

SECTION 5

SAFETY INFORMATION

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The risk of injuries to persons nearby may be reduced by the use of safety restraints attached on either side of the connection.

- (j) Vessels undergoing pneumatic tests should be isolated or enclosed to ensure the safety of persons in nearby buildings, public roads or open areas. If the vessel is not safely isolated it should be contained within a blast pit, retaining walls or substantial enclosure demonstrably capable of withstanding the blast or flying projectiles that could result from vessel failure. The air, steam or gas suddenly released by failure should be exhausted safely.
- (k) A vessel should not be subjected to any form of shock loading such as hammer testing whilst undergoing a pressure test.
- (l) The vessel at pressure should not be approached for close examination until a reasonable period of time has elapsed and the pressure has been reduced. The pressure at which the vessel can be approached for close examination should be specified in the test procedures.

LEAK TESTING

10 Pneumatic leak testing should not be carried out before the integrity of the vessel has been confirmed by a standard pressure test.

11 It is sometimes necessary to carry out preliminary leak testing before the standard pressure test especially for underwater testing. The pressure used for a preliminary leak test using air, steam or gas as the test medium should not exceed 10% of the design pressure. In many cases the preliminary leak test pressure may not need to exceed 0.5 bar g.

12 Precautions for leak tests using air, steam or other gas:

- (a) The precautions set out in paragraph 9 should be considered.
- (b) All articles or vessels should be carefully inspected before being subjected to leak testing. A visual inspection may need to be supplemented by radiographic or other non-destructive tests.
- (c) The leak test pressure should be kept as low as possible and means provided to ensure that the intended test pressure is not exceeded.

13 When leak testing pipework systems of known mechanical integrity, the pressure loss over a measured time may be used to verify that the maximum permissible rate of leakage is not exceeded. The test gas supply should be properly controlled, see para 9(g) and (h). Careful purging procedures may be required during commissioning before normal use.

UNDER WATER PNEUMATIC TESTING

14 Underwater testing is often used to combine a standard pressure test with a leak test. The test tank should be properly designed and tested to safely withstand any sudden release of pressure. Deep immersion of a vessel or article in water does not provide protection if the tank itself is neither capable of withstanding the hydraulic shock of an explosion, nor of venting the volume released to a safe place. Control of water temperature and depth is also required.

15 Safeguards should be provided which have an interlocking system of high integrity. This system should ensure complete immersion of the vessel under test and prevent access into the danger zone while the standard pressure test is being carried out. Close observation of the vessel for leaks should only be permitted:

- (a) before a standard pressure test, when the leak test pressure does not exceed 10% of the design pressure, or
- (b) after a successful standard pressure test, when the pressure does not exceed the design pressure.

PERSONAL PROTECTION

16 There is a risk of injury from particles of dirt and high velocity jets ejected during a hydraulic test at high pressure. A much greater risk exists during a pneumatic test. Personal protection including eye protection should therefore be provided and used by persons required to work within the pressure test facility.

SYSTEMS OF WORK

17 Supervisors and operators of pressure test facilities should receive specific training and instruction. Additionally, a permit-to-work system should be implemented to control work procedures during pressure testing. The Oil Industry Advisory Committee publication *Guidance on permit-to-work systems in the petroleum industry* (1991 HMSO ISBN 0 11 885688 X £2.50) highlights the necessity for permit-to-work systems when pressure testing is required. This guidance may be useful where vessels in other industries have to be tested in situ.

18 Interchangeable pressure test components such as blank flanges, mounting studs, pressure gauges, pressure relief devices and flexible connections should be the subject of regular examination by an appointed person. The appointment should be confirmed in writing to the person and others associated with the pressure test facility. Pressure test components should be properly stored and identified to assist correct selection and use for the purpose intended. Their issue should be recorded.

MULTI-COMPARTMENT VESSELS

19 Special care is required when vessels with more than one compartment are subjected to leak testing. Fatal accidents have been known to occur, for instance, during inspection of the partition welds for leaks when the partitions collapsed under quite low differential pressures. No person should enter a multi-compartment

vessel for leak testing until the mechanical integrity of the partition has been confirmed. The leak test pressure should be substantially below the pressure used to confirm the mechanical integrity.

20 In some cases a vessel may be constructed so that it cannot be fully flooded for a hydraulic test and the stored energy of the trapped air or gas creates a hazard. In these circumstances the precautions given for pneumatic tests in para 9 should be considered.

GENERAL

21 All pressure gauges and temperature gauges used for pressure testing should be compared regularly with a calibrated gauge and records of the comparison kept.

22 A range of air pressures may be required from a common source of supply. In order to reduce the risk of

an incorrect pressure being connected, it may be advisable to have different sizes or types of connections on hose ends, and to arrange that the vessel being tested has compatible connections

23 Where flexible tube connections are used, they should be securely fastened. Tubing simply being pushed onto a pipe or spigot on the test component cannot be accepted as a method of preventing the safe working pressure from being exceeded. Proper pressure relief devices should always be provided and used for pressure testing.

24 As it is vital that safety valves are supplied and maintained in proper working order a test of the setting is required at the initial and subsequent periodic examination, repair or replacement. Safety valves should be removed regularly and be stripped, cleaned, examined and before re-use the set pressure checked.

EQUIPMENT NOISE LEVEL

WARNING!

This equipment may produce excessive noise in certain environments, depending upon the OEL's (Occupational Exposure Levels) the employer and the user should ensure that the necessary hearing protection is provided and used by the operator and others in the work area.

WORKING CODE FOR HIGH PRESSURE EQUIPMENT

1. Never operate hand valves which are not properly secured to a bracket or firm support. Always ensure that pipelines, valves, pressure gauges and other high pressure units are properly secured.
2. Never tighten H.P. couplings under pressure. Never slacken them as a means of "Letting off" pressure.
3. Never pressurise rapidly because air and gases are particularly dangerous when pressurised in a small cavity. Where possible, always purge or bleed a pipeline before pressurising and raise pressure slowly. (N.B. shock pressure testing requires special safety protection)
4. Never have lengths of unguarded, unsupported H.P. tubing which can be trodden on, fallen on, tripped over or merely vibrate in sympathy with a pump or other machinery.
5. Never feel for leaks with a naked hand. Always think and look before touching pipe work.
6. Never operate any equipment unless its function and operation is fully understood.
7. Remember the differential angle on male to female sealing cones is important. Always ensure it exists and is the right way round i.e. male 58° - 59°, female 60° - 61°. Never lap the two mating parts together. Always ensure bleed holes are drilled through.
8. Remember dirt in a hydraulic or pneumatic system is a hazard and prevents the correct operation of the system.
9. All H.P. large capacity testing must be done in the safety of the test cell with expert supervision. The method of testing must be shown on the drawing for the job.
10. Avoid having to complete work on high pressure equipment against a delivery deadline.

SECTION 6

AFTER SALES SERVICE

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AFTER SALES SERVICE

YOUR PIECE OF EQUIPMENT HAS BEEN DESIGNED AND MANUFACTURED TO THE HIGHEST ENGINEERING STANDARDS.

IN ORDER TO MAINTAIN THIS QUALITY, RING OR WRITE TO OUR SERVICE DEPARTMENT FOR FULL DETAILS OF OUR NATIONAL SERVICE FACILITIES.

WE CAN OFFER:

- INSTALLATION
- COMMISSIONING
- PREVENTATIVE MAINTENANCE CONTRACTS
- EMERGENCY BREAKDOWN CALL-OUT SERVICE
- SUPPLY OF SPARE PARTS
- UPGRADING AND MODIFICATION FACILITIES
- CALIBRATION WITH FULLY CERTIFIED EQUIPMENT
- CUSTOMER TRAINING

OXYGEN

Oxygen is a colorless, odorless, and tasteless gas. It makes up about 21 percent of our atmosphere.

WARNING

Oxygen supports and can greatly accelerate combustion.

Oxygen, as a liquid or cold gas, may cause severe frostbite to the eyes or skin. Do not touch frosted pipes or valves. If exposure to liquid oxygen or cold gas occurs, restore tissue to normal body temperature (98.6°F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Call a physician immediately. Rapid warming of the affected part is best achieved by using water at 108°F. Under no circumstances should the water temperature be over 112°F, nor should the frozen part be rubbed either before or after rewarming. The patient should not smoke or drink alcohol. Keep warm and at rest.

Use a pressure-reducing regulator when withdrawing gaseous oxygen from a cylinder or other high-pressure source.

Keep Combustibles Away From Oxygen and Eliminate Ignition Sources.

Many substances which do not normally burn in air and other substances which are combustible in air may burn violently when a high percentage of oxygen is present. DO NOT permit smoking or open flame in any area where oxygen is stored, handled, or used. Keep all organic materials and other flammable substances away from possible contact with oxygen, particularly oil, grease, kerosene, cloth, wood, paint, tar, coal, dust, and dirt which may contain oil or grease. Avoid spills of liquid oxygen. Do not walk on or roll equipment over spills.

Keep All Surfaces Which May Come In Contact With Oxygen Clean to Prevent Ignition.

Even normal industrial soot and dirt can constitute a combustion hazard. Do not place liquid oxygen equipment on asphalt, or on any surface which may have oil or grease deposits. Use cleaning agents which will not leave organic deposits on the cleaned surfaces. In handling equipment which may come in contact with oxygen, use only clean gloves or hands washed clean of oil. Do not lubricate oxygen equipment with oil, grease, or unapproved lubricants.

Maintain Adequate Ventilation.

To prevent accumulation of oxygen in areas containing oxygen equipment and to minimize combustion hazards, adequate ventilation must be provided.

Liquid Oxygen Is Extremely Cold.

(297 deg. F. below zero)

COVER EYES AND SKIN.

Accidental contact of liquid oxygen or cold oxygen gas with the eyes or skin may cause severe frostbite. Handle liquid so that it will not splash or spill. Protect your eyes with safety goggles or face shield, and cover the skin to prevent contact with the liquid or cold gas, or with cold pipes and equipment. Clean, protective gloves without gauntlet that can be quickly and easily removed and long sleeves are recommended for arm protection. Cuffless trousers should be worn outside boots or over high-top shoes to shed spilled liquid. If clothing should be splashed with liquid oxygen or otherwise saturated with oxygen gas, air out clothing immediately. Such clothing should not be considered safe to wear for at least 30 minutes, since it will be highly flammable and easily ignited while the concentrated oxygen remains.

Containers, Equipment, and Replacement Parts Must Be Suitable for Oxygen Service.

Use only equipment, cylinders, containers and apparatus designed for use with oxygen. Many materials, especially some non-metallic gaskets and seals, constitute a combustion hazard when in oxygen service, although they may be acceptable for use with other gases. Make no substitutions for recommended equipment, and be sure all replacement parts are compatible with oxygen and cleaned for oxygen service. Keep repair parts in sealed clean plastic bags until ready for use.

Regulators.

Before attaching regulator to cylinder, inspect the regulator very carefully. Make visually certain that the regulator and the inlet filter are free of oil, grease or other hydrocarbon-type contaminants. These contaminants may be ignited when the cylinder valve is opened and would burn violently in an enriched oxygen atmosphere. Replace the inlet filter if broken, missing or found contaminated. When filter is missing or damaged, the regulator should also be reconditioned and the high pressure gauge replaced. Before attaching the regulator to the cylinder valve, crack the cylinder valve momentarily to blow out any dust or dirt that might have accumulated in the cylinder valve outlet. Connect the regulator to the valve, back out the pressure adjusting screw until it turns freely and then open the cylinder valve very slightly and very slowly so the inlet pressure gauge moves slowly to the Cylinder pressure. Then open the cylinder valve all the way. To minimize chance of injury, stand to one side of the regulator when opening the cylinder valve.



SAFETY INFORMATION

PUMPS, GAS BOOSTERS AND AIR PRESSURE AMPLIFIERS (LIQUID, AIR OR GAS DRIVEN)

> CAUTION <

HIGH PRESSURE GAS OR LIQUID CAN BE DANGEROUS IF IMPROPERLY HANDLED.
EYE PROTECTION, RESPIRATORS AND GLOVES SHOULD BE USED PER MSDS

1. BEFORE INSTALLATION:

- 1.1 Study the technical data received with the unit. Do not hesitate to call your distributor or Haskel, Inc., on any question.
- 1.2 Determine the maximum system pressure that might be encountered for the drive input, pump input, & pump output.
 - 1.2.1 Be certain that the data confirms the unit is rated for those pressures at all three connections.
 - 1.2.2 Be certain that your connecting piping, fittings, gauges, and accessories are rated properly at all three ports and that relief valve or burst disc protection is provided for any potential over pressure.
- 1.3 Review the compatibility of the gas and/or liquids with all components and piping (particularly oxygen gas where each component exposed to the gas should be specifically cleaned, labeled, and designed for oxygen service).
- 1.4 Do not use oxygen gas boosters to pump any other gas.

2. INSTALLATION:

- 2.1 Inspect all connections for contaminants and clean as needed before tightening. If system is for oxygen gas, follow specific special inspection and cleaning procedures to ensure removal of any hydrocarbon contamination.
- 2.2 Fasten unit securely to mounting surface before tightening piping connections.
- 2.3 Use back up wrench to hold unit fitting while tightening connecting fitting.
- 2.4 Stop and inspect for any indication of cross-threading or galling (particularly stainless steel to stainless steel fittings).
- 2.5 Assure that system isolation valves are installed on the drive input, fluid input and fluid discharge lines. Also make sure that bleed down valves are installed so that pressure can be vented off from all connections to the pump.

3. OPERATION:

- 3.1 Be certain you have an understanding of the complete system before operating. Question anything that is unclear.
- 3.2 Equalize inlet & outlet pressures slowly first. Always open fluid inlet and outlet valves (to and from the pump sections) before opening drive valve. (Inlet gas will free flow through all pumps & boosters when inlet pressure exceeds outlet)
- 3.3 Open all valves slowly. Do not use quick acting valves such as 1/4 turn type - particularly in oxygen gas systems.
- 3.4 Presume that ALL installations will eventually leak due to vibration, wear or accident. Consider ALL fluids (except air & water) to be potentially hazardous if confined in a closed area. Therefore, operate only in a well ventilated area.

4. MAINTENANCE:

- 4.1 Prior to performing any maintenance, close all three isolation valves and vent all pressure to zero. **THIS IS CRITICAL. INJURY MAY RESULT IF MAINTENANCE IS ATTEMPTED WHILE THE UNIT IS PRESSURIZED.**
- 4.2 Perform maintenance in accordance with the Operating & Maintenance Manual. Make sure that replacement seals and O-rings are of fluid compatible material. Do not modify the unit in any way without contacting the factory.

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ISO 8573.1 AIR QUALITY RECOMMENDATIONS

Quality Class	Dirt Particles In Micron	Water Pressure Dewpoint F (ppm.vol.) at 100 psig	Oil ppm (including vapor)
1	0.1	-100 (0.3)	0.01
2	1	-40 (16)	0.1
3	5	-4 (128)	1.0
4	15	+37 (940)	5
5	40	+45 (1240)	25
6	***	+50 (1500)	***

**Recommended minimum ISO Quality air supply for Haskel air motors
is Class 4 or better.**

Class 1 or 2 may be required for heavy duty applications, i.e., high cycle rates (over 40cpm) to help prevent freezing, high contamination, or higher pressures. The required frequency of re-lubricating the cycling spool may increase with dryer air.

Installation Hints

- Generally install filters downstream of after-coolers and air receivers at the lowest installation temperature, and as close to the point of application as possible. This ensures that in wet systems as much water & oil vapor has condensed out as possible which can be removed by the coalescing filters. Installing close to the application reduces the risk of pipe scale downstream of the filters contaminating the filtered air. Please refer to above installation hints.
- Filters should not be installed downstream of quick opening valves, and should be protected from possible reverse flow or other shock conditions.
- It may be necessary to install a combination of main line filtration near the compressor installation before entering the building or shop, and install additional filtration at the critical points. Remember especially in existing installations the contamination already in the pipe system downstream of the filters will take a long time to disappear, and probably never will completely.
- Purge all lines leading to the filters before installation and connecting to the final application to be protected.
- Install filters in a vertical position (pipe-work is horizontal) ensuring that there is sufficient room below the filters to facilitate element change.
- Avoid by-pass lines whenever possible as contamination may leak through valves and by-pass the filters.
- Provide a facility to drain away collected liquids where applicable from the filter drains via suitable tubing taking care that no restrictions are caused.
- Install differential pressure gauges to indicate the pressure drop across the filters. This will give an idea of the filter element condition.
- Care should be taken with larger filters to see that they are properly supported by the pipe-work.
- If you have a problem on filter selection or installation please contact your local Haskel distributor, or the Factory.