

# **VPACK**

**OIL FREE  
HIGH PRESSURE  
RECIPROCATING AIR COMPRESSOR**

## **OPERATIONS INSTRUCTION MANUAL**

**MODEL  
HLW -8.5/40**

**Serial No:**

Please specify the Model and Serial No. whenever you contact us.

**NOTE:** Before installation or starting the compressor for the first time, this manual should be studied carefully to obtain a clear knowledge of the unit and of the duties to be performed while operating and maintaining the unit. This Technical manual contains important safety data and should be kept with the air compressor at all times.

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## **Congratulations for purchase an VPACK compressor.**

### **AIR COMPRESSOR WARRANTY AND REGISTERED START UP**

The Company warrants that the equipment manufactured by it and delivered hereunder will be free of defects in material and workmanship for a period of twelve months from the date of placing the equipment in operation or eighteen months from the date of shipment, whichever shall first occur. The Purchaser shall be obligated to promptly report any failure to conform to this warranty, in writing to the Company in said period, whereupon the Company shall, at its option, correct such nonconformity, by suitable repair to such equipment or, finish a replacement part F.O.B. point of shipment, provided the Purchaser has stored, installed maintained and operated such equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others shall carry whatever warranty the manufacturers have conveyed to the Company and which can pass on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the equipment or any costs of labour performed by the Purchaser or others without Company's prior written approval.

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The remedies of the Purchaser set forth herein are exclusive, and the total liability of the Company with respect to this contract or the equipment and service furnished hereunder, in connection with the performance or breach thereof, or from the manufacture, sale, delivery, installation, repair or technical direction covered by or furnished under this contract, whether passed on contract, warranty negligence, indemnity, strict liability or otherwise, shall not exceed the purchase price of the unit of equipment upon which such liability is based.

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# 1. SAFETY AND WARNING

## 1.1 Safety Instructions and precautions

Before you install the air compressor you should take time to carefully read all the instructions contained in this manual. Electricity and compressed air have potential to cause severe personal injury or property damage. Maintenance should be done by qualified personnel, equipped with proper tools. Follow the maintenance schedules as outline in the operator's manual to ensure problem free operation after start-up.

Before installing, wiring, starting, operating or making any adjustments, identify the components of the air compressor using this manual as a guide. The operator should use common sense and good working practices while operating and maintaining the unit. Follow all codes; understand the starting and stopping sequence. Check the safety devices by following the procedure contained in this manual.

Before proceeding, read carefully before installing the compressor or performing any maintenance. Be sure the electrical supply has been cut off and the entire compressor system has been vented of all pressure.

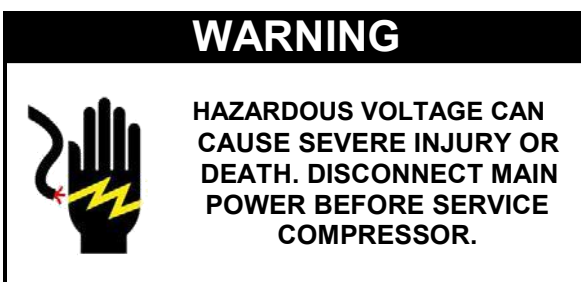
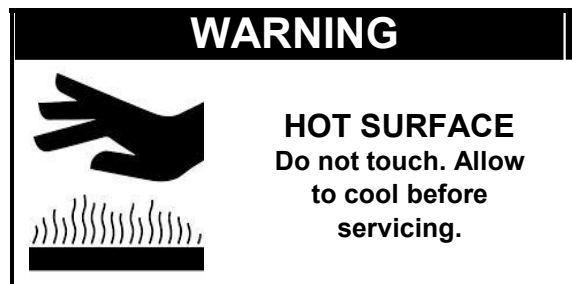
1. Do not remove the covers, loosen or remove any fittings, connections or devices when unit is in operations. High air pressure contained within the unit can cause severe injury or death.
2. Before working on the electrical system be sure to remove voltage from the system by a manual on/off switch. A circuit breaker or fuse safety switch must be provided in the electrical supply line leading to the compressor.
3. Do not operate the compressor at higher discharge pressure or motor current as specified on the Nameplate, resulting in compressor motor shutdown.
4. Whenever pressure is released through the pressure relief valve, it is due to excessive pressure I the system and should be investigated immediately.
5. There can be adverse effects if compressor lubricants are allowed to enter plant sir systems.

## 1.2 Decals

**DANGER!** Is used to indicate the presence of a hazard which will cause death, serve personal injury, or property damage in the danger statement is ignored.

**WARNING!** Is a statement which indicates the presence of a hazard which can cause death, severe personal injury, or property damage if the warning is not heeded.

**NOTICE** Is used to advise the user of installation, operation or maintenance information which is important, but not hazard related.



## 2. RECEIPT OF EQUIPMENT

### 2.1 Unpacking And Handling

When you receive the compressor please inspect it closely. Any indication of careless handling by the carrier should be noted on the delivery receipt especially if the compressor will not be immediately uncrated. Obtaining the delivery man's signed agreement to any noted damages will facilitate any future insurance claims.

**Attention: Lift the unit only by the anchoring points provided.**

## 3. INSTALLATION

### 3.1 Ventilation

Proper consideration should be taken when you decide where to place the compressor, in the plant with adequate ventilation to avoid overheating. Inadequate ventilation under high humidity or very damp climates conditions are conducive to the formation of water condensate in cylinders and frame may result in rusting, oil slugging and rapid wear of running parts. As an option for atmospheric temperature below 5°C, the crankcase shall be heated.

Choose a clean, relatively cool location and provide ample space around the unit with minimum one (1.5) meter for cooling and convenient maintenance accessibility for disassembly of large components like piston and cylinders.

Consider the compressor surrounding environment, should be free of dust, chemicals, metal filings, paint fumes. Ambient temperatures higher than 46°C should be avoided as well as areas of high humidity which will cause the compressor to overheat and are detrimental to seal packing and piston ring service life span.

### # TYPICAL COMPRESSOR ROOM LAYOUT

### 3.2 Foundation Requirements

The compressor floor shall be level and capable to support the weight of the air compressor package. Lifting facilities like chain block on rail shall be provided for assembly and disassembly of heavy components, and maintenance repair. Refer to the foundation plan for the particular model compressor to be installed. See Section 8.2.

### 3.3 Piping

It is essential when installing a new compressor to review the total compressed air system to ensure an effective system. The compressed air distribution piping connected to the compressor shall be at least equal to the outlet connection.

All piping and fittings shall comply for the maximum operating temperature and pressure of the air compressor. For optimum efficiency the piping length, size, number and type of valves and fittings, connection point is essential. A discharge valve shall be installed to isolate the system when the machine is not in operation and advisable to install a non-return valve for multiple units (more than 2 units).

For safety of high pressure piping system, the pipe work shall be perfectly aligned with rigid support, sufficient anchor points that may be subject to vibration stress and must be pressure tested to 1.5 times of the service pressure.

Common problem when ambient humid air is compressed and cooled will result in condensate water in downstream air piping can cause rusting and scaling in pipelines, clogging instruments, and freezing outdoor air lines. Drip-leg assembly with isolated valve to drain shall be installed near the compressor discharge and additional drip-leg at the low points in the piping systems should the downstream piping cool further. To remove the condensation, each compressor is furnished with built-in inter and after-cooler combination condensate separator/trap. To further reduce water formation in compressed air line, compressed air dryer and filters shall be introduced to improve the quality of compressed air.

### 3.4 Electrical Installation

All work on electrical connections should be carried out by qualified electricians to observe the safety regulations and conditions of connection by the local electrical supply utility. Non compliance may result in endangering of personnel and damage to the machine.

Check to confirm that the line voltage and the motor nameplate voltage are complied. Open the starter cabinet to confirm that all electrical connections are properly tightened or fasten and the control transformer is wired correctly for supply voltage. See figure A. Electrical circuit diagram shall be provided in the control cabinet for wiring connections reference.

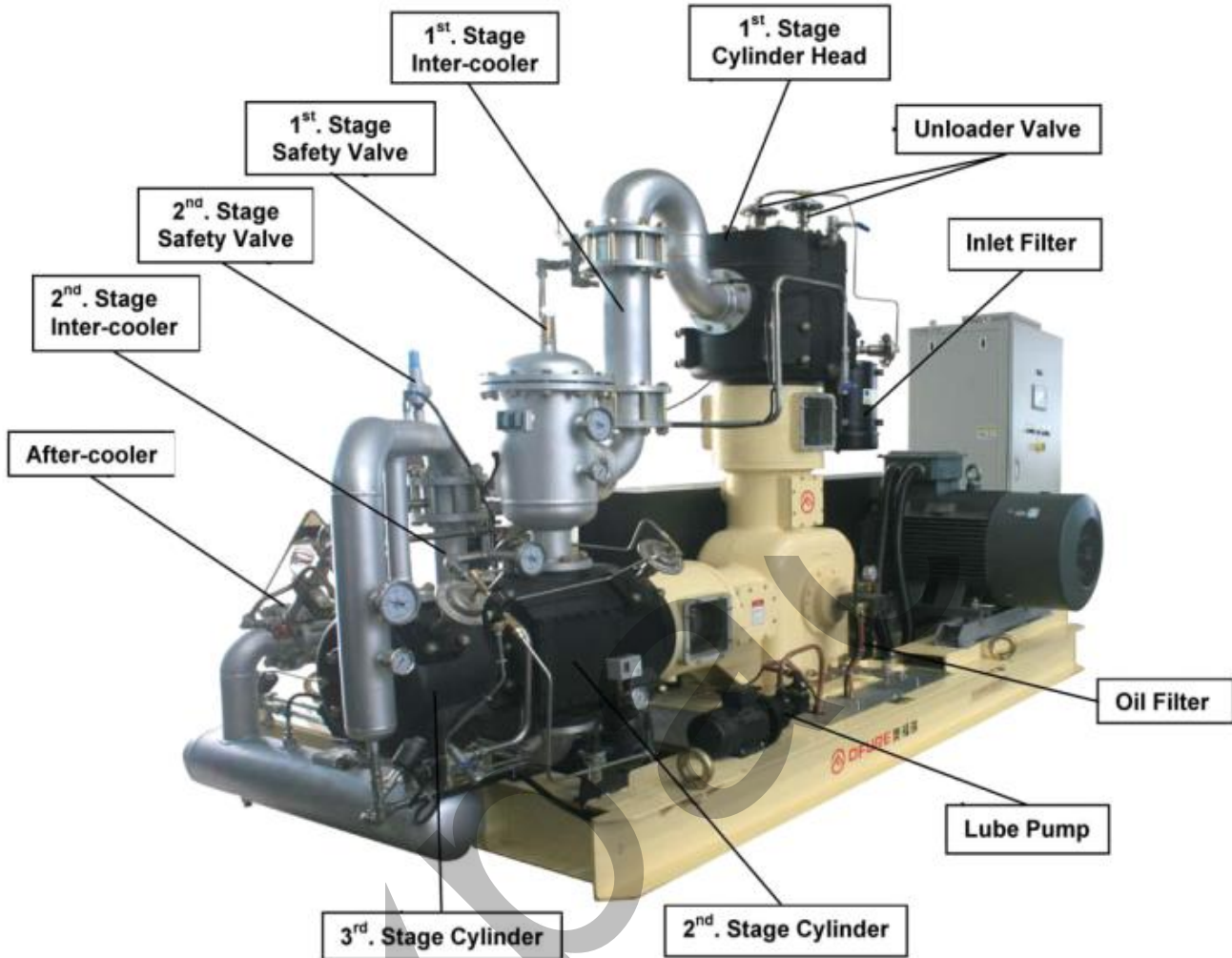
#### # TYPICAL CONTROL TRANSFORMER WIRING CHART

To check the compressor motor rotation, the jogging time must be as short as possible. Depressing the "EMERGENCY STOP" button immediately, after depress the start button.

year

## 4. COMPRESSOR SYSTEM

### 4.1 General Information



#### GENERAL INFORMATION:

Package Model		HLW-8. 5/40
Bare Model		HWC8A
Package Dimension	MM	4050*1750*2350
Total Weight	Kg	5500
Motor Power	Kw	90
Voltage Fluctuation	%	± 5
Number of Stage & Cylinders		3
Buffer Tank Capacity	Lit.	230
Lube Oil Capacity	Lit.	80
Cooling Water Flow	m <sup>3</sup> /hr.	20
Cooling Water Pressure	Kpa	350
Natural Ventilation	m <sup>3</sup>	2*7.3
Forced Ventilation	m <sup>3</sup> /hr.	9350
Ambient Temperature Limits	°C	-20 ~ 40
Compressed Air Quality		Oil Free
Altitude	m	<1000
Environment		Indoor

## 4.2 Air Compressor

ARMSTRONG oil free, high pressure, three (3) stage water cooled reciprocating air compressor is designed for PET blow moulding industries that required compressed air pressure up to 4.0 Mpa.

Oil free designed utilized heat resistant non metallic guides, piston rings, and seal packing at the compression chamber. Incorporated with distance piece and crosshead to isolated the crankcase from the compressed air chamber.

Applicable to other industries that require high purity compressed air are beverage, hospital, pharmaceutical, chemical and food processing.

Basic principle of the compressor operation is as follows:

Atmospheric air is suck into the 1<sup>st</sup>. Stage cylinder through the inlet filter and inlet valve on the 1<sup>st</sup>. stage piston suction stroke. Than the compression stroke compresses this air to an intermediate pressure and discharges through the discharge valve into the water cooled intercooler tubing removing compression heat and moisture. Now the cooled air is draws through the 2<sup>nd</sup>. Stage valves into the cylinder where it is compressed to higher pressure.

After second stage compression the high pressure air is forced out through the 2<sup>nd</sup>. Stage discharge valves and cooled down in the second stage intercooler, separator and into the third stage inlet valve. On the 3<sup>rd</sup>. stage the compression stroke the air is further compressed to its final pressure and discharge out through the water cooled after -cooler, condensate separator into the buffer tank. Once the delivery pressure reaches the set cut off pressure the controller will activate the pneumatic actuator to open the inlet suction valves and released inter stage pressure through the solenoid bleeding valve to unload the compressor.

## 4.3 Inter-Stage Pressure

Due to variable operating conditions, the inter-stage pressure chat provide as reference and may not be identical to the pressure reading on the unit. It is best to record the inter-stage pressure when the machine is new, and should be used as normal inter-stage pressure for daily operation reference.

INTER-STAGE PRESSURE CHART			
Model	Discharge	1 <sup>st</sup> . Stage	2 <sup>nd</sup> . Stage
HW08A	4.0 Mpa	0.42 Mpa	1.55 Mpa
HW12C	4.0 Mpa	0.38Mpa	1.65 Mpa
HW22B	4.0 Mpa	0.4 Mpa	1.35 Mpa



#### 4.4 Noise Level

When the compressor operating noise level exceeds 85 dBA attentions must be given to prevailing Health and Safety Legislation, to limit the exposure of plant operating personnel to the noise. The compressor noise level is dependent on a number of factors, like the operating capacity, piping design, and acoustic characteristics of the foundation and building.

#### 4.5 Water Cooling System

For reliable operation of the air compressor, recommended enclosed circuit cooling tower or water chillier with a pump assembly incorporates a bleed line and valve to provide better cooling efficiency and easy system maintenance with minimum water usage and to avoid residuals build-up in the water distribution system, free from biological and air contamination that lead to scaling, corrosion and reduction heat transfer rate.

To maintain a good water cooling system, the list of major components that should be monitor:

**CORROSION** – High level of dissolved oxygen and low PH levels promote corrosion.

**SCALE** – Major contributor to scale formation is the precipitation of calcium carbonate which depends on the temperature and PH. Scale can be controlled with water treatment, higher PH value increase the chance of scale formation.

**CONTAMINATION** – Biological and organic substances may cause clogging problems, restricts water circulation.

Recommended acceptable water conditions as follows:

Parameter	Concentration
PH	7 to 8
Iron	< 2 ppm
Sulphate	< 50 ppm
Chloride	< 50 ppm
Nitrate	< 2 ppm
Silica	< 100 ppm
Dissolved Oxygen	As low as possible
Ammonia	< 1 ppm

Water cooled intercoolers and after-cooler are installed directly downstream at each cylinder to cool compressed air discharge and reduce moisture level between stage and at delivery. For every 11°C rise in compressed air temperature, the moisture content in the air doubles.

Cooling Water Requirement							
Compressor Model	HLW-7.0	HLW-8.5	HLW-10	HLW-12	HLW15	HLW18	HLW20
Pump Model (Booster)	CDL-7.0	CDL8-5	CDL8-6	CDL8-6	CDL12-5	CDL12-5	CDL12-5
Pump Horsepower, Kw	2.2	2.2	2.2	2.2	3.0	4.0	4.0
Flow Range, m <sup>3</sup> /h	5~12	5~12	5~12	5~12	16~22	16~22	16~22
Inlet Pressure, Kpa	100						
Discharge Pressure, Kpa	300~350						
Ambient Temperature, °C	Max. 40						
Temperature Range, °C	-5 ~ 120						

**Note:** Cooling water must be shut off when units standing idle. The cast iron cylinders may rust if exposed to condensation, which will wear piston rings life. Cylinder water jackets on the units which stand idle for more than 36 hours, should be equipped with heater to hold cylinder water temperature above the dew point.



## 6.2 First Service

When the machine is operate for the first time, during the run- in period of the first 50 hours, it is normal small minor filings residue in the compressor lubricating oil. It is crucial to drain and clean the crankcase and replace the oil filter. Should that be heavy amount of metal filings, notify the manufacturer immediately.

Before starting the compressor for the first time and initial 50 hours, check and re- tighten all bolts after operating under heat and stress load from cylinder assembly to crosshead, piston rod, and especially screw on the valves and valve covers, all connections against leakage with torques reference below.

Diameter	Wrench	Torque
mm	mm	Nm
6	10	7~7.9
8	13	17~19
10	17	20~27
12	19	35~42
14	22	58~64
16	24	90~98
20	30	185~195
22	32	250~260
24	36	320~330
27	41	450~500
30	46	580~620

## 6.3 Inlet Air Filter

It is very important that the air filter are kept clean at all time, dirty inlet filter may reduces the performance of the compressor. The air filter element should be taken out at least once a week for cleaning by carefully blow against the surface of the cartridge with dry compressed air at not more than 5 bar pressure, inspect for damage, seal, cracks, and puncher holes. Damage cartridges must be replaced immediately. For strong pulsation loading like reciprocating air compressor, recommended to change the element after three (3) times of cleaning, 2000 hours or 1 year whichever comes first.

The standard air filter is suitable only for normal industrial applications. Should the compressor be located in a high dust and dirt concentration environment, specially designed heavy duty filter element should be used.

## 6.4 Oil Filter

To monitor the condition of the oil filter check the oil pressure in the current display screen or the gauge on the lube pump. Normal condition the pressure should be 3~3.5 Kpa, if oil pressure drop below 2.5 Kpa replaced the filter cartilage.

**Note:** Improper filter replacement will cause compressor damage.

## 6.5 Compressor Lubricant Oil

Operator must check the oil level at the sigh glass at the compressor crankcase daily or before start-up. If oil level drops below the safe point, add oil to FULL mark, do not over fill. First service oil filters and compressor oil should be 150 hours to remove impurities and residual during installation, follow by every 4000 hours or 6 months whichever comes first.

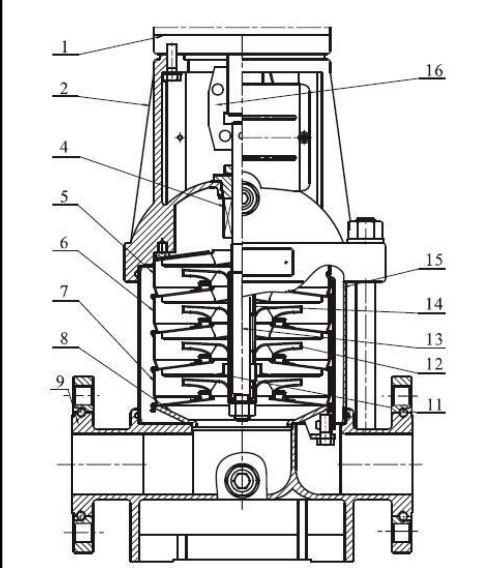
**WARNING:** Use flushing oil to flush. Flushing the crankcase with gasoline, kerosene or flammable fluid can cause serve injury or death.

Recommend lubricant oil should be SAE 150 grade, non-detergent, anti-foaming, esther base.

### 6.6 Water Booster Pump

Water pumps in the system, general maintenance involves cleaning the hydraulic parts and replacing the mechanical seal that does not required scheduled maintenance. As a precaution, you are advice check for leaks, operating pressure and noise.

Water cooled piped intercooler and after-cooler are shell and tube heat exchanger type with compressed air flows through the tubes in one direction as water flows on the shell side in the opposite direction. The purpose of the cooler is to reduce the discharge temperature of the compressed air and to facilitate removal of condensate water. Maintenance the cooler require routine inspect, clean, check approach temperature, pressure drop, and water quality. Dirty cooler shall results in high air temperature.

	No	Parts	Material	AISI/ASTM
	1	Motor		
	2	Pump Head	Cast Iron	ASTM25B
	4	Mechanical Seal		
	5	Outlet Guide Vanes	Stainless Steel	AISI304
	6	Vanes	Stainless Steel	AISI304
	7	Support Vanes	Stainless Steel	AISI304
	8	Deflector	Stainless Steel	AISI304
	9	Housing	Cast Iron	ASTM25B
	11	Bearing		
	12	Impeller	Stainless Steel	AISI304
	13	Axis	Stainless Steel	AISI304
	14	Wheel Spacer	Stainless Steel	AISI304
	15	Pressure Cylinder	Stainless Steel	AISI304
	16	Coupling	Carbon Steel	

### 6.7 Motor Lubrication

Standard ODP IP23 three phase, low voltage squirrel cage motor for cooling with ball bearings fitted grease fitting should be repacked with grease at periodic intervals. It is a good practice to blow off the motor winding with clean dry air to prevent dirt accumulation, monitor bearing temperature, abnormal noise when running and occasional re-varnishing the windings to prolong motor lifespan.

Lubrication Interval or 6 months whichever comes first.	50 Hz	60 Hz
ODP drive motors and fan motors	3000 hours	2000 hours
TEFC drive motors	2000 hours	1000 hours

If motor located in an environment exposed to appreciable quantities of fumes, dirt, water, or oil, it must be specially constructed.

### 6.8 Valves and Cylinders

The valves reliabilities are subject to load intensity, working pressure, and environment conditions. All valves should be cleaned and inspected at regular interval, recommended every 1000 hours or 6 months whichever occurs first.

Dismantling the valve completely to check condition of the parts,

- A. Inspect valve disc plate, replace broken, scratched or badly worn disc.
- B. Check spring compression, replace all springs at the same period if weak. Recommended to every 5000 hours for maximum performance.
- C. The valve seats should be precisely flat, free of scratches and worn mark. Minor defect can rectify by grinding the seat surface, replace if badly worn.

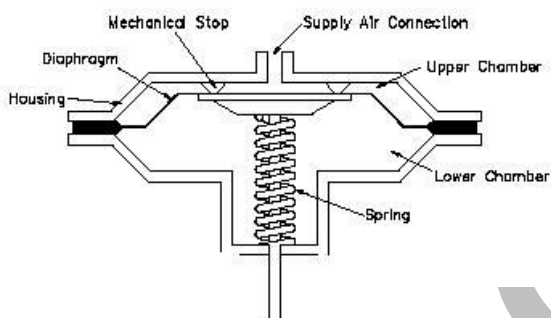
DO NOT USE A WIRE BRUSH to clean the valve parts. Use a stiff bristle brush or a non-flammable safety solvent to remove any dirt, carbon deposit or gasket residue.

Since the valves are removed, carry out visual check the cylinder inner surface condition with the aid of torchlight. Then rotate the flywheel until the piston reached the topmost and bottommost position to measure the both piston clearance with thickness gauge.

### 6.9 Inlet Valve Unloader Actuator

To unload the compressor while running and to facilitate starting, the unloader actuators hold the inlet valves open, reducing unloaded power consumption.

A diaphragm separates the actuator housing into two air chambers; the upper chamber receives supply air through an opening in the top of the housing. Supplied compressed air pressure cause the diaphragm to overcome the spring and move downward to open the suction valve during unloading. If check and found leakage replace the diaphragm.



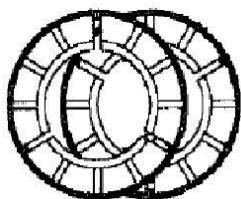
### 6.10 Packing Seal

If leakage reaches an unacceptable level the seals will need replacement, no adjustment possible. When replace the new packing, check the piston rod are clean and free of foreign material. If the rod is worn or scored it should be repaired or replaced.

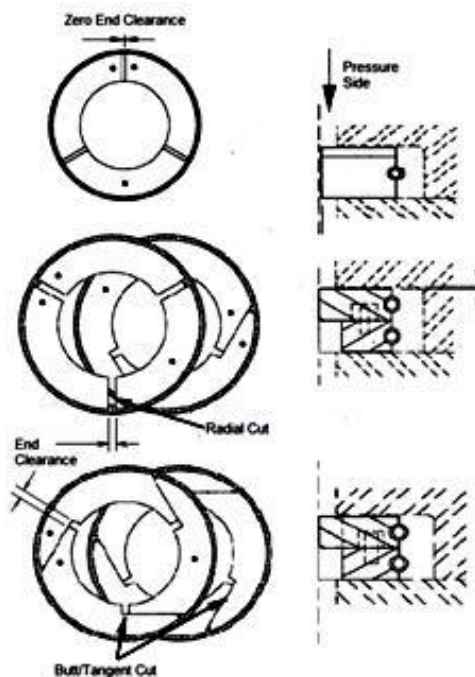
A series of non- metallic self- lubricating seal rings (with bronze back up ring) in the stuffing box bolted to the head, seal around the piston rod passing through a cylinder head is meant to stop compressed air leaks out into the distance piece. The seal packing arrangement consists of a pressure breaker ring, several seal rings, and a vent control ring.

### 6.11 Oil Scraper Packing

The metallic scraper packing is to prevent oil from the crankcase escaping along the piston rod into the distance piece. Piston rod operating temperature should be within 70~90 °C. After replaced new packing, spray Teflon on the piston rod. If reaches 100 °C stop the machine immediately and inspect the ring installed.



Scraper Rings



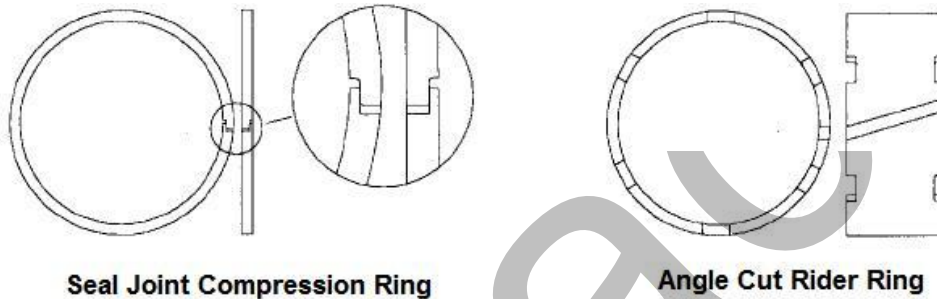
### 6.12 Piston

Inspect the cylinder and piston for scored or cracked, replace the parts if there are signs of being worn or scored. It is necessary to replace a complete new set of piston rings after in service for long period of time, check the condition of the ring grooves between the piston to cylinder for any signs of excessive wear. Worn or broken piston rings can contribute factor to compressor performance decline.

ACCEPTANCE CLEARANCE	MAX.	MIN.
First Stage Piston to Cylinder		
Third Stage Piston to Cylinder		
Crankpin Bushing to Connecting Rod		
Piston Pin to Connecting Rod		
Piston Ring End Gaps		

### 6.13 Piston Rings

The non metallic piston ring for oil free cylinders consist several compression rings and a rider ring. To minimise the leakage, seal joint compressor rings are essential constant during the life of the ring until the gaps open. Worn or broken piston rings often contribute in decline in compressor performance and must replace with a complete set of new rings.



**CAUTION:** To avoid internal leakages always ensure that the consecutive rings joint/cut are opposite one another.

After replaced with new piston ring, run the compressor on unload mode without the valves for a minimum of 2 hours to monitor abnormal noise. Then stop to proceed to installed the valves and load the machine progressively with 10 Kpa incremental each step, check abnormal noise and temperature conditions before proceed to the next step until it reached the working pressure.

### 6.14 Lubrication System

Low speed direct shaft driven pump delivering positive pressure lubrication to all bearings, the crosshead and moving parts. Oil enters the gear pump from the sump and delivered through an external mounted replaceable oil filter cartridge before entering the machine. To ensure constant delivery pressure of 3 Kpa, a pressure sensor is installed immediately after the filter with set warning alarm at 2 Kpa and shutdown protection at 1 Kpa minimum oil pressure at the main bearing.

Generally the gear pump require low level of maintenance outlay, regular checking of all operating data such as pressure, temperature, dirt accumulation in filter, unusual noises, visible leakage may identify possible faults at an early stage.

### 6.15 Thermostatic Expansion Valve

Thermostatic expansion valves are installed at the water supply end connected to the water cooled oil-cooler and 2<sup>nd</sup>. & 3<sup>rd</sup>. Stage cylinder water jacket to control the minimum idle operating temperature and compressor performance. Required low maintenance, faulty pressure blub

## 6.16 V-Belt Drives

The machine is belt driven, it is important that the alignment between the motor pulley and flywheel must be parallel and the belts be properly adjusted. If the belts are not aligned or too loose they will slip and wear and if it is too tight may cause bearing overload, both will shorten the belt and bearing life. Proper tension V-belt is the lowest tension at which the belt will not slip under peak load conditions. A quick check to determine the belt adjustment is proper by observing the slack side of the belt for a slight bow when the unit is in operation. The belts are usually satisfactory when a slight bow is evident.

For new V-belt, check the tension after 50 hours of operation and re-tension, thereafter check and re-tension monthly or at 500 hours interval.

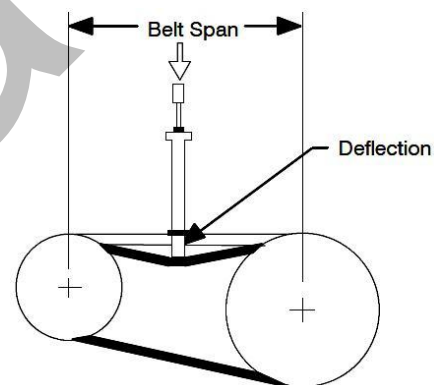
Correct V-belt tension can be achieved using a belt tension tester and Table B-2 or B-3. Use the tables to find the V-belt size (cross-section), the smallest sheave diameter, the belt type for your application. The corresponding deflection force required for new or used belts is shown opposite the RPM range of the machine

The ratio of deflection to belt span is 1:64, if a belt with a span of 64 inches would require a deflection of 1 inch at the force shown on the Tables for your particular application. For example, if the span as measured is 32 inches (813 mm), the V-belt cross-section is C, the smallest sheave diameter is 8 inches, the pump speed is 1450 RPM, and then 11.5 lbs. scale on the tensioner should show 1/2 inch (12.7 mm) of deflection.

### Belt Deflection Force Table:

Belt Type	Smallest Pulley Diameter In. (mm)	Pulley Speed RPM Range	Belt Deflection Force	
			New Belt lbs. (Kg.)	Old Belt lbs. (Kg.)
C, CX	7.0 – 9.0 (175 – 230)	500 -1740	17.0 (7.7)	11.5 (5.2)
	9.5 – 16.0 (231 – 400)		21.0 (9.5)	14.1 (6.4)

Position the bottom of the large O-ring on the span scale of the tensioner at the measured belt span. Set the small O-ring on the deflection force scale to zero. Place the tension tester squarely on the belt at the center of the belt span. Apply force on the plunger, perpendicular to the belt span, until the bottom of the large O-ring is even with the top of the next belt, or with the bottom of a straight edge laid across the sheaves. Read the force applied from the bottom of the small O-ring on the deflection force scale. Compare this force with the value shown in Belt Deflection Table and adjust the tension accordingly. Note that the tension for new belts is higher than that for used belts to allow for expected belt stretching. Do not over-tension used belts to the higher deflection forces shown for new belts



## 6.17 Safety Valves

A safety valve is provided in each interstage and at the discharge. If the safety valve continues blowing the compressor should be stopped at once. It may indicate a leak or broken discharge valve in the next higher pressure cylinder.

### Safety Valve Setting:

Rated Pressure	1 <sup>st</sup> . Stage Interstage	2 <sup>nd</sup> . Stage Interstage	3 <sup>rd</sup> . Stage Discharge
4.0 Mpa (40 Bar)	0.6 Mpa (6 Bar)	1.6 Mpa (16 Bar)	4.1 Mpa (41 Bar)

## 6.18 Automatic Condensate Drain Valve.

The unit are provided with automatic condensate drain valves at the separator after each intercooler and after-cooler to expel the condensate.

## 7 TROUBLE SHOOTING GUIDE

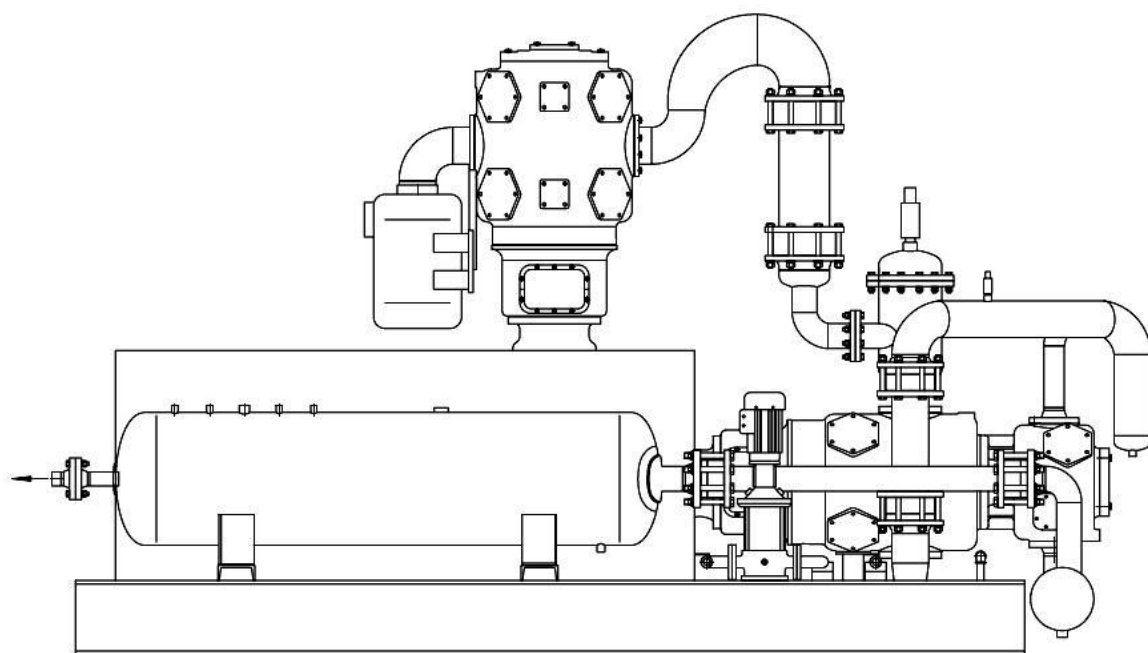
Trouble Symptoms	Check Points
Low discharge pressure / inadequate delivery	1-2-4-6-7-8-9-10-26-28-29
Discharge Safety valve pops	15-36
Inter-stage safety valve pops (1 <sup>st</sup> . or 2 <sup>nd</sup> . Stage)	2-4-15-28-29
High discharge temperature	1-2-4-7-11-17
Motor fails to start	18-30
Motor bearing overheat	13-14-17
Compressor knocks or rattles	4-6-21-22-23-25-27
High vibration	21-25-27
Automatic drain valve does not function	26-36-37
High inlet valve temperature	1-2-4-11-15-17-29
Rusting in cylinders	26-33-37
Low lube oil pressure	20-32
Excessive oil pumping in distance piece	23-32-35

### Trouble Check List

No.	Possible Cause	Corrective Action
1	Intake duct choked or dirty air filter element	Clean or replace air filter element
2	Broken or worn valve disc plate	Replace valve disc plate
3	Faulty monitoring sensor/transmitter	Check loose connection or replace sensor
4	Loose valve set screw	Check and tighten screw
5	Faulty pressure regulator	Check sensor
6	Loose motor fan	Check motor fan
7	Piston rings worn	Replace piston rings
8	Piston rod seal packing worn	Replace seal packing rings
9	Excessive air leakage	Tighten bolts, piping connection or replace tube/hose.
10	High consumption or air leakage in production	Audit consumption or check and fixed piping leakage
11	Cooling water temperature high	Check cooling water
12	High discharge pressure	Check next stage piston valve
13	Inadequate oil lubrication	Greasing or top-up oil
14	Belt tension too tight	Reduce drive belt tension
15	Inlet unloader valve failed	Check and replace ruptured diaphragm
16	Fouled water cooler or cylinder water jackets	Clean and decaling water system.
17	Ambient temperature >40°C	Use high temperature grease
18	Overload Trip	Reduce load
19	Water pump failure	Check power supply or motor failure
20	Oil pump worn	Repair oil pump
21	Excessive bearing play, loose flywheel or motor pulley	check the motor flywheel ,and tighen belt
22	Worn crankshaft or connecting rod	Replace bearing or bushing
23	Loose piston rod	Check piston head clearance, tighten piston rod locknut
24	Loose crosshead slippers	Check the silide and crosshead
25	Poor foundation or anchorage	To level and install vibration mounting and anchorage
26	Defective condensate drain solenoid valve	Check power supply to coil, replace burn coil
27	Piping poorly secured	Tighten bolts and improve pipe support
28	Faulty HP valve	Check & service HP valves, replace worn parts
29	LP valves faulty	Check & service LP valves, replace worn parts
30	Main voltage too low or frequency too high	Check main supply state
31	Leaking check valve	Replace check valve or non return valve
32	Oil viscosity too low	Recommended ISO 150
33	Damp humid atmosphere or extreme low duty.	Improve ventilation or duty cycle or install heater
34	Low oil level	Add oil and check oil leakage
35	Piston rod scraper packing worn	Replace scraper rings
36	Faulty controller	Check setting
37	Dirty or clogged drain	Check and clean connections and valve



# OIL-FREE RECIPROCATING AIR COMPRESSOR LAYOUT



vear