

MAINTENANCE INFORMATION

VP15 Compressor

[Introduction](#)

[Description of compressor parts](#)

[Maintenance](#)

[Checking the oil level](#)

[Storage of Compressor](#)

[Changing the oil](#)

[Microfilter element change](#)

[Valve Inspection](#)

[Unloader system inspection](#)

[Cooler inspection](#)

[Starting compressor after Maintenance](#)

[General maintenance notes](#)

[Troubleshooting](#)

[Low output flow or pressure](#)

[Blowing safety Valves](#)

[Leakage from HP receivers](#)

[Low oil pressure](#)

[Knocking](#)

[Rumbling](#)

[Diagrams](#)

[Fig 1 - Compressor, complete](#)

[Fig 2 – Crankcase](#)

[Fig 3 – Oil Pressure Control](#)

[Fig 4 – Crankshaft](#)

[Fig 5 – Pistons & Connecting Rods](#)

[Fig 6 – 1st Stage Cylinder](#)

[Fig 7 – 2nd Stage Cylinder](#)

[Fig 8 – 3rd Stage Cylinder](#)

[Fig 9 – Cooling Stage 1](#)

[Fig 10 – Cooling Stage 2](#)

[Fig 11 – Cooler Stage 3](#)

[Fig 12 – Fan & Gear Wheel Guard](#)

[Fig 13 – Armature Block](#)

[Fig 14 – Discharge Valves](#)

[Fig 15 - Safety Valves & Pressure Switches](#)

Introduction

This section provides detailed information about the high pressure compressor, including:

- General information
- Description of components
- Servicing
- Parts lists
- Drawings

The VP15 compressor is a Three Stage reciprocating Air cooled compressor with a maximum working pressure of 350 Bar (5000 psi). Lubrication is by Integral crankshaft driven oil pump to crankshaft and big end bearings and by splash/oil mist to the cylinder bores and small end bearings.

Intercoolers are fitted at each stage of compression, with condensate separators and safety valves. The compressor is driven by an induction motor.

The main compressor components are identified in the photographs below.

Description of compressor parts

Compressor Stages

The Compressor takes gas from the suction vessel at approximately 0.25 BarG and compresses it in three stages up to a maximum of 350 Bar (5000 psi). Three stages of compression are used together with the intercoolers, to reduce the temperatures at each stage of compression.

The cylinder bores reduce in size from the first to the third stage, as the pressure in-creases.

All cylinders have cooling fins to dissipate the compression heat in the blast from the fan. Each stage of compression has a suction valve and a delivery valve located in the cylinder head to prevent the gas from flowing back into the previous stage.

Coolers

After each stage of compression, the gas is passed through the coiled cooling coils at the front of the compressor to remove the heat of compression. In front of the cooling coils is a large air blast fan which blows cooling air first over the cooling coils and then over the finned cylinders and cylinder heads. The cooling coils are copper.

Crankcase Breather

Because the compressor is a gas compressor, the crankcase is connected to the first stage inlet, to prevent wastage of any gas which blows past the piston rings.

Motor

The motor is a three-phase induction motor. It is linked via a belt drive coupling to the end of the compressor crankshaft.

Oil Filler

The oil filler cap is where the lubricating oil is added to the compressor. See later this section for filling and changing instructions.

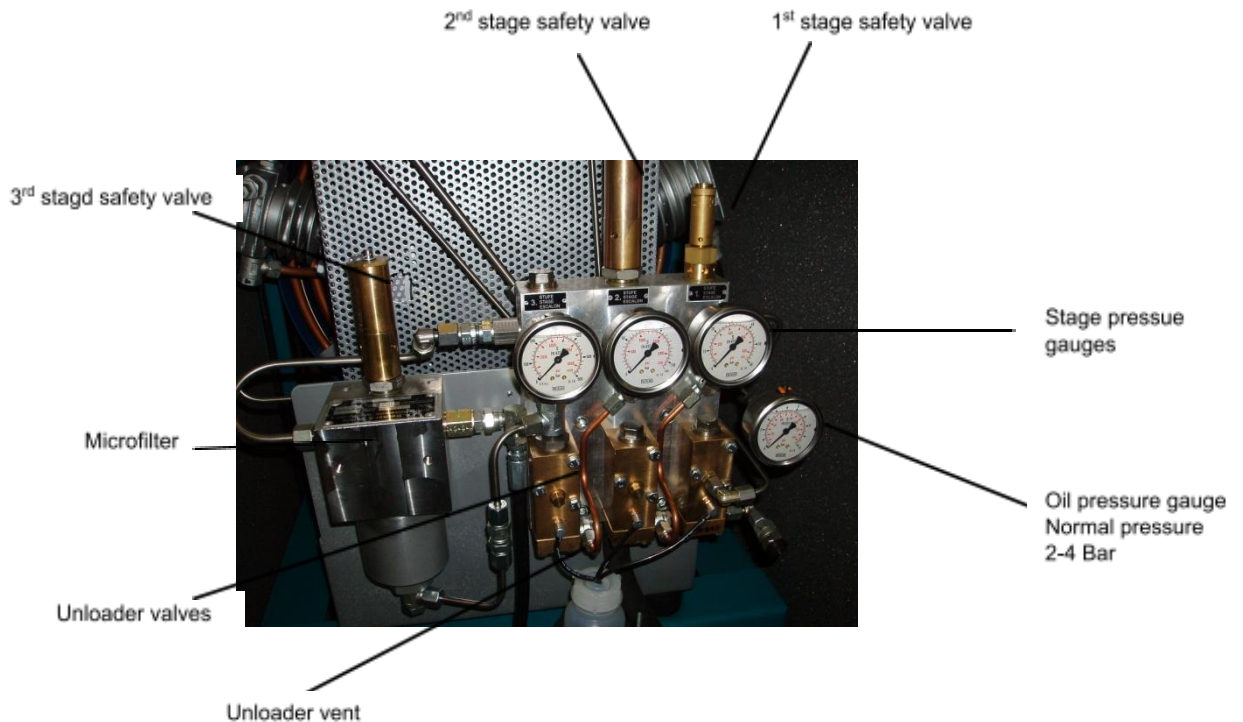
Microfilter

After the final cooler and condensate separator is a small Microfilter, which removes any remaining oil droplets from the compressed gas. The drain of the filter is piped to the unloader system so that it vents automatically whenever the compressor stops running. It is not necessary to drain this filter periodically. Because of the limited volume of the filter, CINPRES's control systems include an 'Autovent' facility to stop the compressor for a short period (normally 1 minute) after a set running time (normally 30 minutes). This ensures that the filter bowl does not become full and prevents oil from being passed over into the high pressure gas line.

Direction of rotation

The direction of rotation is **CRITICAL** to the correct operation of the compressor. The correct direction of rotation is shown on a label on the compressor itself and in the installation section.

The direction of rotation is correct when the fan takes air in at the front of the compressor and expels it over the coolers and compressor cylinders. If you stand in front of the fan, the air should be moving **AWAY** from you.



Unloaders

Every time the compressor stops, gas pressure is retained in the cylinders and coolers of each stage. This gas pressure must be vented to allow the compressor to be started 'off-load'. The unloader system is an automatic system for venting this pressure. The system is operated by oil pressure from the lubrication system, which prevents the gas from each stage from venting to the unloader vent. Therefore, when the compressor stops and the oil pressure subsides, the unloader valves will open and the gas will be vented. The Microfilter is also connected to the unloader system, and its contents, including any condensed oil, will be vented every time the compressor is stopped.

Stage Pressure gauges Stage Pressure gauges

After each cooler there is a pressure gauge, which shows the gas pressure for each stage when the compressor is running. The gauges should all reduce to zero after the unloader has vented the gas from each stage when the compressor stops.

Safety valves Safety valves

After the cooler at each stage is also fitted a safety valve, which prevents each stage from becoming over pressurised. If a safety valve begins to 'blow' (or vent gas to atmosphere), it is normally a sign that the compressor needs to be serviced.

Outlet

MAINTENANCE INFORMATION

At the compressor outlet, there is a non return valve (check valve). This stops gas from the HP gas receivers and pipes from venting back through the compressor's unloader system to atmosphere when the compressor stops.

Oil sight glass

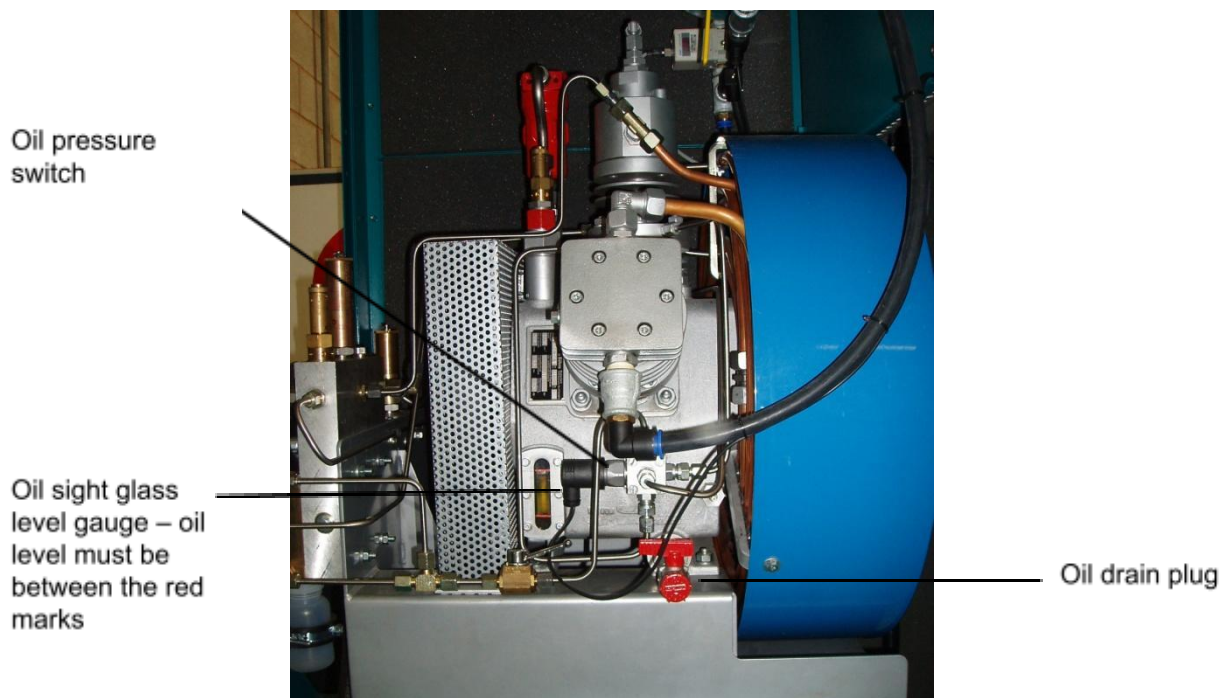
The oil sight glass is used to check the oil level in the compressor sump. It is essential that the oil level is checked regularly and kept between the minimum and maximum marks. Failure to maintain the correct oil level will result in failure of the compressor:

- If the oil level is too low, it will result in failure of the compressor due to insufficient lubrication and overheating.
- If the oil level is too high, it is likely that the crankshaft oil seals will fail.

Oil pressure gauge and switch

A pressure gauge indicates the compressor's oil pressure. The oil pressure should normally remain between 2 - 4 Bar when the compressor is running.

The oil pressure switch provides a signal to the control system. The compressor will be stopped immediately in an alarm state if the compressor oil pressure is lost when the compressor is running.



Oil drain plug

The oil drain plug is used to drain the lubricating oil from the compressor sump. Note that the oil should be drained from the compressor when it is warm. On some systems, where accessibility is limited, a valve and a pipe may be found instead of the drain plug.

Maintenance

It is essential that regular maintenance is carried out. During operation of the compressor, carbon deposits will build up on the compressor valves. If the maintenance is not carried out in accordance with the instructions in this manual, these deposits can cause loss of performance and damage to pistons and cylinders.

Checking the oil level

Check the oil level when the compressor is STOPPED. The oil level must be between the minimum and maximum marks on the oil sight glass. If required, top up the oil level using the recommended lubricating oil. Remove the oil filler cap to top up. After topping up, wipe off any spillage to prevent burning of oil lying on hot surfaces.

Recommended Lubricating oil:

Use only the following synthetic lubricating oils:

ANDEROL 500

ANDEROL 555

MOBIL RARUS 827

NEVER mix two different oils from the list. If you wish to change to a different lubricant, the oil must be drained first.

Storage of Compressor

If the compressor is stored without running for an extended period (i.e. greater than 2 months), the cylinders, cylinder heads and valves must be checked for cleanliness and condition before re-starting. All parts must be lubricated on assembly. See 'Valve inspection' below for more information.

Changing the oil

Run the compressor until warm (about 10 minutes). Stop the compressor and isolate the power. Place a container underneath the drain plug (or drain pipe) to collect the drained oil. Note: the oil sump capacity is 3.5 litres. Unscrew and remove the drain plug (or open the drain valve, if fitted). Allow the oil to drain into the container. Whilst the oil is drained, if required, remove and clean the oil sight glass and replace. Clean the drain plug with petroleum (gasoline), replace and tighten. Remove the oil filler plug and refill with the recommended lubricant, checking for correct oil level using the oil sight glass. Replace the oil filler plug.

Safety Safety

Whenever maintenance is carried out on the compressor, the mains power must be switched OFF, and locked out if necessary.

Note

In this manual, where item nos. are given (eg. 2/140), the first number (i.e. '2') refers to the 'Fig'. number of the diagram at the back of this manual section on which the item is shown. The second number (i.e. '140') refers to the item on the diagram and in the parts lists.

Warning

When operating the compressor normally, the valve pin 2/14 MUST be open. Otherwise the compressor will not unload, and the motor may become overloaded.

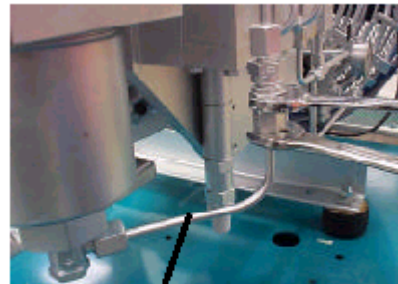
Microfilter element change

The Microfilter has a replaceable element (Part number 163140). The “O” ring 169531 and the disc 101184 should be replaced together with the element. To change the element, the compressor must be stopped:

Unscrew the locking grub screw 2 turns.



Unscrew 2 turns



Remove

Remove the drain pipe.

Using a large spanner, unscrew the filter bowl from the body.



Remove filter bowl



Remove element

Unscrew and remove the filter element by hand.

Clean the inside of the bowl and body with a cloth.

Check the condition of the internal ‘O’ ring. If in doubt, re-place the ‘O’ ring.

Screw on the new filter element by hand.

Replace the filter bowl and tighten until the bowl only UNTIL it stops turning. The bowl seals on its ‘O’ ring, not on the thread or the face.

DO NOT OVERTIGHTEN.

Replace the drain pipe. If necessary, loosen the Banjo fitting to align the pipe, ensuring that the arrows on the 1 way valve point upwards.

Tighten the locking grub screw.



Check/replace/lubricate
‘O’ ring

Valve Inspection

Make sure that the compressor is stopped and the power is isolated before carrying out this work.

Valve Cleaning

Note: do not dismantle valve assemblies for cleaning purposes. Parts within the assembly can be easily damaged.

Carefully clean the valve plate assemblies using soft scrapers (e.g. Copper, wood, plastic), and petroleum (gasoline) to remove carbon deposits and dirt. Ensure that any traces of gasket material are removed and that the mating surfaces are clean and smooth.

1st Stage Valves

Disconnect the inlet hose from the cylinder head

Unscrew the tubing nut adaptor and detach cooler tube from the cylinder head.

Unscrew and remove capscrews 5/16 and washers 5/15 evenly.

Remove the cylinder head 5/14 from the cylinder 5/6, removing the valve plate 5/10

Carefully clean the valve plate assembly 5/10 using soft scrapers (e.g. copper, wood, plastic) and petroleum (gasoline) to remove carbon deposits and dirt. Ensure that any traces of gasket material are removed and that the mating surfaces are clean and smooth.

Clean the inside of the cylinder head 5/14. Ensure that any traces of gasket material are removed and that the mating surfaces are clean and smooth.

Clean the mating surface and cylinder bore of the cylinder 5/6. Ensure that no dust or dirt particles remain in the cylinder 5/6. Use compressed air to blow out if necessary.

If the valve plate assembly 5/10 is excessively worn it must be re-placed.

Reassemble in reverse order, fitting new gaskets. When reassembling, lubricate every component (except gaskets) with clean lubricating oil.

On reassembly, tighten the cylinder head screws to the correct torque loading.

2nd Stage Valves

Unscrew the tubing nut adaptors and detach cooler tubes from the cylinder head.

Unscrew and remove capscrews 6/15 and washers 6/14 evenly.

Remove the cylinder head 6/13 from the cylinder 6/7, carefully removing the 2nd stage valve plate assembly 6/11 which is located between the cylinder head and cylinder.

Carefully clean the valve plate assembly 6/11 using soft scrapers (e.g. copper, wood, plastic) and petroleum (gasoline) to remove carbon deposits and dirt. Ensure that any traces of gasket material are removed and that the mating surfaces are clean and smooth.

Clean the inside of the cylinder head 6/13. Ensure that any traces of gasket material are removed and that the mating surfaces are clean and smooth.

Danger

If carrying out maintenance after the compressor has been working, the cylinder heads and coolers will be extremely hot (up to 180 degrees C).

Extreme care must be taken to avoid the risk of personal injury.

MAINTENANCE INFORMATION

Clean the mating surface and cylinder bore of the cylinder 6/7. Ensure that no dust or dirt particles remain in the cylinder. Use compressed air to blow out if necessary.

If the valve plate assembly 6/11 is excessively worn it must be replaced.

Reassemble in reverse order, fitting new gaskets. When reassembling, lubricate every component (except gaskets) with clean lubricating oil.

On reassembly, tighten the cylinder head screws to the correct torque loading.

3rd Stage Valves

Unscrew the tubing nut adaptors and detach cooler tubes from the cylinder head.

Unscrew and remove valve retainer 7/15 and locking nut 7/14, together with seal 7/13.

Unscrew and remove caphead screws 7/12 and lift off cylinder head valves 7/11.

Remove valve 7/10 together with seals 7/9 and 7/8.

Carefully clean valves using soft scrapers, (eg. copper, wood, plastic) and petroleum (gasoline) to remove carbon deposits and dirt.

Clean the cylinder face of 7/7 and clean cylinder head 7/11 thoroughly, removing all traces of carbon buildup. Ensure that all mating surfaces are clean and smooth.

Clean the mating surface and cylinder bore of the cylinder 7/7 and remove the rest of 7/7 above. Ensure that no dust or dirt particles remain in the cylinder. Use compressed air to blow out if necessary. If the valve 7/10 is excessively worn it must be replaced.

Seals 7/8, 7/9, 7/13 should always be replaced, to avoid premature leakage. When installing these seals ensure that they are correctly located around the valves.

Reassemble in reverse order. When reassembling lubricate every component, (except gaskets but including O-rings) with clean lubricating oil.

To reassemble, locate valve 7/10 into the cylinder head 7/11 with seals 7/8 and 7/9. Mate the assembly with the cylinder 7/7. Replace the capscrews 7/12, turning 1/16th turn at a time in a diagonal pattern. Tighten to the correct torque loading.

Replace locking nut 7/14 with seal 7/13 and tighten against the valve.

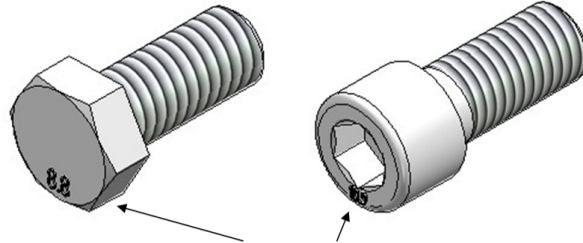
Replace lock-ring 7/15 and tighten.

Re-attach the cooler tubes.

Type of screw	M _{Max}
M6 screw, quality 8.8	10 Nm
M6 screw, quality 10.9	14 Nm
M8 screw, quality 8.8	24 Nm
M8 screw, quality 10.9	32 Nm
M10 screw, quality 8.8	50 Nm
M10 screw, quality 10.9	70 Nm
M12 screw, quality 8.8	88 Nm
M12 screw, quality 10.9	120 Nm
M12 screw, quality 12.9	130 Nm

Central pressure screw conc. valve	200 Nm
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Maximum tightening torques for cylinder head screws and connecting rod screws



Identifying screw head type, e.g. 8.8 and 10.9

See marking on the screw head to determination the correct maximum torque setting.

Unloader system inspection

General Disassembly

Before the unloader blocks can be re-moved from the compressor, the pipes to them must be removed.

Remove the oil pipes from the bottom of the 1st and 2nd stage unloaders. Take care to catch any spilt oil.

Remove the gas pipes from the bottom of then 3rd stage unloader.

Remove the gas pipe from the top of the 3rd stage unloader.

Unloader valve disassembly

NOTE: When disassembling unloader valves, to avoid confusion and incorrect operation, remove and replace only one unloader at a time.

Remove the 3 M6 screws which hold the unloader valve onto the separator block. Remove the valve from the compressor.

Unscrew and remove the four cover retaining screws and remove the cover from the bottom of the valve. Withdraw the piston and seals from inside the valve, noting the arrangement of parts.

Clean the piston and the inside of the unloader valve using a cloth and petroleum (gasoline).

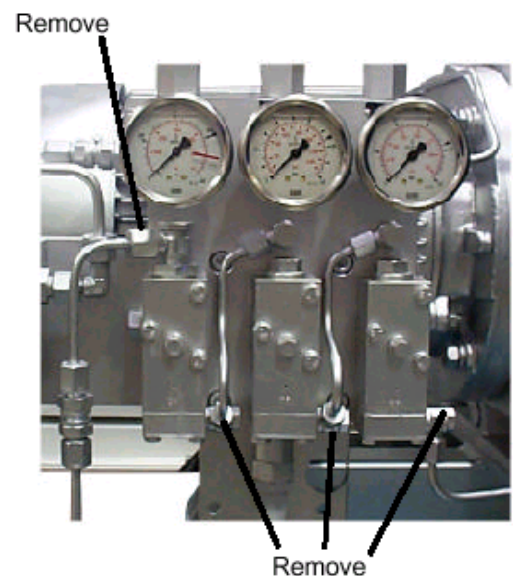
Check the piston seals for wear or damage. Replace any worn or damaged seals.

Check the piston and unloader valve for scoring. If the scoring cannot be removed by rubbing with 800 grade emery paper, replace the parts.

Lubricate the piston seals with acid-free grease (e.g. silicone grease).

Reassemble the parts in reverse order. Always renew the cover gasket and the 'O' ring seal between the unloader valve and the separator block.

Before removing unloaders...



Cooler inspection

Clean the cooling tubes with a cloth to remove accumulated dirt and dust. Use an airline to blow dirt away, to maintain maximum cooling efficiency.

Check all coolers for signs of corrosion or fatigue. Replace any coolers which are cracked or damaged.

Starting compressor after Maintenance

Turn the compressor by hand for a few revolutions. Check that the motion is smooth and free.

Re-check all screws and connections for tightness.

Run the compressor for 10 - 15 minutes until warm.

Re-check all screws and connections for tightness.

General maintenance notes

Delivery valves will wear out before suction valves, due to the higher temperatures.

When replacing piston rings, ALWAYS replace as a complete set for each stage (i.e. do not mix old and new rings in the same cylinder)

Always lubricate components (not paper gaskets) on assembly with clean lubricating oil.

Make sure that cylinders and cylinder head components are extremely clean on assembly. Any particles of dirt left inside can score the cylinder bores and reduce the performance of the compressor valves.

Troubleshooting

Low output flow or pressure

Leakage

If gas is leaking from the compressor cylinders or coolers, the output flowrate will fall, resulting in low pressure. Carry out leakage test.

1st stage cylinder head

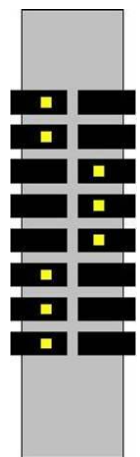
If the 1st stage cylinder head gasket is leaking, or the valve plate gasket is damaged, the flowrate will fall. Check that the gaskets 5/9 and 5/11 are correctly fitted, and in good condition.

Unloader system

If the unloader valves do not seat correctly, gas from the compressor will vent through the unloader vent when the compressor is running. With the compressor running, check that no gas is venting through the unloader vent. If there is gas venting when the compressor is running, carry out the unloader inspection and replace any worn components.

Worn piston rings

July 21



Worn piston rings will reduce the output capacity of the compressor. Replace the piston rings.

Piston rings marked 'TOP' or with a coloured dot, must be installed with the 'TOP'/ dot marks facing the top of the piston.

Illustration is used to show orientation marks on piston rings only.

IMPORTANT:

Piston ring gaps must be rotated through 90 or 120 degrees from each other.

Blowing safety Valves

Possible reasons for safety valves blowing are given below. In addition to these reasons, it may be possible that the safety valves themselves can be faulty. Safety valve adjustments may change due to vibration, or the valve may be worn.

In general, the normal operating pressures of the three stages of the compressor will be as follows:

1st stage: up to 21 Bar

2nd stage: up to 97 Bar

3rd stage: up to 350 Bar

If a safety valve is blowing below the pressures given above for each stage, then it is likely that the valve requires adjustment or replacement. **Note: It is extremely dangerous to adjust safety valves pressures without the correct equipment. Replacement is recommended.**

Crankcase breather safety valve blowing

1st stage cylinder head gasket damaged. Check and replace.

1st stage suction valve faulty. Check and clean/replace.

1st Stage safety valve blowing

2nd stage cylinder head gasket damaged. Check and replace.

2nd stage suction valve faulty. Check and clean/replace.

2nd Stage safety valve blowing

3rd stage concentric valve and/or seals worn or damaged. Check and clean/replace.

3rd Stage safety valve blowing

Outlet Check Valve or outlet pipes blocked. Check and Clean/Replace

Leakage from HP receivers

If the pressure in the HP receivers or pipework reduces, even when no gas is being consumed, it is possible that the compressor outlet check valve is faulty and that gas is leaking back through it and to the unloader vent, when the compressor is not running. Check and replace check valve.

Low oil pressure

Low oil level - Check and refill oil pump suction strainer fitted to drain plug 2/15 is clogged. Drain the compressor oil and clean the strainer. Use compressed air to blow away any dirt, from the inside of the strainer.

Knocking

Hard metallic knocking noises normally indicate worn crankpin journals or big end bearings. If the crankpin journals are excessively worn, the crankshaft 3/1 must be replaced. If the wear is minor, the connecting rods 4/1 (3 pcs) may be replaced.

Rumbling

A deep rumbling sound can indicate that the main bearings 3/17 and 3/8 are worn. Check the crankshaft wear by pulling the shaft from side to side. No movement should be detectable.

Diagrams

FIGURE REF	DETAILS	MANUAL PAGE
1	INDEX OF PICTURES	17
2	CRANK CASE	18
3	OIL PRESSURE CONTROL	20
4	CRANKSHAFT	22
5	PISTON & CON. ROD	24
6	CYLINDER CPLT. ST.1	26
7	CYLINDER CPLT. ST.2	28
8	CYLINDER CPLT. ST.3	30
9-11	COOLING	32
12	FAN WHEEL	34
13	ARMATURE BLOCK CPLT.	37
14	DISCHARGE VALVE CPLT.	39
15	SAFETY VALVES & PRESSURE SWITCHES	41

Fig 1 - Compressor, complete

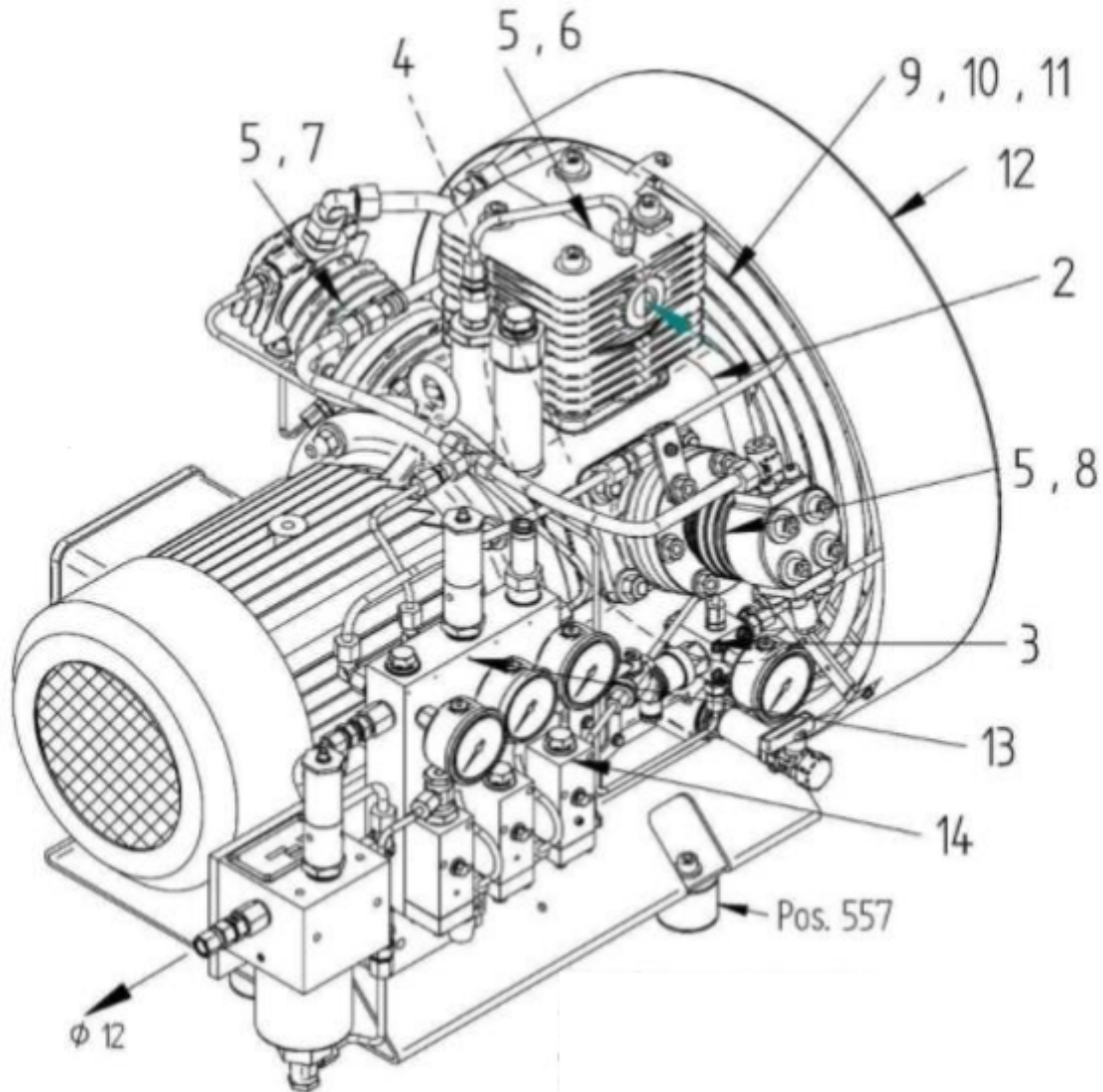


Fig 2 – Crankcase

MAINTENANCE INFORMATION

POS.	PART NUMBER	DESCRIPTION	QUANTITY
101	161901	CRANK CASE	1
102	165851	BEARING COVER SV 225/350	1
103	074047	O-RING 180 x 3	1
104	076333	STUD M12 x 45	4
105	094471	SPRING WASHER D12	20
106	080764	NUT M12	20
107	138703	PUMP COVER	1
108	001384	SCREW M6 x 30	4
109	094447	SPRING WASHER D6	4
110	073466	O-RING 71-2	1
111	039942	CYLINDER ROLLER BEARING	1
112	153818	SPRING WASHER 47 x 1.75	1
113	157732	CYLINDER ROLLER BEARING	1
114	162027	RETAINING RING 85 x 3	1
115	162024	OIL LEVEL GLASS SP100	1
116	00224	SCREW M5 x 25	6
117	125407	RETAINING RING D5	6
118	162235	EXTENSION 1" x 100	2
119	179742	REDUCER 1" x 1/4"	1
120	160530	NON RETURN VALVE 1/4"	1
121	062553	FITTING GE 8 LR	1
122	150010	VALVE HOUSING	1
123	096164	PRESSURE SPRING	1
124	156531	VALVE CONE	1
125	095699	ADJUSTING SCREW	1
126	001104	LOCKING SCREW 1/2"	1
127	071145	GASKET RING EO-DKAZ 1/2"	1
128	160363	O-RING 24 x 2.5	1
129	108758	O-RING 14 x 2	1
130	001074	LOCKING SCREW 1/8"	1
131	088668	LOCKING SCREW 1/4"	1
132	001082	LOCKING SCREW 3/8"	1
133	096172	LOCKING SCREW M20 x 1.5	1
134	030880	GASKET RING 20.7 x 28 x 1.5	1
135	138835	STRAINER	1
136	161874	GASKET RING 34.3 x 42 x 2	1
137	125997	EXTENSION 1/2" x 50	1
138	196509	BALL VALVE	1
139	030872	GASKET RING 21.5 x 28.7 x 2.5	1
140	148784	VALVE SPINDLE CPL.	1
141	161876	GASKET RING 17.4 x 24 x 1.5	1
144	032751	PIPE 8 x 1.5	1
146	139491	STUD M12 x 30	16
147	004103	STUD M6 x 20	6
149	008257	TYPE PLATE 86 x 40	1
151	181379	O-RING 30 x 2.5	2
152	161875	GASKET RING 14.7 x 22 x 1.5	1
501	162219	INTERMEDIATE FLANGE	1

MAINTENANCE INFORMATION

502	143456	EYE BOLT M12	1
504	162711	SCREW M12 x 40	4
505	007030	SPRING WASHER M12	4
522	005541	NUT M6	6
600	068462	REDUCER 1" x 3/4"	1
601	098841	GASKET RING 26.5 x 35 x 2	1
602	001198	LOCKING SCREW 3/4"	1
603	030872	GASKET RING 21.5 x 28.8.2 x 5	1
604	001180	LOCKING SCREW 1/2"	1

Fig 3 – Oil Pressure Control

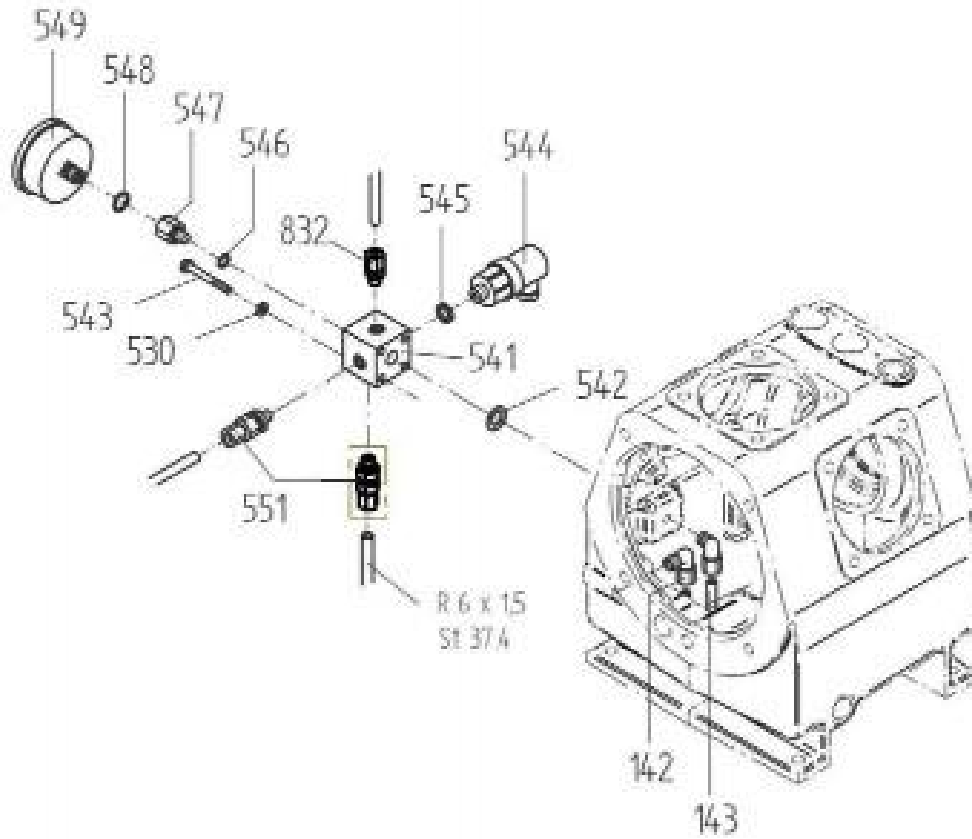


Fig 3 – Oil Pressure Control – parts list

Pos.	Part Number	Description	Quantity
142	070548	Fitting WE 4 LLE	2
143	150037	Pipe 4.0 x 0.5	1
530	125407	Spring Washer D5	4
541	162057	Connecting Piece	1
542	072745	O-Ring 12 x 2	1
543	000230	Screw M5 x 60	4
544	162059	Oil Pressure Switch 0180 Suco	1
545	161875	Gasket Ring 14.7 x 22 x 1.5	1
546	162031	Gasket Ring 10.35 x 16 x 2	2
547	106860	Reducing Fitting 1/8" x 1/4"	1
548	026760	Gasket Ring 1/4" Cu	1
549	038997	Oil Pressure Gauge 63D 0-10	1
550	016829	Pipe 6.0 x 1.5	1
551	162025	Non-return Valve RHV 6 LR	2
832	069388	Fitting GE 6 LR	1
872	001147	Locking Screw 1/8"	1

Fig 4 – Crankshaft

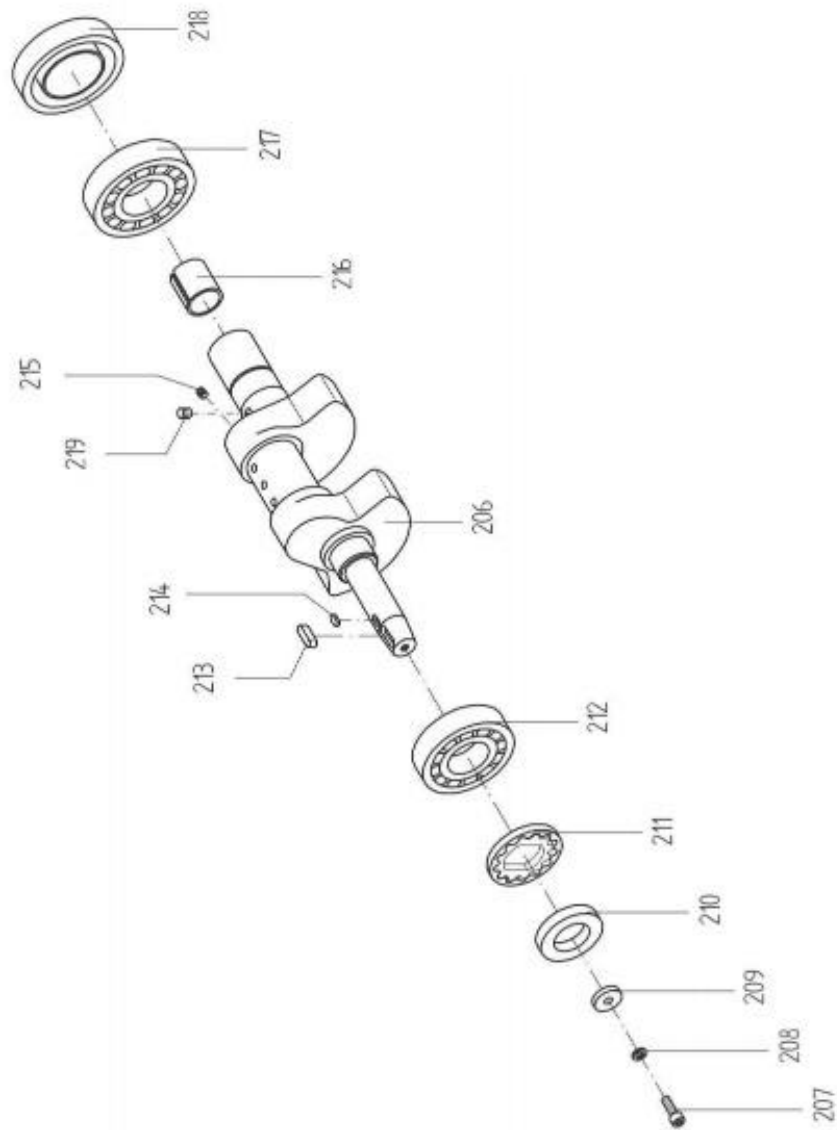


Fig 4 – Piston and connecting rod – parts list

Pos.	Part Number	Description	Quantity
206	166342	CRANKSHAFT	1
207	001511	SCREW M8 x 30	1
208	094455	SPRING WASHER D8	1
209	089893	WASHER	1
210	139475	RADIAL SHAFT SEAL DG 22 x 35 x 7S	1
211	139416	OIL PUMP NR: 320558-155	1
212	139394	CYLINDER ROLLER BEARING	1
213	139459	FEATHER KEY 6 x 6 x 22	1
214	139467	FEATHER KEY 5 x 5 x 5	1
215	001074	LOCKING SCREW 1/8"	1
216	156639	BUSHING FOR MOTOR SHAFT D38	1
217	162034	CYLINDER ROLLER BEARING	1
218	162036	SHAFT SEALING RING S 55 x 80 x 10	1
219	088668	LOCKING SCREW 1/4"	1

Fig 5 - Pistons & Connecting Rods

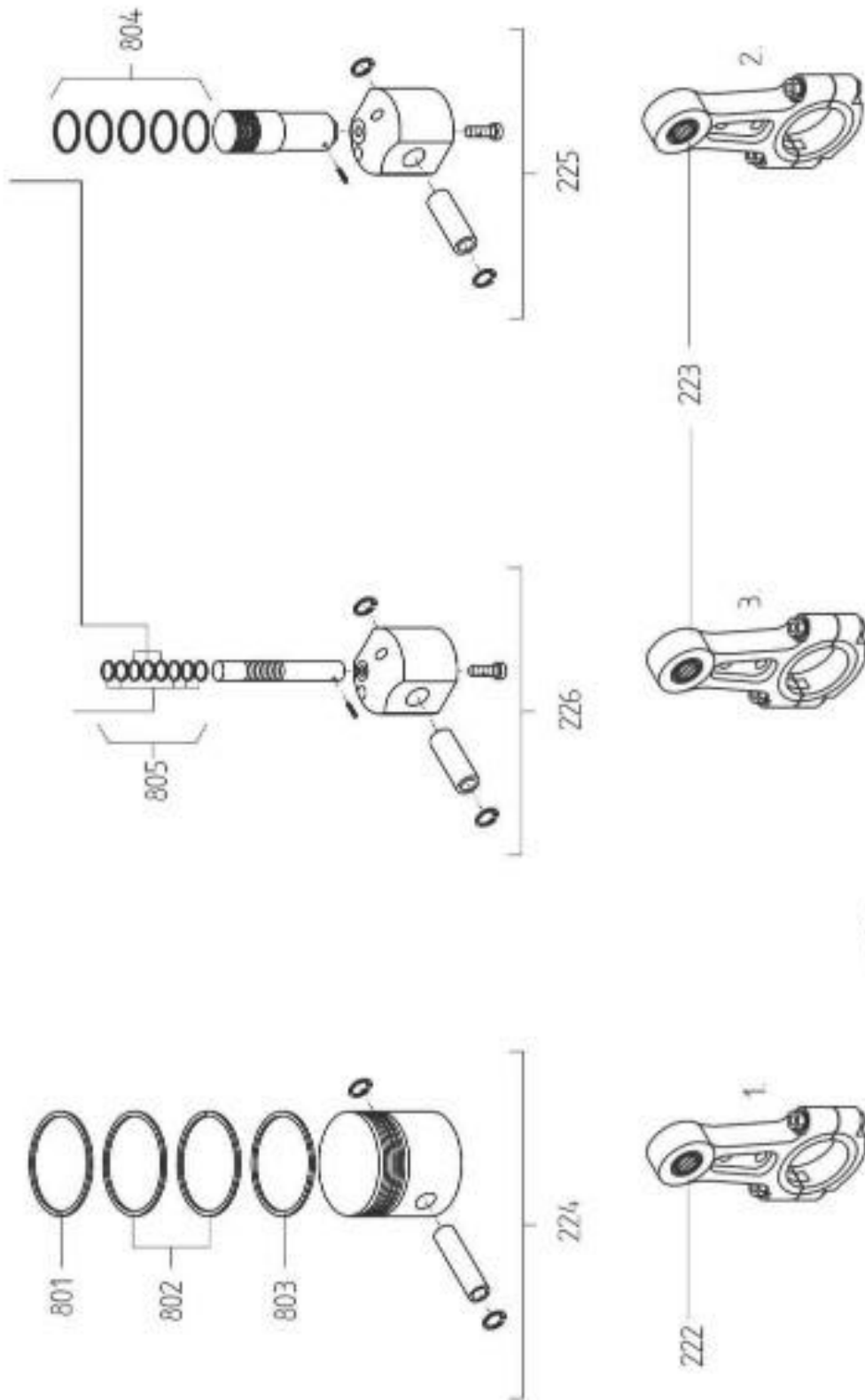


Fig 5 – Pistons & Connecting Rods – parts list

Pos.	Part Number	Description	Quantity
222	162554	Connecting Rod Cpl.	1
223	162021	Connecting Rod Cpl.	2
224	162561	Piston D90	1
225	162022	Piston D33/70	1
226	162023	Piston D16/70	1
801	161681	Piston Ring NM 90 x 82.4 x 2	1
802	159711	Piston Ring M 90 x 82.4 x 2	2
803	159712	Piston Ring G 90 x 82.4 x 4	1
804	162547	Piston Ring M 33 x 2	5
805	042935	Piston Ring M 16 x 2	8

Fig 6 – 1st Stage Cylinder

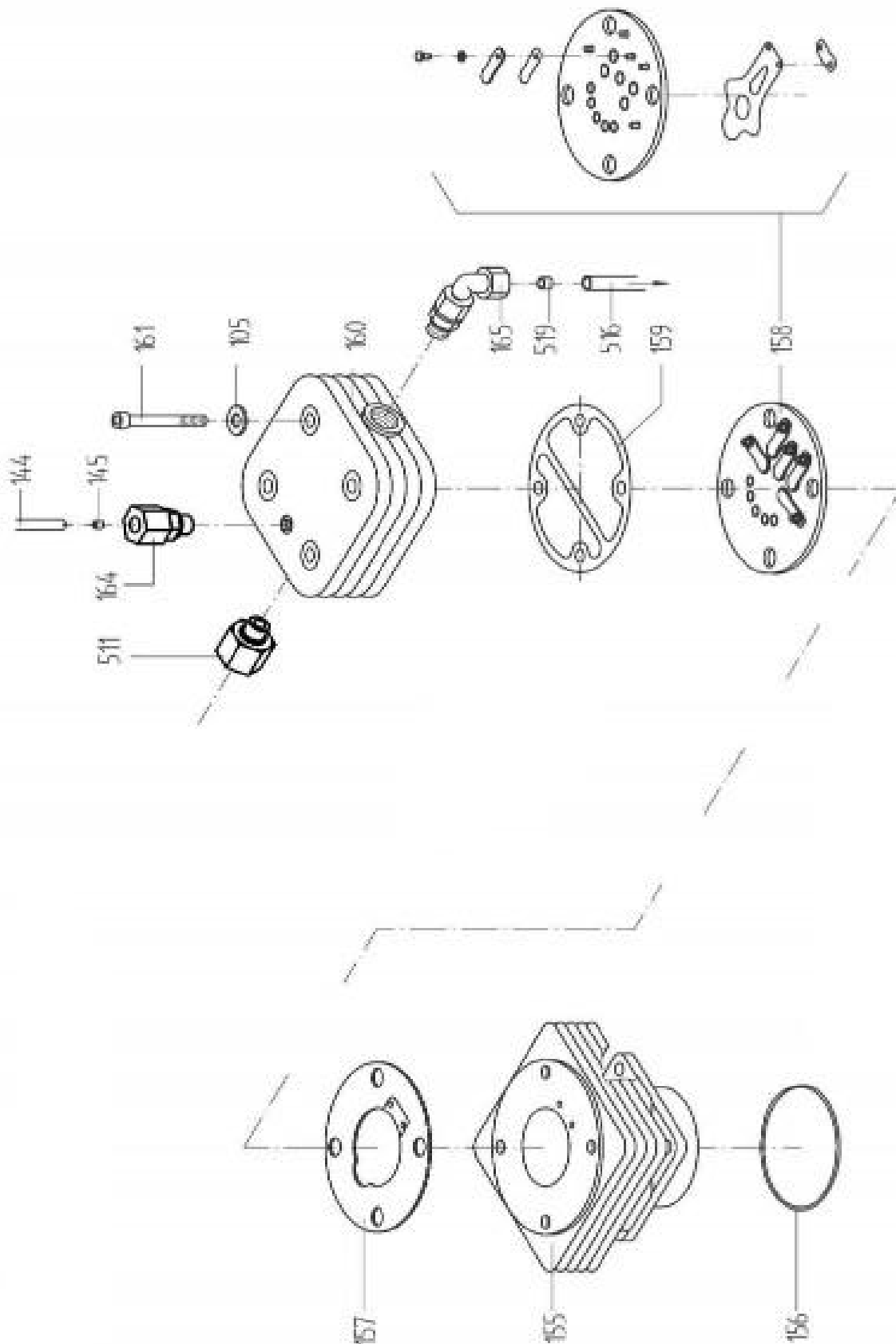


Fig 6 – 1st Stage Cylinder – parts list

Pos.	Part Number	Description	Quantity
105	094471	SPRING WASHER D12	4
144	032751	PIPE 8 x 1.5	1
145	010154	INSERT SLEEVE E 8/5	1
155	162539	CYLINDER D90	1
156	162032	O-RING 100 x 2	1
157	162720	CYLINDER GASKET D91	1
158	159253	LAMELLA VALVE 415	1
159	147133	CYLINDER HEAD GASKET LV 415	1
160	153618	CYLINDER HEAD	1
161	001902	CREW M12 x 100	4
164	178721	FITTING GE 8 LR 1/8"	1
165	162176	FITTING EVW 15 LR	1
511	068420	REDUCING FITTING 1/2" x 1"	1
516	162043	PIPE 15.0 x 1.5	1
519	162044	FITTING VSH 15 x 1.5 MS	1

Fig 7 – 2nd Stage Cylinder

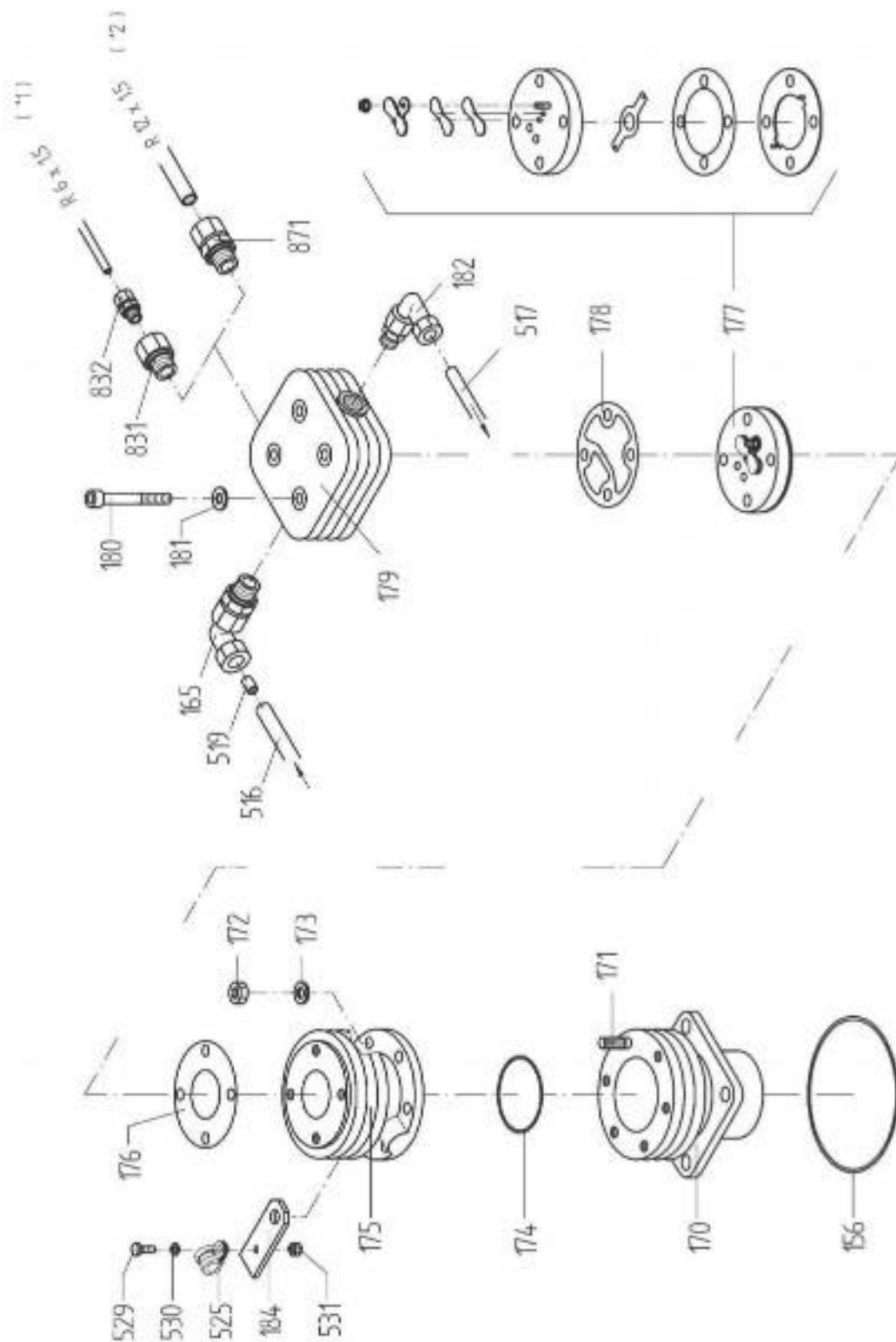


Fig 7 – 2nd Stage Cylinder – parts list

Pos.	Part Number	Description	Quantity
156	162032	O-RING 100 x 2	1
165	162176	FITTING EVW 15 LR	1
170	161922	GUIDE CYLINDER	1
171	004286	STUD M10 x 25	6
172	080772	NUT M10	6
173	084463	SPRING WASHER D10	6
174	073440	O-RING 70 x 2	1
175	161919	CYLINDER	1
176	161559	CYLINDER GASKET D38	1
177	162033	LAMELLA VALVE LV111	1
178	161560	CYLINDER HEAD GASKET	1
179	161920	CYLINDER HEAD	1
180	172364	SCREW M8 x 75	4
181	094455	SPRING WASHER D8	4
182	148733	FITTING SWVE 12 LR 3/8"	1
184	162232	\COOLING PIPE HOLDER	1
516	162043	PIPE 15.0 x 1.5	1
517	025003	PIPE 12.0 x 1.5	1
519	162044	FITTING VSH 15 x 1.5 MS	1
525	126225	FASTENING CLAMP D12/12	1
529	002194	SCREW M5 x 10	1
530	125407	SPRING WASHER D5	1
531	005533	NUT M5	1
831	137839	FITTING RI 3/8 x 1/8	1
832	069388	FITTING GE 6 LR	1
871	069493	FITTING GE 12 LR	1

***1 With Electro-magnetic discharge**

***2 With Hydraulic Discharge**

Fig 8 – 3rd Stage Cylinder

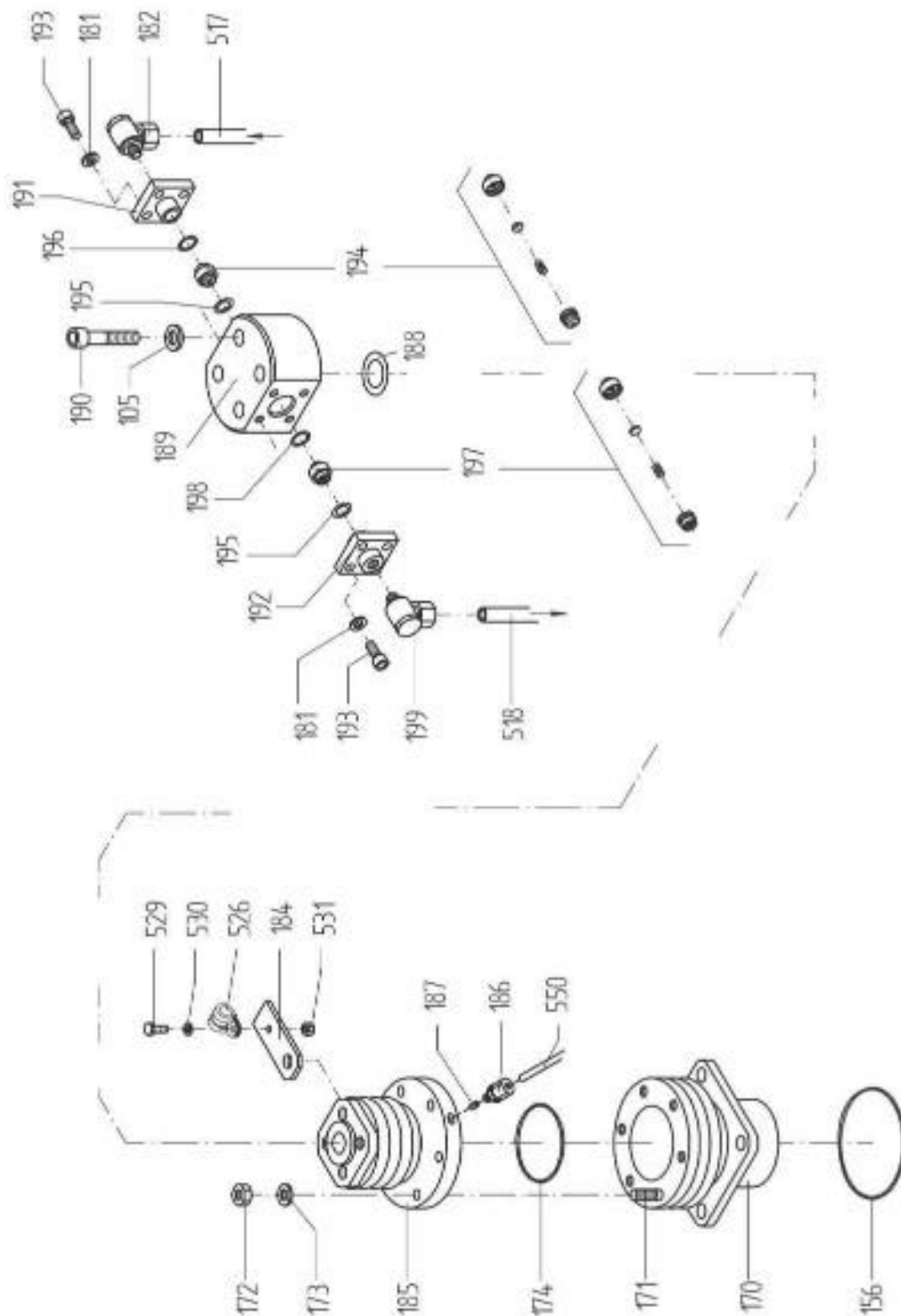


Fig 8 – 3rd Stage Cylinder – parts list

Pos.	Part Number	Description	Quantity
105	094471	Spring Washer D12	4
156	162032	O-Ring 100 x 2	1
170	161922	Guide Cylinder	1
171	004286	Stud M10 x 25	6
172	080772	Nut M10	6
173	094463	Spring Washer D10	6
174	073440	O-Ring 70 x 2	1
181	094455	Spring Washer D8	8
182	148733	Fitting SWVE 12 LR 3/8"	1
184	162232	Cooling Pipe Holder	1
185	161923	Cylinder	1
186	064793	Fitting GE 6 LR	1
187	064785	Nozzle D0.4/M8	1
188	029416	Gasket Ring 33 x 40 x 1 Al	1
189	162553	Cylinder Head	1
190	162710	Screw M12 x 70	4
191	102377	Cover	1
192	082783	Cover	1
193	001481	Screw M8 x 20	8
194	038571	Suction Valve 9A Nr: 22	1
195	028223	Gasket Ring 14.2 x 19 x 0.5 Cu	2
196	028240	Gasket Ring 12 x 19 x 0.5 Cu	1
197	038580	Pressure Valve 9A Nr: 23	1
198	028231	Gasket Ring 11.2 x 19 x 0.5 Cu	1
199	102725	Fitting SWVE 8 SR 1/4"	1
517	025003	Pipe 12.0 x 1.5	1
518	081990	Pipe 8.0 x 2.0	1
526	083054	Fastening Clamp D8/12	1
529	002194	Screw M5 x 10	1
530	125407	Spring Washer D5	1
531	005533	Nut M5	1
550	016829	Pipe 6.0 x 1.5	1

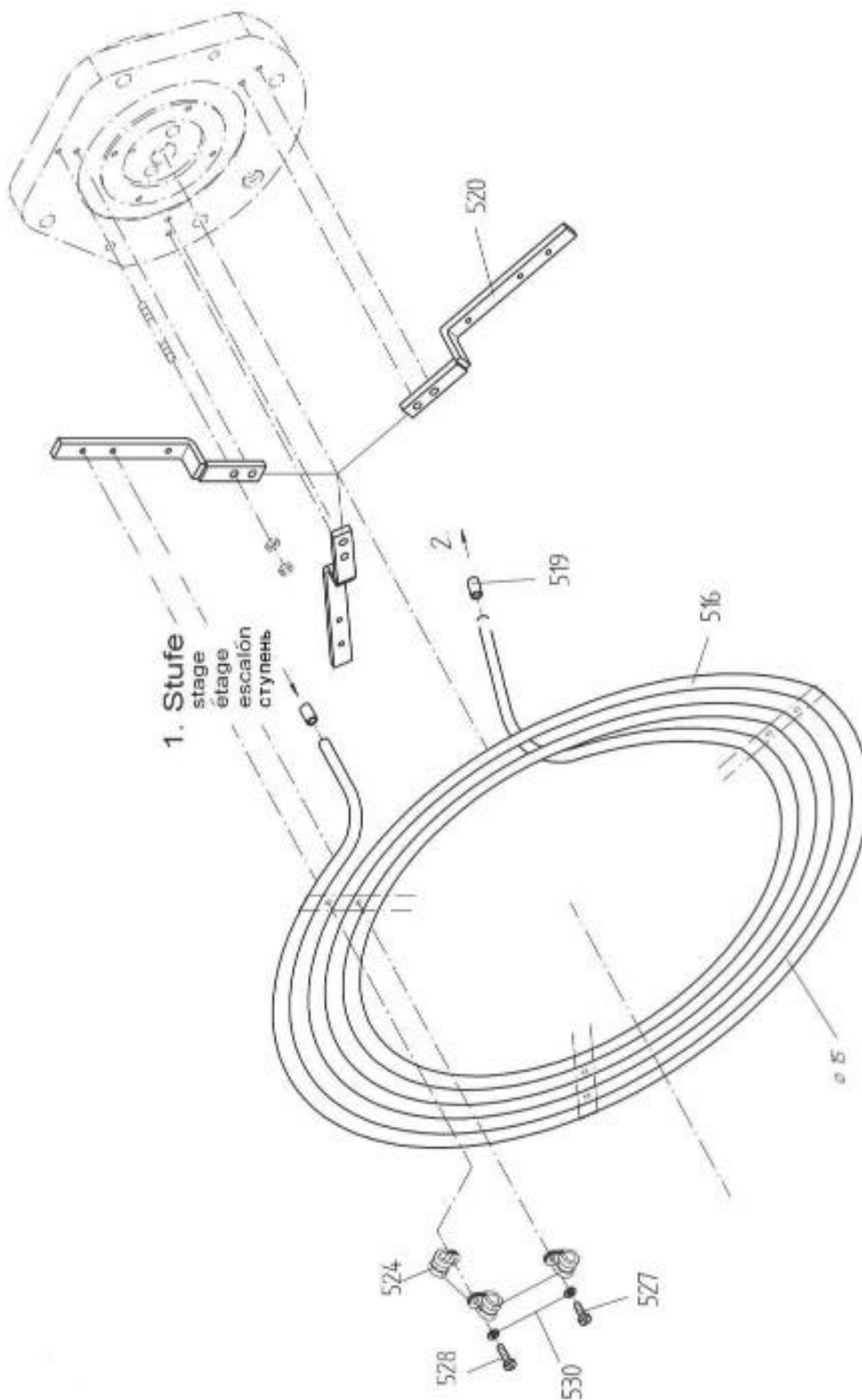


Fig 9 – Cooling Stage 1

Fig 9 – Cooling Stage 1 – parts list

Pos.	Part Number	Description	Quantity
516	162043	Pipe 15.0 x 1.5	1
519	162044	Fitting VSH 15 x 1.5 MS	2
520	161903	Cooling Pipe Holder	3
524	162041	Fastening Clamp D15/12	9
527	171333	Screw M5 x 10	3
528	150223	Screw M5 x 12	3
530	125407	Spring Washer D5	6

Fig 10 – Cooling Stage 2

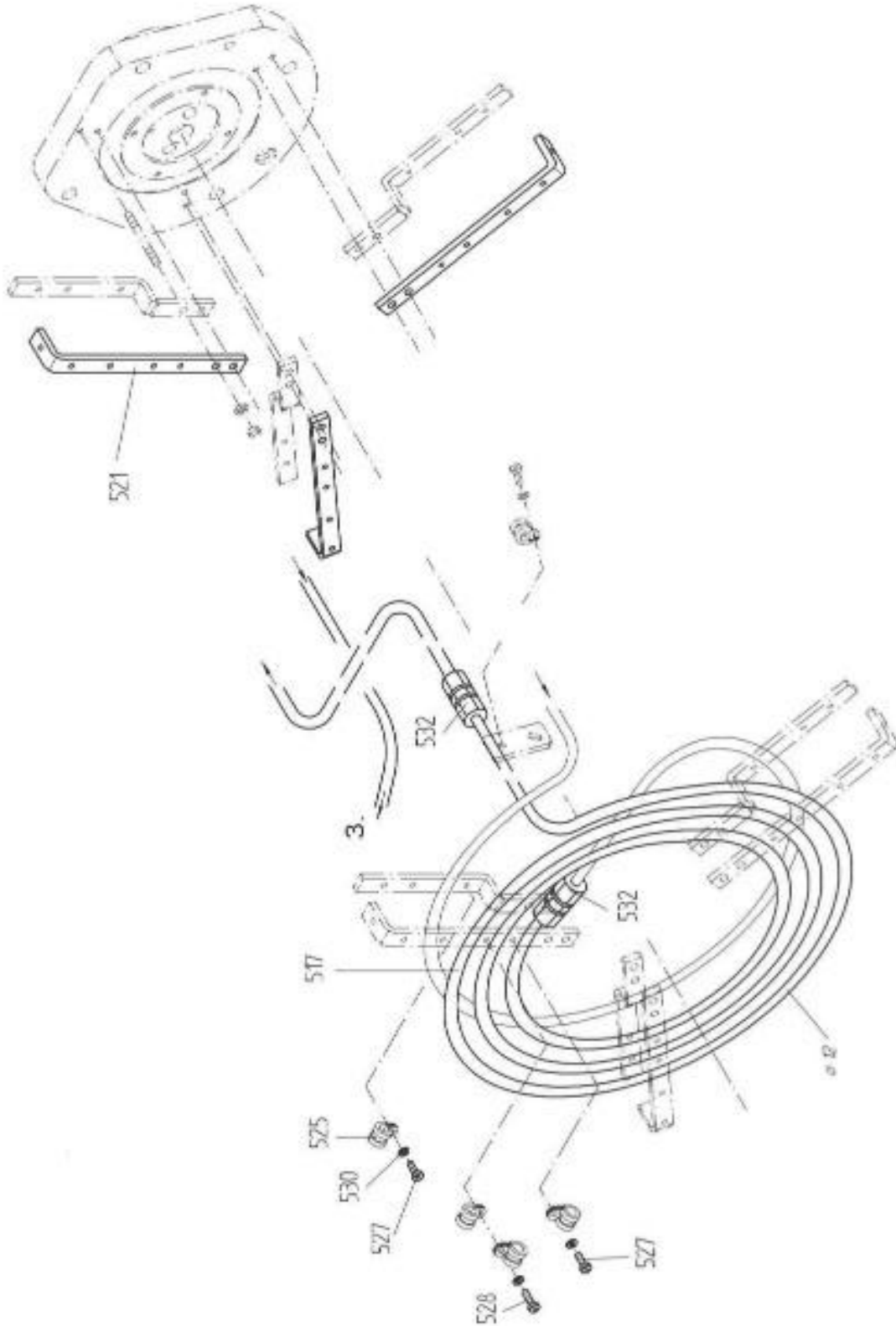


Fig 10 – Unloader Manifold – parts list

Pos.	Part Number	Description	Quantity
517	025003	PIPE 12.0 x 1.5	1
521	161904	COOLING PIPE HOLDER	2
525	126225	FASTENING CLAMP D12/12	12
527	171333	SCREW M5 x 10	6
528	150223	SCREW M5 x 12	3
530	125407	SPRING WASHER D5	9
532	069256	FITTINGS G 12 L	2

Fig 11 – Cooler Stage 3

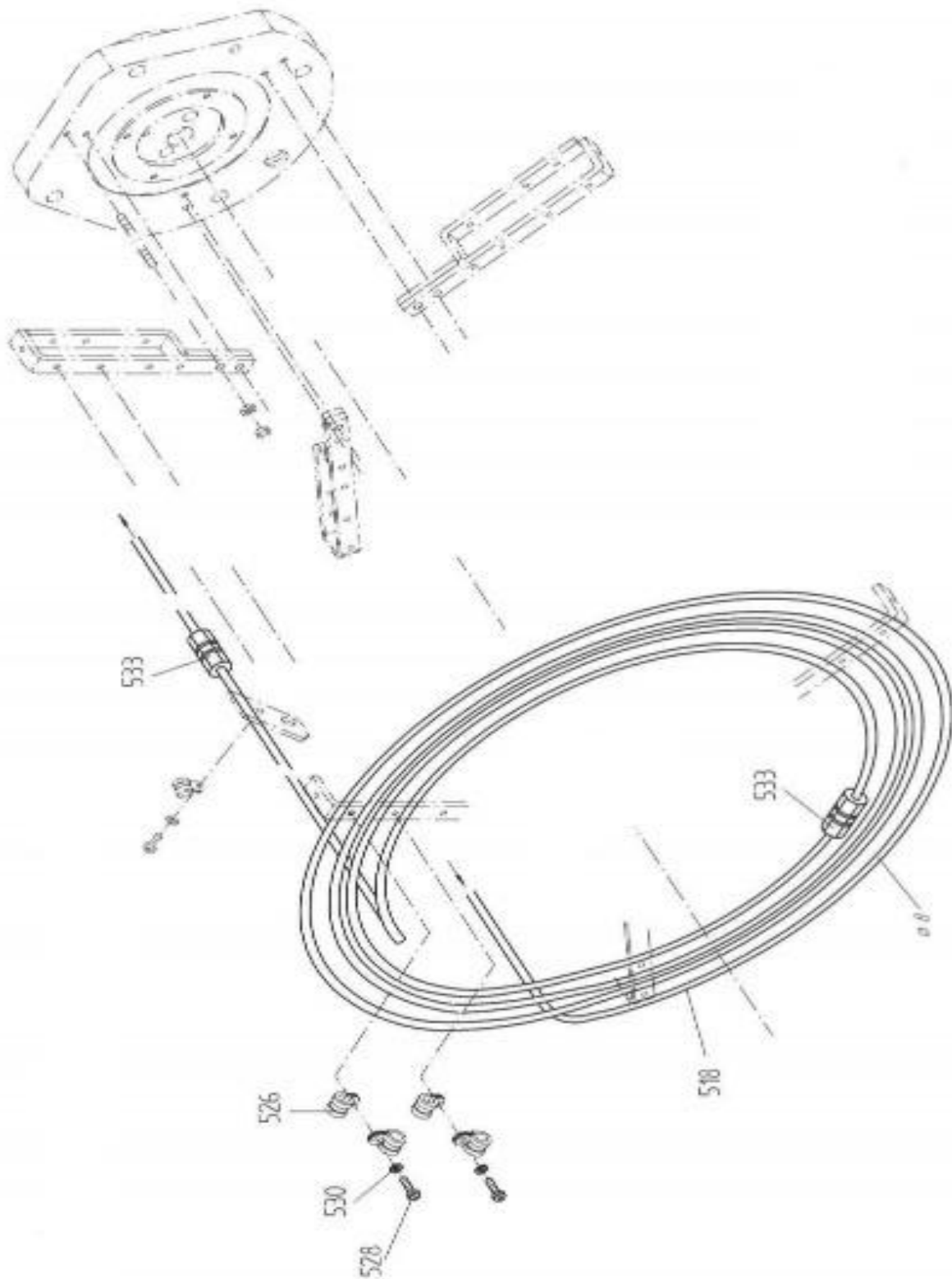


Fig 11 – Cooler Stage 3 – parts list

July 21

Fig 12 – Fan & Gear Wheel Guard

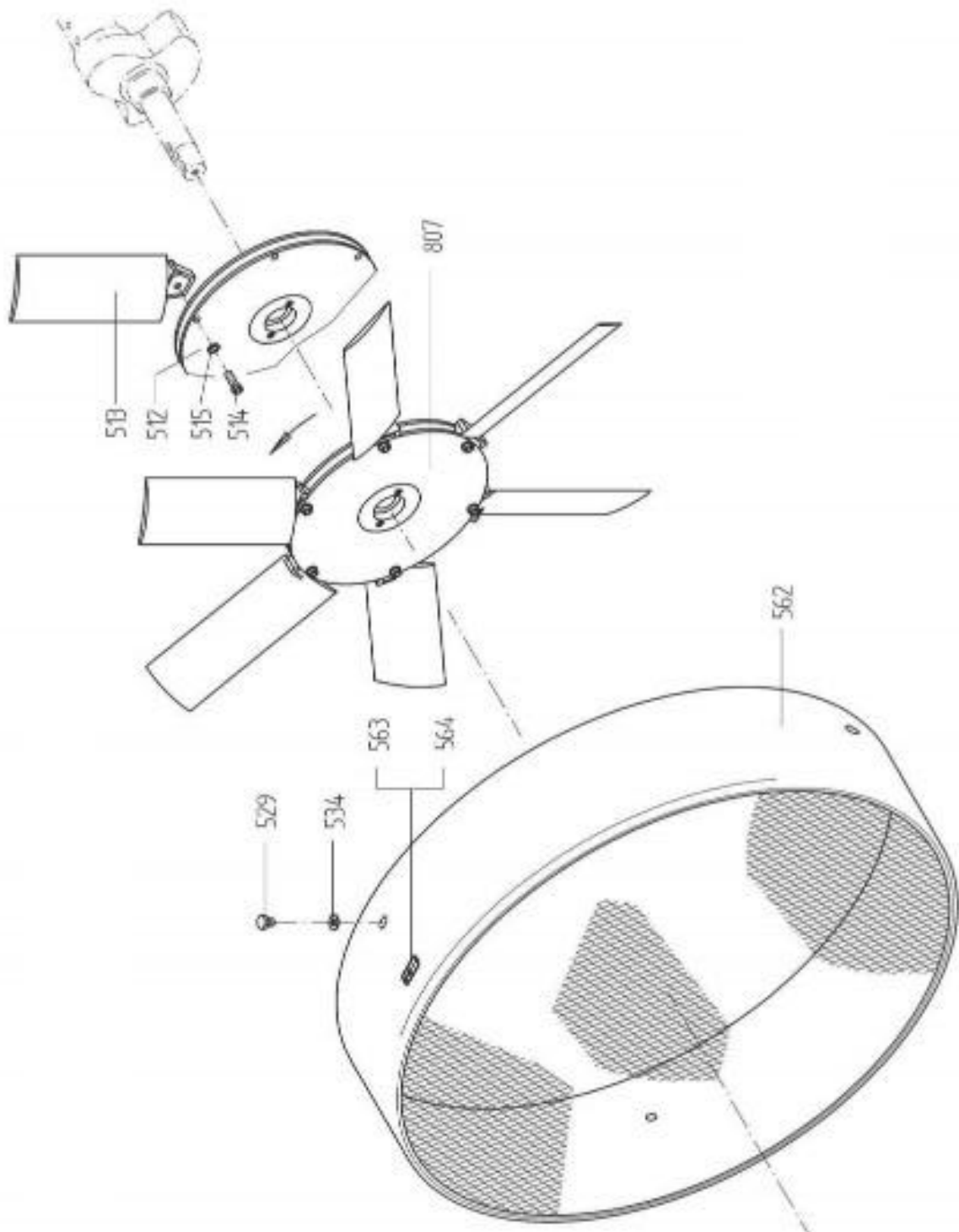


Fig 12 – Fan & Gear Wheel Guard – parts list

Pos.	Part Number	Description	Quantity
512	161902	Fan Wheel Nave	1
513	163602	Fan Blade type E 189	6
514	001368	Screw M6 x 25	6
515	094447	Spring Washer D6	6
536	002267	Screw M6 x 10	3
537	138800	Washer D6.4	3
562	161905	Fan Wheel Hood	1
563	008311	Label "Arrow"	1
564	005398	Round Head Grooved Pin 2 x 4	2
807	163603	Fan Wheel Cpl. - Counterclockwise rotation	1

Fig 13 – Armature Block

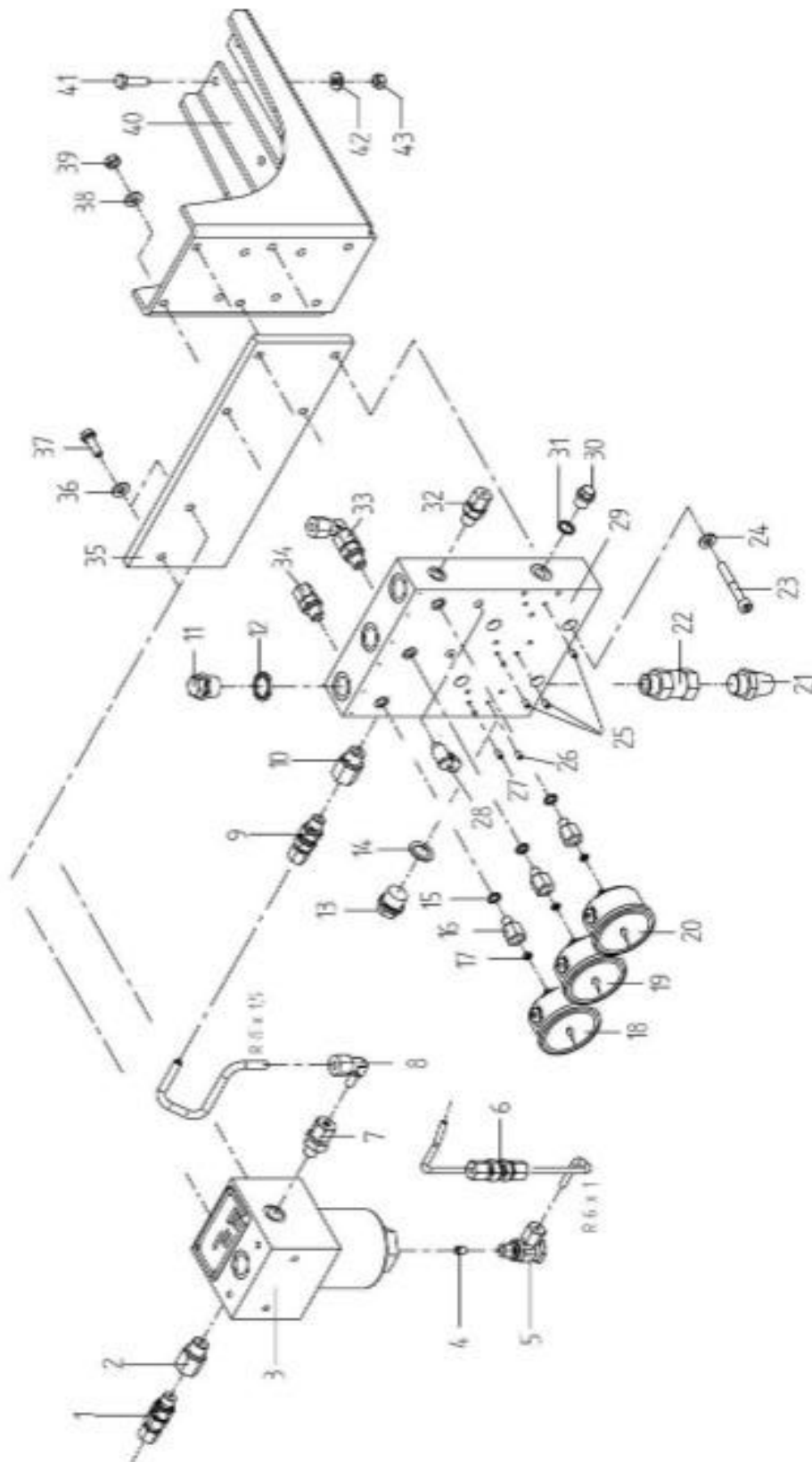


Fig 13 – Armature Block – parts list

Pos.	Part Number	Description	Quantity
1	033120	Non Return Valve RHV 6SR	1
2	170550	Fitting Ri $\frac{3}{8}$ x $\frac{1}{4}$	1
3	501658	Micro Filter cpl.	1
4	191069	Nozzle D0.8xM8	1
5	191068	Fitting Ri SWVE 6SR	1
6	103128	Non Return Valve RHD 6S	1
7	170426	Fitting GE 8PSR $\frac{3}{8}$	1
8	119288	Fitting EVW 8S	1
9	169797	Non Return Valve RHV 8SR	1
10	170550	Fitting Ri $\frac{3}{8}$ x $\frac{1}{4}$	1
11	001180	Locking Screw R $\frac{1}{2}$	1
12	030872	Gasket Ring 21.5 x 28.7 x 2.5	1
13	001180	Locking Screw R $\frac{1}{2}$	1
14	027871	Gasket Ring 21 x 26 x 1.5 Cu	1
15	026760	Gasket Ring $\frac{1}{4}$ Cu	3
16	106860	Reducing Fitting $\frac{1}{8}$ " x $\frac{1}{4}$ "	3
17	175110	Gasket Ring 10x13.5x2 Cu	3
18	198331	Gauge 63D 0-600 / 3rd Stage	1
19	039055	Gauge 63D 0-100 / 2nd Stage	1
20	039055	Gauge 63D 0-25 / 1st Stage	1
21	148687	Silencer G $\frac{1}{2}$	1
22	171997	Non Return Valve R $\frac{1}{2}$	1
23	001600	Screw M8 x 60	4
24	094455	Spring Washer D8	4
25	096768	Nozzle D2 / M5	2
26	096750	Nozzle D3 / M5	1
27	163294	Nozzle D1 / M5	1
28	093270	Fitting SWVE 6LR	2
29	163616	Armature Block	1
30	001155	Locking Screw R $\frac{1}{4}$	1
31	161875	Gasket Ring 14.7 x 22 x 1.5	1

MAINTENANCE INFORMATION

32	069396	Fitting GE 6SR	1
33	068993	Fitting EVW 6SR	1
34	069450	Fitting GE 8 SR	1
35	180381	Micro Filter Holder	1
36	094455	Spring Washer D8	2
37	002488	Screw M8 x 25	2
38	094455	Spring Washer D8	3
39	005550	Nut M8	3
40	198339	Holder	1
41	002488	Screw M8 x 25	6
42	094455	Spring Washer D8	6
43	005550	Nut M8	6

Fig 14 – Discharge Valves

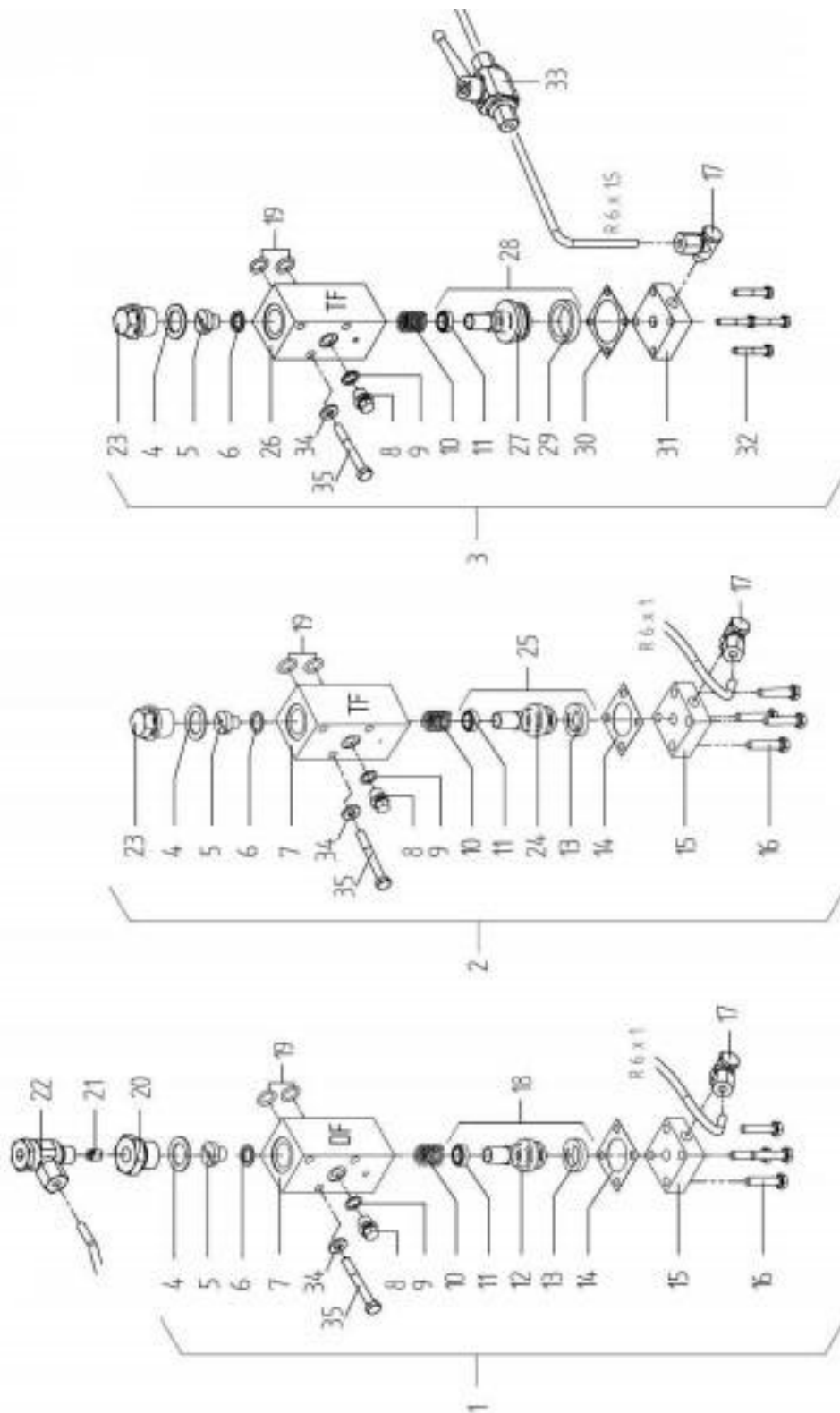


Fig 14 – Discharge Valves – parts list

Pos.	Part Number	Description	Quantity
1	096423	Discharge Valve Cpl., 3rd Stage	1
2	163736	Discharge Valve Cpl., 2nd Stage	1
3	096610	Discharge Valve Cpl., 1st Stage	1
4	027871	Gasket Ring 21 x 26 x 1.5 Cu	3
5	064254	Discharge Valve Seat	3
6	030848	Gasket Ring 16 x 10 x 1.5	3
7	096717	Discharge Valve Housing	2
8	125130	Locking Screw 1/8"	3
9	027782	Gasket Ring 10 x 13 x 1 Cu	3
10	037397	Pressure Spring	3
11	071382	Lip Sealing Ring 16 x 10 x 5 x 4.5	3
12	062219	Discharge Valve Piston	1
13	071439	Lip Sealing ring 25 x 15 x 5 x 4.5	2
14	029505	Cover Gasket	2
15	062081	Housing Cover	2
16	002330	Screw M6 x 30	8
17	093270	Fitting SWVE 6 LR	2
18	177257	Discharge Valve Piston Cpl.	1
19	072737	O-Ring 10 x 3	6
20	068390	Fitting Ri 1/2 x 1/4	1
21	191069	Nozzle D0.8/M8	1
22	191068	Fitting SWVE 6SR	1
23	125121	Locking Screw R 1/2	2
24	062251	Discharge Valve Piston	1
25	177259	Discharge Valve Piston Cpl.	1
26	096687	Housing Cover	1
27	129933	Discharge Valve Piston	1
28	177258	Discharge Valve Piston Cpl.	1
29	096210	Lip Sealing Ring 32 x 24 x 7 x 6	1
30	096679	Cover Gasket	1
31	096660	Housing Cover	1

32	096628	Screw M5 x 30	4
33	033693	Ball Valve	1
34	094447	Spring Washer D6	9
35	002372	Screw M6 x 50	9

Fig 15 - Safety Valves & Pressure Switches

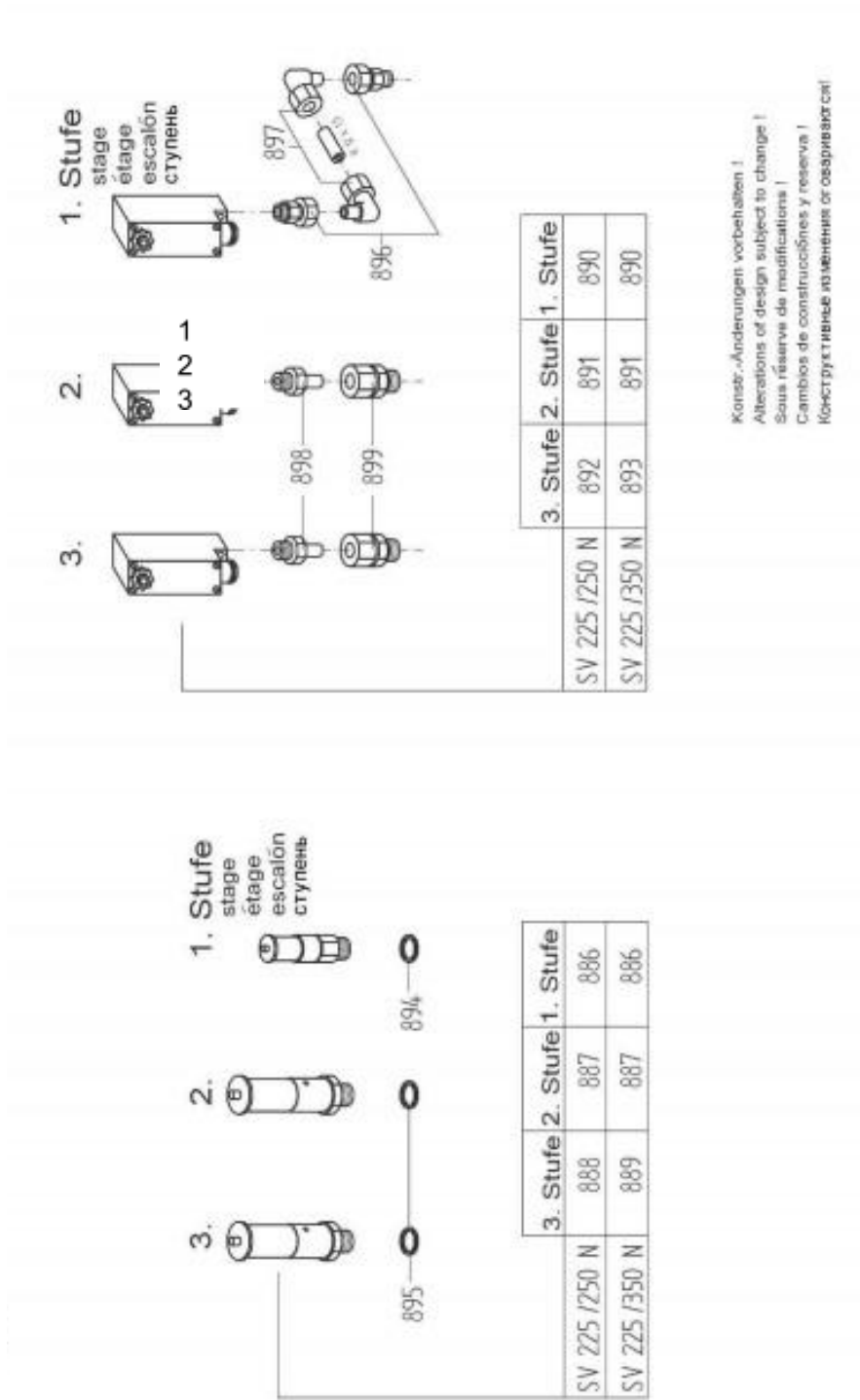


Fig 12 – Safety Valves & Pressure Switches – parts list

Pos.	Part Number	Description	Quantity
886	034371	Safety Valve 11 bar / Stage 1	1
887	169524	Safety Valve 70 bar / Stage 2	1
888	168797	Safety Valve 270 bar / Stage 3 SV225/250	1
889	168813	Safety Valve 365 bar / Stage 3 SV225/350	1
890	161573	Pressure Switch 11 bar / Stage 1	1
891	161574	Pressure Switch 70 bar / Stage 2	1
892	161575	Pressure Switch 270 bar / Stage 3 SV225/250	1
893	161576	Pressure Switch 365 bar / Stage 3 SV225/350	1
894	166401	Gasket Ring 14 x 18.7 x 1.5	1
895	030872	Gasket Ring 21.5 x 28.7 x 2.5	2
896	082970	Fitting GE 12 LR ¼"	2
897	069078	Fitting EVW 12 L	2
898	155772	Tube Socket ¼" x 12	2
899	082988	Fitting GE 12 LR ½"	2