wherever possible.

Soldered connections

If connectors are not used, the bare wires should be soldered (tinned) over a sufficient length to enable the soldered end to be formed into a loop or hook.

Soldered connections should not be used for connecting or terminating any conductor greater than $2.5mm^2$.

Pillar terminals

This is the only type of terminal where it would be acceptable for the connection to be made with the bare ends of the conductors.

Care is needed to ensure that the conductors are bared to the correct length for the terminal and that they are properly engaged by the shank of the screw securing them to the terminal.

Screw & Stud Terminals

The clamping pressure should be applied through an intermediate part, such as a washer, clamping plate or anti-spread device and not directly by the head of the securing screw or nut.

CHECKING Visually check the type of any conductors that can be seen at any termination or junction.
Visually check cables for presence of suitable terminations and connectors. All connections and terminations must be examined for signs of:

- corrosion
- damage
- loose connections
- overheating

FAULTS		
Electric Cables	Not of suitable construction	3.2.2

CABLES - Grading Cables are graded according to the type of PVC insulation used to protect them. Cables of suitable grade will be resistant to damage by:

- flame or heat
- oils and other chemicals
- physical damage

PVC insulation is the most widely used but other types include:

- mineral fibre
- butyl rubber
- silicone rubber
- ethylene propylene

The following are not permitted:

- bare wires
- fabric covered cables

Fabric covered cables Fabric covered cables are not acceptable as the covering is not impervious to attack by fuel or water as required by Standard 3.2.

Identification Unless the cable is visibly marked, the grade cannot be determined by visual examination.

CHECKING Visually check all cables that can be seen for signs of:

- damage or deterioration
- overheating

FAULTS		
Electric Cables	Not of suitable grade	3.2.3

INSULATION & SHEATHING

CHECKING Visually check for presence of outer insulation or sheathing to cables and for any signs of damage and deterioration caused by reaction with fuel or water.

FAULTS		
Electric Cables	Not insulated and/or sheathed	3.2.4

CABLES - Support

Where the cables are fixed directly to the structure of the boat they should be supported by insulated clips or fixings at approximately 300mm centres.

If the cables are run in conduits, the conduits are to be supported at intervals of approximately 900mm.

Where cables pass through bulkheads and partitions they should be supported by grommets or sleeves so there is no direct contact between the cable and the hole through which they pass.

Suitable Conduit

The British Standard for non-metallic conduits is "BS 4607 Non-metallic conduits for electrical installations. Part 1. Specification for fittings and components of insulating materials".

The Standard states that all conduits must be made of insulating material and must be resistant to:

- heat
- burning
- impact

There is also a requirement that all conduit, fittings and components complying with this Standard shall be durably and legibly marked to indicate compliance but it is acceptable for the marking to be applied to any carton or package containing these materials, therefore the conduit itself may not be marked.

CHECKING

Visually and manually check cables for either: support in a safe position or enclosure in supported conduit

Visually check conduit for signs of damage by:

- heat
- burning
- impact

FAULTS		
Electric Cables	Not adequately supported nor run in supported suitable conduit	3.2.5

STANDARD 3.3 - ELECTRICAL CIRCUITS
Main circuits shall be installed above bilge water level and all except starter circuits shall be protected by circuit breakers or fuses of the appropriate rating and of suitable design.

MAIN CIRCUITS - Installation

For the purpose of this standard, main circuits are any circuits which are not allowed to be in the bilge. Circuits which are allowed to be in the bilge are those supplying equipment specially designed to operate in the bilge such as:

- bilge pumps
- float switches
- transducers such as echo sounders and depth gauges
- security alarms
- fire pumps
- gas detectors

All other cables are to be installed above bilge water level as constant immersion in bilge water may result in damage and degradation to the insulation.

It may be possible to run cables under the cabin sole or floor providing the level of the floor is above bilge water level.

Bilge Water Level

The bilge water level can be determined by:

- the presence of a "tidemark"
- the position of the bilge pump
- the level at which the float switch is set

CHECKING

Visually check position of main circuits in relation to normal bilge water level.

FAULTS		
Main Circuits	Not installed above bilge water level	3.3.1

CIRCUIT BREAKERS & FUSES

Circuit breakers and fuses are protective devices which will:

- carry the full load of the circuit continuously

- break the circuit:
    - after a short period for overloads of around 25%
    - in milliseconds if there is a substantial overload

The current rating of the device must therefore always be less than the cables it is protecting.

Additional Circuits

Any protective devices should be examined for indications that additional circuits have been installed which could jeopardise the safety of the system.

The most obvious sign of this is the use of wiring of different construction, design, and colour from that used in the original wiring.

Individual circuits The Standard requires that all main circuits except starter circuits shall be protected by fuses or circuit breakers but at present no check is made that every individual circuit is protected and the absence of protection is not a failure point.

Owners are still required to comply with the requirements of the Standards.

AC circuits There is no requirement at present that AC circuits should be protected by RCDs although it is strongly recommended by the BMEA Code of Practice that they should always be fitted where 240v supplies are installed.

CHECKING Visually examine any fuses or circuit breakers that can be seen and check that rating is not greater than that specified on the fuse holder or body of the circuit breaker. Check that fuse rating is less than the current capacity of the cable protected.

FAULTS		
Electric Circuits	Not protected with fuses/circuit breakers of appropriate rating	3.3.2

CIRCUIT BREAKERS & FUSES - Design Circuit breakers and fuses are to be of appropriate design which means:

- the correct type of fuse or circuit breaker is to be used
- they are to be contained in an enclosure so that they are protected when the lid or cover is closed
- there must be no additions or alterations to the equipment as supplied by the manufacturer

Steel Hulled Boats Steel hulled boats with two wire installations should be fitted with double pole circuit breakers to protect them if a double insulation fault should occur.

A double insulation fault occurs when there is a breakdown in both positive and negative lines.

A.C. Circuits A.C. circuits are protected in a different manner.

The system of wiring should terminate at domestic socket outlets or a fused outlets. Appliances are connected to them by means of square pin plugs fitted with 13 Amp (maximum) fuses.

The incoming supply should be fed via a 30 Amps double pole circuit breaker so that both line and neutral conductors will be isolated when the circuit breaker operates in response to an overload condition.

Where power is taken from a shore supply, the need to break both line and neutral also guards against the possibility of reversed polarity at the shore connection.

Residual current devices should be installed between the circuit breaker and the wires going to all a.c. power outlets to protect people from electric shocks.

Rating of fuses & circuit breakers

The use of fuses and circuit breakers of the correct rating and design provides some protection against the use of unsuitable cables as the fuse or circuit breaker will operate to disconnect the circuit in the event of a failure or overloading of the cable.

Testing RCDs

There is no requirement for RCDs (where fitted) to be tested.

Visual examination

Surveyors/examiners need to be able to see the fuses and circuit breakers to carry out their checks and it is the owner's responsibility to ensure that they are visible as part of the pre-examination preparation.

CHECKING

Visually examine distribution box for presence of lid or cover if required.

Visually examine fuses and circuit breakers and determine:

- the correct wire or cartridge is fitted

Visually examine fuses and circuit breakers to ensure that they are:

- not damaged
- fitted securely
- not held closed by any tape or other device

FAULTS		
Electric Circuits	Not protected with fuses/circuit breakers of appropriate design	3.3.3

STANDARD 3.4 - ELECTRIC CABLES

All cables shall be installed as high as is practicable in the vessel, and they shall be run clear of all sources of heat such as exhaust pipes.

They shall not be run adjacent to fuel or gas pipes unless contained in suitable conduit.

PVC insulated and/or sheathed cables shall not to be run in direct contact with polystyrene thermal insulation.

[see Exemption 11.10]

INSTALLATION HEIGHT

Cables are to be installed in the boat as high as practicable to minimise the risk of damage caused by:

- any machinery or equipment with moving parts
- impact from within the vessel
- water, fuel, oils, chemicals
- members of the crew when moving about the boat

Cables in Bilges

The only cables permitted to run below bilge water level are those supplying equipment specially designed to operate in the bilge e.g.

- bilge pumps
- float switches
- transducers such as echo sounders and depth gauges
- security alarms
- fire pumps
- gas detectors

In most cases these will be factory sealed units and no modifications, extensions, or connections may be made to any part of the equipment or the wiring running in the bilge.

CHECKING

Visually check height of all visible cables within the vessel

FAULTS		
Electric Cables	Not installed as high as is practicable	3.4.1

EFFECT OF HEAT

Cables are to run clear of all sources of heat such as:

- exhaust pipes
- water heaters
- heating appliances
- boilers
- cooking appliances
- refrigerators

Electric cables are generally rated to operate in ambient temperatures of around 20°C but some of the above appliances can produce local temperature rises of 40° or more.

The recommended clearance is 125mm but 75mm should be considered the absolute minimum.

CHECKING Visually check routing of cables for proximity of heat sources and examine cable for signs of heat damage e.g. deterioration of insulation

FAULTS		
Electric Cables	Not run clear of all sources of heat	3.4.2

FUEL AND GAS PIPES Cables are not to be run adjacent to any fuel or gas pipe unless contained in a suitable conduit.

Where they are not run in conduits a minimum clearance of 30mm should be maintained.

Suitable Conduit All conduits must be made of insulating material and must be resistant to:

- heat
- burning
- impact

CHECKING Visually check electrical cables are supported clear of fuel pipes. Minimum clearance is not specified

FAULTS		
Electric Cables	Run adjacent to fuel pipes not in suitable conduit	3.4.3

CHECKING Visually check electrical cables are supported 30mm clear of gas pipes.

FAULTS		
Electric Cables	Run adjacent to gas pipes not in suitable conduit	3.4.4

POLYSTYRENE INSULATION PVC insulation contains plasticisers which react with polystyrene when in direct contact with it. The plasticisers are taken up by polystyrene which partially dissolves leaving the insulation brittle. Ultimately, the insulation crumbles leaving the conductors exposed with a serious risk of short circuits and fire.

Preventive & Remedial Measures Alternative insulation materials such as mineral fibre insulation can be used.

The cables may be run in suitable conduits such as unplasticised PVC or galvanised steel.

Cables insulated with butyl rubber, silicone rubber, or ethylene propylene can be used.

Cables showing any signs of deterioration or indicating low resistance readings should be replaced.

CHECKING Visually examine any insulation in contact with PVC insulated or sheathed cables.

Where visual examination is not possible, Exemption 11.10 will be applied and the owner advised to have the installation tested by a competent electrician with experience in the marine environment.

FAULTS		
*Electric Cables	PVC cables not run clear of polystyrene insulation	3.4.5

EXEMPTION 11.10 Vessels manufactured prior to 16 June 1998 and having PVC insulated or sheathed cables in direct contact with polystyrene thermal insulation are not required to comply with that part of Standard 3.4 which requires that PVC cables shall not run in direct contact with polystyrene insulation until such time that an insulation resistance test discloses an electrical fault in cables in direct contact with polystyrene thermal insulation.

Testing The expert advice available suggests that this test should be carried out at least once a year, and records kept of the resistance values obtained.

Where the tests reveal deteriorating or failed cable insulation indicated by low resistance readings, action should be taken to comply with the requirements of Standard 3.4.

The test should be done even if the insulation is visible and there are no visible signs of damage.

CHECKING Exemption 11.10 will also be applied in cases where a visual examination of the insulation is not possible (see previous check).

FAULTS		
	*EXEMPTION APPLIED	3.4.6

STANDARD 3.5 - BATTERY MASTER SWITCHES

A master switch capable of disconnecting the system (including starter circuits) shall be installed in a readily accessible position as close to the battery as possible.

The master switch must be capable of carrying the maximum current of the system.

Electric bilge pumps, security alarms, fire pumps and electronic navigation equipment with memories when fitted may have circuits which by-pass the master switch but only if separately protected by fuses or circuit breakers.

If the master switch is not visible, its position must be clearly marked.

INSTALLATION

Where there are separate circuits e.g. for starting and boat services, each battery or bank of batteries will require a master switch if the switching is done in the positive line.

If the switch is installed in the negative line, one switch to which all the negatives are connected is acceptable but not recommended (see below).

CHECKING

Visually check presence of master switch(es).

FAULTS		
Master Switch	Not installed	3.5.1

CAPABILITY TO DISCONNECT THE SYSTEM

The master switch must be capable of disconnecting the system. **FIGS 3.1 & 3.2**

To achieve this in all circumstances it should be fitted in the positive line.

If it is fitted in the negative, it will not disconnect the services system if it is opened while the engine is still running as these circuits will continue to receive current from the alternator even though they are isolated from the battery.

In these circumstances, it is possible - even likely - that the current will be cut off by the alternator, fuses or circuit breakers. However, it does mean that the master switch is not, by itself, capable of disconnecting the system in all circumstances which is the purpose of this standard.

CHECKING

Where there are separate batteries or banks of batteries and the switch (es) is installed in the positive line, visually check that a switch is provided for each battery or bank of batteries and that switch disconnects all non-essential equipment.

FAULTS		
Master Switch	Not capable of disconnecting system	3.5.2

CHECKING Visually check every master switch is readily accessible when boat is in normal use.

FAULTS		
Master Switch	Not in a readily accessible position	3.5.3

LOCATION Master switches are to be installed as close to the battery as possible.

It is recommended that it should be located not more than 1 metre from the battery it serves.

Access, however, takes precedence over distance from the battery.

Where there is a long run of unprotected cable, it would be good practice to install a second master switch as close to the battery as possible.

CHECKING Visually check master switch as close as possible to batteries. Note that accessibility takes precedence over distance.

FAULTS		
Master Switch	Not as close to battery as possible	3.5.4

CURRENT CARRYING CAPACITY The master switch must be capable of carrying the maximum current of the system.

The recommended minimum rating is 100 Amps.

CHECKING Visually examine the master switch and the cables connected to it for any signs of:

- overheating
- missing components
- loose connections

FAULTS		
Master Switch	Not capable of carrying maximum current of system	3.5.5

CIRCUITS BY-PASSING THE MASTER SWITCH The following equipments may have circuits which by-pass the master switch providing they are separately protected by fuses or circuit breakers: **FIG 3.3**

- electric bilge pumps
- security alarms (including VHF marine band radios)
- fire pumps
- electronic navigation equipment with memories

This is permitted to allow these equipments to remain operable when the rest of the electrical installation is isolated by the master switch.

It is essential, however, that such circuits are separately protected by fuses or circuit breakers.

CHECKING Visually check that circuits supplying equipment which may bypass the battery master switch i.e. electric bilge pumps, security alarms, fire pumps and electronic navigation equipment with memories are protected by a suitable fuse or circuit breaker.

FAULTS		
Master Switch	Bilge pump/security alarm/fire pump/navigation equipment circuits by-passing the master switch not separately protected by fuses or circuit breakers	3.5.6

MARKING OF POSITION The marking should be placed in a prominent position as close to the switch as practicable.

It should be:

- clearly distinguishable from the surface on which it is mounted
- capable of being read from a distance of approximately 1 metre
- of a permanent nature which means it should not:
  - be removable by abrasion or contact
  - become illegible through cleaning, fading, or normal usage

CHECKING If the master switch is not visible, visually check that position is clearly marked with the marking in open view

FAULTS		
Master Switch	Position not clearly marked	3.5.7

STANDARD 3.6 - MAIN, STARTER, AND PLUG LEADS
Main and starter motor leads subject to high current shall have soldered or pressure crimped connectors. Spark plug leads shall be supported clear of the engine block and cylinder head.

MAIN & STARTER MOTOR LEADS - Connections

Ring- or captive spade connectors should be used.

Conductors must not to be secured directly to terminals by:

- nuts or screws
- any device depending on spring tension e.g. crocodile clips
- temporary fastenings of any kind

Use of screw clamps for battery terminals

The use of screw clamps in which the shank of a screw acts directly on the bare wires of the cable is not permitted. There is a risk of damage to the conductors and it is extremely difficult for the screw to secure all the conductors in the cable.

Clamps which include a sleeve or plate acting between the screw shank and the bare conductors are acceptable for existing boats only.

SAFETY

Connectors of this type ensure that:

- conductors are securely gripped by the connector
- the connector is securely fastened to the terminal
- bare conductors are not directly attached to the terminal

CHECKING

Visually check that main leads are fitted with soldered ends or crimped connectors.

Visually check for battery terminals fitted with screw clamps on existing vessels and verify use of spreader plate in terminal.

FAULTS		
Main Leads	Not fitted with soldered or pressure crimped connectors	3.6.1

CHECKING

Visually check that starter motor leads are fitted with soldered ends or crimped connectors.

FAULTS		
Starter Motor Leads	Not fitted with soldered or pressure crimped connectors	3.6.2

SPARK PLUG LEADS

Spark plug leads are to be supported clear of the engine block and cylinder head by attachment to permanent fixtures.

These leads run close to the engine so it is essential that they are supported clear of the engine and cylinder head so there is no risk of the heat causing damage or deterioration to the insulation.

The leads should be supported by clips or fastenings to give a clearance of approximately 125mm.

CHECKING

Visually check that spark plug leads are supported so they are not touching the engine block or cylinder head.

Visually check leads for signs of heat damage.

FAULTS		
Spark Plug Leads	Not supported clear of engine block/cylinder head	3.6.3

STANDARD 3.7 - IGNITION PROTECTION
All electrical devices fitted in any compartment containing petrol or gas shall be ignition protected in accordance with BS EN 28846 . [see Exemption 11.11]

BS EN 28846 (ISO 8846)

This international standard describes test methods and requirements for the design of electrical devices to be used on small craft so that they may be operated in an explosive atmosphere without igniting surrounding flammable gases.

It does not cover ignition protection procedures for products or components that may operate in hydrogen and air mixtures.

Marking To Indicate Compliance

Items of equipment are marked with:

- the ISO number
- the word "Marine"

Any suitable form of marking is acceptable.

Markings such as the following, on their own, are not acceptable:

- "Ignition Protected"
- "Intrinsically Safe"

Petrol Compartments

A petrol compartment is any compartment in which petrol is used or stored, including petrol engine compartments.

CHECKING

Visually check for presence of electrical devices in any petrol compartment and determine presence of marking to indicate compliance with BS EN 28846.

FAULTS		
*Electrical Device	Fitted in PETROL compartment not ignition protected	3.7.1

Gas Compartments

A gas compartment is any compartment in which gas is stored.

CHECKING

Visually check for presence of electrical devices in any gas compartment and determine presence of marking to indicate compliance with BS EN 28846.

FAULTS		
*Electrical Device	Fitted in GAS compartment not ignition protected	3.7.2

EXEMPTION 11.11 Vessels manufactured prior to 16 June 1998 are not required to comply with Standard 3.7 which requires that all electrical devices fitted in any compartment containing petrol or gas shall be ignition protected in accordance with BS EN 28846 where it is not practicable to comply.

This exemption will be rescinded at some future date by amendment.

Practicability The exemption will be applied at the request of the owner and surveyors/examiners will make a note in their records that this was done.

When any device is replaced or any modifications or additions are made, the new or replacement device must be ignition protected in accordance with BS EN 28846 .

FAULTS		
	*EXEMPTION APPLIED	3.7.3

STANDARD 3.8 - WIRING INSTALLATION

All electrical equipment shall be two-wire insulated except in respect of engine circuits where there must be a low resistance return conductor between the battery and the engine.

Engine installations with two wire insulated electrical systems do not require fitting of the low resistance return conductor.

TWO WIRE INSTALLATIONS

Two wire installations are necessary so that no part of the hull of the boat is used as part of the return circuit.

The object of insulating the electrical system from the hull is to prevent corrosion caused by electrolytic action.

A single wire system could only be found on a boat with a steel hull because it uses the hull as the return circuit. This is not permitted.

CHECKING

Visually check suitable device e.g. horn, headlamp, navigation light for presence of two wire insulated cable.

A single wire installation will have only one insulated conductor connected.

FAULTS		
Electrical Equipment	Not two wire insulated	3.8.1

ENGINE CIRCUITS - Low Resistance Return Conductors

Although there may be electrical connection between the hull of a boat and the bodies of electrical equipment such as alternators and starter motors, an electrical path of low resistance is to be provided between the battery and the engine.

The hull or superstructure is not to be used as one of the conductors.

It is recommended that a heavy duty cable with conductors of at least $25mm^2$ be used.

CHECKING

Identify any temperature, oil pressure sender, stop solenoid etc mounted on the engine and count the wires going to the device.

If there is only one wire, the engine is a single wire installation and a visual check should be made for the presence of a low resistance return conductor between the battery and the engine.

FAULTS		
Engine Circuits	No low resistance return conductor between battery and engine	3.8.2

STANDARD 3.9 - RADIO & TELEVISION INTERFERENCE
The spark ignition and generating systems of engines and all electrical equipment on the vessel shall be effectively suppressed against causing radio and television interference.

CHECKING At present, suppression of radio and TV interference will not be checked as part of the Boat Safety Examination.

FAULTS		
Spark Ignition and Generating Systems	Not effectively suppressed against radio/TV interference	3.9.1
Electrical Equipment	Not effectively suppressed against radio/TV interference	3.9.2

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Boat Safety

Boat Safety Scheme

Technical manual

Part 4

ELECTRICALLY PROPELLED VESSELS

British Waterways

Environment Agency

The Boat Safety Scheme is a joint initiative between BW and the EA

STANDARD 4.1 : COMPLIANCE WITH OTHER STANDARDS

The installation shall comply with the requirements of Part 3 of these standards insofar as they are applicable, and in all cases with the appropriate British Standards and with the Institution of Electrical Engineers (IEE) Regulations for the Electrical and Electronic Equipment of Ships as appropriate to the size of the installation.

BSS Part 3 - Compliance

For any vessel powered solely by batteries, the following faults in Part 3 do not apply:

3.5.4 - master switch not as close to battery as possible
3.5.6 - bilge pumps, security alarms, and fire pumps
3.6.2 - starter motor leads
3.6.3 - spark plug leads
3.7.1 - electrical devices in petrol compartments
3.7.2 - electrical devices in gas compartments
3.7.3 - exemption to 3.7.1 and 3.7.2

CHECKING

Carry out the checks required by Part 3 and if any fault recorded is applicable to the electrical propulsion installation (other than 3.5.4, 3.5.6, 3.6.2, 3.6.3, 3.7.1, 3.7.2, 3.7.3 for a boat powered solely by batteries) a fault is to be recorded at 4.1.1.

FAULTS		
Electric Propulsion	Installation does not comply with Part 3 of these Standards	4.1.1

BRITISH STANDARDS

The following British Standards are appropriate:

- BS 6231 "PVC Insulated Cables for Switchgear and Controlgear Wiring" Table 7 "PVC Insulated Flexible Cables"

- BS 6500 "Insulated Flexible Cords and Cables" Section 3, Table 16 "PVC Insulated, PVC Sheath 3-core Conductors"

- BS EN ISO 8846 "Protection of electrical devices to prevent ignition of surrounding flammable gases

- BS EN 60309 "Industrial plugs, socket outlets and couplers for AC and DC supplies" Section 1, Table 1 "220V-240V Coloured blue"

The requirements of these British Standards, where applicable, are covered by the Boat Safety Standards indicated in the following sections of this manual:

BS 6231	- Standard 3.2
BS 6500	- Standard 4.6
BS EN ISO 28846	- Standard 3.7
BS EN 60309	- Standard 4.6

CHECKING If any fault recorded in the Boat Safety Standards (3.2, 3.7, 4.6) is applicable to the electrical propulsion installation a fault is to be recorded at 4.1.2

FAULTS		
Electric Propulsion	Installation does not comply with British Standards	4.1.2

IEE REGULATIONS The Institute of Electrical Engineers (IEE) Regulations for the Electrical and Electronic Equipment of Ships, Section 14, "Battery Installations" is applicable to vessels subject to the Boat Safety Scheme.

The relevant requirements cover:

- battery stowage and installation
- battery compartment ventilation
- covers for batteries and battery compartments
- location of batteries and battery compartments

These requirements are dealt with in the Boat Safety Standards as follows:

- fault nos. 3.1.1 to 3.1.8 incl.
- fault nos. 4.2.1, 4.2.2, and 4.8.1

The remaining regulations are not appropriate to powered pleasure craft of the size covered by the Boat Safety Scheme.

CHECKING Record a fault if any fault recorded at 3.1.1 to 3.1.8 is applicable to an electrical propulsion installation, or a fault is recorded at 4.2.1, 4.2.2 and 4.8.1.

FAULTS		
Electric Propulsion	Installation does not comply with IEE Regulations	4.1.3

STANDARD 4.2 : BATTERIES - STOWAGE & VENTILATION

The arrangement of batteries, including in particular their stowage and the requirements in respect of adequate ventilation shall comply with the IEE Regulations for the Electrical and Electronic Equipment of Ships - Section 14.

Requirements

The requirements are described in the IEE Regulations Section 14.11 "Location" and may be summarised as follows:

- all batteries shall be securely stowed
- battery compartments are to be adequately ventilated
- batteries are to be covered with insulating and non-corrosive material
- batteries may not be fitted beneath or adjacent to any part of an installation containing petrol or LPG

These requirements are covered by the following parts of the Boat Safety Standards :

REQUIREMENT	BOAT SAFETY STANDARDS
Stowage	3.1.1
Ventilation	3.1.2 & 4.2.2
Battery Covers	3.1.3
Location	3.1.4 - 3.1.8

CHECKING

Record a fault if any fault recorded at 3.1.1 to 3.1.8 is applicable to an electrical propulsion installation, and also record a fault at 4.1.3 "Installation does not comply with IEE Regulations".

FAULTS		
Batteries	Not stowed in accordance with IEE Regulations	4.2.1

VENTILATION

Battery installations shall comply with the IEE Regulations Section 14.12 "Ventilation".

For purposes of battery ventilation there are two categories of boat:

- open boats - which will generally require no special ventilation provision as the batteries or battery compartment are directly exposed to the outside air
- cabin boats - special considerations may apply where the batteries are located below deck

Open Boats

If the batteries are contained with a battery compartment, the requirements of Standard 3.1 apply.

Cabin Boats Where the batteries are stowed below deck a ventilation system is to be provided to take the hydrogen gas to the outside of the boat.

Ventilation Systems Where battery compartment ventilation ducts are installed, the IEE Regulations Section 14.12 state that:

- no part of the ducting is to be inclined at an angle more than 45° from the vertical

- where this cannot be achieved, a fan is to be incorporated in the ducting to provide forced ventilation

Forced ventilation by fan is mandatory where the battery charging device has a maximum power output in excess of 2kW (IEE Regulations Section 14.12 (5) refers).

A 2kW output is:

- 160 Amps for 12 Volt systems
- 80 Amps for 24 Volt systems

The maximum current output to the batteries can usually be found on the manufacturers name plate on the alternator or static battery charger.

Ventilation Fan Motors & Spark Protection There is no standard for motors in the presence of hydrogen/air mixtures, so mechanical ventilation systems which include an electric motor should comply with the requirements of Standard 3.7 as appropriate.

As stated in I.E.E. Regulation 14.6 (11), the motor should be “placed external to the duct and the compartment”.

CHECKING Visually check power output of battery charger.

Record a fault if output is less than 2kW and a fault is recorded at 3.1.2.

If output more than 2kW, identify presence of mechanical ventilation system.

If not fitted, a fault is to be recorded.

FAULTS		
Batteries	Inadequate ventilation	4.2.2

STANDARD 4.3 : MOTOR INSTALLATION

The propulsion motor shall be securely installed.

CHECKING Visually check all parts of the motor mounting system for:

- damage
- corrosion
- rot or other deterioration
- unsuitable fastenings
- missing or loose fastenings

Manually check that the motor is not capable of movement in any direction other than the movement allowed by the use of any flexible mounts.

FAULTS		
Propulsion Motor	Not securely installed	4.3.1

STANDARD 4.4 : REVERSING MECHANISM

Every vessel shall have an effective means of reversing operable from the steering position.

EFFECTIVENESS The motor speed controller is usually provided with a reverse lever which changes the connections for the electro-magnetic field so the motor changes direction of rotation. This is a satisfactory method of obtaining reverse.

CHECKING Visually check presence of a reverse gear selector.

FAULTS		
Propulsion Motor	No effective means of reversing	4.4.1

OPERATION FROM STEERING POSITION It is recommended that it is located within 1 metre or arms length of the steering position.

Practicality It may not be possible to mount it within reach of the helmsman as:

- the control may be an integral part of the motor
- there may not be a suitable mounting point
- the steering position may be at some distance from the motor e.g. forward and midships steering positions

CHECKING Visually check that reverse gear selector can be operated from every steering position.

FAULTS		
Propulsion Motor	No effective means of reversing operable from steering position	4.4.2

STANDARD 4.5 : PROPULSION MOTOR - MASTER SWITCH

A manually operated master switch which can be operated from the steering position shall be fitted.

It shall be capable of cutting off the electrical supply to the propulsion motor.

MANUAL OPERATION

For the purpose of this Standard, manual operation is defined as the need for someone to do something to operate the master switch, as opposed to any automatic operation that might be activated by a sensing device etc.

A speed controller with an "OFF" position is not acceptable because it is not direct action and is not totally reliable in an emergency.

The switch can be either a direct action switch or a remotely operated mechanical or electrical switch providing the operation of the switch was manual which would include the use of a key.

CHECKING

Visually check that a manually operated battery master switch is fitted.

FAULTS		
Master Switch	Not fitted	4.5.1

DISCONNECTION

The switch is to be capable of breaking a current greater than the full load motor current which is marked on the manufacturer's name plate by 20%.

CHECKING

Identify master switch and visually examine the switch and the cables connected to it for any signs of:

- overheating
- missing components
- loose connections
- unauthorised modifications

FAULTS		
Master Switch	Does not disconnect supply to propulsion motor	4.5.2

OPERATION FROM STEERING POSITION

CHECKING

Visually check that battery master switch is located within approximately 1 metre or arms length of every steering position.

FAULTS		
Master Switch	Not operable from steering position	4.5.3

STANDARD 4.6 : CHARGING LEADS & PLUGS
The connection from the battery charger on board the vessel to the charging point ashore shall be by means of a 3 core flexible cable of adequate current carrying capacity and of suitable construction and grade, with connectors complying with the splash-proof category of BS EN 60309 Part 2.

THREE-CORE FLEXIBLE CABLE

Cables with solid conductors are not classed as 3-core flexible cables for the purpose of this standard.

CHECKING

Visually check for presence of 3-core cable.

FAULTS		
Charging Leads	Not 3 core flexible cable	4.6.1

CURRENT CARRYING CAPACITY

The cross-sectional area of the conductors in the cable will depend on the maximum AC current required on board which is usually that of the battery charger.

The current rating of the charger is marked on the manufacturer's name plate.

The current consumption of other AC equipment will need to be taken into account, particularly on larger boats.

The following are cable ratings to BS 6500:

- up to 16 amps - 2.5mm^2
- up to 32 amps - 6.0mm^2

CHECKING

Visually check current rating of battery charger and verify visually that the supply cable is of adequate current carrying capacity.

FAULTS		
Charging Leads	Not of adequate current carrying capacity	4.6.2

CONSTRUCTION & GRADE

The cable for the charging leads should comply with the requirements of BS 6500 "Insulated Flexible Cords and Cables".

Cables to this standard are constructed with multi-strand conductors which are:

- insulated
- contained in a toughened outer PVC sheath

The insulation on the conductors is coloured:

- brown - line
- blue - neutral

- green/yellow - earth

Armoured cables are also used which is acceptable.

If a fault is recorded under 4.6.3 a fault must also be recorded under 4.1.2 "installation does not comply with British Standards".

CHECKING Visually identify charging lead is three core cable of suitable construction.

FAULTS		
Charging Leads	Not of suitable construction and grade	4.6.3

CHARGING CONNECTORS The ship to shore connector is to be of a splash-proof type to BS EN 60309 Part 2.

For the purpose of this standard, the term "connector" includes both male and female connectors (plugs and sockets).

The moulding of connectors of the required standard is:

- coloured blue to indicate 240 volts
- incorporates a spring loaded splash-proof cover

The higher voltage plugs must not be used to avoid the possibility of connecting to a higher or lower voltage supply.

If a fault is recorded under 4.6.4 and fault must also be recorded under 4.1.2 "installation does not comply with British Standards".

SAFETY A male connector should always be fitted to the shore end of the shore-power cable for connection to the socket on the shore supply.

A female connector is fitted to the craft end of the shore-power cable so that anyone carrying or handling the lead is never holding a male connector.

If the shore-power cable is not connected directly to the charger, a shore-power inlet consisting of a shrouded male connector should be mounted on the boat in a suitable location.

The use of the domestic type 13 amp square pin plugs and sockets is not permitted as they are not constructed to be used in anything other than dry conditions.

CHECKING Visually check presence of a charging connector of the correct voltage to BS EN 60309 Part 2.

FAULTS		
Charging Plug	Not splash proof category of BS EN 60309 Part 2	4.6.4

STANDARD 4.7 : CHARGING PANEL (BATTERY CHARGER)

The battery charging panel on the vessel shall be adequately ventilated and shall incorporate a positive switch and an indication light to show when charging of the vessel's batteries is taking place.

VENTILATION

When the charger is working the heat produced could raise the temperature of the unit above its design temperature unless the unit is properly ventilated creating a fire hazard.

Where the charger is fitted into a small compartment some provision, such as louvered slots, must be made for air to circulate to the open air.

This is not necessary where the charger is located in a large space such as an engine bay.

There should be a minimum clearance of not less than 100mm between the case of the charger and the wall of the compartment where there are ventilated louvered slots in the case of the charger.

The compartment should have a direct connection with the outside air.

CHECKING

Visually check there is a means of dissipating heat from the battery charger.

FAULTS		
Charging Panel	Not adequately ventilated	4.7.1

POSITIVE SWITCH

The charging panel is to include a positive switch and the switching may be done by:

- an isolation switch/fuse
- a circuit breaker with a manual switch
- by a positive switch incorporated in the charger unit

A positive switch is a mechanical switch and its purpose is to isolate the battery charger from the incoming a.c. supply.

Electronic cut-outs, thermal sensing devices etc are not positive switches for purposes of this standard.

CHECKING Visually check presence of a manually operated ON/OFF switch on the charger control panel.

FAULTS		
Charging Panel	No positive switch	4.7.2

CHARGING INDICATOR LIGHT

CHECKING Visually check presence of charging warning light.

FAULTS		
Charging Panel	Charging warning light not fitted	4.7.3

STANDARD 4.8
BATTERY COMPARTMENT VENTILATION FANS

The battery charging arrangement shall incorporate control of the battery compartment exhaust ventilation fan, when fitted, such that the fan is automatically switched on when battery charging commences, and continues to run for one hour following the completion of charging.

IEE REGULATIONS IEE Regulations Section 14.12 (5) require the fitting of forced ventilation by fan where the battery charger output is over 2kW.

CHECKING Visually check power output of battery charger.

If over 2kW, visually check for presence of mechanical exhaust system.

FAULTS		
Battery	Exhaust ventilation fan not automatically switched	4.8.1

STANDARD 4.9
MOTOR & CONTROLLER COMPARTMENT VENTILATION

The motor and controller compartments shall be adequately ventilated .

REQUIREMENTS No special ventilation requirements are needed where the volume of the compartment in which the motor and the controller are situated is 10 or more times greater than the volume of the equipment.

Where it is less than this, it is necessary to provide additional ventilation to the compartment in question which should be treated in the same way as a battery compartment (see Part 3 under Fault 3.1.2) and the same checks apply.

CHECKING Visually check there is a means of ventilating the motor compartment.

Visually check for any signs of overheating of the motor and controller equipment and the immediate surroundings.

FAULTS		
Motor Compartment	Not adequately ventilated	4.9.1

CHECKING Visually check there is a means of ventilating the controller compartment. Visually check for signs of overheating of the controller equipment and the immediate surroundings

Controller Compartment	Not adequately ventilated	4.9.2

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Part 5

OUTBOARD and PORTABLE ENGINES

The Boat Safety Scheme is a joint initiative between BW and the EA

OUTBOARD and PORTABLE ENGINES

GENERAL

The filling of petrol tanks and transfer of petrol to outboard and portable engine installations is extremely hazardous. Petrol vapour is very volatile and extreme care should be taken.

It is essential during fuel transfer that there are no naked flames around. If there are any appliances on board with a lit flame e.g. refrigerators, cookers, these must be turned off during the refuelling operation.

Portable tanks must be removed from the boat for refuelling.

APPLICATION OF STANDARDS

These Standards apply to all vessels fitted with, or carrying, outboard or portable engines, whether in use or not.

STANDARD 5.1 : DECK and FUEL FILLING CONNECTIONS
All deck and fuel filling connections shall be situated so as to minimise the risk of cross-contamination and shall be clearly marked on the deck fittings or immediately beside them indicating the purpose of each connection and in the case of fuel connections the exact type of fuel.

CROSS-CONTAMINATION

Cross-contamination may be prevented by: **FIG 2.1**

- separating the connections by approx. 250mm (10").
- the camber of the deck carrying any overflow overboard
- installing a save-all around the connection
- use of deck fitting caps which require different keys to open them

CHECKING

Visually check that risk of cross-contamination is minimised.

FAULTS		
Deck Connections	Not minimising risk of cross contamination	5.1.1

MARKING OF DECK CONNECTIONS

Connections marked only with the word "FUEL" are not acceptable .

Pump-out and Rinse-out fittings may be marked with the "pump-out" symbol.

Purpose clearly marked

Clearly marked means the marking is in direct view of any person using the connection.

The lettering should:

- be a minimum of 5mm high
- be clearly distinguishable from the background
- not be removable by abrasion or contact
- not become illegible through cleaning, fading, or normal usage

CHECKING

Visually inspect all deck connections to ensure they are correctly and clearly marked.

This is not a failure point providing the connection is marked immediately beside it.

FAULTS		
Deck Connections	Not clearly marked 'PETROL'	5.1.2
Deck Connections	Not clearly marked 'PETROIL'	5.1.3
Deck Connections	Not clearly marked 'PARAFFIN'	5.1.4
Deck Connections	Not clearly marked 'DIESEL'	5.1.5
Deck Connections	Not clearly marked 'LPG BUTANE/PROPANE' as appropriate	5.1.6
Deck Connections	Not clearly marked 'WATER'	5.1.7
Deck Connections	Not clearly marked 'PUMP OUT'	5.1.8

Deck Connections	Not clearly marked 'RINSE OUT'	5.1.9

POSITION OF MARKING A separate label is the most appropriate form of marking, preferably in contact with the deck connection.

It should be placed in such a way that there is no doubt to which connection the label refers if there are adjacent fittings.

CHECKING Visually check deck connections, filling or discharge points other than those specified in 5.1.2 – 5.1.9 are correctly and clearly marked. Unused connections or points must be marked appropriately.

FAULTS		
Deck Connections	Marking not on deck fitting nor immediately beside deck connections	5.1.10

STANDARD 5.2 PERMANENTLY INSTALLED FUEL SYSTEMS
Permanently installed fuel systems shall comply with Standards 2.1 to 2.19 inclusive and they and all associated pipe work, cocks and fittings shall be suitably protected against external impact.

PERMANENTLY INSTALLED FUEL SYSTEM - definition

A permanently installed fuel system has a tank not designed for or capable of being removed for refuelling.

The fuel is drawn from a tank which is permanently installed in the vessel in accordance with Standards 2.1 to 2.9.

ENGINE COVERS

Any part of the fuel system located inside the engine cover, if fitted, will not be examined as engine covers are not to be removed by the surveyor/examiner.

For this purpose, the engine cover is that supplied by the engine manufacturer as an integral part of the engine.

'Hush' covers

'Hush' covers do not count as engine covers and owners (or their representatives) should remove them as part of the preparation for the examination if tools are needed for their removal.

CHECKING

Carry out checks 2.1.1 to 2.19.7 inclusive.

A fault is to be recorded under 5.2.1 if any fault recorded at Fault Nos. 2.1.1 to 2.19.7 inclusive is applicable to the permanently installed fuel system of an outboard or portable engine.

FAULTS		
Fuel Systems	Permanent systems not fixed/constructed to Parts 2.1 - 2.19 of these Standards	5.2.1

PROTECTION AGAINST EXTERNAL IMPACT

The system can be protected in two ways:

- physically by means of shields, ducts, conduits
- installing the system away from risk areas such as gangways, access points, accommodation areas.

Care must be taken in providing protection against external impact that accessibility to certain parts of the fuel system as required by Standards 2.2, 2.8, 2.17 is maintained.

The degree of shielding will depend on the perceived risk. "Kicking strips", which would provide suitable protection against being kicked or trodden on by members of the crew, could be of a lighter-duty construction than shielding arrangements designed to give protection against external impact and collisions.

It is also necessary to take account of the construction of the vessel itself. A part of the fuel system which may be considered vulnerable in a marine-ply or GRP hull for example, may not be at risk in a steel hull.

The fuel system includes:

- deck filling connections
- filling pipes
- vent pipes
- fuel tanks
- feed and return pipes
- cocks, valves, level indicators
- all joints and connections (incl. those to the engine)
- all pipe work
- all components which are an integral part of, or mounted on, the engine itself

CHECKING Visually check position of all elements of permanent fuel system in relation to risk of external impact.

FAULTS		
Fuel Systems	Permanent systems not suitably protected against external impact	5.2.2

CHECKING Visually check permanent pipework is protected against external impact

Fuel Systems	Permanent pipework not suitably protected against external impact	5.2.3

CHECKING Visually check permanently installed fuel cocks are protected against external impact

Fuel Systems	Permanent fuel cocks not suitably protected against external impact	5.2.4

STANDARD 5.3 : PORTABLE & INTEGRAL FUEL TANKS

Portable fuel tanks, carried inboard and connected by flexible piping to the engine and close coupled fuel tanks forming an integral part of the engine may be used providing they are in sound condition and that the fuel supply can be readily shut off and no unauthorised modifications are made to the equipment as supplied by the manufacturers.

Portable fuel tanks shall be clearly marked with the type of fuel to be used and when not in use shall be stowed in accordance with Standards 7.2 and 7.3.

DEFINITIONS

A close coupled tank is an integral part of the engine as supplied by the engine manufacturer.

The flexible tubing connecting a portable tank to the engine is regarded as an integral part of the tank.

SECURITY

Where the tank is connected to the engine by flexible tubing it should be secured by suitable means such as webbing or straps.

These securing arrangements are to be such that the tank can readily be removed from the boat for filling.

CONDITION OF PORTABLE/ CLOSE COUPLED TANK

Portable fuel tanks and close coupled fuel tanks forming an integral part of the engine may only be used if they are in sound condition.

These tanks are usually made of mild steel and may have a more limited life than permanently installed tanks.

They should be carefully examined for any indications of leaking fuel, particularly at the seams.

Any flexible hose used to connect a portable tank to an engine should also be carefully examined to determine its condition.

Great care is needed in carrying out the examination of the fuel system and engine installation if there is a strong smell of petrol, which is a good indication of leaking or spilt fuel.

PLASTIC TANKS

Plastic tanks as supplied by, or approved by or on behalf of, the engine manufacturer are acceptable for outboard engines providing all other requirements of the Standards (as appropriate) are met.

CHECKING

Visually and manually examine the fuel tank and any flexible hose used to connect it to the engine for:

- damage and deterioration
- corrosion
- fuel leaks

FAULTS		
Portable/close coupled Fuel Tank	Not in sound condition	5.3.1

FUEL SUPPLY SHUT OFF

The fuel supply is to be capable of being readily shut off.

This can be achieved by valves, cocks or bayonet fittings.

It is not a requirement of this Standard that a shut off device should be readily accessible as defined in the Glossary to the Standards, although it would be good practice.

Guidance on fitting a cock or valve in the fuel feed pipe is given in Section 2.17 but no modifications should be made to the system as supplied by the manufacturer unless approval is obtained from the manufacturer or supplier.

CHECKING

Identify portable or integral fuel tank system.

Visually check that fuel supply can be readily shut off by a valve, cock or bayonet fitting.

FAULTS		
Portable/close coupled Fuel Tank	Fuel supply not capable of being readily shut off	5.3.2

UNAUTHORISED MODIFICATIONS

Modifications to the equipment as supplied by the engine manufacturers are not permitted unless authorised by that manufacturer.

The kind of unauthorised modifications that fall into this category are alterations or modifications to parts of the fuel system such as the:

- tank (including interconnections)
- supply system
- shut off system
- hoses (including extensions)

The main indications that modifications have been carried out are that the additions and/or alterations do not match the manufacturer's specifications for:

- colour
- construction and grade
- marking (name, model, consumer information etc)
- mismatch of name, materials and connections

Replacement tanks

It is understood that most engine manufacturers will approve the use of another manufacturer’s tank providing it is the same type as the one they supply themselves for the engine in question.

These replacement tanks are acceptable providing:

- they are equivalent to the original equipment
- no unauthorised modifications have been made to the tank

or fuel supply (which would include substituting the original tank with a tank of greater capacity)

Painting or labelling

The following are not modifications for the purpose of this Standard:

- re-painting (including rust treatments) for maintenance purposes
- labelling (including painted labelling) to identify the type of fuel

Approval for modifications & replacements

Where it is apparent that any modifications or replacements have been made, documentary evidence from, or on behalf of, the manufacturer is required to confirm that they were authorised or approved.

CHECKING

Visually examine portable or integral fuel tanks, including any flexible hoses, for unauthorised modifications.

FAULTS		
Portable/close coupled Fuel Tank	Unauthorised modifications made	5.3.3

MARKING OF PORTABLE FUEL TANK

The tank must be clearly marked with the type of fuel to be used.

CHECKING

Visually check tank for clear marking of type of fuel used.

FAULTS		
Portable Fuel Tank	Not clearly marked with type of fuel used	5.3.4

STORAGE OF PORTABLE FUEL TANK WHEN NOT IN USE

The tank is being used when it is connected to the engine whether the engine is running or not.

When the tank is disconnected from the engine it is NOT in use.

SPARE TANKS

Providing they comply with the Standards, spare tanks are permitted providing they are stored in accordance with Standards 7.2. and 7.3 when not in use (see above).

CHECKING

Visually check that portable fuel tanks not in use are stowed in a drained, gas tight and fire resistant locker that meets the relevant Standards of Part 7.

FAULTS		
Portable Fuel Tank not in use	Not stowed in accordance with 7.2 and 7.3 of these Standards	5.3.5

STANDARD 5.4 : SPARE PETROL

Petrol not carried in fuel tanks shall be stowed in containers conforming with the requirements of the Petroleum Spirit (Motor Vehicles &c) Regulations 1929 (SR & O 1929/952) or the Petroleum Spirit (Plastic Containers) Regulations S.I. 1982 No.630 and these shall be stowed in accordance with Standards 7.2. and 7.3.

APPLICATION OF REGULATIONS

For the purpose of this Standard, the requirements are that:

- containers are to be marked as complying with the 1929 or the 1982 Regulations
- the capacity is not to exceed 5 litres
- not more than 2 such containers may be carried

CHECKING

Visually check for spare petrol containers and, if present, verify that containers are marked to conform to the 1929 or 1982 Petroleum Spirit Regulations.

FAULTS		
Spare Petrol	Not carried in approved containers conforming to Petroleum Spirit Regulations	5.4.1

STOWAGE

Spare petrol containers are to be stowed in accordance with Parts 7.2 and 7.3 of these Standards.

CHECKING

Visually check that portable fuel containers are stowed in a drained, gas tight and fire resistant locker that meets the relevant Standards of Part 7.

FAULTS		
Spare Petrol containers	Not stowed in accordance with 7.2 and 7.3 of these Standards	5.4.2

STANDARD 5.5 : LPG FUELLED OUTBOARD ENGINES

All vessels with engines fuelled by Liquefied Petroleum Gas (LPG) shall comply with the Liquefied Petroleum Gas Association (LPGA) Code of Practice No.18 except that engine installations shall not be constructed to allow the use of a dual fuel system where LPG constitutes one of the fuels employed.

TYPE OF FUEL These Standards apply to all engines fuelled by LPG in both liquid and vapour states.

DUAL FUEL INSTALLATIONS Paragraph 5.2.6 of the LPGA Code does not apply as the use of LPG in a dual fuel installation is not permitted.

REQUIREMENTS The requirements for complying with LPGA COP No.18 are detailed in Part 2 Standard 2.26.

CHECKING Checking of LPG fuelled engines is currently performed by special arrangement with the BSS Office.

FAULTS		
LPG Engines	Installation not in compliance with LPGA Code of Practice 18	5.5.1

LPG ENGINES - DUAL FUEL SYSTEMS Dual fuel installations where LPG constitutes one of the fuels used are not permitted.

CHECKING Visually identify dual fuel installation and check with the BSS Office for acceptibility.

FAULTS		
LPG Engines	Dual fuel system not allowed	5.5.2

STANDARD 5.6 : OUTBOARD ENGINE INSTALLATION

Outboard engines shall be securely fitted.

INSTALLATION Engines are usually mounted by either: **FIG 5.1**

- a one piece mounting assembly incorporating both securing bolts and a means of raising the engine out of the water
- a bracket with provision for it to be through-bolted to the transom

The engine should be secured directly to the transom or to a bracket secured to the transom.

Spacers and packing pieces may be fitted but should:

- be through-bolted to the transom
- not be held in place by the engine mounting brackets
- be at least twice as long as the distance between the engine mounting bolts

Mounting clamp bolts are to be provided with load-spreading caps securely fixed to the bolt.

Outrigger Arrangements Any "outrigger" arrangement is to be through-bolted to the transom or stern of the boat.

CHECKING Manually check there is no movement in any direction at any of the mounting points.

Visually check all components in the mounting system, including fixings and securing devices, for signs of:

- damage
- deterioration
- corrosion
- unauthorised modifications

FAULTS		
Outboard Engine	Not securely fitted	5.6.1

STANDARD 5.7 : EXHAUST NOISE

Exhaust noise shall be effectively suppressed.

REQUIREMENTS The requirements are described in Standard 2.24.

EFFECTIVENESS The checks under this Standard do not require surveyors/examiners to start or run engines to determine compliance.

CHECKING At present, actual noise levels will not be checked during the Boat Safety Examination.

FAULTS		
Exhaust Noise	Not effectively suppressed	5.7.1

STANDARD 5.8
STOWAGE OF PORTABLE ENGINES/GENERATORS WITH INTEGRAL FUEL TANKS

All portable LPG/petrol internal combustion engines/generators with integral fuel tanks when not in use shall be stowed in accordance with the requirements of Standards 7.2 and 7.3.

Portable diesel internal combustion engines or generators shall be stored securely when not in use.

GENERATORS IN USE

Generators are in use when they are connected to the boat's electrical system whether they are running or not.

When they are disconnected from the boat's electrical supply they are NOT in use (see also 5.3.5).

SMALL OUTBOARD MOTORS

For security reasons, some owners store small outboard engines in the cabin when not in use and this is acceptable providing the integral fuel tank is completely drained and ventilated.

If the engine does not have an integral fuel tank the requirements of this Standard do not apply.

CHECKING

Identify presence of portable LPG or petrol engine/generator.

Visually check storage is in accordance with Part 7 Standards relating to the storage of gas cylinders.

FAULTS		
Portable LPG/Petrol engines/Generators with integral tanks	Not stowed in accordance with Standards 7.2 and 7.3 of these Standards	5.8.1

CHECKING

No check is being carried out for the storage of portable diesel generators because the higher flash point of diesel does not require special storage arrangements.

FAULTS		
Portable Diesel Generators with integral tanks	Not stowed in accordance with Standards 7.2 and 7.3 of these Standards	5.8.2

STOWAGE OF PORTABLE DIESEL ENGINES & GENERATORS

They can be secured by any means that:

- is attached to some part of the permanent craft structure
- prevents movement of the engine or generator

CHECKING

Identify presence of portable diesel engine/generator not in use and, if present, manually check for excessive movement.

FAULTS		
Portable Diesel Generators	Not stored securely	5.8.3
Portable Diesel Engines	Not stored securely	5.8.4

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Boat Safety

Boat Safety Scheme
Technical manual

Part 6

FIRE PREVENTION & EXTINGUISHING EQUIPMENT

αβχδ ENVIRONMENT AGENCY

The Boat Safety Scheme is a joint initiative between BW and the EA

AN INTRODUCTION TO FIRE PREVENTION & EXTINGUISHING EQUIPMENT

CLASSIFICATION OF FIRES

There are three classes fire:

- Class A = paper, wood, textiles and fabrics etc
- Class B = flammable liquids
- Class C = flammable gases

The different classes require a different extinguishing medium and different techniques.

The extinguisher type for each class of fire is shown in the table as follows:

CLASS	MEDIUM	COLOUR
A	water	red
A/B	foam	cream
A/B/C	powder	blue
B/C	CO_2	black

CO_2 Extinguishers

CO_2 extinguishers are not to be provided for living spaces.

Halon Extinguishers

Because halon damages the environment, its production is being curtailed.

Halon extinguishers may be retained until life-expired or discharged, when they should be replaced, preferably with stored pressure ABC dry powder extinguishers.

Meanwhile it is safe to use provided that it is not released in a confined space where the vapours may be inhaled.

FIRE RATING

The fire rating appears as a series of numbers and letters marked on the body of the extinguisher e.g. 5A/34B.

The number indicates the size of fire on which the extinguisher was tested and the bigger the number, the bigger the test fire.

The letter indicates the class of fire for which the extinguisher can be used.

If there is more than one number/letter code this indicates that the extinguisher is suitable for use on more than one class of fire.

MOUNTING AND LOCATION OF EXTINGUISHERS

The 3 common types of extinguisher mounting bracket are:

- hook
- spring bracket
- bracket and clip

Ideally an extinguisher should be wall mounted on an escape route without causing an obstruction.

The following locations for extinguishers are not recommended:
- wall mounted on an escape route - causing an obstruction
- wall mounted close to the floor in a position likely to cause a trip hazard or be knocked
- standing on table or worktop
- standing on a wet floor
- outside, unprotected from the elements

Visibility

Extinguishers should always be visible. If they are not, or if they are stored in a cupboard or locker, their position should be indicated by a suitable sign as recommended in BS 5306 Part 3 section 6.2.

Signs for this purpose should comply with BS 5499: Part 1 "Specification for fire safety signs" which includes the following guidance on the size of lettering:

VIEWING DISTANCE	MINIMUM HEIGHT
up to 2.5m	5 mm
2.5m to 5m	10 mm
5m to 7.5m	15 mm
7.5m to 10m	20 mm

Access

Access to extinguishers should not be obstructed, particularly if they are kept in a cupboard, locker or other storage compartment.

MAINTENANCE OF EXTINGUISHERS

The recommendations for the maintenance of portable fire extinguishers are contained in BS 5306: Fire extinguishing installations and equipment on premises - Part 3. "Code of practice for selection, installation and maintenance of portable fire extinguishers".

Servicing Intervals

All extinguishers should be serviced by a competent person at 12 monthly intervals (BS 5306 Pt 3 section 8.1.1).

BS 5306 Part 3 defines a competent person as "A person with the necessary training and experience, and with access to the requisite tools, equipment and information, to be capable of carrying out the inspection and maintenance procedures"
(BS 5306 Pt 3 section 2.5).

DISCHARGE INTERVALS FOR ALL EXTINGUISHERS

MEDIUM	TYPE	DISCHARGE
Water	Stored Pressure	4 years
Foam	All Types	4 years
Water	Gas Cartridge	5 years
Powder	Gas Cartridge	5 years
Powder	Stored Pressure, Valve Operated	5 years
CO_2	All Types	10 years
Powder	Stored Pressure, Primary Sealed	10 years
Halon	All Types	10 years

BS 5306: Pt3

The following is a summary of the requirements of BS 5306: Pt 3 section 8.1.6 for the recording and marking procedure following an inspection of an extinguisher.

Once an extinguisher has been inspected by a competent person and found to be suitable for continued service it should be marked, by the competent person, as follows:

- "INSPECTED"
- date of inspection
- identifying mark of the competent person

This marking should be either be:

- painted (not stamped) on the body

- indelibly recorded on a durable label firmly fixed to the extinguisher

Alternatively the information should be recorded in a register used for this purpose only, each item having an identification corresponding to the entry in the register.

If no label or alternative record is found or records indicate that the extinguisher has not been inspected within the last 12 months then it must be declared unfit for use.

Inspection requirements

It is good practice to have extinguishers inspected and serviced every 12 months as detailed in BS 5306: Pt 3 but it is not a requirement of the Standards and it is not a fault if it is not done.

Surveyors/examiners will not judge whether an extinguisher has been maintained in good condition on the basis of the presence or absence of a servicing label but on the criteria specified in the Checking section of Fault 6.1.4.

FIXED SYSTEMS

Fixed systems are provided in areas of high fire risk, in this instance refers to engine room/space only.

They are similar in many ways to standard extinguishers, however as their name suggests they are fixed in one position and not portable.

There are two main designs:

- cylinder containing extinguishing medium fixed inside risk space with short section of pipework with dispersing nozzle, attached to the top of the cylinder.

- cylinder(s) containing extinguishing medium located remotely outside risk space and connected via range pipework to dispersant nozzles fixed around the risk space.

Systems of either design can be triggered/set off via a manual release device or a smoke or heat detector sited within the risk space.

An alarm may be installed as part of the system to ensure a warning is given before the extinguishant is released. This could in turn lead to the cupboard within which the remote release is located also being alarmed.

FIRE BLANKETS

BS 6575:1985 "Specification for Fire blankets" specifies requirements for fire blankets intended for use by one person.

The Standard does not cover blankets made from asbestos or of a metallic sandwich construction.

A fire blanket is "A flexible sheet of material intended to be used to extinguish small fires by smothering, or as a protection against radiant heat or small hot objects"

A re-usable fire blanket "is suitable for reuse after cleaning or washing"

Classification - Light Duty

For extinguishing small fires in containers of cooking fat or oils and fires in clothing worn by persons.

Classification - Heavy Duty

For industrial applications with the ability to resist penetration by molten metals ejected from cutting and similar processes and any conducted or radiant heat transfer when used for insulation purposes IN ADDITION to the uses mentioned for light duty blankets.

Instructions

The container should be marked with instructions for use or there should be an instruction sheet fixed near to the stowage position.

STANDARD 6.1 : PORTABLE FIRE EXTINGUISHERS

Powered vessels or vessels carrying or fitted with cooking, heating, refrigerating or lighting appliances shall be equipped with not less than the number of portable extinguishers detailed below, which shall be of a type approved by the BSI and /or the British Approvals of Fire Equipment scheme.

Extinguishers shall be kept in readily accessible positions adjacent to fire risk points, and shall be properly maintained in good condition for immediate use.

Any portable extinguisher provided for the protection of an engine space shall be capable of being discharged without fully opening the primary access.

Length of vessel	Minimum number of extinguishers	Minimum fire rating of each extinguisher	Minimum combined fire rating of extinguishers
Up to 7m (23ft)	2	5A/34B	10A/68B
7m-11m (23-36ft)	2	5A/34B	13A/89B
Over 11m (36ft)	3	5A/34B	21A/144B

The number of extinguishers may be reduced by one fire extinguisher with a fire rating of no more than 5A/34B where either:

i) no cooking, heating, refrigerating, lighting or fuel-burning appliances are carried

or

ii) no engine is installed

(Note: Fire extinguishers which have been manufactured to comply with EN3 and are certified and marked as such by a Certifying Authority and are marked with the fire rating will be considered as acceptable as those which carry the BS kitemark).

[see Exemption 11.12]

APPROVED TYPES

There are two elements involved in the "approval" of portable fire extinguishers:

- manufacture to an approved standard

- testing by an "approving" body

MANUFACTURING STANDARDS

There are two approved manufacturing standards:

- BS 5423: 1987: "Specification for Portable fire extinguishers"
- EN3: "Portable fire extinguishers"

They will be marked to indicate this fact by quoting the relevant BS or EN number somewhere on the body of the extinguisher.

APPROVING BODIES

FIG 6.1

The only extinguishers manufactured to BS 5423 authorised for use in this scheme are those "approved" by:

- British Standards Institute (BSI)
- British Approvals for Fire Equipment scheme (BAFE)
- Loss Prevention Certification Board (LPCB)

Approval will be indicated by either the BSI kitemark, LPCB symbol and/or BAFE symbol, marked somewhere on the body of the extinguisher.

Approval is given following the testing of a number of samples of the extinguisher for which approval is sought, and thereafter, by a system of random tests to ensure that standards are being maintained.

Extinguishers marked as being manufactured to BS 5423 but which do not carry an "approval" marking are not acceptable.

Fire Offices Committee

Extinguishers marked as approved by the Fire Offices Committee (F.O.C.) are acceptable.

The F.O.C. scheme was the predecessor to the LPCB scheme and these extinguishers can be accepted providing the requirements of all other relevant standards are met.

Other Approving Bodies

A list of bodies approving extinguishers manufactured to EN3 standards only is not yet available.

In cases of doubt it may be necessary to refer to the Manager of the Boat Safety Scheme.

Extinguishers marked as being manufactured to EN3 but which do not carry an "approval" marking are not acceptable.

Plastic-bodied extinguishers

There are no standards for plastic-bodied extinguishers of any kind and therefore none are tested by Approving Bodies irrespective of their type and construction.

In consequence, no plastic-bodied extinguisher can carry any approval marking.

Boat owners are perfectly entitled to keep them on board but they are not to be included in the requirements of Standard 6.1.

CHECKING Visually check that each extinguisher is marked as an approved type.

FAULTS		
Fire Extinguishers	Not of an approved type	6.1.1

ACCESSIBILITY Extinguishers are to be kept in readily accessible positions as defined in the Glossary to the Boat Safety Standards.

It is important that extinguishers are properly mounted and the use of a custom-made mounting of the following type is recommended:

- hook
- spring bracket
- bracket and clip

CHECKING Visually check that each extinguisher is readily accessible.

FAULTS		
Fire Extinguishers	Not readily accessible	6.1.2

LOCATION OF EXTINGUISHERS Extinguishers are to be kept adjacent to fire risk points.

They should not be placed so close that they may be inaccessible in the event of fire.

Fire Risk Points A fire risk point can be defined as any installation or piece of equipment that requires the use of a naked flame or may provide a likely ignition source for a fire (e.g. electrical equipment).

Examples of fire risk points are:

- cooking appliances
- lights (fuel oil or gas)
- refrigerators
- engines
- fuel installations (including tanks and containers)
- LPG installations

Owners are strongly recommended to provide sufficient extinguishers to give the protection required in all risk areas rather than restrict coverage to the minimum number required by the Standards.

ISO 9094-1 ISO 9094-1 "Small Craft Fire Protection” is a draft Standard which gives guidance on where extinguishers should be kept and recommends that they should be located as follows:

(a) main helm or cockpit - within 1m
(b) permanently installed open flame device - within 2m
(c) any sleeping accommodation - within 5m

The priorities are as follows:

NO. REQUIRED ON BOARD	LOCATION
1	(a)
2	(a) and (b)
3	(a) (b) and (c)

Protection

Where the main helm or cockpit position is exposed to the elements, extinguishers should be given some protection even if this means storing them in a locker or other storage compartment.

Protection should take precedence over location in order to avoid a situation where an extinguisher may not work properly because it has suffered damage and deterioration due to exposure.

CHECKING

Visually check that extinguishers are kept adjacent to fire risk points.

FAULTS		
Fire Extinguishers	Not adjacent to fire risk points	6.1.3

MAINTENANCE

If the extinguisher has been inspected by a competent person there should be a label giving the date of inspection fixed to it.

As the inspection certificate requirements are met by the fixing of an adhesive paper label bearing only a date and a set of "initials", surveyors/examiners should not rely of the presence of such a label as an indication that an extinguisher has been maintained in good condition.

At present, the presence or absence of a servicing label is NOT a fault criterion.

Discharged or Partially Discharged

Indications that an extinguisher is wholly or partially discharged are:

- "used" indicator visible
- pressure gauge not reading normal pressure
- safety pin or clip missing
- non-replaceable safety tag missing

CHECKING

Visually examine the condition of each extinguisher.

The following are indications that it has not been maintained in good condition:

- missing safety pin
- dents
- gouges
- pressure gauge (where fitted) not in the “green” sector i.e. showing the correct pressure
- perished hose

- rust or other form of corrosion
- wholly or partially discharged
- damage to trigger assembly including deterioration caused by ultra-violet light and heat

FAULTS		
Fire Extinguishers	Not maintained in good condition	6.1.4

FIRE RATING - INDIVIDUAL

The rating is marked on the body of all approved types of extinguisher. **TABLE 6.4**

CHECKING If Exemption 11.12 not applied, visually check the rating of each extinguisher for compliance with the minimum fire rating (individual).

FAULTS		
*Fire Extinguishers	Less than minimum fire rating (individual)	6.1.5

FIRE RATING - COMBINED

CHECKING If Exemption 11.12 not applied, add together the ratings shown on the body of each extinguisher and confirm compliance with minimum fire rating (combined). **TABLE 6.4**

NOTE Any extinguishers not marked with the fire rating are not approved types and are not to be included in any of the fire rating calculations.

FAULTS		
*Fire Extinguishers	Less than minimum combined fire rating	6.1.6

NUMBER REQUIRED

Summary A summary of the extinguisher requirements is shown in Table 6.4. **TABLE 6.4**

CHECKING Count the number of approved extinguishers and confirm compliance with minimum requirement.

FAULTS		
*Fire Extinguishers	Less than the requisite number	6.1.7

EXEMPTION 11.12 Vessels manufactured prior to 16 June 1998 and complying with the navigation authority's previous requirements for fire extinguishers are not required to comply with that part of Standard 6.1 which prescribes a minimum fire rating for each extinguisher and a minimum combined fire rating until such time as the existing extinguishers are life expired or discharged.

Application

This exemption only applies where the provision of portable fire extinguishers complies with any Navigation Authority's previous requirements as to minimum number and weight or capacity. Proof of registration is not required.

The exemption does not apply to:

- type approval for the extinguisher by an Approving Body
- any other requirement of Standard 6.1

Previous requirements

The Navigation Authorities' previous requirements are shown in Tables 6.1 to 6.3.

TABLES 6.1 - 6.3

Action to be taken when previous requirements are not met

One or more extinguishers must be replaced by an extinguisher marked with a fire rating whose weight(s) must bring the total weight up to at least the previous requirements.

The vessel must be equipped with the minimum number of extinguishers at all times.

Replacement extinguishers are to have a minimum rating of 5A/34B.

The weight or the capacity is also marked on the body of the extinguisher.

CHECKING

The total weight of the minimum number of approved extinguishers must equal or exceed any Navigation Authority's previous requirements.

FAULTS		
	*EXEMPTION APPLIED	6.1.8

ACCESS TO ENGINE SPACES

Application

A portable extinguisher should only be provided if:

- the medium is suitable for the flooding of an enclosed space
- the capacity is sufficient for the volume of the engine space

Discharge opening

The opening into the engine space through which the extinguisher is to be deployed should be:

- clearly marked
- large enough to accept the discharge nozzle
- open at all times

Engine space

The term ‘engine space’ means any space in which an engine is installed and includes separate engine rooms .

Engine compartments

Where engines are installed in compartments beneath decks, access can be provided by cutting a "key hole" of the required size

below deck in the deck board etc covering or enclosing the engine space.

CHECKING There is no check for an approved portable extinguisher which is intended for fighting an engine space fire from outside and no check for a way to discharge any extinguisher into an engine space from outside without opening any access hatch or door.

FAULTS		
Portable Fire Extinguisher	Not capable of discharge into engine space without fully opening primary access	6.1.9

STANDARD 6.2 : FIXED SYSTEMS

Any fixed system installed for the protection of a fire risk space shall be in addition to the portable extinguishers required by Standard 6.1 and if remotely operated the release device shall be readily accessible from outside that space.

Fault criteria As fixed systems are additional to the provision of portable extinguishers, none of the checks under Standard 6.1 apply to fixed systems.

CHECKING Visually check that any remote release device for an engine space fire fighting system is:

- readily accessible as defined in the Glossary to these Standards
- located outside the fire risk space

FAULTS		
Fire Extinguisher Fixed System	Remote release device not readily accessible from outside risk space	6.2.1

STANDARD 6.3 : FIRE BLANKETS

In vessels fitted with cooking facilities, a fire blanket marked as complying with at least the "light duty" requirements of BS 6575, and ready for immediate use, shall be kept nearby.

[see Exemption 11.13]

CHECKING Identify presence of cooking facilities and, if present, verify presence of fire blanket.

FAULTS		
Fire Blanket	Required but not fitted	6.3.1

COMPLIANCE WITH BS 6575 For blankets complying with BS 6575, each container, or instruction sheet for fixing near to the stowage position of the fire blanket, should be marked with the following:

- "Fire blanket"
- "heavy duty" or "light duty" and "reusable" as appropriate
- "BS 6575: 1985"

Blankets manufactured to BS 6575 are acceptable.

Any blanket bearing these marks regardless of its rating (i.e. light duty, heavy duty and/or reusable) is acceptable.

At present, the blanket is not to be removed from its container as part of this check.

All relevant markings (i.e. BSI kitemark etc) will be in evidence somewhere on the blanket container or the instruction sheet. It may be necessary to remove the container from its mounted position to access information on its rear.

Surveyors/examiners should take steps to ensure that the blanket is not dislodged while the container is being examined for the correct marking.

CHECKING Visually check the fire blanket container if fitted, or instruction sheet, is marked to BS 6575 "light duty" or BS EN 1869. Note that a BS 476 blanket is not acceptable.

FAULTS		
*Fire Blanket	Not at least to 'light duty' BS 6575	6.3.2

EXEMPTION 11.13 ~~Vessels manufactured prior to 16 June 1998 and carrying a fire blanket in good condition are not required to comply with that part of Standard 6.3 which prescribes that fire blankets shall comply~~

~~with at least the "light duty" requirements of BS 6575.~~

~~This exemption will be rescinded on 16 June 2000 or the first Boat Safety Certificate examination after this date~~.

CHECKING Exemption 11.13 has been rescinded

FAULTS		
	*EXEMPTION APPLIED	6.3.3

ACCESSIBILITY Fire blankets must be available for use, with the minimum possible delay, at all material times.

The container in which they are supplied is designed to serve as a quick-release dispenser and they should be wall mounted at about eye level.

The container should be fixed in such a way that the blanket can be swiftly and easily withdrawn. It should not be placed too close to a horizontal surface or any other object which would delay its deployment.

BS 6575 states that it should be possible for the blanket to be taken from its stowage position, unfolded and held ready for use in not more than 4 seconds.

If the blanket is stored in its container the force required to remove it should not exceed 80 Newton.

Although not recommended, a fire blanket may be housed in a cupboard or locker, providing access to it is not obstructed, and the door is labelled to indicate that a fire blanket can be found within.

CHECKING Visually check that fire blanket is ready for immediate use.

FAULTS		
Fire Blanket	Not ready for immediate use	6.3.4

PROXIMITY TO COOKING FACILITIES Fire blankets should be located within 2m of any cooking appliance but not so close that it may be inaccessible in the event of a fire.

They must not be installed on any wall immediately adjacent to the cooker.

CHECKING Visually check fire blanket is near but not directly above cooking facilities.

FAULTS		
Fire Blanket	Not kept near to cooking facilities	6.3.5

STANDARD 6.4 : PROTECTION OF EXPOSED GRP
In vessels with hulls constructed of glass-fibre reinforced plastic (GRP) those areas of high fire risk, such as an engine room or fuel compartment, shall have any exposed GRP structure coated with a suitable fire retardant material complying with the Class 2 requirements of BS 476: Part 7. [see Exemption 11.14]

Hulls constructed with fire-proof resins

The requirements of the Standards are the same for all GRP hulls including those constructed with the use of fire-proof resins.

CHECKING

At present, the use of a fire retardant treatment will not be checked during the Boat Safety Examination.

[See Exemption 11.14]

FAULTS		
*Exposed GRP	Fire retardant does not comply with Class 2 BS 476 Part 7	6.4.1

EXEMPTION 11.14

Vessels manufactured prior to 16 June 1998 are not required to comply with that part of Standard 6.4 which requires exposed GRP structure to be coated with suitable fire-retardant material complying with the Class 2 requirements of BS 476: Part 7 until such time as visual inspection of the exposed GRP structure shows deterioration .

CHECKING

Visually check exposed GRP for signs of deterioration such as:

- heat damage e.g. charring, scorching, blistering
- physical damage to the GRP surface e.g. exposed fibres

If deterioration is apparent, a failure is recorded at 6.4.1.

FAULTS		
	*EXEMPTION APPLIED	6.4.2

STANDARD 6.5 : POLYSTYRENE THERMAL INSULATION

Polystyrene thermal insulation shall comply with the Type A requirements of BS 3837: Part 1.

[see Exemption 11.15]

CHECKING

No check is being made at present for marking to indicate compliance with BS 3837: Part 1.

The boards are edge-marked and it is impractical to cut the boards so that each cut piece includes the necessary marking.

FAULTS		
*Thermal Insulation	Does not comply with Type A BS 3837 Part 1	6.5.1

EXEMPTION 11.15

Vessels manufactured prior to 16 June 1998 are not required to comply with the requirements of Standard 6.5.

FAULTS		
	*EXEMPTION APPLIED	6.5.2

STANDARD 6.6 : SOFT FURNISHINGS

All soft furnishings, fabrics, and foam materials used in the lining out and furnishing vessels shall be of suitable fire resistant materials, which on combustion release minimal amounts of toxic products.

Upholstery fabrics used shall satisfy the cigarette and butane flame tests of BS EN 1021 Parts 1 and 2.

[see Exemption 11.16]

Soft furnishings, fabrics, & foam materials

Generally, there are no visual indications that a material is fire resistant and as any test is a destructive test, there is no reliable, non-destructive method of determining fire resistance.

In a relatively recent development, some materials have been marked on the reverse side but the use of such materials is so limited it does not justify a change in the checking procedure.

CHECKING

At present, the use of a fire resistant materials will not be checked during the Boat Safety Examination but see Exemption 11.16 below.

FAULTS		
*Soft Furnishings / Fabrics / Foam Material	Not of suitable fire resistant/non toxic materials	6.6.1

UPHOLSTERY FABRIC

Although fabrics may have passed the tests prescribed by BS EN 1021 the material itself is not marked.

Finished items always carry a tag or label to indicate that the fabric complies (not the item itself) but these are almost always removed once the furniture etc is in use.

Once installed in a vessel any labels will often be removed making it virtually impossible to determine compliance with this Standard.

There are no visual indications that the fabric complies with the standard.

Compliance with BS 5852

Materials complying with BS 5852 are also acceptable.

BS 5852 was replaced in April 1994 by BS EN 1021 although it is still cited in legislation. One of the reasons for this is that BS 5852 included tests for completed items of furniture and BS EN 1021 does not.

CHECKING At present, compliance with the cigarette and butane flame tests will not be checked during the Boat Safety Examination but if there are any indications of heat damage such as burning or scorching this is an indication that the material no longer complies.

FAULTS		
*Upholstery Fabric	Not to test standards of BS EN 1021 Parts 1 and 2	6.6.2

EXEMPTION 11.16 Vessels manufactured prior to 16 June 1998 are not required to comply with the requirements of Standard 6.6.

FAULTS		
	*EXEMPTION APPLIED	6.6.3

STANDARD 6.7 : MEANS OF ESCAPE

All vessels shall have two means of escape from accommodation areas.

All means of escape shall have a minimum clear opening of 0.2m^2 (310in^2) and a minimum width of 380mm (15").

[see Exemption 11.17]

TWO MEANS OF ESCAPE

The main principal involved when designing means of escape from any environment is that a person should be able to turn their back on a fire and make a safe exit.

Corridors, gangways, compartments, galleys and accommodation spaces should therefore be provided with two means of escape.

Corridors & gangways

The means of escape from corridors and gangways may open fore and aft or over the side of the vessel.

Compartments opening into corridors

Where the principal means of escape from any compartment, cabin etc is into a corridor or gangway, that corridor or gangway must have two means of escape.

Windows & hatches

Windows, lights and hatches of the required size are acceptable as means of escape.

It is necessary to be able to secure hatches and windows and lights which open against the weather or for security purposes but it must be possible to open them immediately in case of emergency when the vessel is occupied.

They must, therefore, be capable of being opened without the use of keys or tools when the vessel is occupied, unless they are meant to be "broken out" in which case the means of breaking them must be kept adjacent and highly visible.

Hatches should also be capable of being opened:

- outwards
- from inside or outside the space in which it is fitted

The method of opening should be clearly indicated.

Individual cabins

Individual cabins, with one door opening into a fore-aft corridor need not have a second means of escape so long as the corridor allows escape at each end.

Labelling

All leading fire authorities recommend that all exits, excluding the normal entry/exit route should be labelled "emergency exit" preferably with white lettering on a green background.

CHECKING Identify at least two means of escape from accommodation areas.

NOTE [See Exemption 11.17]

FAULTS		
*Means of Escape	No two means of escape from accommodation areas	6.7.1

MINIMUM CLEAR OPENING

Windows & hatches Although a window or hatch etc may be of the required size, if its opening action is restricted this might lead to the actual area through which escape must be made, being smaller than recommended.

The minimum clear opening must be measured by opening any suspect hatches or windows to ensure they comply.

If the window or panel designated as an escape route is not normally capable of being opened and its use requires that it is "broken out":

- the size of the aperture is to comply with this Standard
- the means of breaking it must be adjacent to it and visible

CHECKING Measure the minimum clear opening of all means of escape.

Minimum clear opening is $0.2m^2$ and minimum width 380mm.

Visually check that a means of "breaking out" any fixed window or light designated as an escape route is adjacent to it.

NOTE [see Exemption 11.17]

FAULTS		
*Means of Escape	Opening not of minimum dimensions	6.7.2

EXEMPTION 11.17 Vessels manufactured prior to 16 June 1998 are not required to comply with the requirements of Standard 6.7 where it is not practicable to modify the structure to provide two means of escape.

Practicability Examples of where it would not be practicable to fit a second means of escape are:

- no space to fit the minimum clear opening
- it would be necessary to cut through or remove structural members e.g. deck beams, frames and stiffeners

FAULTS		
	*EXEMPTION APPLIED	6.7.3

FOR GUIDANCE ONLY

The fire rating of an extinguisher appears as a series of numbers and letters marked on the side e.g. 5A/34B. The numbers relate to the ability of the extinguisher to successfully put out a fire under test conditions. The bigger the numbers, the bigger the fire on which the extinguisher has been tested.

Class of fire	Extinguishing medium	Identification - Colour of extinguisher, or band
A	Water	Signal red
A/B	Foam	Pale cream
A/B/C	Powder	French blue
B/C	CO_2	Black

where:

CLASS A fire = paper, wood, textiles and fabric
CLASS B fire = flammable liquids
CLASS C fire = flammable gases

NB: In the event of an electrical fire use dry powder or CO_2 ONLY

It should be noted that:

i) All stored pressure ABC dry powder extinguishers have a Class A/Class B fire rating.

ii) All stored pressure BC dry powder and CO_2 extinguishers only have a Class B fire rating.

iii) Most, but not all, aqueous film forming foam (AFFF) extinguishers have a Class A/Class B fire rating. Some small capacity AFFF extinguishers only have a Class B rating.

iv) CO_2 extinguishers are not to be provided for living spaces.

v) Halon extinguishers may be retained until life-expired or discharged.

vi) The number of extinguishers and the total and individual fire ratings (which are marked on all approved extinguishers) depend on the vessel size, engines (whether inboard or outboard), and installation of LPG or other fuel burning appliances.

Fire buckets with lanyards, where provided, shall be in addition to the extinguishers required.

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Technical manual

Part 7

AN INTRODUCTION TO LPG INSTALLATIONS

AN INTRODUCTION TO LPG INSTALLATIONS

SECTION A : OBJECTIVES OF PART 7 LPG INSTALLATIONS

The objectives of Part 7, LPG Installations are to ensure that:

- any leakage from LPG cylinders is directed safely outside the hull;
- the risk of leaked LPG entering the interior of the hull from cylinder lockers or housings is minimised;
- cylinder lockers and housings provide a reasonable level of protection to cylinders and associated equipment from the risk of mechanical damage and the potential effects of flame impingement;
- the risk of a high pressure leak of LPG from high pressure stage components is minimised;
- flexible hose material is suitable for use with LPG;
- the risk of a leak of LPG from flexible hoses, or hose connections, is minimised;
- the materials used in installation pipework are suitable for LPG;
- installation pipework is installed so as to minimise the risk of mechanical damage, including the effects of heat, vibration and corrosion;
- the potential for leaks from joints in installation pipework is minimised;
- main shut-off valves and appliance isolation valves provide adequate control of LPG supply;
- a means to determine the LPG system is sound is installed

SECTION B : PROPERTIES OF LPG INCLUDING HAZARDS & BEHAVIOUR OF LEAKING LPG

Properties of LPG

Liquefied Petroleum Gas (LPG) is a mixture of light hydrocarbons, gaseous at normal temperature and pressure and maintained in the liquid state by increased pressure or lowered temperature.

The two liquefied petroleum gases in general use are “commercial butane” and “commercial propane”. They exist as gases at normal ambient temperatures but can be liquefied under moderate pressure. Propane has a lower ‘boiling point’ than butane, which means it turns into gas at a lower temperature. In order for it to become liquefied, propane is stored under higher pressure, approximately 7 bar as opposed to about 2 bar for butane.

LPG liquid is colourless and its density as a liquid is approximately half that of water. If LPG liquid is spilt onto water, it will float on the surface before vaporising. One volume of liquid produces approximately 250 volumes of gas and thus a leak of liquid poses a considerable hazard.

LPG vapour is heavier than air, butane about twice as heavy and propane about one and a half times heavier. Because of this LPG vapour will tend to fall to low level and flow along cockpit floors, bilges and other low lying places. LPG vapour may travel some distance and in poorly ventilated places the vapour may persist for some time.

A mixture of LPG and air at a concentration of LPG between 2% and 10% is a flammable mix. Outside of this range the mixture is either too weak or too rich to ignite. If vapour within the flammable range is present in a confined space an explosion will result from ignition.

Hazards

There have been incidents in which escapes of LPG have been ignited resulting in serious fires or explosions.

If the escape is into confined spaces and becomes ignited, the occupants of the craft, or persons in the vicinity could be put at serious risk.

It is also possible for vapour/air mixtures arising from leaks or other causes to be ignited some distance from the point of escape and the flame travel back to the source.

In extreme cases, if the cylinder is lying on its side or if the cylinder valve is faulty or if the exposure to the fire is extended, the cylinder may rupture leading to a violent explosion.

If an LPG cylinder is involved in a fire started elsewhere on the craft, the cylinder may be subject to direct flame impingement. After a period of exposure to extreme heat the pressure may rise inside the cylinder to a point where the pressure relief valve may operate releasing LPG under pressure causing a significant jet of burning gas.

At very high concentrations, as LPG vapour replaces available oxygen it will act initially as an anaesthetic and subsequently as an asphyxiate.

Liquid propane can cause severe cold burns (frostbite) to the skin due to its rapid vaporisation and the consequent lowering of temperature. It can also cool equipment which may, in turn, be cold enough to cause cold burns.

The hazards associated with the combustion products of appliances are referred to in the introduction to Part 8.

Detecting leaking gas

Commercial LPG is odorised so that it has a characteristic smell which can easily be recognised and detected at concentrations down to one-fifth of the lower explosive limit (approx. 0.4% of LPG in air).

Significant leaks may also be detected by a hissing sound or by icing in the area of the leak.

Small leaks may be detected by applying a leak detection fluid/spray to suspect areas and bubbles will form at the leak.

LPG vapour escaping from a cylinder is not readily visible, but under certain conditions can be detected in much the same way as heat can be seen rising from a hot object.

<u>ON NO ACCOUNT SHOULD A NAKED FLAME OR OTHER SOURCE OF IGNITION BE USED TO DETECT A LEAK.</u>

Means for detecting gas leakage may be installed. Suitable means include regular operation of a bubble leak indicator installed in the low-pressure stage and electronic gas detection equipment.

Behaviour of leaking LPG vapour

LPG vapour spreads out as an invisible gas and, as it is heavier than air, sinks to the lowest level in the vessel. The distance it will spread within the boat will depend on the volume of gas escaping, the design of the vessel, and the weather conditions.

Various combinations of these factors and the ventilation provisions within the vessel will also determine the time required to reduce the concentration of vapour to a non-flammable mixture.

Behaviour of leaking LPG liquid

A leak of liquid is readily visible and small leaks will develop frost at the point of escape. Large leaks such as those from a hole or broken fitting will issue as a white cloud caused by the liquid vaporising and expanding so rapidly that it freezes the moisture in the air.

The cloud will be flammable at the outer edges, and will ignite if it comes into contact with a source of ignition.

SECTION C : PARTS OF AN LPG INSTALLATION

Gas installations are divided into three parts:

- high pressure stage;
- low pressure stage;
- appliances (appliances are covered in the introduction of Part 8).

HIGH PRESSURE STAGE

The high pressure stage is that part of an installation between the cylinder and the inlet stage of the low pressure regulator.

It runs at the pressure of the gas in the cylinder which depends on:

- the ambient temperature;
- whether the gas is propane or butane;
- previous running time and appliance load.

The equipment subject to high pressure is:

- cylinders;
- cylinder valves;
- pigtails;
- valves including non-return valves;
- any automatic or manual cylinder changeover device;
- any optional safety features;
- inlet stage of the low pressure regulator.

LPG cylinders

An LPG cylinder is a portable and refillable vessel of approved design used to contain LPG under pressure. Cylinders are generally identifiable as containing either butane or propane. Appliances may have the facility to operate on either gas however the correct regulator for the type of gas contained in the cylinder must be used because of the difference in cylinder pressures. The threads and connections of cylinder valves/regulators are generally designed so that they are not inter-changeable. Should the system be changed from butane to propane, or vice versa, the regulator must be changed at the same time.

On larger systems the number of cylinders that should be provided in parallel to supply the installation is based on the evaporative capacity, or recommended off-take of the cylinders, and on the combined gas rate of the installed appliances. The recommended off-take of a cylinder is usually expressed in cubic metres per hour.

Re-fillable cylinders generally incorporate a pressure relief valve to vent LPG in the event the cylinders are involved in a fire.

Cylinders must be periodically re-tested. This is carried out by the LPG supply company as part of the re-filling process.

LPG cylinder valve

Cylinder valves are subject to the same testing cycle as cylinders. However due cognisance should be given to susceptibility of cylinder valves to be damaged during handling and transportation.

Pigtails & hoses connected to high pressure stage components

High-pressure stage components fitted remote from the cylinder valve must be connected by a pre-assembled length of flexible hose to type 2 of BS 3212 fitted with integral threaded metallic ends and be of minimum practicable length to allow for movement when cylinders are being changed.

The length must not exceed 1 m.

Flexible connectors

All flexible hose connections in the high pressure stage must comply with the type 2 requirements of BS 3212 "*Flexible rubber tubing, rubber hose and rubber hose assemblies for use in LPG vapour phase and LPG/air installations".*

BS 3212

BS 3212 specifies the performance and dimensional requirements of rubber tubing and hose used in environments up to an ambient temperature of 60^0C.

Life expectancy of hoses

There is no mention in BS 3212 of the life expectancy of hoses. The date of manufacture is marked on the hose but this gives no indication as to when the hose was purchased and installed or under what conditions it was stored prior to use or what usage it has been put to since installation.

BS 3574, *"Specification of the controlled storage and packaging of vulcanized rubber and rubber products"*, provides guidance on the initial storage period of hoses dependent upon the material used. For example nitryl butyl rubber (NBR) may be stored for up to seven years with an extension storage period of three years subject to inspection. Ethylene propylene diene monomer (EPDM) may be stored for up to 10 years with an extension storage period of five years subject to inspection. These storage recommendations would only apply if the hose had been stored:

- indoors
- away from direct heat sources
- in relative humidity of less than 75%
- away from direct sun or other ultra violet light sources
- away from any equipment producing ozone

As a guide, LPG hose should be considered a replacement item and should be replaced after five years of use or sooner if there are signs of deterioration.

Classification Tubing and hose is classified in BS 3212 as follows:

- type 1 - flexible tubing for applications not exceeding 50 mbar working pressure;
- type 2 - hoses for applications over 50 mbar working pressure but not exceeding 17.5 bar.

Colour The colour identification is:

- Type 1 - black;
- Type 2 - orange.

Type 2 hoses supplied as complete assemblies (hoses including connections) may have a black cover.

Marking Each length of tubing or hose shall be clearly and durably marked at intervals of not more than 1m with:

- manufacturer 's name or identification;
- number and date of British Standard;
- type number;
- nominal bore;
- for type 1 tubing "Low Pressure LPG";
- for type 2 hose "High Pressure LPG";
- month and year of manufacture.

e.g. NAME/BS3212:1991/2/6.3/HIGH PRESSURE LPG/Dec 90

Although the interval between markings could be up to 1 m, sample surveys show that, in practice, all complete assemblies supplied by manufacturers and retailers in this country are marked in the approved manner irrespective of the length of hose used.

Non-return valves A non-return valve (NRV) is required on each high-pressure stage connection where two or more cylinders are connected.

NRVs are designed to prevent the escape of LPG when either cylinder is disconnected.

Automatic changeover devices manufactured in accordance with BS 3016 will have them fitted to the inlets.

NRVs may be installed at the inlet to double wall blocks. Certain suppliers provide such wall blocks with the initials NRV stamped on the hexagonal nuts at the inlet.

Certain suppliers provide pigtail assemblies which incorporate NRVs but these may not be readily identifiable.

Automatic change over devices

Automatic changeover devices may be found in multi-cylinder installations. With both connected cylinders having opened valves, when the supply cylinder becomes empty the supply will be automatically switched over to the reserve cylinder without interruption to the gas flow.

Manual changeover devices perform the same function but require the user to operate the changeover valve.

Most automatic changeover devices incorporate non-return valves and many also incorporate excess flow and over-pressure shut-off valves as additional safety features.

Optional Safety Features

Over pressure shut-off (OPSO)

An over pressure shut-off (OPSO) is a device that closes to prevent the flow of gas when pressure on the downstream side of the regulating member rises to a pre-determined value. This device is an integral part of the regulator.

Over pressure relief valve (OPRV)

An over pressure relief valve (OPRV) is a device for the discharge of gas which opens to the outside as soon as the gas pressure reaches a set pressure. The valve is closed during normal operation. The opening pressure of the valve is between twice the nominal regulated pressure and 150 mbar.

Under pressure shut-off (UPSO)

An under pressure shut-off (UPSO) is a device that closes to prevent the flow of gas when pressure on the downstream side of the regulating member falls to a pre-determined value. This device is an integral part of the regulator.

Excess flow valve (EFV)

An excess flow valve (EFV) is a device integral with the regulator which causes the shut-off of the gas flow for values of rate greater than the guaranteed rate. Operation of the valve may on certain regulators require the valve to be subsequently re-set. The device operates for an increase in the rate between 100% and 200% of the guaranteed rate.

Thermal cut-out

A thermal cut-out is a closing device which closes under thermal action as well as temperature sensors. The device cuts out the gas supply at a temperature between 70^{o} C and 180^{o} C.

LOW PRESSURE REGULATORS (REGULATORS)

A regulator is an apparatus for automatically maintaining a constant gas outlet pressure at a level recommended for appliance(s).

The outlet pressure may vary within preset limits.

The outlet pressure should be maintained whatever the upstream pressure, the flow rate through the regulator or the ambient temperature.

Faulty regulators

If the low pressure regulator is faulty there is a serious risk of high pressure LPG entering the low pressure system.

A faulty regulator also makes it impossible to carry out any valid tests on the installation.

Regulators must have a sufficient capacity to accommodate the combined maximum gas rates of the installed appliances. The capacity, or flow rate of regulators is usually measured in kilograms per hour, or grams per hour or Btu per hour.

The life expectancy of regulators is estimated by the manufacturers to be 10 years. Those marked in imperial units e.g. Btu, or more than ten years old, should be replaced.

Regulators suitable for marine installation should inherently be protected against corrosion and resistant to the effects of vibration.

Installation of regulators

It is a requirement of these Standards that where cylinders are secured in a separate cylinder locker or housing the regulator must be installed within it.

Where there is more than one such cylinder locker or housing, any connection or linking arrangements between the cylinders and regulators should be contained within one of the cylinder lockers or housings.

This will help to reduce the:

- number of joints;
- length of pipe runs;
- amount of flexible tubing used;
- risk of physical damage.

Types of regulator

There are three types of regulator in common use on boats:

- clip-on butane regulators which are pre-set and clip directly to the cylinder;
- screw-in regulators for propane cylinders which are pre-set and sealed;
- remotely mounted types for both propane and butane.

Other specialised types on larger installations where there are highly rated appliances, e.g. a residential boat with a gas boiler may include a second stage propane regulator for use with multi-cylinder storage.

Manufacturing standards

BS 3016 "*Specification for pressure regulators and automatic changeover devices for liquefied petroleum gases*". This standard covers materials, construction, performance and testing requirements for regulators and changeover devices with screwed and clip-on connectors for use with butane and propane in vapour phase up 20 bar and maximum 20kg/h at –20^0 C to 50^0 C.

BS 5482-3 *"Code of practice for domestic butane and propane gas-burning installations – Part 3: Installations in boats, yachts and other vessels"* makes normative reference to draft European standard prEN 12864, *Low pressure non-adjustable regulators having a maximum outlet pressure of less than or equal to 200mbar with a capacity of less than or equal to 4kg/h, and their associated safety devices for butane, propane or their mixtures.*

One of the important features of manufacturing standards is that they specify the preset operating limits of the regulator in terms of outlet pressure. This information is relevant in assessing the action of the regulator valve to seal and prevent an excessive rise in outlet pressure under conditions of zero flow i.e. lock-up.

Regulator letting-by

If the regulator is not locking-up correctly there is also the risk that when a system is being tested for leaks by means of a "U" gauge, the rate at which the regulator is allowing gas into the system is equal to the rate at which gas is escaping from a leak and therefore no leak would be detected.

Lock-up pressure

BS 3016 permits a tolerance of ± 5mbar to the pre-set lock-up pressure as follows:

- propane 32-42 mbar
- butane 23-33 mbar

Regulators which do not lock-up within these limits should be replaced.

Information regarding maximum lock-up pressures is included at Table 7.1. **TABLE 7.1**

In the UK, LPG systems operate at nominal pressures of 28 mbar for butane and 37 mbar for propane. All three standards referred to in this section recognise that alternative operating pressures, particularly 50mbar, are in use in other countries, and it follows that such systems may be encountered on vessels visiting or imported into the UK. As with all systems, it is essential that the nominal outlet pressure of the regulator is compatible with the required inlet pressure of the appliances.

Marking of regulators

The marking requirements of the manufacturing standards mentioned above are almost the same. The regulator should carry the following information in a durable, legible and visible form:

- the manufacturers name or logo and possibly trademark;
- marking in letters or figures allowing the identification of the regulator;
- the type of gas; butane, propane or LPG;
- nominal regulated pressure expressed in mbar;
- the guaranteed rate in grams per hour;
- the date of manufacture indicated by the last two figures of the year;
- where necessary, an arrow to show the direction of the flow of gas.

Manually adjusted regulators

Manually adjusted regulators allow the operator to alter the outlet pressure. These regulators may not be used or fitted in boats.

They are intended for specialist applications where non-standard pressures are required e.g.

- individual burners e.g. kilns;
- intermediate regulators;
- where control is designed to be at the regulator not the appliance e.g. some blow torches.

These regulators are potentially dangerous, particularly as:

- they are capable of producing very large jets of flame at the appliance which is not only dangerous in itself but could damage the appliance and its components;
- the greatly increased line pressure could be above the design limits for the low pressure system resulting in gas leaks.

LOW PRESSURE STAGE

The low pressure stage is that part of the installation between the outlet stage of the low pressure regulator and the inlet of the appliance.

The equipment subject to low pressure is:

- the outlet stage of the regulator;
- any installed bubble leak indicator;
- any installed main shut-off valve;
- installation pipework;
- appliance isolation valves
- appliances (covered in Part 8).

The outlet stage of the regulator

This subject is covered as part of the high pressure stage under the heading "Pressure Regulators" (see above).

Bubble leak indicator

A bubble leak indicator is a device which provides a visible check on gas soundness downstream of the device. By operating the test facility LPG is allowed to flow through or over a liquid. A leak is positively identified by the presence of bubbles in the sighting chamber.

Bubble leak indicators should be installed within a locker near to the outlet side of the regulator.

Main shut-off valve

A main shut-off valve must be present for each separate LPG system. The valve must be located as close to the cylinders as possible. Where two or more cylinders are connected in parallel by a changeover or wall block device the main shut-off device must be located as close to the device as possible.

The valve of any cylinder or connected low pressure regulator may be used as the main shut-off except where two or more cylinders are connected by an automatic changeover device.

The main shut-off valve provides:

- the facility of an emergency control valve;
- the facility for temporarily shutting down the system during periods of absence, or overnight, or for servicing or maintenance purposes.

The design and construction of main shut-off valves is identical to appliance isolation valves and is covered below.

INSTALLATION PIPEWORK

Fixed pipework - materials

Unless it is an integral part of a gas-burning appliance, all fixed pipework in both high pressure and low pressure stages must be made of:

- seamless copper tube conforming with BS EN 1057 used with copper or copper alloy compression fittings;
- stainless steel tube of a grade suitable for use with LPG and a marine environment used with appropriate compression or screwed fittings;
- copper nickel alloy of a grade suitable for use with LPG and a marine environment used with appropriate compression or screwed fittings;

Pipework, which is an integral part of the appliance is installed by the manufacturer and as such is deemed to be suitable for the purpose intended.

Copper and stainless steel pipes are usually supplied in 6mm, 8mm, 10mm, 12mm and 15mm metric outside diameters and 1/4", 5/16", 3/8", 1/2", and 3/4" imperial outside diameters. All but the largest sizes can be bent with a simple hand bender to form relatively small radius bends.

Seamless copper tube

Seamless copper tube is made by casting a round, hollow billet of copper which is then heated and "drawn" through a die and over a mandrel to produce a seamless tube of the required dimension.

There are 3 types of tube:

- hard — as described above
- half-hard — hard tube is re-heated (annealed) and drawn again
- annealed — half-hard tube is re-heated (annealed)

Generally, the drawing process produces "hard" tubes with thinner walls which are supplied in straight lengths and "softer" or annealed tubes which have thicker walls and are supplied in coils.

Length of pipe run

Annealed tube is generally available in coils of up to 30 m length which, for all practical purposes, allows any pipe run to be made with a single piece of tube without the need for joints. 'Hard' tube is usually supplied in lengths of up to 3 m and could not be used for a pipe run longer than this without joining two or more pieces together with in-line connections. This would not be acceptable as these would be classified as unnecessary joints at Fault 7.19.5.

BS EN 1057

BS EN 1057 "*Copper and copper alloys – Seamless, round copper tubes for water and gas in sanitary and heating applications*", superseded BS 2871 "*Specification for copper and copper alloys - Tubes Part 1. Copper tubes for water, gas and sanitation*".

BS EN 1057 specifies the requirements for copper tubes in 3 conditions (Tables R290, R250 and R220):

- hard drawn (R290, previously Table Z in BS 2871);
- half-hard (R250, previously Table X in BS 2871);
- annealed (R220, previously Table W in BS 2871).

BS 2871 referred to a 4th condition, half-hard & annealed (previously Table Y in BS 2871).

Wall thickness

The nominal thickness of the tube wall varies with the "condition" of the pipe. In general, the "harder" pipes supplied in straight lengths have the thinnest walls and the thinnest, hard-drawn pipes, are not suitable for bending.

Table 3 of BS EN 1057 gives a variation of nominal wall thicknesses.

Nominal Outside Diameter (O/D)	Nominal Wall Thickness
6 mm	0.6-1 mm.
8 mm	0.6-1 mm
10 mm	0.6-1 mm
12 mm	0.6-1 mm
15 mm	0.7-1 mm
22 mm	0.9-1.5 mm

Application

Any of the pipes complying with BS EN 1057 or the previous BS 2871-1 are suitable for both gas and water applications.

Half-hard and annealed tubes are the ones in commonest use.

Working pressure

In general, the maximum working pressure (mwp) for a particular size of pipe increases with the thickness of the wall e.g. for a 15mm pipe at a temperature of 110 °C :

"Condition"	Table R290	Table R250	Table R220
Thickness	0.5 mm	0.7 mm	1.0 mm
MWP	42 bar	52 bar	51 bar

Even the tubes with the thinnest walls - hard drawn (Table R290) - can sustain a working pressure far in excess of that required in LPG installations where the pressure within the high pressure stage is unlikely to extend beyond 8 bar.

Pipework joints

A joint is the LPG-tight coupling of two or more pipes or pipe to fitting.

Appropriate applications for joints include:

- connections to valves, regulators, and test points;
- connections to appliances;
- to make junctions.

They must not be used :

- as an alternative to proper pipe bending techniques;
- to lengthen or extend pipes.

Joints may only be made by compression or screwed fittings as follows:

Material of tube	Type of fitting
seamless copper tube	compression
stainless steel tube	compression or screwed
copper nickel alloy tube	compression or screwed

LPG, natural gas & water installations

Gas and water systems using copper tube and brass fittings are installed using the same basic principles and components.

However, LPG has a very low surface tension and is extremely searching, i.e. it can find its way past seals where natural gas and water could not.

Some components common to all three applications need to be modified, therefore, for use in LPG installations.
A good example is the use of a soft copper olive in a compression fitting for LPG applications instead of a brass olive which would be suitable for both natural gas and water. The compression fitting

itself, and the pipework, could be used in all three applications.

Undue stress on joints

Good installation practice will, of its own accord, produce the highly desirable result of minimised stress at the joints.

Stress itself is not readily visible until the elastic limit of the material is exceeded and it is unlikely that this level of loading could be applied in normal use, but excess stress could have severe consequences for the LPG-tight integrity of joints and fittings.

Compression fittings

These fittings use an olive which is compressed to make the LPG-tight joint. The relevant British Standard is BS EN 1254 "*Copper and copper alloys – Plumbing fittings - Part 2: Fittings with compression ends for use with copper tubes*" which supersedes BS 864 "*Capillary and compression tube fittings of copper and copper alloy, Part 2 Metric units*".

Compression fittings are suitable for use with all grades of copper tube to EN 1057 but fittings 18 mm and above require an internal support when used with R220 (annealed) tube. Boat builders and boat owners are advised to seek specialist advice if large diameter connections are contemplated.

Soldered joints

Soldered joints are not permitted on boats as they are liable to:

- vibration- induced failure;
- melting in the event of excessive heat or fire;
- electrolytic degradation.

Olives

Soft copper parallel olives should be used with all types of pipe and compression fittings.

Brass olives, which are much harder than copper, should not be used in boat installations as they can "harden" and become brittle in use and the joint can leak or fail at the point where the brass ring engages the coupling body.

Copper olives are not susceptible to the same degree of "hardening".

Use of jointing compounds with compression fittings

The use of jointing compounds is not recommended with compression fittings as they may prevent the olive from engaging properly with the coupling body at the mating surface.

Use of jointing tapes & compounds

Washers or gaskets should be :

- suitable for use with LPG;
- durable;
- robust;
- LPG-tight.

Fibre washers and hemp should not be used.

PTFE tape conforming to BS 7786 *"Unsintered PTFE tape : General requirements"* or previously BS 4375 *"Specification for unsintered PTFE tape for thread sealing applications"* should not be used as these standards are not end-use specific and only refer to very general requirements.

Non-hardening jointing compounds should conform to BS EN 751-2 "*Sealing materials for threaded joints in contact with 1st, 2nd and 3rd family gases and hot water – Part 2: Non-hardening jointing compounds*". This standard supersedes BS 6956 Part 6 "*Specification for jointing compounds for 3rd family gases*". Jointing compounds should only be applied to tapered male threads of components.

Note, hardening, or anaerobic, jointing compounds are covered by BS EN 751-1 which supersedes BS 6956 Part 7.

Unsuitable jointing materials

The following jointing tapes and compounds are not suitable for use in LPG applications :

- standard light-duty PTFE tape;
- boss white;
- general purpose jointing compounds;
- fibre washers;
- hemp.

Materials which are not LPG-specific may react with the gas resulting in deterioration at the joint and leaks.

Stainless steel tube

Stainless steel pipework should always be installed with stainless compression or screwed fittings.

Stainless steel fittings are similar to copper but may incorporate a cutting ring ferrule whose purpose is to cut into the outer surface of the tube so that retention of the tube does not rely solely on the compression action of the ferrule as with copper fittings.

Copper nickel alloy tube

There are two main grades of tube. 90-10 (90% copper, 10% nickel) and 70-30 (70% copper, 30% nickel). The 90-10 tube is more readily available and is designated CW352H in European standards. 70-30 is designated CW354H.

Fittings should be made of dezincification resistant brass (DZR brass) or aluminium/brass or stainless steel.

Olives should be copper-nickel or copper.

Use of incorrect fittings

In all cases, the use of incorrect fittings can result in:

- corrosion due to electrolytic action;
- differential expansion and contraction leading to pulled and leaking joints.

Unsuitable materials

The following materials are not permitted for installation pipework for the reasons given:

- aluminium (corrosion, low melting point, vibration);
- lead (creep);
- brass tubing (season cracking);
- steel tubing (corrosion);
- plastics (low melting point, low-temperature embrittlement).

"Creep" is the gradual deformation of solids, including metal, under load and the rate increases with temperature.

"Season cracking" is a combination of stress and corrosion where corrosion can proceed rapidly at spots where stresses are concentrated. Such stresses may be residual (a consequence of the manufacturing process) or a result of installation or use.

Flexible connectors in the low pressure stage

Where flexible hoses are permitted in the low pressure stage, they shall comply with the Type 2 requirements of BS 3212 as described above for flexible hose in the high pressure stage.

Hose connections

In low-pressure applications flexible hoses shall be connected as for high pressure hoses or secured to nozzles by a metal crimped clip or worm-drive clamp. Nozzles should be either of the low pressure 'Fulham' type to BS 3016 (represented at Figure C.1, BS 5482-3) or the serrated type identified as type H.51 within Annex H of pr EN 12864. The spigot of the nozzle should have an outside diameter (O/D) correctly sized to suit the inside diameter (I/D) of the hose.

Appliance isolation valves

Appliance isolation valves must be installed in the supply line to each appliance, unless there is only one appliance in the system. In this case, the main shut-off valve is sufficient.

For LPG, isolation valves should be:

- spring-loaded, tapered-plug valves;
- ball-valves designed for use with LPG;
- screw-down diaphragm valves (sometimes called Saunders valves).

Needle valves and gate valves are not suitable as they cannot be guaranteed to provide a LPG-tight seal and the internal workings may cause a restriction to the flow of LPG.

Tapered-plug cocks (the traditional 'gas tap) are also spring-loaded for use with LPG to ensure the tightest possible seal between the cylinder and the valve body. Apart from the spring assembly they are identical to those used for natural gas.

Where the valve operates by rotation, the closed position must be achieved by rotating in a clockwise direction.

The identification of the ‘open’ and ‘closed’ position must be evident by design or by marking.

Valves positioned at floor level must be positioned to prevent inadvertent operation or be of the drop fan or loose key types.

SECTION D : CYLINDER LOCKERS & HOUSINGS

Definitions

A cylinder locker is a storage space for LPG cylinders, low pressure regulators and associated equipment, only openable from the top.

A cylinder housing is a storage space for LPG cylinders, low pressure regulators and associated equipment, openable from the side or top and side.

Stowage of cylinders in lockers

Cylinders not secured on open deck, cabin tops or outside cockpits where any leakage would flow over board must be installed in a cylinder locker whether full or empty, in use or stored.

Stowage of cylinders in housings

Cylinder housings may be installed in 2 locations only :

- on open decks, cabin tops, or outside cockpits;
- in self-draining cockpits.

Other than in self-draining cockpits as specified in Standard 7.7, they may not be installed in any other location below deck level including other cockpits or well-decks.

In self-draining cockpits it is preferable that a cylinder locker is installed wherever possible.

Fire resistance

The materials used for the construction of the sides and bottom of a cylinder locker or housing must have a fire resistance of 30 min in accordance with BS 476-20.

For metal this is translated as a minimum thickness of 0.9 mm and for fibre reinforced plastic (FRP) a minimum thickness of 5 mm.

For any other materials, if there is no marking by the manufacturer, documentary evidence may be required.

BS 476-20

BS 476-20 "*Fire resistance tests for materials*" describes methods of quantifying the ability of materials to withstand exposure to high temperatures.

A sample of the material is exposed to a specified heating procedure and its performance is monitored for the duration of the test.

The heating procedure depends on the nature of the sample under test, for example, it can be placed in a kiln which can be heated to the required temperature.

Samples are constructed to be as like the intended application as possible and are tested in a furnace heated by gas (natural or LPG) which can be pressurised and in which variable loads can be applied to the sample.

One surface of the sample is exposed to the heating process and it is heated until failure or until a time agreed by the sponsor.

At the end of this time, the sample should show no loss of fire separating function or load bearing function.

If the test is terminated before failure, the duration of the heating phase is the fire resistance of the sample.

The principal tests are for :

- load bearing (the point of physical collapse);
- integrity (the point at which sustained flaming appears on the unexposed face).

Stowage of cylinders in shelters

A shelter is an enclosure which stands on open decks, cabin tops or outside cockpits. Shelter construction need not be equivalent to that of a cylinder locker or housing providing it is constructed or positioned so that any escaping gas is dispersed overboard.

If the shelter is constructed so that any part below the lid, however small, creates a gas-proof section where escaping gas can accumulate, there must be provision for dispersing it overboard.

No part of the shelter may be below deck level.

Carrying cylinders outside the hull

The mounting, carrying or storage of cylinders by any method on the exterior of the hull is not recommended. If cylinders are so located the cylinder locker or cage must be sufficiently robust to provide protection from mechanical damage in the event of a collision or contact with other boats and structures.

No part of any storage arrangements may be below the deepest laden waterline.

Where LPG is used as a propulsion fuel, the current LPGA Code of Practice No. 18 prohibits the stowage of the cylinder outside of the plan of the vessel.

SECTION E : PIPEWORK INSTALLATION

Pipe sizing design considerations

Pipes should be of a size and length to ensure correct operation of the appliance. When designing a LPG installation the aim should be that the pressure drop between the outlet of the regulator and the inlet to any appliance should not exceed 2.5 mbar when the installation is subjected to the expected maximum load.

Pipe sizes and pipe length should be calculated to achieve this aim whilst at the same time using smallest pipe diameter practicable in order to limit the volume of LPG that is retained within the installation pipework. Limiting the volume of LPG in the system could restrict the amount of LPG that could potentially leak out.

Pressure drop

Pressure drop occurs because there is a resistance to the flow of gas caused by pipe walls, bends, joints and fittings.

Guidelines for assessing pressure drop due to pipe resistance are given in Table 7.2. **TABLE 7.2**

Verification of appliance operating pressures must be checked when the system is first commissioned. **TABLE 7.1**

The pressure observed at the inlet on each appliance should not be below that given in Table 7.1.

Modifications or additions to existing installations

When any modifications or additions are made to existing installations appliance operating pressures should be tested on first commissioning and the pressure observed should not be below that given in Table 7.1. **TABLE 7.1**

Installers should not rely on satisfactory flame pictures when making such modifications or additions.

Testing pipework before appliances are connected

In new installations or modifications involving replacing all the installation pipework or all the appliances, the pipework should be tested by the installer before the appliances are connected (or re-connected) using air as the test medium as described in Table 7.3. **TABLE 7.3**

Length of pipework

Factors that may affect the length of pipework are:

- convenience of installation;
- the need for safe installation of pipework;
- accessibility of joints for testing.

Pipework should only be longer than necessary for safety reasons :

- to avoid an unsafe location;
- accessibility of joints and connections.

Height of pipework

Pipework must be run as high as practicable to maximise the likelihood of any leak being detectable to the sense of smell and to minimise the risk of damage from:

- being kicked or trodden on;
- heavy objects coming into contact with pipes;
- exposure to water, oil, and fuel.

Protection against mechanical damage

If persons or equipment on the boat are brought into contact with the pipework there is a risk of it being damaged by:

- impact;
- kinks or flattening;
- pipes being pushed into, or pulled out of joints and connections.

As a result the pipes or connections may fail causing leaks or the flow of gas to the appliances may be restricted.

Pipework may be protected by:

- routing the pipes away from potential danger areas;
- provision of shields or protective covers;
- running the pipes in conduits.

Protection against deterioration

Pipes will deteriorate if they are exposed to:

- vibration (work hardening);
- abrasion;
- heat;
- acid and chemical contamination;
- electrolysis.

SECTION F : HIRE BOATS & HOUSEBOATS

Gas Safety (Installation and Use) Regulations

The Gas Safety (Installation and Use) Regulations (GSIUR) deal with safe installation, maintenance and use of gas systems.

Boats currently subject to the GSIUR (in scope) are those:

- hired out in the course of a business (e.g. hire fleet operations)
- made available to members of the public in the course of a business carried out from the vessel (e.g. hotel, restaurant, trip boats)
- used primarily for domestic or residential purposes (e.g. houseboats)

Note

The Regulations have their origins in the requirements for gas installations in buildings and premises. Boat owners should be aware that all references to buildings and premises in the Regulations are taken to mean any boat 'in scope' wherever they can be applied to a boat installation.

Some important issues for hire boat operators & houseboat owner/occupiers

The bulk of the GSIUR detail the legal responsibilities of installers but hire boat operators and owners/occupiers of houseboats also have legal responsibilities. These include:

- work must be carried out by a CORGI-registered installer;
- no one shall use a gas appliance or permit it to be used if it cannot be used without constituting a danger to any person;
- if gas is escaping, all reasonable steps must be taken to shut-off the gas supply;
- where an escape of gas has been stopped by shutting off the supply, no person shall turn the supply back on until all necessary steps have been taken to prevent a recurrence of the escape;
- no person shall intentionally or recklessly interfere with a gas cylinder so that it could be dangerous when used;
- no person shall make any alterations to any premises that may affect the safety of a gas installation.

Additional responsibilities for hire boat operators

The GSIUR (Regulation 36) "Duties of landlords" place additional important duties on operators of hire craft or boats used for business purposes. These include :

- each appliance (including any flues) must be maintained in a safe condition;
- annual safety checks must be carried out by a CORGI-registered installer;
- a record of these checks must be kept and issued or displayed to tenants.

In this context, the hirer of the boat would be the 'tenant'.

SECTION G : DEFINITIONS OF TERMS

Readily accessible

There are several checks in Parts 7 and 8 which require parts of the LPG installation to be readily accessible for examination.

"Readily accessible" is defined in BS 5482-3 as follows:

"capable of being reached for operation, inspection or maintenance without removal of a vessel structure or use of tools or keys or removal of any item of portable equipment stowed in a place intended for storage of portable equipment (e.g. lockers, drawers or shelves)"

The question of ready access can, however, only be determined at the time of the examination. For example, any indication that a cylinder locker or housing was capable of being locked would not be a failure point providing it was not locked at the time of the examination and the examiner can obtain ready access.

Accessible

"Accessible" is defined in BS 5482-3 as follows:

"capable of being reached for inspection, removal or maintenance, without removal of a permanent vessel structure."

The 'NOTE' to the definition states "Hatches are not included as permanent vessel structures, even if tools are required to open them."

Suitable for use in a marine environment

The term 'suitable for use in a marine environment' is referred to in both Parts 7 and 8. In general the term is intended to ensure that only appropriate system components are selected to be installed in boats.

The condition is satisfied if the manufacturer or supplier of the component can provide an assurance that the component is designed to withstand the combined conditions likely to be encountered under normal operating conditions and storage.

Such conditions may include:

- vibration;
- movement and shock;
- pressure;
- corrosion;
- exposure to solvents, lubricating oil, grease etc;
- extremes of temperature and humidity.

The condition is largely aimed at the selection process to ensure only appropriate equipment and components are installed. Manufacturers may provide an assurance of suitability by any of the following means:

- installation instructions include a section specific to boats;
- brochures and other literature aimed at boat owner market;
- conformity with relevant published standards.

Throughout these Standards there is no requirement for the design purpose of the component to be proved. General checks regarding damage, deterioration and specific checks on materials used or required design features should identify inappropriate equipment.

Modifications and additions

All appliances need to be properly serviced and maintained during their working life and they may also require repair. They may also need to be modified or added to in some way in order to meet these Standards or other requirements.

Providing anything done to an existing appliance is done by a competent person in accordance with appliance manufacturer's recommendations or the equipment or component manufacturers' instructions, the modifications or additions are acceptable under these Standards.

It is not necessary to replace an existing non-room sealed appliance with a room sealed appliance if a modification or additions done in this way achieves the objective.

Existing appliances

Exemptions are only available for existing appliances and Boat Safety Scheme examiners will need to be satisfied that the appliance for which an exemption is claimed was installed before the effective date of the exemption. Where there is evidence that the appliance has been installed after the effective date of the exemption, documentary evidence may be required to support the claim for the exemption.

Examiners will be looking for the more obvious signs that the appliance was installed after the effective date such as:

- the condition of the appliance itself
- information given on any visible data plate
- new pipework, fittings and components
- work done or alterations to the structure of the boat in the vicinity of the appliance

Accommodation

The term accommodation is used to define any part of the vessel inside an enclosed cabin. It includes all such terms as :

- cabin;
- compartment;
- saloon;
- dinette area;
- galley;
- heads.

and any similar terms or descriptions.

Accommodation spaces An accommodation space is any part of the vessel inside an enclosed cabin that is normally divided as a separate compartment or which can be temporarily divided by such things as screens, partitions, and dual-purpose doors but not by the use of curtaining or textile screens.

Bathrooms For the purpose of these Standards, the term bathroom includes shower rooms.

SECTION H : INFORMATION FOR USERS

Note: Throughout Boat Safety Scheme documentation references to British Standards are not dated. This is because British Standards are revised, when necessary, by the issue of either amendments or revised editions. It is important that users of British Standards make sure they possess the latest amendments or additions.

This section contains information on the following:

- leaking LPG;
- fire from an LPG leak;
- fires close to an LPG cylinder;
- changing cylinders;
- handling of empty cylinders;
- damaged cylinders and components;
- refuelling;
- using appliances;
- checking flexible hoses;
- checking for leakage;
- checking flue pipes;
- gas leak detection.

Leaking LPG

If LPG leakage is detected or suspected the following action should be taken immediately.

- Shut off the LPG supply at the cylinder valve(s);
- Extinguish naked flames and other ignition sources e.g. heaters, cooking appliances, pilot lights, cigarettes;
- Do not operate electric switches;
- Ventilate the area with a through draught;
- Evacuate the area if possible.

If leakage is from a cylinder and cannot be stopped, move the cylinder to where LPG can disperse away from the vessel (and other vessels). Take care in moving the cylinder that the gas leaking from it cannot find its way into the boat.

Do not use an installation that has leaked until it has been checked and the cause of the leak rectified by a competent person.

Fire from an LPG leak on a moored vessel

If an LPG leak has ignited on a moored vessel action should be taken as follows:

- alert everyone in the area and evacuate if possible;
- call the fire brigade if practicable;
- do not attempt to extinguish any flame unless it is safe to do so;
- shut off the LPG supply before attempting to extinguish the flame;
- after shutting off the LPG supply, extinguish any free burning materials with extinguishers or water;
- do not re-use the installation until it has been checked and the cause of the leak rectified by a competent person.

Fire from an LPG leak on a vessel offshore

If an LPG leak has ignited on a vessel offshore action should be taken as follows:

- alert everyone on the vessel;
- if it is safe to do so, shut off the gas supply;
- extinguish any free burning materials with extinguishers or water;
- do not re-use the installation until it has been checked and the cause of the leak rectified by a competent person.

Fires close to LPG cylinders

LPG cylinders exposed to fire can explode.

If there is a fire close to an LPG cylinder, the following action should be taken:

- alert everyone in the area and evacuate if possible;
- call the fire brigade if practicable;
- if it is safe to do so, shut off the gas supply and move the cylinder to a safe place in the open;
- if the cylinder cannot be moved, keep it cool with wet blankets and spraying with water;
- do not re-use the installation until it has been checked and the cause of the leak rectified by a competent person.

Changing a cylinder

The following safe practices should be complied with when changing a cylinder:

- ensure that any manually operated valves on both the full and empty cylinder are turned off before changing;
- replace the plastic safety cap or plug on disconnected cylinders;
- store, transport and use cylinders vertically the valve uppermost;
- do not use a cylinder if the cylinder, valve or regulator are damaged. Return the cylinder to the supplier. Do not attempt to repair the fault;
- before changing a cylinder, extinguish any fire, flame or source of ignition, including cigarettes and pilot lights;

- joints should be firm and LPG-tight. If a leak is suspected after changing a cylinder and opening the valve, check the cylinder valve with an ammonia-free leak detection fluid. Do not use a naked flame for testing;
- if a leak cannot be stopped, move the cylinder to a safe place in the open, ensuring that the leaking LPG is dispersed safely;
- ensure that replacement cylinders are appropriate for the installation;
- ensure that the regulator is appropriate for the appliances, and use in accordance with the manufacturer's recommendations;
- ensure that sealing washers, if required, are sound and correctly positioned prior to connecting. Mating surfaces of connections that require metal-to-metal sealing should be clean and undamaged. Do not use damaged valves or connections;
- use the correct size of spanner for connections, and tighten firmly. Self-sealing valves should be connected in accordance with the manufacturer's recommendations;
- regulators fitted with integral relief valves should be ventilated to the open, away from sources of ignition;
- ensure that all appliance taps are turned off before reconnecting cylinders that have been closed, or connecting replacements;
- light appliances without an ignition device by applying a match or taper to the burner before turning on the supply.

Handling of empty cylinders

A nominally ‘empty’ cylinder may still contain LPG in vapour form and is therefore potentially dangerous and should be treated as if it were full.

In a nominally ‘empty’ state the internal pressure is approximately atmospheric and if a valve is left open LPG can escape or, conversely, air can diffuse into the cylinder forming a flammable mixture and creating a risk of explosion. The valves of nominally ‘empty’ cylinders should always be kept closed.

The disposable butane containers of self-contained portable appliances are particularly prone to continue to discharge LPG even though there is insufficient pressure of LPG to run the appliance.

Nominally ‘empty’ containers should be disposed of in a safe place and should never be discarded within the vessel.

Any spare or nominally ‘empty’ cylinders must be either:

- secured on deck;
- contained in a ventilated cylinder locker or housing.

Damaged cylinders and components

Cylinders, cylinder valves or low-pressure regulators should not be used if they are damaged or if the connections are not LPG-tight. Damaged or leaking cylinders/valves should be returned to the supplier, damaged low-pressure regulators should replaced by a competent person.

Low pressure regulators

Regulators marked in imperials units, or more than 10 years old should be replaced.

The date of manufacture is marked on the body of the regulator or the union nut.

Refuelling petrol, diesel or LPG powered vessels

As well as taking normal precautions against spillage, smoking or naked lights when refuelling petrol, diesel or LPG powered vessels, ensure that all gas burners are turned off, and permanent pilot lights extinguished. Disable automatic ignition systems on appliances while refuelling.

Using appliances

The following should be complied with when using appliances:

- operation and maintenance of appliances should be carried out in accordance with the manufacturer's recommendations;
- ventilate the area;
- do not obstruct ventilator openings;
- do not use cooking appliances to heat the area.

Warning

Non-room sealed fuel burning appliances consume oxygen and can release combustion products into the vessel.

Checking flexible hoses

Check flexible hoses regularly and replace if cracked or otherwise deteriorated.

Ensure that the ends of replacement flexible hoses are secure and LPG-tight

Regular checks for leakage

Ensure that the LPG system is regularly tested for leakage. Connections should be checked by:

- routine observation of a bubble tester installed in the cylinder locker or housing; or
- testing with leak detection fluid, with the appliance burners turned off and the main shut-off valve open.

WARNING If there is a leak discovered in the LPG system, close the cylinder valve and ensure the system is checked and the cause of the leak rectified by a competent person.

WARNING Do not use solutions containing ammonia to detect leaks.

WARNING Do not check for leaks with a naked flame.

Checking flue pipes

Check flue pipes at least once per year and replace as appropriate.

Gas leak detection

A means for detecting gas leakage may be installed.

Detection equipment may, for example, consist of a bubble leak indicator installed in the low pressure pipework, as near as practicable to the outlet of the regulator, or an electronic detector.

Detectors should be tested frequently and maintenance carried out by competent persons.

Types of gas detector

Gas detectors should actuate promptly in a gas concentration in air of no greater than 0.5 % (approximately 25 % of the lower explosive limit), and should incorporate both an audible and a visible alarm (although on small vessels a portable, manually operated detector may be used).

Electrical detection equipment

If electrical detection equipment is fitted, it is essential that it is flame-proof or intrinsically safe for the gas.

If practicable, the alarm unit and indicating panel of detectors should be operable from outside the space containing the gas storage and consuming appliances.

Unsafe situations

The BSS Failure Certificate serves two purposes:

- it informs the navigation authority that a boat does not meet the BSS Standards
- it identifies the fault items for the boat owner

In carrying out the checks, the examiner will also assist the owner by ensuring, so far as is possible, that:

- the LPG installation or appliance is left in a safe condition
- owners are aware of the need to have faults rectified as soon as possible by a competent person
- anyone using or attempting to use the installation or appliance before the fault(s) are rectified is made aware of any dangers or risks

LPG Warning Notice

To achieve this, the examiner will complete a written LPG Warning Notice to accompany the Failure Certificate.

Displaying the Warning Notice

The owner will be given 2 copies of the Warning Notice and the owner will be advised to leave one copy displayed in a prominent position on board the boat.

The notice should be displayed where anyone wishing to use the system, or the competent person rectifying the fault(s), will be sure to see it before turning on the gas or the appliance or starting work.

Deciding if a situation is unsafe

All potential unsafe situations are covered by the BSS fault criteria and checking procedures and it is not necessary for any additional checks or fault criteria to be invoked.

Using the existing check list and fault criteria examiners will first decide if they are going to record a fault and issue a Failure Certificate.

If they are going to record a fault, examiners will then use their judgement based on their knowledge and experience, taking into account the specific circumstances, to decide what further action, if any, to take.

If they judge the situation is unsafe, they will follow the procedures described in Table 7.4. **TABLE 7.4**

Dangerous situations

A dangerous installation or appliance is one which, if used or left connected to the gas supply is an immediate danger to life or property.

Examples of such situations are:

- a leak in the LPG system;
- removal of products of combustion not being safely carried out.

In the case of gas leaks or flue spillage from open flues, the examiner will request the owner to disconnect the gas supply at the main shut-off valve or appliance as appropriate and will attach a LPG Warning Label at an appropriate point on the installation or appliance for the benefit of all users.

Labelling

Where a dangerous situation exists, the examiner will secure a LPG Warning Label in a prominent position on or near the main shut-off valve or appliance to ensure that all potential users are aware of the problem until such time as it is rectified by a competent person.

The label will be secured in a position which will immediately catch the attention of anyone wishing to turn on the gas supply or operate the appliance.

Potential risk situations

An installation or appliance presents a ‘risk’ situation if, when used, it could create a risk to life or property.

Examples of such situations are:

- unsatisfactory burner flame pictures if accompanied by indications the low pressure regulator should be replaced;
- pipework or flexible hose defects e.g. severe corrosion, damage, unsuitable material;
- serious flueing or ventilation defects;
- evidence of heat damage to combustible materials adjacent to an appliance.

Action by BSS On being notified by an examiner that a dangerous situation exists, the Manager of the BSS, will decide what further action, if any, needs to be taken and the examiner has no further responsibilities in the matter.

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Part 7

LPG INSTALLATIONS TESTING

LPG INSTALLATIONS TESTING

Introduction

The BSS examination requires examiners to carry out the following practical tests on the LPG installation:

- soundness testing (7.22.2);
- flue spillage test on open flued or non-room sealed appliances in existing installations (8.2.2k);
- burner flame picture (8.2.5);
- safe transfer of gases on room-sealed appliances (8.8.3).

The tests should be done in the order and manner described in this section in order to:

- comply with safe working practice;
- determine there are no leaks in the system or other unsafe situations;
- check that flues are operating correctly;
- avoid unnecessary lighting and re-lighting of burners.

This method also delivers an efficient and cost-effective service to the boat owner by reducing the number of operations involved in the test procedures and thus the time taken to complete the LPG examination.

CARRY OUT CHECKS FOR FAULT 7.22.2

Gas leak detection

For the purpose of the Boat Safety Scheme, leaks may be detected by carrying out a gas soundness test.

Action on discovery of a leak

If a gas leak is detected the examiner must:

- carry out the actions described in Table 7.4;
- stop all further testing of the system;
- decide whether or not to abandon the BSS examination.

Abandoning the BSS examination

If, on discovery of a leak, the examiner decides that the boat does not present him with a safe working environment he should forthwith abandon or postpone the remainder of the BSS Examination.

Soundness testing

The test may be carried out in one of two ways using:

- a "U" gauge at an approved test point; OR
- a bubble tester fitted in the cylinder locker or housing.

Rotary gauges

Rotary pressure test gauges (including ‘gaslo’ meters) may not be used for this test.

Tests have shown they do not provide sufficient perceptible movement for small leaks which are immediately detectable by either the U-gauge or the bubble tester.

The movement is 'lost' in the mechanical transfer through the operating mechanism to the dial indicator or the dial is not large enough to magnify small movements in the mechanism.

"U" gauge method The procedure for carrying out the soundness test using a manometer or U-Gauge is detailed in Table 7.5. **TABLE 7.5**

Readings will not stabilise If the reading does not stabilise and continues to rise during the 5 min temperature stabilisation period it is not possible to continue the test.

This condition is a symptom of a leaking main shut-off valve.

If the owner or the owner's representative is in attendance, it is in order for them to change the cylinders so the test can continue.

Test discontinued If the test is discontinued at this point it is not possible to say - in the absence of a bubble tester - whether the system is sound or not.

Therefore, a fault should be recorded at 7.1.1 and not here.

Bubble tester method The procedure for carrying out a gas soundness test using a bubble leak detector is detailed in Table 7.6. **TABLE 7.6**

CHECKING Determine by carrying out soundness test as appropriate there are no leaks in the system.

Where the test cannot be conducted or is discontinued for any reason, a failure is to be recorded at 7.1.1 not here.

Dangerous situation A leak in the system is a dangerous situation and the examiner is to take the action described in Table 7.4 for a fault which requires the gas supply to be disconnected. **TABLE 7.4**

FAULTS		
Soundness of LPG installation	Leak in system	7.22.2

PROCEED TO FLAME PICTURE ASSESSMENTS (Fault 8.2.5) IF NO LEAK DETECTED

Soundness test using "U" gauge If the soundness test was conducted by use of a "U" gauge, leave the gauge connected to the test point until all tests have been completed.

Soundness test using bubble tester

Return the bubble tester to the working mode in accordance with the manufacturer's instructions.

Light all burners

Light all burners in preparation for the burner flame picture assessments and flue/flue terminal checks (if required).

Burners protected by flame supervision devices

When lighting burners protected by flame supervision devices (FSD), examiners should observe the development of the flames carefully.

If the burner will not light at all, it is an indication that the FSD may have failed. In these cases a fault should be recorded at 8.5.1.

If the burner lights immediately at full gas flow it is an indication that the FSD has been tampered with or by-passed.

This can lead to a uncontrolled and potentially dangerous ignition procedure especially where oven burners are being lit.

If the examiner knows, or has any reason to suspect that the flame supervision device is not failing safe or has been tampered with, a fault should be recorded at 8.5.1.

CARRY OUT CHECKS FOR FAULT 8.2.5

Flame picture

A satisfactory flame picture shall be present at each appliance burner when all appliance burners in the system are operating at maximum rate. **FIG 7.1**

Burner flames

When all burners are:

- lit at their maximum setting;
- all lit at the same time.

and the gas and air mixture is in the correct proportions, the flame at the burners must exhibit the following characteristics:

- stable flame body;
- clear, blue flames;
- correct proportions;
- clearly distinguishable inner and outer cones;
- no separation from burner port;
- odourless;
- prompt ignition and flame development.

If any of the following signs are present, there is a fault:

- flame burning yellow, orange, or with yellow tips;
- total or partial separation of the base of the flame from the burner ports (flame lift) - this may cause the flame to blow itself out;
- smell of gas;
- combustion odour;
- delayed ignition or slow lighting;
- combustion of a flame inside the body of a burner (light back).

The only exception to this is the ribbon-type burner as found in ovens where it is usual for the flame to be yellow-tipped. This must not, however, be so pronounced as to cause the formation of soot on the interior surfaces of the oven.

The likely causes of an unsatisfactory flame picture are covered in the Introduction to Part 8. In all cases, the burner should be checked and the fault rectified by a competent person.

Regulator flow test

One of the possible causes for unsatisfactory flame pictures is a failure of the regulator to deliver the correct outlet pressure.

Where the soundness test has been conducted by use of a “U” gauge and the gauge is still connected to the system with all burners lit at the maximum rate, this can be checked by noting the reading on the “U” gauge.

The regulator should be operating within ±5 mbar of the design operating pressure :

- 32-42 mbar – propane
- 23-33 mbar – butane

Regulator operating outside design limits

If the operating pressure at full flow is outside these limits it is an indication that the regulator is not performing to the manufacturer’s specification.

Where the outlet pressure at the regulator is not within the manufacturer’s specification there is a risk of causing leaks at control taps (over pressure) or unstable or unsafe burner flames (over- or under pressure).

Regulator more than 10 years old

The age of the regulator can affect its performance and BS 5482-3 Annex D recommends that low pressure regulators marked in imperial units or more than 10 years old should be replaced.

Owner should be advised to replace any such regulator(s) at the earliest opportunity.

The date of manufacture is shown on the body or union nut of the regulator.

CHECKING

Confirm that all burners in the system are lit and operating at maximum rate. Visually check a satisfactory flame picture is present at each burner.

If the regulator is:

- not operating correctly
- more than 10 years old
- marked in imperial units

the examiner should also take the actions for non-compliant gas systems described in Table 7.4 for Fault 8.2.5.

The LPG Warning Notice should include a note about the performance or age of the regulator as appropriate.

FAULTS		
Burner Flame Picture	Not satisfactory	8.2.5

PROCEED TO FLUE/FLUE TERMINAL TESTING (8.2.2k or 8.8.3) IF NO LEAK DETECTED

Warm up period

Carrying out the flue/flue terminal tests immediately after the flame picture assessments will have allowed any flues that require to be tested to reach full working temperature.

Appliances not requiring a flue test

Main burners to appliances not requiring a flue test can now be turned off.

CARRY OUT CHECKS FOR FAULT 8.2.2 (k) – NON-ROOM SEALED APPLIANCES

Exemption 11.25 v) - safe transfer of flue gases

Flues must be of appropriate internal diameter to ensure safe transfer of gases to outside the vessel away from areas that could be enclosed by canopies.

Internal diameter

No part of the flue system must be of a smaller internal diameter than the flue spigot on the appliance to which it is attached.

The internal diameter of the system must not be reduced by:

- use of pipe sections of reducing diameter;
- inclusion of dampers or restrictor plates;
- ingress of foreign matter.

Damper plates Damper or restrictor plates must not be fitted unless they are permanently fixed in the open position otherwise they could reduce the internal diameter of the flue.

An exception can be made only in the case of solid fuel stoves intended for use as all-night heaters.

Termination under canopies Terminating flues in areas that could be enclosed by a canopy is not permitted.

When a canopy is erected, the space it encloses is regarded as not being outside the vessel for the purpose of this Standard. This applies irrespective of how many ‘openings’ there are between the canopied area and the outside air.

CHECKING If the flue terminates in an area that could be enclosed by a canopy, do not carry out the spillage test but do record a failure here.

Carry out a flue spillage test on all flues connected to open and closed flued appliances as described in Table 7.7. **TABLE 7.7**

Dangerous situation Continuous smoke spillage is a dangerous situation and the examiner is to take the action described in Table 7.4 for a fault which requires the gas supply to the appliance to be disconnected. **TABLE 7.4**

FAULTS		
Flue	Does not ensure safe transfer of gases to outside of vessel	8.2.2 (k)

CARRY OUT CHECKS FOR FAULT 8.8.3 – ROOM SEALED APPLIANCES

Safe transfer of flue gases Flues and flue terminals shall ensure safe transfer of gases to outside the vessel.

Indications of leaking flues There are 2 indications that a closed flue is leaking combustion products into the interior of the vessel:

- visible signs of damage to areas of the boat surrounding the flue installation;
- venting of hot gases from any breach or defect in the flue when the appliance is working.

CHECKING Visually check in the vicinity of the flue for signs of leaking flue gases such as:

- heat damage
- smoke damage
- soot deposits

With the appliance working and taking great care, manually check that flue gases are not issuing from any part of the flue into the interior of the boat.

Dangerous situation

The leaking of combustion products into the interior of the vessel is a dangerous situation and the examiner is to take the action described in Table 7.4 for a fault which requires the gas supply to the appliance to be disconnected. **TABLE 7.4**

FAULTS		
Flue/Flue Terminal	Does not ensure safe transfer of gases to outside of vessel	8.8.3

CONCLUSION OF PRACTICAL TESTS

On conclusion of the tests, examiners should ensure that the system is returned to the condition in which they found it providing no failures have been recorded for faults:

- 7.22.2;
- 8.2.2 (k);
- 8.8.3.

In these instances, the installation or the appliance will have been disconnected as described in Table 7.4. **TABLE 7.4**

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Part 7

LPG INSTALLATIONS : STANDARDS

Part 7
LPG (Liquefied Petroleum Gas) installations

The following Standards shall apply to all vessels with LPG installations.

(NOTE 1: Guidance on the design considerations when installing, modifying or adding to LPG systems and information regarding the testing of LPG installations is contained within BS 5482-3 and the Boat Safety Scheme Technical Manual.

NOTE 2: Any work on LPG systems should only be carried out by competent persons).

STANDARD 7.1 : COMPLIANCE WITH BS 5482- 3

The installation shall comply with BS 5482 - Code of practice for domestic butane and propane gas-burning installations, Part 3: Installations in boats, yachts and other vessels.

(NOTE: The provision for existing installations contained within Annex A of BS 5482-3 is represented by paragraphs 11.18 and 11.19 and 11.22 to 11.29)

Compliance with BS 5482-3

The installation is deemed to comply with BS 5482-3 providing there are no faults recorded in Parts 7 and 8 of these Standards.

No other fault criteria are to be applied.

Alternative certificates

Examiners must carry out the examination and checks required by the BSS Parts 7 and 8, and must not accept any certificates produced by the owner as a substitute for carrying out any part of the Boat Safety Scheme examination.

CHECKING

A fault must also be recorded at 7.1.1 if for any reason it was not possible to carry out, or complete, the gas soundness test at 7.22.2, the flame pattern test at 8.2.5, or the flue spillage test at 8.2.2(k).

FAULTS		
LPG Installation	Not installed to BS 5482 - 3	7.1.1

STANDARD 7.2 : STORAGE OF LPG CYLINDERS

Every cylinder (full or empty, stored or in use) shall be either:

i) secured on open deck, cabin tops or outside cockpits so that any leakage flows overboard. Cylinders, low pressure regulators and associated equipment shall be at least 1 m away from hatches, other openings and possible sources of ignition.

(NOTE: Cylinders, low pressure regulators and associated equipment may be enclosed in a shelter on open deck, cabin tops or outside of cockpits provided the shelter conforms to this sub-paragraph 7.2 i));

or

ii) secured in a cylinder locker LPG-tight to the hull interior at least to the level of the cylinders, low pressure regulators and associated equipment. Cylinder lockers shall only be openable from the top and shall be provided with a lid or cover to protect cylinders, low pressure regulators and associated equipment from mechanical damage. Cylinder lockers shall be ventilated from outside the vessel to a point above the level of the cylinders.

(NOTE 1: see paragraph 11.18).

A means to drain LPG away from the vessel shall be provided from the lowest point of the cylinder locker to a point outside the hull above the deepest loaded waterline.

(NOTE 2: see paragraph 11.19).

(NOTE 3: Cylinders may be secured in a cylinder housing in a self-draining cockpit provided the installation is in accordance with Standard 7.7).

Cylinder security

The security of cylinders is covered at fault item 7.3.2.

Use of shelters on open decks, cabin tops or outside cockpits

Cylinders and associated equipment may be secured in a shelter on open decks, cabin tops or outside cockpits providing the shelter conforms to Standard 7.2 i).

The use of cylinder lockers or housings, constructed to these Standards are preferable to the use of shelters. Cylinder lockers and housings provide the best possible protection for cylinders and associated equipment and reduce the risks in the event of a gas leak at the cylinder location.

Carrying cylinders on the outside of the hull

For existing boats, cylinders may be stowed on brackets or shelves fixed to the outside face of the transom but this is not recommended practice. In these circumstances the cylinders, regulators and associated pipework must be protected from mechanical damage in the event of a collision and be ventilated to allow escaping gas to flow directly overboard.

Leaking gas

Every cylinder (full or empty, stored or in use) shall be secured on open deck, cabin tops or outside cockpits so that any leakage flows overboard.

There should be no obstructions in the downward path to the flow of gas which could form a 'dam' behind which gas could accumulate.

LPG is heavier than air and always seeks a downward path when free to do so. It is this property which allows any escaping gas from properly sited cylinders, cylinder lockers and housings to flow overboard and away from the vessel.

If it is not dispersed overboard it may accumulate in the bilge or bottom of the boat from where it cannot easily be removed.

Care needs to be taken in locating cylinders, cylinder lockers and housings to ensure an unobstructed path for leaking gas that the position chosen does not form an obstruction to persons moving about the vessel (see 7.3.3 below).

Cylinders stored in shelters

This check is also to be carried out for cylinders carried in a shelter.

CHECKING

Visually check any leaking gas from LPG cylinders on open deck would flow overboard unimpeded.

FAULTS		
LPG Cylinders on open deck	Leaking gas would not flow overboard	7.2.1

Distance from hatches or openings

Cylinders, low pressure regulators and associated equipment shall be at least 1 m away from hatches, other openings and possible sources of ignition.

Cylinders must be sited away from all hatches and openings so that any escaping gas cannot find its way into the interior of the boat.

The minimum distance must be 1m away from any hatch or opening but whatever the distance, there should be no openings of any kind in the path of leaking gas which would allow it to find its way back into the interior of the boat.

In this context, the term 'openings' includes both permanent openings and those capable of being closed without the use of tools, whether they are open or not at the time of the examination.

CHECKING Visually check there are no hatches or openings within 1 metre from the LPG cylinders on deck.

FAULTS		
LPG Cylinders on open deck	Not at least 1 metre away from hatches or other openings	7.2.2

Sources of ignition Cylinders, low pressure regulators and associated equipment shall be at least 1 m away from possible sources of ignition.

Cylinders, must be sited so there is no danger of any escaping gas being ignited.

Possible sources of ignition include the pilot lights of appliances or installed spark inducing electrical equipment such as appliance automatic ignition systems or non-flame proof solenoid shut-off valves.

In addition to being 1 m away, there should be no such ignition source in the path of leaking gas irrespective of the distance it is located from the cylinder installation.

CHECKING Visually check there are no sources of ignition within 1 metre (or in path of leaking gas) of LPG cylinders on deck.

FAULTS		
LPG cylinders on open deck	Not at least 1 metre away from source of ignition	7.2.3

Cylinders not on open deck Cylinders not stored on open decks, cabin tops or outside cockpits must be secured in a cylinder locker.

Self-draining cockpits There is one variation to this rule which can be applied to the stowage of cylinders in self-draining cockpits. The best practice is to comply with these Standards and secure the cylinder in a cylinder locker but in this case only, it would be permissible to install a cylinder housing providing the housing complies with Standard 7.7.

CHECKING Visually check any cylinders not on the open deck, cabin tops or outside cockpits are in a cylinder locker or a cylinder housing.

For stowage of cylinders in cylinder housings assess against the requirements of Standard 7.7.

FAULTS		
LPG Cylinders not on open deck	Not in a cylinder locker	7.2.4

Gas tightness Cylinders not stored on open decks, cabin tops or outside cockpits must be secured in a cylinder locker LPG-tight to the hull interior at least to the level of the cylinders, low pressure regulators and associated equipment.

If the regulator or associated equipment is lower than the cylinders, the cylinder locker must be LPG-tight at least to the height of the cylinder valve.

This means that if any part of the installation within the cylinder locker develops a leak for any reason the leak will be contained in the locker and will drain overboard through the drain at the bottom.

Depth Apart from the requirement for cylinder lockers to be located above the waterline there are no limits set for the overall depth of the locker. Providing it is LPG-tight to the height prescribed, any part of the locker above that height, which includes the lid or cover, need not be LPG-tight.

Visual examination LPG is extremely ‘searching’ as described in the Introduction to Part 7 and the smallest defect will breach the LPG-tight integrity of the locker.

Providing the cylinder locker is constructed in accordance with these Standards, no test for LPG-tightness is being made at present. However, a careful visual examination will be made of the structure both inside and out to ensure there are no signs of any damage or deterioration which would allow leakage of gas to the hull interior.

CHECKING Visually check the cylinder locker is LPG-tight to the hull interior to the level of the cylinders, regulators and associated equipment by examination of the bottom, sides, and seams for signs of:

- holes;
- damage;
- cracks;
- corrosion;
- welding/brazing imperfections e.g. slag intrusions.

FAULTS		
Cylinder Locker	Not LPG-tight to hull interior to height prescribed	7.2.5

Locker opening Cylinder lockers shall only be openable from the top.

LPG is heavier than air and extremely 'searching' and reliance cannot be placed on the effectiveness of any side door seal. Even if an effective seal could be developed, reliance could not be placed upon the practice of the user to close side openings.

CHECKING Visually check the cylinder locker can only be opened from the top.

FAULTS		
Cylinder Locker	Not openable only from the top	7.2.6

Lid or cover Cylinder lockers shall be provided with a lid or cover to protect low pressure regulators and associated equipment from mechanical damage.

Lids or covers must be made robust enough to withstand any use to which they might be put, particularly if they are used as a seat or step.

There is no requirement to make the lid or cover LPG-tight as the locker is required to be ventilated above the level of the cylinders i.e. the LPG-tight area of the locker (see 7.2.8 below).

Lids or covers must be made reasonably weatherproof to reduce the risk of water and debris finding their way into the locker. These could damage the regulator and associated equipment and block the locker drain.

CHECKING Visually check for presence of lid or cover that protects the cylinders, low pressure regulators and associated equipment from mechanical damage.

FAULTS		
Cylinder Locker	Not provided with a lid or cover as prescribed	7.2.7

High level ventilation

Cylinder lockers shall be ventilated from outside the vessel to a point above the level of the cylinders.

The provision of high level ventilation concerns the creation of latent heat to aid vapourisation. As LPG becomes a vapour the contents of the cylinder are cooled thus reducing the vapourisation rate. High level ventilation introduces warmer air around the cylinder which helps maintain the vapourisation rate.

The provision of high level ventilation also helps create an air flow through the locker or housing which should help remove LPG through the drain in the event of a leak.

The total cross-sectional area of high level ventilation openings should be at least equal to that of the locker drain.

Where high level ventilation is introduced above the cylinder but below the low pressure regulator and other associated equipment, any hose used should be suitable for use with LPG. Suitable hoses include EPDM hoses (ethylene propylene diene monomer) and hoses suitable for petroleum products.

The maximum length of ventilation hoses should not exceed 5 times the internal diameter of the duct.

Direct opening in the hull

Where the cylinder locker or housing is an integral part of the hull it may be ventilated by means of a direct opening through the hull.

CHECKING

Visually check for ventilation above the level of the cylinders from outside the vessel.

FAULTS		
*Cylinder Locker	No provision for ventilation above the level of the cylinders	7.2.8

EXEMPTION 11.18 : HIGH LEVEL VENTILATION

Apart from hire cruisers licensed with the Broads Authority, vessels manufactured prior to 3 January 2000 are not required to comply with that part of Standard 7.2ii) which requires cylinder lockers to be ventilated from outside the vessel to a point above the level of the cylinders.

Broads Authority hire craft

This exemption is not available for Broads Authority hirecraft.

Existing installations only Owners are encouraged to provide the ventilation from outside the vessel if at all possible.

CHECKING Identify non-Broads Authority hirecraft and apply the exemption.

FAULTS		
	*EXEMPTION 11.18 APPLIED	7.2.9

Cylinder locker drains A means to drain LPG away from the vessel shall be provided from the lowest point of the cylinder locker to a point outside the hull above the deepest loaded waterline.

The provision of a drain allows any leaking gas to sink to the bottom of the cylinder locker and drain overboard.

Locating the drain at the lowest point ensures that no reservoir is created at the bottom of the cylinder locker where gas can accumulate. The lowest point includes the base of the cylinder locker or the lowest practicable point of a side of the locker at which a drain fitting can be fitted.

The drain must fall continuously to outside the hull so no gas can accumulate in the drain itself.

Location above the waterline The drain point in the hull itself must be above the water line, in all normal states of trim, otherwise water will lie in the bottom of the cylinder locker and the drain will be ineffective.

If, for any reason, water can enter the cylinder locker through the drain hole, there must always be a higher drain hole or opening to ensure an unobstructed passage to the outside air in all states of trim. Any escaping gas would then settle on the water in the bottom of the cylinder locker but would still be able to drain overboard.

If the drain point is above the water line but the base of the cylinder locker is below the waterline, any area below the drain outlet that could potentially retain LPG should be displaced by a solid inert material resistant to LPG.

This arrangement must ensure that the height of the cylinders and associated equipment is contained within the LPG-tight area of the cylinder locker.

Direct opening in the hull Where the cylinder locker or housing is an integral part of the hull it may be drained by means of a direct opening through the hull.

CHECKING Visually check there is a drain from the lowest point of the cylinder locker or housing which exits from the hull to a point outside the vessel above the deepest loaded waterline.

Visually check the drain falls continuously to the outside of the hull.

FAULTS		
*Cylinder Locker/Housing	No provision to drain leaked LPG from lowest point of locker or housing	7.2.10

EXEMPTION 11.19 : CYLINDER LOCKER DRAINS

Vessels manufactured prior to 3 January 2000 and having a cylinder locker drain as near as practicable to the bottom of the cylinder locker are not required to comply with that part of Standard 7.2 ii) which requires the drain to be provided from the lowest point of the cylinder locker.

CHECKING Visually check any area below the drain outlet that could potentially retain LPG is displaced by solid inert material resistant to LPG.

Visually check the drain falls continuously to the outside of the hull.

FAULTS		
	*EXEMPTION 11.19 APPLIED	7.2.11

STANDARD 7.3 : INSTALLATION OF CYLINDERS

All cylinders shall be installed in an upright position with the valve uppermost and secured so that no damage can occur to the cylinders, regulators, hoses or pipework.

Cylinders, cylinder lockers or cylinder housings shall not form an obstruction for persons moving about the deck or walkway or interfere with the normal operation of the vessel.

Cylinders, cylinder lockers or cylinder housings shall not be located near to heat sources.

All cylinders shall be accessible and removable in an emergency.

Installation in upright position

All cylinders shall be installed in an upright position with the valve uppermost and secured so that no damage can occur to the cylinders, regulators, hoses or pipework.

Cylinders should remain upright and installed with the valve uppermost so there is no danger of liquid LPG entering the regulator or pipework.

Safety

If liquid does pass into the regulator, high pressure may be created in the low pressure stage of the regulator which could result in diaphragm failure with the subsequent serious risk of high pressure LPG entering the low pressure system.

CHECKING

Visually check cylinders are installed in the upright position with the valve uppermost.

FAULTS		
Stowage of LPG Cylinders	Not installed in upright position with valve uppermost	7.3.1

Cylinders to be secured

All cylinders (full or empty, stored or in use) whether free-standing or stowed in cylinder lockers, housings or shelters, must be secured to prevent damage to the cylinders, regulators, hoses or pipework.

Cylinders must be restrained individually or collectively to a fixing of sufficient strength to ensure that they cannot move in the event of:

- collision;
- emergency manoeuvres;
- pitching and rolling;
- heeling or listing;
- vibration.

Limits to movement

If there is any movement there is a risk of:

- damage to the cylinders, regulators and pipework;
- damage to the boat and its structures.

The recommendations are as follows:

over 19kg	- no movement, secured near the bottom
3kg-19kg	- sideways movement to be less than 50mm
below 3kg	- must not be able to fall over

Fixing devices

Suitable fixing devices include:

- metal straps and clamps;
- fabric straps and clamps or buckle;
- chains.

CHECKING

Visually and manually check cylinders are secured to prevent damage. Check locker or housing is secured against unintended movement.

FAULTS		
Stowage of LPG Cylinders	Not secured to prevent damage	7.3.2

Creating an obstruction

Cylinders, cylinder lockers or housings shall not form an obstruction for persons moving about the deck or walkway or interfere with the normal operation of the vessel.

The normal operation of the vessel would include such things as interference with mooring lines or their securing points.

It is important that this requirement is taken into account when providing for an unobstructed pathway for leaking gas to drain overboard.

CHECKING Visually check cylinders, cylinder lockers or housings are located in a position where they cannot create an obstruction for persons moving about the deck or walkways which could:

- hinder the handling of the vessel;
- cause personal injury.

FAULTS		
Stowage of LPG Cylinders	Cylinders, cylinder locker or housing forms an obstruction	7.3.3

Proximity to heat sources Cylinders, cylinder lockers or cylinder housings shall not be located near to heat sources.

Effect of increased ambient temperatures Cylinders are designed to operate within normal ambient temperatures, including direct sunlight, and must not be exposed to any heat source which is likely to raise the temperature above this.

As gas pressure is directly related to temperature, the pressure in the cylinder in normal conditions is well within the design standards of the cylinder and its valve.

If the temperature rises above the design standard, the over pressure in the cylinder will open the built-in pressure relief valve and gas will vent to reduce the pressure inside.

Disposable cartridges are not fitted with pressure relief valves and exposure to excessive heat must be avoided.

Cylinder lockers or housings must protect cylinders secured or stored in them from any such increase in temperature so they must located away from any source of heat which could raise the interior temperature.

CHECKING Visually check for signs of heat damage to exterior surfaces of cylinder, cylinder locker or housing.

FAULTS		
Cylinder or Cylinder Locker/Housing	Not located away from heat source	7.3.4

Accessibility All cylinders shall be accessible and removable in an emergency.

The purpose of this requirement is to ensure access for both the occupants of the vessel and the emergency services in the event of an incident.

Security

For security purposes when the boat is not in use, it would be acceptable for a lock to be used as part of the securing mechanism for free-standing cylinders. When the boat is in use, the means of releasing any cylinder securing devices should be in a readily accessible location known to all occupants of the vessel.

Equally, it would be acceptable to secure a cylinder locker, housing or shelter, providing the main shut-off valve remains readily accessible when the boat is occupied, and the position is clearly marked. (Standard 7.9)

CHECKING

Visually check the accessibility of cylinders for removal in an emergency.

FAULTS		
Stowage of LPG Cylinders	Not accessible and removable in an emergency	7.3.5

STANDARD 7.4 : CONSTRUCTION OF LOCKERS & HOUSINGS

Cylinder lockers or cylinder housings shall be constructed of metal of thickness at least 0.9 mm, with welded or brazed joints, or of fibre reinforced plastics (FRP) of minimum thickness 5 mm, or of materials having a fire resistance of 30 min in accordance with BS 476-20.

Materials used in the construction of cylinder lockers

The cylinder locker or housing needs to provide protection for the cylinder installation in the event of fire or impact damage.

It must be thick enough and of fire resistant quality to provide a barrier to fire for at least 30 min to provide an opportunity for the fire to be tackled.

Metal

Whatever metal is used to make the cylinder locker or housing, it must be at least 0.9 mm thick to provide the necessary protection. If it is less than this, the owner will need to provide documentary evidence that it meets the requirements of BS 476-20 and it will be treated as a non-metal locker or housing under 7.4.4.

FRP

FRP (fibre reinforced plastic) must be:

- of adequate thickness;
- fire resistant for 30 min to BS 476-20.

An adequate thickness would be at least 5 mm.

If it is less than this, the owner will need to provide documentary evidence that it meets the requirements of BS 476-20 and it will be treated as a non-FRP locker or housing.

Other materials

Alternative materials to metal thickness 0.9 mm or FRP thickness 5 mm are acceptable provided they are thick enough and are of a fire resistant quality to provide a barrier to fire for at least 30 min. Documentary evidence that alternative materials meet the requirements of BS 476-20 is acceptable.

Fire resistant resins are available and the specification sheet of the resin used may provide satisfactory documentary evidence in cases where the thickness of FRP is less than 5 mm.

The material must also be strong enough to minimise the risk of impact damage.

The joints and seams must be made in such a way that they:

- provide the same protection as the cylinder locker or housing materials;
- are LPG-tight.

Joints made with rivets, bolts or screws, or low-melting point fillers are not acceptable.

BS 476-20 The testing specifications and requirements of BS 476-20 are described in the Introduction.

CHECKING Determine metal thickness is at least 0.9 mm.

Determine FRP thickness is at least 5 mm.

For lesser thicknesses of metal or FRP and for cylinder lockers/housings made of alternative materials, determine materials used provide fire resistance for 30 min to BS 476-20.

FAULTS		
Cylinder Locker/Housing	Not fire resistant for 30 mins to BS 476-20	7.4.1

Metal joints The sides and bottom of any cylinder lockers or housings are to be LPG-tight to hull interior so joints and seams need to be continuously welded or brazed.

Joints made with rivets, bolts or screws, or low-melting point fillers are not acceptable.

If gas does escape into the cylinder locker it is essential that it cannot find its way into any other part of the boat through leaking joints and connections.

Cylinder lockers or housings integral with the hull If the cylinder locker or housing has been constructed as an integral part of the hull, some of the joints and seams may not be fully welded or brazed e.g. they could be of rivetted construction. This is acceptable providing any gas leaking through such a joint or seam could not find its way into the hull interior.

CHECKING Visually check all joints and seams in metal lockers or housings are fully welded or brazed.

FAULTS		
Cylinder Locker/Housing	If metal, joints not fully welded or brazed	7.4.2

STANDARD 7.5 : CYLINDER LOCKER/HOUSING DRAINS

Cylinder locker or cylinder housing drain pipes, hoses and connections shall be of a material suitable for use with LPG and hoses shall be connected in accordance with Standard 7.13.

Drains shall have an internal diameter of at least 19 mm (3/4").

(NOTE: see paragraph 11.22).

Drain pipes/hoses

Cylinder locker or cylinder housing drain pipes, hoses and connections shall be of a material suitable for use with LPG.

There should be no joints in the drain pipe or hose other than those connecting it to the cylinder locker or housing and the through-hull fitting.

Metal drain pipes

As drains are not permanently charged with gas, metal drain pipes need not comply with Standard 7.12 which states that pipework is to be made of seamless copper, stainless steel or copper nickel alloy.

Flexible drain hoses

Although hoses to BS 3212 would be ideally suited, it is understood that sizes beyond 10 mm are unavailable. The following hose specifications are acceptable and may be available in 12 mm, 15 mm, 16 mm, 19 mm and 25 mm nominal bores. Hoses to:

- BS EN 1762 *Rubber hoses and hose assemblies for liquefied petroleum gas, LPG (liquid or gaseous phase), and natural gas up to 25 bar*, previously;
- BS 4089 *Specification for hoses and hose assemblies for liquefied petroleum gas*;
- ISO 7840 *Small Craft. Fire resistant fuel hoses.*

Other suitable hoses include EPDM hoses (ethylene propylene diene monomer) and hoses suitable for petroleum products.

All reputable suppliers should be able to provide copies of hose specifications and should be able to recommend a suitable type given the required internal diameter and the intended use.

Unsuitable materials

Natural rubber and many plastics are attacked by LPG and such materials are not suitable for use as drain hoses.

Marking Some hoses may not be marked to indicate suitability and owners should ask their supplier to confirm it in writing at the time of purchase wherever possible. This could be done on a receipt for example.

Unmarked hoses fulfilling the above conditions will be accepted providing they are in good condition.

CHECKING Visually check drain pipes, hoses and connections for:

- joints;
- corrosion;
- damage;
- deterioration;
- type of hose.

FAULTS		
Cylinder Locker/Housing Drains	Material of drain pipes, hose and connections not suitable for use with LPG	7.5.1

Compliance with Standard 7.13 Cylinder locker or cylinder housing drain hose connections shall be connected in accordance with Standard 7.13.

CHECKING Visually check hose connections for:

- corrosion;
- damage;
- deterioration;
- missing components;
- freedom from burrs and rough edges;
- over-tightened hose clamps;
- hose clamps fixed by spring tension only;
- over sized clamps causing pinch points;
- under sized clamps causing the clamp rack not to be fully engaged.

Determine by measurement all clips and clamps are at least 8mm in width.

FAULTS		
Cylinder Locker/Housing Drain Hoses	Drain hose connections not in accordance with Standard 7.13	7.5.2

Drain size Drains shall have an internal diameter of at least 19 mm (3/4").

This requirement is applicable to the whole length of the drain pipe or hose.

The dimension is a minimum figure. For systems with cylinder sizes or combinations of cylinders that exceed 38 kg total capacity it is recommended that the drain diameter be enlarged at least in accordance with the table at Exemption 11.22.

CHECKING Determine by measurement internal diameter of drain is not less than 19 mm throughout.

FAULTS		
*Cylinder Locker/Housing Drains	Not at least 19 mm internal diameter	7.5.3

EXEMPTION 11.22 : CYLINDER LOCKER/HOUSING DRAINS

Vessels manufactured prior to 3 January 2000 and having an LPG drain with a minimum internal diameter of 12 mm for a cylinder of up to 15 kg capacity and which is enlarged proportionally for additional LPG storage, are not required to comply with that part of Standard 7.5 which requires the drain to have an internal diameter of at least 19 mm (3/4").

Internal diameter of drain The drain shall have a minimum internal diameter of 12 mm (1/2") for a cylinder of up to 15 kg capacity and shall be enlarged pro-rata for additional gas storage.

For some standard cylinder sizes and combinations this would be as recommended in the following table. Note that for a total capacity of more than 47 kg the table represents guidance only.

TOTAL CAPACITY	VENT PIPE/OPENING I.D.
15 kg or less	12 mm
19 kg	14 mm
30 kg	17 mm
38 kg	19 mm
47 kg	20 mm
94 kg	30 mm

CHECKING Determine by measurement internal diameter of drain is not less than 12 mm for up to and including 15 kg gas capacity and is enlarged proportionately for gas capacity over 15 kg.

FAULTS		
	*EXEMPTION 11.22 APPLIED	7.5.4

STANDARD 7.6 : OPENINGS INTO LOCKERS & HOUSINGS

The opening into a cylinder locker or cylinder housing shall enable the operation of valves, replacement of cylinders, and access to connections or regulating devices.

The opening into a cylinder locker shall not be situated in an accommodation space, engine space, fuel space or battery space.

(NOTE: see paragraph 11.23 i)).

Opening into cylinder lockers or housings

This opening into a cylinder locker or cylinder housing shall enable the operation of valves, replacement of cylinders, and access to connections or regulating devices.

This opening should allow the functions to be performed with a full complement of cylinders in the cylinder locker. This fault could be regarded as a design/construction requirement, however the following checks must be carried out.

CHECKING

Visually and manually check all valves can be reached through cylinder locker or housing opening. *(Warning - do not operate any valves)*

Visually and manually check all connections and regulating devices can be reached.
(Warning - do not test or operate any connections or devices)

FAULTS		
Cylinder Locker/Housing opening	Does not enable specified functions	7.6.1

Location of opening into cylinder lockers or housings

The opening into a cylinder locker shall not be situated in an accommodation space, engine space, fuel space or battery space.

Separation from accommodation spaces

Cylinder lockers should be separated from accommodation spaces to:

- reduce the risk to the occupants of the vessel, especially in the event of a catastrophic high pressure gas leak;

- provide the fire and rescue services with an awareness of the likely position of, and better access to the cylinders in the event of a fire on the vessel.

Engine, fuel & battery spaces

Engine, fuel and battery spaces are potential sources of heat, fuel vapours and electrical sparks.

Cylinders in these spaces would be at risk from excessive heat caused by:

- engine running;
- the fire hazard created by the presence of fuel vapours;
- spark producing equipment;
- engine exhaust system.

There is also the risk of any escaping gas being exposed to sparks.

CHECKING

Visually check cylinder locker opening is not situated in an accommodation space, engine space fuel space or battery space.

FAULTS		
Cylinder Locker opening	Situated in accommodation/engine/fuel/or battery space	7.6.2

EXEMPTION 11.23 i) : OPENING INTO ACCOMMODATION SPACE

Vessels manufactured prior to 3 January 2000 that were designed and constructed with a cylinder locker within the hull of the vessel, but outside engine, fuel or battery spaces, are not required to comply with that part of Standard 7.6 which requires that the opening into a cylinder locker shall not be sited in an accommodation space provided the cylinder locker is located in a low risk position.

Existing installations only

Where there is evidence that the locker is not of original design and construction, documentary evidence may be required to support the claim for the exemption.

Low risk positions

In addition to being outside the spaces prescribed, the cylinder locker must not be in a position where it is exposed to heat, sources of ignition, or potential impact damage.

CHECKING Visually check the cylinder locker is of original design and construction.

Visually check cylinder locker is in a low risk position outside engine, fuel or battery spaces.

FAULTS		
	*EXEMPTION 11.23 i) APPLIED	7.6.3

STANDARD 7.7 : HOUSINGS IN SELF-DRAINING COCKPITS

Cylinder housings may open from the side into self-draining cockpits provided that:

i) the drain outlets from the self-draining cockpit are above the deepest loaded waterline;

and

ii) the design of the craft ensures the self-draining cockpit is LPG tight to the interior of the vessel at least to the height of the LPG cylinders, low pressure regulators and associated equipment. *(NOTE: The height of the bridge deck, or any fixed sill to an accommodation space shall be at least to the height specified);*

and

iii) any hatches or openings within the self-draining cockpit are watertight;

and

iv) cylinder housings conform to the ventilating and draining requirements of Standard 7.2 and Standards 7.3, 7.4, 7.5, 7.6, and 7.8.

Use of cylinder housings in self-draining cockpits

A cylinder housing is a storage space for LPG cylinders, low pressure regulators and associated equipment, openable from the side or top and side.

Cylinder housings may open from the side into self-draining cockpits.

It is recommended that cylinders in self-draining cockpits should be secured in a cylinder locker (see 7.2.5) as for any other cylinders not on open decks, cabin tops and outside cockpits.

However, cylinders located in self-draining cockpits may be secured in a cylinder housing providing the cockpit itself meets the constructional requirements detailed in this Standard and the housing meets the ventilating and draining requirements of the Standards listed.

Cylinders in any other cockpit may only be secured in a cylinder locker.

CHECKING Identify self-draining cockpit and visually check any cylinders are contained in a cylinder locker or housing.

FAULTS		
LPG Cylinders in self-draining cockpit	Not in a cylinder locker or housing	7.7.1

Drain outlets Cylinder housings may open from the side into self-draining cockpits provided that the drain outlets from the self-draining cockpit are above the deepest loaded waterline.

Cockpit construction It is not possible to make a housing, which has a side opening (in whole or in part), that is LPG-tight to the prescribed height (see 7.2.5 and 7.2.6).

Therefore, the cockpit itself should act as a catchment for any leaking LPG and be LPG-tight to the interior of the vessel to the height prescribed.

Cockpit drains Any drains from the cockpit must be above the deepest loaded waterline so leaking gas cannot accumulate in the cockpit.

CHECKING Identify presence of LPG cylinder housing in self-draining cockpit.

Visually check cockpit drain outlet(s) are above deepest loaded waterline.

FAULTS		
LPG Cylinder Housing in self-draining cockpit	Cockpit drain outlets not above deepest loaded waterline	7.7.2

LPG-tightness Cylinder housings may open from the side into self-draining cockpits provided that the design of the craft ensures the self-draining cockpit is LPG-tight to the interior of the vessel at least to the height of the LPG cylinders, low pressure regulators and associated equipment.

(NOTE: The height of the bridge deck, or any fixed sill to an accommodation space shall be at least to the height specified.)

This means that if any part of the installation within the cylinder housing leaks gas for any reason and that gas finds its way into the cockpit, it will not enter the accommodation space and should drain overboard through the cockpit drains.

Bridge decks & sills	The height of the bridge deck, or any fixed sill to an accommodation space must be at least to the height specified. The bridge deck or sill is the lowest point of the craft structure at the entrance into the accommodation space.
Visual examination	Providing the cockpit is constructed in accordance with these Standards, no test for LPG-tightness is being made at present but a careful visual examination will be made to ensure there are no signs of any damage or deterioration which would allow leakage of gas into the interior of the vessel.
CHECKING	Identify presence of LPG cylinder housing in self-draining cockpit. Visually check the cockpit is LPG-tight to the interior of the vessel to the height of the cylinders, regulators and associated equipment.

FAULTS		
LPG Cylinder Housing in self-draining cockpit	Cockpit not LPG-tight to interior of vessel to height specified	7.7.3

Hatches & openings	Cylinder housings may open from the side into self-draining cockpits provided that any hatches or openings within the self-draining cockpit are watertight. For the purposes of the Boat Safety Scheme examination only those hatches or openings below the height of the cylinders, regulators and associated equipment will be checked.
Visual examination	Providing the cockpit is constructed in accordance with these Standards, no test of the hatches or openings is being made at present but a careful visual examination will be made to ensure there are no signs of any damage or deterioration which would allow water to get into the interior of the vessel.
CHECKING	Identify presence of LPG cylinder housing in self-draining cockpit. Visually check any hatches or openings, and associated seals, gaskets, below the height of the cylinders, regulators and associated equipment for signs of damage or deterioration.

FAULTS		
LPG Cylinder Housing in self-draining cockpit	Cockpit hatches or openings not watertight	7.7.4

STANDARD 7.8 : RISK OF DAMAGE IN LOCKERS & HOUSINGS
Cylinder lockers or cylinder housings shall not contain any items that could damage the low pressure regulator(s) or associated pipework, or obstruct the drain or ignite leaked LPG.

Storage in cylinder lockers & housings

Cylinder lockers and housings must not be used for general storage. Solid objects such as mooring pins, hammers and other tools can easily damage parts of the cylinder installation, particularly if removed or replaced without care.

It is not necessary for there to be any signs of damage to any part of the installation - the risk alone is sufficient to create a fault here.

CHECKING

Visually check the cylinder locker or housing for any item that could damage the regulator(s) or pipework or equipment.

FAULTS		
Cylinder Locker/Housing	Contains items that could damage regulator(s) or pipework	7.8.1

Risk of blocked drain

Cylinder lockers or housings shall not contain any items that could obstruct the drain.

Cylinder lockers or housings should not be used for storing any materials and equipment which could possibly obstruct the drain. Soft materials such as buoyancy aids, ropes, and cleaning cloths are particularly likely to cause a drain blockage.

CHECKING

Visually check the cylinder locker or housing for any item that could obstruct the drain.

FAULTS		
Cylinder Locker/Housing	Contains items that could obstruct the drain	7.8.2

Ignition of leaking gas

Cylinder lockers or housings shall not contain any items that could ignite leaked LPG.

The cylinder locker or housing is to be checked for obvious spark-inducing electrical equipment or any other obvious source of ignition.

Unless there obvious evidence to the contrary, solenoid-controlled gas shut-off valves may be installed in a cylinder locker or housing for the present, whether or not the valves are associated with electronic gas detection equipment.

CHECKING Visually check the cylinder locker or housing for any item that could ignite leaking gas.

FAULTS		
Cylinder Locker/Housing	Contains items that could ignite leaking LPG	7.8.3

STANDARD 7.9 - MAIN SHUT-OFF VALVES

A readily accessible main shut-off valve situated outside the accommodation space shall be fitted and installed as close to the LPG cylinder(s) as practicable.

(NOTE see paragraph 11.23 ii)).

The valve of any LPG cylinder or of a connected low pressure regulator may be used as the main shut-off except where two or more LPG cylinders are connected by an automatic changeover device.

Where an automatic changeover device is fitted the main shut-off valve shall be situated as close to the outlet of the device as practicable.

If the main shut-off valve is not in a clearly visible position or is in a space that can be closed off by doors or lids, then its position shall be clearly marked.

If there is more than one main shut-off valve, this and the locations of the other main shut-off valves shall be clearly marked on or adjacent to each valve.

A readily accessible main shut-off valve situated outside the accommodation space shall be fitted.

Provision of main shut-off valve

Each separate gas system must be fitted with a main shut-off valve installed outside any accommodation space and as close to the cylinders as practicable.

There is no requirement to fit a main shut-off valve where the valve of any LPG cylinder or of a connected low pressure regulator is used as the main shut-off.

CHECKING

Identify the existence of a main shut-off valve and visually check it is not situated inside any accommodation space.

FAULTS		
*Main Shut-off Valve	Not fitted outside accommodation space	7.9.1

EXEMPTION 11.23 (ii) : SHUT-OFF VALVE IN ACCOMMODATION SPACE

Vessels manufactured prior to 3 January 2000 that were designed and constructed with a cylinder locker within the hull of the vessel, but outside engine fuel or battery spaces, are not required to comply with that part of Standard 7.9 which requires the main shut-off valve to be fitted outside the accommodation space.

CHECKING Confirm application of exemption 11.23 i) at 7.6.3.

Apply exemption 11.23 ii).

FAULTS		
	*EXEMPTION 11.23 ii) APPLIED	7.9.2

Accessibility A readily accessible main shut-off valve shall be fitted.

The main shut-off valve must be readily accessible but it may be contained within a lockable cylinder locker or housing providing always that when the boat is occupied the locker remains unlocked.

When the boat is not occupied, the cylinder locker or housing may be locked providing the position of the valves is clearly marked and at the time of the Boat Safety Scheme examination the cylinder locker or housing is unlocked.

CHECKING Visually check the accessibility of the main shut-off valve.

FAULTS		
Main Shut-off Valve	Not readily accessible	7.9.3

Proximity to cylinders A readily accessible main shut-off valve shall be installed as close to the LPG cylinders as practicable.

It is important that the main shut-off valve is as close to the cylinders as possible in order to reduce the length of pipework containing gas when the shut-off valve is closed.

Ideally the main shut-off valve should be in the cylinder locker if there is one, or immediately outside it.

CHECKING Visually check the main shut-off valve is located as close to the cylinders as practicable, but note that accessibility has priority over proximity.

FAULTS		
Main Shut-off Valve	Not located as close to cylinder(s) as practicable	7.9.4

Use of cylinder or regulator valve as shut-off valve The valve of any LPG cylinder or of a connected low pressure regulator may be used as the main shut-off except where two or more LPG cylinders are connected by an automatic changeover device.

Automatic changeover devices The cylinder valve cannot be used as the main shut-off valve if two or more cylinders are connected to an automatic changeover device.

In this case, a separate shut-off valve is required in the low pressure side (downstream) of the device. Many automatic changeover devices incorporate such a valve.

CHECKING Identify presence of an automatic changeover device.

Visually check no cylinder valve is being used as the main shut-off valve.

FAULTS		
Main Shut-off Valve	LPG cylinder or regulator valve used as main shut-off valve when automatic changeover device installed	7.9.5

Proximity of shut-off valve to automatic changeover device Where an automatic changeover device is fitted the main shut-off valve shall be situated as close to the outlet of the device as practicable.

It is important that the main shut-off valve is as close to the automatic changeover device as possible in order to reduce the length of pipework containing gas when the shut-off valve is closed.

CHECKING Visually check the main shut-off valve is located as close to the outlet of the automatic changeover device as practicable.

FAULTS		
Main Shut-off Valve	Not located as close to the automatic changeover device as practicable	7.9.6

Marking of main shut-off valve If the main shut-off valve is not in a clearly visible position or is in a space that can be closed off by doors or lids, then its position shall be clearly marked.

Visibility It is also desirable that the main shut-off valves should be easily visible so that no time is lost in turning off the gas supply in the case of emergencies.
When the boat is not in use, they may be contained in a locked cylinder locker or housing providing the position of the valves is clearly marked.

It is recommended that the marking should:

- have lettering, minimum 10 mm high;
- be clearly distinguishable e.g. red letters on a white ground;
- not become illegible through cleaning, fading, or normal usage.

It is not necessary for the position to be marked if the valve(s) is clearly visible although it would be good practice.

CHECKING Visually check main shut-off valve is visible. If it is not visible, visually check position is clearly marked.

FAULTS		
Main Shut-off Valve	Not clearly visible and position not clearly marked	7.9.7

More than one main shut-off valve If there is more than one main shut-off valve, this and the locations of the other main shut-off valves shall be clearly marked on or adjacent to each valve.

If the LPG installation consists of two or more separate systems each with its own supply, a main shut-off valve must be installed in each system in accordance with this Standard.

Marking Where two or more main shut-off valves are installed, the location of all such valves must be clearly marked on or adjacent to each of the valves.

CHECKING Identify gas installation consists of two or more separate systems. Visually check that the location of all main shut-off valves is marked on or adjacent to each valve.

FAULTS		
Main Shut-off Valve	Location of other main shut-off valves not marked on or adjacent to each valve	7.9.8

STANDARD 7.10 - HIGH PRESSURE STAGE COMPONENTS
All high pressure stage components shall be installed on the open deck or cabin tops or outside cockpits, or in a cylinder locker or cylinder housing if there is one. If two or more cylinders are connected, each high pressure stage connection shall be protected by a non-return valve. High pressure stage components not directly attached to the cylinder valve shall be connected by a pre-assembled length of flexible hose conforming to type 2 of BS 3212, fitted with integral threaded metallic ends. The hose shall be of the minimum practicable length to allow for the replacement of cylinders and shall not exceed 1m. High pressure stage components not directly attached to the cylinder valve shall be secured in a position that provides protection from mechanical damage and protects vent holes from the ingress of debris or water. External manual-adjustment type regulators shall not be fitted.

Location of components

All high pressure stage components shall be installed on the open deck or cabin tops or outside cockpits, or in a cylinder locker or cylinder housing if there is one.

When cylinders are installed in a cylinder locker or housing as specified in Standard 7.2 ii), the regulator and other high pressure stage components are to be totally contained within the cylinder locker or housing.

This is to ensure any escaping gas is retained within the cylinder locker or housing and dispersed overboard through the drain facility provided.

CHECKING

Visually check all high pressure stage components are installed:

- on the open deck, cabin tops, or outside cockpits; OR, if there is one
- in a cylinder locker or housing.

FAULTS		
High Pressure	Not installed on open deck, or, if there is one, in a cylinder	7.10.1

Stage Components	locker or cylinder housing	

Non-return valves If two or more cylinders are connected, each high pressure stage connection shall be protected by a non-return valve (NRV).

The purpose of a NRV is to prevent a leak when either cylinder is disconnected.

NRVs are already incorporated in most manual and automatic changeover devices. Changeover devices manufactured in accordance with BS 3016 will incorporate NRVs.

Double wall blocks may also be supplied with NRVs. This may be indicated by the letters 'NRV' stamped on the hexagonal nut at the inlet connection of the wall block.

High pressure pigtails can also be supplied with NRVs and this may be indicated by marking as above.

If there is no changeover device or other component which incorporates a NRV, examiners will need to identify the presence of a separate valve in each high pressure connection.

If there are no external indications of their presence in a component documentary evidence may be accepted.

CHECKING Identify installation with two or more cylinders connected on the high pressure side and visually check a non-return valve is fitted in each high pressure stage connection.

FAULTS		
Two or more Cylinders connected	Non-return valve not fitted in each high pressure stage connection	7.10.2

Connection of high pressure components High pressure stage components not directly attached to the cylinder valve shall be connected by a pre-assembled length of flexible hose conforming to type 2 of BS 3212, fitted with integral threaded metallic ends.

Safety If the connection were not flexible it would be extremely difficult to change the cylinders without creating stresses and strains in the rigid connection which could lead to failure and leaks.

CHECKING Identify high pressure stage components not directly attached to cylinders and visually check flexible connection :

- is a pre-assembled length of hose;
- complies with type 2 of BS 3212;

- is fitted with integral threaded metallic ends.

Visually check hose for signs of :

- leaks;
- flaws;
- brittleness;
- cracking;
- abrasion;
- kinking;
- joins;

FAULTS		
High Pressure Stage Components	Components not directly attached to cylinder valve not connected by pre-assembled flexible hose to type 2 BS 3212 as specified	7.10.3

Protection of separately mounted high pressure stage components

High pressure stage components not directly attached to the cylinder valve shall be secured in a position that provides protection from mechanical damage and protects vent holes from the ingress of debris or water.

Fixing of components

Components in cylinder lockers or housings should be fixed with screws or bolts to the sides or, if secured on open deck, to part of the permanent structure of the boat.

Components on open decks, cabin tops or outside cockpits

As there may be no covered shelter to protect them, careful attention needs to be paid to the siting and protection of components on open decks.

There is a risk of damage from:

- during replacement of cylinders;
- contact with other heavy objects;
- persons using them as handholds or footholds.

Careful siting of the regulator will reduce the risk of damage but where some exposure cannot be avoided it may be necessary to fit a shield or cover.

This should provide the same degree of strength and durability as a cylinder locker but careful attention must be paid to the need to provide ready access to valves and joints.

Ingress of debris or water

Regulators with vent holes must always be mounted so that the vent hole points downwards or sideways in order to prevent the ingress of debris or water.

Regulators mounted so that the vent hole points upwards will be deemed to be not suitably protected even if they are

	contained within a cylinder locker, housing or shelter.
CHECKING	Visually and manually check high pressure stage components are securely fixed. Visually and manually check that the vent holes of high pressure stage components are protected from the ingress of debris or water. Visually check all fixings for obvious signs of: • corrosion; • damage or deterioration; • missing components; • movement.

FAULTS		
High Pressure Stage Components	Components not directly attached to cylinder valve not protected as specified	7.10.4

Manually adjusted regulators	External manual-adjustment type regulators shall not be fitted. There is one exception for some LPG fuelled steam-powered engine installations which may be fitted with a manually adjusted regulator as the delivery pressure needs to be adjusted during ‘commissioning’. This is acceptable.
CHECKING	Visually check presence of manually adjusted regulator. Only permitted in gas supply to steam boilers.

FAULTS		
Low Pressure Regulator	External manual-adjustment type fitted	7.10.5

STANDARD 7.11 : INLET GAS CONNECTION
The inlet gas connection on installation pipework shall be securely fixed and readily accessible. For cylinders stowed below decks or in cockpits, the inlet gas connection shall be situated inside the cylinder locker or cylinder housing. Installation pipework from cylinder lockers shall either be from a bulkhead fitting or above the level of the cylinder, low pressure regulator and associated equipment.

Inlet gas connection

The inlet gas connection on installation pipework shall be securely fixed and readily accessible.

The inlet gas connection is the point at which the connection from the low pressure regulator is connected to the installation pipework. The inlet gas connection must be securely fixed and readily accessible. Faults regarding the accessibility of the connection are to be recorded at 7.19.2.

The point where the connection is made must be protected against mechanical damage including unnecessary flexing, bending and abrasion.

Where the inlet gas connection is located on open decks, cabin tops or outside cockpits there is no requirement at present for the connection to be made from a bulkhead fitting but this would be good practice and the simplest way to comply with this Standard.

CHECKING

Visually and manually check the inlet gas connection is incapable of movement in any direction.

FAULTS		
Inlet Gas Connection	Not securely fixed	7.11.1

Inlet gas connection below deck

For cylinders stowed below decks or in cockpits, the inlet gas connection shall be situated inside the cylinder locker or housing.

CHECKING Identify presence of a cylinder locker or housing below deck or in a cockpit and visually check it contains the inlet gas connection.

FAULTS		
Inlet Gas Connection	Inlet gas connection sited below decks or in cockpits not situated in cylinder locker or housing	7.11.2

Pipework from cylinder lockers Installation pipework from cylinder lockers shall either be from a bulkhead fitting or above the level of the cylinder, low pressure regulator and associated equipment.

To ensure the LPG-tightness of cylinder lockers to the height specified bulkhead fittings must be used where the installation pipework exits the locker below that height.

CHECKING Identify presence of a cylinder locker and visually check installation pipework exits the locker:

- from a bulkhead fitting; OR
- above the level of the cylinders, regulators, and associated equipment.

FAULTS		
Installation Pipework from locker	Not from bulkhead fitting or not above the level specified	7.11.3

STANDARD 7.12 : INSTALLATION PIPEWORK

Installation pipework shall be made of either:

i) seamless copper tube conforming to BS EN 1057 with copper or copper alloy compression fittings,

or

ii) stainless steel tube, of a grade suitable for use with LPG and a marine environment with appropriate compression or screwed fitting,

or

iii) copper nickel alloy, of a grade suitable for use with LPG and a marine environment with appropriate compression or screwed fittings.

(NOTE 1: Flexible hose conforming to Standard 7.13 may be used as the appliance connector to a gimballed cooking appliance, or to an appliance that requires movement for hygienic purposes.)

(NOTE 2: If only a cooking appliance is installed, flexible hose may be used to connect it to the low pressure regulator, provided the length does not exceed 1 m.)

Pipework materials

Suitable and unsuitable materials are as follows:

Suitable materials

- seamless copper tube conforming with BS EN 1057 used with copper or copper alloy compression fittings;
- stainless steel tube of a grade suitable for use with LPG and a marine environment used with appropriate compression or screwed fittings;
- copper nickel alloy of a grade suitable for use with LPG and a marine environment used with appropriate compression or screwed fittings.

Unsuitable materials

The following materials are not permitted for installation pipework for the reasons given:

- aluminium (corrosion, low melting point, vibration);
- lead (creep);
- brass tubing (season cracking);
- steel tubing (corrosion);
- plastics (low melting point, low-temperature embrittlement).

CHECKING Visually check material of pipework for suitability.

FAULTS		
Installation Pipework	Not seamless copper, stainless steel or copper nickel alloy	7.12.1

Use of flexible hose appliance connectors

Appliances must generally be installed with suitable rigid metal pipes and fittings (see 7.12.1 and 7.19.1) but flexible hose should be used as the appliance connector for gimballed cooking appliances, and a flexible connector is allowed for appliances required to be moved for hygienic purposes to allow for cleaning the space enclosing them.

A flexible hose used for this purpose must comply with Standard 7.13.

Two points should be noted before the check is applied:

- portable appliances must be connected by flexible hoses (see Standard 7.14 below);
- a flexible hose not exceeding 1m may be used to connect a cooking appliance to the low pressure regulator providing it is the only appliance in the system (see 7.12.3).

CHECKING Identify any appliance connected by a flexible hose and visually check it:

- is a gimballed cooking appliance; OR
- requires to be moved for hygienic purposes.

FAULTS		
Flexible Hose Connector	Used on non-gimballed cooking appliance or on appliance not requiring movement for hygienic purposes	7.12.2

Single cooking appliance installations

If only a cooking appliance is installed, flexible hose may be used to connect it to the low pressure regulator, provided the length does not exceed 1 m.

CHECKING Identify installation comprising a single cooking appliance connected to low pressure regulator by a flexible hose.

Determine by measurement the length of hose does not exceed 1 m.

FAULTS		
Single Cooking Appliance installation	Flexible hose connection exceeds 1metre.	7.12.3

STANDARD 7.13 : FLEXIBLE HOSES

Flexible hose shall conform to type 2 of BS 3212.

Flexible hose shall be of the minimum practicable length, not exceeding 1 m, and shall be readily accessible.

Flexible hose shall be installed without stress or tight radius turns and hose passing through bulkheads, partitions, deck-heads, or decks shall be protected from abrasion.

For low pressure applications, flexible hose shall be a pre-assembled length fitted with integral threaded metallic ends, or secured to nozzles by a metal crimped clip or worm drive hose clamp.

Hose clamps fixed by spring tension shall not be used.

Hose clips and clamps shall be of the correct size for the hose and at least 8mm in width.

Flexible hose shall not be used where it could be subjected to temperatures above 50°C.

Flexible hoses

Flexible hose shall conform to type 2 of BS 3212.

Life expectancy of hoses

There is no mention in BS 3212 of the life expectancy of hoses and it is not a requirement of these Standards that they be replaced after a fixed time. The 'age' of the hose is not a failure point.

The date of manufacture is marked on the hose (see Introduction to Part 7) but this gives no guide to its condition as there is no way to determine when the hose was purchased and installed and it is impossible to know under what conditions it was stored before installation and what usage it has been put to since that date.

The BSS examination therefore requires a careful examination of the physical condition of the hose and its associated fastenings.

BS 3212 hoses

BS 5482-3 states that only type 2 hose should be used on boats as it has a higher specification for resistance to pressure, crushing, and permeation than type 1 hose.

Armoured hoses

Armoured hoses may be used providing they are identified by means of a permanently fixed tag or stamping on the swaged ferrule which clearly identifies the hose as type 2 of BS 3212.

If the armoured cover is damaged or corroded a fault will be recorded as damage of this kind to the metallic covering may result in damage to the flexible hose it is protecting.

Cylinder locker or housing drain hoses

As drain hoses are not permanently charged with gas, it is not necessary for them to conform to BS 3212 .

CHECKING

Visually check distribution hose conforms to type 2 of BS 3212 or BS EN 1763-2 (Class 2 or 3 for low pressure side, Class 3 for high pressure side).

Visually check hose for signs of :

- leaks;
- flaws;
- brittleness;
- cracking;
- abrasion;
- kinking;
- joins.

FAULTS		
Flexible Hose	Does not conform to type 2 of BS 3212	7.13.1

Length of hoses

Flexible hose shall be of the minimum practicable length, not exceeding 1 m.

Minimum length

Flexible tubing should not be longer than necessary otherwise there is a risk of:

- kinking;
- snagging or trapping by other structures.

It must not, however, be too short to avoid any possibility of it being stretched and causing leaks at joints and connections.

The length and routing should also ensure that the bend radius is not be less than 5 times the outer diameter (BS 3212).

CHECKING

Visually check all hose is of minimum practicable length.
Determine by measurement length does not exceed 1 m.

FAULTS		
Flexible Hose	Not of minimum practicable length or exceeds 1 metre	7.13.2

Accessibility Flexible hose shall be readily accessible.

This enables the user to maintain regular checks on their condition which is essential because they have a limited life and are susceptible to mechanical damage.

CHECKING Visually check all hoses are readily accessible.

FAULTS		
Flexible Hose	Not readily accessible	7.13.3

Installation Flexible hose shall be installed without stress or tight radius turns.

It is important that flexible hose is properly installed without being subjected to any poor installation practice which may cause damage or shorten the useful life.

Examples of such practice include twisting during tightening connections or forcing the hose to take up tight bends which may exceed the test requirements of BS 3212.

These actions may cause damage to the hose wall and lead to premature ageing or failure. BS 3212 requires a minimum bend radius of 5x the diameter of the hose.

CHECKING Visually check hose is not installed:

- under stress;
- with tight radius turns.

FAULTS		
Flexible Hose	Installed under stress or with tight radius turns	7.13.4

Flexible hose passing through bulkheads, partitions, deck-heads, or decks shall be protected from abrasion.

Risks from abrasion Where flexible hoses pass through bulkheads, partitions, deck-heads, or decks they must be protected from abrasion by the use of sleeves, grommets or other means.

CHECKING Identify all hose passing through bulkheads, partitions, deck-heads, or decks and visually check there is a means of protecting them from abrasion.

FAULTS		
Flexible Hose	Not protected from abrasion through bulkheads, partitions, deck-heads or decks	7.13.5

Low pressure applications	For low pressure applications, flexible hose shall be a pre-assembled length fitted with integral threaded metallic ends, or secured to nozzles by a metal crimped clip or a worm drive hose clamp. Whatever method of connection is used, all components must be secure and incapable of movement and must show no signs of damage or deterioration. Over-tightened clamps may distort the threads on the clamp rack (housing) and may lead to a relaxation in the clamp tension and may damage the hose outer or inner linings.
CHECKING	Identify flexible hose used in low pressure applications and visually check flexible connection : • is a pre-assembled length; AND • is fitted with integral threaded metallic ends; OR is secured to nozzles by: • metal crimped clips; OR • worm drive hose clamps. Visually check hose clips and clamps for: • security; • corrosion; • damage or deterioration; • missing components; • movement; • freedom from burrs, rough edges; • over-tightening.

FAULTS		
Flexible Hose in low pressure applications	Not connected as specified	7.13.6

Hose clamps	Hose clamps fixed by spring tension shall not be used. Only hose clamps fixed by the use of tools must be used and clamps applied by hand and fixed by spring tension alone are not permitted.
CHECKING	Visually identify hose clamps fixed by spring tension only These are not permitted.

FAULTS		

Hose Clamps	Fixed by spring tension	7.13.7

Use of correct size clips & clamps

Hose clips and clamps shall be of the correct size for the hose and at least 8 mm in width.

Clips and clamps must be of the correct size for the hose. In well designed hose clamps each diameter clamp will have a different radius at the underside of the rack (housing). It is important that the radius range of the clamp is matched to the size of hose because the underside rack forms a significant part of the clamping circle. Oversized clamps become elliptical when tension is applied, rather than circular, and cause the wall of the hose to be 'pinched' and possibly damaged at the tensioning point. If the clamp is under-tightened the sealing ability will be reduced because of the ill-fitting rack.

Undersized clamps do not allow the rack of the clamp to be fully engaged so the connection is not made as tightly as it should be.

All clamps should be at least 8 mm in width to avoid excessive force being applied to the hose at the point where the clamp is fixed which could damage the hose wall.

CHECKING

Visually check clips and clamps for:

- security;
- over sizing causing pinch points;
- under-sizing causing rack not to fully be engaged.

Determine by measurement all clips and clamps are at least 8mm in width.

FAULTS		
Hose Clips & Clamps	Not of correct size for hose	7.13.8

Exposure to excessive heat

Flexible hose shall not be used where it could be subjected to temperatures above 50°C.

No tests are being made at present on the ambient temperature in the vicinity of flexible hoses but irrespective of what that temperature may be, examiners will check every hose for signs of damage or deterioration caused by exposure to heat.

CHECKING

Visually and manually check hose for signs of heat damage or deterioration.

FAULTS		
Flexible Hose	Used where temperature could exceed 50^{o}C	7.13.9

STANDARD 7.14 : CONNECTION OF PORTABLE APPLIANCES

Flexible hose conforming to Standard 7.13 shall be used as the appliance connector between portable appliances and their isolation valves.

Flexible hose shall be connected to the isolation valves by means of a bayonet, plug-in or screwed connection.

Pipework to portable appliances fitted with a screwed connection shall be properly plugged or capped when the appliance is not connected.

Flexible hose shall be connected to the isolation valves by means of a bayonet, plug-in or screwed connection.

Portable appliances

Portable appliances are appliances that are not intended to be permanently installed in the gas system but are intended to be brought onto the craft by the owner and removed from the craft at the time the owner leaves.

Connection of portable appliances

Flexible tubing must be used for the connections between portable appliances and their control points to facilitate:

- the connection and disconnection of appliances
- permit movement where disconnection is not required

Hoses used for this purpose must conform to Standard 7.13 and conformity will be checked at 7.13.1 to 7.13.9 inclusive.

As these appliances can be connected and disconnected many times, it is important that the flexible tubing and its connections are checked frequently to ensure they are in good condition and securely connected.

Use of bayonet, plug-in or screwed fittings

Due to the frequency with which portable appliances are connected and disconnected to their control points, they must be connected to them by means of a bayonet, plug-in or screwed connector.

This type of connector provides:

- a secure anchorage for the connecting hose;
- resistance to accidental disconnection.

The use of connectors fitted with hose nozzles for the direct attachment of flexible hoses by hose clamps or clips is not acceptable.

	It is essential that connectors do not show any signs of damage or deterioration.	**FIG 7.2**

CHECKING Identify any portable appliance and check hose connection to isolation valve is made with a bayonet, plug-in or screwed fitting.

Visually check bayonet, plug-in or screwed fitting for:

- corrosion;
- damage or deterioration.

FAULTS		
Portable Appliance	Appliance connector to isolation valve not fitted with bayonet, plug-in or screwed connection	7.14.1

Plugs or caps to screwed connections Pipework to portable appliances fitted with a screwed connection shall be properly plugged or capped when the appliance is not connected.

CHECKING Identify unused control point for portable appliance.

Identify the control point has a screwed connection and visually check it is properly plugged or capped.

FAULTS		
Portable Appliance isolation valve	Screwed connection not properly plugged or capped when appliance not connected.	7.14.2

STANDARD 7.15 : STORAGE & USE OF SELF-CONTAINED PORTABLE APPLIANCES

Self-contained portable gas appliances having the burner screwed direct to the cylinder or container shall be stored in a cylinder locker or cylinder housing when not in use.

Self-contained portable gas appliances shall not be used whilst unattended on board any vessel.

Definition A self-contained portable appliance has the burner screwed directly to the container e.g. lamps, burner, some heaters, some barbecues.

In use A self-contained portable appliance is in use when it is:

- on board the vessel;
- connected to a gas container;
- not stored in a cylinder locker or housing.

Note that it is in use whether the burner(s) is lit or not. The reason for this is that they must be kept in an upright position (burner assembly uppermost) even when not lit and if they are not stored properly there is a danger that they can be knocked over.

Portable appliances must never be unattended when in use on board.

Safety The dangers are:

- fire;
- gas escape;
- appliance being knocked over;
- appliance falling over.

The appliance may overturn and a fire will almost certainly result if for any reason the boat:

- changes course suddenly;
- heels or lists;
- changes speed suddenly;
- is involved in a collision.

If the appliance overturns for any reason, the flame may be extinguished and/or gas can escape into the interior of the boat resulting in a risk of fire or explosion.

CHECKING Identify self-contained portable appliance.

Visually check any self-contained portable appliances are stored in a cylinder locker or cylinder housing.

FAULTS		
Self-Contained Portable Appliance	Not stored in cylinder locker or housing	7.15.1

STANDARD 7.16 : INSTALLATION PIPEWORK
Installation pipework shall be accessible, run as short as practicable particularly between the cylinder(s) and the highest rated appliance(s) and be as high as practicable within the hull, preferably at gunwale level. Pipework shall be rigidly secured with fixing clips spaced no more than 500 mm apart. Pipework shall be routed, or otherwise protected, to minimise the possibility of damage and where pipework penetrates bulkheads or walls it shall be protected from damage by sleeves, grommets or bulkhead fittings.

Accessibility

Installation pipework shall be accessible.

For the purposes of the examination pipes installed behind panelling need not be made available for inspection providing all the joints which must exist i.e. a 'tee' joint to each appliance, are readily accessible (see 7.19.2).

Pipes behind panelling would fall within the definition of accessible provided the pipes could be reached for inspection and maintenance with the use of tools.

CHECKING

Visually check installation pipework is accessible.

FAULTS		
Installation Pipework	Not accessible	7.16.1

Length of pipework

Installation pipework shall be run as short as practicable particularly between the cylinders and the highest rated appliance(s).

Fixed pipework should be as short as practicable to:

- minimise the volume of LPG in the system;
- reduce the number of joints/connections in the installation;
- help ensure the correct pressure at the appliances.

Practicability

One of the principle factors in determining the route taken by a run of pipe is the need to avoid any areas where there is a risk of the pipe being damaged.

Where there is a risk of damage, safety should always take precedence over the length or height of the pipe run.

CHECKING Where readily accessible visually check pipework takes shortest route between cylinders and appliances.

FAULTS		
Installation Pipework	Not as short as practicable	7.16.2

Height of pipework Installation pipework shall be as high as practicable within the hull, preferably at gunwale level.

Pipework should be run as high as practicable:

- to protect it from physical damage.
- help ensure that any leak is detectable to the sense of smell

Pipework should not be installed:

- at floor level;
- in bilges;
- under cabin soles or floors;
- in any place where it could sustain mechanical damage e.g. from being kicked or trodden on.

The ideal level for pipework is under the gunwale.

The height of pipe runs should take precedence over the length where the pipe could be exposed to the risk of physical damage.

If the only practicable location for the pipes is at floor level or under the cabin sole or floor, the pipework must be:

- protected (e.g. in conduit or boxed in);
- above bilge water level;

CHECKING Where readily accessible visually check pipework is as high as possible in relation to gunwale level.

FAULTS		
Installation Pipework	Not as high as practicable within the hull	7.16.3

Securing pipework Pipework shall be rigidly secured with fixing clips spaced no more than 500 mm apart.

Pipework should be fixed with the correct size pipe clips secured by screws or bolts to permanent structures in the boat.

The use of temporary fixings, adhesives etc. is not permitted.

If pipe work is not rigidly secured there is a danger that vibration may cause:

- the pipe to become brittle and fracture (work hardening);
- joints and connections to become loose and leak.

Clips must be spaced at intervals of not more than 500mm.

Irrespective of the spacing of the fixing clips, if the pipe is not rigidly secured so it cannot move or shows any signs of damage or deterioration a fault will be recorded.

CHECKING Where readily accessible visually and manually check pipe is secure.

Visually check fixings for signs of:

- corrosion;
- damage or deterioration;
- missing components.

Determine by measurement that the fixing clips are spaced approximately 500 mm apart.

FAULTS		
Installation Pipework	Not rigidly secured	7.16.4

Routing & protection Pipework shall be routed, or otherwise protected, to minimise the possibility of damage.

Protection against mechanical damage Pipework may be protected by:

- routing the pipes away from potential danger areas;
- provision of shields or protective covers;
- running the pipes in conduits.

CHECKING Where readily accessible visually check pipework for any signs of damage.

FAULTS		
Installation pipework	Not routed or protected to minimise possibility of damage	7.16.5

Pipework passing through Where pipework penetrates metal bulkheads or walls it shall be protected from damage by sleeves, grommets or bulkhead

bulkheads & walls	fittings. Pipework passing through bulkheads or walls made of other material likely to subject the pipework to abrasion the pipework material, must be protected by the use of sleeves, grommets, or bulkhead fittings. Neither the pipe nor anything used to protect must be capable of being moved or displaced at the point where it passes through the bulkhead or wall.
CHECKING	Identify pipework passing through metal bulkheads or walls and where readily accessible visually check it is protected by the use of sleeves, grommets, or bulkhead fittings. Identify pipework passing through bulkheads or walls made of other material and where readily accessible visually check for signs of abrasion damage. Manually check the pipe and associated fittings for movement.

FAULTS		
Installation Pipework	Not protected where it penetrates bulkheads	7.16.6

STANDARD 7.17 : ROUTING PIPEWORK
Installation pipework shall not run below bilge water level or in contact with any material that could cause corrosion. Pipework shall not pass through petrol engine spaces or spaces dedicated to electrical equipment (including batteries), unless jointless and enclosed in a gas-proof conduit.

Installation above bilge water level

Installation pipework shall not run below bilge water level.

The bilge water level can be determined by:

- the presence of a "tidemark";
- the position of the bilge pump;
- the level at which the float switch is set.

Although there may be a space beneath the cabin floor which is above bilge water level, it would be bad practice, and potentially dangerous, to route pipes through it even if they were in gas-proof conduits and contained no joints.

See also Standard 7.16 which requires that pipework should be run as high as practical.

CHECKING

Visually check position of pipework in relation to bilge water level.

FAULTS		
Installation Pipework	Not run above bilge water level	7.17.1

Corrosion of pipes

Installation pipework shall not run in contact with any material that could cause corrosion.

Definition

A material which causes corrosion is any substance that causes chemical degradation, including battery acid and sea water.

Protection

Where there is any material that could cause the pipes to corrode, protection can be effected either by ensuring the pipes are not in contact with such materials or protecting them if they are in contact with it.

Depending on the material that is likely to corrode the pipes, they can be protected in a number of ways e.g. conduits, lagging, impervious coatings.

	No protective systems will be removed to examine the pipes contained therein but a careful examination will be made of any exposed pipes. If there are any signs of corrosion a fault will be recorded even if the source of the corrosion cannot be identified.
CHECKING	Visually check pipework for signs of corrosion.

FAULTS		
Installation Pipework	In contact with material that could cause corrosion	7.17.2

Pipework in petrol engine space	Pipework shall not pass through petrol engine spaces unless jointless and enclosed in a gas-proof conduit.
Definition	A petrol engine space is any space containing a petrol engine whether it be used for propulsion, auxiliary propulsion or power generation.
Gas-proof conduit	Conduits may be made of copper or stainless steel, PVC or any material that is inherently gas-proof. The open ends of the conduit are to be outside the petrol engine space. There must be no joints in the conduit in the petrol engine space. It is not necessary for conduits installed in this way to have their open ends sealed.
Jointless pipe	A pipe running through a conduit in the petrol engine space must be jointless. The size of the conduit is not necessarily a guide on whether the pipe running through it is jointless or not, especially if a soldered joint has been used. If it is not possible to confirm that the pipe is jointless, this would not be a fault providing the conduit was gas-proof as described above.
CHECKING	Visually check pipework passing through petrol engine space is contained in gas proof conduit. Visually check the conduit to determine:

- the ends are outside the petrol engine space;
- there are no joints in the conduit;
- no pipework joints are obviously present within the conduit.

FAULTS		
Installation Pipework in petrol engine space	Not jointless in gas-proof conduit through petrol engine space	7.17.3

Pipework in dedicated electrical space Pipework shall not pass through spaces dedicated to electrical equipment (including batteries), unless jointless and enclosed in a gas-proof conduit.

Definitions A space dedicated to electrical equipment is a space which contains electrical equipment e.g. batteries, distribution boards, generators, and nothing else. An engine compartment in which the batteries were installed would not be a dedicated space for the purpose of this Standard.

Application The interpretation and application of this fault item are identical to that for 7.17.3 above.

CHECKING Visually check pipework passing through space dedicated to electrical equipment is contained in gas-proof conduit.

Visually check the conduit to determine:

- the ends are outside the space dedicated to electrical equipment;
- there are no joints in the conduit;
- no pipework joints are obviously present within the conduit.

FAULTS		
Installation Pipework in dedicated electrical space	Not jointless in gas-proof conduit through space dedicated to electrical equipment	7.17.4

STANDARD 7.18 : PIPEWORK IN RELATION TO OTHER SERVICES
Installation pipework shall not pass through ventilation or air conditioning ducts and shall not be exposed to leakage from water services. Installation pipework shall be remote and/or insulated from, and shall not pass through the same duct as, electricity or telecommunication services and shall be separated from electrical cables not in a conduit by at least 30 mm. Installation pipework shall not be situated less than 75 mm from exhaust pipes.

Ventilation & air conditioning ducts

Installation pipework shall not pass through ventilation or air conditioning ducts.

Installation pipework must not pass through the ventilation or air conditioning ducts in order to reduce the risk of a spread of leaked gas and to prevent leaked gas reaching any spark inducing electrical equipment associated with the ventilation or air conditioning equipment.

CHECKING

Identify any ventilation or air conditioning duct and visually check for pipework entering or leaving the duct.

FAULTS		
Installation Pipework	Passes through ventilation or air conditioning duct	7.18.1

Leaks from water services

Installation pipework shall not be exposed to leakage from water services.

CHECKING

Visually check that no pipework is exposed to leakage from water services.

Visually check pipework for any signs of damage or deterioration.

FAULTS		
Installation Pipework	Exposed to leakage from water services	7.18.2

Other services

Installation pipework shall be remote and/or insulated from, and shall not pass through the same duct as, electricity or telecommunication services.

CHECKING	Identify any duct containing electricity or telecommunication services and visually check for pipework entering or leaving the duct.

FAULTS		
Installation Pipework	Passes through same duct as electricity or telecommunication services	7.18.3

Pipework adjacent to electric cables

Installation pipework shall be separated from electrical cables not in a conduit by at least 30 mm.

Pipework is not to be installed adjacent to electric cables irrespective of the voltage carried by the cables unless the cables are contained in a suitable conduit.

If the insulation of the cable breaks down or is damaged in any way, it is possible that arcing to the gas pipe could occur resulting in perforation of the pipe by spark erosion.

Installation of cables in conduit

Pipework not in conduits may be adjacent to electric cables if the cables are run in suitable conduit.

An appropriate standard for conduits is BS 4607 "*Non-metallic conduit fittings for electrical installations*" which states that conduit for electric cables must be made of insulating material and must be resistant to:

- heat;
- burning;
- impact.

The minimum separation between pipework and cables not in a conduit is 30 mm.

CHECKING	Determine by measurement that the pipework is separated by at least 30 mm from electrical cables not in a conduit.

FAULTS		
Installation Pipework	Not separated by at least 30 mm from electric cables not in a conduit	7.18.4

Pipework adjacent to exhaust pipes

Installation pipework shall not be situated less than 75 mm from exhaust pipes.

For the purpose of this Standard, an exhaust pipe is any pipe containing hot combustion gases irrespective of how those gases are generated. For example, pipework should not be directly above the primary flue of a LPG or paraffin refrigerator not flued to outside the vessel.

Any signs of heat damage would constitute a fault under 7.16.5 irrespective of the amount of separation.

The minimum separation between pipework and exhaust pipes is 75 mm.

Safety Pipework adjacent to exhaust pipes may be damaged by excessive heat or by differential expansion and contraction leading to work hardening or joints becoming loose.

CHECKING Determine by measurement that the pipework is separated from any exhaust pipe by at least 75 mm.

FAULTS		
Installation Pipework	Not situated at least 75 mm from exhaust pipes	7.18.5

STANDARD 7.19 : JOINTS & FITTINGS
Joints shall be made with compression fittings.   *(NOTE: For stainless steel and copper alloy pipework screwed fittings are acceptable)*.   Soldered joints shall not be used.   Joints shall be readily accessible.   Joints shall be rigidly secured and fixing clips shall be attached no more than 150 mm from each joint connection.   Joints shall be made at a point where stress is minimised.   The number of pipe fittings and joints shall be kept to a minimum.

Compression fittings

Joints shall be made with compression fittings.

For stainless steel and copper alloy pipework screwed fittings are acceptable.

They may not be made by any other means including:

- soldered connections;
- bayonet, plug-in or screwed fittings except for portable appliances;
- push-fit connectors.

CHECKING

Visually check each joint is made as follows:

- copper pipework - compression fittings;
- stainless steel or copper alloy pipework - compression or screwed fittings.

FAULTS		
Joints	Not made as specified	7.19.1

Accessibility

Joints shall be readily accessible.

Every joint is a potential source of a gas leak so they must be readily accessible so they can be checked for leaks and security at frequent intervals.

Joints do not have to be visible but rigid adherence to this

Standard is required i.e. if not visible they must be readily accessible.

Where pipework is installed behind panelling or cannot be visually examined for any reason, the installation is acceptable providing all the joints which must exist i.e. a 'tee' joint to each appliance, are readily accessible.

CHECKING Visually check all joints are readily accessible.

FAULTS		
Joints	Not readily accessible	7.19.2

Security Joints shall be rigidly secured and fixing clips shall be attached no more than 150 mm from each joint connection.

Few joints can be fixed directly to the structure of the boat therefore the method of securing joints will depend on where the joint is made:

- at appliances one part of the joint will be securely fitted to the appliance to make the joint rigid;
- at main shut-off valves, appliance isolation valves and test points etc. where there is no provision for direct fixing, the pipework on each side of the fitting should be secured with saddle clips.

Whatever the distance between securing devices, a fault will be recorded if the installation is capable of being moved at the point where the joint is made.

CHECKING Manually check each joint for movement.

Determine by measurement that fixing clips are attached no more than 150 mm from each joint connection.

FAULTS		
Joints	Not rigidly secured	7.19.3

Minimising stress at joints Joints shall be made at a point where stress is minimised.

Correct and proper installation of a gas piping system results in a dependable and durable pressure containment system. In order to achieve this it is imperative that good pipe fitting techniques are adopted. The important considerations are that pipes enter connections at the correct angle and are not 'pulled in' to align properly; and that joints are correctly assembled e.g. made with the correct length of pipe within the fitting to ensure that an olive is correctly compressed to form a proper seal.

Whilst stress itself is not visible, signs of poor installation are very obvious and for the purpose of this fault the checking involves an examination of pipe/joint alignment and location.

CHECKING Visually check for joints made at points of stress:

- pipes entering joints/fittings at abnormal angles;
- joints/fittings introduced at pipe bends or curves.

FAULTS		
Joints	Not made where stress minimised	7.19.4

Number of joints The number of pipe fittings and joints shall be kept to a minimum.

It is important that the number of joints in the installation should be kept to a minimum as every joint is a potential source of gas leak.

Joints within the vessel should only be used for:

- connections to valves and test fittings;
- connections to appliances;
- making spurs.

In-line connectors must not be used to join pipes together where the pipe run could be made by the use of a continuous length of pipe.

Elbows are nearly always unnecessary unless the required bend is too sharp for a hand made bend e.g. in a tight corner.

CHECKING Visually check for presence of unnecessary joints.

FAULTS		
Joints	Not kept to a minimum	7.19.5

STANDARD 7.20 : APPLIANCE ISOLATION VALVES

Appliance isolation valves shall be installed in the supply line to each appliance, including portable appliances, and shall be readily accessible.

(NOTE 1: see paragraph 11.24.)

(NOTE 2: if there is only one appliance the main shut-off valve is sufficient unless the appliance is a portable appliance)

An isolation valve must be fitted into the supply line to each appliance unless there is only one non-portable appliance in the system. In this case, the main shut-off valve can serve as the appliance isolation valve.

CHECKING For installations comprising more than one appliance, visually check each appliance for presence of an isolation valve in the supply line.

FAULTS		
*Appliance Isolation Valves	Not installed in supply line to each appliance where more than one appliance installed	7.20.1

EXEMPTION 11.24 : APPLIANCE ISOLATION VALVES

Vessels manufactured prior to 3 January 2000 are not required to comply with the requirements of Standard 7.20 unless the appliance is connected with flexible hose.

An isolation valve conforming to Standard 7.20 is required in the supply line to all appliances connected with a flexible hose.

Existing installations only Examiners will also need to satisfy themselves that any appliance connected with rigid metal pipework which does not have an isolation valve in the supply line was installed before 3 January 2000 before applying the exemption. Where there is evidence that the appliance was installed after the prescribed date a fault may be recorded. In cases of doubt documentary evidence showing the date of installation may be acceptable.

CHECKING Visually check each appliance connected by a flexible hose has an isolation valve in the supply line.

Determine that any appliance connected by rigid metal pipe which does not include an isolation valve in the supply line was installed before 3 January 2000.

FAULTS		
	*EXEMPTION 11.24 APPLIED	7.20.2

Isolation valves for portable appliances Appliance isolation valves shall be installed in the supply line to each portable appliance.

A portable appliance is:

- not connected by fixed pipework to the gas supply in the boat;
- fitted with a screwed, plug-in or bayonet connection.

It is not necessary for the portable appliance to be connected to its control point for the examination so examiners will need to identify any control points used for portable appliances to check them for the presence of an isolation valve.

CHECKING Identify any portable appliance or the supply line used for a portable appliance.

Visually check each supply line for a portable appliance is fitted with an isolation valve.

FAULTS		
Portable Appliance Isolation Valve	Not installed	7.20.3

Accessibility Appliance isolation valves shall be readily accessible.

CHECKING Visually check each isolation valve is readily accessible.

FAULTS		
Appliance Isolation Valves	Not readily accessible	7.20.4

STANDARD 7.21 : INSTALLATION OF ISOLATION VALVES
Appliance isolation valves not situated immediately adjacent to appliances shall clearly indicate which appliance they serve. If valves operate by rotation, closing shall be clockwise. “Open” and “closed” positions shall be clearly marked on or adjacent to all valves. Tapered plug valves shall be spring loaded. Needle valves shall not be used. Valves at floor level shall be located to prevent inadvertent operation, or shall be of the drop fan or loose key type. Pipework to appliances permanently removed or removed for servicing shall be properly plugged or capped. Isolation valves alone shall not be used for this purpose.

Marking of isolation valves

Appliance isolation valves not situated immediately adjacent to appliances shall clearly indicate which appliance they serve.

It is important that users should be able to identify instantly which appliance an isolation valves controls. If the valve is not close enough to the appliance to make it immediately obvious, there must be some kind of marking or label on or near the isolation valve indicating which appliance it controls.

CHECKING

Identify any valves not immediately adjacent to the appliance served and visually check there is a clear indication of which appliance is controlled.

FAULTS		
Appliance Isolation Valves	Not immediately adjacent to appliance and appliance served not indicated	7.21.1

Rotary valves

If valves operate by rotation, closing shall be clockwise.

CHECKING

Confirmation that a valve is closed by clockwise rotation is not checked.

FAULTS		
Appliance Isolation Valves	Valves operated by rotation not closed by clockwise rotation	7.21.2

Open & closed positions "Open" and "closed" positions shall be clearly marked on or adjacent to all valves.

CHECKING Visually check that the open and closed positions are clearly marked on or adjacent to each appliance isolation valve unless these positions are evident by design.

FAULTS		
Appliance Isolation Valves	Open and closed positions not clearly marked on or adjacent to valve	7.21.3

Tapered plug valves Tapered plug valves shall be spring loaded.

Tapered plug valves - the traditional "gas tap" - are spring-loaded for use with LPG to ensure the tightest possible seal between the plug and the valve body. Apart from the spring assembly they are identical to those used for natural gas.

The spring assembly can be clearly seen above the nut at the base of the valve.

CHECKING Identify any tapered plug valves and visually check they are spring loaded.

FAULTS		
Appliance Isolation Valves	Tapered plug valve not spring loaded	7.21.4

Needle valves Needle valves shall not be used.

Needle valves are not suitable as they cannot be guaranteed to provide a LPG-tight seal and the internal workings may obstruct the flow of LPG.

Engine pre-heating devices Needle valves are permitted for control purposes on dedicated gas blow lamps for pre-heating hot bulb engines provided a separate isolation valve which complies with this Standard is also installed adjacent to, and upstream of, the needle valve.

CHECKING Visually check for presence of any needle valves. Needle valves are not permitted.

FAULTS		
Appliance Isolation Valves	Needle valve installed	7.21.5

Floor level valves Valves at floor level shall be located to prevent inadvertent operation, or shall be of the drop fan or loose key type.

Valves at floor level must be located to prevent inadvertent operation particularly if they are sited in walkways.

If they cannot be positioned in a safe place then a drop-fan or loose key type of valve should be used. These valves cannot operated accidentally and are, in any case, a better and safer solution wherever the isolation valve is located.

Examiners must make no deliberate attempt to operate the valve by simulated inadvertent operation.

CHECKING Identify any appliance isolation valves at floor level not of the drop fan or loose key type and visually check they cannot be operated inadvertently.

FAULTS		
Appliance Isolation Valves	Floor level valves not located to prevent inadvertent operation and not drop fan or loose key type	7.21.6

Removing appliances Pipework to appliances permanently removed or removed for servicing shall be properly plugged or capped. Isolation valves alone shall not be used for this purpose.

It is important to note that a Boat Safety Scheme examination cannot be carried out on a LPG system from which appliances have been temporarily removed.

A piece of pipe with the open end sealed is not acceptable irrespective of how the end is sealed.

Where they have been permanently removed, the acceptable practice is to remove the supply pipework back as far as is practicable and at least as far as the branch 'tee' joint, which should be plugged or capped, at the main supply. In these circumstances the redundant joint will not be regarded as an unnecessary joint.

CHECKING Identify any pipework to an appliance which has been permanently removed and visually check it has been properly plugged or capped.

FAULTS		
Appliance permanently removed	Supply pipework not properly plugged or capped	7.21.7

STANDARD 7.22 : SOUNDNESS TESTING

A means to determine the gas system is sound shall be fitted by either having:

i) a readily accessible test point on appliances where a test gauge may be attached without dismantling any part of the appliance with the use of tools;

or

ii) a readily accessible approved test point fitted in the pipework;

or

iii) a bubble tester installed in the cylinder locker.

(NOTE 1: Information regarding the tests employed to check the soundness of a gas system is contained within BS 5482-3 and the Boat Safety Scheme Technical Manual).

(NOTE 2: Operators of hire/charter vessels and houseboats are reminded that they are subject to the Gas Safety (Installation and Use) Regulations which deal with safe installation, maintenance and use of gas systems).

Testing for soundness

A means of testing for gas soundness must be fitted in the system.

Three options are available:

- a readily accessible test point on appliances where a test gauge may be attached without dismantling any part of the appliance with the use of tools;
- a readily accessible approved test point fitted in the pipework;
- a bubble tester installed in the cylinder locker.

Hireboats

Vessels which are hired out in the course of a business or made available to members of the public in the course of a business carried out from that vessel are subject to The Gas Safety (Installation and Use) Regulations and annual safety checks are required under Regulation 36 (3) “Duties of landlords”.

Test points on appliances

Some appliances are fitted with test points. These may be used for testing purposes providing the examiner can fit the test gauge without dismantling any part of the appliance with the use of tools.

Approved test points	An approved test point is custom made for connection of a manometer (U-tube gauge) for installation testing. They include a LPG-tight joint for connection of the flexible tube of the manometer and may have an on/off valve operated by a screwdriver. They are closed off with a LPG-tight plug when not in use. It is essential that test points comply with this Standard so that: • tests are easily performed; • the system may be easily returned to gas soundness; • there is no risk of the valve being opened accidentally; • the risk of gas leaks at the test point is minimised.
Bubble tester	A bubble tester is an acceptable alternative to the provision of a gas test point for the purpose of testing for gas soundness providing it is securely fixed in the cylinder locker as defined in these Standards. For the purpose of testing for leaks, owners should be encouraged to fit a bubble tester. As they are permanently installed and require no special skills or tools to operate, boat owners themselves can easily carry out regular checks on the soundness of the installation. For the same reason, they also facilitate soundness testing during the Boat Safety Scheme examination.
CHECKING	Visually check for a means to determine gas soundness by any one of the following: • a test point on an appliance where a test gauge may be attached without dismantling any part of the appliance with the use of tools; • an approved test point fitted in the pipework; • a bubble tester installed in a cylinder locker.

FAULTS		
Means to determine soundness	Not fitted	7.22.1

Gas leak detection For the purpose of the Boat Safety Scheme, leaks may be detected by carrying out a gas soundness test.

Checking procedure A full description of the procedures carrying out the test is given in “Part 7 LPG Installations Testing” of this manual.

FAULTS		
Soundness of LPG installation	Leak in system	7.22.2

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Boat Safety

Boat Safety Scheme

Technical Manual

Part 8

INTRODUCTION TO APPLIANCES, FLUEING & VENTILATION

AN INTRODUCTION TO APPLIANCES, FLUEING and VENTILATION

SECTION A : OBJECTIVES OF THE BOAT SAFETY SCHEME STANDARDS

The objectives of these Standards are to ensure that:

- appliances are assessed to be safely installed;
- all products of combustion are safely passed to the outside air;
- the appliances have a facility to cut off the gas supply in the event of flame failure (where flame supervision devices are fitted by the manufacturer);
- heat produced by appliances does not cause fires or damage;
- there is adequate ventilation to the interior of the boat.

SECTION B : CARBON MONOXIDE POISONING

Carbon monoxide (CO) is:

- an odourless, colourless and tasteless gas;
- a little lighter than air;
- difficult to dilute in air because it does not readily bind with oxygen so the mere presence of it may cause toxic effects despite a supply of fresh air.

The toxic effects are transferred via the lungs into the bloodstream where it replaces oxygen by attaching chemically to haemoglobin as carboxyhaemoglobin. The result is the body is deprived of oxygen. The effects of exposure are dependent upon the saturation level of carboxyhaemoglobin in the bloodstream, together with the duration of exposure. Also relevant are the general health and age and level of current activity of the person exposed.

Symptoms

Symptoms of CO poisoning are similar to, and may initially be mistaken for 'flu'. Symptoms increase in severity as saturation levels increase. Escalation is as follows, tightness across the forehead, headache, weakness, dizziness, nausea, vomiting, collapse, increased pulse rate, coma, intermittent convulsions, depressed heart action, weak pulse, slowed respiration and ultimately death.

How carbon monoxide is produced

CO is produced by the incomplete combustion of gaseous, solid and liquid fuels as a result of one or a combination of the following factors:

- badly installed or poorly maintained appliances;
- insufficient ventilation;
- blocked or damaged flues;
- exhaust products of internal combustion engines.

Preventative measures

Preventative measures:

- minimum ventilation in accordance with these Standards;
- regular servicing and proper maintenance of appliances;
- proper maintenance of the exhaust system of inboard propulsion engines;
- heightened user awareness of the risks leading to a reduction in the incidence of hazardous practices. For example :

  a) cooking appliances must not be used for space heating;
  b) space heaters must not be left on overnight;

c) small petrol powered engines are recognised as particularly hazardous in terms of their CO producing tendencies. On no account must such engines e.g. petrol powered generators, be operated inside an enclosed space or close to any ventilation point which leads into an enclosed space.

- the use of CO detectors suitable for use in boats and certified to the relevant British Standard : BS 7860 "*Specification for carbon monoxide detectors (electrical) for domestic use*".

Action if exposure suspected

Action to be taken if exposure to c~~C~~arbon monoxide is suspected:

- turn off appliances/engines;
- open doors, windows and awnings to ventilate the accommodation space, vacate the space;
- persons subjected to potential exposure should visit a doctor urgently and inform the doctor that symptoms may be related to c~~C~~arbon m~~M~~onoxide. In cases of severe symptoms hospital treatment should be sought;
- the source of any confirmed exposure should be identified and the cause rectified by a competent person.

SECTION C : SELECTION AND REPLACEMENT OF LPG APPLIANCES

BS 5482-3 introduces the need for all LPG appliances to be room sealed with the exception of cooking appliances. In addition, appliances must be recommended by the manufacturer for use in a marine environment. They should also include a test fitting.

The selection of room sealed LPG appliances is widely considered a considerable step forward in reducing the risks associated with the release of combustion products and the presence of a permanent source of ignition presented by continuously burning open flames.

Existing installations

In addition to cooking appliances, existing installations may include LPG appliances which are not room sealed. Exemptions are in place to assist the owner of an existing vessel. As soon as the system requires any changes it must be brought up to the current Standards.

Owners are strongly advised to bring existing installations up to the new Standards in the general course of boat maintenance. Due consideration should be given to the life expectancy of existing LPG appliances and the efficacy of continued parts replacement in order to keep an appliance in service. Without due consideration to these factors owners put themselves, their families and anyone on board at risk.

Replacement of LPG appliances

When LPG appliances other than cooking appliances in an existing installation are replaced only room-sealed models must be installed.

CE marking

All gas appliances supplied by a manufacturer must be CE marked to the Gas Appliances Directive (90/396/EEC) which requires appliances to be designed and built to operate safely and present no danger to persons or property when used normally.

When selecting a new LPG appliance boat owners/operators are encouraged to look for the presence of the CE mark. However the presence of the CE mark does not necessarily mean that the appliance is suitable for installation in boats. Even though the onus is on the manufacturer is to draw the user's attention to any restrictions on use, owners/operators should assure themselves that the intended selection is recommended by the manufacturer for use in a marine environment.

Commissioning of LPG appliances

The appliance operating pressure must be tested on first commissioning and the pressure observed at the appliance inlet must not be below that given in Table 7.1. **TABLE 7.~~5~~1**

The test procedure to be followed is described in Table ~~XX~~8.1. **TABLE ~~XX~~8.1**

Test fittings

It is a requirement of these Standards for new appliances to incorporate a test fitting and the provision of a test fitting provides a good indication that the appliance will be CE marked.

SECTION D : LPG COMBUSTION AND BURNER PERFORMANCE

The efficient and complete combustion of LPG results in the production of carbon dioxide, water vapour and oxides of nitrogen in the exhaust gases.

LPG has a high calorific value and therefore has a high air to gas ratio. One volume of LPG requires 20 to 30 volumes of air to burn correctly.

In a conventional gas burner this air is supplied to the flame in two ways (see Figure 7.1): **FIG 7.1**

- primary air - approximately 50% is drawn into the gas stream through the burner at the injector and mixes with the gas as it passes along the mixing tube;
- secondary air - the other half is drawn into the outer envelope of the flame itself.

On some LPG appliances, the amount of primary air entering the burner mixing tube can be adjusted by an aeration screw or shutter. On others there is no adjustment provision as the burner has fixed aeration built in by the manufacturer.

The amount of secondary air is not normally regulated but to achieve good combustion there must be:

- an adequate supply of fresh air into the combustion chamber;
- an adequate flue;
- an absence of direct draughts.

Flame picture

All burners when operating correctly should exhibit clear, blue flames of the correct proportions without sooting (see Figure 7.1). **FIG 7.1**

The only exception to this is the ribbon-type burner as found in ovens where it is usual for the flame to be yellow-tipped. This should not, however, be so pronounced as to cause the formation of soot on the interior surfaces of the oven.

Causes of unsatisfactory burner flame pictures

There are numerous reasons why a burner may not show a satisfactory flame picture. Some of these and the visual effect they have on the flame are described in Table 8.2. **TABLE 8.2**

Some of the faults are relatively straightforward to correct e.g.:

- blocked burner ports;
- blocked primary air ports;

- too much primary air;
- dirt or dust in the gas/air stream;
- blocked flues;
- cylinder capacity too low.

The problem may also be caused by installation faults such as:

- regulator outlet pressure incompatible with appliance inlet pressure
- faulty regulators
- undersized pipework
- insufficient cylinder capacity

In all cases, the burner should be checked and the cause rectified by a competent person, who should first determine if the problem can be eliminated by such means as cleaning components, adjusting the air flow or changing the cylinder(s).

TABLE 8.1

It may be necessary to carry out a test of the appliance operating pressure as described in Table 8.1.

SECTION E : PROTECTION OF COMBUSTIBLE MATERIALS

Combustible materials can be protected from sources of heat either physically, by the use of non-combustible shields or barriers, or chemically by the use of flame retardant finishes. A flame retardant is a material or coating that will limit the spread of flame along the surface of the material in the event of fire.

The method of testing and classification of these finishes is contained in BS 476-7.

BS 476-7 BS 476-7 "*Fire Tests on Building Materials and Structures. Method for classification of the surface spread of flame of products*" details a method for measuring the lateral spread of flame along the surface of a specimen of a product.

The standard provides data for comparing essentially flat materials which are used primarily as the exposed surfaces of walls and ceilings.

Test procedure The sample is ignited at one edge and the spread of the flame front is timed until it reaches the 825 mm point or 10 min have elapsed whichever is shorter.

Ratings

CLASS	SPREAD at 1.5 min	FINAL SPREAD
1	165 mm	165 mm
2	215 mm	455 mm
3	265 mm	710 mm

Low flame spread material The International Maritime Organisation (IMO) has published a test procedure intended to be used in situations where the International Convention on Safety of Life at Sea (SOLAS) requires "low flame spread" material to be fitted.

This test is Resolution A.653(16) '*Recommendation on improved Fire Test Procedures for surface flammability of bulkhead, ceiling and deck finish materials'*. Any certificate of type approval issued to material which has passed this test will contain the reference. 'IMO FTPC Parts 2 & 5'. (FTPC stands for Fire Test Procedures Code)

Material supplied to the Marine Equipment Directive (not applicable to leisure craft) must satisfy the requirements of this IMO Fire Test and as such is deemed acceptable for the purposes of the Boat Safety Scheme.

Non-combustible material The IMO defines this as material which meets the requirements of ISO 1182 *"Fire tests; building materials; non-combustibility testing"* with some amendments to Annex A of that standard.

SECTION F : INSTANTANEOUS WATER HEATERS

Water heaters should comply with BS 5386 *"Specification for gas burning appliances Part 1; Gas burning appliances for the instantaneous production of hot water for domestic use"*. This standard is directly equivalent to BS EN 26 *"Gas fired instantaneous water heaters for the production of domestic hot water, fitted with atmospheric burners"*.

In general instantaneous water heaters should always be connected to a flue. Any instantaneous water heater fitted in a confined space must be fitted with a flue.

Single point water heaters

Normally a single point water heater may be installed without a flue but if is supplying a shower or bath it must be installed with a flue even if the heater is not installed in the shower or bath compartment.

The reason for this is that good industry practice suggests that no gas water heater of any type should be installed without a flue if it is likely to run for longer than 5 min - wherever it is located.

As heaters supplying a shower or bath will almost certainly run for longer than 5 min they must be flued.

A flue is also required in order to protect anyone in the same compartment as the appliance at the time the appliance is operated remotely by someone else.

Multi-point water heaters

Multi-point water heaters must always be flued.

SECTION G : CATALYTIC HEATERS

Catalytic type appliances are required to conform to BS 5258-11 or BS EN 449.

Catalytic heaters

Catalytic appliances must conform to the requirements of BS 5258–11 *"Safety of domestic gas appliances – Part 11: Flueless catalytic combustion heaters (3rd family gases)*, or BS EN 449, *Specification for dedicated liquid petroleum gas appliances – Domestic flueless space heaters (including diffusive catalytic combustion heaters)* ".

Compliance with BS 5258-11

The requirements of BS 5258-11 which could be determined by visual inspection are as follows:

- a guard which cannot be removed without the use of tools;
- a clearly marked, three-position (OFF-IGNITE-ON) tap;
- a name badge fitted to (or permanently marked on) the appliance that is external or behind a door; includes the type name and/or number of the appliance; and is legible at a distance of 1m;
- any visible flexible rubber tubing and hose must comply with BS 3212 and not exceed 1 m in length;
- any visible flexible plastics tubing must not exceed 1 m in length; be clearly and durably marked with the supplier's name or identification; and the month and year of manufacture;

Use of plastic tubing

BS 5258-11 permits the use of plastic tubing as an integral part of the appliance (see above) but under no circumstances can plastic tubing be used to connect the heater (or any other appliance) to the gas supply.

Compliance with BS EN 449

The requirements of BS EN 449 which could be determined by visual inspection are as follows:

- there must be no deformation of any part;
- metal parts are protected against corrosion;
- appliance pipework and controls shall be metal;
- glass components shall not have sharp edges;
- there must be no sharp corners and edges which could cause personal injury;
- for control devices, the closed, open and any reduced rate positions shall be marked in a visible, legible and durable fashion;
- any special position of the control tap intended for ignition or any special button that has to be operated to cause ignition, shall be clearly marked (e.g. by a star);

- where more than one tap is provided it shall be obvious which burner is controlled by each tap;
- tap handles shall not be capable of inadvertent operation;
- a fireguard shall be fitted;
- mobile and portable heaters shall carry a permanently fixed and durable label positioned so that it cab be easily read when performing the described function.

Safety notice-asbestos panels

It has been illegal since 1983 for anyone to sell catalytic heaters containing any unbonded asbestos.

At that time, the then Minister for Consumer Affairs placed a Prohibition Notice on Impact Heaters (UK) Ltd of Redditch from supplying heaters containing unbonded asbestos and marketed under the brand names:

- Agni;
- Super Ser;
- Corcho.

All other main suppliers had previously agreed to stop supplying them.

It is possible, however, that some of these heaters may still be in use, and any heater bearing one of the above brands should be treated as an asbestos-type unless there is clear documentary evidence that it is not.

Recognition of asbestos panels

The signs are:

- crumbling of the panels;
- bald patches;
- deposits of dust beneath the heater;
- fibres sticking out of the corners or the face of the panels;
- fibres loose inside the heater.

WARNING - SUSPECT HEATERS SHOULD NOT BE TOUCHED

NOT EVEN WHEN WEARING GLOVES!

Disposal

The recommended procedure for disposal is as follows:

- turn off the gas supply;
- notify the local authority who will arrange for its disposal.

SECTION H : CONNECTION OF PORTABLE LPG APPLIANCES

Connections Portable LPG appliances are connected to a gas point by bayonet, plug-in or screwed connections (see Figure 7.2). **FIG 7.2**

Portable appliances Portable appliances are appliances that are not intended to be permanently installed in the gas system but are intended to be brought onto the craft by the owner and removed from the craft at the time the owner leaves.

BS 5482-3 does not cover the installation of portable appliances. Clause 1 (3) ~~"~~'Scope'~~"~~, ~~paragraph 3~~ states "This part of this British Standard does not cover installa~~it~~ion of bulk supplies of LPG, or installations that are supplied from the shore, or portable LPG-burning appliances."

Bayonet or plug-in connections A bayonet or plug-in connection is a purpose made quick connector, that will establish a LPG-tight connection with, and open, the gas supply when fully and correctly inserted.

When disconnected, the gas supply will be fully shut off.

Screwed connections Screwed connections would normally incorporate a parallel thread and a soft metal or washered seating to provide a LPG-tight joint. When not in use, the screwed end of the pipe must be capped off LPG-tight.

Flexible connections Although appliances are part of the low pressure stage of the installation, they must only be connected to their control points with flexible tubing conforming to type 2 of BS 3212 as used in the high pressure stage.

SECTION I : FLUEING

A flue is a passage for conveying combustion products to the outside air.

There are three types of flue systems (see Figure 8.1): **FIG 8.1**

- closed flue systems on room sealed appliances;
- open flue systems;
- closed flue systems.

Room sealed appliances

Room sealed appliances are fitted with closed flue systems in which incoming combustion air and outgoing combustion products pass through sealed ductwork connected to an enclosed combustion chamber and terminating outside the vessel.

In some room sealed appliances the flow of combustion air and combustion products is assisted by an electric fan (fan assisted flue).

The flue systems of room sealed appliances should be installed in accordance with the manufacturer's instructions with special attention being paid to the siting of the terminal.

Open flues

Open flue systems are open to a room or internal space at each appliance position and are fitted to appliances that take air for combustion from the space in which they are fitted.

There are four main components to an open flue system:

- primary flue - which connects an appliance to a draught diverter and which is an integral part of the appliance and designed by the manufacturer to obtain maximum efficiency from the appliance;

- draught diverter - which provides a draught break between the primary flue and the secondary flue. The draught diverter prevents conditions in the secondary flue from interfering with the combustion performance of an appliance. Such conditions include down draught or static conditions or, through the introduction of air, the dilution and cooling of flue gases or the interruption of flue pull.

- secondary flue - which is the section of the flue between the draught diverter and the terminal. To ensure effective operation the secondary flue should be installed in accordance with the appliance manufacturer's recommendations and without restrictions in the length or diameter and without bends or non-vertical sections.

- flue terminal - see 'Flue terminals' below.

Closed flues Closed flue systems are closed to the room or internal space due to the absence of a draught diverter, flue break and any draught break on the appliance. Closed flue appliances take air for combustion from the space in which they are fitted.

Flue terminals Flue terminals are fitted to the flue outlet in order to:

- promote efficient but not excessive flue pull;
- disperse the products of combustion;
- prevent anything getting into the flue that might block the flue;
- prevent down draughts.

Flue terminals should be installed in accordance with the appliance manufacturer's instructions ensuring care is taken to avoid locations where combustion products may re-enter the vessel and locations where heat damage could be caused to surrounding structures.

Boat owners/operators should not place any items near to a flue terminal in such a position that could affect the efficient operation of the flue and no flammable materials should be placed near to a terminal.

Boat owners/operators need to exercise great care to ensure flue terminals on cabin tops are not damaged, blocked or restricted by:

- the stowage of heavy equipment e.g. boarding planks, boat hooks, and lifebuoys
- accident, for example, by crew member inadvertently jumping or kicking the terminal or by way of a collision with a low-lying part of a bridge, or a tree.

It is strongly recommended that flue terminals are regularly inspected for signs of damage.

Owner/operators who harbour concerns regarding the ability of the flue terminal to withstand the ill-treatment likely to be encountered under normal operating conditions are strongly advised to seek advice from the appliance manufacturer. Equally a competent person may be able to modify the existing terminal to include adequate protection from mechanical damage.

Unflued appliances The following are examples of unflued appliances:

- cookers;
- hobs;
- portable appliances;
- radiant fires;
- gas lights;
- some refrigerators;

- some single point water heaters.

In these cases, air for combustion is drawn from the accommodation area in which the appliance is installed and the products of combustion are vented into the same area.

These are then diluted and removed through the fixed ventilation system.

SECTION J : VENTILATION

This section on ventilation covers the following:

- Ventilation design;
- Fixed ventilation;
- Ventilation process;
- Mechanical ventilation.

Ventilation design

All spaces in a vessel should have adequate ventilation drawn from outside the vessel.

The design of such ventilation should take into account the air consumption of all fuel burning appliances together with the fresh air requirements of the occupants of the spaces.

Fixed ventilation which cannot be closed off shall be calculated and provided in accordance with BS 5482-3 and be divided equally, or as near as practicable, between high and low level.

The resulting dimensions are strictly the minimum to secure efficient distribution of fresh air and do not, in any way, displace or reduce the need for the normal, adjustable ventilation provided by portlights, windows or roof-lights.

Ventilators should be weathertight to cater for the worst conditions likely to be encountered and should be designed to avoid draughts.

The purpose of ventilation

Adequate fixed ventilation of all spaces containing fuel burning appliances, including solid fuel stoves, is necessary to provide:

- combustion air for appliances that are not room-sealed;
- for the evacuation of combustion products from appliances that are not room sealed;
- renewal of fresh air for habitation and comfort.

The ventilation process

A fixed ventilation system consists of a series of openings which can neither be adjusted nor closed, to allow for the passage of outside air into and out of an accommodation space.

Ventilation outlets should be linked directly to the atmosphere, and be away from ventilation inlets.

Low level ventilation openings should be provided as low as possible and can be ducted to low level from a high level external source. Openings should ideally be at or below the lowest burner or air intake of any appliance in that space.

High level ventilation should be as high as possible within the space, and not more than 100 mm from the roof.

Ventilation may be provided by wind-actuated, self-trimming cowls or rotary terminals, fixed openings and proprietary roof outlet ventilators.

Mechanical ventilation

Mechanical ventilation systems should be constructed to prevent the possibility of igniting any fuel vapour in the system by the use of flame proof motors or siting the fan motor outside the ducting system.

These systems are not to be counted as part of the fixed ventilation as they can:

- be turned off;
- fail safe in the event of a problem;
- suffer from battery failure.

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Technical manual

Part 8

APPLIANCES, FLUEING & VENTILATION - STANDARDS

STANDARD 8.1 - FUEL INSTALLATIONS
The fuel installation to each appliance shall be in accordance with the appropriate parts of these Standards.

All fuel installations for cooking, heating, refrigerating, and lighting leading to the connection with appliances must be individually assessed for compliance with the Standards relevant to the individual fuel types.

CHECKING For each appliance, identify the type of fuel and determine compliance with appropriate Standards as follows:

- LPG · Part 7 : LPG installations;
- Electricity · Part 3 : Electrical installations;
- Fuel oils · Part 2 : Inboard engines.

FAULTS		
Fuel Installation	Not in accordance with appropriate parts of these Standards	8.1.1

STANDARD 8.2 - SELECTION OF APPLIANCES

LPG Appliances shall be room sealed with the exception of cooking appliances.

(NOTE: see paragraph 11.25).

LPG appliances shall include a test fitting.

(NOTE: see paragraph 11.26).

A satisfactory flame picture shall be present at each appliance burner when all appliance burners in the system are operating at maximum rate.

Selection of appliances

LPG appliances shall be room sealed with the exception of cooking appliances.

CHECKING

Identify all non-cooking appliances and visually check they are room-sealed.

FAULTS		
*LPG Appliance	Non-cooking appliance not room sealed	8.2.1

Existing installations

Exemption 11.25 allows the continued use of non-room sealed LPG appliances installed before 3 January 2000 providing certain conditions are met regarding the installation of those appliances.

These conditions are listed in Exemption 11.25 and they are identical to the requirements (where applicable) of Standards 8.2, 8.3, 8.8, and 8.9 in the previous edition of these Standards.

Examiners will carry out a series of checks on these appliances to determine if Exemption 11.25 can be applied. These checks are described below under Faults 8.2.2 (a) to 8.2.2. (l) inclusive and providing no faults are recorded, examiners will apply Exemption 11.25.

EXEMPTION 11.25 : USE OF NON-ROOM SEALED APPLIANCE

Vessels manufactured prior to 3 January 2000 and having non-room sealed appliances are not required to comply with that part of Standard 8.2 which requires LPG appliances, with the exception of cooking appliances, to be room sealed provided the following requirements are complied with:

i) Replacements for existing non-room sealed appliances, with the exception of cooking appliances, shall be room sealed and installed in accordance with BS 5482-3 and Parts 7 and 8 of these Standards as appropriate.

ii) Modifications or additions to an existing installation shall be performed in accordance with the appliance manufacturer's recommendations.

iii) Pilot lights and burners on LPG or paraffin refrigerators installed in vessels with a petrol engine shall be completely enclosed. Combustion air and combustion products shall be drawn and exhausted through a suitable flame trap, or combustion air piped to the appliance from outside the vessel or from a point inside the vessel above the level of the windows, other openings, or other means of ventilation in the accommodation space.

iv) Catalytic type appliances shall conform to BS 5258-11 or BS EN 449.

v) The flues and draught diverters of existing appliances shall be of a type approved by the manufacturer, and properly fitted and maintained. Flues shall be of suitable material, effectively insulated, and of appropriate internal diameter to ensure safe transfer of gases to outside the vessel, away from areas that could be enclosed by canopies. Appliances designed for use exclusively with a flue, or draught diverter and flue, shall have one fitted. Only the flue supplied or recommended by the manufacturer shall be used with refrigerators flued to the outside. *(NOTE 1: Information regarding the test employed to check the effectiveness of any flue is contained within BS 5482-3 and the Boat Safety Scheme Technical Manual).*

Exemption 11.25 i) - replacement of appliances

Replacements for existing non-room sealed LPG appliances, with the exception of cooking appliances, shall be room sealed and installed in accordance with BS 5482-3 and Parts 7 and 8 of these Standards as appropriate.

Exemption 11.25 is only available for appliances installed before 3 January 2000. Where there is evidence that the appliance has been installed after this date documentary evidence may be required to support the claim for the exemption.

CHECKING Visually check that no non-room sealed, LPG appliances were installed after 3 January 2000. Note that this check does not apply to instantaneous water heaters and cooking appliances.

FAULTS		
Use of Non-Room Sealed Appliance	Non-room sealed, non-cooking appliance installed after the date specified	8.2.2 (a)

Exemption 11.25 ii) - modifications & additions Modifications or additions to an existing installation shall be performed in accordance with the appliance manufacturer's recommendations.

If there is evidence that an existing non-room sealed appliance has been modified or added to after 3 January 2000 and the modification or addition appears contrary to the manufacturer's recommendations, documentary evidence may be required to support the claim for the exemption.

Documentary evidence Where the appliance manufacturer's recommendations do not exist or are unobtainable, alternative documentary evidence is acceptable. This may include:

- evidence that the modifications or additions are in accordance with the equipment/component manufacturer's instructions;
- evidence that appropriate codes of practice have been used.

CHECKING Visually check for evidence that additions or modifications to an existing installation were made after 3 January 2000.

Check additions or modifications were in accordance with appliance manufacturer's recommendations or acceptable documentary evidence.

Where these recommendations are not available, alternative documentary evidence may be required.

FAULTS		
Modifications or Additions	Modifications or additions made after the date specified not in accordance with appliance manufacturer's recommendations	8.2.2 (b)

Note: There are 3 checks to be made under Exemption 11.25 iii) which deals with the installation of LPG or paraffin refrigerators in vessels with a petrol engine. See Faults 8.2.2 (c) to (e) inclusive.

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The conditions described apply to all petrol engines (including outboard motors) whether they are used for propulsion, auxiliary propulsion or power generation.

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Exemption 11.25iii) – pilot lights & burners on LPG or paraffin refrigerators

Pilot lights and burners on LPG or paraffin refrigerators installed in vessels with a petrol engine shall be completely enclosed.

Petrol vapour is extremely dangerous. It would be difficult, but not impossible, for any gas refrigerator other than a room sealed appliance to be safely installed in a petrol engined boat in accordance with the manufacturer's installation requirements. If in doubt seek advice from the appliance manufacturer.

The combination of a non-compliant gas or paraffin refrigerator together with the potential for a petrol vapour escape is potentially extremely dangerous. This is due to the possibility of petrol vapour reaching the permanent low level source of ignition at the burner flame causing a fire or explosion.

The risks are associated with the storage and dispensing of petrol and the alarming propensity for petrol to give off vapour. On evaporation, 1 litre of petrol may give rise to approximately 15 cubic metres of flammable petrol/air mixture.

Gas or paraffin refrigerators must not be installed in a petrol engine compartment and must be completely isolated from it.

Burner assembly to be visible

Examiners need to be able to see the burner assembly to check if the pilot light or burner is completely enclosed.

If the burner assembly cannot be seen e.g. the refrigerator is built-in or enclosed, they will record a fault as they must not assume the pilot light or burner is totally enclosed even if they are familiar with the model in question.

Room-sealed appliances

The question of visibility does not apply to room-sealed appliances because there is no contact between the pilot light or burners and the air in the compartment in which the refrigerator is installed.

CHECKING

Identify gas or paraffin refrigerator in a petrol engined vessel and visually check burner is totally enclosed.

A fault is to be recorded if the burner assembly is not visible.

FAULTS		
Gas or Paraffin Refrigerator in vessel with petrol engine	Pilot light/burner not completely enclosed	8.2.2 (c)

Exemption 11.25iii) – flame trap for LPG or paraffin refrigerators	Combustion air and combustion products shall be drawn and exhausted through a suitable flame trap, or combustion air piped to the appliance from outside the vessel or from a point inside the vessel above the level of the windows, other openings, or other means of ventilation in the accommodation space.
Flame traps	A flame trap is a fitting within an air inlet or exhaust outlet duct, or in a flue or exhaust pipe. The gauze of the flame trap conducts away the heat produced by any flame reaching it so the temperature of any flammable vapour outside the gauze does not reach ignition temperature. A suitable flame trap is: • made of non-combustible, non-corrosive material; • fitted with a wire gauze of mesh not less than 11 to the linear centimetre (28 to the linear inch).
CHECKING	Identify gas or paraffin refrigerator in a petrol engined vessel. Visually check method of air intake and exhaust and visually check a suitable flame trap is fitted if required. Visually compare flame trap gauze with sample to determine suitability. A fault is to be recorded if the method of intake and exhaust cannot be determined.

FAULTS		
Gas or Paraffin Refrigerator in vessel with petrol engine	Combustion air and combustion products not drawn/exhausted as specified	8.2.2 (d)

Exemption 11.25iii) – combustion air for LPG or paraffin refrigerators	If combustion air is not drawn through a suitable flame trap, it must be "... piped to the appliance from outside the vessel or from a point inside the vessel above the level of the windows, other openings, or other means of ventilation in the accommodation space."
Piped supply	Preferably the pipe or duct should be directly connected to the air outside the vessel. If it has to be taken from inside the vessel, it must be taken via a pipe or duct from a point inside the accommodation space in which it is situated above the level of all: • ports; • windows;

- other means of ventilation.

Presence of roof ventilators

If there are roof ventilators in the accommodation space, the air could not be drawn from inside the space. It would have to be taken from outside as there can be no point of supply above the level of the ventilators.

CHECKING Identify gas or paraffin refrigerator in a petrol engined vessel

Identify installation where combustion air is not drawn through a suitable flame trap and visually check the air is piped to the appliance:

- from outside the vessel; OR
- from a point inside the vessel above the level of windows, other openings, or other means of ventilation in the accommodation space.

FAULTS		
Gas or Paraffin Refrigerator in vessel with petrol engine	Combustion air not piped as specified	8.2.2 (e)

Exemption 11.25 iv) - catalytic appliances Catalytic type appliances shall conform to BS 5258-11 or BS EN 449.

Compliance with BS 5258-11 The requirements of BS 5258-11 which could be determined by visual inspection are as follows:

- provision of a guard;
- 3-position on-off tap;
- fitting of a name badge;
- compliance of flexible tubing.

Guards The appliance should be fitted with a guard which cannot be removed without the use of tools.

On-off tap There should be a clearly marked, three-position (OFF-IGNITE-ON) tap. This is critical as the provision indicates the existence of a flame supervision device.

Name badge There should be a name badge fitted to (or permanently marked on) the appliance.

Flexible tubing If any flexible rubber tubing and hose can be seen, it should:

- comply with BS 3212;
- not exceed 1 m in length.

Compliance with BS EN 449 The requirements of BS EN 449 which could be determined by visual inspection are as follows:

- control devices
- control taps
- guards

Control devices For control devices, the closed, open and any reduced rate positions shall be marked in a visible, legible and durable fashion.

Control tap Any special position of the control tap intended for ignition or any special button that has to be operated to cause ignition, shall be clearly marked (e.g. by a star).

Guards A fireguard shall be fitted.

In the absence of visual evidence of compliance documentary evidence may be required.

Warning You are referred to the Safety Notice concerning catalytic heaters produced up until the early 1980s containing unbonded asbestos panels (see Introduction to Part 8).

CHECKING Identify catalytic heater and check compliance with those requirements of BS 5258-11 or BS EN 449 which can be determined by visual inspection.

For BS 5258-11 check:

1. Provision of a guard
2. Three position on-off tap
3. Name badge
4. Flexible tubing to 3212

For BS EN 449 check:

1. Legible and durable marking of open, closed and any reduced rate positions on control taps
2. Clear marking of any special position of the control tap for ignition
3. Provision of a fire guard

FAULTS		
Catalytic Appliance	Does not comply with BS 5258-11 or BS EN 449	8.2.2 (f)

Note: There are 6 checks to be made under Exemption 11.25 v) see Faults 8.2.2 (g) to (l) inclusive.

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Exemption 11.25 v) – approved types of flues & draught diverters The flues and draught diverters of existing appliances shall be of a type approved by the manufacturer.

No component of a flue system supplied as original equipment or as optional extra equipment by the appliance manufacturer should be modified or replaced without written approval from the manufacturer.

Appliances intended to be fitted with a closed flue system may be supplied only with a spigot to which the flue pipe can be attached.

Where the approved system is a closed flue, the appliance must not be fitted with a draught diverter which would convert it to an open-flue system.

The flue systems or components supplied by the appliance manufacturer may include the primary flue and draught diverter of open-flued appliances. Where the flue system or components have not been supplied by the appliance manufacturer, the system should conform to:

- the equipment/component manufacturer's recommendations on suitability for use with the appliance;
- appropriate codes of practice.

All flue systems should:

- be complete;
- not be obstructed;
- serve only one room or appliance;
- have a correctly sited terminal;
- have any dampers or restrictor plates removed or permanently fixed open.

Draught diverters - approved types

Draught diverters must be as approved by the appliance manufacturer and are only fitted to open-flued appliances.

Draught diverters must never be fitted to closed-flued appliances as supplied by the manufacturer.

Draught diverters supplied as original equipment or as optional extra equipment by the appliance manufacturer must not be modified or replaced without written approval from the manufacturer.

Where the flue system or components have not been supplied by the appliance manufacturer, the system should conform to:

- the equipment/component manufacturer's recommendations on suitability for use with the appliance;
- appropriate codes of practice.

CHECKING Determine each flue/draught diverter is of a type approved by the manufacturer.

Where this cannot be determined visually and manually check the flue system:

- is complete;
- not obstructed;
- serves only one room or appliance;
- has a correctly sited terminal.

FAULTS		
Flue/Draught Diverter	Not an approved type	8.2.2 (g)

Exemption 11.25 v) - fitting & maintenance flues & draught diverters The flues and draught diverters of existing appliances shall be properly fitted and maintained.

Fitting The flue system must take the most direct practicable route consistent with structural stability, appearance and termination. An essentially vertical route from the draught diverter is especially desirable.

Any joints in closed flues must be sealed so they are LPG-tight so there is no possibility of flue gases discharging into the interior of the vessel.

Flues with draught diverters need not have totally LPG-tight seals, providing there is an a reasonable overlap of approx. 15 mm at any joint or where the first stage is fitted to the appliance.

All flues are to be properly supported and secured to the permanent structure of the vessel.

All flues are to pass out of the cabin or hull to the open air through properly made and shielded openings.

Terminals Terminals must be:

- connected to the flue system with a weathertight joint;
- fitted and secured so there is no possibility of the terminal being forced into the flue pipe and causing an obstruction;

It may be necessary to provide a protective shield (terminal guard) for a terminal to prevent interference with and damage to the terminal (see Introduction to Part 8).

These guards must be constructed and securely fixed in such a way that the flow of air across the terminal is completely unimpeded.

	Flammable materials must not be sited in the vicinity of flue terminals.
Refrigerators	Where a refrigerator is flued to the outside, only the flue supplied or recommended by the manufacturer shall be used.
Damper plates	Damper or restrictor plates must not be fitted unless they are permanently fixed in the open position. An exception can be made only in the case of solid fuel stoves intended for use as all-night heaters.
CHECKING	Visually and manually check all parts of the flue system, including fixings and fastenings, for signs of: • movement; • damage or deterioration; • perforations; • corrosion. Visually and manually check terminals, including fixings and fastenings, for signs of displacement or damage. Visually check flue for signs that all joints are sealed. Note that this check also applies to solid and liquid fuelled appliances.

FAULTS		
Flue/Draught Diverter	Not properly fitted and maintained	8.2.2 (h)

Exemption 11.25 v) - material used for flues	Flues shall be of suitable material. The material must be non-combustible and capable of withstanding vibration from machinery or weather conditions. Metallic flue pipes should comply with BS 715 "*Specification for metal flue pipes, fittings, terminals and accessories for gas-fired appliances with a rate input not exceeding 60kW*". No standards currently exist for non-metallic flue pipes constructed of materials other than asbestos which is no longer permitted. Terminals are not to be fixed with pop-rivets or other aluminium or lightweight fastenings.

CHECKING Visually check flue is:

- made of a suitable material;
- not perforated in any way.

Note that this check also applies to solid and liquid fuelled appliances.

FAULTS		
Flue	Not of suitable materials	8.2.2 (i)

Exemption 11.25 v) - insulation of flues Flues must be effectively insulated.

The temperature of the gases passing through the flue may be extremely high depending on the fuel used and is sometimes above that required to set fire to wood and other flammable materials.

It is essential, therefore, that the flue is effectively insulated where it passes close to flammable fabric and structure so there is no risk of setting fire to any part of the boat through which the flue passes.

Where a flue passes through a ceiling or deck head it should be contained in a sleeve made of non-combustible material which must be:

- securely attached to the permanent structure of the vessel;
- installed with an air space between the sleeve and the flue pipe.

CHECKING Visually check any part of the vessel, its equipment, or furnishing materials adjacent to the flue for signs of overheating e.g. scorching or blistering.

Note that this check also applies to solid and liquid fuelled appliances.

FAULTS		
Flue	Not effectively insulated	8.2.2 (j)

Exemption 11.25 v) - safe transfer of flue gases Flues must be of appropriate internal diameter to ensure safe transfer of gases to outside the vessel away from areas that could be enclosed by canopies.

Checking procedure A full description of the procedures for carrying out the test is given in “Part 7 LPG Installations Testing” of this manual.

FAULTS		
Flue	Does not ensure safe transfer of gases to outside of vessel	8.2.2 (k)

Exemption 11.25 v) - appliances designed for flues & draught diverters

Appliances designed for use exclusively with a flue, or draught diverter and flue, shall have one fitted.

The need to fit a flue is dependent on the:

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- thermal input of the appliance;
- period of continuous use;
- size of the room, cabin, or space in which the appliance is installed.

Examples of flued appliances

The following appliances are examples of those requiring a flue:

- multipoint instantaneous water heater;
- single point instantaneous water heater supplying a shower or bath;
- any appliance fitted with a flue spigot;
- solid fuel appliances.

~~Unflued~~ ~~r~~Refrigerators

For existing installations in diesel-fuelled vessels only, ~~unflued~~ LPG refrigerators allowing combustion products into the interior of vessels will be deemed acceptable on the grounds that the gas consumption of absorption refrigerators is equivalent to pilot lights that may be found on other unflued appliances installed in vessels.

Draught diverters

Draught diverters can only be installed as part of an open-flue system and are designed to prevent conditions in a secondary flue from interfering with the combustion performance of an appliance.

The primary flue and the draught diverter are generally supplied by the manufacturer and may be an integral part of the appliance.

The requirement for a draught diverter is indicated by the presence of an open-flued appliance fitted with a primary flue.

Balanced- and closed-flued appliances do not have any flue break or draught break in the flue system and therefore cannot be fitted with draught diverters.

CHECKING

Visually check a flue or draught diverter and flue is fitted to an appliance designed exclusively for use with one.

Note that this check also applies to solid and liquid fuelled appliances.

FAULTS		
Flue/Draught Diverter	Not fitted to fuel burning appliance which requires one	8.2.2 (I)

Exemption 11.25 : Use of non-room sealed appliance

Exemption 11.25 can be applied provided no faults are recorded in 8.2.2 (a) to 8.2.2 (l) inclusive.

CHECKING

No faults are recorded in 8.2.2 (a) to 8.2.2 (l) inclusive

FAULTS		
	*EXEMPTION 11.25 APPLIED	8.2.2

Test fittings

LPG appliances shall include a test fitting.

CHECKING

At present, no check is being made during the Boat Safety Scheme examination for the presence of a test fitting on an appliance.

FAULTS		
*Test Fitting	No test fitting on appliance	8.2.3

EXEMPTION 11.26 : TEST FITTING ON APPLIANCE

Vessels manufactured prior to 3 January 2000 are not required to comply with that part of Standard 8.2 which requires LPG appliances to include a test fitting.

Existing installations only

Where there is evidence that an appliance without a test point was installed after 3 January 2000 documentary evidence may be required to support the claim for the exemption.

CHECKING

At present, no check is being made during the Boat Safety Scheme examination for the presence of a test fitting on an appliance.

FAULTS		
	*EXEMPTION 11.26 APPLIED	8.2.4

Flame picture

A satisfactory flame picture shall be present at each appliance burner when all appliance burners in the system are operating at maximum rate. **FIG 7.1**

Checking procedure

A full description of the methodology for carrying out the test is given in “Part 7 LPG Installations Testing” of this manual.

FAULTS		
Burner Flame Picture	Not satisfactory	8.2.5

STANDARD 8.3 - INSTALLATION OF APPLIANCES

Appliances shall be properly installed and in accordance with the manufacturer's recommendations for installation in vessels.

Appliances shall be secured against accidental movement and connected so that there is no undue stress on pipework and fittings. Pipework shall not be used to retain the appliance.

LPG and fuel oil appliances shall not be installed in petrol engine spaces.

Appliances shall be situated in sufficient space, as instructed by the manufacturer, to prevent overheating of nearby surfaces.

(NOTE: see paragraph 11.27).

Manufacturer's recommendations Appliances shall be properly installed and in accordance with the manufacturer's recommendations for installation in vessels and shall be situated in sufficient space, as instructed by the manufacturer, to prevent overheating of nearby surfaces.

Availability Where installation instructions are available, examiners should consult them as necessary to determine correct installation.

If they are not available examiners must carry out a careful check as indicated in the checking procedure for this fault.

Overheating of adjacent surfaces Even if it can be determined the space around the appliance was in accordance with manufacturer's recommendations, a fault will still be recorded if there are any signs of overheating on adjacent surfaces.

CHECKING Determine each appliance is installed in accordance with manufacturer's recommendations for installation in vessels.

Where these recommendations are not available visually and manually check for:

- signs of scorching, blistering or discolouration;
- signs of rubbing or abrasion;
- not level side to side and/or front to back;
- signs of fuel leakage;

- dirty air vents;
- signs of smoke or soot deposits;
- secured i.e. incapable of movement in any direction unless in gimbals;
- not set flush unless so designed.

FAULTS		
*Appliances	Not properly installed	8.3.1

EXEMPTION 11.27 : SPACE AROUND APPLIANCES

Vessels manufactured prior to 3 January 2000 and having woodwork and all other combustible materials including curtains adjacent to all appliances suitably insulated and protected against excessive heat or inherently flame retardant, or treated with a durable flame retardant are not required to comply with that part of Standard 8.3 which requires appliances to be situated in sufficient space, as instructed by the manufacturer, to prevent overheating of nearby surfaces.

Evidence of treatment or protection of combustible materials

Although it is obvious when combustible materials are physically protected or insulated against overheating, there is no way to determine they are inherently flame retardant or treated with a durable flame retardant. Therefore, even if combustible materials adjacent to the appliance are treated or insulated as prescribed, a fault will still be recorded if they show any signs of overheating.

CHECKING

Visually check that no surface near to the appliance shows signs of overheating such as:

- scorching;
- blistering;
- discoloration;
- smoke or soot marking.

FAULTS		
	*EXEMPTION 11.27 APPLIED	8.3.2

Appliance to be secured

Appliances shall be secured against accidental movement and connected so that there is no undue stress on pipework and fittings.

Pipework shall not be used to retain the appliance.

Warning The appliance must be incapable of movement in any direction.

If appliances overturn, or are allowed to move excessively, there is the danger of:

- fractured fuel lines and spillage of fuel oil and gases;
- fires;
- damage to the appliance and the boat.

Under no circumstances must any part of the pipework be used to retain the appliance and this includes using the pipework as an anchor for hooks, chains or any other securing device.

LPG appliances movable for hygienic purposes An LPG appliance which requires to be moved for hygienic purposes (see 7.12.2) will need to be secured in such a way that it complies with this Standard but at the same time can readily be moved when required.

LPG flexible hoses must be readily accessible (see 7.12.3). This may be achieved by using a securing device which is capable of being released without the use of tools or by providing ready access to the hose from side access panels or similar means.

Securing devices are necessary e.g. hooks and chains but the arrangement must be such that there is no movement when the chain or other device is secured.

Manual checking Examiners must not use excessive force when they check that the appliance is incapable of movement.

CHECKING Manually check the appliance is incapable of unintended movement in any direction.

FAULTS		
Appliance	Not secured	8.3.3

Undue Stress on Pipework Appliances shall be connected so that there is no undue stress on pipework and fittings.

Ensuring that appliances are properly and correctly installed will prevent undue stress on the appliance pipework. Signs of poor practice in this instance may be misaligned pipework, broken securing clips, or insufficient securing arrangements for the appliance.

The appliance connector must never be used to retain the appliance in place.

CHECKING Visually check that appliance is connected to minimise stress on supply pipework and fittings.

FAULTS		
Appliance	Not connected to avoid undue stress on pipework & fittings	8.3.4

Pipework in petrol engine spaces LPG and fuel oil appliances shall not be installed in petrol engine spaces.

Engines installed under cockpit floors A cockpit is not part of the engine space even if the lift-up hatches or boards separating it from the engine space are not fastened down or LPG-tight.

Room-sealed appliances Room-sealed appliances (e.g. some oil fired heaters) may not be installed in petrol engine compartments even if they are also protected by fire retardant enclosures unless the enclosure is sealed from the petrol engine space.

Warning If petrol vapour is introduced to a point of ignition it will immediately ignite and the flame will track back to the source of the vapour.

It could easily start fires along that route and will almost certainly result in serious fire or explosion when the flame reaches the source of the vapour.

CHECKING Visually check no LPG or fuel oil appliance is installed in a petrol engine space. These appliances must be installed in a separate compartment.

FAULTS		
LPG/Fuel Oil Appliance	Installed in petrol engine space	8.3.5

STANDARD 8.4 - INSTALLATION OF COOKING APPLIANCES

Cooking appliances (and gimbals, if fitted) shall be securely installed.

Gimballed cooking appliances shall be secure at all angles of heel.

Materials in the vicinity of cooking appliances shall be non-combustible or protected with a finish of class 1 surface spread of flame rating as specified in BS 476-7.

Combustible materials and materials without a class 1 surface spread of flame rating shall not be placed within the following distances of cooking appliances: *(NOTE: see paragraph 11.28)*

i) 400 mm above the cooking appliance, for horizontal surfaces when the vessel is upright;

ii) 200 mm above the cooking appliance, for horizontal surfaces when the vessel is heeled to 30°;

iii) 125 mm horizontally from the cooking appliance, for vertical surfaces.

Curtains and other suspended textile materials shall not be fitted within 600 mm of a cooking appliance.

(NOTE: see paragraph 11.28)

Security of cooking appliances & gimbals

Cooking appliances (and gimbals, if fitted) must be securely installed.

Gimballed cooking appliances shall be secure at all angles of heel.

Security

Security is checked at 8.3.1.

Gimballed assembly

The gimbal assembly must retain the appliance at all angles of heel.

CHECKING

Visually check the mounting assembly retains any gimballed cooking appliance.

FAULTS		
Gimballed Cooking Appliance	Not secure at all angles of heel	8.4.1

Materials in the vicinity of cooking appliances Materials in the vicinity of cooking appliances shall be non-combustible or protected with a finish of class 1 surface spread of flame rating as specified in BS 476-7.

Non-combustible materials Materials in the vicinity of cooking appliances can be inherently non-combustible or a non-combustible shield or barrier can be secured between the appliance and any combustible material. It would be good practice to have a ventilated air space of not less than 25 mm between the appliance and the combustible surface.

Flame retardants An alternative is to chemically protect the combustible materials with a finish of class 1 surface spread of flame rating as specified in BS 476-7.

Details of the method of testing and classification can be found in the Introduction to Part 8.

As there is no reliable method of determining whether any material is inherently flame retardant or treated with a flame retardant, any signs of heat damage would be an indication that the material was either combustible or was not suitably insulated or protected.

"Formica" type laminated clad surfaces Laminated surfaces can be accepted as a fire retardant when fixed in the vertical position.

In the horizontal position it is acceptable near cookers provided there is a gap of at least 25 mm and it shows no sign of heat damage.

Particle boards A particle board is any type of board made from bonded particles, usually wood (chipboard) but other materials are used e.g. hemp.

All exposed edges of particle boards should always be protected due to the highly flammable nature of the bonding compounds.

CHECKING Visually examine all materials in the vicinity of a cooking appliance for signs of overheating as described in 8.3.1.

FAULTS		
Materials in vicinity of Cooking Appliance	Combustible and not protected as specified	8.4.2

Cooking appliances Combustible materials and materials without a class 1 surface spread of flame rating shall not be placed within the following distances of cooking appliances:

i) 400 mm above the cooking appliance, for horizontal surfaces when the vessel is upright;

ii) 200 mm above the cooking appliance, for horizontal surfaces when the vessel is heeled to 30°;

iii) 125 mm horizontally from the cooking appliance, for vertical surfaces.

CHECKING Determine by measurement all combustible and unprotected materials are not placed within the specified distances from a cooking appliance.

FAULTS		
*Combustible & Unprotected Materials	Distance from cooking appliance not as specified	8.4.3

EXEMPTION 11.28 : PROTECTION OF COMBUSTIBLE MATERIALS

Vessels manufactured prior to 3 January 2000 and having woodwork and all other combustible materials including curtains adjacent to all appliances suitably insulated and protected against excessive heat or inherently flame retardant, or treated with a durable flame retardant are not required to comply with the distance measurements applied to combustible materials and materials without a class 1 surface spread of flame rating.

Note : This exemption applies to woodwork, other combustible materials and curtains and therefore gives exemption from Faults 8.4.3 and 8.4.5.

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Evidence of treatment or protection of combustible materials Although it is obvious when combustible materials are physically protected or insulated against overheating, there is no way to determine they are inherently flame retardant or treated with a durable flame retardant. Therefore, even if combustible materials adjacent to the appliance are treated or insulated as prescribed, a fault will still be recorded if they show any signs of overheating.

CHECKING Visually check that no unprotected surface near to the appliance shows signs of overheating such as:

- scorching;
- blistering;
- discoloration;
- smoke or soot marking.

FAULTS		
	*EXEMPTION 11.28 APPLIED	8.4.4

Curtains	Curtains shall not be fitted within 600 mm of a cooking appliance.
Suspended textile materials	The term ‘curtain’ includes any suspended textile materials, including those used as a screen.
CHECKING	Determine by measurement all curtains and other suspended textile materials are more than 600 mm from any cooking appliance.

FAULTS		
*Curtains	Located within 600 mm of cooking appliance	8.4.5

EXEMPTION 11.28 : PROTECTION OF COMBUSTIBLE MATERIALS

Vessels manufactured prior to 3 January 2000 and having woodwork and all other combustible materials including curtains adjacent to all appliances suitably insulated and protected against excessive heat or inherently flame retardant, or treated with a durable flame retardant are not required to comply with the distance measurements applied to curtains and other suspended textile materials, provided in Standard 8.4.

Note : This exemption applies to woodwork, other combustible materials and curtains and therefore gives exemption from Faults 8.4.3 and 8.4.5.

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Evidence of treatment or protection

Curtains adjacent to a cooking appliance in existing installations may be located within 600 mm of the appliance providing they are insulated, or suitably protected, or inherently flame retardant, or treated with a durable flame retardant.

Although it is obvious when curtains are insulated or suitably protected, there is no way to determine they are inherently flame retardant or treated with a durable flame retardant. Examiners will therefore carry out a careful visual examination of the curtains and a fault will be recorded if they show any signs of overheating.

CHECKING

Visually check that no curtains in the vicinity of a cooking appliance show signs of overheating such as:

- scorching;
- discoloration;
- smoke or soot marking.

FAULTS		
	*EXEMPTION 11.28 APPLIED	8.4.6

STANDARD 8.5 - FLAME SUPERVISION DEVICES

Appliance burners, ignition burners and pilot lights shall be fitted with flame supervision devices that completely close the LPG or fuel oil supply.

(NOTE: see paragraph 11.29).

Flame supervision devices

A flame supervision device incorporates a sensing element which causes the gas or fuel oil supply to a burner to be opened or closed according to the presence or absence of the flame which activates the sensing element.

The sensor may be mechanical e.g. a bimetallic strip, or it may be an electrical device.

The latter produces a micro-current when subjected to the heat of the pilot light which holds open a fail-safe fuel valve.

In both cases, loss of the flame or heat causes the device to shut-off the fuel supply.

CHECKING

Identify each appliance burner, ignition burner, or pilot light and visually check it is fitted with a flame supervision device.

The operation of the device is not checked.

FAULTS		
*Flame Supervision Device	Not fitted to appliance burners, ignition burners and pilot lights	8.5.1

EXEMPTION 11.29 : FLAME SUPERVISION DEVICES

Vessels manufactured prior to 3 January 2000 are not required to comply with Standard 8.5 which requires a flame supervision device to be fitted to all appliance burners provided that such devices are fitted to all:

- catalytic type appliances;
- appliances with a pilot light;
- appliances with a continuously burning flame.

Catalytic appliances

Catalytic appliances shall incorporate a low bed-temperature cut-off device which acts in the same way as a flame supervision device.

Appliances with pilot lights All pilot lights are to be protected by a flame supervision device so that if the pilot light is extinguished for any reason the gas or fuel oil supply is shut-off.

A pilot light is a small burner which ignites main burner by means of a flame.

Continuously burning flames For the purposes of these Standards an appliance with a continuously burning flame is any appliance designed to be left unattended with burners lit. It follows that hobs and grills are excluded from the requirement.

There are two basic types:

- pilot lights;
- the burner(s) which stay alight until the gas or fuel oil supply is turned off e.g. gas refrigerators.

Water heaters Water heaters must always be fitted with a flame supervision device.

Ovens not manufactured with flame supervision devices Ovens manufactured without flame supervision devices and maintained in good condition are acceptable.

Ovens of this type were last made over 20 years ago and manufacturers advise that they should be replaced.

Gas lights For existing boats, it is not necessary for gas lights to be fitted with a flame supervision device.

All other appliances must comply with the Standard.

CHECKING Identify all appliances of the types listed in the exemption and visually check a flame supervision device is fitted to all burners.

FAULTS		
	*EXEMPTION 11.29 APPLIED	8.5.2

STANDARD 8.6 – WATER INLET TO INSTANTANEOUS WATER HEATERS

The water inlet to any instantaneous water heater shall be piped only from the vessel's cold water system.

Instantaneous water heaters - operation

Instantaneous water heaters are designed to raise the temperature of water supplied to them rather than heat the water to a pre-determined level.

If the supply were taken from the hot water system, there is a danger of producing dangerously hot water, even steam, if pre-heated water is admitted to the appliance.

It is even more dangerous where a dual hot water system is installed, for example where a calorifier connected to the engine cooling system heats water in a storage tank.

CHECKING

Visually and manually follow the route of the inlet pipe from any instantaneous water heater until a direct connection to the cold water supply of the vessel is established.

FAULTS		
Water Inlet to Instantaneous water heater	Not piped directly from cold water supply	8.6.1

STANDARD 8.7 - FUEL OIL APPLIANCES - SHUT-OFF VALVES
Fuel oil appliances shall have a valve or cock to shut off the fuel supply in a readily accessible position within the same compartment as, but at a safe distance from, the appliance(s).

Requirement to fit a shut-off valve

Fuel oil appliances shall have a valve or cock to shut off the fuel supply.

Installation

Standard 2.17 requires that all fuel feed pipes shall be fitted with a shut-off cock or valve as near as possible to the fuel tank and this Standard requires that all fuel oil appliances be installed with a shut-off valve.

If a single valve or cock is acting as both tank and appliance shut-off valve, it must comply in all respects with the requirements of Standard 2.17.

An on/off valve on the appliance itself does not satisfy the requirements of this Standard, unless the fuel container is built into the appliance or is close coupled.

Use of metering pump as a shut-off valve

The metering pump to a fuel oil appliance may act as the shut-off valve at the appliance if it can be determined that the metering pump shuts off the fuel supply when the control units shuts the appliance down.

CHECKING

Identify any fuel oil appliance and visually check for presence of valve or cock used to shut off the fuel supply.

FAULTS		
Fuel Oil Appliance	No shut off valve/cock	8.7.1

Accessibility

Fuel oil appliances shall have a valve or cock to shut off the fuel supply in a readily accessible position.

The shut off valve or cock is to be readily accessible so there is no delay caused by trying to gain access in case of emergencies.

CHECKING

Visually check each valve or cock is readily accessible.

FAULTS		
Fuel Oil Appliance	Shut-off valve/cock not readily accessible	8.7.2

Location in same compartment

Fuel oil appliances shall have a valve or cock to shut off the fuel supply in a readily accessible position within the same compartment.

The valve or cock shall normally be situated in the same compartment so there is no delay in reaching it in case of emergencies.

However, there may be installations where it is not physically possible to install the cock or valve in the same compartment, for example where:

- the appliance is installed on a bulkhead between compartments;
- there is less than about 1 m of fuel pipe in the same compartment into which the cock or valve can be fitted.

In these cases it would be acceptable for the cock or valve to be installed at the nearest practicable point.

There may also be situations where the cock or valve would be too close to the appliance if installed in the same compartment and in these cases, locating the valve or cock at a safe distance takes priority.

CHECKING Visually check the valve or cock is located in the same compartment as the appliance.

FAULTS		
Fuel Oil Appliance	Shut off valve/cock not within same compartment	8.7.3

Location at safe distance Fuel oil appliances shall have a valve or cock to shut off the fuel supply in a readily accessible position within the same compartment as, but at a safe distance from, the appliance(s).

Although the shut off valve must be immediately accessible and should be in the same compartment, it must be positioned at a safe distance so the fuel supply can be turned off in the event of a fire at the appliance itself making it impossible for the appliance controls to be reached.

Positioning the valve at a safe distance should take priority over installing it in the same compartment.

As a guide, the shut-off valve should not be positioned within 500 mm horizontally and 1 m vertically of the appliance.

CHECKING Visually check the valve or cock is at a safe distance from the appliance.

FAULTS		

Fuel Oil Appliance	Shut-off valve/cock not at safe distance	8.7.4

STANDARD 8.8 - FLUES ON ROOM SEALED APPLIANCES

Flue components on room sealed appliances, including ductwork and terminals, shall be installed in accordance with the appliance manufacturer's recommendations for installations in vessels.

Flue terminals and air inlets shall not be positioned within 500 mm of a ventilator, opening port, hatch, window, refuelling fitting, or fuel tank vent outlet.

Flues and flue terminals shall ensure safe transfer of gases to outside the vessel, away from areas that could be enclosed by canopies and in a position that minimises the risk of accidental damage.

(NOTE 1: Information regarding the test employed to check the effectiveness of any flue is contained within BS 5482-3 and the Boat Safety Scheme Technical Manual).

(NOTE 2: The flueing arrangements on existing appliances are covered in paragraph 11.25(v)).

Note : The flueing arrangements on existing appliances, including the fault descriptions and checking procedures, can be found at 8.2.2 (g) to 8.2.2 (l) above.

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Manufacturer's recommendations

Flue components on room sealed appliances, including ductwork and terminals, shall be installed in accordance with the appliance manufacturer's recommendations for installations in vessels.

Where the appliance manufacturer's recommendations do not exist or are not available, installations should be in accordance with equipment/component manufacturer's instructions or appropriate codes of practice.

CHECKING

Determine the flue of any room-sealed appliance is installed in accordance with manufacturer's recommendations for installation in vessels or equipment/component manufacturer's instructions or appropriate codes of practice.

Where this cannot be determined, visually and manually check the flue components:

- are complete
- serve only one appliance

FAULTS		

Flue Components	Not properly installed.	8.8.1

Position of terminals & air inlets Flue terminals and air inlets shall not be positioned within 500 mm of a ventilator, opening port, hatch, window, refuelling fitting, or fuel tank vent outlet.

Existing room sealed appliances The flueing arrangements for existing room sealed appliances are covered in exemption 11.25 v).

For appliances installed before 3 January 2000 the distance between flue terminals and air inlets and ventilators, openings and refuelling fittings and outlets is not to be measured.

Warning The position of terminals must be such that:

- flue gases cannot re-enter the boat through any of the openings listed in the standard;
- fuel vapours cannot enter the combustion chamber of the appliance by being drawn in through the air inlet being too close to a source of fuel vapour.

CHECKING Determine the appliance was installed after 3 January 2000.

Determine by measurement flue terminals/air inlets are not positioned within 500 mm of any:

- ventilator;
- opening port;
- hatch;
- window;
- refuelling fitting;
- fuel tank vent outlet.

FAULTS		
Flue Terminal/Air Inlet	Positioned within 500 mm of specified locations	8.8.2

Safe transfer of flue gases Flues and flue terminals shall ensure safe transfer of gases to outside the vessel.

CHECKING Visually check in the vicinity of the flue for signs of leaking flue gases such as:

- heat damage
- smoke damage
- soot deposits

With the appliance working and taking great care, manually check that flue gases are not issuing from any part of the flue into the interior of the boat.

The leaking of combustion products into the interior of the vessel is a dangerous situation and the examiner is to take the action described in Appendix B for a fault that requires the gas supply to the appliance to be disconnected.

FAULTS		
Flue/Flue Terminal	Does not ensure safe transfer of gases to outside of vessel	8.8.3

Termination under canopies

Flues and flue terminals shall ensure safe transfer of gases to outside the vessel, away from areas that could be enclosed by canopies.

The flue terminal must be sited outside the vessel. Terminating flues in areas that could be enclosed by a canopy is not permitted.

When a canopy is erected, the space it encloses is regarded as not being outside the vessel for the purpose of this Standard. This applies irrespective of how many 'openings' there are between the canopied area and the outside air.

CHECKING

Visually check any flue terminal is outside the vessel.

Visually check any flue terminal is away from areas that could be enclosed by canopies.

FAULTS		
Flue Terminal	Not outside the vessel away from areas that could be enclosed by canopies	8.8.4

Accidental damage

Flues and flue terminals shall be in a position that minimises the risk of accidental damage.

CHECKING

Visually check terminal for any signs of physical damage.

Visually check flue pipes and flue terminals for signs of:

- damage;
- crushing or distortion.

FAULTS		
Flue Terminal	Not in a position that minimises risk of damage	8.8.5

STANDARD 8.9 - VENTILATION REQUIREMENTS

Adequate fixed ventilation shall be provided in accordance with the requirements of BS 5482-3 in vessels in which LPG or other fuel appliances are used.

(NOTE: Ventilators should be weathertight to cater for the worst conditions likely to be encountered. Vessels which regularly proceed to sea and would likely experience severe weather conditions may have ventilators which can be closed to prevent the ingress of water in such conditions).

On sea going vessels equipped with closeable ventilators a warning notice shall be attached on or near to all non-room sealed appliances. The wording of the notice should state:

"WARNING - Open ventilator(s) before use"

Ventilation requirements

Adequate fixed ventilation shall be provided in accordance with the requirements of BS 5482-3 in vessels in which non-room sealed LPG or other non-room sealed fuel appliances are used.

Fixed ventilation

Ventilators must not be of a type which can be closed or restricted in any way which would affect their effectiveness by reducing the area of clear air opening required by the Standards.

Windows, doors, hatches and any openings which can be fully closed must not be included in the ventilation calculations.

Ventilators which have been modified so they cannot be closed without the use of tools are acceptable, providing they are secured in the open position.

Factors affecting effective area

Ventilators which can be fully closed should not be included in the calculation.

Devices with adjustable opening should only have their minimum area included in the calculation. This will be zero if it can be fully closed.

Careful examination must be made of each ventilator to determine the presence of any device which would reduce the clear air opening e.g. filter, insect screen.

Where filters or screens are fitted, they must also be in a clean and serviceable condition as partial or complete blockage of the clear air openings could make the ventilator totally ineffective.

Louvered doors are a common form of providing permanent ventilation and the effective area needs to be carefully measured.

The minimum effective area of fixed ventilation is designed to provide:

- combustion air for appliances that are not room-sealed;
- for the evacuation of combustion products from appliances that are not room sealed;
- renewal of fresh air for habitation and comfort.

Calculation of ventilation requirements

The formula used to calculate fixed ventilation is derived from BS 5482-3 Annex B and its use is extended by the Boat Safety Scheme to cover all fuel burning appliances.

The minimum effective area of total fixed ventilation should never be less than 4000 mm^2.

The formula for calculating the fixed ventilation ($mm^{2)}$ is as follows:

minimum effective area = [2200 x U] + [650 x P] + [440 x F]

where:

U = input rating for all unflued appliances (inc. cookers) (in kW)
P = number of persons for which the accommodation space is designed
F = input rating for all open flued appliances (in kW)

The required calculation is to be specifically made for each installation with reference to appliance input ratings taken from manufacturer's plates, manuals or accumulated reference lists. It is not acceptable or appropriate to estimate or guess ventilation requirements.

Examiners will retain a written record of the ventilation calculation for each examination made. The record will detail all appliances and ratings and whether flued or not.

Closed flue appliances

The input rating for all closed flue appliances must be included in "F" when making the calculation.

Solid fuel stoves

In the absence of manufacturer's details, an input rating of 3 kW may be assumed as forming a reasonable basis for the minimum ventilation requirement for solid fuel stoves.

Application The calculation should be applied to any part of the vessel containing a fuel burning appliance that:

- is normally divided as a separate compartment;
- can be temporarily divided except by curtaining.

High & low level ventilation The ventilation should be divided equally between high and low level.

Low level ventilation can be achieved by spillage of cold air from vents in doors and/or bulkheads or by means of ducting from a higher level.

Minimum requirements The dimensions produced by the calculation (or 4000 mm^2 whichever is the greater) are strictly the minimum requirements.

Provision of fixed ventilation does not displace or reduce the normal adjustable ventilation provided by openable windows, port holes, roof lights, or hatches but the area of this type of ventilation must not be included in the minimum area required for fixed ventilation.

Note to Standard 8.9 Ventilators should be weathertight to cater for the worst conditions likely to be encountered. Vessels which regularly proceed to sea and would likely experience severe weather conditions may have ventilators which can be closed to prevent the ingress of water in such conditions.

The Note to Standard 8.9 allows a closeable ventilator to be included in the area of minimum requirements but it is normally only available for a vessel which is capable of regularly proceeding to sea.

This will particularly apply where it would be unsafe to commence passage with certain types of ventilator open to the elements.

This invariably means that in conditions where the vessel is likely to ship water through the ventilators, they will have to be capable of being closed.

These types of vessels can be identified by the presence of such things as:

- navigation equipment;
- weather tight decks and hatches.

Vessels normally operating on inland waterways It is unlikely that any vessel which operates on inland, non-tidal waterways will encounter weather conditions which would make it necessary to close the ventilators.

If such vessels make an occasional sea passage, the fixed ventilation must be made weathertight for those occasions rather than equip the vessel with ventilators which can be closed.

CHECKING Calculate the ventilation requirements in accordance with Annex B of BS 5482-3.

Determine by measurement and calculation the effective area of fixed ventilation.

Confirm that the effective area is divided equally between high and low level vents.

No ventilator which can be closed without the use of tools must be included in the calculations unless Note 8.9 applies.

FAULTS		
Fixed ventilation	Not in accordance with BS 5482-3	8.9.1

Warning notice on sea going vessels On sea going vessels equipped with closeable ventilators a warning notice shall be attached on or near to all non-room sealed appliances. The wording of the notice should state:

"WARNING - Open ventilator(s) before use"

CHECKING Visually check for presence of warning notice on or near to all non-room sealed appliances.

Visually check warning notice reads *"WARNING - Open ventilator(s) before use"*.

FAULTS		
Ventilator	No warning notice displayed as specified	8.9.2

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Part 9

POLLUTION

PART 9 POLLUTION - INTRODUCTION TO BOAT SANITATION SYSTEMS

BS MA 101 AND ASSOCIATED STANDARDS

BS MA 101

The principle requirements of BS MA 101 "Toilet retention and recirculation systems for the treatment of toilet waste on small craft" are as detailed below.

Use Of Deodorants And Chemical Products

Where deodorants and chemical products are used in sanitary installations, product information is to be prominently displayed in a permanent form.

Deodorants are to constitute a minimum hazard when handled, stored, and used in accordance with manufacturer's instructions.

Materials

All materials used in the installation are to be capable of withstanding the corrosive effects of the contents and the environment in which it is fitted.

Design & Construction

The system is to:

- be capable of operation under heeled and pitched conditions
- be of sufficient strength for safe operation
- be provided with a means for venting dangerous gases
- preclude the possibility of back syphoning
- prevent the escape to the interior of the vessel of:
  - liquids and sewage
  - fumes (explosive, toxic, malodorous)
- be free of design defects
- be readily accessible for routine servicing
- be provided with a means for indicating when the tank is 75% full

Disposal Equipment

The system shall be designed for the efficient removal of nearly all the solids and liquids in the holding tank.

Where baffles are fitted in holding tanks, they shall have openings to allow liquid and vapour to flow freely across the top and bottom of the tank.

The system is to be equipped with a 1½" BSP (ISO G1½) threaded sewage removal fitting clearly marked to identify its use.

Installation, Operation & Maintenance

All piping and hose shall be smooth bore with a minimum internal diameter of 38mm.

Arrangements are to be made to prevent the accidental or unauthorised operation of valves.

The final overboard valve is to be capable of being sealed.

The holding tank is to be placed as low as is practicable.

Instructions For Installers

Manufacturers are to provide instructions for installation and operation. These are to include:

- the maximum hydrostatic pressure for tanks designed to operate under pressure

- the maximum operating level for liquid containers

- whether the system is designed to operate in association with salt, fresh, or brackish water

Information Leaflet

The manufacturer is to provide a leaflet giving the following details:

- manufacturer's name
- system identification details
- service and maintenance instructions
- operating instructions

Operating Instructions

A placard is to be permanently displayed giving operating instructions and safety precautions in lettering not less than 3mm high.

Identification

A nameplate shall be displayed on the system giving the following details:

- manufacturer's name
- name and model number of the system
- serial number
- date of manufacture
- the appropriate BS, EC, or ISO standard

ASSOCIATED STANDARDS

BS 2081

BS 2081 1980 and BS 2081 1981 cover both portable toilets and fixed toilets using chemicals.

They are intended primarily for manufacturers to ensure that these toilets are safe and satisfactory in use.

BS 2893

BS 2893 is a performance standard for toilet chemicals and does not address environmental or safety issues.

MARINE SANITATION DEVICES (MSD)

There are basically two types of MSD in use:

- those approved by the International Marine Organisation (IMO) for overboard discharge of treated waste in all areas unless any discharge is specifically prevented by local bye-laws

- non-IMO approved systems applicable only in the United States for vessels under 65 feet which are allowed to discharge disinfected toilet waste, subject to the MSD having been approved by the US Coastguard.

BS MA 84 (ISO 4567)

The requirements of BS MA 84 (ISO 4567) for deck fittings are:

- the throat of the fitting, to the minimum diameter of the thread, is to extend below the thread and contain an O-ring to seal the probe connector
- the pump out fitting cap, and rinse out cap if fitted, is to have a release mechanism which accepts a hexagon key
- the deck fittings are to be identified by clearly marked, permanent labels

NOTE: ISO 8099 requires that pump out fittings be identified with the "pump out symbol" but in the UK, written labels "Pump Out" and "Rinse Out" are satisfactory.

Threaded Deck Connectors To Previous Standards

Connectors made to the old ISO standard can connect to the new standard quayside probe by means of a screw-in connection adapter.

UK boatyards tend not to have these adapters available as UK boats are usually fitted with fittings which do not require the connector.

Owners of boats visiting from abroad, or imported boats, are advised to carry one of these adapters on board.

OVERBOARD DISCHARGE

FIG 9.1

Portable and recirculating systems are, by definition, closed systems, and dump-through toilets are rarely used for overboard discharge.

All other toilets can be used to discharge overboard and/or to a remote holding tank.

Increasingly, overboard discharge is not permitted so boats fitted with systems which can discharge overboard are to be provided with a means of sealing the system.

An understanding of the various systems and their plumbing arrangements is necessary to know where and how the system may be sealed.

DESIGN SOLUTIONS

FIG 9.1

Systems can be designed so that they can discharge overboard or to a holding tank or both.

The lay-out of such a system is shown in Figure 9.1 for a toilet fitted above the waterline.

The basic unit is a "sea toilet" which discharges via a diverter valve:

- directly into a holding tank
- overboard through a sea cock fitted in the hull below the waterline

In this installation, there are also two ways to empty the holding tank:

- to a shore installation
- through the toilet overboard discharge sea cock

A diaphragm pump is installed for the purpose but other arrangements are possible.

In dual-purpose systems such as this, overboard discharge would be prevented by sealing the discharge sea cock so that the toilet could still be used by discharging to the holding tank.

It would also be prudent to guard against inadvertant operation of the diverter valve when set for discharge to the holding tank.

TOILET SYSTEMS - COMPONENTS

Sealing Valves

The seacock can be sealed with a wire tie and compressed seal to prevent unauthorised removal.

The diverter valve can be secured by padlock, heavy tape, non-resealable wire tie, or by removing the handle.

The final valve in the system is the one navigation authorities require to be sealed but the sealing or securing of other valves in the system is required to prevent inadvertent operation which could damage the system by operating the toilet against closed valves which can rupture pipework and damage pumps.

Syphon Protection

Syphon protection will depend on whether the toilet system is fitted above or below the water-line.

Below Water-line Systems

Toilet systems below the water-line which are capable of overboard discharge need to be designed to prevent inward syphoning and flooding of the boat.

If flotation water is used for flushing, a vented loop must be installed as shown in.

Above Water-line Outlets

Outlets are to comply with the requirements of Part 10 of these Standards which states that openings shall be positioned so that the lowest point is not less than 250mm above the water-line.

In these circumstances, providing the internal plumbing is a closed system in sound condition there would not necessarily be a need for syphon protection, although there must always be a seacock.

If the system is not closed, an anti-syphon device must be fitted.

Some toilets discharging overboard from a below waterline position do not include an anti-syphon device but rely on the valves of the discharge pump to prevent syphoning. If these valves do not seat properly for any reason there is no protection.

A vented loop should be included to prevent this happening.

Holding Tank Vent Pipes

The internal diameter of the vent pipe must be at least 38mm (1½").

If it is lower than this negative pressure can be created in the tank and cause an implosion.

The pipe must be reinforced to provide vacuum resistance.

Where the internal diameter cannot be measured an estimate can be made by measuring the external diameter which should be at least 51mm.

The pipe must be installed in a way that:

- prevents debris, snow, or ice entering the open end
- drooping or sagging

Holding tank systems not using odour controlling agents may have a vent pipe filter installed. These do not restrict the air flow but water must not be allowed to enter as it will damage the element.

Hoses

The interior of pipes and hoses is to be as smooth as possible and have an internal diameter of not less than 38mm.

Pipe runs should be as short and direct as possible but should not be excessively tight which would place undue strain on joints and connections.

Modern sanitation hose prevents odours from permeating the walls but non-sanitation grade does not.

This is often the cause of unnecessary searches for leaks where sewage lies in contact with the inside walls.

Most macerator toilets are designed to discharge through hoses of 25mm internal diameter which is acceptable.

Mountings & Fixings

All components in the system must be securely fixed to resist the stresses and strains on them caused by such things as:

- vibration
- pitching and rolling
- heeling or listing
- emergency manoeuvres

Tanks should be secured by appropriate methods e.g.:

- straps
- brackets
- framework

No part of the installation should rely for location and support on the clips securing pipework to the structure of the boat.

Careful attention should be paid to all fastenings, bolts, and screws to ensure that they are sound and properly engaged.

Holding Tank Level Indicators

A level indicator must be fitted to show when the tank is 75% full.

A glass sight gauge may be used if the tank is suitably positioned.

If the sides of the tank are translucent and the level can readily be seen this will be acceptable.

Dip stick arrangements are not permitted, nor is any method which relies on visual assessment through any fitting in the top of the tank.

Sharp Edges

Particular attention should be paid to avoiding sharp edges anywhere in the system which could cause personal injury during routine operation, cleaning and maintenance, especially in the vicinity of operating handles and levers.

These can occur throughout the system, for example:

- fixings and fastenings which have been damaged by the use of incorrect tools
- badly cut or finished edges of pipework and materials used in the installation

OTHER INSTALLATION CONSIDERATIONS

LEAKS

Nearly all leaks can be detected visibly and care should be taken not to be misled by sewage smells.

If there is a leak of gas or odour, it is usual for it to be accompanied by a fluid leak.

If the actual source of the leak cannot be seen, stains can usually be detected on other parts of the installation in the vicinity.

CORROSION

The system must be free from corrosion, particularly at hose clips, joints and fixings.

Holding tanks made of non-corrodable materials such as plastics, stainless steel or fibreglass are likely to remain sound for the life of the boat.

Tanks made of mild steel should be examined carefully.

Flexible tanks also need careful examination for any signs of chafing, damage or deterioration.

DISCHARGE OF TANK CONTENTS

The system is to be capable of discharging at least 75% of its contents to the pump out station.

The outlet needs to be positioned close to the bottom of the tank and a loop formed in the outlet pipe where the take-off is in the side will ensure the tank empties completely.

STANDARD 9.1 - SANITATION SYSTEMS
No sanitation system capable of discharging sewage overboard shall be fitted in any vessel unless it is capable of being sealed or rendered inoperable. Sanitation systems shall comply with the requirements of BS MA 101. [see paragraph 11.20]

PREVENTING OVERBOARD DISCHARGE

All systems are capable of being rendered inoperable by some means.

This can be achieved by:

- preventing overboard discharge by locking or sealing the appropriate valves or seacocks
- preventing the use of the system by securing the toilet bowl/lid assembly by means of heavy-duty tape etc

Surveyors/examiners are not required to:

- seal or render systems inoperable
- demonstrate that the system does not discharge overboard

The presence of a system which can discharge overboard is not a failure point.

CHECKING

Visually identify sanitation system capable of discharging sewage overboard.

Surveyors/examiners should make a note in their own records of the type of system installed (if any). No further action is necessary.

FAULTS		
Sanitation System	Not capable of being sealed or rendered inoperable	9.1.1

COMPLIANCE WITH BS MA 101

At present, compliance with BS MA 101 will not be checked during the Boat Safety Examination.

FAULTS		
*Sanitation System	Sanitary system does not comply with BS MA 101	9.1.2

EXEMPTION 11.20

Vessels manufactured prior to 16 June 1998 are not required to comply with that part of Standard 9.1 which requires that sanitation systems shall comply with the requirements of BS MA 101.

FAULTS		
	*EXEMPTION APPLIED	9.1.3

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Part 10

Hire boats/Unregulated passenger boats

PART 10 : HIRE BOATS/ Unregulated passenger boats

APPLICATION

In addition to the standards specified in Parts 1-9 inclusive where applicable, all boats which are let out for hire or reward and unregulated passenger boats shall comply with the following additional requirements.

Existing privately owned boats cannot be failed on the Standards in Part 10.

However, these standards are good practice and boat owners are strongly recommended to comply.

Unregulated passenger boats

Passenger boats which carry less than 12 passengers are not currently regulated under Merchant Shipping legislation but a Code of Practice is currently under development by the Maritime & Coastguard Agency and others.

STANDARD 10.1 - LIFEBUOYS

At least one lifebuoy shall be carried on each vessel in a readily accessible position.

LIFEBUOYS

The type in general use is the 610mm (24") lifebuoy, which provides buoyancy for one person.

A 760mm (30") version is produced which supports the weight of 2 persons.

They are usually made in three colour-ways:

- all orange
- all white
- red/white quarters

Approved Lifebuoys

Only the orange lifebuoy is approved by the Marine Safety Agency (MSA), for reasons of visibility, provided it meets with the construction, performance, and marking regulations for lifebuoys found in Schedule 9, Part II of the Merchant Shipping (Life-Saving Appliances) Regulations 1986.

In summary, these regulations state that a lifebuoy shall be :

- constructed with proper workmanship and materials
- of a highly visible colour
- fitted on each side at 4 evenly spaced points with a piece of retro-reflective material 50mm x 100mm
- of not less than 610mm outer diameter, and not less than 350mm inner diameter
- constructed of inherently buoyant material
- shall not depend on inflation for buoyancy
- of weight not less than 1.3kg
- fitted with a grabline not less than 6mm in diameter and of length not less than 4 times the outside diameter, secured at 4 equidistant points around the circumference to form 4 equal loops

Retro-reflective Tape

Retro-reflective tape is a 50mm silver, highly reflective tape marked MSA, which uses tiny glass beads encapsulated in flexible weather resistant plastic to give much higher brightness than conventional reflective materials even when wet.

Types The principal types of lifebuoy in use are:

- the closed ring
- the horseshoe

The horseshoe-type is no longer approved by MSA and indications are they are no longer manufactured. They are still in use but MSA-approval is not a FAULT criterion.

The following are not classified as lifebuoys:

- tyres
- inner tubes or any other inflatable object
- empty containers
- undefined “floating” objects made from wood, polystyrene and similar materials

Objects of this kind may float, and they may support the weight of a person in water, but they are not lifebuoys.

CHECKING Visually check that at least one lifebuoy is carried.

FAULTS		
Lifebuoy	Not provided	10.1.1

ACCESSIBILITY Lifebuoys must be carried in a readily accessible position as defined in the Glossary to the Boat Safety Standards.

CHECKING Visually check that at least one lifebuoy is carried in a readily accessible position.

FAULTS		
Lifebuoy	Not carried in a readily accessible position	10.1.2

STANDARD 10.2
FITTING OF HANDRAILS AND GUARDRAILS TO WALKWAYS

Where there are walkways, handrails of adequate strength shall be fitted where practicable for the full length of all cabin tops, or guard-rails shall be fitted around the perimeter of the deck.

WALKWAYS A walkway is any part of the external, exposed deck along which people may normally move from one part of the boat to another, whether it was designed for use as a walkway or not.

The following are not classified as walkways under Standard 10.2 :

- the stern area/steering position of narrowboats with aft cabins
- cabin tops
- cockpits
- wells in the deck

HANDRAILS A handrail is a rail fixed to cabin tops or other structures to provide a secure grip for members of the crew.

They may be an integral part of the cabin top providing the can be gripped securely.

GUARD-RAILS Guard-rails are horizontal, protective rails of adequate strength and length, on or around the perimeter of the deck or walkway, connected to the deck or walkway by stanchions.

The space between the top rail and the deck may be filled by:

- intermediate rails
- canvas or other material
- netting (known as “dodgers”)

The minimum recommended height of the top rail is 610mm (24")

The rails may be of 2 types :

- RIGID:
    - metal e.g. steel, aluminium
    - timber

- FLEXIBLE:
    - ropes
    - wires
    - chains

PRACTICALITY It may not be practicable to fit handrails and guard-rails to:

- sailing yachts where they interfere with the running of the boat
- steering positions (particularly on traditional narrowboats)
- any part of the cabin top over which a sliding portion moves
- cockpits, hatches and other openings
- cockpit hoods

- ventilators
- drainage structures

CHECKING Visually check that hand/guardrails are fitted where required.

FAULTS		
Hand/guardrails	Not fitted	10.2.1

STRENGTH Handrails and guard-rails must be of adequate strength.

Handrails and the stanchions supporting guard-rails should be securely fixed to the part of the permanent structure of the boat and the mounting plates should be re-inforced.

The load should be spread by attachment where possible to:

- a deck beam
- a beam forming part of the superstructure

In all cases, welding (in the case of metal cabins and decks) or bolts should be used. The fixing of mounting plates etc into the cabin or deck by means of screws is not recommended.

Tensioning Devices Where cables are used they must be taut or there must be a means of keeping them taut by a tensioning device.

These criteria also apply to any intermediate rails or structures.

CHECKING Manually check all rigid handrails and guardrails for movement

Manually check the supports or stanchions of all flexible guardrails for movement.

Visually check all handrails and guardrails, including supports, fixings, and fastenings for signs of:

- corrosion
- fracture
- damage or deterioration

FAULTS		
Hand/guardrails	Not of adequate strength	10.2.2

LENGTH Where there is a gap, it should be possible for any person to reach the next section of the handrail while still retaining a firm grip on the previous section.

CHECKING Visually check length of handrails and guardrails in relation to area to be protected.

FAULTS		
Hand/guardrails	Not of adequate length	10.2.3

STANDARD 10.3
HULL OPENINGS ABOVE N.L.W.L., SELF DRAINING COCKPITS & WEEDHATCHES

Every opening in the hull of a vessel above the normal laden water-line (including those used as intakes or outlets for air for engine cooling purposes) shall be so positioned that its lowest point is not less than 250mm (10 ins) above the normal laden water-line of the vessel, unless such openings are permanently and securely connected to ducts or pipes which are watertight up to that level.

i) Self draining cockpits are not required to comply with the 250mm height requirement of this Standard so long as effective arrangements are made to minimise the ingress of water into other parts of the hull by incorporation of non return valves in the drains and/or by provision of bulkhead(s) or sill(s) to a height of 150mm.

ii) A weed hatch if fitted shall have a cover at least 150mm (6") above the normal laden water-line and shall be watertight when secured.

Weed hatch - definition
Any opening above the propeller(s) is a weed hatch for the purpose of this Standard and must be fitted with a cover as specified.

Weed hatch - removal of cover
To assist the surveyor/examiner, the owner (or representative) may remove the weed hatch cover as part of the pre-examination preparation or during the examination, but this is not a fault if it is not done.

NORMAL LADEN WATER-LINE (n.l.w.l.)

Boat In The Water
The waterline observed can be taken as the n.l.w.l., providing no attempt has been made to “lighten” the boat and reduce the draft by:

- removing any part of the structure, fittings, or equipment (particularly heavy items such as gas bottles)
- emptying any tanks in whole or in part

Boat Out Of The Water
The n.l.w.l. will have to be determined by :

- inference e.g. a “tidemark”; the level of anti-fouling
- documentary evidence e.g. boatbuilder’s specification; owner’s manual

TYPES OF OPENINGS
Openings above the n.l.w.l. are required in the hull for the following purposes : **FIG 10.1**

- waste water outlet
- sewage outlet

- engine exhaust outlet
- air intake/outlet for air-cooled engines
- vents e.g. gas lockers, fuel tanks, battery compartments, sewage holding tanks

WATER-TIGHTNESS

Ducts or pipes are watertight providing they:

- are permanent
- are secured
- do not admit water to the interior of the boat under any conditions which the boat may encounter

Permanent Ducts

Permanent ducts or pipes are connected at all times.

Temporary connections e.g. portable pumps would not be acceptable.

Flexible Hoses

Where flexible hoses are used, they are to be secured by means of hose clips complying with BS 5315 and "push fit" arrangements are not acceptable.

Connection to Watertight Structures

If an opening in the hull less than 250mm above the n.l.w.l is connected to any locker, compartment or similar structure which could hold water, it will be accepted as watertight providing that structure is watertight to at least 250mm above the n.l.w.l.

The locker or compartment need not be watertight above that level which would permit an open-topped shower tray, for example, to be connected to such an opening providing the top of the tray was not less than the prescribed height.

An opening in the hull to vent a gas locker could also be below the 250mm mark providing the gas locker was watertight to at least this level.

CHECKING

Measure height of all hull openings.

For any opening less than 250mm above n.l.w.l, visually and manually check, where possible, that:

- a duct or pipe is fitted and the routing of the duct or pipe takes it to a height not less than 250mm above the n.l.w.l
- the duct or pipe must be permanent and secure and there must be no signs of leaks at connections or in the immediate vicinity

FAULTS		
Hull Opening	Lowest point not positioned greater that 250mm above normal laden waterline nor is it watertight up to 250mm	10.3.1

SELF-DRAINING COCKPITS

Cockpits may be drained by :

FIG 10.2

- holes in the hull
- rigid pipes
- hoses
- anchor hawse pipes
- locker drains
- bilge pumps

These openings should be protected against the ingress of loose objects by means of a grill cover etc.

Non-Return Valves

A non-return valve is a valve in a pipe-line which automatically closes if the direction of fluid flow is reversed.

The 3 types of non-return valve in general use are:

- flap valve
- clack valve
- floating ball valve

These valves prevent the flow of water into the interior of the boat should the opening into which they are fitted become submerged.

Sills

A sill is a vertical barrier intended to prevent the entry of water into the boat.

They are located across any entrance to the interior of the boat.

Some are designed to be removed but the mounting arrangements will always be visible.

Bulkheads

A bulkhead is any wall of a compartment in the interior of a vessel which is not formed by the side of the vessel.

They may serve as:

- partitions between compartments
- part of the main structure

Their purpose is:

- safety
- strength
- reinforcement
- to create accommodation areas

CHECKING Identify self draining cockpit and determine height above waterline.

If height less than 250mm, visually check for presence of non-return valves.

If non-return valves not fitted, measure height of any sill(s) and bulkhead(s) and confirm height is at least 150mm above the level of the cockpit deck.

FAULTS		
Hull Opening	Self draining cockpit opening not approved	10.3.2

WEED HATCHES Where a weed hatch is fitted, it shall :

- have a cover at least 150mm (6") above the n.l.w.l.
- be watertight when secured

HEIGHT OF WEED HATCH COVER The weed hatch cover is NOT to be removed in order to measure the height above the n.l.w.l. **FIG 10.3**

The method of measuring the height will depend on whether the boat is in or out of the water. Two possible methods are described below.

Boat In Water Measure the height, inside the boat, of the top of the hatch above the bottom of the hull, and subtract the height of the n.l.w.l. measured outside the boat.

Boat Out Of The Water The same method can be used or, if access is possible, the height of the cover can be measured directly via the weed hatch opening from outside the boat.

CHECKING Identify presence of weed hatch and, if present, verify that cover is watertight and is at least 150mm (6”) above n.l.w.l.

FAULTS		
Weed Hatch Cover	Cover not at least 150mm above normal laden waterline	10.3.3

WATER-TIGHTNESS The weed hatch cover is NOT to be removed for purposes of deciding if it is watertight.

The hatch may be judged to be watertight if fitted with :

- a means of securing the cover such as bolts, nuts, clamps
- a gasket between the cover and the hatch

The securing mechanism and gasket must be :

- complete with no missing components, or fastenings
- free from corrosion, damage, or deterioration

SAFETY The weedhatch cover, which is above the water level when the boat is stationary, may be subject to considerable water pressure once the boat is underway and must always be watertight.

Covers which are not watertight because they are either defective or have not been replaced and secured properly, are a common cause of flooding or even sinking.

As the ingress of water does not occur until the boat is underway and the weedhatch cover may not be visible, water can enter the boat for some time before the condition becomes apparent.

CHECKING Visually check for signs of damage and deterioration to:

- fastenings including any nuts and bolts
- gaskets

FAULTS		
Weed Hatch Cover	Not watertight when secured	10.3.4

STANDARD 10.4 - HULL OPENINGS BELOW N.L.W.L.

Every opening in the hull of a vessel below the normal laden water-line provided for use as an intake for water shall be fitted with an adequate valve or cock directly adjacent to it and be readily accessible for immediate use.

RECOGNITION Unless the boat is out of the water, they can only be identified by locating the associated equipment or installation and tracing the intake pipe back to the opening in the hull.

Water intakes include :

- cooling of engines, bow thrusters, generators
- sea-toilet water intakes
- cooling of internal equipment and appliances

CHECKING Visually and/or manually check for presence of valve or cock.

FAULTS		
Water Intakes	Opening below waterline not fitted with directly adjacent valve /cock	10.4.1

ACCESSIBILITY Valves or cocks are to be readily accessible as defined in the Glossary to the Boat Safety Standards .

Testing There is no requirement for surveyors/examiners to test the working of any valves or cocks.

If any leak was identified a fault would be recorded at 10.3.1

CHECKING Visually and/or manually check that cocks or valves fitted to hull openings below the waterline are readily accessible.

FAULTS		
Hull Opening Valve	Not readily accessible	10.4.2

STANDARD 10.5
DISPLAY OF LABELS REGARDING VENTILATORS

Instructions prohibiting the blocking of ventilators shall be inscribed on permanent labels prominently displayed on board the vessel.

LABELLING

The labels are to be permanent which means :

- the label must be securely attached by bolts, screws, or an appropriate adhesive
- the lettering must not :
  - be capable of being removed by abrasion or contact
  - become illegible through cleaning, fading, or normal usage

An appropriate adhesive :

- does not permit the bond to be broken without damaging the label or the surface to which it adheres
- is approved for bonding the material of the label to the material of the display surface

The following systems should not be used:

- embossed lettering on stick-on tapes
- printed paper labels however attached
- transfers
- vinyl letters

Labelling each ventilator

It is not necessary to label each ventilator but it would be good practice.

If each ventilator is not labelled, there must be at least one label in a prominent position which everyone moving about the boat cannot avoid seeing.

CHECKING

If ventilators are required and fitted visually check presence of permanent labels.

FAULTS		
Ventilation Labels	Not fitted	10.5.1

PROMINENTLY DISPLAYED

Prominently displayed means that :

- the label should be readable at a distance of approximately 1 m
- the lettering should be:
    - approximately 5mm high
    - clearly distinguishable from the rest of the label and the surface on which it is mounted

CHECKING

Visually check that labels are prominently displayed in relation to ventilators.

FAULTS		
Ventilation Labels	Not prominently displayed	10.5.2

STANDARD 10.6 - GLAZING MATERIALS

All port lights, side scuttles, windows, and interior glass partitions shall be safety glass to BS 952 Part 1 or of suitable acrylic or polycarbonate material.

[see Exemption 11.21]

TYPES OF SAFETY GLASS

The following types of glass are in common use :

- toughened
- laminated
- wire-reinforced

Toughened

Toughened glass is treated after manufacture and cannot be cut or worked. It is always marked with an appropriate standard such as:

BS MA 24	Ships' side scuttles
BS MA 25	Ships' windows
BS 857	Specification for safety glass for land transport
BS 952	Glass for glazing
BS 6206	Impact performance requirements for flat safety glass and safety plastics for use in buildings

The presence of any other “standards” marking would not necessarily mean that the glass was “safety glass”.

It may be necessary to seek guidance from the Boat Safety Scheme.

Laminated

Laminated glass can be cut or worked after manufacture and may not be marked.

In cases of doubt, it may be necessary to seek documentary evidence from the owner.

Wire-reinforced

The re-inforcement in wire-reinforced glass is readily visible and marking is unnecessary.

CHECKING Visually check all glass for presence of marking to indicate use of safety glass to one of the standards listed above, or an equivalent or higher standard.

Examples of acceptable standards are:
BS MA 24, BS MA 25, BS 857, BS 952, BS 6206

NOTE [see Exemption 11.21]

FAULTS		
*Glass	Not to BS 952 Part 1	10.6.1

ACRYLIC or POLYCARBONATE MATERIALS Acrylic or polycarbonate materials are man-made plastic, sheet materials which can be used for glazing in place of glass, with acrylics being more common than polycarbonates. A more recent introduction is a polyester-based material.

They have considerable impact resistance, and the polycarbonates and polyesters are widely used where vandal-proof or transparent protective materials are required.

They are generally as strong as glass of the same thickness, but are lighter in weight, and can be readily worked, cut and drilled.

They do, however, degrade with age and can become “yellowed”, dull, and lose transparency.

Over a period of time they can also develop hairline cracking, at which point they should be replaced.

IDENTIFICATION These materials can readily be distinguished from glass once they show signs of “ageing”.

When new, however, this may be more difficult. They produce a duller sound than glass when tapped, but this cannot be considered a reliable test for the non-specialist.

There is no requirement to “mark” them to indicate compliance with any Standard and it is not possible to determine by visual examination which type of material has been used.

CHECKING At present, the use of suitable acrylic or polycarbonate materials is not being checked.

NOTE [see Exemption 11.21]

FAULTS		
*Acrylic/ polycarbonate Material	Not of suitable material	10.6.2

EXEMPTION 11.21 Vessels manufactured prior to 16 June 1998 are not required to comply with Standard 10.6 providing that all existing vessels with non safety glass are protected by the use of suitable stick-on film by 16 June 2000 or the first Boat Safety Certificate inspection after this date.

Stick-on Materials There are several stick-on materials sold for the purpose of sticking to glass. Some are decorative, to produce the effect of etched or engraved glass, and some are designed to ensure privacy where clear glass has been used e.g. bathrooms.

CHECKING It is not possible by visual examination to determine the nature or suitability of the stick-on material used but to be effective and provide the protection implied in this exemption the applied film should:

- be free from any defect
- in total contact with the glass - no “bubbles” etc
- completely cover the glass surface
- show no signs of lifting at the edges and corners

FAULTS		
	*EXEMPTION APPLIED	10.6.3

STANDARD 10.7 - UNPOWERED HOTEL BOATS
Unpowered hotel boats not carrying fuel nor fitted with cooking, heating, refrigerating or lighting appliances shall comply with the requirements of Standard 6.1 as if they were a powered vessel.

STANDARD 6.1 The requirements of Standard 6.1 applicable to these vessels are that they must be equipped with the correct number of portable extinguishers which are to be:

- of an approved type
- readily accessible
- kept at fire risk points
- maintained in good condition
- of the correct fire rating

Correct Number The number of extinguishers shown in the table in Standard 6.1 may be reduced by one as the boat is unpowered and not carrying appliances.

Identification Where the vessel cannot be identified as an unpowered hotel boat, the surveyor/examiner may need to refer to the Navigation Authority.

CHECKING Identify unpowered hotel boat and visually check that extinguishers comply with checks prescribed by Standards 6.1.1 to 6.1.8 inclusive.

FAULTS		
Unpowered Hotel Boats	Not complying with Standard 6.1	10.7.1

STANDARD 10.8
MANUALLY PROPELLED VESSELS & SAILING VESSELS

All manually propelled vessels or sailing vessels not carrying fuel nor fitted with cooking, heating, refrigerating, or lighting appliances are not required to comply with the standards as defined.

Definition For the purpose of this standard "fitted" excludes small, self-contained portable appliances.