

Serial number : **25106**
Model : **HORIZON-500**
Customer : **SIDE**
Destination : **KAZAN, RUSSIA**

HORIZON



ARIZAGA BASTARRICA Y CIA., S.A.

Políg. Ind. Azitain N°6, P.O. Box,87
20600 EIBAR (Guipúzcoa) - SPAIN

Telf: (34)-943.820.400

Fax: (34)-943.820.235

E-mail: abc@abc-compressors.com

sat@abc-compressors.com

MANUAL OF INSTRUCTIONS

INDEX

- 1.- GENERAL INSTRUCTIONS
 - 1.1.- REPLACEMENT PARTS ORDER
 - 1.2.- NOISE
 - 1.3.- SAFETY
- 2.- DESCRIPTION
 - 2.1.- GENERAL DESCRIPTION
 - 2.2.- TECHNICAL CHARACTERISTICS
 - 2.3.- PARTICULAR DESCRIPTION
 - 2.3.1.-MECHANICAL PART
 - 2.3.2.-CYLINDERS
 - 2.3.3.-PACKINGS
 - 2.3.4.-VALVES
 - 2.3.5.-SAFETY VALVES
 - 2.3.6.-LUBRICATION
 - 2.3.7.-COOLERS
 - 2.3.8.-INSTRUMENTATION
 - 2.3.9.-DRAINS
 - 2.4.- PLACE FOR OPERATOR
- 3.- INSTALLATION
 - 3.1.- GENERAL INSTRUCTIONS
 - 3.2.- HANGING INSTRUCTIONS
 - 3.3.- UNPACKING
 - 3.4.- COMPRESSOR TURNING AND FOUNDATION
 - 3.5.- AIR PIPE LINE
 - 3.6.- ASSEMBLY
 - 3.7.- INSTRUCTIONS FOR FIRST STARTING-UP
 - 3.8. - EMC RECOMMENDATIONS
- 4.- OPERATION
 - 4.1.- SAFE SERVICE
 - 4.2.- OPERATION OF THE EQUIPMENT
 - 4.3.- STARTING AND STOPPING
 - 4.4.- SAFETIES
 - 4.5.- CHECKING WITHIN SERVICE
- 5.- MAINTENANCE
 - 5.1.- SAFE MAINTENANCE
 - 5.2.- MAINTENANCE CHART
 - 5.4.- COOLERS
 - 5.5.- FILTERS
 - 5.6.- PISTON RINGS
 - 5.7.- LUBRICATION
 - 5.8.- PROCEDURE FOR MANUAL TURNING OF COMPRESSOR
 - 5.9.- TIGHTENING TORQUES
- 6.- INCIDENCES AND REPAIRS
- 7.- SAFETY
 - 7.1.- SAFETY BASIC PRECAUTIONS
 - 7.2.- REMAINING DANGER
 - 7.3.- ADVISE AGAINST WRONG USE
 - 7.4.- SAFETY SIMBOLS
- 8.- GUARANTEE CONDITIONS
- 9.- ANNEXES

1. GENERAL INSTRUCTIONS

This document has been written out with a view to facilitate the mounting, the starting, the survey and maintenance of ABC compressors.

For auxiliary equipment, please refer to its specific manual of instructions.

1.1 REPLACEMENT PART ORDERS

1.- To avoid errors of interpretation, the following data must be indicated in replacement part orders as well as in any correspondence related to compressors:

- Compressor model.
- Production number of the compressor.

The production number and the complete designation of the compressor model are stamped on the descriptive plate located on the casing (They must not be mistaken with the identity plates for boiler makes: coolers and receivers).

2.- Consult the list of the recommend spare parts in the chapter 5.2. of this manual.

3.- If the part requested is not on the list of spare parts, references mentioned on the machine must be given.

Arízaga, Bastarrica y Cía., S.A.- Compressors ABC, reserves the right to modify the technical characteristics without previous notice and waives all legal responsibilities with respect to such modifications.

Any supplementary data concerning the drawing and maintenance of your compressor can be obtained directly from :

ARIZAGA, BASTARRICA Y COMPAÑIA, S.A.

Compresores "ABC"

Políg. Ind. Azitain N°6 - Apartado 87

EIBAR 20600, Guipuzcoa, SPAIN

Telf: (34)-943.820.400

Fax: (34)-943.820.235

E-mail: abc@abc-compressors.com

sat@abc-compressors.com

1.2. NOISE

Being the compressor operating in nominal loading conditions, the Sound Pressure Level (noise) at the place of the operator is shown in the chapter 2.2 of this manual.

The measurement has been performed according to the ISO 3744 standard. The material used for this measurement has been a Brüel & Kjaer analyzer model 2235, and a Brüel & Kjaer calibrator model 4230.



1. GENERAL INSTRUCTIONS

1.3. SAFETY

All the people related to the installation, operation and maintenance of the compressor must read and take into account the following precautions, as well as the chapters dealing with their job, and the SAFETY one. It is strongly recommended to read all the Manual of Instructions.

Precautions:

- Do not make the compressor operate above its service conditions stated on the sheet of Technical Characteristics of this Manual. In case the compressor works on higher conditions than those, it can be submitted to loads that it has not been designed to admit for.
- Take all precautions described on the lifting instructions chapter of this manual of instructions.
- Each compressor stage needs to be protected by safety valves. These relief valves need to avoid overtaking the design pressure of the corresponding compressor stage, even when they are tripping, as they need to release volumen enough so that the tripping or setting pressure is not overtaken in more tan a 10%.
- Before starting up the compressor, it is necessary to check the proper installation of the Relief Valves.
- Whenever the compressor is supplied loose, without motor and/or electric board, ABC is not including the Relief Valves in its supply, so these Safety Valves must be installed by the customer.
- Never install any valve or any other isolating device between the device to be protected and the corresponding safety valve.
- The Safety Valves must be tested at least once a year (checking that the tripping pressure corresponds to the set pressure), and more often under extreme operating conditions.
- Do not handle the seal of the Safety Valve, as it may lead to a very dangerous risk.
- If a Safety Valve triggers during compressor operation, immediately stop; the compressor and do not restart until you have established and resolved the cause.
- In installations where the customer has a capacitor bank installed and the compressor uses electronic starters (progressive, converters, etc.), there is a risk of electric resonance between the starters and the capacitor bank on compressor start-up which could cause failure or tripping of the master switch and may even cause irreparable damage to the same. To prevent this from occurring, ABC recommends that the customer disconnects the capacitor bank before and during the start-up process. Two timer contacts (K380, detailed in the electrical diagram) are therefore included in the supply (on the switchboard terminal block), which may be used to automatically control the capacitor bank disconnection on compressor start-up.
- Volatile flammable liquids must not be used for cleaning the compressor.
- Whenever the compressor is stopped for maintenance, it must be disconnected from its energy sources, and locked if possible, and a warning notice must be placed on the electric board, stating " Maintenance operations taking place", beside the main switch, or the corresponding symbology, on a well visible place of the control board. Always make sure that the compressor cannot be started accidentally.
- In case the compressor has a frequency converter, before manipulating any electric connecting box, including the ones for the motor or electric board, time enough must be waited so that the condensers of these frequency converters are totally emptied. This time depends on the frequency converter manufacturer and, consequently, it must be checked on its corresponding manual of instructions.
- On equipment with soft starters, never manipulate the motor connection box without having previously disconnected the main switch. Please note that with these devices, even if the motor is not in operation, one of the motor connection branches is always under voltage as long as the main switch is energized.
- Before touching any electric connection, always make sure that there is no voltage by means of the proper measuring device.
- Before any part of the compressor is opened, the electric supply must be desconnected, and it must be sure that there is no remaining pressure inside, opening all drains on the pressure vessels. Including the one for regulation, and making sure that there is no pressure remaining in any part of the machine.



1. GENERAL INSTRUCTIONS

1.3. SAFETY

Precautions:

- The fact of installing wrong the suction and discharge valves may lead to a very dangerous situation. So, the Procedure for Assembling the valves on the Maintenance chapter of this Manual must be read and followed.
- After the compressor has been overhauled, or in case it has been resting for a long time, it is necessary to bar over the compressor manually in order to make sure that there is no mechanical interference inside the machine, as specified in the corresponding chapter of the manual of instructions. These operations must always be done with the equipment completely disconnected from the electric supply.
- The compressor shall not be started unless all protections and guards of moving parts have been properly installed.
- Whenever there is a risk of freezing and the compressor stop, make sure that all the drains have been manually purged. Either empty up the cooling circuit or glicolize the circuit in a proper proportion. Empty the water of the cooling circuit through the manual valves and removing the plugs at the cylinder heads, or alternatively mix the cooling water in the proper rate of glycol, in order to avoid the freezing temperature.
- Whenever the water cooling system is using a vaporation cooling tower, it is recommended to consult an specialist in water treatment, in order to prevent and avoid the risks that are detailed in the Manual of the tower itself.
- The use of a wrong lubricating oil may lead to a quick damage on those elements of the compressor submitted to friction. The recommended oil is SAE-30-HD; in case this exact oil quality cannot be achieved, please consult the compressor manufacturer about it.
- Our equipment has one or several earth connections, that need to be connected to the installation site ground net, or to an independent ground with a resistance value lower than 10 Ω .
- In case the compressor is supplied with electric board, this must include a protection system against indirect contact (differential switch) and a main switch against shortcircuits or overloads (magnetothermic switch). If not, the equipment must be connected to an electric board that includes these two protection devices.
- Compressed air blows must no be used for cleaning the cloth of the operators, as it may enter the flood flow through the skin pores.
- Should compressed air be used for cleaning parts, the operator must protect his hands and eyes.
- Do not store easily combustible or flammable substances beside the compressor, such as oil, petrol, solvents, waste, etc...
- Keep the compressor and surroundings perfectly clean and in order.
- The electric installation is designed to bear eventual supply voltage fluctuations upto $\pm 5\%$ of the nominal voltage. Greater variations may lead to strong harm in the equipment; thus they cannot be admitted.
- In case of fire in the electric motor junction boxes or low voltage electric boards (<1000V), always use CO2 and never use water or any other extinguishing agent with a dielectric rigidity lower than 1KV.
- All the pressure equipment within the package (vessels, bottles, piping, coolers, cylinders and heads) must be verified at least annually (welds, corrossion, supports ...) besides the reglamentary inspections applicable locally.
- During normal operation of the compressor, there are, among others, the following risks due to the equipment:
 - Risk of burning due to contact with hot compressor spots (discharge cylinder valves, discharge bottles on each compressor stage, discharge piping, etc...), properly signalled. It is thus recommended to use gloves and long sleeve clothing near those areas.
 - Noise greater than 85 dBA, it is recommended to use the earmuffs described at the chapter of operator site of the manual of instructions.
 - Projections due to dust particles or eventual safety valve trips; it is recommended to use safety glasses (low or médium energy particle impacts).
- Never lock nuts, bolts or screws of equipment under pressure without having previously released such pressure.

1. GENERAL INSTRUCTIONS

1.3. SAFETY

Precautions:

- Before performing any overhaul, intervention or manipulation on any part of the compressor supplied, it is mandatory to read this manual of instructions, as well as the manuals of the auxiliary equipment that might also be part of the supply, such as motors, dryer, frequency converter, starter, etc...
- Besides the risks already described in this chapter, there might be other risks to be taken into account, due to the machine environment (ATEX zone, corrosive ambient, access, etc...) and the ones due to the specific gas to be compressed (corrosive, flammable, harmful, toxic, etc...).
- In case of any question about interpretation on safety issues of this manual, please do never face the risk and always contact any of our authorized service centers (SAT), or our WEB site: www.abc-compressors.com.
- These instructions have been prepared based on the informations available so far, not guaranteing that the content is enough for all possible events and situations. Compliance with these instructions does not exclude from fulfilling the local Regulations.

2. DESCRIPTION

2.1 GENERAL DESCRIPTION

Compressors of the horizontal type with opposed cylinders, double-acting (for the first stage) and single acting (for the second and third stage that are TANDEM cylinders), of the crosshead type.

- Type Horion 400-500 with 1 line of 3 cylinders.

Each line is driven by two cranks set at 180° to each other.

This type of compressor is perfectly well balanced because:

- Primary and secondary forces cancel out, therefore there is no possibility of vibration or beating on the ground works.
- Resulting sitresses to each opposed crank are equal, thus creating an axial couple without reaction on the main bearings.

Each compression stage is water cooled, both cylinders and heads (except on thrid stage), as well as coolers; which, with countercurrent cooling water, provide air or gas outlet temperatures of 10°C above the water inlet temperature.

Power drive is transmitted through a Inertia Flywheel designed for achieveing a minimum irregularity.

One-piece, nodular iron CRANK-SHAFT mounted on antifriction bearings.

Cylinders are made of high resistance iron, with water cooling chambers.

Air compressors with lubricated cylinders have a normal distance piece. The rest of compressors have a longer distance piece. If ordered, an independent distance piece (SAS) may be added for eventual purging with inert gas.

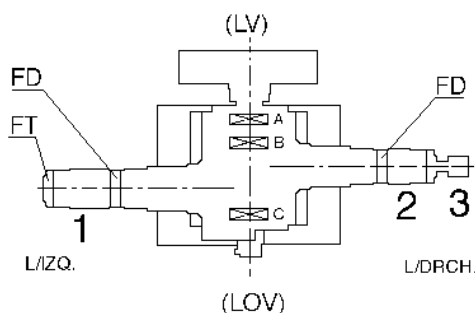
The compressors with lubricated cylinders have a mechanical lubricator direct driven by the crankshaft, in order to lubricate the cylinders independantly, that may have its lubrication oil amount regulated.

The CONNECTING RODS are made of forged steel mounted on friction bearings, with lower bore for force-feed lubrication of the connecting rod little end.

Automatic VALVES. They have reduced flow shade. Heavy-duty construction.

Lubrication of the mechanical part is provided through a gear pump driven by the crankshaft. Some compressor models even have an auxiliary lubrication pump.

The crankcase is close, robust and sealed, designed for easily handling the machanical loads of the compressor and also for storing the lubricant oil.



Ref.	DESCRIPTION
1	First stage cylinder
2	Second stage cylinder
3	Third stage cylinder
LV	Flywheel side
LVO	Pump side
L/IZQ	Left side
L/DRCH	Right side
FD	Front head
FT	Back head
A	Crankshaft bearing A
B	Crankshaft bearing B
C	Crankshaft bearing C

2. DESCRIPTION

2.2. TECHNICAL CHARACTERISTICS



ARIZAGA, BASTARRICA Y CIA S.A.
20600 EIBAR
ESPAÑA / SPAIN
COMPRESOR ALTERNATIVO
RECIPROCATING COMPRESSOR

EAC

MODELO

MODEL

Nº DE SERIE

SERIAL NUMBER

AÑO DE FABRICACION

CONSTRUCTION YEAR

FECHA PRUEBA (DD/MM/AAAA)

TEST DATA

PRESIONES DISEÑO: ASPIRACIÓN / 1ª ETAPA / 2ª ETAPA....

DESIGN PRESSURE: SUCTION / 1ST STAGE / 2ND STAGE....

PRESIÓN DE ASPIRACIÓN MÍNIMA/MÁXIMA

SUCTION PRESSURE MINIMUM / MAXIMUM

PRESIÓN DE ESCAPE MÁXIMA

MAXIMUM DISCHARGE PRESSURE

CAUDAL MÁXIMO

MAXIMUM FLOW

TEMPERATURA ASPIRACIÓN MÍNIMA / MÁXIMA

SUCTION TEMPERATURE MINIMUM / MAXIMUM

TEMPERATURA DISEÑO EQUIPO MÍNIMA / MÁXIMA

EQUIPMENT DESIGN TEMPERATURE MINIMUM / MAXIMUM

POTENCIA MOTOR

MOTOR POWER

R.P.M. COMPRESOR

R.P.M. COMPRESSOR

TIPO FLUIDO

FLUID TYPE

PESO

WEIGHT

HORIZON 500

25106

2019

26/06/2019

0,6 / 1,8 / 4,5

Mpa

0,1

Mpa

4

Mpa

501

m3/h

5 / 40

°C

5 / 40

°C

122 / 90

CV/KW

770

RPM

AIRE / AIR

11.500

Kg



2. DESCRIPTION

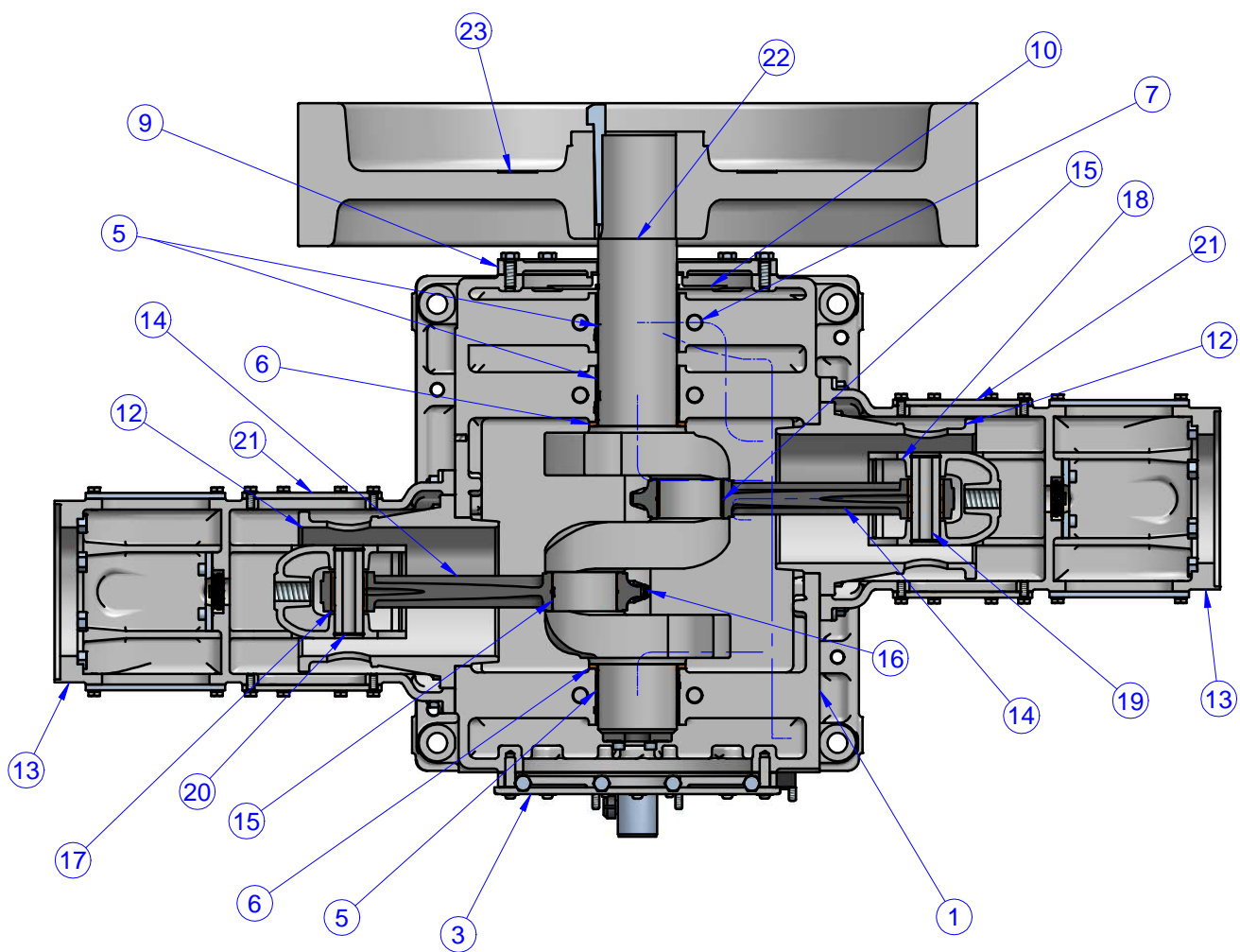
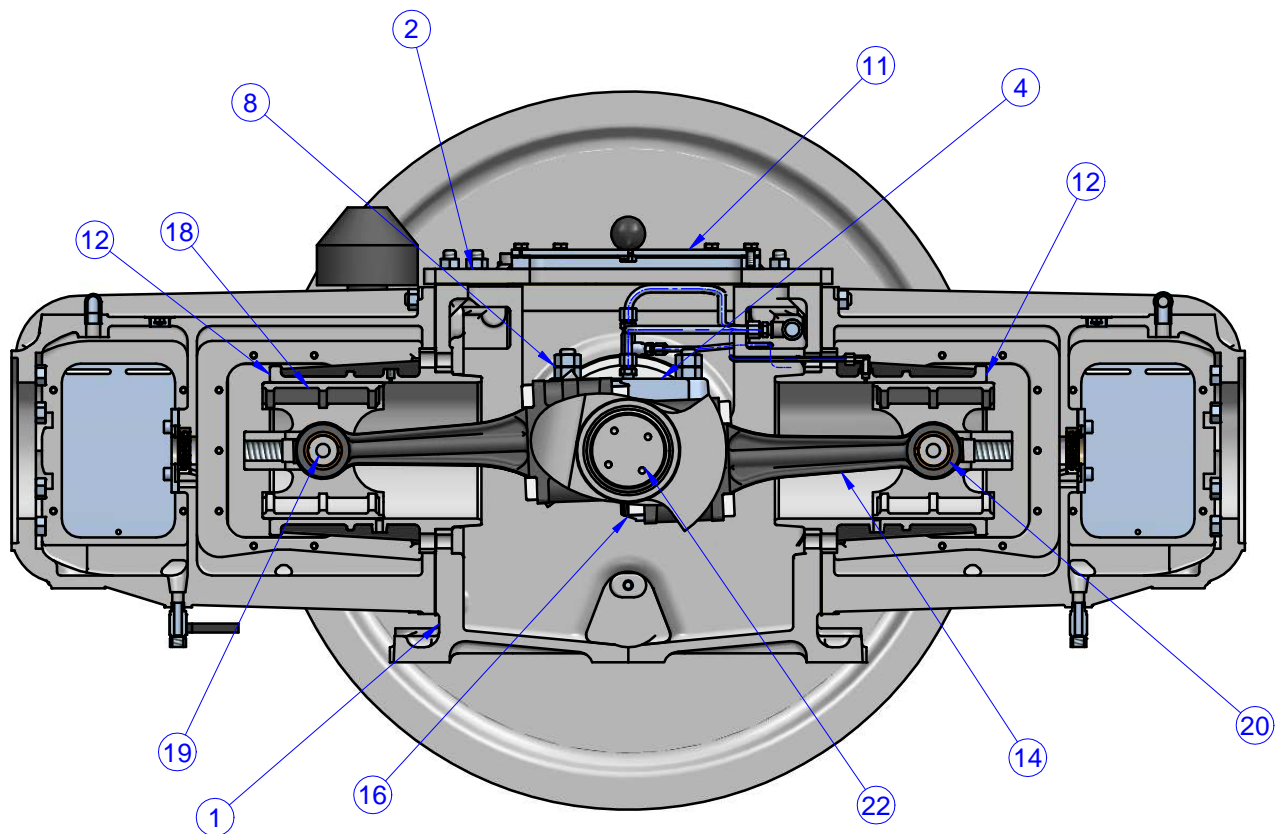
2.2. TECHNICAL CHARACTERISTICS

Working conditions Air suction temperature in °C Cooling water temperature in °C Altitude in meters above sea level Relative humidity in %	30 40 60 50
Fluid Effective volume in m3/hour. Suction pressure in Bar Absorbed power at the compressor crankshaft in HP / KW Transmission Cylinders lubrication	AIR 501 - 112 / 82,6 DIRECT COUPLED NO
Number of stages _ Cylinder 1st stage in mm _ Cylinder 2nd stage in mm _ Cylinder 3rd stage in mm _ Cylinder 4th stage in mm	3 250 175T 85T -
Noise in dB(A)	85
Compressor cooling water flow in m3/h.	6
Regulation air pressure in bar	9,5
Mass of the compressor in kg Mass of the motor in kg Mass of the whole equipment in kg	- 580 6500
Ambient temperature min / max °C Cooling water temperature min / max °C Maximum cooling water pressure in Bar	- 30 / 40 16/40 4
Power voltage in Volts. Control voltage in Volts.s Frequency in Hz.	400 230 50
Total power to be installed HP / Kw.	156 / 115

2. DESCRIPTION

2.3. PARTICULAR DESCRIPTION

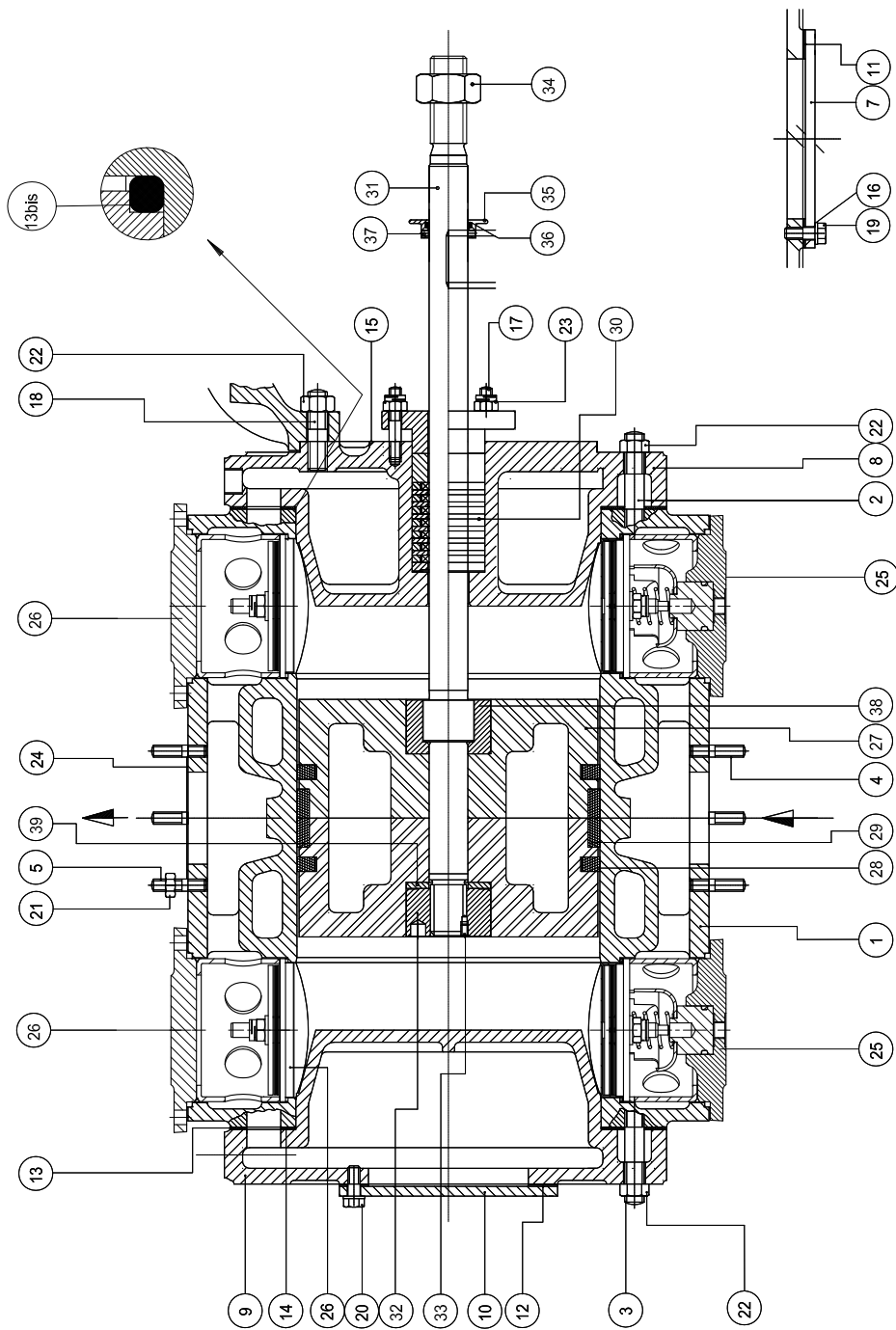
HORIZON 400 / 500 COMPRESSOR		
DRAWING	Qty.	DESCRIPTION
200275	1	Mechanical part
234961	1	1st stage cylinder ø250
234962	1	2nd and 3rd stage cylinder ø175T and 85T
225232	1	2nd and 3rd stage piston ø175T and 85T
239904	1	1st stage packing
239904	1	2nd stage packing
406729M2	2	Oil scraper rings assembly
234132	4	1st stage suction valve assembly
234093B	1	2nd stage suction valve assembly
230048	1	3rd stage suction valve assembly
234120	4	1st stage discharge valve assembly
234113B	1	2nd stage discharge valve assembly
230049	1	3rd stage discharge valve assembly



2. DESCRIPTION

2.3.1. MECHANICAL PART

Ref	CODE	DESCRIPTION	Qty.
1	315647	Frame	1
2	387877	Upper cover	1
3	388129	Pump sidecrankcase cover	1
4	388117	Bearing cover	3
5	319807	Bearing in two parts	3
6	303664	Stop ring in two parts	2
7	335486	Stud bolt	6
8	491735	Nut M20	12
9	388130	Flywheel side crankcase cover	1
10	327104	Slinger	1
	401638	O-ring	1
11	375907	Inspection door (Upper cover)	1
12	327905	Crosshead guide	2
13	308321	Gas distance piece	2
14	307999	Connecting rod	2
15	319809	Big end bearing in two parts	2
16	390456	Connecting rod screw	4
17	316210	Small end bearing	2
18	323510	Crosshead	2
19	310030	Bolt	2
20	402546	Ring	4
21	375908	Blind cover	4
	375947	Plastic cover	4
22	318572	Crakshaft	1
23	398011	Flywheel	1

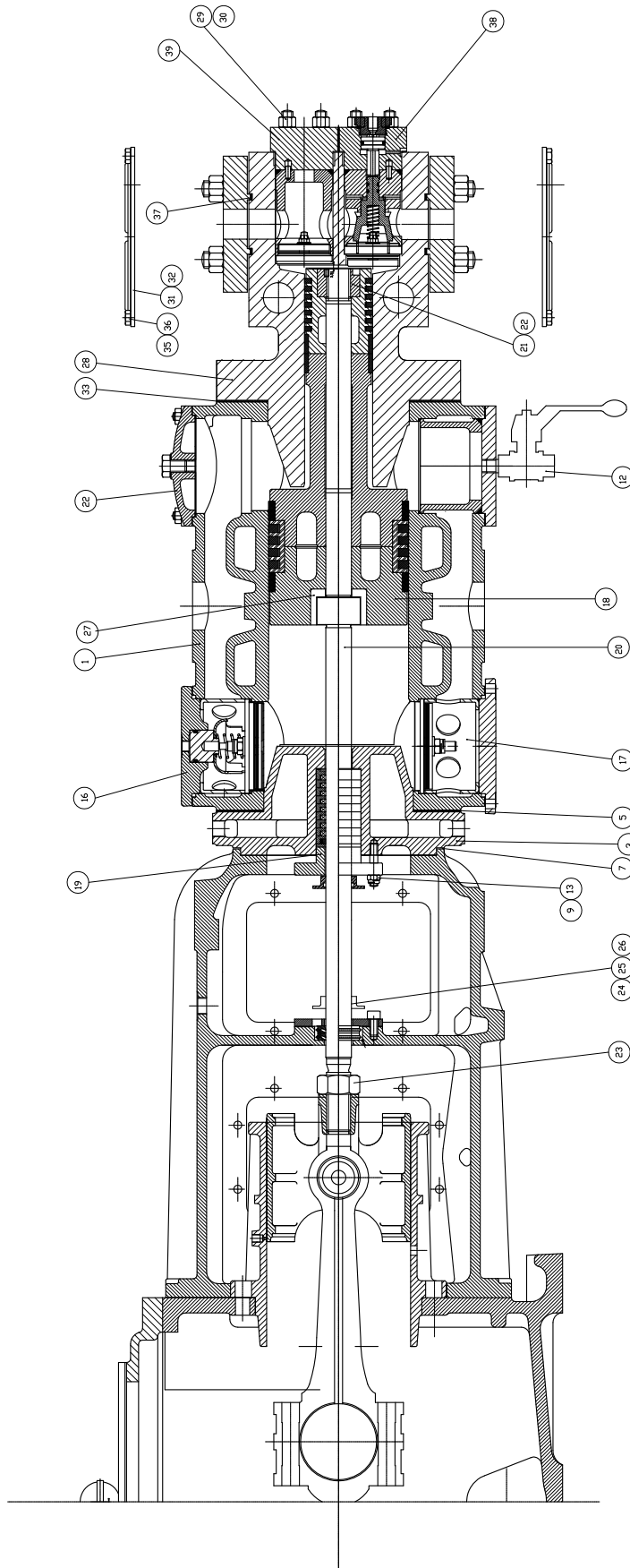


2. DESCRIPTION

2.3.2. CYLINDERS

250 CYLINDER SET		
Ref	Qty.	DESCRIPTION
	1	<u>ø250 Cylinder set</u>
	1	ø250 cylinder with stud-bolts
B-1	1	ø250 cylinder
B-2	8	Front head stud-bolt
B-3	8	Back head stud-bolt
B-4	6	Suction stud-bolt
B-5	6	Discharge stud-bolt
B-6	48	Valve cover stud-bolt
B-7	2	Inspection door
B-8	1	Front head
B-9	1	Back head
B-10	1	Back head cover
B-11	2	Inspection door joint
B-12	1	Back head cover joint
B-13	2	Cylinder - head joint
B-14	8	Water joint
B-15	1	Front head - distance piece joint
B-16	26	Joint
B-17	4	Packing stud-bolt
B-18	8	Front head stud-bolt
B-19	20	Inspection door screw
B-20	6	Back head cover screw
B-21	60	M10 nut
B-22	24	M16 nut
B-23	4	Packing nut
B-24	1	Suction joint (green)
	1	Discharge joint (black)
B-25	4	<u>Suction valve assembly</u>
B-26	2	<u>Discharge valve assembly</u>
	1	<u>ø250 piston assembly</u>
	1	ø250 piston
B-27	2	Half piston
B-28	2	Sealing ring
B-29	2	Rider ring
B-30	1	<u>Packing assembly</u>
	1	<u>Piston rod set</u>
B-31	1	Piston rod
B-32	1	Piston nut
B-33	1	Piston nut screw
B-34	1	Piston rod nut
B-35	1	Slinger
B-36	1	O-Ring
B-37	2	Screw
B-38	1	Bush
B-39	1	Washer

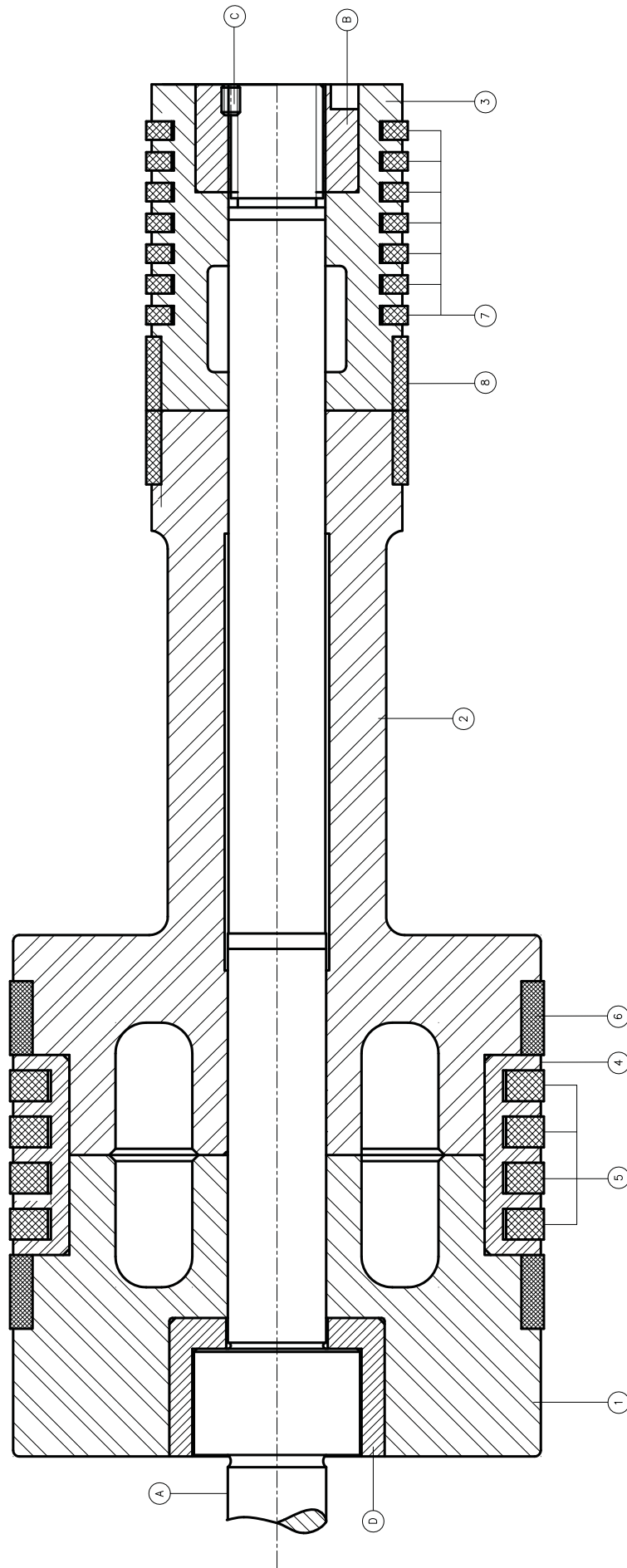
Both the packing and suction valve sets represented at the drawing, it is possible that they are not exactly the ones fitted on this cylinder. These sets are defined separate.



2. DESCRIPTION

2.3.2. CYLINDERS

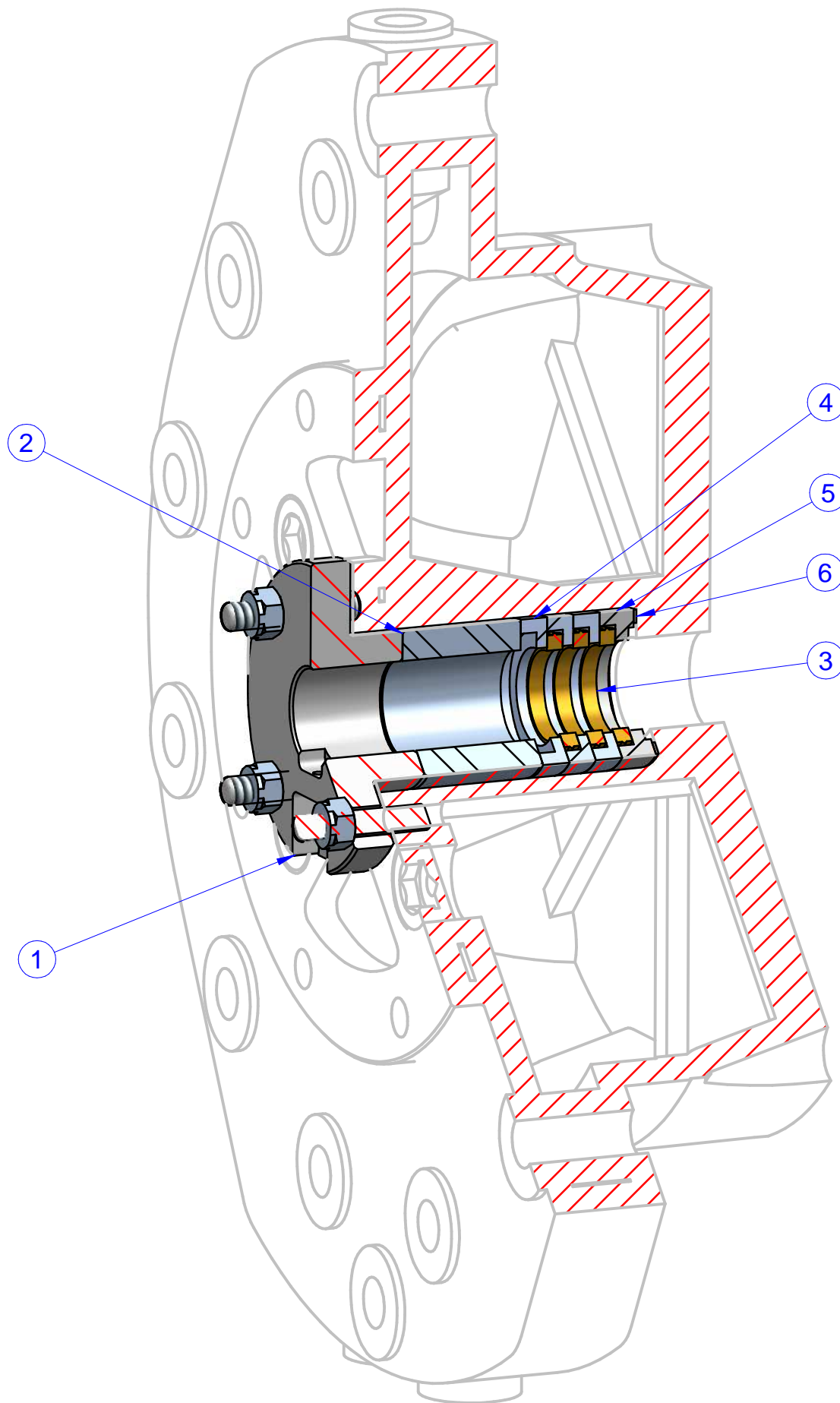
175T-85T CYLINDER SET		
Ref	Qty.	DESCRIPTION
	1	<u>ø175T Cylinder</u>
B-1	1	ø175T cylinder with stud-bolts
B-2	2	Inspection door
B-3	1	Front head
B-4	2	Inspection door joint
B-5	2	Cylinder joint
B-6	4	Joint
B-7	1	Front head joint
B-8	20	Joint
B-9	4	Packing stud-bolt
B-10	20	Inspection door screw
B-11	16	M16 nut
B-12	36	M10 nut
B-13	4	Packing nut
B-14	1	Suction joint (green)
B-15	1	Discharge joint (black)
B-16	1	<u>Suction valve assembly</u>
B-17	1	<u>Discharge valve assembly</u>
B-18	1	<u>ø175T-85T piston assembly</u>
B-19	1	<u>Packing assembly</u>
B-20	1	Piston rod
B-21	1	Piston nut
B-22	1	Piston nut screw
B-23	1	Piston rod nut
B-24	1	Slinger
B-25	1	O-ring
B-26	2	Screw
B-27	1	Bush
	1	<u>Cylinder ø85T</u>
B-28	1	Cylinder ø85
B-29	16	Stud-bolt
B-30	16	Nut
B-31	2	Inspection door
B-32	2	Joint
B-33	1	Joint
B-34	2	Joint
B-35	18	Screw
B-36	18	Joint
B-37	2	Joint
B-38	1	<u>Suction valve assembly</u>
B-39	1	<u>Discharge valve assembly</u>



2. DESCRIPTION

2.3.2. PISTONS

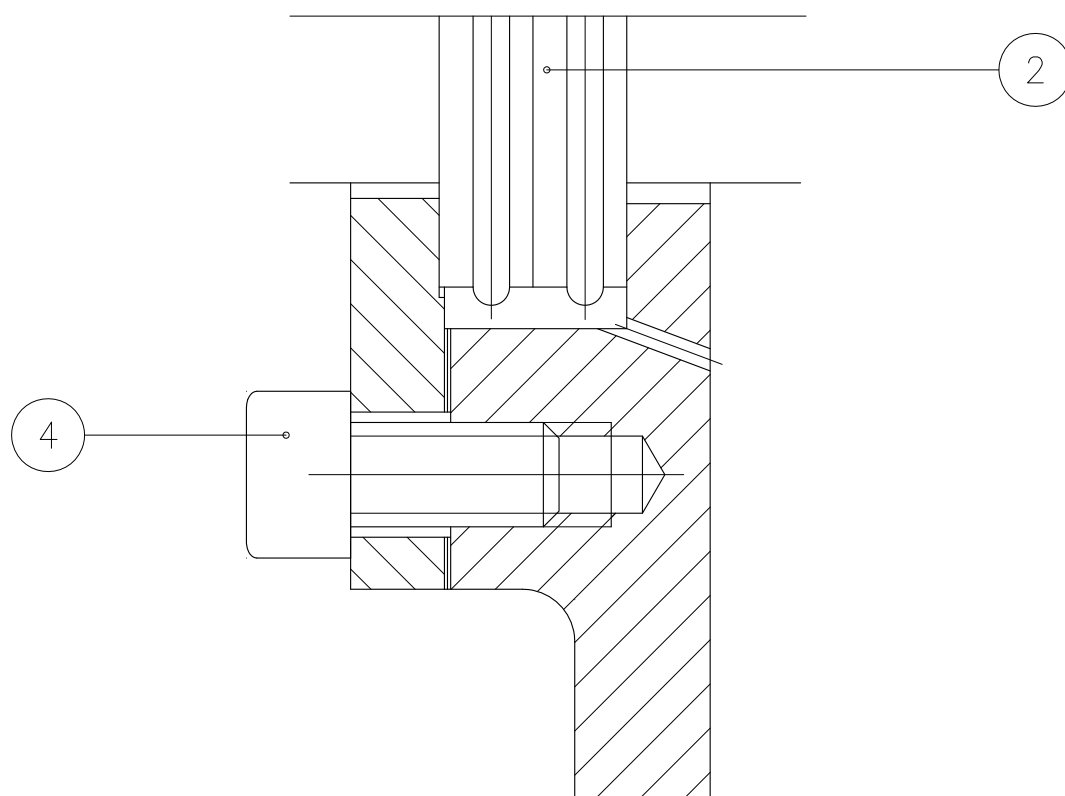
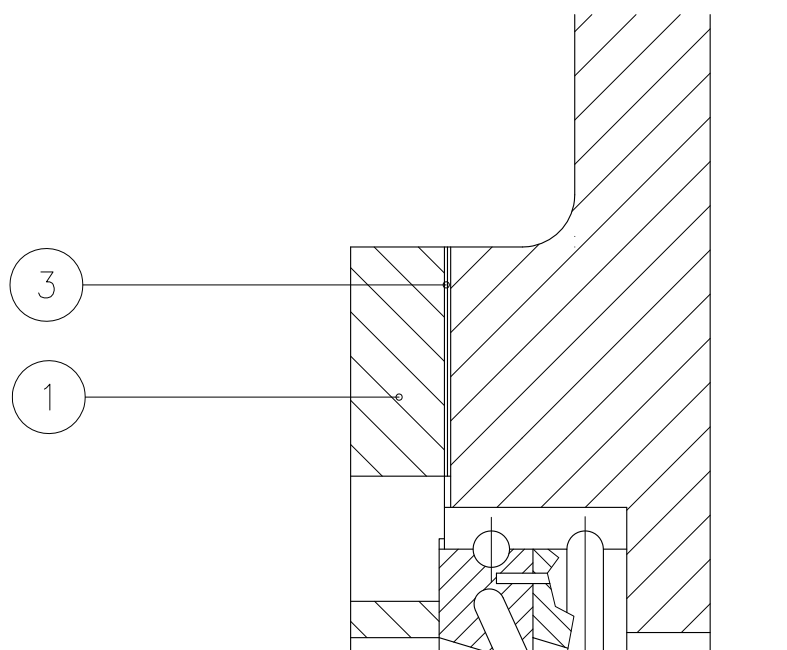
Ø 175T - 85T PISTON		
Ref	Qty.	DESCRIPTION
	1	<u>Ø 175T-85T Piston</u>
1	1	Semi-piston 175
2	1	Semi-piston 175-85
3	1	Semi-piston 85
4	1	Inserted ring 175
5	4	Sealing ring 175
6	2	Rider ring 175
7	7	Sealing ring 85
8	2	Rider ring 85



2. DESCRIPTION

2.3.3. PACKINGS

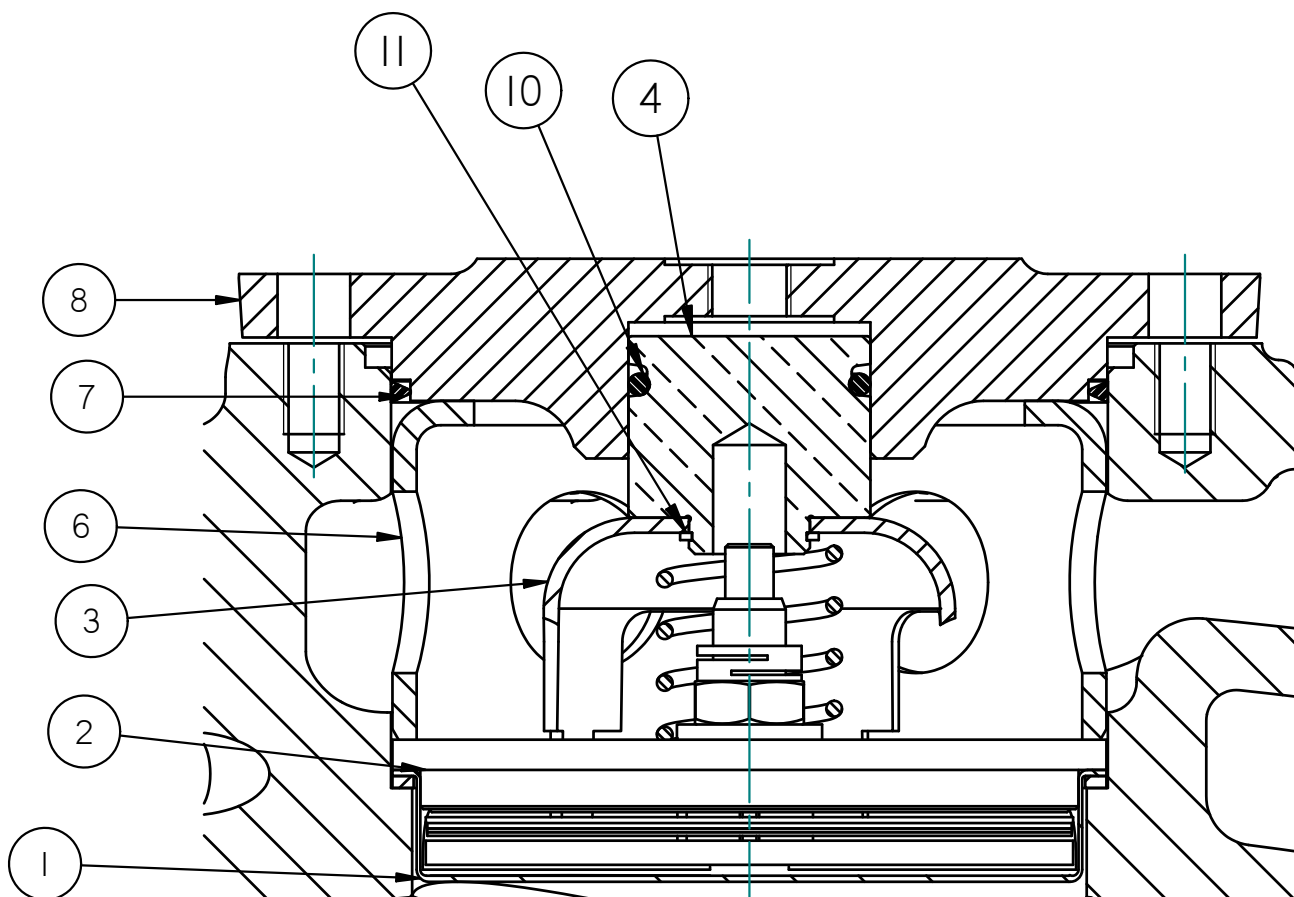
1ST AND 2ND STAGE PACKING SET		
Ref	Qty.	DESCRIPTION
1	1	Stuffing box
2	1	Distance ring
3	3	Sealing ring
4	3	Inserted ring
5	1	Stop ring
6	1	Joint



2. DESCRIPTION

2.3.3. PACKINGS

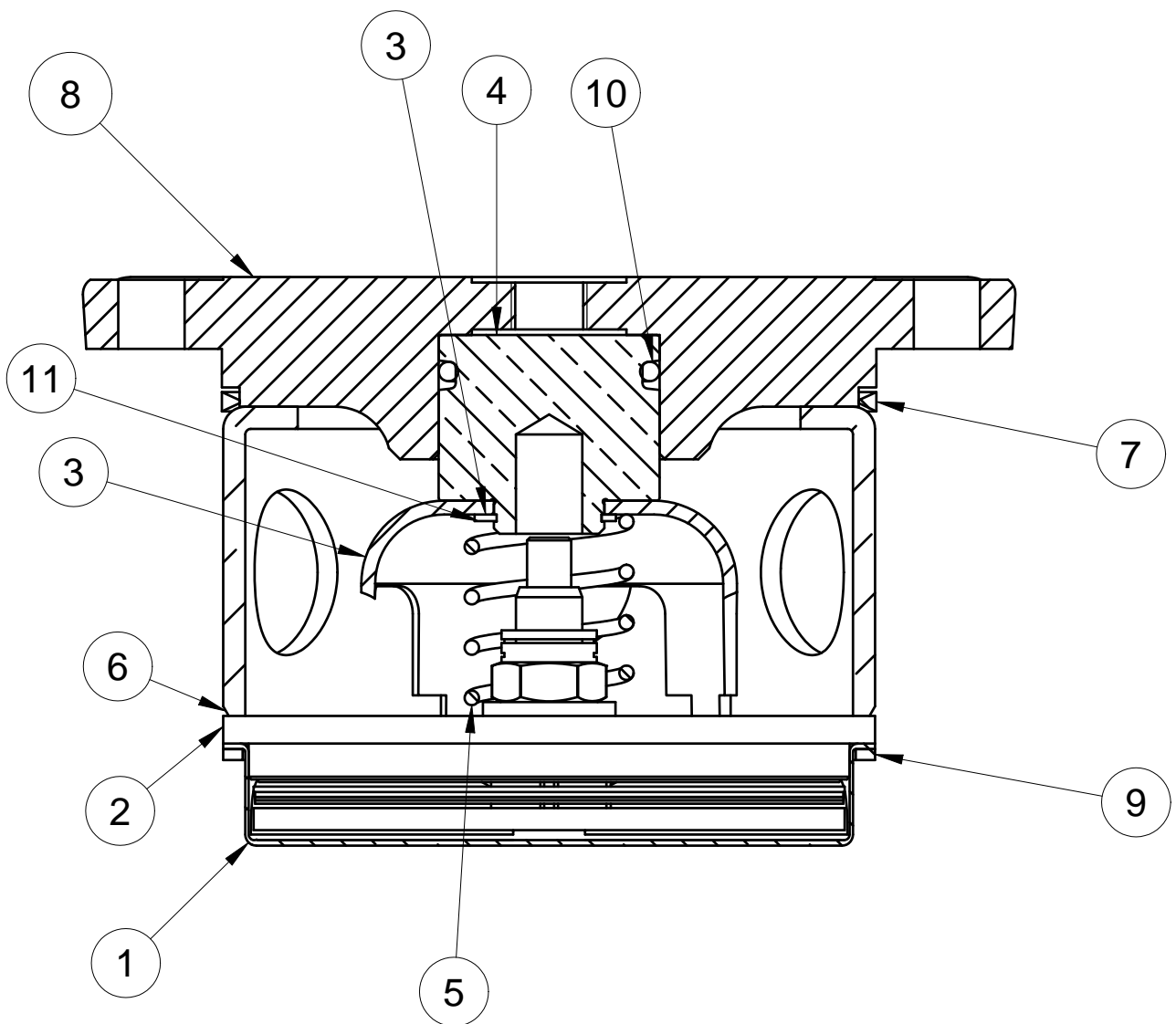
DISTANCE PIECE PACKING		
Ref	Qty.	DESCRIPTION
1	1	Cover
2	1	Oil scraper ring
3	1	Joint
4	4	Screw



2. DESCRIPTION

2.3.4. VALVES

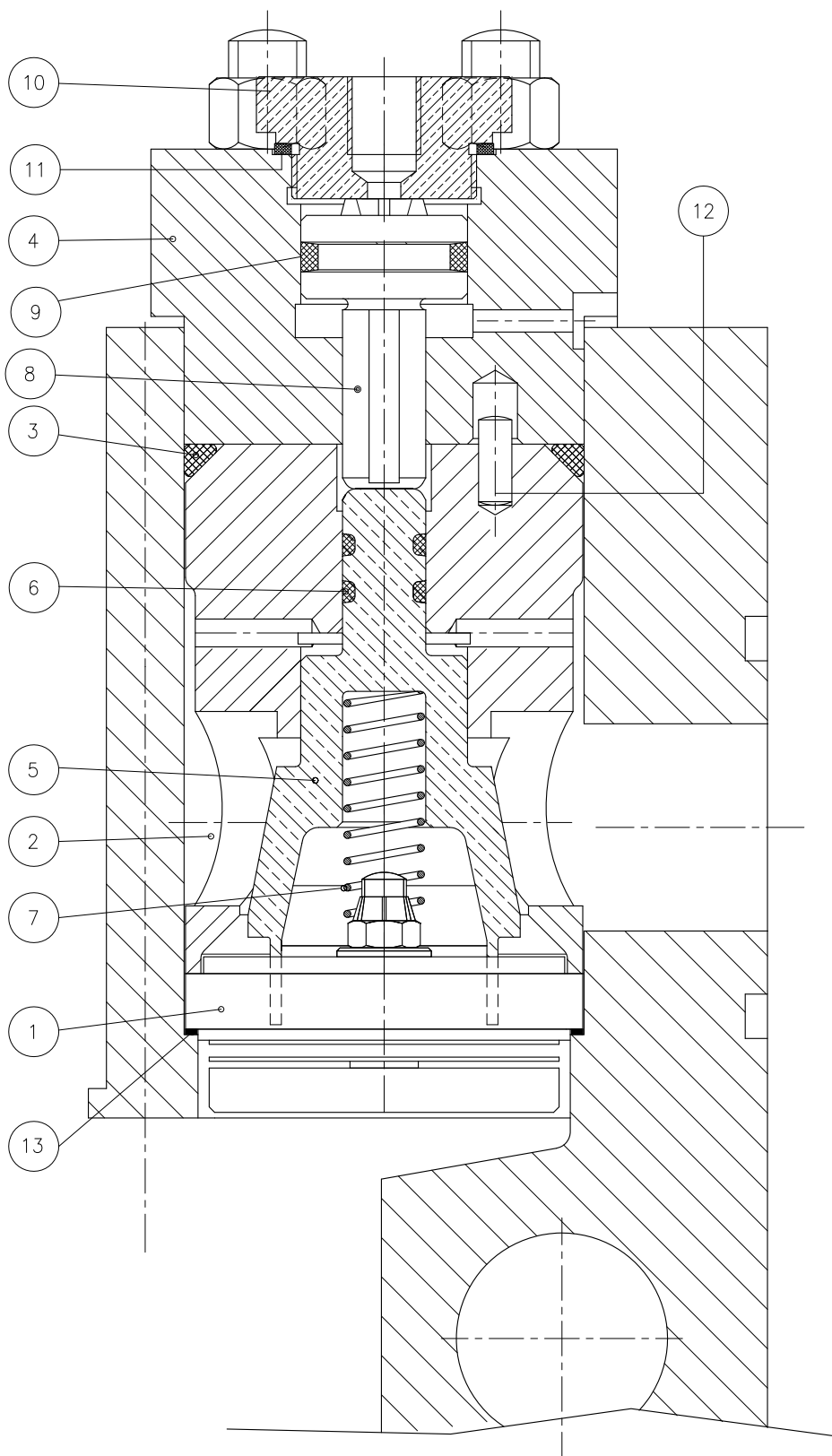
1ST STAGE SUCTION VALVES ASSEMBLY		
Ref	Qty.	DESCRIPTION
1	1	Protection grid
2	1	Suction valve
3	1	Unloader piston
4	1	Regulation piston Ø40
5	1	Spring
6	1	Bush
7	1	O-Ring
8	1	Valve cover with O-Ring
9	1	Joint
10	1	O-Ring
11	1	Security ring



2. DESCRIPTION

2.3.4. VALVES

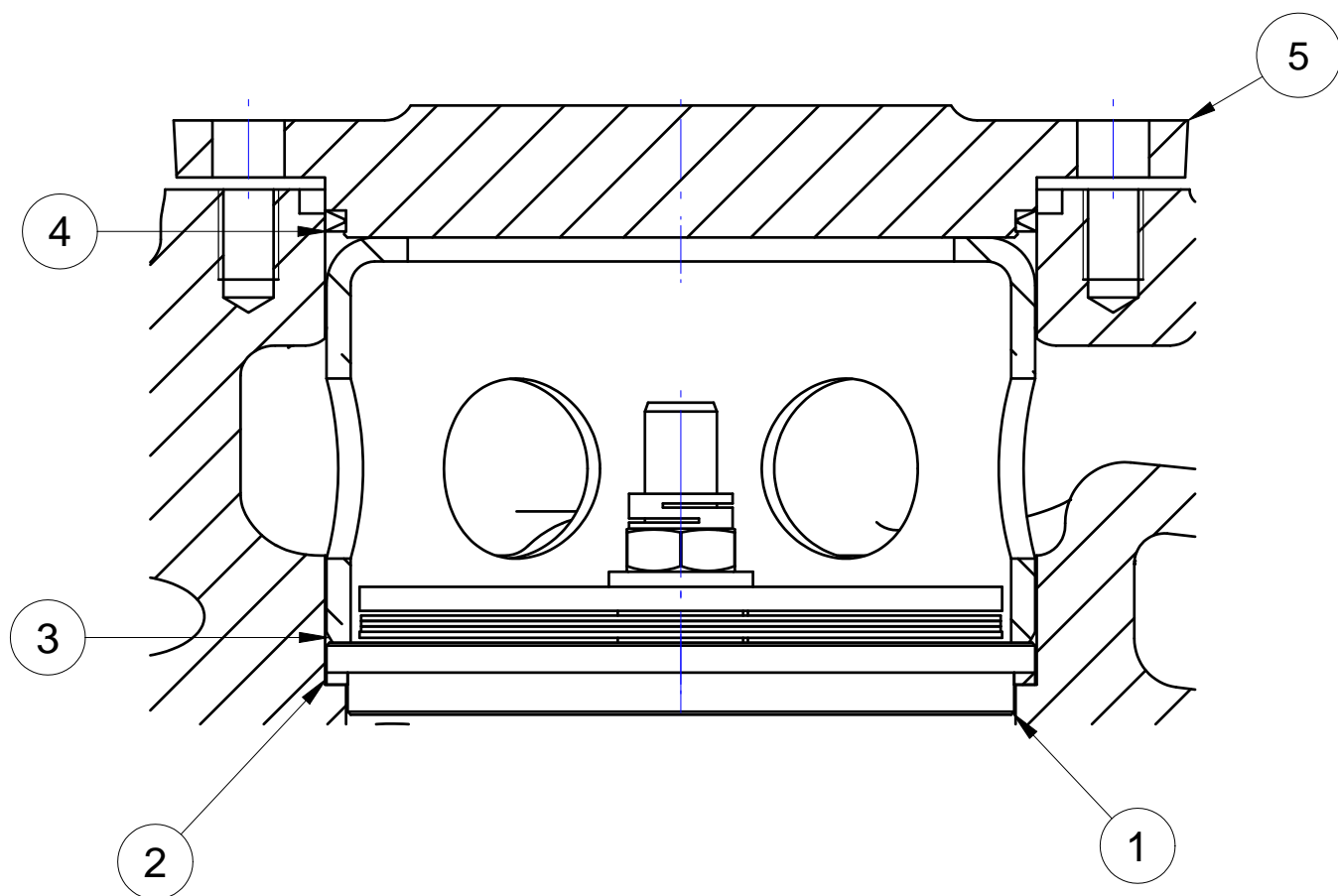
2ND STAGE SUCTION VALVES ASSEMBLY		
Ref	Qty.	DESCRIPTION
1	1	Protection grid
2	1	Suction valve
3	1	Unloader piston
4	1	Regulation piston Ø40
5	1	Spring
6	1	Bush
7	1	O-Ring
8	1	Valve cover with O-Ring
9	1	Joint
10	1	O-Ring
11	1	Security ring



2. DESCRIPTION

2.3.4. VALVES

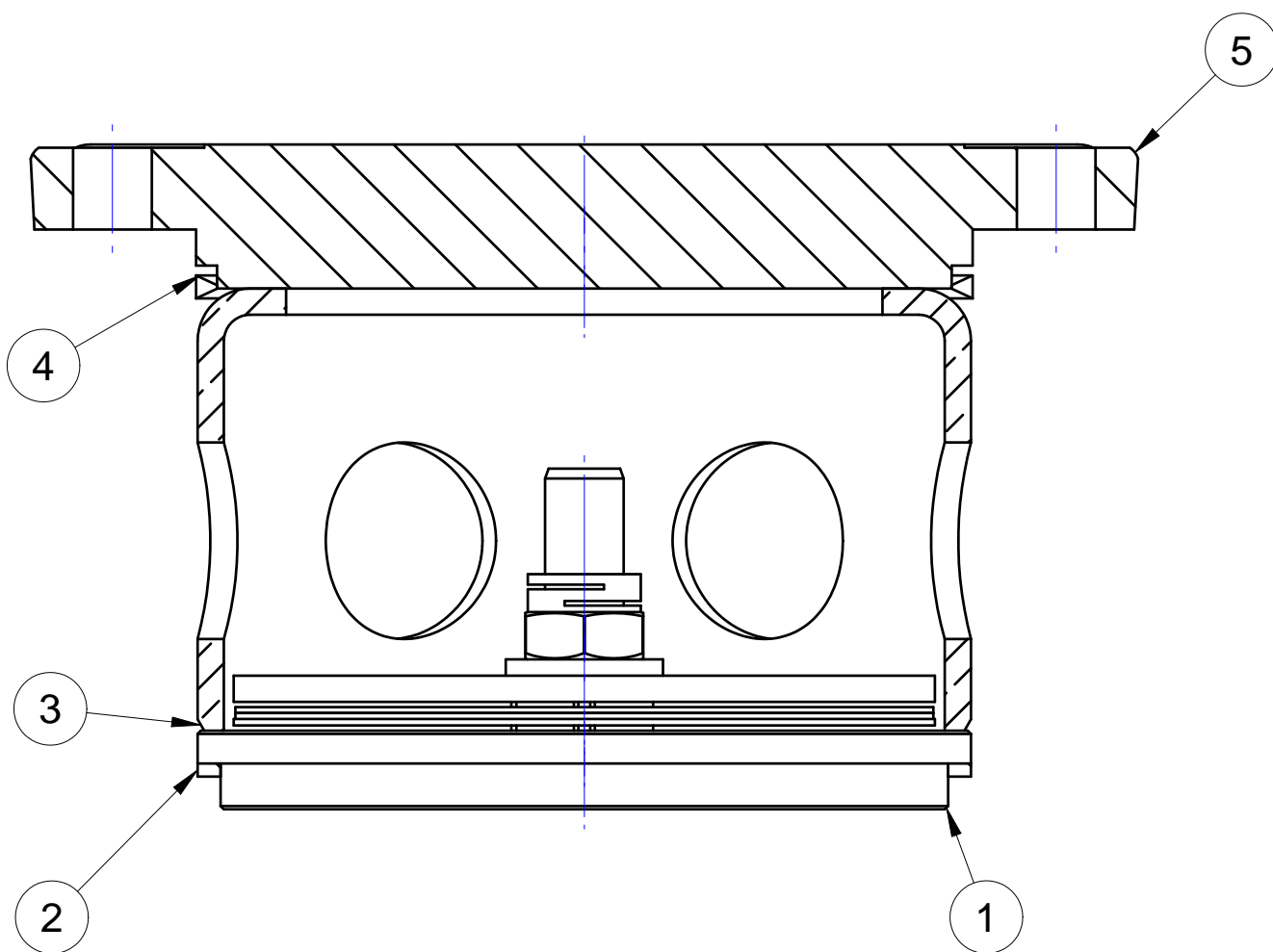
3RD STAGE SUCTION VALVES ASSEMBLY		
Ref	Qty.	DESCRIPTION
1	1	Suction valve
2	1	Bush
3	1	O-Ring
4	1	Valve cover
5	1	Unloader piston
6	1	O-Ring
7	1	Spring
8	1	Piston
9	1	O-Ring
10	1	Reduction
11	1	Joint
12	1	Pin
13	1	Joint



2. DESCRIPTION

2.3.4. VALVES

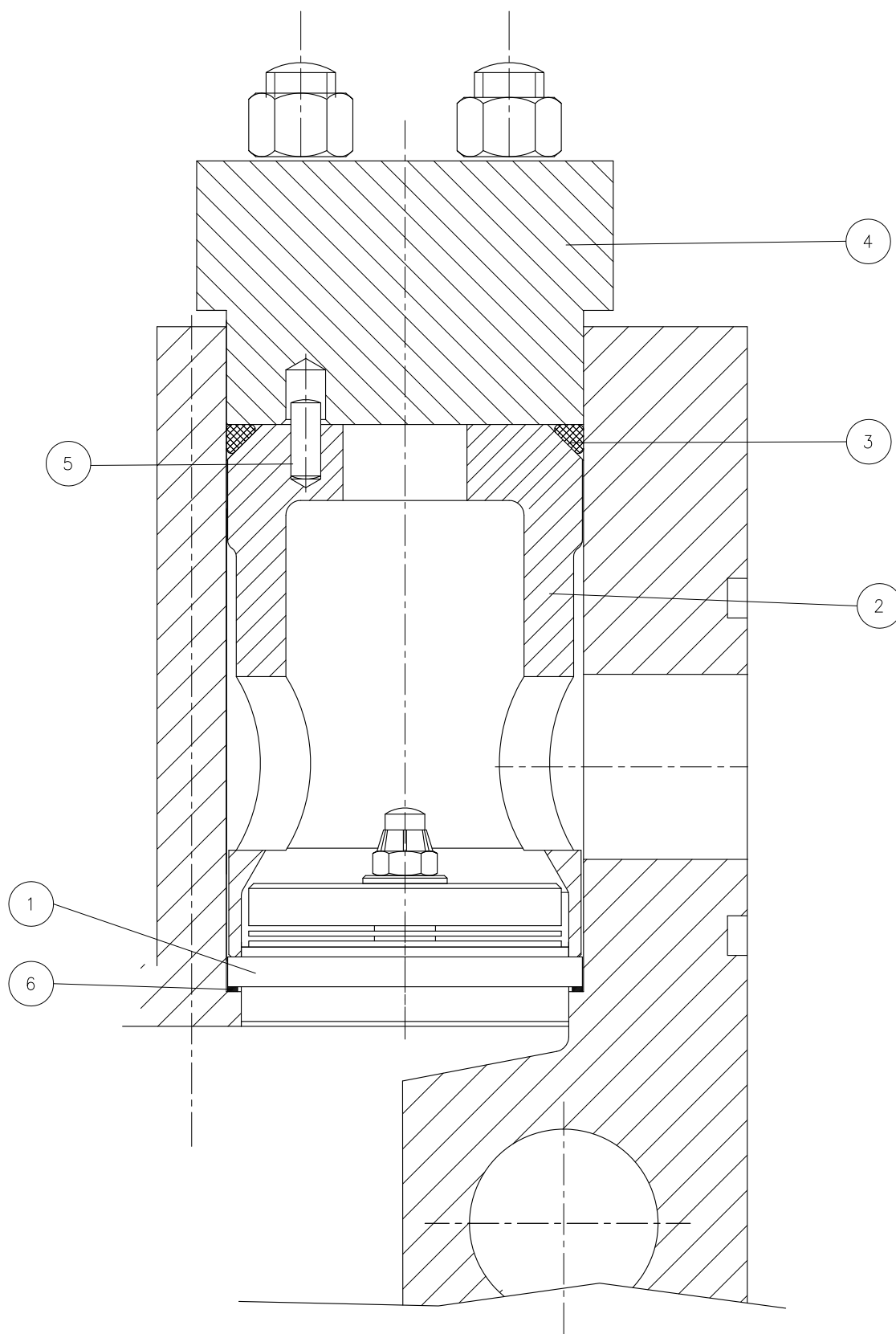
1ST STAGE DISCHARGE VALVE ASSEMBLY		
Ref	Qty.	DESCRIPTION
1	1	Discharge valve
2	1	Discharge valve joint
3	1	Discharge valve bush
4	1	O-Ring
5	1	Cover



2. DESCRIPTION

2.3.4. VALVES

2ND STAGE DISCHARGE VALVE ASSEMBLY		
Ref	Qty.	DESCRIPTION
1	1	Discharge valve
2	1	Discharge valve joint
3	1	Discharge valve bush
4	1	O-Ring
5	1	Cover



2. DESCRIPTION

2.3.4. VALVES

CODE: 398895 DISCHARGE VALVE TYPE 61FD ASSEMBLY			
Ref	CODE	Qty.	DESCRIPTION
1	394533	1	Suction valve 61FD
2	316526	1	Bush
3	402135	1	O-Ring
4	387736	1	Valve cover
5	459160	1	Pin
6	357404	1	Joint

2. DESCRIPTION

2.3.5. SAFETY VALVES

a) Instructions for the installation

Piping, connections, flanges, etc..., must be thoroughly cleaned before installing the safety valves.

It must be specially avoided that any particles like pieces of gaskets, piping internal peelings, dirt, rust, etc..., may be deposited between plate and seat.

As far as possible, before installing a safety valve, its internal part must be blown out, so that any possible particle is sent away.

In case of repairs or before starting the equipment, check that all the safety valves are properly placed and have not obstacle on the outlet.

In case of threaded safety valves and with an only relief orifice for eventual conduction (these safety valves are not manufactured by ABC), do not orientate the discharge orifice towards locations where operators might be or pass by. Besides, in case of placing an elbow at the discharge of these safety valves in order to orientate the discharge without further fastening, it should be conducted vertically, so that the safety valve cannot turn and unscrew caused by the force of the relieving air.

The valve must be fitted vertical, with the inlet at the lower part.

Before installing a safety valve, always check that it is prepared to relieve the capacity produced by the compressor and that the trip pressure is lower than the design pressure of the pressure equipment to be protected.

In case of flanged valve, all bolts must be tightened in a uniform way.

b) Operation

Should the working pressure go up to reach the safety valve tripping value, this instant opening valve shall make a clear shot. In case the flow being high, keeping the safety valve tripping open, pressure should never go up higher than 10% of such tripping pressure..

Once this pressure excess has been eliminated, the valve shall close back automatically in about 10% below the tripping pressure.

2. DESCRIPTION

2.3.5. SAFETY VALVES

c) Cautions

Every compressor must be protected by safety valves.

Safety valves must be tested at least once a year, and more often in case of extreme conditions (environmental dirt, outdoors....etc.).

Do not handle with the timber of the safety valve, because this may lead to a very risky situation, being also then the guarantee automatically expired.

Never fit a valve between a compressor and its corresponding safety valve.

Should any safety valve trip during compressor operation, stop it at once and try to determine the reason.

Safety valves are not intended to work as pressure control valves; that means that they cannot be used for regulating the compressor.

Never operate without the safety valves.

Do never operate with safety valves that have the discharge orifice plugged or obstructed, under no circumstances.

Do not orientate the discharge orifice towards locations where operators might be or pass by; preferably orientate the discharge upwards.

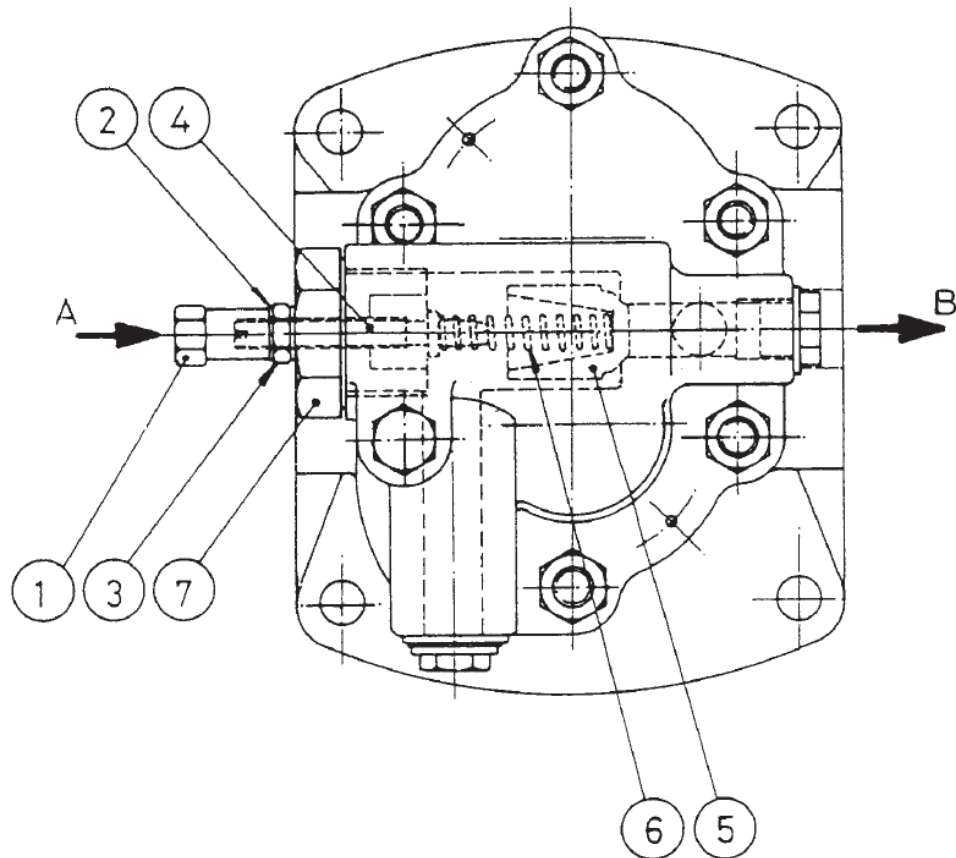
Make sure to leave room enough around the valves, in order to avoid any risk of reaching people or animals.

Do not place obstacles in the discharge line of the valve to ensure the proper discharge of air and not cause damage to persons or property

2. DESCRIPTION

2.3.6. LUBRICATION

OIL PUMP



(A) - OIL INLET
(B) - OIL OUTLET

1. Blind nut
2. Joint between blind nut and lock nut
3. Lock nut
4. Regulation screw
5. Valve
6. Spring
7. Guide screw

PUMP PRESSURE REGULATION

1. Release nut (1) and ease lock nut (3).
2. Rotate screw (4) clockwise to increase the pressure and just the opposite to reduce it.
3. To remove the regulation parts, release screw (7), removing spring (6) and valve (5)..

2. DESCRIPTION

2.3.6. LUBRICATION

CHOICE OF OIL

The oil used should be stable, resist to oxidation, it should not emulse in presence of water. Oil which does not separate easily from water and impurities creates depositis, blocks -up the oil passage and prevents the oil from reaching the bearings in sufficient quantity, which gives rise to very dangerous conditions. In addition, the oil being charged with impurities, the bearing surfaces wear abnormally.

Water and impurities which form on the oil contained in the sump, should be removed periodically by draining off a certain quantity of oil by means of the drain plug provided in the crankcase .

The oil removed must be managed properly and it shall never be poured away.

The oil temperature being rather low, the oil viscosity must have a suitable value. For an ambient temperature of 15°C to 20 °C, a viscosity 5 to 8 ENGLER at 50°C is suitable.

OIL CAPACITY FOR CRANKCASES

HA-2	20 Liters
HA-4	40 Liters
HA-6	60 Liters
HP-2	150 Liters
HP-4	300 Liters
HP-6	450 Liters

When filling the crankcase, be sure that the level in the base is comprised between the two marks max. and min. show on the sight glass.

Main features for a suitable lubricating oil:

Engler viscosity, 50°C	5 to 8
Ignition	200°C min.
Combustion	220 to 230°C
Freezing	-12 to -15°C
Carbon residual	Less than 0,10 %

Recomended oil: **SAE-30-HD**

The oil should be filtered and perfectly clean before filling the sump. Never mix oil of different types.

Every time oil is changed, it is necessary to empty and clean completely the equipment.

Used oil must be properly managed, as well as any type of cloth used for cleaning the mechanical part or the operator hands.

The use of a wrong lubricating oil may lead to a quick damage on those elements of the compressor submitted to friction. The recommended oil is SAE-30-HD; in case this exact oil quality cannot be achived, please consult the compressor manufacturer about it.



2. DESCRIPTION

2.3.6. LUBRICATION

LUBRICATION OF THE MECHANICAL PART OR CRANKCASE

Parts of the compressor: namely bearings, connecting-rod big ends, connecting-rod small ends, crossheads, are force-feed lubricated by a gear pump. The oil pressure is indicated by a manometer, and the pressure should be comprised between 2,5 and 2 kg/cm².

The oil pump has a definite rotation direction, therefore, one must strictly observe that the rotation of the compressor is clockwise for an observer placed in front of the flywheel. An arrow cast on top cover of the crankcase indicates the direction of rotation.

Priming of the oil pump is automatic. However, the gauge pointer has to be watched, because if unstable, it means that a lack of oil in the sump is possible.

Oil pump feeding (priming) is automatic. However, it is necessary to watch the pressure gauge, because any instability might warn of an eventual lack of oil at the crankcase.

Every time the compressor is started for the first time or after a shutdown due to electric supply repair or overhaul or a general shutdown due to lack of power supply from the power distributor company, it must be checked the correct turning direction of the motors, as that might lead to a poor lubrication, with the machine automatically shutdown for low oil pressure.

Do never bypass the oil security.

Every compressor includes a lubrication circuit, comprising:

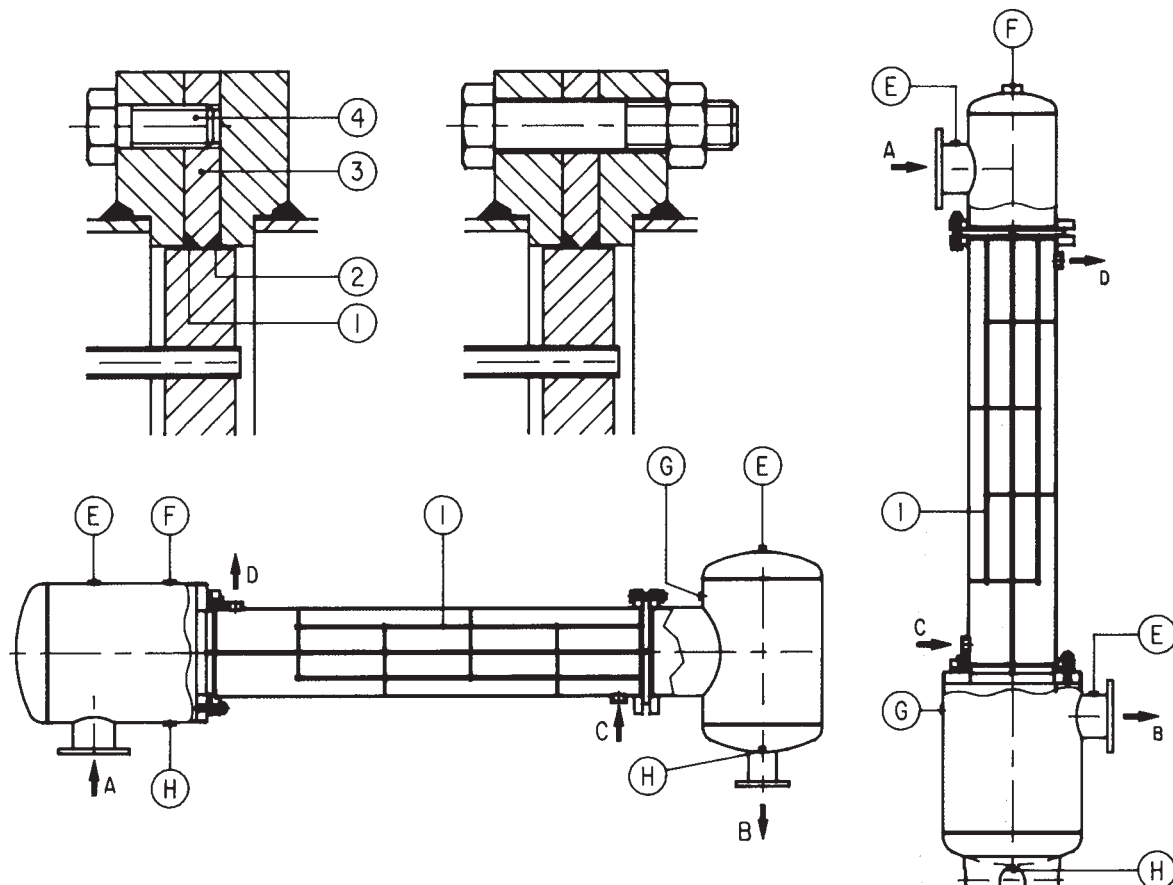
- Lube pump driven by the compressor shaft
- Bourdon type ϕ 63 pressure gauge (0 - 6 bar)
- Oil filter

On certain models, the compressor might also include:

- Electronic motor driven lube pump.
- Oil cooler.

2. DESCRIPTION

2.3.7. COOLERS



A - Air/gas inlet
B - Air/gas outlet
C - Water inlet
D - Water outlet
E - Temperature intake
F - Safety valve port

G - Manometer intake
H - Drain
I - Tubular bundle
J - Inlet bottle
K - Cooler body
L - Outlet bottle

O-Rings change instructions

- 1.- Separate the set: cooler body and tubular bundle from outlet pot.
- 2.- Replace the first defective joint by rubber joint $\varnothing 6$.
- 3.- Maintain the inserted flange 3 by means of 2 screws (4) placed for the purpose.
- 4.- Replace the 2nd joint (2).
- 5.- Reset the set: cooler body and tubular bundle on cooler outlet port.

NOTE.- The two screws (4) will only be used for setting of the 1st joint (1) but not for the definitive tightening.

Sneaking orifice to warn about the status of the o-rings of the floating flange:

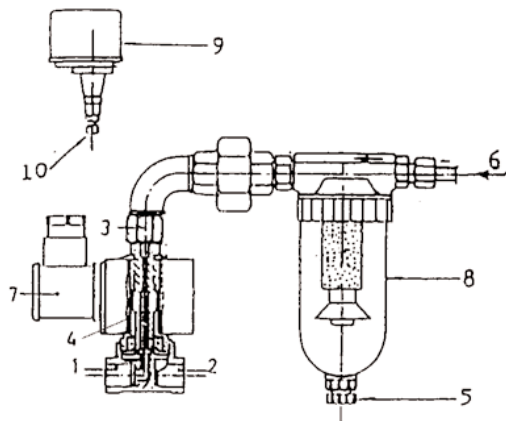
On one of the cooler ends there is an intermediate flange (3) with an small orifice on the side to warn which of two the o-rings might be eventually damaged: In case the damaged one is the air side one (2), then air will leak through it; in case the damaged one is the water side one (1), then water will leak through it.

Please, check the risks and recommendations of the Safety chapter.

2. DESCRIPTION

2.3.8. INSTRUMENTATION

REGULATION SOLENOID VALVE



1. -Air/gas exhaust that actuates on the decompression or pressure relieving.
2. -Air/gas outlet to compressor valves.
3. -Air/gas intake to the pressure switch.
4. -Movable core
5. -Filter drain
6. -Air/gas intake from receiver
7. -Solenoid valve
8. -Separator filter
9. -Monophasic pressure switch
10. -Air/gas intake from receiver

Description

The pressure of the compressed air in the receiver feeds the electropneumatic control device through a separator filter '8'.

Adjustment of pressures

The pressure adjustments, superior to discharge and inferior to load, is attained according to the instructions of each pressure switch.

By means of the electric contact of the pressure switch, the coil in the electrovalve '7', is fed , which attracts the movable core '4', switching over the air flow.

Operation

For one lower pressure to the setting minimum the contact of the pressure switch is closed, providing tension to the solenoid valve, which when actuating on the core, switches off the pressure feeding from the receiver, making the compressor work in normal load.

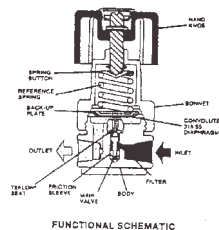
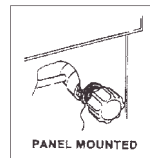
When the pressure of the air reaches the maximum, the pressure switch opens its contact, shutting off the voltage to the solenoid valve which deenergizes the electromagnet making the pressure of the receiver actuate on the suction valves , making the compressor to run with no load until the pressure is reduced to inferior limit, in which, the pressure switch closes its contact, providing again voltage to the solenoid valve, that one that puts the group on load, and exhausted the air remaining in the valves.

In the starting period, the electrical equipment is ready in a way that the solenoid valve does not receive voltage and makes the compressor remain unloaded.

2. DESCRIPTION

2.3.8. INSTRUMENTATION

REDUCTOR



OPERATION

Outlet pressure of the reductor is increased twisting the knob clockwise. So, anticlockwise rotation of the knob as well as venting the air contained downstream of the reductor, allows to get lower pressure values at the reductor outlet.

CAUTION

Although the reductor normally has an internal filter, it is strongly recommended to install a filter upstream, in order to protect the reductor from possible dirt that might come with the air, as well as from moisture, that might produce ice in the reductor.

PROBLEMS & SOLUTIONS

Problem: Regulation pressure keeps on increasing even if the set pressure of the knob has been overcome.

Solution: Change the valve seat.

Problem: Leak through or around the cover edge.

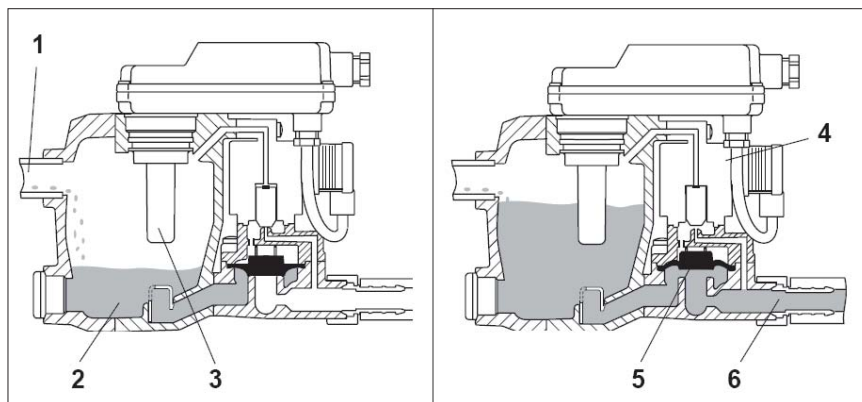
Solution: The reason may be a lack of tightening torque of the cover. Tighten again up to approximately 1 KgXm. Should the leak persist, dismount the reductor and inspect whether it has marks on the radius where the membrane seats on the housing. Should it be marked, change the housing and the membrane, and assemble again the reductor.

Problem: Regulation pressure falls down quickly even when the flow is within the range of the reductor.

Solution: The reason may be the saturation of the inlet filter. Remove this filter with a sharp tool and put a new one in by hand.

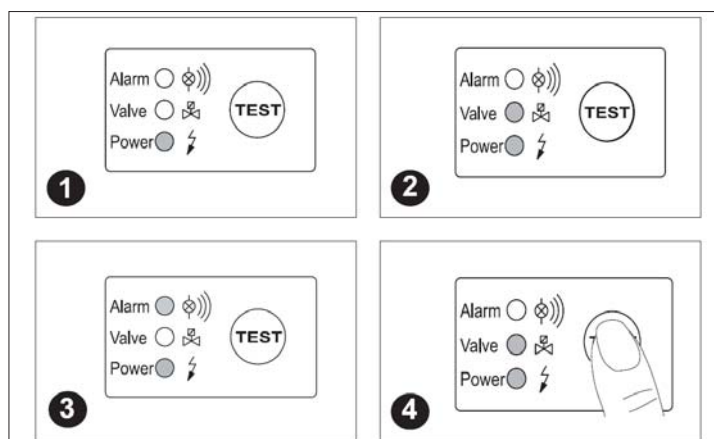
2. DESCRIPTION

2.3.9 DRAINS



FUNCTION

The condensate flows and when the tank has filled, the capacitive level sensor (3) transmits a signal at the maximum point and the solenoid valve is energized and the areas above the valve diaphragm vented. The valve diaphragm (4) lifts off the valve seat (5) and it forces the condensate into the discharge line.



1. Ready for operation. Voltage is being applied.
2. Discharge procedure. Outlet line is open.
3. Malfunction. Alarm mode is activated.
4. Test. Manual drainage / alarm.

The test button is used for checking correct functioning.

When the microcontroller registers a malfunction, the device will automatically change to alarm mode. The switching sequence of the valve continues until the fault is cleared (automatically or through maintenance). The red LED flashes as long as the device is in the alarm mode. Malfunctioning could be caused by, e.g.:

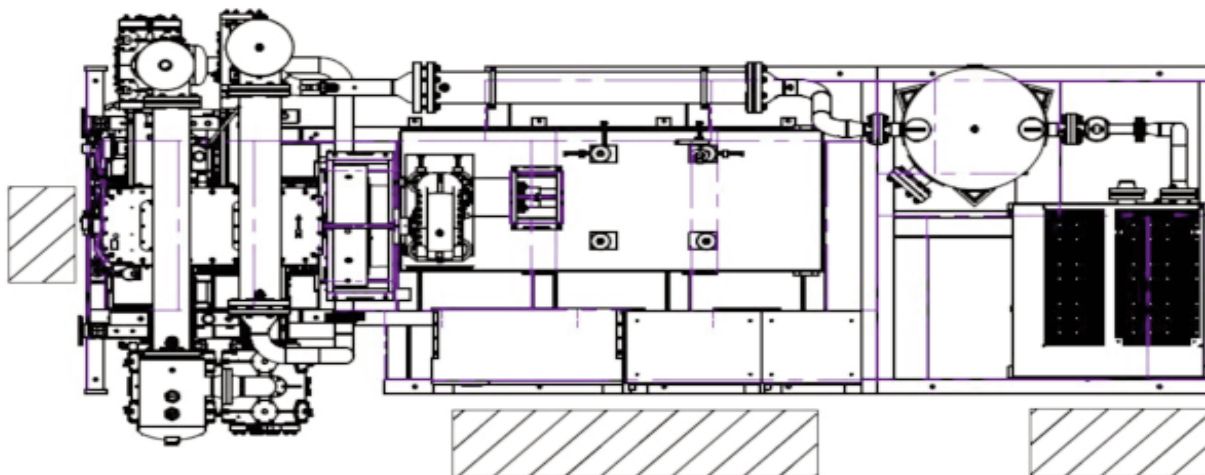
- Mistakes during installation.
- Dropping below the necessary minimum pressure.
- Excessive condensate quantities (overloading)
- Blocked / shut off outlet line.
- Extreme amount of dirt particles.
- Frozen piping

If the fault is not cleared, a fault signal is triggered. After 10 minutes, when the compressor works on load, if in 10 seconds the malfunction has not been corrected, the machine will stop.

2. DESCRIPTION

2.4. PLACE FOR OPERATOR

(Place for Operator example)



 Place for operator

On our type of compressors, the place for the operator might be located on the following areas around the machine:

- In front of the compressor crankcase, in front of the main lube pump and the pressure gauges.
- In front of the electric board, where the main switch is, as well as the emergency stop push button, the control signals and push-buttons (start, stop, ...)
- In front of the pressure gauges of the dryer.

The machine is supplied without lighting. Places for operator are floor level. It is the company end using the machine the one to make sure that the 3 formerly described places for operator have a minimum lighting of 200 lux, and that access to those areas is safe, wide and without obstacles.

Cautions:

As long as the machine is running, the operator must be protected at least against noise with homologated ear-plugs certified with a SNR minimum of 32 dB (Hmin. 20 – Mmin. 20 – Lmin. 20) and with safety glasses against eventual low or medium energy projections.

3 INSTALLATION

3.1 GENERAL INSTRUCTIONS

Make sure to leave enough free space around the compressor for carrying out maintenance operations without hindrance later on, minimum 1 meter around the compressor.

It is necessary to prepare both power and water supplies in accordance with the needs of the compressor equipment.

Our equipment has one or several earth connections, that need to be connected to the installation site ground net, or to an independent ground with a resistance value lower than 10 Ω .

In case the compressor is supplied with electric board, this must include a protection system against indirect contact (differential switch) and a main switch against shortcircuits or overloads (magnetothermic switch). If not, the equipment must be connected to an electric board that includes these two protection devices.

Is advisable to place the compressor in a clean and dry atmosphere.

Should this recommendation not be fulfilled, the suction unit should be located outside the plant or to fit a especial filter which can be supplied on order.

If a sleeve piece is necessary for the installation of the filter, make sure it is as short as possible. Its diameter must be greater than that of the air inlet flange. If elbows need be fitted, they should have the greatest possible radius of curvature and, before making the first trials, their interior should be cleaned thoroughly.

Should the compressor be set in a room where noise cannot be tolerated, it is advised to place between the machine and the filters a vessel with capacity enough to regularize the flows and pressure drop. In case the noise reduction is not enough, then a deeper analysis should be carried out with it corresponding study and added cost.

However, this vessel should have the walls thick enough in order to avoid vibration induced noise.

The electrical installation has been designed for maximum power voltage variations of 5% from the nominal tension. Higher variations may lead to great damage on the equipment; therefore, these cannot be admitted.

IMPORTANT:

Commissioning, starting up, repair, maintenance and overhaul of our equipment must be performed by people already authorized and trained by ABC.

Also, all the spare parts need to be original and supplied by ABC.

In case any of the two former points is not fulfilled, the equipment shall lose the warranty rights and ABC shall not take any responsibility on the eventual defects, harm to others or malfunctioning of the equipment.

3 INSTALLATION

3.2. HANGING INSTRUCTIONS

PRECAUTIONS

- Before any hanging system is used, make sure that it has capacity enough to lift the load.
- Check regularly the hanging elements in order to determine their state.
- Refuse every cable or hanging element worn, or likely to be wrong.
- Never suppose that cables in bad conditions may allow lower loads.
- Cables and ropes used must not have any joints except on their ends.
- Always try to separate from the hanging goods as much as possible. Never place yourself under the hanging good.
- The operator using the crane shall be qualified and trained to perform such a job.
- Before starting to lift the machine and unload it from the truck platform, always check that the load is properly balanced and goes up parallel to the floor.
- Verify that the surface to be covered by the crane with the load suspended is free from obstacles (piping, electric installations, etc...) from the beginning to the end where the machine shall be positioned on the floor.
- Just lift to move the load (if possible try to avoid to raise more than 500 mm from the floor or the original lifting spot) and download slowly and softly.
- When the whole lifting operation is over, do not let the hooks hanging at a height that may cause unexpected knocking on operators.
- If unpacking a compressor from a wooden box or where there is a need to unhook fixing elements from an open-top container in order to remove its roof, this should be performed using a stepladder to ensure correct access to the upper area where the work is to be carried out.

HANGING PROCESS

- Wooden boxes shall be lifted passing hanger straps or wires below on the spots marked with black arrows, placed on the long sides of the box; the length of the straps or wires shall allow the load to be lifted horizontally.
- Wooden boxes shall bear a mark with the center of gravity.
- Due to the machine being screwed to this base, remove those screws in order to free the equipment from its packing.
- Lifting lugs are welded on the package skid.
- It is important to pay attention to the synchronize of the two cranes and make no sudden movements.
- In case two cranes are not available, lifting straps shall be far longer and shall be balanced in length so that the equipment can be lifted balanced and parallel to the floor (not inclined); besides care should be taken at the moment of starting lifting (tensioning of straps) so that these do not press on any part of the equipment and to be free all through their length.

3 INSTALLATION

3.3. UNPACKING

A.- Whenever the transport has been performed being the equipment properly packed in a wooden close box, before unpacking it, the following considerations must be taken into account:

- Before unpacking it, make sure that the foundation has been made properly.
- Use safety gloves to handle Wood.
- Each face of the box is one sole part.
- First thing to remove shall be the screws of the long side panels; once they are loose, remove those side panels by means of a crane. Later, remove the short side panel screws and remove the upper cover with the crane. Finally, gradually remove the lower screws of the small side covers and remove one by one both covers with the crane, so that the equipment stays just on its lower base. All this operation shall be carried out having previously held the wooden panels with the crane that shall remove them.
- Due to the machine being screwed to this base, remove those screws in order to free the equipment from its packing.
- Hang the equipment to place it on the final location, following previously described in this chapter.

B.- When the equipment has been transported in a sea container (open-top), the following considerations must be taken into account during unpacking:

- Open the container doors and remove the container roofing using lifting equipment and the ladders to gain access to and release the different parts of the container roof.
- Remove the fixations and pads of the container base that were intended to movement of cargo during transportation.
- Hold the equipment to be extracted with cranes and follow the steps of the former point.
- In case the compressor frame is HA4 or smaller, the equipment shall be extracted from the upper part of the container. In case it is HA6 or bigger, then it shall be extracted from the back side of the container, according to the following steps:
 - 1- Lift around 10 cm above the container base, complying with the requirements of the former points of this chapter.
 - 2- Carefully displace the load towards the back side of the container.

Or

Leave the load suspended and remove carefully the truck until the load is out of the container.

- Once the equipment has been extracted, place it on its final location or on a flat surface where all the equipment base is supported.

C.- When the equipment has been transported in a hard-top sea container. The following considerations must be taken into account when unpacking:

- In this case the extraction of the compressor is more complex than the previous situation, because the compressor must be moved longitudinally without removing the roof.
- In this case an specific instructions are described for the extraction (drawing 236168), which are attached to the compressor.

All the waste from the compressor packing or spares (Wood, carton, plastic, screws, nails, ...) shall be properly managed, as the responsibility for that falls on the end user.

3. INSTALLATION

3.4. COMPRESSOR TURNING

The following instructions must be followed for the installation and turning of the compressor:

1- Unscrew the baseplate from the skid (Figure 1) or from the wooden base (Figure 2) to raise the compressor.

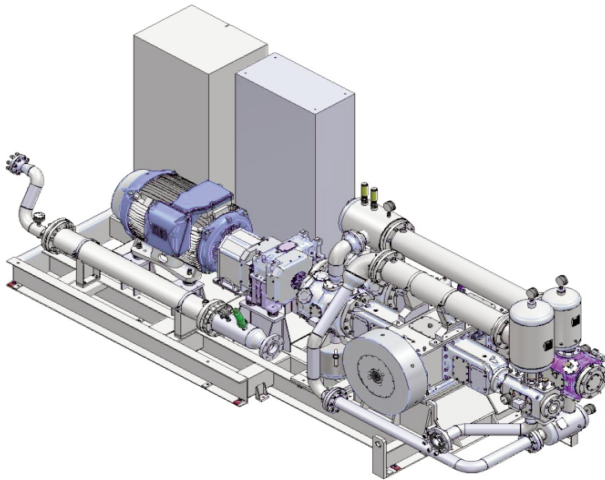


Fig.1

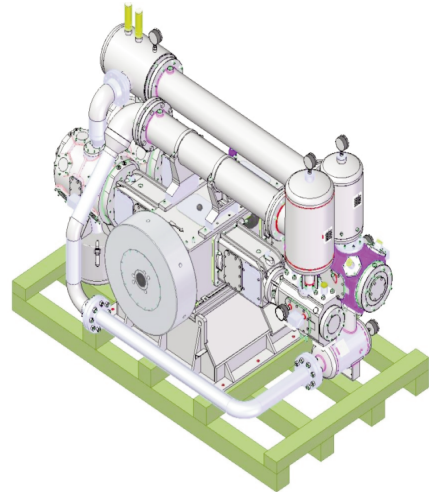
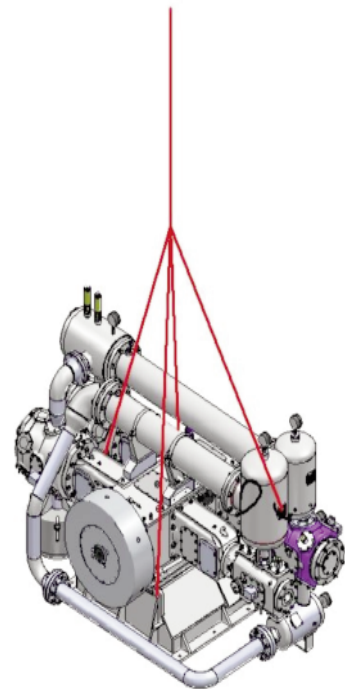
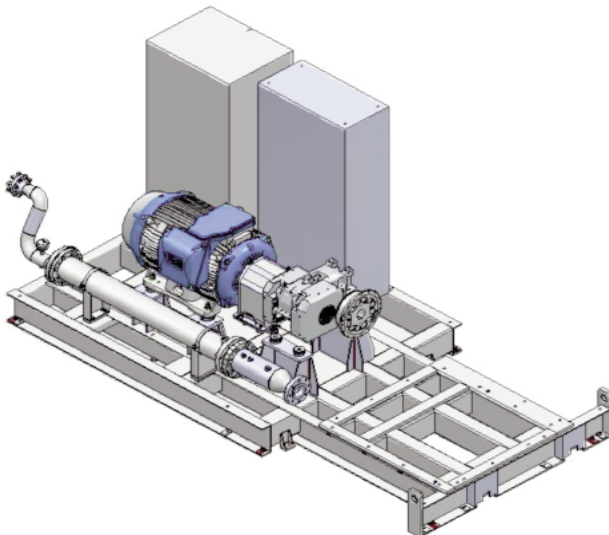


Fig.2

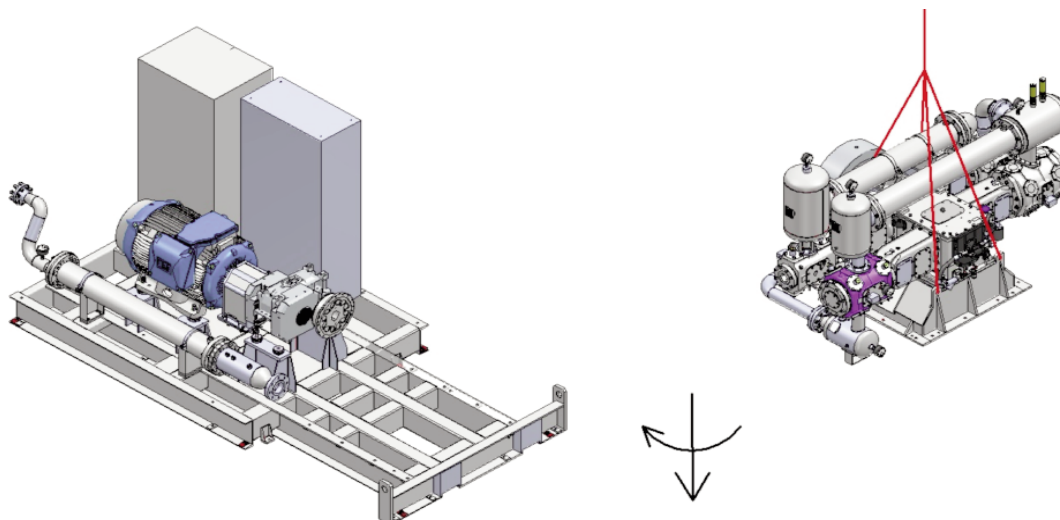
2- Raise the compressor.



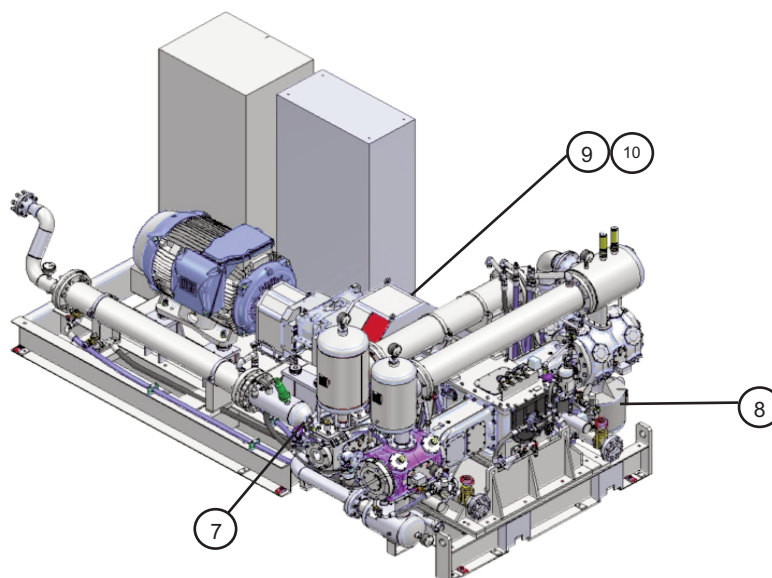
3. INSTALLATION

3.4. COMPRESSOR TURNING (cont.)

- 3- Turn the compressor 90°.
- 4- Put down the compressor and place it in position.
- 5- Place pins DIN 7978 (2x Ø14).
- 6- Fix the baseplate to the skid (M24).



- 7- Let loose the protection from the 3rd stage cooler inlet and place the pipe.
- 8- Install the filters.
- 9- Screw on the flywheel to the coupling.
- 10- Place the guard.



3. INSTALLATION

3.4.1. FOUNDATION

ABC recommends to consult with competent experts on foundations in order to avoid eventual damage on the building structure or the machine.

The foundation must be properly isolated from the rest of the building.

The floor under this foundation must be properly compacted and with a minimum allowable load of 2 Kg/cm², not recommending to place blankets or elastic elements.

The compressive resistance of concrete must be ≥ 30 N/mm², with a minimum base thickness of 245 mm.

ABC is not responsible for the consequences of not fulfilling these points, as well as any possibly sinking due to lack of resistance of the floor material.

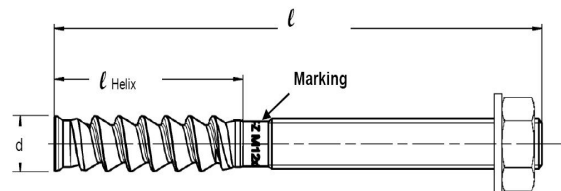
ABC is not responsible if other anchors are used.

After placing the compressor on the concrete slab, which has to follow the specifications showed in the **foundation drawing**, we make the compressor leveling (placing leveling plates where necessary). Fill the gaps between skid and floor with levelling mortar.

After leveling the compressor we continue making the compressor fitting holes **following strictly next page instructions and the information showed in the foundation drawing**, because any variation may affect the loads distributed around each tightening hole and, in consequence, the correct anchoring of the compressor.

The skid anchoring to the ground it must be done without the compressor head.
Once the compressor head is attached to the skid, it is not possible to access to the anchoring points corresponding to already said compressor head.

1- Provided anchors:



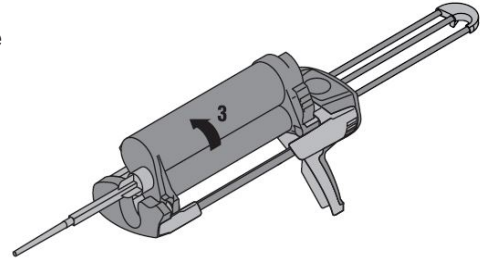
Anchor size			M16
Diameter of anchor	d	[mm]	16
Anchor length	l	[mm]	240
Helix length	l_{Helix}	[mm]	96

3. INSTALLATION

3.4.1. FOUNDATION (cont.)

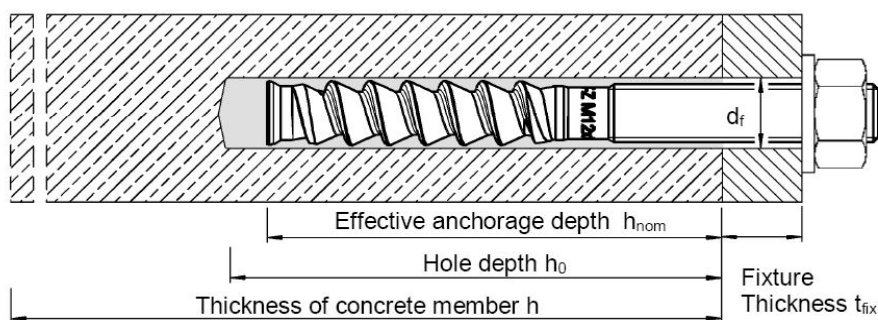
2- Recommended installation tool:

- Drill for drill bit Ø18 (drill bit minimum length 500mm).
- Applicator HDM 330 + housing + mixer for the adhesive HIT-HY 200.
- Torque wrench.



3- Anchoring instructions:

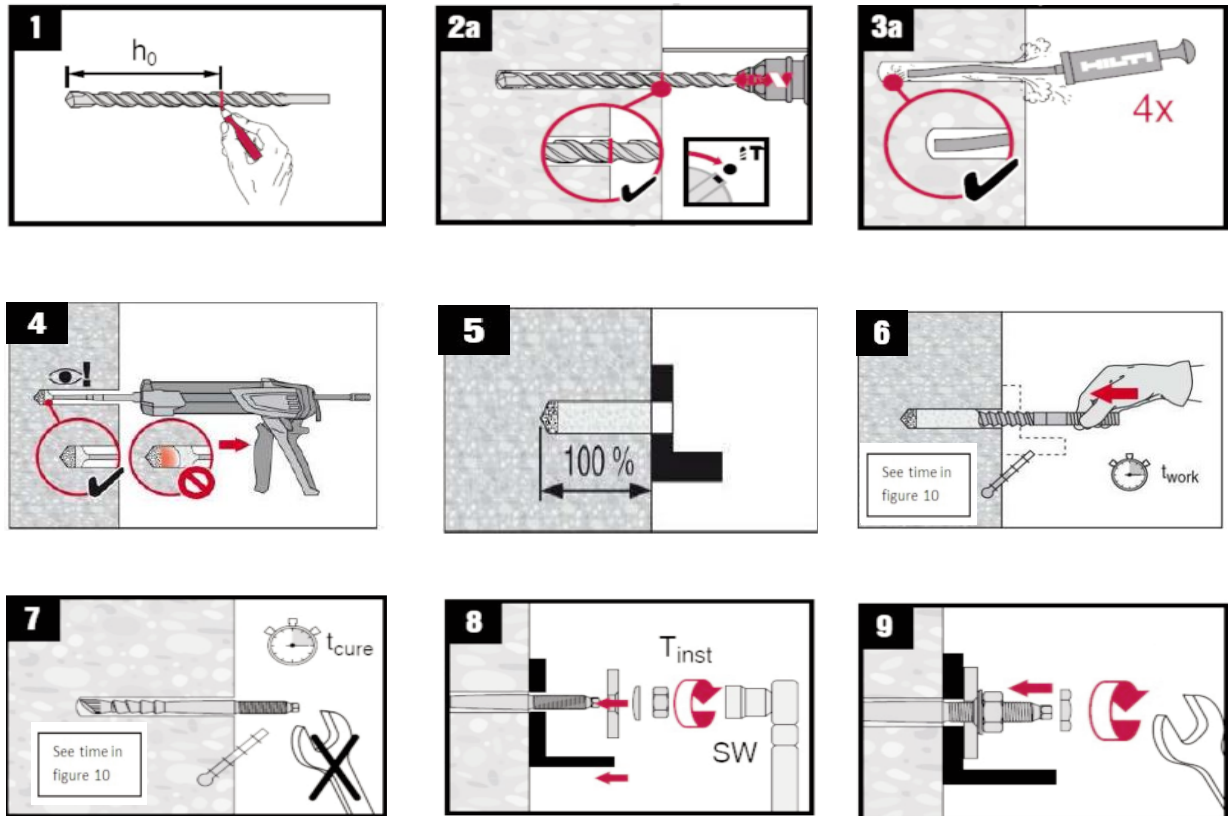
Anchor size			M16
Nominal diameter of drill bit	d_0	[mm]	18
Drill hole depth	h_0	[mm]	145
Diameter of clearance hole in the fixture	d_f	[mm]	≥ 18
Effective anchorage depth	h_{nom}	[mm]	96
Maximum thickness to fix	t_{fix}	[mm]	100
Torque moment	T_{inst}	[Nm]	80
Minimum base material thickness	h_{min}	[mm]	245



3. INSTALLATION

3.4.1. FOUNDATION (cont.)

4- Anchoring procedure:



Curing and working time

Temperature of the base material	HIT-HY 200-A	
	Working time in which anchor can be inserted and adjusted t_{work}	Curing time before anchor can be loaded t_{cure}
5 °C	25 min	2 hour
6 °C to 10 °C	15 min	1 hour
11 °C to 20 °C	7 min	30 min
21 °C to 30 °C	4 min	30 min
31 °C to 40 °C	3 min	30 min

Figure 10

3. INSTALLATION

3.4.1. FOUNDATION (cont.)

4- Anchoring procedure (cont.):

- 1- Ensure to mark the specified setting depth ($h_0 = 145 \text{ mm}$) on the drill bit of the rotary hammer.
- 2- **Drilling the hole:** The concrete slab is drilled according to dimensions and positions showed in the anchors foundation drawing. It should be made as much drills as fitting holes the skid has with a depth of **145 mm**.
- 3- Clean the hole immediately before setting the anchor. Remove drilling dust and standing water from the base of the hole by blowing out well with at least 4 strokes of the blow-out pump, or using compressed air or an industrial vacuum cleaner. The anchor holes must be free of dust, water, ice, oil, bitumen, chemicals or any other foreign matter or contaminants.

Poorly cleaned holes = poor hold.

- 4- Fill the hole with the adhesive using the applicator + housing + adhesive.
- 5- Make sure the hole is filled with 100% adhesive.
- 6- Introduce the anchor rod considering the time "**t work**".

The working time «**t work**» and curing time «**t cure**» which depends on base material temperature, must be observed (see fig. 10).

- 7- After reaching the end of the working time «**t rel**», do not manipulate or disturb the anchor rod in any way until the curing time «**t cure**» has elapsed.
- 8- After the curing time «**t cure**» has elapsed, tighten the anchor with a torque wrench.

Apply the necessary torque of **80 Nm**. This is the maximum recommended torque moment to avoid splitting failure during installation for anchors with the defined spacing and/or edge distance.

- 9- Tie the second nut supplied.

A

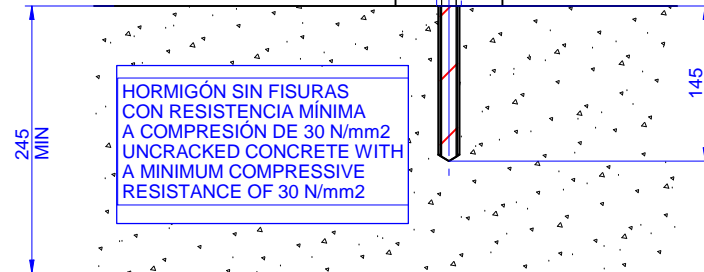
SENTIDO PERFORACION
DRILLING DIRECTION

VARILLA ANCLAJE M16 (488491)
HIT CARTUCHO HY 200-A 330/2 (488346)
M16 ANCHOR STUD BOLT (488491)
RESIN HY 200-A 330/2 (484346)

TUERCA M16 (491775)
(PAR APRIETE 80Nm)
M16 NUT (491775)
(FIXING TORQUE 80Nm)

TUERCA + ARANDELA (488491)
(PAR APRIETE 80Nm)
NUT + WASHER (488491)
(FIXING TORQUE 80Nm)

ARANDELA M16 (DIN 7349) (403420)
M16 WASHER (DIN 7349) (403420)



EL SUELO BAJO EL HORMIGÓN
CON RESISTENCIA MÍNIMA A
COMPRESIÓN DE 2KG/CM2
FLOOR UNDER CONCRETE
WITH MINIMUM COMPRESSIVE
RESISTANCE OF 2KG/CM2

B

SENTIDO PERFORACION
DRILLING DIRECTION

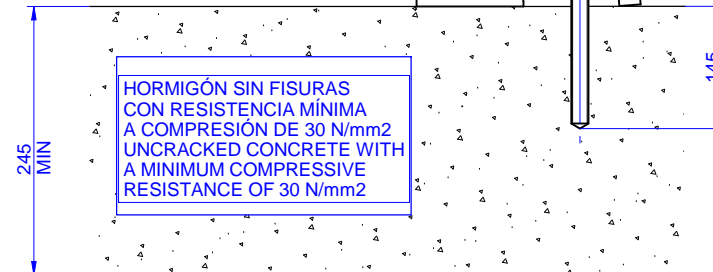
VARILLA ANCLAJE M16 (488491)
HIT CARTUCHO HY 200-A 330/2 (488346)
M16 ANCHOR STUD BOLT (488491)
RESIN HY 200-A 330/2 (484346)

TUERCA M16 (491775)
(PAR APRIETE 80Nm)
M16 NUT (491775)
(FIXING TORQUE 80Nm)

TUERCA + ARANDELA (488491)
(PAR APRIETE 80Nm)
NUT + WASHER (488491)
(FIXING TORQUE 80Nm)

ARANDELA M16 (DIN 7349) (403420)
M16 WASHER (DIN 7349) (403420)


TACO AMARRE (360358)
CLAMPING TIRE (360358)



EL SUELO BAJO EL HORMIGÓN
CON RESISTENCIA MÍNIMA A
COMPRESIÓN DE 2KG/CM2
FLOOR UNDER CONCRETE
WITH MINIMUM COMPRESSIVE
RESISTANCE OF 2KG/CM2

USAR **A** O **B**, SEGÚN EL PLANO DE CIMENTACIÓN DEL COMPRESOR.
TO USE **A** OR **B**, DEPENDING ON THE FOUNDATION DRAWING.

01	22/08/16	SE CAMBIA "TRACCIÓN" POR "COMPRESIÓN"	IAr	-
MOD.	FECHA	DESCRIPCION	INI.	N. ORDEN
MODIFICACIONES				

	FECHA	FIRMA	ARZAGA, BASTARRICA Y CIA. - EBAR 			
DIBUJADO	08/02/16	A.TXURRUKA				
REVISADO	08/02/16	O.MINONDO				
ESCALA	Detalles de cimentación Foundation details			242092	REV.	HOJA
1/5	ESQUEMA AMARRE HILTI CON RESINA HA, HP HILTI TYING SCHEME WITH RESIN HA, HP				01	1/1
FORMATO A3				SUSTITUYE A:		
				SUSTITUIDO POR:		

3. INSTALLATION

3.4.2. AUXILIARY EQUIPMENT FOUNDATION

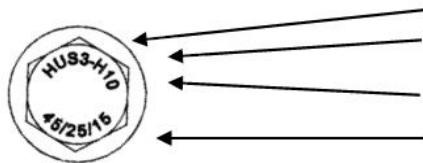
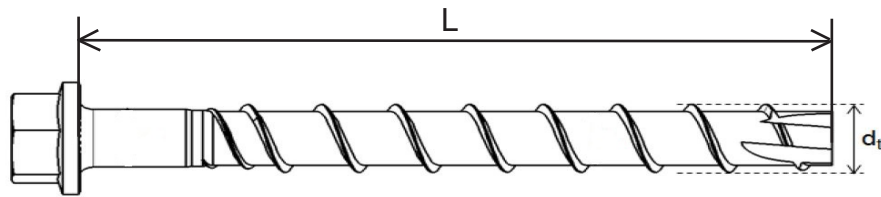
Use Hilti HUS3-H/8x100/60/40/30 screw anchors for: pump unit, cooling tower, aircooler and dryer (if sent separately).

In the case of the cooling tower, do not exceed wind speed values of 120 km/h. Minimum drill depth is 70 mm. If this is not the case, check.

The ground below the foundation must be compacted and sustain a minimum admissible load of 2 Kg/cm²; the placement of blankets or elastic elements is not recommended.

Concrete compression resistance must be ≥ 25 N/mm², with a minimum slab thickness of 110 mm.

1-Supplied screw anchor



HUS3: Hilti Universal Screw 3rd generation.

H: Hex screw.

10: Nominal thread diameter (in this case 8mm).

45/25/15: Maximum attachment thickness as a function of nominal anchor depth.

Exterior thread diameter	d_t	[mm]	10,3
Anchor length	L	[mm]	100

2-Recommended installation equipment

-Drill for bit Ø 8 (CX-8 length 150 mm), models te-2- or te-30 recommended.

-13 mm socket for attaching screw anchor.

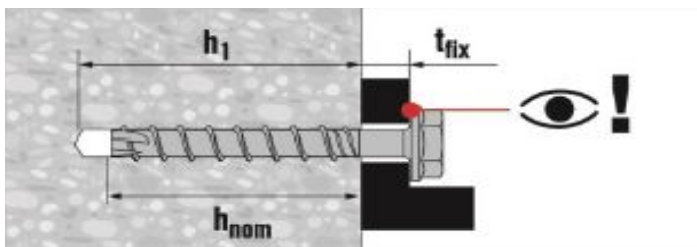
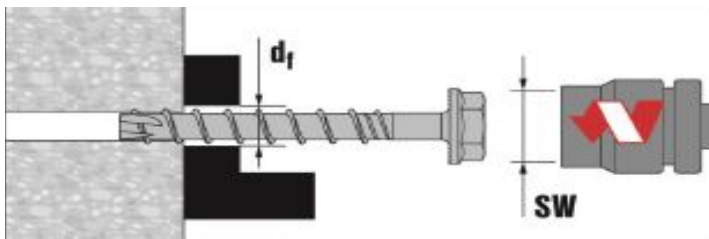
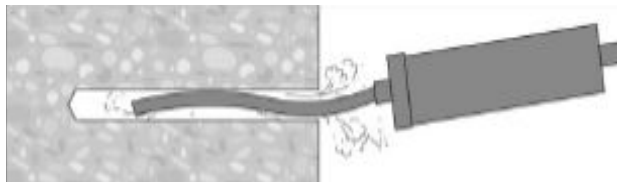
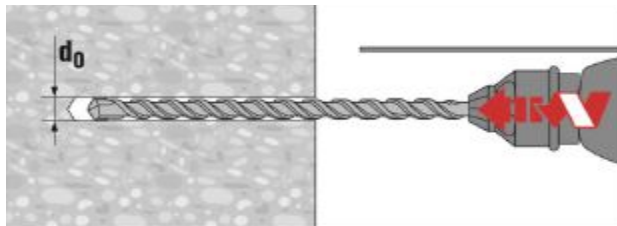
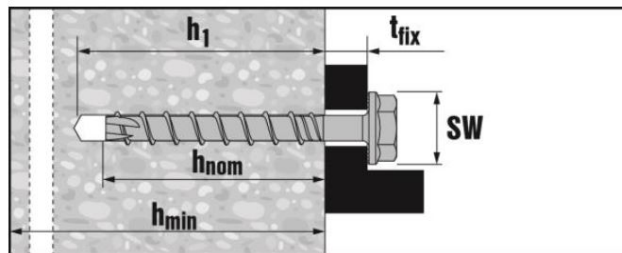


3. INSTALLATION

3.4.2. AUXILIARY EQUIPMENT FOUNDATION (cont.)

3-Anchor instructions and procedure

Nominal bit diameter	d_0	[mm]	8
Drill hole depth	h_1	[mm]	70
Plate drill hole diameter	d_f	[mm]	12
Anchor nominal depth	h_{nom}	[mm]	60
Minimum thickness of base material	h_{min}	[mm]	110
Maximum thickness to attach	t_{fix}	[mm]	40



3. INSTALLATION

3.4.2. AUXILIARY EQUIPMENT FOUNDATION (cont.)

- 1- Hole perforation: drill the slab to a depth of 70 mm with bit diameter $d_0 = 8$ mm. Ensure you mark the drill hole depth on the drill bit before drilling.
- 2- Clean the hole before attaching the anchor. Remove any remains and stagnant water from the bottom of the hole with pressurised air; either by using a pressure pump, compressed air or suction.
- 3- Set the drill to the hammer setting and proceed to attach the screw anchor using a socket with a width of $SW=13$ mm. Also ensure that the drill hole diameter on the plate is $d_f = 12$ mm.
- 4- Lastly, having inserted the anchor to its effective depth $h_{nom}=60$ mm, check that the plate is properly attached.

3. INSTALLATION

3.5 AIR PIPE LINE

In case the compressor supply does not include a final discharge tank, it is necessary to incorporate a volume tank downstream the compressor in order to regulate the flow.

The slope of this pipe work will be directed towards the receiver, and if low points cannot be avoided, draining will have to be provided for at these points.

When there is not room enough to accommodate the main receiver, an auxiliary receiver should be placed near the compressor. These tanks shall be periodically inspected in order to verify their internal oxidation, at least once a year.

Besides, all pressure equipment shall be inspected in accordance with local legislation.

All the receivers must be provided a safety valve, pressure gauge and a drain.

In those supplies that is included in the connecting pipe between receiver and cooler and there are no obstacles in the pipe (check valve, isolation valve, ...), it is considered that the aftercooler safety valve protects the receiver. In these cases you should never manipulate the pipe, otherwise you must provide a safety valve at the horizontal or vertical receiver.

The safety valve will be adjusted to a pressure slightly superior to that of the working pressure so that the pressure regulator, if any, actuates before the valve, but this safety valve trip pressure shall never be higher than the design pressure of the pressure equipment or installation to be protected, and shall be able to relieve the total compressor flow making sure that the pressure does not overcome 10% higher than safety valve trip pressure..

Never fit a valve between compressor and receiver. Should several compressors operate with the same receiver, a valve must be installed at the outlet of each compressor, but in this case it must be taken into account that **THERE MUST ALWAYS BE A SAFETY VALVE BETWEEN COMPRESSOR AND ISOLATING VALVE**. This safety valve shall be able to relieve the total compressor flow making sure that the pressure does not overcome 10% higher than safety valve trip pressure

The receiver should have enough capacity to ensure a good regulation of the flow.

When the compressed air is being used in the surroundings of the compressor, one should not worry about the condensation in the pipework. In all other cases, one cooler with air and oil separator should be installed between the compressor and the receiver.

When the compressed air used need be perfectly dry and clean, fliters and dryers should be installed near the servicing point. These devices should be ordered apart.

3.6. ASSEMBLY

Assembly on baseplate.

- 1.- Whenever the baseplate comprises two parts, both must be joined by means of bolts according with the ASSEMBLY DRAWING.
- 2.- Fit the vertical receiver, aftercooler and any other auxiliary equipment, if any.
- 3.- Fit the connecting piping.
- 4.- Connect the electrical wiring.
- 5.- Bolt the baseplate down to its foundation.

Assembly on foundation

- 1.- Fit the compressor and level it on its base.
- 2.- Fit the motor on its rails and align it with the compressor.
- 3.- Fit the receiver, aftercooler and any other eventual auxiliary equipment, if any.
- 4.- Connect the pressure pipes.
- 5.- Join the electric wiring



3. INSTALLATION

3.7. INSTRUCTIONS FOR FIRST STARTING UP

FIRST STARTING UP

- Verify that electric power is cut and that the stop of the electric board is properly locked.
- Check the proper leveling of the equipment.
- Check tightening of nuts.
- Check that there is oil enough at the crankcase; its level must be between both marks of the sight glass at the front of the crankcase. In case it is necessary to refill it, use the oil specified in this manual of instructions.
- In the lubricated cylinders compressors, check also that the oil level at the lubricator tank is all right. In case it is not like that, fill it up following the instructions given at the LUBRICATION chapter, in DESCRIPTION. It must also be regulated and fed as specified within these instructions.
- Remove the motor locking device used for transportation (please, note that on high power equipment, like HP range, the motor shall travel with the belts loose, misaligned and with the shaft and pulley locked).
- Check the motor compressor drive alignment, and proceed to align it in case it is necessary.
- Check the tension of the belts according to the instructions of this manual.
- Verify that voltage and frequency of the electric line are the same as the ones indicated of the motor nameplate.
- Check the motor connections.
- Check that the cooling water emptying valves are closed.
- Should a chiller be part of the equipment, check that all possible air drains of the cooling circuit are close.
- Open the water inlet and outlet valves of the compressor and auxiliary equipment. In case of having thermostatic valves, the by-pass for each valve must be opened in order to fill up the circuit.
- Should a chiller be part of the equipment, drain the air of cooling circuit.
- Check the sealing of the water circuit. Correct any possible deficiency.
- Check that the close cooling water circuits include a compensation tank on the highest part and that the aeration tube placed on the top of it is open to atmosphere and free from obstructions in order to avoid pressurizing it.
- Check the proper installation of the regulation circuit.
- Check the state of the instrumentation, pressure switches, temperature switches, solenoid valves, . . etc.
- Check that all the safety valves are properly placed and have not any obstacle on the outlet.
- Make sure that the any valve (if any) between compressor and receiver is totally open.
- Open all the air drains of the compressor in order to avoid the creation of pressure before the lubrication oil has flown through all the mechanical parts of the compressor.
- Some turns must be applied on the compressor by hand, being the power supply completely disconnected, in order to make sure that there is no mechanical interference inside the machine.

3. INSTALLATION

- Check that all guards, air suction filters, protectors and covers, of the moving parts are properly placed.
- Check that the filters do not have obstacles avoiding air passing through or nearby objects to be suctioned (cloth, paper, etc)
- Connect the electric supply. (this must be done without voltage) and fit the direct contact protection (Perspex).
- Check that all the precautions listed in section 1.3 of this manual have been followed.
- Unlock (if possible) the control board.
- Close the electrical cabinet doors and turn on the master switch (always with doors closed).
- Verify the proper turning direction of the auxiliary equipment. This operation may be carried out by means of a quick start/stop action. Should the turn occur just all the other way round, change the position of the terminals of the motor having previously disconnected the equipment main switch.
- Verify also that the main motor turns properly.
- Press the START push-button. In case that the different electric pannels are interconnected, this action also starts the auxiliary equipment. Should they not be interconnected, this auxiliary equipment must be started previously.
- In case the machine has an auxiliary lubrication circuit, whenever the start push-button is pressed, only the auxiliary lubrication pump starts, until the pressure of the lubrication circuit reaches up certain value, when the compressor starts turning.
- Keep the compressor idling while the oil is getting hot, so that the compressors settles.
- Check that water and oil pressures are correct.
- Close stepwise the manual drain, so that the pressure goes up gradually.
- Make sure that all the components are working properly.
- At the compressors with cylinders lubrication, check the oil flow through the different sight glasses of the mechanical lubricator.
- Keep the compressor loading in order to see the performance of the equipment. This can be achieved by means of the manual drain of the receiver.
- Check pressures and temperatures of the air circuit.
- Check any possible leak of air, oil or water.
- Check the operation of the automatic drains.
- Check the regulation loading/idling. This can be achieved by means of the manual drain of the receiver.
- Check the safeties of the compressor equipment.

From the moment of the starting up, verify regularly the auxiliary equipment.
(in case they form part of the equipment).

3. INSTALLATION

3.7. INSTRUCTIONS FOR FIRST STARTING UP

DRYER

- Check that the temperatures of the system of the dryer are near the values shown at the sheet of features of the dryer. Look at the particular instructions of the dryer.
- Check that the water inlet and outlet temperatures are within the right limits. Temperatures may be tested by means of the selector of the display.
- Check also the air inlet temperature and the dew point.
- Read the manual of instructions of the dryer annex (if applicable).

AIRCOOLER OR CLOSED TOWER

- Check the water level at the compensation tank, that it is properly place at the highest spot of cooling circuit and its top aeration tube is open to atmosphere (no obstructions or valves).
- Check the water inlet and outlet temperatures, by means of the selector at the electric board.
- Read the water cooling equipment manual of instructions (if applicable).

OPENED TOWER

- Verify the water level at the expander receiver.
- Check inlet and outlet water temperature, through the selector of the electric board.
- Read the water cooling equipment manual of instructions (if applicable)..

STOP

- Press the STOP push-button on the electric pannel.
- Open the manual drains of the coolers and receiver.
- When there is risk of freezing, empty manually the drains; should the water not be glicolized, empty the cooling circuit water opening all the valves and removing the plugs at the cylinder heads.

OBSERVATION: On equipment without touch screen, control and signaling lamps and push-buttons are located on the electric cabinet, while measuring devices (temperature & pressure gauges, etc...) are installed on the compressor equipment itself. Equipment with touch screen have all information and control on the touch screen, including temperatures of all air stages, as well as oil & water pressure

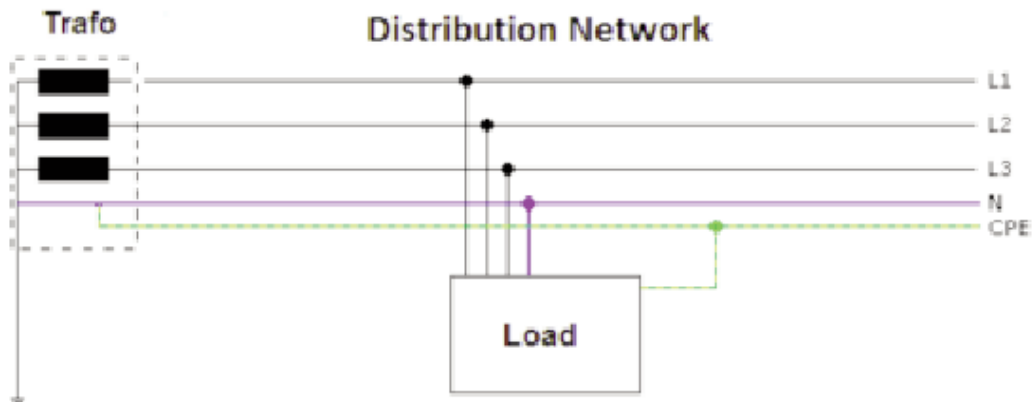
3. INSTALLATION

3.8. EMC RECOMMENDATIONS

Special precautions must be taken if the electrical cabinet is not fitted to the actual compressor chassis and the electrical installation must be made on-site.

In addition to the requirements of Standard EN61800-3 and the Low Voltage and Electromagnetic Compatibility Directives, the following recommendations should also be taken into account:

- Conductors in circuits with different voltages must be separated by a distance of at least 50 cm. If there is no alternative to crossing them, they must do so perpendicularly.
- Power cables must be as short as possible.
- The power cables must be arranged so that the three phases (R, S, T) form an equilateral triangle, in a tube with a metal strip and an earth connection.
- The best method for control cable connection is to use shielded cables. The earth connections of these control loops must be made as correctly as possible, in the form of a clamp, to ensure the largest contact area possible.
- Use separate conduits for control hoses.
- For installations with a variator, the diameter of the earth wire must be the same as that of the motor supply phase wire diameter.
- The preferred connection system is TN-S, as shown in the diagram:



In the event of prolonged situations, consult an expert.

When connecting the general supply wires to the board, they must be run so that they do not interfere with the control, entering via the underside of the power cabinet at all times.

4. OPERATION

4.1. SAFETY SERVICE

Never operate the compressor beyond the conditions set forth on the TECHNICAL FEATURES sheet.

The area around the compressor must be clean.

- Clean the water and oil leaks as soon as possible, and eliminate the reason of the leak.
- Keep every access to the compressor free from tools, oil receivers, clothes or any other obstacle.

Should the compressor be watercooled and in case that for any reason the compressor worked without water and an overheating on cylinders takes place, do not introduce water in the cooling circuit until the cylinders are cool enough. This cool water may cause these cylinders to crack.

Never disconnect or by-pass a safety, and do not allow the compressor to operate unprotected.

Do not tighten the bolts, screws or nuts of the pressure vessels or cylinders unless the compressor is stop and without pressure inside.

In case of fire on any electric component (motor, board, etc, ...) do not use water to fire it off, use CO2.

Should any safety valve trip during compressor operation, stop immediately the compressor, and determine the reason.

Safety valves are not intended to work as pressure regulating valves; that means that compressor regulation must not be carried out by tripping the safety valve.

Whenever there is a risk of freezing and the compressor stop, make sure that all the drains have been manually purged. Either empty up the cooling circuit water opening all the valves and removing the cylinder plugs or glicolize the circuit in a proper proportion.

Whenever the water cooling system is using a vaporation cooling tower, it is recommended to consult an specialist in water treatment, in order to prevent and avoid the risks that are detailed in the Manual of the tower itself.

Easy combustible or flammable substances shall not be stored near the compressor, such as lubricants, petrol, solvents, waste, etc...

The compressor should not be started with the mechanical moving part guards, protectors and covers on.

All compressor alarms shall be respected and immediate corrective actions should be taken, not just ignoring them; after taking a corrective action, they should be reset acting the panel.

Always observe all the precautions described on each chapter of this manual.

4. OPERATION

4.2. OPERATION OF THE EQUIPMENT

The air/gas suctioned through the inlet filters is compressed in the cylinders, increasing both pressure and temperature.

At the series HA and HP, the compressed air/gas temperature is reduced by cooling with water, first at the cylinders and then at the coolers, where water flows outside the pipes of the bundle, in countercurrent. All this allows the access of air / gas to the next stage or to the network happens at a moderate temperature.

Condensates produced at the coolers are separated from the air/gas at the outlet bottles of the coolers, that operate as separators. These condensates are purged through the manual and/or automatic drains.

Whenever there is the risk of producing condensates in the line, or in case that the user needs dry air for his own process, the equipment must be supplied with a dryer, either cooling type (dew point between 1 and 3°C) or adsorption type (dew point below 0°C). Most of the times it is enough with a cooling dryer.

The cooling water of the equipment may operate either in open (local water line) or close circuit. In this later case, it is necessary to cool down the water by means of either a cooling tower or an aircooler (chilling unit).

The lay-out drawing shows the whole equipment, and at the P&I (Flow) Diagram the whole compression process may be followed, as well as the further treatment, in order to supply the air/gas to the user line at the best possible conditions. This P&I Diagram also shows the normal operation values such as pressures, temperatures, ..., as well as the set points of the safeties.

The compressor needs a receiver for its own regulation (loading/idling), as well as storing air, so that an immediate answer is given to the needs of the user while starting the equipment.

OPERATION OF THE STAR-DELTA STARTER: Whenever the starter receives power supply by means of the contactors, it takes about 12 seconds for the "star" period, so that the compressor runs idling (thus reducing the starting intensity) and then passing to "delta" with the normal working conditions.

In case the machine has an auxiliary lubrication circuit, whenever the start push-button is pressed, only the auxiliary lubrication pump starts, until the pressure of the lubrication circuit reaches up certain value, when the compressor starts turning.

There is even the possibility of starting softly by means of an Static starter with variable voltage, that allows starting as a ramp; that is, starting with a very low voltage so that very high intensity peaks are not produced and then increasing the voltage while the load required to the motor is increasing. These starters also have a limit for the absorbed intensity from the power line, so that the starting peaks may always be controlled.

REGULATION of the compressor is achieved by means of a solenoid valve, a regulator or pressure switch, and unloaders, in the following way:

Except during the starting period, the compressor always operates within a pressure differential; being this differential lower the higher the receiver is.

The compressor operates loading until the air/gas pressure at the receiver reaches up the set maximum; then, the regulator/pressure switch opens the contacts that give voltage to the solenoid valve, for being this normally open (open without voltage), so that these solenoid valves when de-energized allow the regulation air act on the unloaders that then keep the suction valves open. Thus, the same air/gas suctioned will go back through the same suction valves, until the pressure at the receiver is reduced down to the value set at the regulator/pressure switch. Then, the coil of the solenoid valve shall be again energized and will cut the regulation air supply, emptying to atmosphere the regulation air remaining on the unloaders, being then these free to start loading and compressing again.

4. OPERATION

4.2. OPERATION OF THE EQUIPMENT (cont.)

If the compressor runs idling during a previously set time, it stops remaining in automatic; thus, whenever the pressure goes down to a minimum value, the compressor will start automatically. The compressor is physically stop, but its operating cycle not; so, should be needed to stop that cycle, then the stop push-button must be pressed.

In case there is a failure in the voltage supply during the working cycle, the compressor will automatically leave that cycle, remaining in a stop condition even if the power is back; so, it is necessary to press the start push-button in order to start again with the cycle.

4. OPERATION

4.3. STARTING AND STOPPING

STARTING

- In the compressors with lubricated cylinders, release the plug of the lubricator and handgive some turns by means of the handle as the compressor is starts. Then, remove the handle and plug it back.
- In case that maintenance work has been performed, or should the compressor have been stop for a long time, some turns must be applied by hand in order to make sure that there is no mechanical interference inside. All this procedure must be carried out with the main electric switch disconnected.
- In the event of a prolonged stoppage and where it is necessary to start the compressor and dryer under sub-zero temperatures, first start the dryer manually for half an hour before running the compressor.
- Check that there is oil enough in the crankcase. Its level must be between the two limits of the dipstick. Fill up if necessary.
- Should the compressor be watercooled, in case of having emptied the water, it must filled up.
- Make sure that the any valve (if any) between compressor and receiver is totally open.
- Check that all protectors and filters are installed.
- Release the emergency stop and connect the main switch of the electric board.
- Press the start push-button.(This action also starts the auxiliary equipment).
- In case the machine has an auxiliary lubrication circuit, whenever the start push-button is pressed, only the auxiliary lubrication pump starts, until the pressure of the lubrication circuit reaches up certain value, when the compressor starts turning.
- Check that oil and water pressures are correct.
- In case of having thermostatic (temperature control) valves, they must be regulated at their working conditions (look at the proper sheet at the chapter of INSTRUMENTATION at this manual).
- Check that all the compressor components operate right.

STOPPING

- Press the stop push-button at the control panel.
- Open the manual drains of the coolers and the receiver.
- Whenever there is a risk of water freezing, empty the drains. Also, if the equipment is watercooled and the water is not glicolized, empty the cooling circuit opening all valves and even removing plugs from the heads.

Procedure for filling up the cooling circuit.

- Check that all water emptying valves of the cooling circuit are close.
- Should a chiller or tower be part of the equipment, check that all possible air drains of the cooling circuit are close.
- Open the water inlet valve. In case of having thermostatic valves, the by-pass for each valve must be opened in order to fill up the circuit.
- There are high water circuit drains that must be opened, carefully, to drain air and assure the correct filling of the cooling circuit.
- Should a chiller or tower be part of the equipment, drain the air of cooling circuit.



4. OPERATION

4.4. SAFETIES

The compressor equipment is furnished with the following safeties:

- In case the switchboard busbars or its electric connections are not protected against direct contacts, the electric cabinet door is provided with electric and mechanic interlocks that do not allow access if the main switch has not been previously disconnected, leaving all the electric installation downstream the main switch without power supply.
- There is a pressure transmitter or a pressure switch at the oil circuit; this instrument gives the alarm signal and performs a change in oil pump (in case this particular model of compressor includes it) and stops the machine whenever the oil pressure goes down to a set value (*).
- During the starting period, in case the equipment supplied includes an auxiliary lube pump, the compressor shall not start until the auxiliary lube pump gets the oil pressure to a certain minimum value; then the compressor will start and, in case the oil pressure does not reach the set minimum value during a certain amount of time, then the compressor shall stop automatically due to low oil pressure.
- The compressors with lubricated cylinders have a safety device against an eventual lack of oil level at the lubricator.
- There is a pressure switch at the water circuit that stops the machine whenever the water pressure goes down to a set value.
- In case of close cooling circuit, water pressure switch shall also be timed within the starting period.
- At the compressor discharge, before the aftercooler, there is a temperature switch that stops the machine whenever the temperature reaches up a set value. This way, any failure on valves or on the cooling circuit may be detected.
- Every compressor stage and the final receiver are supplied with an instant opening safety valve, with capacity enough for releasing the whole capacity produced by the compressor.
- The regulation circuit also has its own safety valve whenever it is supplied with reductor.
- Every motor is provided with a protection magnetothermal relays that stops the equipment in case there is an overload.
- The power and control electric cabinet includes an emergency stop that trips the main switch.
- In case the electric motor is provided with temperature sensors on both bearings and winding, they shall have alarm and shutdown fixed values.*
- All Gas and HP range Compressors include a piston rod drop safety, that gives an alarm signal should the piston rider bands wear out (never manipulate these sensors).
- All machines to operate in classified areas or compressing a flammable gas shall be designed complying with all the requirements of directive 94/9CE (ATEX) for ZONE II Category 3.
- The P&I Flow Diagram represents all the safety devices, as well as their features, situation and operating conditions.

* NOTE: The set point of the safety devices that had been fixed in ABC can be modified by the user within a range that had been established in ABC. This can be doing in the Tactil Panel See chapter 4.6.

4. OPERATION

4.5. CHECKING WITHIN SERVICE

COMPRESSOR

- Control the outlet pressure, specially after a long stop that might have changed the regulation pressure switch/regulator. Should it be necessary to regulate the pressure switch/regulator, look at the cooresponding chapter, in description of the instruments.
- Check pressure at the intercoolers (multi-stage compressors). In case of noticing an important change, search and correct the problem at once. The most often case is the one of leaks through valves. Check the chapter of incidences and repairs.
- Check the inlet and outlet temperatures at the coolers. In case of abnormal values, check the chapter of incidences and repairs.
- Check the oil pressure and the level. Fill up if necessary. For that, stopping the compressor is needed. Look at the LUBRICATION of the DESCRIPTION chapter.
- Check the oil temperature (only in case that it has an auxiliary lubrication system).
- Check the cooling water pressure.
- Check the automatic drains at least once a day. In case of having any doubt, look at the sheet of AUTOMATIC DRAINS of INSTRUMENTATION at the chapter of DESCRIPTION. In case of not having automatic drains or in case one of them is damaged or failing (not draining), manual drains need to be performed with no longer intervals than 15 minutes, being able to increase those periods between drains depending on the ambient temperature and humidity, as well as the amount of drained water achieved on those manual drain operations..
- Check any leak of air/gas, water and oil.
- Should any abnormal noise be heard, search for its possible reasons.
- Check the oil flow through the oil scraper rings of the distance piece. Too much oil flow means that these scraper rings are not operating properly.
- Corrective actions should be applied in case of too much air/gas leak from the packings, or whenever there is a sudden increase of these leaks.

In case the following elements are part of the equipment:

DRYER

- Check that the temperatures of the dryer system are near the values shown at the sheet of features of the DRYER. Look at the perticular Manual of Instructions of the DRYER.
- Check that the water inlet and outlet temperatures are within the right limits. The temperatures may be tested by means of the selector of the display.
- Check also the air/gas temperature and the dew-point.

AIRCOOLER

- Check the water level at the expander receiver.
- Check the water inlet and outlet temperatures by means of the selector at the control board.



5. MAINTENANCE

5.1. SAFE MAINTENANCE

COMPRESSOR

- Whenever the compressor is stopped in order to perform any maintenance work, it must be locked and "MAINTENANCE WORK IN PROGRESS" notice must be used. Make sure that there is no way of starting the compressor by accident.
- Before starting any maintenance procedure, the compressor equipment and surroundings must be clean and specially from oil.
- Before opening any compressor part, disconnect the power supply through the main switch or disconnecting it from the power supply if possible and make sure that there is no pressure inside.(that all the compressor package is completely empty and without any pressure, including the regulating vessels and circuit).
- Make sure also that the system may not pressure up again.
- Before doing any work inside the electrical cabinet, make sure with a proper meter or device that there is no electricity throughout the cabinet and the compressor electric installation, especially in case of frequency converter.
- The fact of installing the suction and discharge valves in a wrong way may lead to a great danger situation. So, read up and follow the procedure of assembly and installation of valves described in the Maintenance chapter.
- Whenever a valve is laying down on its seat, the valve screw must be outwards, so that the flat side must always be facing inside the inside of the cylinder chamber.
- Never place suction valves in discharge valve ports or vice versa, and neither put any of them upside down, as the compressor might malfunction, tripping safety valves and making the piston knock on the suction valve placed on the discharge port.
- At suction valves assembly, the unloaders must always be able to enter through the valve ports, pushing the valve plate inside. It must be checked that the plate really goes in.
- At discharge valves assembly, the unloader must not be able to enter through the valve ports.
- At discharge valves assembly, pushing the valve plate from outside by means of a thin tool, this plate must not descend anything at all.
- Whenever removing, assembling or reassembling any part, it is necessary to observe its position and numerical order.
- After any maintenance process on the compressor or in case that it had been stop for a long time, some turns must be applied on the compressor by hand, being the power supply completely desconnected, in order to make sure that there is no mechanical interference inside the machine.
- Belt guard should only be removed for replacing belts or aligning the motor compressor set; this operation must be performed with the main switch off (without power supply). Once the motor compressor set has been aligned with the new set of belts properly tensioned, then the guard or protection shall be placed back in its position.
- Future interventions for checking the belt tension and manual bar over do not require removing the belt guard. After disconnecting the power supply, these operations can be performed through the upper cover for checking the tension, and the side cover for manually bar over with the specific tool.
- Belt tensioning shall follow the recommendations of this manual of instructions
- As a general rule, maintenance must be performed fater the compressor has already been stop for several hours; that is, with cold discharge pressure vessels and piping.; in case there is no possibility to wait for that period of time, then it must be taken into account that discharge sides and valves might have temperaturas between 100 and 150°C; thus gloves and long sleeve clothing must be used for thiose maintenance operations. Hot spots are indicated with the corresponding risk decals.
- No volatile, flammable liquids may be used for cleaning the compressor.

5. MAINTENANCE

5.1. SAFE MAINTENANCE (cont.)

- Cl₄C cannot be used as a cleaning agent. Whenever and halogenated solvent is used, follow through the instructions of the manufacturer.
- During maintenance, all safeties shall be tested one by one. Never should more than one be tested at the same time. The timing for the oil during the start without auxiliary pump or for the water when the cooling is in close circuit, is not considered as a safety elimination, because this one enters automatically in a few seconds.
- It is not allowed to operate without a safety valve to protect the air circuit, not even during maintenance and neither during tests or any other possible operation.
- Safety valves must be tested at least once a year, and more often under extreme conditions. Safety valves must always be sealed to the trip pressure. In case they are not, then they must be set and sealed to the proper trip pressure
- Using an unproper lubrication oil may cause a quick damage on those compressor elements submitted to friction. Recommended oil is SAE-30-HD.
- On compressors with lubricated cylinders it is necessary to drain the oil resting inside the inlet bottles to the coolers.
- Air and gas piping on lubricated compressors and coolers must be inspected and cleaned from dirt and oil deposits that might narrow their flow section.
- Guarantee will expire completely whenever ABC non original parts are fitted.
- Periodically check the proper operation of the automatic drains by means of the manual drain valve.
- Never remove any moving part guard without having previously disconnected the machine from its power supply. This operation must be performed by qualified personnel.
- Operators shall use the proper and homologated personal protective equipment (gloves, slip shoes, clothes, masl, earplugs and/or glasses). For instance, as some gaskets are made of graphite mesh, the cut section of the mesh might produce risk of cutting hands; thus, gloves should be used. In case of requiring a ladder in order to access certain parts of the machine for maintenance, this must be stable and homologated

DRYER (in case it form part of the equipment)

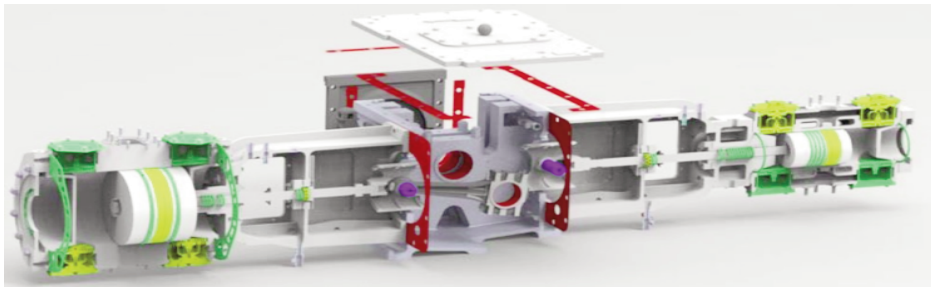
- In case the dryer stops or gets locked, contact our Maintenance Service.
- In case the air circuit gets plugged because of iceing, contact our Maintenance Service.

ELECTRICAL MAINTENANCE(must be carried out by electric specialist)

- Perform the verifications always without tension and without pressure
- Periodically check the inside of the electric cabinet in order to avoid dust acumulation, in general on electric components, strips, restraints, etc...
- Check periodically all the terminals tightenings, lamp tests, ...
- Check the mass continuity to the earth.
- In case of replacing fuses, these ones must be calibrated and must have the same features.

5. MAINTENANCE

5.2. CALENDAR OF MAINTENANCE



KIT 1 - parts to be replaced	KIT 2 - parts to be replaced	KIT 3 - parts to be replaced	KIT 4 - parts to be replaced
Set of piston rings	Set of piston rings	Carter joints set	Bush
Set of valves	Set of valves	Bearings	Bolt
Oil cartridge filter	Air cartridge filter	Coupling pins	
Joints	Joints		
Drain kits	O-rings		
O-rings	Oil scraper rings		
Packing rings	Springs		
Pressure breaker rings	Dryer cartridge filters		

KIT 1 - Jobs to be done	<p>Together with the above part replacement, the following job must be done:</p> <ul style="list-style-type: none"> - Clean electrical cabinet and retighten power screws. - Inspection and measurement of rider rings. - Verify dryer operation. Check evaporation and condensation pressures. - Coolers, verify dT between water inlet and air outlet. - Alignment and coupling review; material status, balance and displacements. <p>Taking advantage of this service, the compressor operator should change the oil of the compressor and gear box (oil to be supplied by customer).</p>
KIT 2 - Jobs to be done	Part replacement
KIT 3 - Jobs to be done	Part replacement
KIT 4 - Jobs to be done	<p>Part replacement.</p> <p>After KIT4, the machine will finish its maintenance cycle, meaning that we should start it again.</p> <p>So as to close the maintenance cycle properly ABC specialist will review the machine as a whole checking parts inside the crankcase and cylinder. General overview of auxiliary equipment; motor, dryer, cabinet, cooling system, instruments.</p>

5. MAINTENANCE

5.2. CALENDAR OF MAINTENANCE (cont.)

KITS	Year	Working days	N. Technician
1	year 1	3	1
1+2	year 2	3	1
1	year 3	3	1
1+2+3	year 4	4.5	1
1	year 5	3	1
1+2	year 6	3	1
1	year 7	3	1
1+2+3+4	year 8	5	1
1	year 9	3	1
1+2	year 10	3	1

- Whatever the operational hours are, the compressor should be visited once per year for evaluation and overhaul if necessary.
- The wearing of the parts differs from one location to another and is directly linked to the operational pattern; number of hours, time load / no load...
- For a detailed evaluation and support go to your nearest ABC support office.
- For a proper maintenance, please read and use your compressors Operational Manual. Having the P&I diagram special importance to understand the machine working logic and parameters.

CRITICAL OPERATIONAL ACTIVITIES. THIS JOB MUST BE DONE BY THE MACHINE OPERATOR BEING STRICT ON THE TIMING AND PROCEDURE:

- Daily Job = Verify operational values and keep an historical record. See in this file a Data Template + Verify the drains operation.
- Clean air-filter (in clean enviroment this could be extended to 2.000 hours).
- Lubrication of main motor bearings = to be done according to the motor plate indications. This is a critical part of the operational maintenance to be done on time, with the right quantity and type of grease. For details check the manual or contact your ABC support.
- After first 500 hours of operation, oil change in the gear box.

5. MAINTENANCE

5.2. CALENDAR OF MAINTENANCE (cont.)

Part list compressor model HORIZON 400 - 500							
Q	COD	DESCRIPTION	KIT 1	KIT 2	KIT 3	KIT 4	SECURITY KIT
2	8165660	Piston ring 1°	2	-	-	-	-
2	8127124	Rider ring 1°	-	2	-	-	-
4	8117505	Piston ring 2°	4	-	-	-	-
2	8715713	Rider ring 2°	-	2	-	-	-
7	8192791	Piston ring 3°	7	-	-	-	-
2	8707053	Rider ring 3°	-	2	-	-	-
4	8242618	Suction valve 1°	1	3	-	-	1
4	8856890	Exhaust valve 1°	1	3	-	-	1
1	8236646	Suction valve 2°	1	-	-	-	1
1	8943690	Exhaust valve 2°	1	-	-	-	1
1	8813694	Suction valve 3°	1	-	-	-	1
1	8180150	Exhaust valve 3°	1	-	-	-	1
16	8219298	Packing ring	16	-	-	-	-
1	8262706	Joints set - Cyl.	1	-	-	-	-
1	8999938	Joints set - Cyl.	1	-	-	-	-
1	8275441	Joints set - Cyl.	1	-	-	-	-
1	8187172	Joints set - Carter	-	-	1	-	-
1	8044086	Air cartridge filter	-	1	-	-	-
1	8553605	Oil cartridge filter	1	-	-	-	-
6	8659779	Joint	6	-	-	-	2
6	8379401	Joint	6	-	-	-	2
2	8267435	Oil scraper ring	1	1	-	-	-
4	8620240	Membrane	4	-	-	-	-
5	8070392	Spring	-	5	-	-	-
2	8537984	Grid	2	-	-	-	-
1	8720244	Spring	-	1	-	-	-
2	8489011	Ring 85X5	2	-	-	-	-
2	8329636	Ring AN-21	-	2	-	-	-
2	8212527	Ring AN-8	-	2	-	-	-
1	8537984	Drain Kit	1	-	-	-	-
3	8109301	Drain Kit	3	-	-	-	-
1	8425191	Cartridge filter	-	1	-	-	-
1	8254952	Coupling pins WHEEL	-	-	1	-	-
1	8090939	Coupling pins MOTOR	-	-	1	-	-
3	8176252	Bearing	-	-	3	-	-
2	8447674	Bearing	-	-	2	-	-
2	8645127	Bush	-	-	-	2	-
2	8134064	Bolt	-	-	-	2	-



5. MAINTENANCE

5.4. COOLING CIRCUIT

Cooling circuits need to be treated properly, with expert guidance, in order to avoid eventual biological developments, calcareous deposits, or other pernicious effects for the equipment and people.

In case the water circuit is emptied, make sure that power supply is disconnected.

Should it be observed that the air/gas outlet temperature from a cooler is 20°C higher than the water inlet temp, it might be because water flow is below requirement; in that case, water temperature at cooler outlet shall be high, or might be because the cooler is dirty, so that water would hardly warm up through the cooler when the compressor is working at his nominal conditions.

Depending on the dirt being either mud or lime, both caused by a bad quality of the water, the cleaning procedure is different.

Both process are equally valid for the cylinder water chambers, piping of the cooling circuit, oil cooler,

NOTE: In circuits where hard water is being used (big rate of lime) it is recommended to use close circuits (close vaporation cooling tower or radiator), and not to use open vaporation cooling towers.

In case of MUD:

- Empty the and clean water circuit (cylinders, piping, coolers, radiator or tower, etc...).
- Open the cylinder water covers and clean mud from the cooling chambers.
- Remove the tube bundle of the cooler, having previously emptied it of water.
- Apply pressure water blasting against the tube sheaf.
- Install bundles and cylinder covers, closing water circuit, but leaving compressor return water exit open after passing through Dry cooler or Tower.
- Assemble tubular bundles and cylinder covers, closing the water circuit, but leaving the water outlet back to compressor open downstream the radiator or cooling tower.
- Fill the compressor water circuit up with clean water, removing the dirty one. Keep this operation until only clean water gets out from the circuit. Water is recommended to be treated against bacteria and mud development.

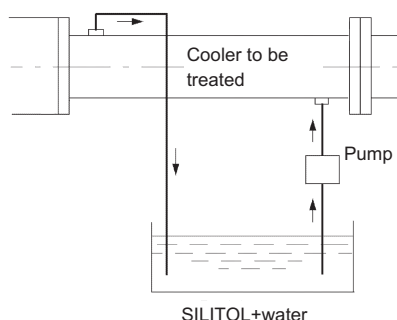
5. MAINTENANCE

5.4. COOLERS (cont.)

In case of LIME:

- * Empty the water from the cooler.
- * Without dismounting the cooler, remove its water inlet and outlet connections.
- * Connect those inlet and outlet to an scaling circuit, for instance SILITOL, and make it flow for about 5 hours, following the procedure annex.

HOW TO USE THE "SILITOL" SCALING.



The SILITOL must always be used mixing it with 2 or 3 parts of water (depending on the hardness of the scale).

It shall not be used on Zn or galvanized surfaces.

After scaling, the treated item must be washed with clean water, even better if it is pressurized.

Preparation

- 1.- Prepare a wooden, rubber, plastic,..., receiver except zinked or galvanized, and put the proper amount of water in order to establish a flow through the circuit to be scaled, as indicated annex, remaining some amount at the receiver, so that it may be suctioned by the pump that, later, will perform the circulation.
- 2.- Suction the liquid with the proper pump and introduce it in the place to scale so that it makes the lap and goes back to the vessel, in order to be able to check that the way is perfect and there is no leak.
- 3.- Knowing previously that the circulation is perfect, empty completely the vessel and carry out the scaling.

Scaling

- 1.- Prepare a mixture based on a part of SILITOL and 2 or 3 parts of water (depending on the composition of the scale) at the vessel and suction it by means of the pump, so that it is introduced in the circuit to be scaled and it goes back to the vessel.
- 2.- The introduced mixture shall flow in for about four or five hours. After this period of time, a normal scale produced by the water should have disappeared totally. This depends on the volume to be scaled.
- 3.- After the latter operation, where it shall be noted that the treated item is scaled for not reacting with the introduced mixture (pouring some drops to the floor it might be seen whether it reacts or not), empty it completely and wash it with clean water, following the same procedure for 15 minutes, finishing so this operation. This washing may also be carried out with a solution of 2% Sovay Soda in order to disappear the acidity of the treated item and also the one of the pump used for the circulation.

5. MAINTENANCE

5.4. COOLERS (cont.)

Scaling

- 4.- It may happen that there is a plug, what might be found out when circulating only water and even it may have been formed due to any scale waste that after separating has stopped, while the mixture was flowing, plugging it way. In that case, that may easily happen in small diameter pipes scaling, the mixture must be introduced pressurized.
- 5.- It may also happen that due to too much scaling and small volume, the prepared mixture had been reduced and consequently more product must be added to the vessel where the mixture is suctioned in order to make the circulation.

Technical features of the scaling product "SILITOL"

Technical name:	Pasivated clorhidric acid
Commercial name:	SILITOL
Chemical formula:	CLH + H ₂ O
Molecular weight:	36.5
Concentration:	20 %

Physical and chemical features of the "SILITOL"

Colour:	Transparent blue-green
Density:	1.10-1.11
Impurities:	Organic waste, free from arsenic or other metals.

Cautions

The Pasivating process does not lead to any change in the chemical risk, so the cautions to take in order to handle are the same as with the CLH. It attacks to human skin and mucous membranes. Therefore, it is recommended to use the same protection devices as for the CLH, as glasses, rubber gloves, rubber boots, etc...

Should the substance get in the eyes, wash them immediately with lots of water for about 15 minutes, at least. In case it gets in contact with the skin, wash it also with water for 15 minutes.

In case that the tubular bundle has any stainless steel part, then some liquid inhibitor must be added to the diluted CLH, in a proper rate.

As an example, "LITHSOLVENT 620", by KRAFF, may be used, in a rate of 2,5 kgs of inhibitor in 1000 litres of diluted acid.

NOTE: Continued and habitual use of this descaling process may damage the tubular bundles and gaskets of the coolers. Thus, they should be inspected and revised annually at least, removing them from the cooler shell and changing the gaskets. Any symptoms of deterioration (chopped baffles, tube narrowing, poor visual appearance, pitting on cooling tubes, loss of tube thickness, etc...) that might raise questions about their integrity, should lead to substitute them by new ones.

5. MAINTENANCE

5.5. FILTERS

FILTER	FREQUENCY	MATERIAL	MAINTENANCE
SUCTION FILTER	1000 HOURS	MIOVYL	Clean or change in case of damage. <ul style="list-style-type: none">- Stop the compressor.- Remove the filter flange with a spanner.- Release the clips of the filter cover.- Remove the filter element.- Blow out with compressed air. It is recommended to use protection glasses.- Clean with Tricloroethylene.- Blow out again with compressed air.- Put the filter element on its place.- Close the clips of the cover..- Tighten the filter flange to the cylinder.
OIL PREFILTER	8000 HOURS	METAL GRID	Clean. <ul style="list-style-type: none">- Stop the compressor.- Release the plug with a tool.- Remove the filter element.- Blow out with compressed air. It is recommended to use protection glasses.- Put the filter element on its place.- Place the plug and tighten with a tool.
OIL FILTER	8000 HOURS	PAPER	Change. <ul style="list-style-type: none">- Stop the compressor.- Unscrew the filter cartridge..- Change the cartridge by a new one.
REGULATION FILTER	8000 HOURS	SINTERICED BRASS	Clean. <ul style="list-style-type: none">- Use a compressor stop.- Make sure that there is no pressure at the filter by means of the manual drain.- Release the cup by hand.- Remove by hand the filter element.- Blow out with compressed air. It is recommended to use protection glasses.- Place the filter element on its position.- Place the cup on its position.

5. MAINTENANCE

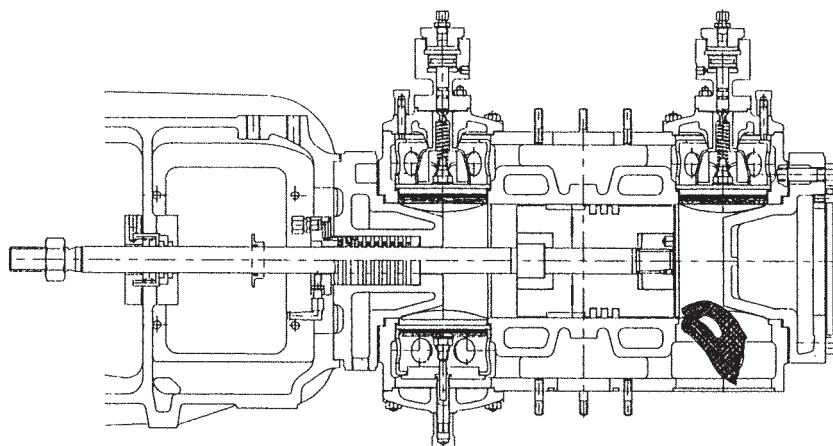
5.6. RINGS

(OIL-FREE COMPRESSORS ONLY)

The bearing rings are the ones to support the piston weight on the cylinder.

It is very important to care for its right maintenance, because in case the ring wears more than the set limit as parameter "H" at the table of the Manual of Instructions, this piston may scrape the cylinder surface and cause a very great mechanical damage.

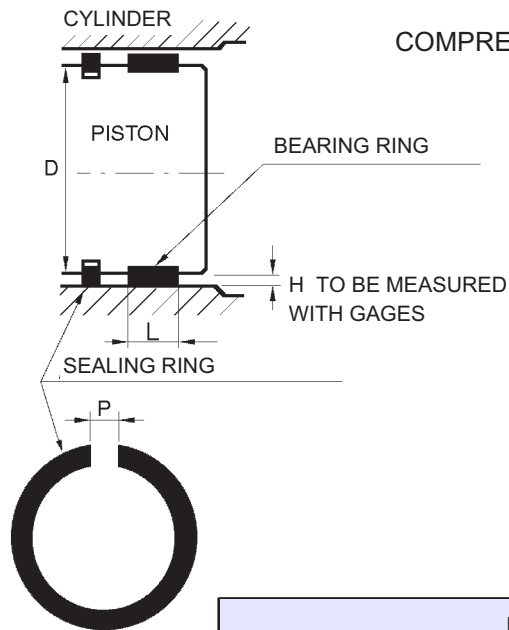
In order to perform the measurement of the parameter "H" with proper frequency, follow the next procedure:



NOTE: The cylinder represented may not correspond to any cylinder of this compressor.

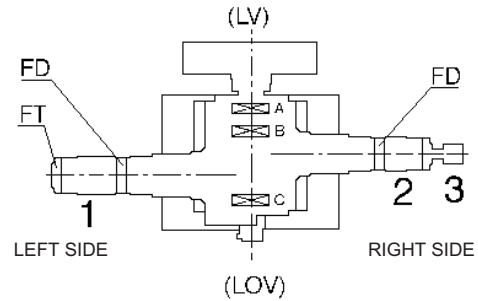
- 1.- Being the compressor properly stop, take the proper care so that there is no way for the machine to start while the measurement is taking place. Before starting, make sure that the machine has been at resting for half an hour at least; so that any possible burning due to touching hot surfaces is avoided, and also in order not to have any mistake at measuring because of possible dilatations of the material.
- 2.- Take a valve from the lower outer part of the cylinder out following the procedure shown at this Manual of Instructions.
- 3.- While a person is making the drive turn following the PROCEDURE FOR MANUAL TURNING OF THE COMPRESSOR of this Manual, another person looks through the dismounted valve housing when the piston is at a good position to introduce the feelers, without introducing yet anything inside the cylinder in order to prevent any accident.
- 4.- Being the transmission completely stop, introduce the corresponding feelers through the valve casing, taking care not to mark on the cylinder.
- 5.- Once it has been determined the proper feeler size, note the value measured at the corresponding sheet of the Manual.
- 6.- Fit back the valve.
- 7.- Give some turns to the whole equipment without voltage following the PROCEDURE FOR MANUAL TURNING THE COMPRESSOR in order to make sure that there is no mechanical interference.

CONTROL SHEET



COMPRESSOR TYPE : **HORIZON 400 / 500**

N° :



PERIODIC CONTROL OF H.

SIT.	TYPE	Ø CYL	DATE HOURS				H MINIMUM ALLOWED
1		250					0,35 MM
2		175					0,35 MM
3		85					*
4							
5							
6							

*Please replace both piston rider rings as one of them reaches the minimum allowed 0.35 mm.

V.B°

	P - MINIMUM ALLOWABLE GAP	P - MAXIMUM ALLOWABLE GAP
SEALING RING Ø 250	5 MM	20 MM
SEALING RING Ø 175T	4 MM	14 MM
SEALING RING Ø 85T	2 MM	9.2 MM



5. MAINTENANCE

5.7. LUBRICATION

All operations of removal or addition of oil must be performed with the compressor stop. The use of a wrong oil may cause a quick damage on all those parts submitted to friction. Recommended oil is : **SAE-30-HD**.

Frequency of the maintenance operations for lubrication:

DAILY

- Check that oil level on the crankcase is between max. and min. limits. In case of oil lubricated cylinders, fill up the receiver of the lubricator.
- Check that the oil pressure gauge shows about 2 Bar. If not, oil pressure pump can be regulated acting on its regulation screw, as indicated at the chapter of LUBRICATION at the description of this Manual.. It must be taken into account that nominal pressure shall not be reached at the circuit until the machine is hot enough.

ANNUALLY

- Empty completely the crankcase oil.
- Clean the crankcase thoroughly with a clean clothe, through a visit cover.
- Fill up with new oil up to the maximum level sign.
- Change the oil filter and clean the metal prefilter.

NOTES:

- 1.- *It is normal that as time goes by, oil passes from the crankcase to the distance piece through the scraper rings, remaining at the lower part. This oil may be recovered through the valve installed at the lower part of the distance piece and so it may be put back in the crankcase, having previously filtered it.*
- 2 - *It must be taken into account that refused oil is not allowed to eliminate free, as it is necessary to comply with the local laws about industrial waste.*

5.8. PROCEDURE FOR MANUAL TURNING OF COMPRESSOR

- First of all, make sure that the machine has not any voltage.
- The compressor must not have any pressure inside, neither in the regulation circuit.
- Remove the coupling guard.
- Insert a bar radially through one of the orifices of the flywheel.
- Make the flywheel turn.

TIGHTENING TORQUES - HA-HP COMPRESSORS

Connecting rod small end pin HA (M20) = 32 kgxm
 Crankshaft bearing bolt HA (M20) = 17 kgxm
 Crosshead guide nut HA (M14) = 14 kgxm
 Crankcase - Distance piece nut HA (M16) = 17 kgxm

Connecting rod small end pin HP (M27) = 45 kgxm
 Crankshaft bearing bolt HP (M27) = 33 kgxm
 Crosshead guide nut HP (M16) = 17 kgxm
 Countbalance HA (M14) = 13 kgxm
 Countbalance HP (M20) = 38 kgxm

<u>HA CYLINDERS</u>	50C- 60C mm kgxm	75C mm kgxm	75 mm kgxm	95-105 mm kgxm	105C mm kgxm	115 mm kgxm	115C mm kgxm	125 mm kgxm
Back head nut	M20 22	M20 22	M16 17	M16 11	M16 17	M16 11	M16 17	M16 17
Front head nut	M20 22	M20 22	M 16 17	M16 11	M16 17	M16 17	M16 17	M16 17
Valve cover nut	M27 45	M27 45	M20 22	M18 17	M18 17	M18 17	M18 17	M18 17
Packing nut		M16 17	M10 5		M16 17		M16 17	

<u>HA CYLINDERS</u>	140 mm kgxm	160 mm kgxm	185 mm kgxm	250 mm kgxm	280 mm kgxm	310 mm kgxm
Back head nut	M16 11	M16 17	M16 17	M16 17	M16 17	M16 17
Front head nut	M16 17	M16 17	M16 17	M16 17	M16 17	M16 17
Valve cover nut	M12 7	M10 5	M10 5	M10 3	M10 3	M10 3
Packing nut	M10 5	M10 5	M10 5	M10 5	M10 5	M10 5

<u>HP CYLINDERS</u>	145 mm kgxm	175 mm kgxm	210/ 230 mm kgxm	280/300 mm kgxm	370 mm kgxm	450 mm kgxm	580 mm kgxm
Back head nut	M18 11	M16 11	M16 11	M18 11	M30 55	M16 17	M30 55
Front head nut	M18 17	M16 17	M16 17	M18 17	M30 55	M16 17	M30 55
Valve cover nut	M12 7	M12 7	M12 8	M14 11	M12 7	M16 11	M12 7
Packing nut	M16 17	M16 17	M16 17	M16 17	M16 17	M16 17	M16 17

Note: These values are general; there might be a different particular case.

Note: 1 kgxm = 9.8 Nxm

6. INCIDENTS AND REPAIRS

RUNNING INCIDENTS

a) *The oil pressure is not constant, the pressure gauge pointer oscillates :*

- Check the oil level in the crankcase.
- Clean filter .
- Check that there is not air inlet in the suction pipe (joint, connection).
- Check that the safety valve is not kept open by a foreign element.

b) *The pressure gauge pointer of the oil pressure remains at zero:*

- If the compressor has been idle for a long time, it is sometimes necessary to prime the pump again.
- Check the oil level.
- Make sure that the pressure gauge is not blocked up.
- Check the pressure gauge and its tap.

c) *The output of the compressor has decreased:*

- Check whether there is a leak on the pipes or on the valve covers.
- See that the valves are in good conditions. In normal running, the valve covers must have the same temperature that the cylinder walls. When they are hot, it is the result either of a broken valve or of a governing piston blocked in the no-load position.
- Check that the inlet filter/s are not obstructed; clean them if necessary.

Note: Before incriminating the compressor, check that the output necessary to the installation has not incidentally increased (pipe leak, tools or screw jack in bad conditions, open taps along the circuit etc..)

d) *The pressure increases in the receiver, the regulator/pressure switch being released:*

- Check whether there is a leak on the regulator pipes.
- Check the membranes or O-Rings of the governing pistons.
- Clarify also that the governing pistons are not blocked up in the running position.

e) *The valves are noisy:*

- Verify that the valves are not held on their seat, and that the valve boxes are well set. A valve which beats on its seat will rapidly deteriorate. That parts might break and provoke serious accidents.

f) *The pressure decreases in a intercooler: (Multi-stage compressors)*

- When the compressor is on load, check the suction and discharge valves of the same stage.
- When the compressor is unloaded, check the discharge valves of the same stage and the unloading device of the suction valves of the following stage.

g) *The pressure increases in a intercooler: (Multi-stage compressors)*

- When the compressor is on load, check the suction and discharge valves of the following stage.
- When the compressor is unloaded, check the discharge valves of the following stage and the unloading devices of the suction valves of the same stage.



6. INCIDENTS AND REPAIRS

RUNNING INCIDENTS (cont.)

f) The compressor knocks :

- Try to determine if the knocking comes from the crankcase or from the cylinders.

For the crankcase

- Take off the inspection door/s at the upper part of the crankcase, and check the big end bolts are not loose.
- Check with a lever that the bearings of connecting-rod big-end do not work with too much clearance.
- Take off the inspection doors of the distance pieces and check the clearance of cross-head and small-end bearing axis.

For the cylinders

- After finding which cylinder knocks, control the tightening of the piston rod and the lock-nut on the cross-head . Check the clearance spaces front and back of the piston.
- Check that no other element (welding particles, fragments of valves etc . .) is placed between the cylinder bottom and the piston.

i) Water or air leaks from the orifice of the floating plate.

- Water leaking means that the shell side o-ring is damaged, and it must be consequently replaced as soon as possible.
- Air leaking means that the pressure vessel side o-ring is damaged, and it must be consequently replaced as soon as possible.
- More clarifications might be found on the corresponding chapter of this manual of instructions, explaining also how to replace those gaskets.

j) On compressor start-up, the master switch has tripped and has also been damaged

- Check there is no capacitor bank running on the power supply the compressor is connected to. If there is, it must be disconnected during compressor start-up (see section 1.3 of the manual).

In case of any incidents not mentioned in this section, if you should require any clarifications or if the recommendations given do not solve the problem, please contact the Technical Assistance Service.

7. SAFETY

7.1. SAFETY BASIC PRECAUTIONS

- Besides the safety precautions of the different chapters of this manual of instructions, the following safety rules are set and reminded:
- Never make the compressor operate above its nominal conditions, shown at the chapter of TECHNICAL CHARACTERISTICS, as it may then be submitted to loads that it has not been designed to resist for.
- Take care that the area around the compressor is clean and free from obstacles.
 - Clean any water or oil leak soon, and eliminate the reason for the leak.
 - Keep the access to the machine free from tools, oil vessels, clothes or any other possible obstacle.
- Never perform any cleaning near moving parts.
- Should the compressor be watercooled and in case that for any reason it works without water, producing overheating on cylinders, never put water in the cooling circuit before the cylinders are cool enough. Introducing cold water may lead to their break.
- Never disconnect a safety and do not allow the machine to operate unprotected.
- Do not tighten bolts, nuts or screws of cylinders and pressure vessels unless the compressor is completely stop and that the equipment to be fastened are not under pressure
- In case of fire on motor, do not use water, use CO2.
- Before starting up the compressor, it is necessary to check the proper installation of the Relief Valves.
- Whenever the compressor is supplied loose, without motor and/or electric board, ABC is not including the Relief Valves in its supply, so these Safety Valves must be installed by the customer.
- Do never install a valve between the equipment to be protected from the overpressure and its safety valve.
- Safety valves must be tested once a year at least (checking that the set pressure corresponds to the trip one), and more often in extreme conditions.
- Do not break the timber-seal of the safety valves, as this may lead to a very dangerous situation.
- If a Safety Valve triggers during compressor operation, immediately stop the compressor and do not restart until you have established and resolved the cause.
- Never obstruct or plug safety valves
- Safety valves are not intended to work as pressure controlling valves; that means that the compressor regulation cannot be carried out tripping the safety valves.
- Compressor must not be started without the protectors of the moving parts.
- In case of abnormal vibration or noise levels, stop the compressor.
- It is not allowed to use volatile, flammable liquids for cleaning the compressor.

7. SAFETY

- Cl4C cannot be used as cleaning agent. Follow the instructions of the manufacturer when using an halogenated solvent.
- When the compressor is stopped for maintenance purposes, it must be disconnected from the power supply, it must be locked as much as possible, and the "MAINTENANCE WORK IN PROGRESS" notice must be used. Put the notice next to the main switch or its corresponding symbol in a conspicuous place of the electric cabinet, so that there is no way of starting the compressor by accident.
- Before access to any compressor moving part, make sure that the power supply main switch is disconnected, because there is a stand-by function where the machine might be ready to start, that might make the compressor start automatically should the discharge pressure go down to a set value (energy saving function) and that might lead to serious accidents or even death.
It may be observed at the electric cabinet whether the compressor is stand-by (ready to start) or not.
- The fact of installing wrong the suction and discharge valves may lead to a very dangerous situation. So, the Procedure for Assembling the valves on the Maintenance chapter of this Manual must be read and followed.
- After any maintenance process on the compressor or in case that it had been stop for a long time, some turns must be applied on the compressor by hand (following the manual bar over procedure), beeing the power supply completely desconnected, in order to make sure that there is no mechanical interference inside the machine.
- Never put a valve or other obstacle after the condensate drain collector that could generate pressure inside.
- Whenever there is risk of freezing and the compressor is stop, make sure that the drains have been manually drained. Empty the cooling circuit opening all the valves and even removing the plugs from the cylinder heads, or glycolize the circuit in the proper rate in order to avoid the freezing temperature.
- Whenever the water cooling system is using a vaporation cooling tower, it is recommended to consult an specialist in water treatment, in order to prevent and avoid the risks that are detailed in the Manual of the tower itself.
- The use of a wrong lubricating oil may lead to a quick damage on those elements of the compressor submitted to friction. Recommended oil: SAE-30-HD, wher this can not be obtained please consult compressor manufacturer.
- For lubricated cylinder compressors, keeping the filters in good shape and using the recommended oil help slowing down the speed of creation of carbon deposits.
- Our equipment has one or several earth connections, that eed to be connected to the installation site ground net, or to an independent ground with a resistance value lower than 10 Ω .
- In case the compressor is supplied with electric board, this must include a protection system against indirect contact (differential switch) and a main switch against shortcircuits or overloads (magnetothermic switch). If not, the equipment must be connected to an electric board that includes these two protection devices.
- Easy combustible or flammable substances shall not be stored near the compressor, such as lubricants, petrol, solvents, waste, etc... Besides, whenever the equipment is supplied without aftercooler, it is necessary that the outlet pipe may expand freely and not being in contact with flammable materials.
- Guarantee will expire completely whenever ABC non original parts are fitted.
- These instructions have been prepared based on the informations available so far, not guaranteing that the content is enough for all possible events and situations. Compliance with these instructions does not exclude from fulfilling the local Regulations.

7. SAFETY

7.2.- REMAINING DANGER

- Hot surfaces: The compressor has hot surfaces that may be classified as as dangerous points (over 70°C).

During operation, these points are cylinders and inlet bottles to the coolers, as well as the discharge manifolds (if any).

During maintenance, besides, in case the compressor is not left cooling down, there are other hot points, such as: Piston rods (packing part), oil (change), discharge valves, etc..








- Voltage inside the electric board, unless the user has an electric switch upstream our electric cabinet and it is used to disconnect the power supply, always there will be voltage on the supply (inlet) side of our cabinet. .
- Turning parts areas have been protected depending on the risk and the possibility of any accident to take place, but in case that parts or tools fall at dangerous zones, it is absolutely forbidden to try to pick them up without stopping the compressor.
- Ready to start: it is a function to save energy. It stops automatically the compressor after a preset time idling, due to no demand from the consumption; but it would start automatically should the demand downstream be restored. Consequently, the compressor might automatically start unexpectedly (this situation is signaled at our electrical cabinet). Therefore, never should be allowed any access to the mechanical parts of the compressor, specially having removed the guards and protectors, unless the main switch has been disconnected (off position).

7.3.- ADVISE AGAINST WRONG USE

- Never operate at higher pressure than the nominal one. This can be found at the chapter of Technical Characteristics.
- Never plug the compensation tank breathing connection.
- Never operate without the protectors of the moving parts on.
- The suction filter must be fitted in order to avoid any possible suction of clothes.
- Never operate without the safety valves. In case of dismantling any safety valve for checking or repairing it, another one must compulsorily be fitted before starting back operation.
- This compressor is not built for classied area.
- This compressor is only valid for compressing air; so it is not allowed to operate with gases, specially if these are flammable, toxic or corrosive.
- The compressor must not operate with any bypassed securities (air/gas, water, oil).
- Always apply the periodic maintenance checks described in this manual, as well as the local legal inspections.

7. SAFETY

7.4. SAFETY SYMBOLS

	It is compulsory that any people that may have any relation with the machine reads this Manual of Instructions.
	Warning: This equipment has remote control and may be started unexpectedly.
	Warning: Do not touch. Hot surface.
	Warning: Maintenance work in progress.
	Warning: Do not touch. Very cold surface.
	Warning: Electrical hazard.
	Holding point for lifting the equipment.

8. GUARANTEE CONDITIONS

ABC offers a guarantee for its production of one year starting from the date of sale of the compressor.

Any part or element which is observed to be defective, will be replaced or repaired according to the manufacturer's criterium, in the factory.

In the case of unauthorized manipulation by the user, incorrect or faulty use, failure to abide by the norms dictated in this manual, or in the case of mounting or installing parts which are not original ABC parts, this guarantee will automatically and completely lose all its validity, not being ABC responsible for any possible damage generated thereof.

The user must send defective parts or elements, carriage freight and duties paid, to the supplier's factory where the ABC verification department will decide whether the part or element will be replaced or not. All parts or elements sent carriage freights or duties due to the supplier's factory, will be rejected and no technical judgement will be passed on the parts or elements in these cases.

Complaints must be directed to the supplier's factory or to the authorized services immediately after the damage has been observed. In the case of a service being carried out by the supplier or by the technical assistance service, the basic factory payment rates, will be charged to the customer's account.



