Title:
AMMONIA COMPRESSORS AND REFRIGERATION PLANT

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Summary:
1 This circular gives advice on the precautions to be taken against the toxic, fire and explos

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Shorting ,grading, packing of fruits and vegetables, Reefer logistics, Reefer trucks , Temper

Article Body:
INTRODUCTION

1 This circular gives advice on the precautions to be taken against the toxic, fire and explos

2 Appendix 1 outlines the general principles of refrigeration, Appendix 2 gives information on

HAZARDS

Toxicity

3 Ammonia is a chemically reactive gas that is very soluble in water and is much lighter than

Exposure to concentrations exceeding 5,000 ppm (0.5%) for quite short periods can result in de

Fire and explosion

4 Ammonia forms a flammable mixture with air at concentrations between 16 and 25% v/v. There h
Existing guidance

5 Current guidance on the precautions which should be taken with ammonia refrigeration plant m

Precautions

6 Under normal circumstances people will not be able to bear ammonia concentrations at even a

PRECAUTIONS AGAINST TOXIC RISK

Respiratory protective equipment

7 Any person entering an area in which ammonia vapour is likely to be present at a significant

8 Suitable respiratory protective equipment must be worn by every person carrying out engineer

A list of suitable equipment is given in form 2502 "Certificate of Approval (Canister Gas Resp

9 Everyone who is likely to need to use respiratory protective equipment must be properly trai

Evacuation and emergency procedures

10 lt is essential that a clear emergency procedure is drawn up which details the precise duti

11 Adequate exits should be maintained from plant rooms at, all times. Personnel seriously aff

Training in plant operation and maintenance

12 All personnel involved in the operation and maintenance of the plant must be adequately tra
PLANT LOCATION

Plant not designed for outdoor location

13 In the case of standard refrigeration plant (ie plant not specifically designed for outdoor

14 ln order to facilitate the provision of ventilation and explosion relief, compressor-houses
Plant designed for outdoor location

15 Only plant specifically designed for the conditions should be installed outdoors. Such inst

Plant in workrooms

16 As a general principle the amount of plant containing ammonia situated in workrooms and oth

Ventilation

17 Compress or houses should be provided with adequate and suitable ventilation to meet the fo

(1) Normal Ventilation Sufficient permanent ventilation should be provided to prevent build up

(2) Emergency ventilation Provision should be made for sufficient mechanical ventilation to pr

18 The ventilation requirements for a particular installation will depend on the type, capacit

(1) permanent natural or mechanical ventilation, or a combination of both, may be used for nor

(2) the ventilation should discharge to a safe place in the open air;
(3) in considering the ventilation to be provided, the potential effects of cold on plant shou

(4) flow of air through cracks around windows, doors etc, or the opening of windows or doors s

(5) the formulae in BS4434 for quantifying ventilation requirements are rules of thumb based o
impracticable; and

(6) it should be noted that the standard of ventilation given by the formulae in BS 4434: 1980

Plant integrity

19 There can be serious corrosion of the low pressure. parts of pipework and plant due to cond

Pipework

20 All parts of refrigerating systems and in particular pipework should be positioned or prote

Oil drain system

21 Many of the reported incidents involving ammonia refrigeration systems have been the result

(1) where short distances are involved and adequate observation of the drain is possible oil d
(2) a double valve arrangement should be provided at oil drains. In addition to the operationa

(3) The use of oil drain catchpots. These are a useful feature on new plant, but existing plan
Ammonia filling point

22 Ammonia filling points should be located in safe, well ventilated positions and, where reas

PRECAUTIONS AGAINST FIRE AND EXPLOSION RISK

Sources of ignition

23 All likely sources of ignition (naked flames etc) should be eliminated from compressor hous

Electrical equipment

24 Guidance on electrical apparatus for use in potentially explosive atmospheres is given in R

25 As a general principle, electrical equipment should be sited outside the compressor room ir

26 Where the ammonia compressors and refrigeration plant are located in the same room as the s

Electrical apparatus selection criteria

27 The use of electrical apparatus in refrigeration plants using ammonia has been considered a

OTHER RISKS

28 Refrigeration systems often have associated risks which may require attention, These includ

ENFORCEMENT APPROACH

29 Enforcement officers should advise that ammonia refrigeration plant should comply with the

(1) ammonia presents a toxic risk at concentrations far below those at which it presents any f

(2) the potential consequences of an incident in terms of injury to personnel, and the general

(3) BS4434 was first published in 1969 and was not intended to be retrospective, although impr

(4) analysis of the l983 visits strongly suggest that where poor conditions of the plant are f

(5) where enforcement officers encounter maintenance contractors they should make enquiries ab

Further advice

30 This is a complicated technical subject and there are strong trade pressure groups. Enforce

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Ammonia is used as a refrigerant because of particular thermodynamic properties which enable i

2. A simple system theoretically needs 4 components:

(1) evaporator;

(2) compressor;

(3) condenser; and
(4) reducing valve

In practice other components such as oil separator, intercooler, liquid receiver, surge drum a

3 The useful refrigeration is produced at the evaporator. Liquid ammonia at low pressure, and

4 In a practical system it is likely there will be other items of plant. An oil separator remo

Downstream of the condenser is generally a liquid receiver. Downstream of the reducing valve i

A simple practical refrigeration system

1 The aim was to collect information about a cross section of installations. One hundred and f

2 Returns covered a wide range of processes in the food and drinks industries. The largest sir

There were a wide range of other uses reported; most parts of the food industry require contro
The oldest component reported was pre-war and there was a fairly even spread of age from 1960

3 Eighty-nine per cent of installations had a separate compressor room. Forty-nine percent had

This raises questions of safe access and also escape in the event of an emergency.

4 Thirty-six percent, had the evaporator in the workroom. (These were usually product freezers

5 Only 3% of installations were identified as having pipework or plant capable of being damage

6 lt proved impossible to carryout meaningful analysis of the ventilation provided in compress

7 Only 16% of all system charging was done by a person on his own; the usual arrangement was 2

8 Forty-two per cent of compressor houses had no gas detectors. Sieger was by far the most com

Approximately half of the detector installations only had one operating level.
Twenty-seven per cent of systems did not shut down the plant but merely raised the alarm. Ten

9 Sixty-six percent of compressor room electrical installations were not fully equipped to Zon

10 Eighty-eight percent of all sites had 2 or more sets of respiratory protection of some kind

11 Forty-seven per cent of sites had reviving apparatus available usually for general first ai

12 Twenty-seven percent of sites had Draeger (or similar) detector tubes for measuring low con

13 Fifty-nine percent of installations were maintained at least partly by contractors. Apart f

14 Fifty-five percent of all sites appeared to have emergency evacuation procedures (43% used

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APPENDIX 3 (paras 1 and 26)

PROTECTION OF ELECTRICAL APPARATUS AT AMMONIA COMPRESSORS AND REFRIGERATION PLANT

EXTERNALLY SITED PLANT

1 Compressors and refrigeration plant sited in out door locations in accordance with para 14 c

INTERNALLY SITED PLANT

2 A flow chart of the basic requirements relating to the electrical apparatus for internally s

Option 1 - Use of explosion protected electrical apparatus

3 Hazardous area classification should be carried out by a competent person. Electrical appara

Option 2 - Detection of leaks by personnel or gas detectors

4 ln this approach, non-explosion protected electrical apparatus, with qualifications, may be

Gas detectors

5 The detectors should be suitably positioned taking into account the physical characteristics

6 As a rough guide only, one might expect to see detectors in the vicinity of the compressors

(This objective, which is also applicable to "detection" of a leak by personnel, is particular

7 The detectors should be suitably explosion protected.

8 The detectors used are of the "pellistor" type and may be subject to poisoning by airborne c

9 The detectors should be capable of detecting concentrations of ammonia at 1 % v/v or less.

Associated electrical apparatus

10 Account should be taken of the electrical control system circuitry and the maximum possible

1975 "Safeguarding of Machinery" Section 6.

11 The isolating device(s), whether manually or automatically operated, which cuts off the ele

12 Attention will need to be paid to the control of other circuits which enter the plant room

Continuously manned rooms

13 Isolation of all electrical circuits should be effected by isolating devices located in a r

Unmanned plant rooms

14 lsolation of all electrical circuits should be effected by isolating devices located in a r

15 Maintenance personnel are required to enter unmanned plant rooms and adequate means of esca

16 Personal protection including breathing apparatus, and possibly impervious suits, may be ne

Unmanned plant rooms linked to a continuously manned control room
17 ln certain applications, (eg chemical plant), sudden loss of cooling facilities caused by a

(1) the alarm arrangement and monitoring of the alarms (ie the manning of the control rooms) i

(2) suitable isolation facilities for the compressor and unprotected electrical equipment are

(3) as a safe system of work is provided for entry into the compressor room and for the overal