

# Z16 Periodical surveys of cargo installations on ships carrying liquefied gases in bulk

(June 1999)  
(Rev.1 Mar 2006)  
(Rev.2 May 2007)  
(Rev.3 Mar 2010)  
(Corr.1 Feb 2011)  
(Rev.4 Oct 2013)  
(Corr.1 May 2022)

## 1 General

### 1.1 Scope

The Surveys required herein are relevant to ships designed for the carriage of liquefied gases in bulk. These requirements are related to cargo installations and are additional to those already specified in Z1 and Z7.

### 1.2 Extent and methods

1.2.1 The surveys are intended to include all installations and equipment related to the carriage and handling of liquefied gases. These survey requirements do not cover fire protection, fire fighting installation, portable equipment, and personnel protection equipment.

1.2.2 The annual survey is preferably to be carried out during a loading or discharging operation. Access for cargo tanks or inerted hold spaces, necessitating gas-freeing/aerating will normally not be necessary unless required by the Rules of the individual Society.

1.2.3 The intermediate survey required in Section Z16.4, intends to supplement the annual survey by testing cargo handling installations with related automatic control, alarm and safety systems for correct functioning. The intermediate survey is preferably to be carried out with the ship in a gas-free condition. The extent of the testing required for the intermediate survey will normally be such that the survey cannot be carried out during a loading or discharging operation.

### 1.3 Survey intervals

Survey intervals are to be in accordance with UR Z1 and Z7.

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#### Note:

1. Changes introduced in Rev.3 (and its Corr.1) are to be uniformly applied by IACS Societies for surveys commenced on or after 1 July 2011.
2. Changes introduced in Rev.4 are to be uniformly applied by IACS Societies for surveys commenced on or after 1 July 2014.

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(cont)**2 Special Survey****2.1 General**

The requirements of Section Z16.4 apply with the following additions.

**2.2 Cargo containment survey**

2.2.1 All cargo tanks are to be examined internally.

2.2.2 Special attention is to be given to the cargo tank and insulation in way of chocks, supports and keys. Removal of insulation may be required in order to verify the condition of the tank or the insulation itself if found necessary by the Surveyor.

Where the arrangement is such that the insulation cannot be examined, the surrounding structures of wing tanks, double bottom tanks and cofferdams are to be examined for cold spots when the cargo tanks are in the cold condition unless voyage records together with the instrumentation give sufficient evidence of the integrity of the insulation system.

2.2.3 Non-destructive testing:

2.2.3.1 Non-destructive testing is to supplement cargo tank inspection with special attention to be given to the integrity of the main structural members, tank shell and highly stressed parts, including welded connections as deemed necessary by the surveyor. However, for type C tanks, this does not mean that non-destructive testing can be dispensed with totally. The following items are, inter alia, considered as highly stressed parts:

- cargo tanks supports and anti-rolling/anti-pitching devices,
- web frames or stiffening rings,
- swash bulkhead boundaries,
- dome and stump connections to tank shell,
- foundations for pumps, towers, ladders, etc.,
- pipe connections.

2.2.3.2 For independent tanks type B, the extent of non-destructive testing shall be as given in a programme specially prepared for the cargo tank design.

2.2.4 The tightness of all cargo tanks is to be verified by an appropriate procedure. Provided that the effectiveness of the ship's gas detection equipment has been confirmed, it will be acceptable to utilize this equipment for the tightness test of independent tanks below deck.

2.2.5 Where findings of Z16.2.2.1 to Z16.2.2.4 or an examination of the voyage records raises doubts as to the structural integrity of a cargo tank, a hydraulic or hydro-pneumatic test is to be carried out. For integral tanks and for independent tanks type A and B, the test pressure is to be in accordance with IACS UR G1.10.5 or G1.10.7 as appropriate. For independent tanks type C, the test pressure is not to be less than 1.25 times the MARVS.

2.2.6 At every other special survey (i.e., 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, etc.), all independent cargo tanks type C are to be either:

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2.2.6.1 Hydraulically or hydro-pneumatically tested to 1.25 times MARVS, followed by non-destructive testing in accordance with Z16.2.2.3.1, or

2.2.6.2 Subjected to a thorough, planned non-destructive testing. This testing is to be carried out in accordance with a programme specially prepared for the tank design. If a special programme does not exist, the following applies:

- cargo tank supports and anti-rolling/anti-pitching devices,
- stiffening rings,
- Y-connections between tank shell and a longitudinal bulkhead of bilobe tanks,
- swash bulkhead boundaries,
- dome and sump connections to the tank shell,
- foundations for pumps, towers, ladders etc.,
- pipe connections.

At least 10% of the length of the welded connections in each of the above mentioned areas is to be tested. This testing is to be carried out internally and externally as applicable.

Insulation is to be removed as necessary for the required non-destructive testing. (The individual Societies may choose to include any one or both of the above listed two alternatives in their Rules.)

2.2.7 As far as practicable all hold spaces and hull insulation (if provided), secondary barriers and tank supporting structures are to be visually examined. The secondary barrier of all tanks is to be checked for their effectiveness by means of a pressure/vacuum test, a visual examination or another acceptable method.

#### 2.2.8

- 1) For membrane and semi-membrane tanks systems, inspection and testing are to be carried out in accordance with programmes specially prepared in accordance with an approved method for the actual tank system.
- 2) For membrane containment systems a tightness test of the primary and secondary barrier shall be carried out in accordance with the system designers' procedures and acceptance criteria as approved by the classification society. Low differential pressure tests may be used for monitoring the cargo containment system performance, but are not considered an acceptable test for the tightness of the secondary barrier.
- 3) For membrane containment systems with glued secondary barriers if the designer's threshold values are exceeded, an investigation is to be carried out and additional testing such as thermographic or acoustic emissions testing should be carried out.

2.2.9 The pressure/vacuum relief valves, rupture disc and other pressure relief devices for interbarrier spaces and hold spaces are to be opened, examined, tested and readjusted as necessary, depending on their design.

2.2.10 The pressure relief valves for the cargo tanks are to be opened for examination, adjusted, function tested, and sealed. If the cargo tanks are equipped with relief valves with non-metallic membranes in the main or pilot valves, such non-metallic membranes are to be replaced. Where a proper record of continuous overhaul and retesting of individually identifiable relief valves is maintained, consideration will be given to acceptance on the basis

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of opening, internal examination, and testing of a representative sampling of valves, including each size and type of liquefied gas or vapor relief valve in use, provided there is logbook evidence that the remaining valves have been overhauled and tested since crediting of the previous Special Survey.

**2.3 Piping systems**

2.3.1 The cargo, liquid nitrogen and process piping systems, including valves, actuators, compensators, etc. are to be opened for examination as deemed necessary. Insulation is to be removed as deemed necessary to ascertain the condition of the pipes. If the visual examination raises doubt as to the integrity of the pipelines, a pressure test at 1.25 times the MARVS for the pipeline is to be carried out. After re-assembly the complete piping systems are to be tested for leaks.

2.3.2 The pressure relief valves are to be function-tested. A random selection of valves is to be opened for examination and adjusted.

**2.4 Components**

Cargo pumps, compressors, process pressure vessels, liquid nitrogen tanks, heat exchangers and other components, including prime movers, used in connection with cargo handling and methane boil-off burning are to be examined as required in the Rules of each individual Society for periodical survey of machinery.

**2.5 Miscellaneous**

2.5.1 Systems for removal of water or cargo from interbarrier spaces and holds are to be examined and tested as deemed necessary.

2.5.2 All gas-tight bulkheads are to be inspected. The effectiveness of gas-tight shaft sealing is to be verified.

2.5.3 The following equipment is to be examined: hoses and spool pieces used for segregation of piping systems for cargo, inert gas and bilging.

2.5.4 It is to be verified that all cargo piping systems are electrically bonded to the hull.

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(cont)**3. Annual Survey****3.1 General**

3.1.1 The log books are to be examined with regard to correct functioning of the cargo containment and cargo handling systems. The hours per day of the reliquefaction plants or the boil-off rate is to be considered.

3.1.2 All accessible gas-tight bulkhead penetrations including gas-tight shaft sealings are to be visually examined.

3.1.3 The means for accomplishing gas tightness of the wheelhouse doors and windows is to be examined. All windows and sidescuttles within the area required to be of the fixed type (non-opening) are to be examined for gas tightness. The closing devices for all air intakes and openings into accommodation spaces, service spaces, machinery spaces, control stations and approved openings in superstructures and deckhouses facing the cargo area or bow and stern loading/unloading arrangements, are to be examined.

**3.2 Cargo handling systems**

The cargo handling piping and machinery, e.g. cargo and process piping, cargo heat exchangers, vapourizers, pumps, compressors and cargo hoses are in general to be visually examined, as far as possible, during operation.

**3.3 Cargo containment venting systems**

Venting systems, including protection screens if provided, for the cargo tanks, interbarrier spaces and hold spaces are to be visually examined externally. It is to be verified that the cargo tank relief valves are sealed and that the certificate for the relief valves opening/closing pressures is onboard.

**3.4 Instrumentation and safety systems**

3.4.1 The instrumentation of the cargo installations with regard to pressure, temperature and liquid level is to be verified in good working order by one or more of the following methods:

- Visual external examination;
- Comparing of read outs from different indicators;
- Consideration of read outs with regard to the actual cargo and/or actual conditions;
- Examination of maintenance records with reference to cargo plant instrumentation maintenance manual;
- Verification of calibration status of the measuring instruments.

3.4.2 The logbooks are to be examined for confirmation that the emergency shutdown system has been tested.

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(cont)**3.5 Environmental control for cargo containment systems**

- 1) Inert gas/dry air installations including the means for prevention of backflow of cargo vapour to gas-safe spaces are to be verified as being in satisfactory operating condition.
- 2) For membrane containment systems normal operation of the nitrogen control system for insulation and interbarrier spaces shall be confirmed to the Surveyor by the Master.

**3.6 Miscellaneous**

3.6.1 It is to be verified that all accessible cargo piping systems are electrically bonded to the hull.

3.6.2 Arrangements for burning methane boil-off are to be visually examined as far as practicable. The instrumentation and safety systems are to be verified as being in good working order in accordance with Z16.3.4.1.

3.6.3 The relevant instruction and information material such as cargo handling plans, filling limit information, cooling down procedures, etc. are to be verified as being onboard.

3.6.4 Mechanical ventilation fans in gas dangerous spaces and zones are to be visually examined.

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(cont)**4. Intermediate survey****4.1 General**

The requirements of Section Z16.3 apply with the following additions:

**4.2 Instrumentation and safety systems**

4.2.1 The instrumentation of the cargo installation with regard to pressure, temperature and liquid level is to be visually examined and to be tested by changing the pressure, temperature and level as applicable and comparing with test instruments. Simulated testing may be accepted for sensors which are not accessible or for sensors located within cargo tanks or inerted hold spaces. The testing is to include testing of alarm and safety functions.

4.2.2 The piping of the gas detection system is to be visually inspected for corrosion and damage as far as practicable. The integrity of the suction lines between suction points and analyzing units is to be verified as far as possible. Gas Detectors are to be calibrated or verified with sample gases.

4.2.3 The emergency shutdown system is to be tested, without flow in the pipe lines, to verify that the system will cause the cargo pumps and compressors to stop.

**4.3 Electrical equipment**

Electrical equipment in gas-dangerous spaces and zones is to be examined as far as practicable with particular respect to the following:

- Protective earthing (Spot check).
- Integrity of enclosures.
- Damage of outer sheath of cables.
- Function testing of pressurized equipment and of associated alarms.
- Testing of systems for de-energizing non-certified safe electrical equipment located in spaces protected by air-locks, such as electrical motor-rooms, cargo control rooms, etc.
- Testing of insulation resistance of circuits. Such measurements are only to be made when the ship is in a gas-free or inerted condition. Where proper records of testing are maintained consideration may be given to accepting recent readings by the ship's crew.

**Note:** See also IACS Rec. No.120 Survey of electrical equipment installed in hazardous areas on tankers.

**4.4 Miscellaneous**

The instrumentation and safety systems for burning cargo as fuel are to be examined in accordance with the requirements of Z16.4.2.1.

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