Gardner Denver Ltd

COMPAIR REAVELL

OPERATOR HANDBOOK

For a

5437.1.IA

Water-cooled Air Compressor

In any correspondence please quote;

COMPAIR JOB NUMBER:-	1323436
CUSTOMER:-	GARDNER DENVER, INC
CUSTOMER ORDER NUMBER:-	1509468
MACHINE NUMBER:-	H21060001 & H21060002 H21069001 & H21069002
PUBLICATION NUMBER:-	98407.1849
ISSUE DATE:-	FEBRUARY 2011

CE

Gardner Denver Ltd. Reavell House
53-56 White House Road IPSWICH ENGLAND IP1 5PB
Telephone: +44 (0) 1473 242000 Fax: +44 (0) 1473 745451 Parts Fax: +44 (0) 1473 743468 Service +44 (0) 1527 838632
www.compair.com e-mail:- sales.ipswich@compair.com

OPERATOR HANDBOOK – 5437.1.IA

CONTRACT NUMBER 1323436

TABLE OF CONTENTS

NOTE:

THE REQUIREMENTS OF THE CONTRACT MAY RESULT IN PART NUMBERS IN THE INCLUDED STANDARD HANDBOOK BEING INCORRECT.
ANY ALTERED PART NUMBERS ARE INCLUDED IN THE **CONTRACT SPECIFIC PARTS** SECTION.

1 SAFETY

5000 SERIES COMPRESSORS

WARNING

The use of replacement parts or lubricating oils not supplied, recommended or approved by **CompAir Reavell** Ipswich, or the failure to maintain this equipment in accordance with the maintenance instructions, may invalidate the WARRANTY, cause equipment failure, create unsafe or hazardous conditions or result in damage to the equipment.

CompAir Reavell Ipswich cannot accept responsibility for damage, injury or failure caused by these situations.

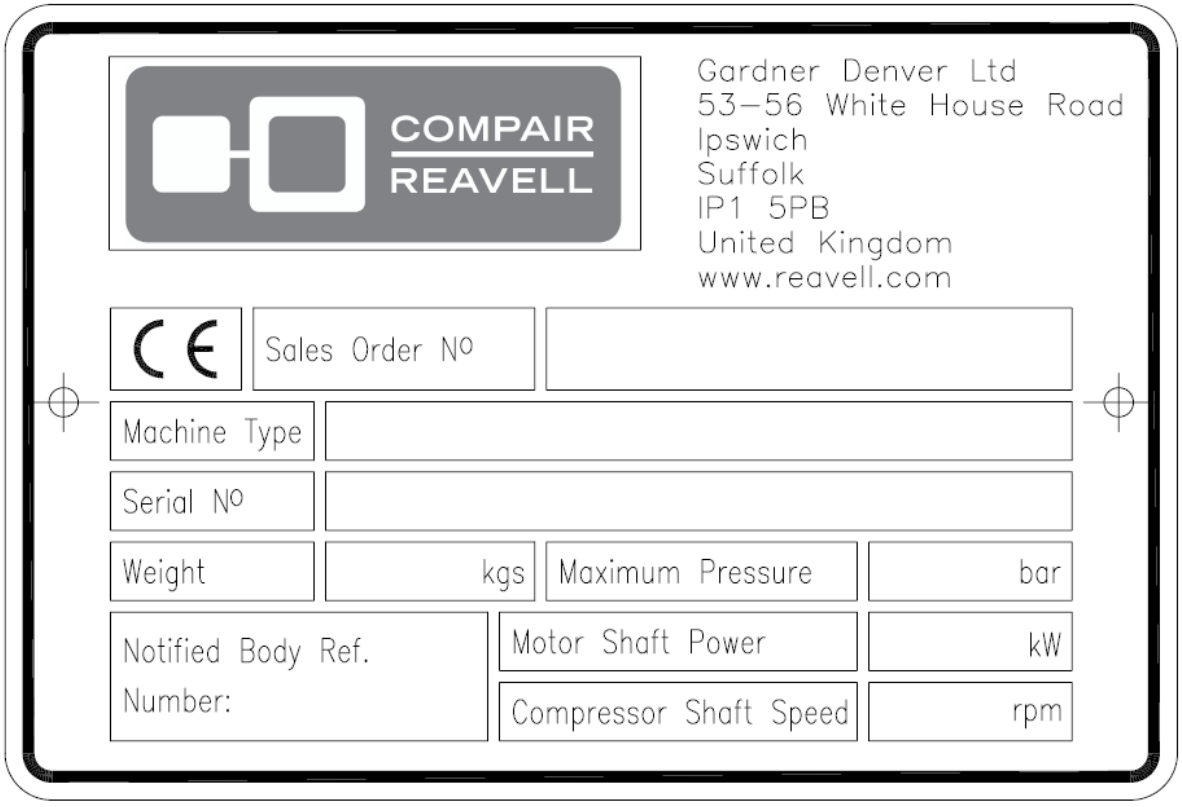
USE ONLY

CompAir Reavell

GENUINE PARTS
AND
AUTHORISED SERVICE AGENTS

1.1 OWNERSHIP DATA

TECHNICAL DATA
It is recommended that details taken from the compressor and motor nameplates are recorded below.



CompAir Reavell CONTACT DETAILS

Contact Name:	**Sales Telephone: +44 (0) 1473 242000**
Address: **Gardner Denver** **Reavell House** **53-56 White House Road** **Ipswich IP1 5PB** **ENGLAND**	**Notes:**
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Contact Names:	**Parts Telephone: +44 (0) 1473 242000** **Parts Fax: +44 (0) 1473 743468**
Contact Names:	**Service: +44 (0) 1527 838632**

For any comments or queries about the contents of this manual, please write to CompAir Reavell at the above address, marked for the attention of Mr. Owen Dale, Technical Author.

1.2 FOREWORD

SPECIAL ATTENTION
The **STANDARD BUILD** of all CompAir Reavell products are not intended for use in either Explosive or Potentially Explosive Atmospheres as defined in Directive 95/9/EC.

An Explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable gases, vapours, hazes or dusts in which, after ignition has occurred, combination propagates to the entire unburned mixture and may cause a hazard.

A Potential Explosive atmosphere is an atmosphere, which could become explosive due to local conditions.

CompAir Reavell H5000 Series compressors are designed and manufactured to give optimum performance, with long life and reliability.

This Manual will help you to obtain the best performance from your compressor. It provides the information required to install, commission and operate the compressor and carry out regular maintenance schedules, which will ensure the maximum satisfactory service life.

Included within the Manual is a comprehensive Parts List to allow the user to order spare parts for servicing.

Servicing facilities and the supply of genuine replacement parts are provided through a world-wide network of CompAir companies and authouised distributors, backed by the **Service tel+44 (0)1527 838632 and Parts department tel (+44 (0) 1473 242000) Fax (+44 (0) 1473 743468 and Sales (+44 (0) 1473 242000 Fax (+44 (0) 1473 743482.**

The information in this Manual was correct at the time of printing but modifications to parts and procedures may be made without notice which could affect the servicing requirements of the compressor. Before any servicing or maintenance work is undertaken the user is advised to contact the local CompAir Company or authorised distributor for revised or up-dated information.

In any communication concerning the compressor it is essential to quote the MODEL, SERIAL No. and any CONTRACT Ref.

It is important this Manual is retained with the compressor for reference and should remain with the compressor if it is sold or transferred to another user. Ensure that the new user is made fully aware of the need to study the Safety Section and any Warnings for safe operation given throughout the text.

Protect the environment by using only approved method of disposal of condensates lubricating oil etc.

Please note:

a. Throughout the Manual all pressures quoted are gauge pressures.

b. Whilst recyclable materials are used as far as possible, please ensure when disposing of condensate, spent oil, used filter elements and any discarded parts or waste material of any kind make sure that there is no pollution to any natural water-course, drain system and that no burning waste takes place which could cause pollution of the atmosphere.

1.3 CAUTION

Use only **CompAir Reavell Genuine Parts** when carrying out routine maintenance or repair. The use of replacement parts or lubricating oils not supplied or recommended by **CompAir Reavell** can lead to expensive failures, which will not be covered by warranty.

Substitution of parts not manufactured or approved by CompAir Reavell can create a potential personnel hazard.

This is a High Pressure Compressor, for safe and reliable operation use only genuine CompAir Reavell Parts

To ensure continued trouble free operation it is important that periodic servicing is carried out in accordance with the information given in this manual - refer to the “Maintenance Section”.

Conditions of CompAir Reavell warranty are stated in our Conditions of Sale. Details of warranty for a particular unit may be obtained from the local CompAir Company or authorised Distributor.

1.4 SAFETY PROCEDURES

- **WARRANTY**
  The Conditions of the CompAir Reavell Warranty are set out in the Standard Conditions of Sale.

- **MAINTENANCE**
  To ensure continued trouble free operation of the compressor it is important that periodic maintenance and servicing are carried out in accordance with the information given in the "Maintenance" section of this Manual. If any replacement or repair is needed use genuine CompAir Reavell parts.

* ***WARNING***
The use of replacement parts or lubricating oils not supplied or approved by
CompAir Reavell may lead to failures in service which would not be covered by warranty.

Any unauthorised modifications or failure to maintain this equipment in accordance with maintenance instructions may make it unsafe. ***The use of replacement parts not supplied by CompAir Reavell may create hazardous conditions over which CompAir Reavell has no control.***

Such hazardous conditions may lead to accidents that can be life threatening, cause substantial bodily injury or result in damage to the equipment. ***CompAir Reavell can bear no responsibility for equipment for which unapproved replacement parts are included.***

SPECIAL NOTE:

THE FOLLOWING HEALTH AND SAFETY PRECAUTIONS MUST BE READ IN CONJUNCTION WITH ANY OTHER MANUFACTURERS EQUIPMENT SUPPLIED.

1.4.1 GENERAL

CompAir Reavell compressor safety relates to the document BS EN1012-1 Compressors and Vacuum Pumps - Safety requirements and the UK Pressure Systems Health & Safety Regulations S.I. No. 128.

- Most accidents which occur during the operation and maintenance of machinery result of failure to observe basic safety rules or precautions. Recognising a situation that is potentially hazardous can often prevent an accident.
- When handling, operating or carrying out maintenance on the unit, personnel must observe safe engineering practices and all relevant local regulations. The attention of users is drawn to the Health and Safety at Work Act 1974, and the regulations of the Institution of Electrical Engineers.
- CompAir *Reavell* cannot anticipate every possible circumstance, which might represent a potential hazard. The WARNINGS in this manual are therefore not all inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by CompAir *Reavell* then they must ensure that the unit will not be damaged or made unsafe and that there is no risk to persons or property.
- Failure to observe these precautions given under "Safety Precautions" may be considered dangerous practice or misuse of the compressor.
- Read and understand all WARNINGS, CAUTION AND MANDATORY LABELS on the unit before operating or carrying out maintenance or servicing.

1.4.2 WARNINGS, CAUTIONS & NOTES

The following details for this Safety Section relate to ESSENTIAL SAFETY REQUIREMENTS referred to in Machinery Directive 89/392/EEC, Amended 91/286/EEC.

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* Warnings call for attention to operating procedures involving specific hazards which could cause injury or death and are identified by the following

RISK OF DANGER

RISK OF HIGH PRESSURE

RISK OF GAS EXHAUST

RISK OF ELECTRIC SHOCK

RISK OF HOT SURFACE

CONSULT MANUAL

1.4.3 GENERAL SAFETY PRECAUTIONS

- When using cleaning solvents, local Health and Safety Regulations must be complied with. Provide good ventilation and use suitable protection such as a breathing filter mask, safety glass, protective apron and gloves.
- Safety footwear should be compulsory in all workshops. Safety helmets must be worn if there is any risk of falling objects.
- If using compressed air for cleaning purposes, ensure safety regulations are complied with and appropriate clothing worn.
- Never direct compressed air onto your skin or at other people. Never use compressed air to clean loose dirt from clothing.
- Before releasing compressed air through a hose make sure the free end is held securely so that it cannot whip and cause injury.
- Avoid injury by using a hoist to lift heavy loads. Check that all chains, hooks, shackles and slings are in good condition and are of the correct capacity. They must be tested and approved according to local safety regulations.
- Cables, chains or ropes should never be applied to lifting eyes. Always use an appropriate shackle or hook, properly positioned. Arrange lifting cables so that there are no sharp bends. Use a spreader bar to avoid side loads on hooks, eyes and shackles and never leave a heavy load unattended.
- When a load is on a hoist stay clear of the danger area beneath and around it. Keep lifting acceleration and speed within safe limits.

1.4.4 INSTALLATION PRECAUTIONS

- Competent personnel under a qualified supervisor must only carry out installation work.
- A fused isolator switch must be fitted between the main power supply and the compressor.
- Precautions must be taken to ensure that no injury is caused to passers-by through loose clothing being sucked into compressor intake.
- Ensure that the discharge pipe from the compressor to the user pipework, receiver or storage is free to expand and that no flammable material is within the vicinity. If any such material is close-by take steps to preclude ignition.
- A manual shut-off valve should be fitted in the discharge line to allow the compressor to be isolated. Non return valves cannot be relied upon for isolating parts from a pressure system. A safety valve must be installed between any compressor unit and the isolating valve.
- A pressure-reliving device must be fitted to every pressure vessel, or equipment containing air or gas above atmospheric pressure. Never remove or tamper with safety devices, guards or insulation fitted. In order to limit the risk of Legionnaires Disease, CompAir Reavell advise caution with the use of cooling towers for water cooling the compressor. Closed circuit or direct mains cooling is preferred.
- Pipework or other parts with a surface temperature above 70°C, which may be accidentally touched in normal operation, must be guarded or insulated. Other high temperature pipework should be clearly marked and all pipework should be clearly marked.

1.4.5 OPERATIONAL PRECAUTIONS

- Competent personnel under a qualified supervisor must only operate the compressor.
- *Do not operate compressor with any removable inspection cover removed e.g. crankcase doors, valve covers etc.*
- Never remove or tamper with safety devices, guards or insulation materials.
- The compressor must only be operated at the supply voltage and frequency for which it is designed. Always isolate power before maintenance or servicing.
- When mains power is ON, lethal voltages are present in the electrical circuits and extreme caution is need when essential work is carried out on the electrical system. ***ALWAYS CONSULT A QUALIFIED ELECTRICIAN BEFORE ANY SUCH ESSENTIAL WORK.***

- Do not open starter compartment to touch electrical components while voltage is applied unless it is necessary for measurement, test or adjustment. Such work should always be carried out by a qualified electrician with appropriates tools and protection against an electrical hazard.
- If the unit is equipped with a Remote Control device, attach warning notices stating ***"THIS UNIT CAN BE STARTED REMOTELY"*** in prominent locations, one on the outside of the unit, the other inside the control compartment.
- As a further safeguard, take adequate precautions that no one is working or checking the unit before attempting to switch on remotely controlled equipment. Attach a ***"CHECK THAT ALL PERSONNEL ARE CLEAR OF UNIT BEFORE STARTING"*** or similar notice.
- Compressed air and gas piping, together with cooling water piping and other parts, with surface temperature greater than 70°C and may be accidentally touched, should be guarded or insulated.
- If there is any indication that the compressor is overheating it must be shutdown. (A high air or gas temperature switch is fitted as standard to guard against operating with excessive temperature). Beware of burns from hot oil and water when working on a unit recently shutdown.
- Do not operate the unit when guards provided for protection for all rotating and reciprocating parts have been removed for essential maintenance. Secure guards following any servicing or repair.
- Local noise regulations must be observed. Ear defenders are suggested by Noise at Work Regulations 1989 when the level is greater than 85 dB A at one meter. Be aware high noise levels can interfere with communication.

1.4.6 MAINTENANCE & REPAIR PRECAUTIONS

- Competent persons under qualified supervisor must carry out maintenance repair and modifications.
- The compressor will have a preserving oil applied to interior surfaces (Oil lubricated models). Oil free models will have desiccant bags in valve covers and distance pieces.
- Handling components such as seals, gaskets and diaphragms should not present a personnel hazard. Preservation oils again should not present a personnel hazard if handled under normal handling practices.
- Whilst compressors are asbestos free, treat all damaged gaskets as asbestos - when the Asbestos at work regulations apply.
- Viton 'O' seals under normal operating conditions are safe.
- However, should there be a fire within the compressor or these seals are likely to exceed a temperature of 300°C the material will decompose.

- **Degraded Viton gives off Hydrogen Fluoride fumes and if in contact with the skin an acid formed causes severe burns.**

- If Viton seals appear charred or gummy do not touch with unprotected hands: use neoprene or PVC gloves.
- Wash the area with limewater and avoid breathing any fumes. If contamination of the skin occurs washes with limewater and seeks medical advice.

Pre-Maintenance Operation

- Isolate the compressor from the main electrical supply. Lock the isolator in the OFF position and remove fuses.
- Attach a label ***" WORK IN PROGRESS - DO NOT APPLY VOLTAGE"***.
- Close the isolating valve between the compression unit and user's pipework. Close the isolating valve in the cooling water inlet pipe. Attach a label ***"WORK IN PROGRESS - DO NOT OPEN".***
- Check that all pressurised gas trapped in the system is released to atmosphere or safely to gas storage. Check that all pressure gauges register zero.
- Ensure that the cooling water system has been drained.
- Check that the drain valve on the delivery manifold is clear and gas pressure has been released.
- Check that all interstage drains are open to ensure any gas trapped between stages has been released.

- Stand clear of all valve covers when removing the securing screws.
- When removing valve covers for valve replacement, ensure a minimum of two threads is left engaged on the valve cover securing screws. Lever the valve cover until the 'O' seal is disengaged from the port in the cylinder head. Remove the securing screws and take out valve cover.
- ***Use only lubricating oils and greases approved by CompAir Reavell to avoid potential hazards especially the risk of explosion or fire and the possibility of decomposition or generation of hazardous gases.***
- Always clean oil spills from the surrounding floor before and after maintenance work.
- Make sure all instructions concerning operation and maintenance are strictly followed and that the complete unit, with all accessories and safety devices, is kept in good order.
- The accuracy of pressure gauges and temperature switches should be regularly checked at least 13 month intervals and thoroughly examined at least every 48 months. They must be renewed or service exchanged when acceptable tolerances are exceeded.
- Protection devices should be tested at each regular service interval and replaced or service exchanged if not functioning correctly. The maximum pressure for safety valves under fault conditions is 1.10 times the set pressure, the set pressure being a minimum of 1.05 times the maximum operating pressure to ensure seat tightness.
- Never use a light source with an open flame for inspection.
- Before dismantling any part of the compressor be sure that all heavy movable parts are secure.
- After completion of any maintenance or repair ensure that no tools, loose items or rags are left on or inside the compressor.
- Do not use any flammable liquid to clean valves, filter elements, cooler passages, pipe bores or any component carrying a flow of air or gas during normal operation. If chlorinated hydrocarbon substances are used for cleaning, safety precautions must be taken against toxic vapours, which may be released.

DO NOT USE CARBON TETRACHLORIDE.

- Precautions must be taken against using acids, alkalis and chemical detergents for cleaning machined parts. These materials cause irritation and are corrosive to the skin, eyes, nose and throat. Avoid splashes and wear suitable protective clothing and safety glasses. Do not breathe mists. Ensure water and soap is readily available.
- When disposing of condensate, old oil, used filter elements and other parts and waste material of any kind make sure that there is no pollution to any drain or natural water course and that no burning of waste takes place which could cause pollution of the atmosphere.
- Keep the compressor clean at all times.
- Protect components and exposed openings by covering with a clean cloth or tape during repair or maintenance work.
- Protect the motor, intake, electrical and regulation components against the entry of moisture e.g. steam cleaning.
- Precautions must be taken when carrying out welding or any repair operation which generates flames or sparks. The adjacent components must be screened with non-flammable material and if oil present, the system must first be cleansed thoroughly by steam cleaning.
- Condensate (oil and water mixture from compression process) must be regarded as trade effluent and is therefore not suitable for discharge into a surface water sewer, soakaway or watercourse.

PROTECT THE ENVIRONMENT USE APPROVED METHODS OF DISPOSAL.

1.4.7 PRECAUTIONS IN THE EVENT OF FIRE

- Use extreme caution when handling components that have been subjected to fire or very high temperature. Some components may contain fluoroelastomer materials, which decompose under these conditions to form highly corrosive residues. Skin contact can cause painful and penetrating burns resulting in permanent skin and tissue damage.

2 AMENDMENTS

ISSUE No	REASON	DATE	PAGE No
1	NEW	FEB 2011	ALL
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3 COMPRESSOR LOG SHEET

COMPRESSOR LOG SHEET															REF NO:		
COMPRESS0R		PRIME MOVER		INSTALLED AT:											OIL GRADE USED:		
TYPE:		TYPE:													CHECK OIL LEVEL		
SPEED:		POWER:													CHECK WATER IN/OUT TEMPS.		
SERIAL NO		DRIVE:		DATE INSTALLED:											CHECK COOLING FAN BLADES		
DATE	TIME	HRS RUN	STAGE TEMP °C	DELY TEMP °C	STAGE PRESSURES BAR / PSI					DELY PRESS. BAR/PSI	SERVICE PLAN NUMBER	REMARKS. SEE OVER FOR MORE	SIGNED				
					1	2	3	4	5								
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		12500															

DATE	REMARKS	DATE	REMARKS

4 TEST SHEET
TEST CERTIFICATE

New Block Test
Serial Number H21060001

From: **Gardner Denver Ltd.**
High Pressure Division
Reavell House,
53-56 White House Road,
Ipswich, Suffolk,
England, IP1 5PB
Tel: +44(0) 1473 242000
Fax: +44(0) 1473 745451
www.compair.com

To: **GARDNER DENVER, INC.**

Contract Number : 1323436
Customer Reference/ L.C Number : 1509468

Description of Equipment : 5437.1323436 , 5437 COMPRESSOR BLOCK
Vee Type, Four Stage, Two Crank, Single Acting, Reciprocating, Water Cooled

Gas Design Type: AIR
Test Medium : Air
Test Date: 07 February 2011

	Target		Actual	(Speed Adjusted)
Customer Unit Of Pressure	PSIG			
Customer RPM	1800	Atmospheric	1745	
		Raised Inlet		
Customer Free Air Delivery M³/Hr	157	Atmospheric	161.34	166.43
		Raised Inlet		
Inlet Pressure				
Outlet Pressure	5003.8		5003.8	
Final Delivery Safety Valve Set @			5584	

Test Motor Used	63.3KW	Volts	440	RPM	
Motor No.		Amps		Cycles	
Manufacturer		KW		Phase	
Type					

Test Performed By : ---------- Dated: ----------

Test Supervisor : ---------- Dated: ----------

British Standard BS ISO 1217 – 2001 Capacity Test
The results contained in this report are valid only for the conditions under which the test was conducted and the specific item tested.

CompAir

COMPAIR REAVELL

TEST CERTIFICATE

New Block Test
Serial Number H21060002

From: **Gardner Denver Ltd.**
High Pressure Division
Reavell House,
53-56 White House Road,
Ipswich, Suffolk,
England, IP1 5PB
Tel: +44(0) 1473 242000
Fax: +44(0) 1473 745451
www.compair.com

To: **GARDNER DENVER, INC.**

Contract Number : 1323436
Customer Reference/ L.C Number : 1509468

Description of Equipment : 5437.1323436 , 5437 COMPRESSOR BLOCK
Vee Type, Four Stage, Two Crank, Single Acting, Reciprocating, Water Cooled

Gas Design Type: AIR
Test Medium : Air
Test Date: 08 February 2011

	Target		Actual	(Speed Adjusted)
Customer Unit Of Pressure	PSIG			
Customer RPM	1800	Atmospheric	1740	
		Raised Inlet		
Customer Free Air Delivery M³/Hr	157	Atmospheric	164.14	169.80
		Raised Inlet		
Inlet Pressure				
Outlet Pressure	5003.8		5003.8	
Final Delivery Safety Valve Set @			5584	

Test Motor Used	63.3KW	Volts	440	RPM	
Motor No.		Amps		Cycles	60Hz
Manufacturer		KW		Phase	3 PHASE
Type					

Test Performed By : ---------- Dated: ----------

Test Supervisor : ---------- Dated: ----------

British Standard BS ISO 1217 – 2001 Capacity Test
The results contained in this report are valid only for the conditions under which the test was conducted and the specific item tested.

CompAir

COMPAIR REAVELL

TEST CERTIFICATE

New Block Test
Serial Number H21069001

From: **Gardner Denver Ltd.**
High Pressure Division
Reavell House,
53-56 White House Road,
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Tel: +44(0) 1473 242000
Fax: +44(0) 1473 745451
www.compair.com

To: **GARDNER DENVER, INC.**

Contract Number : 1323436
Customer Reference/ L.C Number : 1509468

Description of Equipment : 5437.1323436 , 5437 COMPRESSOR BLOCK
Vee Type, Four Stage, Two Crank, Single Acting, Reciprocating, Water Cooled

Gas Design Type: AIR
Test Medium : Air
Test Date: 10 February 2011

	Target		Actual	(Speed Adjusted)
Customer Unit Of Pressure	PSIG			
Customer RPM	1800	Atmospheric	1740	
		Raised Inlet		
Customer Free Air Delivery M³/Hr	157	Atmospheric	161.04	166.60
		Raised Inlet		
Inlet Pressure				
Outlet Pressure	5003.8		5003.8	
Final Delivery Safety Valve Set @			5584	

Test Motor Used	63.3KW	Volts	440	RPM	
Motor No.		Amps		Cycles	60Hz
Manufacturer		KW		Phase	3 PHASE
Type					

Test Performed By : ---------- Dated: ----------

Test Supervisor : ---------- Dated: ----------

British Standard BS ISO 1217 – 2001 Capacity Test
The results contained in this report are valid only for the conditions under which the test was conducted and the specific item tested.

CompAir

COMPAIR REAVELL

TEST CERTIFICATE

New Set Test
Serial Number H21069002

From: **Gardner Denver Ltd.**
High Pressure Division
Reavell House,
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Fax: +44(0) 1473 745451
www.compair.com

To: **GARDNER DENVER, INC.**

Contract Number : 1323436
Customer Reference/ L.C Number : 1509468

Description of Equipment : 5437.1323436 , 5437 COMPRESSOR BLOCK
Vee Type, Four Stage, Two Crank, Single Acting, Reciprocating, Water Cooled

Gas Design Type: AIR
Test Medium : Air
Test Date: 14 February 2011

	Target		Actual	(Speed Adjusted)
Customer Unit Of Pressure	PSIG			
Customer RPM	1800	Atmospheric	1743	
		Raised Inlet		
Customer Free Air Delivery M³/Hr	157	Atmospheric	159.36	164.57
		Raised Inlet		
Inlet Pressure				
Outlet Pressure	5000.0		5000.0	
Final Delivery Safety Valve Set @			5584	

Test Motor Used	63.3KW	Volts		RPM	
Motor No.		Amps		Cycles	
Manufacturer		KW		Phase	
Type					

Test Performed By : ---------- Dated: ----------

Test Supervisor : ---------- Dated: ----------

British Standard BS ISO 1217 – 2001 Capacity Test
The results contained in this report are valid only for the conditions under which the test was conducted and the specific item tested.

CompAir

COMPAIR REAVELL

5 DESCRIPTION OF OPERATION

W A R N I N G :-
BEFORE OPERATING THIS EQUIPMENT USERS SHOULD ENSURE COMPETENCY AND BE MADE AWARE OF AND ENSURE COMPLIANCE WITH THE HEALTH AND SAFETY REGULATIONS APPROPRIATE TO THIS CLASS OF WORK.
ATTENTION OF U.K. USERS IS DRAWN TO THE HEALTH AND SAFETY AT WORK ACT, 1974. & CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 1988.
TAMPERING WITH SAFETY VALVES IS DANGEROUS AND ALSO INVALIDATES THE GUARANTEE.

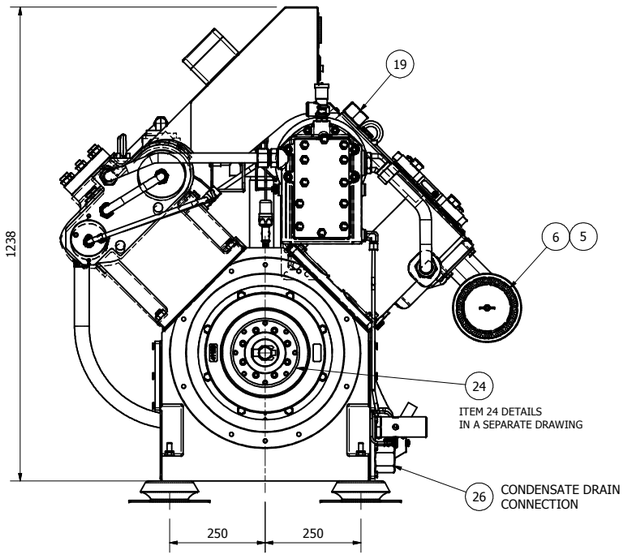
NOTE:- Because the control panel for this compressor was not part of the contract of supply, the control panel operation referred to in the following philosophy is typical only.

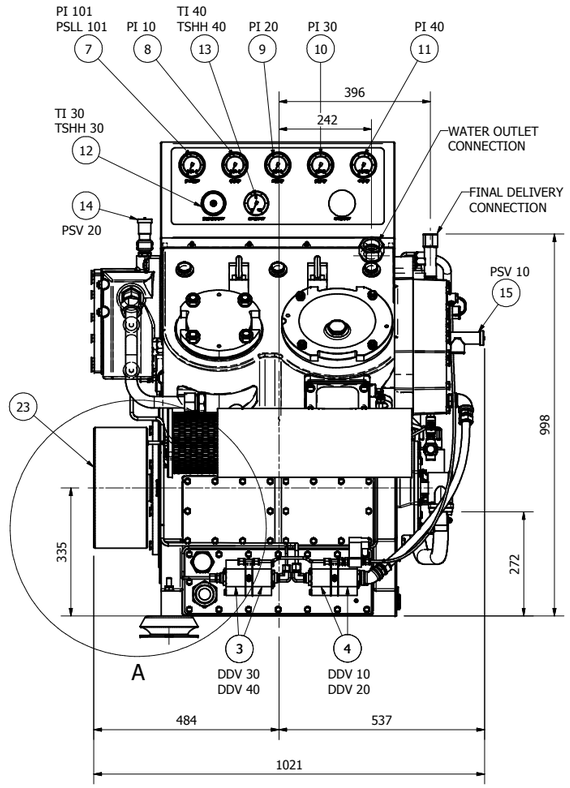
To be read in conjunction with General Arrangement Drawing A41614 & P&I Diagram E47724.
Following on-site connection of electrical supply cables between compressor control panel, marshalling box and motor terminal box.

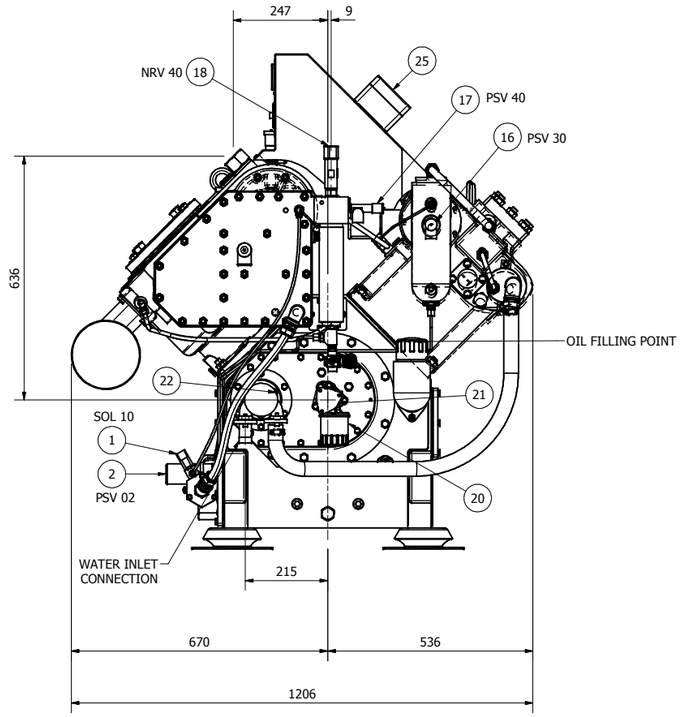
- When control panel isolator is turned to its on position, the power on light and fault light will illuminate.
- Press the reset button to reset trip circuit and extinguish fault light.
- Set MANUAL \ OFF \ AUTO switch to MANUAL or AUTO as appropriate.
- NOTE:- MANUAL operation will prevent re-starting of compressor once full pressure has been reached.
  AUTO operation will allow the compressor to cycle on and off in response to delivery pressure switch.
- Press the start button.
- Immediately, the low oil pressure override timer will energise, power will be supplied to the star / delta timer, and the main and star motor contactors will be energised causing the motor to start in star mode.
- When the star / delta timer operates, the star contactor is de-energised and the delta contactor is energised causing the motor to run in delta mode.
- Additionally, timers for delay to load and diaphragm drain valve operation will be activated together with motor running light and hours run meter.
- As soon as air flows into the compressor, it exits via the delivery drain valve.
- Whilst the compressor is reaching full running speed, the oil pressure rises, causing the low oil pressure switch contacts to close and maintain electrical circuit when override timer operates.
- The delay to load timer then operates in conjunction with the diaphragm drain valve timer, energising the diaphragm drain valve solenoid to close the valve and bringing the compressor onto load.
- Air pressure will increase in the compressor as indicated on the delivery pressure gauge.
- Pressure will continue to rise until the setting of the control pressure switch is reached and its contacts open.
- In MANUAL mode, electrical supply will then be cut to motor contactors, hours run meter, solenoid valves and their timers, together with low oil and low inlet override timers and enable relay.
- The compressor will stop and unload all pressure and will not restart until the start button is pressed irrespective of control pressure switch state.
- In AUTO mode, electrical supply is cut in a similar way to MANUAL mode, except for the enable relay which remains energised allowing automatic restart depending on state of control pressure switch.
- The compressor will continue to operate in this way until one of the following occurs.
  1. Stop button is pressed.
  2. Oil pressure drops to low oil pressure switch setting.
  3. Motor power rises to current overload setting.
  4. Delivery air temperature rises to temperature switch setting.
- Any of the above circumstances will cause the compressor to stop and will prevent restart until the reset button is pressed.
- If current overload has operated, the manual reset button located on the unit will have to be pressed.
- Fault light on control panel will illuminate to indicate fault status.
- During normal running, the cyclic timer will cause the diaphragm drain valves to periodically unload the separators and discharge collected condensate to a suitable collection vessel.

6 DRAWINGS

6.1 GENERAL ARRANGEMENT – A41614







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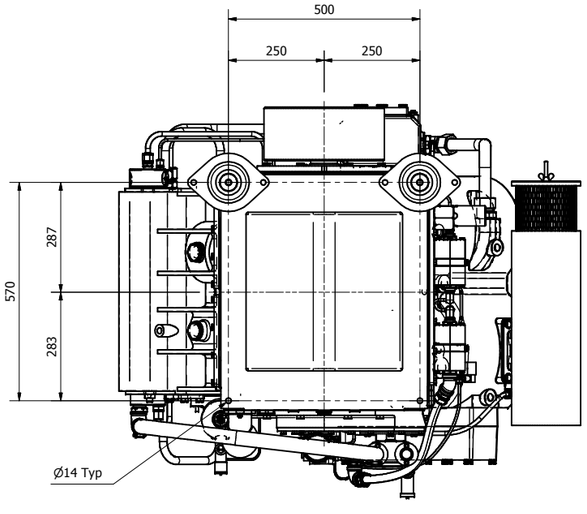
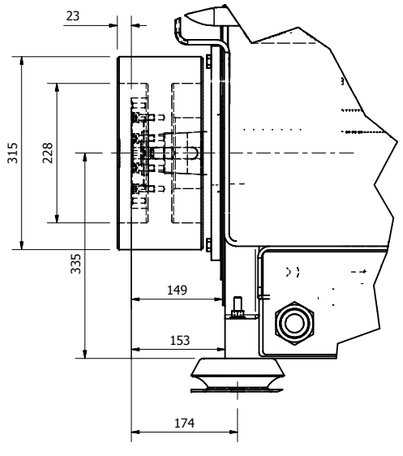
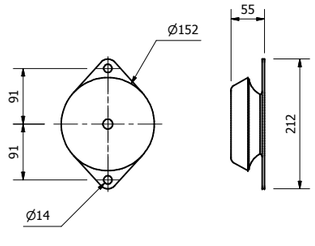






ANTI-VIBRATION MARINE MOUNTS

CONNECTION DETAILS:

FINAL DELIVERY -
CONNECT TO ½" NPT FEMALE ADAPTOR.

WATER INLET -
CONNECT DIRECT TO WATER PUMP VIA HOSE
ADAPTOR TO SUIT 32mm NOM. BORE FLEXIBLE HOSE.

WATER OUTLET -
CONNECT TO 1¼" NPT FEMALE ADAPTOR.

CONDENSATE DRAIN FROM SURGE VESSEL-
CONNECT TO 1½" NPT FEMALE ADAPTOR.

DRAWING REFERENCE

P & I DIAGRAM E47724

APPROXIMATE WEIGHTS

BARE COMPRESSOR ..... 1100 Kg

FLYWHEEL .....48 Kg

TOTAL .....1148 Kg

ITEM	PART NUMBER	DESCRIPTION	QTY
1	PS2197.4	SOLENOID VALVE 12 BAR 100V-60HZ	1
2	98650.1011	SAFETY VALVE 2.1 BAR	1
3	U334.J	DDV ASSEMBLY	1
4	U334.L	DIAPHRAGM DRAIN VALVE	1
5	98262.1010	FILTER SILENCER MAIN BODY	1
6	98262.1063	ELEMENT - PAPER TYPE 3/CP	1
7	98288.1001	GAUGE 0-6 BAR 1/4" BSPP	1
8	98288.1002	GAUGE PRESS. 0-6 BAR CU ALLOY	1
9	98288.1003	GAUGE PRESS. 0-40 BAR CU ALLOY	1
10	98288.1004	GAUGE PRESS. 0-160 BAR CU ALLOY	1
11	98288.1005	GAUGE - 0-600 BAR 1/4"BSPP	1
12	C202556.8	INDICATING TEMP. CONTROLLER - 220 C	1
13	C202960.1	INDICATING TEMP. CONTROLLER - TRIP 75 C	1
14	98650.1021-24	SAFETY VALVE 24 BAR Rp1/2-G3/4	1
15	98650.1020-3.8	SAFETY VALVE 3.8 BAR 1/2"BSPT(M)-3/4"BSPP(F)	1
16	98650.1022-117	SAFETY VALVE 117 BAR 1/2"BSPP(M)-1/2"BSPP(F)	1
17	98650.1355-385	SAFETY VALVE - 385 BAR	1
18	C200433	NPT ADAPTOR - 1/2"NPTF-1/2"BSPP(M)	1
19	C88134	ADAPTOR - 1.1/4"NPT(F)-1.1/4"BSPP(M)	1
20	98262.1009	OIL FILTER - EFL89	1
21	C85737.2	OIL PUMP & DRIVE FITTING ASSEMBLY	1
22	98446.1009	WATER PUMP - JABSCO	1
23	E60248.1	FLYWHEEL PULLEY - DC SETS 315 OD	1
24	D72878	FLYWHEEL ADAPTOR PLATE	1
25	98241.1173	TERMINAL BOX 120x122x91	1
26	C70025	ADAPTOR 1½" BSP TO 1½" NPT	1

COMPUTER GENERATED DRAWING – DO NOT ALTER MANUALLY

CompAir

DO NOT SCALE - IF IN DOUBT ASK

MATERIAL
MATL. SPEC.
REAVELL CODE
PATTERN No.

THIRD ANGLE PROJECTION

STATUS Released SIZE A1
LOCATION
SOFTWARE Inventor 11 MERIDIAN

MANUFACTURING TOLERANCES TO BE AS FOLLOWS UNLESS OTHERWISE STATED
MACHINED ± 0.3 ANGULAR ± 0.5'
FABRICATED ± 1.5 CAST BS6615 CT9
DIMENSIONS IN MILLIMETRES SURFACE TEXTURE VALUE IN MICROMETRES
MACHINE WHERE MARKED..... REMOVE SHARP EDGES

SCALE (A1 PLOT) 1:8
PRODUCT 5437
JOB No. 1323436

DRAWN H.Ayala
REVISED
APPROVED R.Blake 11/01/2011

ISSUE DATE 11/01/2011
LAST MOD No. NONE

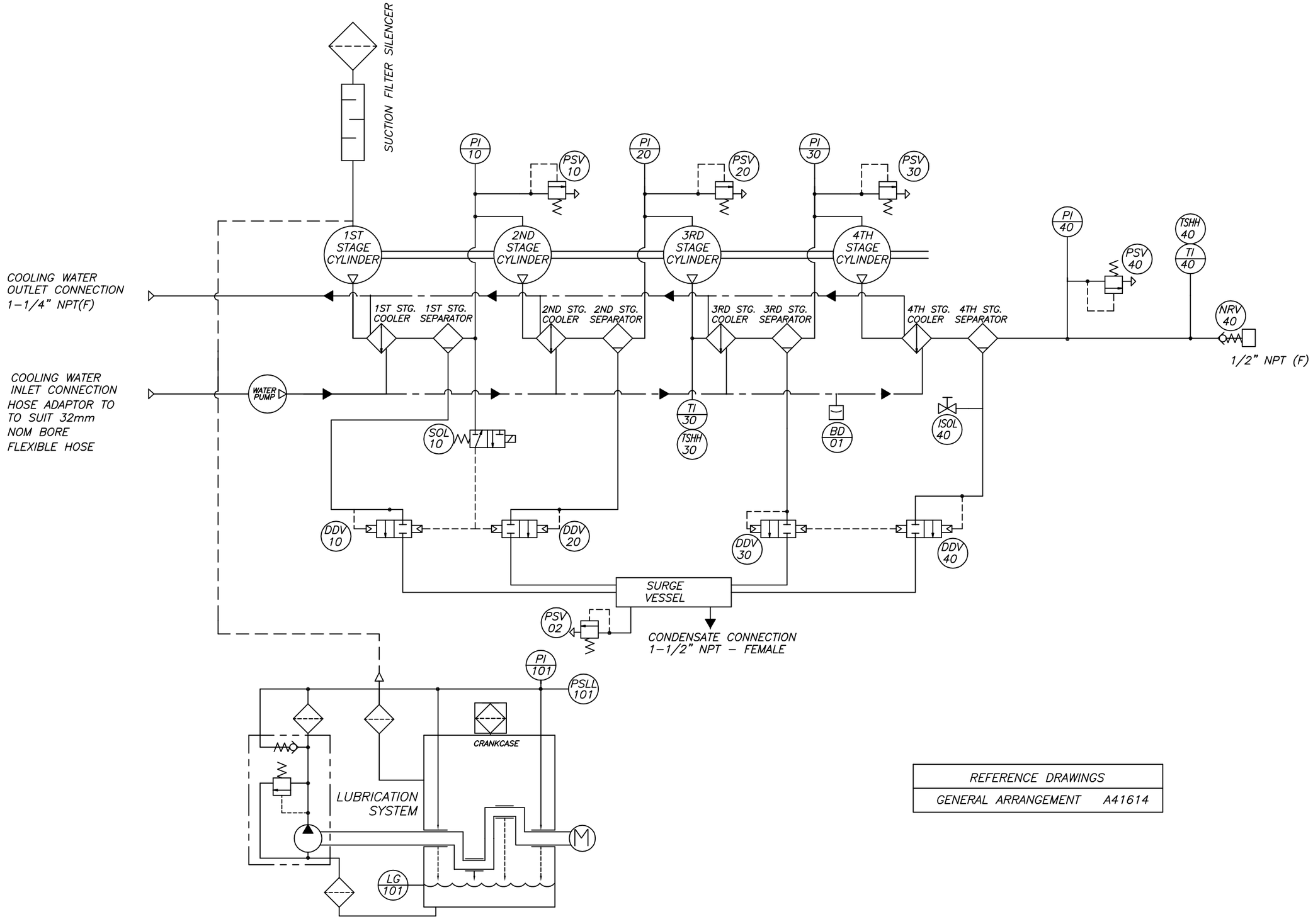
COMPAIR UK LIMITED
REAVELL HOUSE
53-56 WHITE HOUSE ROAD
IPSWICH
SUFFOLK
IP1 5PB
UNITED KINGDOM
TEL +44 (0) 1473 242 000
www.CompAir.com

GENERAL ARRG'T 5437 O-B-A-M

GARNER DENVER INC.

SHT No. 1 OF 1 SHTs | PHASE IS | DRAWING No. A41614 | ISSUE A

6.2 P&I DIAGRAM – E47724



REFERENCE DRAWINGS	
GENERAL ARRANGEMENT	A41614

COMPUTER GENERATED DRAWING - DO NOT ALTER MANUALLY

COMPAIR REAVELL

DO NOT SCALE - IF IN DOUBT ASK

THIRD ANGLE PROJECTION

STATUS Released SIZE A1L-E
LOCATION E47724-A.dwg
SOFTWARE AutoCAD Release 13
WorkCentre Release 1.2a

MATERIAL
MATL. CODE PATTERN No.

MANUFACTURING TOLERANCES TO BE AS FOLLOWS UNLESS OTHERWISE STATED
MACHINED ±0.3 ANGULAR ±0.5°
FABRICATED ±1.5 CAST BS6615 CT9
DIMENSIONS IN MILLIMETRES SURFACE TEXTURE VALUE IN MICROMETRES
MACHINE WERE MARKED..... REMOVE SHARP EDGES

SCALE (A1 PLOT) -------
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ISSUE DATE 11/01/2011
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Gardner Denver Ltd.,
53-56 WHITE HOUSE RD.,
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SUFFOLK,
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TEL. +44 (0) 1473 242000
www.reavell.com

P & I DIAGRAM 5437 0-B-A-M
GD INC

SHT No. 1 OF 1 SHTs	PHASE IS	DRAWING No. E47724	ISSUE A

7 COMPRESSOR HANDBOOK

Gardner Denver Ltd

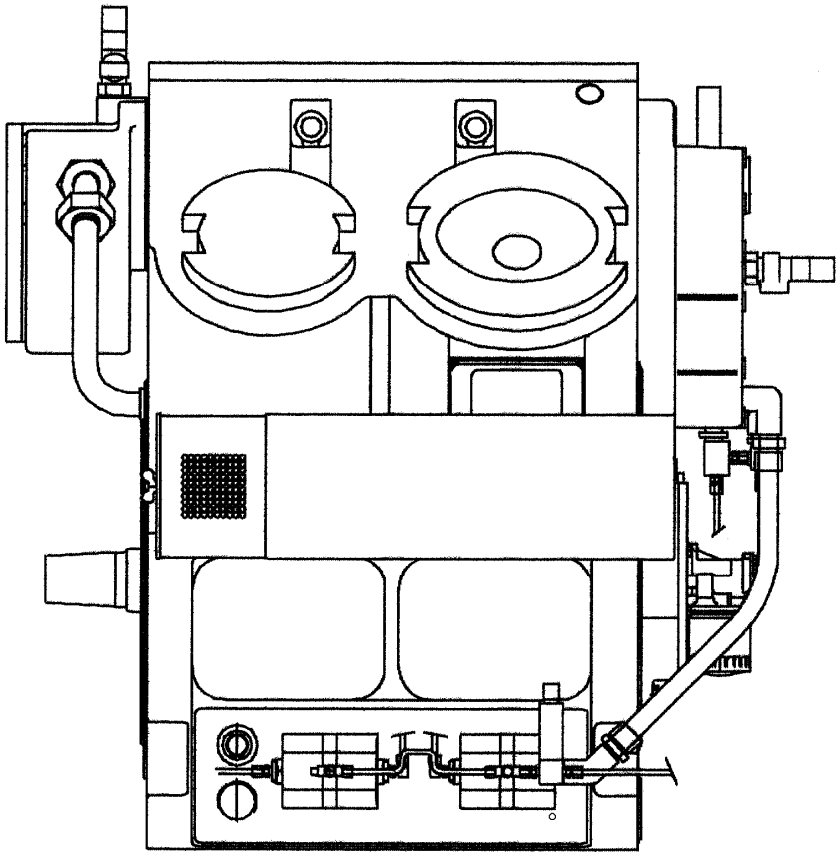
COMPAIR REAVELL

OPERATOR HANDBOOK

For a

H5437.1.IA

HIGH PRESSURE Compressor



In any correspondence please quote;

COMPAIR JOB NUMBER:-
CUSTOMER:-
CUSTOMER ORDER NUMBER:-
MACHINE NUMBER:-
PUBLICATION NUMBER:- 98407.1273 iss6
ISSUE DATE:- JULY 2010

CE

Gardner Denver Ltd. Reavell House
53-56 White House Road IPSWICH ENGLAND IP1 5PB
Telephone: +44 (0) 1473 242000 Fax: +44 (0) 1473 745451 Parts Fax: +44 (0) 1473 743468 Service +44 (0) 1527 838632
www.compair.com e-mail:- sales.ipswich@compair.com

SERVICE MANUAL FOR A 5437.1.IA WATER-COOLED AIR COMPRESSOR

1 SAFETY

5000 SERIES COMPRESSORS

WARNING

The use of replacement parts or lubricating oils not supplied, recommended or approved by **CompAir Reavell** Ipswich, or the failure to maintain this equipment in accordance with the maintenance instructions, may invalidate the WARRANTY, cause equipment failure, create unsafe or hazardous conditions or result in damage to the equipment.

CompAir Reavell Ipswich cannot accept responsibility for damage, injury or failure caused by these situations.

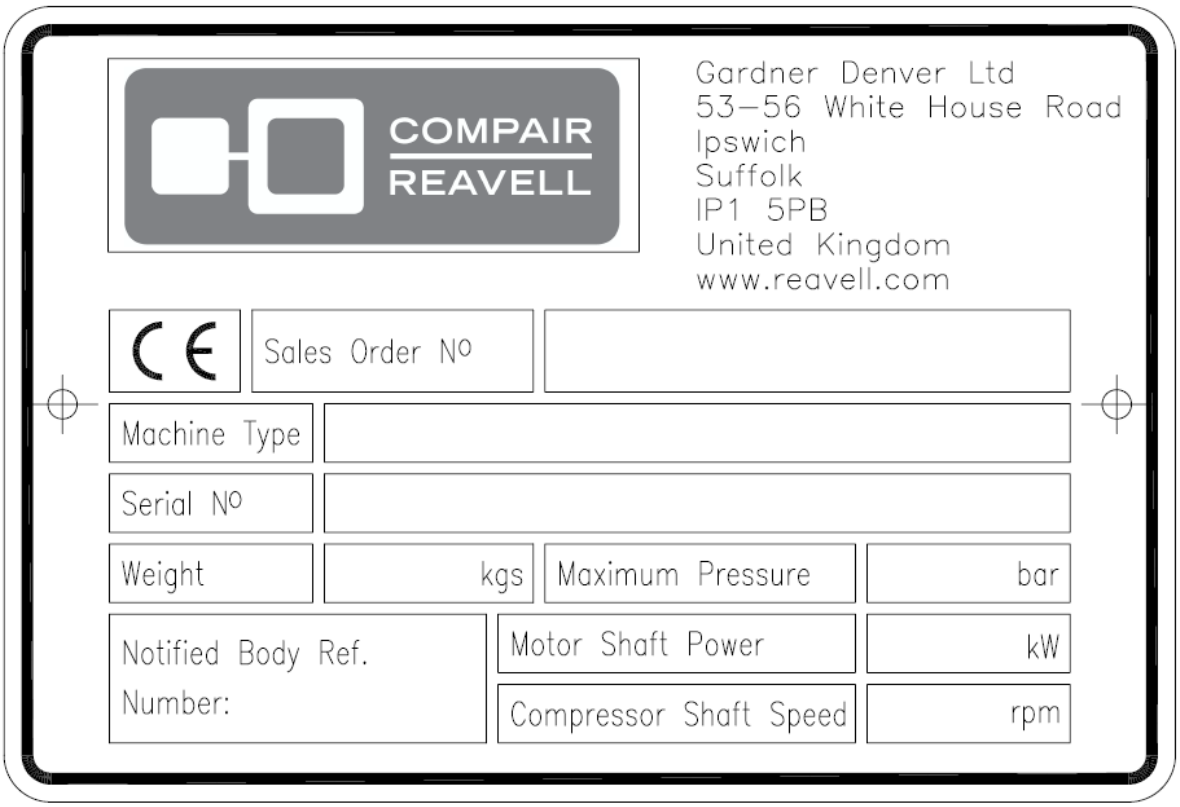
USE ONLY

CompAir Reavell

GENUINE PARTS
AND
AUTHORISED SERVICE AGENTS

1.1 OWNERSHIP DATA

TECHNICAL DATA
It is recommended that details taken from the compressor and motor nameplates are recorded below.



CompAir Reavell CONTACT DETAILS

Contact Name:	**Sales Telephone: +44 (0) 1473 242000**
Address: **Gardner Denver** **Reavell House** **53-56 White House Road** **Ipswich IP1 5PB** **ENGLAND**	**Notes:**
Telephone: +44 (0) 1473 242000	**Fax: +44 (0) 1473 745451**
Contact Names:	**Parts Telephone: +44 (0) 1473 242000** **Parts Fax: +44 (0) 1473 743468**
Contact Names:	**Service: +44 (0) 1527 838632**

For any comments or queries about the contents of this manual, please write to CompAir Reavell at the above address, marked for the attention of Mr. Owen Dale, Technical Author.

1.2 FOREWORD

SPECIAL ATTENTION
The **STANDARD BUILD** of all CompAir Reavell products are not intended for use in either Explosive or Potentially Explosive Atmospheres as defined in Directive 95/9/EC.

An Explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable gases, vapours, hazes or dusts in which, after ignition has occurred, combination propagates to the entire unburned mixture and may cause a hazard.

A Potential Explosive atmosphere is an atmosphere, which could become explosive due to local conditions.

CompAir Reavell H5000 Series compressors are designed and manufactured to give optimum performance, with long life and reliability.

This Manual will help you to obtain the best performance from your compressor. It provides the information required to install, commission and operate the compressor and carry out regular maintenance schedules, which will ensure the maximum satisfactory service life.

Included within the Manual is a comprehensive Parts List to allow the user to order spare parts for servicing.

Servicing facilities and the supply of genuine replacement parts are provided through a world-wide network of CompAir companies and authouised distributors, backed by the **Service tel+44 (0)1527 838632 and Parts department tel (+44 (0) 1473 242000) Fax (+44 (0) 1473 743468 and Sales (+44 (0) 1473 242000 Fax (+44 (0) 1473 743482.**

The information in this Manual was correct at the time of printing but modifications to parts and procedures may be made without notice which could affect the servicing requirements of the compressor. Before any servicing or maintenance work is undertaken the user is advised to contact the local CompAir Company or authorised distributor for revised or up-dated information.

In any communication concerning the compressor it is essential to quote the MODEL, SERIAL No. and any CONTRACT Ref.

It is important this Manual is retained with the compressor for reference and should remain with the compressor if it is sold or transferred to another user. Ensure that the new user is made fully aware of the need to study the Safety Section and any Warnings for safe operation given throughout the text.

Protect the environment by using only approved method of disposal of condensates lubricating oil etc.

Please note:

a. Throughout the Manual all pressures quoted are gauge pressures.

b. Whilst recyclable materials are used as far as possible, please ensure when disposing of condensate, spent oil, used filter elements and any discarded parts or waste material of any kind make sure that there is no pollution to any natural water-course, drain system and that no burning waste takes place which could cause pollution of the atmosphere.

1.3 CAUTION

Use only **CompAirReavell Genuine Parts** when carrying out routine maintenance or repair. The use of replacement parts or lubricating oils not supplied or recommended by **CompAir Reavell** can lead to expensive failures, which will not be covered by warranty.

Substitution of parts not manufactured or approved by CompAir Reavell can create a potential personnel hazard.

This is a High Pressure Compressor, for safe and reliable operation use only genuine CompAir Reavell Parts

To ensure continued trouble free operation it is important that periodic servicing is carried out in accordance with the information given in this manual - refer to the “Maintenance Section”.

Conditions of CompAir Reavell warranty are stated in our Conditions of Sale. Details of warranty for a particular unit may be obtained from the local CompAir Company or authorised Distributor.

1.4 SAFETY PROCEDURES

- **WARRANTY**
  The Conditions of the CompAir Reavell Warranty are set out in the Standard Conditions of Sale.

- **MAINTENANCE**
  To ensure continued trouble free operation of the compressor it is important that periodic maintenance and servicing are carried out in accordance with the information given in the "Maintenance" section of this Manual. If any replacement or repair is needed use genuine CompAir Reavell parts.

* ***WARNING***
  The use of replacement parts or lubricating oils not supplied or approved by CompAir Reavell may lead to failures in service which would not be covered by warranty.

Any unauthorised modifications or failure to maintain this equipment in accordance with maintenance instructions may make it unsafe. ***The use of replacement parts not supplied by CompAir Reavell may create hazardous conditions over which CompAir Reavell has no control.***

Such hazardous conditions may lead to accidents that can be life threatening, cause substantial bodily injury or result in damage to the equipment. ***CompAir Reavell can bear no responsibility for equipment for which unapproved replacement parts are included.***

SPECIAL NOTE:

THE FOLLOWING HEALTH AND SAFETY PRECAUTIONS MUST BE READ IN CONJUNCTION WITH ANY OTHER MANUFACTURERS EQUIPMENT SUPPLIED.

1.4.1 GENERAL

CompAir Reavell compressor safety relates to the document BS EN1012-1 Compressors and Vacuum Pumps - Safety requirements and the UK Pressure Systems Health & Safety Regulations S.I. No. 128.

- Most accidents which occur during the operation and maintenance of machinery result of failure to observe basic safety rules or precautions. Recognising a situation that is potentially hazardous can often prevent an accident.
- When handling, operating or carrying out maintenance on the unit, personnel must observe safe engineering practices and all relevant local regulations. The attention of users is drawn to the Health and Safety at Work Act 1974, and the regulations of the Institution of Electrical Engineers.
- CompAir *Reavell* cannot anticipate every possible circumstance, which might represent a potential hazard. The WARNINGS in this manual are therefore not all inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by CompAir *Reavell* then they must ensure that the unit will not be damaged or made unsafe and that there is no risk to persons or property.
- Failure to observe these precautions given under "Safety Precautions" may be considered dangerous practice or misuse of the compressor.
- Read and understand all WARNINGS, CAUTION AND MANDATORY LABELS on the unit before operating or carrying out maintenance or servicing.

1.4.2 WARNINGS, CAUTIONS & NOTES

The following details for this Safety Section relate to ESSENTIAL SAFETY REQUIREMENTS referred to in Machinery Directive 89/392/EEC, Amended 91/286/EEC.

CE

* Warnings call for attention to operating procedures involving specific hazards which could cause injury or death and are identified by the following

RISK OF DANGER

RISK OF HIGH PRESSURE

RISK OF GAS EXHAUST

RISK OF ELECTRIC SHOCK

RISK OF HOT SURFACE

CONSULT MANUAL

1.4.3 GENERAL SAFETY PRECAUTIONS

- When using cleaning solvents, local Health and Safety Regulations must be complied with. Provide good ventilation and use suitable protection such as a breathing filter mask, safety glass, protective apron and gloves.
- Safety footwear should be compulsory in all workshops. Safety helmets must be worn if there is any risk of falling objects.
- If using compressed air for cleaning purposes, ensure safety regulations are complied with and appropriate clothing worn.
- Never direct compressed air onto your skin or at other people. Never use compressed air to clean loose dirt from clothing.
- Before releasing compressed air through a hose make sure the free end is held securely so that it cannot whip and cause injury.
- Avoid injury by using a hoist to lift heavy loads. Check that all chains, hooks, shackles and slings are in good condition and are of the correct capacity. They must be tested and approved according to local safety regulations.
- Cables, chains or ropes should never be applied to lifting eyes. Always use an appropriate shackle or hook, properly positioned. Arrange lifting cables so that there are no sharp bends. Use a spreader bar to avoid side loads on hooks, eyes and shackles and never leave a heavy load unattended.
- When a load is on a hoist stay clear of the danger area beneath and around it. Keep lifting acceleration and speed within safe limits.

1.4.4 INSTALLATION PRECAUTIONS

- Competent personnel under a qualified supervisor must only carry out installation work.
- A fused isolator switch must be fitted between the main power supply and the compressor.
- Precautions must be taken to ensure that no injury is caused to passers-by through loose clothing being sucked into compressor intake.
- Ensure that the discharge pipe from the compressor to the user pipework, receiver or storage is free to expand and that no flammable material is within the vicinity. If any such material is close-by take steps to preclude ignition.
- A manual shut-off valve should be fitted in the discharge line to allow the compressor to be isolated. Non return valves cannot be relied upon for isolating parts from a pressure system. A safety valve must be installed between any compressor unit and the isolating valve.
- A pressure-reliving device must be fitted to every pressure vessel, or equipment containing air or gas above atmospheric pressure. Never remove or tamper with safety devices, guards or insulation fitted. In order to limit the risk of Legionnaires Disease, CompAir Reavell advise caution with the use of cooling towers for water cooling the compressor. Closed circuit or direct mains cooling is preferred.
- Pipework or other parts with a surface temperature above 70°C, which may be accidentally touched in normal operation, must be guarded or insulated. Other high temperature pipework should be clearly marked and all pipework should be clearly marked.

1.4.5 OPERATIONAL PRECAUTIONS

- Competent personnel under a qualified supervisor must only operate the compressor.
- *Do not operate compressor with any removable inspection cover removed e.g. crankcase doors, valve covers etc.*
- Never remove or tamper with safety devices, guards or insulation materials.
- The compressor must only be operated at the supply voltage and frequency for which it is designed. Always isolate power before maintenance or servicing.
- When mains power is ON, lethal voltages are present in the electrical circuits and extreme caution is need when essential work is carried out on the electrical system. ***ALWAYS CONSULT A QUALIFIED ELECTRICIAN BEFORE ANY SUCH ESSENTIAL WORK.***

- Do not open starter compartment to touch electrical components while voltage is applied unless it is necessary for measurement, test or adjustment. Such work should always be carried out by a qualified electrician with appropriates tools and protection against an electrical hazard.
- If the unit is equipped with a Remote Control device, attach warning notices stating ***"THIS UNIT CAN BE STARTED REMOTELY"*** in prominent locations, one on the outside of the unit, the other inside the control compartment.
- As a further safeguard, take adequate precautions that no one is working or checking the unit before attempting to switch on remotely controlled equipment. Attach a ***"CHECK THAT ALL PERSONNEL ARE CLEAR OF UNIT BEFORE STARTING"*** or similar notice.
- Compressed air and gas piping, together with cooling water piping and other parts, with surface temperature greater than 70°C and may be accidentally touched, should be guarded or insulated.
- If there is any indication that the compressor is overheating it must be shutdown. (A high air or gas temperature switch is fitted as standard to guard against operating with excessive temperature). Beware of burns from hot oil and water when working on a unit recently shutdown.
- Do not operate the unit when guards provided for protection for all rotating and reciprocating parts have been removed for essential maintenance. Secure guards following any servicing or repair.
- Local noise regulations must be observed. Ear defenders are suggested by Noise at Work Regulations 1989 when the level is greater than 85 dB A at one meter. Be aware high noise levels can interfere with communication.

1.4.6 MAINTENANCE & REPAIR PRECAUTIONS

- Competent persons under qualified supervisor must carry out maintenance repair and modifications.
- The compressor will have a preserving oil applied to interior surfaces (Oil lubricated models). Oil free models will have desiccant bags in valve covers and distance pieces.
- Handling components such as seals, gaskets and diaphragms should not present a personnel hazard. Preservation oils again should not present a personnel hazard if handled under normal handling practices.
- Whilst compressors are asbestos free, treat all damaged gaskets as asbestos - when the Asbestos at work regulations apply.
- Viton 'O' seals under normal operating conditions are safe.
- However, should there be a fire within the compressor or these seals are likely to exceed a temperature of 300°C the material will decompose.

- **Degraded Viton gives off Hydrogen Fluoride fumes and if in contact with the skin an acid formed causes severe burns.**

- If Viton seals appear charred or gummy do not touch with unprotected hands: use neoprene or PVC gloves.
- Wash the area with limewater and avoid breathing any fumes. If contamination of the skin occurs washes with limewater and seeks medical advice.

Pre-Maintenance Operation

- Isolate the compressor from the main electrical supply. Lock the isolator in the OFF position and remove fuses.
- Attach a label ***" WORK IN PROGRESS - DO NOT APPLY VOLTAGE"***.
- Close the isolating valve between the compression unit and user's pipework. Close the isolating valve in the cooling water inlet pipe. Attach a label ***"WORK IN PROGRESS - DO NOT OPEN".***
- Check that all pressurised gas trapped in the system is released to atmosphere or safely to gas storage. Check that all pressure gauges register zero.
- Ensure that the cooling water system has been drained.
- Check that the drain valve on the delivery manifold is clear and gas pressure has been released.
- Check that all interstage drains are open to ensure any gas trapped between stages has been released.

- Stand clear of all valve covers when removing the securing screws.
- When removing valve covers for valve replacement, ensure a minimum of two threads is left engaged on the valve cover securing screws. Lever the valve cover until the 'O' seal is disengaged from the port in the cylinder head. Remove the securing screws and take out valve cover.
- ***Use only lubricating oils and greases approved by CompAir Reavell to avoid potential hazards especially the risk of explosion or fire and the possibility of decomposition or generation of hazardous gases.***
- Always clean oil spills from the surrounding floor before and after maintenance work.
- Make sure all instructions concerning operation and maintenance are strictly followed and that the complete unit, with all accessories and safety devices, is kept in good order.
- The accuracy of pressure gauges and temperature switches should be regularly checked at least 13 month intervals and thoroughly examined at least every 48 months. They must be renewed or service exchanged when acceptable tolerances are exceeded.
- Protection devices should be tested at each regular service interval and replaced or service exchanged if not functioning correctly. The maximum pressure for safety valves under fault conditions is 1.10 times the set pressure, the set pressure being a minimum of 1.05 times the maximum operating pressure to ensure seat tightness.
- Never use a light source with an open flame for inspection.
- Before dismantling any part of the compressor be sure that all heavy movable parts are secure.
- After completion of any maintenance or repair ensure that no tools, loose items or rags are left on or inside the compressor.
- Do not use any flammable liquid to clean valves, filter elements, cooler passages, pipe bores or any component carrying a flow of air or gas during normal operation. If chlorinated hydrocarbon substances are used for cleaning, safety precautions must be taken against toxic vapours, which may be released.

DO NOT USE CARBON TETRACHLORIDE.

- Precautions must be taken against using acids, alkalis and chemical detergents for cleaning machined parts. These materials cause irritation and are corrosive to the skin, eyes, nose and throat. Avoid splashes and wear suitable protective clothing and safety glasses. Do not breathe mists. Ensure water and soap is readily available.
- When disposing of condensate, old oil, used filter elements and other parts and waste material of any kind make sure that there is no pollution to any drain or natural water course and that no burning of waste takes place which could cause pollution of the atmosphere.
- Keep the compressor clean at all times.
- Protect components and exposed openings by covering with a clean cloth or tape during repair or maintenance work.
- Protect the motor, intake, electrical and regulation components against the entry of moisture e.g. steam cleaning.
- Precautions must be taken when carrying out welding or any repair operation which generates flames or sparks. The adjacent components must be screened with non-flammable material and if oil present, the system must first be cleansed thoroughly by steam cleaning.
- Condensate (oil and water mixture from compression process) must be regarded as trade effluent and is therefore not suitable for discharge into a surface water sewer, soakaway or watercourse.

PROTECT THE ENVIRONMENT USE APPROVED METHODS OF DISPOSAL.

1.4.7 PRECAUTIONS IN THE EVENT OF FIRE

- Use extreme caution when handling components that have been subjected to fire or very high temperature. Some components may contain fluoroelastomer materials, which decompose under these conditions to form highly corrosive residues. Skin contact can cause painful and penetrating burns resulting in permanent skin and tissue damage.

2 COMPRESSOR LOG SHEET

COMPRESSOR LOG SHEET											REF NO:		
COMPRESS0R			PRIME MOVER		INSTALLED AT:						OIL GRADE USED:		
TYPE:			TYPE:								CHECK OIL LEVEL		
SPEED:			POWER:								CHECK WATER IN/OUT TEMPS.		
SERIAL NO			DRIVE:		DATE INSTALLED:						CHECK COOLING FAN BLADES		
DATE	TIME	HRS RUN	STAGE TEMP °C	DELY TEMP °C	STAGE PRESSURES BAR / PSI					DELY PRESS. BAR/PSI	SERVICE PLAN NUMBER	REMARKS. SEE OVER FOR MORE	SIGNED
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		12500											

COMPRESSOR LOG SHEET

DATE	REMARKS	DATE	REMARKS

3 AMENDMENTS

ISSUE No.	DESCRIPTION	DATE	PAGE Nos.
1	NEW	JUNE 2000	ALL
2	ADD RUNNING IN MINERAL OIL RECOMMENDATION	NOV 2000	10
3	CHANGE TO MAIN BEARING BUSH/THRUST WASHER	AUG 2001	69
4	NEW SERVICE PLAN INSERTED, SECTION 11. REPAGINATION	APRIL 2008	ALL
5	1^{ST} & 2^{ND} STAGE SAFETY VALVE PRESSURES CORRECTED	OCT 2009	21
6	CORROSION ROD QUANTITIES AND POSITIONS CLARIFIED, ANCILIARY PARTS ADDED AT SECTION 13	MAY 2010	66, 69, 70 & 101
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4 LEADING PARTICULARS

4.1 UNIT DESIGNATION

Direct-coupled or belt drive compressor, electric powered ..... R - 5437.1.IA

4.2 TECHNICAL DATA

4.2.1 GENERAL

Type ..... Single acting, four stage, 90° vee
Cooling ..... Sea or fresh water
Direction of rotation, viewed from drive end ..... Anti-clockwise
Number of valves ..... Four
Type of valve ..... Flat plate, low lift

4.2.2 TEMPERATURES

Air Inlet and ambient temperatures ..... 20°C - 1.013 bar
Cooling water Inlet ..... 15° (10 -12°C rise)
Temperatures are maximum mid-stream for 310 bar duty

Compressor Speed	1180 rpm	1500 rpm	1800 rpm
1st Stage Delivery	131°C	148°C	159°C
2nd Stage Suction	28°C	32°C	40°C
2nd Stage Delivery	163°C	175°C	180°C
3rd Stage Suction	33°C	38°C	40°C
3rd Stage Delivery	175°C	180°C	185°C
3rd Stage Temperature Controller	158°C	164°C	170°C
3rd Stage Temperature Controller Maximum	200°C	200°C	200°C
4th Stage Suction	22°C	24°C	27°C
4th Stage Delivery	170°C	175°C	184°C
Final Delivery	16.5°C	17°C	18°C

Maximum air inlet pressure ..... 0.03 bar g
Minimum ambient air inlet temperature ..... 0°C
Maximum air intake ambient temperature ..... 45°C
Maximum air intake ambient temperature for radiator sets ..... 30°C
(Higher ambients possible contact Compair UK Ltd Engineering for more information.
Maximum cooling water inlet temperature ..... 37°C
Temperature rise across machine (Normal requirement) ..... 10°C - 12°C

Note: It is important for the life and safety of the machine not to exceed the maximum operating temperatures.

4.2.3 OPERATING SPEEDS

Minimum speed ..... 750 rev/min
Maximum speed ..... 1800 rev/min
1st stage piston displacement at maximum speed 217.7m³/hr

4.2.4 CAPACITY

R - 5437.1.IA	Capacity at constant pressure		
Speed	160 bar	250 bar	350bar
rpm	m³/hr	m³/hr	m³/hr
750	69.7	605.9	64.9
1000	89.2	88.7	87.0
1250	111.6	110.7	109.8
1460	132.7	131.7	130.5
1500	136.7	135.6	134.5
1760	156.2	154.8	153.9
1800	159.2	157.8	156.9

4.2.5 PRESSURE

Maximum working pressure ..... 350 bar
Minimum working pressure ..... 140 bar
Minimum water pressure ..... 0.6 bar
Maximum water pressure ..... 5.1 bar
Oil pressure (New machine) ..... 2.0-2.75 bar
Minimum oil pressure (Worn machine) ..... 1 bar

4.2.6 LUBRICATION

Oil recommendations are based on normal conditions. If difficulty is experienced a change may be advisable – refer to CompAir Reavell.

Crankcase oil capacity ..... 45 litres
Recommended silicone grease (for assembly) ..... Dow Corning MS33
Recommended oil: ..... Synthetic ..... Reavellite, Anderol 555
Recommended oil: - (Running in only) .... Mineral ..... Shell Corena P100

4.2.7 COOLING

Note: Water must not be allowed to freeze in the compressor water jackets, coolers or in a sea water / fresh water heat exchanger.

Coolant ..... Sea or fresh water
Cooling water flow @ 15°C inlet temp ..... 75 l/h/kW (12 gals/bhp/hr)
Coolant capacity (Approx.) ..... 46 litres

4.2.8 INTERNAL DIMENSIONS

Piston stroke ..... 75 mm
First stage cylinder bore ..... 185 mm
Second stage cylinder bore ..... 95 mm
Third stage cylinder bore ..... 45 mm
Fourth stage cylinder bore ..... 22 mm
Mean piston speed at maximum speed ..... 4.5 m/s

4.2.9 CONNECTIONS

Air inlet connection ..... nominal 75 mm Suction Filter Silencer
Fourth stage delivery ..... ½" BSPP
Condensate drain ..... 1½" BSPP
Water inlet ..... 1" BSPT
Water outlet ..... 1¼" BSPT

4.2.10 WATER TEST PRESSURES

First stage suction ..... 2 bar g
First stage delivery ..... 21 bar g
Second stage ..... 81 bar g
Third stage ..... 300 bar g
Fourth stage ..... 690 bar g
Water jacket ..... 25 bar g

4.2.11 SAFETY VALVE SETTINGS

First stage ..... 3.8 bar g
Second stage ..... 24 bar g
Third stage ..... 117 bar g
Fourth stage ..... Supply pressure +5%
Surge vessel ..... 2.1 bar g

4.2.12 WEIGHTS

Machine (bare) ..... 1090 Kg
Cooling water and lubricating oil ..... 90 Kg
Crankshaft ..... 45 Kg
Flywheel ..... 51 Kg
Cylinder block 1st & 2nd Stage ..... 146 Kg
Cylinder block 3rd & 4th Stage ..... 155 Kg
Crankcase ..... 250 Kg
Typical Direct Coupled Set (Complete set dry) ..... 1500 Kg
Typical Belt Driven Set (Complete set dry) ..... 1600 Kg
Inertia, rotational compressor and flywheel ..... 0.79 kgm²

4.2.13 EXTERNAL DIMENSIONS

Typical Direct Coupled Set - Length ..... 1990 mm
Width ..... 1200 mm
Height ..... 1090 mm
Typical Belt Driven Set - Length ..... 1700 mm
Width ..... 1320 mm
Height ..... 1090 mm

4.3 TORQUE WRENCH SETTINGS

Torque wrench settings for non-lubricated fasteners. (All figures ±5%)
Under no circumstances are any deviations from these figures allowable.

**** Note: These items must be tightened sequentially in 27 Nm (20 Lb.ft) steps.***

FASTENING	SPANNER SIZE A/F	THREAD SIZE	NEWTON METRE (Nm)	POUND FEET (lb.ft)
Big End Bearing Bolts	24MM	M16	203	150
First and Second Stage Cylinder Block to Crankcase	24MM	M16	236	175
First Stage Separator	17MM	M10	55	40
First and Second Stage Cooler Cover – fixed end	17MM	M10	55	40
First and Second Stage Cooler Cover – floating end	17MM	M10	55	40
Second Stage Separator Cover	19MM	M12	95	70
First Stage Valve Cover *	**19MM**	**M12**	**50**	**37**
Second Stage Valve Cover *	**30MM**	**M20**	**121**	**90**
Third and Fourth Stage Cylinder Block to Crankcase	24MM	M16	237	175
Third Stage Cooler Cover	13MM	M8	28	20
Third Stage Valve Cover *	**24MM**	**M16**	**118**	**87**
Fourth Stage Valve Cover *	**24MM**	**M16**	**118**	**87**
Fourth Stage Cooler Cover	17MM	M10	55	40
Third and Fourth Stage Piston	13MM	M8	27	20
Flywheel bolt to Crankshaft	1.1/8"	¾" UNF	162	119
Driving-end Main-end Bearing Housing to Crankcase	19MM	M12	95	70
Outer-end Main-end Bearing Housing to Crankcase	19MM	M12	95	70
Crankcase Door	13MM	M8	28	20
Bursting Disc Cover	17MM	M10	55	40
First Stage Valve	17MM	M10	39	29
Second Stage Valve	13MM	M8	19	14
Third Stage Valve	10MM	M6	8	6
Fourth Stage Valve	8MM	M5	4.6	3.4
Coupling Ring to Flywheel	17MM	M10	55	40
Bell-Housing to Crankcase	19MM	M12	95	70
Bell-Housing to Motor	1.1/8"	¾" UNC	237	175
Oil Pump	13MM	M8	28	20
Surge Vessel Door	13MM	M8	28	20
Diaphragm Drain Valve to Surge Vessel Door	13MM	M8	28	20

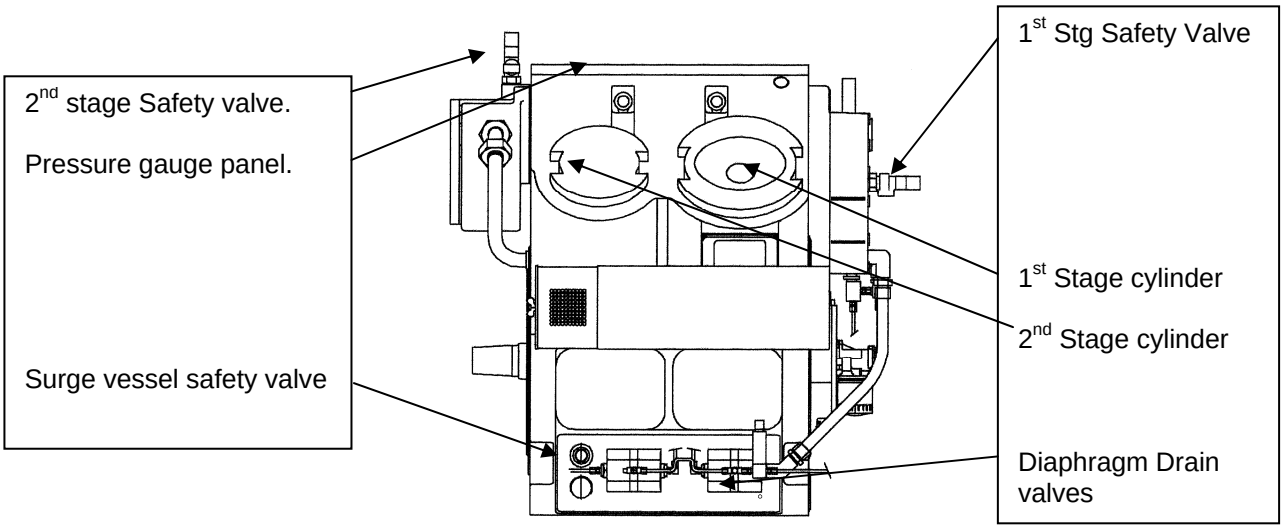
4.4 RUNNING CLEARANCES AND WEARING DIMENSIONS

DESCRIPTION	STAGE	AS FITTED (mm)		MAX. PERMITTED (mm)
Piston vertical clearance	1		0.500 / 1.200	--
	2		0.250 / 0.950	--
(ie. Distance from top of piston to top of liner)	3		0.350 / 1.150	--
	4		0.350 / 1.150	--
Piston ring gaps	1	Taper	0.20 / 0.46	1.63
		Scraper	0.20 / 0.46	1.43
(Measured in unworn portion of cylinder / liner)	2	Taper	0.10 / 0.23	1.37
		Scraper	0.10 / 0.23	1.27
	3	Plain	0.05 / 0.18	1.32
	4	Plain	0.20/0.40	1.50
Piston ring axial clearance	1	Taper	0.04 / 0.09	0.29
		Scraper	0.05 / 0.10	0.30
(Measured between groove & top face of	2	Taper	0.02 / 0.08	0.28
ring with ring in normal running position)		Scraper	0.05 / 0.10	0.30
	3	Plain	0.01 / 0.08	0.28
	4	Plain	0.10/0.06	0.30
Piston ring groove width	1	Taper	4.80 / 4.83	4.91
		Scraper	8.01 / 7.99	8.09
	2	Taper	3.23 / 7.99	3.31
		Scraper	4.83 / 4.80	4.91
	3	Plain	2.05 / 2.01	2.13
	4	Plain	2.56/2.53	2.64
Piston skirt diameter	1		184.77 / 184.74	184.69
	2		94.91 / 94.88	94.83
	3		44.92 / 44.89	44.85
	4		21.905 / 21.935	21.9
Liner bore diameter	1		185.05 / 185.00	185.11
	2		95.04 / 95.00	95.10
	3		45.03 / 45.00	45.09
	4		22.02 / 22.00	22.08
Crosshead diametral clearance	3,4		0.060 / 0.125	0.19
S/E bearing diametral clearance	1		0.01 / 0.05	0.1
In connection rod	2,3,4		Needle roller	--
In piston	1		-0.003 / 0.013	0.03
	2,3,4		0.025 / 0.044	0.09
S/E bearing end float	1		0.15 / 0.64	1.0
	2,3,4		0.15 / 0.55	1.0
Crankshaft journal				
B/E bearing diameter			84.24 / 84.22	83.92
B/E bearing out of round				0.04
Main bearing diameter			79.95 / 79.93	79.90
Main bearing out of round				0.04
B/E bearing diametral clearance	1,2,3,4		0.066 / 0.120	0.24
Main bearing diametral clearance			0.050 / 0.135	0.2
Crankshaft end float			0.23 / 0.66	0.75
Cooler tube nominal bore sizes	1	23 off	10	--
		8 off	13.4	--
	2	8 off	10	--
		6 off	13.4	--
	3	1 off	11.1	--
	4	1 off	6.2	--

5 TECHNICAL DESCRIPTION

5.1 GENERAL DESCRIPTION

TYPICAL ARRANGEMENT



The R - 5437.1.IA compressor is a reciprocating 90° vee configuration, 4 stage, single acting, water cooled machine with the 1st and 3rd stage lines on one crank throw, and the 2nd and 4th stage lines on the opposite crank throw of a counterbalanced crankshaft. The running gear consists of the crankshaft, bearings, connecting rods, oil pump, cylinder lubricator and other accessories.

The air end consists of two cylinder blocks - combined 3rd & 4th stage – combined 1st & 2nd stage. Each block is complete with individual cylinder liners, pistons, valves, valve covers, inter-stage coolers for the 1st, 2nd, 3rd and 4th stages and condensate separators for 1st, 2nd and 3rd stages.

The 1st & 2nd stage cylinder blocks contains renewable wet cylinder liners and are jacketed for water-cooling. The 3rd and 4th stage cylinder blocks contains renewable dry cylinder liners again jacketed for water-cooling. Water flow is arranged within the cylinder jackets and coolers in series to provide even and effective cooling for either sea or fresh water.

First and second stage pistons are conventional trunk type, whilst the third and fourth are an integral piston and crosshead assemblies. All are fitted with split piston rings.

A single combined suction and discharge (concentric) valve is fitted at the head of each cylinder.

Water-cooled inter-stage coolers are provided after each stage of compression, with condensate separators after each inter-stage cooler. The water flows over the tubes and the air through for all stage coolers. All stage coolers are withdrawable to ease maintenance. The fourth or final stage cooler cools the hot air delivered from the fourth stage cylinder to within 5°C of the cooling water inlet temperature.

The oil pump is directly driven from the crankshaft to provide a forced-feed lubrication system via a suction strainer through a filter element to the running gear. The cylinders, pistons and valves are splash/spray lubricated. A low oil pressure switch is provided to protect the running gear against lubrication failure, an oil level sight gauge is provided in the crankcase for maintaining oil to the correct level.

An automatic drainage system drains each stage condensate separator and all coalescing filters at approximately 10 to 20 minute intervals for a period of 5-10 seconds into a discharge surge vessel, in-built in crankcase. This interval and period is dependent upon the ambient temperature and humidity and for high ambient high humidity conditions the interval must be reduced and the period increased. The drainage system whilst removing oil/moisture also acts as an unloading device to prevent the compressor starting under load, by bleeding off automatically all the air in the compressor through the condensate separators whenever the compressor stops.

Pressure gauges to indicate all air stage pressures and oil pressure are located in a gauge board mounted between each cylinder block.

Air relief valves for each stage are fitted to prevent over-pressure in cylinders and coolers, and bursting diaphragms are fitted to protect the water jackets from accidental application of air pressure to the cooling system. A pneumatic water inlet valve (if fitted) will not allow the cooling water to flow when the compressor stops. This helps to prevent over-cooling.

High air temperature switches are fitted to the 3rd stage cylinder discharge and exit from the 4th stage delivery after cooling to stop the compressor on over-temperature in the air stream. These switches combine both a visual dial display of the temperature and again an indication of the switch setting.

The compressor air intake is fitted with a filter to prevent solid particles entering the compressor cylinders. A suction silencer is incorporated within the filter casing.

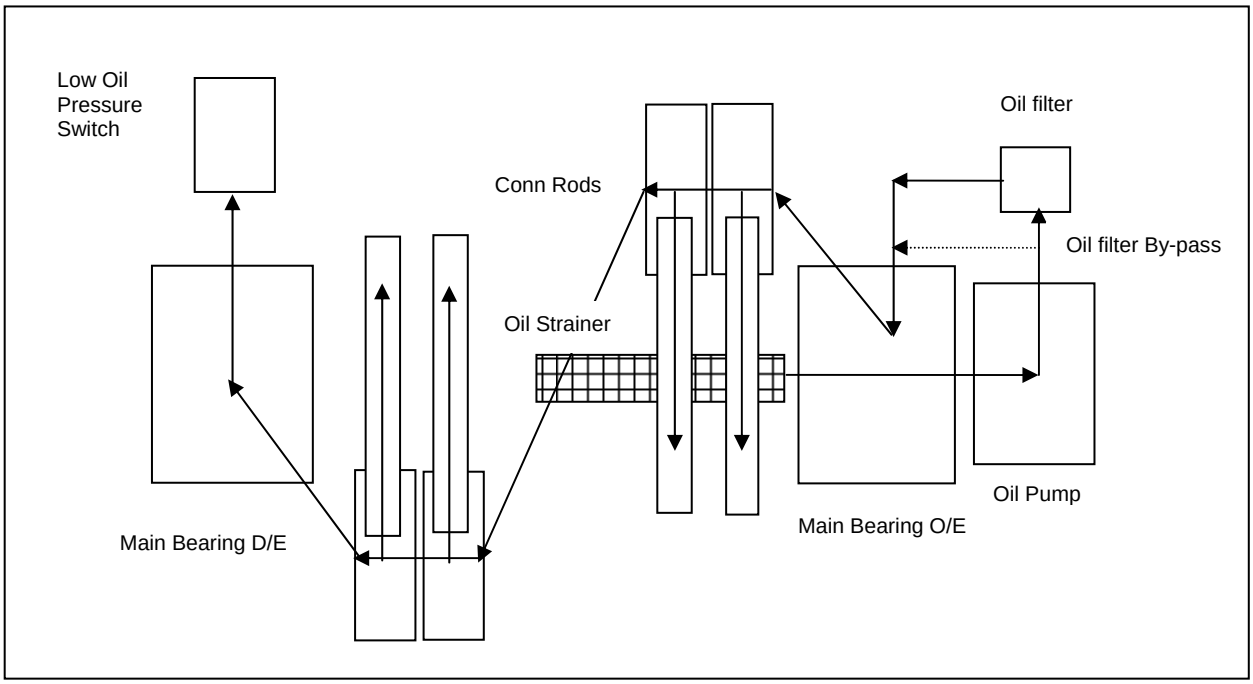
A non-return valve is located at the final discharge connection to prevent system pressure returning to the cylinders when the compressor is shut down.

5.2 MATERIALS OF CONSTRUCTION

Component	Material
Crankcase	Cast Iron
Crankshaft	Spheriodal Graphite Iron
Main-End Bearings	White-metal lined Gun Metal
Connecting Rods	Spheriodal Graphite Iron
Big-End Bearings	Steel backed aluminium-tin with overlay
Small-end Bearing – 1st stage	Phosphor Bronze
Small-end Bearings – 2nd, 3rd & 4th stage	Steel – needle roller
Flywheel	Cast Iron
First Stage Piston	Aluminium alloy
Second Stage Piston	Cast Iron
Third Stage Piston	Cast Iron
Fourth Stage Piston	Cast Iron
First & Second Stage Cylinder Block	Speriodal Graphite Iron
Third & Fourth Stage Cylinder Block	Speriodal Graphite Iron
1st, 2nd & 3rd Stage Cylinder Liners	Grey Cast Iron
4th Stage Cylinder Liner	Nitrided steel
1st & 2nd Stage Cooler Tubes	Copper
3rd & 4th Stage Cooler Tubes	Stainless Steel
Cooler covers & separators	Spheriodal Graphite Iron
Gudgeon Pins	Steel
Tube plates	Cast Iron
Piston Rings	Cast Iron

5.3 LUBRICATION

A forced feed oil pump pressurises the lubrication system conveying oil from the crankcase to the main, big end and small end bearings via a replaceable filter element. Oil thrown off the moving parts ensures adequate lubrication to all stage pistons, crossheads and cylinders. Oil returns to the crankcase and is drawn up to the pump suction through a strainer.



An oil pressure gauge indicates if over-pressure and is relieved through a safety valve within the oil pump. A protective Low Oil Pressure Switch or LOP is installed to shut-down the compressor if the pressure falls below 1 bar (15 psig). On starting if the oil pressure has not built up within about 10 seconds the LOP, connected to a delay timer in the motor starter control, will shut down the compressor.

THE GUARANTEE MAY BE INVALIDATED SHOULD A FAILURE BE ATTRIBUTED TO THE USE OF A LUBRICANT NOT RECOMMENDED BY COMPAIR

5.4 CONDENSATE REMOVAL

Diaphragm Drain Valves or DDV's are installed after each compression stage to automatically drain oil/moisture collected in each inter-stage separator and to act as unloader valves to remove any air load on starting. All these valves are similar in design and operation – only the valve orifice and seat vary to suit each stage.
Each DDV is operated by pilot air pressure from 1st stage via a three-way solenoid valve. With no pilot air pressure all DDV outlets are open to atmosphere. In operation, pilot air pressure acts on the DDV diaphragms to close the valves.
A timed signal every 10 - 20 minutes actuates the three-way solenoid valve for 5-10 seconds to release the air pressure and allow the valves to open and drain the collected condensate in each separator. The sudden release of air and condensate exits the compressor via an integral surge vessel for connection to a suitable containment / treatment system.

5.5 EXTERNAL COMPONENTS

5.5.1 SUCTION SILENCER / AIR FILTER

Should be attached by customer to air intake pipework to provide maximum sound attenuation with minimum air resistance together with a replaceable filter to prevent particle ingress. Air should be drawn from a clean, dry, cool source.

5.5.2 STAGE AIR RELIEF VALVES.

Safety valves are fitted to compressor inlet, crankcase, surge vessel and all compression stages.

5.5.3 BURSTING DISC

Thin plastic membrane and PTFE/metal discs protect the cooling water system against a possible cooler gas leak, ruptured cooler tube etc. It is not intended as a protection against water over-pressure and therefore the burst pressure (17 bar or 250 psig) has no particular relationship to the cooling water system operating pressure.

5.5.4 PRESSURE GAUGES

Pressure gauges are supplied for inlet, crankcase, oil and each compression stage.

5.5.5 PNEUMATIC WATER VALVE

This valve is a normally closed diaphragm operated shut off valve to prevent cooling water flow whenever the compressor is not operating. This function is automatic since the valve is actuated by the first stage gas pressure.

5.5.6 HIGH AIR TEMPERATURE SWITCHES

Combined temperature indicator / switches are fitted into the 3rd stage delivery and at the final delivery after cooling.

5.5.7 FINAL DISCHARGE NON-RETURN VALVE

Fitted at the compressor exit to prevent gas under pressure in the downstream piping or reservoir from flowing back through the machine when the compressor is unloaded and stationary.

6 INSTALLATION INFORMATION

6.1 UNPACKING AND HANDLING

The compressor unit is delivered in a packing case. All openings will have been sealed with plastic plugs or adhesive tape. The packing case should be carefully disassembled to avoid damage to gauges, pipework, and valves etc. and loose components packed separately.
The unit should be lifted by the eyebolts on the motor and compressor.

6.2 LOCATION

It is desirable that the compressor unit is installed in as clean, cool and dry environment within the parameters stated in the 'Leading Particulars' section.
The surface, on which the unit is to stand, must be flat and capable of bearing the total weight of the unit without distortion.
In selecting the location it is essential to consider accessibility. Allow sufficient space around the installation for safe maintenance work. Sufficient clearance must be allowed to ensure that the set will not touch any obstruction or any flexibly mounted equipment, with an added allowance for maximum movement from the mounting system.

6.3 MOUNTING

The compressor unit is mounted on anti-vibration mounts. These mounts should be inspected for any tear of the rubber to metal plate bond or ageing before use. Ensure the mount is not impregnated with oil or grease, and that any protective lacquer is intact. Reject any mount that is not in good condition. Lower the compressor unit onto the mounts and screw on the mount holding down nuts. Rock unit to ensure mounts is free and not distorted, and that the set will not touch any obstructions or other flexibly mounted equipment.

6.4 CONNECTIONS

Note: As the compressor unit is flexibly mounted, all connections must also be flexible. Short flexible sections must be incorporated, should be suitable for the pressures and temperatures involved and capable of easy removal to facilitate maintenance.

6.4.1 SUCTION

The intake air pressure can vary between 0.5 barg and 1.0 barg and must be as clean and dry as possible.

6.4.2 FINAL DELIVERY

The final delivery connection is situated at the end of the non-return valve. The flexible connection must be suitable for the set working pressure.

6.4.3 UNLOADING / CONDENSATE DRAIN

The unloading / condensate drain connection at the crankcase, for the surge vessel, is screwed to accept the discharge pipe. This pipe must be led away with a minimum of bends, and must have a minimum internal diameter of 38mm (1½"). There must be no obstruction in the line as any restriction during operation may cause the safety valve at the crankcase for the surge vessel to open.
Note: Condensate should be piped away to a suitable containment vessel before disposal in accordance with local Health & Safety regulations.

6.4.4 COOLING WATER

The quality, quantity and temperature of the water used can materially affect maintenance. A positive circulation of cool but not cold, clean water, free from suspended particles is required for satisfactory continuous operation.
Note: It is vital a suitable inhibitor is used especially in HARD WATER areas. Therefore it is recommended that a suitable water softener unit be fitted to the inlet water line.
It is recommended that temperature indication or gauges are fitted to water inlet and outlet pipes to monitor water temperature rise across the compressor. If the rise is too high, overheating can cause and accelerate formation of scale in the coolers and water passages. Too low a rise may improve the cooler efficiency, but can cause condensation in the cylinders.
A lockable throttle valve is recommended at the inlet to allow adjustment the water flow to achieve the correct temperature.
Water supply should be prevented when compressor is not running.
Note: Continued water circulation when stationary can cause condensation within the cylinders and breakdown of oil lubrication creating premature wear.

6.4.5 PNEUMATIC WATER INLET VALVE

A pneumatic water inlet valve can be supplied to control water supply and prevent overcooling. It is controlled by 1st stage air pressure to ensure that compressor can not run on full load without water flow.

6.4.6 MOTOR

Main leads from the motor controller / starter should be brought through a suitable flexible armoured cable sheath to the terminal box on the side of the motor. The size of the cable shall be suitable for the supply voltage and current involved, and the terminal connections shall be as shown in the terminal box.
A suitable overload device should always be fitted.
An hours-run meter fitted to the motor starter is recommended for maintenance scheduling.
A timer should be incorporated in the starter to de-energise the solenoid valve for between 5-10 seconds every 10 - 30 minutes to periodically, dependent upon ambient temperature and humidity. Contact CompAir UK Ltd for more information on humidity if required. This will allow the diaphragm drain valves to operate and discharge any accumulated condensate.
Adequate flexibility shall be ensured to allow for movement of the set on the anti-vibration mounts.

6.4.7 SOLENOID VALVE

The cable should be run through a suitable flexible armoured cable sheath from the motor controller.

6.4.8 HIGH AIR TEMPERATURE SWITCHES

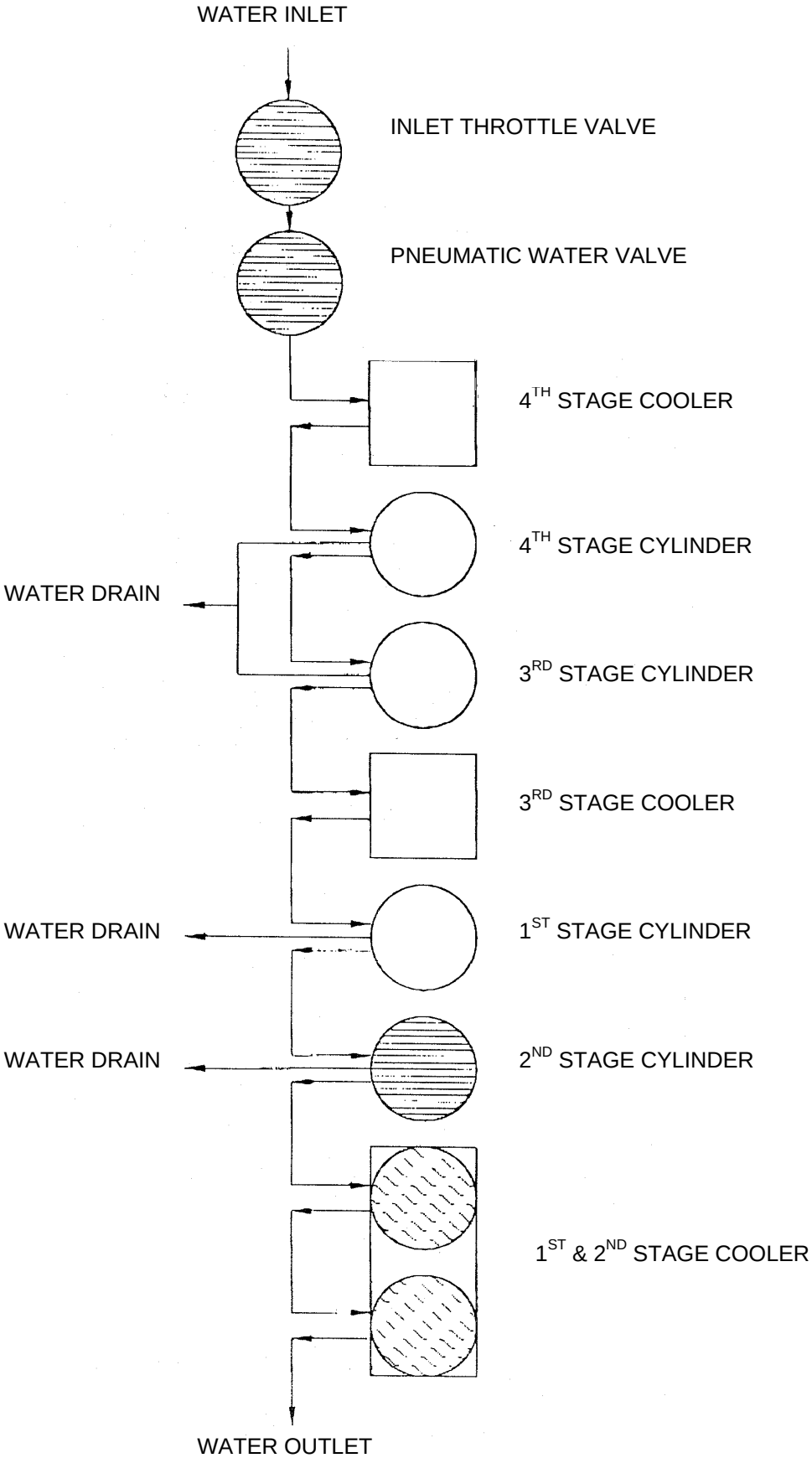
The cable entry is through a conduit entry hole.
Details of the terminal connections are on the switch.
Cable should run through a suitable flexible armoured sheath.

6.4.9 LOW OIL PRESSURE SWITCH

See High Air Temperature Switches above.

Note: When the compressor set is on flexible mounting it can become electrically insulated.
A flexible braided earth strap of suitable length to ensure it will not fail under maximum movement of the set must be fitted between the set and the its seating.

6.5 WATER FLOW PATH DIAGRAM

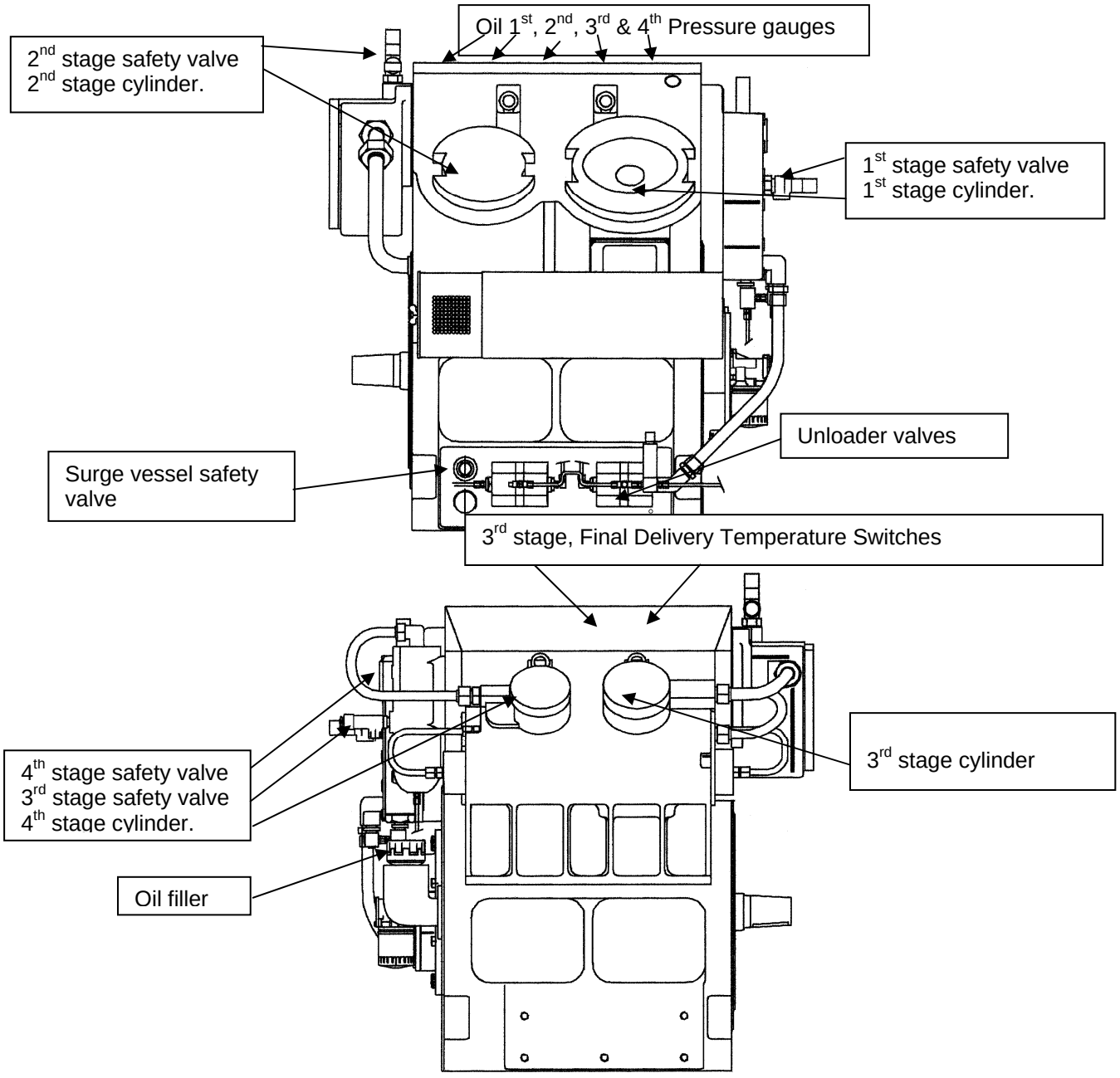


7 OPERATING INFORMATION

WARNING

BEFORE OPERATING THIS EQUIPMENT USERS SHOULD BE MADE AWARE OF AND ENSURE COMPLIANCE WITH LOCAL HEALTH AND SAFETY REGULATIONS & CONTROL OF SUBSTANCES HAZARDOUS APPROPRIATE TO THIS CLASS OF WORK.

TAMPERING WITH SAFETY VALVES IS DANGEROUS AND ALSO INVALIDATES THE GUARANTEE.

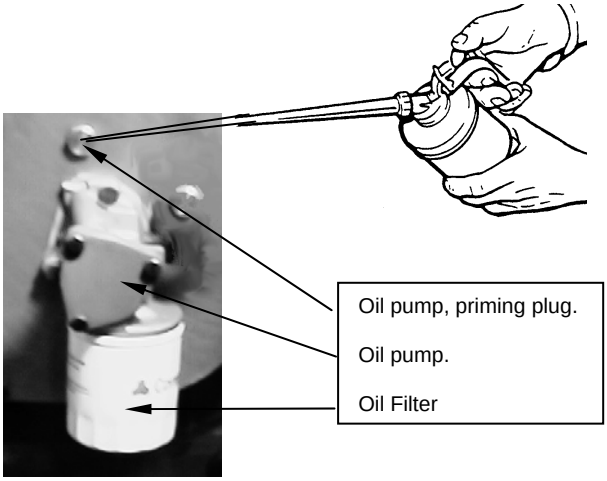


7.1 SAFETY PRECAUTIONS

When operating or working on the compressor unit at any time the following safety precautions must be observed.
Read all starting and operating instructions before running compressor.
Keep face and rest of body clear of relief valves when compressor is being started or is running.
Do not bar over or work on compressor without ensuring that all equipment is isolated from the electrical supply, and will remain isolated whilst work is in progress.
Always open high pressure air line valves SLOWLY.
Never attempt to stop leakage or tighten joints or loose parts when compressor is running or parts are under pressure.
The compressor must NEVER be operated with a malfunction in the oil or cooling water system. Should a fault develop in either of these, the compressor must be stopped immediately and the fault investigated and remedied.

7.2 COMMISSIONING CHECKS

Remove all covers, plastic plugs and adhesive tape used to seal compressor openings during shipment.
Check all electrical connections.
Ensure water is available to the cooling circuit(s).
Fill compressor water jackets with cool clean sea or fresh water, which must be free of suspended particles.
Remove two crankcase doors and ensure that the crankcase interior is clean and free from foreign bodies and obstructions.
Check that bolts on connecting rods are tight.
Check for any water leaks inside crankcase.
Fill crankcase to the maximum level mark on the sight glass with the correct grade of lubricant.
Replace crankcase doors.
Remove oil filter and fill with correct grade of lubricant. Smear oil on filter sealing washer and refit filter. Tighten by hand only.
Remove all valve covers and valves. Check for signs of rust or water. Clean as necessary.
Re-oil inside of the cylinders sparingly.
Refit valves. Smear 'O' rings on valves and valve covers lightly with grease and replace covers. Tighten holding down nuts progressively to correct torque in a "cross" sequence.
Check all external nuts, bolts and other fastenings are tight and correctly torqued, that all external connections are made and pipework adequately supported.



Remove oil pump priming plug, using pump type oilcan, prime system with correct grade oil. Replace plug.
Arrange for compressor to discharge temporarily to atmosphere (unloaded) by opening the manual drain valve at the 4th stage coalescer filter drain and electrically disconnect solenoid valve by removing cable plug from solenoid coil.
Remove cover in the bell housing or vee belt guard and rotate compressor by hand several times to distribute oil and confirm free movement.

7.3 STARTING AFTER COMMISSIONING CHECKS

On completion of preliminary checks, the compressor should be run to prove operation.
Ensure electrical supplies are available.
Press "ON" button on motor controller and immediately press "OFF" button, checking rotation of compressor is correct. Rewire if rotation is incorrect. Rotation must be counter clockwise looking on the driving end.
Restart compressor, check oil pressure is greater than 2 bar (30 psig), that air is being delivered from each stage, and listen for any uncharacteristic noises.
Check for air, oil and water leaks. If leaks are found, stop compressor isolate supplies and rectify.
NOTE: DO NOT TRY TO CORRECT LEAKS WHEN ITEMS ARE PRESSURISED.
Stop compressor and isolate power supplies after running unloaded for 30 minutes and check that outer surfaces of crankcase and cylinders are cool.
Replace solenoid valve plug.
Close manual drain valve at 4th stage coalescer filter drain.
Open stop valve in delivery line to air receiver.
Restart compressor and continue with run, increasing pressure by 40 bar at 15-minute intervals up to working pressure.
Compressor should now be running "on load" and delivering compressed air.

Check the following:

Oil Pressure	*record at 15 minute intervals.*
Stage Pressures	*record at 15 minute intervals.*
Stage Temperatures	*record at 15 minute intervals.*

Safety valves are not leaking.
Unloader valves are not leaking.
Condensate drain valves operate for approximately 5-10 seconds after every 10 - 30 minutes dependent upon ambient temperature and humidity. This must to be carefully monitored, high temperature/humidity conditions will require the drain times to be more frequent, contact CompAir UK Ltd for more details..

Compare pressure and temperature readings with those figures given in Leading Particulars.
After approximately two hours of test run, stop compressor. remove drain plug from sump and drain off any water which may have accumulated. Do not drain oil. An excess of water in crankcase should be investigated. Replenish oil where necessary.

7.4 STARTING DAILY

Ensure that electrical supply is available.
Ensure cooling water is available.
Check crankcase, oil level. Top up if necessary.
Start compressor and run as required.

7.5 ROUTINE ATTENTION WHILE RUNNING

At two hourly intervals, check pressure on air and oil pressure gauges. Abnormal readings must be reported and investigated.
Check motor bearings are not overheating.
Ensure drains operate at approximately pre-set time interval.
Check that no air relief valve is operating continuously.
Note for rectification **when compressor is stopped** any slight air, oil or water leaks.

7.6 STOPPING PROCEDURE

When compressor has been stopped, by means of stop button on control panel, isolate from electrical supply and;
Check for oil and water leaks and rectify.
Rectify any leaks noted while compressor was running.
Close off stop valve on discharge line to relieve air reservoir back pressure from compressor non-return valve.

7.7 PREPARATION FOR SPECIAL ENVIRONMENT

No special preparations are required other than making sure that should the compressor operate in sub-zero temperatures, adequate precautions must be taken to ensure water is not allowed to freeze in the compressor water jackets, pipework (or sea water/fresh water heat exchanger when fitted).

7.8 STARTING AFTER LONG PERIOD OF IDLENESS

Check that all-external nuts, bolts and other fastenings are tight.
Check associated and external pipework is intact and adequately supported.
Turn compressor over a few times by hand to ensure unrestricted rotation.
Ensure cooling system water is available.
Open 4th stage, manual drain valve.
Start compressor.
Listen for any unusual noises during first few minutes of run.
Close 4th stage, manual drain valve.
Check air pressure gauges.
Check that no air safety valve opens continuously.
Ensure separator drains operate at approximately 10-30 minute at pre-set intervals.

7.9 INHIBITION FOR STORAGE

7.9.1 INHIBITION FOR UP TO SIX MONTHS

Check that the compressor has been run with the recommended oil.
Run the compressor for 30 minutes on light load with the final delivery pipe disconnected and with all separators open. Cut down the cooling water supply during this run so that the water outlet temperature is from 38°C to 49°C. After 30 minutes stop the compressor, turn off the cooling water, disconnect the water supply and drain off the water.
EITHER:
Dry out the water jackets with compressed air, if available. Insert air hose at water outlet connection and pass air through jackets until water ceases to flow from water inlet connection.
IMPORTANT: Do not pressurise jacket with air during this procedure.
OR:
Alternatively, if air is not available, fill jacket with PX10 water-displacing fluid and allow standing for 15 minutes before draining off.
Remove and clean compressor valves and wipe out any moisture in valve pockets and passages.
Immerse valve units in PQ11 fluid and allow surplus to drain off.
Insert PQ11 into each cylinder, allowing approximately 1/3 cc. of fluid to each square inch of cylinder surface area. Coat all surfaces and gas passages.
Replace valves carefully and coat valve covers with PQ11.
Seal all screw openings with threaded plastic or metal caps and flanged openings with PQ11 - coating shims clamped between the flanges, and attach a warning label to this effect.

7.9.2 LONG TERM STORAGE

Check that the compressor has been run with the recommended oil.
Drain oil from the sump, preferably while still warm, and till to normal level with PQ11 fluid.
Run the compressor for 30 minutes on light load with the final delivery pipe disconnected and with all separators open. Cut down the cooling water supply during this run so that the water outlet temperature is from 38°C to 49°C. After 30 minutes stop the compressor, turn off the cooling water, disconnect the water supply and drain off the water.
EITHER:
Dry out the water jackets with compressed air, if available. Insert air hose at water outlet connection and pass air through jackets until water ceases to flow from water inlet connection.
IMPORTANT: Do not pressurise jacket with air during this procedure.
OR:
Alternatively, if air is not available, fill jacket with PX10 water, displacing fluid and allow standing for 15 minutes before draining off.
If it is impossible to run the compressor, remove the crankcase doors and coat running gear and crankcase with PQ11 using spray gun, rotating compressor slowly by hand. (When completed, pistons should be in mid-stroke position in readiness for inhibition of cylinders etc.)
Replace crankcase doors.
Remove and clean compressor valves and wipe out any moisture in valve pockets and passages.
Immerse valves in PQ11 fluid and allow surplus to drain off.
Insert PQ11 into each cylinder, allowing approximately 1/3 cc. of fluid to each square inch of cylinder surface area. Coat all surfaces and gas passages.
Replace valves carefully and coat valve covers with PQ11.
Seal all screwed openings with threaded plastic or metal caps and tape afterwards. Seal flanged openings with PQ11 - coating shims clamped between the flanges and attach a warning label to this effect.
Attach instruction label **"DO NOT ROTATE THIS MACHINE"**
For any compressor which is in storage for a long period, a six-monthly inspection is to be carried out as follows;
Remove the valve covers, valves and crankcase doors. Inspect the machine for signs of corrosion and carefully remove any rust that has formed. Turn the compressor round by hand to ensure that the running gear is free.
Coat the running gear and crankcase with PQ11 using a spray gun, rotating the compressor lowly by hand. (When completed, pistons should be in mid-stroke position in readiness for inhibition of cylinders etc.)
Replace the crankcase doors.
Immerse valve units in PQ11 fluid and allow surplus to drain off.
Insert PQ11 into each cylinder, allowing approximately 1/3 cc of fluid to each square inch of cylinder surface area.
Coat all surfaces, including bottom surface, of the cylinder air passages.
Coat the valve covers with PQ11 and replace the valves and valve covers.
Check that all openings are still sealed.
Note: **PQ11 Inhibition Fluid - Trade Name Crodafluid PQ11.**

7.10 FAULT GUIDE

WARNING

BEFORE PROCEEDING WITH MAINTENANCE ON THE COMPRESSOR IT MUST BE STOPPED, ISOLATED ELECTRICALLY AND MECHANICALLY AND VISIBLE WARNING NOTICES DISPLAYED. ADDITIONALLY, ALL INTERNAL PRESSURE MUST BE RELEASED WITH THE UNIT ISOLATED FROM THE STORAGE RESERVOIR AND THE WATER SUPPLY SHUT OFF.

NOTE: A safety valve opening indicates excessive pressure and under NO CIRCUMSTANCES must a safety valve be screwed down to accommodate excessive pressure. THIS IS DANGEROUS. If safety valve opens or appears faulty shut down compressor immediately and investigate.
If fault appears immediately or shortly after a service, first examine those parts disturbed during the service.

Following is a list covering the probably causes of operational faults, together with the suggested remedies.
Before investigating a potential fault, ensure however that:
Cooling water temperature, temperature rise across the machine, and flow rate are correct.
Direction of rotation is correct.
Sump is correctly filled.
Compressor servicing is up to date.
Electrical supply is correct.
If fault appears immediately or shortly after a service, first examine those parts disturbed during the service.

Symptom	Fault	Recommendation(s)
7.10.1 SAFETY VALVE(S) BLOWING	? 4th stage relief valve blowing - final pressure switch not cutting out.	✓ Renew final pressure switch or re-adjust top pressure cut-out point.
	? 3rd stage safety valve blowing	✓ Check, 4th stage valve springs and plates or replace 4th stage valve complete. Check safety valve operating pressure.
	? 2nd stage safety valve blowing	✓ Check, 3rd stage valve springs and plates or replace 3rd stage valve complete. Check safety valve operating pressure.
	? 1st stage safety valve blowing	✓ Check, 2nd stage valve springs and plates or replace 2nd stage valve complete. Check safety valve operating pressure.
	? 4th stage relief valve blowing - incorrectly set or re-assembled items.	✓ Check setting of downstream system valves. Check stage safety valve operation.
	? 4th stage relief valve blowing new Installations -	✓ Verify pipework bore is large enough, has a minimum of bends at the largest possible radius. Ensure any Uni-directional flow valve is fitted the right way round.
7.10.2 FAILS TO REACH PRESSURE	? Intake air filter dirty or blocked.	✓ Check air intake filter detector – if dirty, renew.
	? Unloader / drain valves not closing.	✓ Check solenoid valve is operating correctly and the DDVs seat properly. ✓ Check that operating air pipework is not damaged (or blocked at 1st stage separator end). ✓ Renew diaphragm and valves in the DDVs.
	? Compressor valve malfunction.	✓ 1st stage air valve, suction valve most likely to need attention, but check for correct assembly and condition or for leak from plates/springs in all stage air valves.
	? Safety valve blowing.	✓ Check safety valve is not faulty and replace if not serviceable. DO NOT ADJUST SAFETY VALVES
	? Electrical fault.	✓ Check pressure switch setting.
7.10.3 LOW COMPRESSOR OUTPUT	? Does not reach pressure.	✓ Check solenoid valve is operating correctly and the DDVs seat properly. ✓ Check that operating air pipework is not damaged (or blocked at 1st stage separator end). ✓ Renew diaphragm and valves in the DDVs. ✓ Check and renew inlet filter element
	? Low output due to cylinder/piston ring wear. 'Blow-by' noted from crankcase breather pipe.	✓ Check for Piston ring leakage – 'blow-by' – check final (4th) stage piston rings for wear then progressively 3rd, 2nd and 1st.

Symptom	Fault	Recommendation(s)
7.10.4 STOPS SUDDENLY	? Low oil pressure switch operating.	✓ Check switch. ✓ Check oil level - replenish sump oil after removing any condensate in sump. ✓ Check & clean oil strainer ✓ Renew oil filter. ✓ Renew oil pump. ✓ Check for bearing wear – replace as necessary
	? Final High air temperature switch operating.	✓ Check switch & setting. ✓ Check cooling water exit temperature does not exceed 50°C. ✓ Check cooling water temperature rise is 10-12°C. ✓ Remove 4th stage cooler coil assembly. Clean interior of cooler body and exterior of coil assembly.
	? 3rd stage High air temperature switch operating.	✓ Check switch & setting. ✓ Check cooling water exit temperature does not exceed 50°C. ✓ Check cooling water temperature rise is 10-12°C. ✓ Remove stage cooler assemblies. Clean interior of cooler body and exterior of cooler assemblies.
7.10.5 WILL NOT START	? Electrical fault.	✓ Check power to starter ✓ Check for previous STOP fault condition – high air temperature switches, low oil pressure switch ✓ Check via bell-housing inspection cover compressor free to turn by hand ✓ Check fuses within starter ✓ Check wiring connections to motor terminal ✓ Check continuity in motor windings
7.10.6 OVERHEATING	? Incorrect grade of lubricant.	✓ Drain, clean and refill crankcase with correct grade of lubricant. Check condition of valves and gas passageways.
	? Insufficient water flow, reduced cooling efficiency	✓ Examine condition of water circuit, remove any sludge or scale build-up.
7.10.7 OVERHEATING RADIATOR SET	? Water pump faulty or drive slipping	✓ Renew pump, adjust drive belt tension.
	? Insufficient water flow	✓ Contaminated water, replace and add inhibitor.
	? Incorrect siting, insufficient cooling air flow	✓ Resite unit to give correct cooling air flow.
	? Radiator blocked	✓ Clean matrix and flush out tubes.

Symptom	Fault	Recommendation(s)
7.10.8 LOW OIL PRESSURE	? Oil filter blocked.	✓ Fit new oil filter element.
	? Worn bearings	✓ Check bearing clearances
	? Bearing end plate gasket distorted partially blocking suction port	✓ Examine gasket, replace if necessary, position correctly.
	? Loose pipe connections	✓ Trace and rectify
	? Loose B/E bearing bolts or incorrectly fitted bearings	✓ Examine and re-tighten to correct torque.
7.10.9 CUTS OUT ON START-UP	? Motor overload set too low	✓ Consult qualified electrician.
	? Insufficient electrical supply causing low voltage.	✓ Consult qualified electrician.
	? Star/Delta timer	✓ Full speed should be attained by Star before switching to Delta. Extend timer period to suit.
	? Low oil pressure switch operating.	✓ See fault 'LOW OIL PRESSURE' or reset timer.
7.10.10 UNUSUAL NOISE (ON LOAD)	? Loose components	✓ Trace and rectify.
	? Aas leaks (usually hissing or whistling	✓ Trace, stop compressor, depressurise if safe to do so, renew seal.
	? Worn bearings, cylinders and rings- usually heavy knocking, rumbling or slapping.	✓ Check clearances and renew as necessary.
7.10.11 UNUSUAL NOISE (UNLOADED)	? Piston knocking	✓ Check Top Dead Centre clearance.
	? Compressor set-up or pipework system vibration.	✓ Check compressor pipework system is firmly secured, check clearances and alignment of couplings and tension of vee belts.
7.10.12 HIGH OIL CONSUMPTION	? Incorrect grade of lubricant	✓ Change to recommended lubricant.
	? Piston rings/cylinder worn or damaged	✓ Check for wear and renew as necessary.
7.10.13 PREMATURE WEAR	? Faulty pipeline intake filter	✓ Check to ensure filter is not damaged
	? Incorrect grade of lubricant	✓ Change to recommended lubricant.

8 MAINTENANCE AND REPAIR

MAINTENANCE AND REPAIR WARNING

BEFORE PROCEEDING WITH MAINTENANCE ON THE COMPRESSOR IT MUST BE STOPPED AND ISOLATED FROM ELECTRICAL, AIR AND WATER CIRCUITS. ALL INTERNAL PRESSURES MUST BE RELEASED FROM THE COMPRESSOR AND VISIBLE WARNING NOTICES DISPLAYED.

Note: An O&M manual must cater for a wide variety of operating duties, ambient conditions and methods of control. The following maintenance schedules are only a recommended guide to maintenance periods. It may be found advantageous or desirable to vary the maintenance periods depending on operating conditions and experience.

8.1 MAINTENANCE

8.1.1 GENERAL

It is useful to record stage pressure, temperatures, oil used in a log against hour's run, as this builds up a detailed record of machine condition. It can also provide a trend and indication of a possible problem.
Do not re-use O rings, seals and joints – fit new!
Grease O rings used for all 'dry' joints in contact air. Use a liberal smear of silicone for all O rings used in possible contact with the cooling water. I.e. cooler assemblies, 1st and 2nd stage 'wet' cylinder liners.
Flush out water passages either with high-pressure water or steam cleaning.
Clean thoroughly all oil-ways and carefully blow clean using compressed air.
Lightly grease or oil all surfaces of ferrous components after cleaning to prevent rusting.
Where practical, remove carbon deposits by gently tapping and scraping, taking care not to remove metal.

8.1.2 DAILY

Check oil level in crankcase and top up as necessary.
Check stage pressures, oil pressure and temperatures.

8.1.3 WEEKLY

Check bursting disc for signs of cracking.
Check for oil, air or water leaks; rectify as necessary.
Examine oil in crankcase and ensure that it is not contaminated with condensate. Depending on the degree of contamination, the oil may appear emulsified (creamy in colour) especially if the recommended lubricant is not used. If emulsification takes place the oil must be changed and the crankcase cleaned.
This condition is usually visible through the sight glass, oil level indicator and must be rectified immediately. Trace cause of contamination, rectify, and fit new oil filter and refill crankcase with recommended oil.
If moisture forms without emulsification, as two separate liquids, condensate may be drained from below the oil by means on the drain plug. The oil level should be replenished accordingly with clean oil. Crankcase oil contamination is often accompanied by increase in sight glass oil level, due to oil being supported by condensate fluid.
Check correct operation of all controls.

8.2 AFTER THE FIRST 100 HOURS & AFTER MAJOR OVERHAUL

Drain sump, replace oil filter, clean sump & refill with recommended synthetic oil.
Clean suction and delivery valves.
All components on these compressors are compatible with the recommended synthetic oil but as problems may exist with downstream ancillary equipment, the equipment manufacturer should be consulted.
METHOD
Drain the oil completely from compressor whilst the oil remains warm.

8.2.1 REMOVE CRANKCASE DOORS AND THOROUGHLY CLEAN INTERIOR OF THE CRANKCASE.

Clean suction strainer.
Renew oil filter.
Remove, thoroughly clean and refit all suction and delivery valves.
When inspecting valves, also remove as far as is possible any carbon deposit in valve pockets, passageway pipes and separators.
Replace crankcase doors and refill crankcase to correct levels with recommended synthetic oil.

8.3 SERVICING COMPRESSOR STAGE VALVES

8.3.1 ROUTINE CLEANING AND INSPECTION - ALL STAGES

Valve maintenance is a simple procedure but the following guidelines should be observed:

- Keep a spare oiled and maintained set of valve units in store for quick compressor servicing.
- Carbon may be removed scraping with a soft, blunt instrument, e.g. a piece of wood.
- ***WARNING: Great care should be taken when removing carbon deposits to ensure that the seating faces of the valve components are not damaged.***
- ***Note: Unless replacement of the springs and plates is intended, the order in which these components are removed should be carefully noted so that the valves may be reassembled with the same seating faces in contact.***
- These faces should be clean and bright over their whole area, with no evidence of uneven contact. Renew any plates that are indented, cracked, warped, or have wear grooves which exceed 10% of the plate thickness.
- Valve plates and springs must always be replaced at recommended life periods, regardless of appearance, to achieve maximum reliability.
- If the valve seats show severe wear or indentations, the complete valve assembly must be renewed. The remaining components should be checked for cracks, distortion or other damage liable to impair the valve operation.

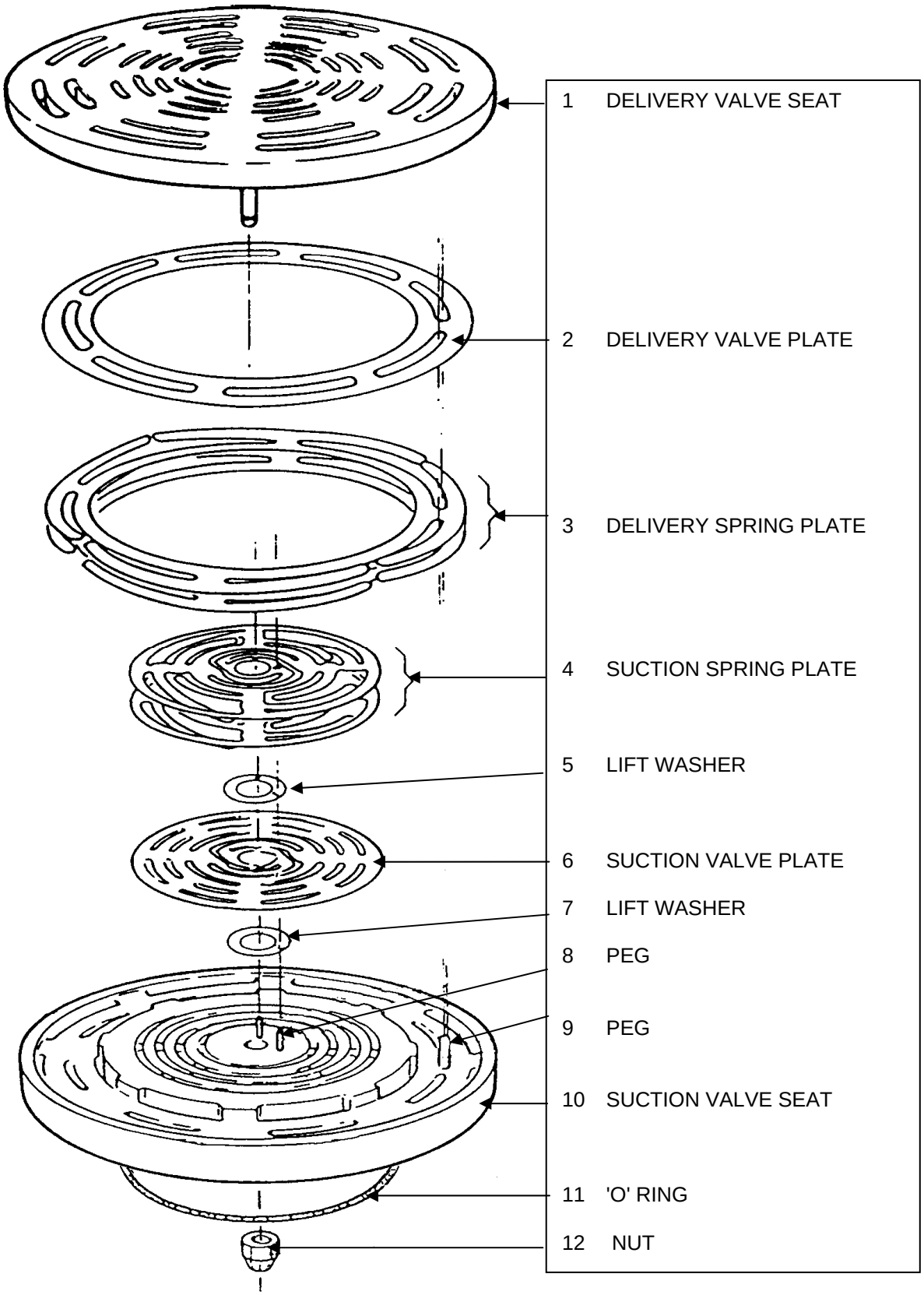
8.3.2 ROUTINE VALVE REMOVAL AND SERVICING

Valve removal is as follows for all stages.
Clean all grease and dirt from valve covers and surrounding areas.
Rotate crankshaft by hand until relevant stage piston is at top dead centre.
Remove valve covers nuts.
Use forcing screws to remove valve covers.
Using the special valve lifting tools, remove valve assemblies. A gentle rocking action pulling at the same time will free the valve from any carbon build up in the pocket.
Carefully wipe any loose carbon from valve pocket ensuring that no carbon is left in valve pocket or on top of the piston.
Move valve to a workbench and remove central nut from valve unit. Carefully separate upper and lower bodies and, with unit on a level surface, lift off upper body.
Remove valve plates and springs, noting **very carefully** their relative positions to the body and each other if they are to be re-used.

8.3.3 ROUTINE VALVE REPLACEMENT

Recheck that valve / valve pocket, top of piston, and the surrounding area is clean before replacing valve assembly.
Ensure valve seats properly as a slight misfit will entail loss of gas.
Check valve cover for cleanliness before assembly.
Renew "O" rings, lightly greasing before fitting.
There should be at least a 2mm gap between the top of cylinder and bottom of valve cover.
Tighten cover retaining nuts sequentially to the correct torque.

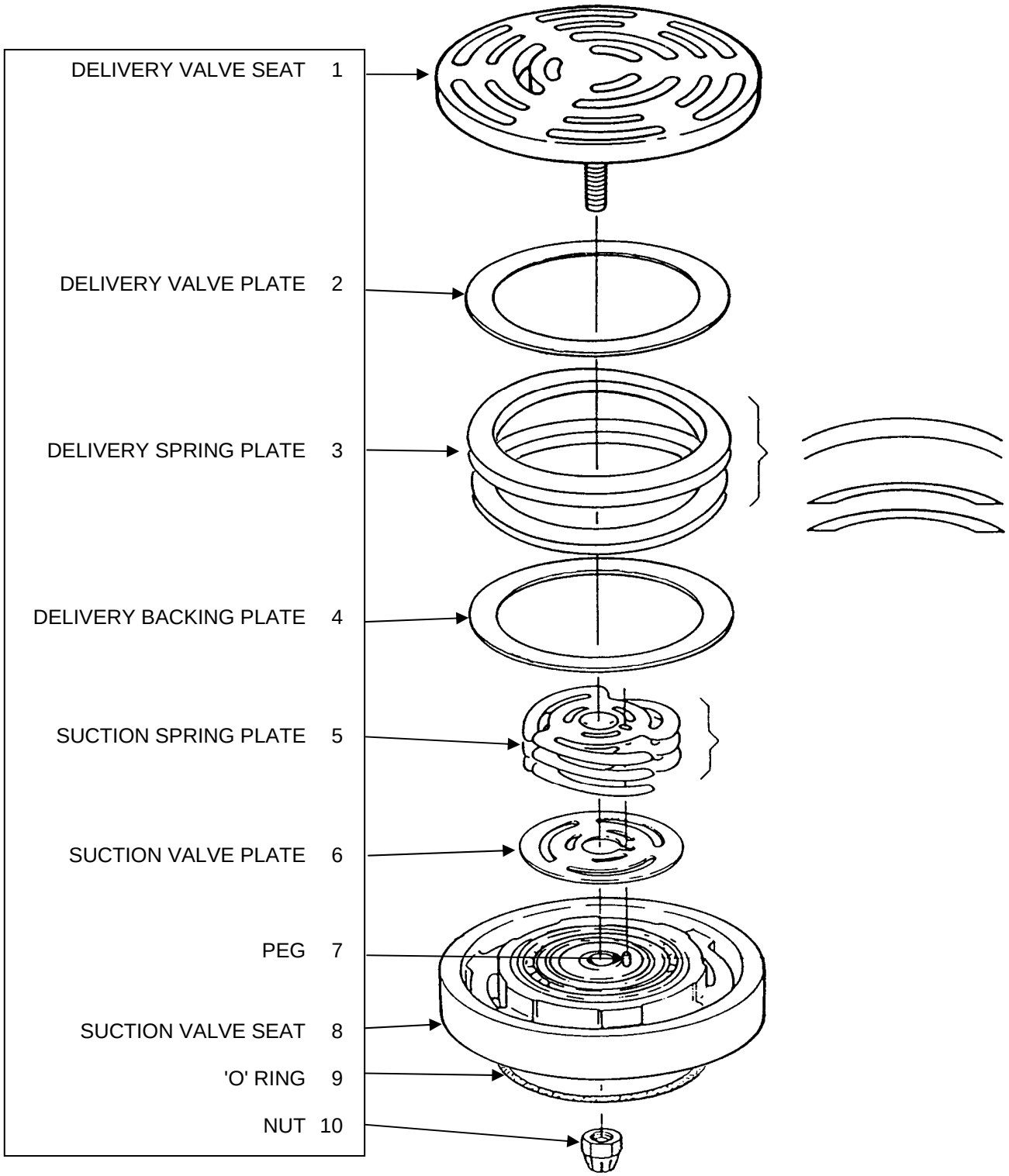
1ST STAGE VALVE



8.3.4 FIRST STAGE VALVE REASSEMBLY

Place suction valve seat (10) face downwards on suitable metal ring, or protected open vice jaws with locating pegs uppermost.
Position spring plates (3) to locate over pegs (9) with bridging strip resting between pegs and springs facing upwards.
Place valve plate (2) onto spring plate, located as above, ensuring concentricity with centre hole.
Place middle lift washer (7) over hole, locating on pegs (8).
Place valve plate (6) onto locating pegs (8).
Place lower lift washer (7) onto locating pegs (8).
Place valve spring plates (4) onto locating pegs (8) with springs pointing downwards.
Place delivery valve seat (1) onto assembly, ensuring inner (8) and outer pegs (9) engage correctly.
If assembly has been carried out correctly, upper and lower body faces will contact.
Screw nut (12) on stud and hand tighten only at this stage.
Test for correct operation by ensuring free movement of suction and delivery valve plates. This is facilitated by gently pushing a small diameter plastic or nylon rod through the ports in the valve to check plates for freedom.
If satisfactory tighten to the correct torque. If plates are not free, dismantle, relocate misplaced part and assemble, check again for free movement of plates before tightening to the correct torque.
Ensure "O" ring (11) is secure in slot in upper valve body.

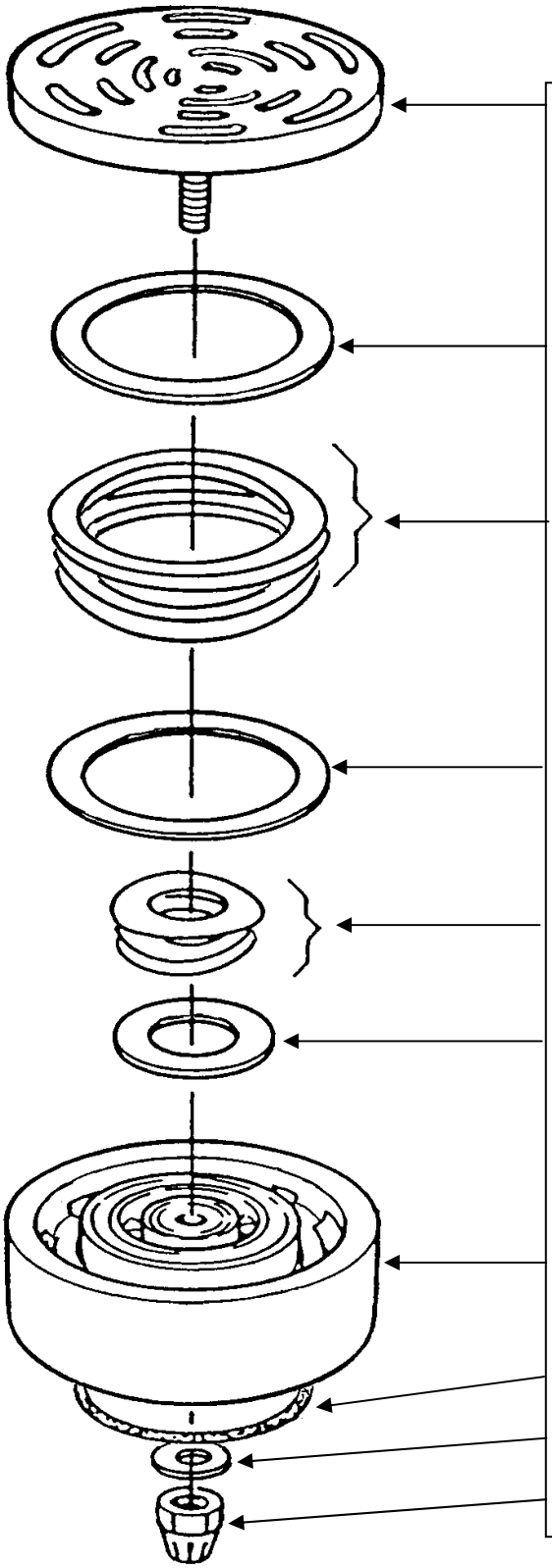
2ND STAGE VALVE



8.3.5 SECOND STAGE VALVE REASSEMBLY

Place suction valve seat (8) face downwards on suitable metal ring or protected open vice jaws with locating peg (7) uppermost.
Position suction valve plate (6) to locate over peg (7).
Fit suction spring plates (5) onto valve plate, locating them on peg (7), springs facing downwards.
Fit delivery valve backing plate (4) into outer recess of valve body.
Place delivery valve springs (3) onto backing plate having first positioned them as follows:
Assemble the delivery plate springs (3) in pairs, rotating one spring in each pair until the inner and outer circumferences are matched perfectly.
Hold the two springs together with their concave faces facing each other and then rotate one pair until edges touch all round the outer circumference and there is a constant gap around the inner edge.
Place delivery valve plate (2) on spring plates and ensure concentricity.
Place delivery valve seat (1) onto assembly. If all components are located correctly upper and lower bodies will contact.
Screw nut (10) on stud and hand tighten only at this stage.
Test for correct operation by ensuring free movement of suction and delivery valve plates. This is facilitated by gently pushing a small diameter plastic or nylon rod through the ports in the valve to check plates for freedom.
If satisfactory tighten to the correct torque. If plates are not free, dismantle; relocate misplaced part and reassemble, checking again for free movement of plates before tightening to the correct torque.
Ensure "O" ring (9) is secure in slot in upper valve body.

3RD STAGE VALVE

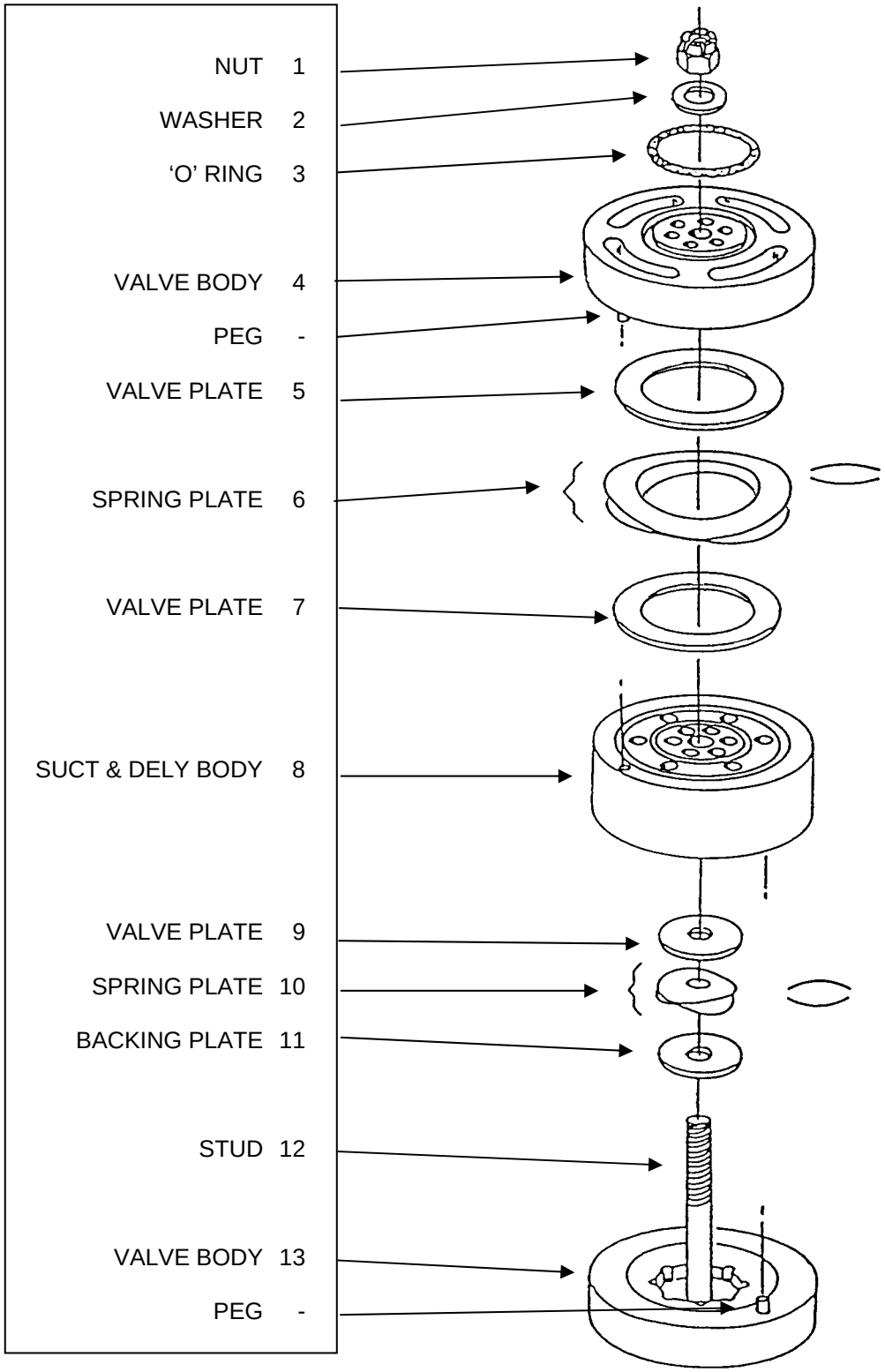


1 DELIVERY VALVE SEAT
2 DELIVERY VALVE PLATE
3 DELIVERY SPRING PLATE
4 DELIVERY BACKING PLATE
5 SUCTION SPRING PLATE
6 SUCTION VALVE PLATE
7 SUCTION VALVE SEAT
8 'O' RING
9 WASHER
10 NUT

8.3.6 THIRD STAGE VALVE REASSEMBLY

Position suction valve seat (7) face downwards on suitable metal ring or open protected vice jaws.
Fit delivery valve backing plate (4) into outer recess of valve body.
Fit delivery valve spring plates (3) onto backing plate having first positioned them as follows:
Assemble the delivery plate springs (3) in pairs, rotating one spring in each pair until the inner and outer circumferences are matched perfectly.
Hold the two springs together with their concave faces facing each other and then rotate one pair until edges touch all round the outer circumference and there is a constant gap around the inner edge.
Place delivery valve plate (2) on spring plates and ensure concentricity.
Place suction valve plate (6) onto valve body ensuring concentricity with centre hole.
Assemble the suction plate springs (5) and place on suction valve plate with springs facing downwards.
Place delivery valve seat (1) onto assembly. If all components are located correctly upper and lower bodies will contact.
Press together and ensure edges of upper and lower body contact then fit washer (9) and nut (10), hand tighten only at this stage.
Test for correct operation by ensuring free movement of suction and delivery valve plates. This is facilitated by gently pushing a small diameter plastic or nylon rod through the ports in the valve to check plates for freedom. If satisfactory tighten to correct torque, however, if plates are not free, dismantle, relocate misplaced part and reassemble, checking for free movement of plates before tightening to the correct torque.
Ensure "O" ring (8) is secure in slot in upper valve body.

4TH STAGE VALVE

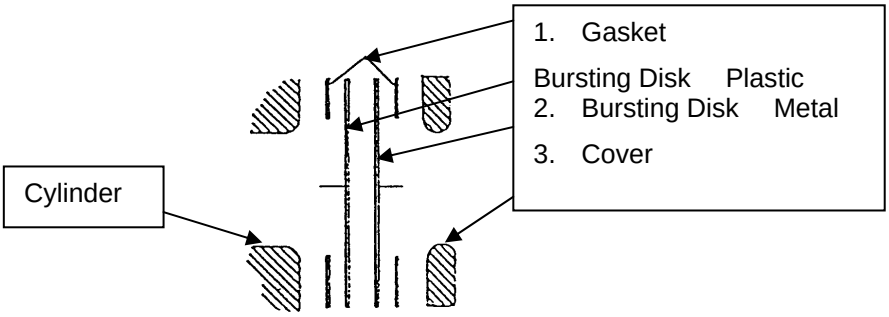


8.3.7 FOURTH STAGE VALVE REASSEMBLY

Place lower valve body (13) on a clean flat surface with stud (12) uppermost.
Fit suction valve backing plate (11) in the valve recess followed by spring plates (10), arranged as shown, and suction valve plate (9).
Fit central body (8) over stud and lower until locating hole engages with peg in lower body.
Carefully push two valve body sections (8 & 13) together until in full and firm contact. If the sections will not locate correctly: separate and re-align to plates and springs. DO NOT FORCE TOGETHER.
Invert upper body (4) and hold in a soft jawed vice or similar.
Fit delivery valve backing plate (5) into recess followed by spring plates (6), arranged as shown, and delivery valve plate (7).
With the central (8) and lower body (12) held firmly together; turn upside down and pass stud through hole in upper body (4), ensuring that the hole in central body engages with peg in upper body. If centre section will not locate correctly with upper body: remove and re-align plates and springs. DO NOT FORCE.
Ensuring that all components are correctly located and held firmly together, remove from the vice and fit washer (2) and nut (1) and tighten to correct torque.
When correctly located and tighten and fit new O ring (3).

8.4 SERVICING – COMPRESSOR PROTECTION

8.4.1 BURSTING DISC



Before refitting ensure the radiused edges of the cylinder hole and cover are smooth and have no burrs or corrosion.
Reassemble in the correct order and tighten screws evenly to the correct torque.
SAFETY NOTE: ONLY USE GENUINE REPLACEMENT DISCS

8.4.2 CORROSION ROD

Drain the water from cylinder blocks and remove the assemblies. If seriously corroded, renew.

8.4.3 SAFETY VALVES

With machine running at or near maximum pressure ensure valves are not leaking significantly. A very slight leakage of air is quite normal. DO NOT listen or look directly at discharge ports. A simple method is to fit a balloon (or similar) over the discharge. Renew faulty valves, **DO NOT ATTEMPT REPAIR.**

8.4.4 LOW OIL PRESSURE SWITCH

None. If faulty, renew.

8.4.5 HIGH AIR TEMPERATURE SWITCHES

None. If faulty, renew.

8.4.6 MAINTENANCE OF SOLENOID VALVE

None. If faulty, renew.

8.4.7 NON-RETURN VALVE

None. If faulty, renew.

8.4.8 AIR INTAKE FILTER / SILENCER

Remove air filter element from unit.
Replace paper element.
Brush or blow out dust and dirt from suction silencer.
Replace air filter element into unit ensuring it sits firmly on the seal.

8.4.9 OIL FILTER

Remove filter, spin-on type, by unscrewing anti-clockwise.
Fit new spin-on filter, lightly oil sealing ring before fitting.
Tighten hand tight.
Check for leaks on restart.

8.5 SERVICING – COMPRESSOR

8.5.1 OIL PUMP

If the pump is in anyway unsatisfactory – replace.

8.5.2 FIRST & SECOND STAGE COOLER TUBESTACK

Remove cooler end cover and separator from non drive-end.
Remove from drive-end 2nd stage separator (remove separator cover to gain access to all studs).
Remove and withdraw combined cooler tubestack for 1st and 2nd stage from driving end.
Wash and brush down exterior of tubes, baffle plates and clean water passages.
Inspect for corrosion and hydrostatically test and replace as necessary
To refit smear cooler end covers and cooler body bore with silicone sealant.
Push the cooler assembly through body, studded end first until 'O' ring groove is exposed.
Silicone and fit 'O' rings, pull back cooler and silicone and fit 'O' rings to other end and then push in flush with O/E.
Fit outer end cover without gasket, tighten bolts, then remove cover and clean excess silicone from face.
Fit gasket and then finish assembly.

8.5.3 THIRD STAGE COOLER COIL

DO NOT ATTEMPT to remove cooler coil assembly end fittings. This is a brazed assembly containing high pressure!
Disconnect 3rd stage inlet pipe, remove separator, remove large circlip from outer-end and withdraw.
Remove outer shroud tube.
Wash and brush down exterior of tubes and clean cylinder block water passages.
If airflow through tube coil is restricted, or there is any doubt to internal cleanliness, renew complete assembly.
Inspect for corrosion and hydrostatically test and replace as necessary
Fit new "O" ring seals, smear cooler end covers 'O' rings and cooler body bore with silicone sealant.
Refit to body.

8.5.4 FOURTH STAGE COOLER COIL

DO NOT ATTEMPT to remove cooler coil assembly end fittings. This is a brazed assembly containing high pressure!
Disconnect 4th stage inlet pipe, remove cooler cover from outer-end and withdraw.
Remove outer shroud tube.
Wash and brush down exterior of tubes and clean cylinder block water passages.
If airflow through tube coil is restricted, or there is any doubt to internal cleanliness, renew complete assembly.
Inspect for corrosion and hydrostatically test and replace as necessary
Fit new "O" ring seals, smear cooler end covers 'O' rings and cooler body bore with silicone sealant.
Refit to body.

8.5.5 PRESSURE GAUGES

Remove gauge panel complete with gauges, after releasing pressure gauge tail nuts.
Loosen screws holding clamp rings, remove gauges.
Send gauges for calibration on dead-weight tester.

8.5.6 CRANKSHAFT

Remove crankcase doors and remove all big end caps.
Raise running gear clear of crankshaft, or remove completely.
Remove all pipes from the crankshaft interior.
Remove main-bearing housing screws at driving end and main bearing housing.
Prise out and discard oil seal.
Support weight of crankshaft using lifting tackle or blocks.
Carefully remove crankshaft through driving end of crankcase.
Remove main-end bearing housing screws at outer end and remove housing.
Inspect running surfaces of crankshaft and main bearings.
If any of the surfaces are scored, oval or worn below limits, those parts should be renewed.
Refit outer-end bearing housing and install housing to crankcase.
Ensure all journals of crankshaft are clean and free from burrs and oil all surfaces.
Insert crankshaft to bearing housing.
Fit new oil seal to driving end bearing housing and install housing.
Check freedom of rotation of shaft and correct end float.

8.5.7 MAIN BEARINGS

Use a hydraulic press to remove old bearings from bearing housings**.**

8.5.7.1 BIG-END BEARINGS

Remove crankcase doors and remove all big end caps.
Measure crankshaft journals in two positions at 90° for each big end.
If any one dimension is below the minimum given in Running Clearances and Wearing Dimensions table, it is recommended the compressor be overhauled.
DO NOT merely fit new bearing shells.
If satisfactory refit big end bearings, ensuring identity numbers are adjacent and facing upwards.
Note: The big end bearings fitted to the connecting rods are of the aluminium / tin line overlay, steel backed shell type, on an underlying copper based bearing material.
It is important to note that due to the bedding process, which occurs during running-in, that the aluminium / tin overlay will be removed in the areas of highest load exposing the underlying copper based bearing material.
This is quite normal and does not indicate a fault in the bearing or the need for shell replacement. After initial bedding in to this level the bearing will show no significant further change for several thousand hours.
When aluminium / tin lining overlay has been removed from an area greater than 90° of the bearing surface of either top or bottom half bearing shell, the complete bearing must be replaced.

8.5.8 SMALL-END BEARINGS

Note: The 1st stage bearing is a plain bush, NOT a rolling contact needle roller bearing.
If there is detectable movement of the piston or crosshead at 90 degrees to its normal plane of movement of the conn-rod, remove and discard the gudgeon pin and needle roller bearing.

8.5.9 GUDGEON PINS

Remove circlips and gently drift out all gudgeon pins.
Check pins for any ‘flaking’ of the surface; renew if worn or flaking of surface is evident.

8.5.10 RUNNING GEAR

8.5.10.1 1ST STAGE

Note: If removing cylinder liner, ensure that cooler body has been drained of water.
Remove valve cover and valve.
Remove crankcase door on opposite side of crankcase.
Remove big-end bearing cap from conn-rod.
Remove piston and conn-rod assembly upwards through valve port using service tools.
Remove cylinder liner upwards through valve port using service tools.
Measure cylinder liner, piston and piston rings and replace or re-use as necessary.
De-glaze cylinder liner bore by light honing if re-using.
Thoroughly clean all seating faces in cylinder bodyl
Replace all cylinder liner O rings and coat with silicone sealant.
Refit cylinder liner to body
Refit piston rings to piston, ensuring that the gaps are staggered around piston.
Oil all wearing surfaces before re-assembly.
Place piston ring compressor into valve pocket and oil surface.
Carefully lower the complete piston and conn-rod assembly through the piston ring compressor into the cylinder liner using service tools, taking care not to rotate the piston.
When rings are engaged in cylinder liner, remove piston ring compressor, refit big-end bearing and conn-rod cap and tighten to correct torque setting.
Replace all valve cover O rings and coat with silicone grease.
Refit valve and valve cover and tighten to correct torque setting.

8.5.10.2 2ND STAGE

Note: If removing cylinder liner, ensure that cooler body has been drained of water.
Remove valve cover and valve.
Remove crankcase door on opposite side of crankcase.
Remove big-end bearing cap from conn-rod.
Withdraw liner, piston and conn-rod assembly upwards through valve port using the service tools.
Measure cylinder liner, piston and piston rings and replace or re-use as necessary.
De-glaze cylinder liner bore by light honing if re-using.
Thoroughly clean all seating faces in cylinder body.
Refit piston rings to piston, ensuring that the gaps are staggered around piston.
Oil all wearing surfaces before re-assembly.
Replace all cylinder liner O rings and coat with silicone sealant.
Fit piston assembly into cylinder liner.
Carefully lower the complete assembly through the valve port using the service tools, taking care not to rotate the piston.
Refit big-end bearing and conn-rod cap, and tighten to correct torque setting.
Replace all valve cover O rings and coat with silicone grease.
Refit valve and valve cover and tighten to correct torque setting.

8.5.10.3 3RD & 4TH STAGE

Remove valve cover and valve.
Undo piston-retaining capscrew.
Withdraw piston from crosshead using service tools.
Remove crankcase door on opposite side of crankcase.
Remove big-end bearing cap from conn-rod.
Withdraw conn-rod and crosshead assembly downwards through crankcase door opening, passing over crankshaft.
Remove cylinder liner upwards through valve port using service tools.
Measure cylinder liner, piston and piston rings and replace or re-use as necessary.
De-glaze cylinder liner bore by light honing if re-using.
Thoroughly clean all seating faces in cylinder body.
Refit piston rings to piston, ensuring that the gaps are staggered around piston.
Oil all wearing surfaces before re-assembly.
Replace all cylinder liner O rings and coat with silicone grease.
Refit cylinder liner into cylinder body.
Refit conn-rod and crosshead assembly upwards through crankcase door opening, passing over crankshaft and locate with crosshead guide and crankshaft journal.
Refit big-end bearing and conn-rod cap, and tighten to correct torque setting.
Refit piston to crosshead using service tools.
Refit piston securing capscrew and tighten to correct torque setting.
Replace all valve cover O rings and coat with silicone grease.
Refit valve and valve cover and tighten to correct torque setting.

8.5.11 DIAPHRAGM DRAIN VALVE

Remove all external pipework from valve unit.
Remove securing nut from central stud and remove valve unit from crankcase.
Remove the screws at each end of the valve unit and pull bodies apart from the central cover.
Discard diaphragm and joints.
Remove and inspect valves, lapping with fine grinding paste if necessary to obtain a leak-free seal.
If the valve seat has been worn to more than approximately 1mm width, or lapping cannot obtain a satisfactory seal, valve and seat must be renewed.
The pipe fittings and locknuts attached to the valve seats can be removed if the body halves are to be renewed, otherwise leave in place.
The cap screws retaining the mushroom plates to the valve can be removed it the valves are to be renewed. Otherwise leave in place.
Use thread sealant between the valve seats and body halves and the cap screws securing the mushroom plates to the valves on re-assembly.
Reassemble units using new diaphragms and joints, tightening the retaining screws finger-tight initially whilst checking the relative position of outlets, securing bolt hole, separator pipe and pilot air connection.
Tighten all six screws sequentially.

8.5.12 FLYWHEEL

Remove motor complete with bell housing and half coupling.
Remove compressor half coupling, ease back tab washer and remove keep bolt, keep plate and tab washer.
Support flywheel and release from the crankshaft taper, a withdrawing tool may be required.
Remove flywheel and key.

8.5.13 PULLEY, BELTS & MOTOR PULLEY

Remove drive belt guard.
Loosen the motor holding down bolts.
Using vee drive tensioning screws, slacken and then remove vee belts.
To remove compressor pulley, ease back tab washer and remove keep bolt, keep plate and tab washer.
Support pulley and release from the crankshaft taper, a withdrawing tool may be required.
Remove pulley and key.
To remove motor pulley, release taperlock bush screws, withdraw complete.

9 PARTS LISTS

9.1 CRANKCASE

Item No.	Description.	Part Number.	Number OFF.
1.1	Door	C201802	4
1.2	Breather cover	C201815	1
1.3	Breather retaining plate	C201816	2
1.4	Joint – breather cover	C201819	1
1.5	Joint - c/case door	C201821	4
1.6	Joint – filler to c/case	C201829	1
1.7	Stud M8 x 20 s.o.	D54109.8.28	2
1.8	Stud M16 x 45 s.o.	D66720.16.69	12
1.9	Plug 3/4" BSP	PS1068.5	1
1.10	Plug 3/4" BSPT	PS1454.6	2
1.11	Rivet Rokut	PS2189.1	2
1.12	Nameplate serial	RP513	1
1.13	Setscrew	95000.228	6
1.14	Setscrew	95000.256	40
1.15	Setscrew	95000.314	16
1.16	Capscrew	95018.274	2
1.17	Nut M8	95111.5	2
1.18	Nut M16	95111.9	12
1.19	'O'-ring – 3rd,4th stg. Body to c/case	95602.149	2
1.20	'O'-ring – 1st,2nd stg. Body to c/case	95602.155	2
1.21	Breather Element	98262.1132	1
1.22	Oil Level Gauge	98281.1002	1
1.23	Oil Level Label	98381.1013	1
1.24	Seal	98660.1154	2
1.25	Seal	98660.1155	1
1.26	Seal ¾" BSP	98660.1156	1
1.27	Crankcase supplied with parts #	A30051.2#	1
1.28	Suction oil pipe assembly	D100809.1	1
1.29	Oil service pipe assembly	D100973.1	1
1.30	Oil feed pipe assembly	D100809.2	1
1.31	Low oil pressure switch	98524.1042	1
2.1	Oil filler	D100622	1
2.2	Oil filter element	98262.1147	1

9.2 MAIN BEARING HOUSING

9.2.1 OUTER END

Item No.	Description.	Part Number.	Number OFF.
3.1	Bearing housing	E60010	1
3.2	Joint - outer- end bearing cover	C200869	1
3.3	Joint - oil pump to cover	C200900	1
3.4	Bush	C85736.2	1
3.5	Outer end cover	D100234	1
3.6	Joint - outer end bearing housing	D100354	1
3.7	Plug	PS1068.2	3
3.8	Plug 3/4" BSPT	PS1454.4	1
3.9	Setscrew	95000.255	10
3.10	Setscrew	95000.256	1
3.11	Setscrew	95000.257	2
3.12	Dowel	95502.366	2
3.14	Oil filter	98262.1009	1
3.15	Seal	98660.1153	1
3.16	Oil pump assembly	C85737.2	1
3.17	Cover Plate	C203648	1
3.18	'O' Ring	95602.50	1
3.19	Setscrew M6 X 16	95000.228	4

9.2.2 DRIVING END

Item No.	Description.	Part Number.	Number OFF.
4	Bearing housing	D66384	1
4.1	Bush	C85736.2	1
4.2	Joint – drive end bearing housing	D100353	1
4.3	Oil Seal	95605.135	1

9.3 RUNNING GEAR

9.3.1 1ST STAGE

Item No.	Description.	Part Number.	Number OFF.
5.1.1	Bush – Small end	C200016	1
5.1.2	Bearings B/E	C201109	1
5.1.3	Gudgeon pin	C85727.1	1
5.1.4	Piston – 1st stage supplied with parts ¥	D66376	1
5.1.5	Connecting Rod.	D66395	1
5.1.6	Circlips – gudgeon pin	95650.30	2
5.1.7	Rings – Oil control ring – 1st stage	98477.1049	1
5.1.8	Rings – Piston ring, 1st stage	98477.1059	2

9.3.2 2ND STAGE

Item No.	Description.	Part Number.	Number OFF.
5.2.1	Bearings B/E	C201109	1
5.2.2	Gudgeon pin	C85727.2	1
5.2.3	Connecting Rod.	D66395	1
5.2.4	Piston – 2nd stage supplied with parts ¥	D67052	1
5.2.5	Circlips – gudgeon pin	95650.25	2
5.2.6	Small end bearing	96072.74	1
5.2.7	Rings – Piston ring, 2nd stage	98477.1060	2
5.2.8	Rings – Oil control ring, 2nd stage	98477.1061	1

9.3.3 3RD STAGE

Item No.	Description.	Part Number.	Number OFF.
5.3.1	Bearings B/E	C201109	1
5.3.2	Gudgeon pin	C85727.2	1
5.3.3	Connecting Rod.	D66395	1
5.3.4	Rings – third stage	PS1159.108	4
5.3.5	Circlips – gudgeon pin	95650.25	2
5.3.6	Small end bearing	96072.74	1
5.3.7	Crosshead supplied with parts ‡	D101589	1
5.3.8	Piston – 3rd stage supplied with parts ¥	C203684	1
5.3.9	Retaining bolt – piston	98086.1028	1

9.3.4 4TH STAGE

Item No.	Description.	Part Number.	Number OFF.
5.4.1	Bearings B/E	C201109	1
5.4.2	Gudgeon pin	C85727.2	1
5.4.3	Connecting Rod.	D66395	1
5.4.4	Circlips – gudgeon pin	95650.25	2
5.4.5	Small end bearing	96072.74	1
5.4.6	Piston ring	98477.1143	6
5.1	Crosshead	D101589	1
5.4.7	Piston – 4th stage supplied with parts ¥	C203685	1
5.4.8	Retaining bolt – piston	98086.1028	1

9.4 CRANKSHAFT

Item No.	Description.	Part Number.	Number OFF.
6.1	Keep plate	C11359-44	1
6.2	Tab washer	C11359-45	1
6.3	Setscrew 3/4-16 unf x 1 1/2 LG	C75163.3	1
6.4	Crankshaft supplied with parts #	D66397	1
6.5	Key	PS1130.21	1

9.5 CYLINDER BODY – 1ST & 2ND STAGE

Item No.	Description.	Part Number.	Number OFF.
7.1	Stud M10 x 60 s.o.	D66720.10.75	2
7.2	Stud M12 X 40	D66720.12.58	4
7.3	Stud M20 X 45	D66720.16.75	4
7.4	Screw M12 x 20	95000.312	4
7.5	Nut M20	95111.11	4
7.6	Nut M12	95111.7	4
7.7	M16 eyebolt	95242.2	2
7.8	1st and 2nd stage cylinder body	A30200	1
7.9	Stud M10 x 145 s.o.	D66720.10.160	12
7.10	Stud M10 x 97 s.o.	D66720.10.112	7
7.11	Gasket	C11359.62	1
7.12	Nut M10	95111.6	20

9.6 COOLER – 1ST & 2ND STAGE

Item No.	Description.	Part Number.	Number OFF.
8.2.1	Stud M10 x 60 s.o.	D66720.10.75	7
8.2.2	Nut M10	95111.6	24
8.2.3	Circlip	98148.1033	36
8.2.4	Tube plate	E61522	1
8.2.5	Stud M10 x 145 s.o.	D66720.10.160	5
8.2.6	Stud M10 x 45 s.o.	D66720.10.60	8
8.2.7	Tube plate	E61525	1
8.2.8	Baffle plate	D100598	3
8.2.9	Baffle plate	D100599	3
8.2.10	Rod spacer	C203692	3
8.2.11	Stud M10 x 165 s.o.	D66720.10.180	4
8.2.12	'O' ring	95602.110	4
8.2.13	Cooler tube 1st & 2nd stage	C203744	31
8.2.14	Cooler tube starfin	98617.1029	14

9.7 SEPARATOR – 1ST & 2ND STAGE

Item No.	Description.	Part Number.	Number OFF.
8.2	Separator – 1st stage	E61518	1
8.1.2	Cover – 1st stage separator	E61521	1
8.1.3	Separator 2nd stage	E61519	1
8.3.1	Cover – 2nd stage separator	D101596	1
8.1.4	Joint – 1st & 2nd stage separator	D101601	1
8.1.5	Joint – 2nd stage separator	C203697	1
8.1.6	Joint – 1st stage separator	C203698	1
8.1.7	Joint – 2nd stage separator	C203699	1

9.8 CYLINDER BODY – 3RD & 4TH STAGE

Item No.	Description.	Part Number.	Number OFF.
9.1	Bursting disc cover	C200584	1
9.2	Pocket thermometer	C201708	1
9.3	Gasket	C81788	2
9.4	Stud M8 X 45 s.o	D100171.8.61	3
9.5	Stud M16 X 50 s.o	D66720.16.74	4
9.6	Stud M16 X 60 s.o	D66720.16.84	4
9.7	Plug 1" BSP	PS1068.6	4
9.8	Dowty seal 1" BSP	PS1322.8	4
9.9	Setscrew M10	95000.282	4
9.10	Nut M8	95111.5	3
9.11	Nut M16	95111.9	8
9.12	Eyebolts	95242.2	2
9.13	Seal ¾" BSP	98660.1156	1
9.14	Body 3rd & 4th	A30201	1

9.9 COOLER – 3RD STAGE

Item No.	Description.	Part Number.	Number OFF.
10.1	Shroud outer	D101586	1
10.2	Tube stack	D101629	1

9.10 SEPARATOR – 3RD STAGE

Item No.	Description.	Part Number.	Number OFF.
10.3	'O' ring.	95602.91	2
10.4	'O' ring.	95602.94	2
10.5	Tension pin.	95440.285	1
10.6	Separator 3rd stage	E61517	1
10.7	Circlip retaining	95650.1110	1
10.8	'O' ring.	95602.31	1

9.11 COOLER – 4TH STAGE

Item No.	Description.	Part Number. **D101610**	Number OFF.
11.1.1	Tube stack.	D101630	1
11.1.2	Tube outer	C202949	1
11.2.1	'O' ring.	95602.87	2
11.2.2	'O' ring.	95602.88	2
11.2.3	Locating lugs	C203809	2
11.2.4	Fitting	C203849	1
11.2.5	Setscrew M8	95000.262	4
11.2.6	Capscrew M10	95018.230	2

9.12 SEPARATOR – 4TH STAGE

Item No.	Description.	Part Number. **C203868**	Number OFF.
20.1	Plug	C73732.22	1
20.2	Seal-dowty	PS1322.9	2
20.3	Swirl fitting	C203669	1
20.4	Body 4th stage separator	C203766	1
20.5	Cap screw	95018.243	2
20.6	Top fitting	D101618	1

9.13 CORROSION ROD

9.13.1 CORROSION ROD - STANDARD

Item No.	Description.	Part Number. **C203868**	Number OFF.
12.1	Corrosion rod – 150 mm	C203869	2

9.13.2 CORROSION ROD - OPTIONAL

Item No.	Description.	Part Number. **C203868**	Number OFF.
12.2	Corrosion rod – 150 mm	C203869	2
12.3	Corrosion rod – 100 mm	C203870	4

9.14 BURSTING DISC

Item No.	Description.	Part Number.	Number OFF.
13.1	Bursting disc	C201658.2	1
13.2	Bursting disc - melinex	C84735.1	1

9.15 LINER/VALVE COVER

9.15.1 1ST STAGE

Item No.	Description.	Part Number.	Number OFF.
14.1.1	Valve cover	D100609	1
14.1.2	Liner	D100802	1
14.1.3	'O' ring	95602.151	1
14.1.4	'O' ring	95602.152	2
14.1.5	'O' ring	95602.153	2

9.15.2 2ND STAGE

Item No.	Description.	Part Number.	Number OFF.
14.2.1	Valve cover	D100604	1
14.2.2	Liner	D100005	1
14.2.3	'O' ring	95602.100	2
14.2.4	'O' ring	95602.140	1
14.2.5	'O' ring	95602.141	1
14.2.6	'O' ring	95602.98	1

9.15.3 3RD STAGE

Item No.	Description.	Part Number.	Number OFF.
14.3.1	Back up ring.	98504.1112	2
14.3.2	Liner	C203686	1
14.3.3	Valve cover	C203680	1
14.3.4	'O' ring	98504.1385	2
14.3.5	'O' ring	98504.1384	2

9.15.4 4TH STAGE

Item No.	Description.	Part Number.	Number OFF.
14.4.1	Back up ring.	98504.1090	1
14.4.2	'O' ring	98504.1105	1
14.4.3	'O' ring	98504.1106	1
14.4.4	Liner	C203687	1
14.4.5	'O' ring	98504.1386	1
14.4.6	Valve cover	C203681	1
14.4.7	Back up rings for 14.4.5	98504.1387	2

9.16 VALVE UNITS

Item No.	Description.	Part Number.	Number OFF.
15.1	Valve unit 1st stage	98650.1519	1
15.2	Valve unit 2nd stage	98650.1039	1
15.3	Valve unit 3rd stage	98650.1049	1
15.4	Valve unit 4th stage	98650.2037	1

9.17 SUCTION FILTER

Item No.	Description.	Part Number.	Number OFF.
16.1	Suction filter	98262.1010	1
16.1	Element – suction filter	98262.1063	1

9.18 DRAIN SYSTEM

Item No.	Description.	Part Number.	Number OFF.
17.1	Washer nylon.	C201488.1	4
17.2	Washer nylon.	C201488.2	2
17.3	Gasket.	C201820	1
17.4	Stud M8 X 90 s.o	D66720.8.102	2
17.5	Diaphragm drain valve 3rd & 4th stage	U334.J	1
17.6	Diaphragm drain valve 1st & 2nd stage	U334.L	1
17.7	Setscrew M8	95000.256	16
17.8	Nut M8	95111.5	2
17.9	Surge vessel cover	C201804	1
	Solenoid valve – 240v/50Hz	PS2129.1	1

9.19 INSTRUMENTATION

Item No.	Description.	Part Number	Number OFF.
18.1	Pressure gauge - oil	98288.1001	1
18.2	Pressure gauge - 1st stage	98288.1002	1
18.3	Pressure gauge - 2nd stage	98288.1003	1
18.4	Pressure gauge - 3rd stage	98288.1004	1
18.5	Pressure gauge - 4th stage	98288.1005	1
18.6	Temperature switch - 3rd stage	C202556.8	1
18.7	Temperature switch - Final stage	C202960.1	1

9.20 SAFETY VALVES

Item No.	Description.	Part Number	Number OFF.
19.1	Safety valve - surge vessel	98650.1011	1
19.2	Safety valve - 1st stage	98650.1020-3.8	1
19.3	Safety valve - 2nd stage	98650.1021-24	1
19.4	Safety valve 3rd stage	98650.1022-117	1
19.5	Safety valve 4th stage	98650.1355-385	1

9.21 NON RETURN VALVE

Item No.	Description.	Part Number	Number OFF.
20.1	Union	C82148	1
20.2	Seal Dowty	PS1322.4	2
20.3	Non return valve	98650.1655	1

9.22 PIPE ASSEMBLIES

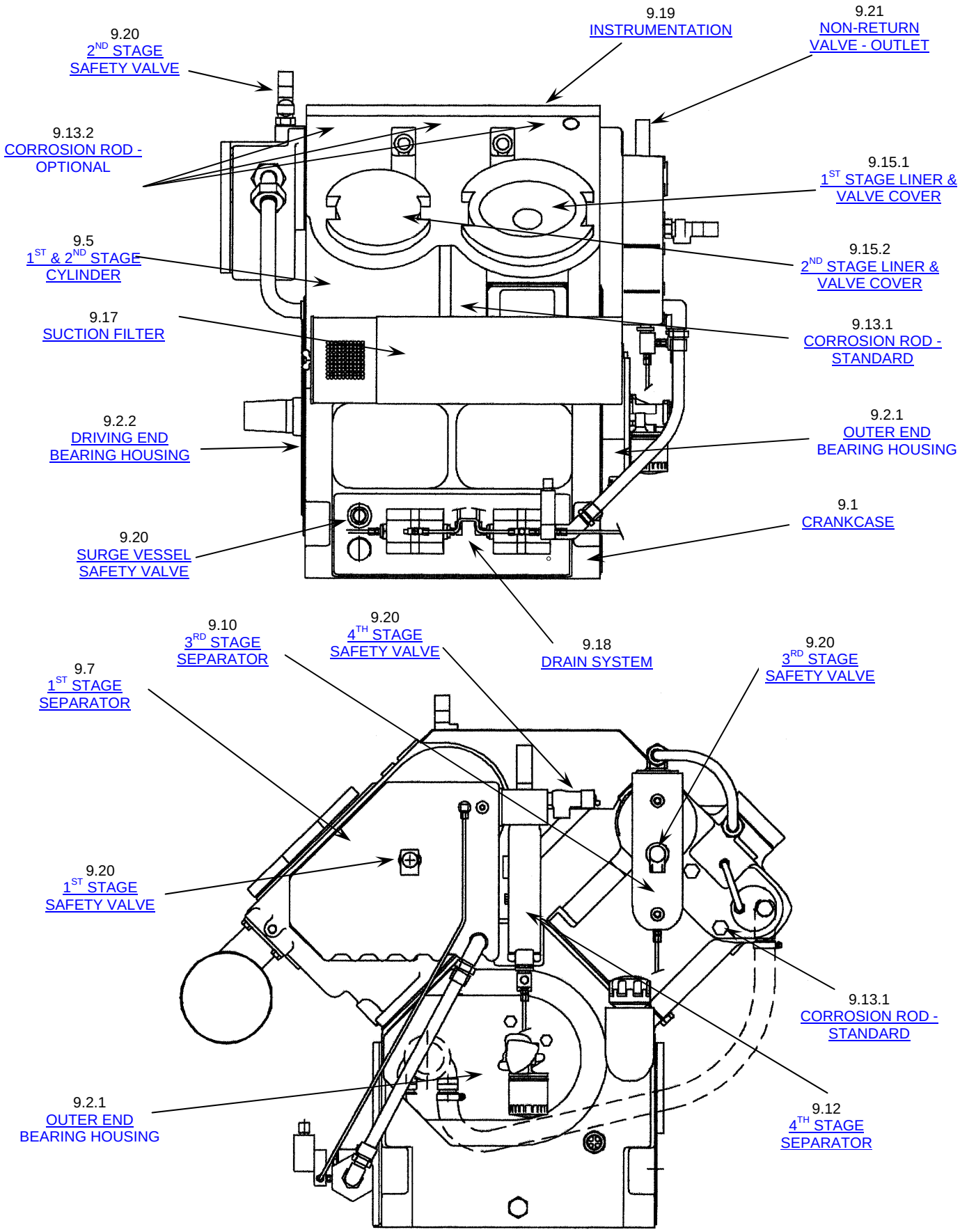
	2^{nd} stage delivery	C203919	
	3^{rd} stage suction	C203920	
	3^{rd} stage delivery	C203914	
	4^{th} stage suction	C203921	
21.1	4^{th} stage delivery	C203858	
	4^{th} stage cooler outlet	C204005	
	1^{st} & 2^{nd} stage separator drains	C203915	
	3^{rd} & 4^{th} stage separator drains	C203916	
	DDV control	C203917	
	Water transfer	C203951	
21.2	Crankcase breather.	D100973.6	
	Oil pressure gauge	C203918.5	
	1^{st} Stage pressure gauge	C203918.1	
	2^{nd} Stage Pressure gauge	C203918.2	
	3^{rd} Stage Pressure gauge	C203918.3	
	4^{th} stage pressure gauge	C203999.4	

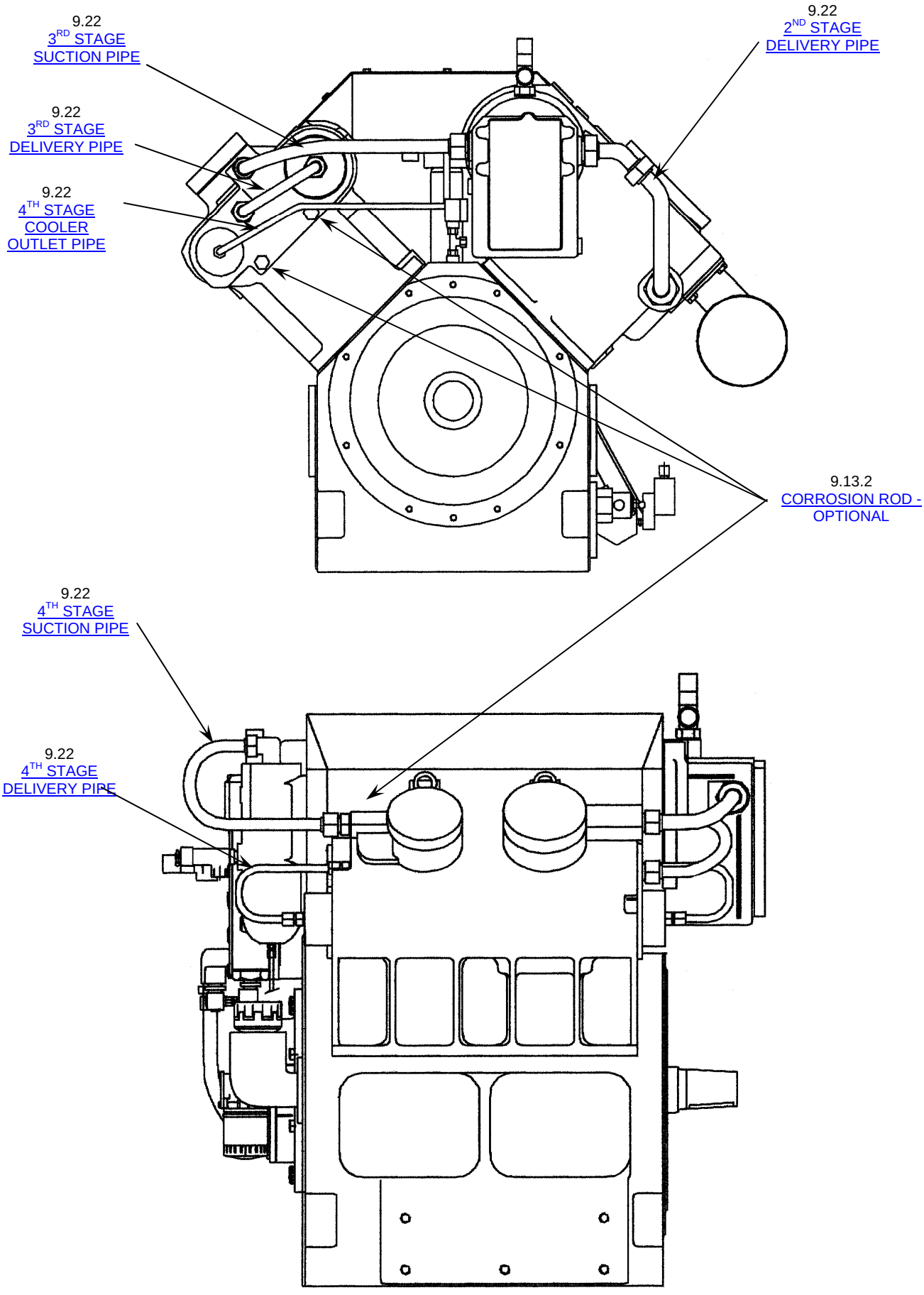
9.23 TOOLS

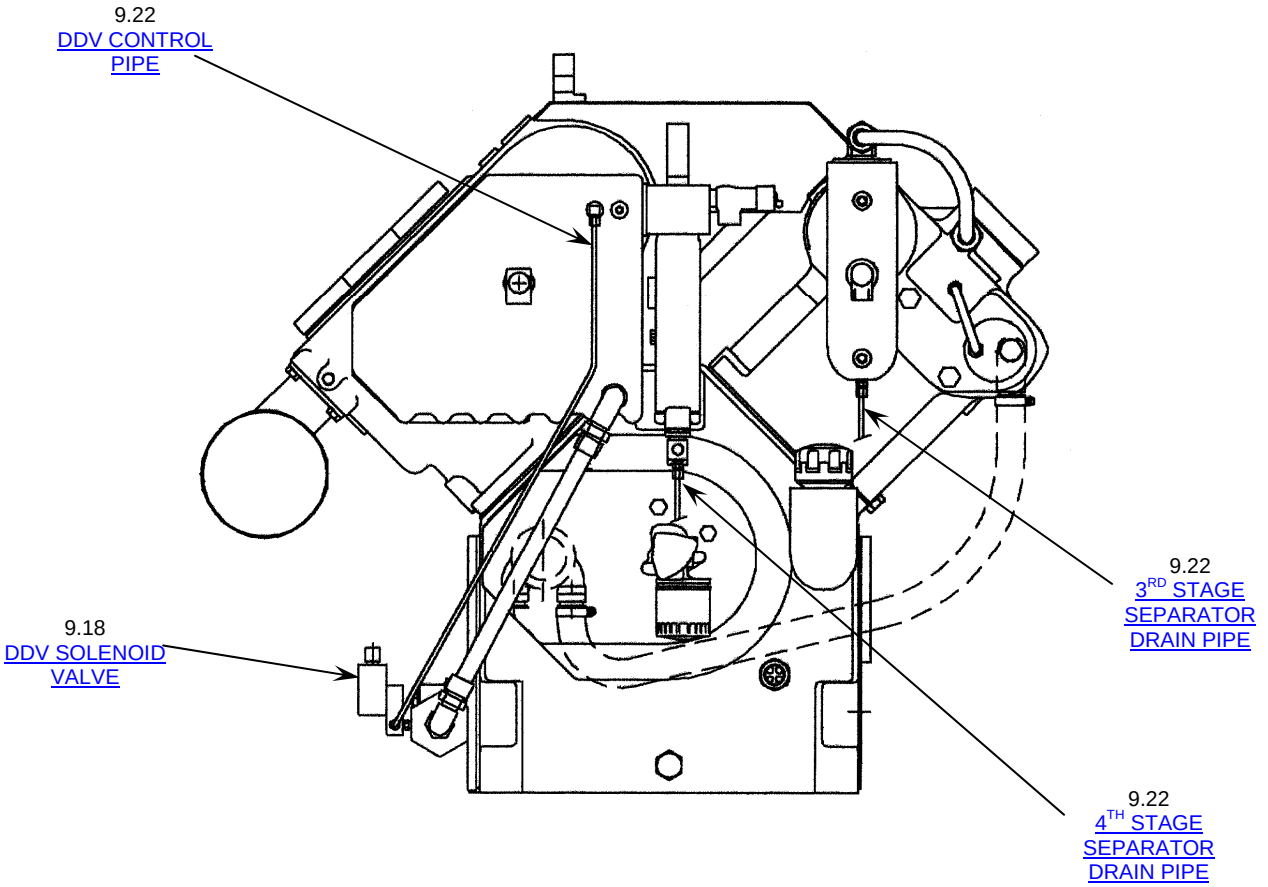
Item No.	Description.	Part Number	Number OFF.
22.1	Valve lifter - 1st stage	C200066.1	2
22.2	Valve lifter - 1st & 2nd stage valve	C84096.1	1
22.3	Valve/piston lifter	C203706	1
ex	1^{st} & 2^{nd} stage special tool assembly	C203740	1
ex	3^{rd} & 4^{th} stage special tool assembly	C203705	1
ex	Special Tool Assembly – all coolers	C203739	1

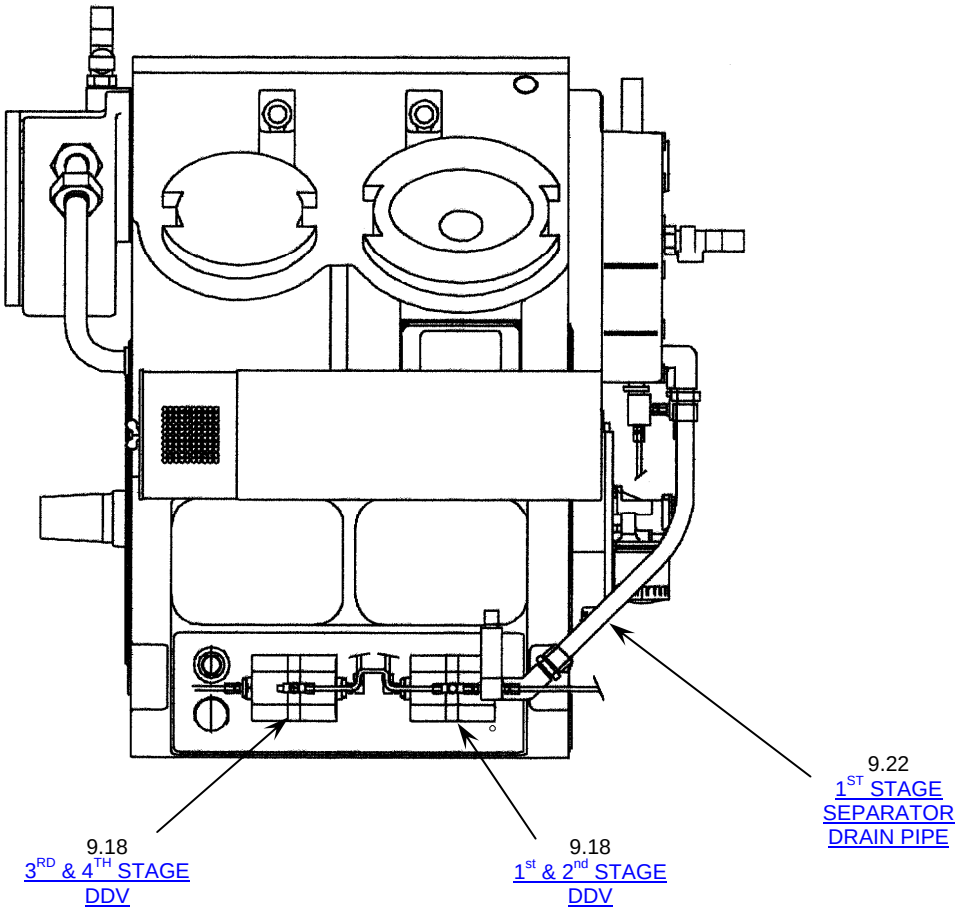
10 ILLUSTRATIONS

10.1 EXTERNAL VIEWS

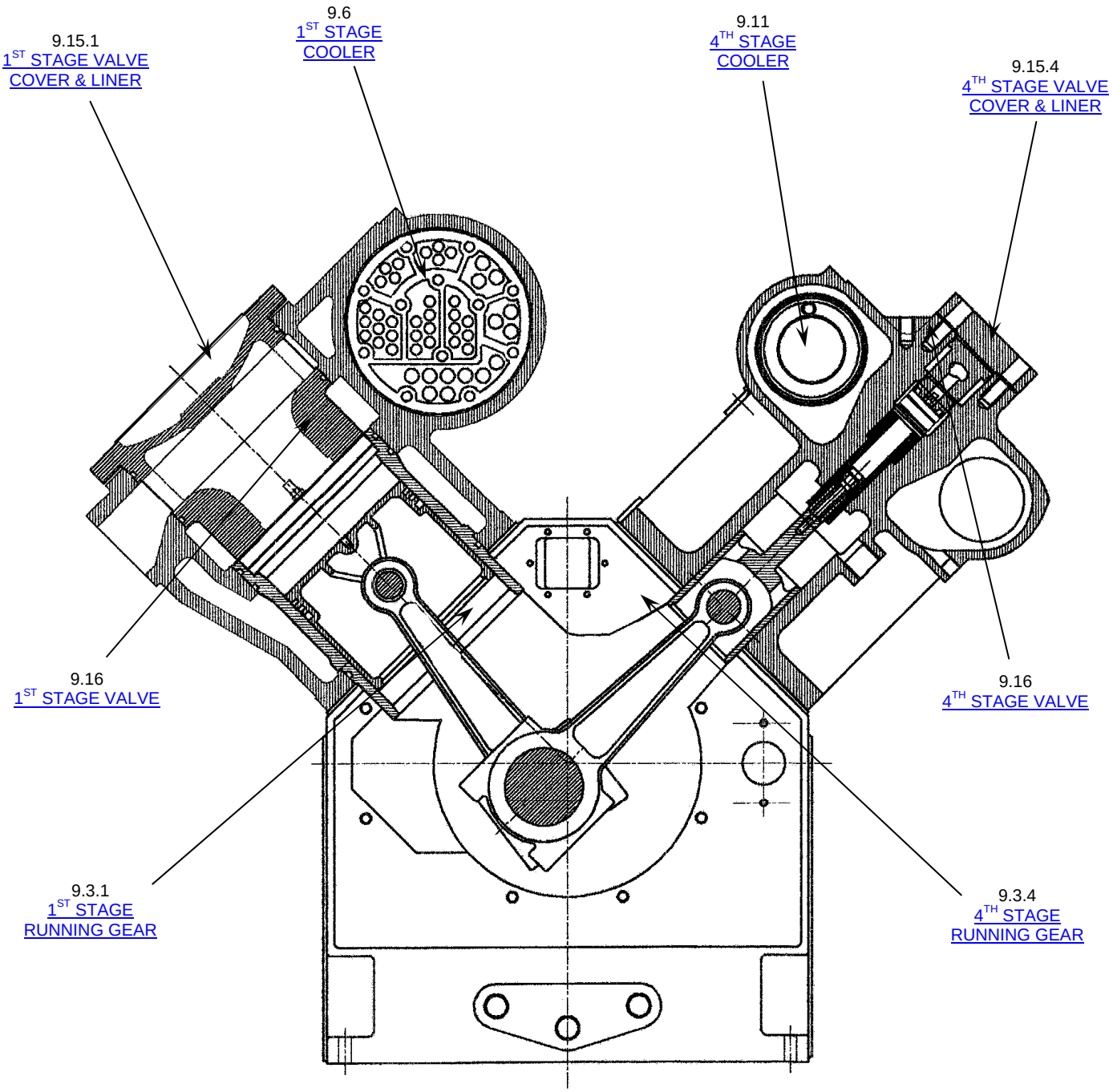



9.22
3RD STAGE
SUCTION PIPE
9.22
3RD STAGE
DELIVERY PIPE
9.22
4TH STAGE
COOLER
OUTLET PIPE
9.22
2ND STAGE
DELIVERY PIPE
9.13.2
CORROSION ROD -
OPTIONAL
9.22
4TH STAGE
SUCTION PIPE
9.22
4TH STAGE
DELIVERY PIPE

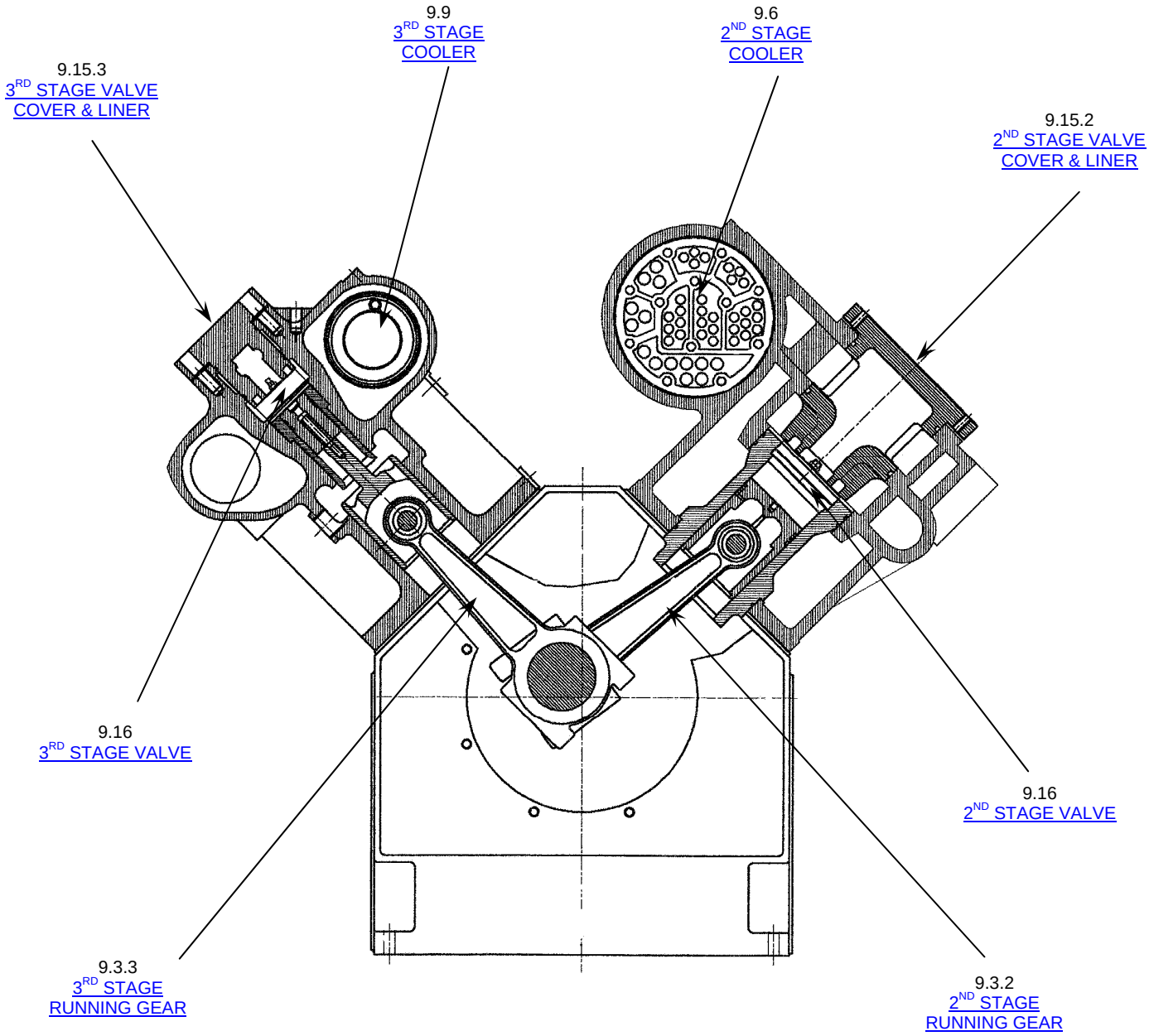

9.22
DDV CONTROL PIPE
9.22
3RD STAGE SEPARATOR DRAIN PIPE
9.18
DDV SOLENOID VALVE
9.22
4TH STAGE SEPARATOR DRAIN PIPE


9.22
1ST STAGE SEPARATOR DRAIN PIPE
9.18
3RD & 4TH STAGE DDV
9.18
1st & 2nd STAGE DDV

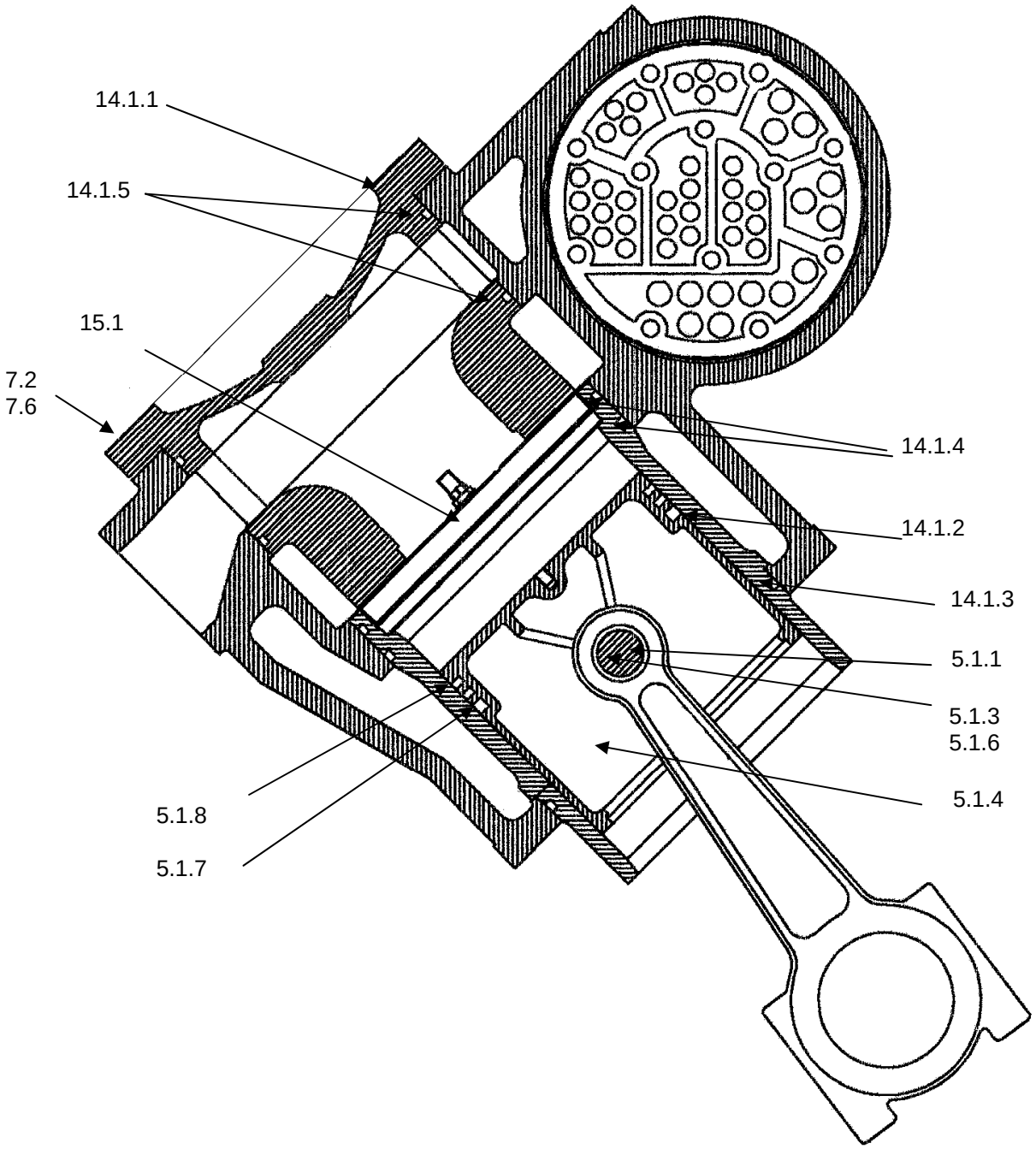
10.2 1ST & 4TH STAGE CYLINDERS



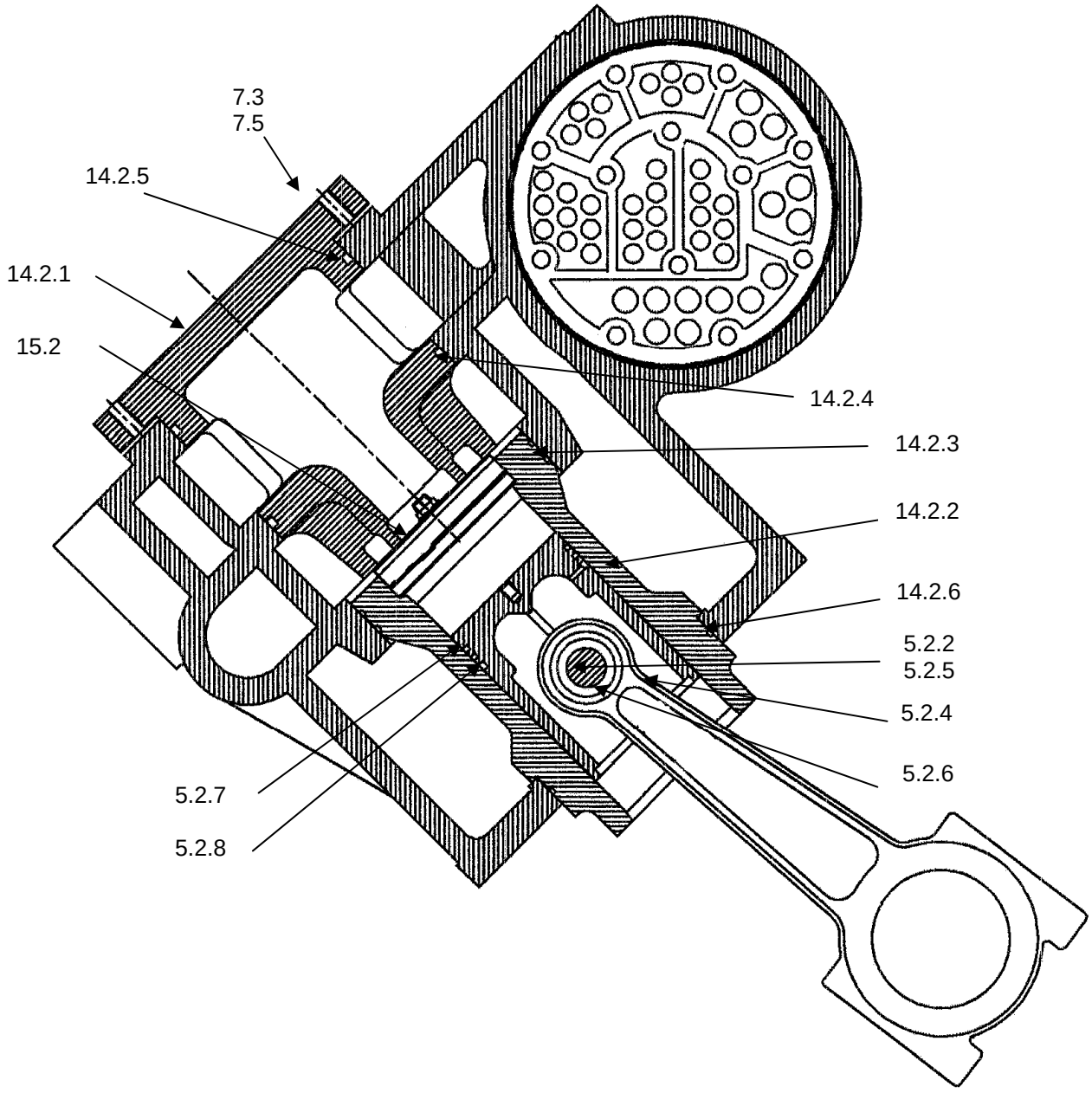
10.3 2ND & 3RD STAGE CYLINDERS



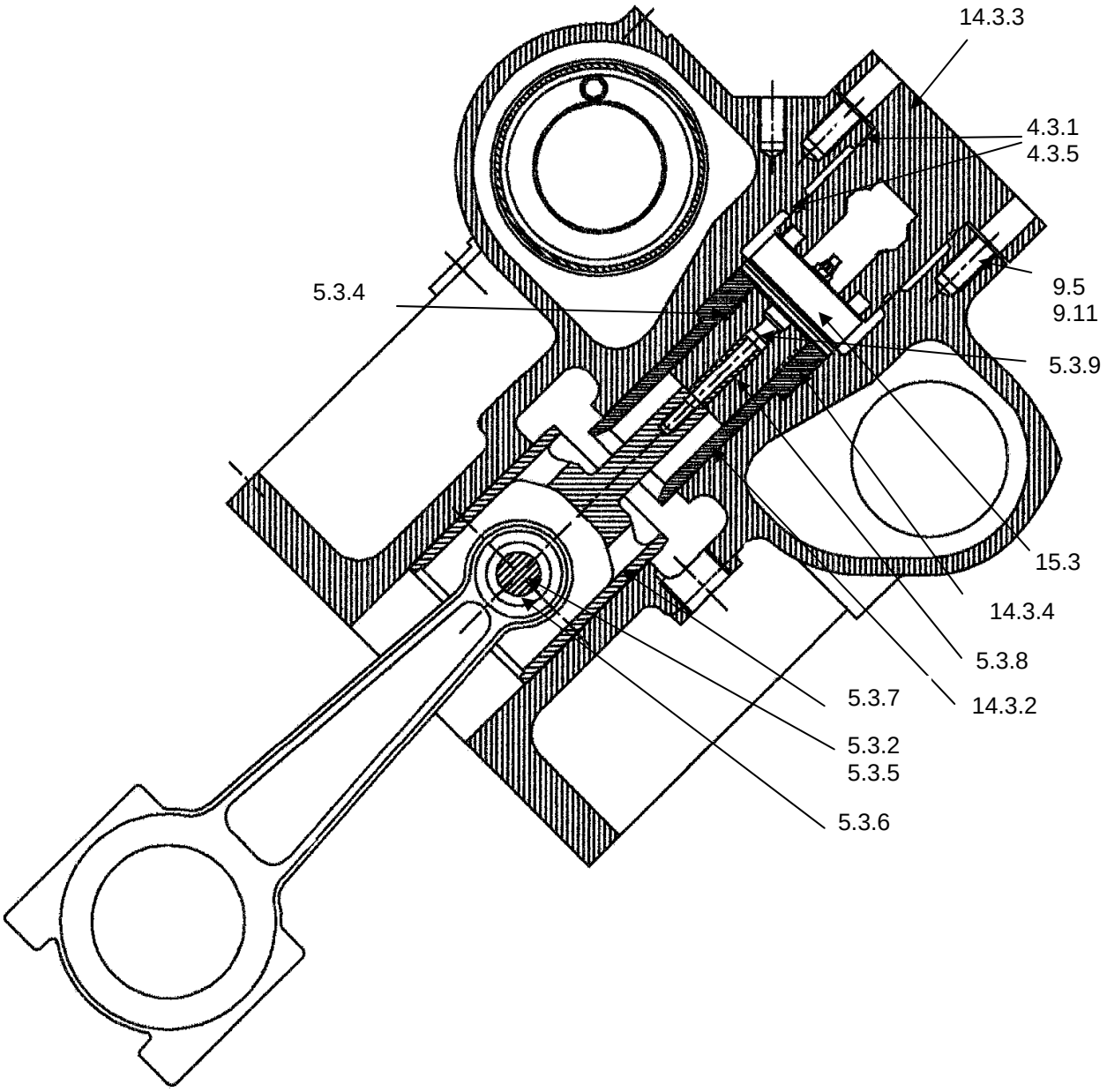
10.4 1ST STAGE CYLINDER PARTS



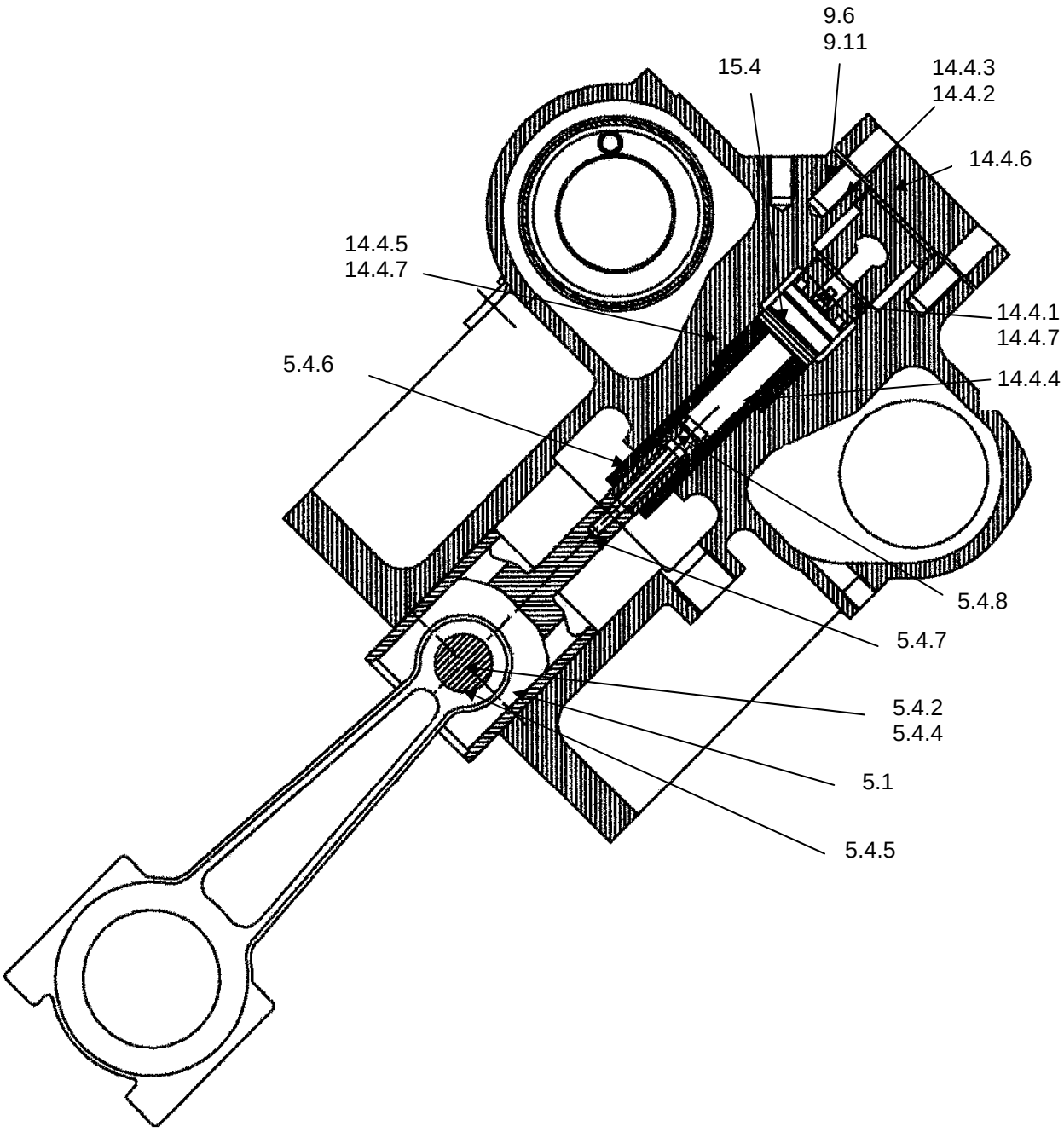
10.5 2ND STAGE CYLINDER PARTS



10.6 3RD STAGE CYLINDER PARTS

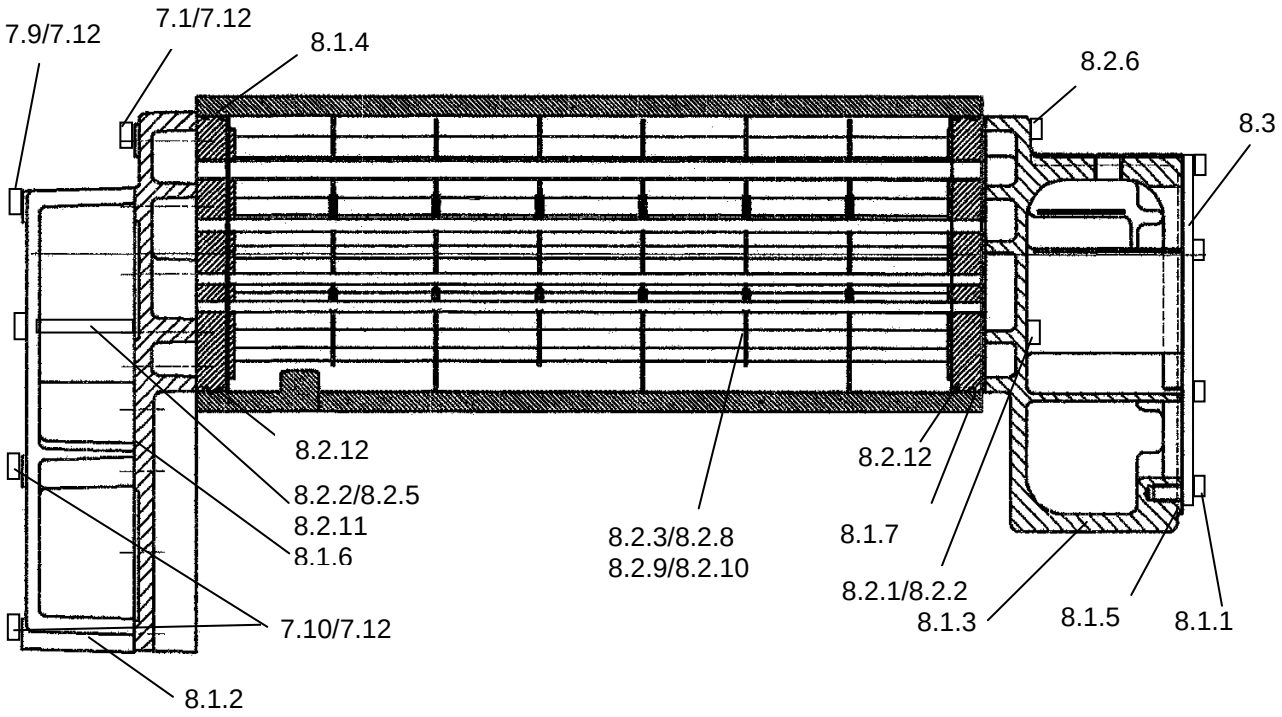


10.7 4TH STAGE CYLINDER PARTS

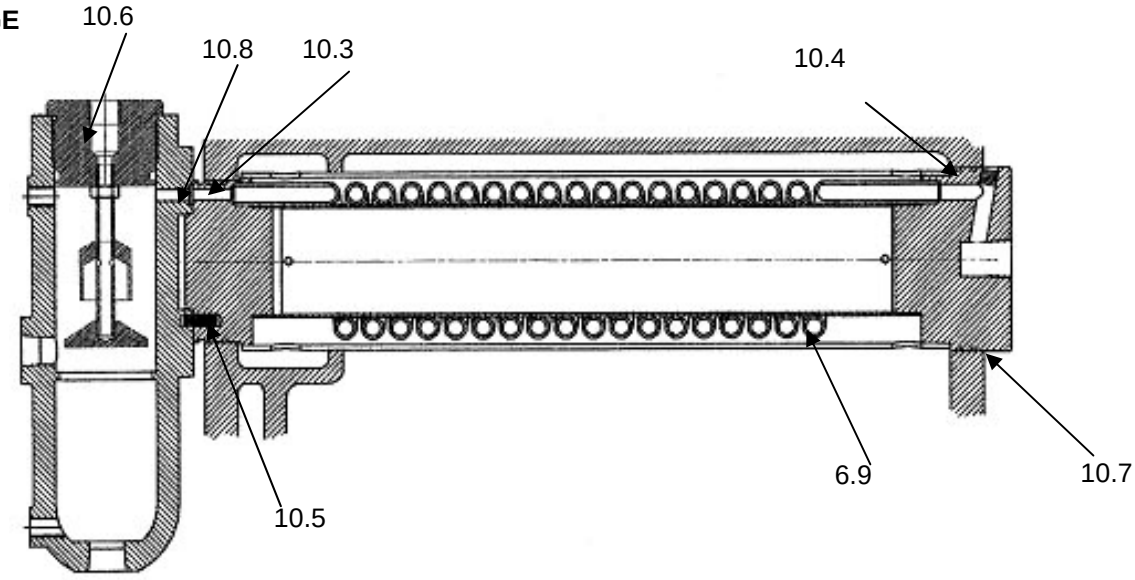


10.8 COOLER / SEPARATORS

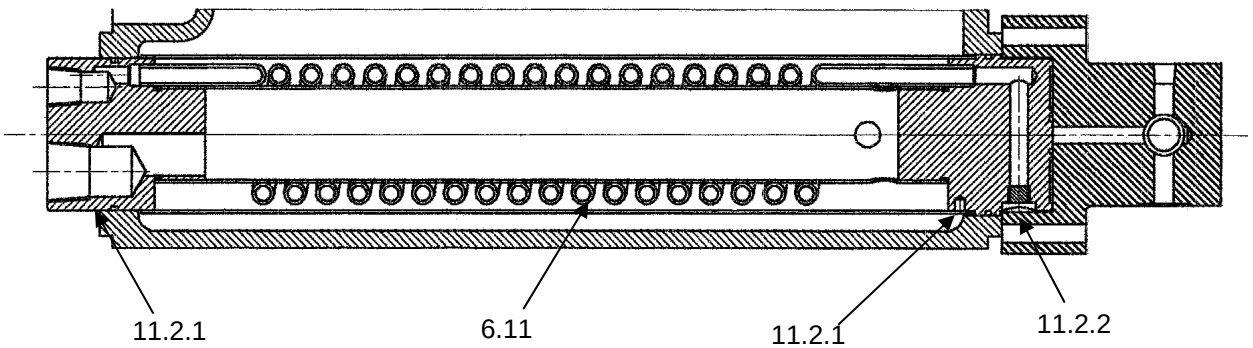
10.8.1 1ST / 2ND STAGE



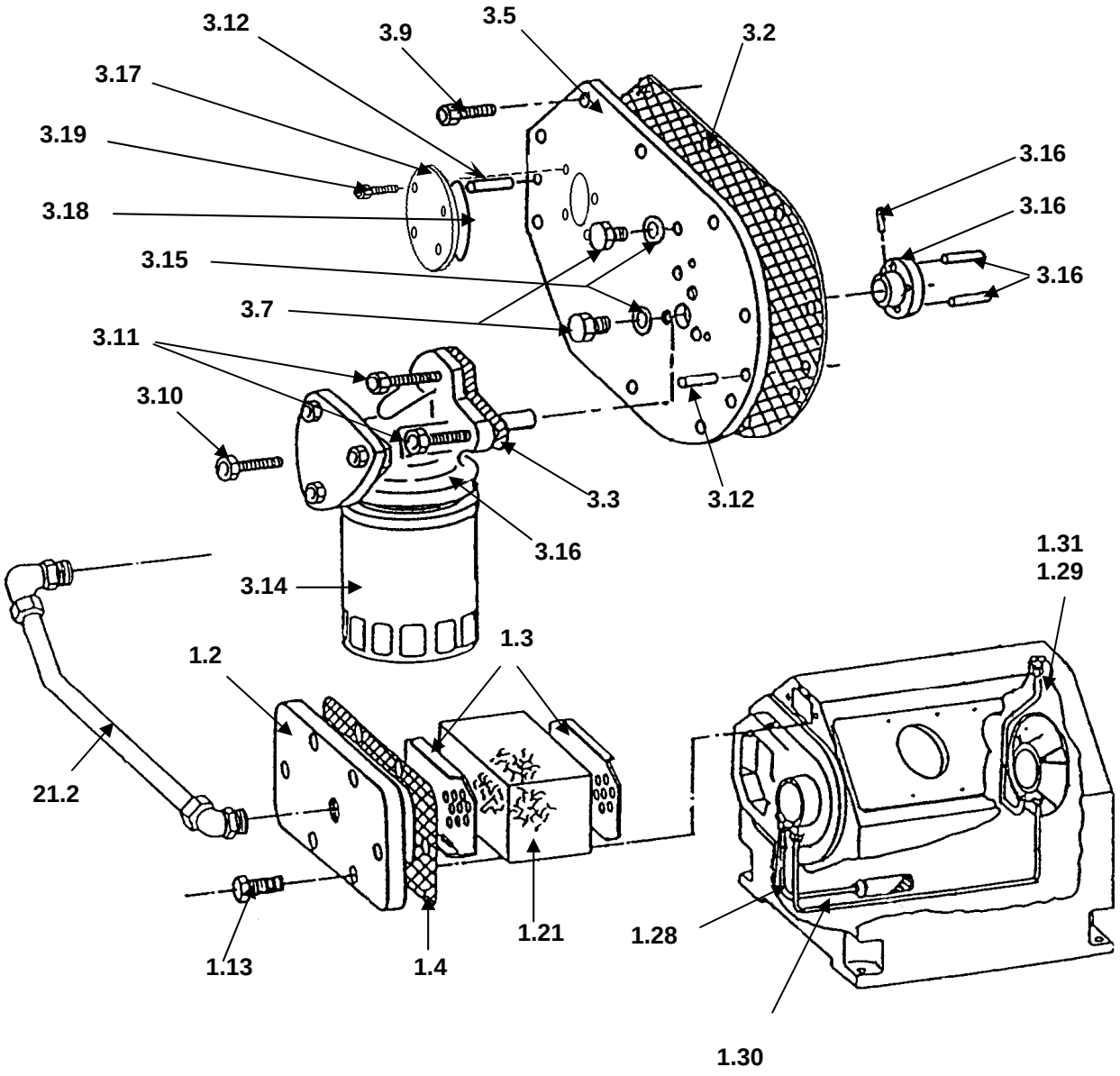
10.8.2 3RD STAGE



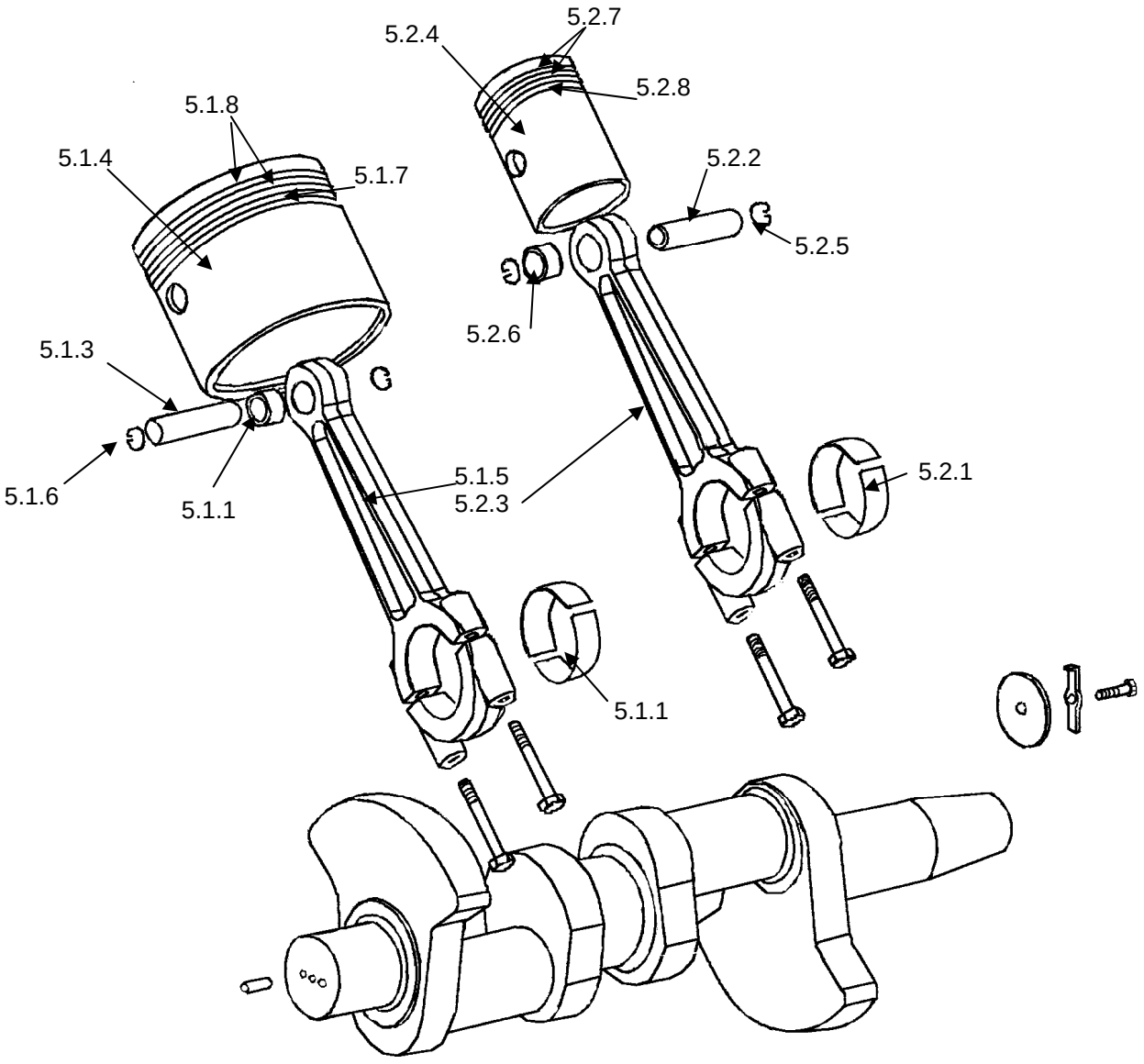
10.8.3 4TH STAGE



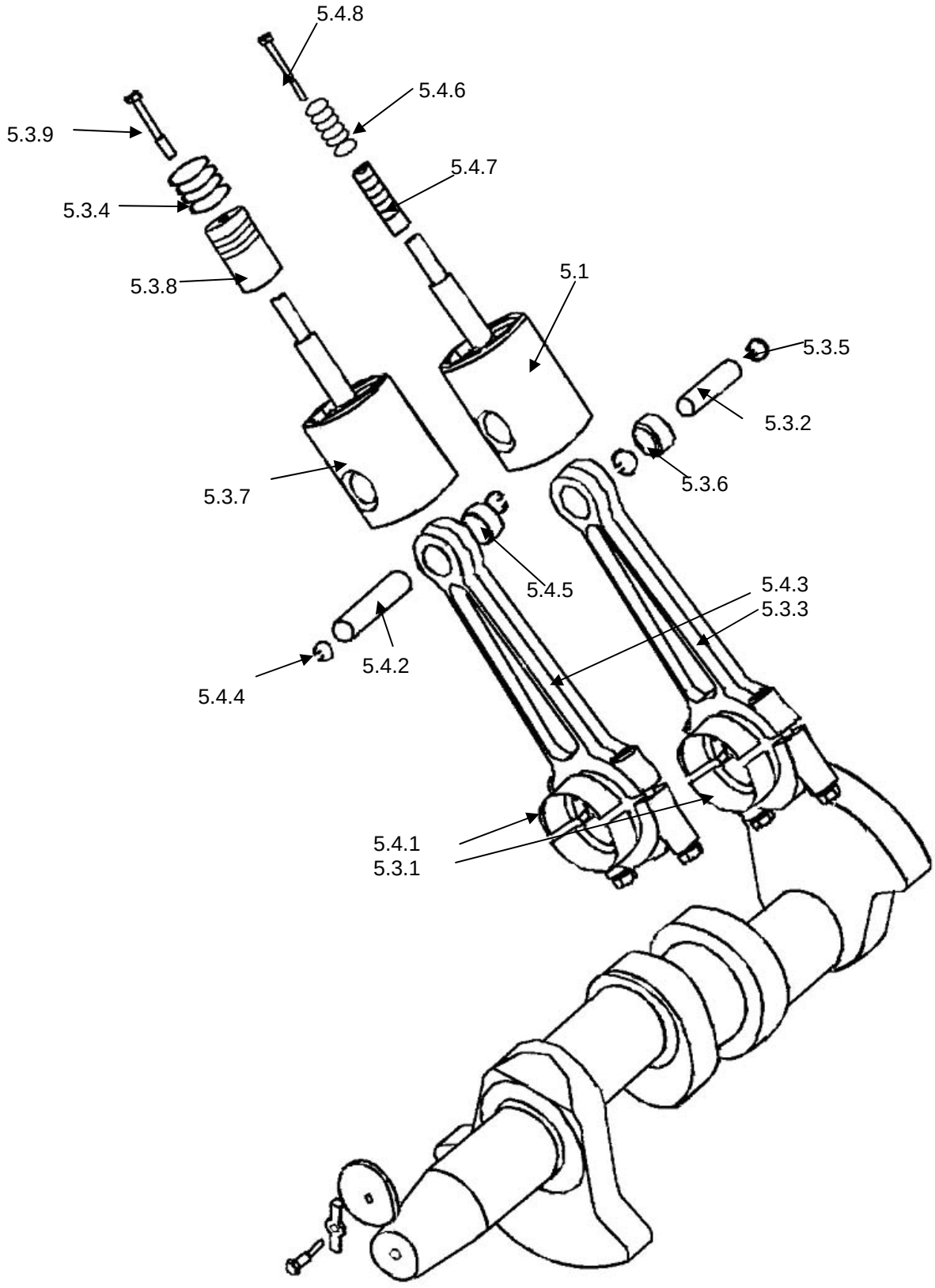
10.9 OIL PUMP DRIVE ASSEMBLY



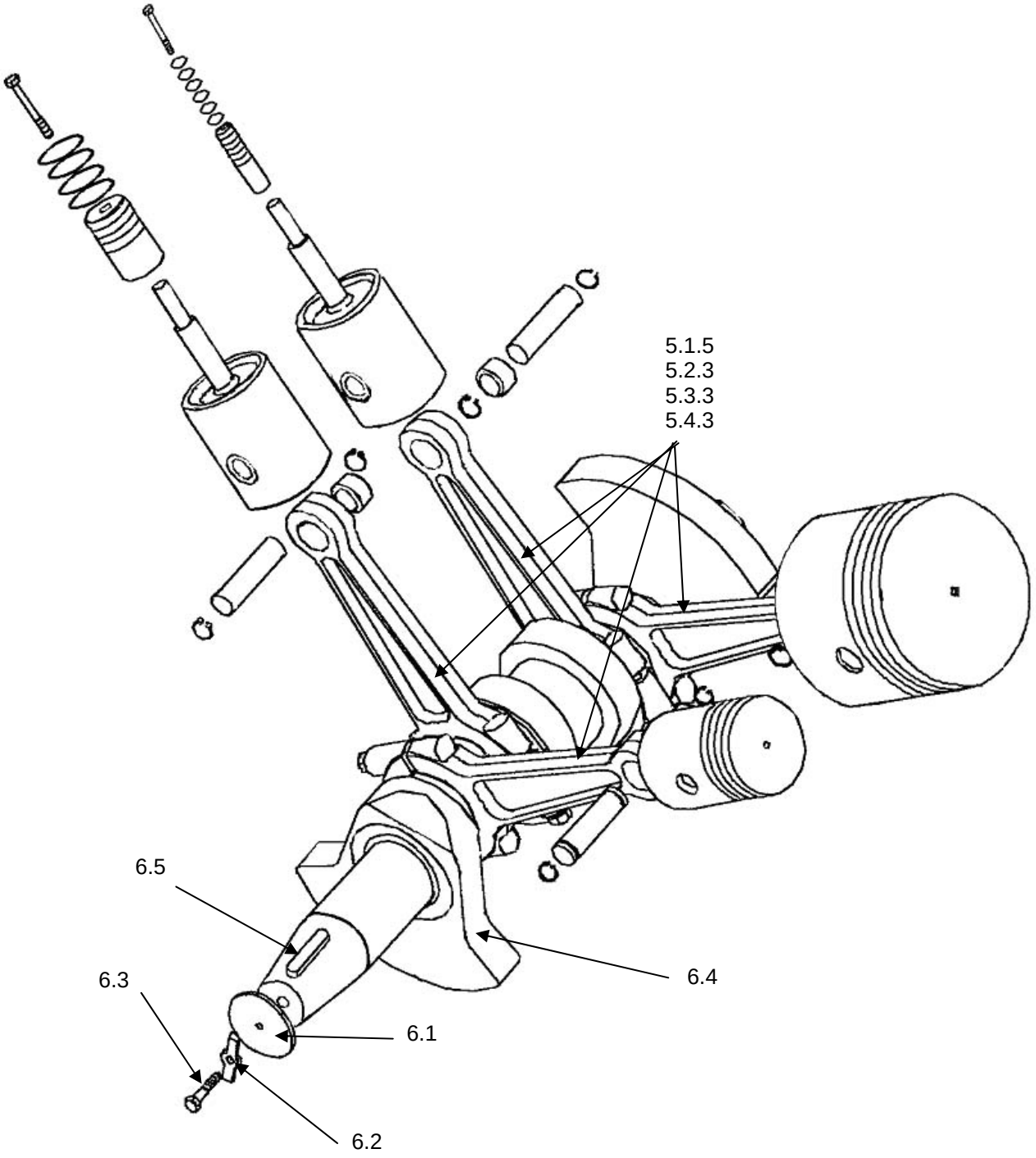
10.10 1ST & 2ND STAGE RUNNING GEAR



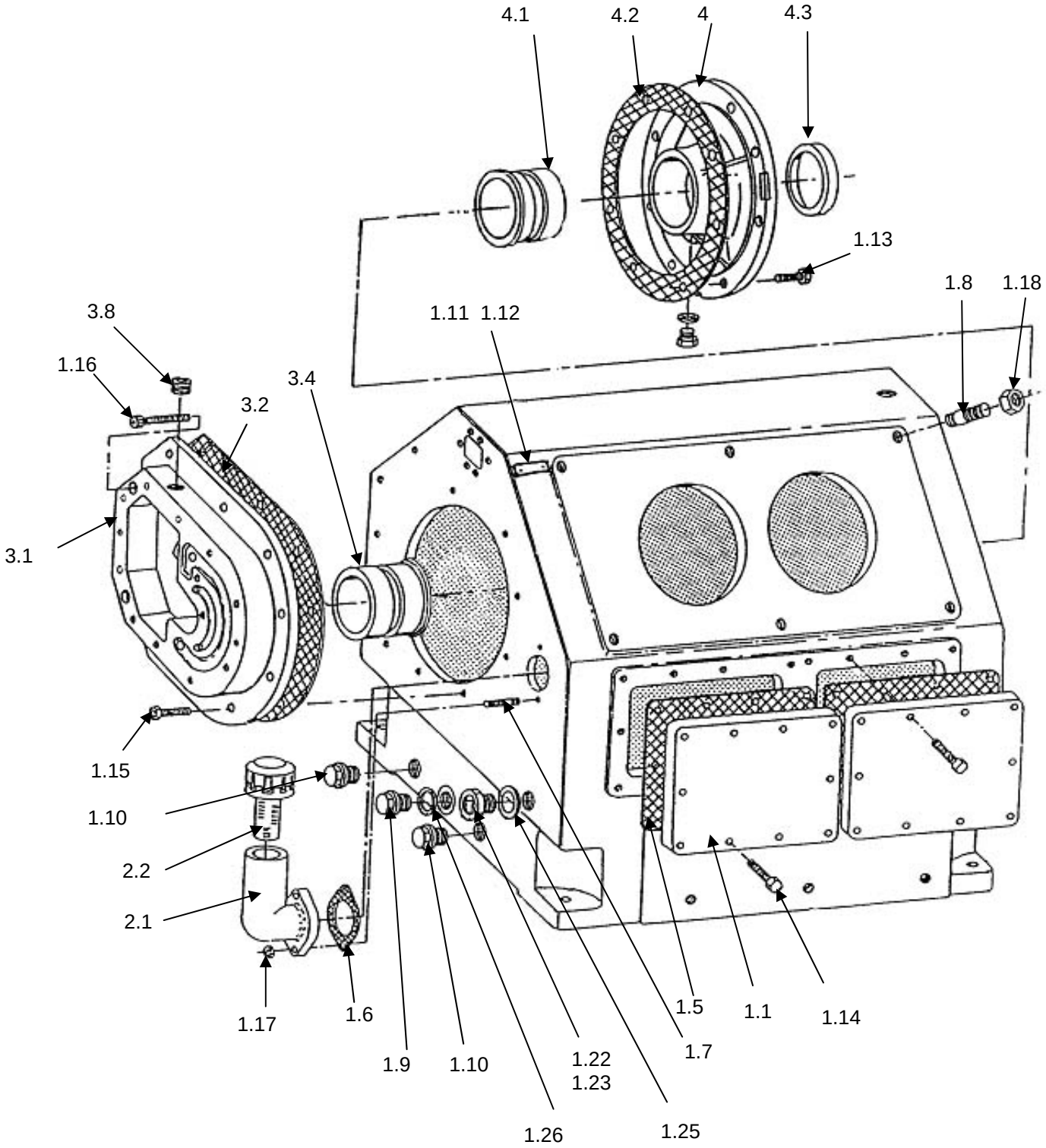
10.11 3RD & 4TH STAGE RUNNING GEAR



10.12 CRANKSHAFT ASSEMBLY

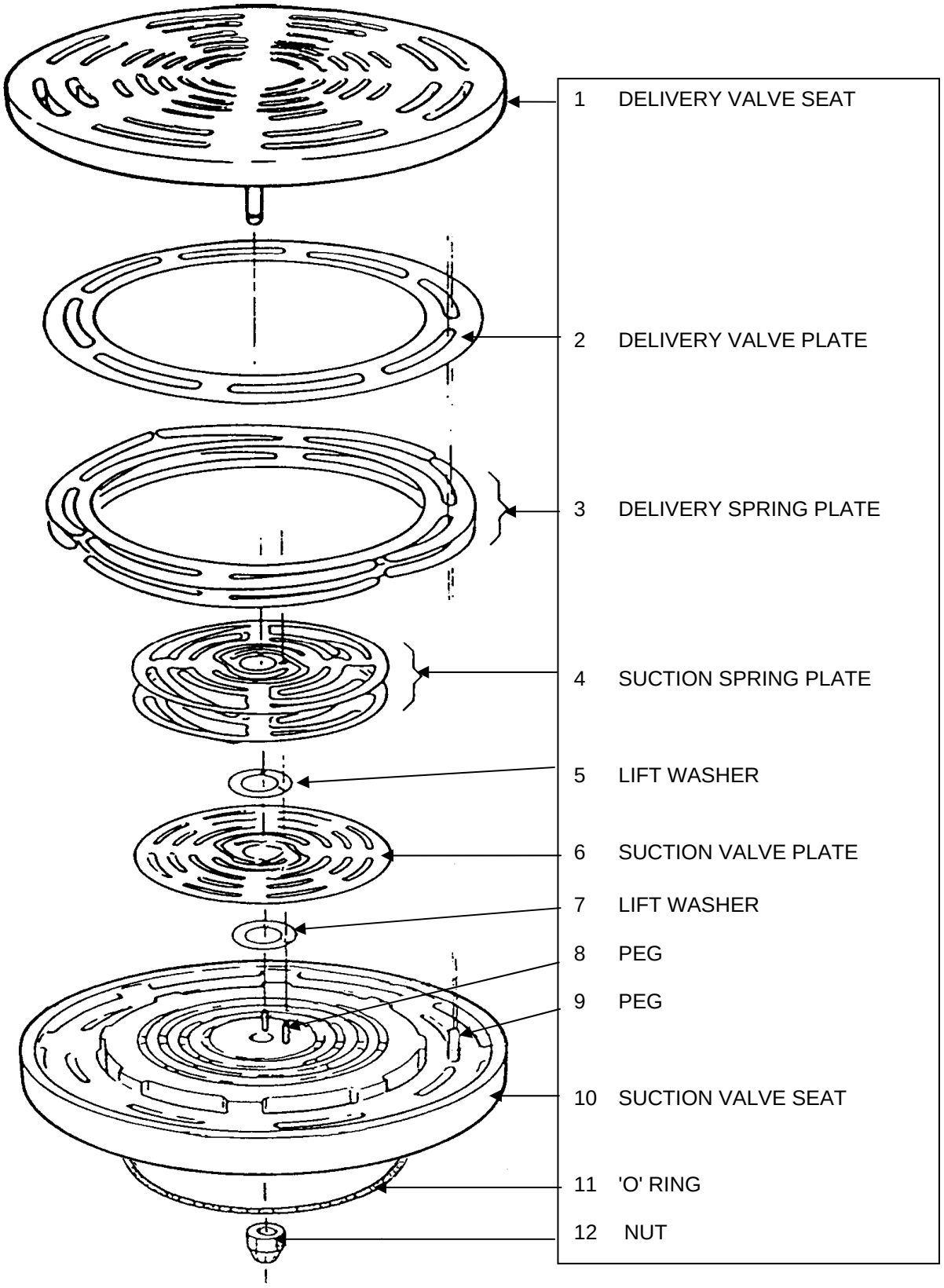


10.13 CRANKCASE



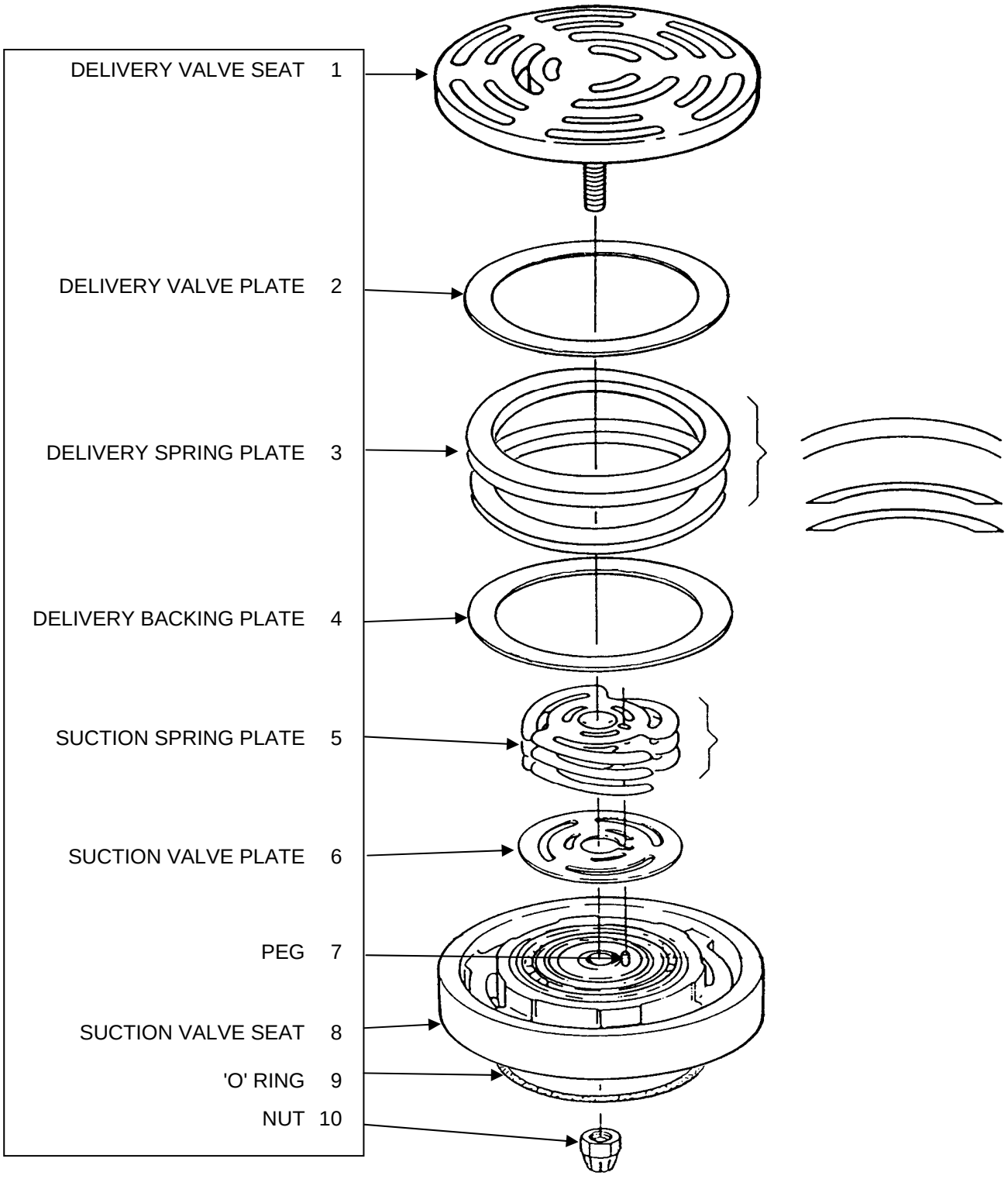
10.14 1ST STAGE VALVE

1ST STAGE VALVE



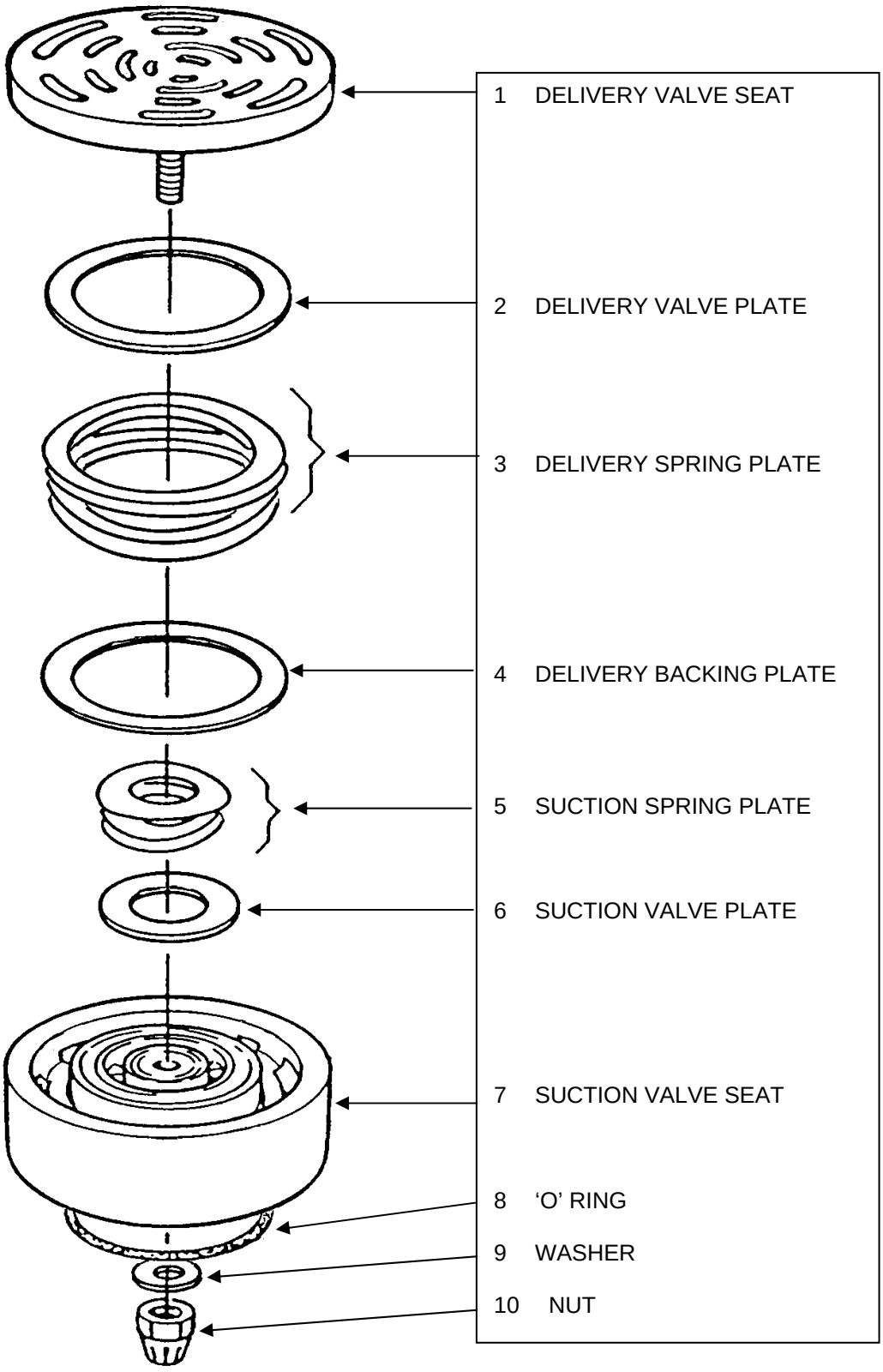
10.15 2ND STAGE VALVE

2ND STAGE VALVE



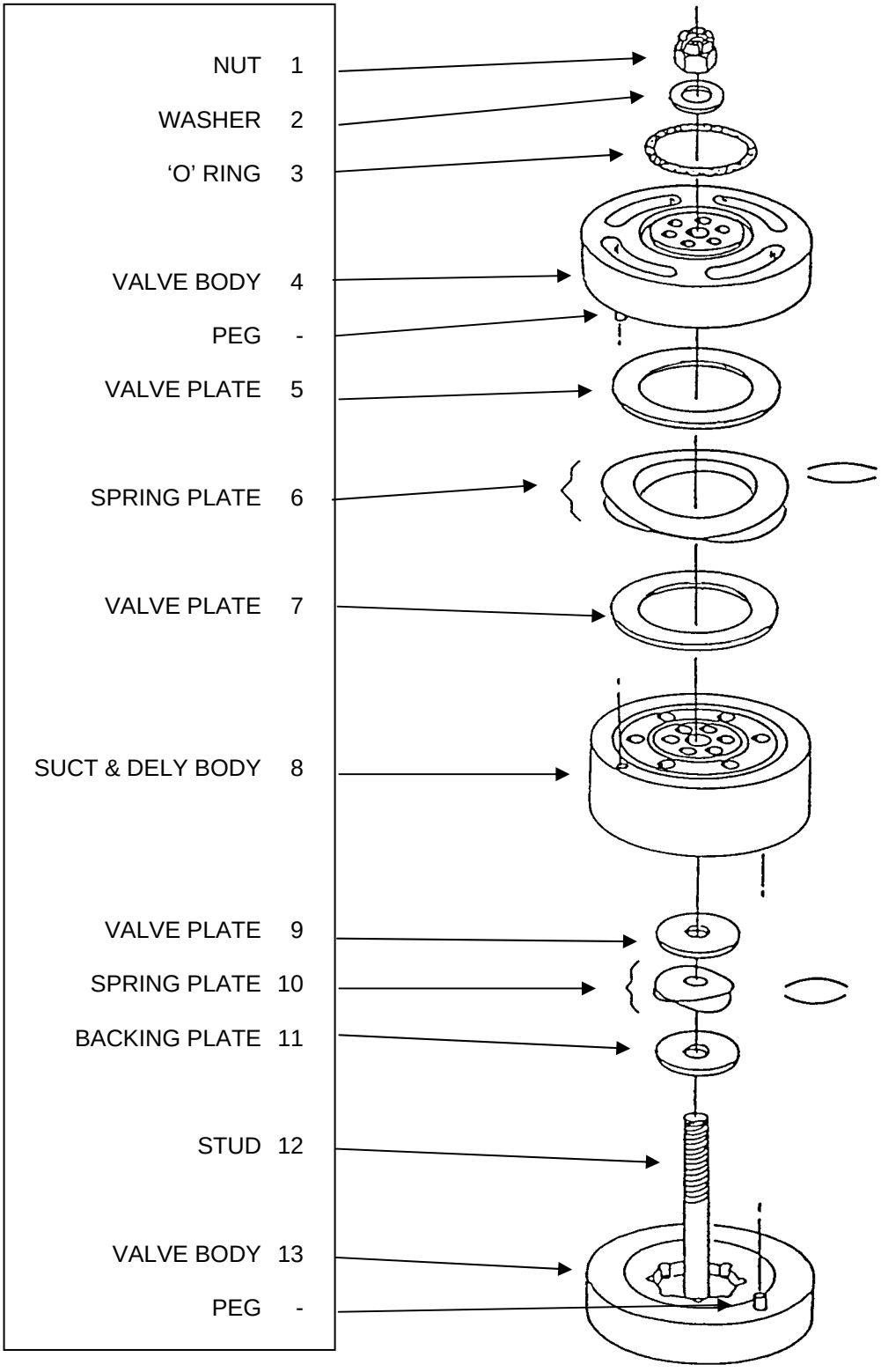
10.16 3RD STAGE VALVE

3RD STAGE VALVE

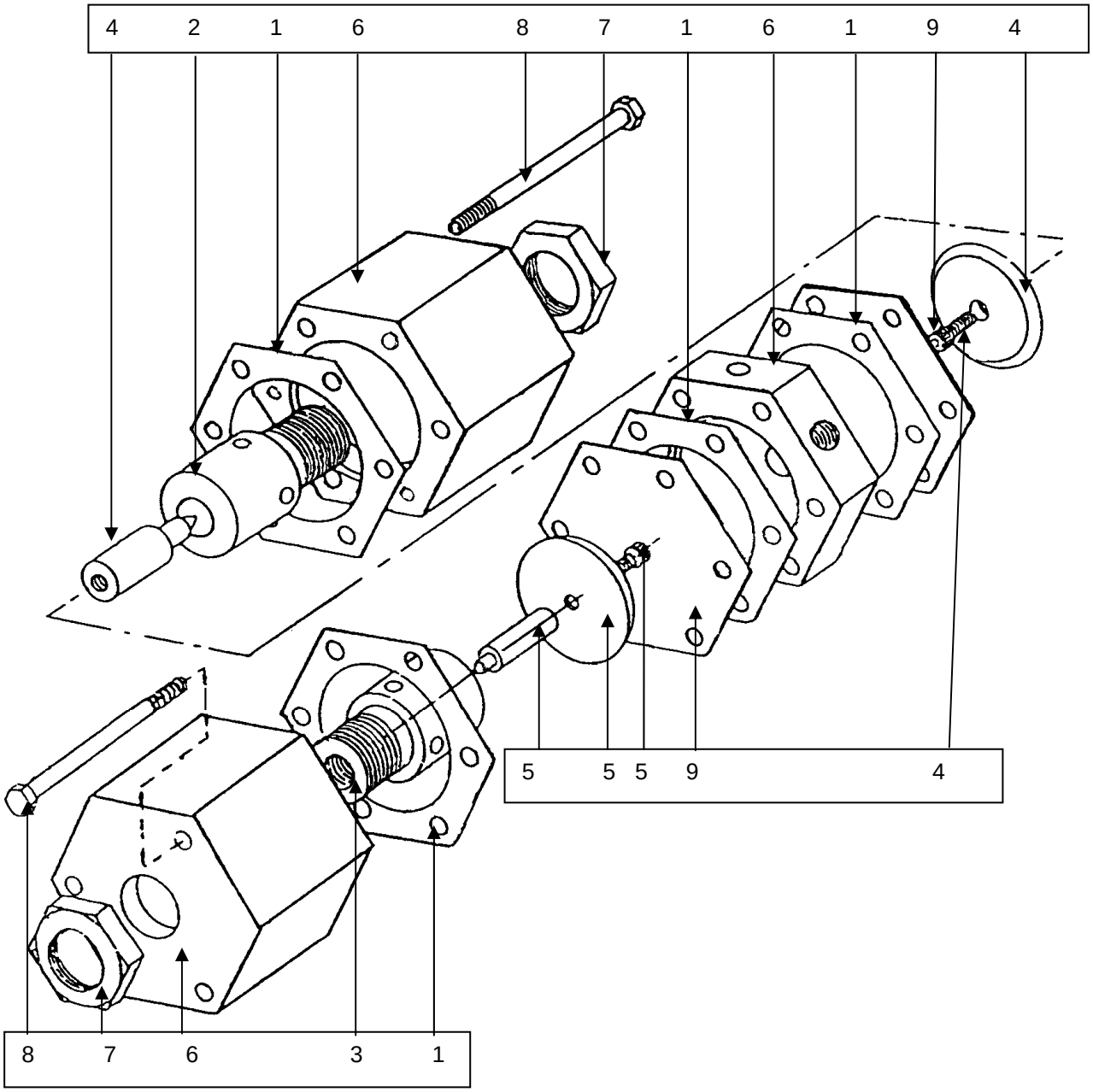


10.17 4TH STAGE VALVE

4TH STAGE VALVE

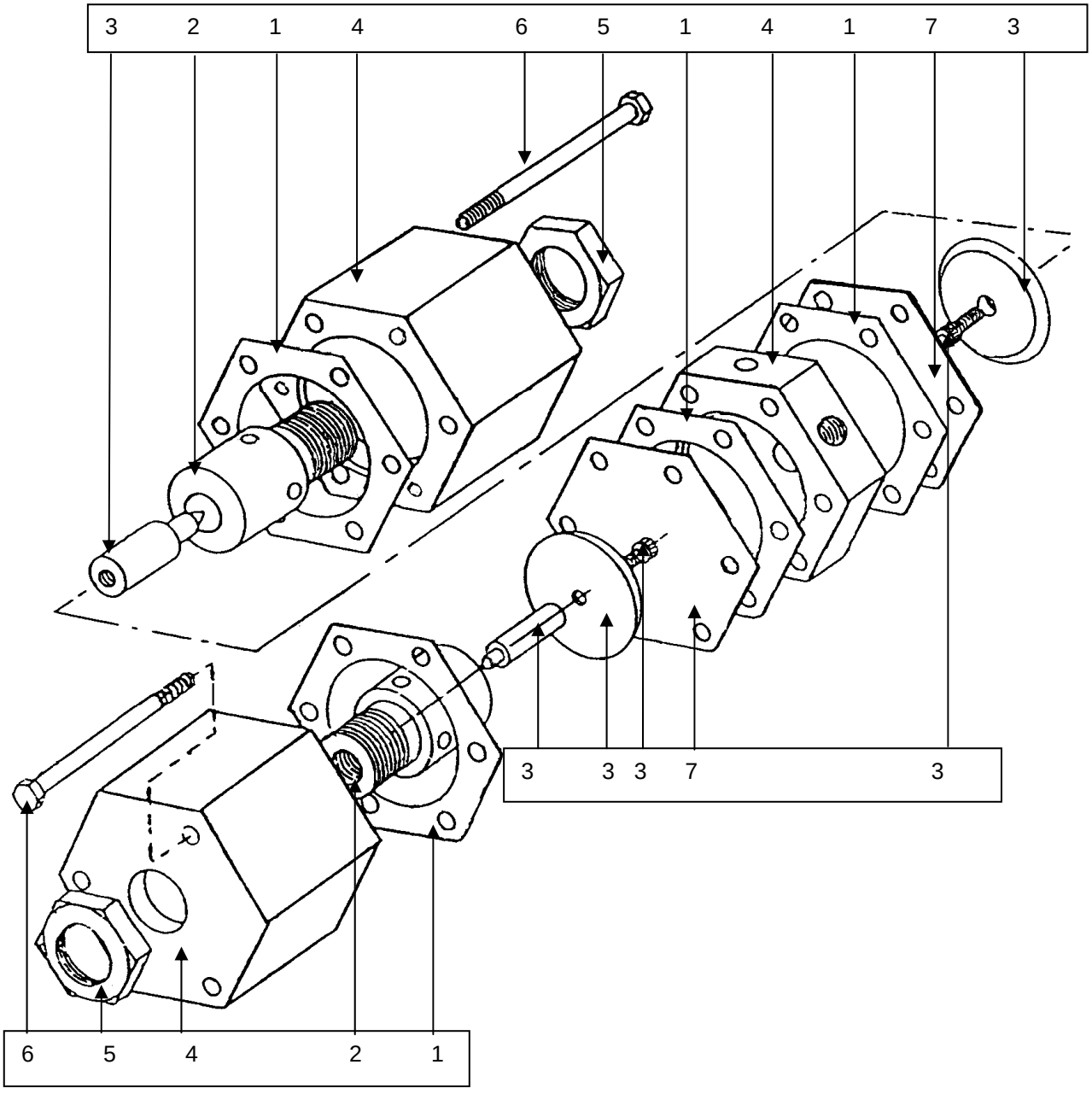


10.18 1ST & 2ND D.D.V ASSEMBLY



ITEM	DESCRIPTION	PART NO	NO OFF
1	JOINT	C200722	4
2	SEAT	C200842	1
3	SEAT	C201417	1
4	VALVE ASSY	C201980	1
5	VALVE ASSY	C201981	1
6	BODY ASSY	C203190.1	1
7	LOCKNUT	PS1290.4	2
8	BOLT M6 X 75	95006.133	6
9	DIAPHRAGM	98210.1002	2

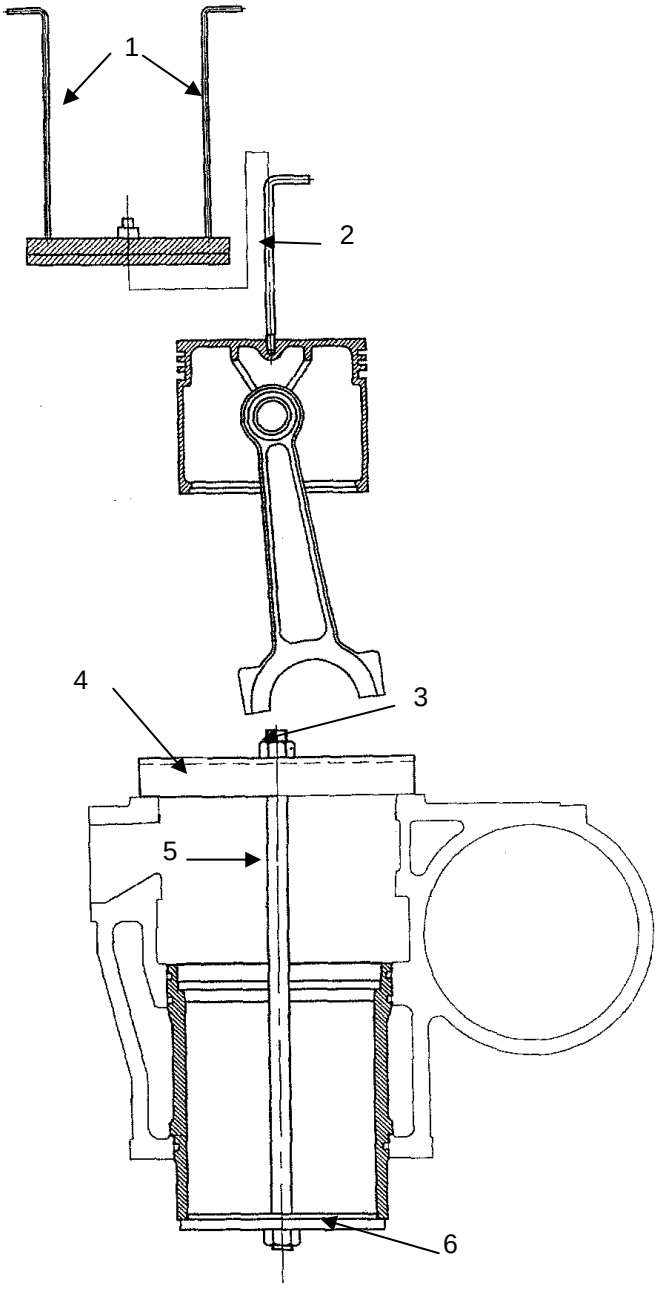
10.19 3RD & 4TH D.D.V ASSEMBLY



ITEM	DESCRIPTION	PART NO	NO OFF
1	JOINT	C200722	4
2	VALVE SEAT	C201159	1
3	VALVE ASSY	C201981	1
4	BODY ASSY	C203190.1	1
5	LOCKNUT	PS1290.4	2
6	BOLT M6 X 75	95006.133	6
7	DIAPHRAGM	98210.1002	2

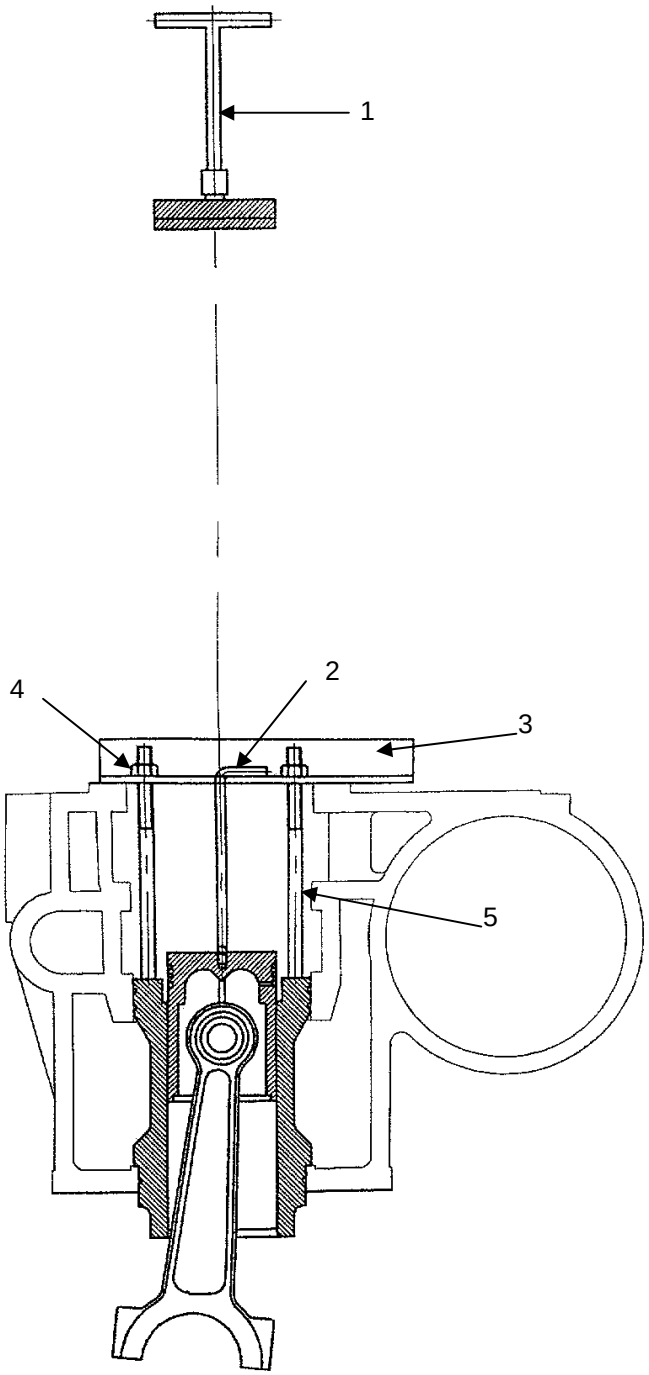
11 TOOLS

11.1 1ST STAGE RUNNING GEAR



ITEM	DESCRIPTION	PART NO	NO OFF
1	1ST STAGE VALVE LIFTER	C200066.1	2
2	PISTON LIFTING TOOL	C200223	1
3	M20 NUTS	95111.11	2
4	BAR	C203716	1
5	STUD	C203717	1
6	PLATE	C203718	1

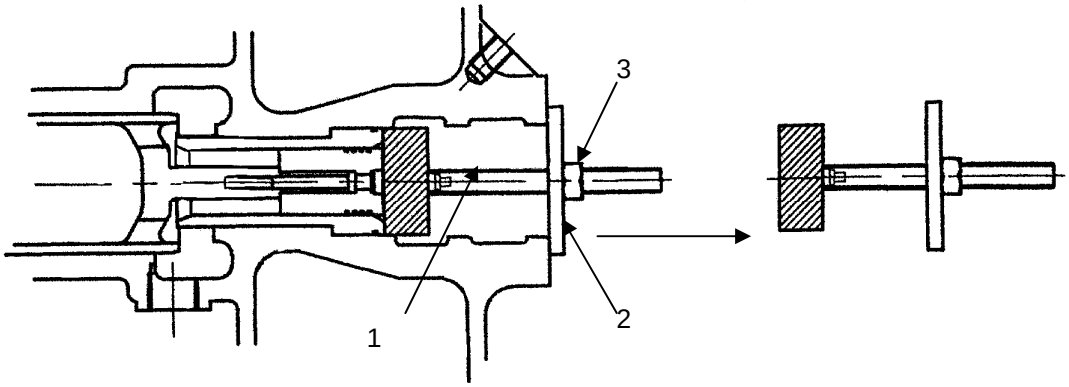
11.2 2ND STAGE RUNNING GEAR



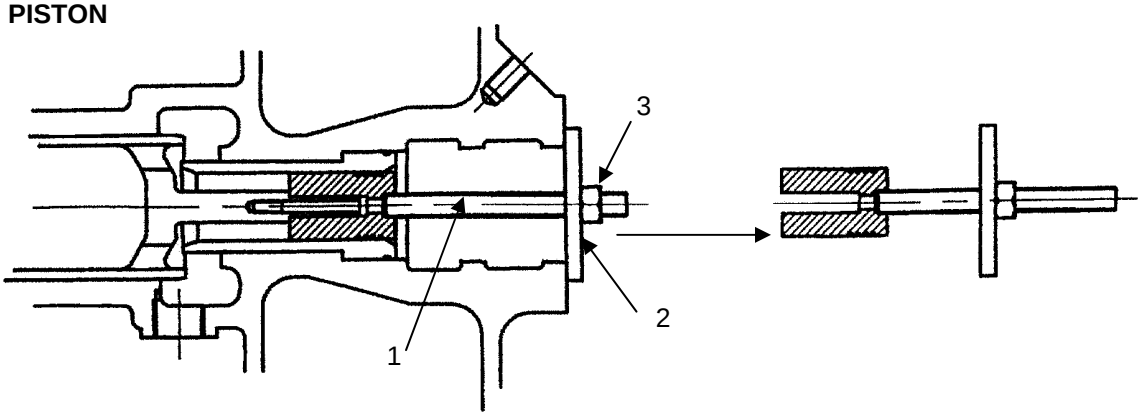
ITEM	DESCRIPTION	PART NO	NO OFF
1	2ND STAGE VALVE LIFTER	C84096.1	1
2	PISTON LIFTER	C200223	1
3	BAR	C203716	1
4	M12 NUTS	95111.7	2
5	STUDS	C200421	2

11.3 3RD & 4TH STAGE RUNNING GEAR

11.3.1 VALVE

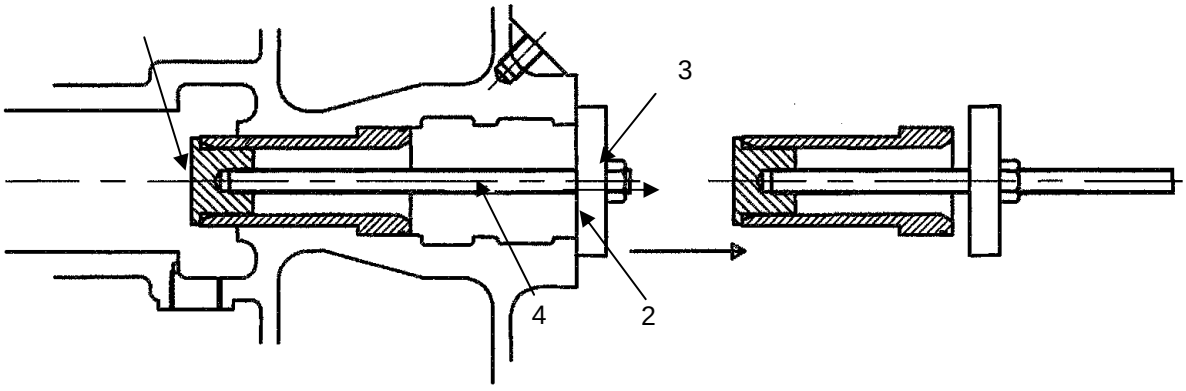


11.3.2 PISTON



11.3.3 LINER

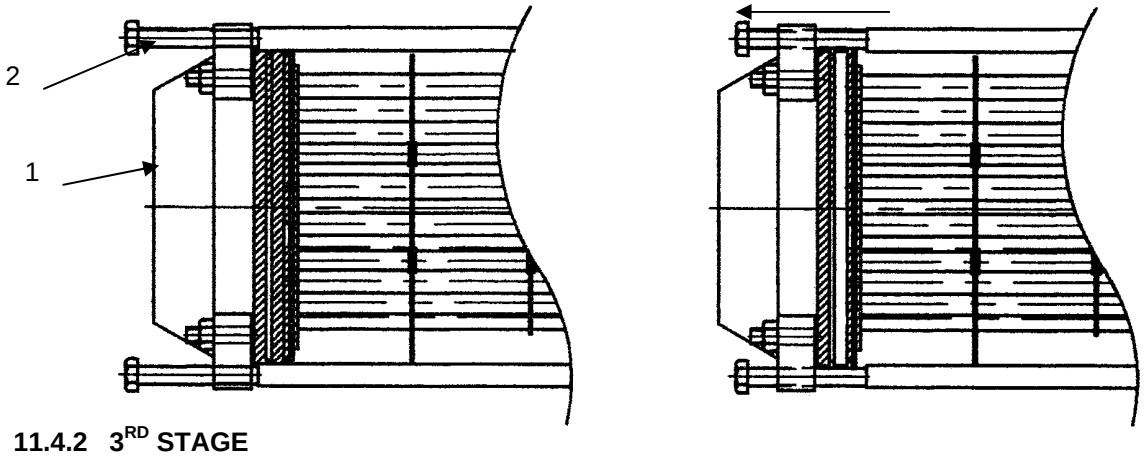
5. 3RD STAGE
6. 4TH STAGE



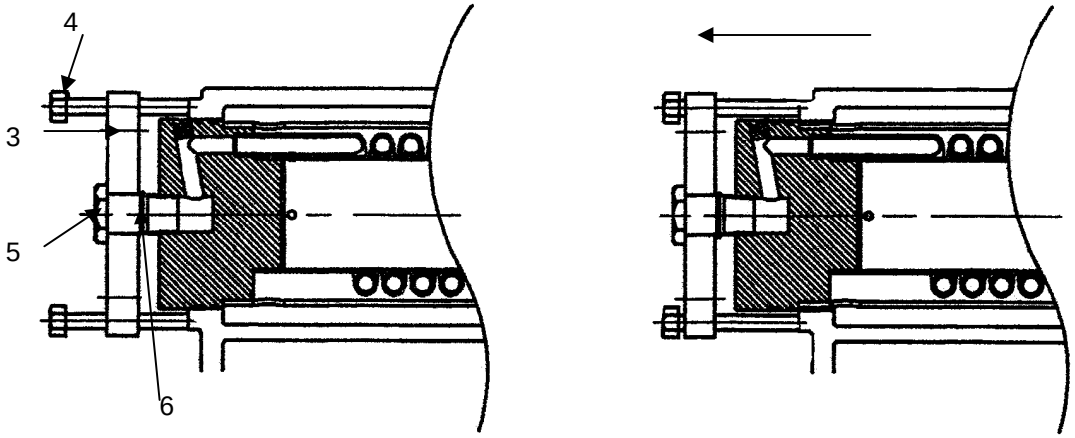
ITEM	DESCRIPTION	PART NO	NO OFF
1	VALVE / PISTON LIFTER	C203706	1
2	PLATE	C203704	1
3	M16 NUT	95111.9	1
4	WITHDRAWING SCREW	C203738	2
5	GUIDE BLOCK – 3RD STAGE	C203736	1
6	GUIDE BLOCK – 4TH STAGE	C203737	1

11.4 COOLERS

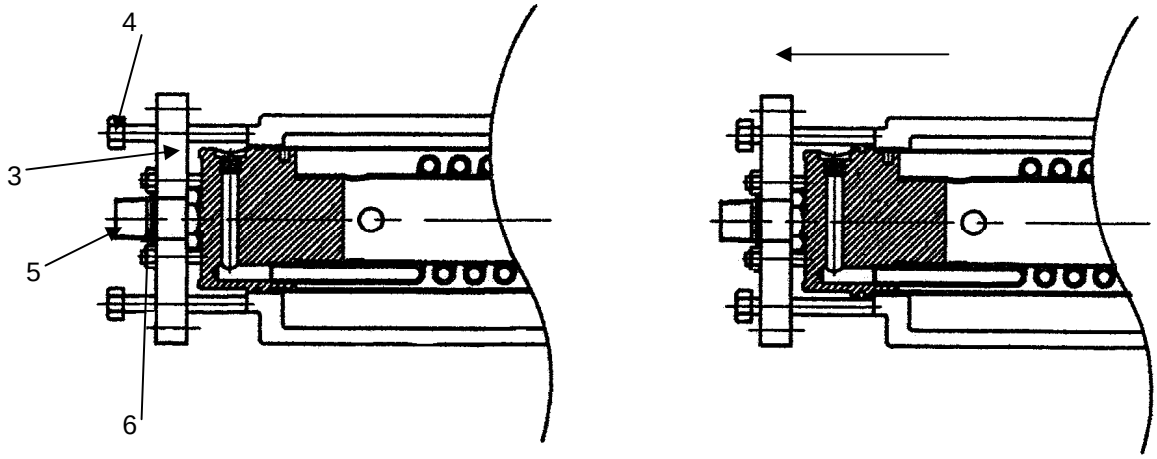
11.4.1 1ST & 2ND STAGE



11.4.2 3RD STAGE



11.4.3 4TH STAGE



ITEM	DESCRIPTION	PART NO	NO OFF
1	WITHDRAWING PLATE	C203733	1
2	SCREW M12 X 80	95000.324	2
3	WITHDRAWING PLATE	C203734	1
4	SCREW M10 X 80	95000.294	2
5	ADAPTOR	C203735	1
6	CIRCLIP	95650.1026	1

12 SERVICE PLAN

Service Plan - 5437AIR

		Service Kit Number												
		HSK1201	HSK1228	HSK1236	HSK1244	HSK1252	HSK1244	HSK1236	HSK1228	HSK1260	HSK1279			
		12 Months From Installation/Last Service Or												
Run Hours	Commission	100	1500	3000		4500	6000		7500	9000				
		9100	10500		12000	13500		15000	16500		18000	Task	Preparatory Task	Task Description	Parts Provided	Qty
		X	X	X	X	X	X	X	X	X				Replace inlet filter	Filter element	1
		X		X	X		X	X		X	X	1	+4	Clean sump		
		X	X	X	X	X	X	X	X	X	X	2		Inspect/replace Belt Tension or Drive coupling		
										X	X	3		Inspect/replace corrosion rods	Corrosion rods kit	1
	X	X		X	X		X	X		X	X	4		Remove crankcase doors	Door joints	4
	X									X	X	5	+7+*4*	Replace oil	CompAir Mineral lubricant 20 Litres	3
		X		X	X		X	X				6	+7+4	Replace oil	Reavellite S lubricant 20 Litres	2
															Reavellite S lubricant 5 Litres	1
		X	X	X	X	X	X	X	X	X	X	7		Replace Oil filter	Oil filter	1
			X	X	X	X	X	X	X			8		Replace water pump impellor(ONLY)	Impellor kit	1
		X	X	X	X	X	X	X	X	X	X	9		Remove 4th stage valve cover	Cover O ring	1
															Cover O ring	1
															Back up ring	1
															Back up ring	1
			X			X			X			10	+9	Service 4th stage valve	Valve kit	1
				X	X		X	X		X	X	11	+9	Replace 4th stage valve	Valve assy	1
				X				X		X				Inspect 4th stage liner @ 3000, 9000 & 15000 Hrs		
					X		X				X	12	+9+4	Replace 4th stage liner @ 6000, 12000 & 18000 Hrs	Liner assy	1
				X	X		X	X		X	X	13	+9	Replace 4th stage piston/ring assy	Piston assy	1
										X	X	14	+9+4	Replace 4th stage X-head / small end	Bearing S/E	1
															gudgeon pin	1
															Circlips	2

Service Plan - 5437AIR

		Service Kit Number													
		HSK1201	HSK1228	HSK1236	HSK1244	HSK1252	HSK1244	HSK1236	HSK1228	HSK1260	HSK1279				
		12 Months From Installation/Last Service Or													
Run Hours	Commission	100	1500	3000		4500	6000		7500	9000					
		9100	10500		12000	13500		15000	16500		18000	Task	Preparatory Task	Task Description	Parts Provided	Qty
										X	X	15	+9	Inspect/replace 4th big end bearings	Bearing Shells Pair	1
															Big end bolts	2
			X	X	X	X	X	X	X	X	X	*16*		*Remove 3rd stage valve cover*	*Cover O ring*	*2*
															Cover O ring	*2*
			X	X	X		X	X	X			17	+16	*Inspect & Clean 3rd stage valve*	O ring- valve to valve cover	1
						X						19	+16	Service 3rd stage valve	Valve kit	1
										X	X	20	+16	Replace 3rd stage valve	Valve assy	1
						X				X	X	21	+16+4	Replace 3rd stage piston assy	Piston assy	1
						X				X	X	22	+16+4	Replace 3rd stage liner	Liner asy	1
			X	X	X		X	X	X					*Inspect 3rd stage liner*		
										X	X	23	+16+4	Replace 3rd stage X head / small end	Bearing S/E	1
															Gudgeon pins	1
															Circlips	2
										X	X	24	+4	Inspect/replace 3rd big end bearings	Bearing Shells Pair	1
															Big end bolts	2
						X				X	X	25		*Remove 2nd stage valve cover*	*Cover O ring*	*1*
															Cover O ring	*1*
						X						26	+25	Service 2nd stage valve	Valve kit	1
										X	X	27	+25	Replace 2nd stage valve	Valve assy	1
										X	X			*Inspect 2nd stage piston*		
										X	X	28	+29+25 +4	Replace 2nd stage piston rings	Piston ring kit	1
										X	X			*Inspect 2nd stage liner*		
										X	X	29		*Remove 2nd stage liner*	O ring	2
															O ring	1
										X	X	30		Deglaze 2nd stage liner		

Service Plan - 5437AIR

Run Hours	Commission	100	1500	3000		4500	6000		7500	9000					
		9100	10500		12000	13500		15000	16500		18000	Task	Preparatory Task	Task Description	Parts Provided	Qty
										X	X	31	+30+25 +4	Replace 2nd stage small end	Bearing S/E	1
															Gudgeon pins	1
															Circlips	2
										X	X	32	+4	Inspect/replace 2nd big end bearings	Bearing Shells Pair	1
															Big end bolts	2
						X				X	X	33		*Remove 1st stage valve cover*	*Cover O ring*	*2*
						X						34	+33	Inspect & clean 1st stage valve	O ring- valve to valve cover	1
										X	X	35	+33	Replace 1st stage valve	Valve assy	1
										X	X			*Inspect 1st stage piston*		
										X	X	36	+37+33 + 4	Replace 1st stage piston rings	Piston Ring Kit	1
						X				X	X			*Inspect 1st stage liner*		
										X	X	37		Deglaze 1st stage liner		
										X	X	38	+33 + 4	Replace 1st stage small end	Bush	1
															Gudgeon pin	1
															Circlip	2
										X	X	39	+4	Inspect/replace big end bearings	Bearing Shells Pair	1
															Big end bolts	2
										X	X			*Inspect crankshaft*		
										X	X	40	IF FITTED	Service water valve-U231.H	Service kit	1
										X	X	41		Replace main bearing & oil seal D/E	Bearing bush	1
															Joint	1
															Brg. Hsg. Oil seal	1
										X	X	42		Remove end cover-oil pump plate O/E	Joint end cover	1
										X	X	43	+42	Replace main bearing O/E	Bearing bush	1
															Joint-O/E bearing hsg.	1

Service Kit Number	12 Months From Installation/Last Service Or
HSK1201	100
HSK1228	1500
HSK1236	3000
HSK1244	
HSK1252	4500
HSK1244	6000
HSK1236	
HSK1228	7500
HSK1260	9000
HSK1279	

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Run Hours		Service Kit Number														
		HSK1201	HSK1228	HSK1236	HSK1244	HSK1252	HSK1244	HSK1236	HSK1228	HSK1260	HSK1279					
		12 Months From Installation/Last Service Or														
	Commission	100	1500	3000		4500	6000		7500	9000						
		9100	10500		12000	13500		15000	16500		18000	Task	Preparatory Task	Task Description	Parts Provided	Qty
										X	X	44	+42	Replace oil pump	Oil pump with coupling & gasket	1
										X	X	45	+42 IF FITTED	Replace water pump drive chain	chain	1
										X	X	46	+42 IF FITTED	Service water pump	seal & impellor kit	1
															Joint-water pump bracket	1
															Joint-water pump	1
															Joint-water pump IN/OUT	2
						X				X	X	47		Replace bursting discs (Radiator Set @9000hrs.)	Bursting discs kit	1
						X				X	X	48		Replace drain valve diaphragm	Service kit	2
															Screw seal	2
															Joint-drain to surge vessel	4
						X						49	+48	Replace diaphragm drain valves &seats 4thStage	4th valves &seats	1
										X	X	50		Inspect/replace diaphragm drain valves &seats	1st/2nd valves &seats U334L	1
												51			3rd/4th valves &seats U334J	2
										X	X	52		Inspect test separators	Joint 1st&2ndstage	1
															Joint 1st stage	1
															Joint 2nd stage	1
															Joint 2nd stage	1
										X	X	53		Inspect test 1st/2nd stage cooler	O ring	4
										X	X	54		Inspect test 3rd stage cooler	O ring	2
															O ring	2
															O ring	1
															Tension pin	1
															Circlip retaining	1
										X	X	55		Inspect test 4th stage cooler	O ring	2
															O ring	2

Service Plan - 5437AIR

Run Hours	Commission	100	1500	3000		4500	6000		7500	9000		Task	Preparatory Task	Task Description	Parts Provided	Qty
		9100	10500		12000	13500		15000	16500		18000					
											X	56		Suction filter silencer	Silencer	1
															Joint	1
														Inspect/test safety valves in accordance with regional requirements		
										X	X				1st stage	1
										X	X				2nd stage	1
										X	X				3rd stage	1
										X	X				4th stage	1
										X	X				Surge vessel	1
										X	X			Test pressure gauges	1st stage	1
										X	X				2nd stage	1
										X	X				3rd stage	1
										X	X				4th stage	1
										X	X				Oil	1
										X	X			Test temperature switches	3rd stage	1
										X	X				Final stage	1
										X	X			Test low oil pressure switch	L.O.P	1
										X	X			Test non return valve	non return valve	1
										X	X				Seal	1

Service Kit Number									
HSK1201	HSK1228	HSK1236	HSK1244	HSK1252	HSK1244	HSK1236	HSK1228	HSK1260	HSK1279
12 Months From Installation/Last Service Or									

13 EQUIPMENT DATA SHEETS

The following details are for those items that are most commonly supplied with the compressor.
Not all of these items are fitted to the standard compressor build and some contracts will have extra equipment that is not included within this section.

13.1 ANTI-VIBRATION MOUNT

13.1.1 MARINE – APP001

NOVIBRA TYPE 'RAEM' WITH STOPS

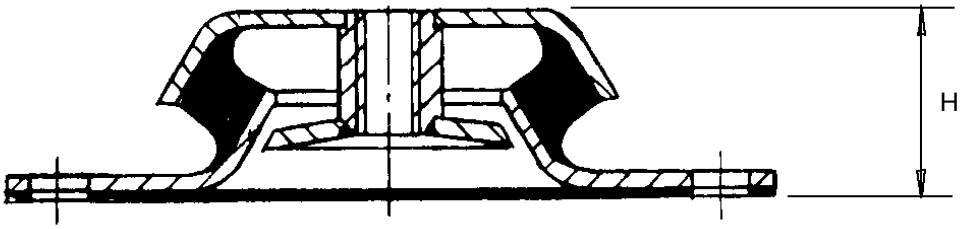
PART NUMBERS 98418.1018,1019, 1029 & 1030

NOVIBRA TYPE 'RAEM' WITHOUT STOPS

PART NUMBERS 98418.1022,1023 & 1024

PREVENTIVE MAINTENANCE

1) After installation, and initial running in. Record height dimension (H), of each mount.
2) After a week or 100 hours running time recheck and record dimension (H)
3) Check this dimension every 3 to 6 months depending on usage i.e. regular usage every 3 months.
   Note: This dimension may only change a small amount during the life of the mount approximately 1mm.
4) Any oil contact with the rubber mount will affect the life and performance, so keep to a minimum by regularly cleaning and clearing any contamination from the surrounding area.
5) Under normal working conditions the life expectancy will be 5 to 8 years.
6) Temperatures in excess of 70° C will have an adverse effect on the rubber, which will shorten the life expectancy.



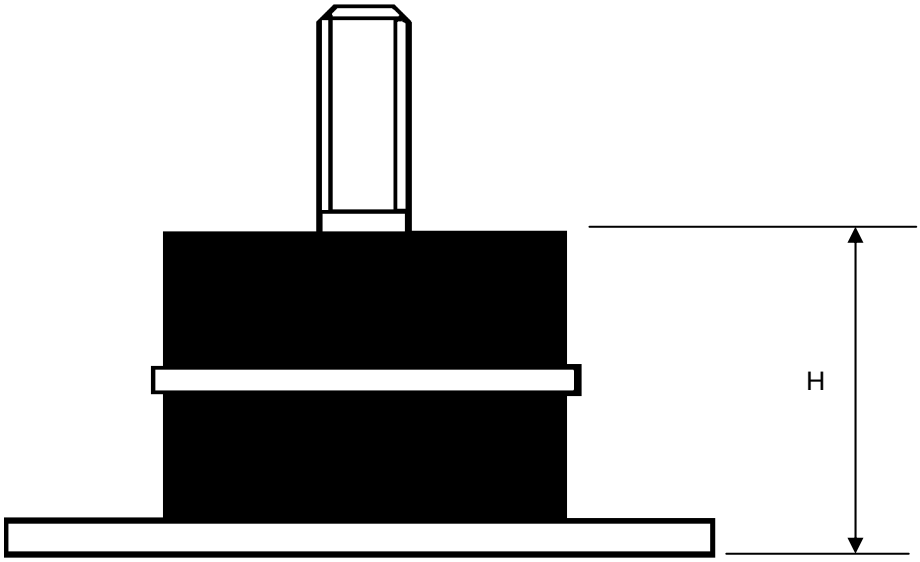
13.1.2 STANDARD – APP003

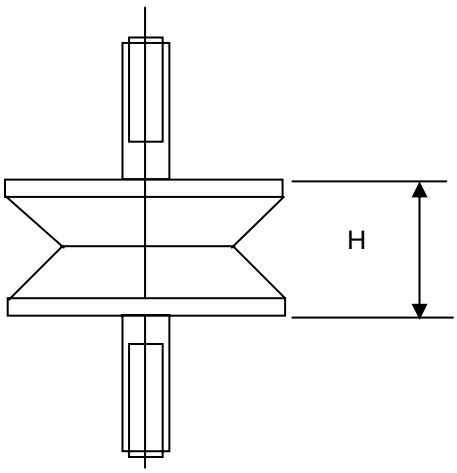
AVA TYPE

PART NUMBERS VARIOUS

PREVENTIVE MAINTENANCE

1) After installation and initial running in. Record height dimension (H) of each mount.
2) After a week or 100 hours running time recheck and record dimension (H)
3) Check this dimension every 3 to 6 months depending on usage i.e. regular usage every 3 months.
   Note: This dimension may only change a small amount during the life of the mount approximately 1mm.
4) Any oil or paint contact with the rubber mount will affect the life and performance, so keep to a minimum by regularly cleaning and clearing any contamination from the surrounding area.
5) Under normal working conditions the life expectancy will be 5 to 8 years.
6) Temperatures in excess of 70° C will have an adverse effect on the rubber and will shorten the life expectancy.





13.2 MOTOR – APP034

ELECTRIC MOTOR MAINTENANCE

WARNING :

Isolate power supply to motor before commencing any routine cleaning or maintenance work.

Routine Cleaning :

Remove the fan cover and ensure that all holes are completely open. Clear any dirt and fluff from behind the fan and along the ribs of the frame.

Periodic Maintenance :

Remove the cover and the fan which is fitted on the shaft extension.

Slacken and remove bearing cover screws and endshield bolts/studs. The endshields should then be eased off their spigots.

The rotor can now be withdrawn carefully from the stator.

Having dismantled the motor, maintenance can now be carried out to remove all dirt. Dry, compressed air under comparatively low pressure is best as a high velocity stream can force dirt into the spaces between windings, etc.

Grease removing solvents should only be used very sparingly so as not to damage impregnating varnish or insulation.

Bearings are charged with sufficient grease to last at least two years, provided there is little or no grease leakage. When replenishing, use only good quality lithium based grease and avoid overfilling the bearing housing.

Motors should be reassembled in the reverse order from dismantling, taking care not to damage the windings on insertion of rotor, taking care not to damage the windings on insertion of rotor, remembering to ease endshields on bearings and spigots. DO NOT USE FORCE.

Before starting, check that the rotor revolves freely. Ensure that the electrical connections are correct and terminal nuts tight.

Refit any pulley, coupling, sprocket etc. which have been removed, being particularly careful to ensure correct alignment with the driven part, as misalignment may lead to ultimate bearing failure and shaft breakage.

13.3 VEE-BELT DRIVE – APP011

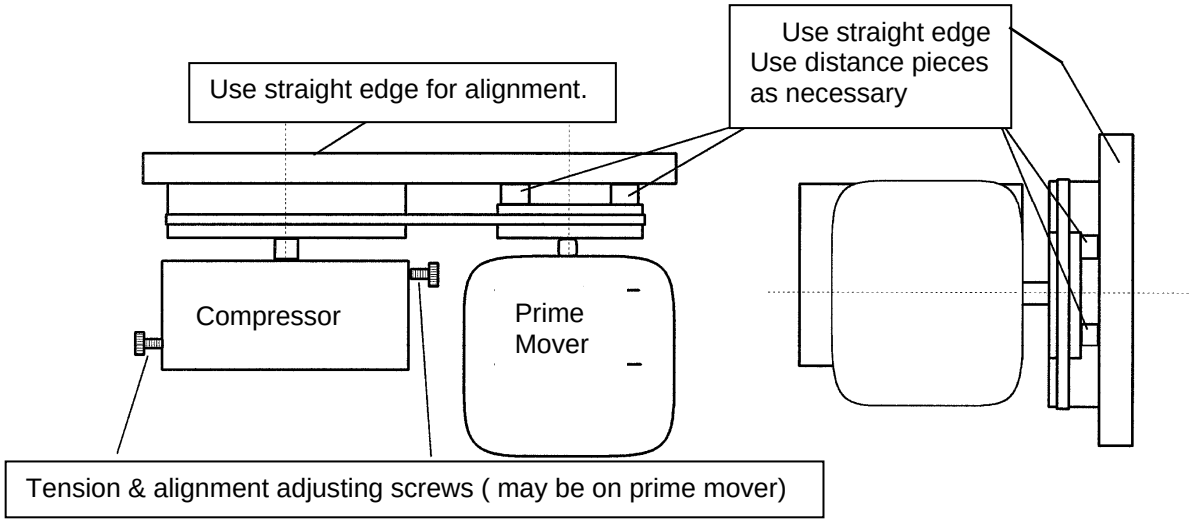
DRIVE RECOMMENDATIONS (V-BELT TRANSMISSION)

Details of drive arrangements and non isolation pad mountings are available from Reavell Works, Ipswich.
An overload device must always be fitted to motors.
Manufacturers terminal box wiring instructions must be observed.
An hours run meter fitted to the motor starter is recommended for efficient maintenance scheduling.

Belt Drive:

It is very important that the driving and driven pulley grooves are in line and both pulley shafts parallel. V-belt tensioning procedures follow normal BS.3790, 1981 practice.

TYPICAL DRIVE ARRANGEMENT



Belt Drive Tensioning:

Recommended Practice for Installation Tension in Belt Drives:-

It is necessary to be able to measure the belt tensions with sufficient accuracy to avoid belt slip or overloaded bearings or to meet particularly arduous conditions.

Measure the length of the span in millimetres. At the centre of the span apply a force with a spring scale in a direction perpendicular to the span, until the belt is deflected from the normal by an amount equal to 0.015 mm for every millimetre of span length. For example, the deflection for a span of 1 metre would be 1000 mm x 0.015 mm or 15 mm.

In all cases it is essential that the pulley centres be fixed and that the larger pulley be then rotated at least four times before making the measurement. On a multiple belt drive it is essential that a matched set of belts be used and the above procedure be carried out on each belt.

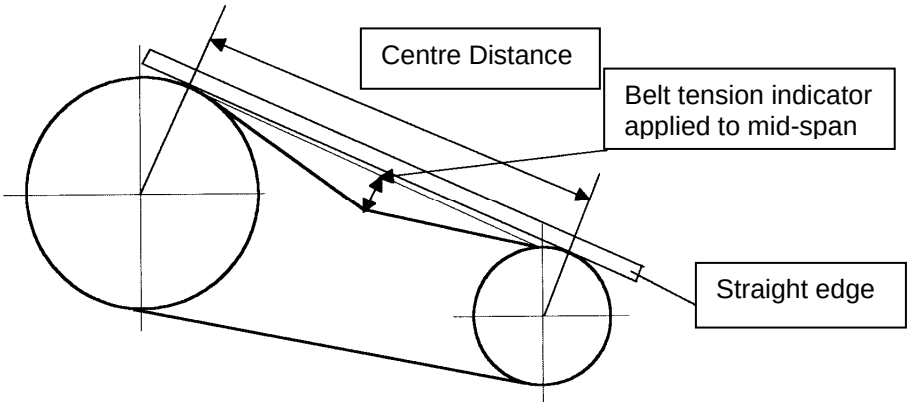
A measured forced below the lower value in the table indicates under tensioning, whilst a measured force above the higher value indicates over tensioning. However, when starting up a drive with new belts, the drive should be tensioned to the higher value since the tension falls rapidly in the early stages of running in.

All belts should be watched carefully during the running in period after initial start-up. Retensioning and checking for wear should be carried out every 2000 hours using the above procedure for alignment and tensioning.

BELT DEFLECTION MEASUREMENT

Required Deflection Force "P" at Centre of Span For Compressor Speed Ranges (Newtons)
Above follows current BS3790 practice.

RECOMMENDED TENSIONING FORCE



ADJUSTMENT METHOD

If belt tension is incorrect, release the compressor holding down screws enough to allow the adjustment screws to be free to slide the compressor on its adjustment slots without being too loose.
Using a suitable straight edge (long enough to span both pulleys), use method as described on page 3 to tension the belt. Note: - When using the adjusting screws it is important to maintain both the correct belt tension and pulley alignment.
Having established the correct deflection and pulley alignment tighten compressor holding down screws, check deflection is correct. If not repeat the whole sequence again.

TABLE

Belt Section	Force required to deflect belt 16 mm per metre of span		
	Small Pulley Ø mm	**Newton (N)**	**Kilogram force (kgf)**
SPZ	67 to 95	10 to 15	1.0 to 1.5
	100 to 140	15 to 20	1.5 to 2.0
SPA	100 to 132	20 to 27	1.5 to 2.7
	140 to 250	27 to 35	2.7 to 3.5
SPB	160 to 224	35 to 50	3.5 to 5.1
	236 to 315	50 to 65	5.1 to 6.6
SPC	224 to 355	60 to 90	6.1 to 9.2
	375 to 560	90 to 120	9.2 to 12.2
8V	335 & above	150 to 200	15.3 to 20.4
Z	56 to 100	5 to 7.5	0.5 to 0.8
A	80 to 140	10 to 15	1.0 to 1.5
B	125 to 200	20 to 30	2.0 to 3.1
C	200 to 400	40 to 60	4.1 to 6.1
D	355 to 600	70 to 105	7.1 to 10.7

Method of Belt, Tensioning. Using a Belt Tension Indicator.

1. Calculate the deflection distance in mm, on a basis of 16 mm per metre of span.
   Centre distance (m) X 16 = Deflection (mm). If distance & deflection is known, go to .2.

2. Set the lower marker ring at the deflection distance required in mm on the lower scale.

3. Set the upper marker ring against the bottom edge of the top tube.

4. Place the belt tension indicator on top of the belt at the centre of span. And apply a force at right angles to the belt deflecting it to the point where the lower marker ring is level with the adjacent belt, on single belt drives place a straight edge across the two pulleys to act as a datum.

5. Read off the force value indicated by the top edge of the upper marker ring.

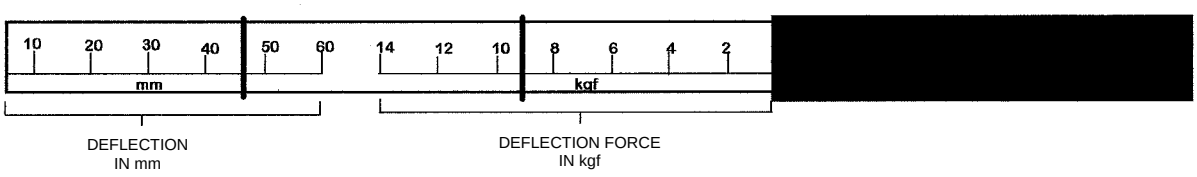
6. Compare this force to kgf value shown in the table above.

7. Tighten or loosen belt tensioning screws to achieve the correct value.

8. If the measured force falls within the values given, the drive should be satisfactory.

Note:- If a belt tension indicator is not available, a suitably scaled spring balance and rule will suffice.

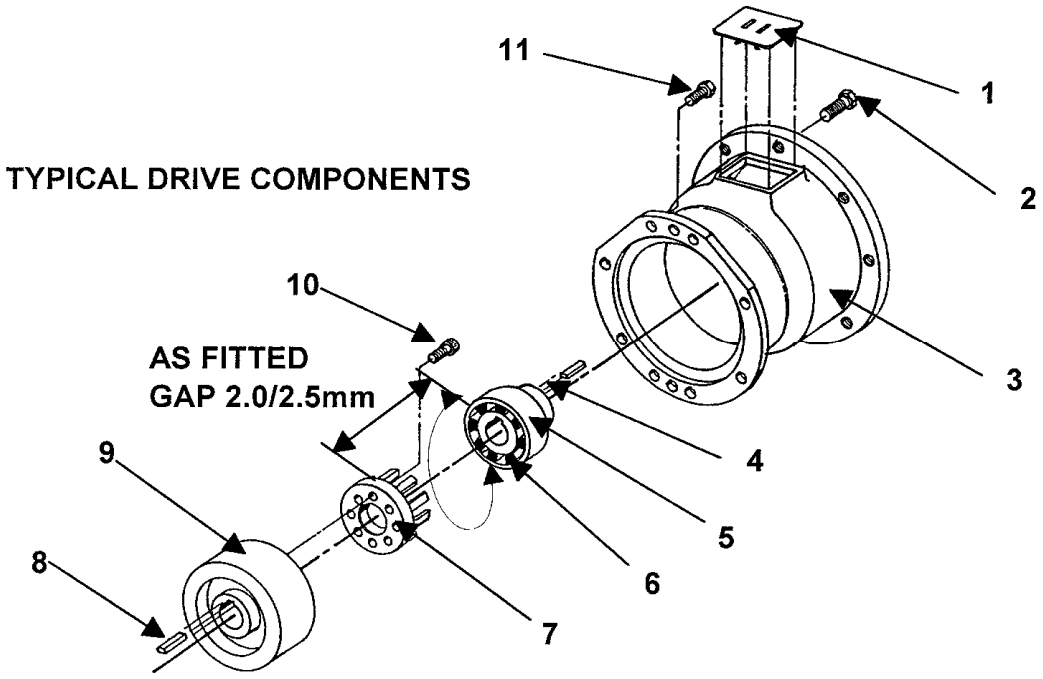
BELT TENSION INDICATOR



13.4 DIRECT COUPLED DRIVE – APP011B

DIRECT DRIVE:

Ensure compressor and drive motor is correctly aligned as the flexible couplings are for vibration duties only and not as non-alignment couplings. Note direct coupled sets with bell type housing (see below) are self aligning.



DIRECT DRIVE CHECKING FOR FREE PLAY AND WEAR.

After the first 500 hours and every 2000 hours, more frequently on arduous duties such as more than 6 starts per hour on auto stop/start operation, check the following:-
Ensuring compressor is isolated from mains supply, remove inspection cover (1) from bell housing (3) to expose drive components (5, 6 & 7), then by gripping the motor half coupling (5) firmly check for free movement by rotating backwards and forwards. The amount of free movement should be minimal 0.5 to 1.0 mm, excessive movement i.e. 3 to 4 mm or more should be investigated and the rubber couplings (6) replaced (complete set) as necessary.

13.5 SAFETY VALVE – APP167

INSTALLATION AND OPERATING INSTRUCTIONS
SAFETY VALVES

INTRODUCTION
Due consideration should be taken of climatic. Process or other conditions which might adversely affect the performance of the safety valve. Installation must be undertaken by qualified technicians and to good engineering practice. In addition, user's attention is drawn to our joint responsibility to ensure that the Health and Safety at Work Act is not contravened by incorrect installation. Commissioning or servicing. It is important that the valve to be installed is correct in every aspect, i.e. set pressure, size, material and type etc. for the application.

STORAGE OF VALVE BEFORE INSTALLATION
Valves should be stored preferably between-5°C and +25°C and a relative humidity of less that 75%. Very moist or dry conditions should be avoided. If a safety valve is installed after six months, or more, of storage, it must be subjected to functional test before commissioning. Thread protectors should not be removed until immediately, prior to testing or installation, as they also prevent the ingress of foreign matter, which could harm the valve.

INSTALLATION
VALVE INLET: Under no circumstances should it be possible to isolate the safety valve from the protected system. Safety valves should be mounted as close as possible to the protected system. The connecting pipe should be straight and as short as possible. The inlet line to the safety valve should have an effective area of flow, at least equal to that of the safety valve inlet. CompAir Limited should be consulted if the safety valve is to be mounted in any position other than vertically. The maximum pressure drop through the inlet line to the safety valve should not exceed 3% of the set pressure when the valve is discharging at its rated capacity.

VALVE OUTLET: No isolating devices shall be fitted to the outlet pipe. Discharge pipes should be as short as possible and of such a size that the pressure developed therein not reduce the relieving capacity. Ensure arrows indicating the direction of the flow are pointing in the correct direction. The cross-sectional area of the discharge pipe should not be less than the area of the safety valve outlet. Where safety valves are discharged into a manifold, the manifold must be capable of accommodating simultaneous discharge of all valves connected to the manifold. Atmospheric discharge or discharge pipes should terminate at a location which will not cause a hazard to personnel, particular attention being given to hazardous fluids or particles.

GENERAL: Inlet and outlet piping should be capable of supporting the safety, valve so that no unacceptable mechanical load or vibration is transmitted to the valve, and be sufficiently strong to withstand 'the effects of the reaction forces when the valve is discharging. All pipework or pressure vessels to which the safety valve is connected should be thoroughly cleaned before fitting the safety valve, to ensure that foreign matter does not pass through the valve. Particular care should be taken with the use of scaling compounds and P.T.F.E. tape to ensure that they do not enter the valve.

Atmospheric discharge valves should not be painted or coated with any substance, which could possibly obstruct or restrict free and full discharge through the valve. Suitable protection should be provided to prevent environmental build up or ingress of foreign matter. Any condition that could lead to blockage of discharge piping or discharge ports on safety valves must be avoided. Where appropriate, discharge pipes should be provided to a non-hazardous location. Where there is a possibility of a liquid head forming in a discharge pipe, a drain should be provided which leads to a safe discharge location. To prevent unnecessary lifting of the safety valve it is recommended that there is a margin of at least 10% between the maximum operating pressure and the set pressure of the safety valve.

FUNCTIONAL TESTING
Once installed in service. Valves should be tested at least once every six months to ensure free movement of parts. This should be carried out by operating the easing gear when the valve is under a pressure of not less than 75'% of the set pressure. Where valves are supplied without easing gear, the test should be in accordance with the full functional test described overleaf. Due regard must be paid to the safety personnel. Testing should not create a hazard, particular attention being given to foreign matter located in discharge outlets.

CONFIGURATION
The valves have a base number for different type valve arrangement from this information the valve set pressure can be obtained, examples:-

98650.2073 is the base unit number.

98650.2073-16.2 -16.2 being to the setting in bar g - wire locked.

98650.2073-96.25 -96.25 being to the setting in bar g - wire locked.

98650.1164 is the base unit number.

98650.1164-28 -28 being to the setting in bar g - wire locked.

98650.1163 is the base unit number.

98650.1163-7.6 -7.6 being to the setting in bar g - wire locked.

98650.1020 is the base unit number.

98650.1020-3.8T -3.8 being to the setting in bar g - wire locked and tagged.

98650.1021 is the base unit number.

98650.1021-9.6 -9.6 being to the setting in bar g - wire locked.

98650.1022 is the base unit number.

98650.1022-90T -90 being to the setting in bar g - wire locked and tagged.

Note the valves cannot be interchanged as the range of setting is limited

13.6 PRESSURE MAINTAINING VALVE – APP059

PRESSURE MAINTAINING VALVE U572/B U572/G & U572/H

U572/B

This valve is fitted to maintain back pressure through separators, filters and dryers (if fitted). This ensures that equipment reaches optimum working pressure as soon as possible to give long filter life, good oil separation and low oil consumption.

Setting Procedure
This valve is factory set or set during commissioning to the correct back pressure for the contract duty and should not require adjustment. However if necessary it can be adjusted by a competent person who understands the valve function.

Adjustment is made by rotating adjusting screw (11). Rotation is clockwise for increasing back pressure and counter clockwise for reducing back pressure. Locknut (12) secures the adjusting screw in position. Under all circumstances, the maximum dimension between underside of adjusting screw (11) and valve body (1) as shown on following drawing, must not exceed 150 mm. If the desired pressure cannot be attained then consult CompAir.

Note: Later models have a bracket fitted as shown in the following drawing, limiting the maximum allowable dimension to 150mm. **DO NOT REMOVE THE BRACKET IN SERVICE. REFIT AFTER MAINTENANCE.** This bracket is available and can be retrofitted.

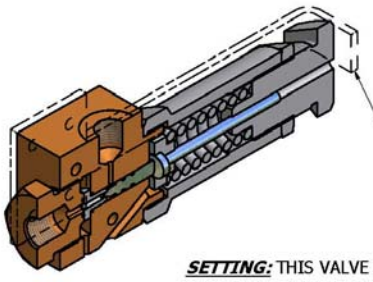
COMPUTER GENERATED DRAWING - DO NOT ALTER MANUALLY
0 10 20 30 40 50 60 70 80 90 100 125 150

THIRD ANGLE PROJECTION

DO NOT SCALE
IF IN DOUBT ASK

STATUS Released SIZE A3
LOCATION
SOFTWARE Inventor 2008 MERIDIAN

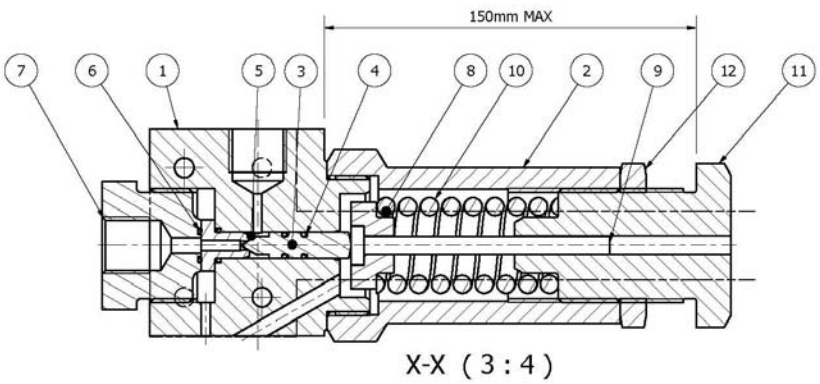
ITEM	PART NUMBER	DESCRIPTION	QTY
1	C200302	VALVE BODY	1
2	C76319	COVER - PMV	1
3	C77555	VALVE	1
4	PS1205.14	O'RING - NITRILE	2
5	C76317.2	VALVE SEAT	1
6	PS1205.4	O' RING - NITRILE	2
7	C200303	SEAT RETAINING PLUG	1
8	C76320.3	SPRING COLLAR	1
9	C74454.1	VALVE ROD	1
10	C23005	SPRING	1
11	C76320.1	ADJUSTING SCREW	1
12	C76320.2	LOCKNUT	1



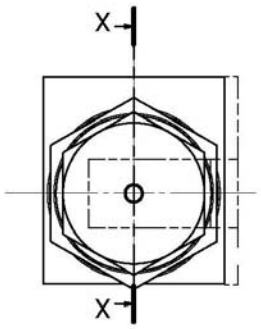
NOTE: U572.B PMVs DO *NOT* INCLUDE BRACKET C204512. THIS BRACKET MAY BE RETRO-FITTED AND ACTS AS A STOP TO LIMIT THE EXTENT TO WHICH THE ADJUSTING SCREW MAY BE UNSCREWED. ***IF RETRO-FITTED, DO NOT REMOVE THE BRACKET IN SERVICE AND REFIT AFTER MAINTENANCE.***

SETTING: THIS VALVE IS FACTORY SET. HOWEVER, IT CAN BE ADJUSTED BUT REFERENCE MUST BE MADE TO THE MANUAL SECTION APP 059 FOR INSTRUCTIONS.

MAX. WORKING PRESSURE: 430 BAR (6250 PSI)



X-X (3 : 4)



CompAir

MATERIAL REAVELL CODE
MATL. SPEC. PATTERN No. NONE

GENERAL MANUFACTURING TOLS TO BE AS FOLLOWS
MACHINED ±0.3 ANGULAR ±0.5°
FABRICATED ±1.5 CAST BS6615 CT9
DIMENSIONS IN MILLIMETRES
MACHINE WHERE MARKED ▽ REMOVE SHARP EDGES
SURFACE TEXTURE VALUE IN MICROMETRES Ra

SCALE (A3 PLOT)
PRODUCT U572.B
JOB No.

DRAWN T.J.Chick 29/09/2008
REVISED
APPROVED T.J.Chick 29/09/2008
ISSUE DATE 29/09/2008
LAST MOD No.

COMPAIR UK LIMITED, REAVELL HOUSE, 53-56 WHITE HOUSE ROAD, IPSWICH, SUFFOLK, IP1 5PB, U.K. TEL +44 (0) 1473 242 000 www.CompAir.com

U572.B PMV
MAINTENANCE REFERENCE DRAWING

PHASE DV | DRAWING No. SK210.159 | ISSUE A.1

MAINTENANCE
Replacing valve and seat.

Ensure all pressure has been released from pressure maintaining valve and system.

Remove any pipework from valve.

Dismount valve from system and hold securely in workshop vice.

Measure and record dimension between underside of adjusting screw (11) and valve body (1) (It will be less than 150 mm).

Slacken locknut (12) and remove together with adjusting screw (11).

Withdraw valve rod (9), spring (10) and spring collar (8) through cover (2).

Unscrew and remove seat retaining plug (7).

Using a suitable small, soft drift through the top (adjustment) end of the valve body, tap out valve (3) and seat (5), taking care not to damage valve bore.

Discard old valve, seat and o-rings.

Thoroughly clean all parts to be re-used.

Fit new valve seat (5) into valve body (1).

Fit lightly greased new o-ring (6) to seat retaining plug (7) and fit to valve body to retain valve seat (5).

Fit lightly greased new o-rings (4) to new valve (3) and carefully fit into valve body (1) through the valve cover (2). Never fit valve from valve seat end of body as this will cut or damage the 'O' rings.

Refit valve rod (9), spring (10) and spring collar (8) through cover (2).

Refit adjusting screw (11) and locknut (12).

Screw down adjusting screw (11) to tension spring (10). Adjust to measured set dimension recorded at start of this procedure.

Remove complete assembly from vice.

Refit completed valve to its original position.

Refit any pipework.

Start compressor and check for leaks. Check back pressure is correct.

After maintenance of the valve, it maybe necessary to make small adjustments to the preset factory or commissioning dimension to attain correct back pressure. Refer to setting procedure previously described.

U572/G

This valve is fitted to maintain back pressure through separators, filters and dryers (if fitted). This ensures that equipment reaches optimum working pressure as soon as possible to give long filter life, good oil separation and low oil consumption.

Setting
This valve is factory set or set during commissioning to the correct back pressure for the contract duty and should not require adjustment. However if necessary it can be adjusted by a competent person who understands the valve function.

Adjustment is made by rotating adjusting screw (2). Rotation is clockwise for increasing back pressure and counter clockwise for reducing back pressure. Locknut (4) secures the adjusting screw in position. Under all circumstances, the maximum dimension between underside of adjusting screw (2) and valve body (1) as shown on following drawing, must not exceed 150 mm. If the desired pressure cannot be attained then consult CompAir.

Note: Later models have a bracket fitted as shown to limit the maximum allowable adjusting screw travel. **DO NOT REMOVE THE BRACKET IN SERVICE. REFIT AFTER MAINTENANCE.** This bracket is available and can be retrofitted.

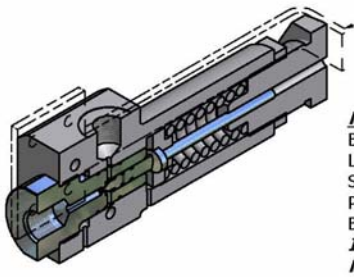
COMPUTER GENERATED DRAWING - DO NOT ALTER MANUALLY

THIRD ANGLE PROJECTION

DO NOT SCALE
IF IN DOUBT ASK

Parts List

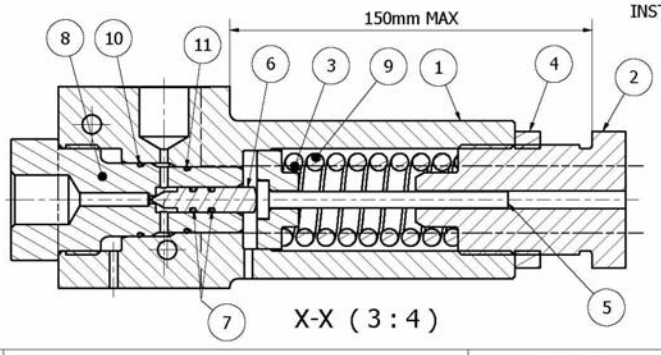
ITEM	QTY	PART NUMBER	DESCRIPTION	SUPPLIMENTARY TITLE
1	1	C204326	VALVE BODY	
2	1	C76320.1	ADJUSTING SCREW	
3	1	C204328	SPRING COLLAR	
4	1	C76320.2	LOCKNUT	
5	1	C74454.1	VALVE ROD	
6	1	C77555	VALVE	
7	2	PS1205.14	O'RING - NITRILE	BS 1806 No 010
8	1	C204327	VALVE SEAT	
9	1	C23005	SPRING	
10	1	95602.19	O'RING - VITON	BS REF No. 0251-16
11	1	95602.18	O'RING - VITON	BS REF No. 0221-16

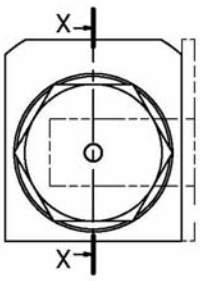


NOTE: U572.G ISSUE B PMVs INCLUDE BRACKET C204512 TO ACT AS A STOP TO LIMIT THE EXTENT TO WHICH THE ADJUSTING SCREW MAY BE UNSCREWED. U572.G ISSUE A PMVs MAY BE RETRO-FITTED WITH THIS BRACKET. ***DO NOT REMOVE THE BRACKET IN SERVICE AND REFIT AFTER MAINTENANCE.***

MAX WORKING PRESSURE: 430 BAR (6250 PSI)

SETTING: THIS VALVE IS FACTORY SET. HOWEVER, IT CAN BE ADJUSTED BUT REFERENCE MUST BE MADE TO THE MANUAL SECTION APP 059 FOR INSTRUCTIONS.





CompAir

MATERIAL
MATL. CODE
PATTERN No.

GENERAL MANUFACTURING TOLS TO BE AS FOLLOWS
MACHINED ±0.3 ANGULAR ±0.5°
FABRICATED ±1.5 CAST BS6615 CT9
DIMENSIONS IN MILLIMETRES
MACHINE WHERE MARKED ▽ REMOVE SHARP EDGES
SURFACE TEXTURE VALUE IN MICROMETRES Ra

SCALE (A3 PLOT) 1:1
PRODUCT 5437
JOB No.

DRAWN T.J.Chick 20/12/2005
REVISED
APPROVED T.J.Chick 30/09/2008
ISSUE DATE 30/09/2008
LAST MOD No. R005944

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U572.G PMV
MAINTENANCE REFERENCE DRAWING

PHASE DV | DRAWING No. SK210.158 | ISSUE A.1

MAINTENANCE

Removing valve and seat.

Ensure all pressure has been released from pressure maintaining valve and system.

Remove any pipework from valve.

Dismount valve from system and hold securely in workshop vice.

Measure and record dimension between underside of adjusting screw (2) and valve body (1) (It will be less than 150 mm).

Slacken locknut (4) and remove together with adjusting screw (2).

Withdraw valve rod (5), spring (9) and spring collar (3) through valve body (1).

Unscrew and remove seat (8) together with valve (6).

Discard old valve, seat and o-rings.

Thoroughly clean all parts to be re-used.

Fit lightly greased new o-rings (7) to new valve (6) and carefully fit into valve seat (8).

Fit lightly greased new o-rings (10 & 11) to new valve seat (8) and fit into valve body (1).

Refit valve rod (5), spring (9) and spring collar (3) through valve body (1).

Refit adjusting screw (2) and locknut (4).

Screw down adjusting screw (2) to tension spring (9). Adjust to measured set dimension recorded at start of this procedure.

Remove complete assembly from vice.

Refit completed valve to its original position.

Refit any pipework.

Start compressor and check for leaks. Check back pressure is correct.

After maintenance of the valve, it maybe necessary to make small adjustments to the preset factory or commissioning dimension to attain correct back pressure. Refer to setting procedure previously described.

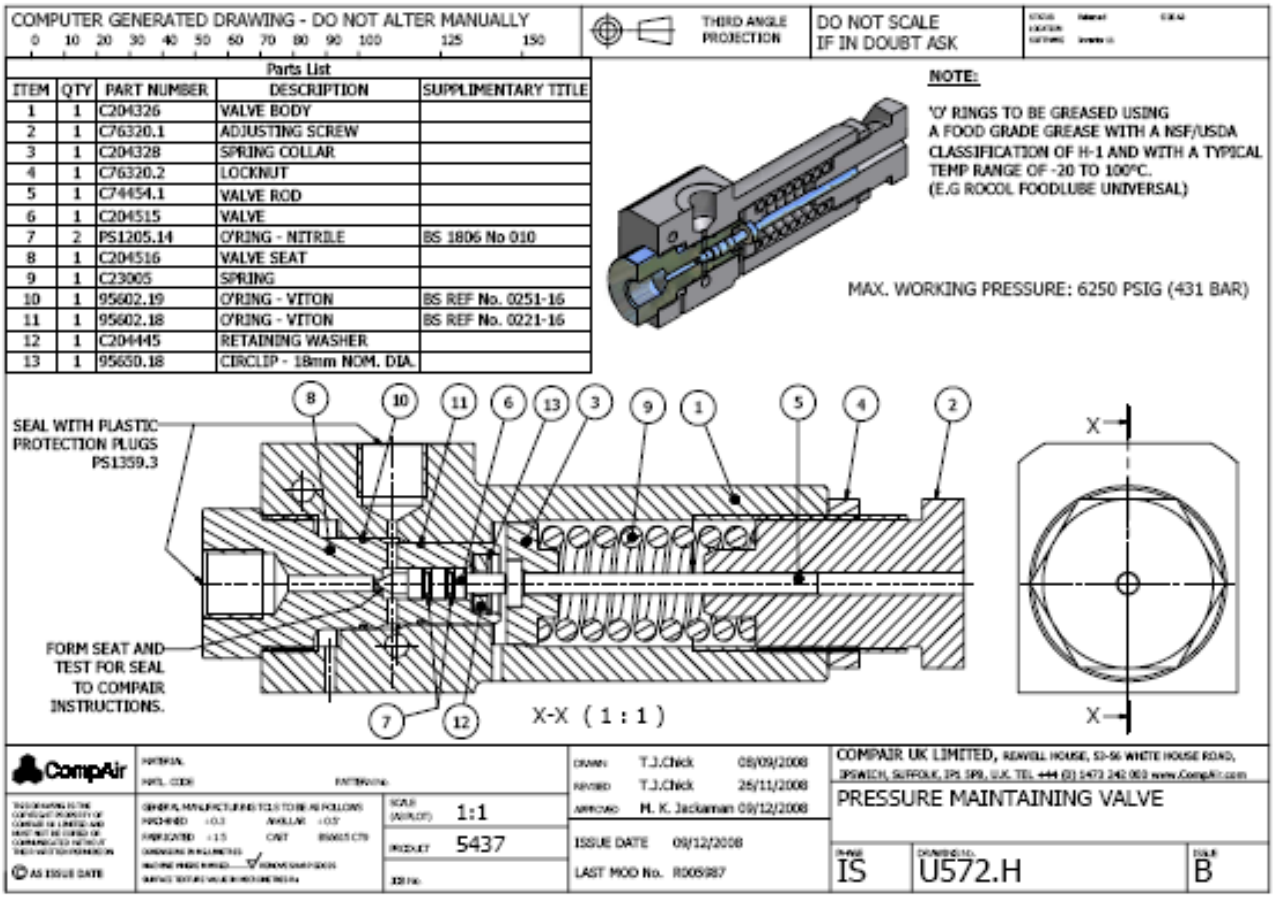
U572/H

This valve is fitted to maintain back pressure through separators, filters and dryers (if fitted). This ensures that equipment reaches optimum working pressure as soon as possible to give long filter life, good oil separation and low oil consumption.

Setting
This valve is factory set or set during commissioning to the correct back pressure for the contract duty and should not require adjustment. However if necessary it can be adjusted by a competent person who understands the valve function.

Adjustment is made by rotating adjusting screw (2). Rotation is clockwise for increasing back pressure and counter clockwise for reducing back pressure. Locknut (4) secures the adjusting screw in position. If the desired pressure cannot be attained, consult CompAir.

The valve is fitted with a retaining ring (12) and circlip (13) which prevent the internal parts of the valve from being ejected under pressure if the adjusting screw (2) is unscrewed from the valve body (1).



MAINTENANCE

Replacing valve and seat.

Ensure all pressure has been released from pressure maintaining valve and system.

Remove any pipework from valve.

Dismount valve from system and hold securely in workshop vice.

Measure and record dimension between underside of adjusting screw (2) and valve body (1) (It will be less than 150 mm).

Slacken locknut (4) and remove together with adjusting screw (2).

Withdraw valve rod (5), spring (9) and spring collar (3) through valve body (1).

Unscrew and remove seat (8) together with valve (6), retaining washer (12) and circlip (13).

Remove circlip (13) from seat (8) and withdraw valve (6) and retaining washer (12).

Discard old valve, seat and o-rings.

Thoroughly clean all parts to be re-used.

Fit lightly greased new o-rings (7) to new valve (6) and carefully fit into valve seat (8).

Fit retaining washer (12) over valve and locate in seat (8), securing with circlip (13).

Fit lightly greased new o-rings (10 & 11) to new valve seat (8) and fit into valve body (1).

Refit valve rod (5), spring collar (3) and spring (9) through valve body (1).

Refit adjusting screw (2) and locknut (4).

Screw down adjusting screw (2) to tension spring (9). Adjust to measured set dimension recorded at start of this procedure.

Remove complete assembly from vice.

Refit completed valve to its original position.

Refit any pipework.

Start compressor and check for leaks. Check that operating pressure is correct.

After maintenance of the valve, it maybe necessary to make small adjustments to the preset factory or commissioning dimension to attain correct operating pressure. Refer to setting procedure previously described.

13.7 SOLENOID VALVE – APP138

3 WAY SOLENOID VALVE

PS2197

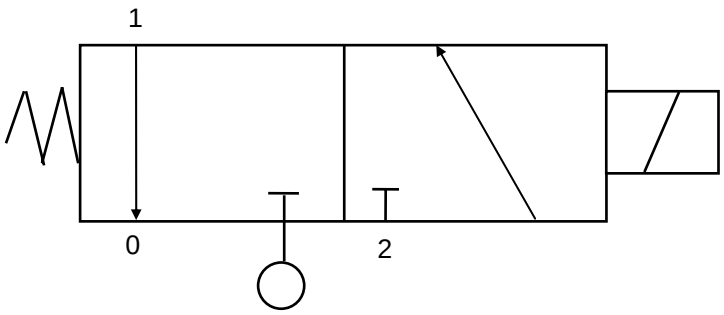
OPERATION

3 way normally closed energise to open, continuous duty.
On starting the solenoid valve opens (energised) this operates the diaphragms which in turn closes the valves within the D.D.Vs. (Diaphragm Drain Valves) thus allowing pressure to build up in the system to the desired pressure. On shutdown the solenoid valve closes (de-energised) this takes the pressure of diaphragms thus allowing the drains to blow any condensate collected within the stage separators.

INSTALLATION

Technical Details			Current consumption	
Part No	Voltage	Hz	Current Inrush	Hold
PS2197.1	230	50 AC	26 VA	16 VA
PS2197.2	110	50 AC	26 VA	16 VA
PS2197.3	220	60 AC	26 VA	16 VA
PS2197.4	110	60 AC	26 VA	16 VA
PS2197.5	24	DC	-	10 watts
PS2197.6	110	DC	-	10 watts
PS2197.7	230	DC	-	10 watts
PS2197.8	24	50 AC	26 VA	16 VA
PS2197.9	12	DC	-	10 watts
PS2197.10	24	60 AC	26 VA	16 VA
PS2197.11	125	DC		10 watts
PS2197.12	48	50AC	26VA	16VA
98516.5121	440	60	26VA	16VA

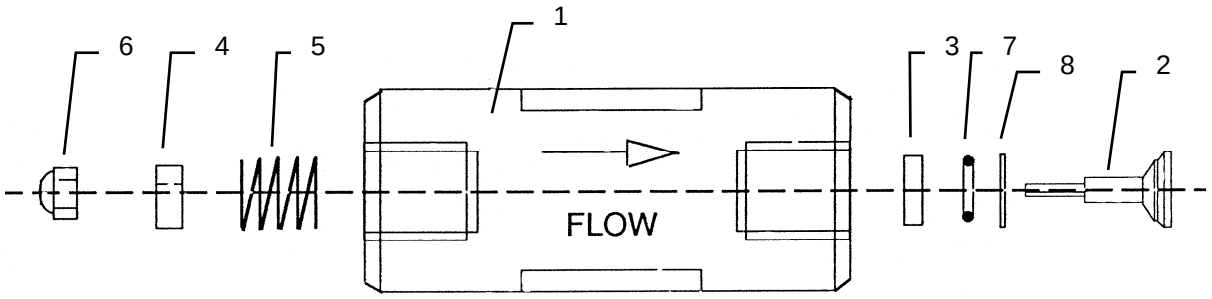
Electrical connection Amps pin to DIN 46242
Connector To DIN 43650
Protection IP65
Cable thread size PG9
Coil Class 'H' 180°C insulation
Coil duty Continuous
Voltage tolerance from normal -10% to +10%
Port Size G 1/8"
Orifice Size Ø1.6mm
Maximum working pressure 12 bar g.
Working fluid Air, water, gas, fuel oil & non corrosive liquids.
Ambient temperature range -15°C to +50°C



13.8 NON-RETURN VALVE – APP158 & APP161

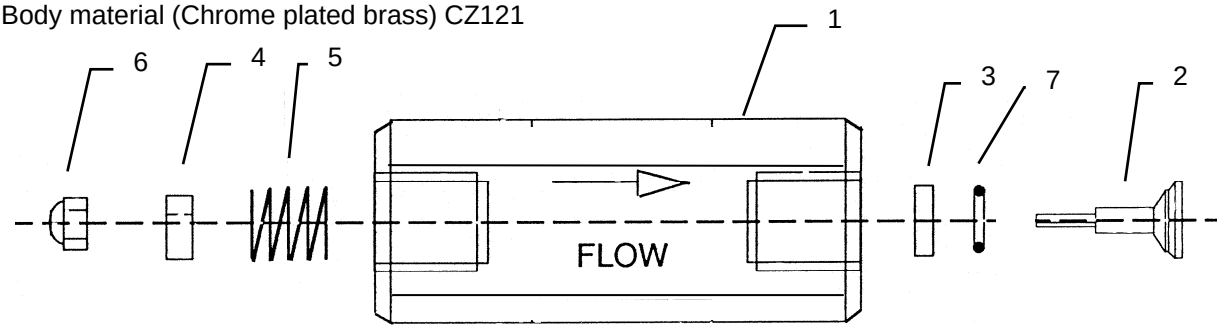
NON-RETURN VALVES

Connections 1/2" BSP (G1/2)
CompAir Part Number 98650.1655
TECHNICAL SPECIFICATION
Maximum Working Pressure - 6000 psi
Body material (Stainless Steel)



Item No.	Description	No Off
1	Body	1
2	Spindle	1
3	'O' ring collar	1
4	Guide Washer	1
5	Spring	1
6	Locknut	1
7	'O' Ring - PS1205/9	1
8	Retainer Clip	1

Connections 1/4" BSP (G1/4)
CompAir Part Number 98261.1422
TECHNICAL SPECIFICATION
Maximum Working Pressure - 6000 psi
Body material (Chrome plated brass) CZ121



Item No.	Description	No Off
1	Body	1
2	Spindle	1
3	'O' ring collar	1
4	Guide Washer	1
5	Spring	1
6	Locknut	1
7	'O' Ring	1

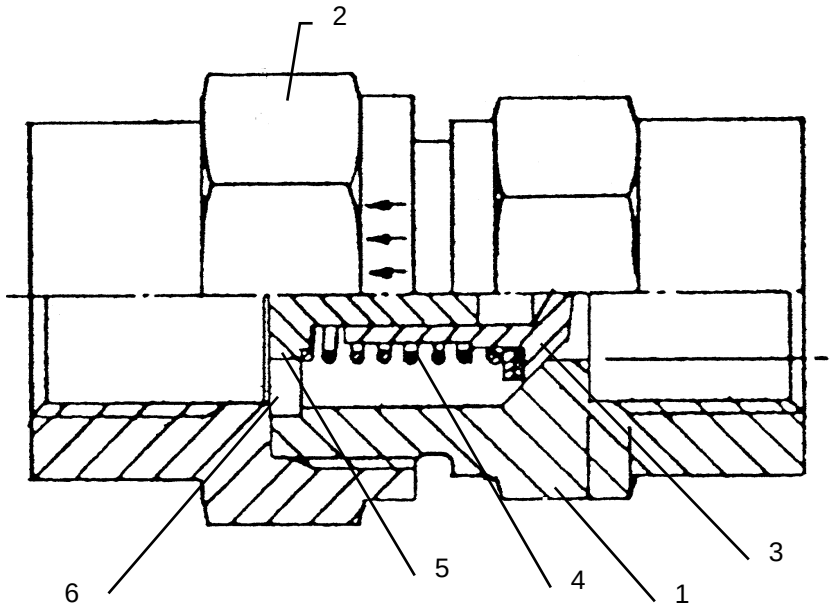
NON-RETURN VALVE

APP161
Connections – see table below

CompAir Part Number. 98650/1562 - 1569

TECHNICAL SPECIFICATION

Maximum Working Pressure - see table below
Material - see table below



Y407750.24.006	1/2 BSP - RHD1 R1/2 1TL 0.5BAR71
Y407750.24.007	1/4 BSP - RHD1 R1/4 1TL 0.5BAR71
Y507804.24.005	1/4 BSP - RHD1 R1/4 1TL 0.5BAR71

Item No.	Description	Stainless Steel Internals	Max Press - Bar	No Off
1	Valve Seat	YES	400	1
2	Body - Outer	NO	400	1
3	Valve	YES	400	1
4	Spring	YES	400	1
5	Valve Guide	YES	400	1
6	Retaining Washer	YES	400	1

Part Number	Reference No.	Internals Part No.	Max Press - Bar	Thread	Stainless Steel Internals
98650/1562	RHD1 R 1/8	6-L/6U8-S	400	G1/8	NO
98650/1563	FT257	Ident No 203045	400	G1/4	YES
98650/1564	RHD1 R 3/8	10-L/12-S	400	G3/8	NO
98650/1565	RHD1 R 1/2	15-L/16/710.5	400	G1/2	YES
98650/1566	RHD1 R 3/4	18-L/20/710.5	400	G3/4	YES
98650/1567	RHD1 R 1	22-L/25/710.5	250	G1	YES
98650/1568	RHD1 R 1.1/4	28-L/30-S	250	G1	NO
98650/1569	RHD1 R 1.1/2	35-L/38-S	250	G1	NO

13.9 WATER FLOW VALVE – APP704

APP704
PNEUMATIC WATER VALVE
COMPAIR PART NUMBERS:

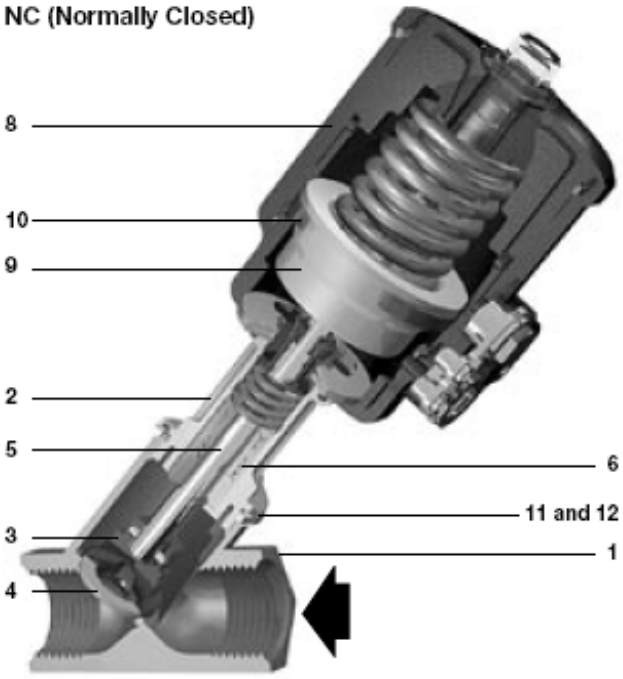
	PORT SIZE	BODY MATERIAL
98650.2584.1	1" BSP	BRONZE
98650.2584.2	1" BSP	STAINLESS STEEL
98650.2585.1	¾" BSP	BRONZE
98650.2585.2	¾" BSP	STAINLESS STEEL
98650.2612	1 ½" BSP	BRONZE

DESCRIPTION
A 2-port pneumatically actuated on/off valve for use on water, air, oil and gasses.
A pneumatic signal acts on the actuator piston to open or close the valve with a spring return action. The valve plugs have a PTFE soft seal to provide a tight shut-off. A valve position indicator is included on standard and flow regulator models.

The valves are normally closed and flow is from port 1 to port 2.

BRONZE BODY

NO	PART	MATERIAL
1	BODY	BRONZE
2	BONNET	BRASS
3	PLUG	STAINLESS STEEL
4	PLUG SEAL	PTFE
5	VALVE STEM	STAINLESS STEEL
6	STEM SEALS	PTFE CHEVRONS
7	STEM O-RING	VITON
8	ACTUATOR HOUSING	GLASS FILLED POLYMIDE
9	PISTON	GLASS FILLED POLYMIDE
10	PISTON LIP SEAL	VITON
11	GASKET	PTFE
12	O-RING	FKM



STAINLESS STEEL BODY

NO	PART	MATERIAL
1	BODY	STAINLESS STEEL
2	BONNET	STAINLESS STEEL
3	PLUG	STAINLESS STEEL
4	VALVE PLUG SEAL	TFM 1600
5	VALVE STEM	STAINLESS STEEL
6	STEM SEAL	PTFE + FKM CHEVRON
7	STEM O-RING	FKM
8	ACTUATOR HOUSING	30% GLASS FILLED POLYMIDE
9	PISTON	50% GLASS FILLED POLYMIDE
10	PISTON LIP SEAL	NBR
11	GASKET	PTFE
12	O-RING	FKM

13.10 PRESSURE SWITCH

13.10.1 LOW OIL PRESSURE – APP088

LOW OIL PRESSURE SWITCH

PART NO: 98524.1042, 98524.1122, 98524.1140 & 98524.1170

OPERATION
Located in the crankcase on water-cooled & large air-cooled compressors, in the oil filter body on air-cooled, the pressure switch stops the compressor when the oil pressure drops to pre-set pressure setting.

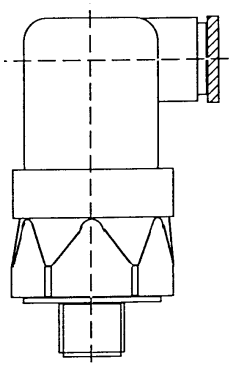
Part No.	Compressor Type	Inlet Pressure	Setting
98524.1042	WATERCOOLED	Standard	1 bar (15 psi) falling
98524.1122	AIRCOOLED	Standard	0.5 bar (7.5 psi) falling
98524.1042	AIRCOOLED – GAZPACKS	over 0.1 bar	1 bar (15 psi) falling
98524.1042	AIRCOOLED – 5450/5470	Standard	1 bar (15 psi) falling
98524.1122	AIRCOOLED – GAZPACKS	up to 0.1 bar	0.5 bar (7.5 psi) falling
98524.1140	AIRCOOLED – GAS	Standard	1 bar (15 psi) falling
98524.1169	AIRCOOLED – IZAR	up to 0.1 bar	0.5 bar (7.5 psi) falling
98524.1170	WATERCOOLED – GAS	24 VDC Gold Contacts	1 bar (15 psi) falling

The switch transforms a change of pressure into an electrical "On" or "Off" signal.

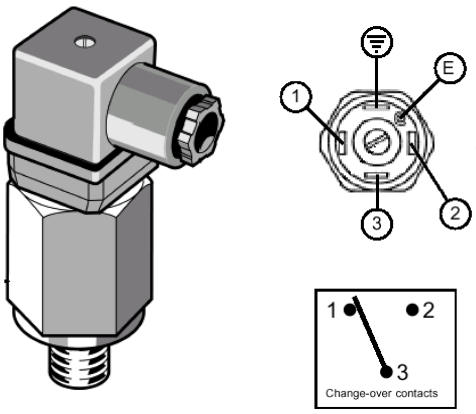
When a pre-set pressure is reached the snap action contact stops the compressor.

INSTALLATION

Either of two makes of low oil pressure switch may be fitted as shown below. Terminal connections are shown for clarity.



Connect Common (1) and Normally Open (4) terminals to compressor control panel



Connect Common (3) and Normally Open (2) terminals to compressor control panel

13.10.2 COMPRESSOR CONTROL – APP081

PRESSURE SWITCH

98524.1004 & 1139

OPERATION

Located as close as possible to the H.P. delivery line, the pressure switch stops the compressor when the upper pressure limit is attained and triggers off the start when the lower limit is reached.
The switch transforms a change of pressure into an electrical 'On' or 'Off' signal.
When a pre-set pressure is reached the snap action contact changes state.

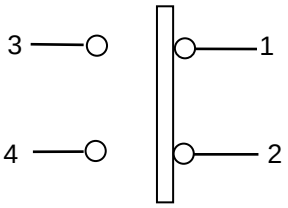
INSTALLATION

Pressure switches may be mounted in any convenient position close to the H.P. line, provided it is not subject to vibration and that the connecting pipe to the receiver does not exceed five metres.

Mount the switch by the lugs provided on the casing.

Where possible the pressure switch operating line should be taken from the receiver to avoid pressure oscillations.

It is usual to connect 1 and 2 to the compressor electrical control circuit terminals marked pressure switch'.



SETTING

Example of pressure setting to 200 bar minimum and 225 bar maximum.

Turn screw (A) to raise the GREEN pointer to its highest point.

Turn screw (B) so that the higher setting (225 bar) coincides with the RED pointer.

Turn screw (A) again to set the lower pressure 200 bar on the GREEN pointer.

NOTE: ALWAYS USE A CALIBRATED PRESSURE GAUGE WHEN SETTING PRESSURE SWITCHES, AS THE MARKINGS ON SWITCHES ARE FOR INDICATION ONLY.

13.11 PRESSURE GAUGE – APP070

PRESSURE GAUGES

GENERAL

The pressure gauge should be installed such as to avoid exposure to heat and vibration and to enable easy observation of the dial indication.

IMPORTANT

It is common practise to install the pressure gauge without an isolating device, so to facilitate calibration or replacement the system must be de pressurised before any work is carried out.

The pressure gauge is liquid filled to provide better damping from pulsation's.

INSTALLATION & COMMISSIONING

The tightening and loosening of torque applied to the connection should be by means of the spanner flats provided on the stem and should not be by means of grasping the case as this may damage the gauge.

No pressure higher than indicated by the working pressure symbol ▼ must be applied to the gauge during hydrostatic pressure testing of the system. Otherwise the gauge must be isolated or removed during this operation.

No attempt should be made to remove a pressurised gauge. The pressure system must be totally relieved if the gauge can not be isolated otherwise.

The remainder of the pressure medium contained in the element may be hazardous or toxic. This should be considered when handling and storing the removed pressure gauge.

PRESSURE GAUGES IN SERVICE.

Always open isolating devices always gently and never abruptly, as this may generate sudden pressure surges that may damage the gauge.

The maximum working pressure for which the gauge is suitable, or also the minimum working pressure in cases of vacuum, is indicated on the dial by corresponding marks ▼. Fluctuating pressure always reduces the maximum working pressure of the gauge.

Correct zeroing may be inspected by closing the isolating valve and relieving the gauge from pressure. The pointer must fall within the thickened portion of the zero mark. Unless the gauge temperature is considerably higher or lower than 20°C, a pointer not returning to zero may indicate serious damage to the gauge.

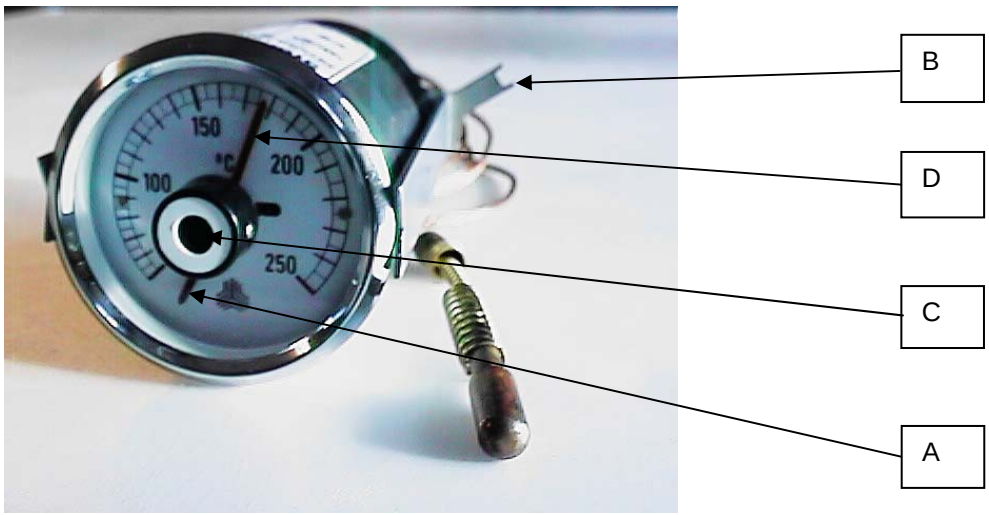
On-site testing of the pressure gauge is feasible by means of special isolating devices enabling connection of a test gauge together with a suitable pressure source.

13.12 TEMPERATURE CONTROLLER – APP090C

THERMOMETER SWITCHES
C202556, C202749, C202960 & C202964
98288.1093, 98288.1094 & 98288.1215

THESE THERMOMETER SWITCHES ARE SET TO THE FIGURES QUOTED BELOW, THE FOLLOWING INFORMATION IS FOR SETTING INFORMATION ONLY, IF THE TEMPERATURE SWITCH HAS TO BE REPLACED OR RE-ADJUSTED.

IF THE SWITCH NEEDS TO BE RE-ADJUSTED DUE TO A HIGHER AMBIENT TEMPERATURE OR ANY REASONS PLEASE CONTACT COMPAIR UK LTD. IPSWICH FOR MORE INFORMATION.



TO SET TRIP INDICATOR POINTER.

RUN COMPRESSOR TO ESTABLISH NORMAL RUNNING TEMPERATURE OF BLACK POINTER [A].

WHEN READING IS STABLE, REMOVE ADJUSTING KEY [B] FROM REAR OF SWITCH AND INSERT INTO FRONT OF CENTRAL KNOB ADJUSTER [C].

ROTATE KEY TO ADJUST RED POINTER [D] TO 10°C ABOVE RUNNING TEMPERATURE POINTER [A].

ADJUSTMENT OF TRIP POINTER MUST BE WITHIN RANGE THAT HAS BEEN PRE-SET AT COMPAIR BEFORE DESPATCH, BUT MAY BE ADJUSTED WITHIN THIS RANGE DEPENDING ON AMBIENT CONDITIONS.

NOTE: DO NOT RESET TEMPERATURE CONTROLLER SETTING IF IT TRIPS, ALWAYS LOCATE AND CORRECT POSSIBLE FAULT BEFORE ANY ATTEMPT IS MADE TO ALTER SETTING.
CONTACT CompAir UK Ltd IPSWICH ENGINEERING DEPARTMENT FOR MORE INFORMATION IF THE COMPRESSOR TRIPS WHEN SWITCH IS SET AT MAXIMUM VALUE.

CONTROLLER PART No	**TRIP POINTER STOP SETTING °C**	**USED ON COMPRESSOR MODEL**
C202556.1	125	5236.1
C202556.2	140	5212
C202556.3	150	5336,5415
C202556.4	155	5215 & 5217
C202556.5	170	5236.2,5315
C202556.6	180	5415E5317,5417.5417N
C202556.7	205	5436(CU TUBES)
C202556.8	220	5436.1 &.2,5436H,5436N,5436SN & 5437
C202749.1	200	5280
C202749.2	210	5280
C202749.3	175	5409
C202960.1	75	WATERCOOLED M/C'S DELIVERY
C202960.2	60	5211
C202960.3	55	WATER OUTLET
C202960.4	80	5207,5209,5213
C202960.5	50	5417N,5436N
C202964.1	75	5280,5281,5282,5283, DELY
C202964.2	60	5450,5470 DELY
CONTROLLER PART No	**TEMPERATURE RANGE °C**	**USED ON COMPRESSOR MODEL**
98288.1089	50 - 250	WATERCOOLED 5000 SERIES
98288.1121	0 - 120	WATERCOOLED 5000 SERIES
CONTROLLER PART No	**WHERE FITTED**	**USED ON COMPRESSOR MODEL**
98288.1093	1st – 5th STG. DELIVERY	5450 & 5470
98288.1094	FINAL DELIVERY	5450 & 5470

98288.1215

THE PURPOSE OF THIS SWITCH IS TO PREVENT THE COMPRESSOR FROM STARTING IN LOWER THAN RECOMMENDED AMBIENT TEMPERATURES.IT IS FITTED AT THE COMPRESSOR GAS INLET PORT.THE MINIMUM TEMPERATURE OF -10°C HAS BEEN SET AT THE FACTORY, BUT THIS CAN BE RAISED ON SITE IF REQUIRED BY FOLLOWING THE PROCEDURE BELOW.

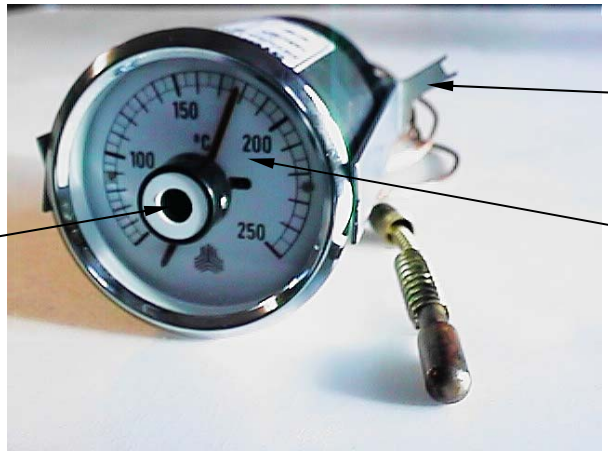
TO SET.

RELEASE ADJUSTING KEY (A) FROM BACK OF INSTRUMENT BY REMOVING SECURING NUT.

INSERT END OF KEY INTO CENTRAL ADJUSTER KNOB (B) AND TURN TO ADJUST SET POINTER TO REQUIRED MINIMUM TEMPERATURE **ABOVE -10°C.**

REPLACE ADJUSTING KEY AND SECURE WITH NUT.

CONTROLLER PART No	**TEMPERATURE RANGE**	**TRIP POINTER STOP SETTING °C**	**USED ON COMPRESSOR MODEL**
98288.1215	-40° / +80°C	-10°C FALLING	5000 SERIES WATER-COOLED
			COMPRESSORS



13.13 STARTER / CONTROL PANEL – APP091

INSTALLATION & MAINTENANCE INSTRUCTIONS FOR A.C MOTOR CONTROLS AND CUSTOM BUILT EQUIPMENT

IMPORTANT/SAFETY

All control panels/starters for operating on low voltage contains devices which are dangerous and can cause serious or fatal injury.

Some control panels/starters may contain live terminals which are supplied from a separate external source.

It is essential that all supplies are isolated before working on the control panel/starter.

Because of this danger, it is recommended that any personnel working on the equipment are within sight of other personnel at all times.

Persons responsible for installation should have a working knowledge of the IEE Wiring Regulations, Health & Safety At Work Act 1974 and the Electricity At Work Regulations 1989.

No special tools are required to service the control panel/starter.

GUIDANCE ON INSTALLATION

BEFORE INSTALLATION

Remove all packing materials and check inside and outside the control panel/starter for any obvious defects or damage.

Check that the control panel/starter is correct in all respects for the application, particularly in respect of:

1) Voltage.
2) Frequency.
3) Number of phases.
4) Current rating.
5) The starter is suitable for the operating environment.

Check all moving parts of contactors, relays etc. for ease of operation to ensure that they have been damaged in transit.

NOTE: Where control panel/starters have been in transit for long periods, which may have subjected the equipment to vibration, it is advisable to check all terminals and fixings for tightness before installation.

LOCATION AND MOUNTING

1) Vibration free location.

2) Protect from moisture and water ingress (fit anti-condensation heaters).

3) Ensure enclosure is dust free.

4) **DO NOT** allow swarf to enter enclosure.

WIRING

1) All external connections to be in accordance with IEE Regulations.

2) Fit separate earth conductor connecting through to the motor.

3) DO NOT earth via conduit fittings.

OPERATIONAL CHECKS

1) Connect incoming supply cables as shown in circuit diagram.

2) Conduct operational checks before connecting the motor.

3) Check the operation of control circuit.

It is also advisable to remove as many mains fuses as is practical. The number of mains fuses which may be removed is dependent on how the control circuit is supplied (see circuit diagram). In this condition, the operation of the control circuit can be carried out by means of the push buttons, control circuit switches and remote switches (ie. pressure switches, level switches etc.). If a remote switch is not available or functioning, its operation may be simulated by a switch or push button wired across the terminals.

In this mode, correct sequencing can be checked, indicator lamps checked and operation of contactors and relays can be checked for noisy operation without the corresponding equipment being used, thus avoiding the possibility of machine noise interfering with the checks.

4. Check thermistor protection units by disconnecting the thermistors and connecting a push button/ switch across the thermistor unit terminals. With this switch closed, the starter circuit should be operated normally. With the switch open, the starter should stop. This test can be used to differentiate between a faulty `Thermistor Protection` unit and faulty thermistors - See page 6 - Section 9.

5. Ensure that any overload devices are set to the appropriate full load current as marked on the motor.

6. Check that all timers are set to give the correct time delay.

7. Soft Starts (if fitted) require setting for appropriate voltage ramp time and current limit potentiometer (if fitted).

8. Inverters (if fitted) require setting.

FINAL CONNECTION

Ensure that any cables are kept clear of any parts that are liable to excessive temperature rise and that any lengthy cable runs are adequately supported.

Ensure that all earth connections are secure and free from mechanical stress.

WORKING ON LIVE EQUIPMENT

During servicing when it is necessary to work on the equipment with the supply connected (eg. checking voltages are currents).

It is essential to observe the following precautions before working on the starters with the supply connected:

1. Ensure that it is absolutely necessary to work on the equipment whilst in the a live condition.

2. Ensure that you are fully aware of the layout of the starter and where to expect live connections.

3. Ensure that you are within sight of other people who could come to your aid if necessary.

4. Ensure that any tools or equipment used are suitable for working on live equipment.

GENERAL GUIDANCE ON ROUTINE INSPECTION

DISCONNECT ALL EXTERNAL SUPPLIES

Open panel/starter and make visual inspections for:

1. Overheating/arcing.
2. Ingress of dirt/moisture.
3. Check all screws and fixings to ensure that they are tight.
4. Check all wiring connections to ensure that they are tight.
5. Check all moving parts for ease of operation.
6. Examine all wiring, particularly in the vicinity of metal parts of the equipment, to ensure that none of the insulation is damaged.
7. Check mechanical interlocks of contactors, isolators, etc. to ensure that they are functioning correctly.
8. Check push buttons and switches for normal mechanical operation.
9. Check door seals are free from damage and ensure door hinges are also free from damage and do not restrict door opening.
10. Check cable entry plates and glands to ensure that incoming and outgoing cables are securely fastened to the enclosure.
11. Check all earth connections are tight and free from corrosion. Particular attention should be paid to the earth links between the enclosure and the doors, where they are fitted.
12. Electrical checking of the wiring should be carried out by means of high voltage test equipment to check the insulation resistance to earth and between phases. It should be noted that electronic equipment may require disconnecting in order to carry out this test.
13. Check all earth connections for continuity, particularly on enclosure doors which are fitted with electrical equipment.

DETAILED CHECK OF COMPONENTS AND ACTION REQUIRED

1. BUSBARS

Check all busbar connections for tightness and ensure that all busbar mountings are secure. Check all busbar mountings for damage and replace any that are cracked or broken.

Check that all busbar surfaces are clean and free from corrosion. If any dirt or corrosion is present, clean or replace as appropriate and determine reason for problem.

2. FUSES

Check that all fuses are intact and of the correct size for the application. Ensure that connections to the fuseholder are tight and that the fuse is securely fastened to the fuse carriers. Examine fuse connections for signs of overheating (ie. discoloration of surrounding metal parts) and if present replace complete fuseholder assembly.

DO NOT: Replace cartridge fuses with wire.
Replace fuses with fuses of a different type or size.
Attempt to rewire a cartridge fuse.

3. ISOLATORS

Check all connections for tightness and examine the immediate vicinity of the main contacts for excessive arcing. Check the main terminal areas for signs of overheating. If either of the above is present, dismantle isolator and check state of operating mechanism for wear and examine contacts for excessive damage. If appropriate replace contacts or isolator assembly complete.

Where fitted, ensure that door interlocks are effective in preventing door being opened with isolator in `on` position and ensure that isolator operation via the handle is satisfactory.

4. CONTACTORS

Check that the moving contact carriage is free to operate and that it returns freely to the fully open position. If the contactor does not return to the fully open position, then it is probable that there is some internal damage to the contactor. If so, the contactor should be dismantled and repaired or replaced. An attempt should be made to determine the cause for the failure.

Check areas around main contacts for signs of excessive arcing and areas around main terminals for signs of overheating. If either is present, dismantle contactor and examine for damage. Repair or replace as necessary, again attempting to determine the cause for failure.

Checks of the main and auxiliary contacts should be made with suitable checking equipment to ensure that main and auxiliary contacts are opening/closing properly. (NOTE: This may not be practical on some auxiliary contacts because of interwiring. If in doubt disconnect one side of the contact involved).

Mechanically interlocked contactors should be checked for freedom of operation to ensure that the interlock is not interfering with normal operation of the contactor. Whilst holding one contactor in the closed position the other contactor should be checked to ensure that it cannot be pushed into the closed position. If this test fails, dismantle and examine the interlock and contactor mountings.

5. OVERLOAD UNITS

Check that the current range and the position of the setting lever are suitable for the motor involved. Adjust if necessary. If the overload unit is fitted with a `test` arrangement, check that the unit trips when tested and resets either automatically or via the reset button. In the event of suspected faulty operation, check by replacing the overload unit.

6. RELAYS

Relays should be checked in a similar manner to contactors.

7. PUSH BUTTONS/SWITCHES

Examine push buttons and switches for any external signs of damage and check, with suitable test equipment, that circuits are operating in accordance with circuit diagram (ie. that contacts are closed/open when required).

In the event of any damage or malfunction, replace the complete unit unless a simple repair is obvious.

8. TIMERS

Examine timers for correct range and check with suitable test equipment that the contacts are correct in the off position. Timers in general are not serviceable units and should be replaced completely if suspected of faulty operation.

9. THERMISTOR PROTECTION UNITS

Thermistor protection units should be checked with care, certain parts of the circuit are vulnerable to higher voltages. In the off state (ie. no supply voltage) the relay should be checked for normally open/closed contacts in accordance with the circuit diagram. A test voltage of approx. 500v can be applied between all terminals and earth, but on no account should this check be made between the thermistor terminals (terminals 1 and 2). All other checks have to be made with the supply voltage applied (See Page 3 Section 4). Thermistor units are not serviceable units and should be replaced if faulty.

10. INDICATOR LAMPS

Check all connections to indicator lamps and ensure that they are tight. Ensure that the correct type of bulb is fitted and that the lenses are not cracked. In either case, replace the bulb/lens or complete indicator lamp.

11. WIRING

Should any of the insulation on the panel wiring appear damaged or should any wire fail on the insulation test, then the wire involved should be replaced immediately. Check that all cable supports are in position and all the wiring is effectively supported.

12. INSTRUMENTS

Ensure all instruments are reading zero when no power is supplied Adjust if necessary. Check that all instrument cases and glasses are intact. Replace if necessary. Ensure instrument mountings are effectively tight and that instrument connections (particularly ammeters) are tight and not suffering from any corrosion. Remove corrosion and protect with electrical varnish or replace instrument if necessary.

CHECKING INTERVALS

It is also advisable to carry out the mechanical checks detailed previously at regular intervals throughout the life of the equipment. How often these checks are carried out depends on the particular circumstances of the site and operation involved. For starters operating once or twice a day in a relatively clean environment, a check every 12 months is probably all that is necessary. However, for a site which is very dusty and where a starter may operate several hundred times a day, it may be necessary to carry out the checks every 2 to 3 months to ensure that no problems develop to an extent that could cause failures.

SPARES

Most parts of the equipment are not regarded as serviceable items and therefore, in general, complete components are required.

In order to ensure that the correct parts are supplied please quote the details given on the starter legend plate.

WARRANTY

All goods are guaranteed for one year from date of purchase. This does not effect the statutory rights of the user.

All information contained in this publication is, as far as possible, correct at the time of going to print. However, due to our policy of continued improvement, we reserve the right to alter specifications without prior notice.

WARNING

The use of replacement parts or lubricating oils not supplied, recommended or approved by **CompAir Reavell**, may lead to failure in service which would not be covered by the warranty.

Any unauthorised modifications or failures to maintain this equipment is accordance with the manufacturers maintenance instructions may make it unsafe. The use of replacement parts not supplied by or recommended by CompAir Reavell may create unsafe and hazardous conditions or result in damage to the equipment over which CompAir Reavell has no control. Such hazardous conditions may lead to accidents that can be life threatening, cause substantial bodily injury or result in damage to the equipment.

CompAir Reavell can bear no responsibility for equipment in which unapproved replacement parts are included.

GENUINE PARTS
CompAir Reavell

Use ***Synteck*** compressor lubricant.
Advantages:

- Longer life.
- Longer time between oil changes.
- Longer valve life.
- Can be used in new or old compressors.
- Reduces carbon build up.
- Reduces oil consumption.

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8 CONTRACT SPECIFIC PARTS

8.1 DIFFERING FROM STANDARD COMPRESSOR

REF No.	PART No.	DESCRIPTION	QUANTITY
3.5	D100526	BEARING HOUSING COVER – OUTER END	1

8.2 EXTRA TO STANDARD COMPRESSOR

PART NUMBER	DESCRIPTION	QUANTITY
E60248.1	FLYWHEEL – COMPRESSOR	1
D72878	ADAPTOR PLATE – FLYWHEEL	1
98446.1009	WATER PUMP	1
C201809	FLANGE – WATER PUMP INLET & OUTLET	2
C201503	JOINT – WATER PUMP FLANGE	2
PS1923.3	CAPSCREW – WATER PUMP FLANGE	4
C201504	JOINT – WATER PUMP TO BRACKET	1
D100527	BRACKET – WATER PUMP	1
C201538	JOINT – WATER PUMP BRACKET TO COVER	1
C201537	SPROCKET - 17 TOOTH – WATER PUMP DRIVE	1
C85739.1	GEAR WHEEL - 18 TOOTH – WATER PUMP DRIVE	1
PS2062	ROLLER CHAIN – WATER PUMP DRIVE	1
98418.1018	ANTI-VIBRATION MOUNT	4
PS2197.4	SOLENOID VALVE – DDV'S	1
98650.1355-385	SAFETY VALVE – COMPRESSOR DELIVERY	1

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