Publication 9347/6

CompAir Reavell

SIEBE A SIEBE COMPANY

OPERATING AND MAINTENANCE INSTRUCTIONS

FOR

5415

RECIPROCATING COMPRESSOR

DIRECT COUPLED OR V-BELT DRIVE

MAINS OR RADIATOR COOLING

IN ANY CORRESPONDENCE RELATING TO THIS MACHINE PLEASE QUOTE:-

JOB NUMBER
MACHINE TYPE 5415
MACHINE NUMBER
(Indicated on machine nameplate)

WHEN ORDERING PARTS ALSO QUOTE:-

PUBLICATION NUMBER 9347/6
PARTS LIST ISSUE NUMBER 5

ISSUE DATE: AUGUST 1985

COMPAIR REAVELL LTD. REAVELL WORKS IPSWICH ENGLAND IP2 0AE
TELEPHONE: IPSWICH (0473) 602222 TELEX: 98254 FAX: IPSWICH (0473) 601282

COMPRESSOR LOG SHEET

Reavell

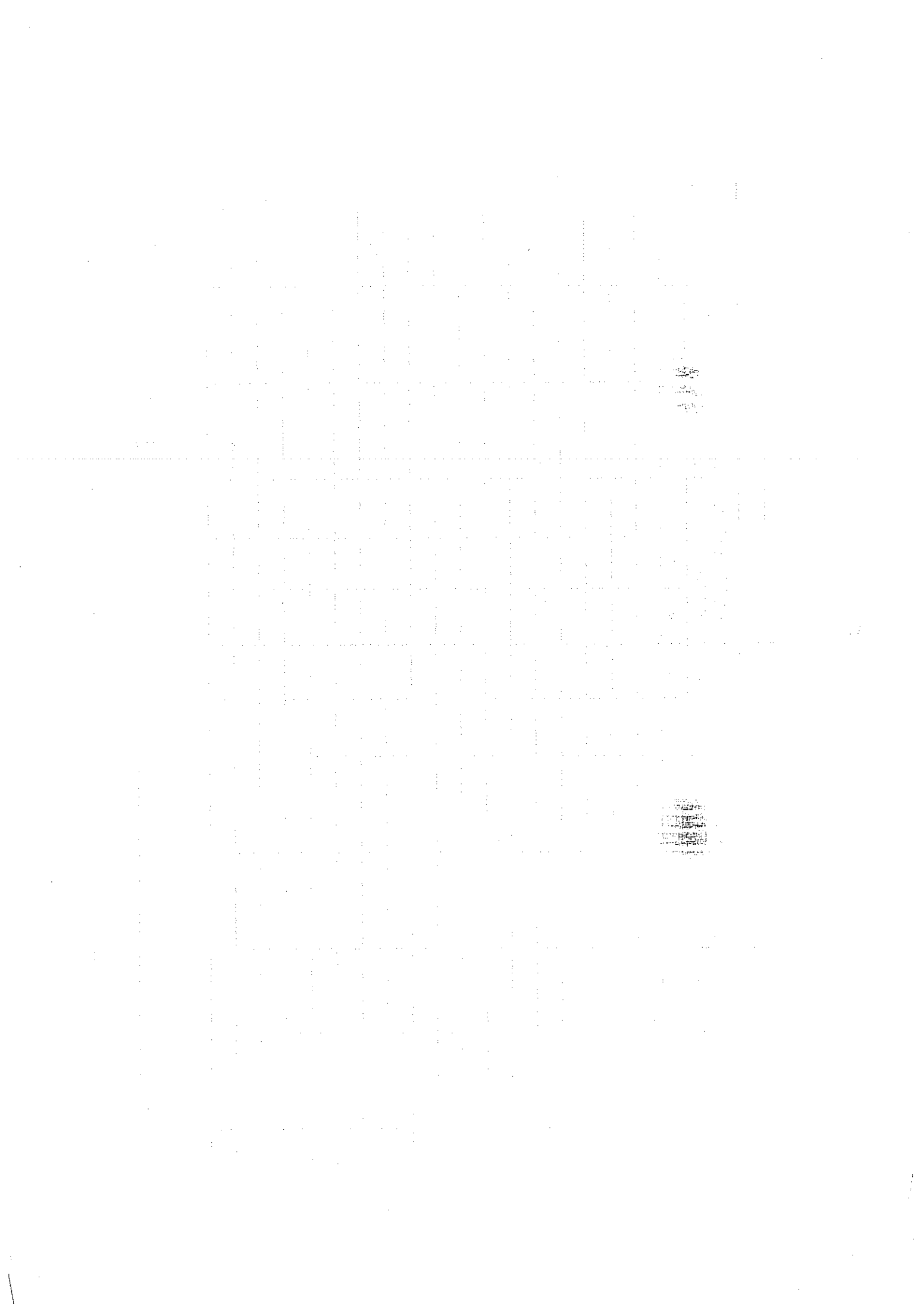
COMPRESSOR	PRIME MOVER	INSTALLED AT	OIL GRADE USED
TYPE:	TYPE:		
SPEED:	B.H.P.		
SERIAL NO:	DRIVE:	DATE INSTALLED:	

DATE	TIME	HOURS RUN	ROOM TEMP.	FINAL AIR PRESSURE	STAGE PRESSURES					OIL LEVEL	FILTER CHECKED	REMARKS
					1	2	3	4	5			

Total Hours Run .....

Signed .....

CompAir



FOREWORD

1. These compressors have been designed and manufactured to provide maximum performance. Regular servicing will assist in maintaining this high performance.

2. World-wide service and parts facilities are provided by CompAir Distributors. Service and Parts Department at Ipswich are available should any difficulty arise.

3. **Job numbers and compressor serial numbers should be quoted in all communications.**

4. All pressures referred to are gauge pressures.

5. In addition to automatically invalidating the Warranty, the substitution of parts not manufactured or approved by CompAir Reavell can reduce performance or service life and create potential or personnel hazards.

6. The right is reserved to modify the contents of this manual, without notice, and the data given is in no way binding on the manufacturers.

7. It is expected that users will employ safe working practices and will observe any related legal requirements when installing, operating and overhauling these compressors. (The attention of UK users is drawn to the Health & Safety at Work Act, 1974 and Control of Substances Hazardous to Health Regulations 1988.)

IMPORTANT SAFETY WARNING

THESE MACHINES ARE SAFE AND WILL NOT PRESENT A RISK TO HEALTH WHEN PROPERLY USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL.

ALL MOVING PARTS MUST BE GUARDED SO THAT THEY CANNOT BE ACCIDENTALLY TOUCHED, I.E. COUPLINGS, FLYWHEELS, PULLEYS ETC.

ALL ANCILLARY EQUIPMENT, SUCH AS PIPEWORK, CONNECTIONS, ADDITIONAL SAFETY VALVES, FITTINGS ETC., MUST BE SUITABLE FOR THE PRESSURES AND CAPACITIES INVOLVED. IN ADDITION, REGULATIONS APPLICABLE AT SITE MUST BE OBSERVED.

BEFORE MAINTENANCE OR DISMANTLING, ISOLATE ALL ELECTRICAL SUPPLY FROM MACHINE AND ANCILLARY EQUIPMENT, ISOLATE SUPPLY FROM STORAGE PIPEWORK AND RELEASE ALL PRESSURE FROM THE MACHINE, PIPEWORK AND STORAGE VESSEL.

WHEN WATER COOLED ISOLATE MACHINE FROM THE WATER SUPPLY AND DRAIN JACKETS AS NECESSARY.

SAFETY PRECAUTIONS

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 1988

The compressors and associated systems as supplied by CompAir Reavell Limited do not constitute any health hazards in the assembled form.

Normal good engineering and safety precautions should be carried out when using the products.

The compressor will have preserving oil applied to the interior surfaces, under normal handling practices this should not be hazardous in the terms of the above regulations.

SERVICING AND SPARES

The handling of components such as seals, gaskets and diaphragms etc. during servicing and repair do not present any health hazards if used in the prescribed manner.

However, in the event of handling damaged or split gaskets during stripping, the dust from some gaskets should be treated as Asbestos - when the control of Asbestos at Work Regulations 1987 apply.

Inhalation of Asbestos dust over a period may cause lung disorders, including asbestosis, pleural plaque, lung cancer and mesothelioma.

Viton 'O' ring seals, under normal operating conditions are perfectly safe and are suitable for compressed air/gas duties.

However, should the equipment have been involved in a fire or the seals are likely to have exceeded a temperature of 300°C the material does not burn but decomposes.

Degraded Viton seals give off Hydrogen Fluoride fumes and if in contact with water the fumes react to form Hydrofluoric Acid which causes severe burns to the skin.

If Viton seals appear charred or gummy do not touch them or the surrounding areas with unprotected hands, use neoprene or PVC gloves.

Wash the area with lime water and avoid breathing any fumes. If contamination of the skin occurs wash with lime water and **obtain immediate medical attention.**

CONDENSATE DISPOSAL

Customers are reminded that any condensate produced from the compressor must be regarded as trade effluent and is therefore not suitable for discharge into a surface water sewer, soakaway or watercourse.

In the UK the correct method of disposal is discharge into the public foul sewer which requires the approval of the trade effluent department of the local water services company.

BREATHING AIR - SAFETY PRECAUTIONS

The filtration towers incorporate replaceable (i.e. non reusable) cartridges. To maximise cartridge life and to ensure compliance with BS.4275 compressor air intake must be situated in an area low in CO, CO_2 and all equipment should be installed in a cool environment. Used cartridges must be disposed of in a safe manner.

Filtration equipment should be subject to a regular visual inspection, the threaded connection on the towers should be checked at normal service intervals and at least once every 12 months. More checks should be made when cartridge changes are frequent . The inner wall of the towers are also to be checked for possible corrosion at the same time.

Every five years within a benign atmosphere the whole assembly should be hydraulically tested at 1.5 times the working pressure. This service can be provided by **CompAir Reavell** who will quote for this service when required.

Hoses should be checked for possible defects before every use i.e. cuts or bubbles in the hose also damage to the thread or face of the cylinder connector. **The recommended service life for hoses is two years after this period they should be renewed**

SAFETY

IMPORTANT SAFETY WARNING

Most accidents involving unit operation and maintenance are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognising potentially hazardous situations beforehand.

Read and understand all warning, caution, prohibition and mandatory notices and labels on the unit before operating or carrying out any maintenance or servicing.

Asbestos

Some components on these units, such as compressible washers, gaskets or joints, may contain asbestos fibres. Breathing asbestos dust is dangerous to your health. Caution must be used to avoid breathing dust that may be generated when handling components containing asbestos fibres. If service operations are to be carried out on parts containing asbestos, there are a number of precautions that should be observed:

- Never use compressed air/gas for cleaning equipment containing asbestos material.

- Use vacuum or wet methods when cleaning up after working on components containing asbestos.

- Use exhaust ventilation when cutting or drilling components containing asbestos fibres. If any cutting or drilling of components containing asbestos is to be attempted, the item should be dampened and only hand tools or low speed power tools used.

- Wear an approved respirator if there is no other way to control the dust.

- Follow environmental rules and regulations for disposal of asbestos. Dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal.

(WARNING)

Do not operate this unit until you have read and understand the instructions in the 'Operation' section of this manual. Improper operation, lubrication or maintenance of this unit can be dangerous and could result in injury or death.

Do not perform any servicing or maintenance on this unit until you have read and understand the instructions in the 'Maintenance' section of this manual.

When handling, operating, overhauling and/or performing maintenance or repair, personnel are expected to use safe engineering practises and to observe all relevant local safety requirements and regulations. The attention of U.K. users is drawn to the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 1988 and the Institute of Electrical Engineers Regulations.

CompAir Reavell cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this manual are therefore not all inclusive. If an operating procedure, tool or work method not specifically recommended by CompAir Reavell is used, the user must satisfy himself that it is safe for him and others. The user must also ensure that the unit will not be damaged or made unsafe by the method of operation or maintenance procedure used.

Before Disassembly or Assembly

Before carrying out any disassembly on the unit or removing unit panels, carry out the following:

1. Isolate the unit from the main power supply. Lock the electrical power supply isolator in the 'open' position or remove the fuses.

2. Attach a 'WORK IN PROGRESS - DO NOT APPLY VOLTAGE' or similar warning label to the power supply switch or the unit control panel before carrying out any work on the unit. Do not apply electrical power or attempt to start the unit if such a warning label is attached to the power supply isolator

3. Close the gate valve between the unit and the distribution pipework to isolate the unit from the pressurised air/gas. On water cooled units, close the stop valve installed in the water supply pipe to isolate the unit from the cooling water supply. Attach a 'WORK IN PROGRESS - DO NOT OPEN' or similar warning label to the isolating valves.

4. Be sure the blowdown valves have operated, releasing all pressure from the machine. Check that the pressure gauges on the gauge panel register zero. Release all pressure from the system by opening the drain cocks

Maintenance

Only use genuine CompAir Reavell replacement parts.

Keep a record of all maintenance and repair work in a unit logbook. The frequency and nature of repairs can reveal unsafe conditions.

Use only lubricating oils and greases approved by CompAir Reavell. Make sure the selected lubricants comply with all applicable safety regulations, especially with regard to explosion or fire risk and the possibility of decomposition or generation of hazardous gases.

Make sure all instructions regarding unit operation and maintenance are strictly followed and that the complete unit with all accessories and safety devices are in good repair, free from abnormal wear or abuse and are not tampered with.

Maintenance, overhaul and repair work must only be carried out by adequately trained personnel under supervision of someone qualified for the job.

Maintain all regulating and safety devices with care to ensure they continue to function properly. They must not be put out of action. Take care to avoid damage to relief valves and other protection devices, especially to avoid plugging by paint, oil coke or dirt accumulation, which could interfere with the functioning of the device.

Pressure and temperature gauges must be checked regularly with regard to their accuracy.

Change faulty gauges whenever outside acceptable tolerances.

Protection devices must be regularly tested to determine that they are in good operating condition.

It is essential that the unit is maintained in a clean condition at all times. Observe scrupulous cleanliness during maintenance and repair. Keep away dirt by covering the parts and exposed openings with clean cloth, paper or tape.

Protect the motor, air/gas intake filter, electrical and regulating components to prevent the entry of moisture; e.g. when steam cleaning.

Never weld or perform any other operation involving heat near oil systems. Systems which may contain oil must be completely purged, e.g. by steam-cleaning, before carrying out such operations. Never weld on, or in any other way modify, a pressure vessel.

When performing any operation involving heat, flames, or sparks on a unit, the surrounding components must first be screened with non-flammable material. Never use a light source with open flame for inspecting the interior of a unit, pressure vessel, etc.

Before stripping a unit, or undertaking major overhaul on it, prevent all heavy movable parts from accidentally rolling over or moving.

When a repair has been completed, make sure no tools, loose parts or rags are left in, or on, the unit, the prime mover or the driving gear. The unit must be barred over several revolutions to ensure there is no mechanical interference inside the unit or prime mover. Check the direction of rotation of electric motors when starting up the unit initially and after any alteration to the electrical connection(s) or switch gear.

General Precautions

When washing parts in or with a cleaning solvent, provide the required ventilation and use appropriate protection such as a breathing filter, safety glasses, protective apron and gloves, etc.
Safety shoes should be compulsory in any workshop and if there is a risk, however small, of falling objects, a safety helmet should be worn.

If there is a risk of inhaling hazardous gases, fumes, or dust, the respiratory organs must be protected and, depending on the nature of the hazard, so must the eyes and skin.

Remember that where there is visible dust, the finer, invisible particles will almost certainly be present too; but the fact that no dust can be seen is not a reliable indication that dangerous, invisible dust is not present in the air/gas.

When using cartridge type breathing filter equipment, ascertain that the correct type of cartridge is used and that its useful service life is not exceeded.

Products which can be harmful to health and/or environment are to be kept in their original containers and placed in a safe, locked store to which only authorised persons have access. Each container should be clearly and indelibly marked.
If such products are to be divided over several containers, ascertain that the latter are suitable to hold the product and that each one is marked as above.

The markings on the containers must be the legal symbols for the type of hazard involved. Furthermore, they must state the name of the product, the nature of possible hazards, the safety precautions as well as the measures to be taken if a hazardous situation should arise, written in the local language.

Make sure that persons handling or applying hazardous products are well aware of the dangers involved and the safety precautions to be taken. Servicing personnel will also be informed and periodically
reminded of the measures to be taken if, in spite of everything, the product should cause injury or become harmful.

Installation Precautions

Make sure the aspirated air/gas is free from flammable fumes or vapours, e.g. paint solvents, that can lead to internal fires or explosions.

Arrange the air/gas intake so that loose clothing of passers-by cannot be sucked in; this reduces the risk of injuries.

Be sure the delivery pipe from the unit to the receiver or user's pipework is free to expand under heat and that it is not in contact with any flammable material.
If any such material is close to the pipework, take steps to preclude ignition.

In compressed air or inert gas systems with multiple units, manual valves must be installed to isolate each unit. Non-return valves must not be relied upon for isolating parts of a pressure system.

Never remove or tamper with the safety devices, guards or insulation materials fitted to the units. Every pressure vessel or auxiliary equipment installed outside the compressor units to contain air or inert gas above atmospheric pressure must be protected by a pressure-relieving device or devices as required.

Compressed air/gas and cooling water piping must be painted or marked according to local code. Pipework or other parts with a temperature in excess of 80°C and which may be accidentally touched by personnel in normal operation must be guarded or insulated. Other high-temperature pipework must be clearly marked.

On a unit equipped with an Automatic Start/Stop system, attach a sign stating 'THIS UNIT MAY START WITHOUT WARNING' next to the unit control panel.

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 to make sure there is no one checking or working on the unit before attempting to switch on remotely controlled equipment. Attach a 'CHECK THAT ALL PERSONNEL ARE CLEAR OF THE UNIT BEFORE STARTING' or similar warning notice to the remote start equipment.

Injury Prevention

Stationary housing guards are normally provided on all rotating or reciprocating parts not otherwise protected and which may be hazardous to personnel. Do not operate the unit, when such guards have been removed, before the guards are securely reinstalled.

Do not open electrical cabinets, compartments or other equipment while voltage is supplied. If such cannot be avoided, e.g. for measurements, tests or adjustments, have the action carried out by a qualified electrician only, with appropriate tools, and make sure the required bodily protection against electrical hazards is used.

Noise

All personnel should use ear protectors when working in a compressor room in which an open unit (not equipped with an enclosure) is operating. The noise level can be considerable.

Noise, even at reasonable levels, can cause irritation and disturbance which, over a long period of time, may cause severe injuries to the nervous system of personnel. Therefore, it is good practise to have a separate compressor room in order to screen the noise from the general working area.

Take care that noise transmitted through walls and windows does not create excessively high noise levels in the surrounding area.

Servicing Access

Position platforms, stairs or railings required for maintenance so that access is given to all areas where routine maintenance or operator inspection is necessary. Their positioning, however, must not interfere with maintenance of any parts with respect to accessibility or lifting.

Be sure platform floors are of grid or plate construction. Install safety rails on all open sides. Stairs or ladders of more than four risers must have a safety rail fitted on one side as a minimum.

Stairs must not be steeper than 50°; anything above this being classified as a ladder. Stairs must be the standard execution when platforms are required. Access stairs, ladders, platforms, etc. must comply with local statutory requirements.

Protect stairs and platforms from corrosion. Plated floors should have a non-slip paint or similar finish.

Oil Leaks

Oil leakage may make the floor slippery. Many accidents are caused by oily floors or unit parts. Always precede and follow a service with cleaning the floor and the outside of the unit.

Burn Prevention

Whenever there is an indication or any suspicion that an internal part of a unit is overheated, stop the unit but do not open any inspection or access covers before sufficient cooling time has elapsed. This is to avoid the risk of spontaneous ignition of the oil vapour when air is admitted.

To avoid burns, be alert for hot parts on a unit that has just been stopped and hot fluids in pipes, hoses and compartments.

Do not remove the insulation or safety guards that protect parts the temperature of which can be in excess of 80°C (which may be accidentally touched by personnel) until the parts have cooled to room temperature.

When hot parts have to be handled, use special heat-resisting gloves and, if required, use other body protection.

Pressurised Air or Gas

Air or gas under pressure can cause injury. When using pressurised air or inert gas for cleaning, do so with caution and use the appropriate protection, wear protective glasses and protective clothing.

Do not apply compressed air or inert gas to your skin or direct an air or gas stream at people.

Never use compressed air or inert gas to clean dirt from your clothes.

Before blowing compressed air or inert gas through a hose, ensure that the open end is held securely, so that it cannot whip and cause injury.

Protective Guards

Make sure that all guards or shields are installed correctly. If a guard or shield must be removed to carry out any work on the unit, use extra caution and ensure the work carried out is properly supervised.

Stay clear of all rotating and moving parts. Keep objects away from rotating fan blades. Do not operate a unit if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged must be changed for a new item.

Do not use flammable fluids to clean valves, filters, the air/gas passages of coolers, air/gas pipes or any other part exposed to air/gas flow during normal operation. If chlorinated hydrocarbon non-flammable fluids are used for cleaning, appropriate safety precautions must be taken against any toxic vapours that may be released during the cleaning operation. Do not use carbon tetrachloride.

Lethal voltages are present within this equipment. Extreme caution should be exercised whenever it is necessary to carry out electrical checks.

Hoisting Precautions

To avoid injury, use a hoist when lifting heavy components. To lift heavy components, be sure all chains, hooks and slings are in good condition, tested and approved according to local safety regulations and are of the correct capacity

When lifting the unit or parts with one or more lifting eyes, use hooks or shackles meeting local safety regulations. Never allow cables, chains or ropes to be applied directly on or through lifting eyes. Never allow sharp bends in lifting cables, chains or ropes. Be sure hooks or shackles are positioned correctly.

Do not apply a side load to lifting hooks, eyes or shackles during a lifting operation - use a spreader bar.
Lifting hooks, eyes and shackles must never be bent and must only have stress in line with their design load axis. The capacity of a lifting device is reduced when the lifting force is applied at an angle to its load axis. If required, use a lifting beam or bar between the hoist and the load. When heavy parts are being lifted with a hoist, never dwell or pass under the load or in the space which is

liable to be hit if the load or part of it should topple over or come loose. Never leave a load hanging on a hoist. Keep lifting acceleration and retardation within safe limits.

Install a hoist in such a way that the object will be lifted in a perpendicular direction. If that is not possible, the necessary precautions must be taken to prevent load-swinging. This can be achieved by using two hoists, each at approximately the same angle not exceeding 30° from the vertical, however take into account a reduction in the safe working load capacity.

Tool Safety

Always use tools that are in good condition and be sure you understand how to use them before carrying out any service work. Use the proper tool for each job. With the knowledge of correct tool use and knowing the limitations of tools, along with some common sense, many accidents can be prevented.

Special service tools are available for specific jobs and should be used when recommended. The use of these tools will save time and prevent damage to parts.

Use only spanners or sockets whose opening fits the fastener. Apply an open-end spanner only in the plane of the fastener head, square to the thread axis. Never cock an open-end spanner.

Do not use a pipe or other improvised leverage extensions on handles. Do not hammer on spanners or other tools which are not specially designed for that purpose.

Do not use adjustable spanners to tighten or slacken fasteners; they are intended to hold the other end of the fastener.

Always support the ratchet head when using socket extensions.

Discard any spanner with broken or battered points or edges.

Never use hand-type sockets on power or impact tools. Select only heavy-duty impact sockets for use with pneumatic or electric impact tools. Discard sockets showing cracks or wear; keep sockets clean.

Never use screwdrivers for prying, punching, chiselling, scoring, or scraping. Use the correct type and size of screwdriver for the job. The bit must match the fastener. A screwdriver with rounded edges will slip; it needs to be redressed or discarded.

Never use a screwdriver or any other tool near a live wire or electrical component. Plastic covering of handles is for comfort and grip only. They are not intended to act as insulation if such is not clearly marked by the manufacturer.

Never strike a hammer against a hardened object; use a soft drift against the object and strike against the drift. Strike the object with the full face of the hammer.

Never use a hammer with a loose head. Discard a hammer if it has a chipped or mushroomed face. Never use a chisel or punch with a chipped or mushroomed striking face.

Always pull on a spanner or socket handle, if possible, and adjust your stance to prevent a fall if something lets go.

Wear approved eye protection when using percussion tools or when scraping, chipping, shaving or grinding. Wear protective gloves when holding a chisel or punch.

PURGING

When the gas being compressed is of a hazardous nature or its purity is important, it may be a plant requirement to purge the machine to remove any air in it before letting the process gas into the system. If so the machine should be purged free of air, in accordance with purging procedures which apply to the whole plant using the inert gas specified, after the compressor has been commissioned on air and before the process gas is introduced into the system .

Note:
Care must be taken at all times when operating the process compressor and ancillary equipment and before any attempt is made to run the compressor on gas the operator must be fully conversant with the operating procedures of the equipment.

Operators should also be aware that the plant is not guaranteed leak tight whether in normal operation or under fault conditions and it is assumed that the compressor is situated in a well ventilated area with suitable gas leakage detection equipment to minimise possible risks.

Due to the unknown nature of plant processes involved CompAir Reavell cannot be held responsible for any heath risk arising from leakage of gas into the atmosphere.

Where there is a requirement to purge, the installation will normally have valves fitted permitting inert gas used for purging, to be admitted and discharged before and after the CompAir Reavell equipment.

IMPORTANT
If in any doubt as to efficiency of the purging, ALWAYS REPEAT THE PROCEDURE.

The following comments may help achieve successful purging of the compressor:-

Feeding the purge gas at pressure (maximum 0.5 bar g) will speed up procedure.

The crankcase is connected to the suction chamber and will be purged more quickly if the oil filler cap is removed and the rod inside is depressed to allow the air to escape.

Run compressor on the purge gas for several minutes, allowing it to discharge to atmosphere through the valve provided in the system beyond the compressor.

Note : It is important that at no time must the compressor be run on load during the purge process.

The lines from the separators to the unloader valves will be purged when compressor unloads (this occurs whenever compressor stops).

The lines from the first stage to unloaders (and water valve if fitted) can be purged by disconnecting the pipes where they are connected to these items, allowing the purge gas to pass through to remove the air before reconnecting the pipes.

After any maintenance or repairs have been carried out which involves dismantling and opening up gas containing parts, the system must always be re-purged.

DRY GASES

Lubrication is the introduction and maintenance of a continuous film of oil between two moving surfaces. When this breaks down, wear occurs.

In an air compressor the agitation, caused by the oil distribution and recovery system, results in the lubricant absorbing some air whilst it is in the crankcase and cylinders. The oxygen in the entrained air gradually forms and maintains oxide skins on the moving surfaces. These improve the adhesive strength of the oil film, preventing its breakdown.

When gas is being compressed and there is no oxygen present, even in small amounts, the help from these skins is not normally available. However, it has been established that if moisture is present, film breakdown is prevented. The reason is that air entrained in the water at source, provides the oxygen for oxide skin formation.

If the gas is dry (we define this as less than 50 ppm by weight) and if no oxygen is present (less than 10 ppm by volume) it is necessary to use a special lubricant capable of maintaining a high film strength to prevent its breakdown.

The properties needed are a stronger than normal adhesion to the metal surfaces and additives which will help oxide film formation. These are provided by an oil which has a HIGH viscosity, a HIGH level of anti-wear additives and a LIMITED amount of anti-oxidant additives.

The lubricant we recommend for this duty is Anderol 1200.

When commissioning or re-commissioning the compressor, it is recommended that the machine is run on air for 10 hours using the recommended oil as this will speed up the formation of oxide skins before changing to gas and Anderol 1200.

IMPORTANT

ASBESTOS FREE GASKETS

Original gaskets/joints provided by CompAir Reavell for this compressor **may have been manufactured from asbestos free materials.**

If asbestos free replacement gaskets are required this should be clearly stated in any order to CompAir Reavell to ensure the correct material is supplied.

CompAir Reavell

5000 Series

REAVELLITE Compressor Lubricant

DATA SHEET

REAVELLITE long life, synthetic diester compressor lubricant has been developed to offer important basic benefits and advantages over natural petroleum oils, when used in CompAir Reavell 5000 Series reciprocating compressors.

Whether used in new or old, medium or high pressure 5000 Series compressors, REAVELLITE will improve performance and reduce costs dramatically. For example, in cylinder lubrication, cleaning of carbonized valves has been a major maintenance cost associated with normally reliable reciprocating compressors. The use of REAVELLITE lubricant reduces carbonization to an absolute minimum, resulting in significant savings on replacement parts and valve maintenance. In addition, recompression, due to carbonized valves is no longer a problem and lower discharge temperatures can be achieved with improved safety and efficiency.

The use of REAVELLITE for both cylinder and crankcase lubrication eliminates the possibility of using the wrong lubricant for crankcase or cylinders.

Flash, fire and auto-ignition temperatures of REAVELLITE are approximately 100°F higher than those of petroleum compressor lubricants, offering a much greater safety margin. This, coupled with a significant reduction in valve carbonization and intercooler/aftercooler fouling, reduces the most common causes of compressor explosions and fires. High film strength, a low order of toxicity and biodegradability are other features of this unique lubricant.

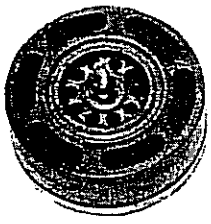
Advantages of using REAVELLITE compressor lubricant

DOUBLES	time between oil changes
INCREASES	valve life by 2 to 3 times
IMPROVES	ignition safety factors compared to mineral oil
RETAINS	high compressor efficiency
SAVES	on normally required replacement parts and maintenance associated with wear and deposits from mineral oil
SEPARATES	water condensate more rapidly and completely
REDUCES	oil consumption and carry-over by up to 35%
ELIMINATES	virtually all varnish, sludge and deposits — and the need for seasonal oil changes

Typical properties of REAVELLITE compressor lubricant

Property		Test Method	
ISO Viscosity grade	100	ASTM	D2422
SAE Viscosity grade	30	SAE	J300
Viscosity at 40°C cSt	95	ASTM	D445
Viscosity at 100°C cSt	9.2	ASTM	D445
Viscosity at 100°F cSt (SUS)	107 (496)	ASTM	D445
Viscosity at 210°F cSt (SUS)	9.4 (57)	ASTM	D445
Viscosity at 0°F (-17.8°C) cSt	20000	ASTM	D445
Viscosity index	60	ASTM	D2270
Pour point °C (°F)	-34 (-30)	ASTM	D97
Flash point °C (°F)	266 (510)	ASTM	D92
Auto-ignition temperature °C (°F)	410 (770)	ASTM	E659
Copper strip corrosion, 3hrs at 100°C (212°F)	1A	ASTM	D130
Oxidation resistance, viscosity change % (24hrs at 180°C/365°F) Acid No. change	=1.9 =0.03		
Specific gravity 25°C (77°F)	0.95	ASTM	D1298

Mineral oil after
600 hours



Reavellite after
1200 hours

Toxicity

REAVELLITE synthetic diester-based compressor lubricant is low in toxicity. However, prolonged or repeated skin contact may cause irritation by removing fats and oils from the skin (Wash affected parts thoroughly with soap and water after contact). Also, as with any lubricant, prolonged or repeated inhalation of mists should be avoided.

The following test results apply to REAVELLITE lubricant:

Test	Result
Acute Oral Toxicity, LD50	>5gm/kg
Acute Inhalation Toxicity	Low - no deaths during 14 day test
Primary Skin Irritation, DRAIZE SCORE	1 (mild irritant)
Contact Hypersensitivity	None
U S D A Category	H-2

Compatibility

The following table shows seals, paints and plastics compatible with, or not recommended for contact with REAVELLITE lubricant:

Compatible	Not Recommended
Viton	Neoprene
High nitrile Buna N	SBR Rubber
Teflon	Low nitrile Buna N
Epoxy paint	Acrylic paint
Oil resistant Alkyd	Lacquer
Nylon	Polystyrene
Delrin	PVC
Celcon	ABS

Packing And Storage

REAVELLITE lubricant is available in 5 litre cans, 25 litre drums and 208 litre barrels.

REAVELLITE lubricant should be stored in protected locations, to prevent contamination. It is stable with low volatility and high flash point.

REAVELLITE lubricant presents very little hazard in handling, provided ordinary care is exercised.

Safe Usage

REAVELLITE synthetic compressor lubricant is safe if used in clean, well maintained compressors, provided that recommended operating procedures and good lubrication practices are followed. Do not use above 450°F (232°C). Since the user has total control over the use of REAVELLITE lubricant, he assumes total responsibility for its safe usage.

Availability

REAVELLITE synthetic compressor lubricant is available from the address given below:

CompAir

CompAir Reavell Limited
P.O. Box 44
Ranelagh Road
Ipswich
Suffolk
England IP2 0AE
Telephone: Ipswich (0)473 602222
Telex: 98254 Fax: (0)473 601704

Publication No. 5990/ETP/3M/9.87 Printed in England

How to order spares

IN ORDER TO AVOID UNNECESSARY DELAY, PLEASE QUOTE:-

1. Complete invoicing and shipping address
2. Machine Model Reference No.
3. Machine No.
4. Item Reference
5. Part No.
6. Description
7. Quantity required

SUPPLEMENTARY INFORMATION

IMPORTANT NOTE:
Information in this section is to be read first.

TECHNICAL INFORMATION SHEET
ISSUE DATE : FEBRUARY 1989

SERVICE INFORMATION

SPECIAL ATTENTION

A recent case of a compressor being operated **ABOVE THE RECOMMENDED TEMPERATURE CONDITIONS** has been brought to our attention. Severe corrosion and failure of the cooler tubes was caused by acidity from the lubricating oil. Although the compressor had been operated with a recommended lubricant, acidic breakdown occurred when the oil was overheated. This emphasizes the importance of keeping within the CompAir Reavell recommended maximum operating temperatures and temperature trip settings.

NOTE : THE MAXIMUM OPERATING TEMPERATURES ARE IMPORTANT TO THE LIFE AND SAFETY OF THE MACHINE.

Maximum stage delivery temperatures are given in the operation manuals. These are monitored by a temperature trip fitted to one of the stages on the machines listed in the following table, together with their maximum trip settings.

DIAL INDICATING TYPE TEMPERATURE TRIP
The setting is denoted by the fixed pointer

MACHINE	STAGE	MAX TEMP SETTING
5212	1st Delivery	140°C
5215	1st Delivery	155°C
5236 Mk.1	1st Delivery	125°C
5236 Mk.2	1st Delivery	170°C
5315	2nd Delivery	170°C
5336	2nd Delivery	150°C
5415	3rd Delivery	150°C
5415E	3rd Delivery	180°C
5436	3rd Delivery	*205°C
5436H	3rd Delivery	220°C

FIXED TYPE TEMPERATURE TRIP
The setting is stated on a label on the switch body or on micro switch internally.

5212	1st Delivery	125°C
5215	1st Delivery	125°C
5236	1st Delivery	110°C
5315	2nd Delivery	175°C
5336	2nd Delivery	150°C
5415	3rd Delivery	150°C
5436	3rd Delivery	*200°C

* N.B. When 5436 fitted with **cupro-nickel tubes** maximum temperature setting allowed is 220°C.

Existing compressor users are requested to verify **IMMEDIATELY** that their machine is fitted with an operational temperature trip set **WITHIN THE SPECIFIED MAXIMUM** and fitted to the appropriate stage as listed above (some early machines were fitted with a trip on the final delivery only).

If the trip is **FAULTY** in any way, a new one should be ordered from CompAir Reavell and fitted **AS SOON AS POSSIBLE**

If the trip is **NOT** fitted, CompAir Reavell Service Department should be contacted for advice forthwith.

Maximum ambient and cooling water temperatures are stated in the operation manuals and are as follows :

FOR WATER COOLED 5000 SERIES COMPRESSORS

Maximum water inlet temperature .....37°C
Maximum ambient temperature.....45°C
Maximum ambient temperature for radiator sets .....30°C

THESE TEMPERATURES MUST NOT BE EXCEEDED except under certain reduced operating conditions, details of which can be obtained from CompAir Distributors or from CompAir Reavell Service Department.

FOR AIR COOLED 5000 SERIES COMPRESSORS

Maximum ambient temperature : 5402, 5404 & 5405.....35°C
5406 to 5409 inclusive.....45°C

THESE TEMPERATURES MUST NOT BE EXCEEDED except under certain reduced operating conditions, details of which can be obtained from CompAir Distributors or from CompAir Reavell Service Department.

MODIFICATION SECTION

Due to CompAir's policy of continuous improvement, modifications have been incorporated on your machine since the production of this Manual.

Please refer to this Section before carrying out any maintenance or ordering parts.

V MASTER COMPRESSORS - RADIATOR SETS

SALES AND SERVICE INFORMATION

When supplying and installing V Master 5000 Series, water cooled, reciprocating compressors with radiator cooling, the following instructions must be adhered to.

A. The radiator header must be positioned at least 3" (77 mm) above the compressor. See: ILLUSTRATION 1.

B. If the radiator is positioned LOWER than the compressor, a header tank must be fitted and positioned at least 3" (77 mm) higher than the compressor. The pump suction connection must be made to the bottom of the header tank, the vent pipes from the radiator top and compressor top to the top of the header tank. Vents must have a 2.5 mm restrictor in the line to regulate flow. See: ILLUSTRATION 1.

C. All pipe connections must be 25 mm bore, i.e. 1¼" BSP fittings and 1¼" bore pipe. Ensure couplings are correct as they differ with various manufacturers.

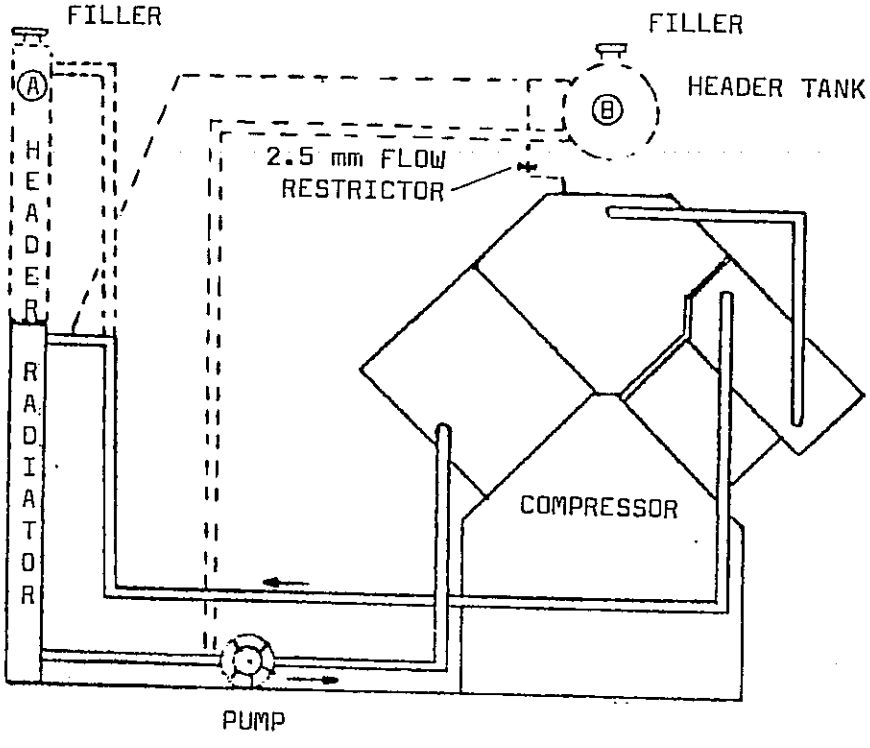
D. A temperature trip must be fitted (see table below). If machine was originally fitted for mains cooling the temperature trip must be replaced by a re-adjusted trip, or re-adjusted.

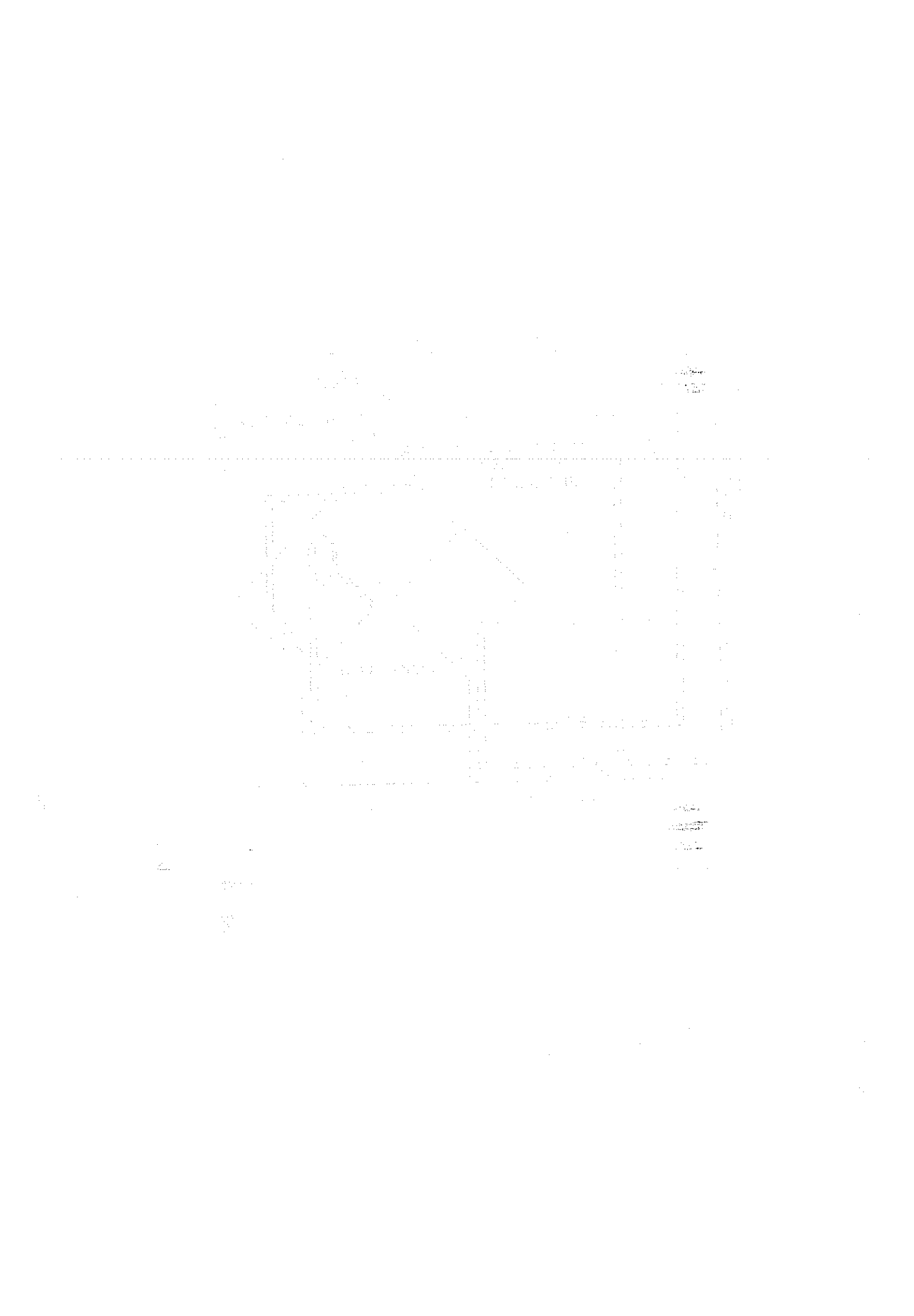
E. Effects on the environment when operating radiator cooled compressor sets will be as shown on the following table.

MACHINE TYPE	HEAT DISSIPATED INTO THE ATMOSPHERE KW	FLOW RATE THROUGH RADIATOR (TO BE VENTED AWAY) FROM MACHINE M^3/HR	COMPRESSION STAGE IN WHICH TEMPERATURE TRIP SHOULD BE FITTED
VMP12 (5212)	12.9	8520	FIRST
VMP15 (5215)	25.2	8520	FIRST
VMP36 (5236)	61.5	15000	FIRST
VIP15 (5315)	16.9	8520	SECOND
VIP36 (5336)	37.2	15000	SECOND
VHP15 (5415)	22.4	8520	THIRD
VHP36 (5436)	47.4	15000	THIRD

F. Radiator cooled compressor sets must not be used if the ambient cooling air temperature through the radiator is above 30°C (86°F). However, where lower duties are in operation, higher ambients are acceptable with the prior approval of Reavell Works. For operations above this temperature at full duty, also a multi-compressor installation, an evaporation system, i.e. cooling towers will cool the compressors more efficiently.

1. LAYOUT OPTIONS OF A V-MASTER RADIATOR SET





INDEX

INDEX - cont.

..... Continued

INDEX - cont.

DIAGRAMS

DRAWINGS

LEADING PARTICULARS

1.1 DESIGN DESIGNATION

Flange coupled motor driven machine 5415

V-belt driven machine, electric or internal combustion powered 5415

1.2 TECHNICAL DATA - GENERAL

Type ..... Single acting, four stage, 90° Vee

Cooling ..... Water

Direction of rotation viewed from drive end ..... Anti-clockwise

Number of valves ..... One combined suction and delivery per stage

Type of valve ..... Flat plate, low lift

Mounting ..... Three point, anti-vibration mounts

Lifting points ..... Three

TEMPERATURES

Minimum ambient temperature ..... 0°C (32°F)

Maximum compressor air intake temperature ..... 45°C (114°F)

Maximum cooling air temperature (Radiator Sets) ..... 30°C (86°F)

Maximum water inlet temperature ..... 37°C (99°F)

Temperature rise across machine ..... 10°C-12°C (18°F - 22°F)

SPEEDS

Maximum speed ..... 1500 rev/min

Minimum speed ..... 725 rev/min

PRESSURES

Minimum working pressure ..... 140 bar (2030 lbf/in^2)

Maximum working pressure ..... 350 bar (5080 lbf/in^2)

Maximum water pressure ..... 5 bar (75 lbf/in^2)

Oil pressure ..... 2.6 bar (40 lbf/in^2)

LUBRICATION

Crankcase oil capacity ..... 23 litres (40 U.K. pints)

Cylinder lubricator capacity ..... 1 litre (1.7 U.K. pints)

Cylinder lubricator feed rate (3 & 4 stages) ..... 1 rev every 45.75 secs

Recommended oil ..... Shell Turbo T78

Recommended alternative oil ..... Mobil Rarus 427

Recommended grease (for assembly) ..... Shell Alvania R3

Synthetic lubricants ..... See: separate section

LEADING PARTICULARS - cont.

COOLING

Water	Mains or water pump circulation
Cooling water flow rate @ 15°C (59°F)	75 l/h/Kw (12 g/h/bhp)

INTERNAL DIMENSIONS

Piston stroke	55 mm (2.105")
First stage cylinder bore	140 mm (5.512")
Second stage cylinder bore	77 mm (2.76")
Third stage cylinder bore	35 mm (1.38")
Fourth stage cylinder bore	18 mm (0.709")

CONNECTIONS

First stage suction	Special flange adaptor Rp2 (2" bsp)
Fourth stage delivery	Rp½ (½" bsp)
Water inlet	Rp¾ (¾" bsp)
Water outlet	Rp¾ (¾" bsp)

WATER TEST PRESSURES

First stage cooler	7.6 bar (110 psig)
Second stage cooler	42 bar (610 psig)
Fourth stage cooler	525 bar (7600 psig)
Water jacket	7.6 bar (110 psig)

UNIT WEIGHT (Approx)

Bare machine	520 Kgf (1140 lbs)
Flange mounted machine	819 Kgf (1806 lbs)
Radiator set on bedplate	983 Kgf (2168 lbs)

HIGHER AMBIENT AND WATER TEMPERATURES MAY BE ACCEPTABLE WITH RESTRICTIONS ON DUTY - REFER TO REAVELL WORKS

1.3 RUNNING CLEARANCES (MILLIMETRES)

DESCRIPTION	STAGE	AS FITTED	MAX PERMISSIBLE
Piston (Plunger) Vertical Clearance	1	0.25/1.0	1.0
	2	0.25/1.0	1.0
	3	0.35/1.05	1.05
	4	0.35/1.32	1.32
Piston Ring Gaps	1	0.15/0.33	3.3
	2	0.08/0.20	2.0
	3	0.05/0.18	1.8
	4	0.05/0.18	1.8
Piston Ring Axial Width Clearance	1	0.05/0.10	0.15
	2	0.05/0.10	0.12
	3	0.029/0.084	0.13
	4	0.025/0.06	0.1
Piston (Plunger) Diametral Clearance above top ring	1	0.18/0.24	0.36
	1	0.36/0.45	0.75
	2	0.075/0.130	0.19
	3	0.060/0.115	0.17
Piston stalk	4	0.28/0.34	0.5
Piston ring build-up	4	0.32/0.36	0.54
Crosshead Diametral Clearance	3	0.06/0.12	0.18
	4	0.06/0.12	0.18
Small End Bearing Diametral Clearance In Conn. Rod	1	0.080/0.095	0.19
	2,3,4	Needle Roller	
In Piston	1	0.003/0.015	0.024
	2,3,4	0.015/0.030	0.045
Big End Bearing Diametral Clearance		0.061/0.087	0.17
Small End Bearing End Float	1	0.15/0.65	1.0
	2,3,4	0.15/0.65	1.0
Main Bearing Diametral Clearance		0.05/0.13	0.2
Crankshaft End Float		0.15/0.7	0.9
Oil Pump Outer Rotor Diametral Clearance		0.14/0.19	0.26
Oil Pump Inner Rotor Lobe Clearance		0.013/0.064	0.15
Oil Pump Axial Clearance between Cover and Rotors		0.025/0.063	0.13
Coupling Face Distance for Direct Coupled Sets		2/4	4

1.4

TORQUE WRENCH SETTINGS - 5415 (VHP 15)

CLASS A - CRITICAL TORQUE SETTINGS

All Figures ± 5%

FOR NON LUBRICATED FASTENERS

Assembly Operation	Size	Number off	Newton Metre (Nm)	Lbf Ft
Big End Bearing Bolts	M10	8	54	40
First and Second Stage Cooler Covers	M10	19	54	40
Third Stage Cooler Covers	M12	11	95	70
Fourth Stage Piston	M 6	1	13	10
First Stage Valve Cover	M10	6	27	20
Second Stage Valve Cover	M10	4	27	20
Third Stage Valve Cover	M16	4	108	80
Fourth Stage Valve Cover	M16	4	67	50
First and Second Stage Cylinders to Crankcase	M12	6	95	70
Fourth Stage Cylinder Barrel to Crankcase	M10	4	54	40
Third and Fourth Stage Cylinders to Crankcase	M12	6	95	70

CLASS B - ADVISED TORQUE SETTINGS

All Figures + 5%
- 15%

FOR NON LUBRICATED FASTENERS

Assembly Operation	Size	Number off	Newton Metre (Nm)	Lbf Ft
Driving End Main Brg.Hsg. to Crankcase	M12	8	95	70
Outer End Main Brg.Hsg. to Crankcase	M12	10	95	70
Outer End Chain Cover	M 8	11	27	20
Crankcase Door	M10	24	54	40
Bursting Disc Cover	M10	4	54	40
Cooler Doors	M10	24	54	40
First Stage Valve	M10	1	21	16
Second Stage Valve	M 6	1	6	5
Third Stage Valve	M 6	1	6	5
Fourth Stage Valve	2BA	4	-	-
Bell Housing to Crankcase	M12	6	95	70
Bell Housing to Motor	M16	4	162	120
Coupling Ring to Flywheel	M10	6	54	40
Motor Bracket to Crankcase	M16	5	162	120
Oil Pump	M 8	3	27	20
Cylinder Lubricator	3/8 BSW	4	35	26

NOTE : Under no circumstances are any deviations from the above figures allowed unless authorised in writing by the Chief Designer or Development Engineer.

1.5 Use of Synthetic Lubricants

Synthetic lubricants, such as recommended Anderol 500 or alternatives Mobil Rarus 827 and Castrol SN100 may be used after the compressor has been run in for a minimum of 100 hours on the recommended conventional lubricant.

The crankcase may then be drained and replenished with synthetic lubricant.

After major overhaul the compressor must be run in again for at least 100 hours on recommended conventional lubricant, before the use of synthetic lubricants.

1.6 Pressure and Temperature Acceptance Levels

5415 PRESSURES (psig)

DELIVERY	OIL	FIRST	SECOND	THIRD	FOURTH
2000	38-44	43-49	234-257	860-970	-
2500	38-44	43-49	239-263	910-1020	-
3000	38-44	43-49	244-268	960-1070	-
3500	38-44	42-49	250-274	1000-1120	-
4000	38-44	43-49	255-280	1050-1175	-
4500	38-44	43-49	260-285	1100-1230	-
5000	38-44	43-49	265-290	1150-1280	-
UNLOADED (750-1500 rpm)					
		10-20	10.25	25-70	100
TEMPERATURE					
Maximum Stage		200°C	200°C	200°C	200°C
Final delivery max.					70°C

2.0 GENERAL DESCRIPTION

2.1 The 5415 compressor is of four stage, single acting, 90° Vee configuration, which provides complete primary balance.

Air enters the machine through a filter/silencer and is compressed by the first stage piston, after which it passes through cooler tubes to the second stage for further compression. Cooled again, the process is repeated through the third stage, after which it is cooled again before entering the final stage for compression. After further cooling the air is delivered at the designed pressure to the system.

Cooling is by water flowing through the jackets and passages either from the mains or by a radiator cooled, self contained system. Sea water cooling is used for marine applications.

Drive is by either flanged mounted motor or v-belt transmission from a suitable power source, such as electric motor or internal combustion engine.

The paired cylinders, which incorporate internal coolers and renewable liners, are mounted on the crankcase.

Main bearing bushes, big end bearing halves and small end bearings are all replaceable.

First and second stage pistons are conventional, whilst the third and fourth are of the crosshead type.

Multi-stage coolers are fitted after each compression stage and are maintained by an access door. First, second and third stage coolers are fixed, whilst the fourth stage has a withdrawable tubestack.

All stage valves are of the flat plate, low lift, multi-ported type and combine both suction and delivery functions. Ease of access, only one valve cover per cylinder and good flow characteristics are a feature of this reliable valve design.

System Description - Lubrication

A forced lubrication system is utilized, conveying oil to the big end and main bearings via a filter and crankshaft passages. Oil is forced through the bearing clearance and thrown off the rotating crankshaft to ensure an adequate supply to cylinders, pistons and small end bearings. Return flow oil is drawn through a strainer and excess pressure regulated by a spring loaded relief valve. Oil pressure is gauge indicated and sight feed glasses allow observation of the feed rate of the third and fourth stage mechanical lubricator.

..... Continued

2.0 GENERAL DESCRIPTION - cont.

The crankcase is filled through the filler fixing on the main bearing housing and the oil level is indicated in a sight glass on the crankcase end plate. The cylinder lubricator tank has a lifting cap on top for filling purposes, except when machine is fitted with automatic topping up system.

Lubricating oil to the recommended specification must be used at all times to ensure safe and efficient operation with minimum wear and protection against moist air corrosion. Recommendations are the result of extended research at Reavell Works and all responsibility for the use of an oil other than that recommended is placed on the purchaser and his oil supplier.

THE NORMAL GUARANTEE MAY BE INVALIDATED SHOULD A FAILURE BE ATTRIBUTED, BY REAVELL WORKS, TO THE USE OF A LUBRICANT NOT RECOMMENDED.

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

System Description - Controls

For starting purposes, automatic or manual unloaders/drains are fitted to all stages. Automatic unloaders provide initial venting when starting and close as the compressor attains operational speed, opening again for condensate draining when the machine is shut down.

A timer may be incorporated in the unloading circuit to effect timed drainage (compatible with environmental and operating conditions). High humditity requires more frequent draining.

Pressure safety valves are fitted at each stage.

Oil and air pressure gauges for each stage are mounted on a common panel.

Low oil pressure and high temperature switches are standard equipment.

Bursting discs are fitted to prevent excessive pressure build up in the water passages. Excessive pressure will rupture specified pressure disc to relieve internal pressure.

2.2 Synthetic Oils

These are oils which are arrived at by chemical synthesis from petroleum feed stocks, although in some cases would be from vegetable and mineral oils, rather than by straight run distillation of crude.

..... Continued

2.0 GENERAL DESCRIPTION - cont.

Advantages

1. Carbon desposits are significantly reduced compared with mineral type oils, thus extending, by 1½ to 3 times, the maintenance periods normally expected for high pressure valves.

2. Oil change periods can be increased by 2 to 3 times normally expected.

3. Wear rates are reduced.

4. These oils being produced to close tolerances have properties, and hence obtain performance, which are consistent from batch to batch.

5. Oil carry-over reduced by up to 35%.

Disadvantages

1. Compressors must be 'run-in' on normal mineral type oils and this applies both to new machines and those upon which major maintenance work has been carried out.

2. There are some materials, e.g. certain rubbers, paints, plastics and metals which are not compatible with synthetic oils (See: Compatibility of Materials Chart). Components on the 5000 series compressors are compatible with synthetic lubricants but a problem may exist with auxiliary equipment, so consult their manufacturer to determine compatibility. See: SECTION 6

The following synthetic type oils are approved:-

REAVELLITE

ANDEROL 500

CASTROL SN100

MOBIL RARUS 827

These oils are approved for use in the 5000 series compressors, having been evaluated for performance and compatibility with materials used in their construction.

The above oils have been found to give better and more consistant valve life on high pressure valves (i.e. third and fourth stages).

We have been given assurance by the manufacturers of Reavellite and Anderol 500 that they are non-toxic and suitable for use in breathing air compressors.

2.3 COMPATIBILITY OF MATERIALS WITH SYNTHETIC TYPE OILS

ACCEPTABLE	MARGINAL	NOT RECOMMENDED

A. SEAL MATERIALS

Fluorocarbon (Teflon, FEP) Fluorosilicone Rubber Silicone Rubber * Nitrile Rubber (Bruna-N,NBR) Polysulfide (Thiokol)	+ Nitrile Rubber (Buna-N, NBR) Polyurethane Ethylene-Propylene Terpolymer Epichlorohydrin	Polychloroprene (Neoprone) Natural Rubber Styrene-Butadieno Rubber (SBR,Buna-S Butyl Rubber Chlorosulfonated Polyethylene Polyacrylate Rubber Nitrile Rubber (Buna-N, NBR) x

B. PAINT

Epoxy Baked Phenolic Two Component Urethane Moisture cured Urethane	Alkyds (Baked finish preferred) Phenolic Single Component Urethane Industrial Latex	Acrylic Latex (Household type) Vinyl (PVC) Varnish Lacquer

C. PLASTICS

Nylon Fluorocarbon (Teflon) Polyacetal Polysulfone	Urethane Polyethylene Polypropylene Polycarbonate Acrylate & Methacrylate	Polystyrene Polyvinyl Chloride ABS (Acrylonitrile/ butadione/styrene

D. METALS

Steel and alloys Aluminium and alloys Copper and alloys C Tin Nickel Inconel, Monel	Cadmium	Zinc

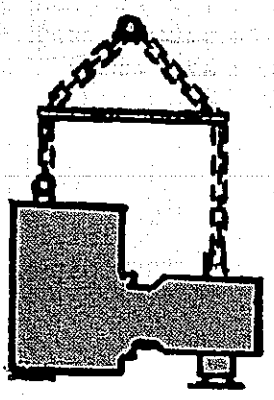
* High nitrile content (36% acrylonitrile)
x Low nitrile content (30% acrylonitrile)
\+ Medium nitrile content (30-36% acrylonitrile)
C Minimizing exposure to copper will extend the life of any oil

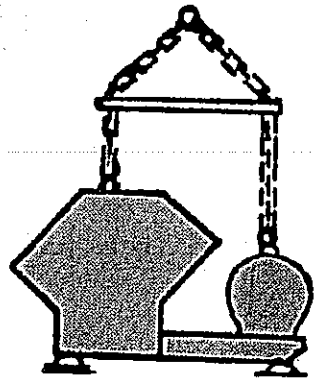
3.0 INSTALLATION

3.1 Handling of Unit

When using the compressor and motor eyebolts as the slinging attachment, it is essential that a spreader is used. The lift should always be made vertical as inclined loadings drastically reduce the eyebolts strength. Suitable shackles should be used for this operation.

DIRECT DRIVE





BELT DRIVE

1

3.2 Location

Compressor should be installed in a cool, level, well ventilated position, clear of fumes, heat or high humidity, to ensure efficient performance and also to prevent temperature problems. Should circumstances necessitate installation in an unsuitable atmosphere, clean cool air must be piped to the compressor via a suction filter to eliminate ingress of abrasive or foreign matter. Suction ducting, when fitted, must be structually rigid to withstand pulsating suction effects.

If a radiator set, it is imperative that the radiator fan works in a clean, cool direct airflow and that there is a reasonable air gap around the radiator. As a large percentage of the compressor cooling water heat is dissipated via the radiator to the inducted air stream, it is essential that expired cooling air has an unobstructed passage and exit and does not under any circumstances circulate in the immediate compressor environment.

Allow sufficient space around the installation to enable safe maintenance working conditions.

Protection from severe weather conditions is desirable.

If the ambient cooling air temperature through the radiator rises above 30°C (86°F), stop compressor and re-start when cooling air temperature drops to 30°C (86°F) or below. If it stays above 30°C (86°F) contact Reavell Works.

3.0 INSTALLATION - cont.

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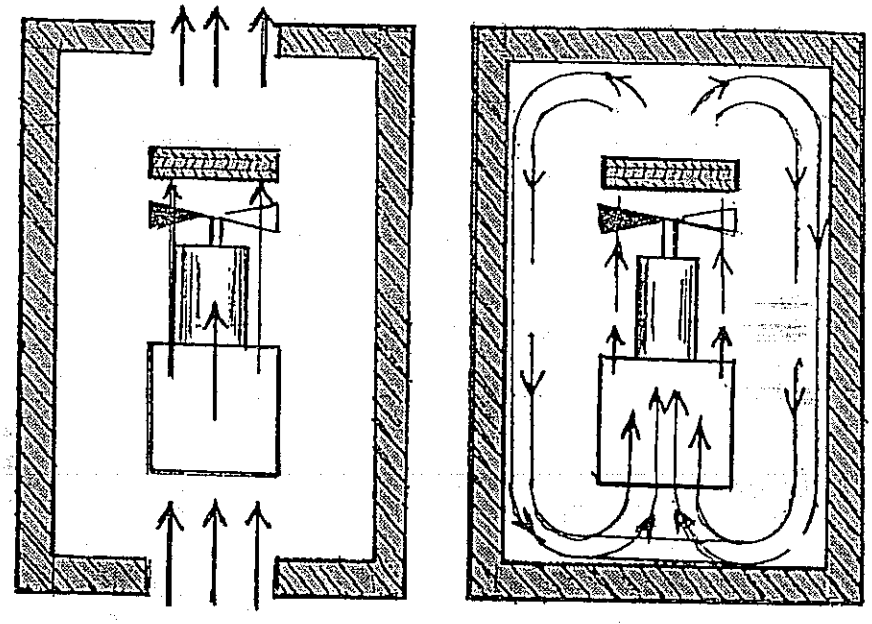

INCORRECT

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3.3 Mounting

Under normal circumstances a special foundation is unnecessary but verification must be obtained that the support floor is structually adequate as well as flat and level. If installed adjacent to vibrating machinery it may be necessary to bolt down the isolation pads but when tightening, ensure the isolation pads are not distorted.

If bedplate mounted, ensure floor is level and even surfaced, to prevent distortion.

3.4 Connections, Pipework and Fittings

Full consideration must be given to system and pipework layout. Check piping and connections are suitable for pressures and capacities and if the compressor is flexibly mounted, adjacent pipework must also be flexible.

Pipework adjoining the compressor should consist of short flexible sections to facilitate maintenance removal of pipework and absorb any vibration.

It is essential that all pipework is made and installed so that it is not constrained or distorted when connected to the compressor. Where ever possible use 90° bends with 8" (0.2 m) radius, not elbows. This should provide the discharge pipework with the necessary flexibility to allow for thermal expansion.

..... Continued

3. INSTALLATION - cont.

Before completing pipework assembly ensure all port protection plugs and blanks are removed and suction pipe sections are clear of jointing compound, scale, swarf, dirt or other foreign substance. The system must be suitably braced to prevent vibration and coupling strain on the compressor. Flexible suction piping should be suitable to withstand suction collapse.

If suction delivery is from an air main, prevent transfer of liquid from the main to the compressor pipe by connecting the latter to the top of the main pipe.

Separators and drain traps of adequate capacity should be fitted in an easily accessible low section of the pipework system to prevent condensate or oil carry over build up. These must be drained regularly.

The delivery line should incorporate non-return valves, especially for large capacity systems or where two or more compressors are linked to a common main.

Unloading and control gear piping must be as short as possible.

CompAir Reavell compressors incorporate safety valves at all stages as standard equipment. However, they also must be fitted to the receiver and pipework system to protect it from excess pressure build up.

3.5 Drive Recommendations (Direct or 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.

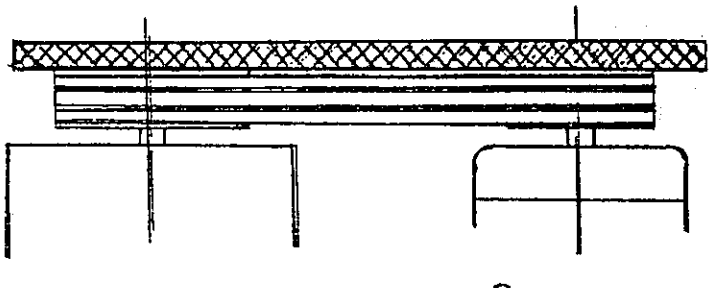
Manufacturers terminal box wiring instructions must be observed.

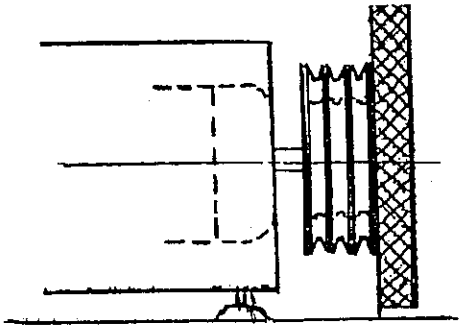
An hours run meter fitted to the motor starter is recommended for efficient maintenance scheduling.

Belt Drive

It is very important that the driving end driven pulley grooves are in line and both pulley shafts parallel. V-belt tensioning procedures follow normal BS3790, 1981, practice. See SECTION 5.

USE STRAIGHT EDGE FOR ALIGNMENT





3. INSTALLATION - cont.

Direct Drive

Ensure compressor and drive motor are correctly aligned as the flexible couplings are for vibration duties only and not as non-alignment couplings.

3.6 Cooling

Satisfactory compressor operation depends on correct cooling, which requires positive circulation of cool, clean water, free from suspended particles.

Sea water may be used for marine applications.

It is recommended that a filter be fitted in the inlet water line (Mains).

Maximum permitted water pressure within the compressor is 5 bar (75 psig) equivalent to 52 metres of water head (172 ft).

Cooling water flow rate is determined by temperature rise across the machine adjusted on site to 10°C to 12°C (18°F to 22°F).

Maximum recommended water inlet temperature is 30 °C (86°F).

It is recommended that temperature gauges are fitted to water inlet and outlet pipes to monitor water temperature (Mains).

Water flow rate at 15°C (59°F) inlet temperature will be 75 1/h/Kw (12 g/h/bhp) approximately (Mains).

Prevent overcooling by shutting off flow when running unloaded and turning off when compressor is not running (Mains).

Thermostatic water temperature control or a regulating valve or orifice in the water inlet pipe will govern water flow. The latter should only be installed where there is a constant water pressure (Mains).

A CompAir Reavell automatic water valve can be fitted to govern water supply when stopping or starting the compressor (Mains).

Water flow arrangements should be fail safe to ensure that compressor can only run on full load for short periods without water flow (Mains).

During freezing weather conditions, cooling water should be drained from the system if the compressor is not being used (Mains) or anti-freeze added to radiator sets in manufacturers specified quantities (Radiator).

3.7 Electrical Connections

Ensure compressor is installed to comply with local electricity authority stipulations and that necessary electrical work is carried out by a competent electrical engineer. Check electrical requirements for machine with manufacturer before commencing installation wiring.

3.8 Recommended Ancillaries Summary

1. Flexible pipe at final delivery
2. Overload trips
3. Water inlet and outlet thermometers
4. Water flow control
5. Separators and drain traps
6. Non-return valves

3.9 Anti-Freeze and Rust Inhibitors for use with Jabsco Water Pump

Anti-freeze - by trade name:-

DONGARD	SHELLZONE
PYRO PERMANENT	PEAK
HUBBARD-HALL	PERMA STA
SMITH BLUE COLD	PERMAGUARD
TELAR	TEXACO PT
	WILCO

- by chemical name:-

METHANOL (METHYL ALCOHOL)
ETHYLENE
GLYCOL

Suitable rust inhibitors - by trade name:-

AIDCO 29	LAZY WAY
AIDCO 44	MAC'S NO.13
AQUA CLEAR	PERMATEX
DUPONT NO.7	WILCO STOP RUST

- by chemical name:-

SODIUM CHROMATE

4. COMMISSIONING OR RECOMMISSIONING

4.1 Before Starting

Before starting up ensure one is familar with safety devices and type of control.

Ensure suction filter is in good condition. Make sure that protective blank fitted to the first stage suction is removed. Check that silencer bore and any suction pipework is clean before reassembling.

Check that the inside of the crankcase is clean and filled with the correct grade of oil until oil level sight glass is filled. Replenish if level falls below sight glass centre line.

Remove valve from each cylinder and check condition of bores. Add a small quantity of oil to the upper cylinder through valve openings. Ensure fourth stage piston is well lubricated. Liberally spray all bearings and the bottom ends of cylinder bores with recommended oil.

Check oil level in cylinder lubricator and prime pump and mechanical lubricator. Ensure pipes are primed. Remove plug from outer end cover, above force feed pump and prime with recommended oil.

Check water level in radiator and that water pump is primed (Radiator sets).

Turn over the machine at least one revolution by hand, to ensure freedom of movement.

Replace all items which have been removed, and ensure all loose tools have been cleared away.

NOTE: It is not necessary to remove any inhibitor oil which may have been applied before despatch, unless there are specific instructions attached to the machine stating otherwise.

4.2 Start-up Procedure

Check radiator is topped up on radiator sets or water is flowing in mains water installations.

Operate starter.

Check rotation immediately, a plate attached to the machine indicates correct rotation.

Ascertain air is being delivered from each stage by checking pressure gauges.

..... Continued

COMMISSIONING OR RECOMMISSIONING - cont.

Check oil pressure is above 20 psig (1.37 bar).

Check there are no uncharacteristic noises.

Check cylinder lubricator feed rate and set to 2 revs per minute each feed.

NOTE: When following this procedure after overhaul it is good practice to double the rate of feed for the first hour of operation as above.

Run for 15 minutes unloaded.

Stop and isolate the compressor and release all pressures.

Remove crankcase doors and check that bearings and running gear are not over-heating. Replace doors, ensuring joints are correctly seated.

Restart the compressor.

If appropriate, set the machine for automatic operation.

Check and adjust the control equipment settings, if applicable. For example, pressure switch.

Continue to check that machine is functioning correctly and not over-heating. If thermostats are fitted check temperatures are within normal limits.

Observe stage pressures and temperatures are normal.

Check for air, water or oil leaks.

Ensure that automatic controls are operating correctly. If machine is manually controlled open all condensate drains at 30 minute intervals.

Run at full load for one and a half hours and record compressor rpm, oil pressure and stage pressures at 30 minute intervals.

Re-set mechanical lubricator to 1 revolution per minute per feed.

4.3 After The First 100 Hours Running Time

Check crankcase oil and filter. If it is desired to use synthetic lubricant, follow directions as under.

4.4 Changing over from mineral to synthetic lubricant

Basically all compressor components in contact with the lubricant should be as clean as is practical before changing over. This is necessitated by the excellent solvency of synthetic oils which tend to loosen and remove existing deposits.

COMMISSIONING OR RECOMMISSIONING – cont.

1. Drain the old mineral lubricant completely whilst the oil is warm.

2. Remove from crankcase sump all deposits and/or sludge.

3. Renew oil filter.

4. Inspect suction and delivery valves. If they are covered by carbon and/or heavy lacquer deposits, remove and thoroughly clean.

5. When inspecting valves, also remove any heavy deposits from the accessible air passageways.

6. Where separate lubrication system is fitted for high pressure cylinders, drain and clean lubricator sump.

7. Periodically inspect downstream filters, separators and air flow passages for sludge which may have been removed from portions of the compressor which are not cleaned.

   In order to minimize the requirement for periodic inspections, follow the Operating and Maintenance Instructions recommended procedures for thoroughly cleaning all valves, air passages, intercoolers and separators.

4.4 After The First 250 Hours Running Time

Remove and examine all suction and delivery valves. Check that all safety devices are in good condition. E.g. bursting disc, corrosion rod etc.

5. OPERATION AND ROUTINE MAINTENANCE

5.1 Operation and Daily Maintenance

The commissioning procedure (SECTION 4) should be used:

(a) For the first commissioning run
(b) Following overhaul
(c) After standing idle for a long period

The exterior of the compressor, especially pipe connections and joints, should be kept clean at all times. If oil film and condensate are wiped away regularly, any leaks that occur will be more easily seen.

It is good practice to monitor and record stage pressures. This information gives a good indication of machine operation and can give advanced warning of a malfunction. The readings vary with ambient conditions but pressure readings are usually within plus or minus 4%. A useful visual indication can be obtained if the gauge glass is marked.

Starting Up

Before starting up ensure one is familiar with the safety devices and types of control (See SECTION 9).

Check oil level in crankcase and top up, if necessary, using recommended oil, until oil level sight glass is full.

Check oil level in cylinder lubricator and top up as necessary.

Check v-belts are in good condition and correctly tensioned.

Ensure there is adequate water in the cooling system (Radiator sets) or supply from mains.

Check stop valves fitted in main and control pipework are set correctly.

Check main isolator is on.

Ensure fault circuits are re-set.

For automatic starting control the machine should already be unloaded ready for starting.

Operate main control/motor starter.

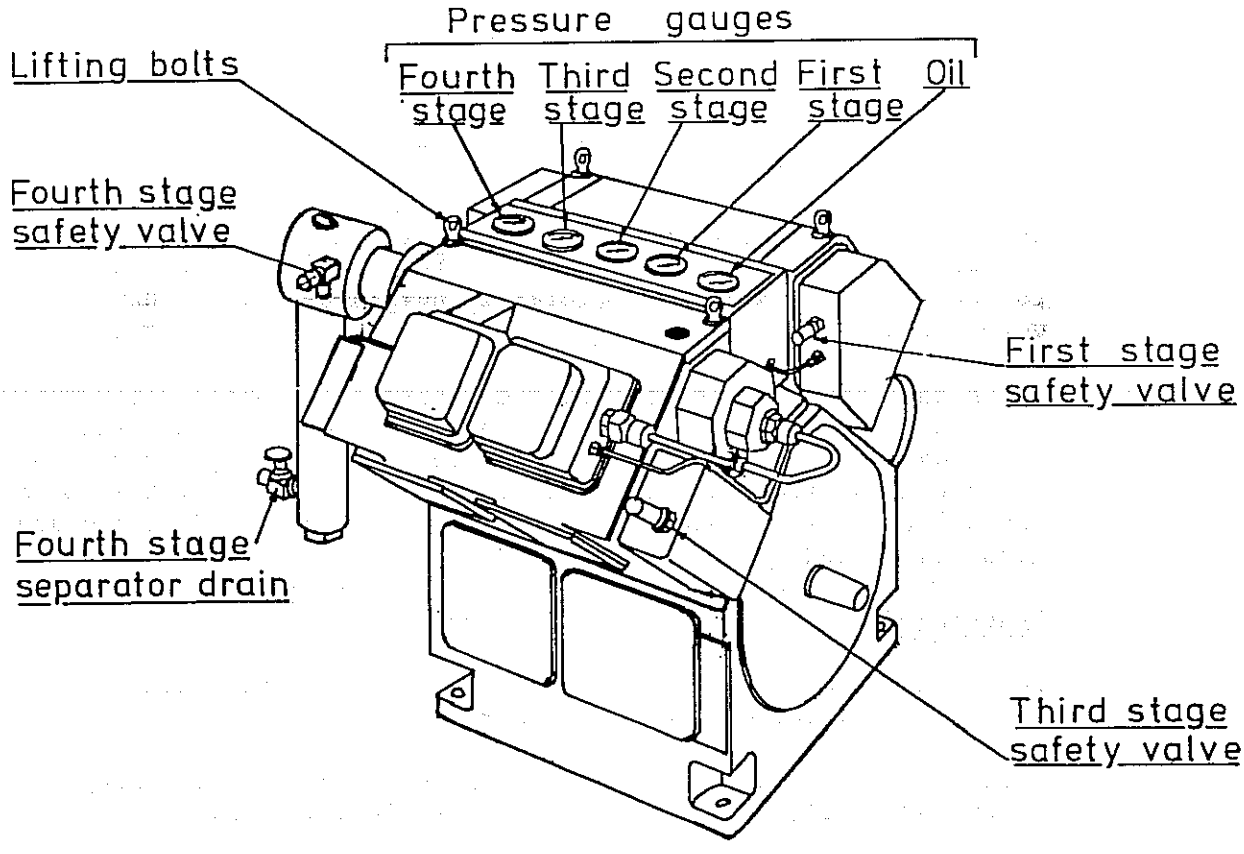
Running on Load

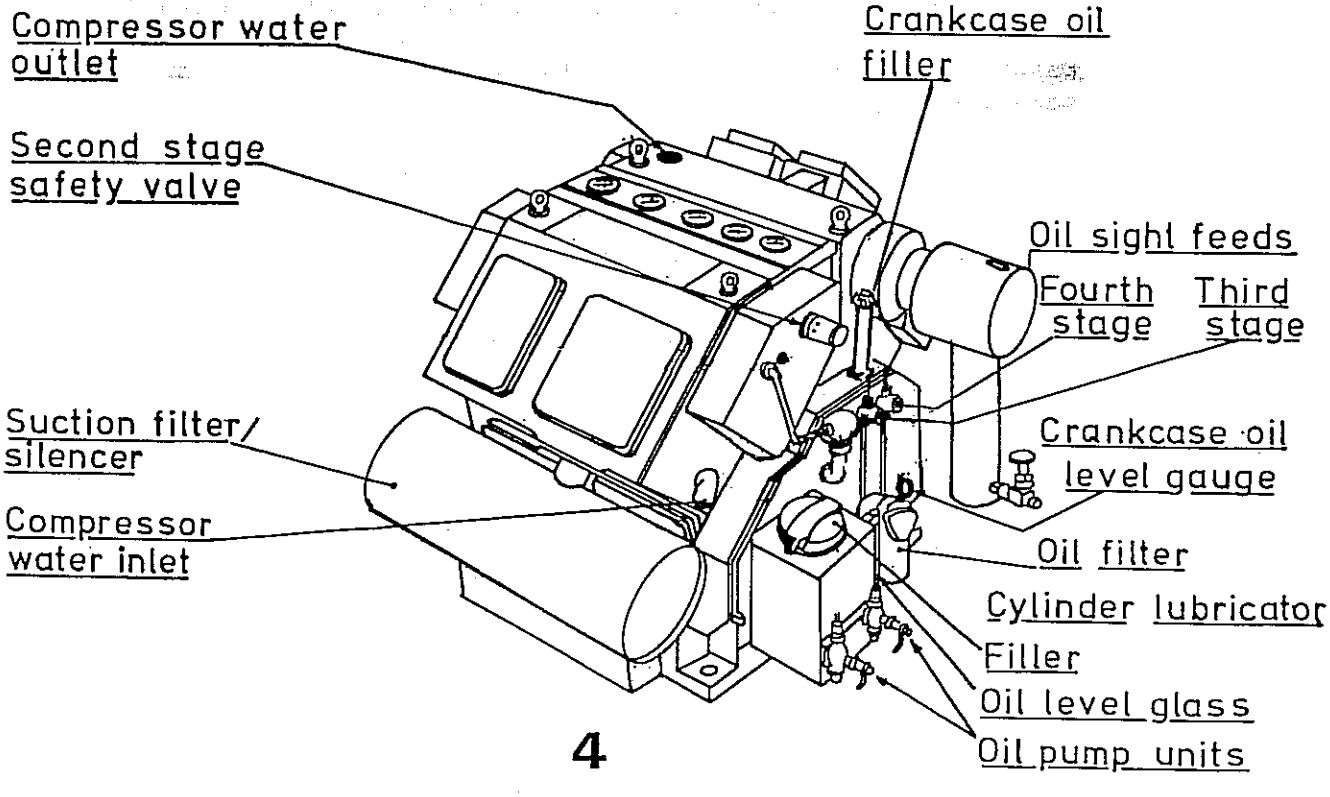
Check gauges are indicating normal pressures.

Check cylinder lubricator feed rates regularly.

..... Continued

OPERATING AND MAINTENANCE DIAGRAM





5. OPERATION AND ROUTINE MAINTENANCE - cont.

5.1 Operation and Daily Maintenance - cont.

Temperature rise of water flowing through the machine should be 10°C to 12°C (18°F to 22°F). This should be checked once the machine has settled.

Check that machine is running correctly, for example, no excessive vibration or noise.

Stopping

Machine will stop automatically if pressure falls below setting on inlet or final pressure switch. Emergency stops may be made by use of stop button on starter panel.

Standing Idle

Condenste drains will be left automatically open.

Suitable precautions should be taken to prevent cooling water from freezing, e.g. introduce anti-freeze solution to cooling system by quantity specified by anti-freeze manufacturer. (Radiator sets only).

If machine is to stand idle for more than five weeks (or shorter period if ambient conditions are unfavourable) it is advisable to carry out recommended inhibition procedure, as per Section 6.15.

5.2 Maintenance Schedule

Weekly

In addition to operational checks, check all nuts, screws and fittings for tightness and inspect for air, oil or water leaks, which should be rectified immediately.

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.

If moisture forms without emulsification, as two separate liquids, condensate may be drained from below the oil by means of 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.

..... Continued

5. OPERATION AND ROUTINE MAINTENANCE - cont.

Periodically

The optimum period between servicing will depend upon the operating conditions. Regular servicing is essential if the design performance of the compressor is to be maintained.

VALVE PLATES AND SPRINGS SHOULD BE REPLACED AT VALVE INSPECTION PERIODS.

Service 'A' - 500 Hours

Carry out initial service.

Inspect water pump for correct operation (if applicable).

Ensure correct operation of all ancillary equipment.

Replace 'o' ring and spring in final delivery non-return valve.

Ensure third and fourth stage cylinder lubricators have correct settings.

Check water treatment is correctly administered (if applicable).

Check v-belt tension (if applicable).

Check flexible couplings for wear and security.

Inspect and service third and fourth stage valves.

Change oil filter. Run unit briefly to confirm satisfactory operation.

Service 'B' - 1000 Hours

Carry out Service 'A'.

Regardless of conditions, change plate and spring in third and fourth stage valves.

Change crankcase oil and filters. If using synthetic lubricant see Section 2.2.

Run unit briefly to confirm satisfactory operation.

Service 'C' - 2000 Hours

Carry out service 'B'.

Clean out suction filter.

Clean oil strainer.

..... Continued

5. OPERATION AND ROUTINE MAINTENANCE - cont.

Remove crankcase doors and visually check running gear in crankcase. If not in good condition check main bearings for wear.

Remove top cover and check all cooler tubes for cleanliness.

Examine condition of v-belts or coupling rubbers.

Clean cylinder lubricator sight glasses.

Check condition of all cylinder bores.

Regardless of condition change plate and spring in first and second stage valve assemblies.

Check strength of anit-freeze in radiator sets.

Ensure all safety devices, i.e. bursting discs, corrosion rod and safety valves, are fully operational.

Check all pressure gauges for correct readings.

Run briefly to confirm satisfactory operation.

Service 'D' - 4000 Hours

Carry out service 'C'.

Fit reconditioned valves in third and fourth stages.

Service lubricator pumps.

Check and service diaphragm drain valves by ensuring each stage drains. If not, dismantle relevant valve, clean and reassemble.

Renew bursting discs with correct replacement discs.

Flush out and refill cooling system (radiator sets).

Service 'E' - 8000 Hours

Carry out Service 'D'.

Fit reconditioned valves in first and second stages.

All inter and aftercoolers should be hydraulically tested (water) to ensure there is no risk of tube failure. Thoroughly clean.

All flexible pipes should be changed every two years, or sooner if damaged in any way.

Replace third stage piston and liner.

..... Continued

5. OPERATION AND ROUTINE MAINTENANCE - cont.

Replace fourth stage plunger and liner.

The satisfactory performance of the compressor is sufficient indication that major component renewal is not necessary. However, it is good practice to give the compressor a full mechanical check at this stage and any out of tolerance components must be replaced.

RECOMMISSION THE COMPRESSOR AS PER COMMISSIONING PROCEDURE

The actions suggested in the foregoing maintenance periods are progressive and should be processed at each interval after the first maintenance section (service 'A').

Suggested component replacement periods result from machine trials, but will vary according to duties and environment.

5.3 Maintenance Details

Warning:

BEFORE MAINTENANCE OR DISMANTLING, ISOLATE ALL ELECTRICAL SUPPLY FROM MACHINE AND ANCILLARY EQUIPMENT. ISOLATE COMPRESSOR FROM STORAGE PIPEWORK AND RELEASE PRESSURE FROM ALL COMPRESSOR STAGES, PIPEWORK OR STORAGE VESSELS.

ALL WORK MUST BE CARRIED OUT IN COMPLIANCE WITH THE HEALTH & SAFETY AT WORK ACT, 1974.

NOTE: Numbers in brackets refer to parts list numbers, for easy identification.

Crankcase Oil

Examine crankcase oil for condensate contamination which will appear emulsified and creamy in colour. This is visible through the crankcase oil level gauge (80) and must be rectified immediately.

Remove oil drain plug (81) after compresssor has been shut down and drain crankcase whilst oil is still warm.

Trace, if possible, cause of contamination and rectify.

Fit new filter (123).

Insert drain plug (81) and fill crankcase to above centre line on oil level indicator (80) with recommended lubricant.

NOTE: Crankcase oil contamination is usually indicated by higher than normal oil level readings, due to oil being supported on top of condensate liquid.

..... Continued

5. OPERATION AND ROUTINE MAINTENANCE - cont.

Compressor Valve Inspection

The periods quoted in the table below for valve inspection are based on the use of synthetic lubricants. If mineral oils are used it is recommended that the periods be halved.

When operating these compressors under adverse running conditions, such as high ambient temperatures and pressures and utilizing mineral oil, more frequent inspection may be necessary for the final stage.

For compressors being used on light duties, i.e. low pressure, low speed and non-arduous ambient conditions, the period between valve inspections may often be increased by assessing valve condition on initial running periods and extending them to suit.

Valve Inspection Periods - Synthetic Lubricants

STAGE	5415
FIRST	4000 HOURS
SECOND	4000 HOURS
THIRD	2000 HOURS
FOURTH	1500 HOURS

Valve Removal

Valves should have a thin carbon layer and be slightly moist with oil. Special tools provided will assist in valve removal. Valve removal is a common procedure for all stages, as follows:-

Remove valve cover holding down screw/nuts (15)

Insert forcing screws into valve cover tapped holes (14,17,67,69)

Tighten forcing screws down evenly and remove valve cover.

Lift out complete valve assembly for dismantling (13,19,65,73)

Servicing Valve Assemblies

Always renew valve components in sets.

The seating face of each valve plate/ring should be clean and bright with all round even contact and be free from indentation. If severely indented, renewal of complete valve unit is essential. Should depth of wear on plate/ring reach 1/10th of thickness or they are not flat or are cracked in any way, they must be renewed.

Check valve spring for wear and damage and renew if necessary.

Keep spare oiled and maintained set of valves in store for quick compressor servicing.

5. OPERATION AND ROUTINE MAINTENANCE - cont.

Valve Re-assembly

For correct valve assembly sequence see valve drawings overleaf and sub-section 8.

Completely clean all components, as obstructed passages will adversely effect valve operation.

Ensure valve plates/rings are reassembled with existing faces contacting. NEVER REVERSE A VALVE PLATE/RING.

Check centre suction plate moves downwards to open, and delivery upwards.

First Stage DIAGRAM 7

Using suitable metal ring or distance piece X as an assembly fixture, lay (7) centrally on X with pegs (A) (B) and (C) facing upwards.

Place (8) on peg (A) followed by collar (9).

Insert springs (10) with hole A on peg A.

Place large slotted springs (12) with locations B and C on pegs B and C.

Follow this with slotted valve plate (13) as with slotted springs.

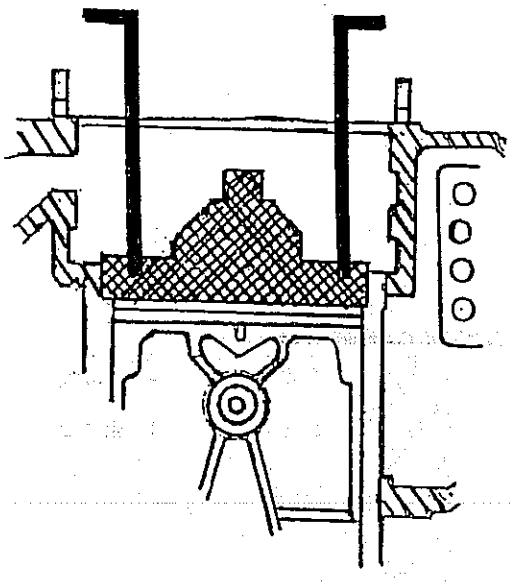
Gently place lower body (14) with centre stud passing through plates and springs to allow pegs B and C to enter holes in body plate B and C.

Centre stud of lower body (14) will now be protruding through plate and spring assembly into distance piece X.

Holding assembly tightly together, screw nut (6) on centre stud and tighten to torque wrench settings as per Section 1.

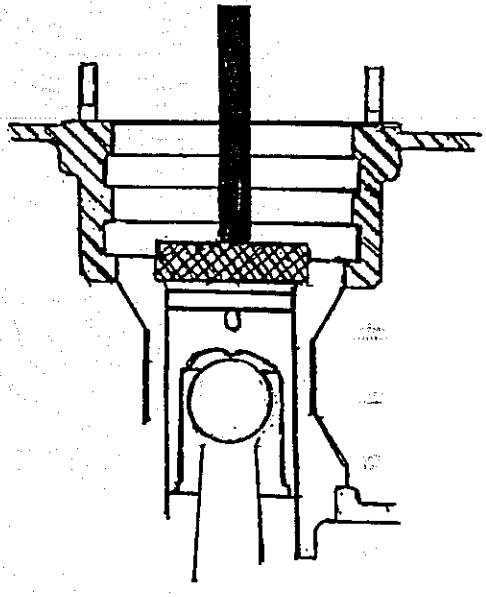
It may be necessary to restrain springs and spring plates during assembly using method suggested in DIAGRAM 8.

NOTE: Valves assembled by this method are up-side down. Turn over before replacing in compressor.



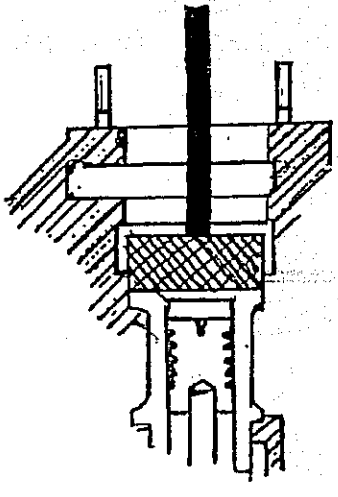
FIRST STAGE

Valve Lifter
Part Number C.200066/1



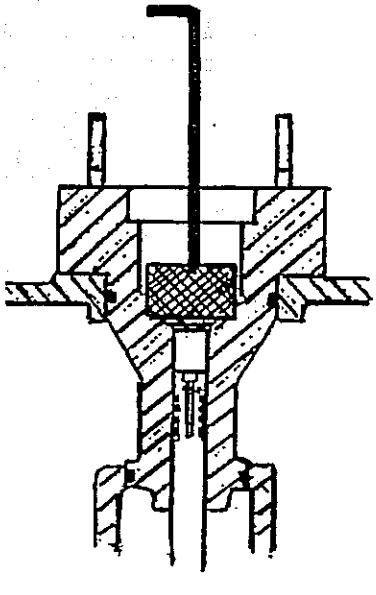
SECOND STAGE

Valve Lifter
Part Number C.200142



THIRD STAGE

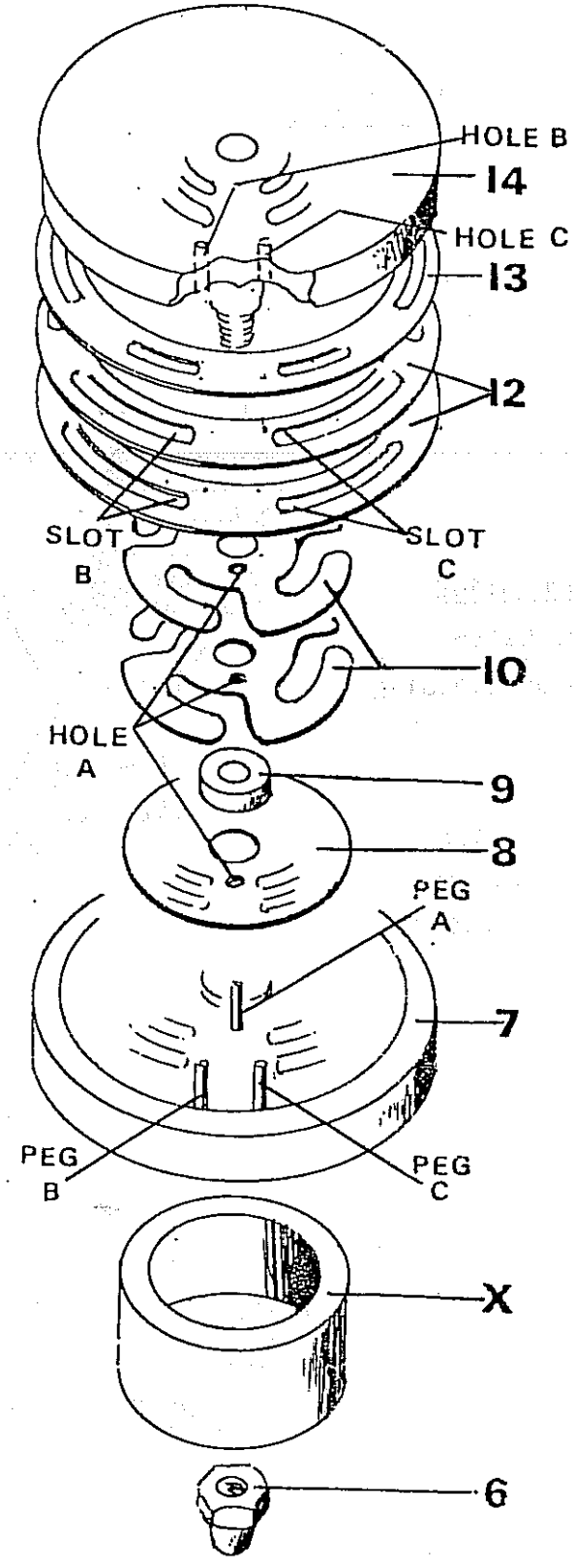
Valve Lifter
Part Number C.200142



FOURTH STAGE

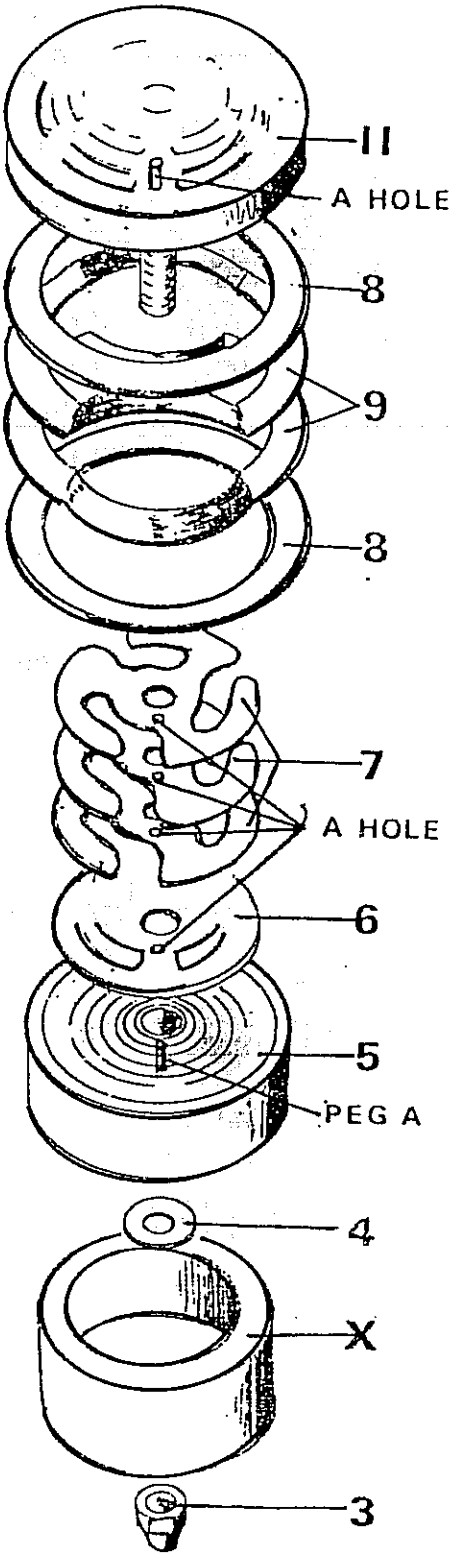
Valve Lifter
Part Number C.200066/1

Some versions of this valve
have 3 of Item 12 instead of 2



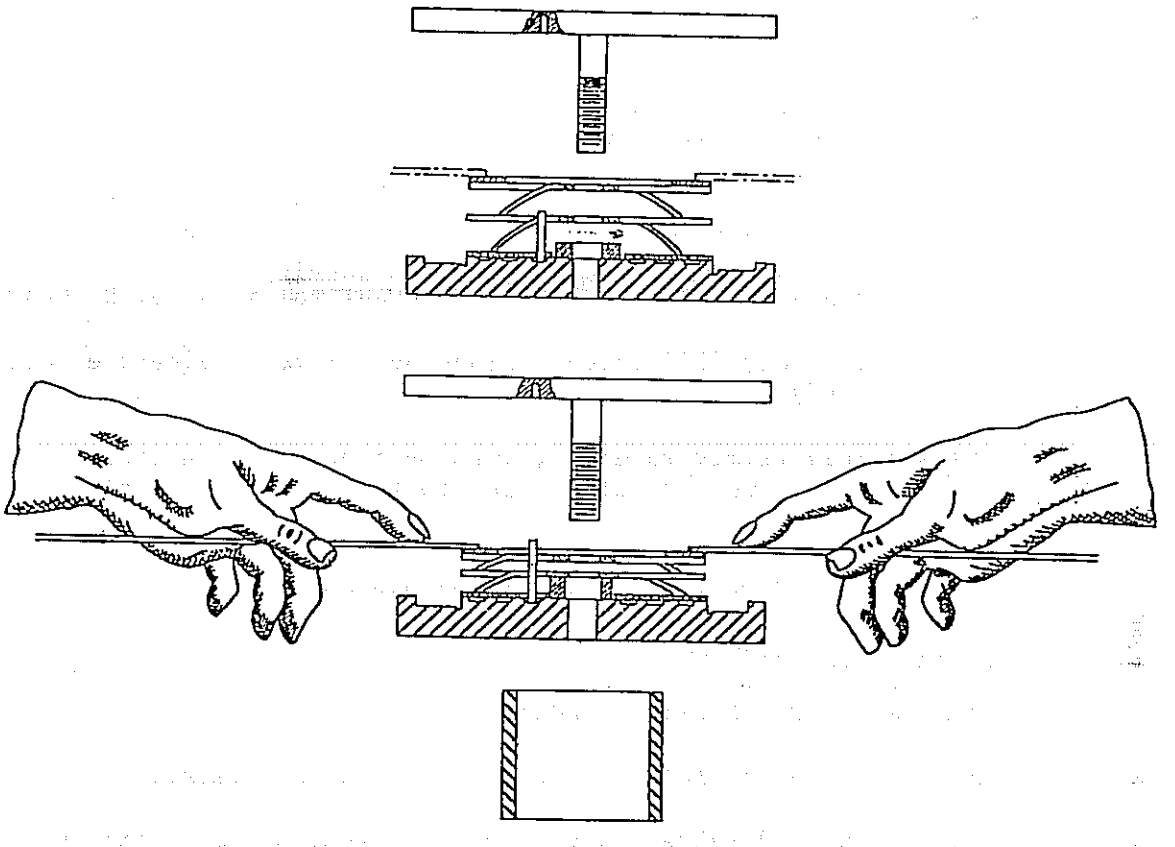
FIRST STAGE VALVE

DIAGRAM 6



SECOND STAGE VALVE

DIAGRAM 7



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Second Stage DIAGRAM 8

Using suitable metal ring or distance piece X as an assembly fixture lay (5) centrally on X with peg A upwards.

Place valve plate (6) over peg A followed by three valve springs (7) also on peg A.

Insert valve ring (8) in recess in (5) and bowed springs (9) assembled as shown in drawing I, to give bowed effect, and insert in plate (8).

Place upper valve plate (8) on spring assembly and restrain with steel rules, as per DIAGRAM. 8.

Gently insert lower body with centre stud passing through springs and plates and upper body (5) peg A fits into line hole A on (11).

Holding assembly firmly together, place washer (4) on centre stud, nut (3) and tighten up as per torque wrench settings SECTION 1.

See NOTE at end of first stage valve assembly.

5.0 OPERATION AND ROUTINE MAINTENANCE - cont.

Third Stage DIAGRAM 9

Using suitable metal ring or distance piece X as an assembly fixture lay upper body (5) centrally on X.

Place valve plate (6) on body (5) followed by spring rings (7) in bowed position as per drawing J.

Insert valve ring (8) into recess in body (5) followed by spring rings (9) also in bowed position and then valve ring (8).

Restrain rings and plates with stiff steel rules as per DIAGRAM 8.

Insert lower body (11) through rings and plates and centre holes in upper body (5).

Hold assembly firmly together, turn over and place washer (4) on centre stud and nut (3) tightening to torque wrench setting SECTION 1.

See NOTE at end of first stage valve assembly.

Fourth Stage DIAGRAM 10

Assemble in two stages as under:-

Place body (7) on flat surface with peg (A) uppermost.

Insert plate (8) valve plates (9) in correct bowed positions followed by plate (8).

Gently place top plate (10) onto assembly ensuring peg (A) fits into recess.

Insert retaining screws (2) and tighten.

Turn assembly upside down and place plate (5) valve plates (6) in position with correct bow, and follow with plate (5).

Place cover (4) in position, insert screws (2) and tighten.

Ensure 'o' ring (3) is correctly inserted in cover groove.

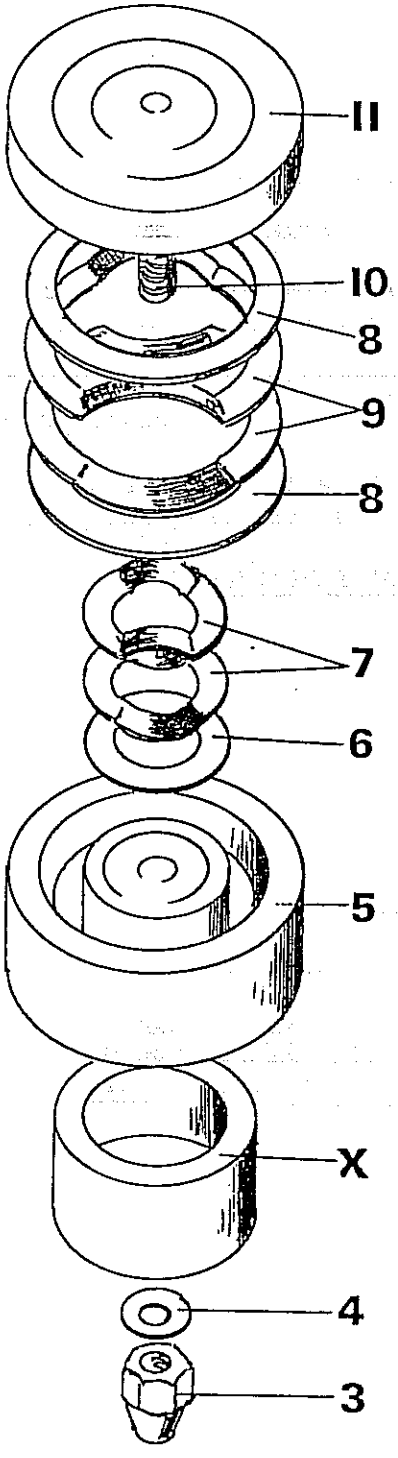
See NOTE at end of first stage valve assembly.

General

Ensure valve pocket is clean before replacing valve assembly.

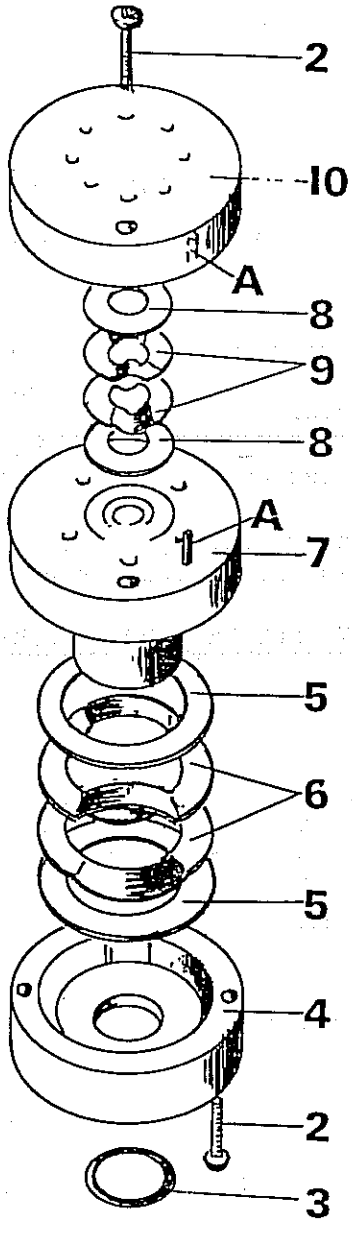
When fitting new valve it should be lapped into its pocket using fine carborundum paste and finishing with metal polish. Ensure complete cleanliness before fitting.

Ensure valve beds properly as at pressure a slight misfit will entail the loss of a large amount of air.



THIRD STAGE VALVE

DIAGRAM 9



FOURTH STAGE VALVE

DIAGRAM 10

5.0 OPERATION AND ROUTINE MAINTENANCE – cont.

Check valve cover for cleanliness before re-assembly, and that it beds down evenly.

Renew 'o' rings, slightly greasing before fitting.

NOTE: THERE SHOULD BE A 2 MM GAP BETWEEN THE TOP OF CYLINDER AND BOTTOM OF VALVE COVER.

Pressure Gauges (154,156,158,160)

Relate pressure readings against a gauge of known accuracy and if faulty, renew.

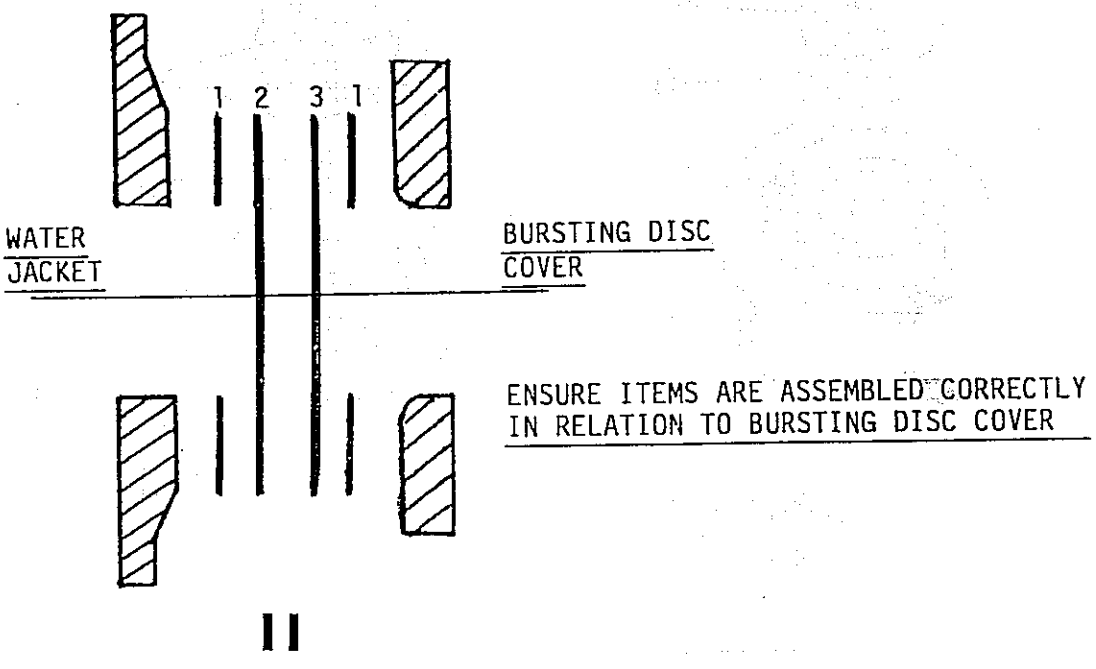
Bursting Discs (57,58,59)

Should a rupture occur, stop compressor immediately and turn off cooling water supply.

Rectify cause of excess pressure before fitting new bursting discs.

Fluctuating water pressure can cause such failure and if pulsing water supply is unavoidable, renew bursting discs more frequently than scheduled.

USE ONLY GENUINE COMPAIR BURSTING DISC AS REPLACEMENT



PART LIST

1.	BURSTING DISC JOINT	1/64" CAF	2
2.	BURSTING DIAPHRAGM (0.003")	MELINEX	1
3.	BURSTING DIAPHRAGM (0.004")	PIFE COATED ALUM	1

5.0 OPERATION AND ROUTINE MAINTENANCE

Corrosion Rod (197)

If severe electrolytic action is encountered inspect rod more frequently than specified in maintenance cycle.

Cylinder Lubricators (127)

After extended periods of operating, examine all valves, springs and plungers (See: SECTION 6). Prime after servicing by means of hand lever.

Sight Feed (133)

Replace if defective as it is not possible to service the rotary sight feeds.

Removal of Carbon Deposits

First, Second and Third Stage Separators

Remove screw plugs for access, immerse in boiling water or steam clean.

Fourth Stage Cooler Cover

Dismantle, scrape as necessary, steam clean or flush clear using hot water.

First and Second Stage Delivery Passages

Check visually after removing first stage separator.

Remove cooler body from machine for cleaning, scraping or brushing out deposits.

Steam clean or flush clean with boiling water.

Valve Covers and Cylinder Ports

Visually check, remove any carbon deposits ensuring loose carbon does not enter cylinder.

Suction and Delivery Pipes

Check ends for carbon deposits.

Remove by immersing in boiling water or steam clean.

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 or tensionmeter 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 - See: DIA.11. For example, the deflection for a span of 1 metre would be 1000 mm x 0.015 mm or 15 mm.

5.0 OPERATION AND ROUTINE MAINTENANCE - cont.

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 force below the lower value 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.

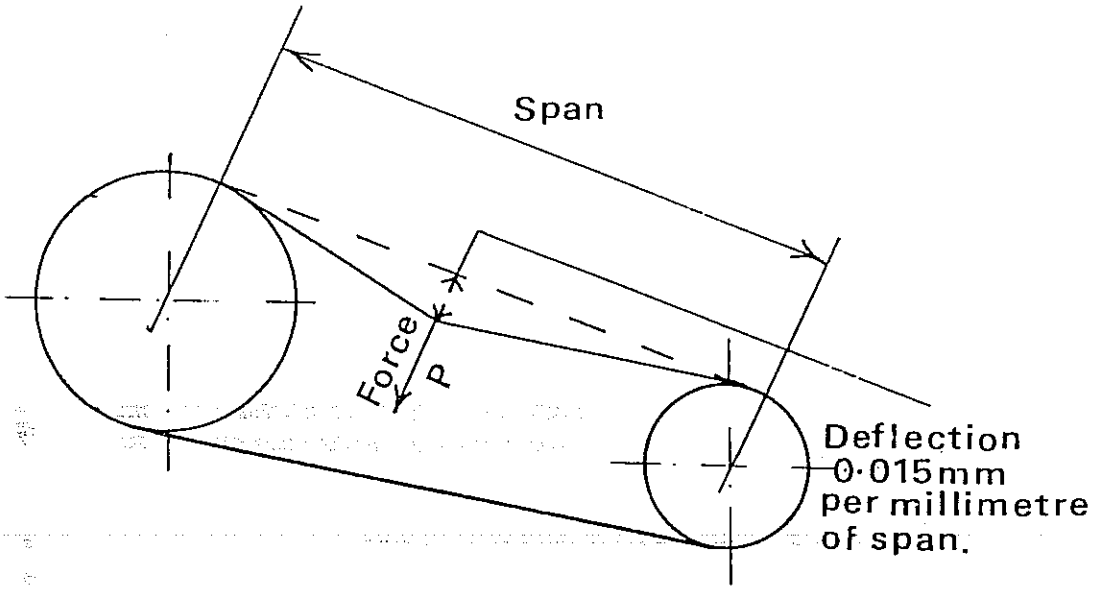
All belt drives should be watched carefully during the running in period after initial start-up. Re-tensioning should be carried out by the above procedure, when necessary.

First, Second and Third Stage Cooler Tubes (88,112)

Visually check with light shining through tubes. Clean by passing suitable diameter rod gently through tube followed by tube brush, and finish with air gun cleaning.

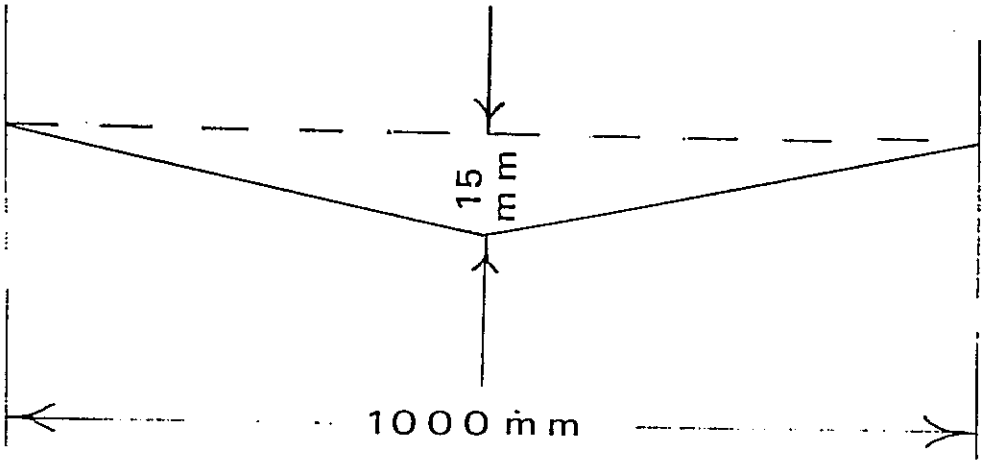
Fourth Stage Tube Stack (103A)

Remove and immerse in boiling water or steam clean whilst in position.



BELT DEFLECTION MEASUREMENT

EXAMPLE–1000mm x 0·015mm = 15mm deflection.



12

SMALLER PULLEY DIAMETER	REQUIRED DEFLECTION FORCE 'P' AT CENTRE OF SPAN FOR COMPRESSOR SPEED RANGES OF:	
	725 RPM – 1230 RPM	1300 RPM – 1500 RPM
MM	NEWTONS	NEWTONS
160 – 265 265 and above	35 – 50 52.5 – 64	29.5 – 34 52 – 57

6. OVERHAUL

The following overhaul procedure provides a basis for compressor dismantling in manageable sections for examination, further dismantling, if necessary, and reassembly.

6.1 Pipework

Remove gauge panel to gain access to pressure gauges and water and air transfer lines.

6.2 Suction/Delivery Valve Assemblies

Remove all valve covers and valves (See: SECTION 5)

6.3 Cylinders and Running Gear

Remove crankcase door screws (83), doors (84) and joints (85).

First Stage Running Gear

Release big end bearing bolts (31), cap (32), bearings (34).

Withdraw running gear through cylinder top by means of special lifting tool. (DIAGRAM 13).

Second Stage Running Gear

Release big end bearing bolts (31), cap (32) and bearings (34).

Withdraw running gear through cylinder top by means of special lifting tool (DIAGRAM 13).

Cylinder Block (if fitted)

Support cylinder blocks (8) weight before removing cylinder block to crankcase fixing screws (7).

Third and Fourth Stage Running Gear

Release big end bearing bolts (28), cap (29) and bearings (31).

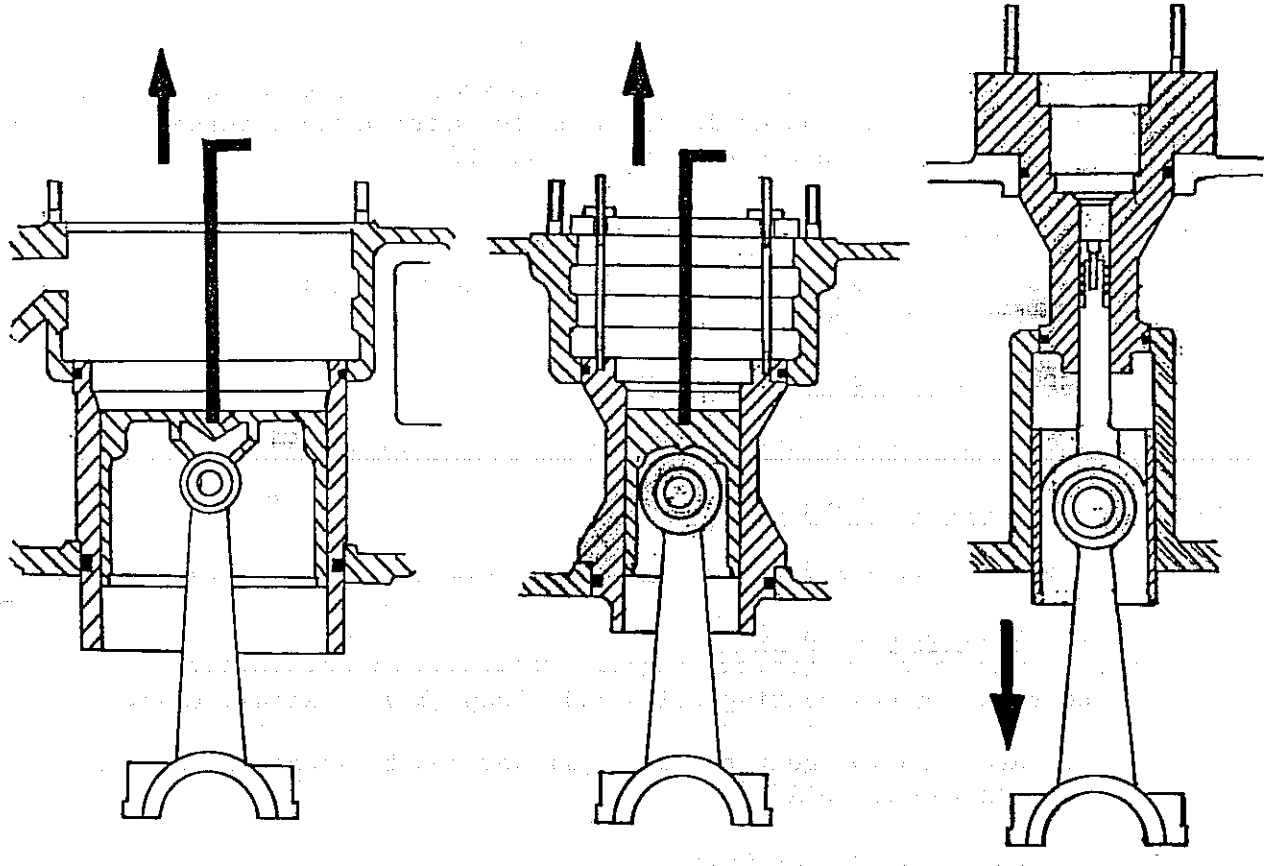
Remove running gear and crosshead (49 and 56) through crankcase DIAGRAM 12.

Cylinder Block (if removing)

Support cylinder block (60) weight before removing block to crankcase fixing screws (7).

..... Continued

6.0 OVERHAUL - cont.



FIRST STAGE
Piston Lifter
Part Number C.200223

SECOND STAGE
Piston Retainer
Part Number C.200223
Liner Withdrawing Gear
Part Number: Bar C.200413
: Stud C.200419

THIRD AND FOURTH STAGE
Remove through crankcase

13

6.4 Oil Pump Outer End Chain Cover and Cylinder Lubricator

The outer end chain cover (139) is removed complete with oil pump (124) and cylinder lubricator (127) attached, by removing all the end cover securing screws (126) including the two which pass through the oil pump.

The driving chain (115) can then be disconnected by releasing chain tensioner (116) and uncoupling the chain connector link.

6. OVERHAUL - cont.

6.5 Flywheel (Direct Coupled) or Flywheel Pulley (V-Belt Drive)

If compressor is direct coupled to a flanged motor with bell housing, remove motor complete with bell housing and half coupling.

Remove coupling securing screws, tab washer and keep bolt.

Support flywheel or flywheel pulley and release from crankshaft.

Withdraw flywheel pulley key.

6.6 Main Bearing and Crankshaft

Remove lubricating pipes (145, 150, 151) from crankcase interior.

Remove main bearing housing screws at driving end (77) and main bearing housing (79).

Support weight of crankshaft using lifting tackle or blocks.

Carefully remove crankshaft through driving end of crankcase.

Remove main bearing housing screws at outer end (2 & 3) and outer end cover and housing.

6.7 Overhaul, inspection and reassembly

Thoroughly clean all components using a suitable solvent and allow to dry.

NOTE : ALWAYS OBSERVE STATUTORY SAFETY PRECAUTIONS APPLICABLE TO SOLVENT USED.

Should more stringent methods be necessary, ensure that no metal is removed from the machine's working surfaces.

See: SECTION 1 for clearances and tightening torques.

6.8 Crankshaft and Bearings

Examine main bearings (6) for wear and renew, if necessary.

Great care must be exercised when pressing out old bearings and replacing new ones, to prevent damage to bearing faces.

When inserting new bearings ensure all holes are correctly aligned.

If new bearings are not drilled for oil holes, drill appropriate sized hole and clean hole edges.

..... Continued

6.0 OVERHAUL - cont.

If crankshaft journals are scored oval or worn beyond recommended limits, renew crankshaft or have worn crankshaft professionally re-worked to correct dimensions. IF IN DOUBT CONSULT COMPAIR REAVELL, IPSWICH.

When refitting crankshaft, check end float (See: SECTION 1).

Metal to metal jointing compound may be used on main bearing housing.

6.9 Flywheel Pulley

Examine for signs of fretting on bore and/or visible wear on belt groove.

6.10 Oil Pump, Chain Drive and Cylinder Lubricator

After extended operation, cylinder lubricator plungers may require overhaul. Proceed as follows:

Drain oil from lubricator reservoir.

Remove plungers, examine ball type non-return valve and springs, renewing any item showing damage or wear.

Reassemble lubricator and fill lubricator reservoir to correct level with recommended lubricant.

Regulate pump output by adjusting position of regulator sleeve and locknut.

NOTE: Feed pipe must be carefully primed before operating the compressor. Remove the small bleed screw on the pump unit to prime pump system.

6.11 Oil Pump

If pump is not delivering lubricant at the correct pressure of approximately 40 psig (2.6 bar) examine filter for cleanliness and renew, if necessary. If this does not effect a cure, fit new pump assembly.

When reassembled, remove plug from outer end cover above force feed pump and prime with recommended oil.

6.12 Outer End Chain Cover

When refitting chain cover, ensure pump drive engages crankshaft. Always fit new joints during overhaul reassembly.

6. OVERHAUL - cont.

6.13 Running Gear and Cylinders

Third and Fourth Stages

Examine big end bearings (31) and if worn, renew.

Extract internal circlips (36) and with a soft drift gently tap out gudgeon pin (42). Examine for wear and check dimensions. Renew, if necessary.

Inspect liners (63 & 74A), pistons (49 & 56) and piston rings (48 & 53) for wear, after cleaning, and renew any worn components.

If new liner is fitted always renew 'o' rings (62,64,70,71), lightly coating with silicone grease before insertion.

Reassemble crosshead/piston guide and insert in cylinder from crankcase, hand pressure being sufficient to restrain piston rings whilst carrying out this procedure.

ALWAYS RENEW CYLINDER COVER 'O' RINGS BEFORE REFITTING CYLINDER COVERS

First and Second Stages

Remove all piston rings (37,38,39,40) from pistons (34 & 41).

Thoroughly clean and check for wear and ring gaps and renew rings, if necessary.

Extract internal circlips (36) and with a soft drift gently tap out gudgeon pins (35 & 42). Clean components, examine for wear and renew as necessary.

Check liner (10 & 21) bore for wear or damage.

Check big end bearing (31) and renew if worn.

When fitting new liner always renew 'o' rings (11,12,20,22), lightly coating with silicone grease before fitting.

ALWAYS RENEW CYLINDER COVER 'O' RINGS BEFORE REFITTING CYLINDER COVERS

WHEN REPLACING FIRST STAGE PISTON, USE PISTON RING COMPRESSOR C.200444A.

Reassemble as DIAGRAM 15.

RECOMMENDED METAL TO METAL JOINTING COMPOUND MUST BE USED BETWEEN CYLINDER AND CRANKCASE. (HYLOSIL 302)

6. OVERHAUL - cont.

6.14 Coolers See DIAGRAM 13

First, second and third stage cooler tubes are fitted in position to the cylinder casting, accessible by removing the cylinder block cooler doors, whilst the fourth stage is removable from the machine.

Exterior of tubes can be cleaned with high pressure water or air jet but refer to SECTION 5.10 for interior cleaning.

Water test to specified test pressure to detect leakage. If tubes are in a poor condition, renew, ensuring that tightness of other tubes is not impaired during the process.

To remove tube (A) drill off one beaded tube and using suitable sized drill so that the tubeplate will not be damaged (B).

Insert slightly larger tube bore sized screw tap (B & C), pass rod through tube (C) and gently hammer tube free. Clean holes in tubeplate without removing metal and insert replacement tube, ensuring measurement X is equal. Using tube expander (D) expand the tube into block and bead over at each end with beading tool (E).

Hydraulically test to pressures shown in Leading Particulars.

6.15 Inhibition for Storage

For Short Term Storage (up to six months)

Start compressor with all interstage and separator drains open and run this for 10 minutes to expel all condensate from cylinders and coolers.

Stop compressor, drain off sump oil and wipe out sump with lint free clean cloth. Remove all valves from cylinders, clean and examine for defects, dip in PX4 * inhibitor and allow surplus to drain off.

With valves still removed, examine all cylinder bores through valve ports and if satisfactory spray bores with PX4 * inhibitor, turning compressor by hand to distribute fluid over all surfaces.

Replace valves, close all openings with redcaps + or masking tape. Attach label with date of inhibition.

For Long Term Storage (Up to three years)

Start compressor with all interstage and separator drains open and run this for 10 minutes to expel all condensate from cylinders and coolers.

Stop and isolate compressor, drain oil from sump while warm and re-charge sump with PX4* corrosion inhibiting fluid. Restart

..... Continued

6. OVERHAUL - cont.

6.15 Inhibition for Storage - cont.

compressor and run on light load with drains open, for 20 minutes, to distribute fluid all over internal surfaces.

Stop compressor, drain PX4* from sump and wipe out surplus fluid with clean cloth.

Remove inlet and outlet valve units from all cylinders, clean and examine for defects and dip units in PX4* fluid and allow surplus to drain off.

Exmaine all cylinder bores through valve ports and if satisfactory, spray bores with PX4* fluid, rotating compressor slowly by hand to distribute fluid over cylinder surfaces.

Replace valves, secure valve covers and seal all openings with plastic caps or masking tape. Attach labels with date of inhibition.

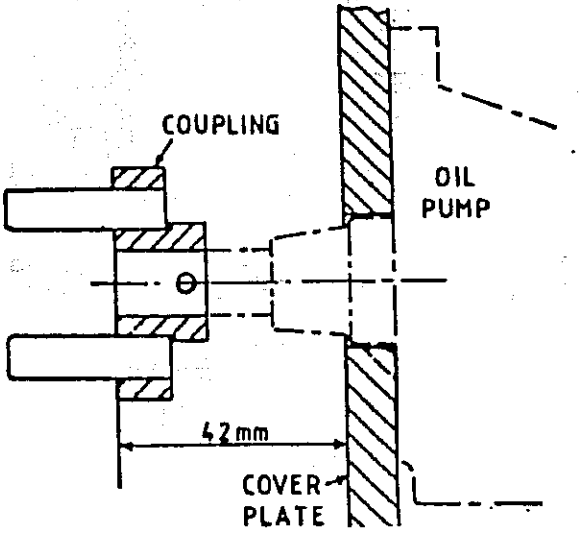
Before returning the machine to service a thorough examination of the compressor and ancillary equipment should be carried out.

6.16 Oil Pump and Chain Drive Fitting

Oil Pump

If the pump is not delivering lubricant at the correct pressure of 40 p.s.i.g. (2.6 bar) fit new assembly. This necessitates removing the tension pin and gear drive fittings from the new pump drive shaft. The shaft is then passed through the cover plate, the drive fitting installed on the shaft end and the tension pin re-fitted. For dimensions, see sketch.

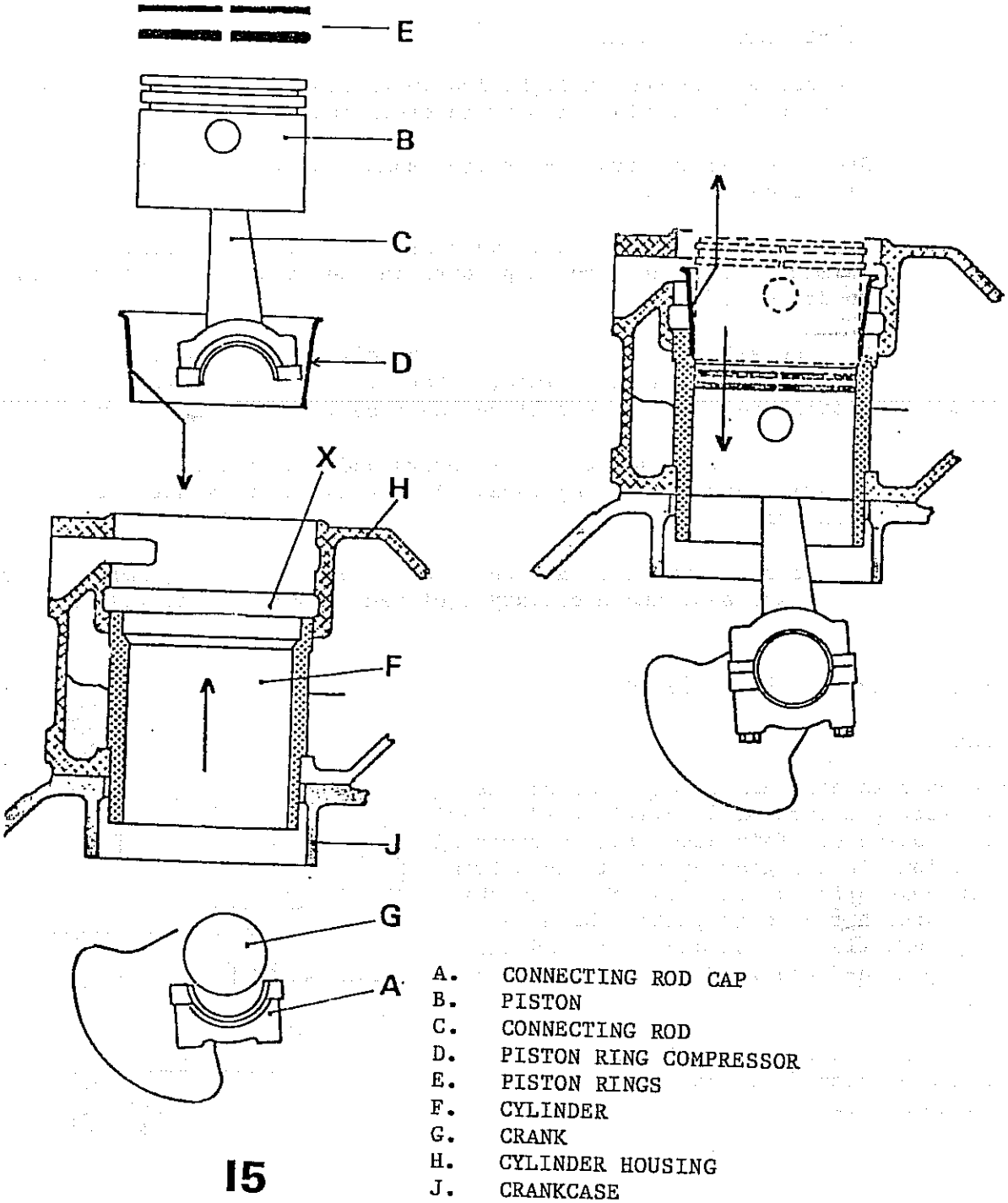
When re-assembled, remove plug from outer end cover above force feed pump and prime with a recommended oil.



* PX4 is to Specification DEF STAN 80034/1/. Trade name Crodafluid PQ11

6.17

USING PISTON RING COMPRESSOR



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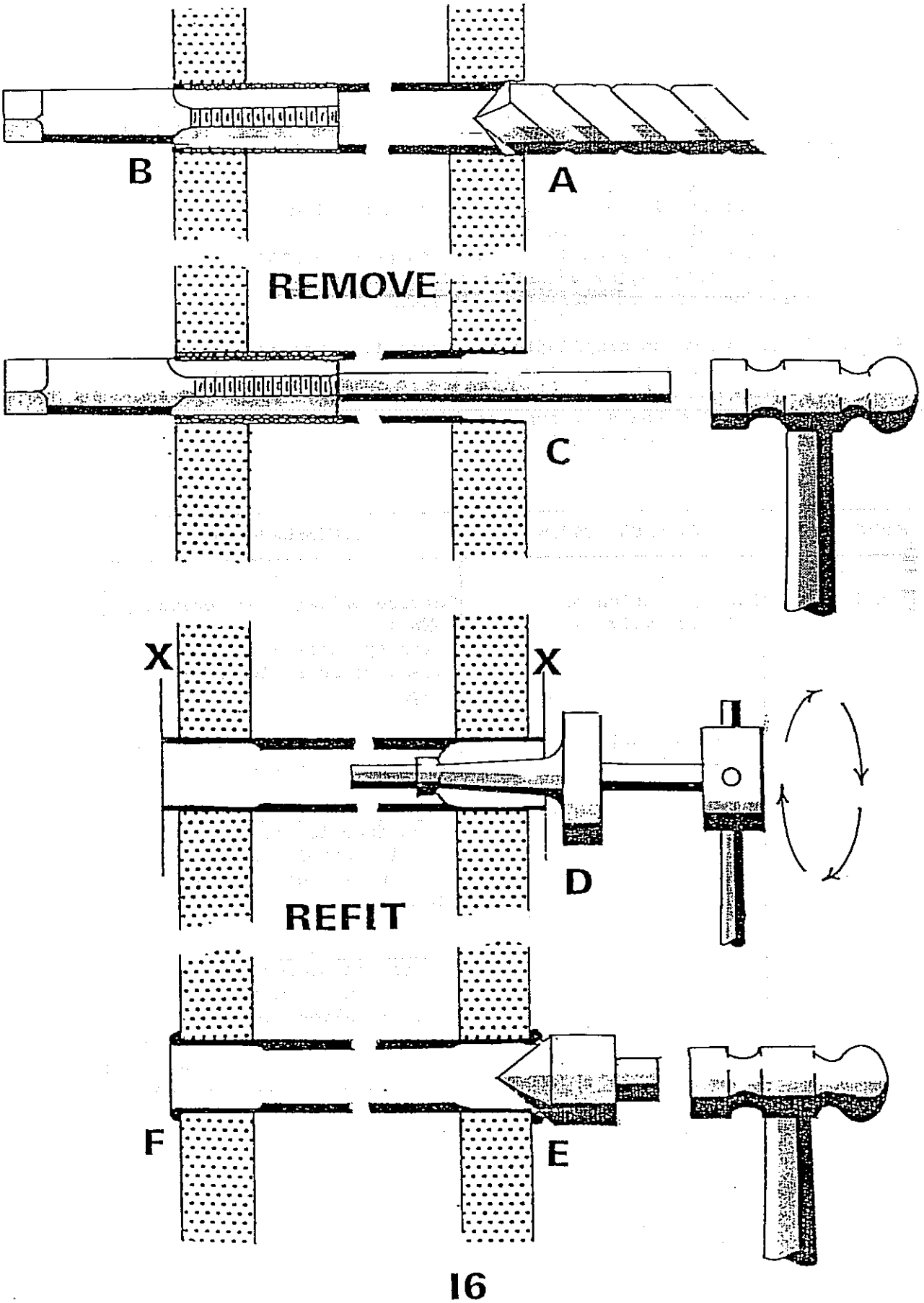
A. CONNECTING ROD CAP
B. PISTON
C. CONNECTING ROD
D. PISTON RING COMPRESSOR
E. PISTON RINGS
F. CYLINDER
G. CRANK
H. CYLINDER HOUSING
J. CRANKCASE

PROCEDURE

1. Remove connecting rod cap (A)
2. Withdraw piston (8) and connecting rod (C)
3. Press ring compressor (D) into seat (X)
4. Fit piston rings (E) into grooves in piston (B)
5. Press piston (B) into cylinder (F) through ring compressor (D)
6. Fit connecting rod (C) to crank (G) and fit cap (A)
7. Withdraw piston ring compressor (D)
8. Fit valves, valve cover etc.

6.18



7. FAULT GUIDE

The suggestions are a guide to the more common aspects of fault location. It is assumed that :-

1. Cooling water inlet temperature is correct.
2. Temperature rise across machine is within limits.
3. Cooling water flow rate is correct.
4. Efficient driving unit and adequate power supply.
5. Correct uncontaminated lubricant.
6. Fully operational lubrication system

NOTE : 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.

FAULT	PROBABLE CAUSE	RECOMMENDATION
7.1 EXCESSIVE PRESSURE	Faulty suction or delivery valve(s)	Service valve(s) as necessary. NOTE : A faulty suction valve gives excess pressure in previous stage.
	Pressure gauge inaccurate	Check gauge against instrument of known accuracy.
	Pipeline restriction	Existing Installation Check functioning and setting of all control valves. Clean pipeline filters and service elements. New Installation Ensure all protective plugs are removed from ports and control valves are set correctly. Ascertain pipework is of adequate dimensions with minimum of bends. Check joint gaskets for correct positioning and size.
	Final delivery pressure control fault, i.e. air governor (relay) or pressure switch.	Automatic Control Inspect control equipment for malfunction, rectify as necessary.

.... Continued

FAULT GUIDE - Continued

FAULT	PROBABLE CAUSE	RECOMMENDATION
7.2 INSUFFICIENT PRESSURE OR VOLUME See Also : Excessive Pressure	Blocked suction filter	Remove and service.
	First stage suction valve fault	Remove, examine and rectify.
	Air leakage from machine/ system	Locate and rectify. Check drain valves.
	Wear	If general wear is suspected, strip machine, examine components and renew as necessary.
	Loss of drive	Check coupling, v-belt drive and tension
7.3 OVERHEATING See Also : Excessive Pressure and Insufficient Pressure	Above maximum recommended operation.	Reduce operation level
	Reduced cooling efficiency	Examine cooler(s) for partial blockage.
7.4 EXCESSIVE NOISE See Also : Insufficient Pressure	Machine set up or pipe-work system vibration	Examine machine seating, ascertain pipework system is firmly secured, check clearances and alignment of couplings and tension of v-belts
7.5 EXCESSIVE WEAR	Excessive speed and/or pressure	Operation within limits.
	Dirty air and/or suction pipeline	Examine filters and renew elements. Clean out suction pipeline.
	Excessive side or end thrust	Check alignment and clearance of couplings and v-belt tension
	Excessive moisture content in air cylinder	Check drainage system and crankcase oil for contamination
7.6 EXTENDED RUNNING	Insufficient speed or machine capacity too low	Up-rate machine if possible or install parallel unit or larger replacement. Check v-belt.

.... Continued

FAULT GUIDE - Continued

FAULT	PROBABLE CAUSE	RECOMMENDATION
7.7 FAILURE TO START	Seizure	Failure to turn freely when unloaded indicates a serious fault. Examine and ensure there are no broken or damaged components, before attempting to re-start.
	Electrical or control fault	Trace and rectify.

5415 MARK 1

ILLUSTRATED LIST OF PARTS

ISSUE 5

THIS SECTION IS OBSOLETE AND INCLUDED FOR REFERENCE ONLY.

SEE SEPARATE PUBLICATION 5415 WHEN ORDERING SPARE PARTS.

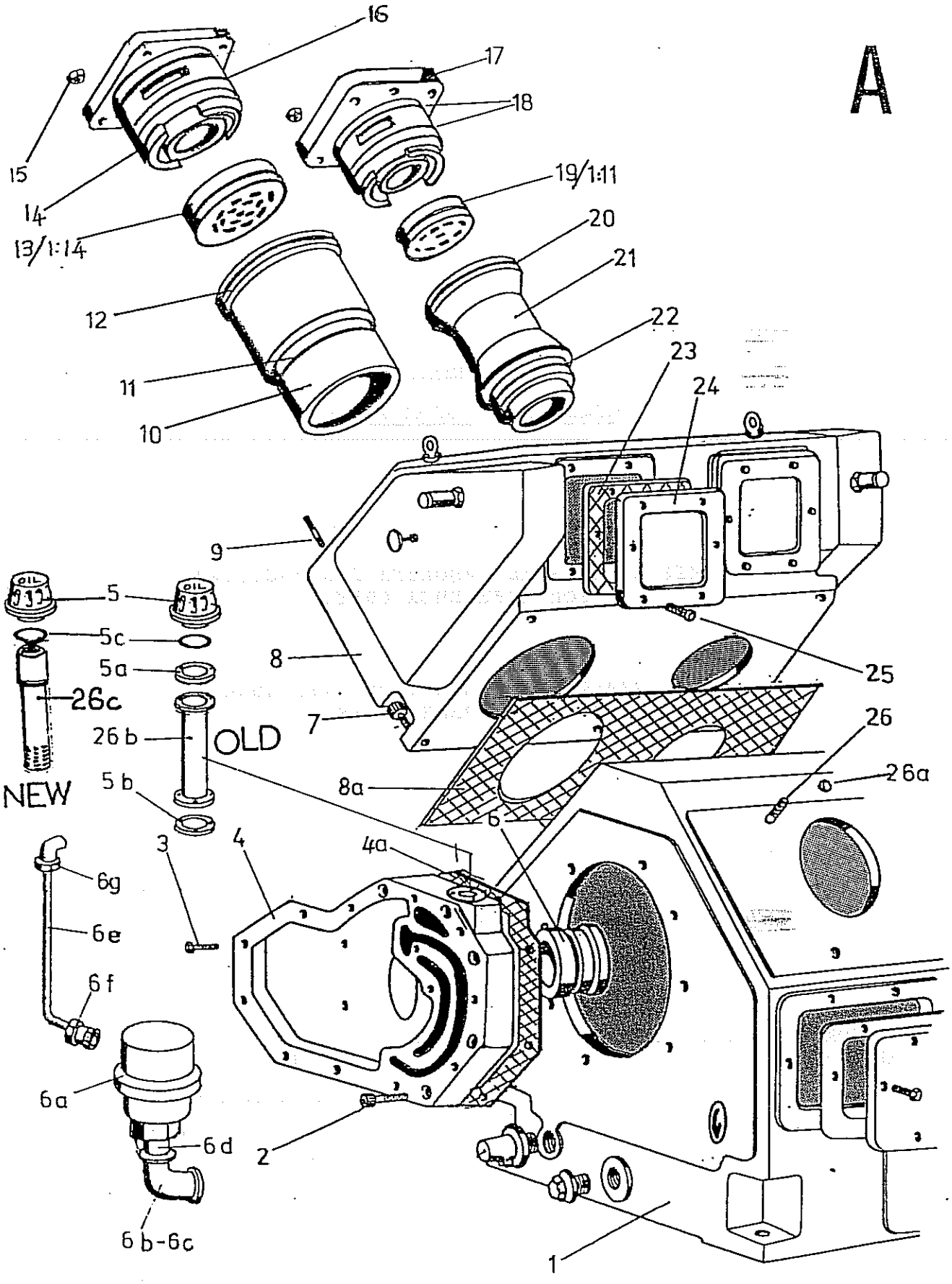
IN ANY CORRESPONDENCE RELATING TO THE MACHINE PLEASE QUOTE:

- JOB NUMBER
- MACHINE NUMBER
- MACHINE TYPE AND MARK NUMBER (Indicated On Machine Nameplate)

WHEN ORDERING PARTS ALSO QUOTE:-

- PUBLICATION NO.
- PARTS LIST ISSUE NO.
- ITEM AND PART NUMBER

* Item not illustrated
\+ Item not available, only supplied as part of complete assembly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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
1	CRANKCASE	1	E.60037	
2	CAPSCREW - SOCKET HEAD	5	95018/0279	
3	SCREW	12	95000/0255	
4	MAIN BEARING HOUSING - OUTER END	1	E.60003	
4A	MAIN BEARING HOUSING JOINT	1	D.100356	
5	OIL FILLER CAP	1	98262/1045	
5A	OIL FILLER FLANGE	1	C.200715	
5B	OIL FILLER FLANGE JOINT	2	C.200641	
5C	HOBBS WASHER	1	PS.1302/5	
6	MAIN BEARING BUSH	2	C.200020	
6A	CRANKCASE BREATHER FILTER See Also	1	98262/1044	
6B	BEND 90° ½" BSP FEMALE Separate	1	95405/0166	
6C	NIPPLE ½" BSP PARALLEL Section	1	95414/0164	
6D	BREATHER ADAPTOR	1	C.200887	
6E	NYLON TUBE, 400mm x 10mm x o/d x 8mm BORE	1	98617/1003	
6F	MALE STUD COUPLING ¼" BSP	1	C.200886	
6G	MALE STUD ELBOW 3/8" BSP	1	95440/0234	
7	SCREW	6	95018/0272	
8	FIRST AND SECOND STAGE CYLINDER	1	E.60001	
8A	FIRST AND SECOND STAGE CYLINDER JOINT	1	C.200631	
9	STUD	10	D.66720/10/45	
10	FIRST STAGE CYLINDER LINER	1	C.200013	
11	'O' RING	1	95602/0100	204
12	'O' RING	1	95602/0102	204
13/1:14	FIRST STAGE VALVE ASSEMBLY	1	98650/1080	
14	FIRST STAGE VALVE COVER	1	C.200004	
15	NUT	10	95111/0006	
16	'O' RING	2	95602/0103	203
17	SECOND STAGE VALVE COVER	1	C.200005	
18	'O' RING	2	95602/0094	203
19/1:11	SECOND STAGE VALVE ASSEMBLY	1	98650/1099	
20	'O' RING	1	95602/0093	204
21	SECOND STAGE CYLINDER LINER	1	C.200015	
22	'O' RING	1	95602/0091	204

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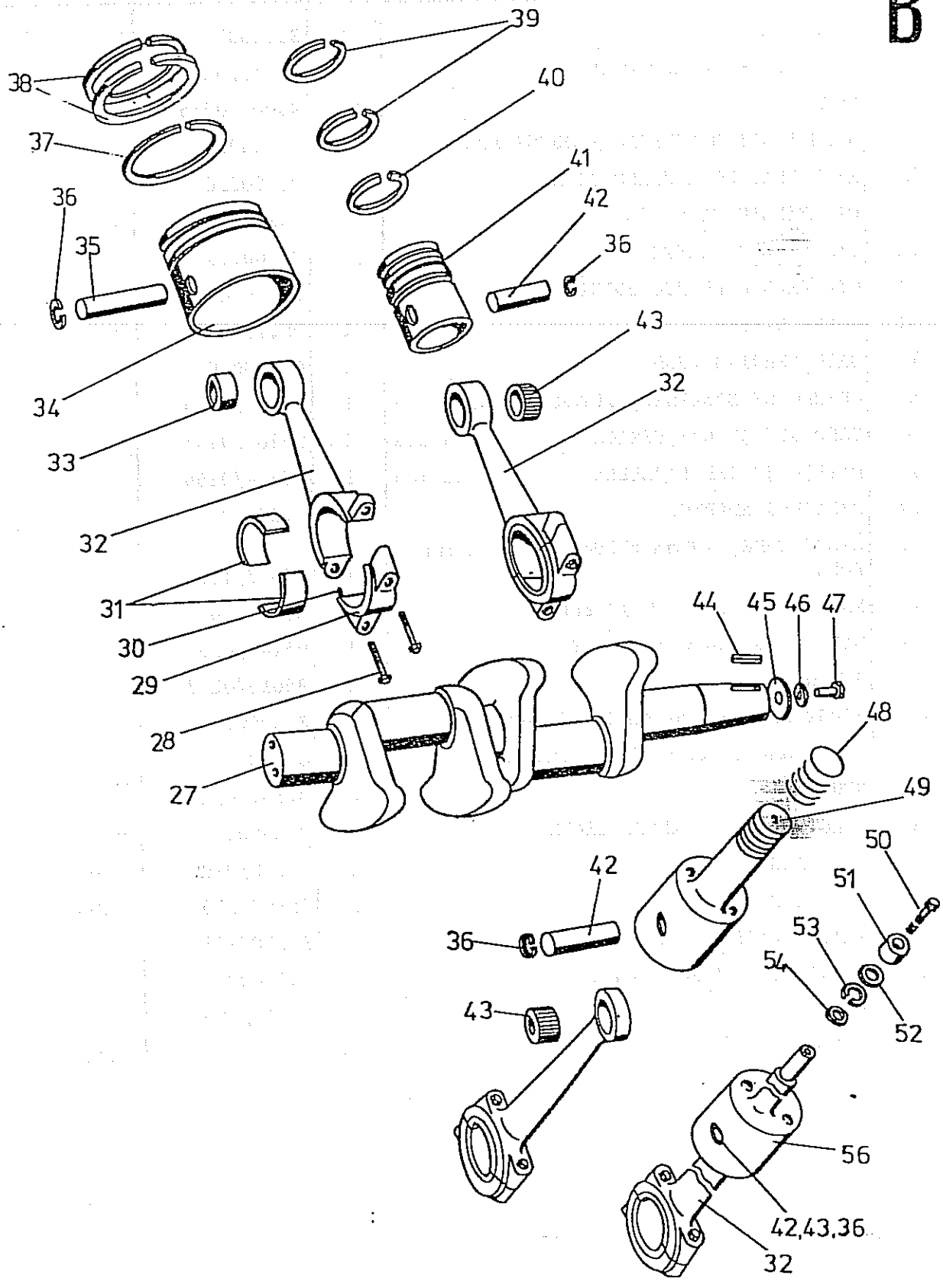
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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
23	JOINT	4	C.200204	
24	COOLER DOOR	4	C.200819	
25	SCREW	28	95000/0283	
26	STUD	6	D.66720/12/53	
26A	NUT	6	95111/0007	
26B	STANDPIPE ASSEMBLY	1	C.200289/1	
26C	OIL FILTER TUBEPIECE TO REPLACE 5C, 5B AND 26B	1	95414/008	
27	CRANKSHAFT	1	D.100008	
28	BOLT	8	95000/0294	
29	CONNECTING ROD CAP	4	*	32
30	PANEL PINS	8	*	32
31	BIG END BEARING	4	98074/1006	
32	CONNECTING ROD UNIT with items 28,29, 30 and 31	4	U.271A	
33	BUSH - FIRST STAGE - SMALL END	1	C.200029	
34	PISTON - FIRST STAGE with items 35,36, 37 and 38	1	D.100014	
35	GUDGEON PIN - FIRST STAGE	1	C.200028	
36	CIRCLIPS	8	95605/0025	
37	SCRAPER RING - FIRST STAGE	1	98477/1051	
38	RING - FIRST STAGE	2	98477/1058	
38A	SECOND STAGE RING (TOP) PLAIN	1	PS.1159/112	
39	RING - SECOND STAGE (TAPER STEPPED)	1	98477/1055	
40	SCRAPER RING - SECOND STAGE	1	98477/1052	
41	PISTON - SECOND STAGE	1	D.100015	
42	GUDGEON PIN - SECOND, THIRD AND FOURTH STAGE	3	C.200032	
43	SMALL END BEARING - SECOND, THIRD AND FOURTH STAGE	3	98076/1013	
44	KEY - CRANKSHAFT	1	PS.1130/21	
45	KEEP PLATE	1	C.200025	
46	TAB WASHER	1	C.68798/11	
47	SCREW	1	95000/0371	

* Not illustrated

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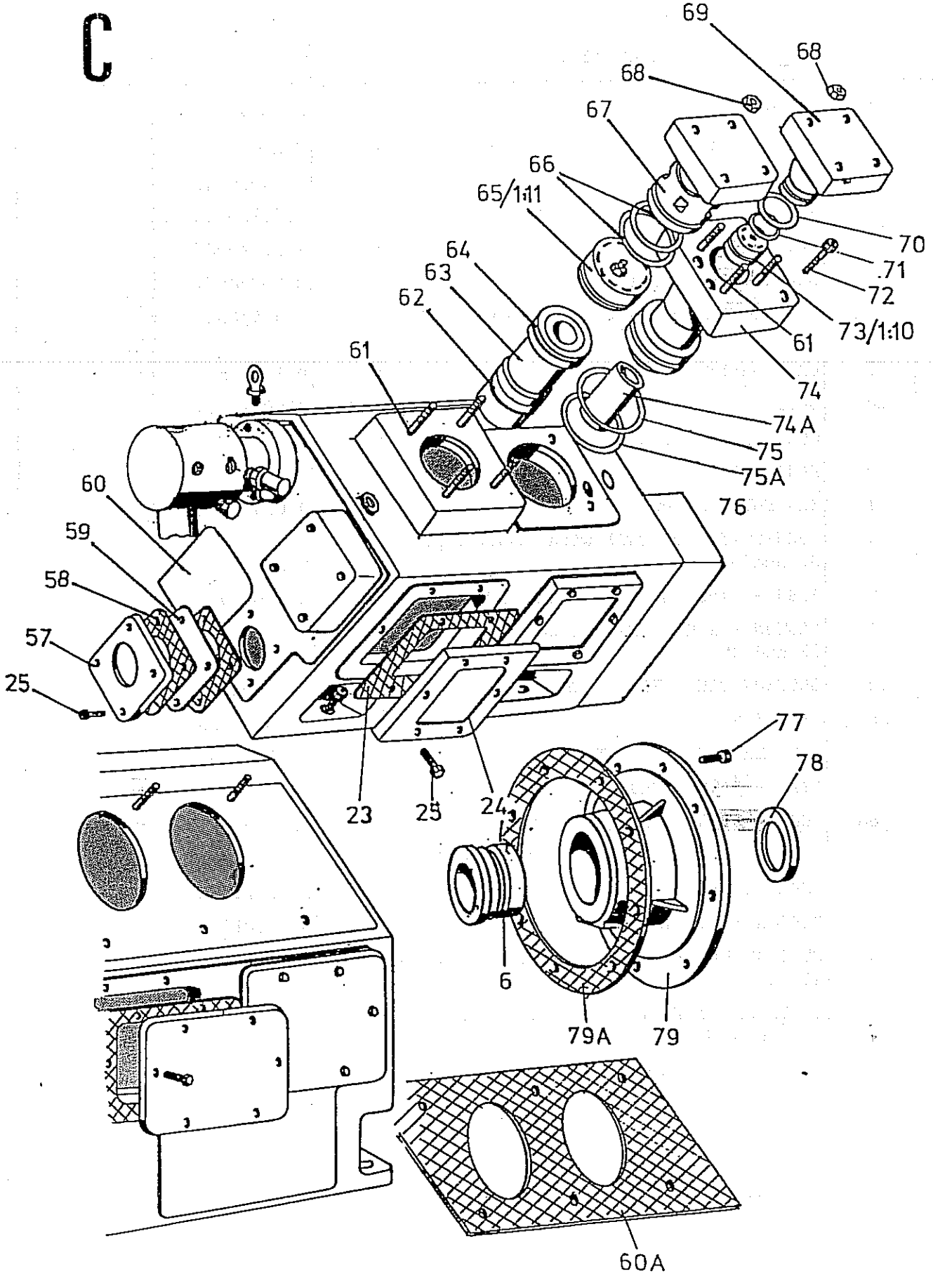
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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
48	PLAIN RINGS - THIRD STAGE	5	DPS.1159/113	
49	PISTON - THIRD STAGE with item 48	1	C.200030	
50	SCREW	1	95018/0176	
51	JUNK RING	1	C.200216	
52	SPACER WASHER	6	C.200212/2	
53	PISTON RING	6	PS.1159/114	
54	SPACER WASHER	6	C.200215/2	
56	PISTON ASSEMBLY - FOURTH STAGE	1	C.201167	
57	BURSTING DISC COVER	1	C.72395/1	
58	BURSTING DISC JOINT	2	C.81788	204
59	BURSTING DISC	1	C.200053	
59A	BURSTING DISC	1	PS.1532/1	
60	CYLINDERS - THIRD AND FOURTH STAGE	1	E.60002	
60A	JOINT - THIRD AND FOURTH STAGE	1	C.200866	
61	STUD	8	D.66720/16/74	
62	'O' RING	1	95602/0079	204
63	CYLINDER LINER - THIRD STAGE	1	C.20031	
64	'O' RING	1	95602/0083	204
65/1:11	VALVE ASSEMBLY - THIRD STAGE	1	98650/1049	203
66	'O' RING	2		203
* 66A	BACK UP RING	1	98504/1112	
67	VALVE COVER - THIRD STAGE	1	C.200006	
68	NUT	8	95111/0009	
69	VALVE COVER - FOURTH STAGE	1	C.200194	
70	'O' RING	1	98504/1105	203
71	'O' RING	1	98504/1106	203
* 71A	'O' RING	1	95604/0015	
* 71B	BACK UP RING	1	98504/1090	
72	SCREW	4	95018/0235	
73/1:10	VALVE ASSEMBLY - FOURTH STAGE	1	98650/1115	
74	CYLINDER BARREL - FOURTH STAGE	1	D.100059	
74A	LINER - FOURTH STAGE	1	C.200256	
75	'O' RING	1	95602/0087	204
75A	'O' RING	1	95602/0083	204

* Not illustrated

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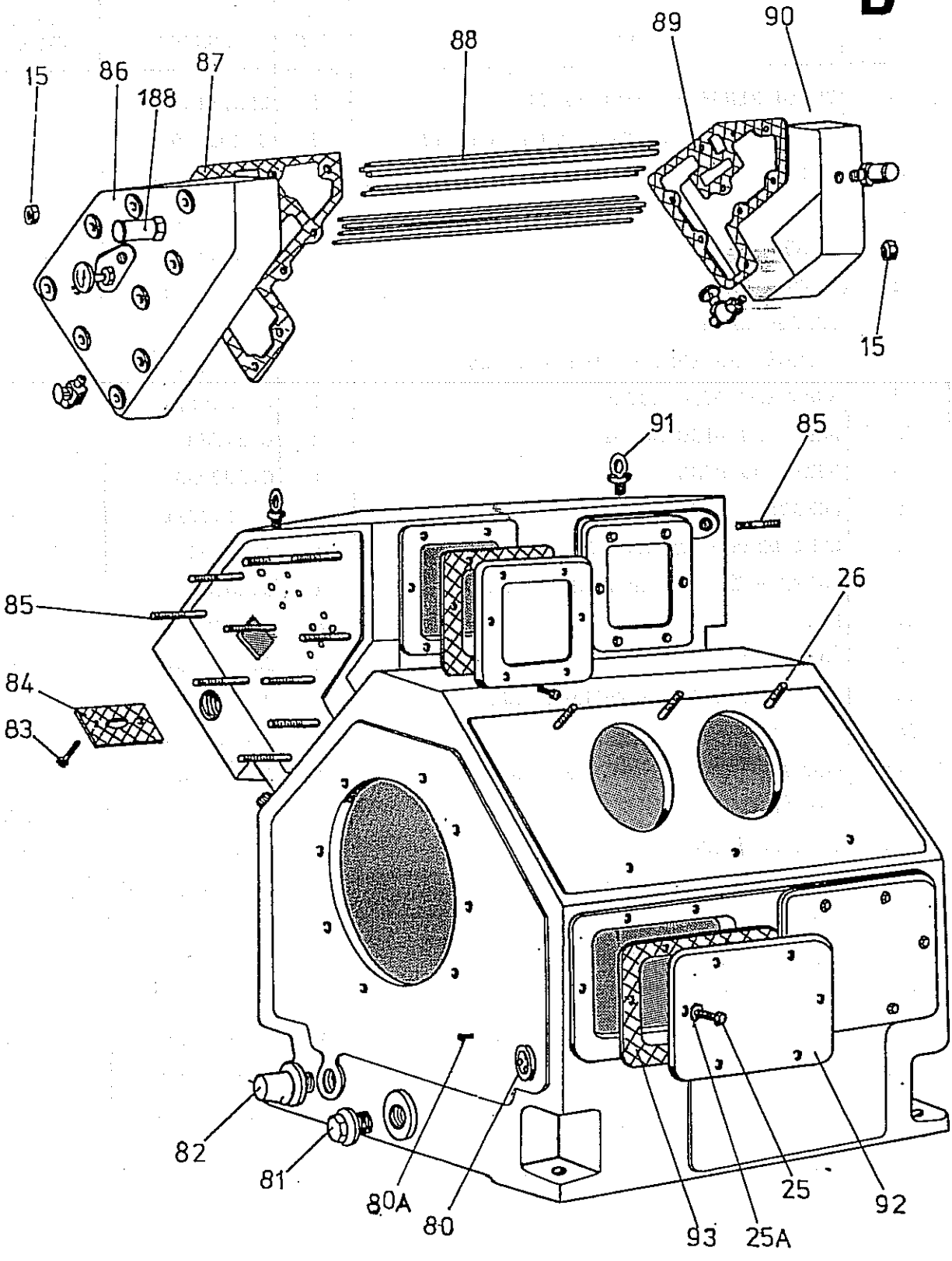
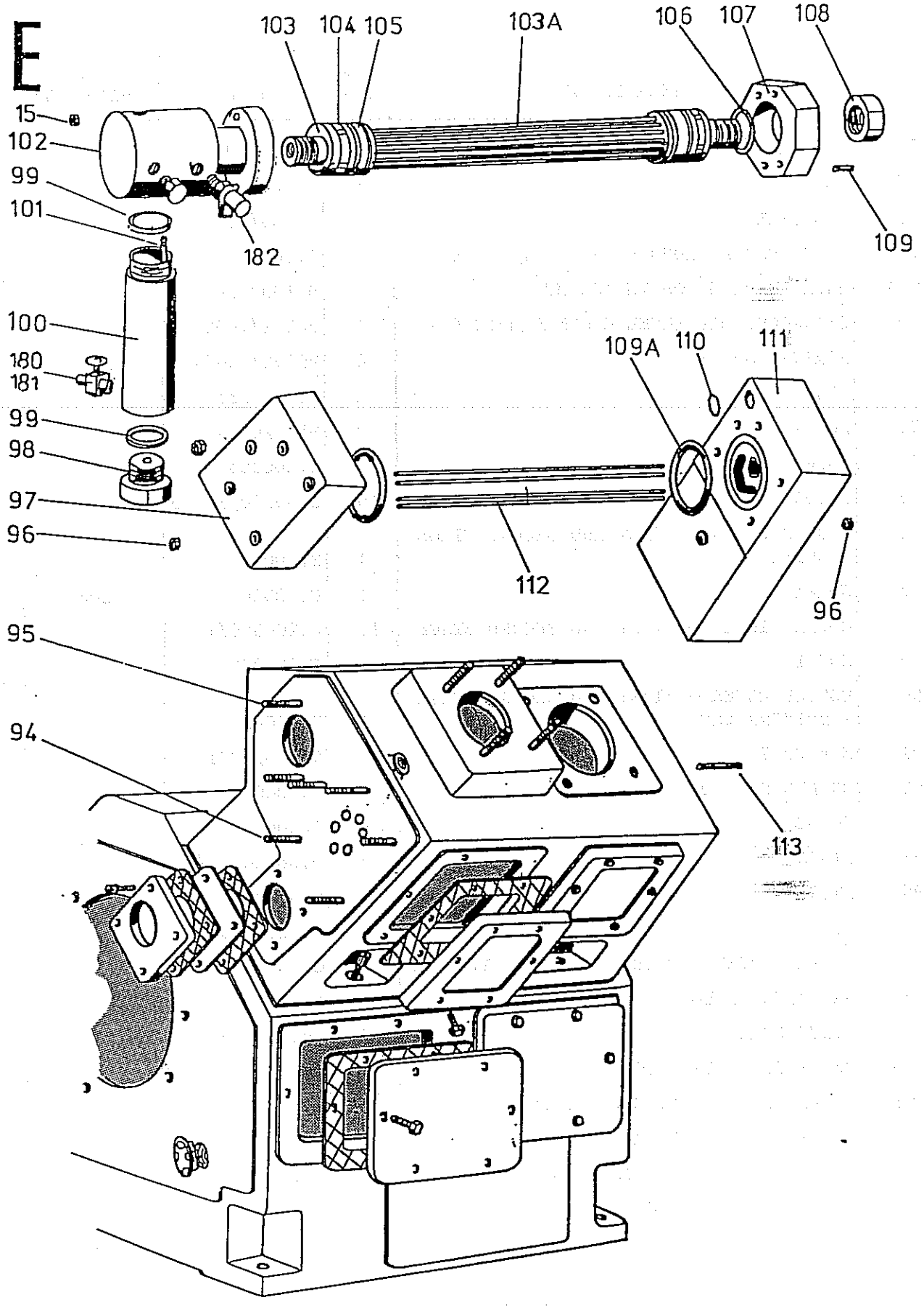


ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
76	'O' RING	1	95602/0037	
77	SCREW	11	95000/0314	
78	OIL SEAL	1	98505/1002	
79	MAIN BEARING HOUSING - DRIVING END	1	D.10009	
79A	MAIN BEARING HOUSING JOINT	1	D.100355	
80	CRANKCASE OIL LEVEL GAUGE COMPLETE	1	98281/1002	
80A	SCREWS FOR '80'	4	95092/0368	
81	PLUG	2	PS.1068/5	
83	SCREW	2	9500/0314	
84	JOINT	1	C.200205	204
85	STUDS	19	D.66720/10/85	
86	COOLER COVER - FIRST AND SECOND STAGE - OUTER	1	E.60007	
87	JOINT	1	C.200203	204
88	COOLER TUBES - FIRST AND SECOND STAGE	12	C.200390/1	
89	JOINT	1	C.200202	204
90	COOLER COVER - FIRST AND SECOND STAGE - DRIVING END	1	E.60008	
91	EYE BOLT	2	98086/1001	
92	CRANKCASE DOOR	4	C.200009	
93	JOINT	4	C.200867	
94	STUDS	5	D.66720/12/78	
95	STUDS	2	D.66720/10/75	
96	NUT	17	95111/0007	
97	COOLER COVER - THIRD STAGE - OUTER END	1	C.200000	
98	SEPARATOR PLUG	1	C.73732/22	
99	DOWTY SEAL	2	PS.1322/9	
100	SEPARATOR BODY - FOURTH STAGE	1	C.200003	
101	SEPARATOR DOWN PIPE - FOURTH STAGE	1	C.86460/2	
102	COOLER COVER - FOURTH STAGE (FIXED)	1	D.100269	
103	TUBE FITTING - FOURTH STAGE	2	C.86457	103A
103A	COOLER TUBES - FOURTH STAGE	10	D.100019/2	
104	'O' RING	2	95604/0083	204
105	'O' RING	2	95602/0083	204

* Not illustrated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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
106	'O' RING	1	95604/0077	204
107	COOLER COVER - FOURTH STAGE	1	C.86668	
108	COOLER NUT - FOURTH STAGE	1	C.86472	
108A	TUBESTACK ASSEMBLY, comprising items 103 and 103A	1	D.100019/1	
109	DOWELS	4	95504/0424	
109A	'O' RING	2	95602/0084	204
110	'O' RING	2	95602/0069	204
111	COOLER COVER - THIRD STAGE	1	D.100000	
112	COOLER TUBES - THIRD STAGE	6	C.200390/1	
113	STUDS	6	D.66720/12/93	
114	END COVER JOINT	1	C.200870	204
115	CHAIN	1	PS.1841	
116	CHAIN TENSIONER	1	98146/1001	
117	CHAIN TENSIONER PILLARS	2	C.85740/1	
118	SCREWS	5	95000/0227	
119	DOWEL PINS	2	95504/0424	124
120	CHAIN WHEEL	1	98146/1002	
121	PUMP DRIVE FITTING	1	C.85737/3	124
122	TENSION PIN	1	95540/0100	124
123	OIL FILTER	1	98262/1009	
124	OIL PUMP with items 119, 122 and 123	1	98446/1001	
125	SCREW	2	95000/0257	
126	SCREW	14	95000/0255	
127	CYLINDER LUBRICATOR with items 128,129 and 130	1	PS.1737	
128	CYLINDER LUBRICATOR PUMP JOINT	2	*	204
129	CYLINDER LUBRICATOR PUMP UNIT	2	PS.1732	
130	SCREW	2	95000/0257	
131	FOURTH STAGE SIGHT FEED PIPE AND FITTINGS	1	*	
132	THIRD STAGE SIGHT FEED PIPE AND FITTINGS	1	*	
133	SIGHT FEED UNIT	2	98340/1003	224
* 133A	STRAIGHT MALE ADAPTOR	2	98156/1294	

* Not illustrated

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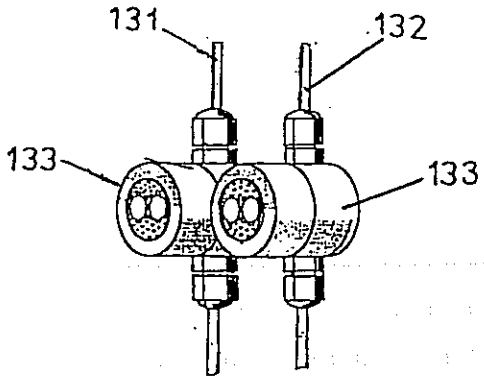
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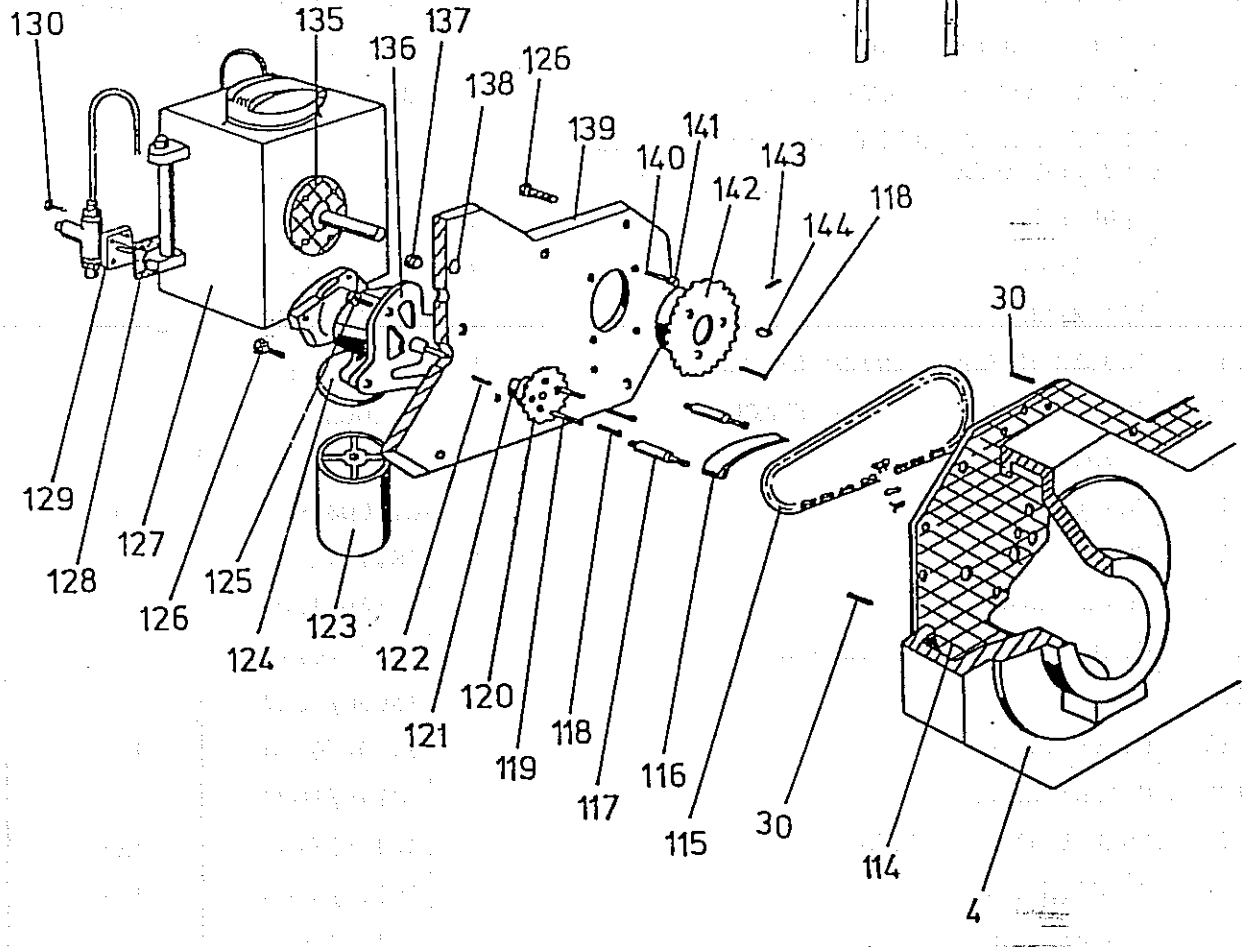
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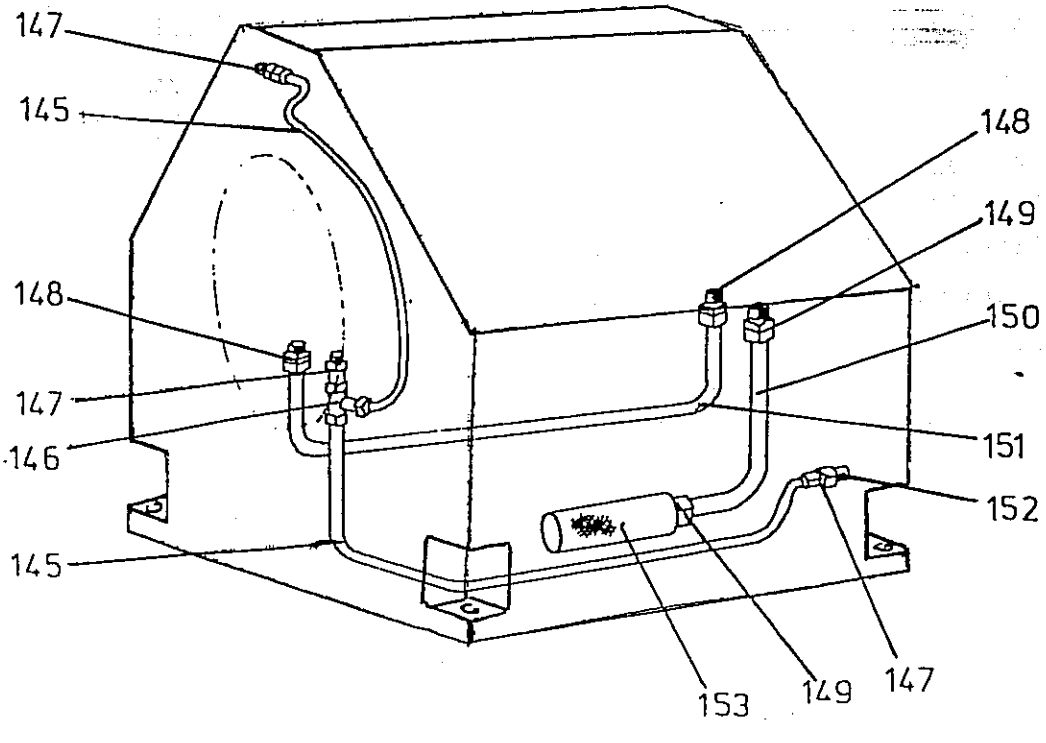
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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
* 133B	TUBING SLEEVE	2	98156/1326	
* 133C	TUBING NUT	2	98156/1315	204
135	CYLINDER LUBRICATOR JOINT	1	C.200855	204
136	OIL PUMP JOINT	1	C.200900	
137	PLUG	2	PS.1068/2	
138	WASHERS	2	95635/0002	
139	END COVER	1	D.100001	
140	SCREW	4	PS.1042/3	
141	CYLINDER LUBRICATOR DRIVE FITTING	1	C.86311	
142	CHAIN WHEEL	1	C.98146/1003	
143	GRUB SCREW	1	95074/0038	
144	KEY	1	PS.1164/1	
145	OIL PIPE, 6mm O/D x 1.0mm x 600mm - TEE TO PRESSURE SWITCH TEE TO OIL PRESSURE TAKE-OFF	1		
146	TEE, 1/4" BSP x 6mm PIPE	1	98156/1343	
147	COUPLING, 1/$" BSP x 6mm O/D PIPE	3	98156/1042	
148	COUPLING, 3/8" BSP x 10mm O/D PIPE	2	98156/1050	
149	COUPLING, 1/2" BSP x 12mm O/D PIPE	2	98156/1054	
150	OIL PIPE, 12mm O/D x 1.2mm x 150mm	1		
151	OIL PIPE, 10mm O/D x 1.0mm x 600mm	1		
152	REDUCING BUSH, 1/2" - 1/4" BSP	1	95405/0854	
153	OIL STRAINER	1	PS.2081	
* 154	OIL STRAINER SOCKET, 1/2" BSP	1	95405/1004	
155	FOURTH STAGE PRESSURE GAUGE	1	98288/1023	
156	THIRD STAGE PRESSURE GAUGE	1	98288/1022	
158	SECOND STAGE PRESSURE GAUGE	1	98288/1021	
160	FIRST STAGE PRESSURE GAUGE	1	98288/1020	
162	OIL PRESSURE GAUGE	1	98288/1019	
164	PRESSURE GAUGE PANEL	1	E.60290	
168	STRAIGHT ADAPTOR	2	98156/1307	
169	PIPE, 12mm O/D x 1.2mm x 620mm C.U.	1		
170	COUPLING	2	98156/1054	
171	PIPE, 12mm O/D x 1.2mm x 300mm C.U.	1		
172	SETSCREWS	4	98500/1003	

* Not illustrated

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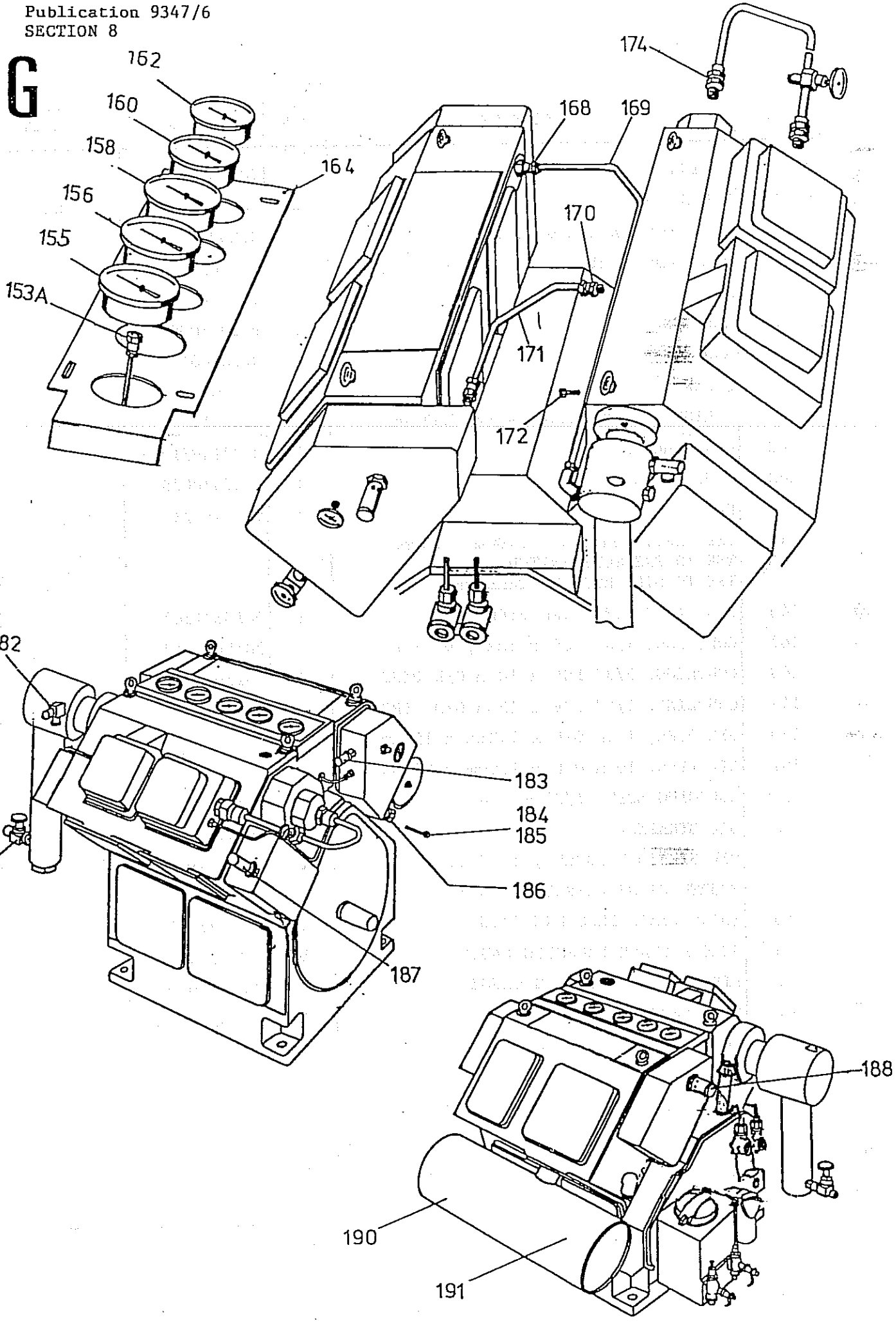
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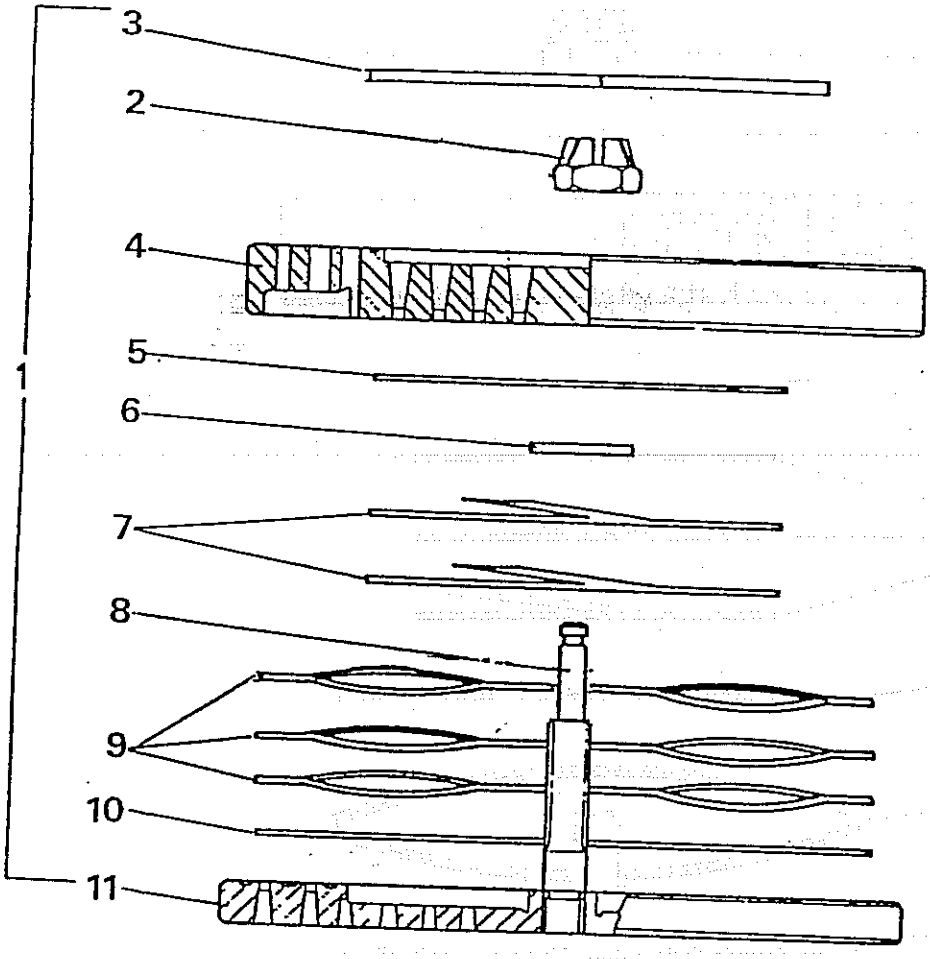
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
174	PIPE, 12mm O/D x 3.0mm x 400mm	1		
* 174A	NYLON TUBE, 5mm O/D - FIRST STAGE PRESSURE AND OIL	1	98617/1002	
* 174B	FEMALE ADAPTOR - STRAIGHT, 1/4" - 5mm	2	98156/2392	
* 174C	TUBING SLEEVE, 5mm	4	98156/1387	
* 174D	TUBING NUT, 5mm	4	98156/1316	
* 174E	MALE ADAPTOR - STRAIGHT, 1/4" - 5mm	2	98156/1295	
* 175	TUNGUM TUBING - SECOND STAGE PRESSURE GAUGE			
* 176	TUNGUM TUBING - THIRD AND FOURTH STAGE PRESSURE GAUGE	2		224
* 173/1	TUBING NUT	3	98156/1315	
* 176/2	TUBING SLEEVE	3	98156/1326	
* 177	CONNECTOR - MALE, 4mm TUBE	3	98156/1294	
* 178	FERRULE	3	C.200573	
* 179	WASHER - PRESSURE GAUGE	3	98660/1102	155
* 179A	PRESSURE GAUGE NUT	3	98422/1005	
180	STOP VALVE	1	PS.1046/2	
181	VALVE ADAPTOR	1	C.76059/2	
182	FOURTH STAGE SAFETY VALVE	1	98650/1023	
183	FIRST STAGE SAFETY VALVE	1	98650/1020	
184/5	CORROSION ROD COMPLETE	1	U.753C	
186	STOP VALVE	1	PS.1045/2	
187	THIRD STAGE SAFETY VALVE	1	98650/1022	
188	SECOND STAGE SAFETY VALVE	1	98650/1021	
190	AIR INTAKE FILTER	1	98262/1026	
191	AIR FILTER ELEMENT	1	98262/1062	
192	PILOT UNLOADING VALVE	1	PS.1648	
200	JOINTING COMPOUND (TUBE)	1	98502/1003	204
201	CYLINDER LUBRICATOR PUMP UNIT SERVICE KIT	2	PS.1824	
203	VALVE MAINTENANCE 'O' RING KIT		98504/1003	
204	OVERHAUL JOINT KIT		98504/1004	

* Not illustrated

ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER	SUPPLIED WITH ITEM
	SERVICE TOOLS			
	FIRST STAGE PISTON RING COMPRESSOR	1	C.200444	
	FIRST AND FOURTH STAGE VALVE LIFTER	1	C.200066/1	
	FIRST & SECOND STAGE PISTON LIFTER	1	C.200223	
	SECOND STAGE WITHDRAWING PLATE	1	C.200418	
	LIFTING STUDS	2	C.200419	
	NUTS M8	2	95111/0005	
	SECOND & THIRD STAGE VALVE LIFTER	1	C.200142	

FIRST STAGE VALVE - 98650/1080



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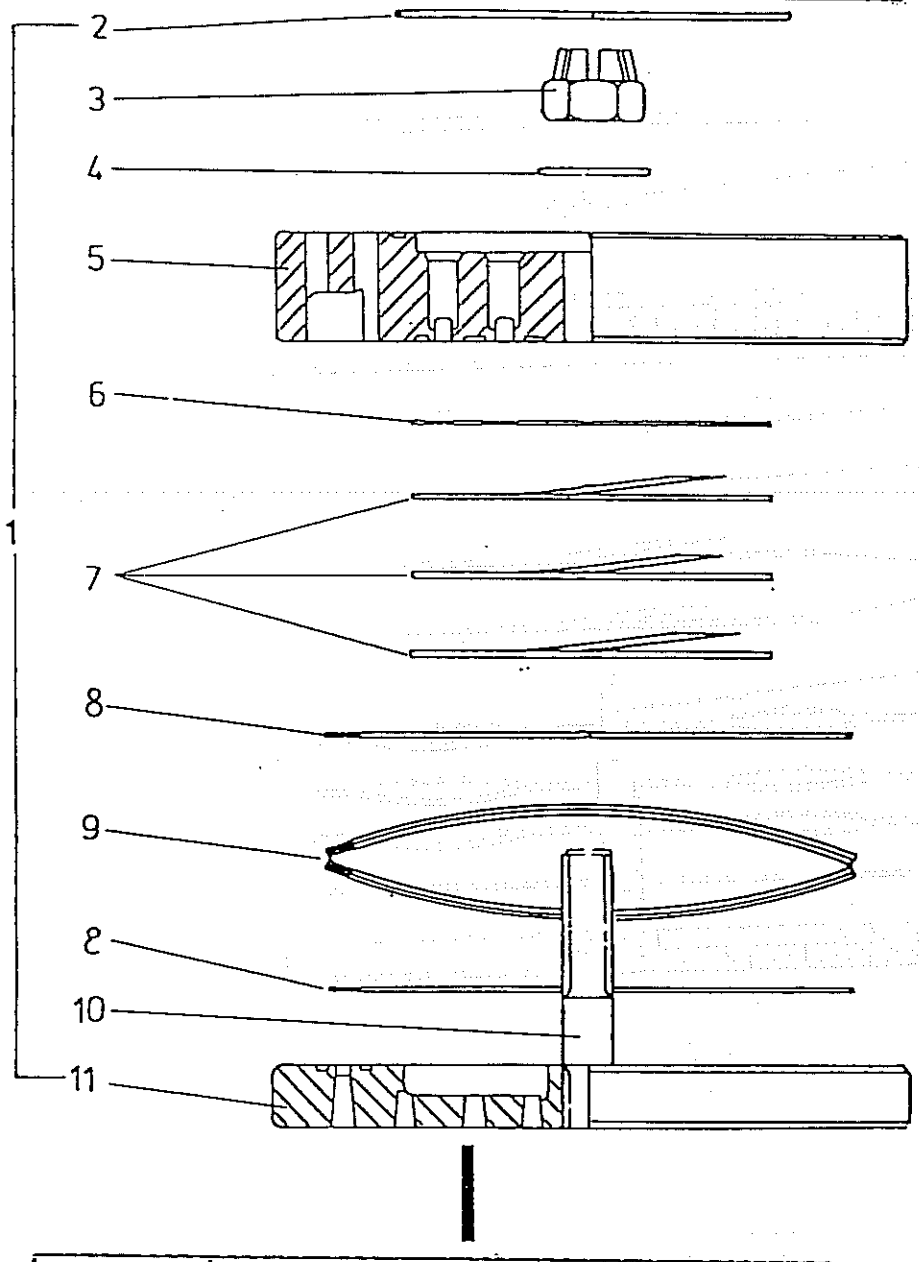
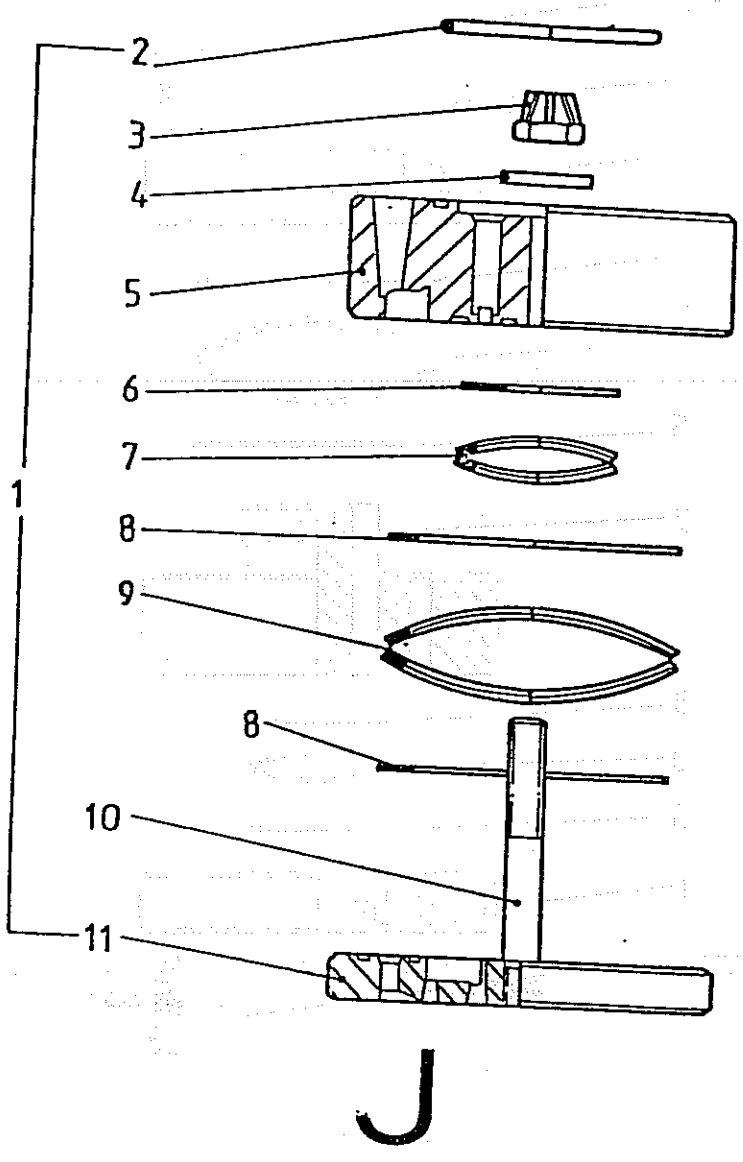
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	VALVE	1	98650/1080
2	NUT	1	
3	'O' RING	1	98504/1006
4	UPPER BODY	1	
5	VALVE PLATE	1	98650/1085
6	GUIDE WASHER	1	98650/1086
7	SPRING PLATE	2	98650/1087
8	CENTRE BOLT	1	
9	SPRING RING	3	98650/1089
10	VALVE PLATE	1	98650/1090
11	LOWER BODY	1	

SECOND STAGE VALVE - 98650/1099



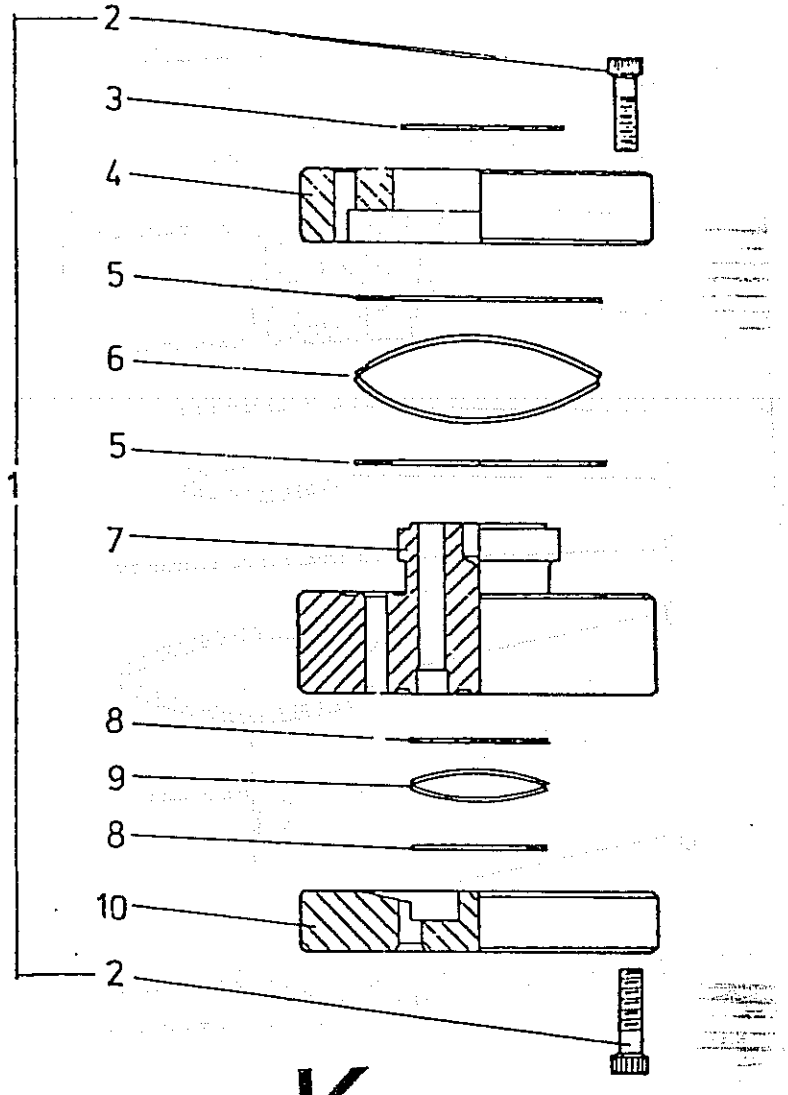
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	VALVE	1	98650/1099
2	'O' RING	1	98504/1005
3	NUT	1	*
4	WASHER	1	98650/1101
5	UPPER BODY	1	*
6	VALVE PLATE	1	98650/1103
7	SPRING PLATE	3	98650/1104
8	RING	2	98650/1105
9	SPRING RING	4	98650/1106
10	CENTRE BOLT	1	*
11	LOWER BODY	1	*

THIRD STAGE VALVE - 98650/1049



ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	VALVE	1	98650/1049
2	'O' RING	1	95602/0024
3	NUT	1	*
4	WASHER	1	*
5	UPPER BODY	1	*
6	VALVE RING	1	98650/1053
7	SPRING RING	3	98650/1054
8	RING	2	98650/1055
9	SPRING RING	4	98650/1056
10	CENTRE STUD	1	*
11	LOWER BODY	1	*

FOURTH STAGE VALVE - 98650/1115



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ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	VALVE	1	98650/1115
2	SCREW	4	98650/1116
3	'O' RING	1	95602/0015
4	UPPER BODY	1	*
5	RING (BACKING AND VALVE)	2	98650/1118
6	SPRING RING	2	98650/1119
7	MIDDLE BODY	1	*
8	RING (BACKING AND VALVE)	2	98650/1121
9	SPRING RING	2	98650/1122
10	LOWER BODY	1	*

8.1

EXPECTED LIFE OF RECOMMENDED PARTS

PART NUMBER	DESCRIPTION	QTY	HOURS
C.200020	MAIN BEARING BUSH	2	8000
98650/1080	FIRST STAGE VALVE ASSEMBLY	1	8000
98650/1085	VALVE PLATE - SUCTION	1	2000
98650/1087	SPRING PLATE	2	2000
98650/1089	SPRING RING	2	2000
98650/1090	VALVE PLATE DELIVERY	1	2000
98650/1099	SECOND STAGE VALVE ASSEMBLY	1	8000
98650/1103	VALVE PLATE - SUCTION	1	2000
98650/1104	SPRING PLATE	3	2000
98650/1105	VALVE SPRING	2	2000
98650/1106	SPRING RING	4	2000
98074/1006	BIG END BEARING	4	8000
C.200029	SMALL END BUSH	1	8000
98650/0025	CIRCLIP	8	8000
98477/1051	FIRST STAGE SCRAPER RING	1	8000
98477/1058	FIRST STAGE PLAIN RING	1	8000
PS.1159/112	SECOND STAGE PLAIN RING	1	8000
98477/1055	SECOND STAGE RING - TAPER STEPPED	1	8000
98477/1052	SECOND STAGE SCRAPER RING	1	8000
98076/1013	SMALL END BEARING	3	8000
PS.1159/13	THIRD STAGE PLAIN RING	4	4000
98650/1049	THIRD STAGE VALVE ASSEMBLY	1	4000
98650/1053	VALVE RING	1	1000
09650/1054	SPRING RING	4	1000
98650/1055	VALVE RING	1	1000
98650/1056	SPRING RING	4	1000
98650/1115	FOURTH STAGE VALVE ASSEMBLY	1	3000
98650/1119	SPRING RING	2	1000
98650/1118	VALVE RING - SUCTION	2	1000
98650/1121	VALVE DISC - DELIVERY	2	1000
98650/1122	SPRING	2	1000

.... CONTINUED

8.1 EXPECTED LIFE OF RECOMMENDED PARTS - Cont.

PART NUMBER	DESCRIPTION	QTY	HOURS
C.81788	BURSTING DISC JOINT	1	4000
98505/1002	OIL SEAL	1	8000
C.200053	BURSTING DISC JOINT	1	4000
PS.1532/1	BURSTING DISC	1	4000
98262/1009	OIL FILTER	1	1000
98262/1062	AIR FILTER ELEMENT	1	2000/4000
PS.1824	CYLINDER LUBRICATOR PUMP SERVICE KIT	2	4000
PS.1847	SIGHT FEED SERVICE KIT	2	8000
98504/1003	VALVE MAINTENANCE 'O' RING KIT	1	2000
98504/1004	COMPRESSOR OVERHAUL JOINT KIT	1	8000
PS.1159/114	FOURTH STAGE PISTON RING	6	1000
C.200212/2	SMALL SPACERS	6	1000
C.200215/2	SPACERS	6	1000
C.200216	JUNK RING	1	1000
95018/0176	SCREW	1	1000
98210/1002	DIAPHRAGM DRAIN VALVE DIAPHRAGMS	4	4000
	FIRST AND SECOND VALVE SEATS	2	8000
	THIRD AND FOURTH VALVE SEATS	2	4000
	PRESSURE GAUGES		8000
	NON-RETURN VALVE 'O' RING		2000

DRIVE FITTINGS

BELT-DRIVE (Not illustrated)

ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
A	MOTOR PLATE	2	C.200783
B	SETSCREW M12 X 1.75 X 25	4	95000/0313
C	WASHER PLAIN M12	4	95148/0016
D	MOTOR ADJUSTING BLOCK	2	C.86469
E	SETSCREW M8 X 1.25 X 45	4	95000/0260
F	MOTOR ADJUSTING SCREW ITEMS		
	SCREWED ROD M12	4	C.86470/2
	WASHER PLAIN M12	12	95148/0016
	NUT M12	8	95111/0007
	TENSION PIN 2.5 DIA X 20	8	95540/0085
G	GUARD - VEE DRIVE	1	E.60277
H	SETSCREW M10 X 1.5 X 16	5	95000/0281
I	FLYWHEEL PULLEY	1	D.100245
J	PULLEY 315mm PCD 2 X SPB	1	98080/1174
K	TAPER LOCK BUSH NO.2517	1	98074/1117
L	WEDGE BELT SPB 2000	2	98080/1051
M	KEY 16 X 10 X 63 PARALLEL	1	95301/0063
N	ANTI-VIBRATION MOUNT	3	98418/1019
O	SETSCREW M12 X 1.75 X 35	3	95000/0315
P	WASHER PLAIN M12	3	95148/0016
	DIRECT DRIVE (Not illustrated)		
1	BELL HOUSING	1	E.60021
2	SETSCREW M16 X 1.75 X 40	4	95000/0345
3	SETSCREW M12 X 1.75 X 30	6	95000/0314
4	BELL HOUSING COVER PLATE ASSEMBLY	1	PS.1813/16
5	HALF COUPLING DRIVEN	1	E.1813/21
6	CAPSCREW M10 X 1.5 X 25	6	95018/0230
7	HALF COUPLING MOTOR	1	98158/5/1
8	KEY PARALLEL 16 X 10 X 63	1	95301/0063
9	ANTI-VIBRATION MOUNTS	3	98418/1014

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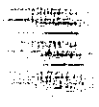
DRIVE FITTINGS - cont.

DIRECT DRIVE (Not illustrated) - (cont.d)

ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
10	NUTS M12	3	95111/0007
11	WASHER PLAIN M12	3	95148/0016
12	BASE RAIL	1	C.87645
13	BASE RAIL	1	C.87646
14	MOTOR SUPPORT	1	C.200506
15	SPACER	1	C.200499
16	MOUNTING PLATE	3	C.200507
17	SETSCREW M12 X 1.75 X 45	2	95000/0317
18	SETSCREW M12 X 1.75 X 35	4	95000/0315
19	SETSCREW M12 X 1.75 X 50	2	95000/0318
20	NUTS - M12	12	95111/0007
21	BOLT M12 X 1.75 X 110	4	95006/0209
22	WASHERS 1/2" PLAIN	4	PS.1118/8
23	FLYWHEEL	1	D.100301
24	KEY 14 X 9 X 50 MM PARALLEL RECT	1	95301/0049

SAFETY DEVICES, CONTROL AND ANCILLARY EQUIPMENT



9. SAFETY DEVICES

SAFETY VALVES - STANDARD EQUIPMENT

9.1 OPERATION

Safety valves are installed after each compression stage and are fitted to protect the compressor only. System pressure vessels and pipework must incorporate their own safety valves in compliance with site safety regulations.

Designed for emergency pressure release purposes only, safety valves must not be used as continuous surplus air discharge vents.

Stop the compressor immediately a safety valve lifts, investigate cause of discharge and rectify.

UNDER NO CIRCUMSTANCES WHATSOEVER MUST A SAFETY VALVE BE ADJUSTED DOWN TO CONTAIN EXCESSIVE PRESSURE AS THIS IS DANGEROUS.

Blowing inter-stage safety valves usually signify suction valve malfunction in the following stage but inter-stage cooler or connecting pipe blockage will have the same effect.

Final stage safety valve discharge signifies malfunction of the compressor control system, i.e. pressure switch failure, but may also be associated with aftercooler or storage vessel pipework discharge blockage.

CompAir Reavell safety valves are designed to allow delivered air to pass through the safety valves with only a 10% pressure build up.

Valve seat design, machining accuracy and working pressure margin determine the amount of valve leakage under working conditions. With a minimal margin, pressure pulsations cause valve float and occasional leakage. Metal seated valves are never 100% leak-tight under working conditions and it would be uneconomic to attempt this in practice.

9.2 Maintenance & Adjustment

Safety valves fitted to "V" series machines must not be adjusted as valves with Survey/Insurance approval must never be adjusted or dismantled. If a valve is faulty - renew. Never remove or leave off safety valve top cap whilst valve is under pressure.

For major overhaul or insurance assessment purposes, it may be necessary to prove valve settings by removing valve from the compressor and connecting to direct air supply of suitable pressure rating.

Static pressure will only give an indication of the true safety valve setting when on dynamic pressure as peak cylinder pressure pulsations are greater than static pressure readings.

STATIC PRESSURE SAFETY VALVE SETTINGS ARE STAMPED ON EACH VALVE.

9.0 SAFETY VALVES - cont.

9.3 Bursting Discs - Standard Equipment

Bursting discs are fitted to prevent excessive pressure build up in the water passages. If the maximum pressure is exceeded the disc material ruptures, thus relieving the excess pressure.

If a bursting disc fails, stop the compressor and turn off the water supply.

Before fitting a new bursting disc ascertain the cause of the failure. Failure may be caused either by excessive pressure, by fatigue of the bursting disc material, or by pressure fluctuations in the water supply. Check the condition of cooler tubes and joints. If pressure fluctuations caused the failure, it is best to renew the bursting disc more frequently than normally recommended.

9.4 Corrosion Rod - Standard Equipment

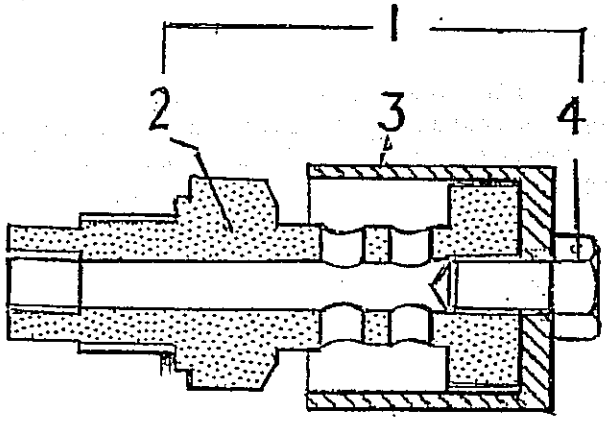
An aluminium rod is fitted in the water jacket to prevent corrosion of the cooler tubes and tubeplates. This will be attacked by the electrolytic action before the brass and copper of the coolers.

If it is suspected that there may be severe electrolytic action, it is best to inspect the corrosion rod more frequently than normally recommended.

9.5 Fusible Plug (Optional Equipment)

These plugs are usually fitted down-stream of the aftercooler. If the delivered air temperature reaches an unacceptable level the filling in the plug melts. This unloads the delivery and consequently reduces the temperature.

If the plug filling melts, stop the compressor immediately. Before fitting a new plug, ascertain and remedy the cause of the high delivered air temperature.



FUSIBLE PLUG - C.73451/5

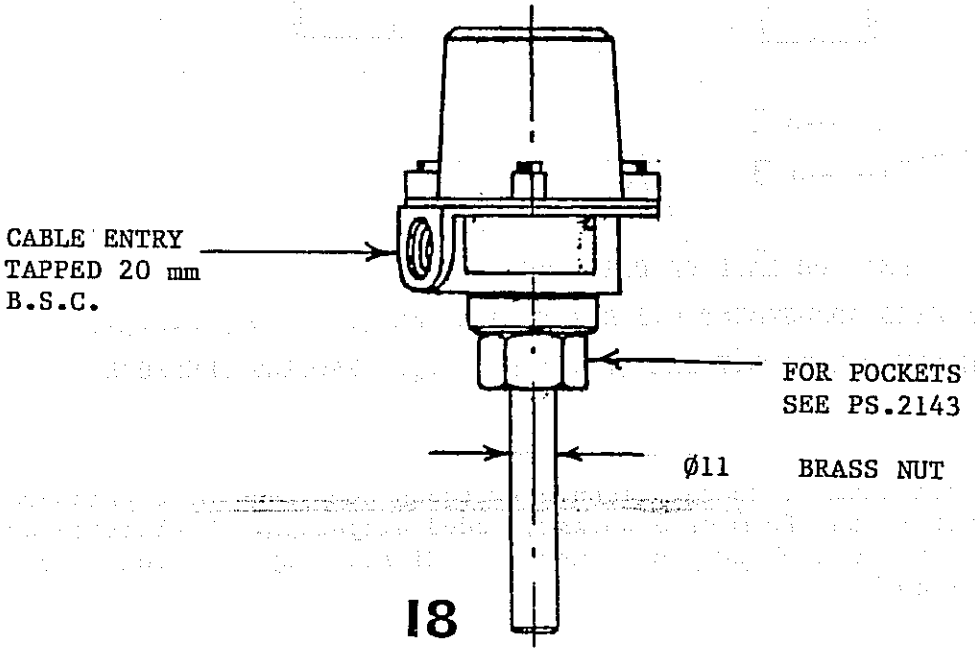
FUSIBLE PLUG MARKED - "LT"
NOMINAL MELT TEMPERATURE 120°C
MAXIMUM PRESSURE 69 BAR (1000 psig.)

9.5 FUSIBLE PLUG - cont.

PARTS LIST * ITEMS ONLY SUPPLIED AS A COMPLETE UNIT

Item No.	Description	No. Off	Part No.
1	FUSIBLE PLUG COMPLETE	1	C.73451/5
2	BODY COMPLETE WITH FILLING	1	*
3	CAP	1	*
4	SCREW	1	*

9.6 HIGH AIR TEMPERATURE SWITCH PS.2142/1



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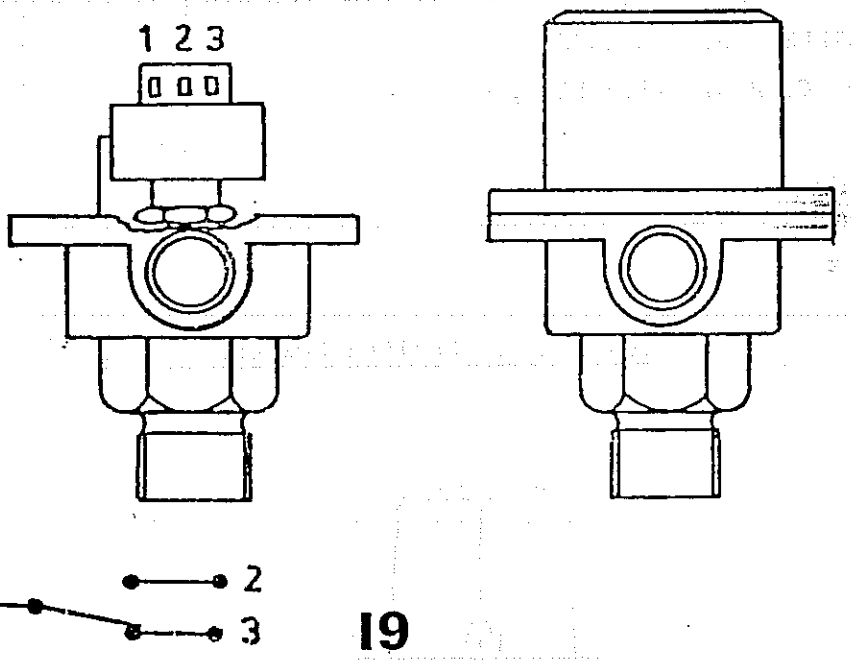
PURCHASE SPECIFICATION NO.	PYROPRESS REF NO.	PYROPRESS PRE-SETTING TEMPERATURE °C	MIN - MAX SWITCHING POINTS °C	SWITCH DIFFERENTIAL °C	MAX TEMP AT STEM °C
2142/1	T156B	75	0 - 130	3	75

STEM .....STAINLESS STEEL
ADJUSTING SCREW .....BRASS
SWITCH BASE .....POLYESTER COMPOUND - GLASS FIBRE REINFORCED
SWITCH COVER .....PHENOLIC TYPE GX TO BS771
SWITCH BLOCK .....PHENOLIC TYPE GX TO BS771

9.7 Low Oil Pressure Switch - PS.1647



1 & 3 BREAK ON FALL OF PRESSURE

SWITCHING ADJUSTMENT 0.3 BAR TO 3.8 BAR (5 to 55 p.s.i.g.)

NORMALLY SET TO 0.7 BAR (10.15 p.s.i.g.) FALLING PRESSURE

Operation

The operating mechanism of these pressure switches comprises of a pressure sensitive element in the form of a spring loaded diaphragm. Deflection of this diaphragm under pressure change is transmitted directly by push rod to a snap action micro-switch.

Adjustment

The switching point is set by location of the adjusting nut. This adjusting nut is provided with a nylon locking feature in the screw thread which prevents movement due to vibration.

Each instrument is set to operate at the required pressure, unless otherwise stated.

Limiting Conditions and Operating Features

Switching differential:		0.14 bar (2 psi)	
Max. Permissible Operating pressure:		207 bar (3000 psig)	
Max. Permissible Instrument Temperature:		100°C	
Switch capacity:	at 230 volt AC:	5 amps resistive	5 amps inductive
	at 30 volt DC:	2 amps resistive	1 amp inductive
	at 220 volt DC:	0.2 amp resistive	0.02 amp inductive

9.8 Control of Unloaders and Condensate Drains

The compressor must be unloaded when starting up in order not to overload the driving unit, and the same sequence can be employed to control compressor output when running at normal speed. This is necessary when delivered air output exceeds demand.

Do not run compressor for long periods in unloaded condition as apart from economic reasons it can lead to valve problems.

The diaphragm drain valves operate as unloading and condensate drains.

9.9 Details of Automatic Stop/Manual Start (High Pressure Compressors)

This system is used when the demand for air is infrequent.

Main Control Components

Pressure Switch
Piped to receiver

Solenoid Pilot Unloading Valve
Piped to low stage pressure air providing operating air for unloaders.

Diaphragm Unloader (Diaphragm Drain Valve)
Fitted to each stage and also acts as a condensate drain.

Non-return Valve
Fitted between final stage diaphragm unloader and receiver.

9.10 At initial starting the compressor is unloaded, after a few seconds time delay, when full working speed is reached, the diaphragm unloaders close and the compressor delivers normally. Running normally the receiver pressure reaches the pre-determined setting and pressure switch signals the compressor to stop. At the same time, the automatic motor starter in the control box signals the pilot unloading valve to cut off loader operating air ready for re-starting.

9.0 SAFETY DEVICES - cont.

9.11 Diaphragm Unloader/Drain Valve

Types

Double Diaphragm U.334 L
Double Diaphragm U.334 J

Operation

When connected to the cylinder delivery, this valve functions as an unloader and as a drain valve also if connected to an oil and moisture separator.

Servo air pressure activates a flexible diaphragm which seats a small diameter valve sealing off any escape of high pressure air. Absence of servo air pressure allows high pressure air to vent.

Activating servo air pressure is controlled by a solenoid pilot unloading valve which may be connected to allow the diaphragm valve(s) to automatically unload the compressor on compressor shut down. Low/medium stage air is utilized for the servo actuation.

9.12 Pilot Unloader Valve (Solenoid Operated) - PS.1648 (Optional)

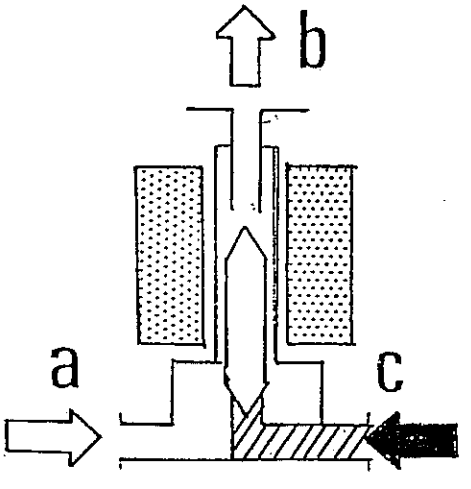
Operation

This valve comprises a three-way air valve operated by a solenoid in one direction and a combination of air and spring pressure in the opposite direction.

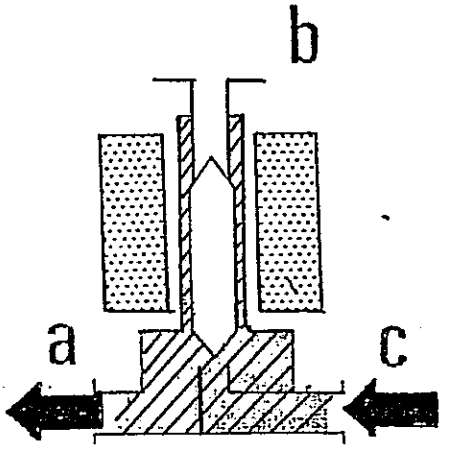
Connections

The exhaust connection will discharge a small amount of air when the unloaders are released.

Connection (A) - to compressor unloaders
(C) - to source of low pressure (servo air)



DE-ENERGISED SOLENOID
(Compressor unloaded)

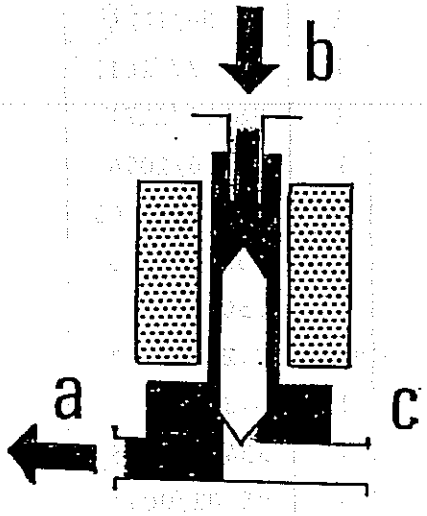


ENERGISED SOLENOID
(Compressor on load)

9.0 SAFETY DEVICES – cont.

Limiting Conditions and Operating Features

PART NUMBER		PS.1648
MAX WORKING PRESSURE	bar	31
	psig	450
VOLTAGE RATING		220 50/60 Hz



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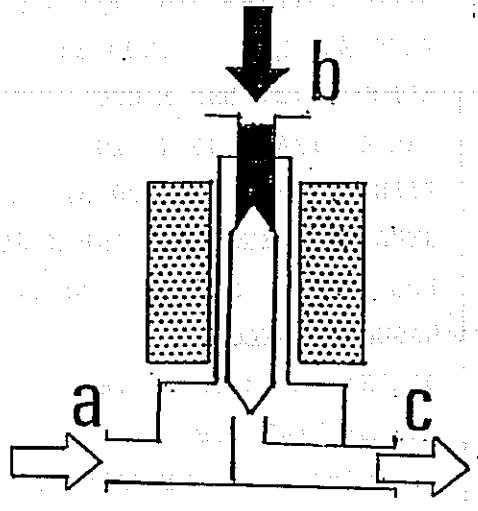
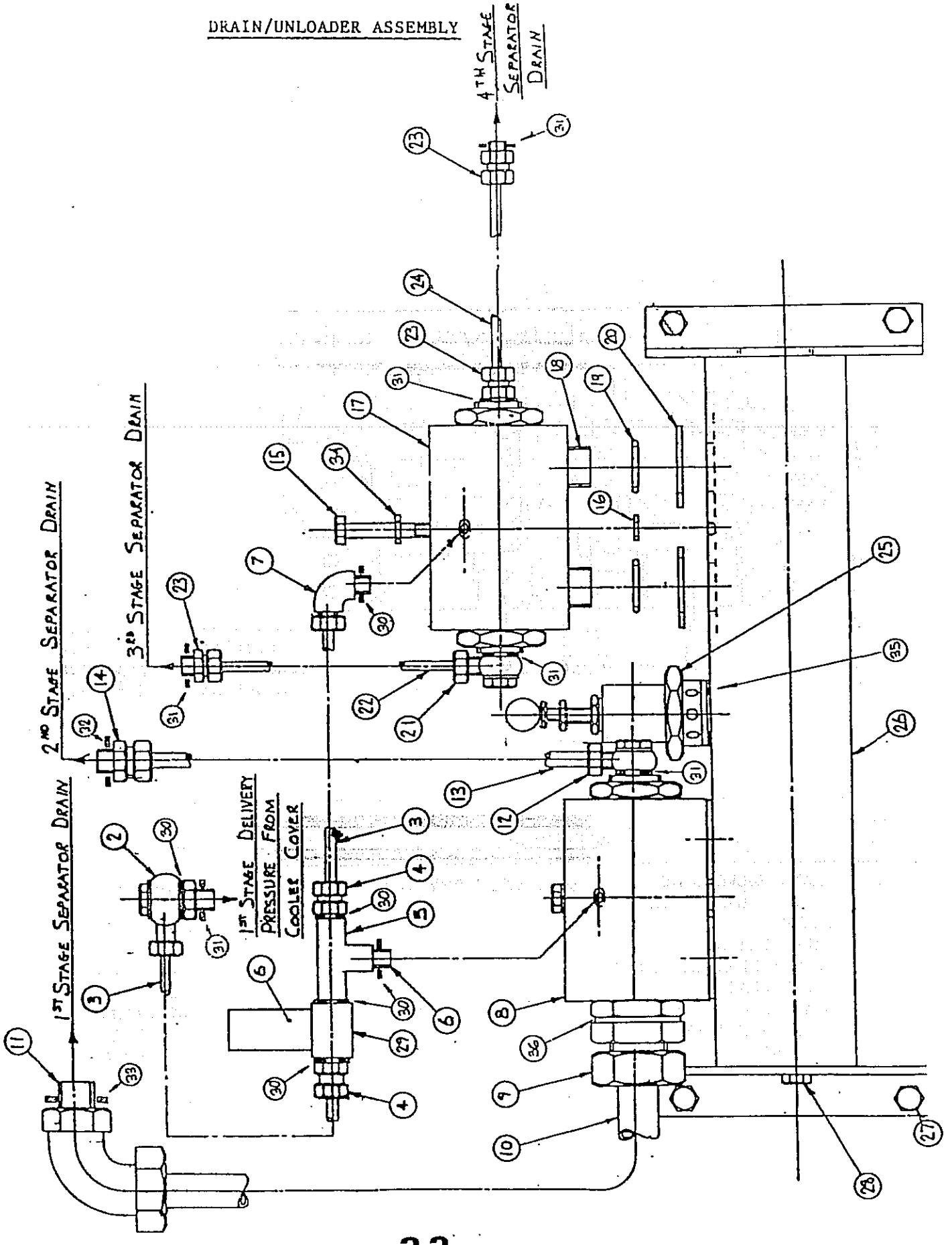


DRAIN/UNLOADER ASSEMBLY

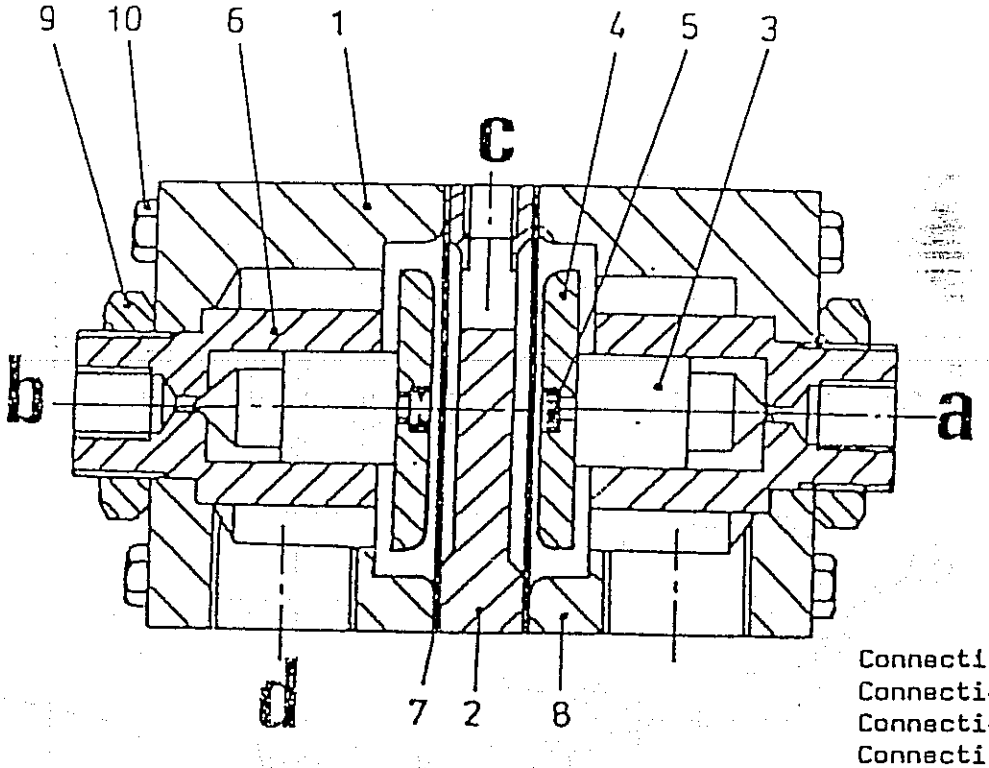
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
2	BANJO 1/4" BSP X Ø6	1	95440/0579
3	COPPER PIPE Ø6 X 1 X 1500 mm	1	M.3225/0604
4	STUD COUPLING 1/8" BSP X Ø6	2	95440/0030
5	TEE 1/8" BSP	1	95405/0349
6	NIPPLE 1/8" BSP	2	95414/0161
7	ELBOW 1/8" BSP X Ø6	1	95440/0178
8	DIAPHRAGM DRAIN VALVE	1	U.334L
9	STUD COUPLING 3/4" BSP X Ø20	1	98156/1158
10	PIPE Ø20 X 1 L=1000 mm	1	M.3077/2017
11	ELBOW 1/2" BSP X Ø20	1	98156/2271
12	BANJO 1/4" BSP X Ø10	1	98156/2094
13	PIPE Ø10 X 1 L=1200 mm	1	M.3077/1008
14	STUD COUPLING 3/8" BSP X Ø10	1	98156/1050
15	BOLT HEX M8 X 1.25 X 90 LG	2	95006/0157
16	WASHER - NYLON	2	C.201488/2
17	DIAPHRAGM DRAIN VALVE	1	U.334 J
18	NIPPLE 3/4" BSP	4	95414/0165
19	'O' RING BS. REF 0265 30 VITON	4	95602/0067
20	WASHER - NYLON	4	C.201488/1
21	BANJO 1/4" BSP X Ø6	1	98156/2097
22	PIPE Ø6 X 1.5 L=1500 mm	1	M.3205/0603
23	STUD COUPLING 1/4" BSP X Ø6	3	98156/1042
24	PIPE Ø6 X 1.5 L=1000 mm	1	M.3205/0603
25	SAFETY VALVE	1	98650/1011
26	SURGE VESSEL	1	E.60337
27	SCREW HEX M10 X 1.5 X 16 LG	4	95000/0281
28	BLANKING PLUG M5	1	98156/2560
29	SOLENOID VALVE 120V 60Hz	1	PS.2035
30	COPPER WASHER 1/8" BSP	5	95635/0001
31	COPPER WASHER 1/4" BSP	6	95635/0002
32	COPPER WASHER 3/8" BSP	1	95635/0003
33	COPPER WASHER 1/2" BSP	1	95635/0004
34	SCREW SEAL M8	2	LJ 20010
35	COPPER WASHER 1" BSP	1	95635/0008
36	COPPER WASHER 3/4" BSP	1	95635/0006
	NON RETURN VALVE 1/2" BSP (not illustrated)	1	PS.1741

DRAIN/UNLOADER ASSEMBLY



9.14

DIAPHRAGM DRAIN VALVE U.334J



Connection A 1" B.S.P.
Connection B 1" B.S.P.
Connection C 1/8" B.S.P.
Connection D & E 3/4" B.S.P.

23

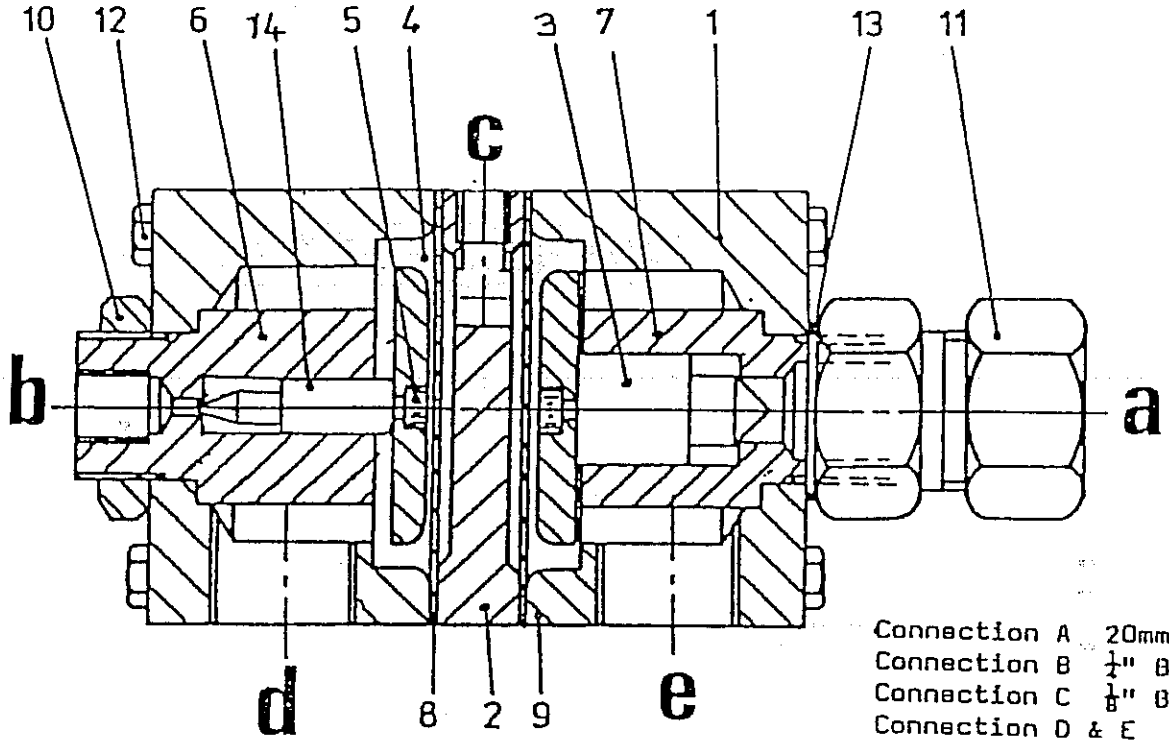
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	DRAIN VALVE BODY	2	C.200840
2	DRAIN VALVE COVER	1	C.200841
3	VALVE	2	C.201160
4	VALVE PLATE	2	C.200845
5	SOCKET HEAD CAP SCREW	2	95018/0100
6	VALVE SEAT	2	C.201259
7	DIAPHRAGM	2	98210/1002
8	DIAPHRAGM JOINT	4	C.200722
9	BACKNUT	2	PS.1290/4
10	HEX HEAD BOLT	6	95006/0133

ASSEMBLY INSTRUCTIONS

1. Assemble with screws finger tight.
2. Apply air pressure through 1/8" BS pipe to deflect diaphragm.
3. Tighten screws evenly with spanner while air pressure is on.

9.15

DIAPHRAGM DRAIN VALVE U.334L



Connection A 20mm o/d pipe
Connection B ½" B.S.
Connection C ⅛" B.S.
Connection D & E ¾" B.S.

Maximum operating pressure 100 p.s.i.
Servo operating connection (C) 1/8" B.S.P.

24

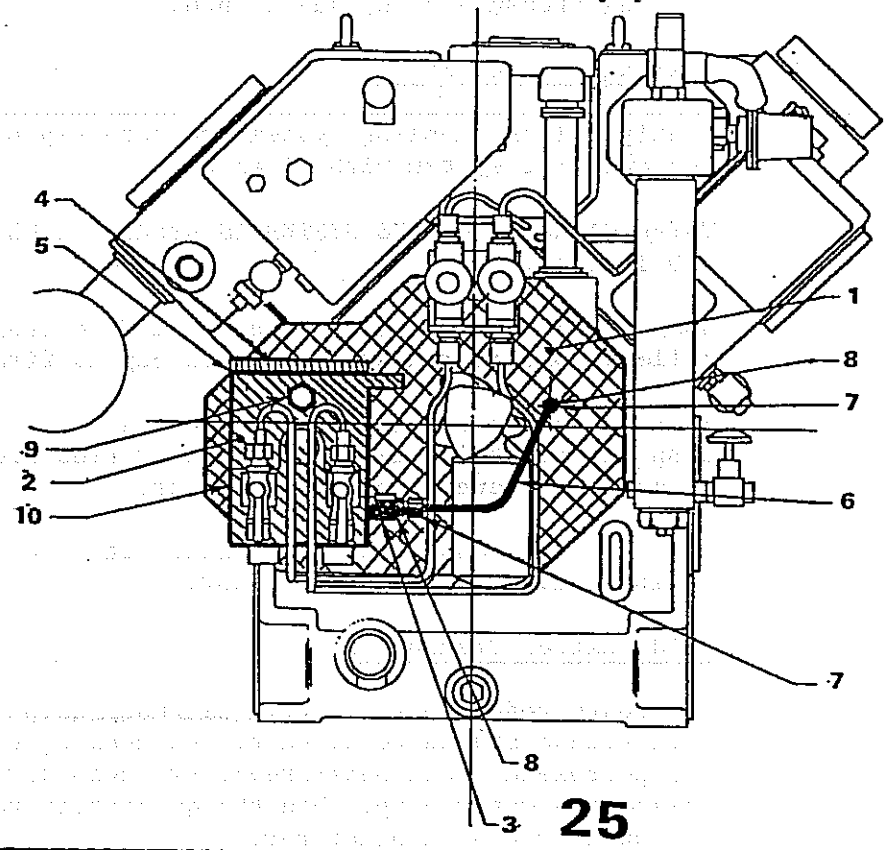
ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	DRAIN VALVE BODY	2	C.200840
2	DRAIN VALVE COVER	1	C.200841
3	VALVE	1	C.200844
4	VALVE PLATE	2	C.200845
5	SOCKET HEAD CAP SCREW	2	95018/0100
6	VALVE SEAT	1	C.201417
7	VALVE SEAT	1	C.200842
8	DIAPHRAGM	2	98210/1002
9	DIAPHRAGM JOINT	4	C.200722
10	BACKNUT	1	PS.1290/4
11	FEMALE COUPLING	1	98156/1158
12	HEX HEAD BOLT	6	95006/0133
13	COPPER WASHER	1	95635/0006
14	VALVE	1	C.201160

9.16 AUTOMATIC TOP UP LUBRICATOR (Optional)

This system replenishes the Kirkham Lubricator reservoir with pressurized oil piped from the compressor crankcase. For this reason the normal filler lid is replaced by a plate and gasket and a contents sight glass is fitted in the reservoir side wall.

Before operating the compressor ensure that the lubricator reservoir is filled with the same lubricant as the compressor and oil level shows half way up the sight glass.

Check that all lubricator oil pipes are fully primed.



25

ITEM NO.	DESCRIPTION	NO. OFF	PART NUMBER
1	MODIFIED OUTER END COVER	1	SK.203/27
2	MODIFIED KIRKHAM LUBRICATOR	1	SK.202/27
3	ORIFICE	1	SK.202/26
4	TOP COVER	1	SK.202/25
5	TOP COVER GASKET	1	SK.204/42
6	LENGTH 6mm DIAMETER X 1.0mm COPPER PIPE OIL DELIVERY TAPPING TO ORIFICE NOTE: ON LATE MODELS THIS PIPE MAY BE MADE OF NYLON	1	-
7	METRIC COUPLING, 1/4" BSP MALE TO 6mm PIPE, OIL DELIVERY TAPPING AND ORIFICE	2	98156/1042
8	1/4" BSP WASHER	2	95635/0002
9	TEDECO LIQUID LEVEL GAUGE	1	PS.1599
10	LUBRICATOR GASKET	1	SK.203/26

9.17 Radiator and Water Pump

9.17.1 General

The radiator is constructed from metals with very high co-efficients of heat transfer, e.g. copper and aluminium and care should be exercised at all times when handling or cleaning. It is mounted horizontally instead of the normal vertical position and therefore has a separate filling facility.

Working pressure 7lbs/square inch.

9.17.2 Filling Cooling System

Gently release cooling system pressure cap on compressor top and fill system with clean water.

TOTAL CAPACITY OF THE SYSTEM IS APPROXIMATELY 9 GALLONS (40 litres).

When compressor is full, water will flow from the radiator filler. Ensure radiator pressure cap is firmly screwed on.

Start compressor and after it has run for a short period, stop and carefully removing radiator pressure cap to release pressure, top up with water.

Once the compressor has been filled it is only necessary to periodically top up the radiator.

9.17.3 Cold Weather Precautions

In frosty conditions a methyl alcohol (methanol) based anti-freeze should be added to the cooling system. Do not use petroleum based anti-freeze or inhibitor as it will damage the water pump. Use the quantities recommended by the anti-freeze manufacturer.

9.17.4 Maintenance

Very little maintenance is required as the strong air flow and flat fins minimize and fouling tendancies.

Do not remove grease or dirt with the use of TRICHLORETHYLENE (Trike). Clean bare aluminium with PERCHLOROETHYLENE.

Check periodically for leaks from pipe connections which could result from excessive mechanical or hydraulic vibration. Tighten or renew joint, as necessary.

Flush cooling system every two years.

9.17.5 RADIATOR AND COOLING SYSTEM PARTS LIST (Not Illustrated)

DESCRIPTION	NO. OFF	PART NUMBER
EXTENSION SHAFT ASSEMBLY	1	C.87190/1
HEX HEAD SETSCREWS FOR '82' M10 X 1.5 X 25 U/H	2	95000/0283
SPRING LOCKWASHERS FOR '85'	2	95179/0051
KEEP PLATE FOR FAN	1	SK100/51
HEX HEAD SETSCREW FOR '87' M8 X 1.25 X 20 U/H	1	95000/0255
SPRING LOCKWASHER FOR '87'	1	95179/0006
HEX HEAD SETSCREWS, M16 X 2.0 X 40 U/H - ROD SUPPORT TO BED	4	95000/0345
106mm PCD WATER PUMP DRIVING PULLEY, GROOVED FOR 1- A SECTION BELT COMPLETE WITH TAPER BUSH, BORED 38mm. KEYWAY 10mm WIDE	1	REF: 1610
LENGTH OF BRAMMER BELT, 1/2" X 10"	1	PS.1203/9
RADIATOR TYPE WSAE 128/96 COMPLETE WITH FAN	1	SK.101/56
SOCKET HEAD CAPSCREW, M10 X 1.5 X 20 U/H - RADIATOR TO LEGS	4	95018/0229
SPRING LOCKWASHERS FOR '113' M10	4	95179/0007
HEX NUTS, M10, FOR '113'	4	95111/0006
WATER PUMP GUARD	1	D.68851
HEX HEAD SETSCREWS FOR '120'	4	95000/0201
JABSCO WATER PUMP, TYPE 6490-254	1	
HEX HEAD SETSCREWS - PUMP TO BRACKET	2	95000/0256
PUMP ADJUSTING BRACKET	1	C.87257
SOCKET HEAD CAPSCREW FOR '134'	2	95018/0201
PLAIN WASHERS FOR '135'	2	95148/0014
ENOTS HOBBS STRAIGHT CONNECTOR WATER INLET/OUTLET	2	98156/1018
ENOTS HOBBS CONED LOCKNUT	2	98156/1029
ERMETO UNIONS 20mm O/D TO 3/4" BSP - WATER CONNECTIONS ON COMPRESSOR	2	98156/1090
90° ELBOW 3/4" ENOTS CONNECTOR - RADIATOR INLET	1	PS.1291/9

9.17.5 Radiator and Cooling System Parts List - cont.

DESCRIPTION	NO. OFF	PART NUMBER
3/4" ENOTS TUBING SLEEVES	2	PS.1285/9
3/4" ENOTS TUBING NUTS	2	PS.1286/9
JUBILEE HOSE CLIPS, SIZE 1	6	PS.1180/7
NYLON REINFORCED PVE REINFORCED HOSE, 3/4" I/D		98617/1005

ITEM NUMBERS REFER TO WORKS PARTS LIST ONLY

9.17.6 Water Pump

The Jabsco Model 6490-254 water pump is of bronze, stainless steel and neoprene compound construction and is of the impeller type. It incorporates sealed for life ball bearings and is basically maintenance free, although periodical inspection is recommended.

This pump is self priming over a wide speed range but feed lines must be air tight to ensure self-priming. Pump will prime when dry but as it depends on liquid pumped for lubrication it should NEVER BE RUN DRY FOR MORE THAN 30 SECONDS as lack of liquid will result in serious impeller burning.

Operating Notes

Temperature range 45° - 180°F (7°C - 82°C)
Freezing temperatures - Most methyl alcohol (Methanol) based anti-freezes can be used. DO NOT USE PETROLEUM BASED ANTI-FREEZE COMPOUNDS OR RUST INHIBITORS.

9.17.7 Maintenance

Use only the genuine replacement gasket, as a thicker one will reduce priming ability whilst a thinner one will cause the impeller to bind.

A pump Service Kit should be kept on hand to re-build all but the most badly worn pumps.

Dismantling

Remove end cover screws, end cover and gasket.

Remove impeller using water pump pliers.

Remove seal, seal spacer and 'o' ring, using two pieces of hooked wire.

Loosen cam screw about two turns and break joint between cam and body by lightly tapping on the cam screwhead.

9.17.7 Maintenance - cont.

To remove bearing and shaft from bearing housing, heat O/D of bearing housing/pulley uniformly with a gas flame.

Remove stationary slinger and rotating shield.

Remove bearing - SEE: FIG Z, with shaft end bearing housing removed according to service instructions, insert plug as shown. Attach two forks on bearing 180° apart. Tighten extractor screw against plug extracting bearing. Plug should be solid steel 7/8" O/D X 9/16" long with one end slightly countersunk to match extractor screw.

Remove bearing shield. Draw shaft through and out of bearing housing.

NOTE: Do not press splined end of shaft through housing.

Inspect all parts for wear or damage. Replace as necessary.

Assembly

Install bearing shield over bearing shoulder with flange facing AWAY from impeller.

Press bearing onto body until it battans.

NOTE: PRESS ON THE INNER RACE OF THE BEARING WHILST SUPPORTING THE PUMP AT THE IMPELLER END

Install rotating shield with dimple facing away from bearing. Install stationary slinger.

Pass drive end of shaft through bearing housing using tool fitted into impeller bore, to ensure correct alignment and positioning, SEE: FIG Z.

Heat bearing housing to approximately 275°F (135°C) in oven and drop over bearing. Housing will immediately shrink upon contact with bearing, therefore it must be positioned quickly. Take care not to 'cock' the housing. Apply sight pressure to the housing whilst cooling.

NOTE: An ordinary domestic oven can be used. Approximately 10-15 minutes in the over at full power will usually heat the housing sufficiently.

Remove all jointing compound from cam screw and can using a solvent, e.g. petrol. Coat upper surface of the cam and cam screw threads with a non-setting jointing compound. Fit cam making sure that it is level with the front end of the impeller housing. Remove excess jointing compound.

Fit 'o' ring and seal spacer.

NOTE: If original shaft has been replaced (after knurling) and shaft is worn, do not replace the seal spacer.

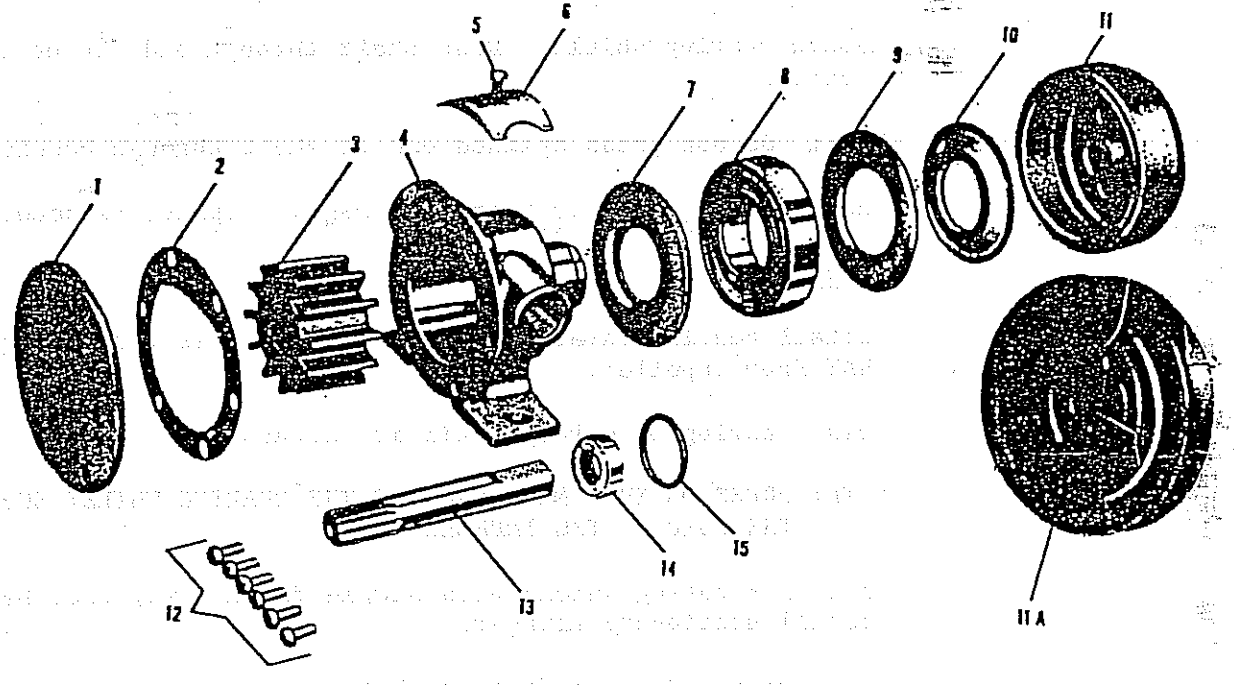
9.17.7 Maintenance – cont.

Lightly grease shaft splines, place seal over shaft with spring facing towards impeller. Make sure that the seal is pushed right home.

Install impeller assembly on shaft with a rotary motion until splines engage, then push into bore.

Install gasket, end cover and secure with end cover screws.

EXPLODED VIEW



9.17.8 PARTS LIST

26

ITEM	DESCRIPTION	NO. OFF	PART NO.
1	END COVER	1	6495-254
2	END COVER GASKET	1	6496-01
3	IMPELLER	1	1210
4	BODY	1	6494-200
5	CAM SCREW	1	SP.1003-09
6	CAM	1	10336
7	BEARING SHIELD	1	3078
8	BALL BEARING	1	SP.2600-09
9	ROTATING SHIELD	1	1161
10	STATIONARY SLINGER	1	1554
11A	PULLEY	1	10758
12	END COVER SCREWS	6	SP.1003-09
13	SHAFT	1	1737-224
14	SHAFT SEAL	1	SP.2700-06
15	'O' RING	1	SP.2000-21
	SEAL SPACER (not shown)	1	3166
	SERVICE KIT comprising: Impeller, Gasket. 'o' ring, End cover screws		SK.225-21

9.18 Pneumatic Water Valve (Optional)

The pneumatic water valve provides automatic opening and closing of the water supply when starting and stopping the compressor.

Operation

The water flow is interrupted by a pneumatically operated valve. This valve contains a flexible diaphragm which allows the operating air to push the valve stem, allowing water to pass through the seat. When the operating air is removed, the valve then closes because the area of the upper diaphragm is greater than that at the valve seat. This action is assisted by the conical spring.

If the compressor is arranged for automatic stop/start the operating air is usually taken from the first stage of the compressor. When the compressor stops, this pressure will fall away and the water valve will close.

If the compressor is arranged for continuous running operating air usually passes through the pneumatic pilot valve, which in turn is operated by an air governor or a solenoid pilot unloader valve. The small bleed screw is removed to allow a small flow of water to take away the heat produced when running unloaded.

If the compressor control system is using the run-on timer method, the bleed screw is not removed because the amount of heat generating during the unloaded running period is not sufficient to create excessive rises in temperature of the water already in the machine.

Two diaphragms are fitted and should either diaphragm fail the leakage will vent to atmosphere by the vent holes in the distance collar. This ensures that air can never enter the water system in the event of a diaphragm failure.

9.18.1 Installation

The valve should be fitted to the water inlet of the compressor or, when fitted, to the inlet of the aftercooler/separator. In either case, the water pressure should not exceed 2.4 bar to avoid rupture of the water jacket bursting discs. Operating air, whether from the compressor or a secondary source, should be between 4 and 11 bar. The maximum water pressure for which the valve is suitable is 6.9 bar.

9.18.2 Maintenance

When fitting new diaphragm the nuts holding the diaphragm cover to the main body should be tightened finger tight only. Air pressure should then be applied to the operating side of the diaphragm to deflect it; the nuts should then be tightened evenly while the air pressure is still being applied.

..... Continued

9.18 Pneumatic Water Valve – cont.

If the unit is not operating correctly this will effect the water flow through the compressor. No water flow will cause overheating. Full water flow when standing idle or running unloaded will usually cause condensate contamination of the crankcase oil. These faults may have serious consequences, therefore, regular checks are advised.

9.19 Pressure Switch 98524/1004

Type — Telemecanique XM6-B-500
Range, 40 to 500 bar (580-7250 psi)
Lower setting 20 to 50 bar (290-275 psi)
Upper setting 158 to 175 bar (2291-2538 psi)
Max. occasional surge pressure 600 bar (8700 psi)
Weight 1.450 kilos

9.19.1 Operation

Located as close as possible to the receiver, the pressure switch stops the compressor when the upper pressure limit is attained and triggers off the start-up sequence when the lower limit is reached. The switch transforms a change of pressure into an electrical signal "ON or "OFF". When a pre-set pressure is reached the snap action contact changes state.

9.19.2 Installation

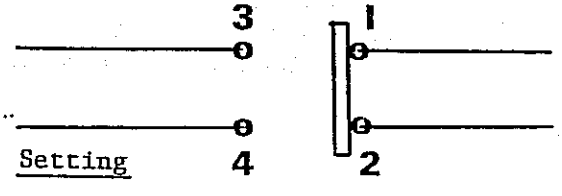
Pressure switches may be mounted in any convenient position close to the air receiver, providing they are not subject to vibration and that the connecting pipe to the air receiver does not exceed five metres in length.

If the pilot unloading valve is connected to the air receiver the pressure switch and pilot unloader valve pipes should be separate to avoid inter-action between the unloader valve and pressure switch.

Mount switch by lugs provided on casing.

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

It is usual to connect 1 and 2 to compressor electrical control circuit terminals marked "PRESSURE SWITCH (AIR)".



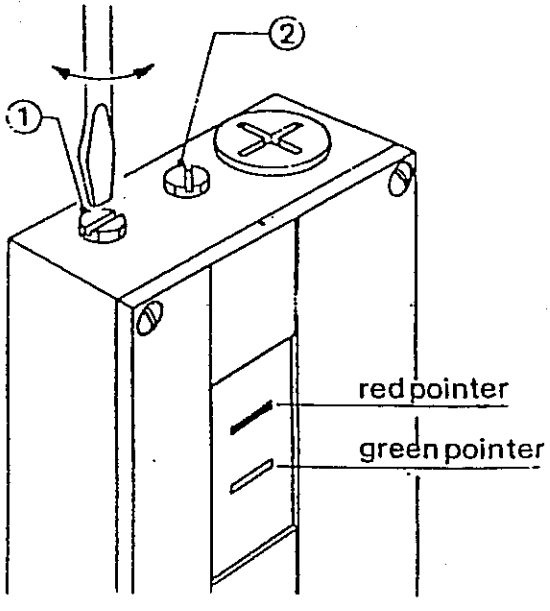
9.19.3 Setting

Example of pressure setting for 20 bar min and 175 bar max.

Turn screw (1) to raise the GREEN pointer to its highest point

Turn screw (2) so that the higher setting (175 bar) coincides with the RED pointer

Turn screw (1) again to set the lower pressure (20 bar on the GREEN pointer



9.20 DIAPHRAGM GLOBE VALVE - U.231 H

Optional, Current Production

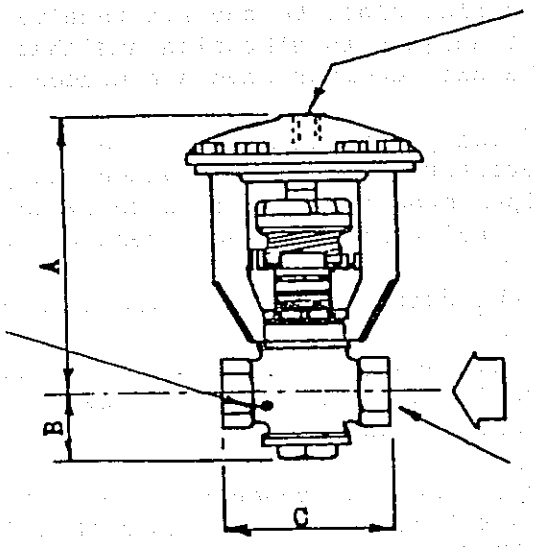
This diaphragm globe valve supersedes the previous Bakelite pneumatic water valve U.231D and is fitted on current production machines. It is of the 1" connection, normally closed type, as opposed to the 3/4" connections used on previous machines.

For machines with 3/4" connections, order replacement units as under.

3/4" Normally closed - U.231 F
3/4" Normally open - U.231 G

Where a by-pass system is fitted the following 3-way valves will be required:-

3/4" BSP - 98650/1303
1" BSP - 98650/1304



FUNCTION ..... NORMALLY CLOSED
TEMPERATURE ..... FLUID + 5°C TO + 18°C
AMBIENT + 5°C TO + 60°C

CONSTRUCTION

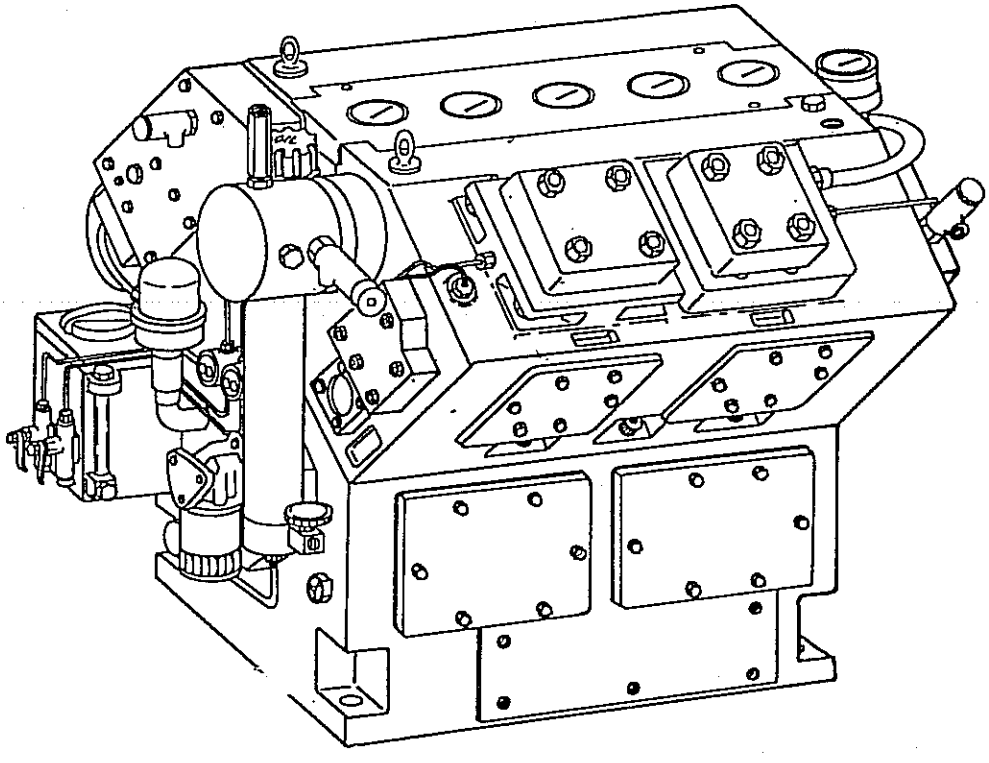
VALVE BODY ..... BRONZE PN16
ROD ..... STAINLESS STEEL

Ø PORT BSP	Ø ORIFICE MM	MSP IN BARS	DIMENSIONS		
			A	B	C
3/4"	20	16	170	44	100
1"	25	16	187	48	110

PUBLICATION NUMBER 5415 : 1

CompAir Reavell

SIEBE
A SIEBE COMPANY



PARTS LIST

5415

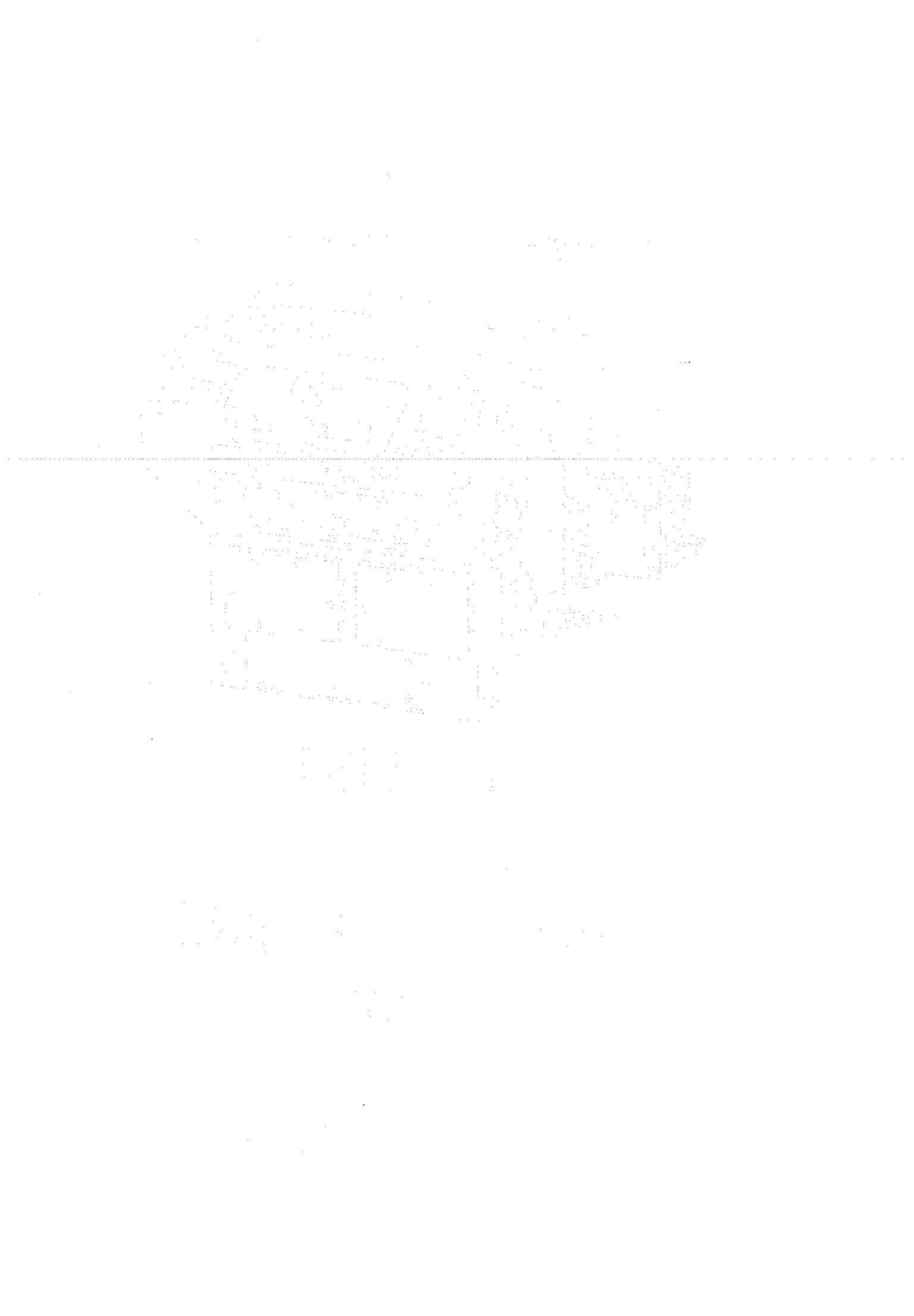
STANDARD MACHINE

Basic Unit

In any correspondence please quote :

MACHINE NUMBER (indicated on nameplate)
PUBLICATION NUMBER : 5415 : 1
ISSUE DATE : February 1988

COMPAIR REAVELL LTD. REAVELL WORKS IPSWICH ENGLAND IP2 0AE
TELEPHONE: IPSWICH (0473) 602222 TELEX: 98254 FAX: IPSWICH (0473) 601282



How to order spares

IN ORDER TO AVOID UNNECESSARY DELAY, PLEASE QUOTE:-

1. Complete invoicing and shipping address
2. Machine Model Reference No.
3. Machine No.
4. Item Reference
5. Part No.
6. Description
7. Quantity required

5415 STANDARD MACHINE

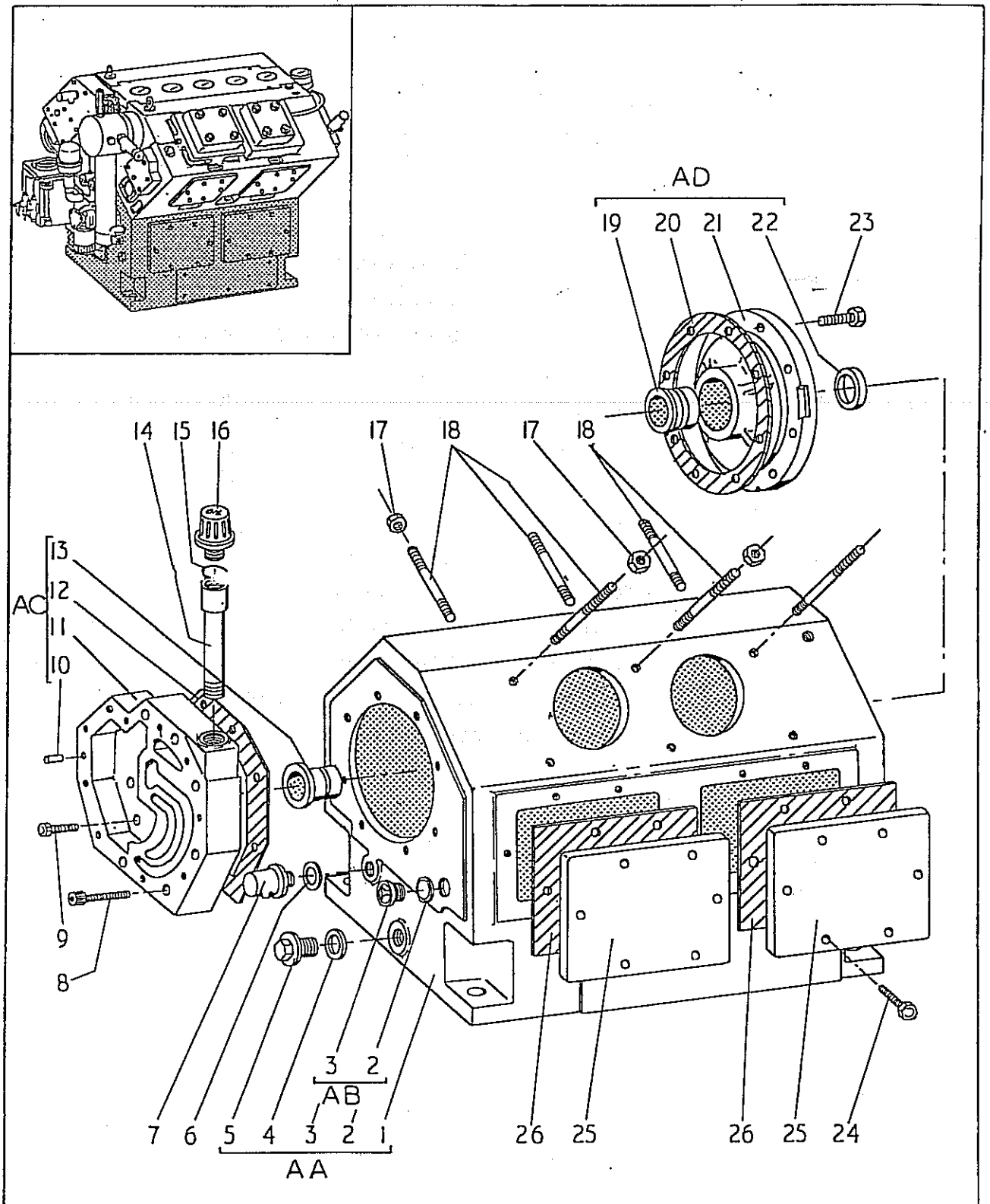
CONTENTS LIST

NOTE:

Standard parts are available where indicated by either a number or letters. The letters indicate that an item is available as a component of an assembly. Items indicated with * are also available as a part of a joint or 'O' ring kit. Non-listed or individual items of assemblies where reference numbers are not indicated, are not standard replacement parts and can only be obtained at the discretion of CompAir Reavell. The assemblies have been chosen based on the experience gained by our own Parts and Service Departments.

The right is reserved to modify the contents of this list, without notice, and the information given is in no way binding on the manufacturers.

5415 STANDARD MACHINE



A

CRANKCASE

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'A'

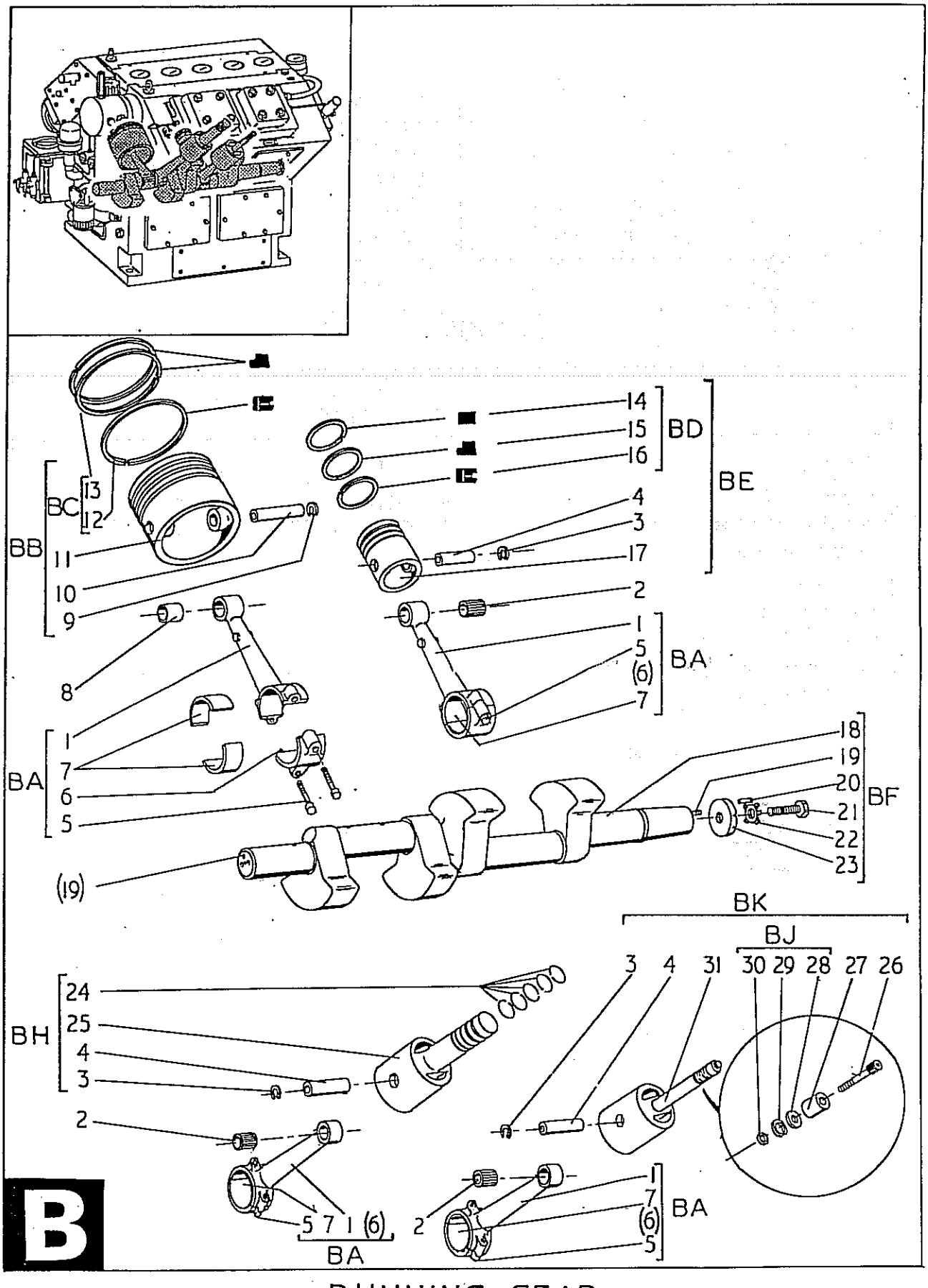
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
AA	CRANKCASE ASSEMBLY	1	A1,2,3,4 & 5	E.60037/100
AB	OIL LEVEL SIGHT GLASS ASSEMBLY	1	A2 & 3	98281/1002
AC	BEARING HOUSING ASSEMBLY - Outer End	1	A10,11,12 & 13	E.60003/100
AD	BEARING HOUSING ASSEMBLY - Driven End	1	A19,20,21 & 22	D.10009/100

CRANKCASE

ITEM NO.	DESCRIPTION		NO. OFF	PARTS REFERENCE	
A1	CRANKCASE		1	AA	
A2	WASHER - Fibre	(For Item A3)	1	AA & AB	
A3	OIL LEVEL SIGHT GLASS		1	AA & AB	
A4	WASHER - Copper	(For Item A5)	1	98660/1156 & AA	
A5	DRAIN PLUG		1	PS.1068/5 & AA	
A6	WASHER - Copper	(For Item A7)	1	98660/1155	
A7	LOW OIL PRESSURE SWITCH		1	PS.1647	
A8	SETSCREW - Socket Head		5	95018/0279	
A9	SETSCREW - Hexagon Head		3	95000/0314	
A10	DOWEL		2	95502/0336 & AC	
A11	BEARING HOUSING - Outer End		1	AC	
A12	JOINT	(For Item A11)	1	D.100356 & AC	*
A13	BUSH - Main Bearing		1	C.200020 & AC	
A14	OIL FILLER STANDPIPE		1	95414/0018	
A15	WASHER - Hobbs	(For Item A16)	1	PS.1302/5	
A16	OIL FILLER CAP		1	98262/1045	
A17	NUT		6	95111/0007	
A18	STUD		6	D.66720/12/53	
A19	BUSH - Main Bearing		1	C.200020 & AD	
A20	JOINT	(For Item A22)	1	D.100355 & AD	*
A21	BEARING HOUSING - Driven End		1	AD	
A22	OIL SEAL	(For Item A21)	1	98505/1002 & AD	
A23	SETSCREW - Hexagon Head	(For Item A21)	8	95000/0314	
A24	SETSCREW - Hexagon Head	(For Item A25)	24	95000/0283	
A25	CRANKCASE DOOR		4	C.200009	
A26	JOINT	(For Item A25)	4	C.200867	*

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



B

RUNNING GEAR

5415 STANDARD MACHINE

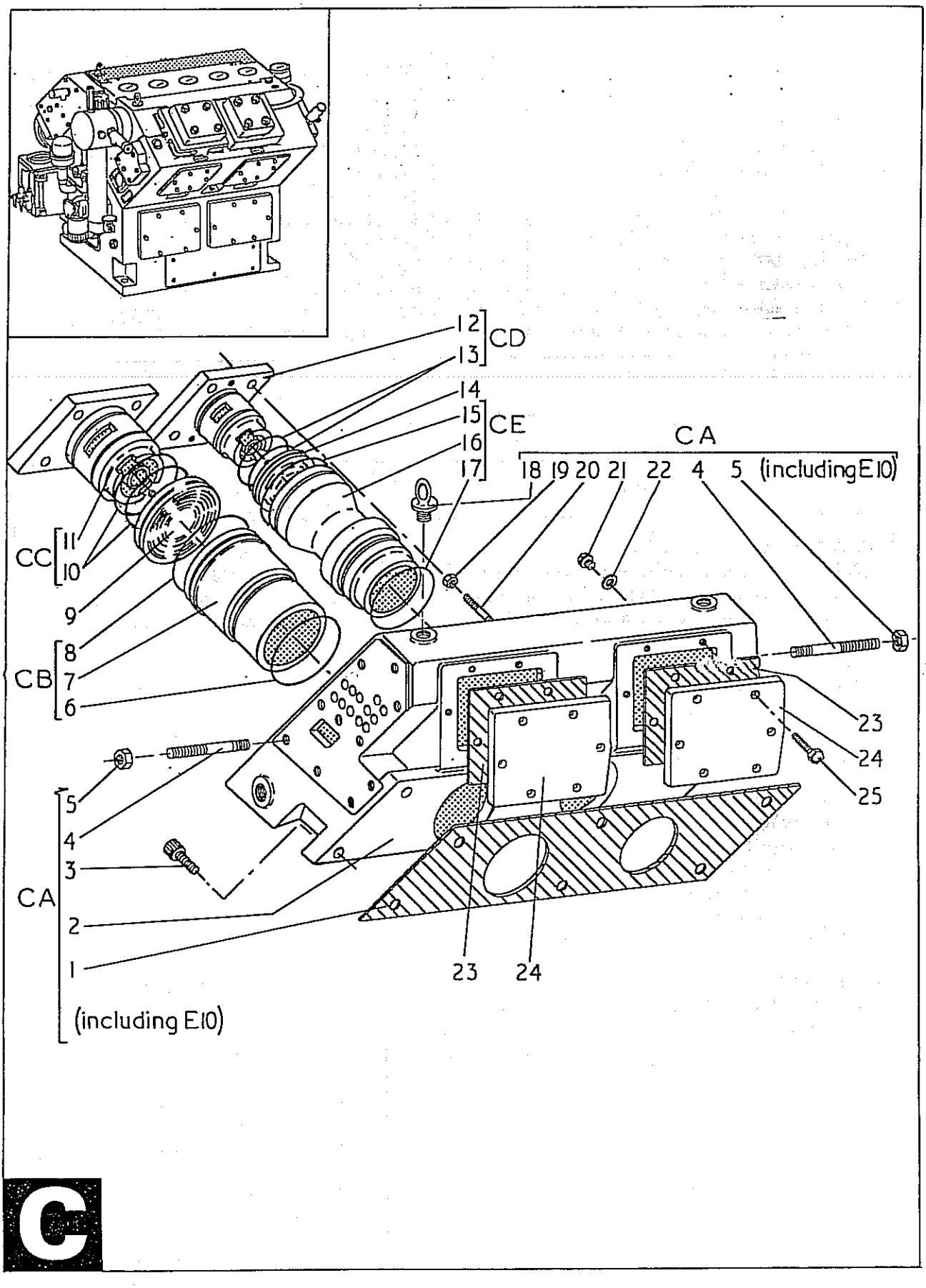
PARTS ASSEMBLIES 'B'

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
BA	CONNECTING ROD ASSEMBLY	4	B1,5,6 & 7	U.271/A
BB	PISTON ASSEMBLY - 1st Stage	1	B9,10,11,12 & 13	D.100014/50
BC	PISTON RING SET - 1st Stage	1	B12 & 13	98477/1009
BD	PISTON RING SET - 2nd Stage	1	B14,15 & 16	98477/1010
BE	PISTON ASSEMBLY - 2nd Stage	1	B3,4,14,15,16 & 17	D.100015/50
BF	CRANKSHAFT ASSEMBLY	1	B18,19,20,21,22 & 23	D.100008/100
BG	PISTON RING SET - 3rd Stage	1	B24	98477/1011
BH	PISTON ASSEMBLY - 3rd Stage	1	B3,4,24 & 25	C.200030/50
BJ	PISTON RING SET - 4th Stage	1	B29	98477/1012
BK	CROSSHEAD/PISTON ASSEMBLY - 4th Stage	1	B3,4,26,27,28,29,30 & 31	C.201167

RUNNING GEAR

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
B1	CONNECTING ROD (with cap)	4	BA
B2	BEARING - Small End (2nd, 3rd & 4th Stage)	3	98076/1013
B3	CIRCLIP - Gudgeon Pin (2nd, 3rd & 4th Stage)	6	95650/0025 & BE,BH & BK
B4	GUDGEON PIN (2nd, 3rd & 4th Stage)	3	C.200032 & BE,BH & BK
B5	BOLT - Connecting Rod	8	95000/0291 & BA
B6	DOWEL PIN	8	BA
B7	BEARING - Big End	4 Prs	98074/1006 & BA
B8	BUSH - Small End (1st Stage)	1	C.200029
B9	CIRCLIP - 1st Stage Gudgeon Pin	2	95650/0025 & BB
B10	GUDGEON PIN - 1st Stage	1	C.200028 & BB
B11	PISTON - 1st Stage	1	BB
B12	OIL CONTROL RING - 1st Stage Piston	1	BB & BC
B13	PISTON RING - 1st Stage Piston (Top and Middle)	2	BB & BC
B14	PISTON RING - 2nd Stage - Plain (Top)	1	BD & BE
B15	PISTON RING - 2nd Stage - Taper Faced (Middle)	1	BD & BE
B16	OIL CONTROL RING - 2nd Stage	1	BD & BE
B17	PISTON - 2nd Stage	1	BE
B18	CRANKSHAFT	1	BF
B19	GRUBSCREW	2	95074/0047 & BF
B20	TENSION PIN	1	95540/104 & BF
B21	SETSCREW - Hexagon Head (For Item B23)	1	95000/371 & BF
B22	TAB WASHER (For Item B23)	1	C.68798/11 & BF
B23	END PLATE (For Item B18)	1	C.200025 & BF
B24	PISTON RING - 3rd Stage	5	BG & BH
B25	PISTON - 3rd Stage	1	BH
B26	SETSCREW - Socket Head	1	95018/0176 & BK
B27	JUNK RING	1	C.200216 & BK
B28	SPACER WASHER (Inside Item B29)	6	BJ & BK
B29	PISTON RING - 4th Stage	6	BJ & BK
B30	SPACER WASHER (For Item B29)	6	BJ & BK
B31	CROSSHEAD - 4th Stage	1	BK

5415 STANDARD MACHINE



C

1st AND 2nd STAGE CYLINDER

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'C'

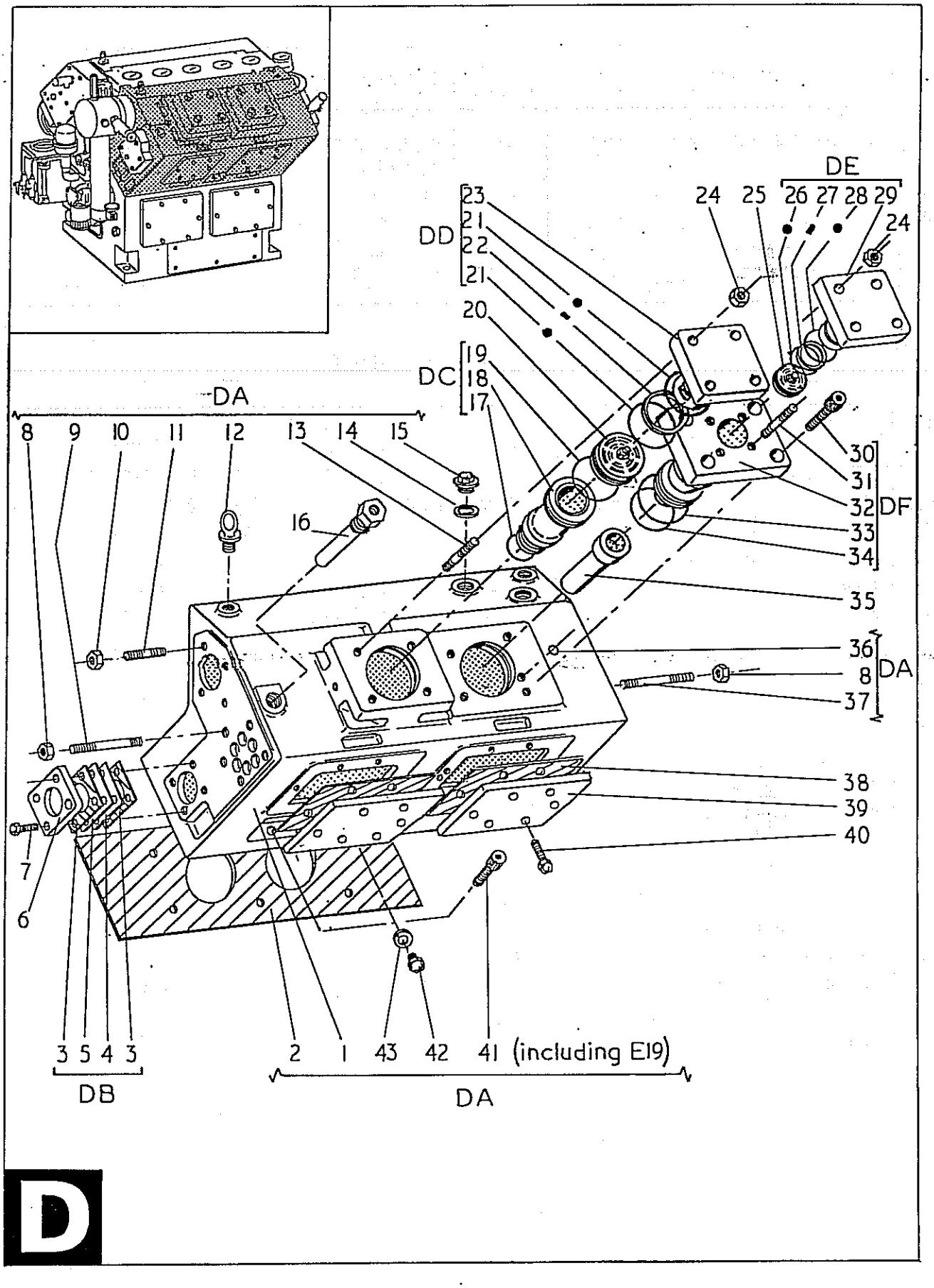
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
CA	CYLINDER ASSEMBLY - 1st & 2nd Stage	1	C1,2,3,4,5,18,19,20,21, 22 & E10	E.60001/100
CB	LINER ASSEMBLY - 1st Stage	1	C6,7 & 8	C.200013/100
CC	VALVE COVER ASSEMBLY - 1st Stage	1	C10 & 11	C.200004/100
CD	VALVE COVER ASSEMBLY - 2nd Stage	1	C12 & 13	C.200005/100
CE	LINER ASSEMBLY - 2nd Stage	1	C15,16 & 17	C.200015/100

1ST AND 2ND STAGE CYLINDERS

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE	
C1	JOINT (For Item C2)	1	C.200631	*
C2	CYLINDER - 1st & 2nd Stage	1	CA	
C3	SETSCREW - Socket Head	3	95018/0272 & CA	
C4	STUD (For Items E2 & E12)	19	D.66720/10/85 & CA	
C5	NUT (For Item C4)	19	95111/0006 & CA	
C6	'O' RING (For Item C7)	1	95602/0100 & CB	*
C7	CYLINDER LINER - 1st Stage	1	CB	
C8	'O' RING (For Item C7)	1	95602/0102 & CB	*
C9	CONCENTRIC VALVE ASSEMBLY - 1st Stage	1	98650/1080	
C10	'O' RING (For Item C11)	2	95602/0103 & CC	*
C11	VALVE COVER - 1st Stage	1	CC	
C12	VALVE COVER - 2nd Stage	1	CD	
C13	'O' RING (For Item C12)	2	95602/0094 & CD	*
C14	CONCENTRIC VALVE ASSEMBLY - 2nd Stage	1	98650/1099	
C15	'O' RING (For Item C16)	1	95602/0091 & CE	*
C16	CYLINDER LINER - 2nd Stage	1	CE	
C17	'O' RING (For Item C16)	1	95602/0093 & CE	*
C18	EYE BOLT	1	98086/1001 & CA	
C19	NUT (For Item C20)	10	95111/0006 & CA	
C20	STUD (For Items C11 & C12)	10	D.66720/10/45 & CA	
C21	PLUG	4	PS.1068/3 & CA	
C22	DOWTY SEAL	4	PS.1322/3	
C23	JOINT (For Item C24)	2	C.200204	*
C24	COOLER DOOR	2	C.200819	
C25	SETSCREW - Hexagon Head (For Item C24)	12	95000/0283	

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



D

3rd AND 4th STAGE CYLINDER

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'D'

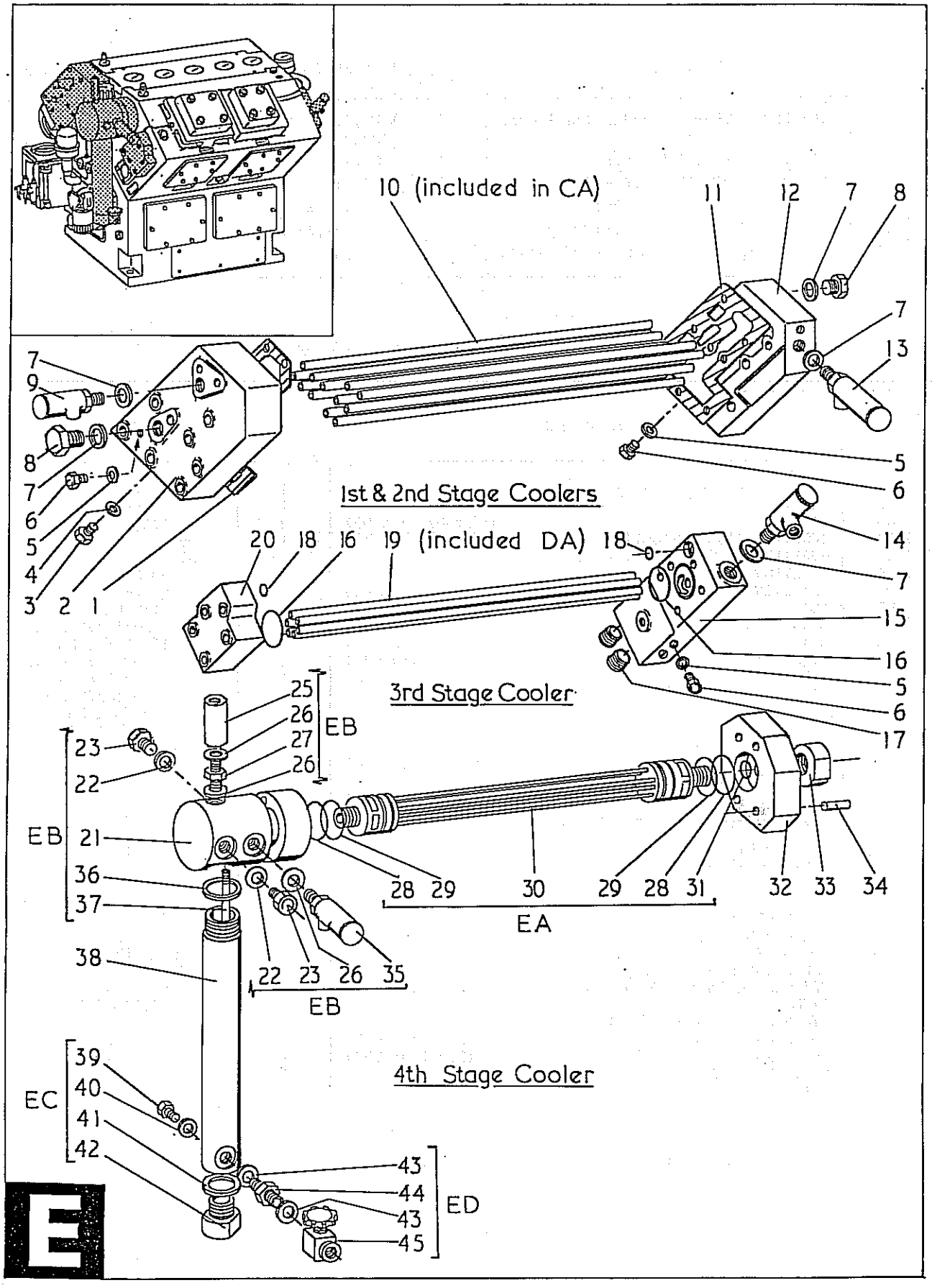
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
DA	CYLINDER ASSEMBLY - 3rd & 4th Stages	1	D1,2,8,9,10,11,12,13,15, 36,37,41,42,43 & E19	E.60002/100
DB	BURSTING DISC & JOINT KIT	1	D3,4 & 5	C.201556/100
DC	CYLINDER LINER ASSEMBLY - 3rd Stage	1	D17,18 & 19	C.200031/100
DD	VALVE COVER ASSEMBLY - 3rd Stage	1	D21,22 & 23	C.200006/100
DE	VALVE COVER ASSEMBLY - 4th Stage	1	D26,27,28 & 29	C.200194/100
DF	CYLINDER BARREL ASSEMBLY - 4th Stage	1	D31,32,33 & 34	D.100059/100

3RD & 4TH STAGE CYLINDERS

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE	
D1	CYLINDER - 3rd & 4th Stage	1	DA	
D2	JOINT (For Item D1)	1	C.200866 & DA	*
D3	JOINT (For Items D4 & D5)	2	C.81788 & DB	*
D4	BURSTING DISC - Plastic	1	DB	
D5	BURSTING DISC - P.T.F.E./Metal	1	DB	
D6	BURSTING DISC COVER	1	C.200584	
D7	SETSCREW - Hexagon Head (For Item D6)	4	95000/282	
D8	NUT (For Items D9 & D37)	11	95111/0007 & DA	
D9	STUD (For Item E20)	5	D.66720/12/78 & DA	
D10	NUT (For Item D11)	2	95111/0006 & DA	
D11	STUD (For Item E21)	2	D.66720/10/75 & DA	
D12	EYE BOLT	1	98086/1001 & DA	
D13	STUD	4	D.66720/16/74 & DA	
D14	DOWTY SEAL	1	PS.1322/6 & DA	
D15	PLUG	1	PS.1068/5 & DA	
D16	THERMOMETER POCKET	1	C.201708	
D17	'O' RING (For Item D18)	1	95602/0079 & DC	*
D18	CYLINDER LINER - 3rd Stage	1	DC	
D19	'O' RING (For Item D18)	1	95602/0083 & DC	*
D20	CONCENTRIC VALVE ASSEMBLY - 3rd Stage	1	98650/1049	
D21	'O' RING (For Item D23)	2	98504/1104 & DD	*
D22	BACK-UP RING - P.T.F.E.	1	98504/1112 & DD	*
D23	VALVE COVER - 3rd Stage	1	DD	
D24	NUT	8	95111/0009	
D25	CONCENTRIC VALVE ASSEMBLY - 4th Stage	1	98650/1115	
D26	'O' RING (For Item D29)	1	98504/1106 & DE	*
D27	BACK-UP RING	1	98504/1090 & DE	*
D28	'O' RING (For Item D29)	1	98504/1105 & DE	*
D29	VALVE COVER - 4th Stage	1	DE	
D30	SETSCREW - Socket Head (For Item D33)	4	95018/0235	
D31	STUD	4	D.66720/16/74 & DF	
D32	CYLINDER BARREL - 4th Stage	1	DF	
D33	'O' RING (For Item D33)	1	95602/0087 & DF	*
D34	'O' RING (For Item D33)	1	95602/0083 & DF	*
D35	CYLINDER LINER - 4th Stage	1	C.200256	
D36	'O' RING (Between Items D2 & D32)	1	95602/0037 & DA	*
D37	STUD (For Item E15)	6	D.66720/12/93 & DA	
D38	JOINT (For Item D39)	2	C.200204	*
D39	COOLER DOOR	2	C.200819	
D40	SETSCREW - Hexagon Head (For Item D39)	12	95000/282	
D41	SETSCREW - Socket Head	3	95018/0272 & DA	
D42	PLUG	1	PS.1068/3 & DA	
D43	DOWTY SEAL	1	PS.1322/3 & DA	

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



1st, 2nd, 3rd AND 4th STAGE COOLERS

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'E'

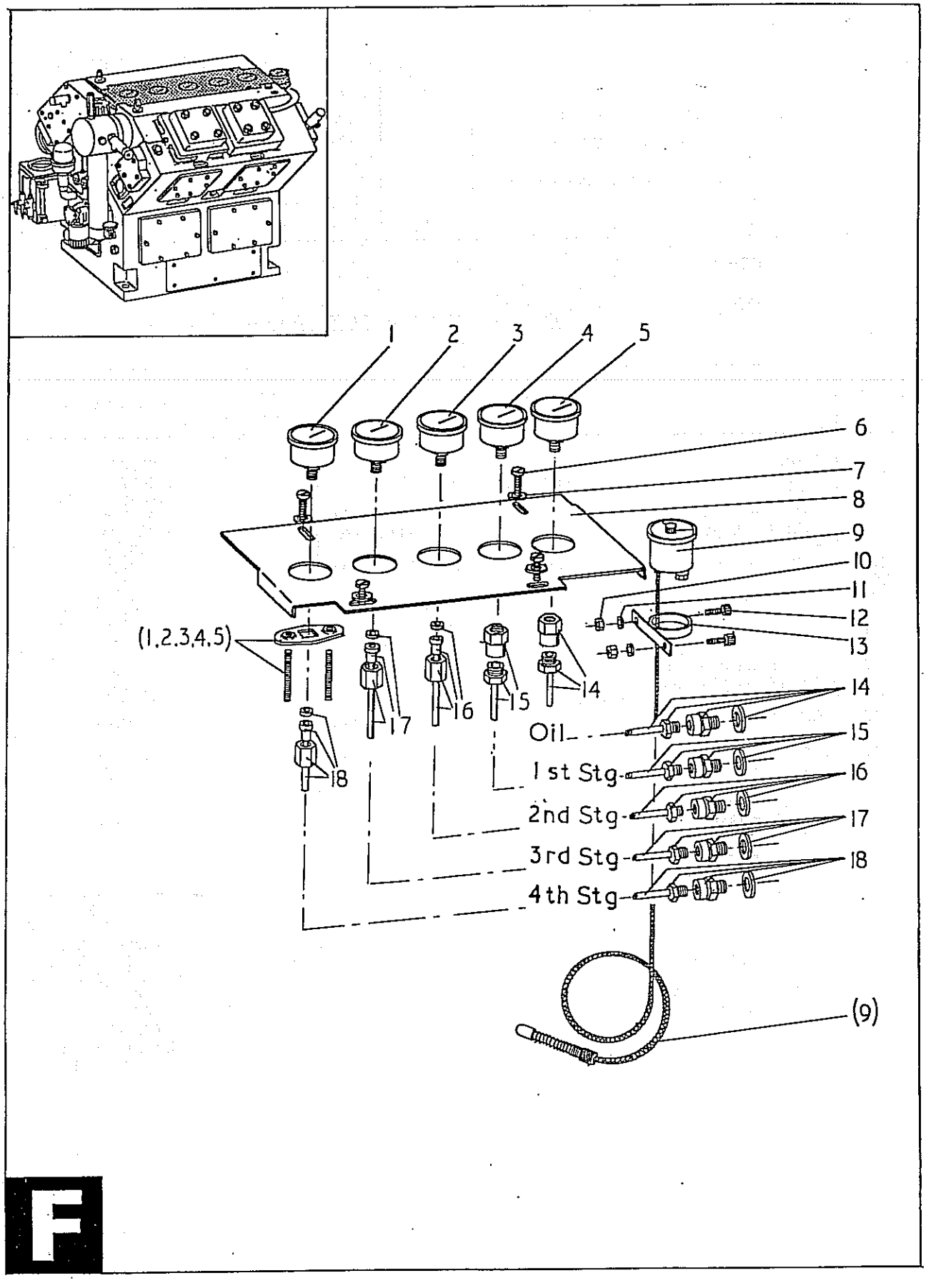
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
EA	COOLER TUBESTACK ASSEMBLY - 4th Stage	1	E28,29,30 & 31	D.10019/1/100
EB	COOLER COVER ASSEMBLY - 4th Stage	1	E21,22,23,25,26,27,35, 36 & 37	D.100269/50
EC	SEPARATOR BOTTOM FITTING ASSEMBLY - 4th Stage	1	E39,40,41 & 42	C.73732/22/50
ED	DRAIN VALVE ASSEMBLY	1	E43,44 & 45	C.76059/2/50

1ST, 2ND, 3RD & 4TH STAGE COOLERS

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE	
E1	JOINT (For Item E2)	1	C.200203	*
E2	COOLER COVER - Outer End (1st & 2nd Stage)	1	E.60007	
E3	PLUG	1	PS.1068/3	
E4	WASHER - Copper (For Item E3)	1	98660/1154	
E5	WASHER - Copper (For Item E6)	3	98660/0002	
E6	PLUG	3	PS.1068/2	
E7	WASHER - Copper (For Items E8,E9,E13 & E14)	5	98660/1155	
E8	PLUG	2	PS.1068/4	
E9	SAFETY VALVE - 2nd Stage	1	98650/1021	
E10	COOLER TUBES - 1st & 2nd Stage	12	C.200390/1 & CA	
E11	JOINT (For Item E12)	1	C.200202	*
E12	COOLER COVER - Driven End (1st & 2nd Stage)	1	E.60008	
E13	SAFETY VALVE - 1st Stage	1	98650/1020	
E14	SAFETY VALVE - 3rd Stage	1	98650/1022	
E15	COOLER COVER/SEPARATOR - 3rd Stage	1	D.100000	
E16	'O' RING (For Items E15 & E20)	2	95602/0084	*
E17	PLUG - Taper	2	PS.1454/7	
E18	'O' RING (For Items E15 & E20)	2	95602/0069	*
E19	COOLER TUBE - 3rd Stage	6	C.200390/2 & DA	
E20	COOLER COVER - 3rd Stage - Outer End	1	C.200000	
E21	COOLER COVER - 4th Stage - Fixed End	1	D.100269 & EB	
E22	WASHER - Copper	2	98660/1156 & EB	
E23	PLUG	2	PS.1814/1 & EB	
E24	----------	---	----------	*
E25	NON-RETURN VALVE	1	98650/1655 & EB	
E26	WASHER - Copper	3	98660/1155 & EB	
E27	UNION (For Item E25)	1	C.82148 & EB	
E28	'O' RING (For Item E30)	2	95604/0083 & EA	*
E29	'O' RING (For Item E30)	2	95602/0083 & EA	*
E30	COOLER TUBESTACK	1	D.100019/1 & EA	
E31	'O' RING (For Item E30)	1	95604/0077 & EA	*
E32	COOLER COVER - 4th Stage - Floating End	1	C.86668	
E33	COOLER NUT - 4th Stage	1	C.86472	
E34	DOWEL (For Item E33)	1	95504/0424	
E35	SAFETY VALVE - 4th Stage	1	98650/1190 & EB	
E36	DOWTY SEAL (For Item E38)	1	PS.1322/9 & EB	
E37	SEPARATOR DOWN PIPE	1	C.86460/2 & EB	
E38	SEPARATOR BODY - 4th Stage	1	C.200003	
E39	PLUG	1	PS.1814/4 & EC	
E40	WASHER - Copper (For Item E39)	1	98660/1153 & EC	
E41	DOWTY SEAL (For Item E42)	1	PS.1322/9 & EC	
E42	SEPARATOR PLUG	1	C.73732/22 & EC	
E43	WASHER - Copper (For Item E44)	2	98660/1153 & ED	
E44	ADAPTOR	1	C.76059/2 & ED	
E45	STOP VALVE	1	PS.1046/2 & ED	

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



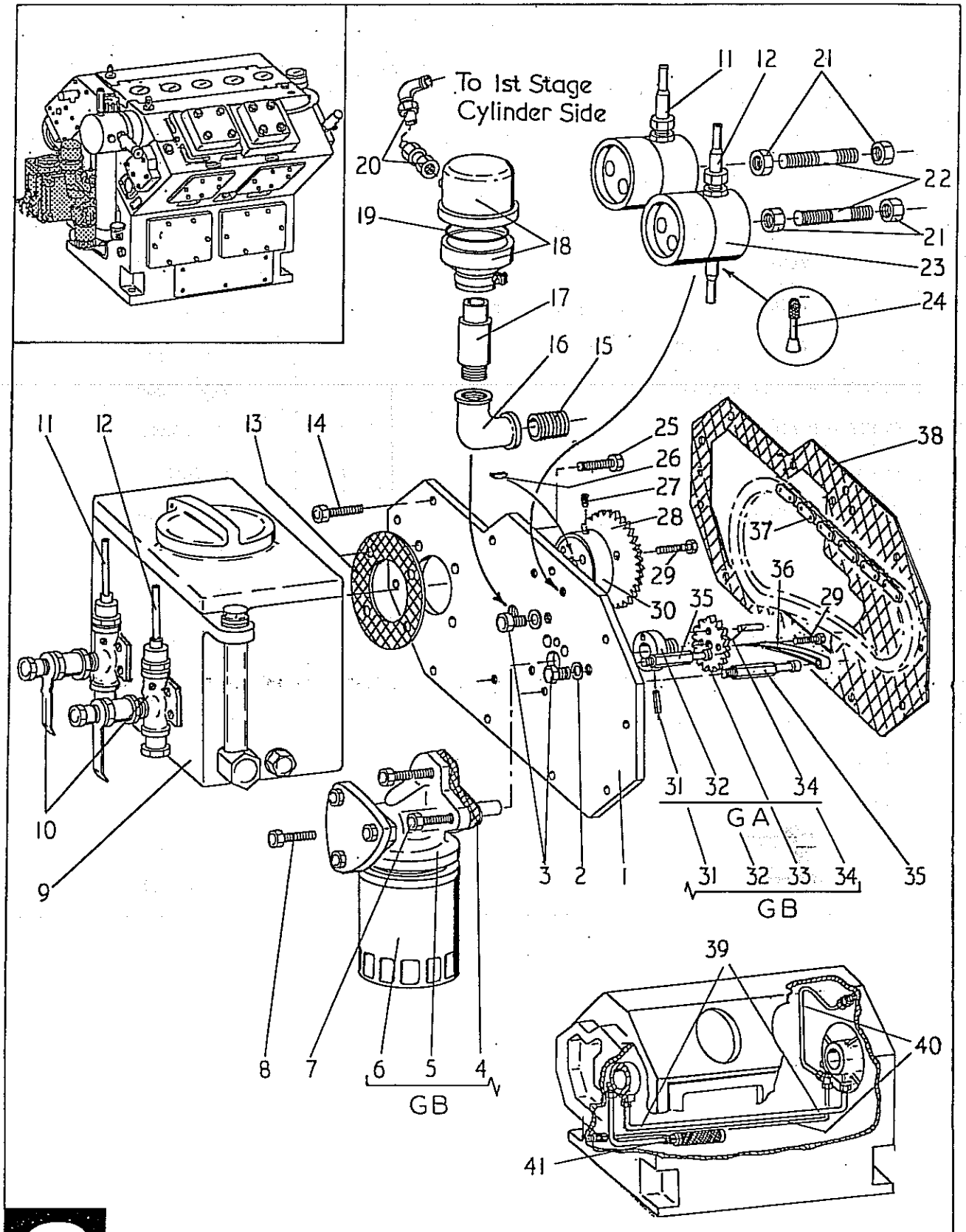
F

5415 STANDARD MACHINE

INSTRUMENTATION

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
F1	PRESSURE GAUGE & FITTINGS - 4th Stage - Air	1	98288/1005
F2	PRESSURE GAUGE & FITTINGS - 3rd Stage - Air	1	98288/1004
F3	PRESSURE GAUGE & FITTINGS - 2nd Stage - Air	1	98288/1003
F4	PRESSURE GAUGE & FITTINGS - 1st Stage - Air	1	98288/1002
F5	PRESSURE GAUGE & FITTINGS - Oil	1	98288/1001
F6	SETSCREW - Hexagon Head	4	95000/0200
F7	WASHER - Plain	4	95148/0012
F8	GAUGE PANEL	1	E.60291
F9	SWITCHED THERMOMETER	1	98288/1076
F10	NUT	2	95111/0002
F11	WASHER - Spring	2	95179/0003
F12	SETSCREW - Socket Head	2	95018/0101
F13	THERMOMETER CLIP	1	98150/1031
F14	GAUGE PIPE ASSEMBLY - Oil	1	C.201967/1
F15	GAUGE PIPE ASSEMBLY - 1st Stage	1	C.201967/2
F16	GAUGE PIPE ASSEMBLY - 2nd Stage	1	C.201967/3
F17	GAUGE PIPE ASSEMBLY - 3rd Stage	1	C.201967/4
F18	GAUGE PIPE ASSEMBLY - 4th Stage	1	C.201967/5

5415 STANDARD MACHINE



G

LUBRICATION

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'G'

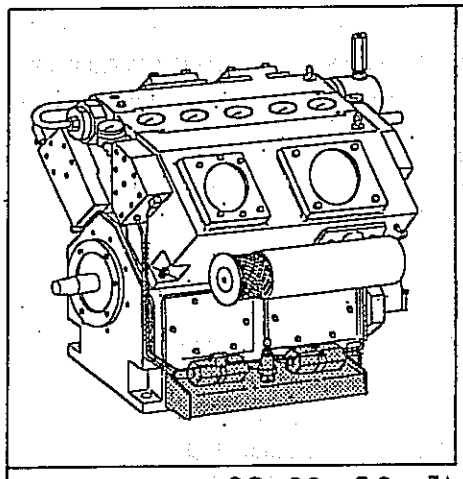
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
GA	DRIVE WHEEL ASSEMBLY	1	G31,32 & 34	C.85737/3
GB	OIL PUMP ASSEMBLY	1	G4,5,6,31,32,33 & 34	C.85737/2/50

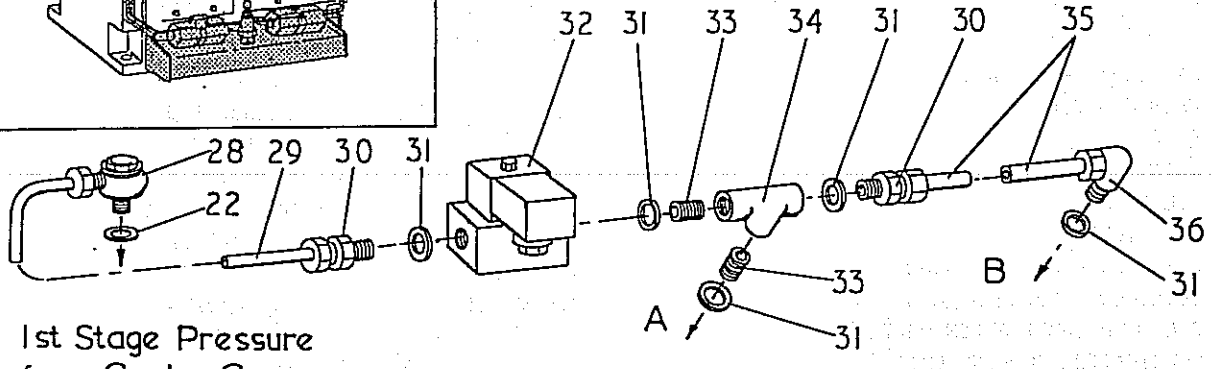
LUBRICATION

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
G1	END COVER - Outer End	1	D.100001
G2	WASHER - Copper (For Item G3)	2	98660/1153
G3	PLUG	2	PS.1068/2
G4	JOINT (For Item G15)	1	C.200900 & GB *
G5	OIL PUMP	1	98446/1001 & GB
G6	OIL FILTER	1	98262/1009 & GB
G7	SETSCREW - Hexagon Head (For Item G5)	2	95000/0257
G8	SETSCREW - Hexagon Head (For Item G5)	1	95000/0256
G9	CYLINDER LUBRICATION UNIT	1	PS.1737
G10	LUBRICATION PUMPING UNIT	2	PS.1732
G11	OIL FEED PIPE AND INDICATOR ASSEMBLY - 4th Stage	1	C.201971/2
G12	OIL FEED PIPE AND INDICATOR ASSEMBLY - 3rd Stage	1	C.201971/1
G13	JOINT (For Item G9)	1	C.200855 *
G14	SETSCREW - Hexagon Head (For Item G1)	11	95000/0255
G15	NIPPLE	1	95414/0164
G16	90° Bend	1	---- /0166
G17	ADAPTOR (For Item G18)	1	C.200887
G18	CRANKCASE BREATHER	1	98262/1044
G19	'O' RING (For Item G18)	1	98504/1079 *
G20	AIR BREATHER PIPE ASSEMBLY	1	C.201968
G21	NUT (For Item G22)	4	95111/5
G22	STUD (For Item G23)	2	D.100171/8/41
G23	OIL SIGHT GLASS (Included with Items G11 & G12)	2	98340/1003
G24	OIL STRAINER (Included with Item G23)	2	-
G25	SETSCREW - Hexagon Head (For Item G9)	4	PS.1042/3
G26	KEY - Woodruff (For Item G30)	1	PS.1164/1
G27	GRUBSCREW (For Item G30)	1	95074/0038
G28	CHAIN WHEEL - 36 Teeth	1	C.85739/2
G29	SETSCREW - Hexagon Head (For Items G28 & G33)	5	95000/0227
G30	DRIVE FITTING - Cyldr. Lubrication Unit (For Item G28)	1	C.86311
G31	TENSION PIN (For Item G32)	1	GA & GB
G32	DRIVE FITTING - Oil Pump	1	C.86311, GA & GB
G33	CHAIN WHEEL - 18 Teeth	1	C.85737/1 & GB
G34	DOWEL PIN (For Item G31)	2	GA & GB
G35	CHAIN TENSIONER PILLAR	2	C.85740/1
G36	CHAIN TENSIONER	1	98146/1001
G37	ROLLER CHAIN with connection link	1	PS.1841
G38	JOINT (For Item G1)	1	C.200870 *
G39	OIL TRANSFER PIPE ASSEMBLY	1	C.201966/2
G40	OIL PRESSURE SWITCH & GAUGE TAKE-OFF PIPE ASSEMBLY	1	C.201966/3
G41	OIL SUCTION PIPE ASSEMBLY	1	C.201966/1

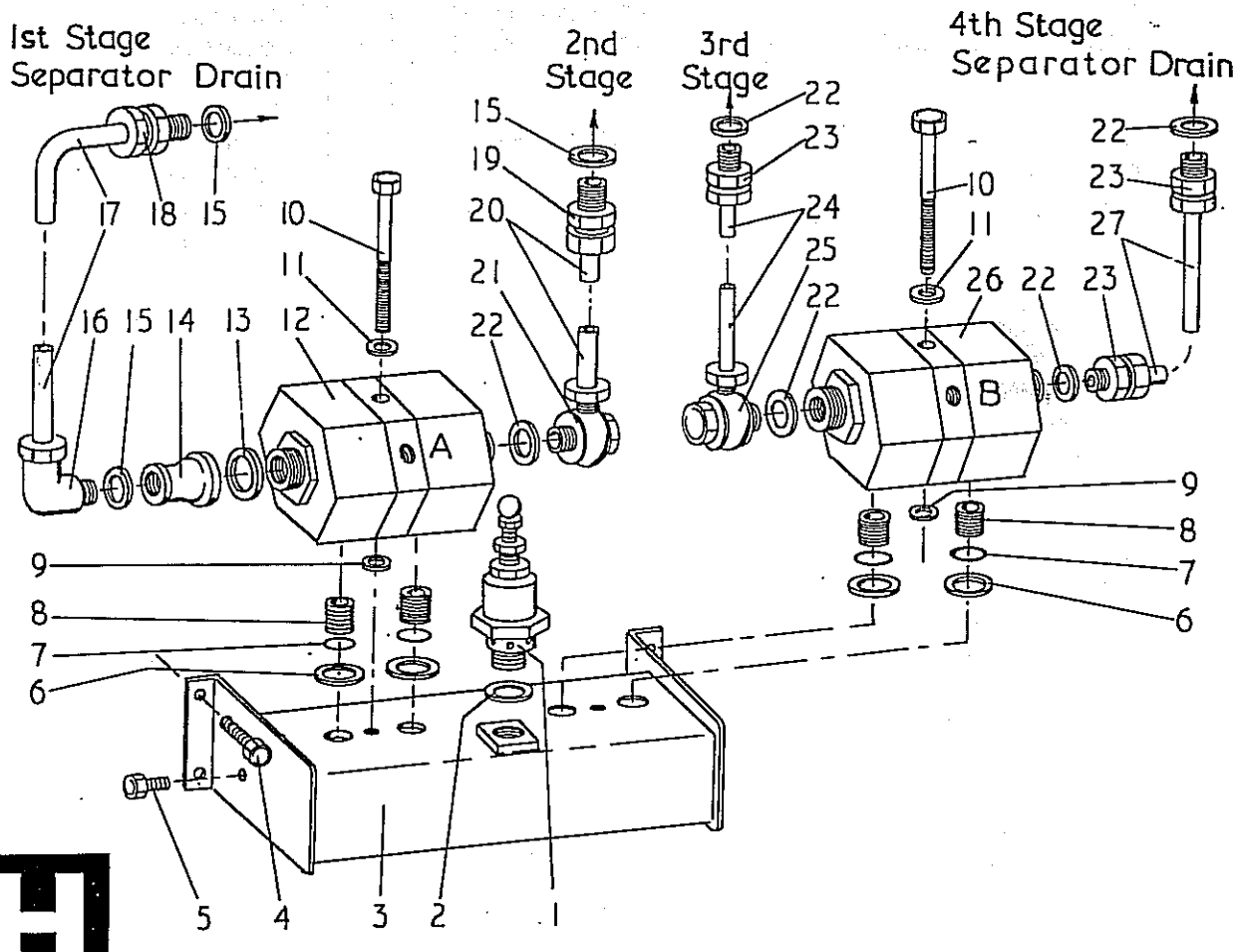
* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE





1st Stage Pressure
from Cooler Cover



H

DRAIN VALVES AND SURGE VESSEL

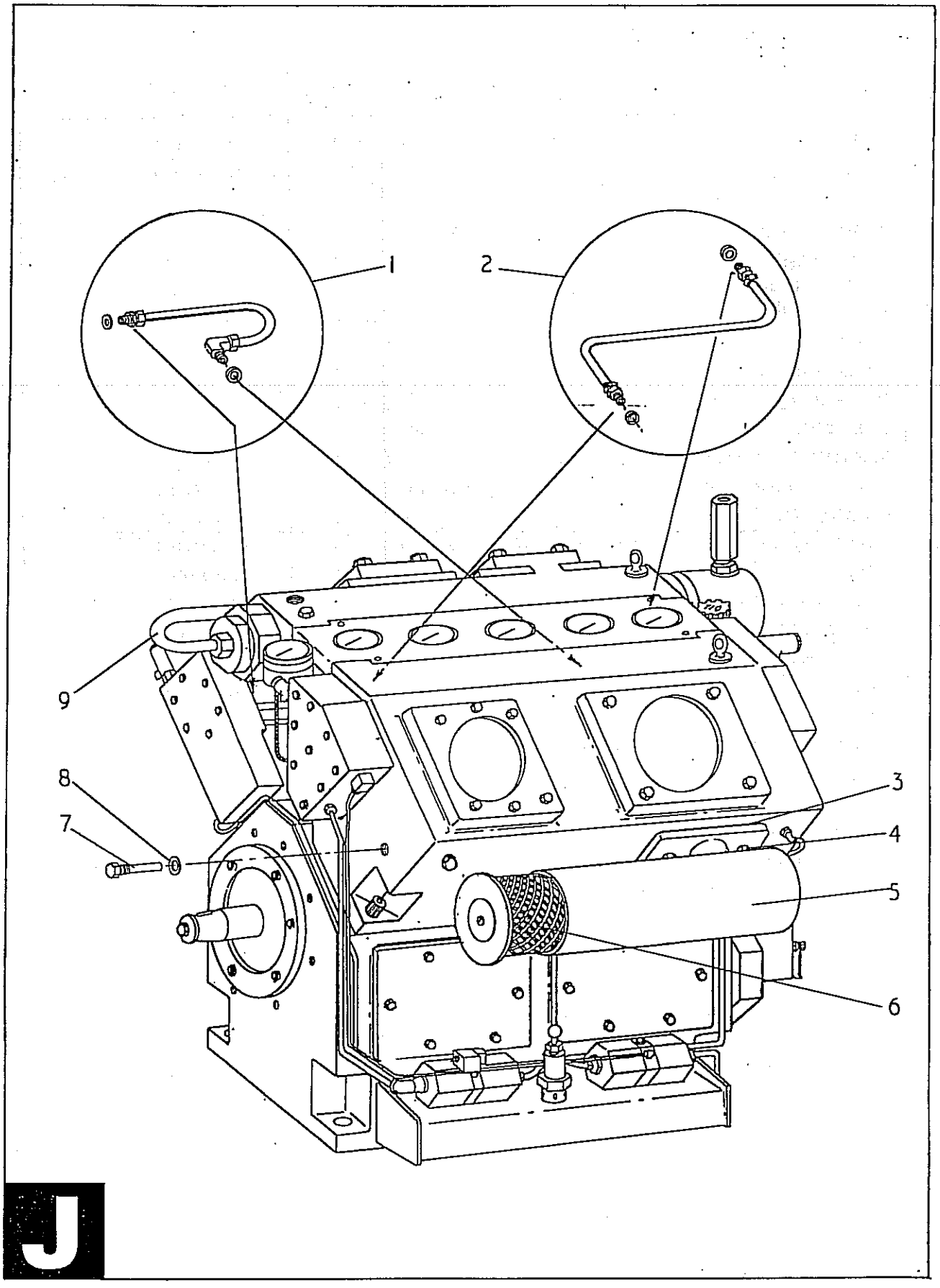
5415 STANDARD MACHINE

DRAIN VALVE AND SURGE VESSEL

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE	
H1	SAFETY VALVE	1	98650/1011	
H2	WASHER - Copper (For Item H1)	1	98660/1157	
H3	SURGE VESSEL	1	E.60338	
H4	SETSCREW - Hexagon Head	4	95000/0281	
H5	BLANKING PLUG	1	98156/2560	
H6	WASHER - Nylon	4	C.201488/1	*
H7	'O' RING	4	95602/0067	*
H8	NIPPLE	4	95414/0165	
H9	WASHER - Nylon	2	C.201488/2	*
H10	BOLT - Hexagon Head	2	95006/0157	
H11	SCREW SEAL (For Item H10)	2	RT.6495/56	
H12	DIAPHRAGM DRAIN VALVE ASSEMBLY - 1st & 2nd Stage	1	U.334/L	
H13	WASHER - Copper (For Item H14)	1	98660/1156	
H14	REDUCING SOCKET	1	95405/1026	
H15	WASHER - Copper (For Items H16, H18 & H19)	3	98660/1154	
H16	ELBOW	1	95440/0185	
H17	PIPE - Nylon (600 mm)	1	98617/5112	
H18	STUD COUPLING	1	95440/0040	
	COUPLING	1	98156/1057	
H20	PIPE - Stainless Steel (1200 mm)	1	M.3077/1008	
H21	BANJO	1	98156/2094	
H22	WASHER - Copper (For Items H21, H23, H25 & H28)	6	98660/1153	
H23	STUD COUPLING	3	98156/1042	
H24	PIPE - Copper Nickel (1500 mm)	1	M.3205/0603	
H25	BANJO	1	98156/2097	
H26	DIAPHRAGM DRAIN VALVE ASSEMBLY - 3rd & 4th Stage	1	U.334/J	
H27	PIPE - Copper Nickel (1000 mm)	1	M.3205/0603	
H28	BANJO - Brass	1	95440/0579	
H29	PIPE - Nylon (800 mm)	1	98617/5106	
H30	STUD COUPLING	2	95440/0030	
H31	WASHER - Copper (For Items H30, H33 & H36)	5	98660/1152	
H32a	SOLENOID VALVE - 220v/50Hz	1	PS.2197/1	
H32b	SOLENOID VALVE - 110v/50Hz	1	PS.2197/2	
H32c	SOLENOID VALVE - 220v/60Hz	1	PS.2197/3	
H32d	SOLENOID VALVE - 110v/60Hz	1	PS.2197/4	
H33	NIPPLE	2	95414/0161	
H34	TEE	1	95405/0349	
H35	PIPE - Nylon (200 mm)	1	98617/5106	
H36	ELBOW	1	95440/0178	

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



J

EXTERNAL COMPONENTS

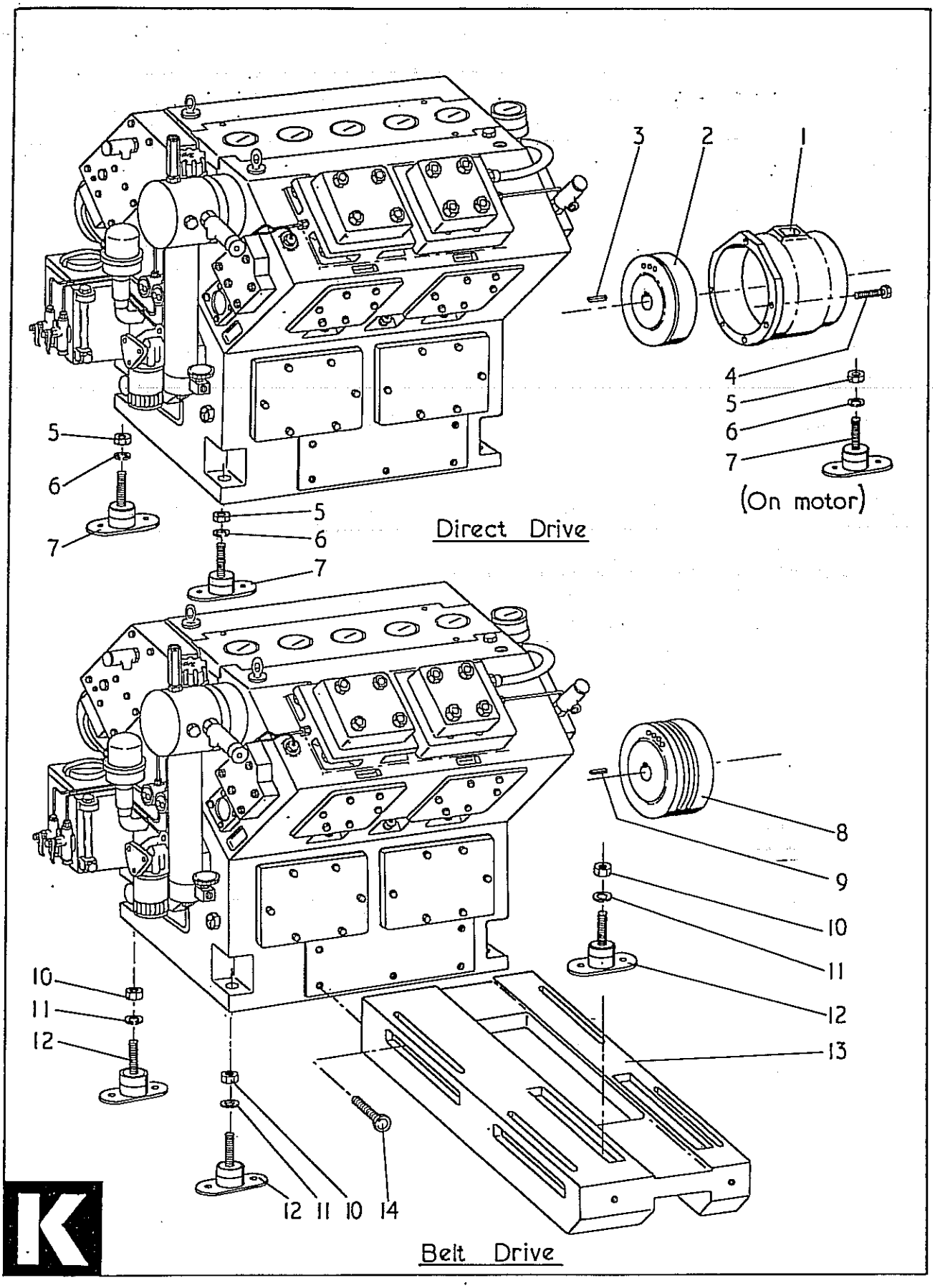
5415 STANDARD MACHINE

EXTERNAL COMPONENTS

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
J1	SUCTION PIPE ASSEMBLY - 3rd Stage	1	C.201969/1
J2	WATER TRANSFER PIPE ASSEMBLY	1	C.201970
J3	JOINT (For Item J5)	1	C.200205 *
J4	SETSCREW	2	95000/0312
J5	INTAKE FILTER SILENCER	1	98262/1026
J6	FILTER ELEMENT	1	98262/1062
J7	CORROSION ROD	1	U.753/C
J8	DOWTY SEAL	1	PS.1322/3
J9	DISCHARGE PIPE ASSEMBLY - 4th Stage	1	C.201969/2

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



DRIVE ARRANGEMENTS

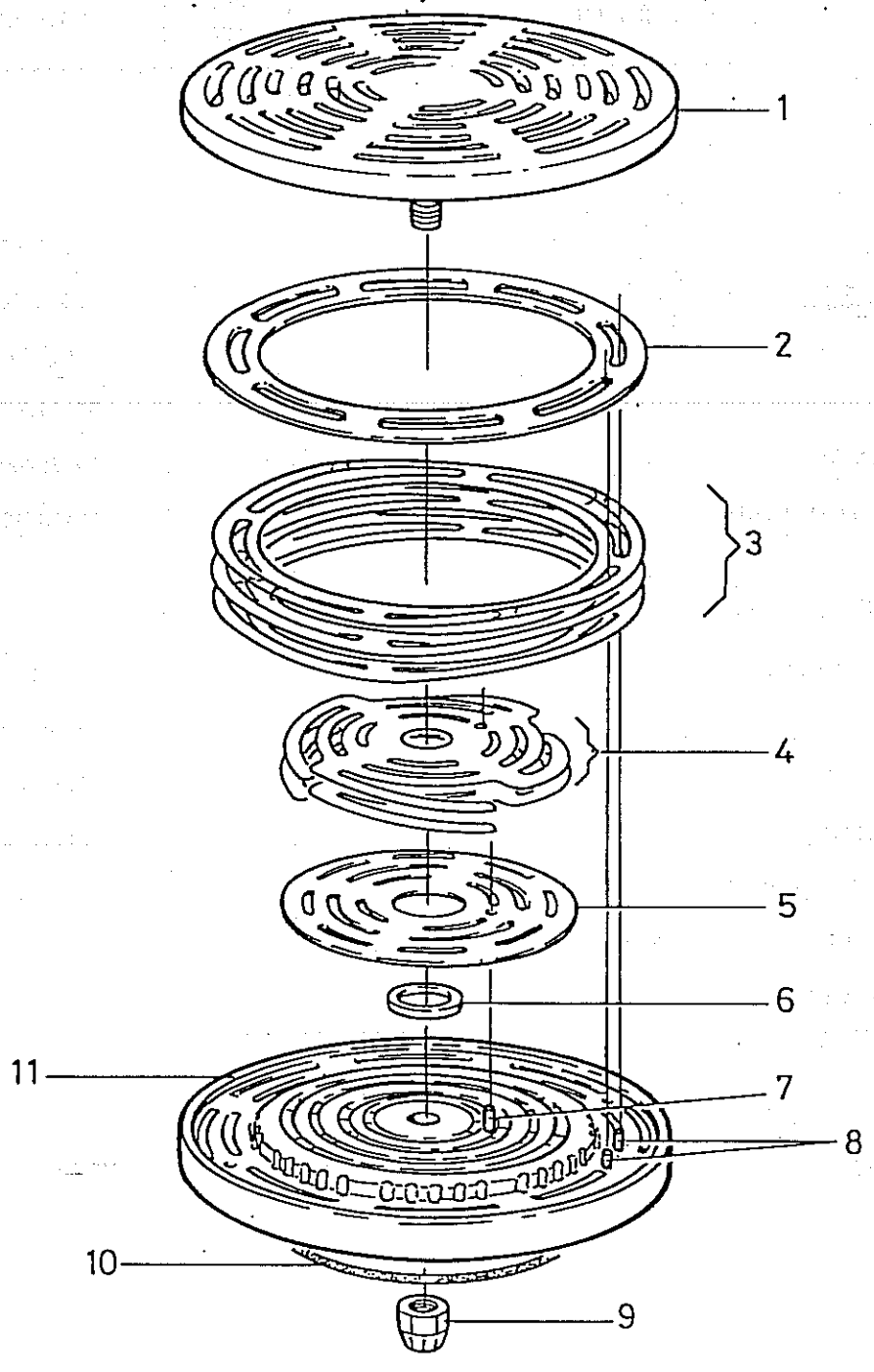
5415 STANDARD MACHINE

DRIVE ARRANGEMENT

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	DIRECT DRIVE		
K1	BELL HOUSING	1	E.60021
K2	FLYWHEEL	1	D.100301
K3	KEY	1	95301/0063
K4	SETSCREW - Hexagon Head	10	95000/0315
K5	NUT	3	95111/0007
K6	SPRING WASHER	3	95179/0003
K7	ANTI-VIBRATION MOUNTS	3	98418/1014
	BELT DRIVE		
K8	FLYWHEEL - Grooved	1	D.100245
K9	KEY	1	95301/0063
K10	NUT	3	95111/0007
K11	SPRING WASHER	3	95179/0003
K12	ANTI-VIBRATION MOUNTS	3	98418/1014
K13	MOTOR BRACKET (For C180M Motor Frame Size)	1	E.60031
K14	SETSCREW - Socket Head	5	95000/0345

NOTE : This section has been included to detail items which would normally be required to make a bare shaft machine into a configuration that can easily be assembled into an operational package by means of the addition of widely available commercial equipment.

5415 STANDARD MACHINE



L

NOTE: Valve is shown inverted.

1st STAGE CONCENTRIC VALVE

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'L'

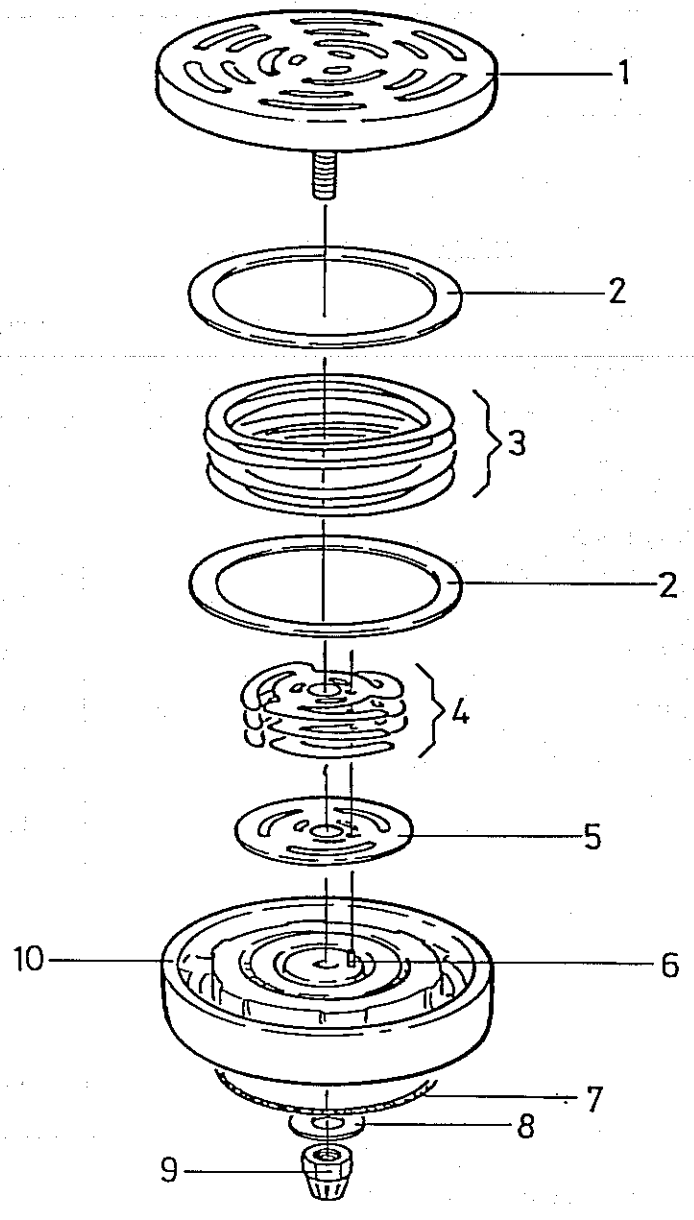
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
LA	MAINTENANCE KIT - 1st Stage Concentric Valve	1	L2,3,4,5,6,9 & 10	98650/1579

1ST STAGE CONCENTRIC VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	98650/1080
L1	LOWER BODY (Including Stud)	1	-
L2	VALVE PLATE - Delivery	1	LA
L3	SPRING PLATE - Delivery	3	LA
L4	SPRING PLATE - Suction	2	LA
L5	VALVE PLATE - Suction	1	LA
L6	GUIDE WASHER	1	LA
L7	DOWEL	1	-
L8	PEG	2	-
L9	LOCKNUT	1	LA
L10	'O' RING	1	98504/1006 & LA *
L11	UPPER BODY	1	-

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



NOTE: Valve is shown inverted.

2nd STAGE CONCENTRIC VALVE

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'M'

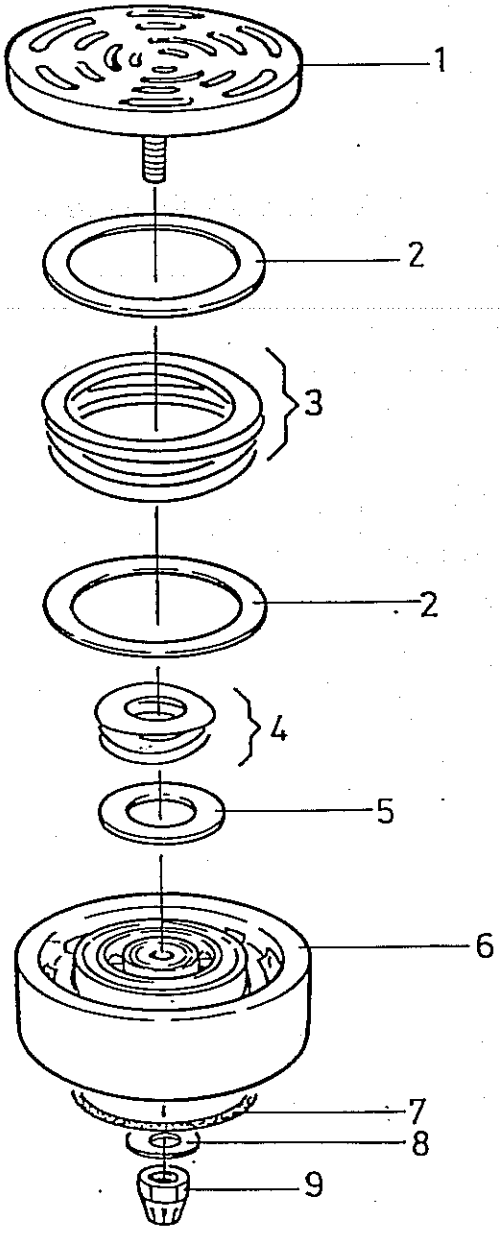
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
MA	MAINTENANCE KIT - 2nd Stage Concentric Valve	1	M2,3,4,5,7,8 & 9	98650/1578

2ND STAGE CONCENTRIC VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	98650/1099
M1	LOWER BODY (Including Stud)	1	-
M2	VALVE/BACKING PLATE - Delivery	2	MA
M3	SPRING PLATE - Delivery	4	MA
M4	SPRING PLATE - Suction	3	MA
M5	VALVE PLATE - Suction	1	MA
M6	PEG	1	-
M7	'O' RING	1	98504/1005 & MA *
M8	WASHER	1	MA
M9	LOCKNUT	1	MA
M10	UPPER BODY	1	-

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



N

NOTE: Valve is shown inverted.

3rd STAGE CONCENTRIC VALVE

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'N'

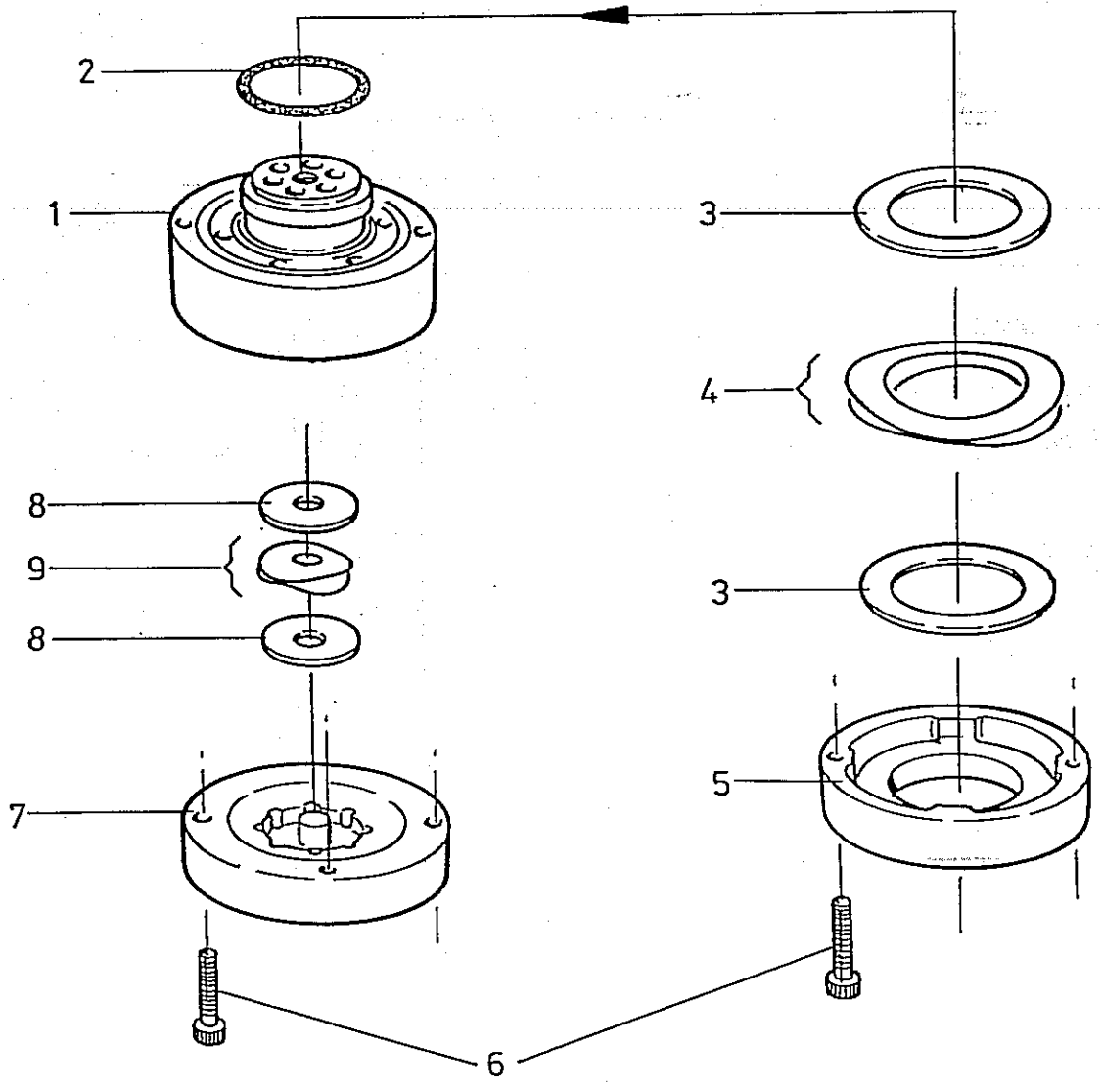
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
NA	MAINTENANCE KIT - 3rd Stage Concentric Valve	1	N2,3,4,5,7,8 & 9	98650/1059

3RD STAGE CONCENTRIC VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	98650/1049
N1	LOWER BODY (Including stud)	1	-
N2	VALVE/BACKING PLATE - Delivery	2	NA
N3	SPRING PLATE - Delivery	4	NA
N4	SPRING PLATE - Suction	3	NA
N5	VALVE PLATE - Suction	1	NA
N6	UPPER BODY	1	-
N7	'O' RING	1	95602/0024 & NA *
N8	WASHER	1	NA
N9	NUT	1	NA

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



P

4th STAGE CONCENTRIC VALVE

5415 STANDARD MACHINE

PARTS ASSEMBLIES 'P'

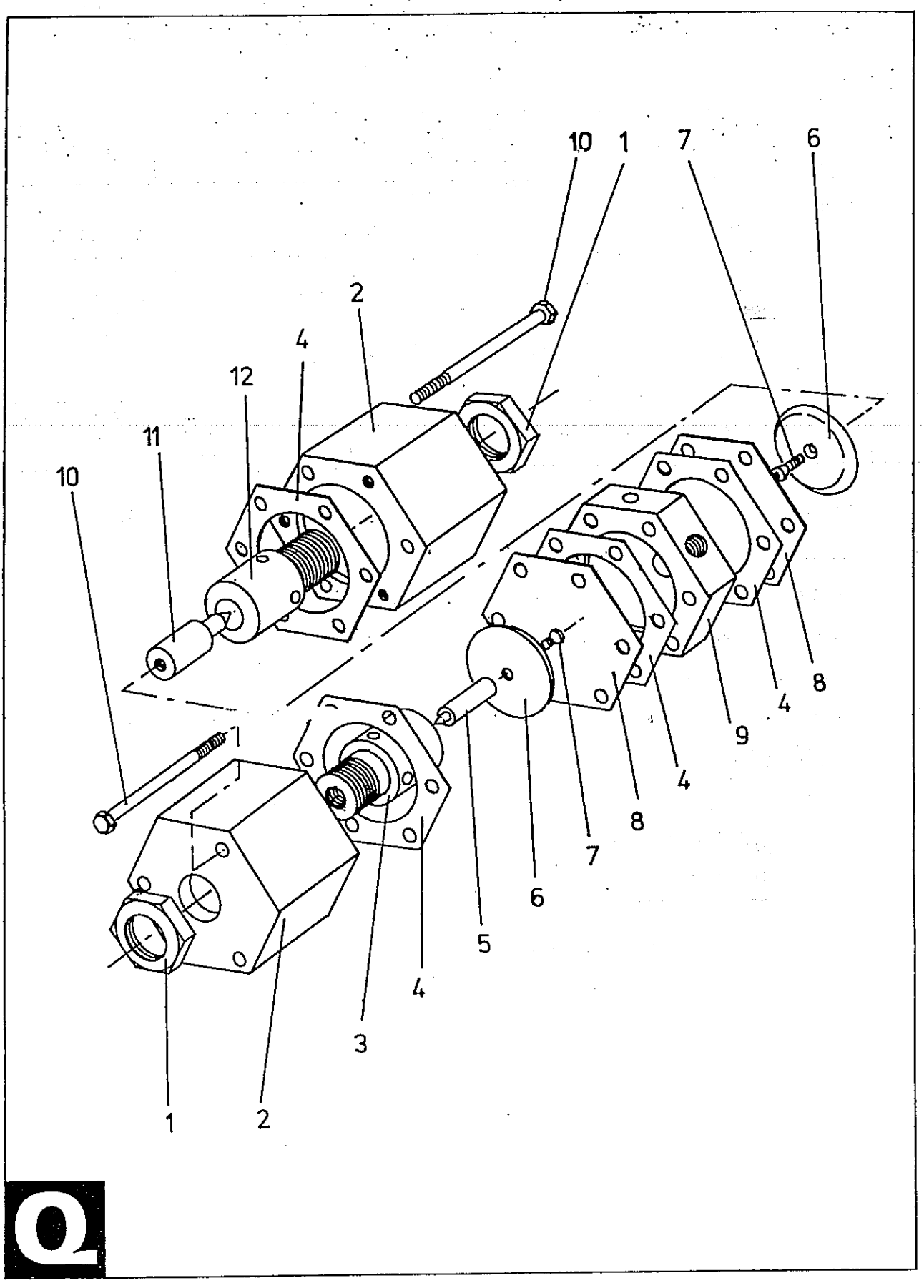
REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
PA	MAINTENANCE KIT - 4th Stage Concentric Valve	1	P2,3,4,6,8 & 9	98650/1577

4TH STAGE CONCENTRIC VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	98650/1115
P1	MIDDLE BODY	1	-
P2	'O' RING	1	95604/0015 & PA *
P3	VALVE/BACKING PLATE - Delivery	2	PA
P4	SPRING PLATE - Delivery	2	PA
P5	UPPER BODY	1	-
P6	SETSCREW - Socket Head	4	PA
P7	MIDDLE BODY	1	-
P8	VALVE/BACKING PLATE - Suction	2	PA
P9	SPRING PLATE - Suction	2	PA

* Also part of Maintenance Kit. Refer to Section 'U'

5415 STANDARD MACHINE



1st AND 2nd STAGE DIAPHRAGM VALVE

5415 STANDARD MACHINE

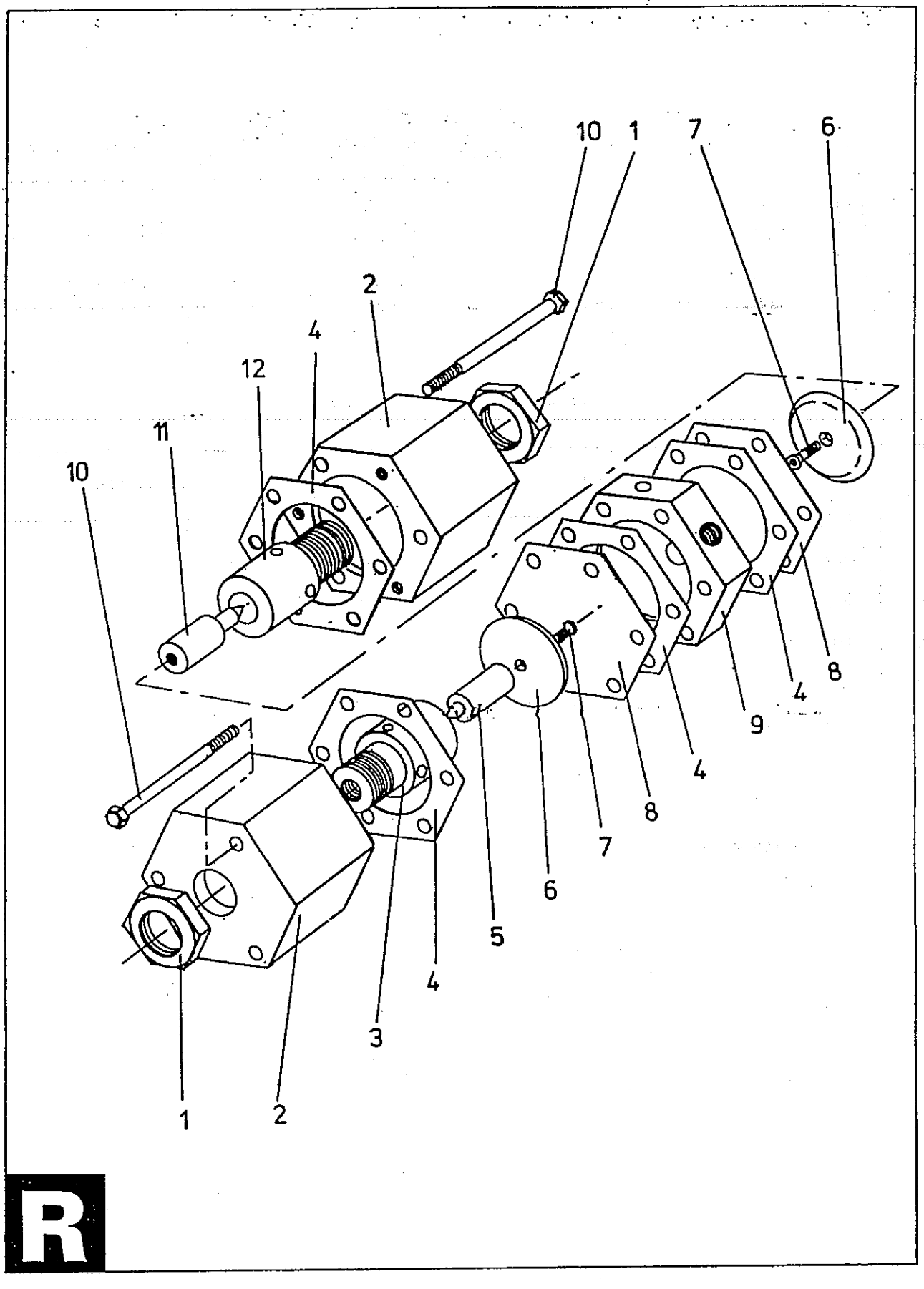
PARTS ASSEMBLIES 'Q'

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
QA	MAINTENANCE KIT - 1st & 2nd Stage Diaphragm Valve	1	Q3,5,11 & 12	98650/1531
QB	Service Kit - 1st & 2nd Stage Diaphragm Valve	1	Q4 and R8	98650/1535

1ST AND 2ND STAGE DIAPHRAGM VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	U.334L
Q1	BACKNUT	2	PS.1290/4
Q2	DRAIN VALVE BODY	2	-
Q3	VALVE SEAT	1	QA
Q4	DIAPHRAGM JOINT	4	QB
Q5	VALVE	1	QA
Q6	MUSHROOM PLATE	2	-
Q7	SOCKET HEAD CAP SCREW	2	95018/0100
Q8	DIAPHRAGM	2	QB
Q9	DRAIN VALVE COVER	1	-
Q10	BOLT - Hexagon Head	6	95006/0133
Q11	VALVE	1	QA
Q12	VALVE SEAT	1	QA

5415 STANDARD MACHINE



R

3rd AND 4th STAGE DIAPHRAGM VALVE

5415 STANDARD MACHINE

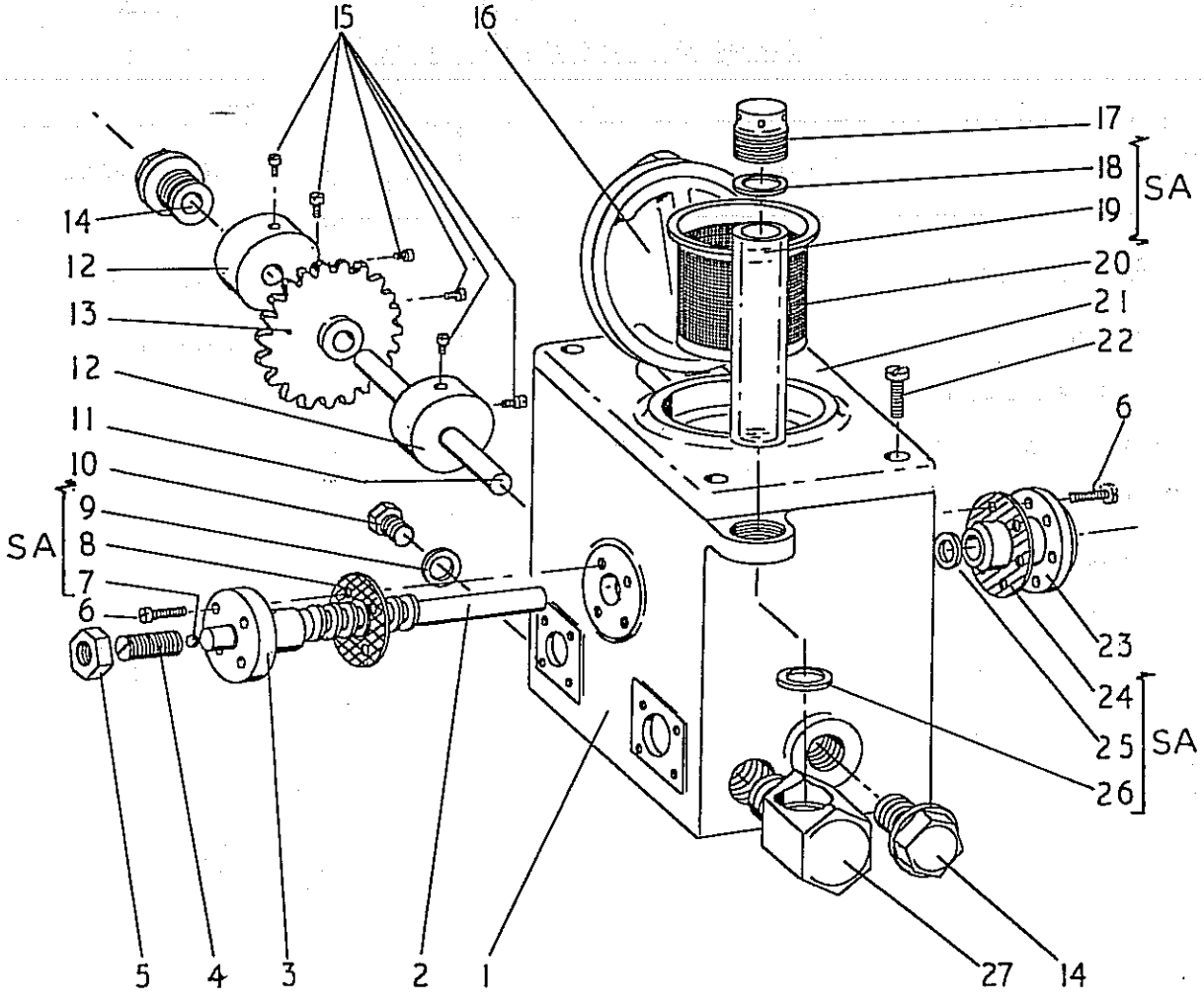
PARTS ASSEMBLIES 'R'

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
RA	MAINTENANCE KIT - 3rd & 4th Stage Diaphragm Valve	1	R3 and 5	98650/1532
RB	SERVICE KIT - 3rd & 4th Stage Diaphragm Valve	1	R4 and 8	98650/1535

3RD AND 4TH STAGE DIAPHRAGM VALVE

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	VALVE COMPLETE	1	U.334J
R1	BACKNUT	2	PS.1290/4
R2	DRAIN VALVE BODY	2	-
R3	VALVE SEAT	2	RA
R4	DIAPHRAGM JOINT	4	RB
R5	VALVE	2	RA
R6	MUSHROOM PLATE	2	-
R7	SOCKET HEAD CAP SCREW	2	95018/0100
R8	DIAPHRAGM	2	RB
R9	DRAIN VALVE COVER	1	-
R10	BOLT - Hexagon Head	6	95006/0133

5415 STANDARD MACHINE



Note:- Pumping Unit not shown

S

LUBRICATOR

5415 STANDARD MACHINE

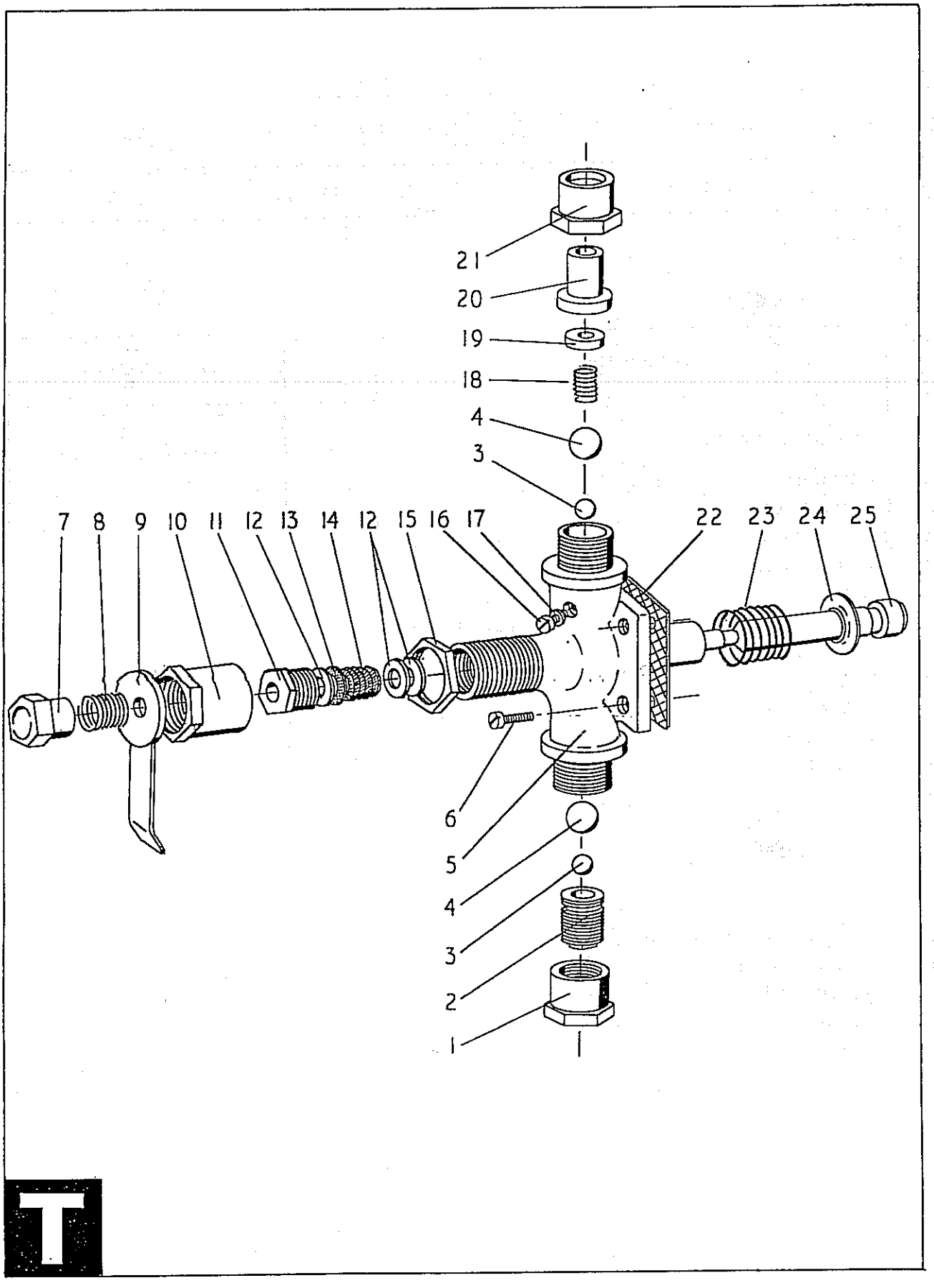
PARTS ASSEMBLIES 'S'

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
SA	SERVICE KIT - Lubricator	1	S3,5,9,18,19,24,25 & 26	PS.1825

LUBRICATOR

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	LUBRICATOR COMPLETE	1	PS.1737
S1	CONTAINER	1	-
S2	WORM SPINDLE	1	-
S3	FRONT BEARING (For Item T2)	1	-
S4	REGULATING SCREW	1	-
S5	LOCKNUT (For Item T4)	1	-
S6	SCREWS (For Items T3 & T23)	10	-
S7	BALL - Regulating Ball	1	SA
S8	GASKET (For Item T3)	1	SA
S9	SEALING RING (For Item T10)	1	SA
S10	DRAIN PLUG	1	-
S11	CAM SHAFT	1	-
S12	CAM	2	-
S13	WORM WHEEL	1	-
S14	END BEARING (For Item T11)	2	-
S15	SCREW (For Items T12 & T13)	6	-
S16	STRAINER COVER	1	-
S17	TOP FITTING - Oil Gauge Glass	1	-
S18	JOINT RING - Top (For Item T19)	1	SA
S19	OIL GAUGE GLASS	1	SA
S20	STRAINER	1	-
S21	COVER	1	-
S22	SCREW (For Item T21)	4	-
S23	BACK BEARING (For Item T2)	1	-
S24	GASKET (For Item T23)	1	SA
S25	OIL SEAL	1	SA
S26	JOINT RING - Bottom (For Item T19)	1	SA
S27	BOTTOM FITTING - Oil Gauge Glass	1	-

5415 STANDARD MACHINE



LUBRICATOR PUMPING UNIT

5415 STANDARD MACHINE

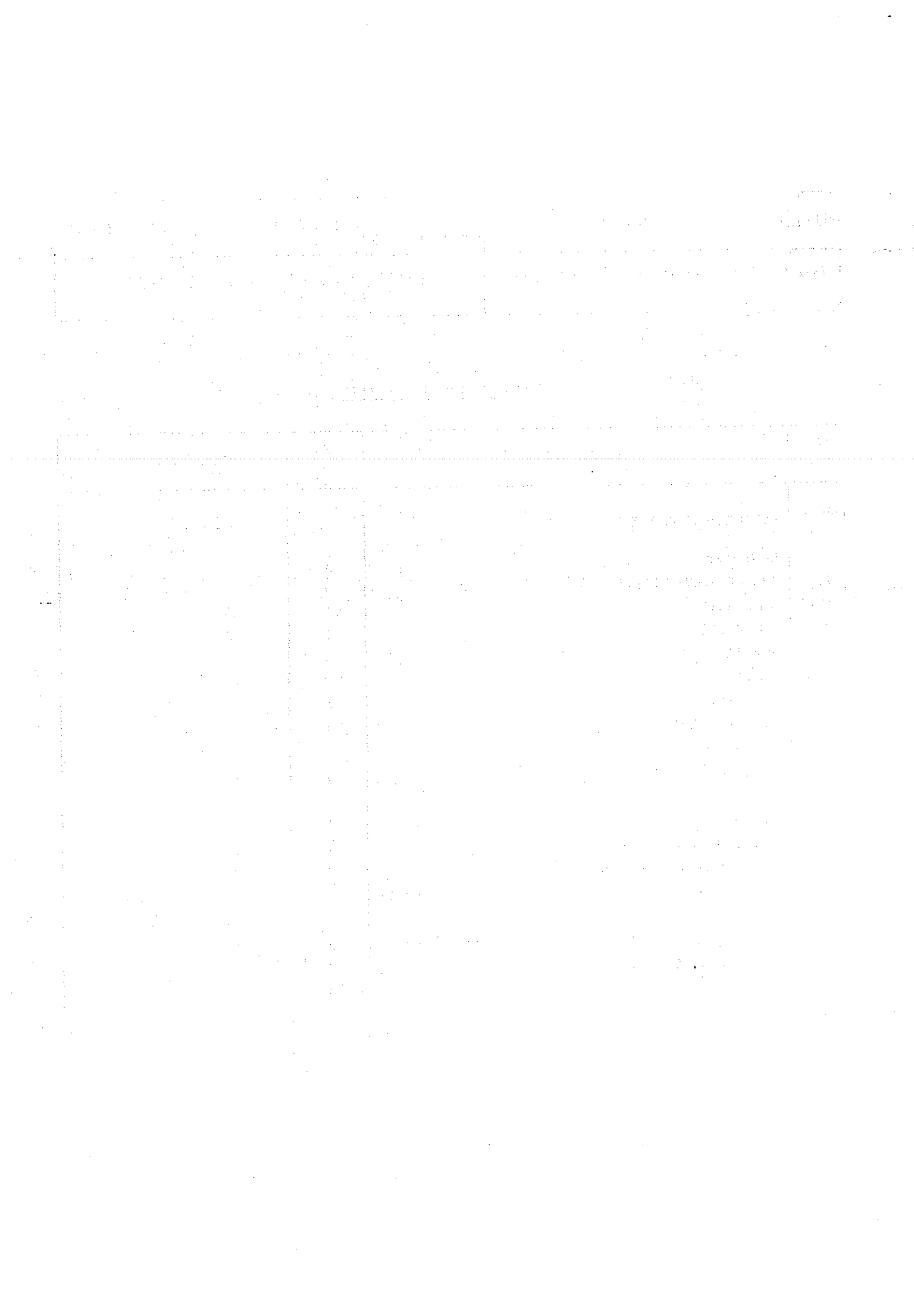
PARTS ASSEMBLIES 'T'

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
TA	SERVICE KIT - Lubrication Pumping Unit	2	T3,4,8,13,14,16,17,18, 22 & 23	PS.1824

LUBRICATION PUMPING UNIT

ITEM NO.	DESCRIPTION	NO. OFF	PARTS REFERENCE
	PUMPING UNIT COMPLETE	2	PS.1732
T1	BLANK NUT	1	-
T2	SUCTION VALVE HOUSING	1	-
T3	BALL VALVE	2	TA
T4	BALL VALVE	2	TA
T5	PUMP BODY	1	-
T6	SCREW	4	-
T7	THUMB NUT	1	-
T8	TRIGGER SPRING	1	TA
T9	TRIGGER	1	-
T10	REGULATOR	1	-
T11	GLAND NUT	1	-
T12	WASHER	3	-
T13	GRAPHITED PACK WASHER	1	TA
T14	GLAND PACKING (230 mm long)	1	TA
T15	LOCKNUT (For Item T10)	1	-
T16	VENT SCREW	1	TA
T17	FIBRE WASHER (For Item T16)	1	TA
T18	DELIVERY VALVE SPRING	1	TA
T19	VALVE KEEP	1	-
T20	STEEL TAIL	1	-
T21	UNION NUT	1	-
T22	GASKET	1	TA *
T23	PLUNGER SPRING	1	TA
T24	PLUNGER WASHER	1	-
T25	PLUNGER	1	-

* Also part of Maintenance Kit. Refer to Section 'U'



5415 STANDARD MACHINE

MAINTENANCE KITS

REF.	DESCRIPTION	NO. PER MACHINE	COMPRISING OF ITEMS:	PARTS REFERENCE
UA	OVERHAUL JOINT KIT	1	A12,20 & 26 C1,6,8,10,13,15,17 & 23 D2,3,17,19,21,22,26,27,28, 33,34,36 & 38 E1,11,16,18,24,28,29 & 31 G4,13,19 & 38 H6,7 & 9 L10, M7, N7, P2, J3 & T22	98504/1004
UB	VALVE MAINTENANCE 'O' RING KIT	1	C10 & 13 D21,22,26,27 & 28 L10, M7, N7 & P2	98504/1003