

ADVANTAGE AMMONIA

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Factory Inspection Requirements and Applicable Laws in Tamil Nadu

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The Factories Act

Introduction to ammonia

Safety in design

Safety in manufacturing and installation

Personal Protection Equipment

A few tips on how to have an efficient plant.

Some common ammonia safety issues

ABSTRACT

The paper deals with the points to be taken in designing a food processing plant with ammonia refrigeration keeping in mind the Factories Act . The various aspects to be looked into in order to have a safe factory are discussed. Safety aspects in the design, installation and operation of an ammonia plant will be dealt with.



Association of
AMMONIA REFRIGERATION

THE FACTORIES ACT, 1948

(63 OF 1948)

WITH

THE TAMIL NADU FACTORIES RULES, 1950 ;
THE TAMIL NADU FACTORIES (WELFARE OFFICERS)
RULES, 1953 ;

THE TAMIL NADU SAFETY OFFICERS (DUTIES,
QUALIFICATIONS AND CONDITIONS OF
SERVICE) RULES, 2005

AND

SHORT NOTES OF CASES



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purpose and a notice containing this provision and the penalty for its violation shall be prominently displayed at suitable places in the premises.

(4) Whoever spits in contravention of sub-section (3) shall be punishable with fine not exceeding five rupees.

CHAPTER IV

SAFETY

21. *Fencing of machinery.*—(1) In every factory the following, namely :—

- (i) every moving part of a prime mover, and every fly-wheel connected to a prime mover, whether the prime mover or fly-wheel is in the engine house or not ;
- (ii) the headrace and tailrace of every water-wheel and water turbine ;
- (iii) any part of a stock-bar which projects beyond the head stock of a lathe ; and
- (iv) unless they are in such position or of such construction as to be safe to every person employed in the factory as they would be if they were securely fenced, the following, namely,—
 - (a) every part of an electric generator, a motor or rotary converter ;
 - (b) every part of transmission machinery ; and
 - (c) every dangerous part of any other machinery,

shall be securely fenced by safeguards of substantial construction which ¹[shall be constantly maintained and kept in position] while the parts of machinery they are fencing are in motion or in use :

¹ Subs. by Act 94 of 1976, s. 10.

¹[Provided that for the purpose of determining whether any part of machinery is in such position or is of such construction as to be safe as aforesaid, account shall not be taken of any occasion when—

- (i) it is necessary to make an examination of any part of the machinery aforesaid while it is in motion or, as a result of such examination, to carry out lubrication or other adjusting operation while the machinery is in motion, being an examination or operation which it is necessary to be carried out while that part of the machinery is in motion, or
- (ii) in the case of any part of a transmission machinery used in such process as may be prescribed (being a process of a continuous nature the carrying on of which shall be, or is likely to be, substantially interfered with by the stoppage of that part of the machinery), it is necessary to make an examination of such part of the machinery while it is in motion or, as a result of such examination, to carry out any mounting or shipping of belts or lubrication or other adjusting operation while the machinery is in motion,

and such examination or operation is made or carried out in accordance with the provisions of sub-section (1) of section 22.]

(2) The ²[State] Government may by rules prescribe such further precautions as it may consider necessary in respect of any particular machinery or part thereof, or exempt, subject to such condition as may be prescribed, for securing the safety of the workers, any particular machinery or part thereof from the provisions of this section.

¹ Subs. by Act 94 of 1976, s. 10.

² Subs. by the A.O. 1950, for " Provincial ".

22. **Work on or near machinery in motion.**—¹[(1) Where in any factory it becomes necessary to examine any part of machinery referred to in section 21, while the machinery is in motion, or, as a result of such examination, to carry out—

- (a) in a case referred to in clause (i) of the proviso to sub-section (1) of section 21, lubrication or other adjusting operation; or
- (b) in a case referred to in clause (ii) of the proviso aforesaid, any mounting or shipping of belts or lubrication or other adjusting operation,

while the machinery is in motion, such examination or operation shall be made or carried out only by a specially trained adult male worker wearing tight fitting clothing (which shall be supplied by the occupier) whose name has been recorded in the register prescribed in this behalf and who has been furnished with a certificate of his appointment, and while he is so engaged,—

- (a) such worker shall not handle a belt at a moving pulley unless—
 - (i) the belt is not more than fifteen centimetres in width;
 - (ii) the pulley is normally for the purpose of drive and not merely a fly-wheel or balance wheel (in which case a belt is not permissible);
 - (iii) the belt joint is either laced or flush with the belt;
 - (iv) the belt, including the joint and the pulley rim, are in good repair;
 - (v) there is reasonable clearance between the pulley and any fixed plant or structure;
 - (vi) secure foothold and, where necessary, secure handhold, are provided for the operator; and

¹ Subs. by Act 94 of 1976, s. 11.

- (vii) any ladder in use for carrying out any examination or operation aforesaid is securely fixed or lashed or is firmly held by a second person;]
- (b) without prejudice to any other provision of this Act relating to the fencing of machinery, every set screw, bolt and key on any revolving shaft, spindle, wheel or pinion, and all spur, worm and other toothed or friction gearing in motion with which such worker would otherwise be liable to come into contact, shall be securely fenced to prevent such contact.

¹[(2) No woman or young person shall be allowed to clean, lubricate or adjust any part of a prime mover or of any transmission machinery while the prime mover or transmission machinery is in motion, or to clean, lubricate or adjust any part of any machine if the cleaning, lubrication or adjustment thereof, would expose the woman or young person to risk of injury from any moving part either of that machine or of any adjacent machinery.]

(3) The ²[State] Government may, by notification in the Official Gazette, prohibit, in any specified factory or class or description of factories, the cleaning, lubricating or adjusting by any person of specified parts of machinery when those parts are in motion.

23. **Employment of young persons on dangerous machines.**—(1) No young person ³[shall be required or allowed to work] at any machine to which this section applies, unless he has been fully instructed as to the dangers arising in connection with the machine and the precautions to be observed and—

- (a) has received sufficient training in work at the machine, or

¹ Subs. by Act 25 of 1954, s. 6, for the original sub-sec. (2).

² Subs. by the A.O. 1950, for "Provincial".

³ Subs. by Act 20 of 1987, s. 10 (w.e.f. 1st December, 1987).

winch, teagle, pulley block, gin wheel, transporter or runway ;

“(b) “lifting tackle” means any chain sling, rope sling, hook, shackle, swivel, coupling, socket, clamp, tray or similar appliance, whether fixed or movable, used in connection with raising or, lowering of persons, or loads by use of lifting machines.]”

30. **Revolving machinery.**—(1) “[In every factory] in which the process of grinding is carried on there shall be permanently affixed to or placed near each machine in use a notice indicating the maximum safe working peripheral speed of every grind-stone or abrasive wheel, the speed of the shaft or spindle upon which the wheel is mounted, and the diameter of the pulley upon such shaft or spindle necessary to secure such safe working peripheral speed.

(2) The speeds indicated in notices under sub-section (1) shall not be exceeded.

(3) Effective measures shall be taken in every factory to ensure that the safe working peripheral speed of every revolving vessel, cage, basket, fly-wheel, pulley, disc or similar appliance driven by power is not exceeded.

31. **Pressure plant.**—“(1) If in any factory, any plant or machinery or any part thereof is operated at a pressure above atmospheric pressure, effective measures shall be taken to ensure that the safe working pressure of such plant or machinery or part is not exceeded.]

(2) The “[State] Government may make rules providing for the examination and testing of any plant or machinery such as is referred to in sub-section (1) and prescribing such other safety measures in relation thereto

¹ Subs. by Act 20 of 1987, s. 13 (w.e.f. 1st December, 1987).

² Subs. by Act 20 of 1987, s. 14 (w.e.f. 1st December, 1987).

³ Subs. by Act 20 of 1987, s. 15 (w.e.f. 1st December, 1987).

⁴ Subs. by the A.O. 1950, for “Provincial”.

as may in its opinion be necessary in any factory or class or description of factories.

“(3) The State Government may, by rules, exempt, subject to such conditions as may be specified therein, any part of any plant or machinery referred to in sub-section (1) from the provisions of this section.]

32. **Floors, stairs and means of access.**—In every factory,—

(a) all floors, steps, stairs, passages and gangways shall be of sound construction and properly maintained “[and shall be kept free from obstructions and substances likely to cause persons to slip] and where it is necessary to ensure safety, steps, stairs, passages and gangways shall be provided with substantial hand-rails ;

(b) there shall, so far as is reasonably practicable, be provided and maintained safe means of access to every place at which any person is at any time required to work ;

“(c) when any person has to work at a height from where he is likely to fall, provision shall be made, so far as is reasonably practicable, by fencing or otherwise, to ensure the safety of the person so working.]

33. **Pits, sumps, openings in floors, etc.**—(1) In every factory every fixed vessel, sump, tank, pit or opening in the ground or in a floor which, by reason of its depth, situation, construction or contents, is or may be a source of danger, shall be either securely covered or securely fenced.

(2) The “[State] Government may, by order in writing, exempt, subject to such conditions as may be

¹ Ins. by Act 94 of 1976, s. 13.

² Ins. by Act 94 of 1976, s. 14.

³ Subs. by Act 20 of 1987, s. 16 (w.e.f. 1st December, 1987).

⁴ Subs. by the A.O. 1950, for “Provincial”.

(4A) **Passage ways for cranes** — (i) To provide access to rail tracks of overhead travelling cranes suitable passage-ways of at least 50 cm. (20 inches) width with toe boards and double hand rails 90 cm. (3 feet) high shall be provided alongside, and clear of the rail tracks of overhead travelling cranes, such that no moving part of the crane can strike persons on the ways, and the passage-way shall be at a lower level than the crane can strike persons on the ways, and the passage-way shall be at a lower level than the crane track itself. Safe access ladders shall be provided at suitable intervals to afford access to these passage-ways, and from passage-ways to the rail tracks.

[(ii) The Chief Inspector may, for reasons to be specified in writing, exempt any factory in respect of any overhead travelling crane from the operation of any provisions of clause (i) subject to such conditions as he may specify.]

(5) All rails on which a travelling crane moves and every track on which the carriage of a transporter or runway moves, shall be of proper size and adequate strength and have an even running surface and every such rail or track shall be properly laid, adequately supported and properly maintained.

(6) All chains, and lifting tackle, except a rope sling shall, unless they have been subjected to such other heat treatment as may be approved by the Chief Inspector, be effectively annealed under the supervision of a competent person at the following intervals : —

(i) All chains, slings, rings, hooks, shackles and swivels used in connection with molten metal or molten slag or when they are made of 12.7 millimetres bar or smaller, once at least in every six months.

(ii) All other chains, rings, hooks, shackles and swivels in general use, once at least in every twelve months :

Provided that chains and lifting tackle not in frequent use shall, subject to the Chief Inspector's approval, be annealed only when necessary. Particulars of such annealing shall be entered in a register prescribed under sub-rule (4) which shall be kept available for inspection.

(7) Nothing in the foregoing sub-rule (6) shall apply to the following classes of chains and lifting tackle : —

(i) Chains made of malleable cast iron.

¹ Sub. by G.O. Ms. No. 210, Labour and Employment, dated the 18th March, 1978.

- (ii) Plate link chains.
- (iii) Chains, rings, hooks, shackles and swivels made of steel or of any non-ferrous metals.
- (iv) Pitched chains, working on sprocket or pocketed wheels.
- (v) Rings, hooks, shackles and swivels permanently attached to pitched chains, pulley blocks or weighing machines.
- (vi) Hooks and swivels having screw threaded parts or ball-bearing or other case-hardened parts.
- (vii) Socket shackles secured to wire ropes by white metal capping.
- (viii) Bordeaux connections.

Such chains and lifting tackles shall be thoroughly examined by a competent person once at least in every twelve months and particulars entered in the register kept in accordance with sub-rule (4).

(8) All lifting machines, chains, ropes and lifting tackle, except a fibre rope or fibre rope sling, which have been lengthened, altered or repaired by welding or otherwise shall, before being again taken into use, be adequately re-tested and re-examined by a competent person and a certificate of such test and examination be obtained and particulars entered in the register kept in accordance with sub-rule (4).

(9) No person under 18 years of age and no person who is not sufficiently competent and reliable shall be employed as driver of a lifting machine whether driven by mechanical power or otherwise, or to give signals to a driver.

Rules 56 and 56-A prescribed under sections 31(2) and 31(3). **[56. Pressure Plant.** — (1) **Definition.** — In this rule —

- (a) 'design pressure' means the maximum pressure that a pressure vessel or plant is designed to withstand safely when operating normally ;
- (b) 'maximum permissible working pressure' is the maximum pressure at which a pressure vessel or plant is permitted to be operated or used under this rule and is determined by the technical requirements of the process ;
- (c) 'plant' means a system of piping that is connected to a pressure vessel and is used to contain a gas vapour or liquid under pressure greater than the atmospheric pressure, and includes the pressure vessel ;

¹ Sub. by G.O. Ms. No. 541, Labour and Employment, dated the 13th June, 1975.

(d) 'pressure vessel' means '[a] vessel that may be used for containing, storing, distributing, transferring, distilling, processing or otherwise handling any gas, vapour or liquid under pressure greater than the atmospheric pressure and includes any pipeline fitting or other equipment attached thereto or used in connection therewith; and

²[(e) "notified person" means a person notified by the State Government, for the purpose of this rule;]

(2) **Exceptions.**— Nothing in this rule shall apply to—

(a) ³[***]

(b) vessels made of ferrous materials having an internal operating pressure not exceeding 1 kg./cm² (15 lbs/square inch);

(c) steam boiler, steam and feed pipes and their fittings coming under the purview of Indian Boilers Act, 1923 (Central Act V of 1923);

(d) metal bottles or cylinders used for storage or transport of compressed gases or liquified or dissolved gases, under pressure covered by the Gas Cylinder Rules, 1940 framed under the Indian Explosives Act, 1884 (Central Act IV of 1884);

(e) vessels in which internal pressure is due solely to the static head of liquid;

(f) vessels with a nominal water capacity not exceeding 500 litres connected in a water-pumping system containing air that is compressed to serve as a cushion;

(g) vessel for nuclear energy application;

(h) refrigeration plant having a capacity of three tons or less of refrigeration in 24 hours; and

(i) working cylinders of steam engines or prime movers, feed pumps and steam traps; turbine castings; compressor cylinders; steam separators or drivers; steam strainers; steam desuper heaters; oil separators; air receivers for fire sprinklers installations; air receivers of monotype machines provided the maximum working pressure of the air receiver does not exceed 1.33kg./cm² (20 lbs./sq inch) and the capacity 84.95 litres (3 cu.ft); air receivers of electrical circuit breakers; air receivers of electrical relays; air vessels on pumps, pipe coils, accessories of instruments and appliances,

¹ Sub. for "an unfired", by G.O. Ms. No. 1523, Labour and Employment, dated the 10th July, 1980.

² Sub. by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1985.

³ Cl. (a) omitted by G.O. Ms. No. 572, Labour, dated the 18th March, 1983.

such as cylinders and piston assemblies used for operating relays and interlocking type of guards; vessels with liquids subjected to static head only; and hydraulically operating cylinders other than any cylinder communicated with an air loaded accumulator.

(3) **Design and construction.**— Every pressure vessel or plant used in a factory—

(a) shall be properly designed on sound engineering practice;

(b) shall be of good construction, sound material, adequate strength and free from any patent defects; and

(c) shall be properly maintained in a safe condition;

Provided that a pressure vessel or plant in respect of the design and construction of which there is an Indian Standard or a standard of the country of manufacture or any other law or regulation in force, shall be designed and constructed in accordance with the said standard, law or regulation, as the case may be and certificate thereof shall be obtained from the manufacturer or from the '[notified person]' which shall be kept and produced on demand by an Inspector.

(4) **Safety devices.**— Every pressure vessel shall be fitted with—

(a) a suitable safety valve or other effective pressure relieving device of adequate capacity to ensure that the maximum permissible working pressure of the pressure vessel shall not be exceeded. It shall be set to operate at a pressure not exceeding the maximum permissible working pressure and when more than one protective device is provided, only one of the devices need be set to operate at the maximum permissible working pressure and the additional device shall be set to discharge at a pressure not more than 5 per cent. in excess of the maximum permissible working pressure;

(b) a suitable pressure gauge with a dial range not less than 1.5 times the maximum permissible working pressure, easily visible and designed to show at all times the correct internal pressure and marked with a prominent red mark at the maximum permissible working pressure of the pressure vessel;

(c) a suitable nipple and globe valve connected for the exclusive purpose of attaching a test pressure gauge for checking the accuracy of the pressure gauge referred to in clause (b) of this sub-rule;

¹ Sub. for "competent person", by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1984.

(d) a suitable stop valve or valves by which the pressure vessel may be isolated from other pressure vessels or plant or source of supply of pressure. Such a stop valve or valves shall be located as close to the pressure vessel as possible and shall be easily accessible ; and

(e) a suitable drain cock or valve at the lowest part of the pressure vessel for the discharge of the liquid or other substances that may collect in the pressure vessel :

Provided that it shall be sufficient for the purpose of this sub-rule if the safety valve or pressure relieving device, the pressure gauge and the stop valve are mounted on a pipeline immediately adjacent to the pressure vessel and where there is a range of two or more similar pressure vessels served by the same pressure lead, only one set of such mountings need be fitted on the pressure lead immediately adjacent to the range of pressure vessels, provided they cannot be isolated.

(5) **Pressure reducing devices.** — (a) Every pressure vessel which is designed for a working pressure less than the pressure at the source of supply, or less than the pressure which can be obtained in the pipe connecting the pressure vessel with any other source of supply, shall be fitted with a suitable pressure reducing valve or other suitable automatic device to prevent the maximum permissible working pressure of the pressure vessel being exceeded ;

(b) To further protect the pressure vessel in the event of failure of the reducing valve or device, at least one safety valve having a capacity sufficient to release all the steam, vapour or gas without undue pressure rise as determined by the pressure at the source of supply and the size of the pipe connecting the source of supply, shall be fitted on the low pressure side of the reducing valve.

(6) **Pressure vessel or plant being taken into use.** — (a) No new pressure vessel or plant shall be taken into use in a factory after coming into force of this rule unless it has been hydrostatically tested by a competent person at a pressure at least 1.3 times the design pressure, and no pressure vessel or plant which has been previously used or has remained isolated or idle for a period exceeding two months or which has undergone alterations or repairs shall be taken into use in a factory unless it has been thoroughly examined by a ¹[notified person] externally, and internally if practicable, and has been hydrostatically tested by the ¹[notified person] as a

¹ Sub. for "competent person", by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1984.

pressure which shall be 1.5 times the maximum permissible working pressure :

Provided, however, that the pressure vessel or plant which is so designed and constructed that it cannot be safely filled with water or liquid or is used in service even some traces of water cannot be tolerated, shall be pneumatically tested at a pressure not less than the design pressure or the maximum permissible working pressure as the case may be :

Provided further that the pressure vessel or plant which is lined with glass shall be tested hydrostatically or pneumatically as required at a pressure not less than the design pressure or maximum permissible working pressure as the case may be.

Design pressure shall be not less than the maximum permissible working pressure and shall take into account the possible fluctuations of pressure during actual operation.

(b) No pressure vessel or plant shall be used in factory unless there has obtained from the maker of the pressure vessel or plant or from the ¹[notified person] a certificate specifying the design pressure or maximum-permissible working pressure thereof, and stating the nature of tests to which the pressure vessel or plant and its fittings (if any) have been subjected, and every pressure vessel or plant so used in a factory shall be marked so as to enable it to be identified as to be the pressure vessel or plant to which the certificate relates and the certificate shall be kept available for perusal by the Inspector.

(c) No pressure vessel or plant shall be permitted to be operated or used at a pressure higher than its design pressure or maximum permissible working pressure as shown in the certificate.

(7) **In service test and examinations.** — Every pressure vessel or plant in service shall be thoroughly examined by a ¹[notified person] —

- (a) externally, once in every six months ;
- (b) internally, once in every twelve months.

If by reason of the construction of a pressure vessel or plant, a thorough internal examination is not possible, this examination may be replaced by a hydrostatic test which shall be carried out once in every two years :

¹ Sub. for "competent person", by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1984.

Provided that for a pressure vessel or plant in continuous process which cannot be frequently opened, the period of internal examination may be extended to four years ;

(c) hydrostatically tested once in every four years ; and

(d) the hydrostatic test pressure to be carried out for the purpose of this rule shall be 1.25 times the design pressure or 1.5 times the maximum permissible working pressure whichever is less :

Provided that in respect of a pressure vessel or plant with thin walls such as sizing cylinder made of copper or any other non-ferrous metal, periodic hydrostatic test may be dispensed with subject to the condition that the requirements laid down in sub-rule (8) are fulfilled :

Provided further that when it is impracticable to carry out thorough external examination of any pressure vessel or plant every six months as required in clause (a) of this sub-rule, or if owing to its construction and use a pressure vessel or plant cannot be hydrostatically tested as required in clauses (d) and (c) of this sub-rule, a thorough external examination of the pressure vessel or plant shall be carried out at least once in every period of two years ; and at least once in every period of four years thorough systematic non-destructive test like ultrasonic test for thickness or other defects of all parts the failure of which might lead to eventual rupture of the pressure vessel or plant shall be carried out.

(8) **Thin walled pressure vessel or plant.** — (a) In respect of any pressure vessel or plant of thin walls such as sizing cylinder made of copper or any other non-ferrous metal the maximum permissible working pressure shall be reduced at the rate of 5 per cent. of the original maximum permissible working pressure for every year of its use after the first five years and no such cylinder shall be allowed to continue to be used for more than twenty years after it was first taken into use ;

(b) If any information as to the date of construction, thickness of walls, or maximum permissible working pressure is not available, the age of such pressure vessel or plant shall be determined by the ¹[notified person] in consultation with the Chief Inspector from the other particulars available with the manager ;

(c) Every new and second hand pressure vessel or plant of thin walls to which repairs likely to affect its strength or safety have been carried

¹ Sub. for "competent person", by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1984.

out shall be tested before use to at least 1.5 times its maximum permissible working pressure.

(9) **[Report by notified person].** — (a) If during any examination any doubt arises as to the ability of the pressure vessel or plant to work safely until the next prescribed examination, the ²[notified person] shall enter in the prescribed register his observations, findings and conclusions with other relevant remarks with reasons and may authorise the pressure vessel or plant to be used and kept in operation subject to a lowering of maximum permissible working pressure, or to more frequent or special examination or test, or subject to both of these conditions ;

(b) A report of the result of every examination or test carried out shall be completed in the prescribed Form No. 8 and shall be signed by the person making the examination or test, and shall be kept available for perusal by the Inspector at all hours when the factory or any part thereof is working ;

(c) Where the report of any examination under this rule specified any condition for securing the safe working of any pressure vessel or plant, the pressure vessel or plant shall not be used unless the specified condition is fulfilled ;

(d) The ²[notified person] making report of any examination under this rule, shall within seven days of the completion of the examination send to the Inspector a copy of the report in every case where the maximum permissible working pressure is reduced or the examination shows that the pressure vessel or plant or any part thereof cannot continue to be used with safety unless certain repairs are carried out or unless any other safety measure is taken.

(10) **Application of other laws.** — (a) The requirements of this rule shall be in addition to and without any prejudice to and not in derogation of the requirements of any other law in force ;

(b) Certificates or reports of any examination, or test of any pressure vessel or plant to which sub-rules (7) to (9) do not apply, conducted or required to be conducted under any other law in force and other relevant record relating to such pressure vessel or plant, shall be properly maintained as required under the said law and shall be produced on demand by the Inspector.

¹ Heading substituted, by G.O. Ms. No. 2547, Labour, dated the 3rd December, 1984.

² Subs. for "competent person", *ibid.*

**DIRECTORATE OF INDUSTRIAL SAFETY AND HEALTH
CHECKLIST FOR INSPECTION IN FACTORY**

1. General particulars										
1.1	Date and time of inspection									
1.2	Name & Registration number									
1.3	Address of the Factory									
1.4	Particulars of Manufacturing Process									
	i)	Nature of Manufacturing Process								
	ii)	NIC Code								
	iii)	Dangerous operation with Schedule								
	iv)	Hazardous Process (mention the process)								
1.5	Details of the occupier (Name, Age, Father's Name and address)									
1.6	Details of the Manager (Name, Age, Father's Name and address)									
1.7	No. of workers employed on the date of inspection		Adult		Adolescent		Child		Total	
			M	F	M	F	M	F		
	Home State (Tamil Nadu workers)	Direct								
		Contract	Contractor 1							
			Contractor 2							
		Total workers								
	Migrant Workers (Provide State wise)	Direct								
		Contract	Contractor 1							
			Contractor 2							
		Total workers								
Overall total workers (Home State + Migrant)										
1.8	Coverage under Employees' State Insurance Scheme	Employer's Code no.								
		Period of validity								
		No of worker								
1.9	Coverage under Employees Provident Fund Scheme	EPF registration no.								
		Period of validity								
		No of worker								
1.10	Coverage under other Insurance Schemes	Insurance no								
		Period of validity								
		No of worker								

2. Factories Act 1948 and Tamil Nadu Factories Rules 1950			
2.1	Particulars of latest plan approval	Approval No	
		Date	
		Approving authority	
2.2	Stability Certificate obtained for the building	Certificate date	
		Validity	
		DISH Approval number of competent person	
2.3	Particulars of License	Horse Power	
		Number of Workers	
		Renewed upto	
2.4	Are the plans of all the buildings in the factory approved? If so, are the buildings constructed according to the approved plans?		
2.5	Is the factory registered and licensed? Is the license fee paid correctly?		
2.6	Is the change of manager intimated?		
2.7	Is the factory kept clean?		
2.8	Is the floor of every workroom washed at least once in a week?		
2.9	Are the drains properly constructed and kept clean?		
2.10	Are the inside walls and ceiling including all wood work lime washed or colour washed once in fourteen months or painted or varnished once in five years?(give dates of such treatments)		
2.11	How are the trade wastes and effluents disposed of? Is the approval of the health officer obtained?		
2.12	Is there adequate number of windows in all the working rooms of the adequate circulation of fresh air?		
2.13	Is the temperature in the working rooms high? If so, what are measures to be taken to reduce it?		
2.14	Is dust or fume given off in the manufacturing process? If so, are the exhaust arrangements satisfactory?		
2.15	Whether test report of dust extracting system (Form No.37) available?		

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Seafood firms told to shift workers' quarters away from plants

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THE Industrial Safety and Health Department has directed all seafood processing units to relocate labour quarters to safe locations from the processing units immediately.

The order comes in the wake of the Tiruvallur gas leak tragedy that left 18 workers dead, as their accommodation was in close proximity to the factory's anhydrous ammonia plant. "At least a dozen women labourers who died took refuge in a sanitary area in the plant to escape the toxic gas," said a senior official wishing anonymity. Following the incident, the state formed a high-level committee for inspecting safety standards at seafood processing factories handling toxic gas.

The joint directors at the regional levels had served notices to the factories, prohibiting the

stay of labourers on the plant premises, stating it is unsafe to human life as per Section 40(1) of the Factories Act, 1948.

According to a notice served to a leading frozen foods factory, the employer shall immediately shift the workers' accommodation to a residential area situated far away from the factory premises and at a safe distance from the ammonia refrigeration installation, within three days. The factories shall submit a compliance report with documentary evidence to the Joint Director of Industrial Safety and Health, the notice said. Besides, the inspection committee serves a 28-page questionnaire on the safety of workers, hygiene, risk management, machinery, and other features.

Seafood processing factories operate anhydrous ammonia (NH₃) refrigeration systems for manufacturing ice blocks to



The firms have been given a time of just 3 days for the relocation | FILE PICTURE

freeze and pack fish, shrimps, crabs, squids and octopus to maintain the export quality. The packed items are frozen at -40 °C and the temperature should be maintained at -20 °C for three months until they reach the destination, an industrialist said.

In case of an untoward incident, the leaked liquefied anhydrous ammonia may rapidly evaporate and form a toxic and corrosive vapour cloud capable

of causing serious and lethal injuries to the labourers. The only escape is to cover the nose with a wet cloth, and run far from the area within eight minutes, said sources in the industry safety department.

A senior official said that an aerial separation distance of 300-500 m may provide a level of safety. However, the actual safe distance should be established based on a detailed hazard identification (HAZID), quantitative risk assessment (QRA), and consequence modelling in accordance with applicable national and international safety standards, he said.

Seafood Exporters Association of India-Tamil Nadu region president C Selwin Prabhu told *TNIE* that the Industrial Safety and Health Department has directed all the factories to shift labour accommodation within three days. "Given the number of workers, it is unim-

aginable to resettle them within three days. Their food, safety, and transport need to be taken care of," he said, seeking more time so that the production would not be affected.

"We are relocating them to a residential area outside the factory; but, the short duration is a concern for the employers," said another factory operator.

As each factory has 400 to 600 workers, constructing an accommodation to house all the workers would cost a lot; hence, they are looking for various options like hostels and rented apartments, he said.

Tamil Nadu has over 45 seafood processing factories, with 30 in Thoothukudi district alone, employing more than 10,000 workers. Over 60% of the workers are migrant labourers and the majority are women. The industry fetches over ₹6,000 crore annually to the state exchequer.

that the appointments are subject to the case outcome.

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**HOW DO WE APPLY THE
FACTORIES ACT WITH
RESPECT TO AN AMMONIA
REFRIGERATION PLANT ?**

INTRODUCTION TO AMMONIA

Ammonia is one of the most common compounds found in nature. It is essential to earth's nitrogen cycle. Its release in the atmosphere is immediately recycled.

Ammonia is produced both naturally as and as a byproduct of numerous manmade processes and is widely available on the market at a very low price.

Ammonia (NH_3 , R-717) is an alkaline and colourless chemical compound at atmospheric pressure. Being a mildly flammable and toxic substance.

It is classified as B2L.

A- Non toxic, B – Toxic:

1-Non flammable, 2-flammable, 3- highly flammable:

L – low flammability

Ammonia does not destroy atmospheric ozone and does not contribute to the greenhouse effect linked to global warming. It has an ODP of 0.

Refrigeration grade ammonia is capable of absorbing large amounts of heat when it evaporates.

These characteristics make it a highly energy efficient refrigerant which can be used effectively in the food industry.

From an operational perspective, ammonia is generally accepted as the most efficient and cost-effective industrial refrigerant available. its lower operating costs contribute to lower food prices

First used as a refrigerant in 1850.

Ammonia's self-alarming quality is due to its well recognizable and easily detectable odor. Even the slightest traces of ammonia in the air can be detected.

The safety record of ammonia refrigeration is also due to the fact that ammonia is 1.7 times lighter than air and thus easily vented by mechanical means into the atmosphere

APPLICATIONS

Ammonia has found its greatest application as a refrigerant in industrial settings, primarily in the food processing and food distribution sectors.

Sea food, meat, fruit and vegetable, dairy-related products, breweries and ice making.

Under food distribution we have cold storages.

It is also used in the petrochemical and pharmaceutical sectors.

SAFETY

In the design and operation of a refrigeration plant, the most critical area is safety. Accidents result in a loss or damage to stored products as well as injury to people.

Safety has to be implemented in 3 areas

Design

Manufacturing and Installation

Operation

SAFETY IN DESIGN

The first step involves the calculation of the heat load. Care should be taken that all the necessary factors are taken into account for the calculation of the heat load.

The second step involves the design and selection of right equipment based on the refrigeration load and operating conditions. The design should be based on specific codes which are available for pressure vessels, piping and valves

The third step involves the selection of the individual equipment based on efficiency, price and availability



SAFETY IN MANUFACTURING AND INSTALLATION

Specific codes need to be followed in the manufacture of equipment to ensure that they are suitable for the operating conditions.

The installation of the equipment should be based on standards and specifications

Good workmanship is important. Pipes should be cleaned and v cut before welding.

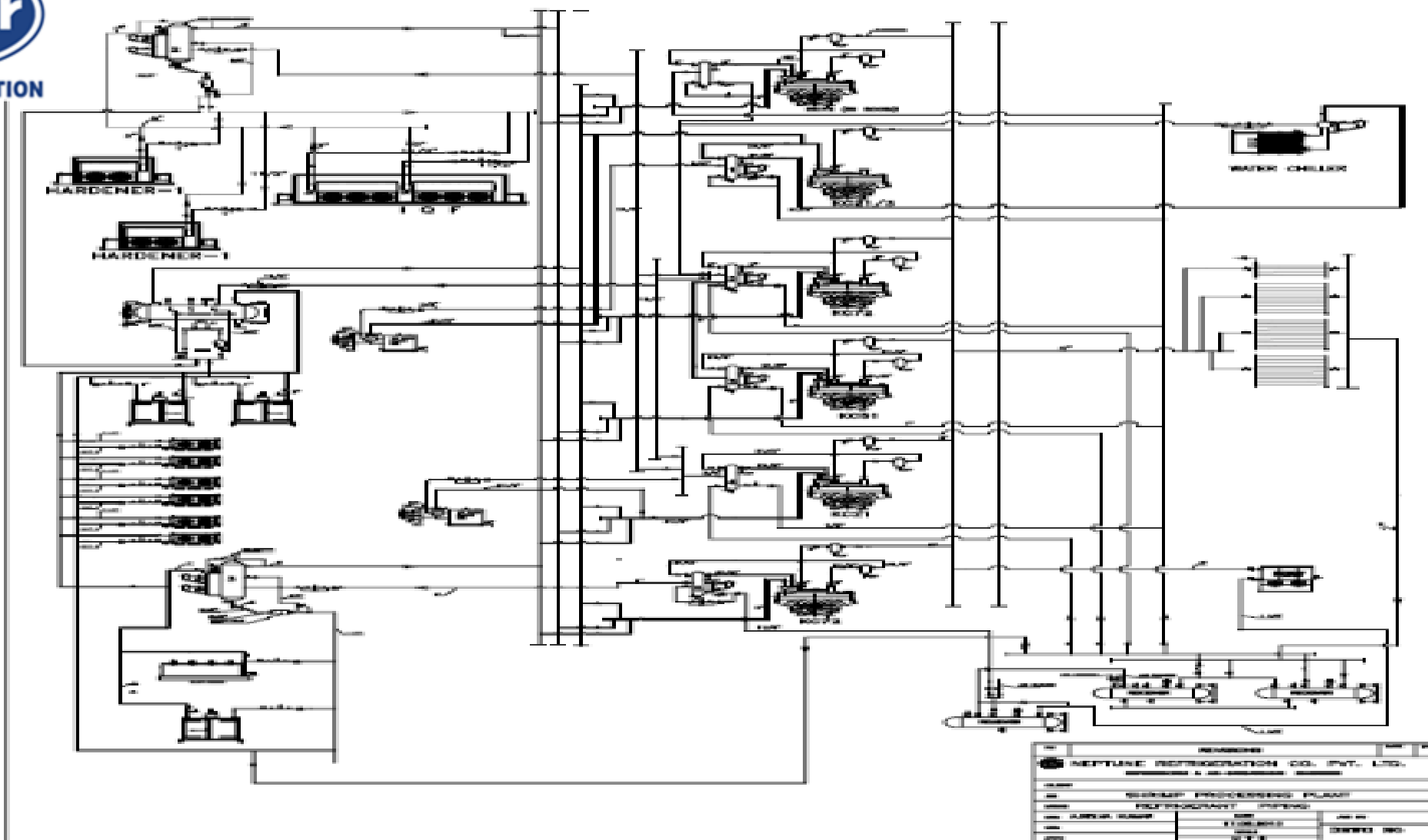
Equipment should be properly secured.

Design documents never specify all the details, the installer has a key role in providing good workmanship and making judgments that prevents failure once the plant is in operation.





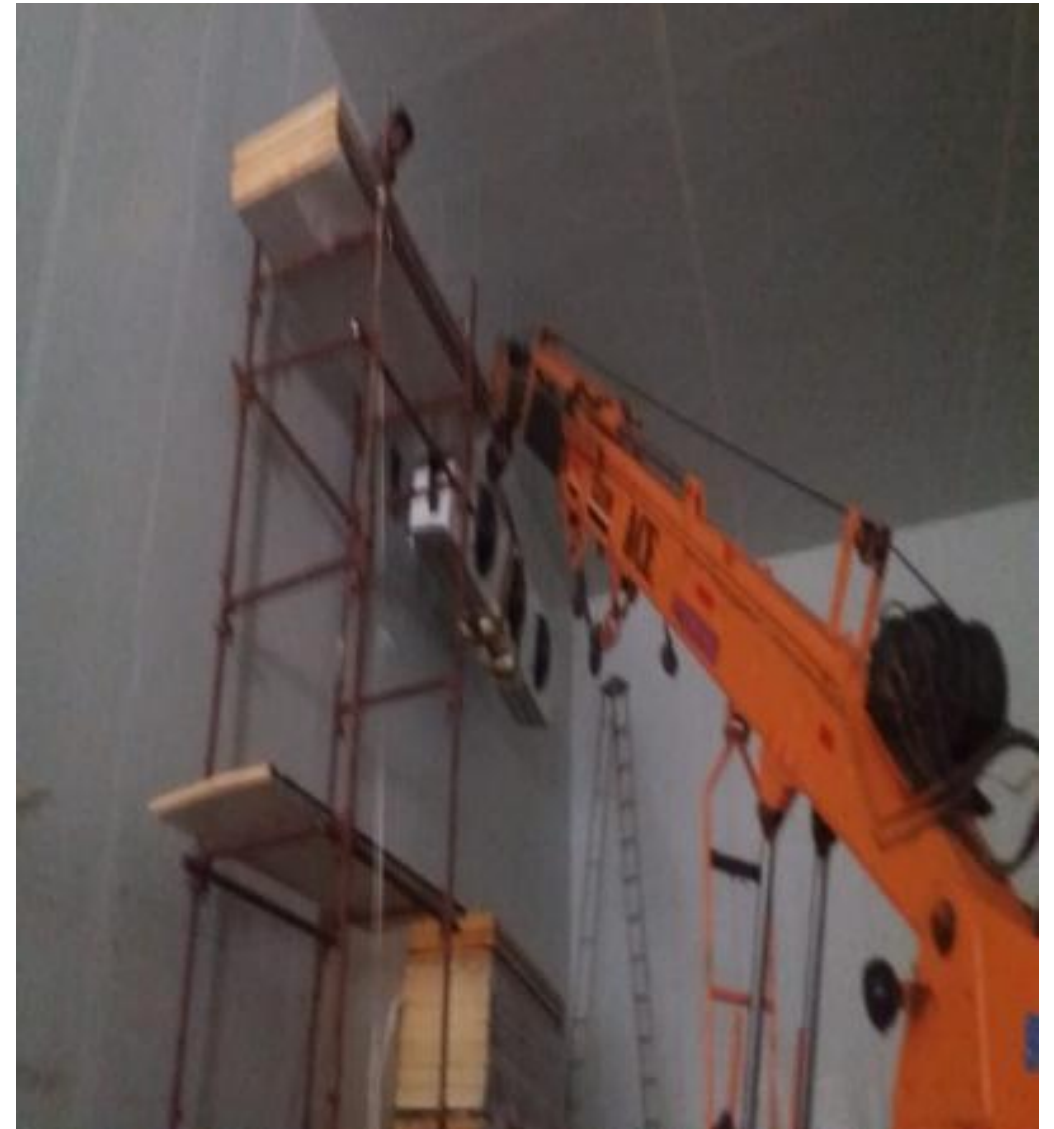
Association of
AMMONIA REFRIGERATION



Correct equipment should be used for lifting and positioning equipment .

Correct ladders / scaffolding should be used for working at heights

Safety belts should be provided while working at heights.





Refrigerating plants must be positioned so as to prevent their being damaged by site traffic and transport activities.

Refrigerant pipelines must be protected from mechanical damage. Mechanical damage may be caused by vehicles or heavy loads.

- Laying above the vehicle height.
- Mounting of protective bars
- Laying in pipeline ducts

Refrigerant pipelines should have proper supports to prevent vibrations.



Refrigerating plants must be positioned so as to allow inspection from all sides and to provide sufficient space for maintenance work.



Rescue passages (escape passages) from an installation room to safe rooms must not be longer than 20 m and must be properly marked.

Machinery rooms must allow quick escape in case of leakages. 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.

Air exhaust openings like windows 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.

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.

In case of leakage ammonia should be led to an absorption system which is used to dissolve escaping ammonia in water.

According to Pollution Control Board NH₃ and oil must be prevented from entering the sewerage network.

A sufficient number of fire extinguishers must be available

Pipe labelling should be done



OPERATION

When operating, servicing and maintaining equipment, the following instructions are listed below:

Any work may only be carried out by appropriately trained and instructed staff. Instructions should be explicit

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

Store fire extinguishers at an accessible point of the refrigeration machinery room

A Safety plan should be made available

Poster on first aid should be placed at suitable points

EMERGENCY PHONE NUMBER
23211

YOUR ROLE
BE FAMILIAR WITH EXTENDED-FIRE ALARM AND EMERGENCY EQUIPMENT IN YOUR WORK AREA.

EVACUATION PROCEDURE

1. WHEN EVACUATION SIGNAL SOUNDS (PLAZA BELL TONE), LEAVE YOUR WORK AREA, EVACUATION ROUTE.
2. UPON LEAVING THE BUILDING, ASSEMBLE AT YOUR DESIGNATED ZONE. EMERGENCY VOA THE PARKING AREA, IF YOU ARE DIRECTED TO ASSEMBLE THERE.
3. KEEP SAFE DISTANCE FROM BUILDING AND EMERGENCY OPERATIONS. DO NOT BLOCK FIRELANES.
4. RETURN TO YOUR WORK AREA ONLY AFTER INSTRUCTED TO DO SO.

WORK AREA WITH PROCEEDING

1. WHEN EMERGENCY SHELTER SIGNAL SOUNDS (CONSTRUCTION TONE), PROCEED TO NEAREST SHELTER AREA.
2. RETURN TO YOUR WORK AREA ONLY AFTER INSTRUCTED TO DO SO.

KEY

SHELTER AREA: [Yellow arrow pointing right]

EMERGENCY GATHERING AREA: [Blue hatched box]

BUILDING LOCATIONS: [Red box with number]

ZONE 1: EGA, WEST ALARM PARKING LOT

ZONE 2: EGA, ACROSS ROAD FROM FUEL TANK DOCK

ZONE 3: EGA, CONSTRUCTION SERVICES PARKING LOT

ZONE 4: EGA, E.E. ALARM PARKING LOT

LEGEND

DEPARTMENTS

- A. FUEL TANK DOCK
- B. FUEL TANK DOCK
- C. FUEL TANK DOCK
- D. FUEL TANK DOCK
- E. FUEL TANK DOCK
- F. FUEL TANK DOCK
- G. FUEL TANK DOCK
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- R. FUEL TANK DOCK
- S. FUEL TANK DOCK
- T. FUEL TANK DOCK
- U. FUEL TANK DOCK
- V. FUEL TANK DOCK
- W. FUEL TANK DOCK
- X. FUEL TANK DOCK
- Y. FUEL TANK DOCK
- Z. FUEL TANK DOCK

KNOW YOUR EVACUATION ROUTES WHICH ARE POSTED IN YOUR WORK AREA

Premier



Association of
AMMONIA REFRIGERATION

AMMONIA SAFETY POSTERS

Ammonia Basic Preventive Maintenance

For Mechanical Refrigerating Systems

Recommendations

I. Record Keeping

1. Maintain daily pressure and temperature log sheets.
2. Analyze three readings each day.
3. If readings differ from design or established limits, determine the cause and make corrections immediately.
4. Maintain a permanent Preventive Maintenance Log Book.
5. Maintain a record of:
 - i. Ammonia added to system
 - ii. Oil added and drained from system

II. Housekeeping

1. Keep machinery, walkways and clear.
2. Keep all machinery clean.
3. Keep all electrical equipment clean.
4. Inspect all piping and vessels clean, free of rust and paint.
5. Keep all pipes and vessels free of leaks and repair immediately.

III. Lubrication

1. Always use equipment manufacturer's recommended lubricants.
2. Always follow equipment manufacturer's frequency, in quantity.
3. Be sure that valves, stems are cleaned and oiled before closing any valve.

IV. Equipment

1. Follow the equipment manufacturer's preventive maintenance recommendations for all refrigeration system equipment.
2. Test all safety controls and interlocks at least once per year.
3. Replace or inspect, clean and test safety relief valves every five (5) years. (Timing shall be done by the national lab.)
4. Visually inspect both service and charge valves at all 1/2 inch devices.
5. Visually inspect all gauges in all direct drive compressors.
6. Inspect and clean condenser fins and spray nozzles weekly.

7. Inspect and clean condenser pans and drains as needed.
8. Inspect and clean condenser water treatment equipment and ammonia bleed-off system and functioning properly.
9. Inspect all condenser coils for fouling (properly clean under no load defrosting).
10. Lubricate and repair all refrigerant and oil leaks promptly.
11. Perform annual check of all electrical connections for proper tightness.
12. Check calibration of all pressure gauges at least once per year.
13. Test ammonia detection system operation a minimum of twice per year.
14. Service machinery every condition system at least once per year.
15. Test all pump, heater, pump test heater, compressor, condenser, heater and all heat traps annually.

V. Manufacturers

1. Assess that all personal protective and handling equipment is properly stored and maintained.
2. Drain oil from the system on a regular schedule.

All preventive maintenance should be performed by qualified individuals and all safety procedures must be strictly followed.

Phone Numbers

NEPTUNE
NEPTUNE REFRIGERATION COMPANY P.LTD.
REGD. OFFICE: 152 MOUNT ROAD,
CHENNAI - 600 002
PH: 26463333, 26463374, 26463382
FAX: 26463381
e-mail: neptune@neptuneindia.com
www.neptuneindia.com

Ammonia First Aid for Ammonia Exposure

Preparing for an Ammonia Emergency

I. Learn Ammonia First Aid Procedures

1. Mouth to Mouth Resuscitation
2. Cardiopulmonary Resuscitation (CPR)
3. Treatment for Shock
4. Be prepared - DELAY and INCAPABILITY may result in a more serious injury

II. Make your emergency support is knowledgeable about ammonia first aid treatment

1. Local Fire Department / Ambulance Service
2. Emergency Clinic
3. Local Hospital

III. NEVER wear contact lenses when working with Ammonia

Overexposure to Ammonia Vapor

1. Remove victim to fresh air
2. Summon an ambulance
3. If breathing fails, start mouth-to-mouth resuscitation
4. If no pulse begin CPR
5. If patient goes into shock, treat accordingly
6. Oxygen may be administered by trained persons

Phone Numbers

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www.neptuneindia.com

Ammonia Minimum Protective Equipment

For Mechanical Refrigeration System

Recommendations

I. General Protective Equipment:

1. Goggles
2. Full Face Shield
3. Chemical Resistant Gloves (rated for appropriate temperature levels)
4. Chemical Resistant Boots
5. Emergency Showers / Eye Wash Stations
6. First Aid Kit
7. Full Face Mask
8. Positive Pressure Self-Contained Breathing Apparatus
9. Chemical Resistant Suits (rated for ammonia use)
10. 2-way Radio
11. Hearing Protection (earplugs)

II. Tools

1. Rescue Rope
2. Non-sparking Pipe Wrench

Phone Numbers

3. Ammonia Rated Purge Hose
4. Portable Monitoring Equipment
5. Flashlights
6. Water Hose w/Mist Nozzle
7. Portable ventilation fans

NOTE: Leak area should not be entered if concentrations exceed 4% (40,000 ppm) or visible cloud

III. Training

1. Employees should be knowledgeable of all applicable system safety procedures
2. Employees expected to wear personal protective equipment must be trained in its proper use
3. Equipment must be cleaned, inspected and maintained according to Manufacturer's recommendations at least monthly and after each use

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www.neptuneindia.com

The refrigeration units must not be operated unless full functional and operational safety and reliability of all components, safety devices and circuits and of the electrical switchgear is ensured.

It might be difficult to reliably detect ammonia at temperatures below freezing. It is essential that Ammonia sensors for leak detection should be provided.

Safety relief valves must be provided and be operational.

Testing of the entire plant has to be performed prior to start-up

The detailed operating manuals of the plant manufacturers shall be taken into account as well.

Prevention is key to ensuring a safe work environment associated with any refrigeration system.

HOW TO MAKE YOUR PLANT EFFICIENT AND SAFE



Association of
AMMONIA REFRIGERATION

PLANT AUDIT

1.0 Refrigeration Compressors

Compressor No-1

Make Kirloskar
Model KC3
Speed (RPM)
S.No 342K521
Date of Manufacture May-02

Electric Motor

Make Kirloskar
Capacity 60 Hp
Type Slip ring motor
Speed (Rpm) 1440 Rpm
S.No MKF53-08
Date of Manufacture

Oil separator

Make
Size - Length 36" L
Size - Dia 12" D

Gas & Liquid Cooler

Make
Size - Length 72" L
Size - Dia 24" D
Shell thickness

Compressor No-2

Make Kirloskar
Model KC72
Speed (RPM)
S.No 347K122
Date of Manufacture May-02

Electric Motor

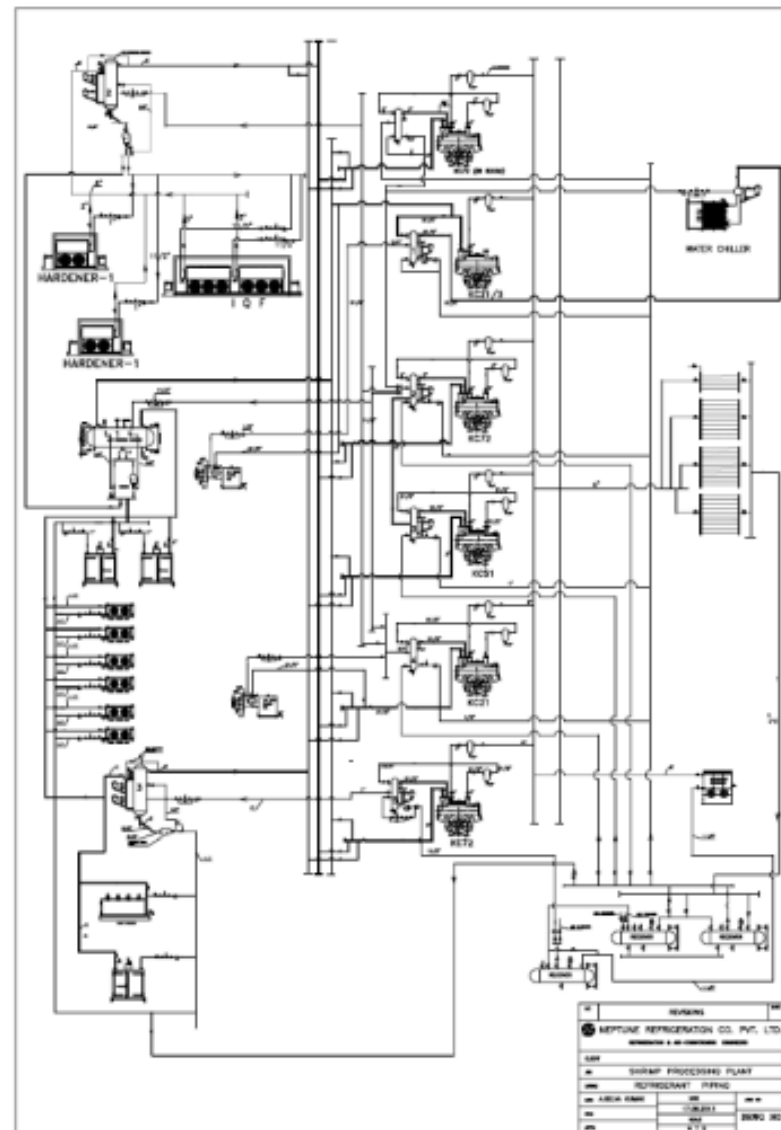
Make Kirloskar
Capacity 150 Hp
Type Slip ring motor
Speed (Rpm) 1440 Rpm
S.No SKF-26-30
Date of Manufacture

Oil separator

Make 36" L
Size - Length 12"
Size - Dia

Gas & Liquid Cooler

Make
Size - Length 78" L
Size - Dia 20" D
Shell thickness



PIPE MARKINGS

ABBREVIATION	SYSTEM
HSD	HIGH STAGE DISCHARGE
LTRL	LOW TEMPERATURE RECIRCULATED LIQUID
HPL	HIGH PRESSURE LIQUID
HTRL	HIGH TEMPERATURE RECIRCULATED LIQUID
LSS	LOW STAGE SUCTION
VAP	VAPOUR STATE
LIQ	LIQUID STATE



LABELLING



COMMON AMMONIA SAFETY ISSUES

1. Poor housekeeping practices (oily or wet floors, storing items in the machine room)
2. Poor pipe quality beneath insulation
3. Absence of adequate pipe labels or no maintenance program of labelling
4. Equipment is operated outside design parameters

5. Blocked escape routes from areas with ammonia present
6. Heavy ice buildup on piping and components; not taking weight into consideration
7. Operators with insufficient training of ammonia refrigeration operations and safety awareness

8. Unsafe access to frequently used valves, equipment, etc. for maintenance
9. Leak detection systems that are either non existent, inoperable, not calibrated or not tied to ventilation systems
10. Failure to implement maintenance cycling program on valves

11. Open oil draining valves.

13. Gas mask systems and safety equipment are not readily accessible

14. Open electrical cabinets

15. Safety valve closed

THANK YOU