

The Unknown Risks and Costs of Refrigerant Leaks



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Risks of refrigerant leakage

Most refrigeration and HVAC systems on board use hydrofluorocarbons (HFCs) or a blend of hydrofluoro-olefins (HFOs) that are typically colorless and odorless. They lack a distinct smell, posing a challenge for the crew in detecting refrigerant leaks by odor alone. Refrigerant leaks may begin as a minor issue, but if left unaddressed, they can develop into a much bigger problem.

Cost impact of refrigerant leaks



Reliability of equipment

Undercharged refrigeration systems can result in overexertion with reduced efficiency. Prolonged operation can lead to compressor overheating, excess wear and tear, ultimately resulting in irreversible damage.



Safety hazard

Refrigerants such as HFC, HFO, and HCFC are an asphyxiation risk as they are odorless, colorless, and heavier than air. As they are undetectable by smell, the crew can be left exposed in the affected area, potentially leading to illness or loss of consciousness.



Environmental hazard

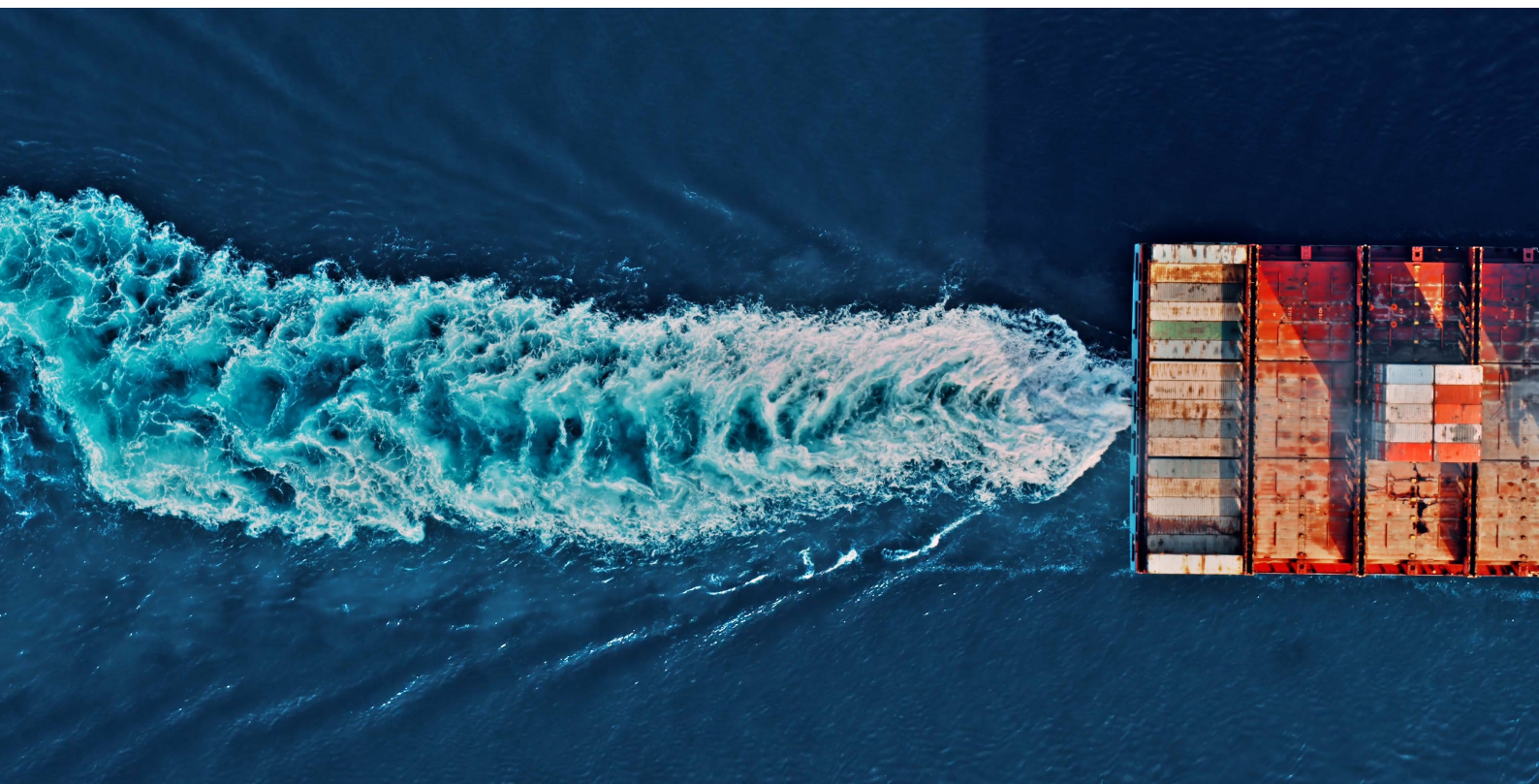
The escape of refrigerant gases significantly contributes to global warming, as they possess high global warming potential when released into the atmosphere. Excessive leakage of refrigerants will also result in fines and penalties.



Compliance with regulations

Leak prevention is one of the key requirements in many major regulations such as MARPOL, EU F-gas regulation, EPA and many others. Failure to prevent refrigerant leaks may result in your vessel being non-compliant.

The cost of inaction can be severe, resulting in operational disruptions due to system failure and incur potential fines and penalties. Moreover, the cost of constantly topping up refrigerants will continue to increase, exacerbated by the global HFC phasedown, making it an ineffective method to manage refrigerant leakage.



The regulatory landscape

In recent years, the maritime industry has placed a growing focus on addressing refrigerant leakage onboard vessels, driven by major regulations from authorities like the International Maritime Organisation (IMO) and marine classification societies. This includes mandates for monitoring, reporting, and reducing refrigerant leaks. These initiatives collectively reflect the industry's commitment to reducing environmental impact and promoting a more responsible and conscious maritime sector.

F-Gas Regulation

Article 5 of Regulation (EU) 2024/573 has introduced mandatory leak checks, and the frequency depends on the amount of refrigerant charge in the refrigeration system. The charge amount is measured in CO₂ equivalent tons. Leak checks must be conducted by personnel certified in accordance with Article 10.

Operators / Manufacturer	HFC Refrigerant Charge amount (CO ₂ Equivalent Tons)	Inspection Frequency (months)	
		Without Leak Detection Systems	With Leak Detection Systems
Refrigeration equipment, Air conditioning equipment, Reefer containers	≤ 50	12 months	24 months
	50 - 500	6 months	12 months
	≥ 500	Compulsory to install	6 months

EN378: 2016 - Refrigerant Leak Detector Requirements

The European Standard EN378:2016 regulation covers many aspects of the refrigeration systems, including safety and maintenance.

	Machine Room	Cold Room	Occupied spaces
Leak Monitoring system required	Yes	Yes	Yes
Alarm Requirements	Audio Visual Alarms both inside and outside the room (can also include supervised location).	Audio Visual Alarms inside the room. Best practice to also include outside the room.	Audio Visual Alarms inside the room and supervised location.
Maintenance Period	Once every 12 months	Once every 12 months	Once every 12 months
Sensor Monitoring	Replace damaged sensors immediately.	Replace damaged sensors immediately.	Replace damaged sensors immediately.

US EPA

In October 2023, the US EPA proposed a rule for managing HFCs under subsection (h) of the AIM Act, which includes the installation of refrigerant leak detectors for refrigeration systems with a charge size of 680kg (1500lbs) or more.

Proposed Requirements	Proposed Effective Date
Installation of Automatic Leak Detection (ALD) systems on commercial refrigeration and Industrial Process Refrigeration appliances installed prior to effective date of the final rule with a charge size of 1,500 lbs or more.	Within one year after the date of final rule publication.
Installation of ALD systems on commercial refrigeration and Industrial Process Refrigeration appliances installed on or after the effective date the final rule with a charge size of 1,500 lbs or more.	Within 30 days of appliance installation.

ASHRAE 15 - Refrigerant Leak Detector Requirements

ASHRAE Standard 15 specifies requirements for the safe design, construction, installation, and operation of refrigeration systems.

Requirements	Section in ASHRAE 15
Installation Requirements	8.11.2.1 Each refrigerating machinery room shall contain a detector, located in an area where refrigerant from a leak will concentrate, that actuates an alarm and mechanical ventilation in accordance with Section 8.11.4 at a value not greater than the corresponding TLV-TWA (or toxicity measure consistent therewith). The alarm shall annunciate visual and audible alarms inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room.

Other regulatory body and marine classification society notations

Regulatory Body	Note
IMO Marpol 73/78 Parties to Annex VI	<ul style="list-style-type: none"> - Consumption Logbook - Max Leak = 10% of total charge annually - Leak inspection check for system charge > 50 lbs every quarter, or annually
ABS ES/ENVIRO+ Notation	<ul style="list-style-type: none"> - Fixed leak detection system - Max Leak = 10% of total charge annually
LRS ECO Class Notation	<ul style="list-style-type: none"> - Fixed leak detection system - Monthly checks for max leakage rate (%) per system: <ul style="list-style-type: none"> 10%, 3-30 kg system 5%, 30-300 kg system 3%, >300kg system
DNV GL Clean Class Notation	<ul style="list-style-type: none"> - Fixed leak detection system - Conduct check with handheld detector on weekly basis - Max Leak = 10% of total charge annually
BV Cleanship Notation	<ul style="list-style-type: none"> - Fixed leak detection system - Consumption Logbook



A comprehensive solution to leak detection

Refrigerant leakage can be managed easily by following these steps:

- 1 Refrigerant leak monitoring
- 2 Periodic leak checks
- 3 Find hidden leaks

Refrigerant leak monitoring - for new leak detector users

For existing ships considering installing a new fixed refrigerant leak monitoring system, our Refrigerant Leak Monitor Kit 6CH can accommodate your needs. The Refrigerant Leak Monitor Kit 6CH offers an ideal solution for multi-point surveillance of machinery rooms and walk-in freezer rooms where refrigerant gases may be present.

The kit consists of:

- 1 x Monitoring Unit MPU6C (Product No.: 708027)
- 4 x Detector New MP-DS-HFC-4000 (Product No.: 708042)
- 1 x Red combined flash/siren FI-RL-R-SEP (Product No.: 708052)
- 2 x 100m halogen free cable 3x0.75mm² (Product No.: 708053)

The monitoring unit MPU6C comes equipped with 4 detectors with an option to add 2 more. It can display operating statuses and alarm information independently for each channel via LEDs. They are suitable for monitoring all HFC and HFO refrigerants.

Key features:

- Easily monitor operating statuses remotely through relay output
- Clear visual displays show alarm statuses independently for each channel via LEDs
- Flexibility to monitor different refrigerants with up to 3 configurable alarm concentrations
- Fail-safe monitoring with inbuilt buzzer and ready output for siren use



Refrigerant Leak Monitor Kit 6CH
(Product No.: 708051)

Refrigerant leak monitoring - for existing leak detector users

We have entered into an agreement with SAMON to become their exclusive distributor for refrigerant leak monitoring products in the maritime industry. This agreement enables us to provide SAMON's comprehensive range of products and after-sales service parts through our extensive global supply network.

It is important to ensure the leak monitoring system is functioning accurately and replace visibly damaged monitors and detector immediately.



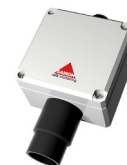
GR model



GR model



GR model



MP-DS (for monitoring kit)

Product	Product Number
DETECTOR NEW MP-DS-HFC-4000 (SAMON: 38-420 W/SEN027)	708042
DETECTOR NEW GS24-HFC-4000-ZM (SAMON: 37-420-ZM W/SEN027)	708043
DETECTOR NEW GS230-HFC-4000-ZM (SAMON: 37-425-ZM W/SEN027)	708044
DETECTOR NEW GS24-HFC-4000 (SAMON: 37-420 W/SEN027)	708045
DETECTOR NEW GS230-HFC-4000 (SAMON: 37-425 W/SEN027)	708046
DETECTOR NEW GSR24-HFC-4000 (SAMON: 37-920 W/SEN027)	708047
DETECTOR NEW GSR230-HFC-4000 (SAMON: 37-925 W/SEN027)	708048
DETECTOR NEW GR24-HFC-4000 (SAMON: 37-620 W/SEN027)	708049
DETECTOR NEW GR230-HFC-4000 (SAMON: 37-625 W/SEN027)	708050

Refrigerant leak monitoring - sensor calibration (every 12 months)

It is recommended to calibrate the sensors once every 12 months using calibration tools.

- DT300 is a diagnostic tool used for checking and calibrating detectors without the need for calibration gas.
- DT300 is used together with a sensor module (SM300-HFC or SM300-Self Sense), which is purchased separately.

As the sensor modules served as a reference point, it should be replaced annually to ensure accuracy.

SM300 HFC is compatible with SEN004, and SM300-Self Sense is compatible with SEN027.

Calibration Tools		
Diagnostic Tool DT300	Sensor Module SM300	Sensor Module SM300- Self Sense
 <p>Product No: 708037 DT300 (SAMON: 60-130)</p>	 <p>Product No: 708038 SM300-HFC (SAMON: 60-134) <i>**Compatible with old sensor SAMON: SEN004 only</i></p>	 <p>Product No: 708039 SM300-Self Sense (SAMON: 60-150) <i>**Compatible with new sensor SAMON: SEN027 only</i></p>

Refrigerant leak monitoring - sensor replacement (every 5 years)

- Under normal circumstances, the lifetime of the sensor in the detector is up to 5 years.
- Ship owners are advised to plan for sensor replacements when the sensor is nearing the fifth year of operation.
- SAMON has developed a new sensor that can be fitted in existing installations where SEN004 is used.
- The main feature of the SEN027-Self Sense is its built-in filter that makes the sensor much more resistant against false alarms caused by dust, dirt, liquids, and aerosols.
- The sensor can be replaced without any changes in alarm settings.



Upgrade your detector sensor with better protection – SEN027 (P/N:708041)

Product	Product Number
NEW HFC SENSOR 0-4000PPM SELF SENSE (SAMON: SEN027)	708041

Periodic leak checks

A handheld detector able to detect all halogen refrigerants (CFC, HCFC, HFC, HFO). The sensor of the most sensitive refrigerant leak detectors in the industry.

- Corona Discharge Sensor
- 5 ppm sensitivity (less than 0.2502 per year)
- High and Low sensitivity level
- Seven-segment visual leak size indicator
- One touch reset and keypad controls



Product	Product Number
Electronic Handheld Leak Detector	716142

Find hidden leaks

The Unitor Refrigerant Leak Detection U.V. Tracer Kit (1.5V) is an effective tool for pinpointing the invisible refrigerant leaks (tiny or intermittent leakages hidden in inaccessible areas) in the systems.

- The UV tracer fluid is suitable for all refrigerants and compressor oils.
- Biodegradable solvent spray cleaner can remove UV Tracer fluid residue and other stains effectively.



Product	Product Number
UV Tracer Kit	587199

Responsible Refrigeration and benefits of our leak detection solution

 <p>Safety of crew members</p>	<ul style="list-style-type: none"> • Round-the-clock monitoring and alarm • Alerts ship crew in case of emergency • Dependable remote alarm monitoring • Protect yourself and your crew
 <p>Cost-saving</p>	<ul style="list-style-type: none"> • Reduces risk of refrigeration failure and product loss • Minimises refrigerant loss • Enhances energy efficiency • Reduces operating costs
 <p>Time-saving</p>	<ul style="list-style-type: none"> • Send enquiries and place orders directly with your local WSS personnel • Products can be delivered together with other marine products from WSS
 <p>Regulatory compliance</p>	<ul style="list-style-type: none"> • Complies with major regulatory bodies such as: <ul style="list-style-type: none"> - F-gas Regulation - EN378: 2016 - US EPA - ASHRAE 15:2016 - IMO - Classification Society Notations
 <p>Environmentally friendly</p>	<ul style="list-style-type: none"> • Make environmentally- conscious decisions • Enables early detection • Minimises the release of environmentally harmful substances into the atmosphere

Scan now



for a closer look

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