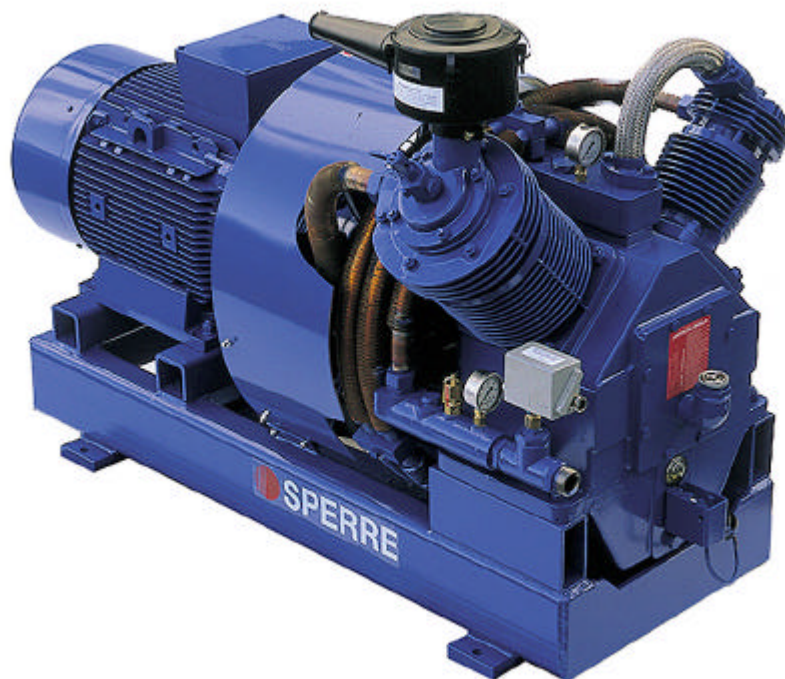




# INSTRUCTION MANUAL

## AIR COMPRESSOR HL2/160



# GB

## *INSTRUCTION MANUAL*

### *FOR AIR-COOLED AIR COMPRESSOR HL2/160*

#### **IMPORTANT**

The following information must be given when ordering spares:

- (A) Compressor type, HL2/160
- (B) Compressor number, e.g. 160007
- (C) Quantity, description and parts number of the spares required

(A) and (B) are stamped on the compressor rating plate which is fixed to the side of the crankcase and (C) will be found in the spare parts list at the back of this instruction book.

SPERRE INDUSTRI AS reserves the right to amend technical specifications without prior notice and disclaims all legal liability in connection such amendments.

#### ***PERSONAL SAFETY***

**Whenever work is to be carried out on the compressor, the electric current must be switched off, and the compressed air delivery pipe valve must be closed.**

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## ***GENERAL DESCRIPTION***

This is a two-stage 90° vee compressor. Cylinders and compressed air coolers are air-cooled. Supply pressure is determined by adjusting the safety valve.

Cooling air is supplied by a well-dimensioned fan.

The compressor and motor are normally supplied mounted together on a strong bedplate. The compressor and motor are connected by means of a heavy duty flexible coupling.

All the materials used are of first class quality, thoroughly tested and in accordance with the requirements of the classification societies.

Instrumentation is supplied in accordance with classification society requirements and if desired the compressor can be fitted with equipment for fully automatic operation.

Bearings and cylinder walls are splashlubricated. The oily level in the sump can be checked through a sight glass. An automatic low oil level alarm can be supplied as an optional extra.

The compressors is normally supplied without a relief mechanism for the L.P. cylinder suction valve. However, a relief mechanism can be ordered from SPERRE if required.

The compressor set can be supplied either for bolting direct to the foundation or for flexible installation by means of resilient mountings fitted under the bedplate.

## ***INSTALLATION***

When the compressor is to be installed it is of the greatest importance to ensure that no distortion of the bedplate occurs. The compressor and motor are normally supplied ready-fitted to the bedplate. In cases where the motor is installed separately, alignment must be carried out with great care

Alignment should be carried out as follows:

1. Use vernier callipers or inside micrometer callipers to check that the distance between the coupling halves is equal around the whole circumference. The distance between the coupling halves should be  $37 \pm 1$  mm.
2. When angular alignment has been checked as described above, check for parallel displacement, using a dial gauge mounted on a magnetic base. Measure parallel displacement around the circumference. Displacement must not exceed  $\pm 0,07$  mm

In order to ensure trouble-free operation it is important that the foundation should be well stiffened and free from vibrations from other installed machinery. This applies to rigid mounting and flexible mounting alike.

A well-dimensioned fresh air duct must be provided to the location where the compressor is to be installed. The mouth of the duct should be as close as practically possible to the suction side of the cooling fan. The ambient temperature should not exceed 45°C.

In principle the pipe from the compressor to the air reservoir should be arranged as shown in the installation diagram supplied with the compressor. A non-return valve of strong construction and offering little air resistance should be installed after the compressor.

If the compressor set is installed with resilient mountings, a flexible connection (hose) must be installed in the compressor air supply line after the compressor. A water/oil separator should be fitted at some distance from the compressor, and so arranged that the line slopes downwards from the compressor to the separator. This will prevent condensate from damaging valves and cylinders.

It is recommended to provide the water separator with manual and automatic draining. Equipment for automatic draining is available as an optional extra.

If the pipe from compressor to reservoir is longer than about 10 metres the dimensions shown in the installation diagram supplied with compressor should be somewhat increased to ensure the lowest possible air resistance.

Care should be taken to arrange the piping so that condensate cannot collect in pockets.

All piping must be well clamped and free from vibration.

## ***STARTING UP***

Before initial starting up and after long periods out of use, carry out the following operations in the sequence given:

1. Check out the oil level (sight glass).
2. If the unit has been unused for more than 6 months, remove valves and lubricate cylinder walls.
3. Turn over the compressor by hand.
4. Open air line cocks and start the unit.
5. Check that all components are running normally. Inspect instruments, check and repair any leaks.

## ***OPERATION***

During operation, pressures and temperatures must be within the given limits. Any deviation is abnormal and its cause should be ascertained by means of the fault tracing chart. In the case of pressure or temperature deviations it is recommended first to check the values with new thermometers and pressure gauges in order to ensure that the fault is not to be found in the instruments.

## ***STOPPING***

No special adjustments or the like are required before stopping the compressor.

If the compressor is to remain unused for a long period, lubricate valves and cylinder walls with oil. The compressor should be turned over from time to time.

## ***MAINTENANCE - OVERHAUL - REPAIRS***

Only ORIGINAL SPERRE REPLACEMENT PARTS must be used in connection with overhauls and repairs. Before ordering spare parts, please read the instructions given on page 1.

### ***Valves***

#### ***L.P. Valve***

To dismantle the valve, proceed as follows:

1. Loosen pipe connections.
2. Loosen and remove cylinder head.

Valve overhaul: Release the lock at the top of the valve, loosen the nuts and carefully split the valve in two. Note the location of the parts, so that they can be correctly refitted.

Clean the valves, carbon deposits can best be removed by means of a good solvent, carbon remover or the like, then flush with water.

#### ***H.P. Valve***

To dismantle the valve, proceed as follows:

1. Loosen pipe connections.
2. Loosen cylinder head nuts and lift off cylinder head.
3. Now lift the valve out of the cylinder.

**IMPORTANT!** SEALING SURFACES MUST NOT BE SCRAPED WITH SHARP TOOLS: USE A WIRE BRUSH IF NECESSARY.

Worn and damaged parts and gaskets should be replaced. Valve assembly sequence is the opposite of the above.

Clean the valve in the same way as the L.P. valve. Assembly sequence is the opposite of the above

**IMPORTANT!** ONLY ORIGINAL SPERRE COPPER RINGS MUST BE USED AS VALVE SEATING GASKETS. EXACT DIMENSIONS AND CORRECT HARDNESS IS OF DECISIVE IMPORTANCE FOR GOOD OPERATING RESULTS.

Cylinder head nuts should be tightened a little at a time, in sequence, to avoid torsional strain on the valve.

### ***Piston and Connection Rod***

The procedure for dismantling and assembling the piston and connecting rod is as follows:

1. Loosen and remove the cylinder head.
2. Remove the crankcase cover from the crankcase and take off the locking plate at the end of the crankpin.
3. Loosen the cylinder from the crankcase.
4. Turn the crankshaft until the piston is at T.D:C.
5. Lift the cylinder and piston clear of the stud bolt. The connecting rod can now be pushed off the crankpin.
6. Pull the piston out of the bottom of the cylinder.

Assembly sequence is the opposite of the above.

### ***Bearings - Dismantling and Assembly***

Work on bearings requires great care and scrupulous cleanliness.

### ***Crankshaft Bearings***

These are needle bearings.

#### **IMPORTANT!**

WORN OR DAMAGED CRANKSHAFT BEARINGS MUST BE REPLACED COMPLETE. REPLACEMENT OF PARTS OF THE BEARINGS IS NOT SATISFACTORY. BEARINGS DISMANTELED FROM SHAFT AND/OR CONNECTINGS ROD MUST ALWAYS BE REPLACED BY NEW BEARINGS.

1. Remove the outer ring from the connecting rod, using pressing tools.
2. Remove the inner ring from the crankpin by heating it rapidly with a welding torch, then push it off the pin by means of a screwdriver or the like. If necessary, rapidly cool the ring so that it cracks, or grind a notch in it to reduce its tension.
3. Fit a new outer ring to the connecting rod by means of a pressure tools.
4. To fit the inner ring, heat it in an oil bath or on an electric hotplate to 80 - 100°C before pressing it onto the pin.

#### **IMPORTANT!**

DO NOT USE AN OPEN FLAME TO HEAT THE NEW RING.

### ***Gudgeon pin bearings***

The gudgeon pin bearings are needle bearings.

Dismantle as follows:

1. Remove seeger rings.
2. Press out the gudgeon pin. If necessary, heat the piston slightly and rapidly.
3. Use pressing tools to remove and re-install the connecting rod bearing outer ring.

#### **IMPORTANT!**

CHECK THAT THERE IS SLIGHT AXIAL PLAY BETWEEN CONNECTING ROD AND PISTON AFTER INSTALLATION.

### ***Frame bearings for crankshaft***

Dismantling and replacement procedure is as follows:

1. Remove the grille from the front of the fan, loosen the air deflector from base and manifold and pull the deflector backwards over the electric motor.
2. Dismantle fan and flywheel.
3. Loosen the cooler pipe from the manifold, cylinder head and lower clamp.
4. Dismantle cylinders, pistons and connecting rods as described under "PISTON AND CONNECTING ROD".
5. Loosen frame bearing housing nuts. Pull the bearing housing and crankshaft clear of the crankcase.
6. Remove the internal seeger rings in the bearing housing and pull the crankshaft complete with bearings out of the bearing housing.
7. Pull the bearings off the shaft.
8. Check that the oil sealing ring in the bearing housing is undamaged.

Before fitting the bearings, heat them in an oil bath to about 100°C. Ensure that the seeger rings are correctly placed in their respective slots.

In other respects, assembly is effected in the opposite sequence to dismantling.

### ***Multi-finned Tube Coolers***

To ensure trouble-free operation it is of the greatest importance to ensure that the coolers are kept clean and free of foreign matter at all times. If the coolers are not kept properly clean, high air temperatures will result, with a consequent reduction of working life of valves and cylinders.

The coolers can be externally cleaned by spraying on a good grease solvent and then blowing them clean with compressed air.

In the case of heavy deposits of dirt the coolers should be dismantled for external and internal cleaning.

Any carbon deposits in the tubes can be removed by placing them in a bath of carbon remover or similar solvent overnight, and then flushing with hot fresh water.

### ***Gaskets***

In order to achieve satisfactory operation it is recommended to replace gaskets at every overhaul. Worn or damaged gaskets will reduce compressor capacity and cause faulty operation.

Use only original SPERRE gaskets.

## ***LUBRICATING OIL***

The crankcase lub. oil volum is 10.0 litres. The following lubricating oils are recommended:

<b>Syntetic oil</b>	<b>Mineral oil</b>
BP ENERSYN RX 100	BP ENERGOL RC 68
CASTROL AIRCOL SN 100	CASTROL AIRCOL PD 100
CHEVRON HD COMPR. OIL 100	CALTEX RPM COMPR. OIL 68
DAPHNE MARINE COMPRESSOR 100	ESSO/ EXXON EXXCOLUB 77
BARELF AL 100	FINA EOLAN AC
ESSO/EXXON ZERICE S 100	GENERAL COMPOL A 100
ESSO/EXXON SYNTESSTIC 68	MITSUBISHI COMPR. OIL 100
MOBIL RARUS 827	MOBIL RARUS 427
NIPPON OIL CO. FAIRCOL SA100	NYNÄS COMPR. OIL 68
SHELL CORENA AP 68	PHILLIPS COMPR. OIL 68
STATOIL COMPWAY S 100	SHELL CORENA P 68
TEXACO SYN STAR DE 100	

Ask SPERRE for advice before using lubricating oil of any other type.

## ***TABLE OF NORMAL PRESSURES AND TEMPERATURES IN SERVICE***

Temperatures in service, with shaft speed 1450 rpm.

The given values are for intake temperature (ambient temperature) 40°C and supply pressure 30 bars.

Pressure after L.P. cylinder:	4.5 -5.3 bars
Temperature after L.P. cylinder:	150-180°C
Temperature after L.P. cooler:	60-70°C
Temperature after H.P. cylinder:	200-240°C
Temperature after H.P. cooler:	60-70°C

At lower or higher intake temperatures the temperatures at the points indicated above will be approximately an equal number of degrees lower or higher.

Temperatures will be lower at lower shaft speeds.

## ***MAINTENANCE SCHEDULE***

The following is a guideline for a normal maintenance schedule. However, compressor operating conditions vary widely from installation to installation and it is therefore important to adapt the maintenance schedule to the experience of the individual operator.

The following schedule applies to automatically monitored and manually operated installations alike.

### ***Daily inspection:***

Make a quick general inspection of the whole compressor (in normal operation) and specially check the following;

1. Lubricating oil level.
2. Compressed air temperature and pressure.

### ***After the first 200 hours' operation:***

Change lubricating oil. Drain the sump while the oil is hot, clean the sump thoroughly before filling with fresh oil.

*Further maintenance* can suitably be effected in accordance with the following plan (the scope of each maintenance routine is given in the notes).

<i>Total running time from installation of the new unit</i>	<i>Maintenance routine</i>
1000 hours	Routine A
2000 hours	Routine A
3000 hours	Routine A
4000 hours	Routine A
5000 hours	Routine B
6000 hours	Routine A
7000 hours	Routine A
8000 hours	Routine A
9000 hours	Routine A
10 000 hours	Routine C

From 10 000 hours begin from the top of the schedule again, repeating

Routine A at 11 000 hours

Routine B at 15 000 hours

Routine C at 20 000 hours and so on

## ***ROUTINE A***

1. Change lubricating oil.
2. Remove the valves from both cylinders. Check for carbon deposits. Use a stick or similar object to check whether springs, plates or the like have been broken. Dismantle the valve for cleaning and/or repair if necessary.
3. Inspect the flexible coupling between compressor and motor.
4. Check bed bolts. Also check vibration dampers and hose connections if the unit is flexibly mounted. Check that no oil has come into contact with the rubber elements in the vibration dampers.
5. Function-test the safety valve. Close the stop valve on the pipe to the receiver. The safety valve should blow at maximum working pressure + 10%. If necessary, dismantle safety valve, clean and readjust.
6. Check all pipe connections (compressor running).
7. Check that all automatic equipment is functioning correctly.
8. Clean air filter.
9. Check all bolts and nuts for proper tightness.

## ***ROUTINE B***

1. Change lubricating oil.
2. Remove the valves from both cylinders. It is recommended to dismantle the valves for full inspection and cleaning or replacement as necessary.
3. Carry out Routine A, items 3,4,5,6,7 and 8.
4. Dismantle compressor cooler tubes and clean internally as described on page.

## ***ROUTINE C***

1. Change lubricating oil.
2. Remove the valves from both cylinders. It is recommended to dismantle the valves for full inspection and cleaning or replacement if necessary.
3. Dismantle cylinders, pistons and connecting rods. Inspect cylinder walls, pistons and piston rings. Clean and replace any damaged or worn parts. Inspect big end and little end bearings.
4. Dismantle compressor cooler tubes and clean internally as described.
5. After dismantling cylinders, pistons, cooler tubes etc., check wear on crankshaft frame bearings by testing crankshaft lateral play. The life of ball and roller bearings may vary considerably.
6. Carry out Routine A, items 3,4,5,6,7 and 8.

## ***FAULT TRACING CHART***

### 1. Compressor capacity is low, or compressor not supplying full pressure.

<i>Possible causes</i>	<i>Remedy</i>
Dirty, damaged or worn valves	Clean and check all valve plates, springs and gaskets. Replace defective parts.
Carbon deposits on valves	Piston compression rings worn. Replace. Unsuitable lubricating oil. Change.
Piston rings have stuck	Loosen and remove rings. Clean grooves and rings. (after long periods out of use the cylinder will be dry and it may therefore easily be scored when the compressor is started up. This is indicated by a sharp increase of blow-off through the crankcase cover relief valve).

Air filter blocked	Clean filter.
Faulty automatic control equipment	Inspect components and circuits.

### 2. Safety valve blows off

<i>Possible causes</i>	<i>Remedy</i>
Supply line stop valve closed	Open valve.
Carbon deposits in non-return valve	Clean valve.
Faulty adjustment of automatic system: Compressor does not stop when air reservoir is full.	Check automatic circuitry.
Safety valve damaged or defective (causing it to blow at lower pressure).	Overhaul safety valve.



### 3. Valves require maintenance too frequently

<u>Possible causes</u>	<u>Remedy</u>
Overheating	High ambient temperature. Improve fresh air supply. Carbon deposits in coolers. Clean coolers.
Dirt or foreign matter in intake air Cooler tubes dirty	Air filter damaged. Clean or replace. Clean.

### 4. Bearings and bearing housings running hot. Lubricating oil overheating. Noise from bearings.

<u>Possible causes</u>	<u>Remedy</u>
Damaged or worn bearings	Replace bearings.
Uneven wear on for crankshaft bearings	Check crankshaft straightness.
Low oil level	Replenish sump.

### 5. Piston running hot

<u>Possible causes</u>	<u>Remedy</u>
Worn little end bearing	Check little end bearing, piston rings and piston clearance.
Piston and/or rings binding in cylinder	Check fresh air supply to cooling fan. If the piston has completely seized, wait a while before turning over the compressor. lean cylinder thoroughly and clean off piston, fit new piston if necessary.

## **TOLERANCES - WEARING LIMITS**

### 1. End tolerances for piston rings

Push a piston without rings halfway into the cylinder from below, and place the piston ring in the cylinder bore so that it presses against the top of the piston. Withdraw the piston and using a feeler gauge measure the clearance between the ends of the piston ring.

<i>Piston Diameter</i>	<i>Clearance for new rings in cylinder without wear</i>	<i>Maximum permissible clearance (approx.)</i>
77 mm	0.3-0.45 mm	0.8 mm
160 mm	0.55-0.75 mm	1.15 mm

### 2. Height clearance in piston ring grooves

Clean piston rings and ring grooves. Fit ring in groove and using a feeler gauge measure the height clearance of the ring in the groove.

	<i>Clearance for new rings in piston without wear</i>	<i>Maximum permissible clearance (approx.)</i>
Top ring	0.015-0.04 mm	0.06 mm
All other rings	0.00-0.025 mm	0.04 mm

These values apply to both piston diameters.

### 3. Clearances between pistons and cylinders

Measure the clearance by means of a dial gauge, taking the cylinder and piston separately. Alternatively the piston can be placed in the cylinder and the clearance measured with thickness gauges. If the latter method is chosen, two gauges should be used, one inserted at either side of the piston, opposite each other. The piston clearance should be measured in the area above the upper ring groove.

The sums of clearance on both sides should be as follows:

<i>Piston diameter cylinder</i>	<i>Clearance for new piston in new clearance</i>	<i>Maximum permissible (approx.)</i>
77 mm	0.20 mm	0.60 mm
160 mm	0.32 mm	0.72 mm

### 4. Clearance between piston crown and cylinder head.

The clearance between the top of the piston and the cylinder head valve must be around 1.0-1.5 mm at a normal gasket thickness is ca. 1,0 mm.

## COMPRESSOR TYPE HL2/160

Qty	Description	Part No.	Qty	Description	Part No.
1	Crankcase.....	1020	1	Tubular pin.....	3350
1	Crankcase cover.....	1035	1	Piston, L.P.....	3364
1	Bearing housing.....	1054	1	Piston, H.P.....	3423
1	Flywheel.....	1082	1	Gudgeon pin, H.P.....	3455
1	Cylinder, H.P.....	1141	1	Gudgeon pin, L.P.....	3458
1	Cylinder, L.P.....	1147	2	Compression ring,stepped,L.P.....	3493
1	Cylinder head, H.P.....	1285	3	Compression ring, plain, H.P.....	3502
1	Cylinder head, L.P.....	1287	1	Oil ring, H.P.....	3529
1	Flywheel nut.....	1330	2	Oil ring, L.P.....	3542
1	Outlet manifold.....	1334	1	Inspection glass.....	3634
1	Manifold.....	1348	1	Intermediate cooler,complete.....	3661
1	Drive coupling.....	1376	1	Aftercooler, complete.....	3662
1	Crankshaft.....	1405	1	Flywheel key.....	3677
2	Piston rods.....	1426	1	Breather valve.....	3700
1	Air filter support.....	1500	1	Air filter.....	3715
1	Counterbalance.....	1518	1	Filter cartridge.....	3718
1	Driven coupling, compressor.....	1983	1	Pressure gauge, L.P.....	3771
1	Coupling housing.....	1987	1	Pressure gauge, H.P.....	3773
1	Fan.....	1997	1	Grille.....	3789
2	Right angle bracket.....	2043	1	Guard, outer.....	3795
1	Grille bracket.....	2044	1	Guard,inner.....	3796
1	Support plate.....	2047	1	Seeger ring.....	3803
1	Valve, L.P. complete.....	3034	1	Seeger ring.....	3805
1	Valve, H.P. complete.....	3035	4	Seeger ring.....	3808
1	Gripper, complete.....	3047	1	Sealing ring.....	3861
1	Upper valve section L.P.....	3081	1	Ball bearing.....	3873
1	Lower valve section LP.....	3082	1	Ball bearing.....	3874
1	Upper valve section H.P.....	3083	2	Needle bearing.....	3879
1	Lower valve section H.P.....	3084	2	Needle bearing.....	3880
1	Valve seat, L.P.....	3118	1	Bolt.....	3882
1	Valve plate, L.P.....	3119	2	Bolt.....	3883
1	Valve plate, H.P.....	3120	2	Bolt.....	3884
2	Valve plate, H.P.....	3121	1	Plug.....	3900
2	Fixing pin.....	3142	1	Copper gasket, H.P.....	3914
1	Fixing pin.....	3145	2	Copper gasket, H.P.....	3915
2	Fixing pin.....	3146	1	Copper gasket, L.P.....	3916
1	Valve bolt, HP.....	3225	2	Copper gasket, L.P.....	3917
1	Valve bolt, L.P.....	3226	2	Copper gasket.....	3925
1	Valve nut, H.P.....	3236	1	Copper gasket.....	3926
1	Valve nut, L.P.....	3237	4	Copper gasket.....	3927
1	Valve opener complete.....	3245	5	Copper gasket.....	3929
1	End plate, crankshaft.....	3249	1	Copper gasket.....	3930
1	Locking plate, crankshaft.....	3250	1	Copper gasket.....	3932
1	Valve spring, suction,L.P.....	3275	2	Spring washer.....	3940
1	Valve spring, pressure, L.P.....	3276	16	Bolt.....	3945
4	Valve spring, suction, H.P.....	3277	1	Bolt.....	3947
4	Valve spring, suction, H.P.....	3278	8	Bolt.....	3949
1	Guide ring, H.P.....	3299	1	Stud bolt.....	3969
1	Guide ring, L.P.....	3300	2	Gasket.....	4081
1	Relief cap.....	3302	1	Gasket.....	4097
1	Relief cylinder.....	3308	2	Gasket.....	4098
1	Relief piston.....	3316	1	Gasket.....	4100
2	Elbow.....	3341	1	Set of gaskets.....	4124
1	Oil scoop.....	3349			

Qty	Description	PartNo.	Qty	Description	Part No.
1	Clamp, set.....	4129	2	Plug.....	4294
1	Clamp, set.....	4148	2	Plug.....	4296
1	Clamp, set.....	4149	1	Plug.....	4297
1	Clamp, set.....	4150	1	Plug.....	4298
20	Stud bolt.....	4192	1	Flexible steel hose .....	4400
2	Stud bolt.....	4196	6	Bolt.....	4405
1	Stud bolt.....	4198	2	Nipple .....	4412
4	Stud bolt.....	4200	2	Nipple .....	4413
6	Stud bolt.....	4202	16	Washer .....	4414
8	Stud bolt.....	4207	4	Washer .....	4416
39	Nut .....	4238	1	Safety valve, H.P.....	4420
8	Nut .....	4240	1	Safety valve, L.P. ....	4421
10	Lock nut .....	4251	2	Bolt.....	4431
2	Set screw .....	4268	2	Bolt.....	4432
2	Nipple muff.....	4283	1	Bolt.....	4446
1	Reduction.....	4292	1	Coupling insert, complete .....	4516

# SPERRE HL2/160

