GEA Grasso
Refrigeration Division

Reciprocating Compressors for industrial refrigeration Grasso

Safety Instructions Refrigerant Ammonia

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Legal Notice

General

This manual must be carefull read and understood prior to servicing and running the compressor (package). For all safety instructions refer to Chapter 1

This user manual is written with great care, but the contractor/installer is held responsible for examining this information and to take care of possible additional and/ or deviated safety measures. Please consult your contractor (supplier).

Symbols used in this manual

WATCH OUT, BE CAREFUL, IMPORTANT

WARNING; This is an important warning. Ignoring these warnings can result into considerable personal accidents or considerable damage to the compressor or the refrigeration plant.

TIP, HINT

Hint

Before consulting your contractor (supplier) for any reason, make note of the data on the type plate fixed on the compressor, package and/or other package components.

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Table 1 Revision notes IMM Grasso 10

v	Description	Date M-YY	Ref.
001	Initial version	01-03	KK

1. SAFETY

1.1 GENERAL SAFETY INSTRUCTIONS

Operating, servicing and maintaining

When operating, servicing and maintaining Grasso compressors (packages) keep inmind, **in particular**, the following instructions taken from the standards, rules, ordinances and laws listed:

- ⇨ It is forbidden to weld or use open flames unless special safety instructions are observed.
- ⇨ Smoking is not allowed in the refrigeration machinery room.
- ⇨ Escape routes must be free from obstacles.
- ⇨ Store suitable personnel protective equipment and respirators at an accessible point of the refrigeration machinery room (acc. to EN 378-4).
- ⇨ Store fire extinguishers at an accessible point of the refrigeration machinery room (acc.to EN 378-3).
- ⇨ Any work on units and chillers may only be carried out by appropriately trained and instructed staff.
- ⇨ Intimate knowledge of the complete delivered documentation is a prerequisite for operating the equipment correctly and safely.
- ⇨ The refrigeration units must not be operated unless full functional and operational safety and reliability of all components, safety devices and circuits (refrigerant and oil circuits, secondary refrigerant and cooling water circuits) and of the electrical switchgear is ensured.
- ⇨ The elements of the safety chain, the sensors and controllers shall be adjusted according to the designed values and must not be set out of operation, not in part either.

1.2 INSTALLATION /OPERATION OF EQUIPMENT

The following European norms, rules, ordinances and laws have to be strictly observed to ensure the safety and functional reliability of the compressor packages:

(a) For the installation of refrigeration machines and the protection of personnel EN378-3 and prEN12693
(b) For testing the refrigeration machine prior to its start-up EN378-2
(c) For renewal testing EN378-2
(d) For testing for corrosion EN378-2
(e) For taking a plant record EN378-2 and EN378-4
(f) For taking measures in case of emergency EN378-2
(g) For instruction of the competent operating personnel EN378-4
(h) For maintenance and repair EN378-4
(i) For recovery, reuse and disposal of refrigerants, oil, secondary refrigerants and parts of the refrigeration machine (e.g. filters, driers, heat insulation) EN378-4
(j) For draining oil from an ammonia refrigeration machine EN378-4
(k) For handling and storage of refrigerants EN378-4

REMARK: Grasso is not liable for damage resulting from the operator's infringement of the mentioned rules or other laws and regulations binding at the respective place of installation.

2. SAFETY SYSTEM

2.1 INTRODUCTION

Strict safety provisions have been defined to protect human beings and facilities. In the following paragraphs, reference is made to the main guidelines and provisions to be observed inplanning and operating NH_3 refrigerating plants. With regard to their operation, the detailed operating manuals of the plant manufacturers shall be taken into account as well.

2.2 INSTALLATION OF AMMONIA REFRIGERATING PLANTS

Refrigerating plants must be positioned so as to prevent their being damaged by site traffic and transport activities.
In areas used for traffic, refrigerant pipelines (e.g. NH3) must be laid without detachable connectors and fittings.
Refrigerant pipelines must be protected from mechanical damage.

Mechanical damage may be caused by vehicles or heavy loads. Protection can be provided inter alia by the following measures:

- Laying above the vehicle height with a given profile limitation
- Mounting of protective bars or driving limitation rails
- Bumpers mounted on pipeline supports
- Laying in pipeline ducts

Refrigerating plants must be positioned so as to allow inspection from all sides and to provide sufficient space for maintenance work.
NH_3 and oil must be prevented from entering the sewerage network. Therefore, the installation area of the NH_3 refrigerating plant must be free of drains, or existing drains have to be closed.
Rescue passages (escape passages) from an installation room to safe rooms must not be longer than 20 m and must be properly marked.
A sufficient number of fire extinguishers must be available.

2.3 LOCATION OF INSTALLATION

Machinery rooms must be designed so as to allow exhausting of escaping NH_3 avoiding it being transferred into adjacent rooms, staircases, narrow yards and corridors.

This requirement is met if:

- in case of natural ventilation, the cross sectionarea to be open to the outside is at least "A" m

or

- in case of mechanical ventilation, an air flow from outside the endangered area of at least "Q" m/h can be switched on

and

- the doors of the machinery room not leading directly to the outside are self-locking.
  "A" = 0,14 x G (m),
  "Q" = 50,0 x G 2/3 (m/h),
  "G" = filling weight of the plant (kg).

In case of installing several plants, this parameter is derived from the plant with the larger filling weight.
Air exhaust openings (windows, outlets, channels) shall be arranged to prevent human beings from being harmed by the refrigerants carried by the exhaust air.
A mechanical ventilation is provided if natural ventilation through windows or doors is impossible or insufficient. An effective air exchange can be accomplished only if a sufficient quantity of outside air can flow in.
As NH_3 is lighter than air, the polluted air shall be exhausted near the ceiling while fresh air shall be supplied near the floor.
The machinery room may also be provided as a gastight machine housing being vented to the outside.
An absorption system may be applied to dissolve escaping NH_3 e.g. in water or in acid.
Machinery rooms must allow quick escape in case of danger.
Depending upon the size of the machinery room and the refrigerant filling weight, an emergency exit directly to the outside is recommended.
Doors must open towards the escape direction and must be able to be opened at any time from the inside, e.g. by mounting a panic lock.
Refrigerating plants installed in machinery rooms must allow switchoff from outside the machinery room. The control devices must be properly and clearly marked.
Facilities for refrigerant discharge must allow actuation from a non-hazardous position.

2.4 STAFF PROTECTION

The entrepreneur shall provide personal safety equipment against exposure to refrigerant. This equipment shall be stored ready-for-use outside the hazardous areas in an easily accessible manner. Safety equipment for at least two persons should be available.

Safety equipment for ammonia:

- Safety gloves
- Safety goggles
- respiratory equipment with filter

2.5 EXPLOSION PROTECTION

NH_3 is explosive if mixed with air at ratios between 15 and 28% although the reaction energy is very low, and a ventilation system is operating. NH_3 is a hardly inflammable gas which does not continue to burn without a supporting flame as its ignition temperature is very high (630°C). Therefore, no explosion protection is prescribed (except for special cases for fans, fan motors and pertaining electrical equipment: EN378-3). Open flames and smoking are not allowed in the installation area.

2.6 SAFETY SYSTEMS

In order to provide a high degree of safety against ammonia leaks,
a. ammonia warning systems and
b. absorption systems
can be ordered.

2.6.1 AMMONIA WARING SYSTEMS

Detecting devices and warning systems are requiredaccording to EN378-3. For refrigerant filling amounts exceeding 500 kg additional measures are to be taken to check all the connected water- or liquid circuits for the presence of refrigerant.

2.6.2 ABSORBTION SYSTEMS

When operating NH_3 liquid chillers in refrigerating plants, the machinery room has to be ventilated in accordance with EN378-1 to 4.
In case of leakage, the machinery room air shall be let off to the outside in a non-hazardous manner. Should this be impossible, the machinery room air shall be led through an absorption tank and to be resupplied to the machinery room after cleaning.

For this case, Grasso has developed a series of ammonia absorption facilities the size of which depends upon the quantity of refrigerant in the NH_3 liquid chillers and refrigerating plants.
If there are several liquid chillers, the absorption facility shall be selected with regard to the liquid chiller having the largest filling weight. If the maximum amount should be exceeded, a combination of several absorption facilities is possible.
The absorption facilities have been designed to be integrated into usual ventilation systems.

2.7 TESTING THE ENTIRE PLANT PRIOR TO START-UP

Testing of the entire plant has to be performed according to EN 378-2, prior to startup.
Renewal tests of the entire plant have to be carried out with due regard to EN 378-2.
The entrepreneur shall ensure that flexible refrigerant lines which are moved actively be tested for leaks by an expert at least every 6 months.
„Notified bodies" (e.g. TÜV) are the competent authorities for testing of pressure equipment and piping subject to the EC Directive „Pressure Equipment"

2.8 PHYCISCAL PROPERTIES

Hazardous substance: **Ammonia (NH_3)**

- Waterfree, gaseous, liquid and dissolved in water
- Group 2 in accordance with EN378-1, molecular weight 17 kg/mol
- Density 0,7 kg/m as a gas at 1 bar and 20°C, lighter than air
- If ammonia is present in the closed circuit of the liquid chiller/ compressor package in case of an emergency, it is dissolved in water by using the absorption device or by using the jet of water.

2.9 DANGER FOR PEOPLE AND ENVIRONMENT

- A concentration of 25 ppm is highly perceptible; max. working-site concentration: 50 ppm.
- Ammonia as a gas highly irritates and harms the eyes, has an offensive pungent odour causing tears and is toxic when inhaled.
- Liquid ammonia, its concentrated watery solutionand gaseous ammonia in high concenteration causes severe irritation to skin, mucous membranes and eyes.
- Liquid ammonia can cause frostbite, if it gets in contact with the skin.
- Ammonia and air produce an explosive mixturebetween 15...28 Vol.-%.

2.10 PROTECTION MEASURES AND BEHAVIOUR REGULATIONS

- The compressor unit/ liquid chiller must be operated only by trained and qualified staff.
- Interventions in the ammonia-circuit must be carried out only by experts in this field.
- Handling of ammonia is only allowed to management confirmed persons.
- Regular instructions on handling of ammonia have to be carried out (with proof).
- A proper machinery room ventilation has to be guaranteed. In case of ammonia odour in the machinery room don't eat, drink and smoke there!
- The skin contact with liquid ammonia has to be avoided absolutely.
- A respiratory protection apparatus with ammonia filter has generally to be put on in case of working on the refrigerating plant.

2.11 BEHAVIOUR IN CASE OF DANGER

- Leave the working area immediately and actuate the alarm if ammonia escapes from the refrigerating plant.
- If need be, put on a respiratory protection apparatus with ammonia filter (colour: green).
- Rubber gloves, protection apron and protection boots have to be used.
- Ammonia has to be precipitated with a lot of water (spray water). Attention! Don't ignore the automatic start of the absorption device!
- Don't drain ammonia-containing water into the sewerage system or public waters.

2.12 FIRST AID

- The harmed person(s) has (have) to get away from the contaminated atmosphere into the openair.
- Ammonia contaminated clothes have to be taken off.
- Irritated parts of the body - mouth and eyes too - have to be sufficiently rinsed with water for about 20 minutes.
- Don't cover the parts of the body concerned with bandages, oil etc., but protect them against frost.
- The harmed person(s) has (have) to get away into the hospital or to a doctor as soon as possible after rinsing off the parts of the body concerned.

- Medical treatment is immediately necessary, if ammonia was inhaled in great quantities and in case of irritations — especially of the eyes.

2.13 APPROPRIATE DISPOSAL

Ammonia and its watery solution have to be disposed with special caution and responsibility!

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Please contact the technical department of your supplier for extra information.