

HAMWORTHY COMPRESSOR SYSTEMS

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BREATHING AIR CHARGING SETS

BP6E, BP6P, BP6D

BP8E, BP8P, BP8D

Publication Number HCS0304/0694

HEALTH AND SAFETY AT WORK ACT 1974

Where a complete factory-built air compressor set is supplied, we ensure that measures are taken to comply with our responsibilities in respect of the Act.

In addition, it is essential that the operator is aware of the inherent hazards associated with the use of compressed air, particularly in such applications as breathing air and food and drink processing where specialist filtration is essential.

Certain responsibilities under the Act will also pass to the customer, and will include ensuring that:-

1. All drives and moving parts are adequately guarded.
2. Our recommendations on operating conditions, including maximum pressure and speed are not exceeded.
3. Any air receiver or pressure vessel, used in conjunction with the compressor is constructed to be suitable for the working pressure of the unit.
4. Interconnecting pipework is adequate in strength.
5. A suitable safety valve, correctly situated, and a pressure control device are included in the installation.

If in doubt, ask our advice.

WARNING

Misuse of compressed air can be dangerous. It cannot be stressed too strongly the importance of taking every precaution in the use of compressed air and its associated equipment.

NEVER Commence any maintenance or servicing work on a compressor or compressed air system without ensuring entire system is fully depressurised. Failure to observe the precaution may result in serious injury.

NEVER Screw down a pipe union that is under pressure.

NEVER Screw down a safety valve beyond the manufacturer's setting. A safety valve is fitted to prevent overpressuring the air receiver and overloading the air compressor. To interfere with its setting could result in serious damage or injury.

NEVER Carry out any work whatsoever unless the electric supply has been switched off at the mains - this applies to the electrically driven plants.

NEVER Pass in front of an air receiver wheel valve when compressed air is being released. This is particularly dangerous as any particles of iron scale in the air stream could become imbedded in the skin and cause a serious wound.

NEVER Attempt to straighten badly bent pipes or re-use damaged union fittings.

NEVER Use worn or damaged components that particularly rely on threads for security - ie. nuts, bolts, nipples and drain taps etc.

NEVER Tamper with a live electrical circuit. If in doubt call upon the services of a qualified electrician.

REMEMBER Before opening a manual drain or vent valve, always ensure that valve exhaust port is not blocked or plugged. Remove any red plastic plugs that may be present.

Determine in which direction air will exhaust through port to atmosphere and avoid positioning any part of the body in the direction of flow.

ALWAYS open a drain or vent valve **SLOWLY** and with caution. **NEVER** open a drain or vent valve rapidly.

REMEMBER To firmly secure all externally fitted installation pipe work. This will prevent undue vibration and possible fracture under pressure.

REMEMBER To have your components installed in accordance with your local Electrical Authority requirements. A piece of three core flex and a three pin plug does not constitute an installation.

REMEMBER COMPRESSED AIR CAN KILL - TREAT IT WITH RESPECT

NOTE: THE OPERATOR MUST ENSURE THAT ENGINE FUEL AND LUBRICANT ARE OF THE CORRECT TYPE BEFORE STARTING THE SET.

BREATHING AIR CHARGING SETS
BP6E, BP6P, BP6D
BP8E, BP8P, BP8D

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SECTION 1 TECHNICAL DATA AND DESCRIPTION

1.1 BP6 TECHNICAL DATA

COMPRESSOR	V14H-AL
No of Stages	3
Stage Pressures	
Stage 1	8.0 Bar - 116 PSI
Stage 2	58.0 Bar - 841 PSI
Stage 3	Up to 345 Bar - 5000
PSI	
Safety Valve Settings	
Stage 1	11.3 Bar - 164 PSI
Stage 2	69.0 Bar - 1000 PSI
Stage 3	10% Above Working Pressure
Compressor Speed	1200 RPM
Average Charging Rate	10.2 M ³ /hr - 6.0 CFM
Cooling	Fan Driven Air Flow
Lubrication	Controlled Splash
Sump Capacity	1.56 Litres 2.75 pints
Recommended Oil	Anderol 555

Anderol 555 is a synthetic oil suitable for high temperatures. The use of any other lubricant will result in carbonisation of the compressor valves and eventual failure. Hamworthy Compressor Systems will invalidate product warranty if any other lubricant is used.

IMPORTANT: Mineral oils are not miscible with synthetic oils, therefore **DO NOT** mix.

Inhibiting Oil	Shell Ensis 158
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ELECTRIC MOTOR - FITTED TO BP6E

Frame Size	D132S
Power Rating	5.5 Kw
Speed 50 Hz Supply	3000 RPM
Supply Details	See Motor Data Plate

PETROL ENGINE - FITTED TO BP6P

Engine Type	Honda
Power Rating	6.7 Kw
Speed	3000 RPM

DIESEL ENGINE - FITTED TO BP6D

Engine Type	Yanmar
Power Rating	4.5 Kw
Speed	3000

1.2 BP8 TECHNICAL DATA

COMPRESSOR	V14H-AL
No of Stages	3
Stage Pressures	
Stage 1	8.0 Bar - 116 PSI
Stage 2	58.0 Bar - 841 PSI
Stage 3	Up to 345 Bar - 5000PSI
Safety Valve Settings	
Stage 1	11.3 Bar - 164 PSI
Stage 2	69.0 Bar - 1000 PSI
Stage 3	10% Above Working Pressure
Compressor Speed	1750 RPM
Average Charging Rate	13.6 M ³ /hr - 8.0 CFM
Cooling	Fan Driven Air Flow
Lubrication	Controlled Splash
Sump Capacity	1.56 Litres 2.75 pints
Recommended Oil	Anderol 555

Anderol 555 is a synthetic oil suitable for high temperatures. The use of any other lubricant will result in carbonisation of the compressor valves and eventual failure. Hamworthy Compressor Systems will invalidate product warranty if any other lubricant is used.

IMPORTANT: Mineral oils are not miscible with synthetic oils, therefore **DO NOT** mix.

Inhibiting Oil	Shell Ensis 158
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ELECTRIC MOTOR - FITTED TO BP8E

Frame Size	D132S
Power Rating	5.5 Kw
Speed 50 Hz Supply	3000 RPM
Supply Details	See Motor Data Plate

PETROL ENGINE - FITTED TO BP8P

Engine Type	Honda
Power Rating	8.3 Kw
Speed	3000 RPM

DIESEL ENGINE - FITTED TO BP8D

Engine Type	Yanmar
Power Rating	6.6 Kw
Speed	3000

1.3 FILTRATION SYSTEM

Filter Type	PAS 6	
Maximum Operating Pressure	345 Bar - 5000 PSI	
Safety Valve Setting	10% Above Working Pressure	
Pressure Maintaining Valve Setting	124 Bar - 1800 PSI	
Outlet Air Purity Specification	BS 4275	
Process Capacity	400M ³	
Replacement Cartridge No.	Y38947	
	BP6	BP8
Frequency of Cartridge Replacement - Hours Running*	40	30

***NOTE:** Under extreme atmospheric conditions, such as high temperature or high humidity levels, cartridge life could be considerably reduced. It is recommended that the cartridges are changed at three monthly intervals, even if the compressor running time is less than the above.

1.4 DESCRIPTION

The BP6 and BP8 series comprise a range of modular build charging sets designed to provide air up to a maximum pressure of 345 Bar, with flows from 10.2 M³/hr to 13.6 M³/hr. The BP6E and BP8E are electric motor powered, the BP6P and BP8P are petrol engine powered and the BP6D and BP8D are diesel engine powered.

Atmospheric air is drawn across the compressor by the flywheel fan. A proportion of this air enters the intake filter whilst the remainder of the air flows over the external surfaces of the compressor unit for cooling purposes. Therefore, it is important that the fan is not obstructed whilst the set is running and that warm air is allowed to circulate freely away from the compressor set.

Air is compressed in 3 stages up to the final pressure requirements of the system. During the compression cycle, the air is cooled by interstage coolers and an aftercooler, resulting in air leaving the compressor unit at only 5 to 10°C above the ambient temperature. Accumulated condensate is either manually drained from the interstage moisture separators or automatically drained via an unloader system.

The PAS 6 filtration system is attached to the base of the compressor set. The filter is designed to remove various contaminants, ensuring that the air leaving the purification system conforms to the specification defined by BS 4275.

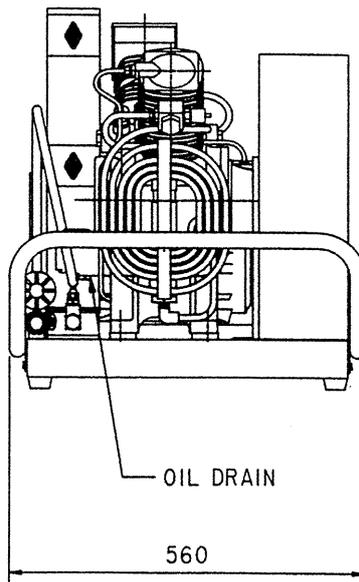
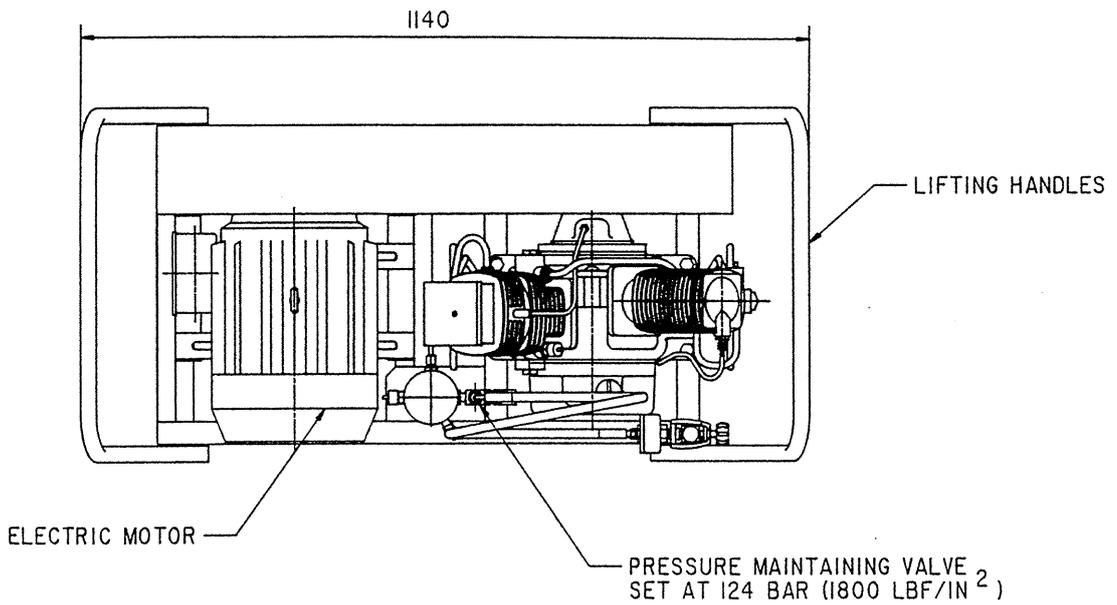
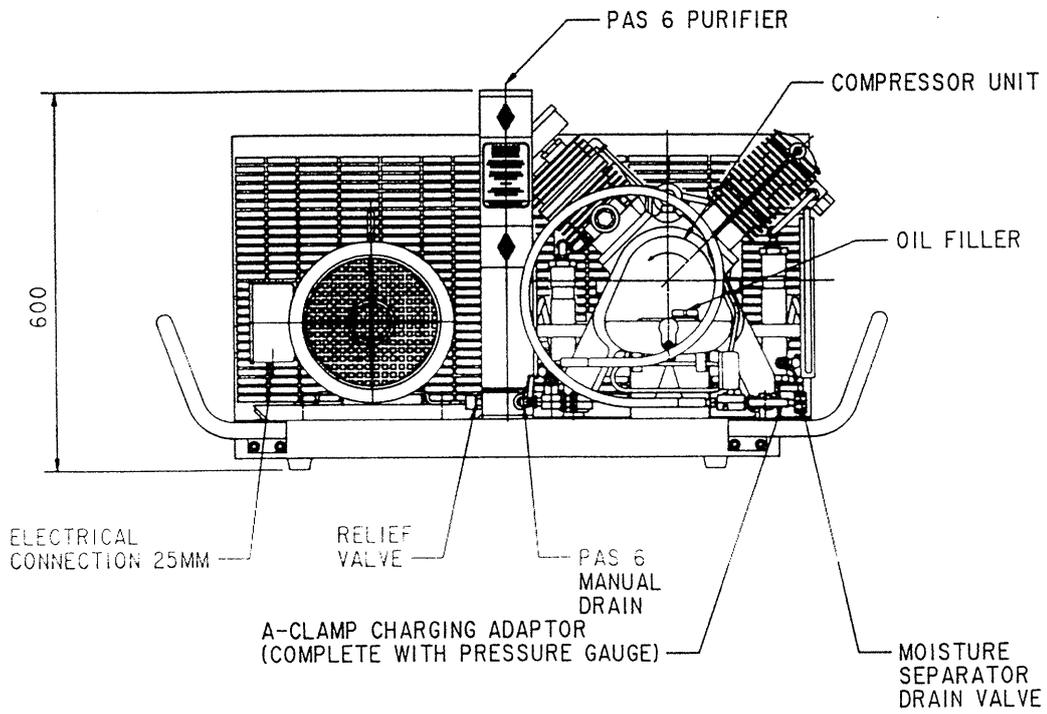
Air is retained within the filtration system by a pressure maintaining valve until a minimum pressure of 124 Bar has been achieved. At this pressure, the PMV will open

allowing clean air to pass into the hose for filling of suitable breathing air cylinders via the charging adaptor. The adaptor incorporates a pressure gauge which registers charging pressure. When not in use, the charging adaptor is stowed in a retaining block mounted on the baseplate. The BP6 series charging sets are fitted with a single hose and the BP8 series charging sets are fitted with twin hoses.

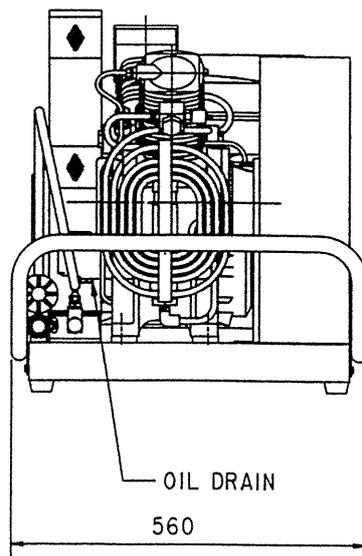
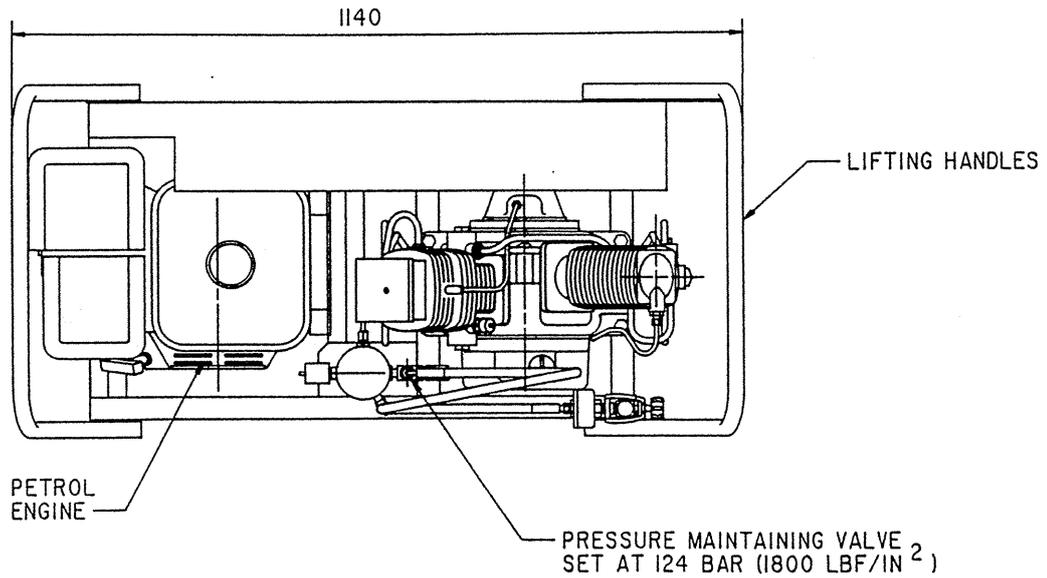
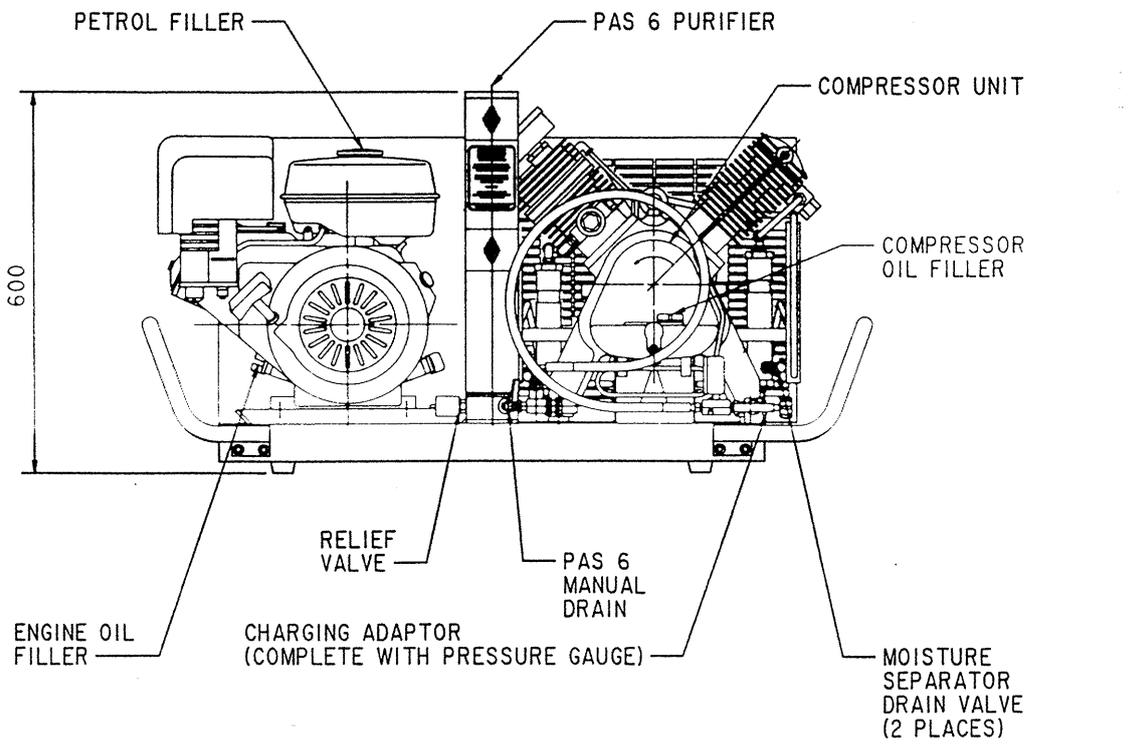
The compressor set is normally under manual control, but optional builds allow either semi-automatic or full automatic control via a pressure switch and unloader valve system. When system pressure reaches pressure switch upper limit, the charging set stops and unloads, venting accumulated condensate from the moisture separators and PAS 6 purifier. The semi-automatic set can only be restarted manually. The automatic set will restart under pressure switch control.

The charging sets are also capable of dual pressure charging via a manually operated diverter valve fitted downstream of the pressure maintaining valve. The low pressure circuit is protected by safety valve and incorporates a hose fitted with a suitable low pressure charging adaptor. The diverter valve allows output from the purification system to be passed to either the high pressure or low pressure charging hose, but not to both simultaneously.

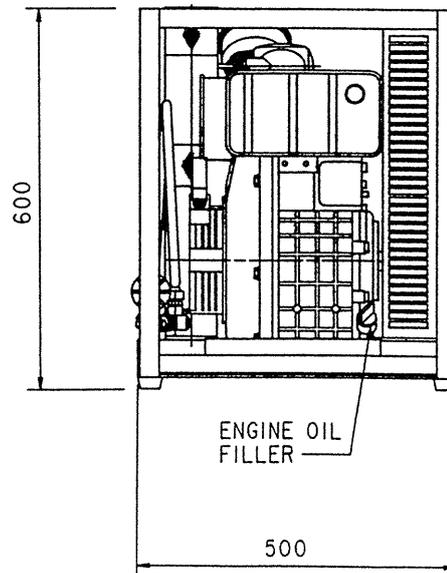
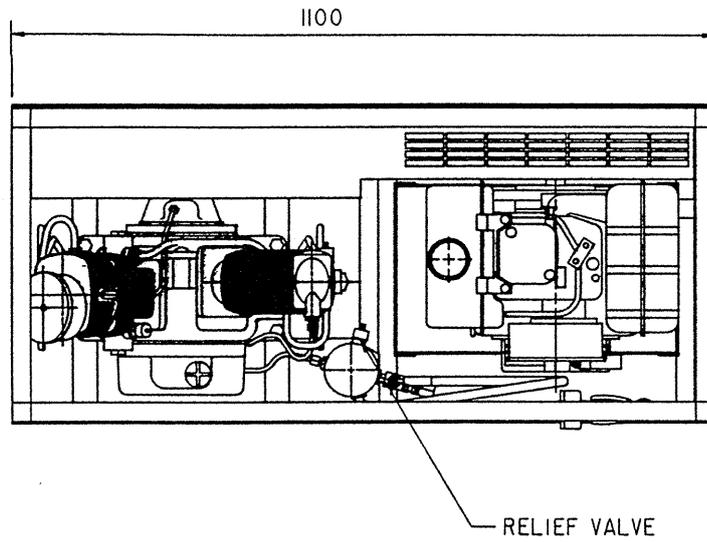
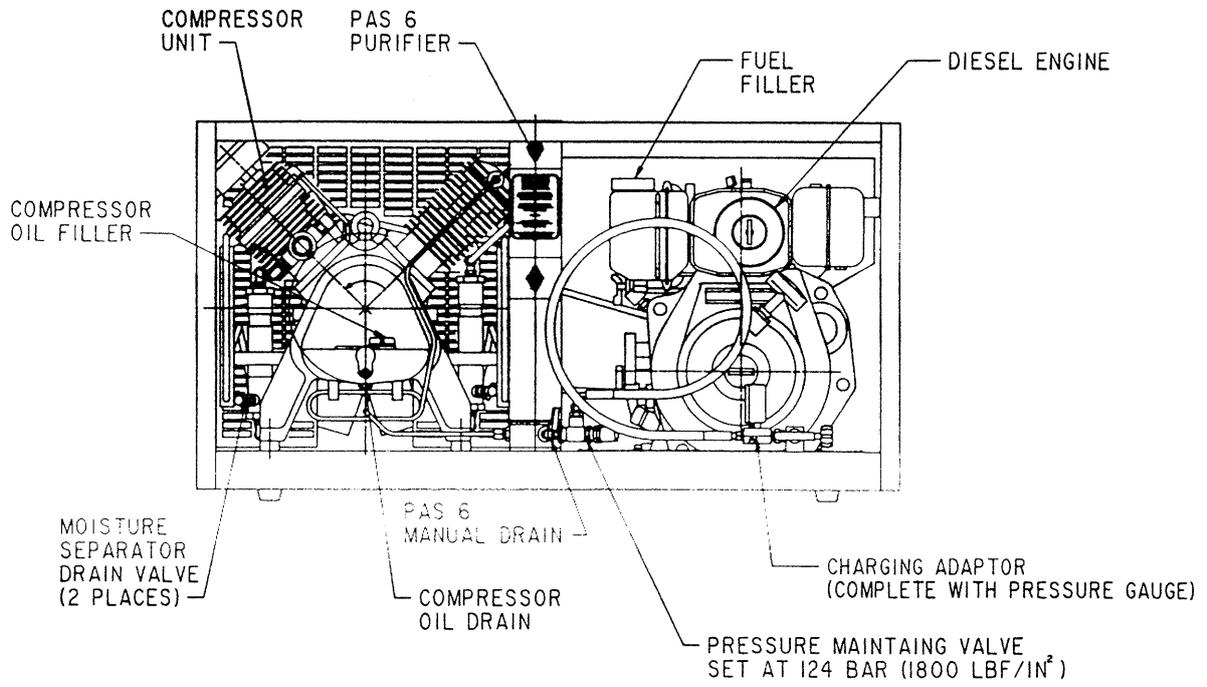
An optional high air temperature switch is fitted to the compressor final stage outlet and will shut down the compressor set when the desired operating limits have been exceeded. The switch is only available on the fully automatic version.



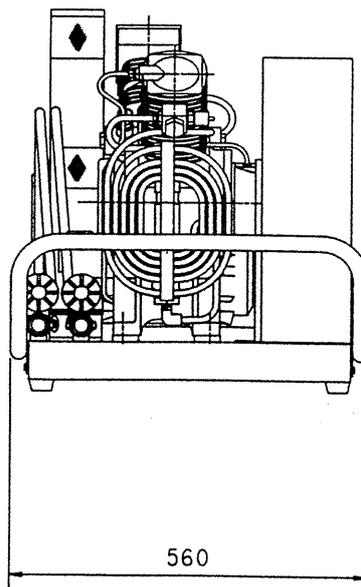
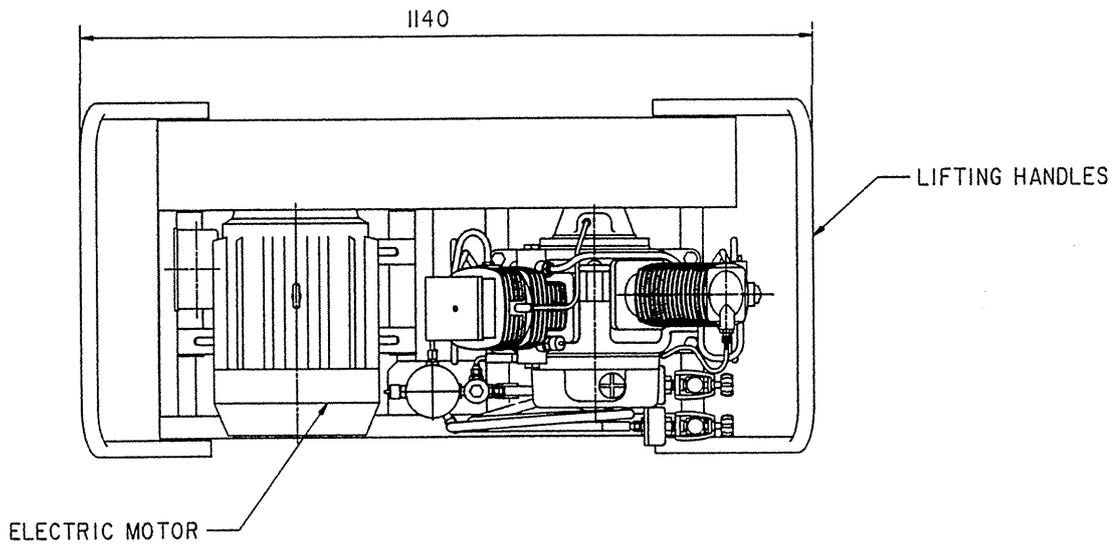
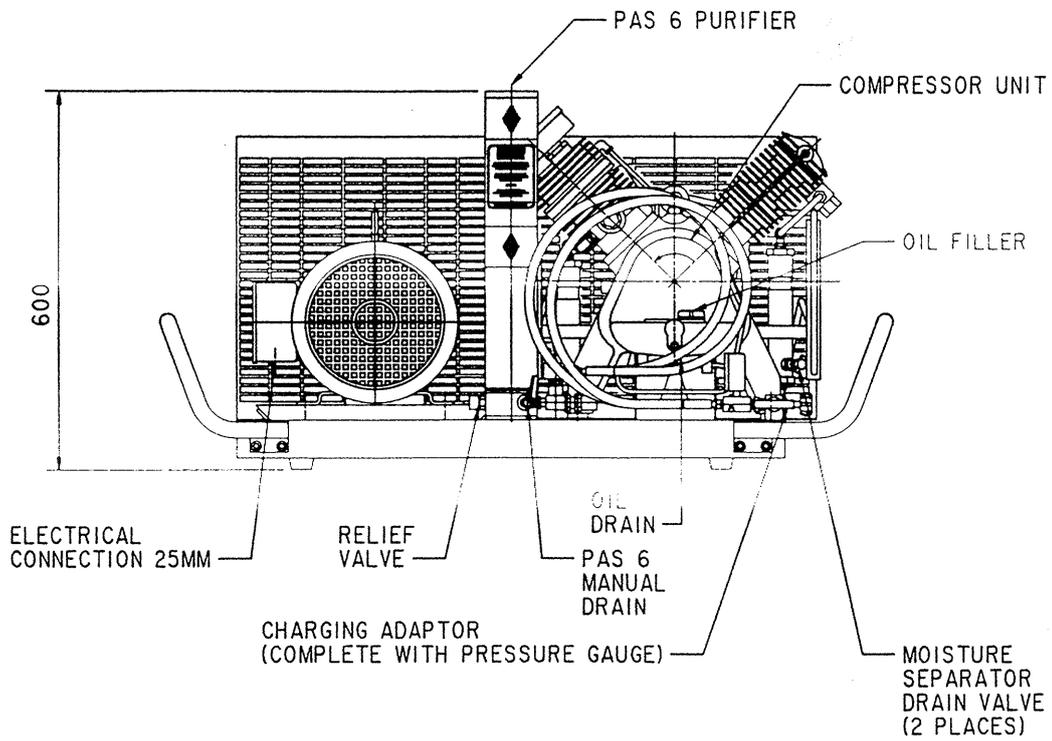
1.5 BP6E CHARGING SET



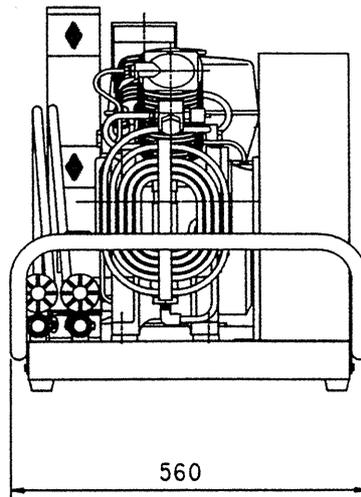
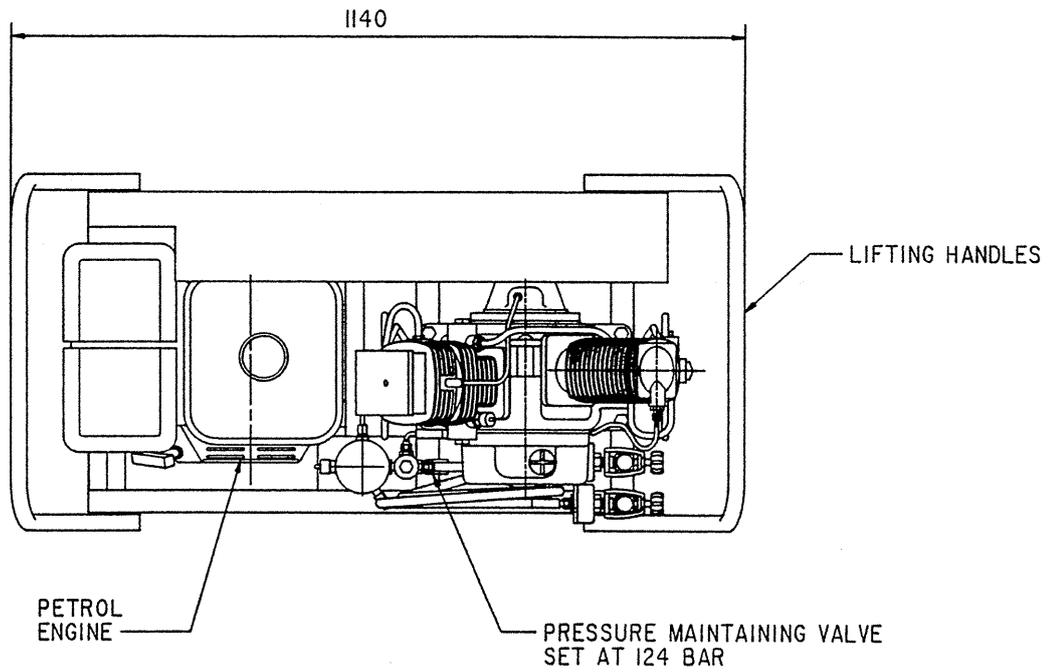
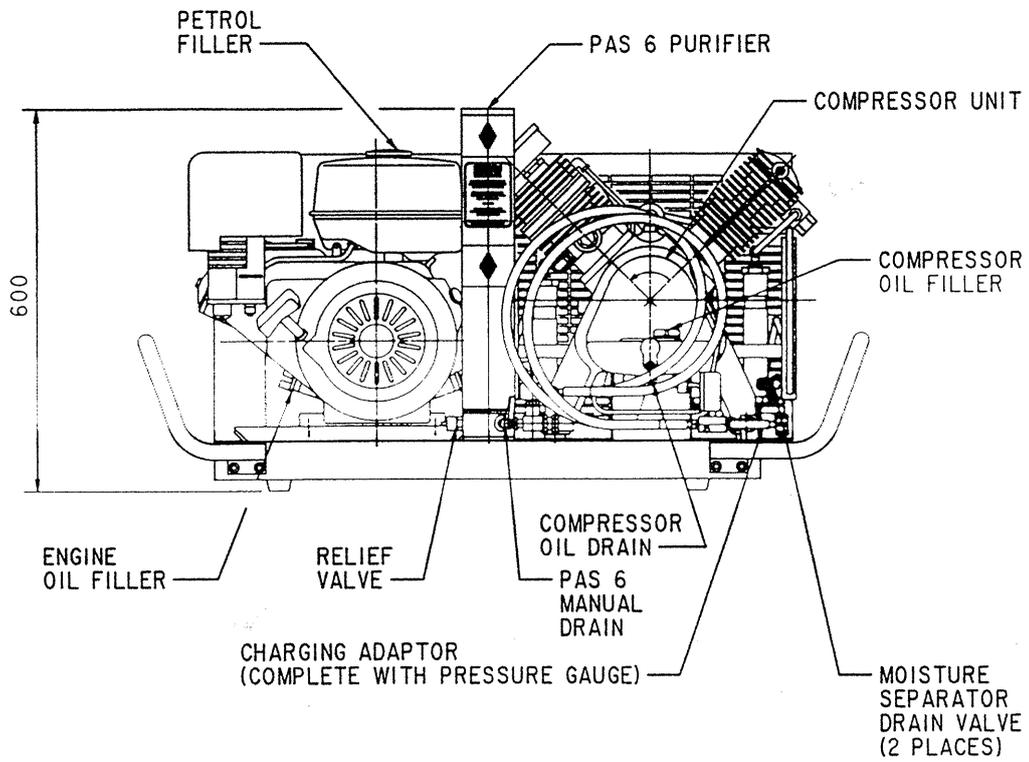
1.6 BP6P CHARGING SET



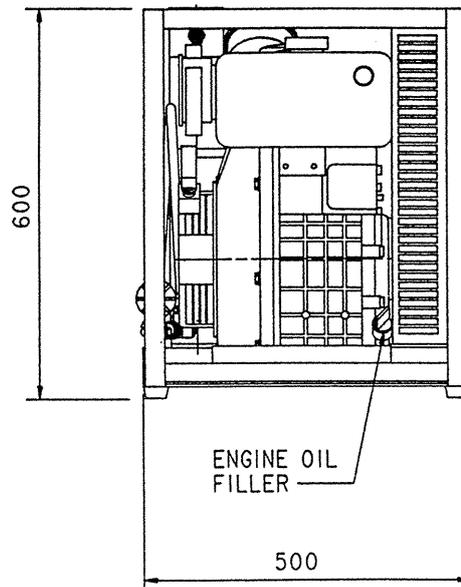
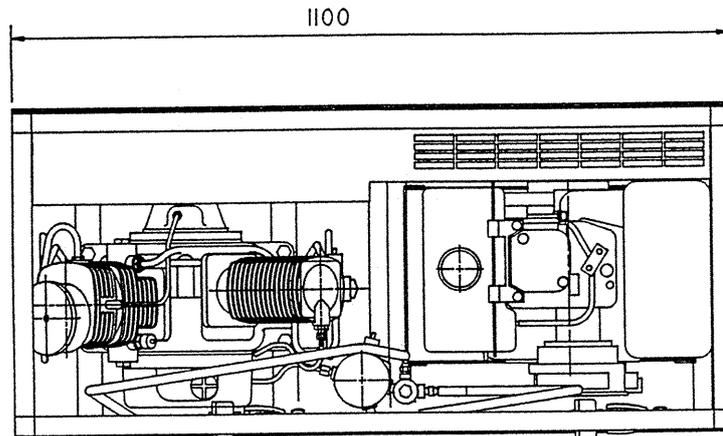
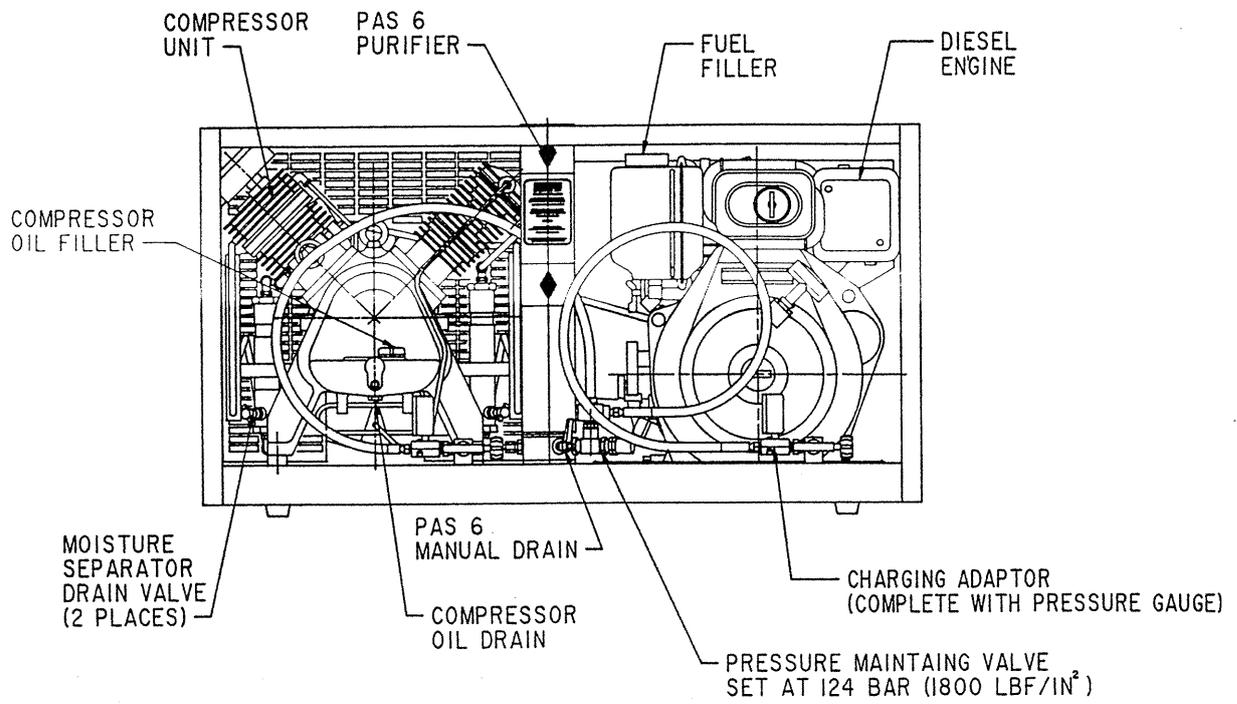
1.7 BP6D CHARGING SET



1.8 BP8E CHARGING SET



1.9 BP8P CHARGING SET



1.10 BP8D CHARGING SET

SECTION 2 - MECHANICAL DESCRIPTION

2.1 FILTRATION SYSTEM

The filtration system cleans the compressed air to within the specification laid down by BS 4275.

CONTAMINANT	BS 4275 REQUIREMENT
Carbon Monoxide	5 PPM
Carbon Dioxide	500 PPM
Oil	0.5 mg/m ³
Water	0.03 mg/litre

Air passes from the compressor outlet into the PAS 6 purifier, which houses a sealed filter cartridge containing specific chemicals, each designed to remove a particular contaminant. The filter cartridge also contains colour indicating silica gel, which changes from blue to pink as the chemical becomes saturated, as well as filter pads which intercept solid particles down to 10 microns in size.

Moisture and oil droplets impinge on the underside of the cartridge and collect in the base of the purifier. This accumulated condensate must be drained regularly during operation.

The air is held inside the purifier until a minimum pressure of 124 Bar has been reached, at which point the pressure maintaining valve will open allowing the clean air out of the purifier. This air can now be used for charging breathing air cylinders.

To maintain the quality of the processed air, it will be necessary to replace the purifier cartridges at the intervals shown in Section 1.3, under normal operating conditions.

It is the responsibility of the operator to check the condition of the purifier cartridges and replace when necessary.

NOTE: Under severe atmospheric conditions such as high ambient temperature and/or high humidity, the cartridges must be changed more frequently.

In the event of extended lay-off periods between use, it is necessary to replace the purifier cartridges every 3 months, even though the purifier cartridges may not be totally contaminated.

The purifier vessel is manufactured from high quality aluminium alloy which has been designed to withstand a pressure of 1380 Bar. A safety valve is connected to the inlet port of the purifier base to protect the system from over-pressurisation.

2.2 PRESSURE SWITCH

An electrical pressure switch is fitted on the semi-automatic and automatic build. When the required working pressure has been reached, the pressure switch will break,

cutting power to the motor or earthing the engine sparking plug, thus stopping the compressor. This reduces the overall running time of the compressor and keeps maintenance to a minimum.

2.3 STARTER PANEL

The electrical starter panel provided for both the **manual** and **semi-automatic** versions contain the following controls:

1. **START** - a push button control energises the start circuits to switch the incoming power supplied to the motor and control circuits. The semi-automatic control circuits contain a run-down timer which ensures that the machine will run unloaded for two minutes for cooling and ventilation purposes to prevent condensation.
2. **STOP/RESET** - a push button control which breaks the supply to the control circuits and switches off the power supply to the motor.

The starter panel provided for the **fully automatic** version has the following controls and indicators:

1. **STARTER ON** - a red lamp which illuminates to indicate that mains supplies have been switched on to the motor and to the control circuits.
2. **DRAIN OPEN** - a green lamp which illuminates to indicate that the drains from the moisture separators are open. The lamp can only be active when the compressor is running.
3. **FULL PRESSURE** - an amber lamp which illuminates to indicate that the working pressure has been reached and the compressed air is available for charging. The lamp will remain on until the system pressure has decayed by 40 Bar, after which the pressure switch will reset.
4. **RESTART/RESET** - a push button control which energises the start relay to switch the power supply to the motor and control circuits.
5. **HAND/OFF/AUTO** - a 3 position switch used to select the various control modes of the charging set. The **HAND** position is commonly used for charging individual cylinders. In this mode of operation, the compressor will run up to the pressure switch setting and stop. Once stopped, the compressor can only be restarted manually. The **AUTO** mode is commonly selected when charging or maintaining pressure in a bank of cylinders. In this mode of operation, the compressor will enter a run on sequence when the cylinders are fully charged before stopping. When system pressure has decayed to pressure switch lower setting, the compressor restarts automatically.
6. **STOP/LOCK** - a push button isolator used to make the equipment safe in case of emergency or prior to servicing by cutting off the supply to the control circuit and to the motor. Once depressed, the button

remains locked in and must be twisted to release.

In addition to the start panel, an **ON/OFF** mains isolator switch should be provided on site to switch the power supply at source.

WARNING All lamps extinguished does not mean the panel is electrically isolated. Always switch off at the isolator before opening the case.

2.4 MOTOR

The electric motor is a totally enclosed fan-cooled type, which drives the compressor via a link belt. The motor is powered by a suitable supply as shown on the reference plate and switched via the starter circuit from the starter panel. The motor is mounted on a carrier and can be moved vertically to adjust the tension in the drive belts.

2.5 ELECTRICAL SYSTEMS

The electrical wiring will vary according to the charging set options and the starter control requirements. The standard arrangements for manual, semi-automatic and automatic versions are as follows:

MANUAL OPERATION

The main supply to the starter panel is via the site **ON/OFF** fused isolator switch. The starter panel is wired for star delta motor control and operation of the **START** push button initiates a start-up sequence for the motor. A current overload trip is built into the circuit.

An emergency stop push button may be remotely mounted and wired into the starter panel circuit so that the input supply may be immediately switched off in an emergency.

SEMI-AUTOMATIC OPERATION

The main supply to the starter panel is via the site **ON/OFF** fused isolator switch. The starter panel is wired for star delta motor control and operation of the **START** push button initiates a start sequence. A current overload trip is built into the circuit.

A supply is also routed to the control panel via a 1 amp fuse to power the hour meter whenever the mains supply is switched to the motor.

The emergency stop push button may be remotely mounted and wired into the starter panel circuit so that the input supply may be immediately switched off in an emergency.

A dump switch may be wired into the circuit which, when operated, de-energises the unloader solenoid valve to initiate system de-pressurisation and condensate dump operation. This operation is also automatically initiated during the starting and shutdown sequences.

The single and dual operational pressure switches operate at pre-set working pressures to initiate a shutdown sequence when the selected working pressure is reached.

AUTOMATIC OPERATION

The mains supply to the starter panel is via the site **ON/OFF** fused switch. The 3-phase supply is used to drive the star delta motor. The red and yellow phase are transformed to provide the 240 V a.c. required for the control circuits.

The two modes of operation are **HAND** and **AUTO**. When **HAND** is selected, operation of the **START/RESET** switch initiates a start sequence for the motor. The red lamp illuminates to indicate power supply is available and switched to the motor. If the motor is switched off for any reason e.g. when the working pressure has been reached, the motor will not automatically restart, unless the **START/RESET** push button is again operated.

When **AUTO** is selected, operation of the **START/RESET** push button initiates a start sequence for the motor and the red lamp illuminates to indicate the power supply is available and switched to the motor. If the motor is switched off by operation of the shutdown timer, the red lamp will remain illuminated and the motor will automatically restart when the shut-down timer is reset ie. when the working pressure has dropped to a level which operates the pressure switch.

A supply is also routed to the control panel via a 1 amp fuse to power the hour meter whenever the mains supply is switched to the motor.

Provision is made for a remote **EMERGENCY STOP** push button to be wired into the starter panel circuit so that the supply may be immediately switched off in an emergency.

A dump switch may be wired into the circuit which, when operated, de-energises the unloader solenoid valve to initiate system de-pressurisation and condensate dump operation. This unloading operation is also initiated during the start up and shut down sequences and every 20 minutes during continuous running. A green lamp illuminates to indicate that draining is taking place.

A single and if fitted, dual pressure switch operates at a pre-set working pressure to switch off the motor supply when the required working pressure is reached. The amber lamp illuminates when full pressure has been reached.

2.6 ENGINE

The engine is either a single cylinder four stroke petrol or diesel engine which drives the compressor via a vee belt. For a full description of the engine, refer to the manufacturer's handbook supplied with the equipment.

2.7 UNLOADER SYSTEM

An unloader system may be fitted to the semi-automatic or automatic versions only. Interstage moisture separators are located on the compressor and the separator drains are piped into the unloader system. This permits the draining of condensate to be controlled via the manual unloader switch.

When operated, the manual unloader switch de-energises a solenoid valve, which in turn, controls a supply of first stage air to the unloader system. The unloader system contains three pistons which open and close allowing accumulated condensate to drain from the compressor moisture separators and the filtration system drains.

Because of the sequential method by which these valves are controlled, they will unload in sequence, which will be apparent by the sound of a loud hiss when the compressor unloads.

The unloader system will operate automatically to ensure that the compressor is unloaded during the start up and run down sequence

In addition, the fully automatic set is fitted with a control timer which will automatically operate the solenoid every 20 minutes to expel accumulated condensate.

2.8 HIGH AIR TEMPERATURE SWITCH

The high temperature switch is mounted in the compressor final stage outlet and is set to operate at 195°C. The switch is only available with the fully automatic version and consists of a high thermal expansion ratio metal cylinder which is used as the sensing part and a metal of low expansion ratio which is used as the interior contact point assembly. The difference in the expansion ratios of the two metals determines the opening and closing of the electrical contacts connected to an external switching circuit.

SECTION 3 - INSTALLATION & COMMISSIONING

SECTION 3 - INSTALLATION & COMMISSIONING

3.1 RECEIPT

Check the equipment on receipt and immediately report any damage or deficiencies to the manufacturer.

On despatch, compressor is either inhibited for 6 months with oil drained or supplied with a full charge of oil in the sump, as indicated on label attached to compressor.

On receipt of equipment, examine label to determine which condition applies. If compressor is drained of oil, fill to the correct level with the correct grade of lubricant. If compressor is filled with oil, check oil level and replenish if necessary.

IMPORTANT

Compressors supplied with oil in sump are filled with Anderol 555. This is a synthetic oil and must **NOT** be mixed with mineral oil under any circumstances. If synthetic and mineral oils are mixed, failure of the lubrication system will occur, resulting in seizure.

A compressor supplied with Anderol 555 in the sump must be operated using Anderol 555. However, if a change to mineral oil is required, drain synthetic oil, thoroughly clean all internal parts with flushing oil and refill sump with recommended mineral oil. Observe the same procedure if changing from mineral to synthetic oil.

3.2 INSTALLATION

1. No special foundations are necessary, but a firm level surface is required sufficient to support weight of charging set.
2. Equipment should be sited in a cool, dust free and well ventilated position.
3. Place a suitable receptacle below purifier manual drain outlet to collect discharged condensate. If fitted with an unloader system, tether flexible drain hose into a suitable receptacle.

ELECTRIC MOTOR POWERED SET

4. If installed indoors, a minimum space of 0.75 M around the proposed installation should be provided to allow sufficient access to charging set for servicing and maintenance.
5. Compressor room should be provided with reliable and sufficient ventilation to ensure warm air is not recirculated around charging set. Entire power consumption of motor will be dissipated as heat, therefore, if a 2.2 Kw motor is fitted, 2.2 Kw of heat will be generated.
6. Electrical connections should be made by a competent electrician in accordance with appropriate wiring diagram.

Connect to mains supply in accordance with local electrical specifications. Always check motor power requirements with electrical supply before connection.

PETROL OR DIESEL ENGINE POWERED SET

7. Locate out of doors on level ground. Ensure engine is down wind and intake hose is extended upwind to prevent exhaust fumes being drawn into compressor.

3.3 COMMISSIONING

ELECTRIC MOTOR POWERED SET

1. Fill compressor crankcase to top notch on dipstick with the recommended grade of lubricating oil. Refer to Technical Data Section 1.
2. Open purifier manual drain valve.
3. Switch on input supply at mains starter panel.
4. Operate START push button on electrical control panel.
5. As soon as compressor starts, check direction of rotation relative to arrow indication on compressor crankcase or on flywheel. Direction of rotation is clockwise when looking on flywheel.
6. If compressor rotation is incorrect, switch off mains power supply at source. With supply isolated, reverse any two incoming mains supply leads to motor.

CAUTION

The motor and switchgear are wound and set for specific voltages and any attempt to operate the equipment on a supply other than that specified on the motor reference plate will inevitably lead to equipment failure.

The compressor will be starved of oil and will overheat if run in the wrong direction.

7. Run charging set for 3 to 5 minutes with purifier drain valve open to purge inhibiting oil.
8. Stop motor by operating STOP push button on electrical control panel. Allow all pressure to dissipate through open purifier drain valve.
9. Install purifier cartridge and purge purification system as described in Section 3.5.

PETROL OR DIESEL ENGINE POWERED SET

10. Fill compressor crankcase to top notch on dipstick with recommended grade of lubricating oil. Refer to Technical Data Section 1.
11. Read and understand engine operator's handbook supplied with equipment. Fill engine with recommended grade of lubricating oil and fuel.

12. Ensure compressor intake hose is extended upwind of engine.
13. Open purifier manual drain valve.
14. Start engine in accordance with the operator's handbook. Run charging set for 3 to 5 minutes with purifier drain valve open to purge inhibiting oil.
15. Stop engine. Allow all pressure to dissipate through open purifier drain valve.
16. Install purifier cartridge and purge purification system as described in Section 3.5.

3.4 STORAGE

If compressor is not to be used immediately or is taken out of service for more than four weeks, it is recommended that compressor is inhibited as detailed in compressor handbook supplied with charging set. The principle objective of inhibiting compressor for either short or long term periods is to remove all traces of moisture from the machine and to replace normal lubricating oil with a rust inhibiting oil. The only inhibiting oil currently recommended by Hamworthy Compressor Systems is Shell Ensis 158.

3.5 CARTRIDGE INSTALLATION

1. Slowly open purifier manual drain valve to ensure that system is vented of all pressure.
2. Carefully unscrew body (item 6) from base (item 5) using a strap wrench if necessary. Refer to Section 3.6 PAS 6 Purifier Cartridge Installation Diagram.
3. Carefully clean all internal surfaces with a clean lint free cloth. Apply a little silicone grease to the base/body thread.
4. Remove new filter cartridge (item 4) from packing and insert the correct way up in the filter base. Ensure that 'O' ring (item 2) is correctly fitted in base of new cartridge (item 1). The cartridge is supplied in a sealed pack and must not be opened until required for use.
5. Assemble spring (item 3) and spring cap (item 4) on top of cartridge and replace purifier body. Screw down body fully and then back off 1/4 turn to prevent seizure of the body to the base.
6. Close purifier manual drain valve.
7. Remove charging adaptor from retaining block and open hose charging valve.

NOTE: Charging adaptor **MUST** be removed from retaining block prior to starting the set.

8. Repeat starting procedure and allow set to run for at least 5 minutes to purge the system and charging adaptor.

NOTE: There will be a short delay before air escapes from the charging adaptor due to the presence of a pressure maintaining valve in the purification system.

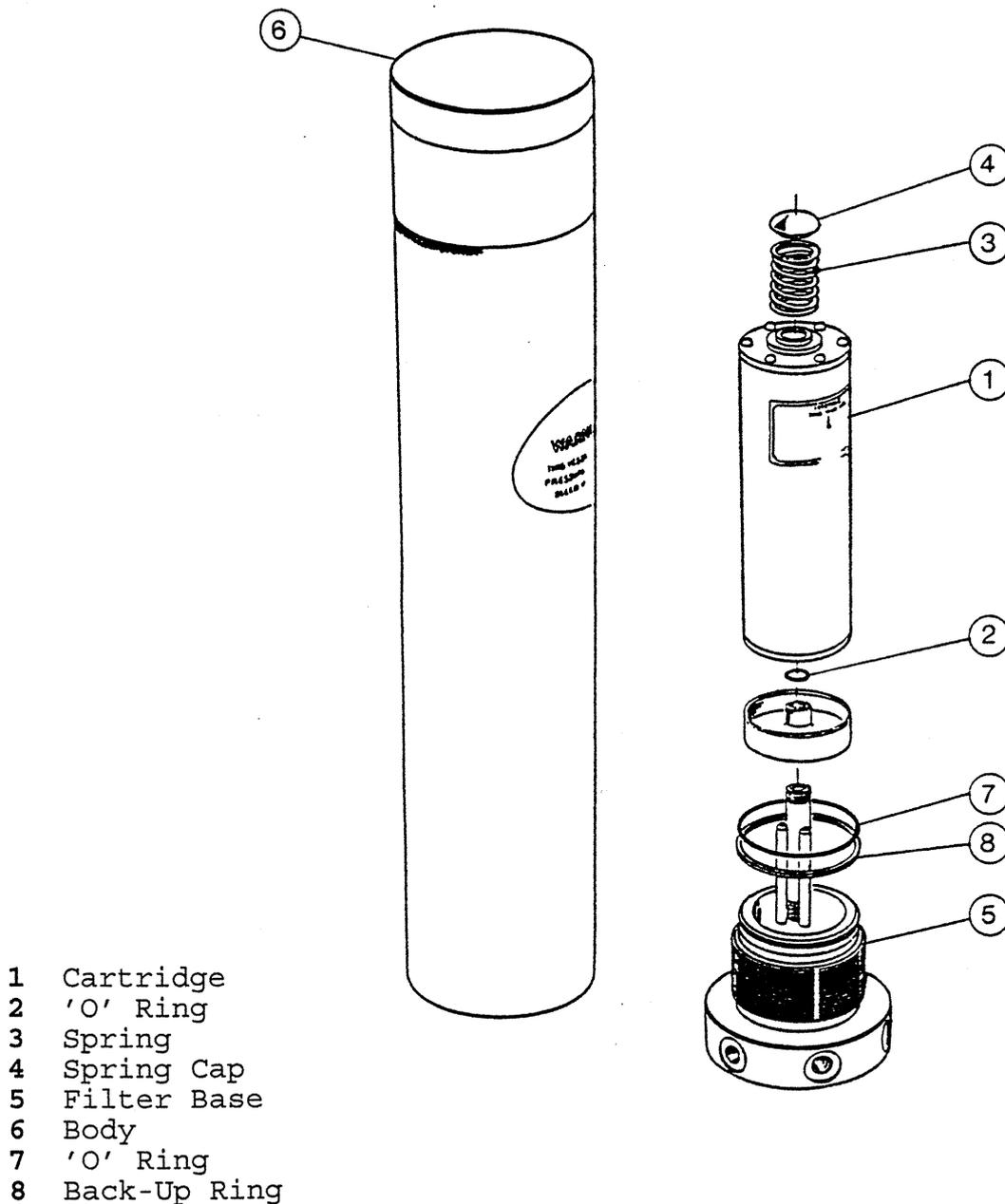
If set incorporates twin hoses or is designed to operate at dual pressure, repeat purging instructions for each charging adaptor.

9. Stop set.

10. Ensure that hose is depressurised ie. charging pressure gauge indicates zero. Replace charging adaptor into retaining block.

11. Record running time and oil filling details on compressor log sheet.

The set is now ready for operation as required.



3.6 PAS 6 PURIFIER CARTRIDGE INSTALLATION

SECTION 4 - OPERATING INSTRUCTIONS

4.1 OPERATING INSTRUCTIONS - MANUAL VERSION

1. Ensure that charging set has been properly installed and commissioned as detailed in Section 3 and has been regularly serviced and maintained as detailed in Section 5. Always check compressor oil level before starting and maintain at top notch on dipstick.
2. Open compressor moisture separator manual drain valve and PAS 6 manual drain valve to ensure compressor is unloaded before starting.
3. Remove charging adaptor from retaining block and connect to breathing air cylinder. Hand tighten only.

NOTE: Before starting set, check cylinder maximum operating pressure. **DO NOT OVERCHARGE.**

4. Open cylinder isolation valve.
5. Operate **START** push button on starter panel and check that compressor is running. For the engine powered set, start engine in accordance with the operator's handbook. After 10 seconds, close moisture separator and PAS 6 manual drain valves. Cylinder begins to charge.
6. Pressure gauge on charging adaptor will indicate the cylinder pressure. When cylinder is charged as required, close cylinder isolation valve.
7. Open PAS 6 manual drain valve.
8. Bleed charging adaptor and hose by slowly unscrewing knurled bleed valve.

NOTE: **DO NOT** attempt to remove charging adaptor from cylinder unless adaptor and hose has been bled of all pressure.

9. Disconnect charging adaptor from cylinder and replace in retaining block. Close knurled bleed valve.

NOTE: Always keep charging adaptor in retaining block when not in use to prevent contamination or damage.

10. During operation, slowly open compressor moisture separator drain valve and PAS 6 manual drain valve for 5 seconds every 20 minutes running to eject any accumulated condensate.
11. To shut down charging set at the end of each charging session, slowly open compressor moisture separator drain valve and PAS 6 manual drain valve to unload compressor. Allow compressor to run in this condition for at least 2 minutes to ventilate the system and expel any condensate.

NOTE: Failure to allow compressor to run for 2 minutes in an unloaded condition may lead to the formation of internal condensation, resulting in corrosion and possible seizure.

12. Operate **STOP** button on control panel to shut down charging set. Switch off mains isolator. For the engine powered set, stop engine in accordance with instructions in operator's handbook.
13. Allow pressure to dissipate slowly and safely through open drain valves, then close drain valves.

4.2 OPERATING INSTRUCTIONS - SEMI-AUTOMATIC VERSION

1. Ensure that charging set has been properly installed and commissioned as detailed in Section 3 and has been regularly serviced and maintained as detailed in Section 5. Always check compressor oil level before starting and maintain at top notch on dipstick.
2. Open compressor moisture separator manual drain valve and PAS 6 manual drain valve to ensure compressor is unloaded before starting.
3. Remove charging adaptor from retaining block and connect to breathing air cylinder. Hand tighten only.

NOTE: Before starting set, check cylinder maximum operating pressure. **DO NOT OVERCHARGE.**

4. Open cylinder isolation valve.
5. Operate **START** push button on starter panel and check that compressor is running. For the engine powered set, start engine in accordance with the operator's handbook. After 10 seconds, close moisture separator and PAS 6 manual drain valves. Cylinder begins to charge.
6. Pressure gauge on charging adaptor indicates the cylinder pressure. When cylinder is charged as required, close cylinder isolation valve.
7. Open PAS 6 manual drain valve.
8. Bleed charging adaptor and hose by slowly unscrewing knurled bleed valve.

NOTE: **DO NOT** attempt to remove charging adaptor from cylinder unless adaptor has been bled of all pressure.

9. Disconnect charging adaptor from cylinder and replace in retaining block. Close knurled bleed valve.

NOTE: Always keep charging adaptor in retaining block when not in use to prevent contamination or damage.

10. During operation, slowly open compressor moisture separator drain valve and PAS 6 manual drain valve for 5 seconds every 20 minutes running to eject any accumulated condensate.

11. When system pressure reaches pressure switch upper setting, charging set automatically stops. When stopped, slowly open compressor moisture separator drain valve and PAS 6 manual drain valve to unload compressor.
12. Start charging set again and run for at least 2 minutes with drain valves open to ventilate the system and expel any condensate.

NOTE: Failure to allow compressor to run for 2 minutes in an unloaded condition may lead to the formation of internal condensation, resulting in corrosion and possible seizure.

13. Operate **STOP** button on control panel to shut down charging set. Switch off main isolator. For the engine powered set, stop engine in accordance with instructions in the operator's handbook supplied with the set.
14. Allow pressure to dissipate slowly and safely through open drain valves, then close drain valves.
15. For charging sets fitted with an unloader valve system, a timer in the control panel operates the unloader valves for 5 seconds every 20 minutes running to eject accumulated condensate. In addition, the shut down sequence is automatic and operates as follows:

- a) When the compressor reaches full working pressure, the pressure switch will operate, the compressor will unload and enter a 2 minute run down sequence with all drains open to ventilate the system and expel any accumulated moisture. At the end of the run down sequence, the compressor is stopped by a timer in the starter panel and can only be restarted by depressing the **START** push button.
- b) When the compressor has been stopped by the pressure switch, it cannot be restarted until the pressure has fallen approximately 40 Bar below the working pressure. This allows the pressure switch to reset, after which the **START** push button will become operational again.

NOTE: This option is only available with an electric motor drive charging set.

4.3 OPERATING INSTRUCTIONS - FULLY AUTOMATIC VERSION

NOTE: The fully automatic option is only available with an electric motor drive charging set.

1. Ensure that the charging set has been properly installed and commissioned as detailed in Section 3 and has been regularly serviced and maintained as detailed in Section 5. Always check compressor oil level before starting and maintain at top notch of dipstick.
2. Remove charging adaptor from retaining block and connect to breathing air cylinder. Hand tighten only.

NOTE: Before starting set, check cylinder maximum operating pressure. **DO NOT OVERCHARGE.**

3. Open cylinder isolation valve.
4. Switch on the mains supply to the equipment at the mains isolator. **STARTER ON** lamp illuminates.
5. Select **HAND** or **AUTO** mode on the 3 position switch on the starter panel.
6. With the 3 position switch in **HAND**, the operation of the charging set is identical to the Semi-Automatic version, as described in Section 4.2.
7. With the 3 position switch in **AUTO**, press the **START** push button and check that the compressor is running.

NOTE: a) The unloader system will operate and the **DRAIN OPEN** lamp on the starter panel will illuminate during the star phase of the **MOTOR** start up sequence. When the panel switches to delta, the **DRAIN OPEN** lamp extinguishes and the compressor loads. If a direct on line starter is used, a timer in the starter ensures the compressor is unloaded during starting.

b) When the compressor reaches full working pressure, the **FULL PRESSURE** pressure lamp will illuminate and the pressure switch will operate, causing the compressor to unload and enter a 2 minute run down sequence with all drains open to ventilate the system and expel any accumulated condensate.

c) When the compressor has stopped at the end of the run on sequence, it will not start until the system pressure had decayed to the pressure switch lower setting, usually 40 Bar below the working pressure. At this pressure, the compressor will start and will run automatically between the pressure switch upper and lower settings until manually stopped.

d) The unloader system is timer controlled allowing moisture dumping to take place every 20 minutes of compressor running. In addition, a yellow manual override switch may be fitted. By turning the switch, the charging set may be unloaded at any time.

8. Cylinder begins to charge. Pressure gauge on charging adaptor indicates the cylinder pressure. When cylinder is charged as required, close cylinder isolation valve. The compressor will otherwise continue to charge until the full working pressure is reached.
9. Bleed charging adaptor and hose by slowly unscrewing knurled bleed valve.

NOTE: Do **NOT** attempt to remove charging adaptor from cylinder unless adaptor and hose has been bled of all pressure.

10. Disconnect charging adaptor from cylinder and replace in retaining block. Close knurled bleed valve.

NOTE: Always keep charging adaptor in retaining block when not in use to prevent contamination or damage.

NOTE: If more than one cylinder is to be charged, or if for any other reason the compressor is running continuously, the separator drains may be opened by turning the yellow manual override switch. This will prevent any further pressure rise in the system, allowing the operator to change cylinders without the compressor entering the automatic run down sequence.

11. At the end of each charging session:-

a) Switch off the charging set by turning the 3 position switch to on the starter panel to the **OFF** position to initiate the automatic run down sequence.

b) Switch off at the mains isolator when the run down sequence has been completed and the compressor has stopped.

c) Slowly open PAS 6 manual drain valve. Allow pressure to dissipate slowly and safely through open drain valve, then close drain valve.

12. In case of emergency, operate the **EMERGENCY STOP** push button to bring the compressor to an immediate halt. The control must not be used for normal shut down operation. After emergency stop, twist button to release and operate as required.

4.4 OPERATING INSTRUCTIONS - DUAL PRESSURE CHARGING

IMPORTANT NOTE:

IT IS THE RESPONSIBILITY OF THE OPERATOR TO ENSURE THAT ALL PERSONNEL ARE AWARE OF THE MAXIMUM WORKING PRESSURE OF THE LOW PRESSURE CHARGING CIRCUIT.

IT IS ESSENTIAL THAT BOTTLES SUITABLE FOR LOW PRESSURE CHARGING ARE ONLY PROCESSED ON THE LOW PRESSURE CHARGING CIRCUIT.

DO NOT USE HIGH PRESSURE CIRCUIT TO CHARGE LOW PRESSURE BOTTLES.

EXAMINE MAXIMUM WORKING PRESSURE FOR EACH BOTTLE BEFORE CHARGING TO DETERMINE IF SUITABLE FOR HIGH OR LOW PRESSURE CHARGING.

1. The low pressure charging circuit comprises a manually operated diverter valve fitted downstream of the pressure maintaining valve, a low pressure safety valve and one hose outlet fitted with an adaptor suitable for low pressure charging.

2. Turn diverter valve to required charging circuit.

NOTE: Either the low pressure or high pressure charging circuits may be selected, but not both simultaneously.

3. Once the desired charging circuit has been selected, the method of operation is identical to that described for single pressure charging sets.

4.5 TWIN CHARGING HOSES

Charging sets supplied with twin charging hoses are fitted with charging adaptors incorporating isolating valves, allowing one cylinder to be charged if required. Operate charging set as detailed in Section 4.1, 4.2 or 4.3. In addition, operate twin charging hose adaptors as follows:

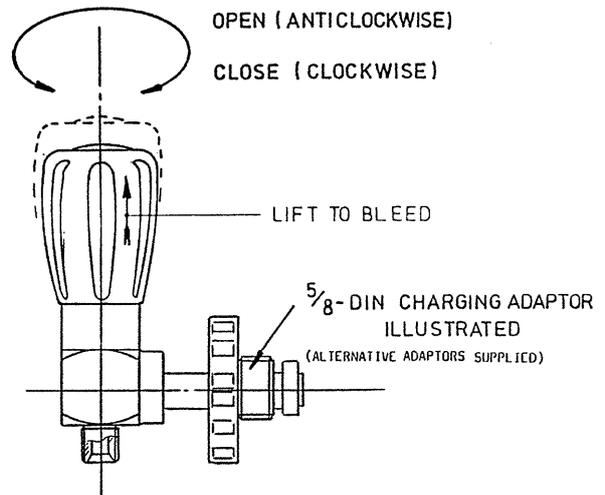
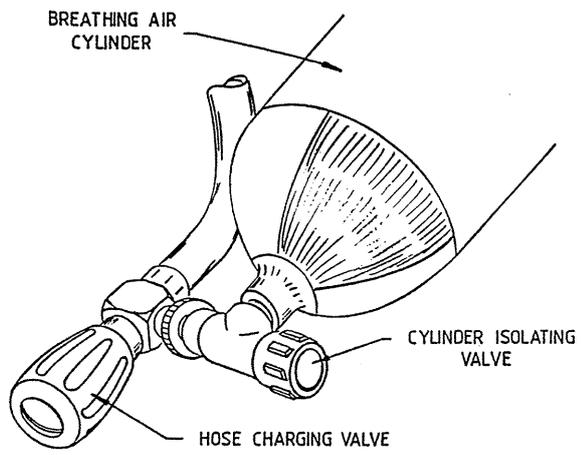
1. Connect charging adaptor to breathing air cylinder and hand tighten.
2. Open cylinder isolation valve. Open hose charging valve black handwheel.
3. Charge cylinder as detailed in Section 4.1, 4.2 or 4.3.
4. When cylinder is charged as required, close cylinder isolation valve. Close hose charging valve black handwheel.
5. To bleed charging valve, black handwheel must first be turned clockwise to fully closed position. Bleed function is then achieved by lifting handwheel vertically upwards. This bleeds charging valve, but not charging hose.

NOTE: When charging cylinders, operator must bleed charging valve **BEFORE** removing adaptor from cylinder. **ALWAYS** ensure that cylinder isolating valve is fully closed before bleeding charging valve.

6. Disconnect charging adaptor from cylinder and replace in retaining block.

NOTE: Always keep charging adaptor in retaining block when not in use to prevent contamination or damage.

7. It is recommended that at the end of each working day or when all charging requirements have been achieved, any pressure stored within the charging hoses be released. Slowly open each charging valve black handwheel to depressurise hoses. Allow pressure to dissipate slowly and safely until charging pressure gauge indicates zero pressure, then shut each charging valves.



SECTION 5 - MAINTENANCE PROCEDURES

5.1 INTRODUCTION

The BP6 and BP8 charging sets will give long and satisfactory service provided regular maintenance is carried out in accordance with the following recommendations.

It is important to keep the equipment clean at all times. Regularly wipe away any oil films, dust and condensate which may collect on the equipment.

A daily general visual examination of the set, coupled with a record of hours running times and all maintenance work carried out will help indicate possible impending malfunctions. Preventative maintenance can be effectively planned from the compressor log sheets.

Refer to engine operator's handbook for engine servicing intervals and procedures.

5.2 DAILY

1. Check the compressor lubricating oil level and top up as necessary. Maintain level at the top notch on the dipstick.

For the engine powered set, check engine lubricating oil level and top up as necessary.

2. Run the set and listen and look for signs of unsatisfactory operation.
3. Check the purifier cartridge and replace if necessary.

5.3 PAS 6 PURIFIER CARTRIDGE REPLACEMENT

Change purifier cartridge after the following intervals:

BP6 - Every 40 hours of operation or 400 M³ of processed air or when silica gel in cartridge indicates life has expired.

BP8 - Every 30 hours of operation of 400 M³ of processed air or when silica gel in cartridge indicates life has expired.

NOTE: Cartridge has expired when silica gel turns pink.

Check remaining life of purifier cartridge and replace if necessary. Under extreme atmospheric conditions, such as high temperatures or high humidity levels, cartridge life could be considerably reduced.

It is recommended that the cartridge is changed at three monthly intervals even if compressor running time is less than the figure given above.

The replacement procedure is as follows:

1. Slowly open purifier manual drain valve to ensure that system is fully depressurised.

2. Carefully unscrew body (item 6 Section 3.6) from base (item 5) using a strap wrench if necessary. Recover cap and spring. Withdraw and discard old cartridge.
3. Remove new purifier cartridge (item 1) from packing. Ensure new 'O' ring (item 2) is correctly fitted in base of new cartridge. Insert cartridge correct way up on purifier stand.

NOTE: New cartridge is supplied in a sealed pack and must not be opened until required for use.

4. Check condition of anti-extrusion ring (item 8) and 'O' ring (item 7) on purifier base and replace if necessary.
5. Assemble spring (item 3) spring cap (item 4) on top of purifier cartridge.
6. Ensure that no debris has been wiped onto base and body threads. Apply a small amount of silicone grease to threads and refit body.
7. Screw body fully down, then back off 1/4 turn to prevent seizure of body to base. Do not allow any excess grease to contaminate internal surfaces of purifier.
8. Close purifier manual drain valve, run set and check purifier for leaks.

IMPORTANT: If leaks are discovered, slowly depressurise system before rectifying.

NEVER SCREW DOWN A FITTING THAT IS UNDER PRESSURE.

9. Purge system for at least 5 minutes as detailed in Section 3.5 Paras 7 to 9.

IMPORTANT: If any part of the filtration system is subject to cyclic loading by regular venting of accumulated condensate to atmosphere during operation, either by manual or automatic means, the separator/coalescer/purifier subject to that cyclic loading must be replaced if damaged in any way or after every 7500 hours of operation, reference HCS Engineering Standard ES-004.

Such vessels should not be re-hydro-tested every 5 years as demanded by BS 5430 Part 1, only visually inspected. This is a requirement of the Pressure Systems and Transportable Gas Containers Regulations 1989.

5.4 COMPRESSOR ROUTINE MAINTENANCE INTERVALS

For details, refer to the compressor operations and maintenance manual supplied with the charging set. The table summarises the maintenance intervals in total hours running.

	BP6	BP8
MAINTENANCE ITEM		
Change lubricating oil	100	100
Clean air intake filter	100	100
Check valve retainers for tightness	100	100
Clean sintered bronze filter	100	100
Clean external surfaces	100	100
Check fastenings and pipe fittings for tightness	100	100
Check drive belts for wear and tension	100	100
Check valves and valve springs for wear	800	800
Major overhaul	1600	1600

5.5 DRIVE BELT

The main compressor belt drive should be checked for tension after initial 50 hours of operation and adjusted as required. Access is by removing the front of the belt guard. Once correctly set, the belt tension will only need checking at six monthly intervals or if the belt is seen to be slack during operation.

Correct tension is when belt can be twisted through 90° at mid distance between pulleys using finger and thumb pressure only. To adjust, loosen motor/engine bolts, move motor/engine and tighten bolts. After adjustment, ensure correct alignment of pulleys and refit front of beltguard.

5.6 HIGH AIR TEMPERATURE SWITCH

The high temperature switch is located at the fourth stage delivery outlet and is set to operate at 195°C. The unit is pre-set in the factory before despatch and should require no readjustment on site, although it may be readjusted without the aid of special tools by turning the screw located at one end. For spares purposes, order Part No.Y27421.

5.7 PRESSURE SWITCH

If fitted, the pressure switch is mounted on the compressor baseplate and is set at the pressure indicated in the safe working limits located in the front of this manual.

The switch is pre-set and should not normally need adjusting. However, if adjustment is required, proceed as follows:

1. To set lower pressure, turn knurled barrel clockwise to increase pressure ie. from right to left. Turn barrel anti-clockwise to decrease pressure ie. from left to right.

NOTE: Lower setting must be adjusted first.

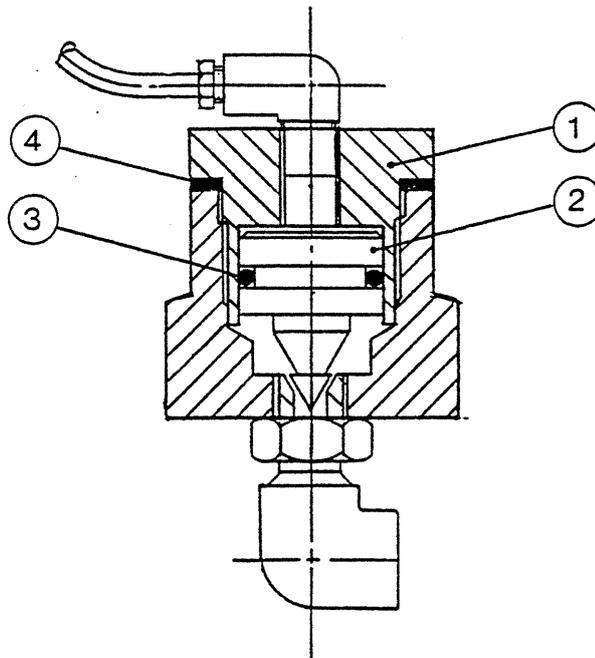
2. To set upper pressure, turn differential setting screw in top of casing clockwise to increase pressure and anti-clockwise to decrease pressure.

For spares purposes, order Part No.Y36389.

5.8 UNLOADER SYSTEM

If fitted, the unloader system is located on the compressor crankcase and comprises three unloader valves mounted on a common exhaust manifold. To service, proceed as follows:

1. Ensure system pressure is fully dissipated.
2. Remove pipes from top of each unloader valve.
3. Remove unloader piston housing and withdraw unloader piston.
4. Thoroughly clean all parts. Examine unloader piston for signs of wear or damage and replace as necessary.
5. Examine all 'O' rings and seals and replace as necessary.
6. Reassemble piston into unloader, ensuring correct location of 'O' ring.
7. Refit unloader piston housing and all pipework.



- 1 Unloader Piston Housing
- 2 Unloader Piston
- 3 'O' Ring
- 4 Bonded Seal

SECTION 6 - ILLUSTRATIONS AND PARTS LISTS

SECTION 6 - PARTS LIST

6.1 INTRODUCTION

Spare parts for the BP6 and BP8 charging sets may be obtained from:

Hamworthy Compressor Systems
Spare Parts Department
Chequers Bridge
Gloucester
GL1 4LL
England

Telephone - 01452 528431

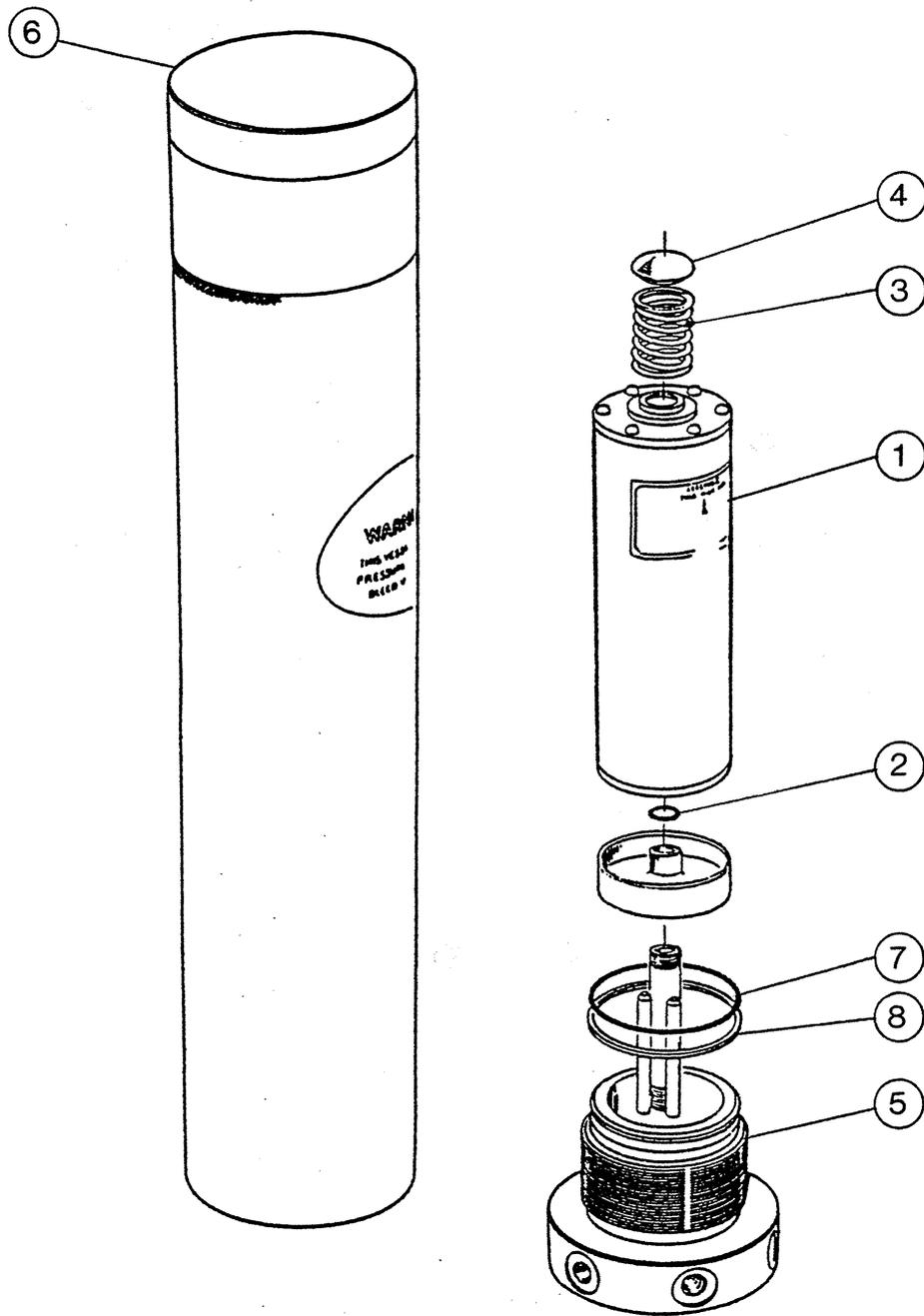
Telex - 43233 WILJAY G

Fax - 01452 507394

When ordering parts, please give the following information:

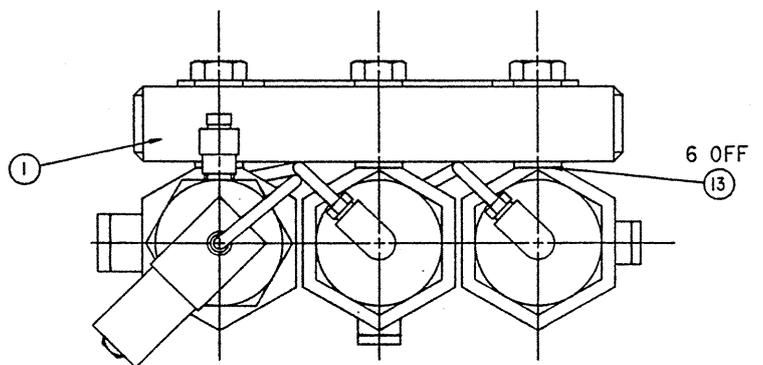
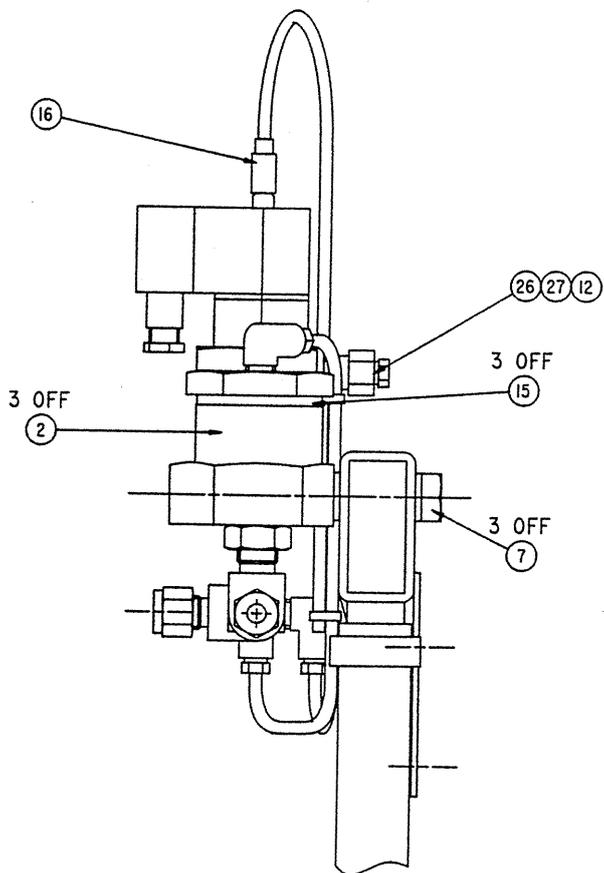
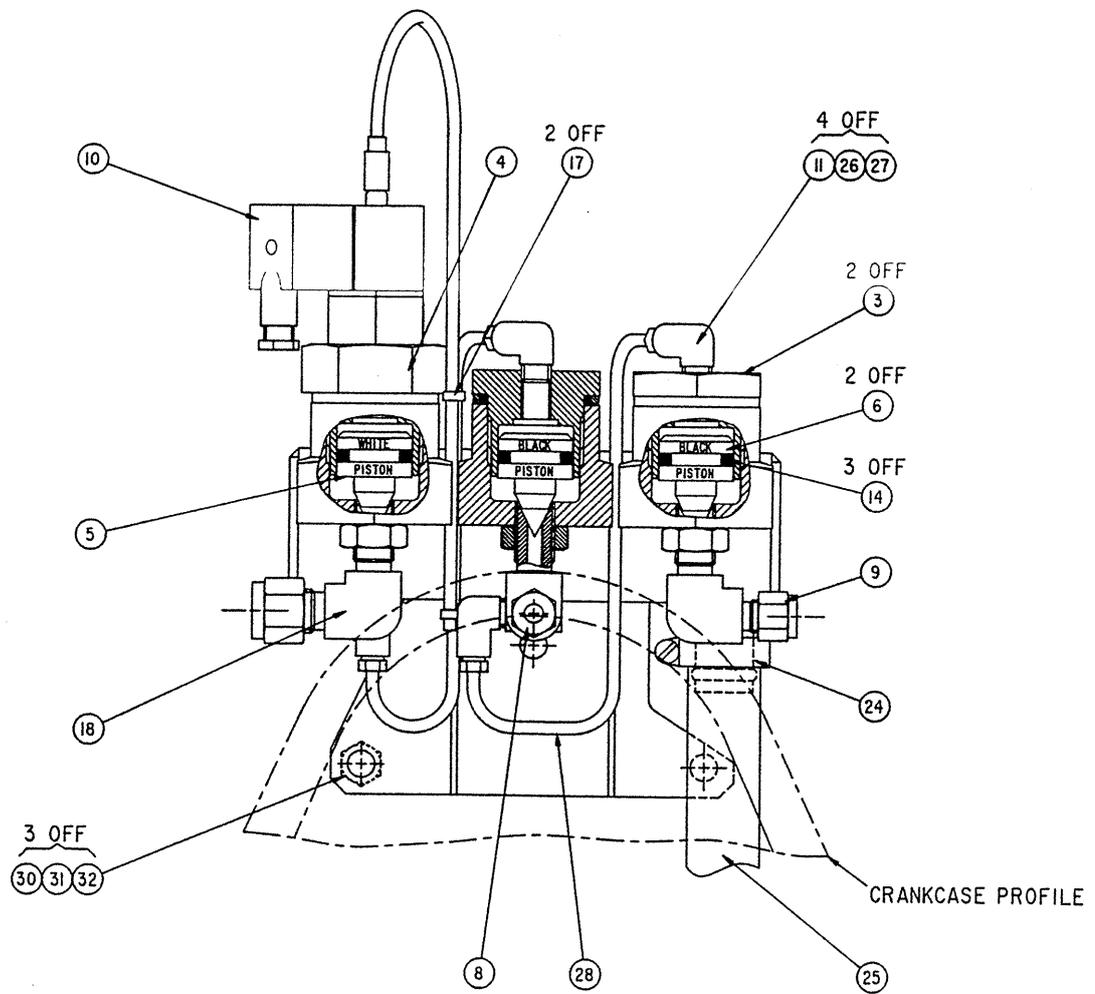
1. Type of equipment and model number
2. Serial number of equipment
3. Part number, if known
4. Description of parts
5. Number of parts required
6. Full postal address of ordering department

For detailed lists of the compressor, refer to the handbook supplied with the set.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	Y38947	Cartridge	1
2	Y38929	'O' Ring - Cartridge Base	1
3	Y24486	Spring	1
4	Y24485	Spring Cap	1
5	Y28519/1	Filter Base	1
6	Y38962	Filter Body	1
7	Y24289	'O' Ring	1
8	Y24290	Anti-Extrusion Ring	1

6.2 PAS 6 PURIFIER ASSEMBLY



6.3 UNLOADER VALVE ASSEMBLY Y27721/1

6.3 UNLOADER VALVE ASSEMBLY PARTS LIST Y27721/1

ITEM	PART NUMBER	DESCRIPTION	QTY
1	Y27232	Manifold	1
2	Y26405	Drain Body	3
3	Y26406	Piston Housing	2
4	Y26528	Unloader Piston Housing	1
5	Y26407	Drain Piston - White	1
6	Y27714	Drain Piston - Black	2
7	Y27053	Banjo Bolt	3
8	Y27045	Positional Elbow 1/4" BSP x 1/4" Tube x 1/8" BSPF	1
9	Y23968	Positional Elbow 1/4" BSP x 1/4" Tube	1
10	Y26566	Solenoid Valve	1
11	Y24468	Male Elbow Union 1/8" BSP x 4 mm	4
12	Y24243	Male Adaptor 1/8" BSPT x 4 mm	1
13	10001/14	Bonded Seal 1/8" BSP	6
14	Y26538	'O' Ring	3
15	Y26539	Bonded Seal 1 1/4"	3
16	Y28801	Male Stud Coupling M5 x 4 mm	1
17	Y27388	Cable Tie	2
18	Y27626	Positional Elbow 1/4" BSP x 3/8" T x 1/8" BSPT	1
19			
20			
21			
22			
23			
24	Y09823	Hose Clip	1
25	Y27370/100	Flexible Hose 3/4" Bore	1.0 M
26	Y23724	Tubing Nut 4 mm	5
27	Y23725	Tubing Sleeve 4 mm	5
28	Y23728/20	Tube 4 mm Dia x 0.2 m	2
29	Y28802/23	Nylon Tube	0.23 M
30	Y27235	Spacer	3
31	Y24566/40	Setscrew M8 x 40 mm	3
32	Y24690	Spring Washer 8 mm	3

1.1 BP6 TECHNICAL DATA

COMPRESSOR	3S10-50
No of Stages	3
Stage Pressures	
Stage 1	8.0 Bar - 116 PSI
Stage 2	58.0 Bar - 841 PSI
Stage 3	Up to 345 Bar - 5000 PSI
Safety Valve Settings	
Stage 1	11.3 Bar - 164 PSI
Stage 2	69.0 Bar - 1000 PSI
Stage 3	10% Above Working Pressure
Compressor Speed	1200 RPM
Average Charging Rate	10.2 M ³ /hr - 6.0 CFM
Cooling	Fan Driven Air Flow
Lubrication	Controlled Splash
Sump Capacity	1.56 Litres 2.75 pints
Recommended Oil	Anderol 500

Anderol 500 is a synthetic oil suitable for high temperatures. The use of any other lubricant will result in carbonisation of the compressor valves and eventual failure. Hamworthy Compressor Systems will invalidate product warranty if any other lubricant is used.

IMPORTANT: Mineral oils are not miscible with synthetic oils, therefore **DO NOT** mix.

Inhibiting Oil	Shell Ensis 158
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ELECTRIC MOTOR - FITTED TO BP6E

Frame Size	D132S
Power Rating	5.5 Kw
Speed 50 Hz Supply	3000 RPM
Supply Details	See Motor Data Plate

PETROL ENGINE - FITTED TO BP6P

Engine Type	Honda
Power Rating	6.7 Kw
Speed	3000 RPM

DIESEL ENGINE - FITTED TO BP6D

Engine Type	Yanmar
Power Rating	4.5 Kw
Speed	3000

1.2 BP8 TECHNICAL DATA

COMPRESSOR	3S10-50
No of Stages	3
Stage Pressures	
Stage 1	8.0 Bar - 116 PSI
Stage 2	58.0 Bar - 841 PSI
Stage 3	Up to 345 Bar - 5000 PSI
Safety Valve Settings	
Stage 1	11.3 Bar - 164 PSI
Stage 2	69.0 Bar - 1000 PSI
Stage 3	10% Above Working Pressure
Compressor Speed	1750 RPM
Average Charging Rate	13.6 M ³ /hr - 8.0 CFM
Cooling	Fan Driven Air Flow
Lubrication	Controlled Splash
Sump Capacity	1.56 Litres 2.75 pints
Recommended Oil	Anderol 500

Anderol 500 is a synthetic oil suitable for high temperatures. The use of any other lubricant will result in carbonisation of the compressor valves and eventual failure. Hamworthy Compressor Systems will invalidate product warranty if any other lubricant is used.

IMPORTANT: Mineral oils are not miscible with synthetic oils, therefore **DO NOT** mix.

Inhibiting Oil	Shell Ensis 158
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ELECTRIC MOTOR - FITTED TO BP8E

Frame Size	D132S
Power Rating	5.5 Kw
Speed 50 Hz Supply	3000 RPM
Supply Details	See Motor Data Plate

PETROL ENGINE - FITTED TO BP8P

Engine Type	Honda
Power Rating	8.3 Kw
Speed	3000 RPM

DIESEL ENGINE - FITTED TO BP8D

Engine Type	Yanmar
Power Rating	6.6 Kw
Speed	3000