

FRICK INDIA LTD

STARTING OF THE SYSTEM

- ◉ Check the water level in the condenser tank or cooling tower
- ◉ Start the condenser water pump and also check up compressor head jacket outlet water
- ◉ Check the oil level in the compressor, open the compressor automatic unloading valve switch, if it is manual unloading open the manual unload valve.
- ◉ Start the compressor motor step wise until it reaches the rated speed
- ◉ Close the unloading valve of compressor and check the oil pressure

CONT'D

- ◉ Open the suction manifold of the compressor gradually such that the compressor motor ampere should not cross the rated amps
- ◉ After complete opening of suction manifold valve, put the evaporator blower in operation for cold storage, agitator for ice plant, chilled water pump sets for S & T chiller etc.
- ◉ Open the liquid line feeding valve and also adjust the expansion valve to maintain constant suction pressure in accordance with evaporative temp.
- ◉ Note all the compressor parameters in log book for every one hour
- ◉ Check the compressor head temp and pressure. If it is above designed range find out cause and rectify it
- ◉ See that the pressure difference between suction and oil shall be a minimum of 25 PSIG
- ◉ Check the temp of the compressor motor

STOPPING OF THE SYSTEM

- ◉ Close the liquid line solenoid valve / stop valve at receiver
- ◉ Close the compressor suction manifold valve as soon as compressor suction pressure reaches 5 PSIG
- ◉ Should not run the compressor under Vacuum
- ◉ Switch off the blower fans / agitators etc.
- ◉ Stop the compressor
- ◉ But run the condenser water pump, until receiver pressure reaches minimum possible

DO'S & DON'TS AT OPERATION, MAINTENANCE & ERECTION

1. Do not use the compressor as a vacuum pump or air building pump for evacuations and pressure testing the system
2. Do not start the HDI compressor before priming the oil pump
3. Do not let the compressor run without a minimum oil level of half of the indicator glass
4. Do not run the compressor fitted with flexo seal assembly without water
5. Do not keep your compressor running if abnormal heating of the compressor noticed
6. Do not run the compressor if you find any abnormal sound while running

CONT'D

7. The suction trap fitted in compressor is equipped with a filter bag inside the suction screen. This bag is used for during the running period only and is to be replaced with a clean bag after the 1st 24 hours of operation. Do not keep filter bag in the trap more than one week.

8. Use only FRICK recommended compressor oil in the compressor i.e. shell claves – 68 (Bharat Shell) or equivalent Viz. (1) Servo Freez – 68 (Indian Oil), (2) Setwin – 68 (Hindustan Petroleum), Freezol – 68 (Bharat Petroleum)

9. Do not run your compressor with dirty oil, so check it out after every 200 hours of running. If it is dirty, first drain the dirty oil and then make sure that you clean the crank case from inside and the filter system completely before you fill the new oil

CONT'D

10. Replace faulty pressure gauges with correct one's immediately
11. Do not run the compressor under charged because this will lead to the over heat
12. Do not run the compressor over charged to avoid the liquid coming to the compressor
13. Do not run the compressor if you find discharge pressure is very high. It will cause over heating. Check out for non – condensable gas in the system, which must be removed
14. Maintain the log sheet regularly and correctly, having following parameters being filled after ever one hour of running: (a) suction pressure, discharge pressure, oil pressure, discharge temp, motor amps, voltage, etc.

CONT'D

15. Use only genuine FRICK spare parts procured from FRICK Company or from its branch offices
16. Under no circumstances belts be forced on the sheaves with crow bars, wedges, screw drivers or bars of any kind. Because outside jacket of the belts is made of fabric can be easily broken when placed under shearing strain
17. Belt sheaves must be in correct alignment. If they are out of line, the belt will show excessive wear very quickly
18. During erection: Be sure however to keep your weld at least a foot or more away from threaded joints, because the welding heat on the pipe is apt to run the thread connections
19. Use approved pipe joint compound only. We recommend the use of litharge and glycerin. When using litharge and glycerin be sure it is carefully and thoroughly mixed and that no free litharge or glycerin is permitted to get into the system

CONT'D

20. Flare Joints: These must be made with care. If the flaring tool is used, dry or without proper oiling, it will thin out the tubing to a point where there may be danger or breakage
21. Strainer: These must be placed in the line ahead of all expansion valves of the automatic and manual type. Suction traps are standard equipment with all compressors and are intended to remove the fine particles of dirt which may accumulate in the system
22. The higher the back pressure carried and lower head pressure carried the more efficient the machines and the more economical to operate
23. The frost may be allowed to follow the suction pipe to the compressor, but it should not be made to cover the compressor cylinders

CONT'D

24. Open the compressor about one month after being put in operation, remove the safety heads, if it appears dry, it may necessary to carry the oil level slightly higher in the crank case. If excessive oil appears in the heads, the level in the crank case may be lowered slightly. See that the screws and bolts should be tightened carefully after re-assembling
25. Some oil will be carried over the ammonia compressor into the high pressure trap. This trap should be drained at least once in a week. Do not make a pipe connection from the high pressure trap to the crank case of the compressor
26. After about one week operation, the compressor should be opened and thoroughly cleaned and that try the nuts on the connecting rod bolt to be sure they are tight.

CONT'D

27. Adjusting Crank Bearing: In HDI compressor, connecting rod crank end bearings are split and are provided with laminated spaces between the halves. If the bearings become worn, they can be taken up by removing one of the thin liners on each side. If one liner is too much adding liners made of thin paper.

28. Test readjustment of connecting rod: To test the adjustment of connecting rod uses a piece of 2" x 4" batten or something similar as a lever and the front of the crank case as a fulcrum. Place one end under the connecting rod and move up and down to see if the bearing is loose. By turning the machine over by hand it can be determined whether connecting rod adjustment is too tight.

CONT'D

29. Removing pistons – Pistons rings: Always place the piston ring guide furnished with each compressor in the head before attempting to remove the piston. Clamp several washers around cylinder head studs to hold the ring guide down while the piston are being withdrawn or replace. The piston rings are made of the finest materials obtainable for such work and they will run a long time without needing replacement

30. Re-bore of cylinders: If the piston bore of the machine become worn out don't put over size piston rings to the standard bore and piston. The machine should be sent to factory for re-boring and also replaced with suitable over size piston and piston rings.

31. Compressor Valves: All puppet valves should be grounded to a prefect seat about once in a year by using fine grade of automobile valve grinding paste, plate valves will very rarely require grinding. Inspect them about once in every six months and keep screws over cage drawn up tight

CONT'D

32. Glanding / Re-packing ammonia valves: All ammonia stop valves are double seated and can be re-packed under pressure by opening the valves wide, until the back of the valve bottom seated again the bonnet.
33. Charging and starting of plant: Proper charging of the plant is very important, causes have been noticed where the new plants have been damaged at the time first starting, proper care as laid down is essential for the long life of the costly equipment
34. At the time the machine is opened to clean, it is better to try and tighten the nuts on the connecting rod bolts to be sure that they are alright
35. Before starting an assembled compressor (after repairs / maintenance) remove plug on the discharge side of the cylinder and run the compressor by closing the suction and discharge valves. The air in the compressor will then be discharged. Just as the machine is stopped replace the plug after which the compressor may be put in operating in normal manner.

CONT'D

36. A new machine / motor should always be run unloaded or at slow speed for an hour or so, in order to make sure that it operates properly
37. If the compressor is cooled by means of cooling water, the water flow must always be stopped during period of standstill. This is normally done by means of a solenoid valve in the water inlet line to the compressor
38. Water or other fluids must not be used for pressure gauge between the nitrogen cylinder and the plant. The compressor stop valves must also be closed during pressure testing
39. Plant safety valves must normally be blanked off during pressure testing as their opening pressure is lower than the testing pressure
40. It is not advisable to re-use oil which has been drawn from a compressor or plant. This oil would have absorbed moisture from the air and may cause operating problems. Always switch off the power to the crank case heating element before drawing off the oil.

SEASONAL SHUT DOWN

- ⦿ System should not be allowed to stand for months with pressure in the lines and equipment. System should not be pumped down and vacuumised for seasonal shut down or for long period
- ⦿ Outlet valve – close
- ⦿ Suction valve – cut opening
- ⦿ Compressor off
- ⦿ AFT 10 Min.
- ⦿ Pump off.

CERTAIN TIPS ON OPERATION & MAINTENANCE OF REFRIGERATION PLANTS

- ◉ **Operation:** These days power is not only costlier, but scarce also. Hence the operation of the plant should be in such a way to keep the power consumption to the minimum and at the same time the required design conditions are maintained in the chambers. Now we will try to analyze the various factors that contribute for the variations in power consumption. The power consumption of any refrigeration system shall depend on;
 - ◉ System design & installation
 - ◉ Adjusting the system / ammonia flow rate
 - ◉ Condensers & Evaporators
 - ◉ Removal of non – condensable gases
 - ◉ Oil in the cooling coil
 - ◉ Leakage in starting by-pass valves and suction valve assemblies
 - ◉ Belts
 - ◉ Electrical contact points
 - ◉ ACU fan motors / agitator fan motors
 - ◉ Product loading
 - ◉ Stopping & starting of the plant during short period of standstill
- Operators

◉ **System Design & Installation**

System should be properly designed and installed only by experienced professionals for proper balancing of all equipments of the refrigeration system. It's always advisable to go in for a system with **single source responsibility**

◉ **Adjusting the system / ammonia flow rate**

The main operating parameter which controls the power consumption shall be suction and discharge pressure. Keep the suction pressure as high as practicable depending on the temp level of work to be done and discharge pressure as low as practicable.

For best result adjust the ammonia flow rate to allow frost to develop as far back as the suction scale trap. Now let us see the factors that influence the suction and discharge pressure.

○ Suction Pressure

a. Coil / Fins surface cleanliness

Coils and fins surfaces should be kept clean and washed with forced water spray at least once in a year

b. Obstruction free fins spacing

Fin spacing should be clear and dusts removed for free flow of air, other wise

c. Oil in the cooling coil

Oil in the cooling coil reduces heat transfer area and there by reduces its capacity. Oil from cooling coils should be removed once in 4 months

d. Defective / Burnt air cooling coil motors

The defective / burnt air cooling unit motors reduce not only the air quantity, but also air velocity across the cooling coil, resulting reduction in capacity

e. Product stocking

We should leave at least 3' clear space all around the cooling coils and leave at least 18" clearance at the ceiling, otherwise cooled air short cycles resulting low suction pressure. Also there should be at least 6" clearance between the wall surface and the product. This will allow warm air to reach the ceiling to be drawn by the air cooling unit.

⦿ **Suction Pressure**

All the above leads to the following:

Low suction pressure which reduces the compressor capacity and increases running time

Ammonia liquid return to compressor

Increases frosting over coils and then longer defrosting time

⦿ **Discharge Pressure**

a. **Clean condenser surface**

Condenser surface should be clean and free of scales. It's advisable to clean the surface every month and apply a coat of Zinc rich paint with heat reflection properties

b. **Sufficient water flow**

Ensure pump condition is OK. Water line filters and strainers are cleaned every 4 months

c. **Blocked sprinkler header hole**

Keep the sprinkler header holes clean from fungus and scale blockage

d. Non - condensable gases

During maintenance, there is every possibility of air entering the system, which does not condense in the condenser and thereby increase the condensing pressure

◉ Discharge Pressure

All the above leads to the following:

- a. High discharge pressure which decreases the compressor capacity and leads long running
- b. Compressor runs hot and increases wear & tear

◉ Condensers & Evaporators

Keep the condensers and evaporators tubes free from dust / scals, which improves the heat transfer rate

- ◉ **Removal of non - condensable gases**

Presence of non condensable gases in system increases the discharge pressure and thus the power consumption. System is to be purged at least once in a month and compulsorily immediately after any repair / maintenance

- ◉ **Procedure for Purging**

Plant should remain stopped for the night, while the condenser water pump should be kept running for about 3 or 4 hours. Early in the morning open the purge valve on the condenser header very slightly and air purged into a bottle of cold water, when bubbles start getting bigger close the valve.

- ◉ **Oil in the Cooling Coil**

Any oil in the cooling coil / evaporator reduces the effective heat transfer area of the coil. Drain the oil from the cooling coil at least once in 4 months

- ◉ **Leakage in starting bypass valves & suction valve assemblies**

The above not only results in compressor becoming hot but also the compressor efficiency gets reduced.

- ◉ **Belts**

Worn out belts will slip, these are to be checked periodically and replaced if damaged / worn out. Care should be taken that belt grooves and belts are clean and oil free. During maintenance there is every possibility that by accident oil comes in contact with fly wheel, motor pulley and belts

- ◉ **Electrical contact points**

All electrical termination and other electrical contact points should be regularly checked / carbon formation if any should be removed & tightened

- ◉ **ACU fan motors**

Defective and burnt motors of air cooling units and agitators are to be replaced immediately for maximum utilization of cooling coil capacity

◉ **Product loading**

Product loading in the storage shall be pre – planned for minimum infiltration and also to minimize the temp fluctuation inside the chamber

◉ **Stopping & Starting of plant during short period of standstill**

For short duration of stopping the system, capacity must be reduced to about 50% (i.e. 50% of evaporators are flooded) by closing the receiver outlet valve, we need not pump down the system completely. It is not necessary to shut of the suction and discharge stop valves. Compressor is started at preferably not more that 50% capacity and increased gradually by operating the received outlet valves in order to avoid possible liquid hammering in the compressor and oil foaming in the crank case.

◉ **Operators**

Maintaining the optimum operational parameters as indicated under item no. (2), during operation to some extent largely depend on the attitude of operators. For fear of ammonia liquid return during nights / leisure period, operators tend to reduce the ammonia flow rate to a safe level, thereby running the compressor at partial capacities

CONDITIONS OF NORMAL OPERATION

1.Oil Pressure	20 PSIG above suction pressure
2. Oil Level	¾" Level in Oil Sight Glass
3.Oil Consumption	1.3 to 1.5 liters / day / 20 Hours operation
4.Temp. of head cooling water inlet	Approximately – 100 °F
5.Compressor crank case temp	Not more than 50 °F above ambient temp
6.Cylinder head and discharge line	Average Maximum : 225 °F Minimum : 290 °F
7.Frosting	Frost should never appear beyond suction scale trap

ROUTINE MAINTENANCE OF PLANT

Daily

- ⦿ Check sight feed lubricator
- ⦿ Check oil pressure
- ⦿ Check suction pressure and discharge pressure
- ⦿ Check suction temperature
- ⦿ Check fly wheel and motor pulley alignment
- ⦿ Check frosting on suction scale trap

Once in a Week

- ⦿ Check oil seal leak
- ⦿ Check discharge line temperature
- ⦿ Check water jacket temperature

CONT'D

Once in a Month

- ⦿ Check all motors and pumps for adequate lubrication
- ⦿ Check belts for tension and cleanliness
- ⦿ Belt to be depressed to about $\frac{3}{4}$ " – 1" with normal thumb pressure
- ⦿ Do not force the V-Belts on the pulley / flywheel by screw driver / hacksaw blade / spanner
- ⦿ Purging of non – condensable gases from the system
- ⦿ Cleaning of the condensers

Once in a Year

- ⦿ Condensers should be cleaned and painted with zinc rich paint
- ⦿ All belts should be checked and worn out belts should be replaced
- ⦿ All strainers in the water line and refrigerant line should be cleaned
- ⦿ Conditions of contractors / terminators in all the electrical system should be checked
- ⦿ Oil should be drained from oil separator, receiver and also evaporator
- ⦿ Check suction and discharge valves assemblies in the compressor

SEASONAL SHUT DOWN

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