No. 140 Recommendation for safe precautions during Survey and Testing of Pressurized Systems

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A. Preamble

A1. This Recommendation has been developed to assist Classification Societies (CS) when developing their own internal procedures and / or instructions to safeguard their surveyors when dealing with systems under pressure or during pressure testing of ships' and offshore units' equipment, machinery, structures, piping systems.

A2. The objective is to promote the safety of the surveyor and associated personnel engaged in the above types of operations while carrying out inspections on such systems. CSs are encouraged to develop their own internal procedures based on these recommendations and other similar references. It is recommended that all personnel, when dealing with systems under pressure, thoroughly familiarise themselves with the applicable procedures and instructions in the interest of their own safety. They should also be encouraged to read the original documents referenced in this recommendation for a more thorough understanding of the hazards caused by the equipment and systems being pressurized and under pressure.

A3. This Recommendation has been developed by drawing extensively on the references listed in Section B of this document, using the latest version available. IACS acknowledges their contribution and is thankful to those agencies that developed those documents.

The quoted text has been reworded, where considered necessary, to suit the context of this Recommendation and also to maintain consistency of presentation.

A4. This Recommendation is intended to give an overview of the procedures and associated hazards of pressure testing of ships' and offshore units' structural parts, pressure vessels, components, systems and equipment and of dealing with a system under pressure, whether these are permanent or temporary fixtures on board a ship or offshore unit. Individual government agencies may have additional health and safety requirements that should be taken into consideration. It is recommended that CS identifies the applicable legal and other requirements and verify their compliance with local regulations when reviewing pressure testing procedures or witnessing pressure testing.

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B. References

Below referenced documents were used in the development of this IACS recommendation. IACS reserves the right to make or not future updates, upon revisions made to the referenced documents.

B1. UK HSE – Safety of Pressure Systems (Pressure System Safety Regulation 2000).

B2. UK HSE – Pressure Systems – A brief Guide to Safety.

B3. UK HSE - Written Schemes of Examination (Pressure System Safety Regulation 2000).

B4. ABSA (The Pressure Equipment Safety Authority) User Guide on Pressure Equipment Safety Regulation – AB- 516, Rev. 6. 09-01-2014.

B5. Pressure System Safety Guidance Notes – GN SC 38 Dec 2012 by Safe contractor.

B6. Health & Safety Authority - Guide to the Safety Health and Welfare at work (Regulation 2012) on Pressure System.

C. Scope

This Recommendation applies only to personnel of IACS Classification Societies when dealing with pressurized systems and/or during witnessing a pressure test. Non-IACS Classification Societies may also choose to apply this Recommendation in their work procedures.

This recommendation may not cover all health and safety aspects of cryogenic systems and ships using gas or other low flash point fuels.

Classification Societies should document procedures and / or instructions, addressing the recommendations contained in this document, as necessary for their personnel when engaged in the above activities and as applicable to the nature and extent of the services provided.

D. Definition

Pressure means pressure relative to atmospheric pressure, i.e. gauge pressure and, as a consequence, a vacuum is designated by a negative value. The pressure units system (bar) has been used in this document, except in paragraph F5.9, referring to offshore industry data, where both, bar and psi, are used.
Uncontrolled or potential release of pressure may cause hazardous conditions.

Pressure Equipment means vessels, piping, protective devices and pressure accessories used with a relevant fluid or gas and, where applicable, pressure equipment includes attachments relevant to the integrity of the equipment.

Pressure System

A pressure system is defined as:

- any system comprising of one or more pressure vessels of rigid construction, their associated pipework and protective devices.

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- the pipework with its protective devices to which a transportable pressure receptacle is, or is intended to be, connected.
- a pipeline and its protective devices which contain or are liable to contain a relevant fluid or gas, but does not cover transportable pressure receptacles.

Pressurized Tanks and Systems mean tanks and systems that are subjected to an applied pressure.

Medium means any fluid (liquid or gas).

Owner/User in relation to a pressurized system, means the “company” responsible for the technical operation of the ship / offshore unit.

Facility means units and locations where the tasks covered within this recommendation are carried out. Examples of facility are ships, offshore units, shipyards (new building and repair), machinery and equipment manufacturer plants.

Competent Person is a qualified person, having the appropriate knowledge, experience and independence, to identify the hazards and their control while work on a pressurized system is carried out and to undertake other functions required of them, including approval of ‘Written Scheme of Examination’ for the Pressure Systems. He/she may be a self-employed individual or a member of an in-house inspection department or from an organisation providing an independent inspection service.

Protective devices mean devices designed to protect pressurized equipment whenever the safe operating limits may be exceeded.

Remote location means a safe location, away from the applicable hazards and comprising of all necessary equipment to witness the pressure test and / or to observe the pressurized items in compliance with the applicable rules and regulations.

Safe Operating Limits mean the operating limits (incorporating a suitable margin of safety) beyond which system failure is liable to occur.

Surveyor for the purpose of this Recommendation is any person employed or contracted by a Classification Society, performing services in the field on behalf of the Classification Society.

Tests - Pressure Testing involves the application of a stored energy to a part or an assembly of parts in order to verify their strength / integrity (e.g. tightness) / functionality.

Common Types of Pressure Tests are described below:

a. **Burst Pressure Test** is a process to determine a pressure point at which a component such as a valve, hose or other pressure equipment will fail as a result of excess pressure. It may also determine the pressure immediately before which failure will occur, targeting for a pre-established pressure/or load named **burst pressure/ or breaking load**.

Thus Burst Pressure can be considered as the maximum pressure which a component can endure before a catastrophic failure occurs. It gives an indication of the “factor of safety” employed in the design, particularly when this cannot be easily determined by calculation.

b. **Proof Pressure Test** is similar to a burst pressure test. It is used to prove that a component or pressure equipment is capable of withstanding a pressure greater than the

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standard Pressure Test without distortion or failure, based on an agreed (design) or defined (statutory) 'Factor of Safety'.

c. **Standard Pressure Test** is carried out initially after manufacture, subsequently after modification/repairs and also as a periodic test. The test medium may be hydraulic or pneumatic and test pressure is normally between 1.25 and 1.5 times the design pressure, depending upon the design code used and the age of the equipment or item being pressurized.
Standard Pressure test is also normally used to verify pressure relief systems.

d. **Leak (or Leak-proof-ness/Tightness) Test** as the name implies, is designed to check for leaks in systems, components or pressure retaining parts.

e. **Functional Test** is used to check operation of a system including tightness of isolating valves, mechanical joints and functioning of moving parts, if any.

f. **Safety Valve Testing:** Safety valves (pressure releasing devices) are tested at the shop floor, following their manufacture, after reassembly following routine maintenance and during surveys of ships in service. The safety valve is required to be checked for lift (popping up) pressure as well as reseat pressure.

g. **Flexible Hose Test** is used for prototype burst test to an international standard.

h. **Pressure Pulsation Test** is used as necessary for mechanical joints and it is defined in UR P2.

E. Training

E1. All surveyors who are expected to carry out inspections on Pressure Systems or participate in pressure testing should be trained in safety aspects and requirements for such activities, according to Class Society's internal procedures and applicable regulations.

E2. This training should include:

a. Recognising pressure systems, their hazards and associated level of risks.

b. Recognising, evaluating and managing the hazards and the risks associated in dealing with pressure systems and pressure testing.

c. Pressure measuring equipment, its selection (suitable for appropriate pressure rates) and calibration, including remotely located instruments.

d. Role of the Owner/User and Competent Person.

e. Use of hazard control means, such as personal protective equipment, barriers, protective guards, isolated / remote location for witnessing of tests.

E3. Competency in the areas covered by the training identified in item E2 should be periodically assessed, either as a part of activity monitoring or some other suitable means. The maximum period between these assessments of competency should be 3 years. Assessment records should be maintained.

E4. Classification Societies should document in accordance with their internal procedures, situations when these competency assessments are not held as addressed by this recommendation and when surveyors do not pass these competency assessments.

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F. Pressure Testing

F1. Introduction

During the course of surveys and inspections, both on board ships or offshore units and at manufacturers' premises, Surveyors may be called upon to witness different types of Pressure Tests, generally known as Hydraulic Testing, Pneumatic Testing, Hydro – Pneumatic Testing and Leak Testing.

Such types of tests are required, by the Rules, Regulations and applicable Standards, to be carried out on pressurized tanks, pressure equipment and pressure systems. Such types of testing are normally required after manufacture (initial testing), at the time of fabrication of components, during construction of ships and after repairs or modifications. These tests are also required as part of a periodical inspection regime for compliance with Class or Statutory requirements, including testing of safety valves or other pressure relieving devices (PRDs).

Pressures encountered during such testing can range from a vacuum (testing of P/V valves and other pressure receptacles) up to in excess of 1500 bar for deepwater drilling applications.

F1.1 There are a number of different types of test that a Surveyor may be called upon to witness, each having its own characteristics, pressure ranges and procedures, and appropriate safety precautions.

F1.2 Different types of compartments are tested at time of attendance for tightness and/or structural integrity verification on board ships, during new construction and at the time of surveys after construction. In general, these types of tests are carried out on board the ships and fall within one of the definitions (Section D, a through f.) "Common Types of Pressure Tests".

Surveyors should familiarize themselves with specific issues, by studying the referenced guideline and applicable Rules and Procedures. Subject Rules should include applicable terminology and required items for use during these types of tests (e.g. use of U-Tube).

F1.3 Surveyors should take special care in cases where the manufacturer, fabrication facility or building facility proposes to substitute a type of testing using parameters (i.e. pressure rates, test medium) from another accepted method of testing. It is important to note that additional or undetermined hazards may exist when mixing applicable parameters from different types of testing. If, for example, a pneumatic test is to be carried out at low temperature conditions in place of a hydraulic test, then test pressure hazards and increased risks could result requiring additional precautions.

To further promote safety in such cases, surveyors should confirm that the test procedures and conditions have been reviewed and approved (e.g. "Pneumatic tests in Lieu of Hydrostatic tests"), by a competent person within the class society.

F2. Pressure Testing Procedure

Surveyors should not organize or conduct any form of pressure testing. The Surveyor should attend solely to witness the test and confirm that it meets regulatory and/or other requirements including any pre/post inspection pass/fail criteria. In this respect, the entity responsible for carrying out the pressure test should be in possession of and work in accordance with, suitable test procedures. These procedures should be developed by a competent person, based on a risk assessment of the intended operation, taking into account

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relevant hazards, dangers and any local/national Health and Safety legislation pertaining to safety in the workplace.

Most manufacturers, shipyards, depots, test houses and specialist testing companies should be in possession of hydraulic or pneumatic test procedures as part of their established quality systems.

In these cases, it is responsibility of the attending Surveyor to confirm that the subject documented procedures comply with applicable Class, Statutory, and Legal and other requirements for the test. In the case of any perceived unsafe working conditions, noted by the surveyor, it should be resolved to the surveyor's satisfaction before the tests commence.

F3. Test Procedures

Test procedures can vary significantly: from the very basic, covering just one test operation, to quite comprehensive documents which may detail many different types of test under one cover. Whilst it is not expected that a Surveyor officially approve the applicable pressure test procedures, those procedures should be reviewed by the Surveyor for anticipated hazards and their controls. If such procedures appear deficient (e.g., fail to identify any hazards) the Surveyor should document his findings, comments or identified unsafe conditions and should seek changes and corrections to rectify deficiencies prior to witnessing the conduct of the test.

A typical procedure should contain reference to the following subjects as applicable:

1. Purpose
2. Scope
3. Responsibilities and qualification of key Personnel
    a. Test Supervisor
    b. Test Operator
    c. Class Surveyor
    d. Safety Director
    e. Others
4. Pressure Test Hazards and their controls
    a. Checklists
    b. Fittings
    c. Pressure Sources
    d. Test Area
    e. Barricades, cordoning and marking of test area and other appropriate means to restrict access at the time of pressurization, during the test process and depressurization.

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5. Test Procedures

   a. Flow diagram and test equipment

   b. Position, specification of test gauges, safety valves and other means of pressure relieving (e.g. U-tube for certain air leak tests).

   c. Position of isolating valves and test medium supply line.

   d. Sequence of opening and closing vent valves (where multiple valves fitted).

   e. Test pressure, medium and time for the gradual pressurization / depressurization where applicable.

   f. Instrumentation to record timing, pressurization and depressurization when deemed necessary to carry out the test under remote presence of the Surveyor.

6. Pass/Fail Criteria

7. Reporting

8. Reference (other documents or information sources pertinent to the test, including temporary arrangements).

F4. Hydraulic versus Pneumatic Testing

In most cases pressure testing is carried out using water as the test medium, but there may be occasions where a liquid other than water (e.g. hydraulic oil, or kerosene) is used. All such testing is collectively known as hydraulic testing and although not without risk, depending on the pressure, it is safer than using a gas which, being compressible, has the ability to store more energy for any given test pressure compared to an equivalent volume of liquid.

However, there are cases of high pressure hydraulic test being applied mainly to Offshore Industry components and Gas Carrier Industry components and for those cases, careful consideration should be given to review, consider, apply and follow all relevant safety precautions.

There are occasions, on the other hand, where it may be necessary to resort to what is collectively termed pneumatic testing (e.g. using air, steam, nitrogen or other inert gas as the test medium), primarily where the interior of the pressure equipment may be contaminated by water or other liquid, or where the containment system or its supporting structure is not designed to withstand the weight of the volume of liquid required to carry out a hydraulic test. The Surveyor should therefore be aware of and understand the additional hazards involved in pneumatic testing and, in particular, the stored energy available in the event of a catastrophic failure of the pressurized item that could result in injury or death from blast waves, as well as pieces or portions of material that may become projectiles.

F5. Precautions related to Pressure Testing

General Precautions

Any pressurized equipment has the potential to cause serious injury or even death in the event of a catastrophic failure. In order to reduce the risk, appropriate risk assessment should be carried out considering the test items, equipment, medium, procedure and ambient conditions. Specifically, the following points should be taken into consideration.

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F5.1 Where the surveyor is not protected by suitable barriers / screens, verify and confirm that the test procedure is followed, test equipment is in good condition, isolating valves are tight, test pressure gauges (at least 2 pcs) are calibrated and are of suitable range as per test pressure, that they are not isolated or bypassed, and that releasing mechanisms or safety valves are of adequate size/rating and correctly set. Pipe work, especially flexible piping, should be free from damage or leaking joints. Inlet, outlet and release arrangement for the test medium to or from the item being tested are properly fabricated and supported, including their appropriate dimensions (e.g. Smaller diameter for inlets and bigger diameter for outlets, as well as releasing means).

F5.2 Test pressure should be applied gradually to avoid shock loading of the item under test. Where items are tested together this should only be accepted where their test pressures are identical. Where a number of items are tested together, the test pressure should not exceed what is necessary to prove the weakest part but this pressure must meet the test pressure of all parts being tested. The temperature of the test medium should not be lower than that specified in the procedure to avoid the possibility of brittle fracture.

F5.3 Close visual inspection of the equipment should be conducted only when the pressure does not exceed the design pressure level for hydraulic pressure tests or pneumatic pressure test, the pressure should be reduced to the leak test level.

F5.4 Couplings and connections of flexible hoses subjected to the pressure should be adequately secured to prevent injury due to “flailing” in the event of failure. Adequate precautions should be in place to protect test personnel and observers, either by using a purpose built test enclosure (barricades or strong baskets) or by putting in place a safety zone. The sizes of the enclosure or the safety zone will depend on the type of test and pressures involved.

F5.5 Where leakage is detected in joints or fittings, whether on the item under test or on the test equipment itself, pressure should be reduced to atmospheric pressure prior to rectifying the leak. On no account should the test piece be subjected to a “hammer test” while under pressure and this includes the “peening” of welds to prevent seepage. Other means to attempt correction of leaks under pressure, especially welding, should be avoided.

F5.6 Necessary personal protective equipment, as applicable, should be worn by the surveyor working within the test area.

F5.7 Where safety valves are being tested (floated), the venting arrangements should lead away from the work/test area. In case of setting a boiler safety valve, drainage arrangements and escape piping should be particularly examined for blockages, appropriate support and damage.

F5.8 For higher pressure tests surveyors should witness the tests from a remote location. For these cases, provision of pressurization, depressurization and suitable time recording instruments may be required by the attending surveyors.

F5.9 The test procedure should specify precautions to safeguard against hazards resulting from the possible expansion of the test medium, during the test. If a pressure test is to be maintained for a period of time, during which the test medium in the system is subject to thermal expansion, precautions should be taken to avoid excessive pressure. Additional pressure relief devices, set at an appropriate percentage of the test pressure, are recommended, during the pressure test of these types of items/systems (e.g. Mud Line in the Offshore industry is tested to 15,000 – 20,000 psi) (1034.21 – 1378.95 bar).

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F6. Precautions Specific to Hydraulic Testing

In addition to the general precautions cited above, the following points should be taken into consideration:

F6.1 When water is used as the test medium the temperature during the test should not be less than 7°C in order to avoid the possibility of ice damage. When a pressure test is carried out with water at an ambient temperature below 0°C it has to be confirmed that the test medium, test gauges and connecting lines cannot freeze.

F6.2 The item under test should be totally filled with the fluid to be used as the test medium and closed systems should be properly vented. Where, due to the design of the item under test, it is not possible to eliminate all air/gas pockets then the additional precautions noted below for pneumatic testing should be considered.

F6.3 The effect of the weight of the test medium on the item under test, and any supporting structure or foundation needs to be especially considered.

F6.4 If liquid other than water is used as a test medium, e.g. kerosene, then hazards specific to that medium should also be considered.

F7. Precautions Specific to Pneumatic Testing

In addition to the general precautions cited above the following points should be taken into consideration:

F7.1 Because of the potential for high levels of stored energy, the internal volume of any items to be pneumatically tested should be kept to a minimum by isolating certain sections or testing components individually. Alternatively, the use of non-compressible material should be considered.

F7.2 For large volumes under test, consideration needs to be given to the effects of blast waves and projectiles in the event of a catastrophic failure. The test procedure should specify a suitably sized restricted zone to protect human life and properties in such cases.

F7.3 Local chilling due to filling and emptying of the items under test needs to be controlled to avoid the possibility of local brittle fracture. This can be achieved by maintaining constant flow rates across inlets or exhaust nozzles. The internal pressure of the test medium should also be controlled to avoid any shock loading by using suitably sized reducing valves and flow control valves.

F7.4 Normally, class society Rules refers to the use of U-Tube for Air Leak test during testing of structural tanks and spaces for tightness. However rules may allow the use of a releasing mechanism, in place of a U-Tube. If a safety valve is selected, Surveyors should be aware that, in some cases, this approach has resulted in catastrophic failure of the space being tested. If a releasing mechanism is used in lieu of a U-tube the Surveyor should carefully review the safety precautions adopted for the test and evaluate the risks after taking into account necessary precautions and whether the design of the mechanism is similar to the U-tube principle (i.e. suitable to be lifted by the predetermined excessive pressure, and not subject to any kind of spring or restricting device) (See also G9.2).

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F8. Precautions Specific to Hydro-Pneumatic Testing

There are also standards that accept the method of test that combines liquid and gas (normally water and air) as the test mediums. Where the subject method is applied, then the additional precautions noted above should be considered, as applicable for each medium.

F9. Pressure Piping Tests

F9.1 Pressure piping leak tests should be conducted using the hydrostatic method.

F9.2 A pressure piping system should not be tested at a temperature that is colder than its minimum design temperature.

F9.3 When conducting pressure tests, the ductile to brittle transition temperature and the possibility of brittle fracture should be considered by the competent person.

F9.4 Before testing any pressure piping system, the surveyor should obtain from the Owner/User or the facility management confirmation that the materials, construction and installation of the piping system is in accordance with applicable regulation and/or the approved design.

F9.5 When conducting tests or initial starts ups, applicable safety precautions should be observed and only essential personnel should be present during the test.

G. Pressure Systems

G1. Introduction

The failure of pressurized equipment or systems can result in fatalities and serious injuries and cause major damage to property.

G1.1 CS's surveyors are also called upon to examine or witness tests of systems which are under operating working pressure (e.g. during steering system trial, windlass trial, trial of thrusters, jacking systems, drilling system, mud circulating system, cargo system).

G1.2 Examples of pressure systems and equipment include but are not limited to:

- boilers and steam heating systems
- pressurized process plant and piping
- compressed air systems (fixed and portable)
- hydraulic systems such as steering gear, Windlass, V/V actuating system
- fuel Oil circulating system
- liquid cargo loading/unloading system
- heat exchangers and refrigeration plant
- valves, steam traps and filters
- pipe work and hoses
- pressure gauges and level indicators

G2. Hazards of Pressure System

Pressure systems present particular hazards because pressure vessels can release large amounts of stored thermal and kinetic energy, following leaks or explosion of gases, liquids, vapours or steam.

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G2.1 The main hazards while dealing with such systems are:

- impact from the blast of an explosion or release of compressed gas or liquid
- impact from parts of equipment that fail or any flying debris
- contact with the released liquid, gas or steam, including compressed air
- fire resulting from the escape of flammable liquids or gases

G2.2 Pressurized systems may fail at the point of connection of flexible hoses (e.g. Portable tools, causing the unsupported length of hose to whip or snake violently).

G3. Principal Causes of Incidents

Principal causes of incidents are:

- defective equipment and / or system design
- lack of maintenance of pressure equipment
- unsafe installed systems of work leading to release of pressure
- operator error, insufficient training / supervision
- unsafe / worn out installation
- inadequate repairs or modifications

G4. Level of Risk

The level of risk from the failure of pressure systems and equipment depend on a number of factors including but not limited to:

- the pressure in the system
- the type of media, liquid or gas, and its properties
- the suitability of the equipment and pipe work that contains it
- the age and condition of the equipment
- the complexity and control of its operation
- the prevailing conditions (e.g. a process carried out at high temperature)
- the skills and knowledge of the people who design, manufacture, install, maintain the system, carry out the test, and operate the pressure equipment and systems

G5. General Safety Requirements for Pressure Systems

G5.1 The objective is to control the hazards presented by a pressure system under test:

- by way of design, installation, maintenance and periodic examination
- by providing a robust regime for the management of pressure systems, including requirements for preliminary and periodic examinations of pressure systems

G5.2 The pressure system should be manufactured from material suitable for the substances it will contain.

G5.3 Owners/Users should know, by checking with designers, manufacturers or installers, the safe operating limits of the involved fluid of the system and of any equipment directly linked to it or affected by it.

G5.4 The Owner/User of the pressure system should:

- maintain an accurate inventory of its pressure equipment
- control and verify that its pressure equipment is inspected at the prescribed intervals
- maintain appropriate records of inspections

The above may be in the form of a written scheme of examination.

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G5.5 Safety Legislation of certain countries may require Written Scheme of Examination as applicable to industrial facilities where surveyors may attend to witness pressure tests.

G6. Written Schemes of Examination:

A written scheme of examination is a document containing information about selected items of the plant or equipment which form a pressure system, operate under pressure and contain a 'relevant fluid'.

G6.1 A written Scheme of Examination is required to obtain the Statutory approval of the Pressure System in the case of an industrial application. A written Scheme of Examination normally covers all protective devices and should include every pressure vessel and those parts of pipelines and pipework which, if they fail, may give rise to danger. The written scheme should specify the nature and frequency of examinations and include any special measures that may be needed to prepare a system for a safe examination.

G6.2 The Owner/User is responsible for ensuring the suitability of the scope of the written scheme and that it covers all the pressure vessels, protective devices and pipework.

G6.3 Records are required to be maintained for inspections, repairs and testing as evidence of following the written scheme.

G6.4 The pressure system, together with records of examination by the Owner/User, should be examined in accordance with the written scheme by a Competent Person.

G6.5 For fired (heated) pressure systems, such as steam boilers, the written scheme should include an examination of the system when it is cold and stripped down and when it is running under normal conditions.

G7. What types of typical pressurised systems might require a written scheme of examination?

G7.1 The following pressurised systems are likely to require a written scheme of examination:

- a compressed air receiver and the associated pipework, where the product of the pressure in bars multiplied by the internal capacity in litres of the receiver is equal to or greater than 250 bar litres.
- a fixed high pressure fire-fighting system, using gas smothering media and associated pipework and protective devices.
- a steam boiler and associated pipework and protective devices.
- a gas loaded hydraulic accumulator.
- a vapour compression refrigeration system where the installed power exceeds 25 kW.
- the components of self-contained breathing apparatus sets (excluding the gas container).
- a fixed liquefied petroleum gas (LPG) storage system, supplying fuel for heating in a workplace.

G7.2 Various regulations, such as Quality Management System (QMS) standards, Safety Management System standards such as IMO International Safety Management System (ISM) Code, require Owners/Users to determine a documented system of maintenance, inspection and testing of all Pressure Systems as per maker's recommendations and other applicable requirement such as SOLAS, Flag administration regulations and class Rules.

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G8. Precautions while dealing with Pressure System

Considering that the management of the industrial and shipbuilding units are responsible for maintaining a certified QMS/SMS, ship Owners/ Users generally have a certified safety management system in accordance with the ISM Code in place, as applicable for convention ships, it is reasonable for surveyors to require and receive adequate care and support while dealing with pressure systems.

G8.1 Knowledge of Operating Conditions:

Before working in the vicinity of a pressure system, the class surveyor should verify that the following checks have been performed by the Owner/User:

- is the gas or liquid toxic or flammable?
- what are the process pressures and temperatures?
- what are the safe operating limits?
- is there a set of operating instructions for all of the equipment?
- have the operators had suitable training on the operating instructions?
- have the protective devices been set correctly and in good operating condition?
- audible and visual warning devices are in satisfactory condition.
- do the fitted safety valves, bursting disc and other releasing systems discharge towards a safe place?
- has the condition of the pressurized system(s) been found satisfactory?

If a Surveyor notes non-compliance with any of the above requirements or a deterioration in the condition of a pressurized system (e.g. corrosion) the survey in the vicinity should not be undertaken until a thorough investigation and rectification has been carried out by the owner.

G8.2 Surveyors should confirm that the system under survey is generally in satisfactory condition and the Owner/User of pressure systems has a Written Scheme of Examination, if required by statutory regulations and maintenance of the system and has assigned a competent person.

G8.3 No part of the pressure system should be allowed to operate beyond the safe operating limits.

G8.4 To check and confirm that limits are not exceeded, protective devices should be correctly specified and, where applicable, adjusted to the correct setting.

G8.5 The Owner/User of a pressure system should keep control and verify that it is operated in accordance with the manufacturer’s recommendations or in accordance with the Written Scheme of Examination, if applicable.

G8.6 Instrumentation and measuring equipment are properly selected, maintained and calibrated.

G9. Class surveyors should consider also the following precautions before attending a pressurized system test:

G9.1 Overpressure Protection:

Applicable Industry Regulations require that all pressure equipment be provided with overpressure protection.

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1. It is required that the Owner/User of the pressure equipment controls and verifies that it has been installed with an overpressure protection that is certified as:

   a. a pressure relief valve that meets the requirements of the applicable Code (e.g. ASME Code, Class Rules), or
   b. other means of overpressure protection acceptable to the Administration / Class Society.

2. The protection device is required to be set to open before the pressurized equipment exceeds the maximum allowable working pressure.

3. The Owner/User of the equipment under pressure controls and verifies that the overpressure protection system is designed and maintained so that the maximum pressure in the equipment does not exceed the prescribed limit allowed in the applicable code/standard.

G9.2 Pressure Relief Devices

1. Adjustable parts of the pressure relief device are required to be sealed at the time of servicing and remain sealed during operation. Seals are to be installed in a manner that prevents changing the adjustment of a pressure relief device without breaking the seal.

2. A pressure relief device is to be serviced at an interval acceptable to the regulating authority. A pressure relief valve is to be serviced, repaired, set and sealed only by a qualified/competent person.

3. Any change to the adjustable parts of the pressure relief devices are to be done on a controlled basis, as this can affect the system operation and safety. Adjustments are to be made by duly qualified and authorised persons only.

4. Safety Management System, under ISM Code, requires that all safety equipment and relieving devices, including alarms and measuring instruments are tested regularly to enhance their reliability. Records of this should be made available to the surveyor.

G10. Maintenance and modification of pressure systems

G10.1 Class Rules normally require that Owners/Users are responsible for controlling and verifying that all pressure systems and associated pipes and equipment are operated by qualified personnel. Evidence should be provided that the equipment has been properly maintained and inspected as per documented procedures.

G10.2 Prior to any modifications being carried out, Owners/Users should conduct a proper assessment to confirm that all the technical and safety aspects of the change have been considered. Modifications are to be reviewed/approved by the Class Society.

G10.3 Owners/Users should also carry out a risk assessment and take appropriate measures to remove or mitigate the risk of hazards while working with pressure systems on board a ship, offshore unit or in industrial workshops.

G10.4 Following modification or repair of any part of a system, the person carrying out such work is normally required, immediately after completion of the work, to supply to the Owner/User written information concerning the work carried out and the instructions for the safe operation of the system, including any newly issued instructions if appropriate.

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G10. 5 When pressure systems are under repair, precautions need to be in place to prevent the system being accidently restarted before all the safety devices or systems have been restored.

G10.6 Whenever possible, systems should be depressurised before maintenance work is carried out, but for various reasons this may not be always achievable. In such cases it may be possible to safely isolate the part of the system which requires attention. In certain circumstance work on a live system may be necessary.

G10.7 Protective measures for work on a pressure system may need to address “Permit to Work” arrangements, isolation procedures and methods.

H. Personal Protective Equipment (PPE) for pressure systems:

1. Eye protection - safety glasses / goggles
2. Ear protection, when required.
3. Hand Protection
4. Safety Shoes
5. Helmet
6. Body protection/apron, where required
7. Multi-gas meter, when required
8. Safety Torch
9. Safety Face Shields, where required
10. Additional special PPE, if and as required.

The surveyor should use the necessary personal safety equipment and Protective Equipment according to the specific conditions and the survey being carried out. Other PPE not listed above may be used by the surveyors, as found necessary and applicable.

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