A Guide to Refrigerant Gas Leak Detection

MARPOL Annex VI Regulation 12

Ozone Depleting Substances

1 This regulation does not apply to permanently sealed equipment where there are no refrigerant charging connections or potentially removable components containing ozone depleting substances.

2 Subject to the provisions of regulation 3.1, any deliberate emissions of ozone depleting substances shall be prohibited. Deliberate emissions include emissions occurring in the course of maintaining, servicing, repairing or disposing of systems or equipment, except that deliberate emissions do not include minimal releases associated with the recapture or recycling of an ozone depleting substance. Emissions arising from leaks of an ozone depleting substance, whether or not the leaks are deliberate, may be regulated by Parties.

3.1 Installations which contain ozone depleting substances, other than hydro-chlorofluorocarbons, shall be prohibited:

> **.1** on ships constructed on or after 19 May 2005; or
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> **.2** in the case of ships constructed before 19 May 2005, which have a contractual delivery date of the equipment to the ship on or after 19 May 2005 or, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 19 May 2005.

3.2 Installations which contain hydro-chlorofluorocarbons shall be prohibited:

> **.1** on ships constructed on or after 1 January 2020; or
>
> **.2** in the case of ships constructed before 1 January 2020, which have a contractual delivery date of the equipment to the ship on or after 1 January 2020 or, in the

absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 1 January 2020.

4 The substances referred to in this regulation, and equipment containing such substances, shall be delivered to appropriate reception facilities when removed from ships.

5 Each ship subject to regulation 6.1 shall maintain a list of equipment containing ozone depleting substances.

6 Each ship subject to regulation 6.1 which has rechargeable systems that contain ozone depleting substances shall maintain an Ozone Depleting Substances Record Book. This Record Book may form part of an existing log-book or electronic recording system as approved by the Administration.

7 Entries in the Ozone Depleting Substances Record Book shall be recorded in terms of mass (kg) of substance and shall be completed without delay on each occasion, in respect of the following:

.1 recharge, full or partial, of equipment containing ozone depleting substances;

.2 repair or maintenance of equipment containing ozone depleting substances;

.3 discharge of ozone depleting substances to the atmosphere:

.3.1 deliberate; and

.3.2 non-deliberate;

.4 discharge of ozone depleting substances to land-based reception facilities; and

.5 supply of ozone depleting substances to the ship.

Lloyds Register EP Notation

2.4 Refrigeration systems

2.4.1 These requirements apply to refrigeration and air conditioning installations on all ships. This includes refrigeration installations on conventional refrigerated cargo ships, container ships carrying produce in containers cooled by ducted air, and gas carriers fitted with reliquefaction plants. These requirements do not apply to the domestic stand-alone refrigerators used in galleys, pantries, bars and crew accommodation.

2.4.2 The use of chlorofluorocarbons (CFC) in refrigeration or air conditioning installations is prohibited.

2.4.3 Systems are to be arranged with suitable means of isolation so that maintenance, servicing or repair work may be undertaken without releasing the refrigerant charge into the atmosphere. Unavoidable minimal releases are acceptable when using recovery units.

2.4.4 For the purposes of refrigerant recovery, the compressors are to be capable of evacuating a system charge into a liquid receiver. Additionally, recovery units are to be provided to evacuate a system either into the existing liquid receiver or into cylinders dedicated for this purpose. The number of cylinders is to be sufficient to contain the complete charge between points of isolation in the system.

2.4.5 Where different refrigerants are in use they are not to be mixed during evacuation of systems.

2.4.6 Refrigerant leakage is to be minimised by leak prevention and periodic leak detection procedures. The annual refrigerant leakage rate for each system shall be less than 10 per cent of its total charge.

2.4.7 A leak detection system appropriate to the applicable refrigerant is to be provided to monitor continuously the spaces into which the refrigerant could leak. An alarm is to be given in a permanently manned location when the concentration of refrigerant in the space exceeds a predetermined limit (25 ppm for ammonia; 300 ppm for halogenated fluorocarbons). Remedial measures to repair the leakage are to be implemented as soon as practicable after an alarm is activated.

2.4.8 Procedures detailing the means to be adopted to control the loss, leakage, venting and disposal of refrigerants are to be established and implemented effectively.

2.4.9 Refrigerant inventory and log book records are to be maintained covering:

(a) Refrigerant added to each system.

(b) Refrigerant leaks, including remedial actions.

(c) Refrigerant recovered and where stored.

(d) Refrigerant disposal.

ABS Environmental Safety (ES) Notation

15.5 Refrigeration Systems

15.5.1 General requirements
Any specified restrictions and conditions are applicable to refrigeration plants with centralized cargo refrigeration systems, centralized air conditioning systems and centralized domestic refrigeration systems. Standalone air-conditioning and refrigerator units are not subject to these requirements.

15.5.2 Acceptable Refrigerants
Refrigeration systems are to be provided with environmentally friendly refrigerants. The use of ozone depleting refrigerants is not allowed, however, the use of hydrochlorofluorocarbons (HCFCs) will be permitted until 01 January 2020. Furthermore, the use of refrigerants with Global Warming Potential index, GWP, greater than 2000 is prohibited.

15.5.3 Systems Arrangements
Refrigeration systems are to provide suitable protection to prevent releasing any substantial quantity of the refrigerant. Unavoidable minimal release associated with recapture or recycling is permitted provided that recovery units are installed for the evacuation of the system. For the refrigerant recovery, compressors are to be capable of evacuating a system charge into a liquid receiver. Additionally, recovery units are to be provided to evacuate a system either into the existing liquid receiver or into empty gas cylinders provided for this purpose.

15.5.4 Systems Leaks Monitoring
Annual refrigerant leakage is to be not more than 10% of the total refrigerant charge of each system. A leak detection system is to be provided to continuously monitor spaces into which the refrigerant could leak. Further, an alarm is to be given in a manned location when the refrigerant concentration exceeds a predetermined limit, e.g. 25 ppm for ammonia.

Refrigerant leaks, consumption or disposal are to be documented in the logbook, which is to be maintained for the refrigeration plant.

DNV Environmental Class

408 Refrigerants in refrigeration systems shall be controlled in a manner suitable for detection of all types of leakage, including those normally not detected by an automatic leak detection system. Acceptable solutions may include one, or a combination, of the following:

- leak detection system appropriate to the applicable refrigerant with automatic alarm if presence of refrigerant is measured outside the refrigeration system
- level measurement in refrigeration system with alarm for low level
- refrigerant volumes must be logged at regular intervals, as a minimum once per week, to detect slow leaks.

The intent of this paragraph is to ensure that leaks to the atmosphere are avoided, or kept to a minimum. The efficiency and practical layout need to be evaluated when deciding what approach to use for leak detection.

Continue reading for information about the Martek Marine Refrigerant Gas Leak Detection System – MM2000®.

MM2000® – Refrigerant Gas Leak Detection System

MM2000® is an intelligent addressable gas detection system designed to provide refrigerant gas detection for ships in line with MARPOL Annex VI Regulation 12 – Ozone Depleting Substances.

Refrigerant gases are monitored continuously by fixed gas sensors installed in the vicinity of refrigeration and air conditioning machinery. Class societies advocate the use of fixed leak detection systems for environmental protection (e.g. Lloyds EP Notation). The MM2000® system operates on a single 4-core cable having the capacity to monitor from 1 to 32 addressable sensors.

The control system provides local indication of the measured parameters and alarm conditions together with relay contacts to shut down air conditioning or refrigeration plants as necessary.

- Type Approved
- Loop sensor cable for low cost installation
- No moving parts
- Continuous monitoring of all locations

Visit the MM2000® Refrigerant Gas Leak Detection System web page

www.martek-marine.com