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## **OPERATION AND MAINTENANCE MANUAL**

**FOR**

**IPSWICH CITY COUNCIL**

**BUNDAMBA STP**

**SLUDGE DEWATERING FACILITY**

**VOLUME 1 OF 2**

**CONTRACT No. 136-97/98**

**JOB NO. 7387**

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# **AQUATEC-MAXCON**

**Water Treatment Technology and Equipment**

## **OPERATION AND MAINTENANCE INSTRUCTIONS**

**FOR**

**IPSWICH CITY COUNCIL**

**BUNDAMBA STP**

**SLUDGE DEWATERING FACILITY**

**VOLUME 1 OF 2**

**CONTRACT No. 136-97/98**

**JOB NO. 7387**

**THIS MANUAL IS YOUR GUIDE TO THE  
BASIC OPERATION AND MAINTENANCE  
OF YOUR NEW EQUIPMENT.**

**PLEASE TAKE TIME TO READ IT  
CAREFULLY, AS WITH ANY EQUIPMENT,  
NEW OR OLD, PROPER CARE AND  
MAINTENANCE IS ESSENTIAL FOR  
TROUBLE FREE OPERATION. OUR  
COMPANY WILL BE GLAD TO PROVIDE  
FURTHER INFORMATION OR ASSISTANCE  
AND IS EQUIPPED TO HANDLE YOUR  
FUTURE SERVICE NEEDS.**

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## **1.0 WORKPLACE HEALTH AND SAFETY**

All reasonable care must always be taken to ensure the plant is without risk to the health and safety of the people who operate and maintain the plant as required by the Workplace Health and Safety Act (1995). *An employer has an obligation to ensure the workplace health and safety of each of the employer's workers at work.*

The plant must not be misused. The plant must only be used for the purposes for which it has been designed and, in the interests of safety, the safe working loads on the items of the plant are not to be exceeded.

All persons performing work on the plant must be competent and capable of performing the work and must be familiar with the plant. Adequate information, instruction, training and supervision must be provided to enable the persons to perform work without risk to health and safety.

It is the owners responsibility to ensure that all persons entering or working on the plant use the appropriate personal protective equipment. Personal protective equipment includes gloves, safety glasses, hard hats, ear protection, safe footwear and, where necessary, specialist protective clothing for hazardous areas.

All maintenance, service and repair must be performed as and when required. This not only enhances the life of the plant but prevents the plant from deviating from the design intention in a way which is a risk to health and safety.

Any item should always be isolated before maintenance or repairs commence to ensure that the inadvertent operation of the item does not result in risk to the health and safety of any person. Where the item is isolated, and total or partial plant shutdown will result, any total or partial shutdown should not allow a hazardous situation to be created. Where the item cannot be isolated, another person should be stationed at the controls of the plant and an effective means of direct communication should exist between the persons carrying out the maintenance and the person stationed at the controls.

All safeguards that are provided as protection against moving parts must be retained in position at all times except when maintenance or servicing is being undertaken. All safeguards must be replaced prior to start up of the plant.



## **2.0 EQUIPMENT DESCRIPTION**

### **INTRODUCTION**

The sludge dewatering equipment is located within the sludge processing building. This building houses the following equipment: two Tema belt filter presses, with space allocation for a future unit, an Allied Colloids polymer dosing package, three Mono Pumps WAS sludge pumps, with space allocation for a future unit, a Mono Pumps macerator unit, two Grundfos washwater booster pumps, two Kaeser air compressors and an air receiver, a Spirac horizontal conveyor, a Spirac transfer conveyor and a Spirac slewing conveyor.

The building also houses a control room and a separate MCC and PLC room for electrical cabinets.

### **BELT PRESS**

The sludge is dewatered by the belt press. Each belt press has a heavy design structural steel frame, which has a corrosion resistant coating. The belt press is driven by a mechanical variable speed gearmotor with an operating speed range of 2–12 metres per minute.

The Series 500 belt filter press is designed for the continuous dewatering of waste sludge to a high sludge cake solids concentration. Dewatering is accomplished in the following stages; gravity drainage of free water, sludge compression and shear section.

A polymer flocculant is added to the sludge prior to entry to the flocculation tank. The flocculated mixture flows by gravity from the flocculation tank to the sludge feed box and onto the dewatering screen. During transport to the high pressure section, the majority of free water drains from the flocculated sludge.

The thickened sludge is then transferred by gravity to the lower screen, where additional free water is removed. At the entry to the high pressure section dewatering area, the sludge and lower screen come in contact with a second continuous dewatering screen.

The two screens then pass over a perforated drainage roll and a series of solid rollers of decreasing diameter. The perforated roller allows water to drain through both the upper and lower screens. Dewatering pressure in the high pressure section is accomplished by independent, pneumatic tensioning of the two dewatering screens.

The decreasing diameters of the compression section rollers result in an increasing contact pressure on the sludge through this stage. The dewatered sludge exits the compression stage, and is removed from the screens by doctor blades. Both dewatering screens are continuously washed on their return to the head end of the



belt press. Filtrate water and screen washwater are collected in separate drainage pans and removed from the press.

### **POLYMER DOSING PACKAGE**

The polymer dosing package consists of a 3m<sup>3</sup> bulk powder hopper, and an Auto Jet Wet 100T polymer preparation system, comprising three dosing pumps, complete with associated pipework and fittings, 1000L liquid mixing tank, with lightnin agitator, dispersing head, 2000L storage tank, junction box, valves, level controls, access ladder, handrails, all mounted on a common skid base.

The bulk powder hopper is filled by a bulk road tanker as and when required. Low level indication is provided in the hopper.

By means of powder screw feeder/blower assembly located under the hopper, the product is transported by pipe to the Auto Jet Wet preparation system, where it is mixed with water in a special dispersion head and enters the 1000L mixing tank, where it is further mixed by a dual impeller fixed agitator.

Level control is provided in the mixing tank.

The mixed solution is then gravity fed from the Auto Jet Wet preparation system to a 2000 litre storage tank, situated below the mixing tank.

This storage tank is equipped with level probes to monitor the level in the tank and to provide set points for control system sequencing and pump protection by the PLC.

Three dosing pumps mounted on a common skid are provided for dosing the flocculant solution from the storage tank to the plant process dosing point on the sludge intake line to each of the belt presses.

Each dosing pump is provided with a calibration tube, solenoid controlled dilution line with rotameter, in line static mixer and pressure relief line.

### **WAS PUMPS**

Three positive displacement sludge pumps are provided in a two duty and one standby arrangement. These pumps will transfer the sludge taken from the sludge holding tank to the flocculator tanks situated in front of each belt press.

### **MACERATOR UNIT**

A Mono Pumps macerator unit is fitted in the DN300 sludge feed pipework to the WAS sludge pumps, to break up any solids in the sludge feed. A Keystone DN300 knifegate valve is fitted to each side of the macerator for isolation purposes. A DN300 full flow bypass pipe together with a Keystone DN300 knifegate valve is provided should the macerator become blocked or out of service for some reason.



## **WASHWATER BOOSTER PUMPS**

Two Grundfos washwater pumps are supplied to provide recycled effluent washwater to the spray bar equipment on each belt press. This washwater is also provided to a series of washwater stations at nominated locations around the sludge processing plant.

## **AIR RECEIVER AND COMPRESSOR**

Two Kaeser screw type air compressors have been provided and set up to run in a duty/standby configuration. The compressors are belt driven by electric motors.

An oil separating cartridge is fitted into the oil separating tank allowing practically oil free compressed air supply to the air receiver.

The regulation of the compressor unit ensures that compressed air is generated within the set pressure limits.

A safety function protects the compressor unit against failure of important systems through automatic shutdown.

A fan is provided to ensure ventilation of the compressor unit and also to provide sufficient cooling air for the air cooled oil cooler and the air cooler.

Compressed air from the air receiver is piped to each of the belt presses for their operational requirements.

An SMC auto drain is fitted to the bottom of the air receiver to discharge any condensate which may form in the air receiver.

## **SLUDGE CONVEYORS**

### **Horizontal Conveyor**

The conveyor consists of a horizontal trough with covers, a trough liner and a spiral screw, driven by a helical gear motor mounted on the end plate of the trough. The conveyor trough is supported from the processing building floor level by a series of galvanised steel support frames.

This conveyor is located adjacent to the rear of the two belt presses and perpendicular to the centre lines of each press. Dewatered sludge from each of the belt presses is discharged from the screens and onto the conveyor below. The rotating spiral screw transports the dewatered sludge along the conveyor trough, where it discharges onto the transfer conveyor.

### **Transfer Conveyor**

This conveyor is similar in construction to the horizontal conveyor mentioned above.

The transfer conveyor is located outside the sludge processing building. It is positioned beneath the perpendicular to the end of the horizontal conveyor. This conveyor however, has a 10° inclination. The transfer conveyor accepts the dewatered sludge discharged from the end of the horizontal conveyor. The spiral screw transports this sludge up the inclined trough where it is discharge onto the adjacent slewing conveyor.

### **Slewing Conveyor**

This conveyor is located externally to the eastern end of the sludge processing building. The slewing conveyor is similar in construction to the conveyors mentioned above. The conveyor has a 30° inclination to the floor and is fitted with a slewing angle of 60°.

The slewing conveyor is positioned perpendicular to the transfer conveyor and accepts the dewatered sludge discharge from this conveyor. The spiral screw transports the sludge up the inclined trough where it is discharged into sludge holding bins or trailers provided by others.

### **SLUDGE TANK**

The sludge tank is located at the south west corner of the sludge processing building.

A Flygt submersible mixer is located in this tank, complete with guide rail and lifting device. The function of the mixer is to prevent settling of solids in the waste activated sludge prior to the sludge being transferred to the belt presses for dewatering.

An ultrasonic level sensor is also provided in the tank to monitor sludge levels and provide signals to the PLC for control purposes.

A galvanised, elevated platform and access ladder is provided for service and maintenance purposes on the mixer or sensor.

A DN300 pipe spool has been supplied and cast into the tank wall to provide for the sludge draw-off pipework. Two DN100 pipe spools have been supplied and cast into the tank wall. One connection provides a DN100 Kamlok coupling for a septic tanker draw-off. The other connection provides a DN100 sludge discharge line to the sludge drying beds.

A drain outlet at the bottom centre of the tank has been provided by others.

## **ODOUR CONTROL UNIT**

An Aarcon odour control unit has been provided and is located outside the north wall of the sludge processing building. The unit is 1500mm diameter and is constructed of glass reinforced plastic (GRP) with a white gel finish coat.

The unit draws foul air from the sludge processing building. This air enters the unit via a filter and pre-treatment unit. After filtering the foul air from the building, a humidistat senses the humidity of the approaching foul air.

If in excess of 80% relative humidity, then a heater bank will be activated to raise the air temperature to reduce the relative humidity to below the 80% set point. The foul air then enters a centrifugal fan, the discharge from this fan directs the foul air through the packed activated carbon bed which adsorbs any hydrogen sulfide and other odourous compounds. The purified air is then discharged to atmosphere.



### **3.0 EQUIPMENT SPECIFICATIONS**

<b>ITEM</b>	<b>DESCRIPTION</b>
Drawing No. 7387-01 Belt Press & Polymer Dosing – General Arrangement	<p>Tema Belt Press, Series 500 BEP x 2.25m with 0.37kW flocculator drive, DN80 Table D inlet.</p> <p>Allied Colloids 3m<sup>3</sup> Mini Bulk Powder Hopper.</p> <p>Allied Colloids Auto Jet Wet Package Model 100T.</p> <p>Mono Sludge Pump Model CB09KACIR8/G138 c/w 18.5 kW 415V/3ph/50Hz electric motor, DN150 PN16 suction/discharge, 90m<sup>3</sup>/hour, c/w mechanical seals.</p> <p>Mono Macerator Model CT205GBW9B2, c.w 2.2kw 415V/3ph/50Hz electric motor, DN300 PN16 flange connections.</p> <p>Flygt Submersible Mixer Model SR4630.410 c/w 1.5kW motor, 705rpm.</p> <p>ABB Magmaster DN250 Water / Waste Flowmeter / Transmitter Model MF/F251F4110A005ER1301111</p> <p>Grundfos Multistage Centrifugal Pump Model CRN60-30 c/w 7.5kW 415V/3ph/50Hz electric motor, DN100 PN16 suction/discharge connections.</p> <p>Kaeser Screw Compressor Model SX3, c/w 2.2kw 415V/3ph/50Hz electric motor.</p> <p>Milltronics Ultrasonic Level Sensor Model PL-425 the probe c/w 2" BSP threaded ends.</p> <p>Aarcon Odour Control Unit Model 1500SC, design air flow 500L/sec, activated carbon charge – 600kgs</p> <p>Dezurik DN100 Three Way Plug Valve, cast iron body, resilient plug facing, level operated, Code PTW, 100, F1D, CI, 6, S-1-CR, LV-ACC-LVT 102.</p>

ITEM	DESCRIPTION
	Spirac Transfer Conveyor Model U320-SPX/SS 10° Inclined, Serial No. 3152-02 c/w 1.1kw 415V/3ph/50Hz electric motor.
	Spirac Slewing Conveyor Model U320-SPX/SS 30° Inclined, Serial No. 3152-03 c/w 3.0kW 415V/3ph/50Hz electric motor.
	Spirac Horizontal Conveyor Model U320-SPX/SS, Serial No. 3152-01 c/w 3.0kw 415V/3ph/50Hz electric motor
	Big Country Building Systems Sludge Building Structure.
Drawing No. 7387-07 Belt Press & Polymer Dosing – Sludge Pump Pipework Details	Keystone DN150 Knifegate Valve Type F951, rising spindle, table D flange drilling.  Keystone DN300 Knifegate Valve Type F951, non-rising spindle.  Keystone DN150 Wafer Check Valve Type F86-204.  Eurapipe DN80 Ball Valve Code No. 01 880 080.  Stubbe 2" BSP Pressure Relief Valve Fig DHV715 solvent weld ABS connections.
Drawing No. 7387-13 Belt Press & Polymer Dosing – Sludge Tank Details	Keystone DN100 Knifegate Valve Type 951, non-rising spindle, 316 S/S body and gate.  Kamlok DN100 Flanged Adapter Fig. 633LA, Table D 316 S/S.  Kamlok DN100 Dust Cap Fig. 634B, 316 S/S.
Drawing No. 7387-18 Belt Press & Polymer Dosing – New Sludge Pump Pipework Details	Mono Sludge Pumps Model CE07IMSIR8/C406 441rpm IP56 5.5kW motor c/w VFD and mechanical seal frame 161-D132.  John DN100 Check Valve Fig. 404 Table D c/w counterweight.





ITEM	DESCRIPTION
	John DN100 Sluice Valve Fig. 630 Cl 16, Table D.
Drawing No. 7387–19 Washwater Pumps & Pipework	Eurapipe DN100 Union Ball Valve Code No. 01 880 100.
Drawing No. 7387–20 Poly Dosing Pipework Details	Eurapipe DN40 Ball Check Valve Code No. 01 836 040.
	Eurapipe DN40 Ball Valve Code No. 01 880 040
Drawing No. 7387–25 Compressed Air Details	Kaeser 180 Litre Capacity Air Receiver
	SMC ½" BSP Auto Drain AD402–04



## 4.0 EQUIPMENT SUPPLIERS

ITEM	SUPPLIER	CONTACT NO.
Odour Control Unit	Aarcon Air Conditioners 34 Commercial Drive <u>SOUTHPORT</u> QLD 4215	Ph: (07) 5591 2032 Fax: (07) 5591 2032
Flowmeter	ABB Kent-Taylor Pty Ltd 8/39 Tennyson Memorial Drive <u>YERONGPILLY</u> QLD 4105	Ph: (07) 3848 6123 Fx: (07) 3848 6091
Auto Jet Wet Unit, Bulk Powder Hopper	Allied Colloids (Aust) Pty Ltd 17 Graystone Street <u>TINGALPA</u> QLD 4173	Ph: (07) 3890 2377 Fx: (07) 3890 2388
ABS Valves and Fittings	Eurapipe Australia Pty Ltd 10B/43 Links Avenue <u>EAGLE FARM</u> QLD 4009	Ph: 1800 811 848 Fx: (07) 9460 2791
Submersible Mixer	Flygt Austrlia Limited 14 Devlan Street <u>MANSFIELD</u> QLD 4006	Ph: (07) 3849 7477 Fx: (07) 3894 7633
Multistage Centrifugal Pump	Grundfos Pumps Pty Ltd 515 South Road <u>REGENCY PARK</u> SA 5010	Ph: (08) 8461 4611 Fx: (08) 8340 0155
Kamlok Adapter, Dust Cap	Harvey Hose Supplies Pty Ltd 1898 Ipswich Road <u>ROCKLEA</u> QLD 4106	Ph: (07) 3277 5466 Fx: (07) 3875 1427
Sluice Valve, Check Valve	John Valves 172 Evans Road <u>SALISBURY</u> QLD 4107	Ph: (07) 3277 8700 Fx: (07) 3274 0007
Air Compressor, Receiver, Water-Oil trap, Solenoid Operated Drain	Kaeser Compressors Aust Ltd 121 Kerry Road <u>ARCHERFIELD</u> QLD 4108	Ph: (07) 3255 5055 Fx: (07) 3255 5001
Knifegate Valve, Wafercheck Valve	Keystone Flow Control Qld 1189A Kingsford Smith Drive <u>EAGLE FARM</u> QLD 4009	Ph: (07) 3260 2444 Fx: (07) 3260 2140
Sludge Pumps, Macerator	Mono Pumps Limited 2 Glentanna Street <u>KEDRON</u> QLD 4301	Ph: (07) 3350 4582 Fx: (07) 3350 3750



ITEM	SUPPLIER	CONTACT NO.
Ultrasonic Level Sensor	Sencon Pty Ltd 185 Moggill Road <u>TARINGA</u> QLD 4068	Ph: (07) 3870 3331 Fx: (07) 3870 3202
Drain Trap	SMC Pneumatics (Aust) Pty Ltd 17 Shannon Place <u>VIRGINIA</u> QLD 4014	Ph: (07) 3865 4014 Fx: (07) 3865 3999
Conveyors	Spirac Engineering Pty Ltd 2 Kalmia Road <u>BIBRA LAKE</u> WA 6163	Ph: (08) 9434 2127 Fx: (08) 9434 2128
Belt Press	Tema Engineers Pty Ltd 19 Fitzpatrick Street <u>REVESBY</u> NSW 2212	Ph: (02) 9792 3555 Fx: (02) 9792 3134
Plug Valve	Valveflo Engineering Pty Ltd 381 Montague Road <u>WEST END</u> QLD 4101	Ph: (07) 3844 4566 Fx: (07) 3844 4233



## **5.0 EQUIPMENT OPERATION**

### **5.1 OPERATION**

The sludge processing plant is designed to run as a fully automatic operation. The plant equipment will be started in the correct sequence by the PLC, which will monitor and select the appropriate drives of associated equipment accordingly.

### **5.2 PRE-START CHECKS**

#### **5.2.1 Belt Press**

- Check drive oil levels.
- Ensure all safety protection devices are operational.
- Ensure the belt tracking limit switch arms are correctly positioned.
- Check that screen tension rolls and pneumatic regulators are correctly adjusted.
- Check that the upper and lower doctor blades are correctly positioned.
- Check the proportional tracking valves are operating the appropriate air spring when then the control arms are manually operated.
- Ensure that the belt wash control valves are both open and the air gauge readings are 700kPa.

#### **5.2.2 Polymer Dosing System**

- Check all drives by hand to ensure free movement of rotating equipment.
- Bump test all drives to ensure correct direction of rotation (Fill in checklist in Section 5.4 of the operating instructions).
- Calibrate the screw feeder as per Section 3.2 of the operating manual instructions.
- Check that the hopper vibrator shaft rotates freely.
- Check that all vibrator fastening bolts are correctly tensioned.
- Check vibrator motor insulation resistance.
- Check and fit the breather plug on the screw feeder gearmotor (Refer Section 5.5.4 of the operating instructions).
- Check electrical insulation readings on all drive motors. Correspond to motor nameplate values.

#### **5.2.3 WAS Pumps**

- All pumps must be filled with liquid prior to first time start-up, or if the pump is left standing for an appreciable time, or if the pump has been dismantled and reassembled.
- Turn the pump by hand to lubricate the stator.
- Bump start the pump and determine the direction of rotation is correct.
- Check that the pressure relief valve on the discharge side of the pump is operational.

#### **5.2.4 Macerator**

- Check the gearbox oil level.
- Ensure that direction of rotation is correct.
- Ensure that all pipework joints on the suction side of unit are vacuum tight.

#### **5.2.5 Washwater Pumps**

- Check the electrical insulation readings for the pump motor.
- Ensure that direction of rotation is correct. The pump should rotate counter-clockwise when viewed from above.
- Prime the pump before starting in accordance with page 11 of the operating instructions.

#### **5.2.6 Air Compressor/Receiver**

- Check the oil level in the oil separator tank.
- Check the drive belt tension.
- Check that the shut-off valve is open.
- Check that the air end rotates in accordance with 7.3 of the operating instructions.
- Check that the rated motor current agrees with motor nameplate.
- Increase the timing relay K1-1T to 20 seconds for the initial start-up.
- Run the compressor. Shut down prior to the end of the 20 second period.
- Reset the timer relay K1-1T to 6 seconds before operating the compressor any further.
- Set up the off-load running timing relay and line pressure switch for cut-in/cut-out times in accordance with Clause 7.5 and 7.7 of the operating instructions.

#### **5.2.7 Conveyors**

- Inspect that gearbox is securely fastened to the drive plate on each of the respective conveyors.
- Check all electrical connections to the drive motors, ensuring compliance with each respective motor nameplate.
- Remove motor cooling fan cowling and rotate the spiral via the fan to ensure ease of rotation and correct direction of rotation.
- Check gearbox oil level.
- Ensure that all covers and guards are correctly fitted.
- Operate conveyors empty for 1–2 hours, making continuous check of gearmotors for excessive bearing heat or noisy operation.
- Operate conveyors on reduced feed rate and gradually increase until full rated capacity is achieved.
- Stop and start conveyor several times, and allow to run for a few hours. Continuously monitor the conveyor operation.
- Shut down conveyors, lock out power supply. Remove covers and inspect and tighten all bolted connections.
- Replace all covers, guards, etc. The conveyors are now ready for operation.



### **5.2.8 Submersible Mixer**

- Ensure that the mixer slides easily up and down on the guide bar.
- Ensure that the motor cable is securely fastened and cannot be drawn into the propeller.
- Check that the direction of rotation of the mixer is correct (clockwise phase sequence L1, L2, L3 motor rotates clockwise viewed from motorside).
- Check the motor insulation resistance and rated current complies with the motor nameplate values.
- Check that oil level reaches up to the oil fill hole.
- Check that the propeller can be rotated by hand.
- Ensure that motor cable entry is securely tightened.

### **5.2.9 Level Sensor**

- Ensure that sensor is correctly mounted in an area away from high voltage or current runs.
- The unit should be positioned such that the sound path is perpendicular to the liquid surface and does not intersect the fill path of the tank, nor any rough walls, seams or internal ladder rungs.
- Run cable to and attach to the probe as shown on page 3 of the operating instructions.
- Calibrate the unit in accordance with the reference method or scrolling method as shown in the operating instructions.

### **5.2.10 Odour Control Unit**

- Ensure that the granular activated carbon has been loaded correctly and is distributed evenly in the adsorption chamber.
- Check that the direction of rotation of the fan is correct.
- Allow the unit to run for approximately thirty minutes before checking the air flow with an anemometer.
- Excessive air flow should be avoided as it reduces the contact time of the foul air through the activated carbon.

### **5.2.11 Thickened Sludge Pump**

- All pumps must be filled with liquid prior to first time start-up, or if the pump is left standing for an appreciable time, or if the pump has been dismantled and reassembled.
- Turn the pump by hand to lubricate the stator.
- Bump start the pump and determine the direction of rotation is correct.
- Check that the pressure relief valve on the discharge side of the pump is operational.



## **5.3 STARTING**

### **5.3.1 Belt Press**

- Check that compressed air is flowing to the regulators.
- Ensure that the sludge transfer conveyors are running.
- Start the belt wash pump (check spraybar pressure is 700kPa).
- Start the belt press and set operational speed to 50% of speed range.
- Run the screens until they are completely wet.
- Start the flocculator mixer.
- Start the polymer pump and set to desired flow rate.
- Commence dilution water flow to dilute polymer concentration as required.
- Start sludge pump and set to 50% of operational flow.
- Check that all speeds, pressures and flows are running at optimum values.

Note: For detailed notes on optimisation of running values, refer to Section 3 page 10 of operation instructions, which can be found in Section 11.12 of this manual.

### **5.3.2 Polymer Dosing System**

- Start the flocculant blower.
- Open water supply isolating valve and open dispersion solenoid.
- When the water level covers the impeller blades of the mixer, start up the agitator.
- Start the screw feeder and run for the prescribed time.
- When the water level reaches the high level set point, close the dispersion solenoid valve to shut off the water supply.
- Stop the flocculator blower
- Continue mixing the batch solution for approximately thirty minutes then stop the agitator.
- Open the transfer valve and discharge the batch solution to the storage tank.

Note: For detailed notes on the operating requirements for this system, refer to Section 6 of the operating instructions, which can be found in Section 11.3 of this manual.

### **5.3.3 WAS Pumps**

- Test run the helical rotor pumps noting the current consumption, which should be less than the rated current.
- Check that the pump is operating satisfactory. ie. no excessive vibration or noise.
- Check that the pump delivery pressure is within the designed operating range.

**Note: Never run the pump in a dry condition even for a few revolutions, or the stator will be damaged immediately.**



#### **5.3.4 Macerator**

- Set the appropriate selector switch for the macerator unit to **RUN** on the MCC located in the plant room of the sludge processing building.
- Press the **START** pushbutton at the local control panel adjacent to the macerator unit.
- Check that the macerator is operating satisfactory. ie. no unusual noise or vibration is present.

#### **5.3.5 Washwater Pumps**

- Set the appropriate selector switch for the washwater pumps to **RUN** on the MCC located in the plant room of the sludge processing building.
- Press the **START** pushbutton at the local control panel adjacent to the washwater pump.
- Check that the washwater pumps are operating satisfactory. ie. no unusual noise or vibration is present.

#### **5.3.6 Air Compressor/Receiver**

- Set the main supply switch for the air compressors to **ON** position at the MCC located in the plant room of the sludge processing building.
- Turn the control switch (item 4 on control panel) to **START** position.
- The compressor will run and charge the air receiver until the line pressure equals the operating set point pressure.

#### **5.3.7 Conveyors**

- Set the appropriate selector switch for the conveyor unit to **RUN** on the MCC located in the control room of the sludge processing building.
- Press the **START** pushbutton at the appropriate local control panel adjacent to the conveyor unit.
- Check that the conveyor unit is operating satisfactory. ie. there is no excessive build up of sludge at the screen discharge points and sludge cake is being discharged from the ends of each conveyor unit.

#### **5.3.8 Submersible Mixer**

- Test run the mixer noting the current consumption, which should be less than the rated current.
- Check that the flow is non-turbulent and that the mixer does not vibrate.
- Ensure that the mixer is set at an optimum operating level with regard to the water level in the tank.
- Observe that the mixer is operating correctly and there is no 'vortex' forming in the immediate operating area.





- Ensure that the 'lifting chain' on the mixer is kept as tight as possible when the mixer is in its operating position. This is to ensure that the mixer blades do not foul either the chain or the power cable.

**Note:** Never allow a continuously operating mixer to run at full power.

- The mixer can now be operated in either manual or automatic mode.

#### **5.3.9 Odour Control Unit**

- Ensure that the mains switchboard circuit breaker is in the **ON** position.
- Ensure that all switches in the local control cubicle are in the **ON** position.
- The green pilot light on the Aarcon switchboard fascia is lit to indicate normal operation.
- No red or orange fault lights on the Aarcon switchboard are lit indicating a fault condition.
- The unit is now ready for manual or automatic operation.

#### **5.3.10 Thickened Sludge Pump**

- Test run the helical rotor pumps noting the current consumption, which should be less than the rated current.
- Check that the pump is operating satisfactory. ie. no excessive vibration or noise.
- Check that the pump delivery pressure is within the designed operating range.

**Note:** Never run the pump in a dry condition even for a few revolutions, or the stator will be damaged immediately.

### **5.4 MANUAL STARTING**

The equipment is controlled from **RUN-OFF-AUTO** selector switches, fitted on the motor control centre in the plant room of the sludge processing building.

With the appropriate selector switch set in the **RUN** position, the drive for the applicable equipment will be operable in the manual mode via the pushbuttons, situated on the local control panels located adjacent to the equipment.

Manual operating is primarily used for commissioning and maintenance purposes. It is also useful for visual observation to check for correct operation of individual equipment prior to start-up.

For a more detailed explanation of manual start-up and operation, reference should be made to the electrical manuals supplied by J&P Richardson Industries.

## **5.5 AUTOMATIC STARTING**

For normal operation, the equipment shall run in automatic mode requiring minimal supervision from the operator.

For automatic control of this equipment:-

1. The **RUN-OFF-AUTO** switch shall be set to the **AUTO** position on the motor control centre in the plant room of the sludge processing building.
2. The automatic starting and stopping of the equipment is controlled by the PLC process controller, using signals from the switchboard control circuitry and field transducers. For further information on automatic control of the equipment, refer to the manuals supplied by J&P Richardson Industries.



## 6.0 TROUBLESHOOTING

BELT PRESS TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
Press stops or does not start	<ul style="list-style-type: none"> <li>No electrical power.</li> <li>No air pressure.</li> <li>Lanyard switches not adjusted.</li> <li>Drift switches actuated.</li> </ul>	<ul style="list-style-type: none"> <li>Check three-phase supply to MCC.</li> <li>Check supply. Check regulator settings.</li> <li>Adjust.</li> <li>Screen overrun; relieve pressure in air system and pull back screen to centre by hand.</li> </ul>
Screen tracking does not function	<ul style="list-style-type: none"> <li>No air pressure.</li> <li>Air control valve malfunction.</li> <li>Check rubber air spring.</li> <li>Incorrect adjustment air control arm.</li> </ul>	<ul style="list-style-type: none"> <li>Check supply.</li> <li>Check air lines. Check air intake and exhaust through valve.</li> <li>Check air spring has no left rim. Check rubber for damage.</li> <li>Return arm to correct position. I.e. centralise the screen, with air springs neutral.</li> </ul>
Feed box leaks, floods	<ul style="list-style-type: none"> <li>Worn seals.</li> <li>Incorrect position.</li> <li>Slack screen.</li> </ul>	<ul style="list-style-type: none"> <li>Replace seals.</li> <li>Reposition</li> <li><b>IMMEDIATELY</b> shutdown and restore air supply.</li> </ul>
Screens are not clean	<ul style="list-style-type: none"> <li>Spray nozzles blocked.</li> <li>Nozzles not directed at screen.</li> <li>Water pressure low.</li> <li>Doctor blades.</li> <li>Polymer dose rate incorrect.</li> </ul>	<ul style="list-style-type: none"> <li>Clean nozzles.</li> <li>Reposition.</li> <li>Check supply pump operation. Increase pressure to 700kPa to each wash station.</li> <li>Check for wear. Increase pressure.</li> <li>Restore dose rate to settings that work generally requires increasing the dose rates.</li> </ul>
Sludge squeezes wide in pressure section	<ul style="list-style-type: none"> <li>Too high screen tension.</li> <li>Too low polymer dosage.</li> <li>Too low speed.</li> <li>Too high feed rate.</li> </ul>	<ul style="list-style-type: none"> <li>Decrease screen pressure/tension.</li> <li>Increase polymer dosage.</li> <li>Increase speed.</li> <li>Reduce feed rate.</li> </ul>
Output cake solids low	<ul style="list-style-type: none"> <li>Too high speed.</li> <li>Too low feed.</li> <li>Too low screen tension.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce speed.</li> <li>Increase feed.</li> <li>Increase screen pressure/tension.</li> </ul>



ODOUR UNIT TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
Unit stops operating – HPT fault light indication	<ul style="list-style-type: none"> <li>Fan motor failure.</li> <li>Dirty filter element.</li> <li>Blocked ductwork.</li> <li>Locate fault and reset HPT.</li> </ul>	<ul style="list-style-type: none"> <li>Replace motor.</li> <li>Remove and clean elements.</li> <li>Inspect for obstructions – remove.</li> </ul>
Dirty filter light indication	<ul style="list-style-type: none"> <li>Filter elements clogged.</li> </ul>	<ul style="list-style-type: none"> <li>Clean or replace filter elements.</li> </ul>
Fan fault light indication	<ul style="list-style-type: none"> <li>Fan motor tripped out due to low voltage, phase failure or motor failure.</li> </ul>	<ul style="list-style-type: none"> <li>Check and remedy any electrical faults found. Reset overload.</li> </ul>
Air flow fault light indication	<ul style="list-style-type: none"> <li>Dirty filter elements.</li> <li>Fan failure.</li> <li>Low voltage.</li> </ul>	<ul style="list-style-type: none"> <li>Remove and clean filter elements.</li> <li>Replace motor.</li> <li>Check incoming electrical supply.</li> </ul>
Red or orange pilot light indication	<ul style="list-style-type: none"> <li>Indication of a general fault condition.</li> </ul>	<ul style="list-style-type: none"> <li>Check for faults listed above. Remedy as necessary.</li> </ul>
Green pilot light indication	<ul style="list-style-type: none"> <li>System operating normal.</li> </ul>	<ul style="list-style-type: none"> <li>Carry out routine monthly maintenance schedule.</li> </ul>

POLYMER DOSING UNIT TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
Mixing unit batching water or reduced strength mixture	<ul style="list-style-type: none"> <li>Powder product hopper empty.</li> <li>Blockage in screw feeder unit, venturi or spigot.</li> <li>Timer function for feeder non-operational.</li> <li>Drive on screw feeder or blower not running.</li> </ul>	<ul style="list-style-type: none"> <li>Refill hopper.</li> <li>Disassemble and clean as necessary.</li> <li>Check sequence by manual means.</li> <li>Check by manual means, energise motor and replace if faulty.</li> </ul>
Mixing unit not following correct sequence.	<ul style="list-style-type: none"> <li>Level controller failure.</li> <li>Level probes in mixing tank shorted out.</li> </ul>	<ul style="list-style-type: none"> <li>Check function of switch by manual means and replace if faulty.</li> <li>Clean probes and all mounted connections, ensure that no thin trails or hairs of flocculant or product remain.</li> </ul>



POLYMER DOSING UNIT TROUBLESHOOTING GUIDE – Cont'd		
SYMPTOM	POSSIBLE CAUSE	ACTION
Lump formation in mixing tank or block of partly dispersed product in acrylic tube	<ul style="list-style-type: none"> <li>• Low or fluctuating water pressure/flow.</li> <li>• Agitator not functioning or not coming in for timed sequence.</li> </ul>	<ul style="list-style-type: none"> <li>• Check incoming water pressure and flow rate.</li> <li>• Check motor function by manual means and replace motor if faulty.</li> <li>• Check PLC for correct sequence state.</li> </ul>
Mixing tank taking too long to fill	<ul style="list-style-type: none"> <li>• Main water supply valve not opening.</li> <li>• Loss of water pressure or flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Test solenoid operation manually and check for power supply to solenoid.</li> <li>• Check water supply pressure.</li> </ul>
Non-transfer of prepared liquid product from mixing tank to storage tank	<ul style="list-style-type: none"> <li>• Transfer valve motor not operating.</li> </ul>	<ul style="list-style-type: none"> <li>• Check by manual means energise, and replace if faulty.</li> </ul>

WAS & THICKENED SLUDGE PUMP TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
No discharge from pump outlet	<ul style="list-style-type: none"> <li>• Incorrect direction of rotation.</li> <li>• Pump is not primed.</li> <li>• Pump suction is blocked or obstructed.</li> <li>• Drive train breakage.</li> </ul>	<ul style="list-style-type: none"> <li>• Reverse the motor.</li> <li>• Bleed system of air – prime pump with liquid.</li> <li>• Clear the pump suction line.</li> <li>• Check and replace any broken or damaged parts.</li> </ul>
Pump or motor overheating	<ul style="list-style-type: none"> <li>• Product viscosity is above design parameters.</li> <li>• Delivery pressure is above the design parameter.</li> <li>• Gland is overtight.</li> <li>• Pump speed is above rated figure.</li> <li>• Coupling misaligned.</li> <li>• Shaft bearing wear or failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Decrease the pump speed.</li> <li>• Check for possible blockage or obstructions in delivery line.</li> <li>• Adjust the gland tightness.</li> <li>• Decrease the pump speed.</li> <li>• Check and adjust the coupling alignment.</li> <li>• Check and replace the bearings as necessary.</li> </ul>
Excessive pump noise and vibration	<ul style="list-style-type: none"> <li>• Air entering the pump suction line.</li> <li>• Delivery pressure is above rated figure.</li> <li>• Gland not tightened sufficiently.</li> </ul>	<ul style="list-style-type: none"> <li>• Check pipe joints and pump gland packing.</li> <li>• Check for blockages in the delivery line.</li> <li>• Adjust and tighten the gland correctly.</li> </ul>



<b>WAS &amp; THICKENED SLUDGE PUMP TROUBLESHOOTING GUIDE – Cont'd</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>ACTION</b>
	<ul style="list-style-type: none"> <li>• Coupling misaligned.</li> <li>• Insecure pump drive mounting.</li> <li>• Shaft bearing wear or failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Check and adjust the coupling alignment.</li> <li>• Check and tighten all pump fastening bolts.</li> <li>• Check and replace the bearings as necessary.</li> </ul>
Excessive gland or seal wear	<ul style="list-style-type: none"> <li>• Gland overtight.</li> <li>• Product entering the packing area.</li> <li>• Stuffing box eats packing.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust gland tightness.</li> <li>• Check packing condition and type. Replace as necessary.</li> <li>• Check for worn shaft and replace as necessary.</li> </ul>
Gland leakage	<ul style="list-style-type: none"> <li>• Gland not tightened sufficiently.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust and tighten the gland correctly.</li> </ul>

<b>WASHWATER PUMP TROUBLESHOOTING GUIDE</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>ACTION</b>
Pump will not prime	<ul style="list-style-type: none"> <li>• No liquid in pump casing.</li> <li>• Worn gasket.</li> <li>• Leaky suction line.</li> </ul>	<ul style="list-style-type: none"> <li>• Fill pump casing with liquid.</li> <li>• Replace gaskets.</li> <li>• Fix leaky suction.</li> </ul>
Suddenly stops pumping	<ul style="list-style-type: none"> <li>• Clogged suction line.</li> </ul>	<ul style="list-style-type: none"> <li>• Clean suction line.</li> </ul>
Excessive leakage	<ul style="list-style-type: none"> <li>• Worn pump seal.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace seal.</li> </ul>
Noisy operation	<ul style="list-style-type: none"> <li>• Worn motor bearings.</li> <li>• Impeller clogged.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bearings.</li> <li>• Remove and clean impeller.</li> </ul>
Excessive power consumption	<ul style="list-style-type: none"> <li>• Mechanical or electrical defects.</li> </ul>	<ul style="list-style-type: none"> <li>• Check bearings, impeller, shaft alignment, and electrical connections and supply.</li> </ul>

<b>AIR COMPRESSOR TROUBLESHOOTING GUIDE</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>ACTION</b>
Compressor overheating	<ul style="list-style-type: none"> <li>• Ambient temperature too high.</li> <li>• Incorrect direction of rotation.</li> <li>• Fan cannot draw-in air freely.</li> </ul>	<ul style="list-style-type: none"> <li>• Lower ambient temperature.</li> <li>• Changeover motor terminals L1 and L2.</li> <li>• Check for possible obstructions to air flow.</li> </ul>
Starting difficulty	<ul style="list-style-type: none"> <li>• Solenoid valve not operating.</li> <li>• Damaged bearings.</li> <li>• Power supply fault.</li> <li>• Oil level too high.</li> </ul>	<ul style="list-style-type: none"> <li>• Check electricals, clean or replace faulty valve.</li> <li>• Replace the bearings.</li> <li>• Check the power supply.</li> <li>• Drain oil to correct level on sight glass.</li> </ul>



AIR COMPRESSOR TROUBLESHOOTING GUIDE – Cont'd		
SYMPTOM	POSSIBLE CAUSE	ACTION
Running continuously	<ul style="list-style-type: none"> <li>Air filter clogged.</li> <li>Excess pressure losses in the system.</li> <li>Solenoid valve or coil defective.</li> </ul>	<ul style="list-style-type: none"> <li>Clean or replace the air filter element.</li> <li>Check the piping and fitting for air leaks.</li> <li>Clean the valve or replace as necessary.</li> </ul>
Safety valve blows off prematurely	<ul style="list-style-type: none"> <li>Dirt particles stuck in valve seat.</li> <li>Defective valve spring.</li> <li>Incorrectly adjusted.</li> </ul>	<ul style="list-style-type: none"> <li>Activate valve for a short period and allow to blow itself clean.</li> <li>Replace the safety valve.</li> <li>Set the valve pressure to correct operating level.</li> </ul>

SPIRAC CONVEYOR TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
Conveyor fails to start	<ul style="list-style-type: none"> <li>Blown fuse.</li> <li>Motor protection device activated.</li> <li>Motor protection device faulty or will not reset.</li> </ul>	<ul style="list-style-type: none"> <li>Determine and correct cause of failure and replace fuse.</li> <li>Reset protective device. Identify and correct cause for failure.</li> <li>Check protection device for faults.</li> </ul>
Conveyor starts but motor protection device trips immediately	<ul style="list-style-type: none"> <li>Spiral jam from foreign object entering trough.</li> <li>Gearbox seizure due to no oil.</li> <li>Settings on motor protection incorrect.</li> <li>Motor improperly connected.</li> </ul>	<ul style="list-style-type: none"> <li>Remove object and restart.</li> <li>Remove gearbox and service.</li> <li>Check and re-set.</li> <li>Check connection diagram in conduit box cover and correct the wiring.</li> </ul>
Excessive vibration	<ul style="list-style-type: none"> <li>Loose drive station.</li> <li>Unstable ground conditions.</li> <li>Loose support/trough connections.</li> </ul>	<ul style="list-style-type: none"> <li>Check and re-tighten fixing bolts.</li> <li>Rectify.</li> <li>Check and re-tighten.</li> </ul>
Conveyor output is too low	<ul style="list-style-type: none"> <li>Worn spiral screw.</li> <li>Material being conveyed is not as originally specified.</li> </ul>	<ul style="list-style-type: none"> <li>Replace spiral.</li> <li>Contact Spirac.</li> </ul>
Motor overheats	<ul style="list-style-type: none"> <li>Insufficient cooling air volume due to obstructed air flow.</li> <li>Motor allowable duty cycle is exceeded. Too many starts per hour.</li> <li>Single phasing due to break or loose connection in supply line or blown fuse.</li> </ul>	<ul style="list-style-type: none"> <li>Provide clearance around fan area.</li> <li>The problem may not be solved by a larger unit. Review with manufacturer.</li> <li>Repair supply line. replace fuse.</li> </ul>



SPIRAC CONVEYOR TROUBLESHOOTING GUIDE – Cont'd		
SYMPTOM	POSSIBLE CAUSE	ACTION
Spiral screw jamming	<ul style="list-style-type: none"> <li>Excess material causing spiral to rise and interfering with lids/cross bars.</li> <li>Foreign object in conveyor.</li> <li>Liner has come loose and wedged itself inside the spiral.</li> <li>Incorrect alignment of screw when welding causing eccentric rotation.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce material inflow. Install anti-lift bars.</li> <li>Remove object.</li> <li>Remove and replace liner.</li> <li>Confirm and replace/re-weld.</li> </ul>

SUBMERSIBLE MIXERS TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSE	ACTION
Mixer fails to start	<ul style="list-style-type: none"> <li>Alarm signal indicated on the control panel.</li> <li>Stator temperature too high.</li> <li>Fault in thermal switch.</li> </ul>	<ul style="list-style-type: none"> <li>Check control equipment.</li> <li>Check/replace the thermal switches.</li> <li>Check that the overload protection is reset.</li> </ul>
Mixer starts and motor protection trips out	<ul style="list-style-type: none"> <li>Mixer not receiving full voltage.</li> <li>Loss of one phase in power supply.</li> <li>Density of mixed liquor too high.</li> <li>Fault on overload protection.</li> </ul>	<ul style="list-style-type: none"> <li>Check the fuses.</li> <li>Check the power supply.</li> <li>Change the propeller to one of lower pitch.</li> <li>Replace the overload protection.</li> </ul>
Mixer start/stops in rapid sequence	<ul style="list-style-type: none"> <li>Contactors selfholding function breaking</li> </ul>	<ul style="list-style-type: none"> <li>Check contactor connections.</li> <li>Check control circuit voltage.</li> </ul>



## **7.0 PLANT MAINTENANCE**

To ensure proper operation of the plant, the following should be observed.

- a. The plant should be kept clean and tidy at all times. Not only is this of aesthetic value, but it also lengthens the life of the equipment.
- b. Check that the equipment is operating correctly.
- c. The following items of equipment should be hosed down and cleaned daily:–

- \* Belt Filter Screens
- \* Conveyor Troughs

**Avoid hosing directly onto drive motors and electrical equipment.**

- d. All maintenance, service, modifications and significant deviations from normal operating conditions should be recorded in the **Plant Service Log** (Section 10.0).
- e. To ensure proper operation of the equipment the **Lubrication Schedule** (Section 8.0) should be strictly adhered to. Lubricant properties deteriorate with time and use, therefore correct lubrication is essential. Do not mix different types and makes of greases and oils.
- f. After a month of operation check the tension of all bolts associated with the plant, and thereafter periodically. Bolted connections on painted surfaces can loosen due to thinning of the paint underneath the bolt head bearing surface. Motor mounting bolts and other bolted connections subjected to vibration should be periodically checked for loosening.
- g. **Before starting work on any item ensure that the power supply is isolated and the item cannot be started.**

We cannot over-emphasise the importance of preventative maintenance based on a well thought out plan. Regular maintenance and suitable care of the equipment will assure a long and reliable service life of the equipment.

Many stoppages can be avoided by following the recommended maintenance. Do not wait until you hear the grinding of equipment that has broken down. If you see any item wearing down, replace it, before it causes damage to other associated items.

The following data sheets recommend the inspection intervals and the maintenance requirements for each item of equipment in the plant. Reference should also be made to the suppliers manuals contained in Section 11.0 of this manual.

## 8.0 LUBRICATION SCHEDULE

ITEM	LOCATION	LUBRICANT	PERIOD
Belt Press	Screen rolls (10 points)	Shell Alvania EP2 Grease	Once per month.
	Screen tension and tracking pivot points (4 points)	Shell Alvania EP2 Grease	Once per month.
	Belt press drive gear motor	Shell Omala 220 Oil	Change oil ever three years.
	Flocculator drive gearmotor	Shell Omala 220 Oil	Change oil every three years.
Polymer Dosing System	Screw feeder drive bearing	Esso Unirex N3 Grease	Re-grease every 2 years.
	Screw feeder gearbox bearings	BP Energrease HT-EP-OO	Re-grease every 2 years.
	Flocculant blower bearings	Esso Unirex N3 Grease	Re-grease every 4 years.
	Screw feeder gearbox	Mobil SHC 632	Change oil every 4 years.
	Agitator gearbox	Mobil Temp 77	Refill on disassembly.
WAS Pumps	Pump bearings	BP Energrease LC2	Re-grease during routine pump inspection.
Macerator	Drive gears	BP Energrease LC2	Re-grease every 12 months.
	Gear motor unit	Mobil SHC 320 Oil	Change oil every 2 years
Air Compressor	Oil separating tank and oil cooler	Kaeser Mineral Oil M-460	Change oil annually
Conveyors	Bell housing gland packing	Castrol EPL2 Grease	Every six months.
	Gear motor unit	BP Energol GR-XP 220	Change oil every 12 months.
Flygt Mixer	Oil casing	Mobil Whiterex 309 Oil	Change the oil every 2 years.
Odour Control Unit	Centrifugal fan bearings	Shell Alvania R2 Grease	Inspect/repack motor bearings every two years.
Thickened Sludge Pump	Pump bearings	BP Energrease LC2	Re-grease during routine pump inspection.



## 9.0 SPARE PARTS LIST

Illustrations and schedules for identification of spare parts and contained in the respective manufacturers pamphlets. Suppliers should be contracted for lead times and prices on specific items as these can vary.

The recommended spare parts that should be kept in stock are listed below:–

ITEM	RECOMMENDED SPARE PARTS	QTY
Belt Filter Press	Upper and Lower Screens	1 set
	Doctor Blade	1
	Tensioning Air Spring	1
	Tracking Air Spring	1
	Spray Nozzles	6
	Spray Nozzle Gaskets	6
Polymer Dosing System	Clamp for Acrylic Cylinder	1
	Clear Acrylic Cylinder	1
	Anti-Static Hose	5m
	Screw Feeder Spiral – Solid	1
	Omron Floatless Level Switch	1
Macerator	Inspection Cover Gasket	2
	Main Body Gasket	1
	Rotary Shaft Lipseal	1
	Mechanical Seal Assembly	2
	Ball Bearing	2
Conveyors	Gland Packing (for each gearbox)	1 set
	Trough Liner (for each conveyor)	1
Flygt Mixer	O-Rings	1 set
	Mechanical Seal – Outer	1
	Ball Bearing	1
	Roller Bearing	1
	Lip Seal – Inner	1

Should any component fail and a replacement part or component be required, contact should be made to the supplier as listed in Section 4.0 of this manual quoting the following information:–

- Make and model number of equipment.
- Serial No. of equipment.
- Gearbox ratio (where applicable).
- Motor details (where applicable).

This information is usually found on the manufacturers nameplate attached to the item of equipment.

Reference should also be made to the relevant manufacturers brochures contained in Section 11.0 of this manual.







## **11.0 MANUFACTURERS INFORMATION**

The manufacturers manuals and information as listed below are included in this manual to give detailed information regarding the individual items and equipment used in the plant.

### **Volume 1 of 2**

- 11.1 Aarcon Odour Control Unit
- 11.2 ABB Flowmeter
- 11.3 Allied Colloids Polymer Dosing System
- 11.4 Flygt Submersible Mixer
- 11.5 Grundfos Washwater Pump
- 11.6 Kaeser Air Compressor
- 11.7 Milltronics Level Sensor
- 11.8 Mono Pumps Macerator

### **Volume 2 of 2**

- 11.9 Mono Pumps Thickened Sludge Pump
- 11.10 Mono Pumps WAS Pump
- 11.11 Spirac Conveyors
- 11.12 Tema Belt Press
- 11.13 Miscellaneous – Valves, etc
  - Dezurik
  - John
  - Kamloc
  - Keystone





**OPERATING AND MAINTENANCE**

**INSTRUCTIONS FOR**

**PUMP STATIONS**

**INSTALLED BY**

**AARCON AIR CONDITIONING PTY. LTD**

**A.C.N. 010 476 641**



## **BRIEF DESCRIPTION OF ODOUR CONTROL SYSTEM**

- The system supplied for the Pump Station comprises one Aarcon Model 1500 SC activated carbon adsorption unit.
- The unit draws air from an underground pvc pipe connected to the wet well of the Pump Station.
- Foul air enters the odour control unit via a filter and pre treatment unit. After filtering air from the wet well a humidstat sensors humidity of the approaching air and if this is in excess of 80% RH a heater bank will raise air temperature to reduce this figure.
- Air then enters the centrifugal fan, the discharge of which distributes the air/gas to an activated carbon bed from where it discharges to the lower unit plenum and finally discharging the clean air to atmosphere via a 400 x 300 discharge grille which also acts as an access opening to the controls and heater bank.

## **BASIC OPERATING INSTRUCTIONS FOR THE ODOUR CONTROL SYSTEM**

### **NORMAL SWITCH SETTINGS**

1. Main control circuit breaker inside the main pump station switchboard "ON".
2. Isolating switches inside odour control system switchboard "ON".
3. Fan circuit breaker/isolating switch inside odour control system switchboard "ON".
4. Heater circuit breaker/isolating switch inside odour control system switchboard "ON".
5. Control circuit breaker/isolating switch inside odour control system switchboard "ON".
6. Key operated control switch on side of the odour control system switchboard turned clockwise to "ON".

### **TO START THE PLANT AFTER ISOLATION OR MAIN POWER FAILURE.**

Switch all switches to the "ON" position after first checking that the main board circuit breaker is in the "ON" position.

## **INDICATING LIGHTS**

### **GREEN PILOT LIGHT**

- The green pilot light on the switchboard fascia indicates normal operation when alight.

### **RED OR ORANGE PILOT LIGHT**

- The red or orange pilot light on the switchboard fascia indicates a fault condition.

### **FAN FAULT LIGHTS**

- The fan fault lights will light when the fan motor trips the contactor due to low voltage, phase failure or motor failure.
- Locate fault and reset overload.

### **H.P.T. FAULT LIGHT**

- The H.P.T. fault light indicates an over temperature condition caused by fan failure, dirty filter or blocked ducts.
- Locate fault and reset H.P.T.

### **AIR FLOW FAULT LIGHT**

- As above but will automatically reset when fault corrected.

### **DIRTY FILTER LIGHT**

- The dirty filter light indicates to clean filter. Light will reset automatically.

## **MAINTENANCE**

Maintenance can be restricted to the following -

- DAILY** Ensure correct operation of the plant by checking the indicating lights.
- WEEKLY** Ensure operation of the dehumidification unit by actually observing its operation i.e. light should cycle ON and OFF at approx. 10 minute intervals.
- MONTHLY** Check filter and clean if necessary.  
Check H<sub>2</sub>S levels at inlet and discharge.

## SUBCONTRACTORS AND SUPPLIERS

### ODOUR CONTROL UNIT

AARCON AIR CONDITIONING  
PTY LTD ACN 010 476 641  
34 COMMERCIAL DRIVE  
SOUTHPORT 4215  
PO BOX 6170  
GOLD COAST MAIL CENTRE 4217  
PHONE: 07 55912032  
FAX: 07 55912032

### EXHAUST FAN

AARCON AIR CONDITIONING  
PTY LTD ACN 010 476 641

### ELECTRICAL SWITCHBOARD AND WIRING

BRIDGER ELECTRICAL  
31 WALLABY DRIVE  
MUDGEERABA  
PHONE: 07 55304671

### AUTOMATIC CONTROLS

KAYSON CONTROLS  
5 KIDMAN CLOSE  
MCDOWALL  
PHONE: 07 33531469  
FAX: 07 33531924  
HPT: LSC 1A  
AIR FLOW: PENN P32-AF2  
THERMOSTAT: REMOTE BULB  
MODEL A19ABC-5C

### HEATER

CONWELL TRADING CO  
52 DOGGETT STREET  
FORTITUDE VALLEY 4006  
PHONE: 07 32527850  
FAX: 07 32522658  
MODEL PPN100W240

## SUBCONTRACTORS AND SUPPLIERS

### FAN MOTOR

WESTERN ELECTRIC AUST P/1  
3 BLIVEST STREET  
OXLEY  
PHONE: 07 33751266  
FAX: 07 33751290  
MODEL: T.E.F.C. FLANGE  
MOUNTED 1.1. KW  
3 PHASE 2 POLE  
4AA 80.2

### LED INDICATING LIGHTS

EMAIL ELECTRONICS  
937 KINGSFORD SMITH DRIVE  
EAGLE FARM 4007  
PHONE: 07 3868 1055  
FAX: 07 38681525

### ACTIVATED CARBON

SWIFT AND COMPANY  
ARCHERFIELD  
PHONE: 07 32741999  
FAX: 07 32741554  
CARBON: NORIT ROZ3

# DATASHEET

## NORIT ROZ 3

### GRANULAR ACTIVATED CARBON

**NORIT ROZ 3** is an impregnated steam activated carbon to remove sulphur-components from gases. It's best performance is reached when some oxygen is present in the gas to oxidize the sulphur-components into sulphur.

#### Typical analysis\*

Apparent bulk density (dry basis)	g/l	400
Pellet diameter	mm	2.9
Moisture (as packed)	wt%	2
Total ash content	wt%	<10
Abrasion resistance (ASTM)	%	95
Total surface area unimpregnated carbon from benzene adsorption, according to B.E.T.	m <sup>2</sup> /g	900
Airflow resistance (1 m carbon layer at 25 cm/sec air velocity)	kPa	1.8

\*preliminary data

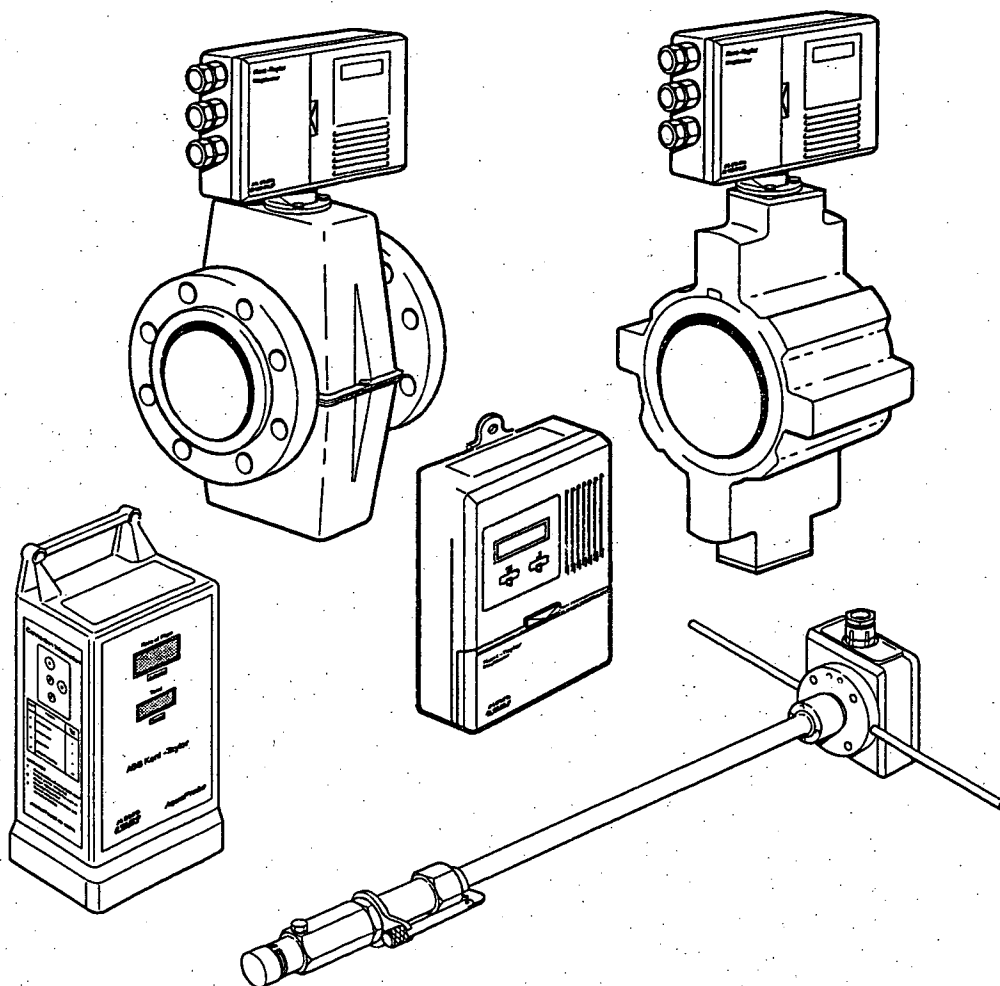




# Instruction Manual

## Electromagnetic Flowmeters

### Information



**ABB Kent-Taylor**



**ABB KENT-TAYLOR**

**St Neots**  
ISO 9001 1987 and  
EN 29001 1987  
BS 5750 Part 1 : 1987  
Certificate No. Q5907



**Stonehouse**  
ISO 9001 1987 and  
EN 29001 1987  
BS 5750 Part 1 : 1987  
Certificate No. FM 21106



**Stonehouse**  
Certificate No.0255

## The Company

ABB Kent-Taylor is an established world force in process instrumentation offering users a total capability in the wide range of product lines available, backed by the worldwide manufacturing, test, calibration and sales and service facilities that are expected from a market leader.

The quality, accuracy and performance of the Company's products result from over 100 years experience of instrument manufacture, combined with a continuous programme of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Kent-Taylor's dedication to quality and accuracy.

The Company's instrumentation is suitable for a wide range of industrial and scientific applications such as process control, batch processing, power generation, heat treatment, heating and ventilation, laboratories, food, chemical, petrochemical and water industries.

All products are backed by a high standard of technology, service and engineering support, from skilled, experienced sales and design engineers.

## Health and Safety at Work Act 1974 (UK)

Section 6(4) of the above Act requires manufacturers to advise their customers on the safety and handling precautions to be observed when installing, operating, maintaining and servicing their products. Accordingly, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

## Notice

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Kent-Taylor.

## Use of Instructions



**Warning.** An instruction that draws attention to the risk of injury or death.



**Caution.** An instruction that draws attention to the risk of damage to the product, process or surroundings.



**Note.** Clarification of an instruction or additional information.



**Information.** Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

# CONTENTS

## INFORMATION

This manual includes the following documents:

### INFORMATION

#### BOOK 1 HAZARDOUS AREA APPROVED VERSIONS

#### BOOK 2 MECHANICAL INSTALLATION

#### BOOK 3 ELECTRICAL INSTALLATION

#### BOOK 4 OPERATION

#### BOOK 5 FAULT FINDING

#### BOOK 6 ACCESSORIES AND SPARES

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<b>CONTENTS</b> .....	<b>1</b>
<b>1 INTRODUCTION</b> .....	<b>1</b>
1.1 Typical Systems.....	2
<b>2 UNPACKING</b> .....	<b>3</b>



#### Warning.

- Installation and maintenance must only be carried out by suitably trained personnel.
- HAZARDOUS AREA DESIGNATION ON THE EQUIPMENT LABEL MUST BE SUITABLE FOR THE INTENDED DUTY AND LOCATION.
- All relevant Books in this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.

## INTRODUCTION

**MagMaster™** is a range of high performance electromagnetic flowmeters for the measurement of electrically conductive fluids and slurries, and is normally supplied as a calibrated system with the transmitter factory configured to a supplied full-bore or insertion probe sensor.

A wide range of options is available to suit most applications, including:

- Integral or remote transmitter
- Flanged or wafer style sensors
- Insertion Probes
- Approved Versions, including
  - Hazardous area operation
  - Hygienic
  - HART™ communication protocol.

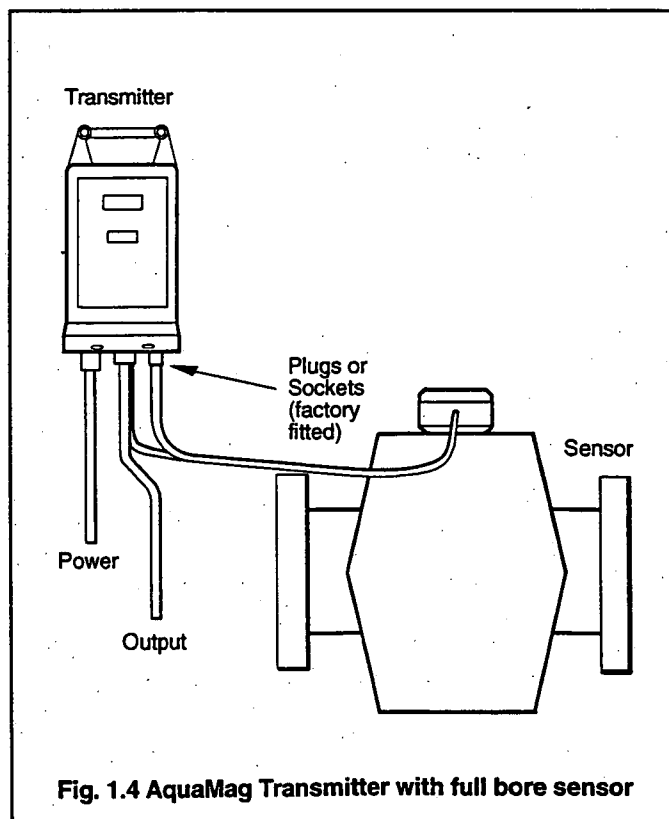
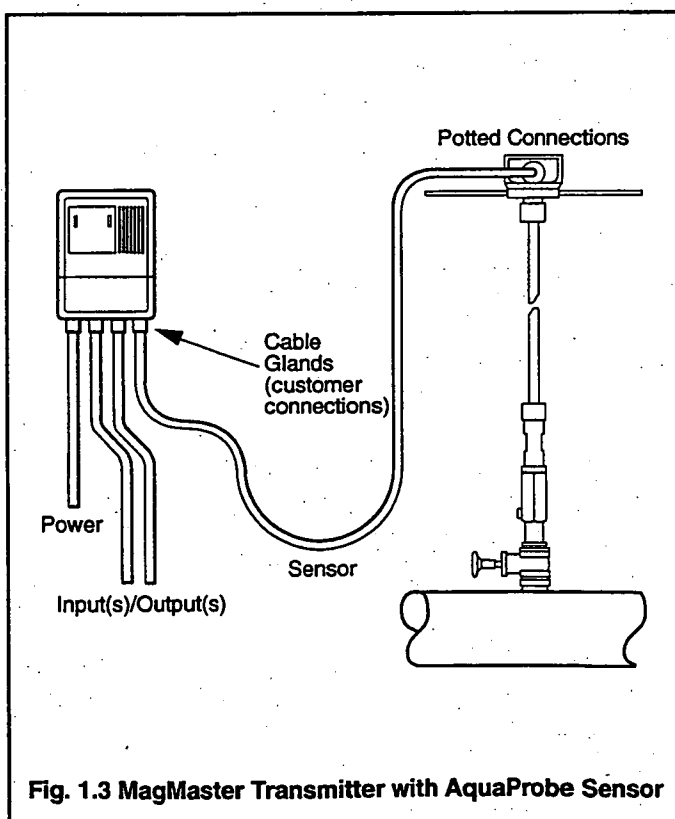
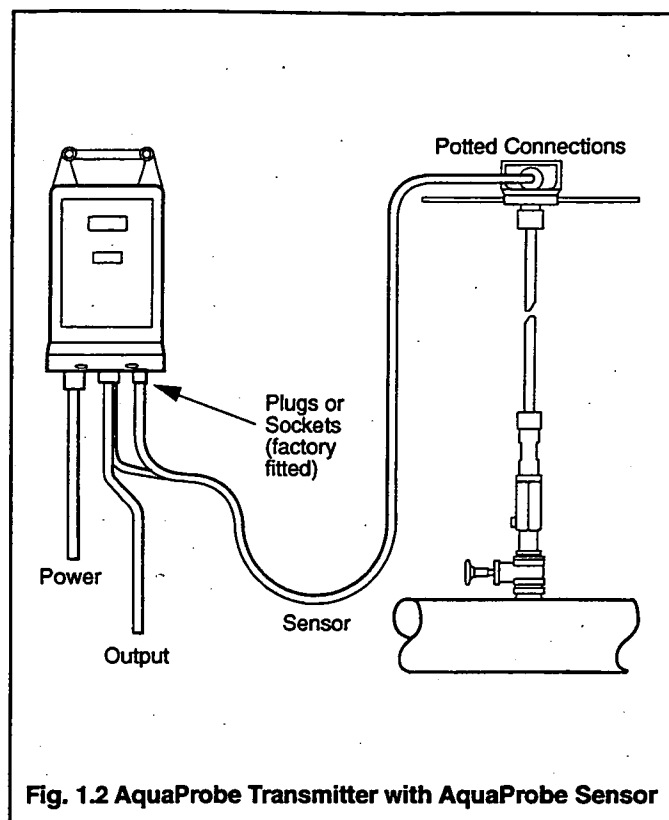
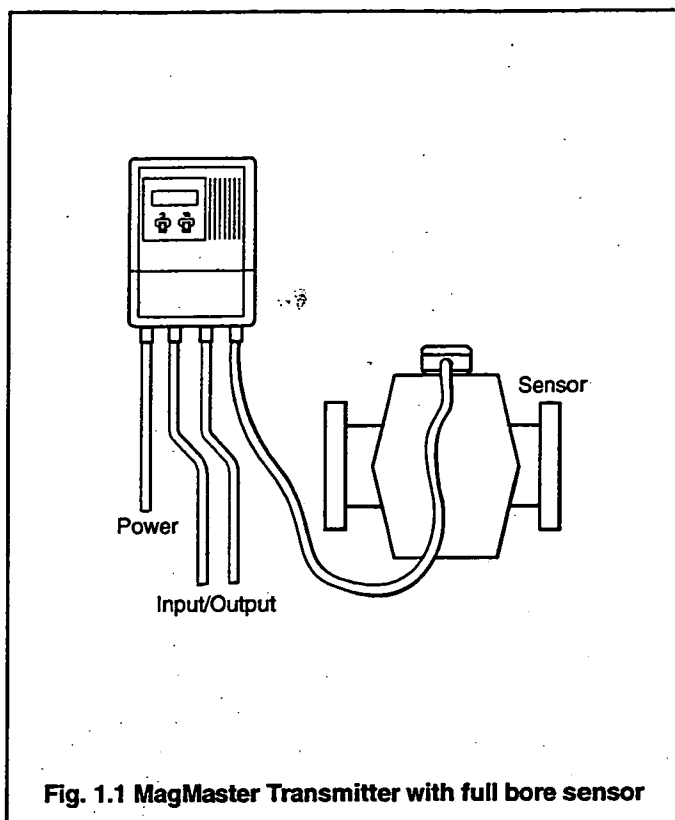
The **AquaProbe** electromagnetic insertion flowmeter is designed for measurement of the velocity of water and for use in survey applications such as leakage monitoring and network analysis and in permanent locations where cost or space limitations preclude the use of conventional closed pipe meters.


AquaProbe is normally supplied as a calibrated system with an AquaProbe or a MagMaster Transmitter, factory configured to a supplied insertion probe sensor.

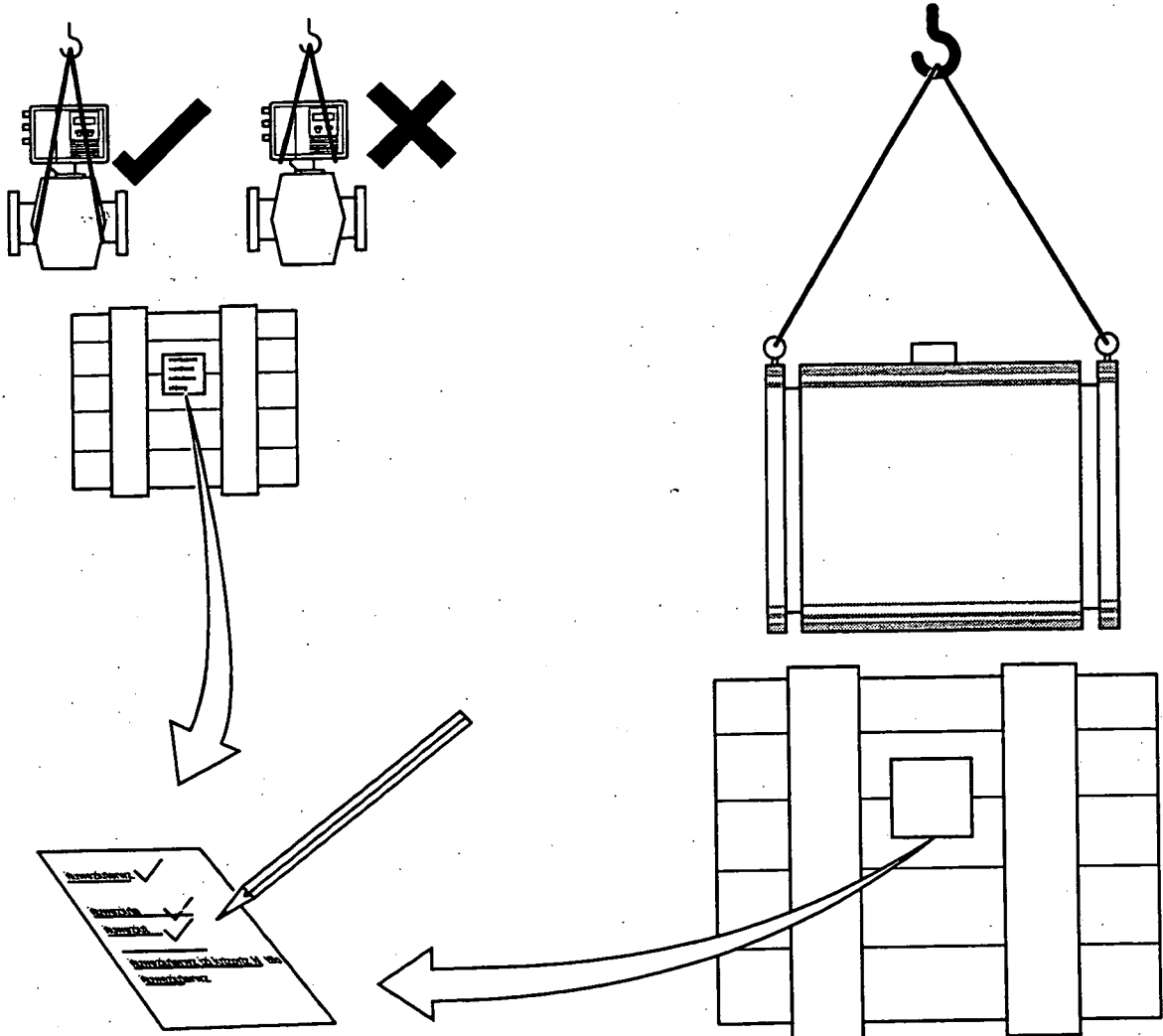
**AquaMag** is a 12 volt d.c. operated electromagnetic flowmeter measuring system comprising a sealed flow sensor and pre-calibrated, programmable transmitter unit, normally supplied as a calibrated system with transmitter factory configured to a supplied full-bore sensor.

## ...1 INTRODUCTION

### 1.1 Typical Systems

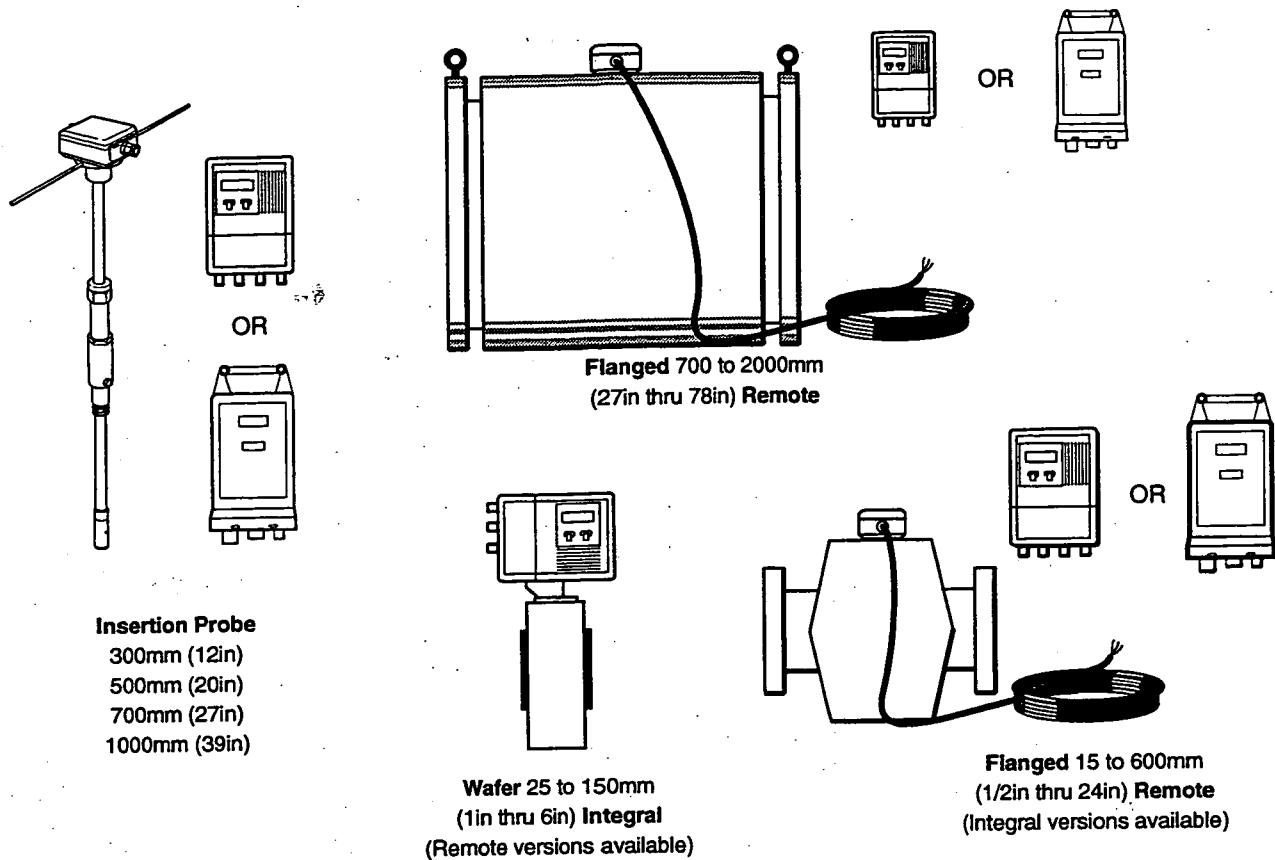


 **Warning.** National and/or local standards for use of slings and shackles, must be observed.



**Fig. 2.1 Unpacking and Location of Identification Labels**

## ...2 UNPACKING



**Fig. 2.2 Typical Sensor Arrangements with Remote and Integral Transmitters**

## PRODUCTS AND SERVICING

### A Comprehensive Instrumentation Range

**Sensors, transmitters and related instruments for flow, temperature, pressure, level and other process variables**

**Flowmeters**

electromagnetic, ultrasonic, turbine, differential pressure, wedge, rotary shunt, coriolis.

**Differential Pressure transmitters**

electronic and pneumatic.

**Temperature**

sensors and transmitters, fibre optic systems.

**Pressure transmitters.**

**Level**

sensors and controllers.

**Tank gauging systems.**

**Cable-length measuring systems.**

**Indicators, recorders, controllers and process management systems**

**Recorders**

circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

**Controllers**

digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.

**Pneumatic panel or rack-mounted display and control instrumentation**

**Liquid and gas monitors and analysers for on-line and laboratory applications**

**Sensors**

pH, redox, selective ion, conductivity and dissolved oxygen.

**Transmitters**

Online pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.

**Monitors and Analysers**

for water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.

**Packaged analytical instrumentation laboratories.**

**Gas analysers**

Zirconia, paramagnetic, infrared, thermal conductivity.

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 New York 14602-0550  
 USA  
 Tel: (716) 292 6050  
 Fax: (716) 273 6207



# MagMaster™/AquaMag Electromagnetic Flowmeters

## BOOK 2 Mechanical Installation

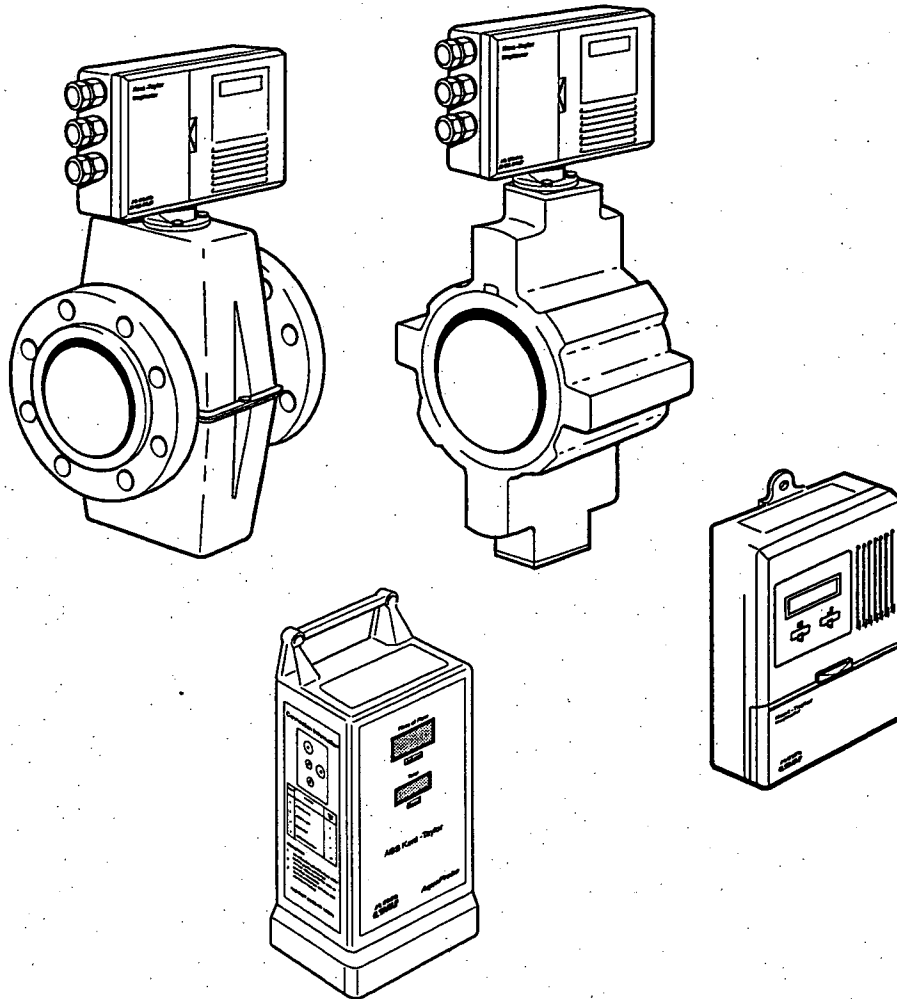


ABB Kent-Taylor





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# CONTENTS

# 1 INTRODUCTION

## BOOK 2 MECHANICAL INSTALLATION

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3 INSTALLATION .....	4
3.1 Transmitters .....	4
3.1.1 Location .....	4
3.1.2 Mounting .....	4
3.2 Sensors .....	5

This book describes the mechanical installation of MagMaster™ and AquaMag ranges of electromagnetic flowmeters.

Attention to safety measures, installation conditions and general precautions will ensure trouble free operation.



**Note.** Not all available versions are approved. Mechanical Installation covers general aspects of both approved and non-approved products.



### Warning.

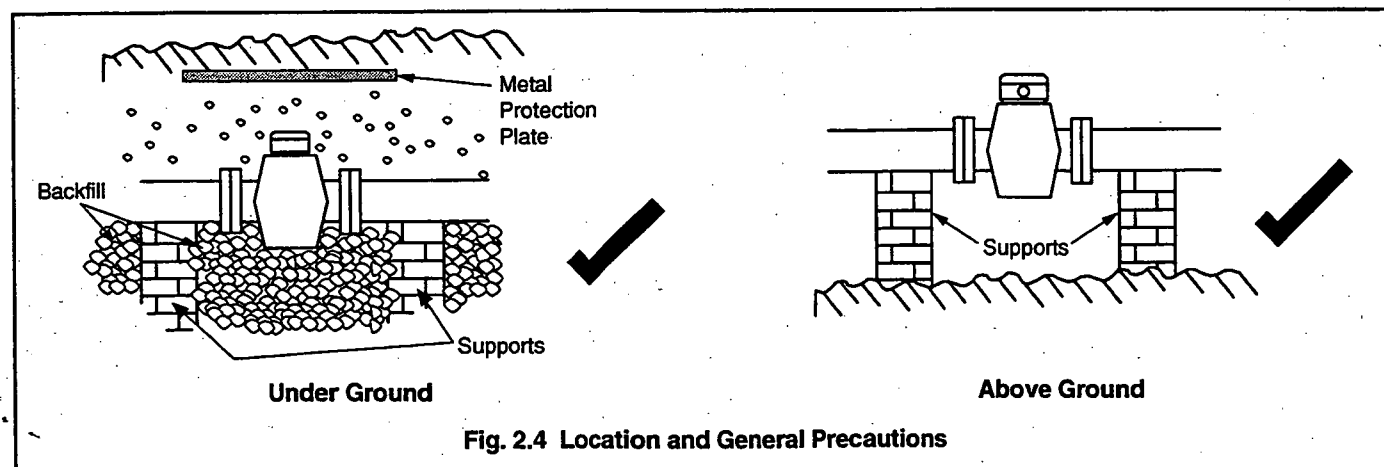
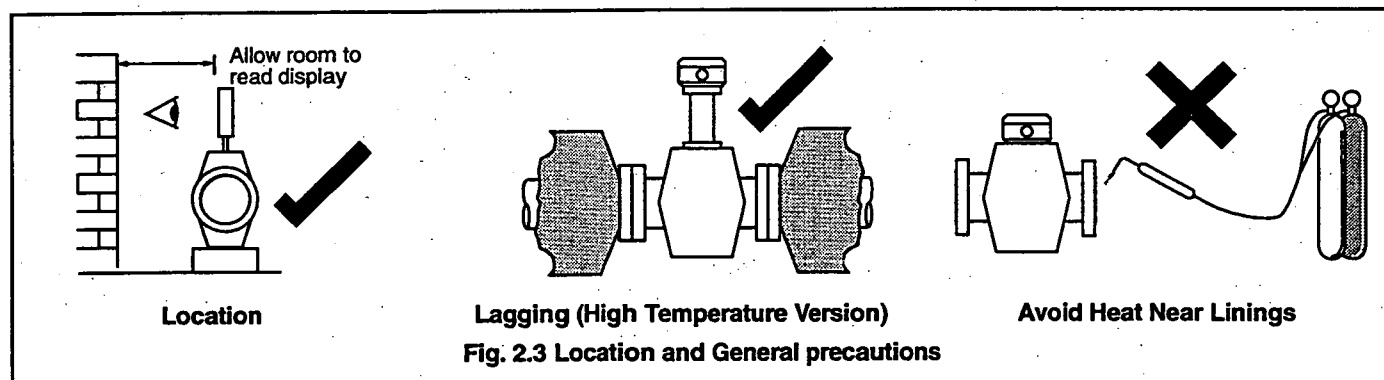
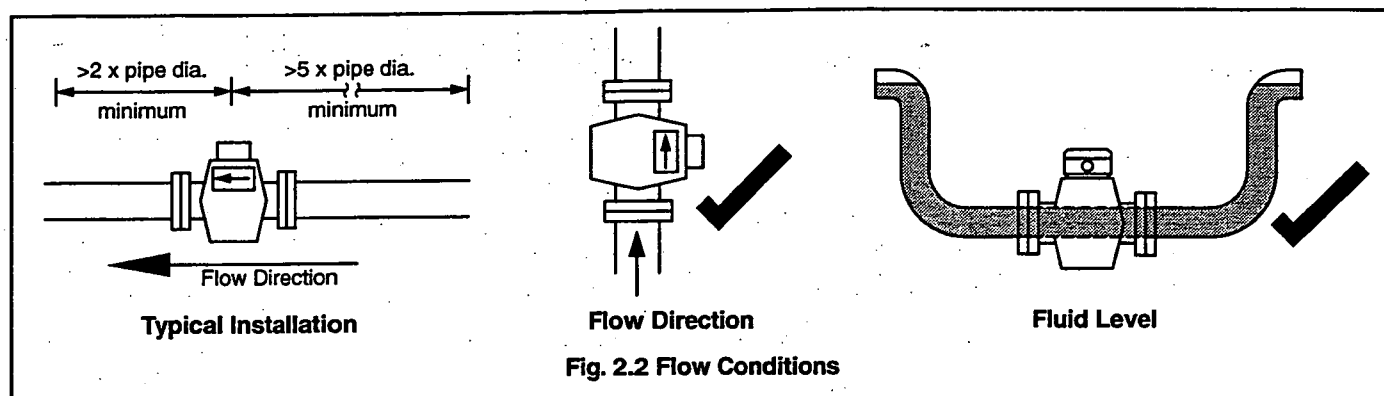
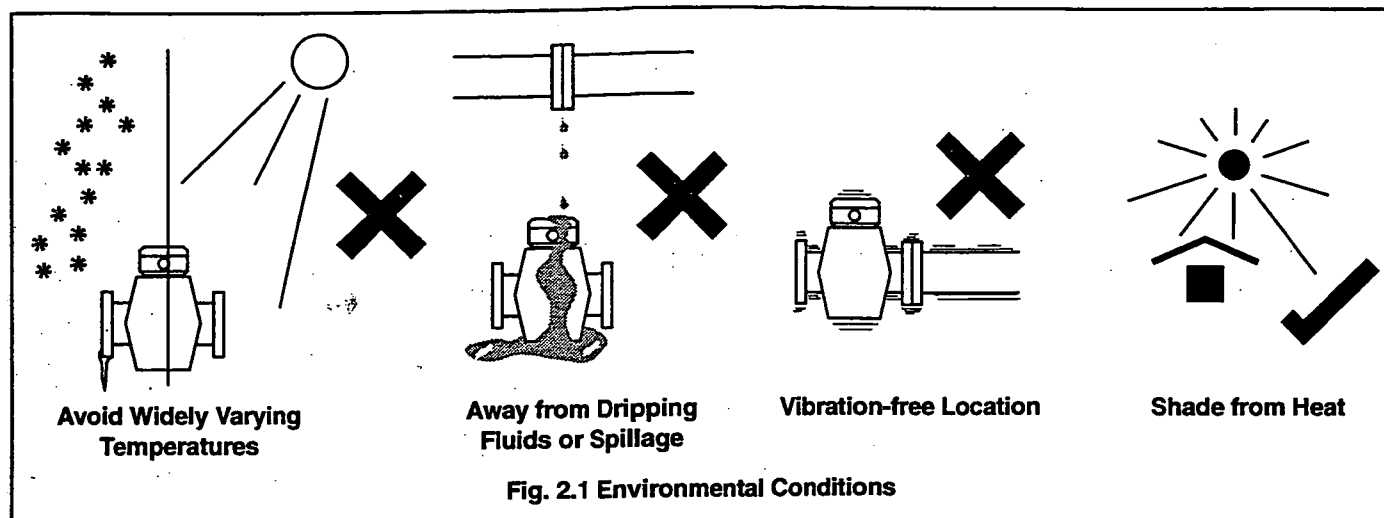
- Installation and maintenance must only be carried out by suitably trained personnel.
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- All relevant sections of this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment, and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.

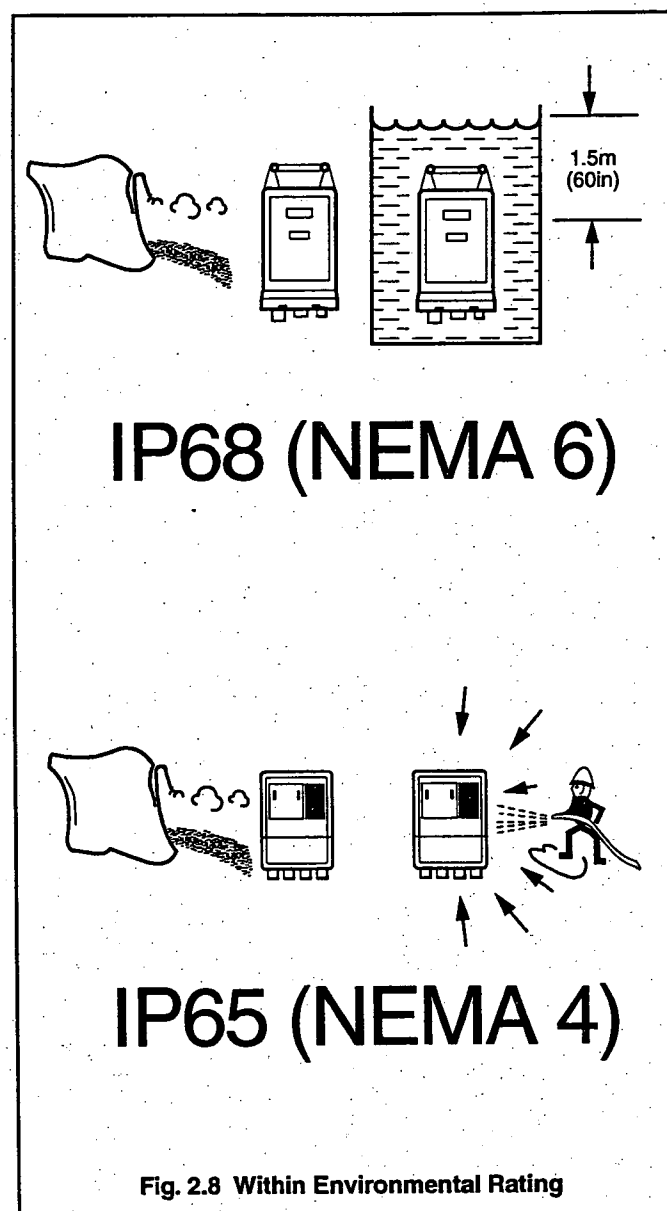
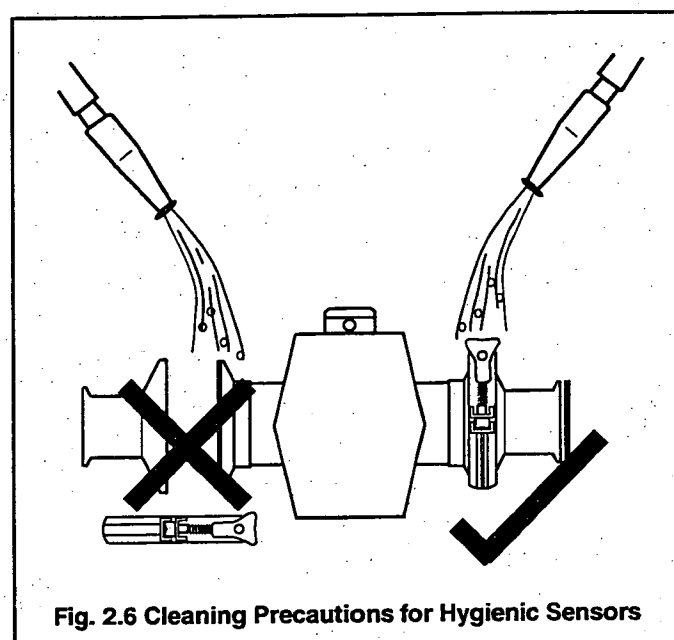
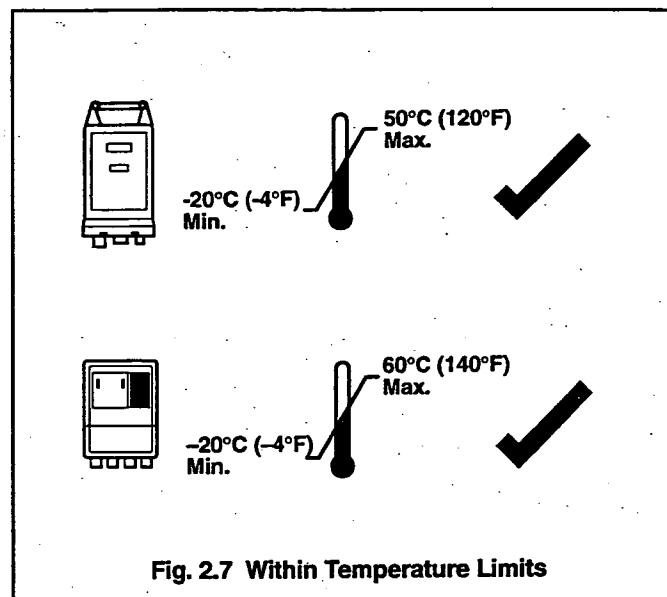
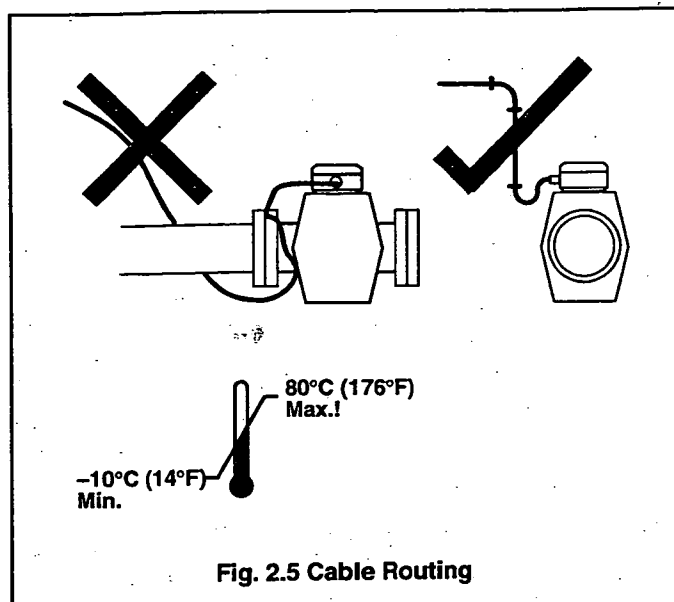


### Warning.

- Mating Hygienic end connections, clamps and supplied gaskets as ordered may have a lower pressure and temperature limit than that shown on the sensor data label.

## 2 INSTALLATION CONDITIONS





### 3 INSTALLATION

#### 3.1 Transmitter

##### 3.1.1 Location

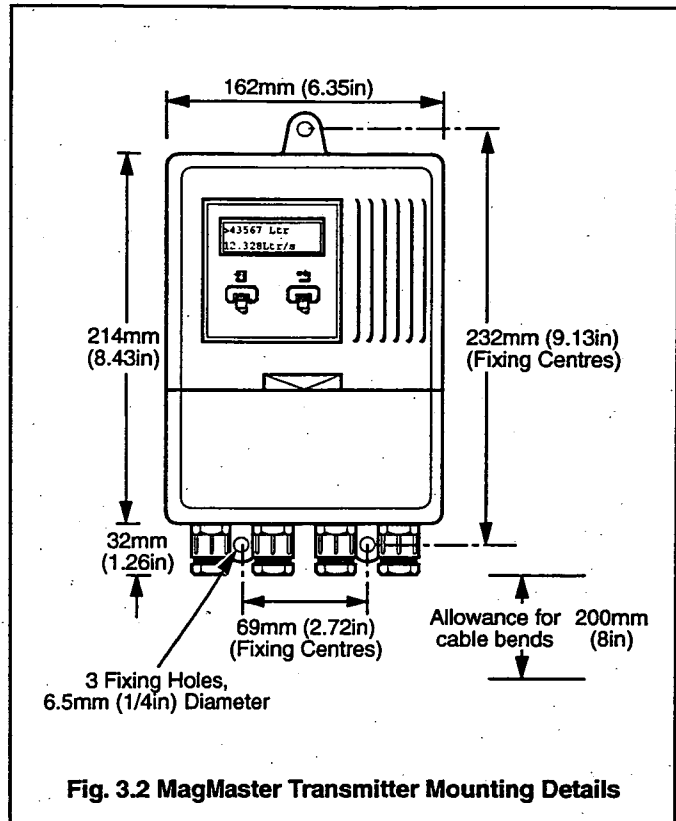
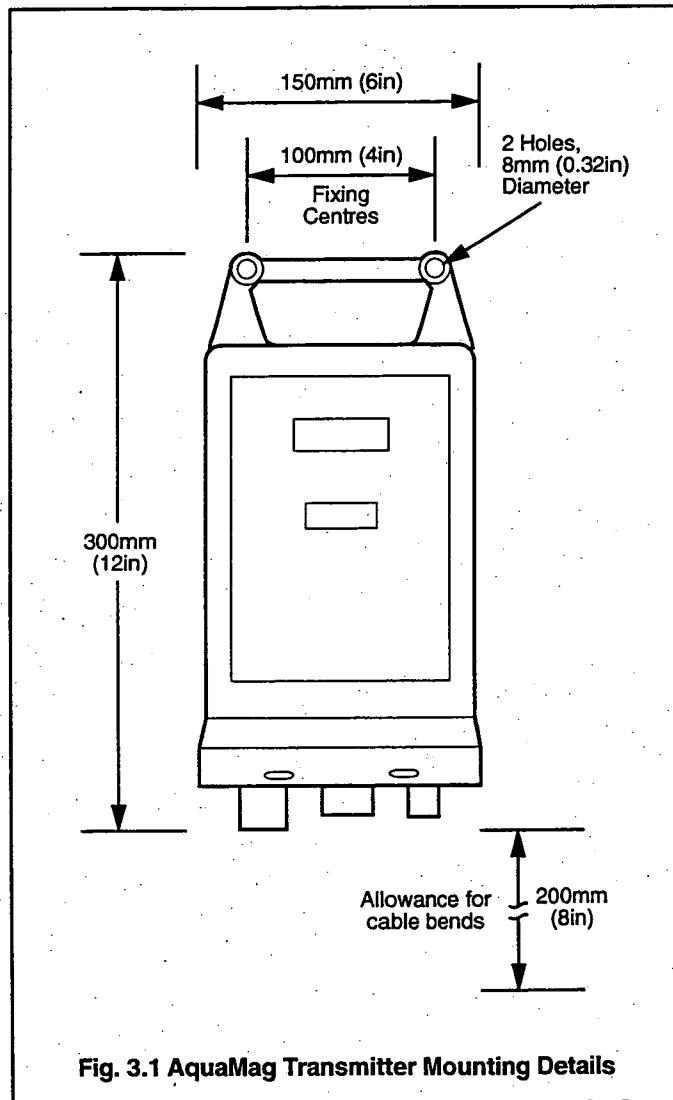
Select a location where the transmitter unit will not be subject to undue vibration or exposed to environmental conditions beyond the degree of protection. The location chosen should be free from harsh electrical noise such as that from adjacent equipment, cables, r.f.i. or e.m.i.

##### 3.1.2 Mounting



**Caution.** Do not overtighten fixings, especially on an uneven surface.

Providing that free access is available to allow the display to be viewed as required, the unit can be either wall mounted or panel mounted with masonry fixings or nuts and bolts respectively via the fixing holes provided.



## 3.2 Sensors

**Caution.**

- Do NOT exceed the maximum working pressure marked on the equipment.
- Use stainless steel (austenitic) bolts, studs and nuts for flanged sensors below 200mm bore.

Sensor size Nominal Bore		Maximum Misalignment	
(mm)	(in.)	(mm)	(in.)
≤ 50	≤ 2	1.5	0.06
50 to 300	2 to 12	2	0.08
> 300	> 12	4	0.16

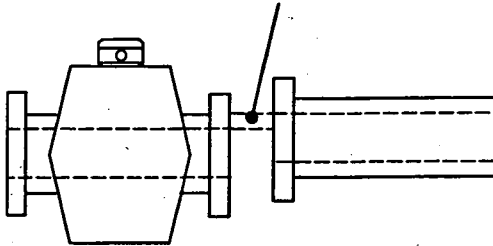


Fig. 3.3 Sensor Alignment

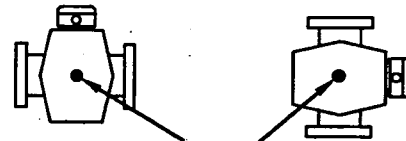
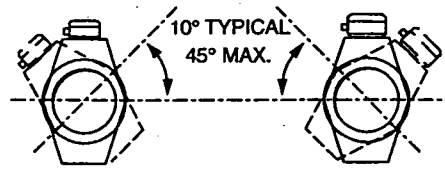


Fig. 3.4 Sensor Position

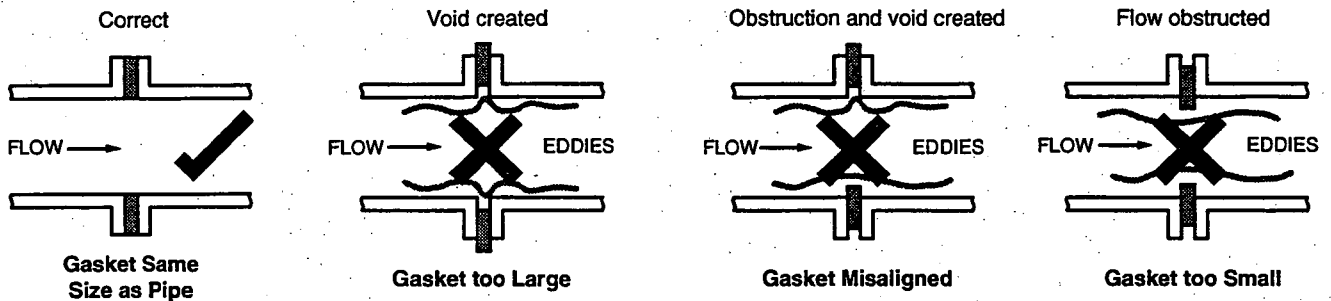
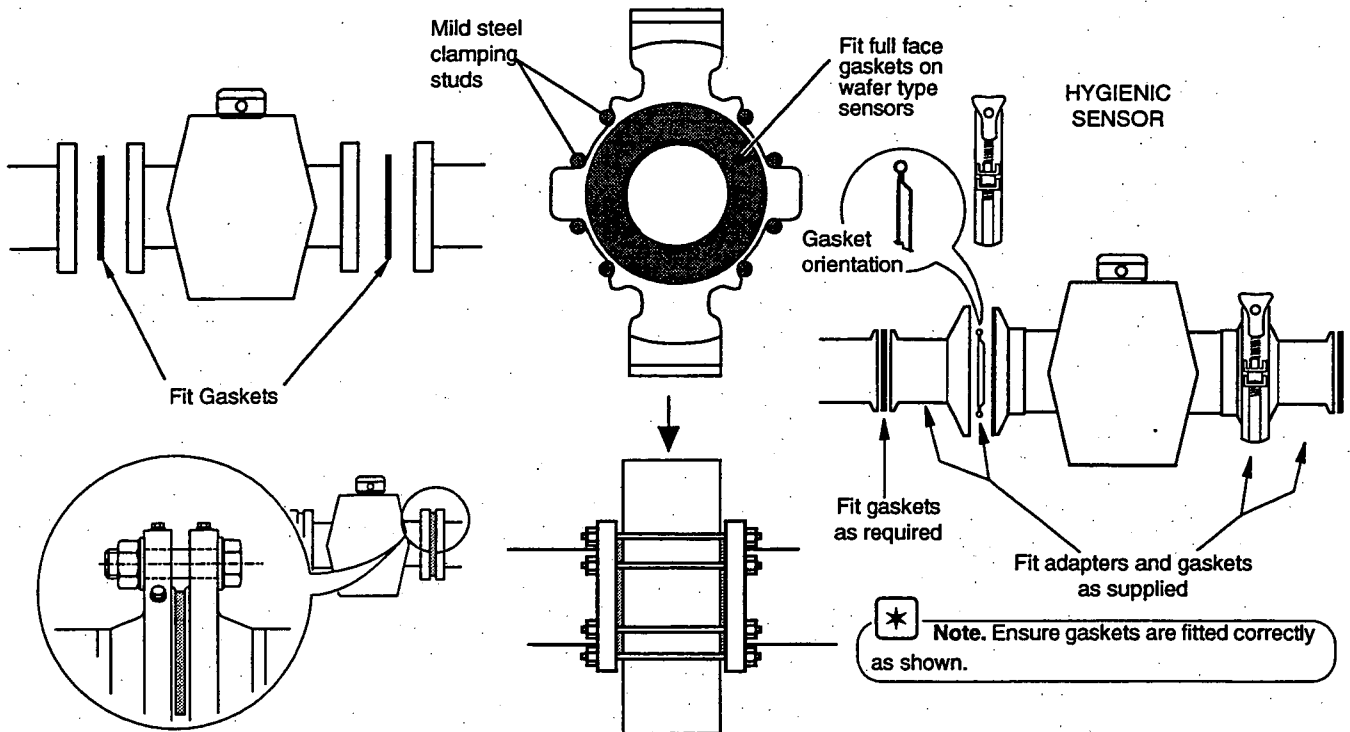


Fig. 3.5 Gasket Installation

### ...3 INSTALLATION

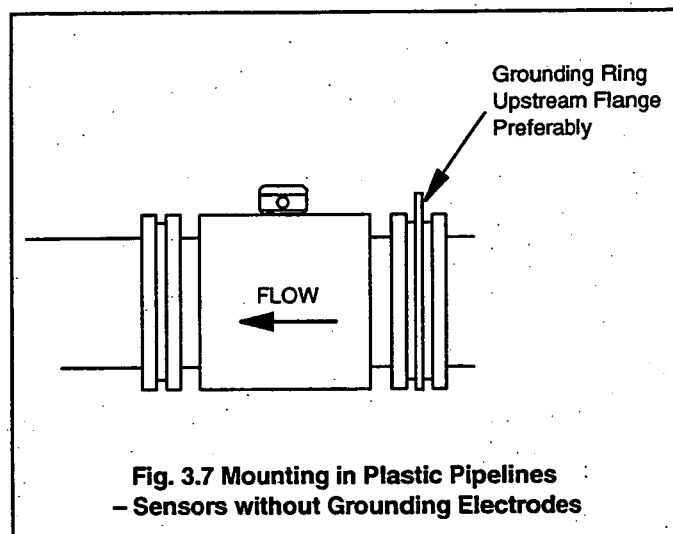
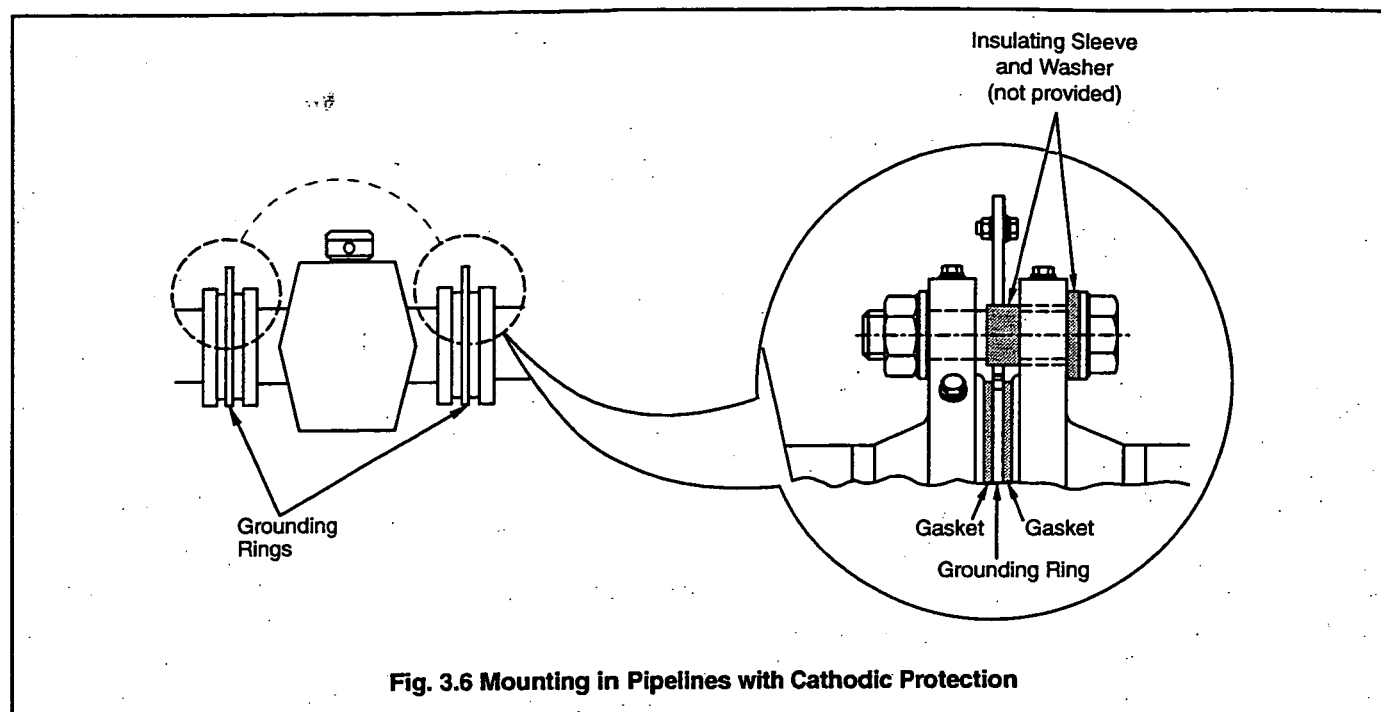


**Caution.** Do not rely on flange bolts or studs for electrical connection.



**Information.** See ELECTRICAL INSTALLATION book for ground wiring.

#### ...3.2 Sensors





## PRODUCTS AND SERVICING

### A Comprehensive Instrumentation Range

**Sensors, transmitters and related instruments for flow, temperature, pressure, level and other process variables**

**Flowmeters**

electromagnetic, ultrasonic, turbine, differential pressure, wedge, rotary shunt, coriolis.

**Differential Pressure transmitters**

electronic and pneumatic.

**Temperature**

sensors and transmitters, fibre optic systems.

**Pressure transmitters.**

**Level**

sensors and controllers.

**Tank gauging systems.**

**Cable-length measuring systems.**

**Indicators, recorders, controllers and process management systems**

**Recorders**

circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

**Controllers**

digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.

**Pneumatic panel or rack-mounted display and control instrumentation**

**Liquid and gas monitors and analysers for on-line and laboratory applications**

**Sensors**

pH, redox, selective ion, conductivity and dissolved oxygen.

**Transmitters**

Online pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.

**Monitors and Analysers**

for water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.

**Packaged analytical instrumentation laboratories.**

**Gas analysers**

Zirconia, paramagnetic, infrared, thermal conductivity.

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No. SUPP 1/95

Date 22.5.95

## MagMaster Installation

**Ensure all transportation ties, tapes or temporary feet/protection strips (fitted to the underside of sensors) are removed prior to installation.**

**Failure to remove such items could invalidate any approval associated with the product.**

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# MagMaster™ Electromagnetic Flowmeters

## BOOK 4 Operation

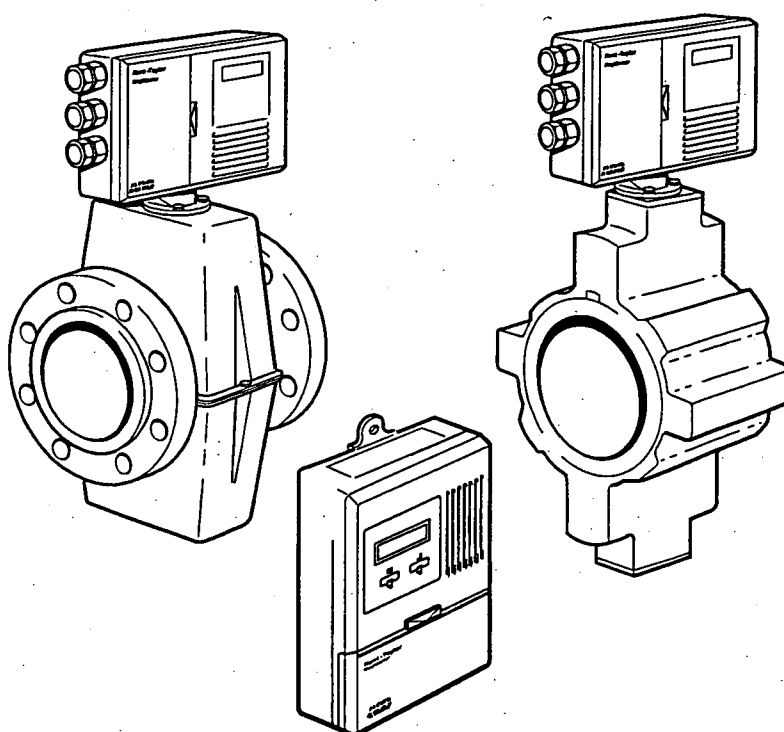


ABB Kent-Taylor



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## The Company

ABB Kent-Taylor is an established world force in process instrumentation offering users a total capability in the wide range of product lines available, backed by the worldwide manufacturing, test, calibration and sales and service facilities that are expected from a market leader.

The quality, accuracy and performance of the Company's products result from over 100 years experience of instrument manufacture, combined with a continuous programme of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Kent-Taylor's dedication to quality and accuracy.

The Company's instrumentation is suitable for a wide range of industrial and scientific applications such as process control, batch processing, power generation, heat treatment, heating and ventilation, laboratories, food, chemical, petrochemical and water industries.

All products are backed by a high standard of technology, service and engineering support, from skilled, experienced sales and design engineers.

## Health and Safety at Work Act 1974 (UK)

Section 6(4) of the above Act requires manufacturers to advise their customers on the safety and handling precautions to be observed when installing, operating, maintaining and servicing their products. Accordingly, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information

## Notice

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Kent-Taylor.

## Use of Instructions



**Warning.** An instruction that draws attention to the risk of injury or death.



**Caution.** An instruction that draws attention to the risk of damage to the product, process or surroundings.



**Note.** Clarification of an instruction or additional information.



**Information.** Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

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## BOOK 4 OPERATION

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### SAFETY MEASURES



#### Warning.

- **EXPLOSION HAZARD.**  
SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.
- **EXPLOSION HAZARD.**  
DO NOT REMOVE FUSE OR DISCONNECT POWER LEADS WHILE CIRCUIT IS LIVE.
- **THE LOCAL TERMINAL MUST NOT BE USED WHEN THERE IS AN EXPLOSION RISK.**

### MESURES DE SÉCURITÉ



#### Avertissement.

- **RISQUE D'EXPLOSION.**  
SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATÉRIEL INACCEPTABLE POUR LES EMBLEMES DE CLASSE I, DIVISION 2.
- **RISQUE D'EXPLOSION.**  
NE PAS RETIRER LE FUSIBLE NI DÉBRANCHER LES FILS D'ALIMENTATION TANT QUE LE CIRCUIT EST SOUS TENSION.
- **NE PAS UTILISER LE TERMINAL LOCAL EN ATMOSPHÈRE EXPLOSIVE.**



#### Warning.

- Installation and maintenance must only be carried out by suitably trained personnel.
- **HAZARDOUS AREA DESIGNATION ON THE EQUIPMENT LABEL MUST BE SUITABLE FOR THE INTENDED DUTY AND LOCATION.**
- All relevant sections of this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment, and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.

## 1 INTRODUCTION

This manual provides details to enable the MagMaster™ transmitter to be reconfigured from default parameters or from parameters initially set up by the factory to special order. This may be achieved via the communications link or a HART Terminal.

## 2 OPERATION

### 2.1 Startup

Switch on the power supply to the flowmeter and if a transmitter with display has been ordered, the flow rate will be shown on the bottom line of the display as shown below.

Sequential application of the provided magnetic wand to the left hand icon in the transmitter display area steps the top line display through the following sequence:

%	(Flow Rate % of Range)
>	(Forward flow total value)
<	(Reverse flow total value)
*	(Net flow total value)
Alm	(Active alarms)
Vel	(Flow Velocity in m/s or ft/s)

Any alarms are displayed sequentially if more than one alarm is present.

The second display line normally indicates flow rate in chosen units, but alternates with an alarm indication signal (Alm) if any alarms occur – see **Fault Finding** book.

Application of the wand to the right hand icon resets the totaliser display if reset is enabled (see Para 3.7, Parameter 73).

To gain access to the above information when a transmitter without display has been ordered, proceed as detailed in the following pages.

## 3 CONFIGURING THE TRANSMITTER

### 3.1 Filing Cabinet Analogy

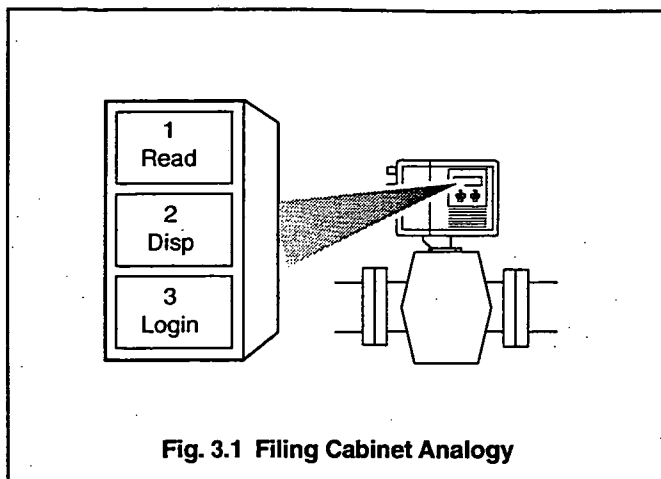


Fig. 3.1 Filing Cabinet Analogy

The main menu is accessed similarly to opening the drawers of a filing cabinet, each drawer of the cabinet representing an item of the main menu.

Main Menu items 1 to 3 are generally accessible; the remainder are password protected.

Files in the drawers of the cabinet would represent the groups of parameters provided by the transmitter which, if required, may be viewed or changed as shown in this, and the following pages.

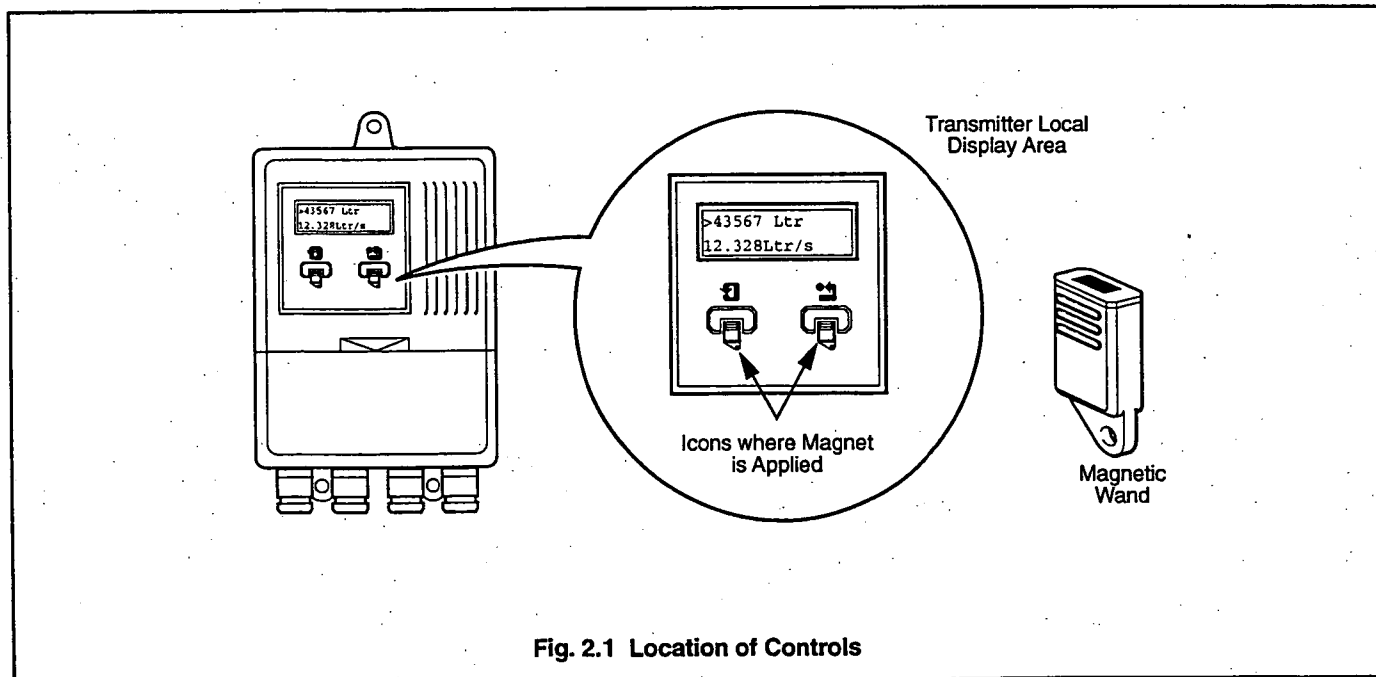


Fig. 2.1 Location of Controls



**CONFIGURING THE TRANSMITTER...****3.2 Getting Started**

The Transmitter is delivered set up either with your chosen units, or set with our standard default values.



**Warning.** Ensure Plant Safety while configuring at all times.

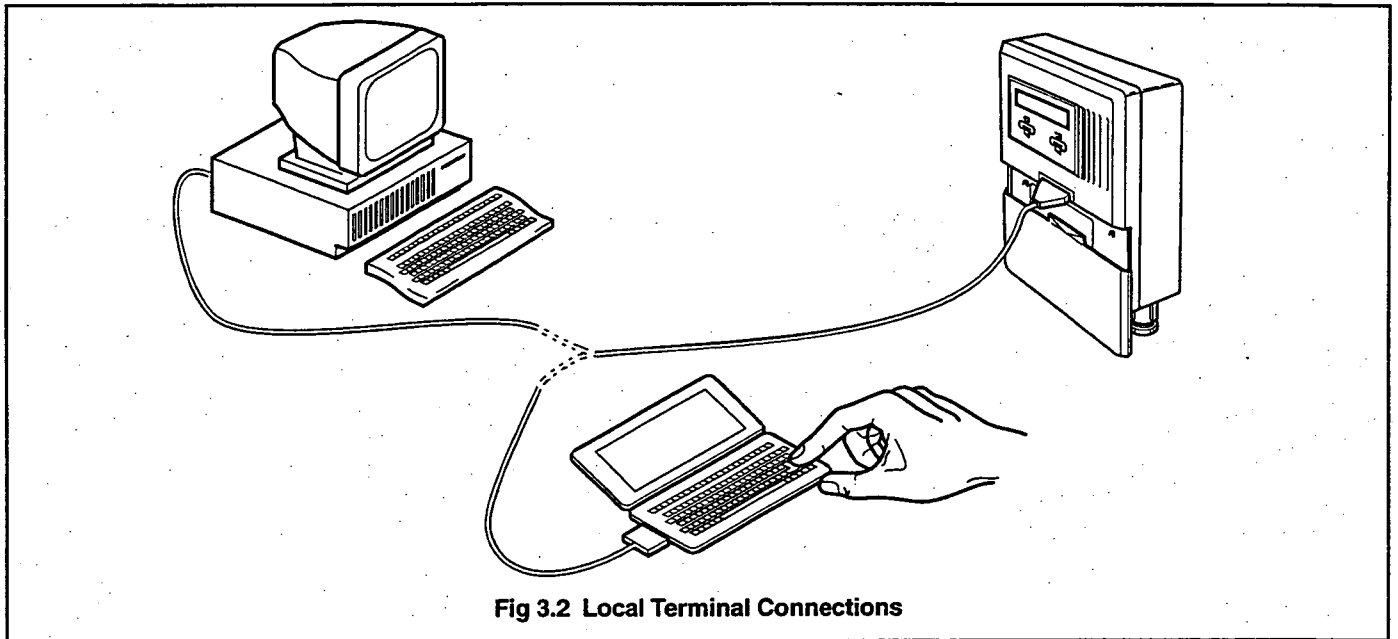
If you need to change the transmitter configuration for any reason, this may be done by connecting a terminal device e.g. Personal Computer, Electronic Organiser etc., to the transmitter via the 9-way D-Type connector, found by sliding the movable section of the transmitter cover in the direction of the cable glands.



**Note.** There is no 9-way D-Type connector available on the Hygienic version transmitter; cable must be hard-wired from inside the transmitter via the cable glands.

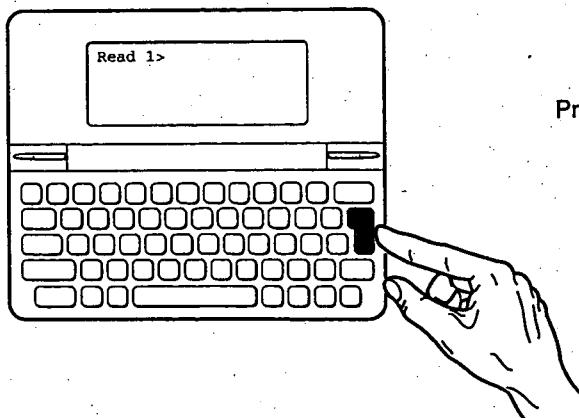
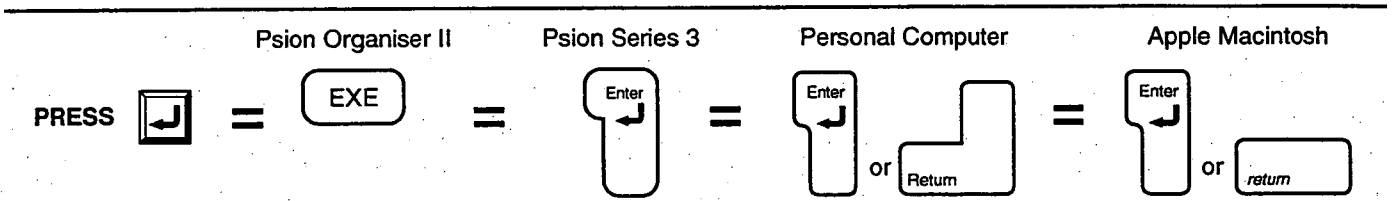
Special software is not required for configuring the transmitter; any communication program will suffice.

Connect the programming terminal to the transmitter (See APPENDIX A for details of connection and setup of data terminals etc. to the transmitter).

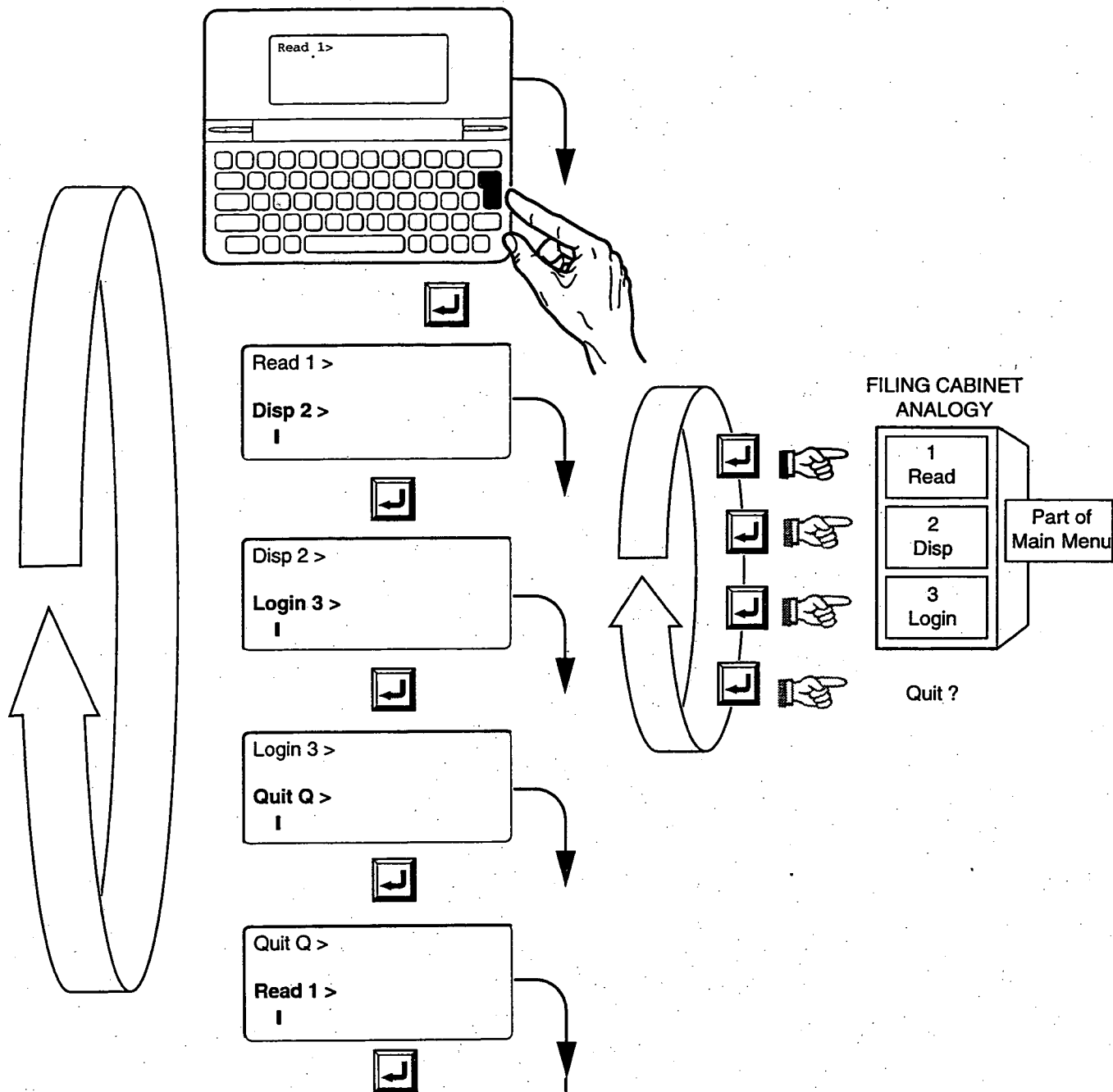
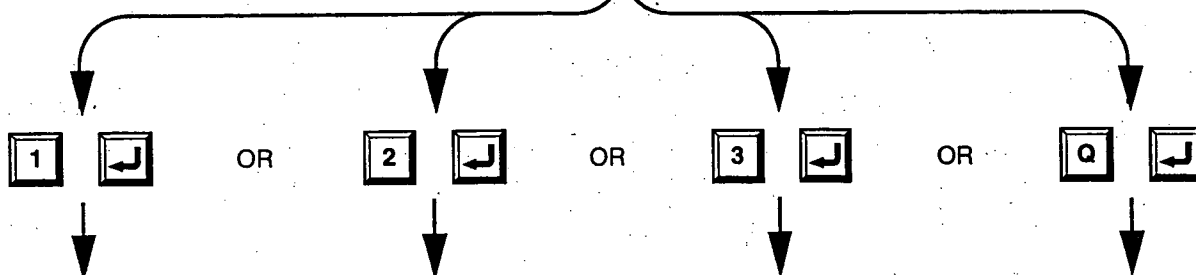


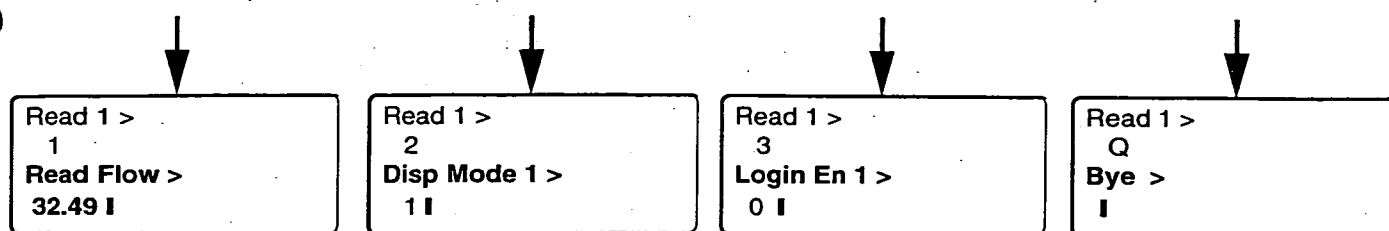
**Fig 3.2 Local Terminal Connections**

With connections made and the power switched onto the transmitter and terminal, proceed as shown below:



Press until display shows first item on main menu  
i.e. 'Read 1>'

**...CONFIGURING THE TRANSMITTER****3.3 Looking at the Main Menu****3.4 Choosing a Main Menu Item**

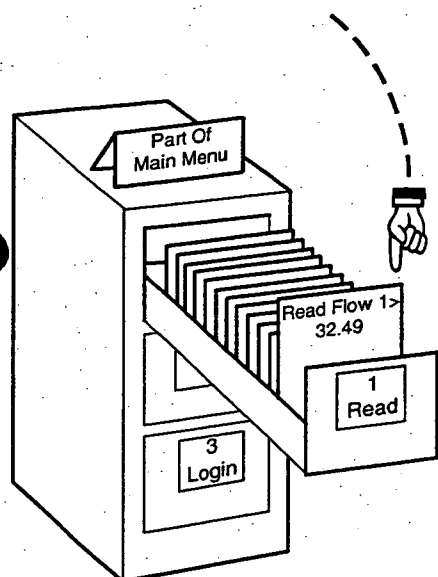
**CONFIGURING THE TRANSMITTER...**

'Read Flow' (Item 1 of 'Read' menu) opened and parameter value displayed.

'Disp Mode' (Item 1 of 'Disp' menu) opened and parameter value displayed.

'Login En' (Item 1 of 'Login' menu) opened and parameter value displayed.

'Quit'



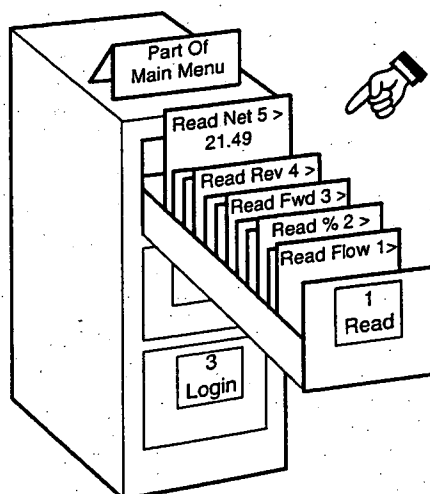
Similar to example shown.

Closes any open drawers of filing cabinet.

Read Flow 1 >  
32.49 5  
Read Net 5  
21.49? I

'Read Net' (Item 5 of 'Read' menu) opened and parameter value displayed.

FILING CABINET ANALOGY



## ...2 CONFIGURING THE TRANSMITTER

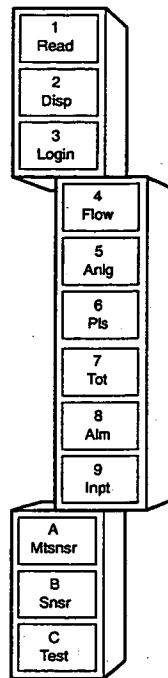
### 3.5 The Main Menu

#### SECURITY ACCESS

No security password required  
(Level '0')

User security password required  
(Level '1')

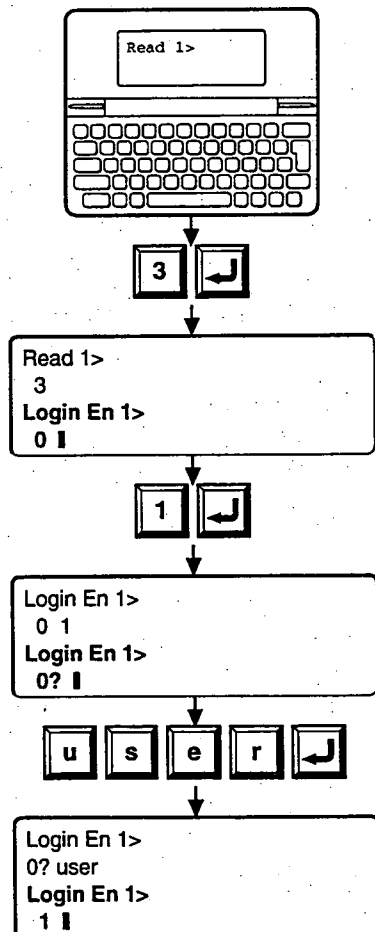
Engineer security password required  
(Level '2')



Read 1 >	Read flow rate, totaliser etc.
Disp 2 >	Set display options
Login 3 >	Enter Security Password for parameter access
Flow 4 >	Set up units of flow measurement & range
Anlg 5 >	Set up analogue output / HART options
Pls 6 >	Set up pulse output and totaliser
Tot 7 >	Set up totaliser units
Alm 8 >	Set up alarm operation
Inpt 9 >	Set up input contact function
Mtsnsr A >	Set up empty pipe detection
Snsr B >	Sensor calibration details etc.
Test C >	Test operation of flowmeter system
Quit Q >	Exit

### 3.6 Password Access

#### 3.6.1 Gaining access to the user level



#### \* Note.

The passwords shown below ('user' and 'engineer') are the factory default settings: you can change these for increased security, if required.

From '3.1 Getting Started'

Entering '3' accesses 'Login' item from Main Menu.

Entering '1' accesses Login Enable parameter.

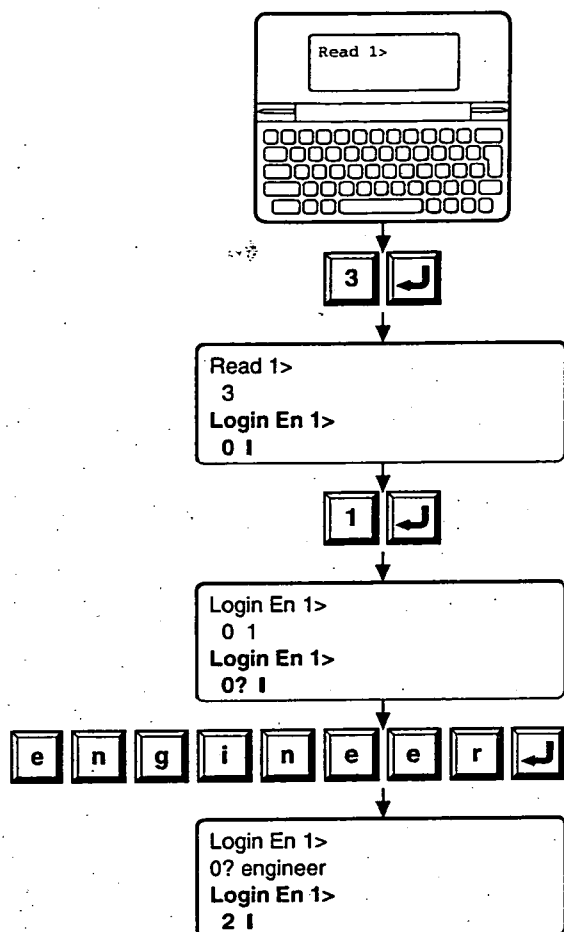
'?' shows that you can change the '0' security level value.

Entering password 'user' accesses level 1 security level.  
Note the use of lower case in this example. All passwords are case sensitive.

'1' indicates security access level 1 is now in operation.

## 2 CONFIGURING THE TRANSMITTER...

### 3.6.2 Gaining Access to the Engineer Level



From '3.1 Getting Started'.

Entering '3' accesses 'Login' item from Main Menu.

'0' indicates security access level 0 is in operation.

Entering '1' accesses Login Enable parameter.

'?' shows that you can change the '0' level value.

Entering password 'engineer' accesses level 2 security level. Note the use of lower case in this example. All passwords are case sensitive.

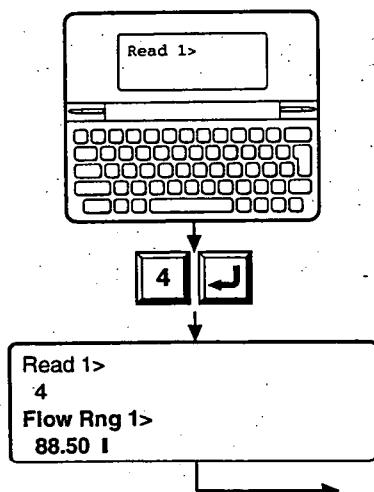
'2' indicates security access level 2 is in operation.

### 3.7 Changing the Value of a Parameter

#### 3.7.1 Numerical Value Parameters



**Note.** Many parameters, e.g. the flowrate, are calculated internally, and the new value entered will therefore be ignored.

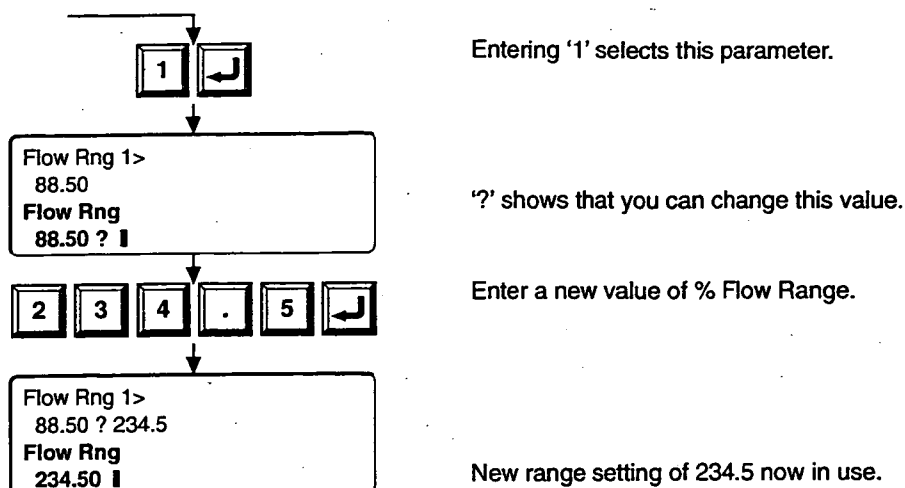


From 3.5.1 or 3.5.2, after gaining 'user' or 'engineer' access.

Entering '4' accesses Flow sub-menu from Main Menu: Item 1 (Flow Range) displayed.

'88.50' indicates present 100% Flow Range or 'Upper Range Value' ('URV')

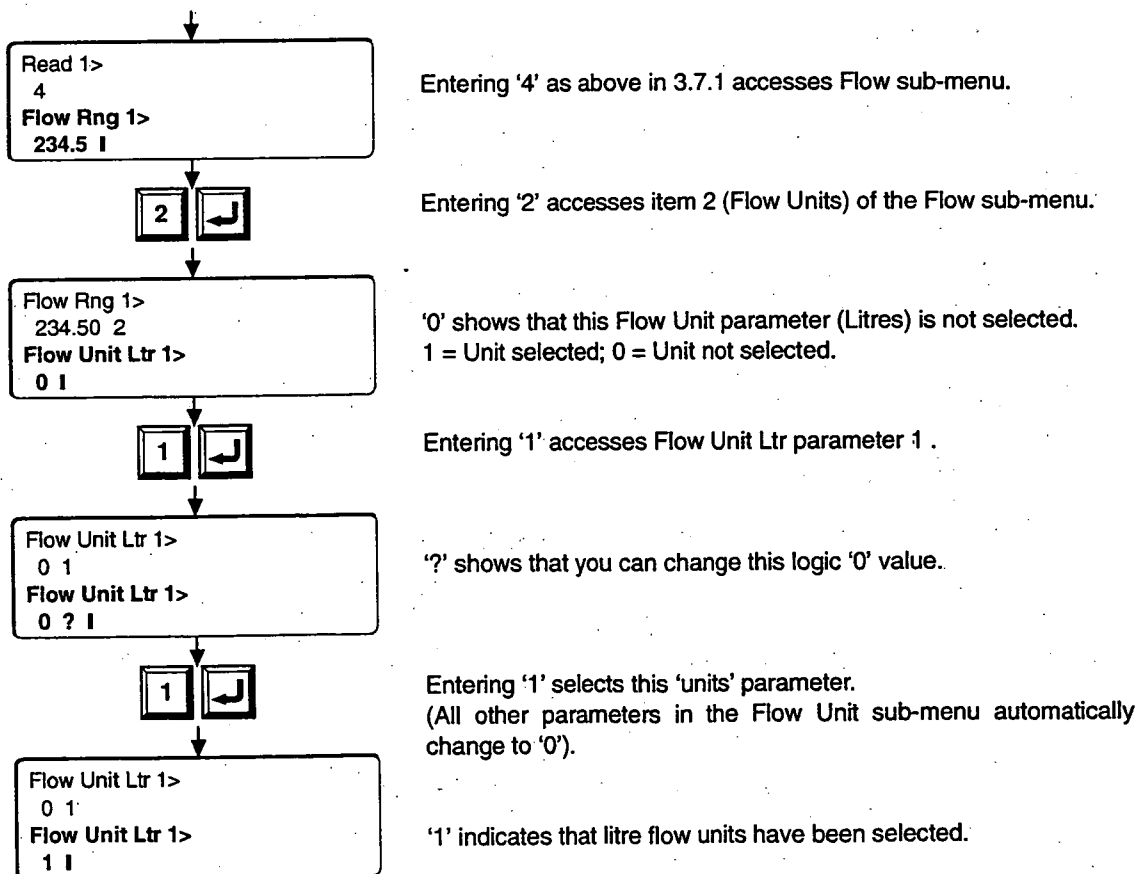
## ...2 CONFIGURING THE TRANSMITTER



**Note.** When a '?' prompt is showing, press to leave current value unaltered.

### 3.7.2 Logic ('1' or '0') Value Parameters (excluding Alarm Parameters)

**Note.** Flow units are mutually exclusive in that only one unit can be selected at any one time. All other units are automatically deselected.

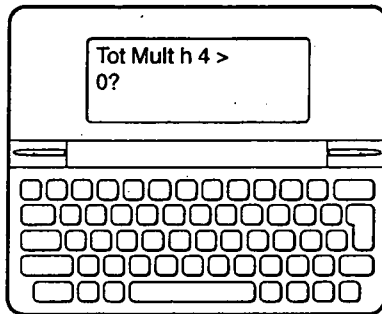


**...2 CONFIGURING THE TRANSMITTER****3.7.3 Alarm Parameters**

\* **Note.** Alarm Parameters are selected with a '1' and deselected with a '0' as shown in the previous flow unit types, but any combination of Alarm Parameters may be selected or deselected as required. Automatic deselection of parameters not required does not take place with alarm parameters.

**3.8 Advanced Techniques****3.8.1 Fast Selection of Parameters**

Refer to the B1.1 Parameter Tree Structure diagram.



To select 'Flow Unit lGal' from any parameter (e.g. Tot Mult h):

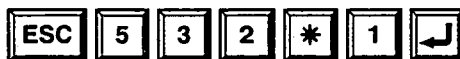
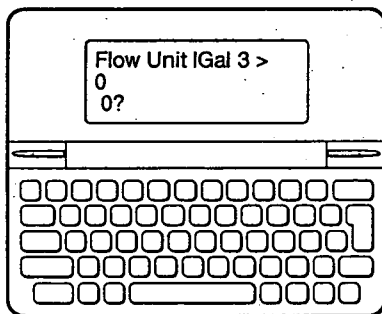
Pressing the ESCAPE key resets the prompt to the START position. 4 2 3 routes the prompt through the required menus to the Flow Unit Menu.

'0' indicates that the gallon units are not selected.

? indicates that it is possible to change the value to a '1' if required.

Any route through the tree structure can be similarly processed if the associated numbers and/or letters for the route is known.

e.g. ESC 8 3 1 followed by ENTER will allow the High Alarm Trip Level to be altered.

**3.8.2 Fast Selection plus Data Entry**

```

!
>532 * 1
Anlg Dir Rev2> 1

```

To select 'Reverse Analogue Direction parameter'

Pressing the ESCAPE key resets the prompt to the START position.

5 3 2 routes the prompt through the required menus to the **Reverse Analogue Direction** parameter.

\* simulates the ENTER key without terminating the sequence, which would occur if the normal ENTER key were used.

'1' is entered to select the parameter.

\* **Note.** Any other necessary data can be entered at this point; e.g. with the correct routing, a password could be entered. (31\* user)

The enter key completes the command.

## APPENDIX A

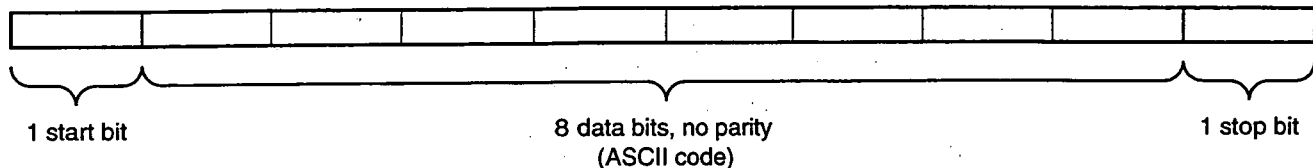
### A1.1 Programming The Transmitter with a Data Terminal

The nine-pin transmitter front panel connector is compatible with most serial devices, e.g. PSION Organiser, IBM PC, using proprietary adaptors where required. This connection is for 'local' use only, i.e. for up to approximately 5 metres between transmitter and data terminal.

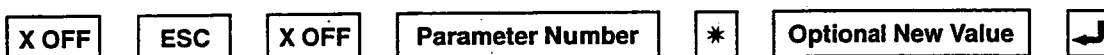
The optional RS422/423 interface may be used for considerably greater distances (see **Installation Manual** for connections).

Most serial data terminals may be connected to the transmitter providing that the following three requirements are met:

1. The data rate (transmit and receive) is 4800 Baud.
2. The data format is:



3. Format for computer entry is as above plus the control codes to alter response are typically as follows:



Where 'X OFF' suppresses character echo and the reply consists of the value only.

'ESC' forces the parameter number to start from the top of the Menu Tree.

'\*' Separates the Parameter Number from the New Value.

**N.B.** If no value is entered before pressing ENTER, RETURN etc, the current value is retained.

X ON and/or ENTER will cancel the X OFF control.

Consult the Handbook for your particular terminal device.

### A1.2 Using Personal Computers with MagMaster

Many communications software packages are available and in use, and can be used to interface with the MagMaster™.

The following is a sample of typical communications programmes and setup details for interfacing with the MagMaster™.

A personal computer can be used to communicate with MagMaster to set up its operating parameters. The only requirements are:

- 1) The computer can be any make or type (eg. Apple, BBC, Atari, Amiga, PC etc.) but it must be equipped with a serial communications port capable of operation at 4800 baud. (RS232C is the most common type). Most computers are fitted with this as standard. It is not possible to give specific instructions for all types of computer, because of the large number of computers available, but reference to the instructions of the machine to be used will provide the necessary information. A "dumb terminal", usually found connected to a mainframe computer, can also be used for configuring MagMaster.
- 2) The computer must be equipped with Terminal emulation software. In many machines (for example the BBC computer) this is built in, in others (IBM PC and AT for example) this has to be added. The software is not special in any way and there are many programmes on the market which provide or include this function, all of which are suitable for MagMaster use. Typical examples for the IBM PC/AT are:

Central Point's PC Tools	(Desktop Telecommunications)
Microsoft Windows	(Built in Terminal Emulator)
Odyssey	(Shareware programme)
Procomm Plus	(Shareware programme)
VBC.EXE	(ABB Kent-Taylor)
AQUAMAG.EXE	(VBC.EXE upgrade)



In all cases the Comms port parameters need to be set up as below; this function is normally provided as part of the software package being used.

#### Settings

Baud rate	4800
Data bits	8
Stop bits	1
Parity	NONE
Handshaking	NONE (OR RTS/CTS)
COMMS PORT	As appropriate (COM1, COM2 etc.)

#### Interconnection details

9-pin to 9-pin		9-pin to 25-pin	
2	3	2	2
3	2	3	3
4	6	4	6
5	5	5	7
6	4	6	20
7	8	7	5
8	7	8	4

The most common reason for lack of communication between a MagMaster and a computer or terminal, assuming that everything is set up as above, is the interconnecting lead. The correct lead to use is a LAPLINK lead, also known as a NULL MODEM. This is a lead which is designed to connect the communication ports of two computers together, and therefore the internal wiring "crosses over" (see **Interconnection Details** above). A serial printer lead will therefore not be suitable.

However, where the incorrect lead has been fitted, correct operation will normally result if the wires on pins 2 and 3 of one of the connectors are swapped over. **N.B.** A suitable lead (which also permits operation with certain Toshiba Laptop PCs) is available from ABB Kent-Taylor – see Book 6 Spares and Accessories.

#### A1.2.1 PC Tools

From the 'Desktop: Telecommunications' utility, use 'Edit: Create new entry' to enter the serial settings as required above and use 'Modem: Setup' to select the COMMS Port.

Use F8 or select 'Manual' to run the utility as a terminal emulator. Press ALT and ESC together once (the MENU bar will show 'ALT-ESC On'). This will allow the ESC key to be used with MagMaster.

#### A1.2.2 Windows 'TERMINAL'

Use 'Settings : Communications' to set up terminal settings as above.



**Note.** Avoid using the backspace key for editing, as this produces misleading results with the Windows Terminal display. Use the Delete key instead for this function.


#### A1.2.3 Odyssey and Procomm Plus

Use the Port and Setup menus to configure the settings as above.

#### A1.2.4 'VBC' and 'Aquamag'

These two programmes are very similar and provide a basic, but totally adequate, communication facility for MagMaster. The programmes are configured ready to use with COM1. They will also terminate if the serial port is not connected.

#### A1.3 Quick Set-up for Psion Series 3

The following instructions are a quick guide to setting up a Psion Series-3 for use with a MagMaster. Refer to the Psion Series-3 Instruction Manuals for full information. These steps are only necessary the first time that the Series 3 is used. If your Psion Series 3 was supplied by ABB Kent-Taylor, the Comms. Application will have been installed. Locate 'MagMastr' under the COMMS icon and press ; otherwise proceed as follows:

## ...APPENDIX A

- 1) Fit batteries to Organiser as described in Series 3 User guide page 3. Note ERRATUM sheet, if any, packed with unit.
- 2) Use the **[Esc]** key to turn it on and then use **[↑]** and **[↓]** keys, followed by **[Enter]** to select the language required (most models have this facility).
- 3) There may be a warning that the Backup battery is low, if so this can be ignored at this stage. (a new backup battery should be fitted later – see manual). If this happens press the **[Esc]** key.
- 4) To ensure sufficient memory is available (128k Model), close down the applications 'Data', 'Word', 'World', 'Calc' and 'Agenda' as follows:

Move the highlight block with **[←]** or **[→]** to application, press **[Delete]**, followed by **[Y]**.

Switch off by holding down **[⏻]** and **[1]** together.

- 5) Assemble the Psion 3-link cable as described in the 3-link manual page 2 onwards and plug it into the connector on the left side of the Series 3.
- 6) Press **[Esc]** to switch on again, this will give the system screen, showing the applications available. Press the Menu key, and use the **[←]** and **[→]** keys to select the "Apps" menu (the centre menu). Select "Install application" by using the **[↑]** and **[↓]** keys then press **[Enter]**.

Short cut: from the system screen, hold down **[⏻]** and press **[1]**.

- 7) Press **[↓]** key to select disk and then **[←]** and **[→]** to select "C". The top line should now show "Comms.app". If so press **[Enter]**. (If not press the **[↑]** and then use the **[←]** and **[→]** keys to select it, then press **[Enter]**). A new icon will appear, a picture of the organiser connected to a computer.
- 8) If necessary, use the cursor keys to highlight "Comms[C]" and press **[Enter]** to run the communications application. One of two possibilities will occur:
  - a) The screen will blank briefly and then a box containing a flashing cursor will appear, together with a message "Online..." Proceed to step 9.
  - b) A message "No system memory" appears. See step 4 above.

Move the highlight back to "Comms[C]" and repeat step 8.

- 9) Hold down **[⏻]** and press **[J]**. Use the cursor (**[←]**, **[→]**, **[↑]** and **[↓]**) keys to make Serial Port settings as below:

### Set Serial Port

* Baud rate	4800
* Data bits	8
* Stop bits	1
* Parity	none
* Ignore parity	yes

Press **[Enter]** when finished.

- 10) Hold down **[⏻]** and press **[K]** to set up handshakes as below.

### Set Serial Handshake

* Xon/Xoff	off
* Rts/Cts	off
* Dsr/Dtr	off
* Dcd	off

- 11) Press the **[⏻]** and **[O]** keys, followed by **[↑]**, **[←]**, **[→]** to select drive 'Internal' and then press **[↑]**.

Type in a suitable name, eg. 'MagMastr' (8 characters max.) and press **[Enter]**, to save the settings for future use.

The Series 3 is now ready for use with the MagMaster transmitter, as described in this Configuration Manual.

**A1.4 Setup for Psion Organiser II (CM, XP, LZ, LZ64)**

**Note.** It is recommended that the mains adapter is used to power the 'Organiser' where possible.

1. Connect the Psion Organiser Communications Link Adapter to the MagMaster Transmitter using a suitable adapter lead consisting of a 25-pin D-Type plug to 9-pin D-Type socket (available as a Psion accessory).
2. Scroll through the following list of items which will be shown on the 'screen' in the Comms 'SETUP' mode.

BAUD	4800
PARITY	NONE
BITS	8
STOP	1
HAND	NONE
PROTOCOL	NONE
ECHO	HOST
WIDTH	NONE
TIMEOUT	NONE
REOL	<CR><LF>
REOF	NONE
RTRN	NONE
TEOL	<CR>
TEOF	NONE
TTRN	NONE

Enter the following numbers to give the operations shown in the above:






13,10                      <CR><LF>

13                          <CR>



Select 'TERM' from the 'Comms' menu to allow communication with the MagMaster Transmitter.  
Set COMMS to 'No Handshaking', 'No translations'.

Set the MagMaster Display Mode (Parameter '21') to '1'. (Refer to 3.6 Changing the Value of a Parameter in this manual).

**A1.4.1 Keyboard Designations (Psion Organiser II)**

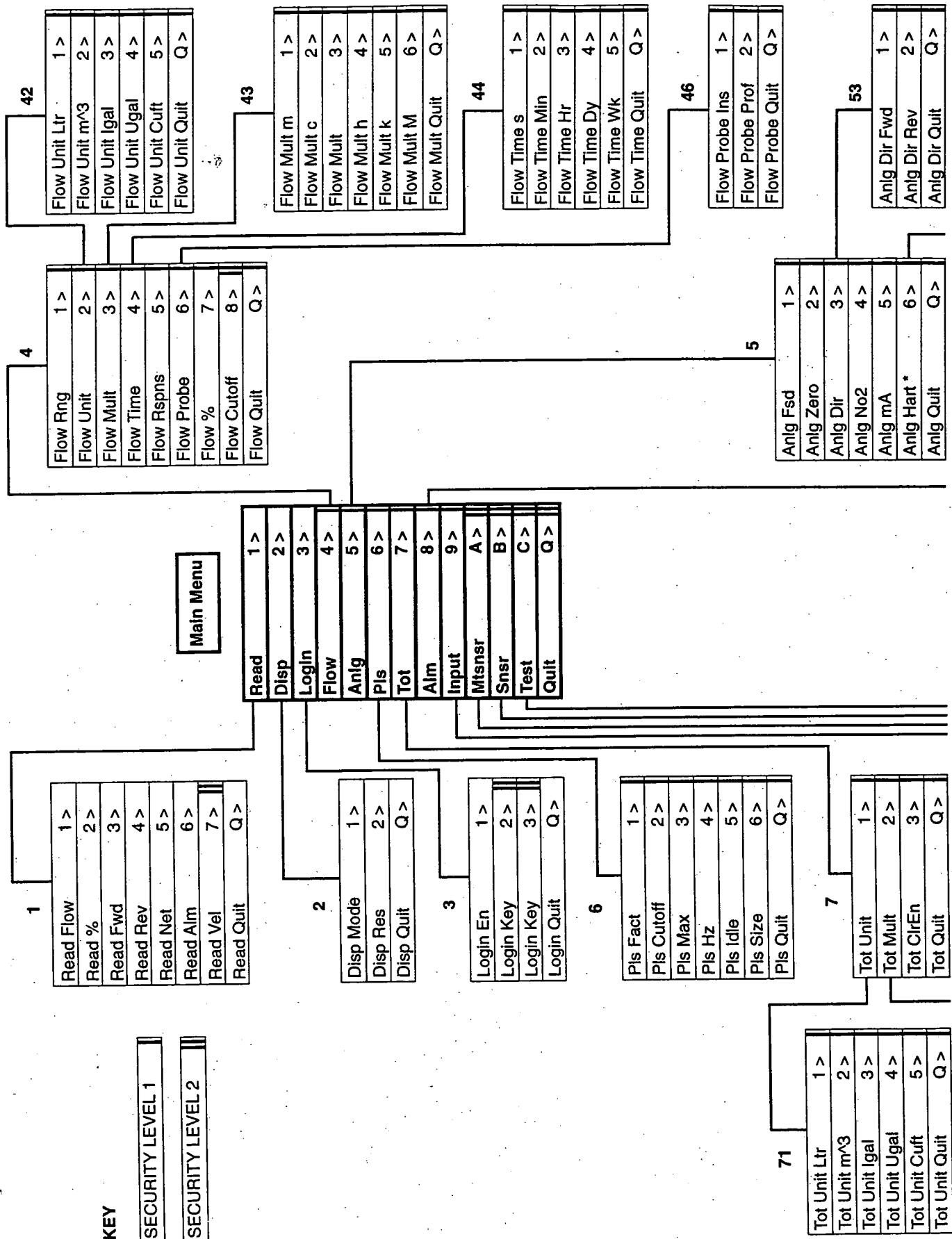
Function	Key
	
DEL	
ESC	 + 

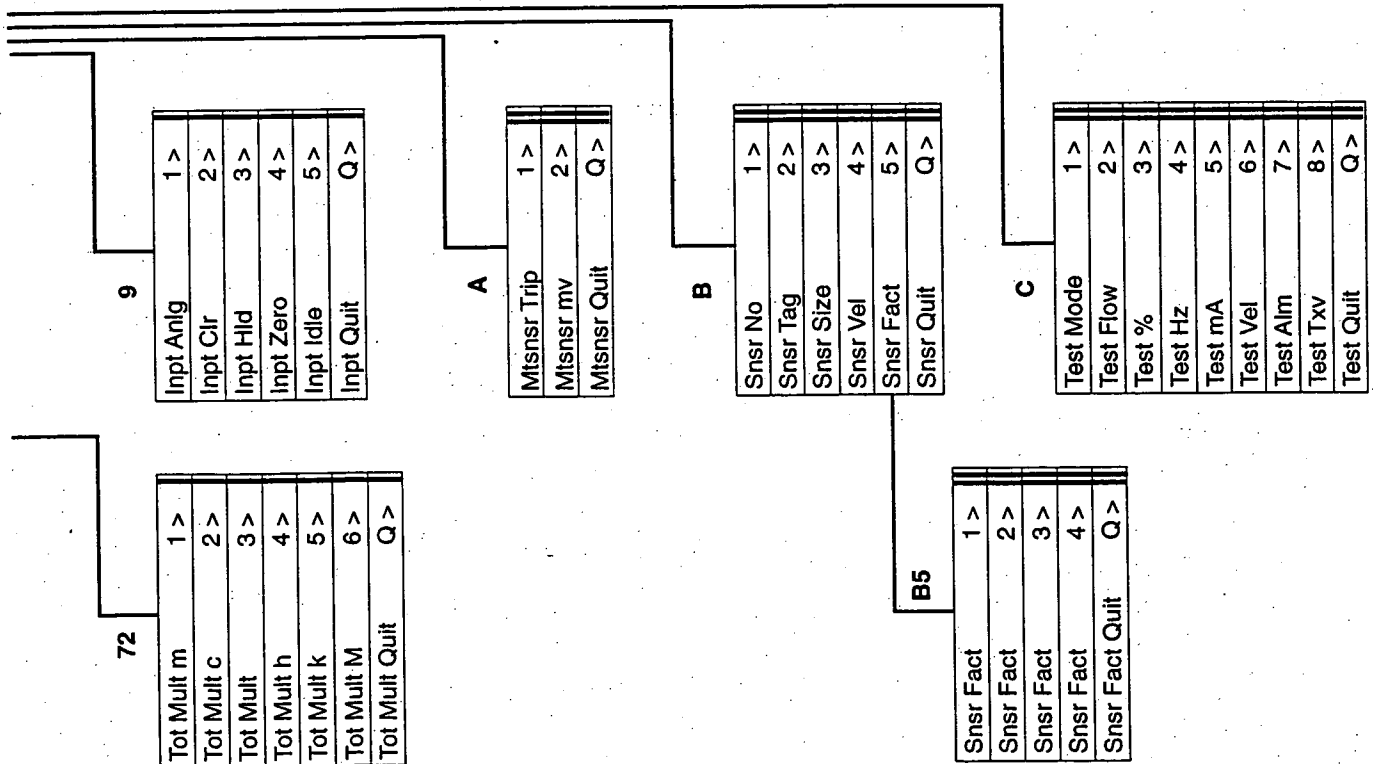
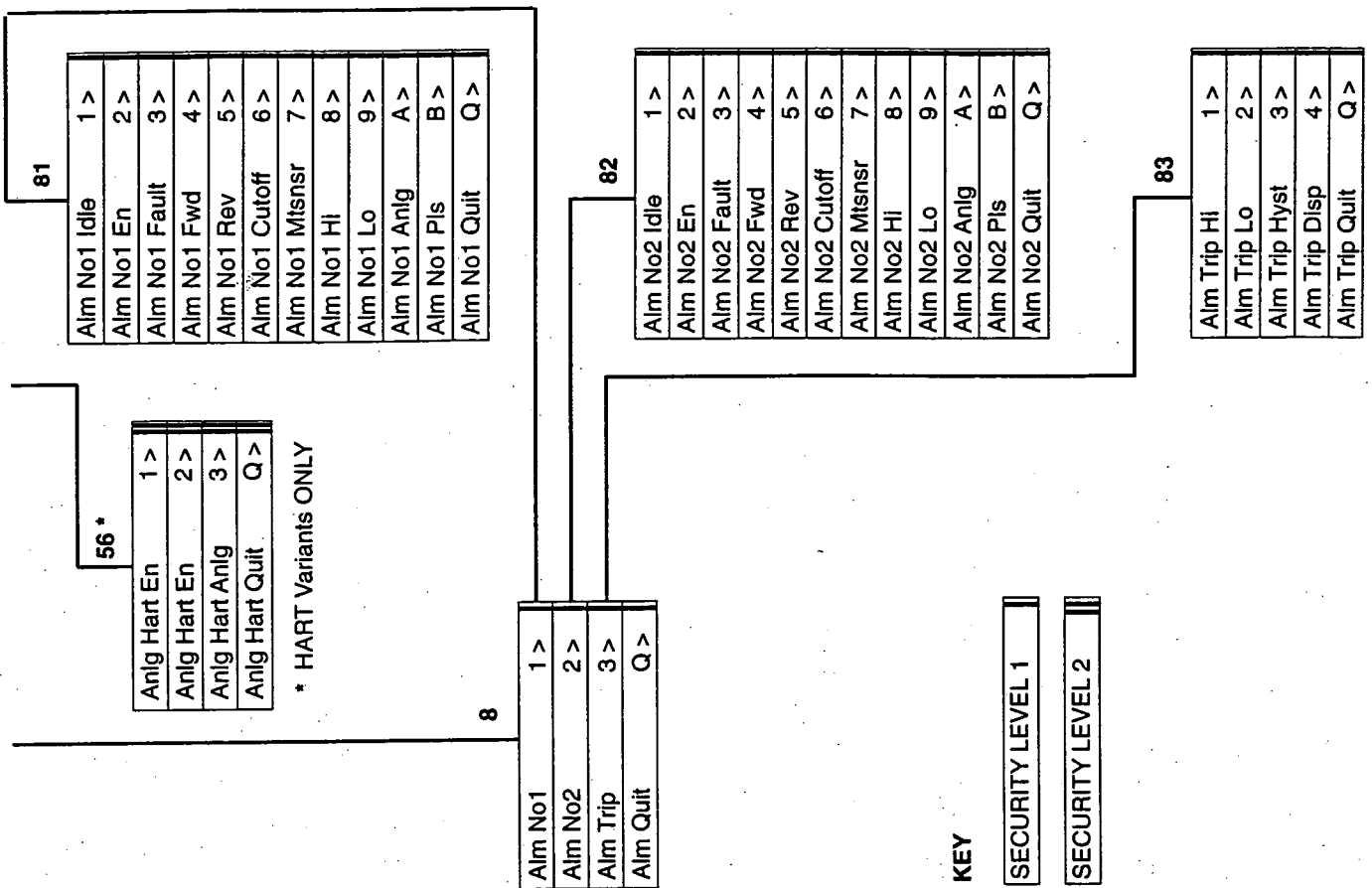


**Note.** The  and  keys cannot be used, as these enable and disable the Organiser data output. Consult the Psion Organiser handbook for further information.

## APPENDIX B

### B1.1 Parameter Tree Structure





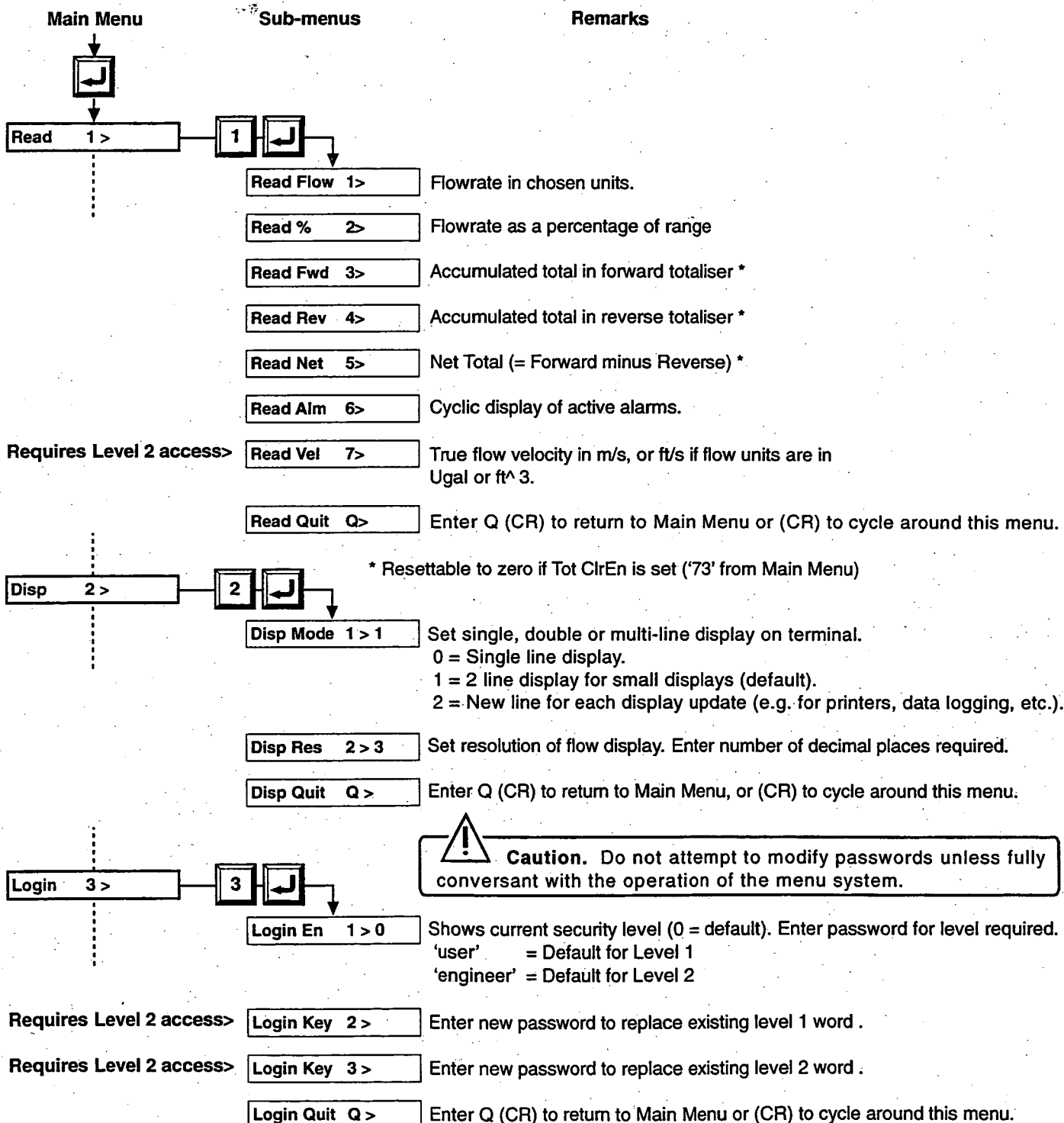
## ...APPENDIX B

### B1.2 Description of Parameters

Select the access number or letter, of any of the items in the Main Menu, followed by a CR (RETURN etc), to access its associated sub-menu. It is not necessary for the parameter to be displayed to select it by number.

**\* Note.** The correct security level must be selected in **Login** parameter below to access certain parameters. See headings in this description or access notes against individual parameters.

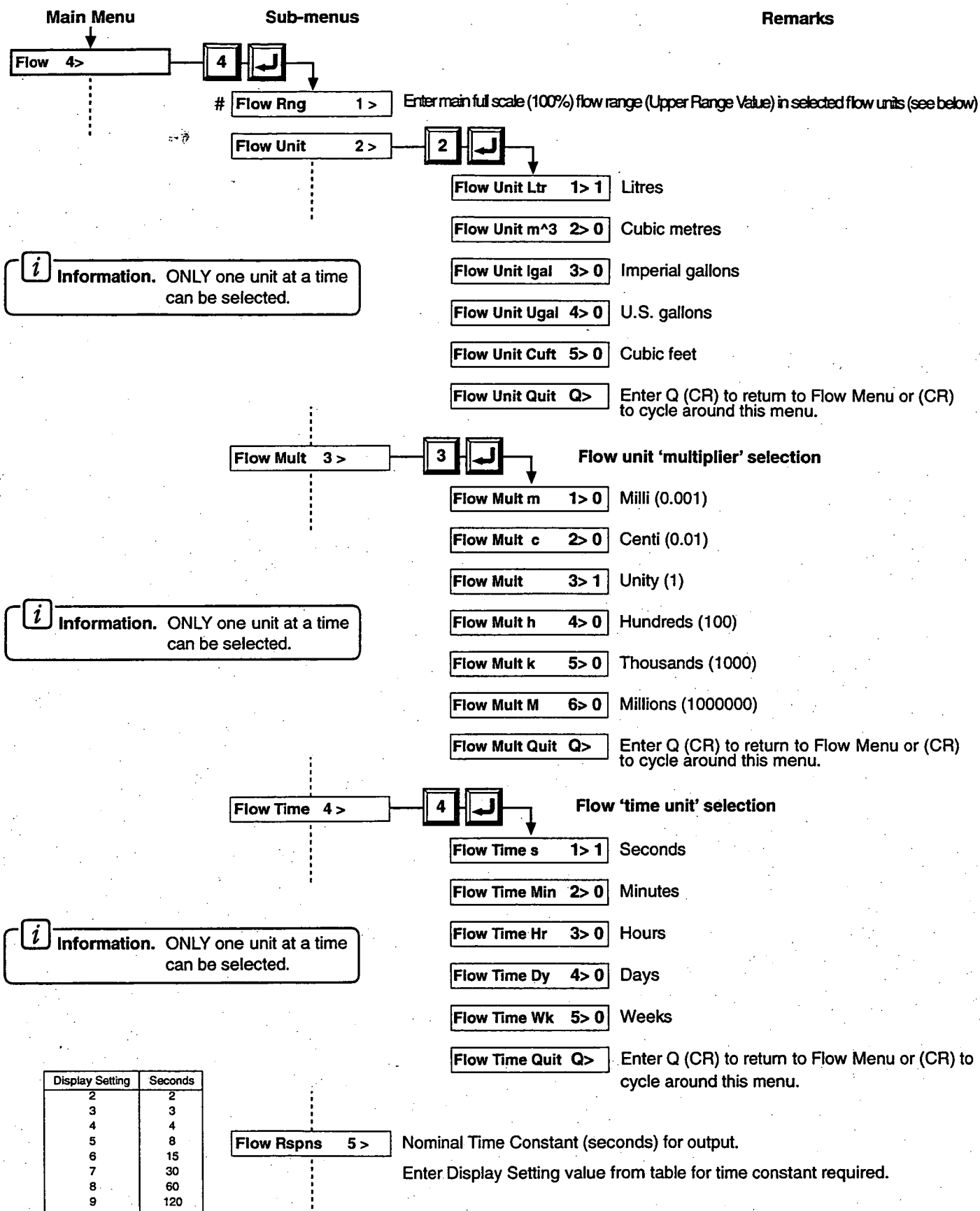
Select the access number or letter of any item in a sub-menu, followed by a CR, to read the value or to change it as necessary. (CR)s without an access code cycles through a menu continuously without accessing a parameter. All 'live' data displayed is updated each second.



**\* Note.** Access level selected is reset to Level 0 after a 'Quit' from Main Menu.

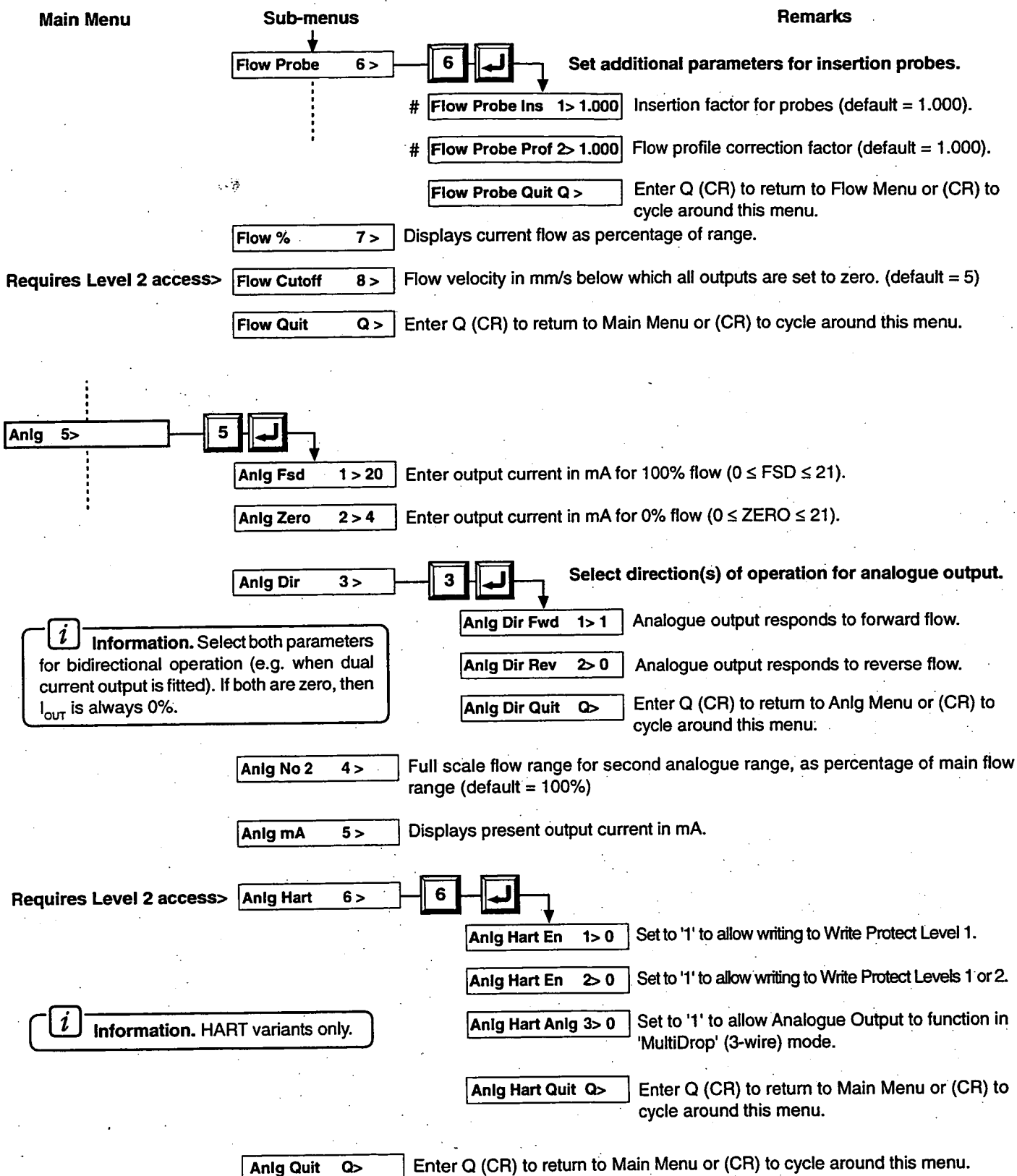


**Information.** THE FOLLOWING PARAMETERS REQUIRE 'LEVEL 1' OR 'LEVEL 2' ACCESS.  
(Enter passwords in 'Login En' parameter above).

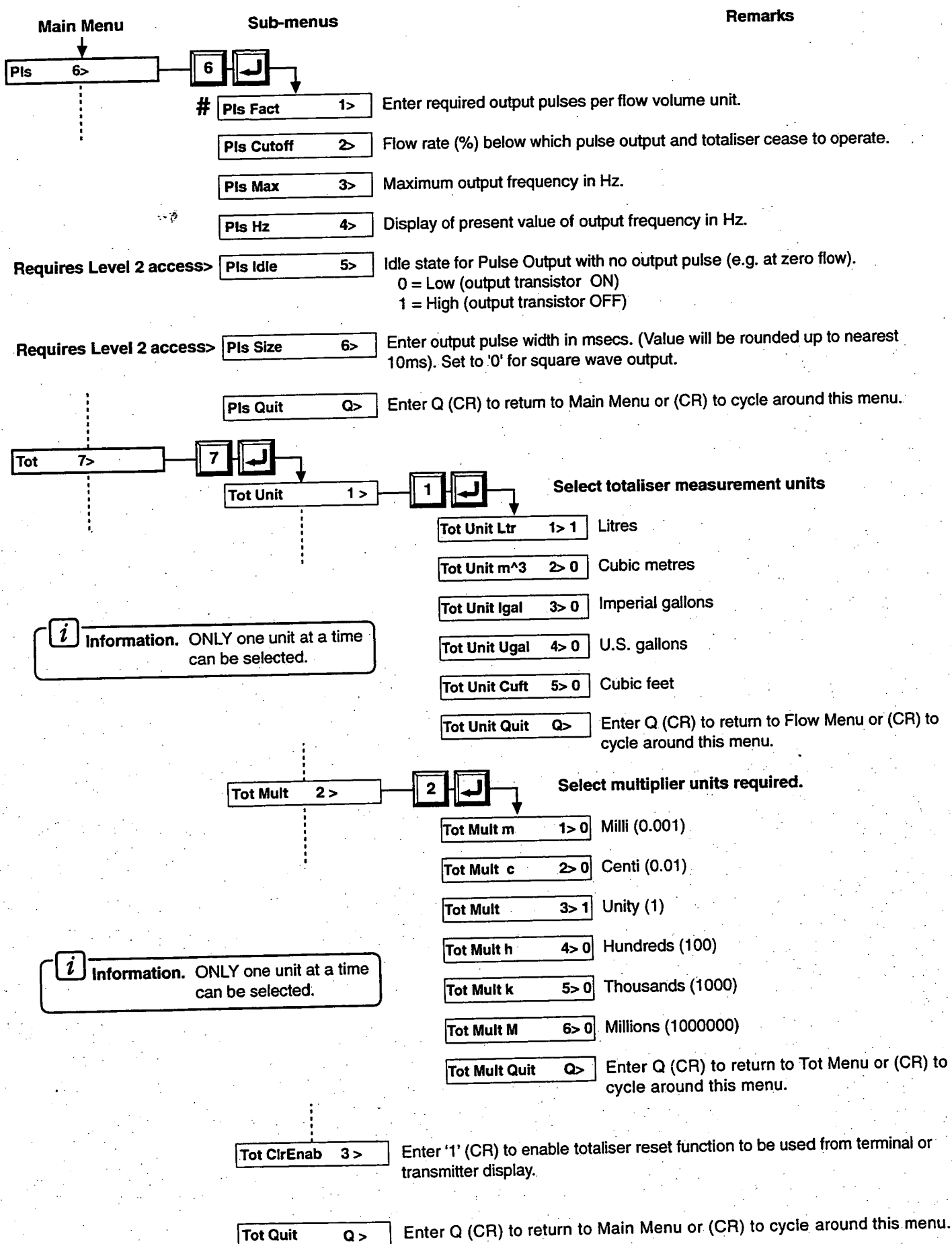


## ...APPENDIX B

### ...B1.2 Description of Parameters

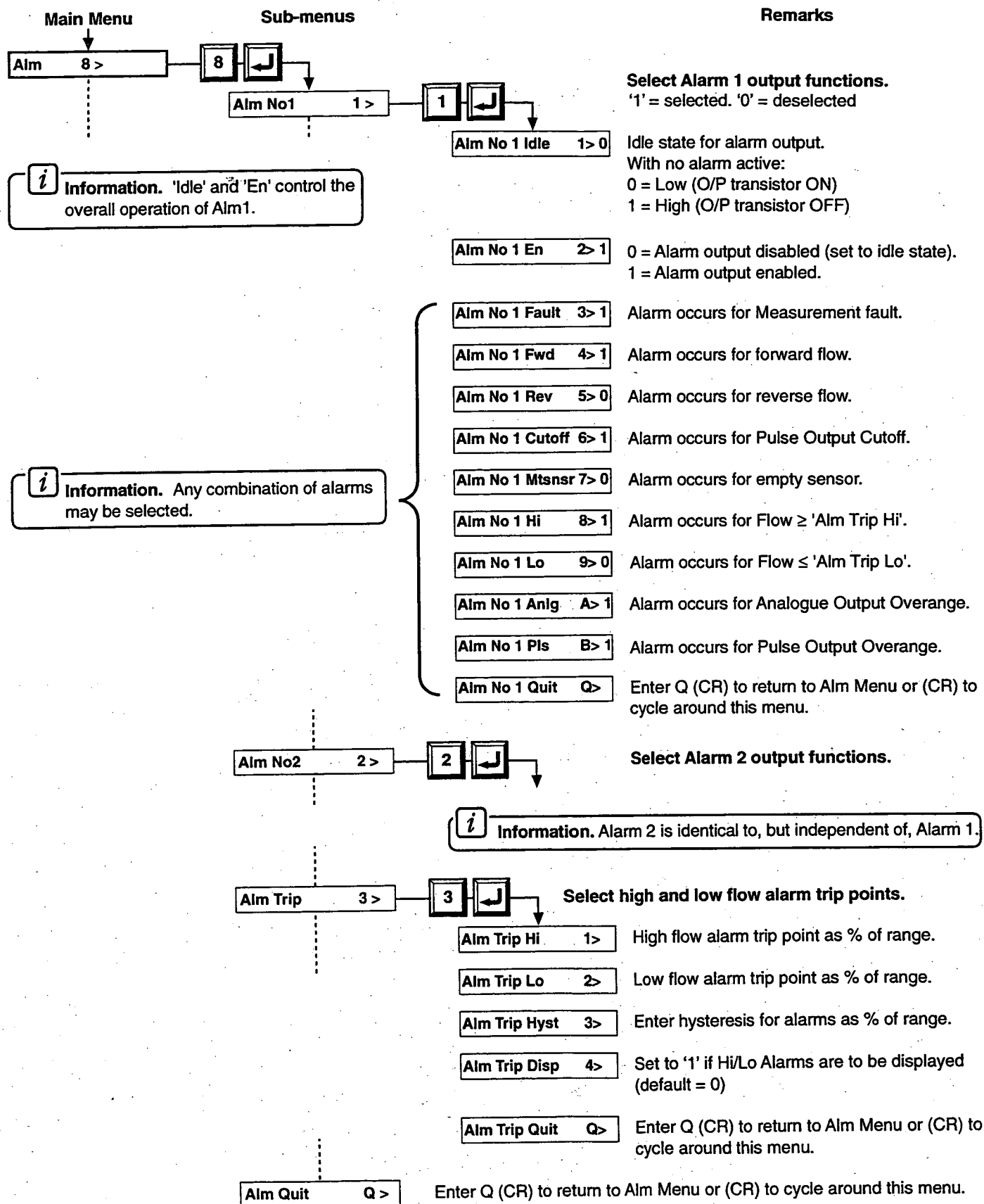


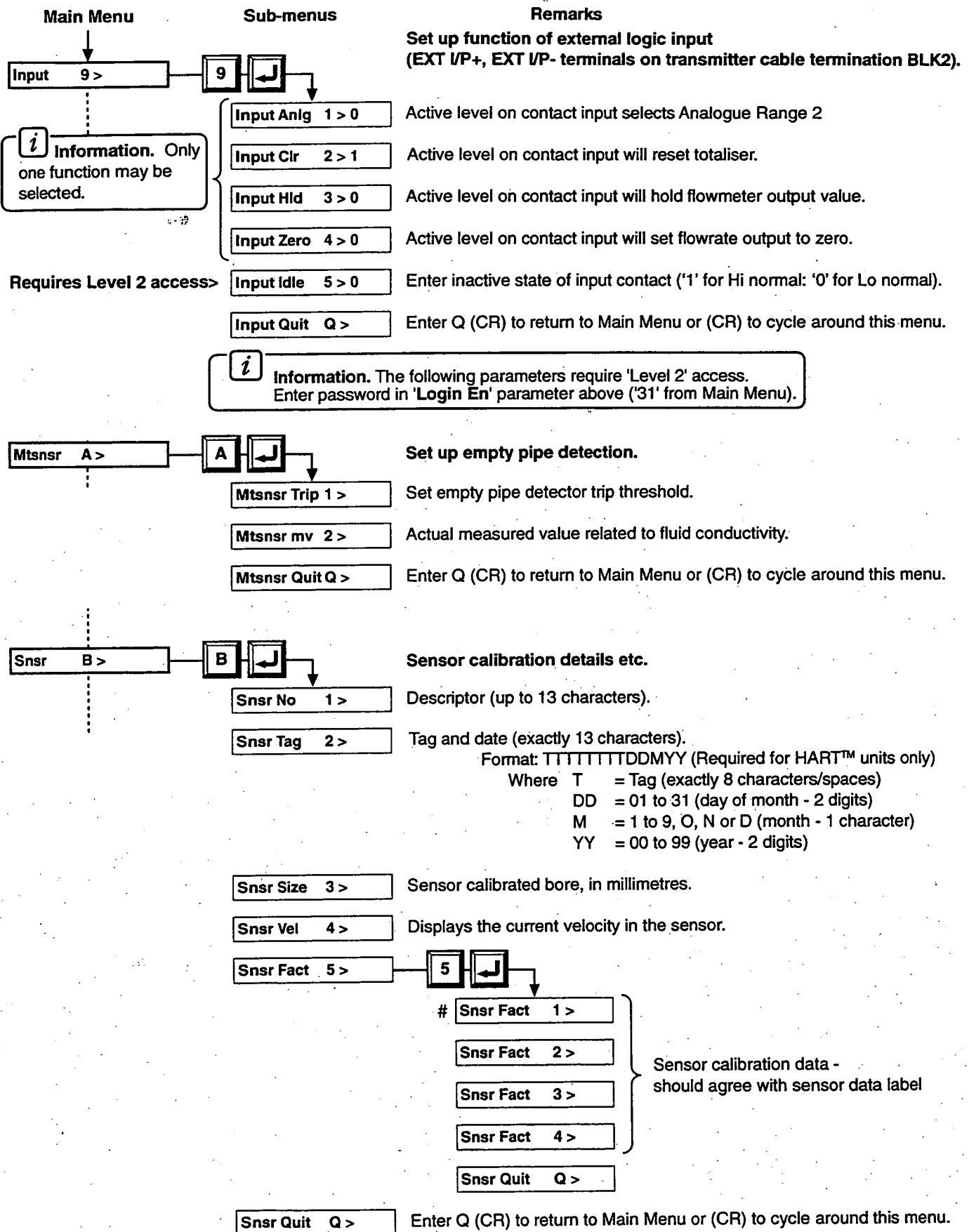




## ...APPENDIX B

### ...B1.2 Description of Parameters





## ...APPENDIX B

### ...B1.2 Description of Parameters

Main Menu	Sub-menus	Remarks
Test C >	<b>C</b> <b>J</b>	<b>System Test:</b> Exercises all outputs (as programmed) from manually entered flowrate.
	Test Mode 1 >	If set to '1', transmitter is in 'Test Mode'
	# Test Flow 2 >	Displays current flowrate: if in 'Test Mode', then any value may be entered manually
	Test % 3 >	Flowrate as a percentage.
	Test Hz 4 >	Output Frequency.
	Test mA 5 >	Output Current.
	Test Vel 6 >	Flow velocity in sensor (for the flowrate above).
	Test Alm 7 >	Shows currently active alarms,* sequentially ('Clr' indicates no alarms active).
	Test Txv 8 >	Live flow velocity (uncorrected for sensor calibration).
	Test Quit Q >	Enter Q (CR) to return to Main Menu or (CR) to cycle around this menu.

Calculated from  
'Test Flow 2' above



**Information.** 'Test Mode' self cancels after 30 minutes, if no further entries are made.

\* If the sensor is empty or disconnected, the alarms 'MtSnsr' and Coil will be displayed as appropriate.

# The maximum which can be entered must not exceed 21000. The value entered may be displayed with a small error in the decimal digits e.g. 1.900 may be displayed as 1.899. This is a display characteristic and the value 1.900 will be used by the MagMaster.

**END OF PARAMETERS**



## NOTES

## PRODUCTS AND SERVICING

### A Comprehensive Instrumentation Range

**Sensors, transmitters and related instruments for flow, temperature, pressure, level and other process variables**

#### **Flowmeters**

electromagnetic, ultrasonic, turbine, differential pressure, wedge, rotary shunt, coriolis.

#### **Differential Pressure transmitters**

electronic and pneumatic.

#### **Temperature**

sensors and transmitters, fibre optic systems.

#### **Pressure transmitters.**

#### **Level**

sensors and controllers.

#### **Tank gauging systems.**

#### **Cable-length measuring systems.**

**Indicators, recorders, controllers and process management systems**

#### **Recorders**

circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

#### **Controllers**

digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.

#### **Pneumatic panel or rack-mounted display and control instrumentation**

**Liquid and gas monitors and analysers for on-line and laboratory applications**

#### **Sensors**

pH, redox, selective ion, conductivity and dissolved oxygen.

#### **Transmitters**

Online pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.

#### **Monitors and Analysers**

for water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.

#### **Packaged analytical instrumentation laboratories.**

#### **Gas analysers**

Zirconia, paramagnetic, infrared, thermal conductivity.

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# MagMaster™ Electromagnetic Flowmeters

## BOOK 5 Fault Finding

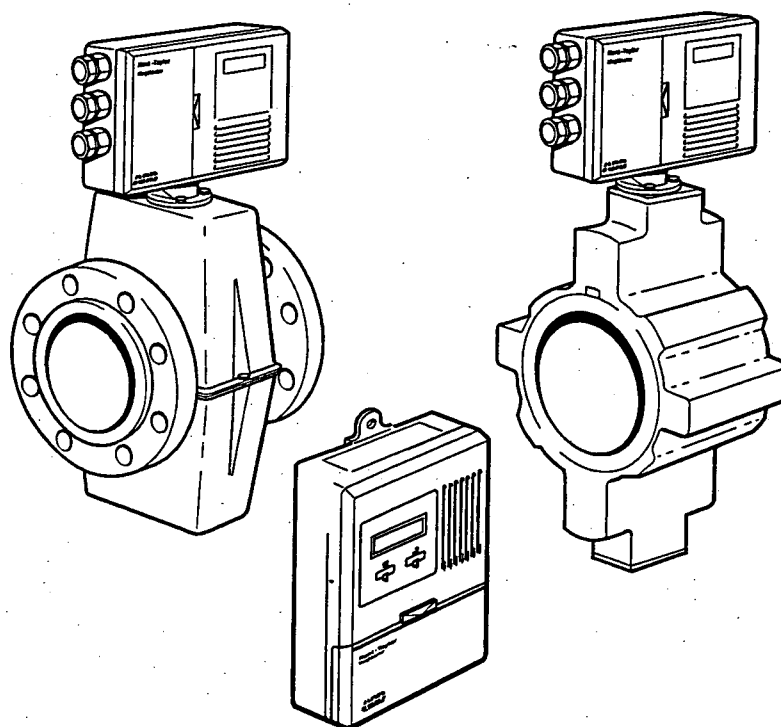


ABB Kent-Taylor





**St Neots**  
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EN 29001 1987  
BS 5750 Part 1 : 1987  
Certificate No. Q5907



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ABB Kent-Taylor is an established world force in process instrumentation offering users a total capability in the wide range of product lines available, backed by the worldwide manufacturing, test, calibration and sales and service facilities that are expected from a market leader.

The quality, accuracy and performance of the Company's products result from over 100 years experience of instrument manufacture, combined with a continuous programme of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Kent-Taylor's dedication to quality and accuracy.

The Company's instrumentation is suitable for a wide range of industrial and scientific applications such as process control, batch processing, power generation, heat treatment, heating and ventilation, laboratories, food, chemical, petrochemical and water industries.

All products are backed by a high standard of technology, service and engineering support, from skilled, experienced sales and design engineers.

## Health and Safety at Work Act 1974 (UK)

Section 6(4) of the above Act requires manufacturers to advise their customers on the safety and handling precautions to be observed when installing, operating, maintaining and servicing their products. Accordingly, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information

## Notice

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Kent-Taylor.

## Use of Instructions



**Warning.** An instruction that draws attention to the risk of injury or death.



**Caution.** An instruction that draws attention to the risk of damage to the product, process or surroundings.



**Note.** Clarification of an instruction or additional information.



**Information.** Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

**CONTENTS****Page****1 INTRODUCTION****BOOK 5 FAULT FINDING****Section****Page****SAFETY MEASURES ..... 1****1 INTRODUCTION ..... 1****2 FAULT FINDING ..... 2****2.1 Alarms ..... 2****2.2 Test Mode ..... 2****2.3 Fault Finding Flow Chart ..... 3**

A very powerful test mode, especially useful during commissioning and plant fault finding, enables all external devices connected to the MagMaster to be tested over the full range of flow rates.

This mode can be used regardless of flow conditions in the sensor, or even with the sensor disconnected, and does not require the use of additional equipment.

**SAFETY MEASURES****MESURES DE SÉCURITÉ****Warning.**

- EXPLOSION HAZARD.  
SUBSTITUTION OF COMPONENTS MAY IMPAIR  
SUITABILITY FOR CLASS I, DIVISION 2.
- EXPLOSION HAZARD.  
DO NOT REMOVE FUSE OR DISCONNECT  
POWER LEADS WHILE CIRCUIT IS LIVE.
- THE LOCAL TERMINAL MUST NOT BE USED  
WHEN THERE IS AN EXPLOSION RISK.

**Avertissement.**

- RISQUE D'EXPLOSION.  
SUBSTITUTION DE COMPOSANTS PEUT RENDRE  
CE MATÉRIEL INACCEPTABLE POUR LES  
EMPLACEMENTS DE CLASSE I, DIVISION 2.
- RISQUE D'EXPLOSION.  
NE PAS RETIRER LE FUSIBLE NI DÉBRANCHER  
LES FILS D'ALIMENTATION TANT QUE LE CIRCUIT  
EST SOUS TENSION.
- NE PAS UTILISEZ LE TERMINAL LOCAL EN  
ATMOSPHÈRE EXPLOSIVE.

**Warning.**

- Installation and maintenance must only be carried out by suitably trained personnel.
- HAZARDOUS AREA DESIGNATION ON THE EQUIPMENT LABEL MUST BE SUITABLE FOR THE INTENDED DUTY AND LOCATION.
- All relevant sections of this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.

## 2 FAULT FINDING



### Warning.

- Observe all safety measures (See INTRODUCTION).
- Take all precautions to avoid risk to personnel, plant and risk of explosion in hazardous areas.
- Do NOT open the transmitter main casing. There are no user serviceable parts or adjustments inside.
- Service access is restricted to the termination area

Should the MagMaster fail to operate, first check the power supply, then the power supply connections and fuse located in the termination area. If necessary, replace the fuse with one of the correct rating as listed in Book 6.



**Note.** All approved versions to use specified fuses – see Book 6.

Check that all external connections are made correctly.

### 2.1 Alarms

The transmitter has built in diagnostics with alarm indication which interrupts the transmitter local display. A data terminal connected to the transmitter will display these alarms in 'Read Alm' parameter; '16' from Main Menu (see **Warning** in next column).

The table below shows possible alarm indications and Fig. 2.1 Fault Finding Flow Chart indicates checking procedures to find the problems causing the alarms.

For method of interrogating the local display see Startup Section in Book 4.

**Table 2.1 Possible Alarm Indications**

Display	Alarm
MtSnsr	Empty Sensor
Hi	High flow
Lo	Low flow
Anlg	Analogue over range
Pls	Pulse frequency limited
Coil	Sensor Coil open circuit
19, 20, 21	See Fault Finding Flow Chart

### 2.2 Test Mode

To access the Test Mode, connect a terminal device to the Programming Connector as described in APPENDIX A Section.

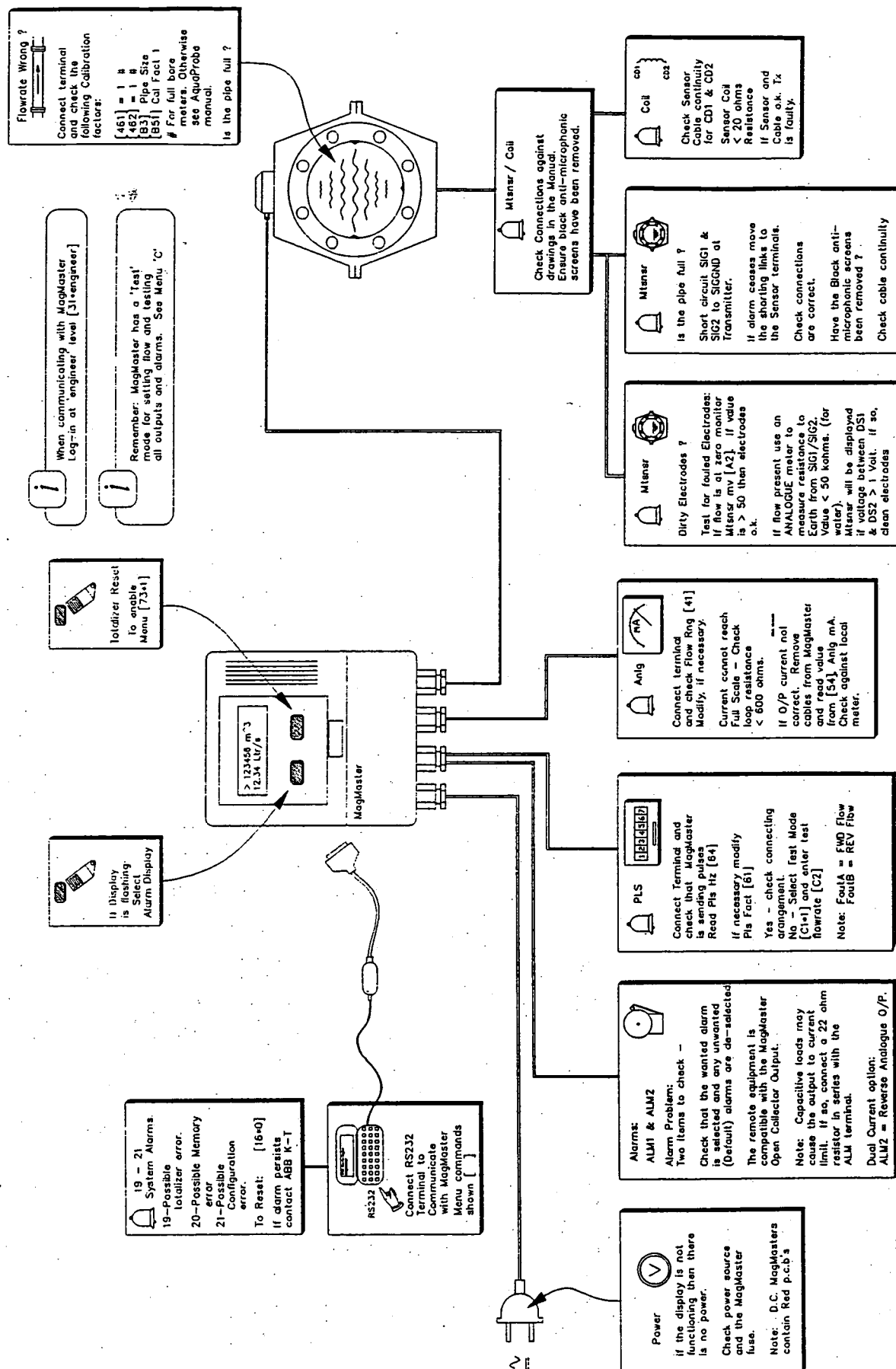
Select 'Engineer' security level (see Configuration Section). Set 'Test Mode' parameter to '1' and enter an appropriate flow rate in the 'Test Flow' parameter.

Output responses may now be viewed from the various 'Test' parameters. (See Configuration Section for full details of operation.)



**Warning.** Refer to Safety Measures if a data terminal is to be used to diagnose faults in hazardous locations.

## 2.3 Fault Finding Flow Chart



## NOTES

## PRODUCTS AND SERVICING

### Comprehensive Instrumentation Range

**Sensors, transmitters and related instruments for flow, temperature, pressure, level and other process variables**

#### **Flowmeters**

electromagnetic, ultrasonic, turbine, differential pressure, wedge, rotary shunt, coriolis.

#### **Differential Pressure transmitters**

electronic and pneumatic.

#### **Temperature**

sensors and transmitters, fibre optic systems.

#### **Pressure transmitters.**

#### **Level**

sensors and controllers.

#### **Tank gauging systems.**

#### **Cable-length measuring systems.**

**Indicators, recorders, controllers and process management systems**

#### **Recorders**

circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

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digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.

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**Liquid and gas monitors and analysers for on-line and laboratory applications**

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pH, redox, selective ion, conductivity and dissolved oxygen.

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Online pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.

#### **Monitors and Analysers**

for water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.

#### **Packaged analytical instrumentation laboratories.**

#### **Gas analysers**

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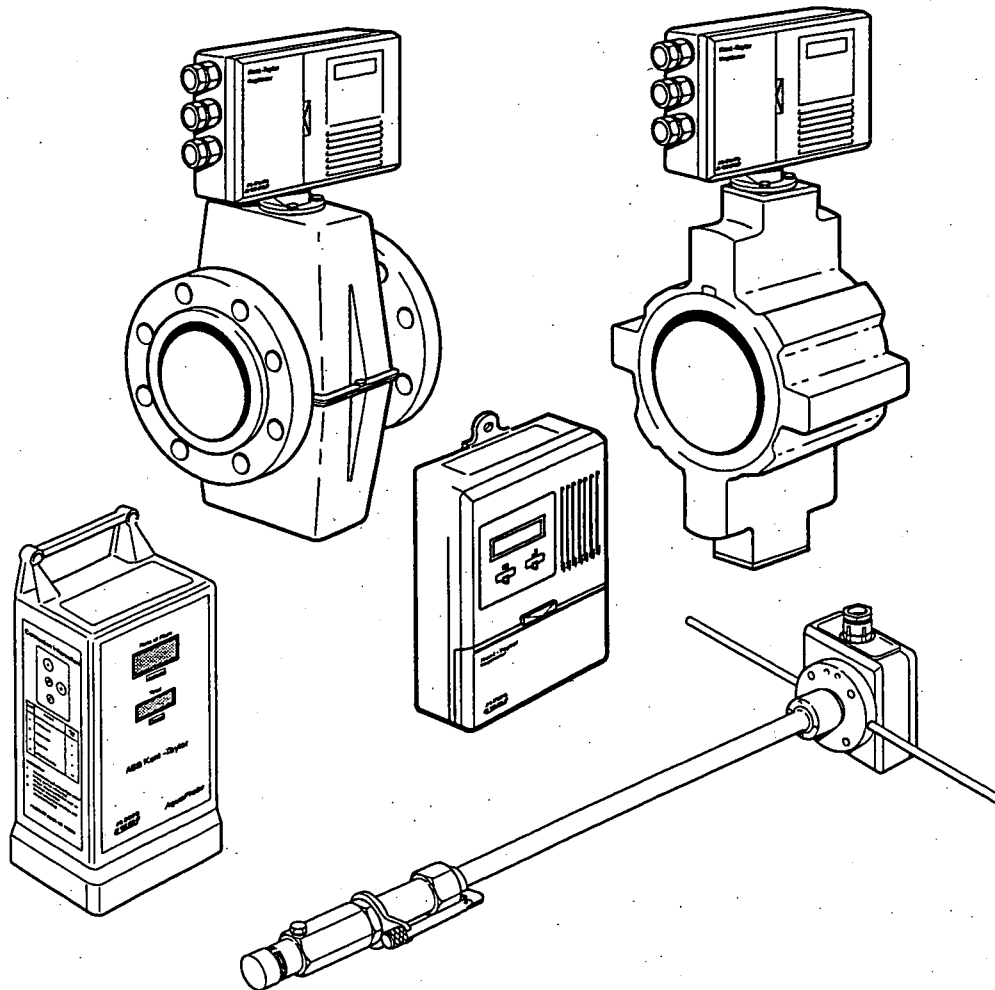
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## Instruction Manual

**MagMaster™,  
AquaMag and AquaProbe  
Electromagnetic  
Flowmeters****BOOK 6  
Accessories and Spares****ABB Kent-Taylor**

**ABB KENT-TAYLOR**

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6. When disposing of chemicals ensure that no two chemicals are mixed.

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**Caution.** An instruction that draws attention to the risk of damage to the product, process or surroundings.



**Note.** Clarification of an instruction or additional information.



**Information.** Further reference for more detailed information or technical details.

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## CONTENTS

### BOOK 6 ACCESSORIES AND SPARES

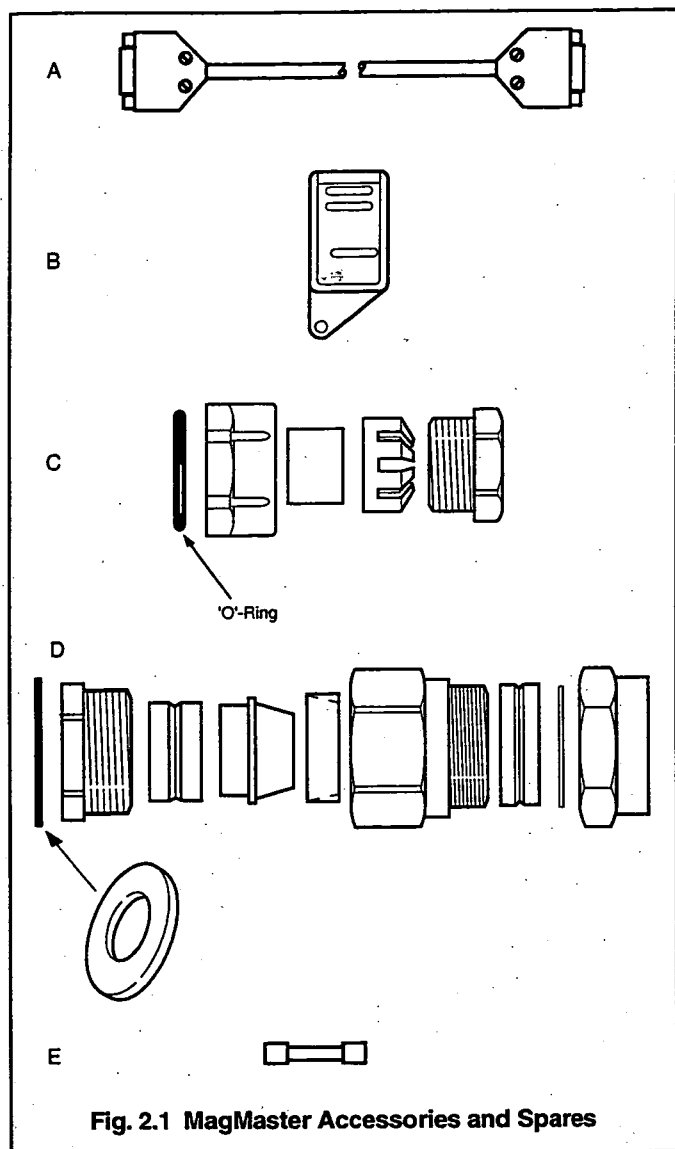
Section	Page
1 INTRODUCTION	1
2 ACCESSORIES AND SPARES	
2.1 MagMaster	2
2.2 AquaMag and AquaProbe	3
2.2.1 AquaProbe Replacement Parts	3

## 1 INTRODUCTION

The items in the following lists may be obtained from the Company, by quoting the relative Part Number.

## 2 ACCESSORIES AND SPARES

### 2.1 MagMaster



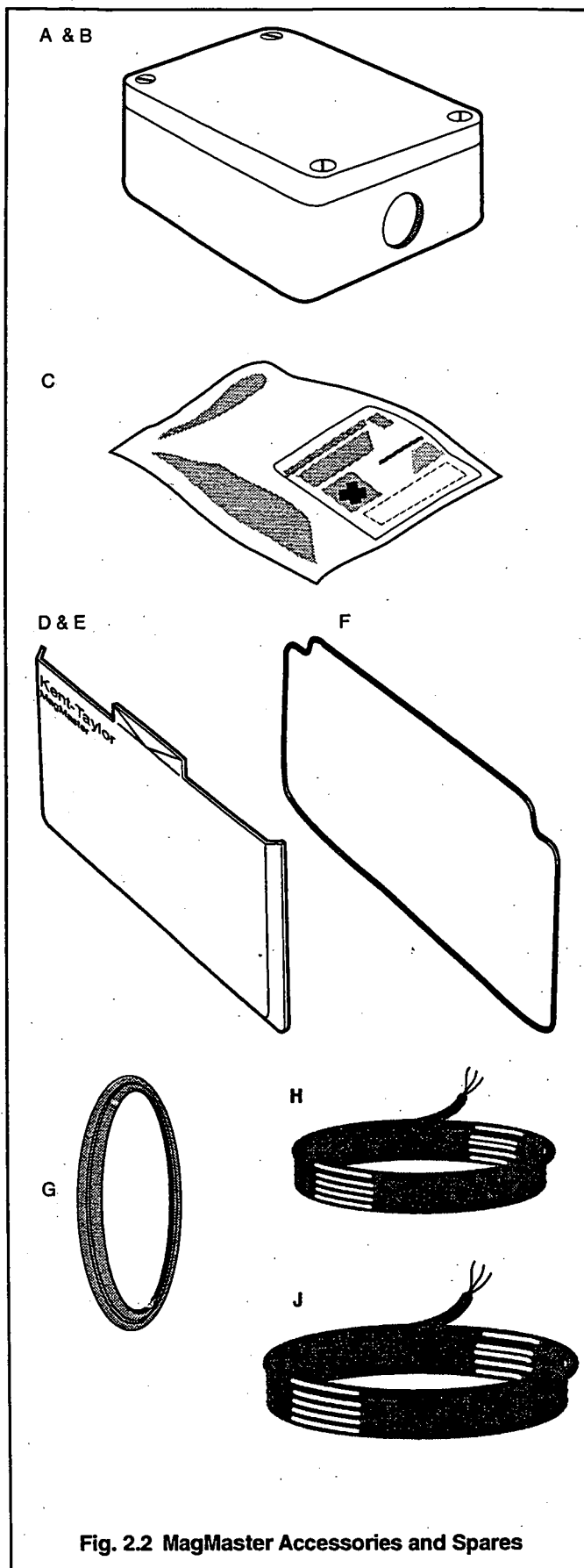
**Fig. 2.1 MagMaster Accessories and Spares**

**Fig. 2.1**

A	Serial Data Lead (MagMaster to PC & Toshiba.)	WEBC 0003
B	Display Operating Wand	MEBX 9902
C	M20 Plastic Gland (with fittings)	MUFA 9912
D	Armoured Gland (with fittings)	MUFA 9913
E	Fuses (see Table 2.1)	
F	HART Command Summary Information	MEFD 0001

**Fig. 2.2**

A	Sensor Cable Junction Box ( M20 fitting)	WABX 0020
B	Sensor Cable Junction Box ( 1/2" NPT fitting)	WABX 0021
C	250g Potting Compound (Standard)	0218474
	(Hazardous Area - 2 Packs Required).	
D	Transmitter Terminal Cover (Remote Version)	MEAX 9916
E	Transmitter Terminal Cover (Integral Version)	MEAX 9915
F	Transmitter Terminal Cover Seal	MEAX 9924
G	Gasket (Hygienic Flowmeter)	see Table 2.2
H	Standard Sensor Cable	Call Sales Office.
J	Armoured Sensor Cable	Call Sales Office.



**Fig. 2.2 MagMaster Accessories and Spares**

Table 2.1 Fuses

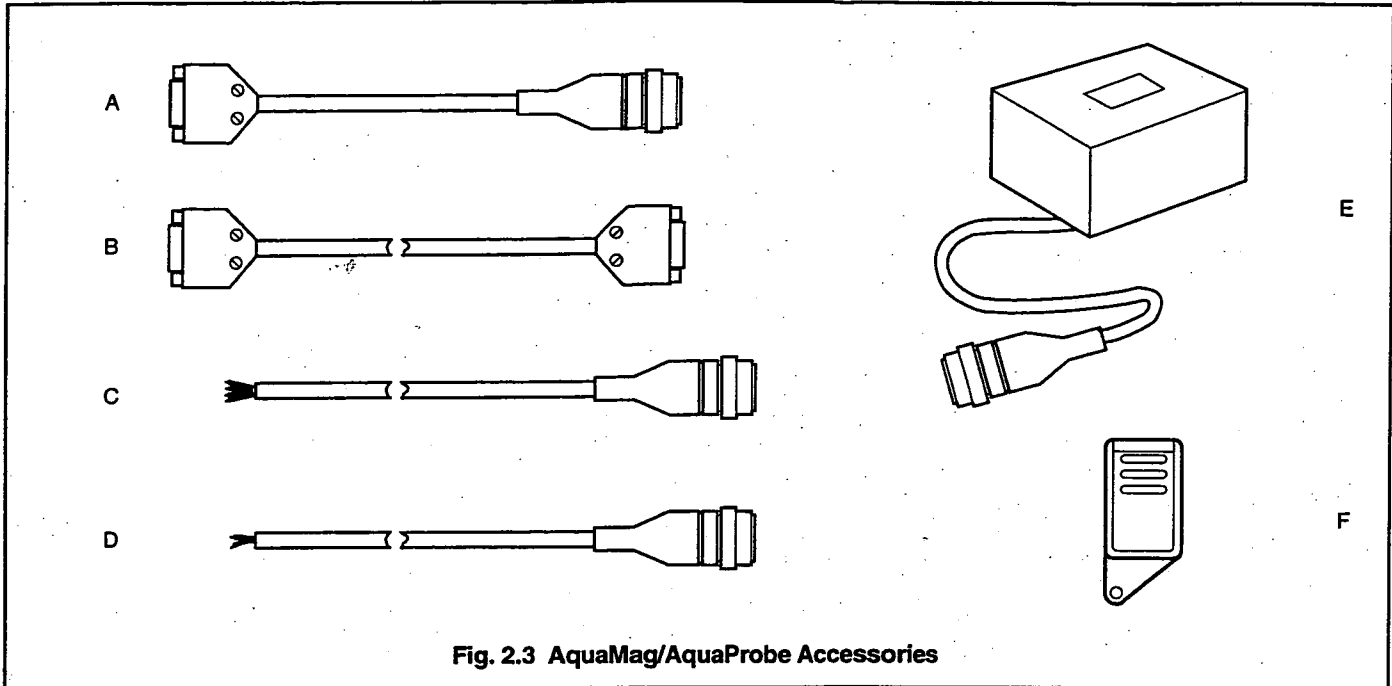
Component Ref.	Part No.	Description	Supplier	Approvals	
				IEC	BS
F1 - DC	B6490	FUSE 3.15A AS.T 20mm	SHURTER 034-3122	IEC 127/111	BS4265
			BUSSMAN S506/3.15A	IEC 127/111	UL BS4265
F1 - AC	B7721	FUSE 500mA AS.T 20mm	SHURTER 034-3114	IEC 127/111	BS4265
			BUSSMAN S504/500MA	IEC 127/111	UL BS4265
			BUSSMAN S506/500MA	IEC 127/111	UL BS4265

Table 2.2 Gaskets (for Hygienic Flowmeters)

Meter Size	Part No.	
	EPDM	Nitrile Rubber
20mm (0.75in)	MRAX2708	MRAX2808
25mm (1in)		
40mm (1.5in)	MRAX2711	MRAX2811
50mm (2in)	MRAX2712	MRAX2812
65mm (2.5in)	MRAX2713	MRAX2813
80mm (3in)	MRAX2714	MRAX2814

## ...2 ACCESSORIES AND SPARES

### 2.2 AquaMag and AquaProbe

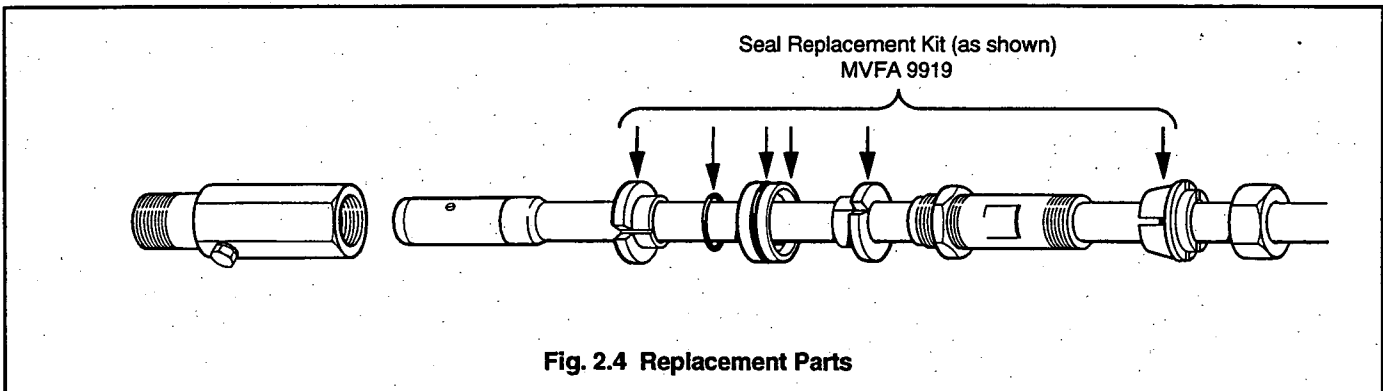


**Fig. 2.3 AquaMag/AquaProbe Accessories**

- A Communication adaptor (to connect to Psion Organiser etc.)
- B Serial Data Lead (to connect PC to 'A' above)
- C Output Cable Assembly (14-core plus screen)
- D Power Supply Lead
- E Battery Pack
- F Display Operating Wand

WEBC 0004  
WEBC 0003  
MVBX 99147  
STT 3162  
STT 3310  
MEBX 9902

#### 2.2.1 AquaProbe Replacement Parts



**Fig. 2.4 Replacement Parts**

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**Cable-length measuring systems.**

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# Instruction Manual

## MagMaster™ Electromagnetic Flowmeters

### BOOK 7 Keypad Version

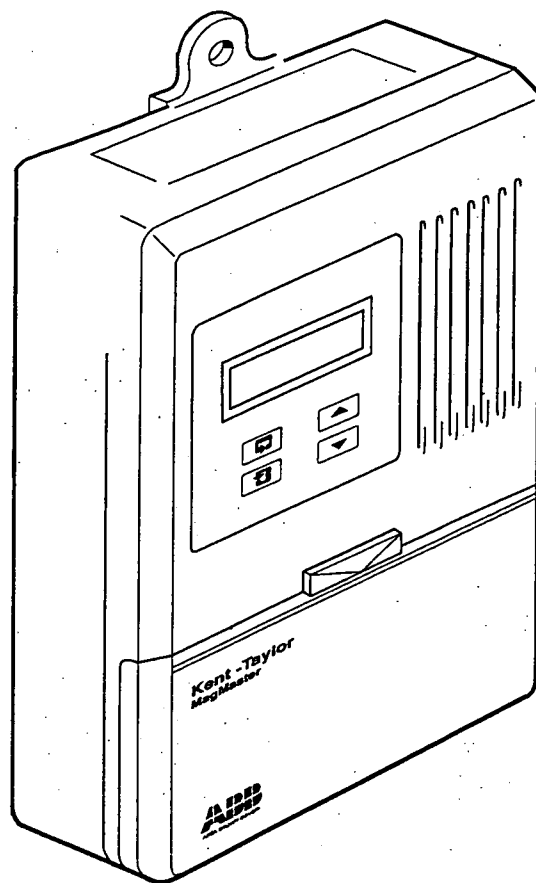


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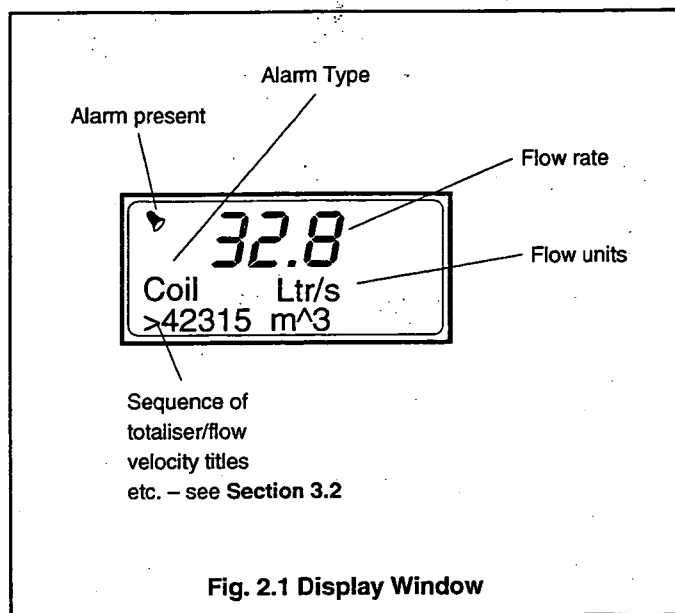
## 1 INTRODUCTION

This manual provides details to enable the Keypad MagMaster™ transmitter to be reconfigured from default parameters or from parameters initially set up by the factory to special order.

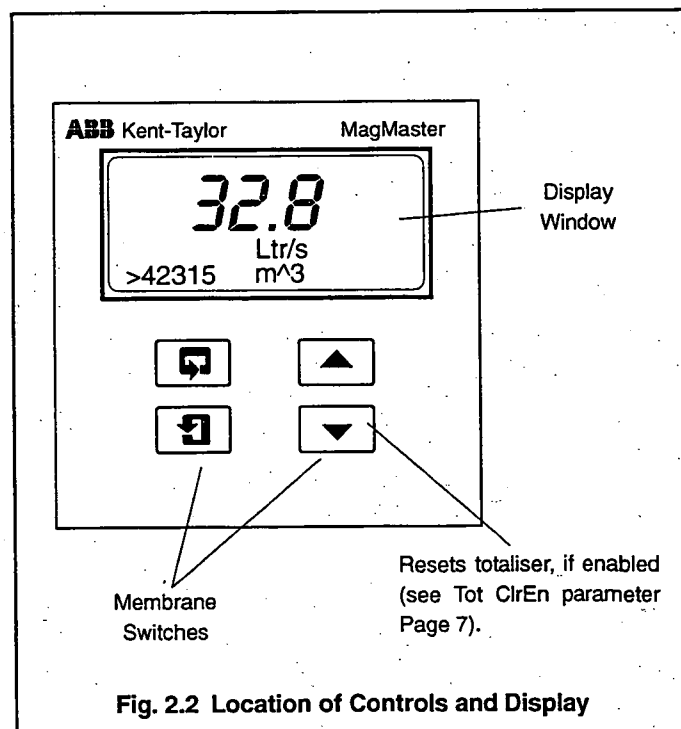
## 2 CONTROLS AND DISPLAYS

### 2.1 Displays – Fig. 2.1

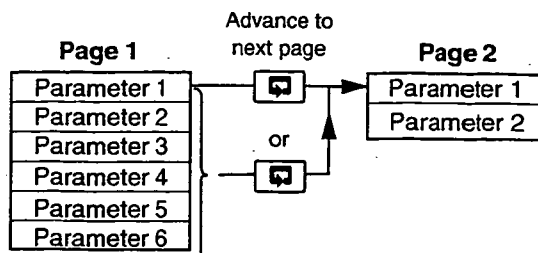
The display comprises a 5-digit, 7-segment digital upper display line and two 16-character dot-matrix lower display lines. The upper display shows the flow value. The middle display line shows alarm codes on the left, when an alarm is present – see **Book 5 Fault Finding**, and flow units in the centre. The lower display line shows user information – see Section 3.1.



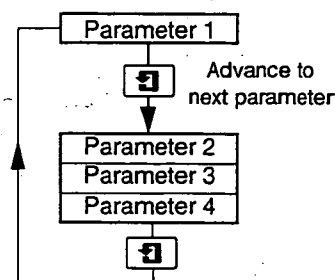
### 2.2 Switch Familiarization – Fig. 2.2



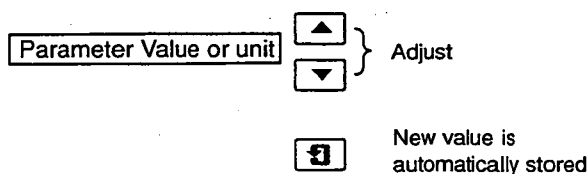
#### A – Advancing to Next Page



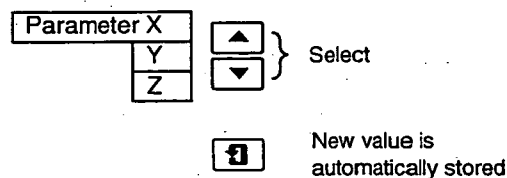
#### B – Moving Between Parameters



#### C – Adjusting and Storing a Parameter Value




#### D – Selecting and Storing a Parameter Choice



**Fig. 2.3 Membrane Switch Functions**

### 2.3 Rapid Reset/Escape

-  Depressing this switch for 5 seconds and then releasing it will exit the menu system and return to normal operating mode.

**Fig. 2.4 Rapid Reset/Escape Switch**

## 3 OPERATION

## 3 OPERATION...

### 3.1 Startup

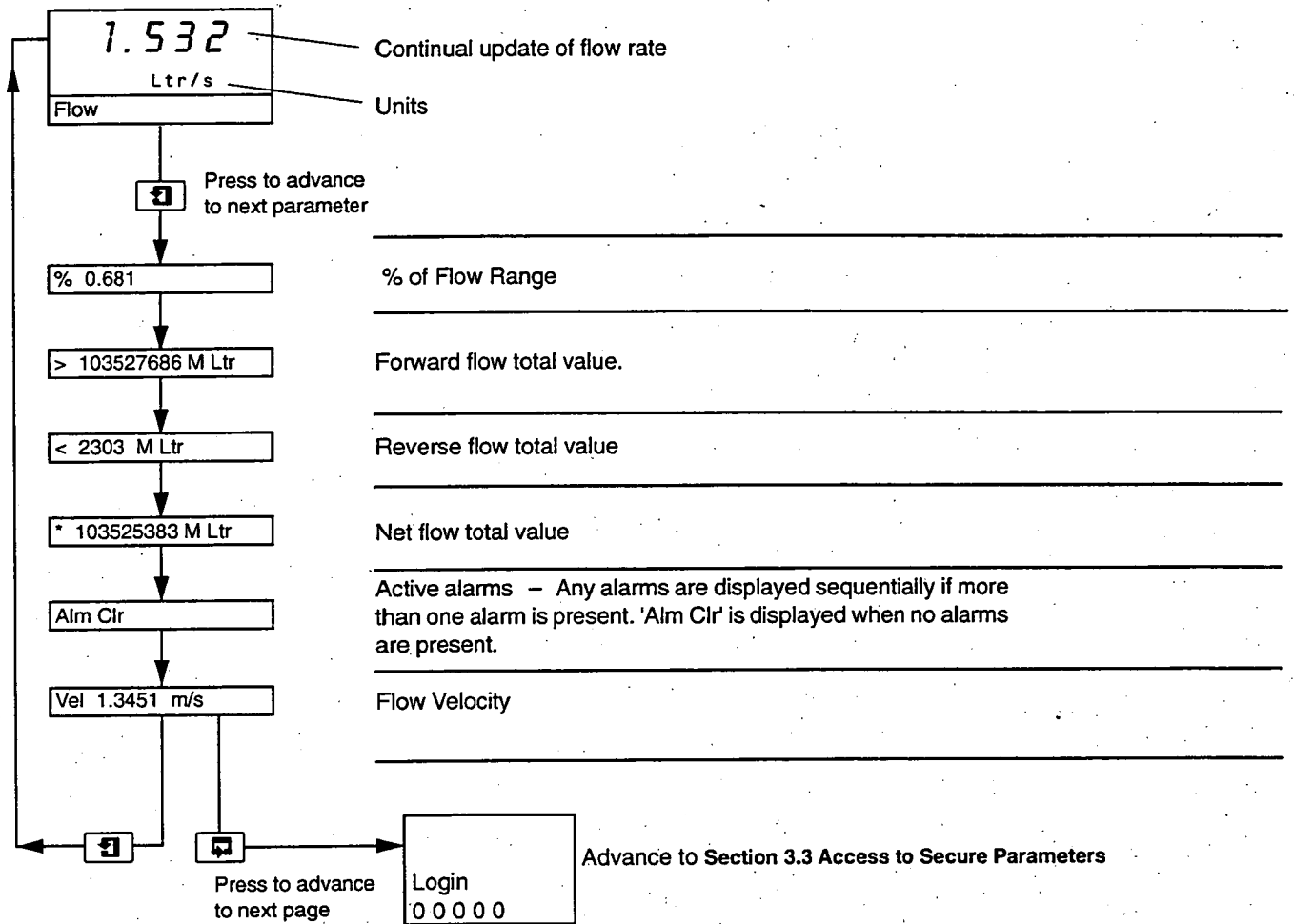
Ensure all necessary electrical connections have been made and switch on the power supply to the flowmeter.

After a short delay, the bottom line of the display will alternate between 'ABB Kent-Taylor' and 'MagMaster V x.x' (MagMaster software version).

In a few seconds the flow rate will appear on the display together with the flow rate units.

### 3.2 Operation

Viewing User Information (Read Only)



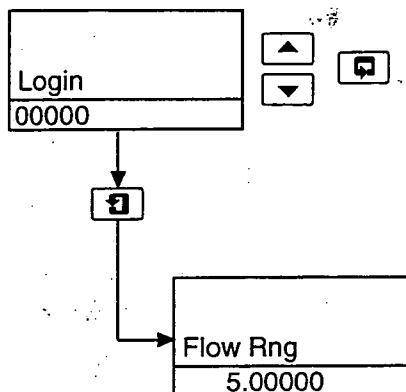
### 3.3 Access to Secure Parameters

A 5-digit security code is used to prevent tampering with the secure parameters

#### 3.3.1 Security Codes

A code number, between 00000 and 99999, must be entered, to gain access to the secure parameters. A default user code of '10760' has been installed, but this may be changed if required with the 'Login Key 1' parameter - see Section 3.4 Menu Layout.

An 'engineer' code (default - 56360) is used to gain access to test procedures, security code settings and parameters not essential at the user level. This code can be changed if required with the 'Login Key 2' parameter - see Section 3.4 Menu Layout.



At the flashing cursor on the first digit of the Login code number, press either or membrane switches to reach the required digit. To set this digit and pass to the next digit, depress the switch. Continue until all digits have been set, and depress the switch to enter the complete code. If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the Operating Page.

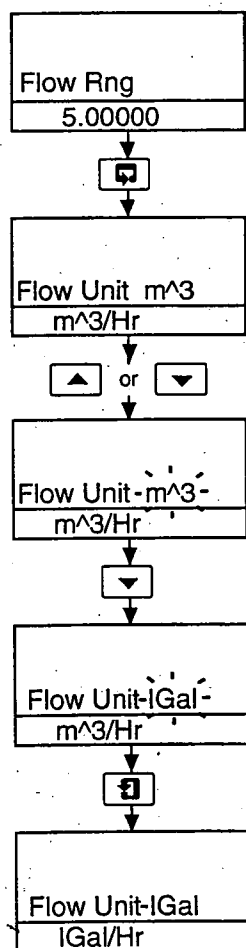
#### Flow Range Parameter

Press to advance to next parameter - see Section 3.4 Menu Layout.

or

Press to advance to next page - see Section 3.4 Menu Layout.

These two switches are used to advance to all subsequent parameters and pages. If a parameter is changed, it is automatically stored on operation of the switch.



#### 3.3.2 Changing Parameter Values and variables

When a parameter is selected, which holds one or more variable units e.g. 'Flow Unit' parameter which can be Litres, Cubic metres, Gallons etc., proceed as follows to change the units: ('Flow Rng' selected).

'Flow Unit' selected.

Press or switch to change the units.

**\*** Note the existing units will flash at the first depression of the or switch, and further switch depressions will change the type of units displayed.

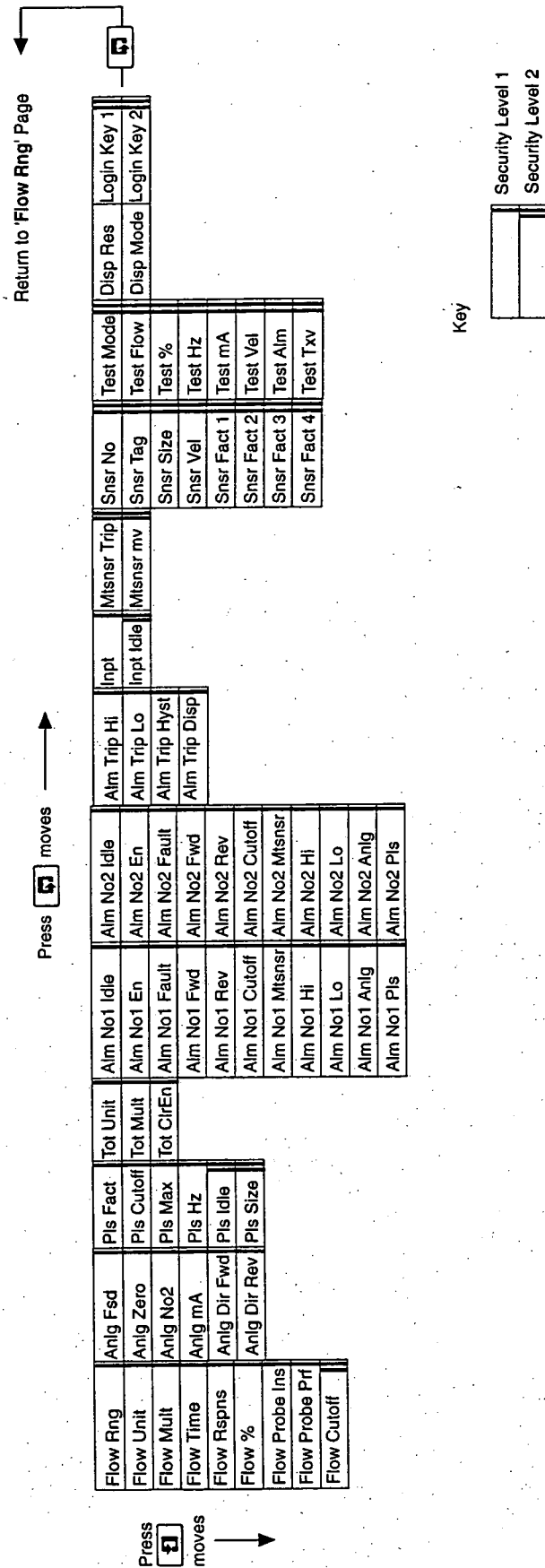
Depressing the switch will now enter the newly selected units.

This type of action is similar for all variable units.

Where numerical values are to be changed, initial depression of the or switches cause the first of five digits to be highlighted by a flashing cursor. Change the value with the and switches, the particular digit with the switch and enter the final selection with the switch.

### 3.4 Menu Layout

Below is a summary of all the parameters contained in the menu.



### ...3 OPERATION

#### 3.5 Parameter Access and Change

The correct security level **MUST** be selected as in **Section 3.3**.

Select the parameter to read the value, or to change it as necessary. All 'live' data displayed is updated each second.

Use the  key to move between pages.

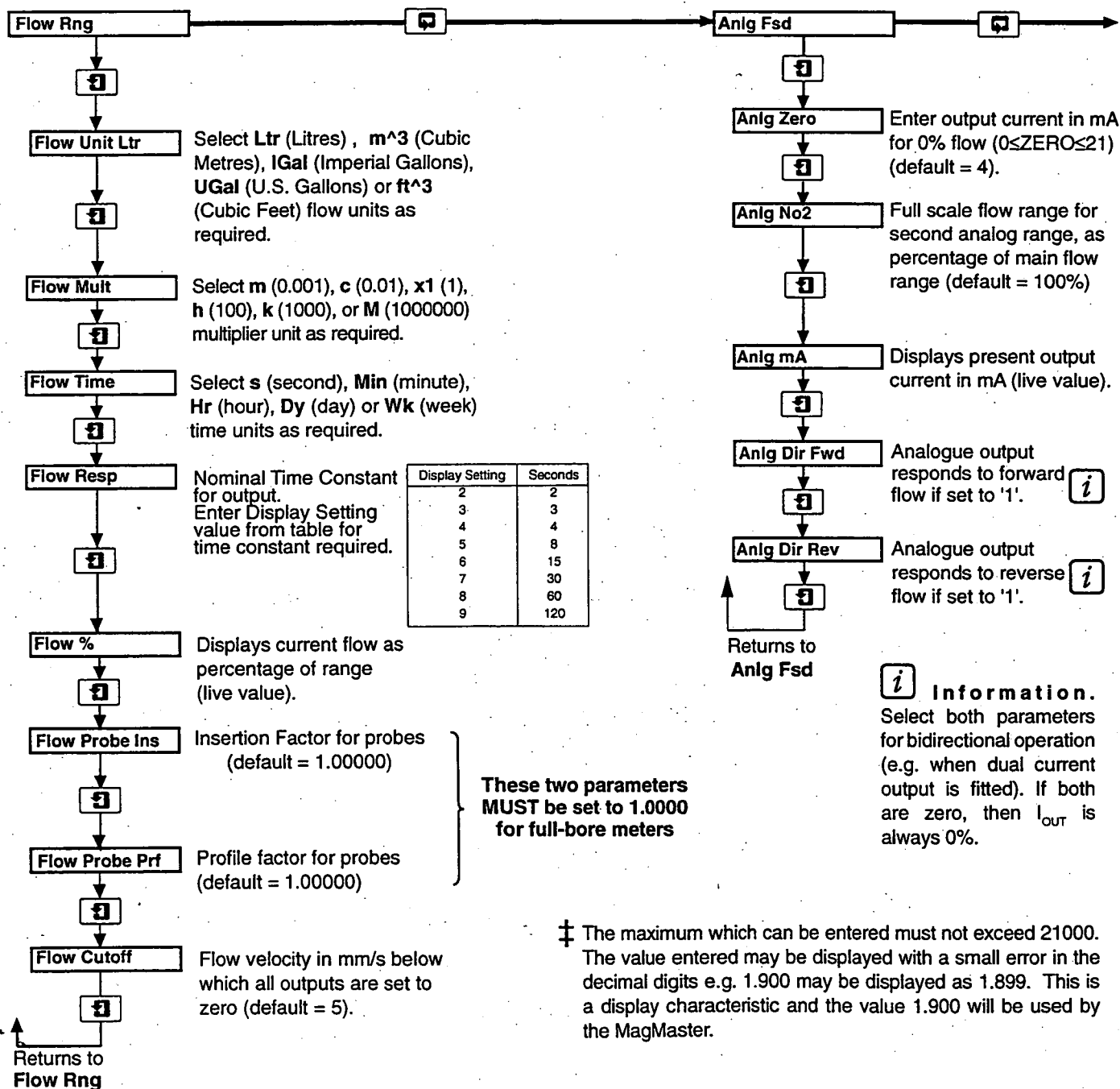
Use the  key to move between parameters.

The  and  keys change displayed values and units.

The  key will accept the chosen value or unit.

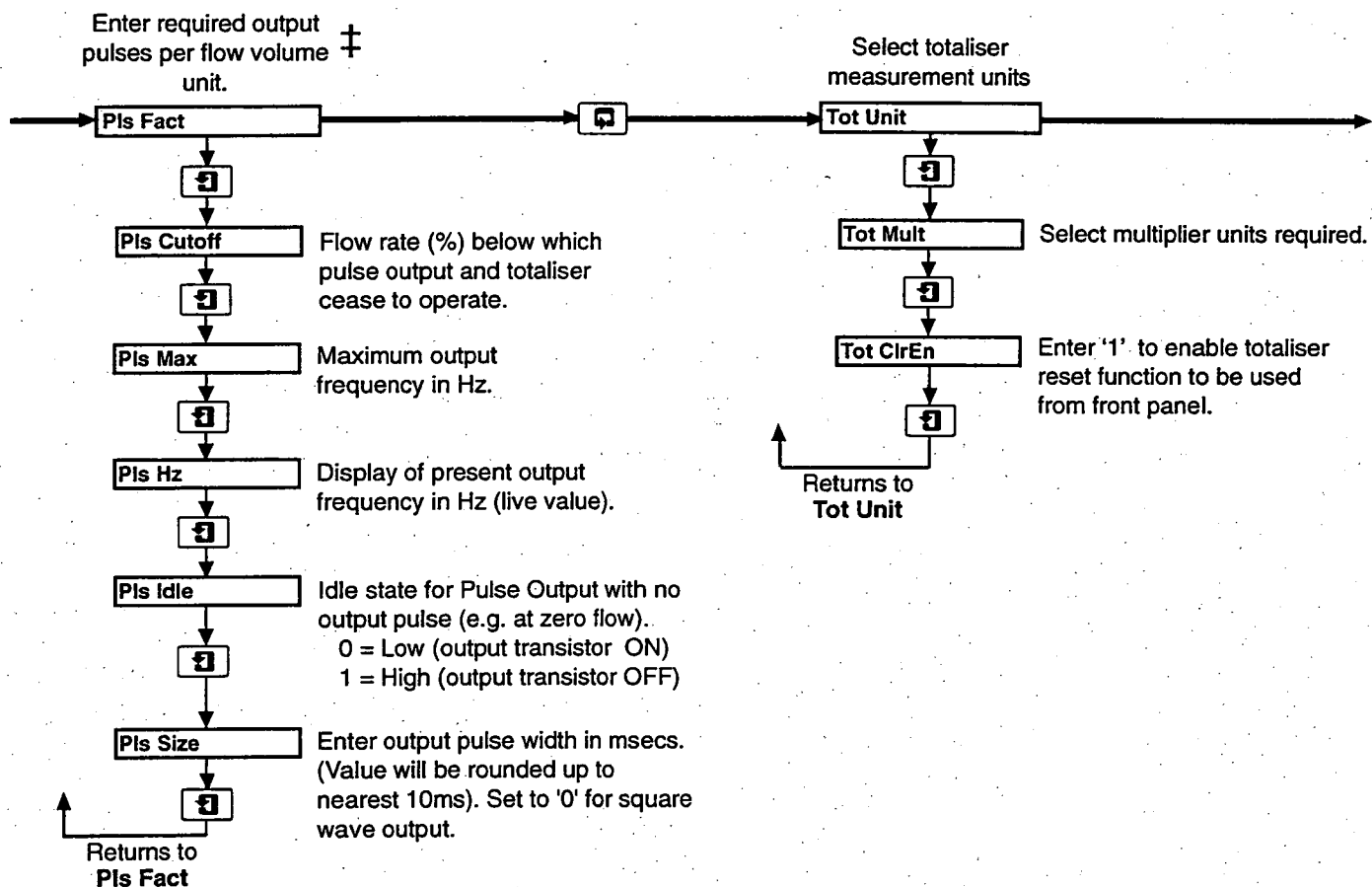
Enter main full scale (100%) flow range (Upper Range Value) in selected flow units (see below)‡

Enter output current in mA for 100% flow ( $0 \leq \text{FSD} \leq 21$ ) (default = 20.)





## ...3.5 Parameter Access and Change



‡ The maximum which can be entered must not exceed 21000. The value entered may be displayed with a small error in the decimal digits e.g. 1.900 may be displayed as 1.899. This is a display characteristic and the value 1.900 will be used by the MagMaster.

### ...3 OPERATION

#### ...3.5 Parameter Access and Change

##### Select Alarm 1 output functions.

'1' = selected. '0' = deselected

Idle state for alarm output. With no alarm active:

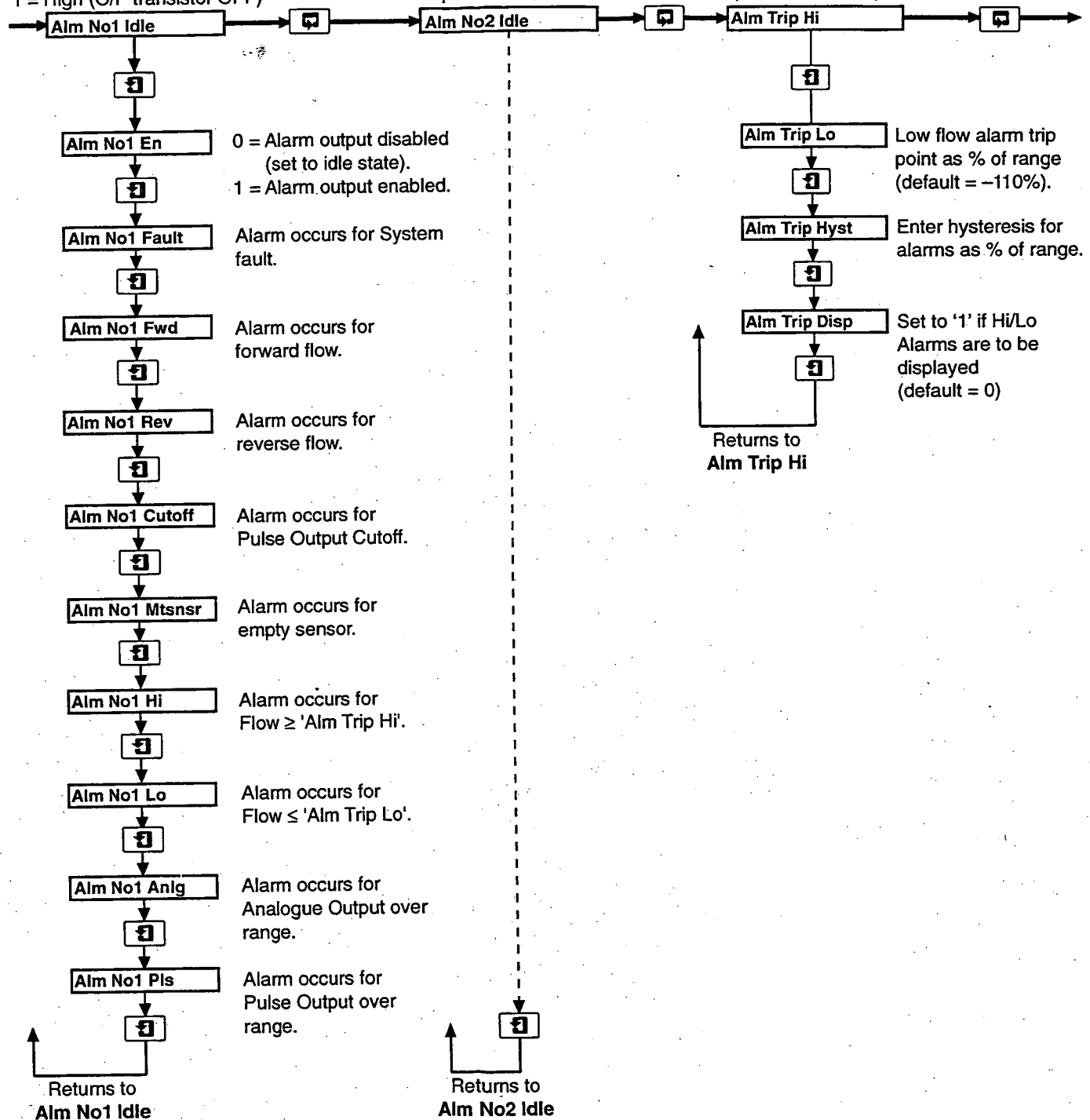
0 = Low (O/P transistor ON)  
1 = High (O/P transistor OFF)

##### Select Alarm 2 output functions.

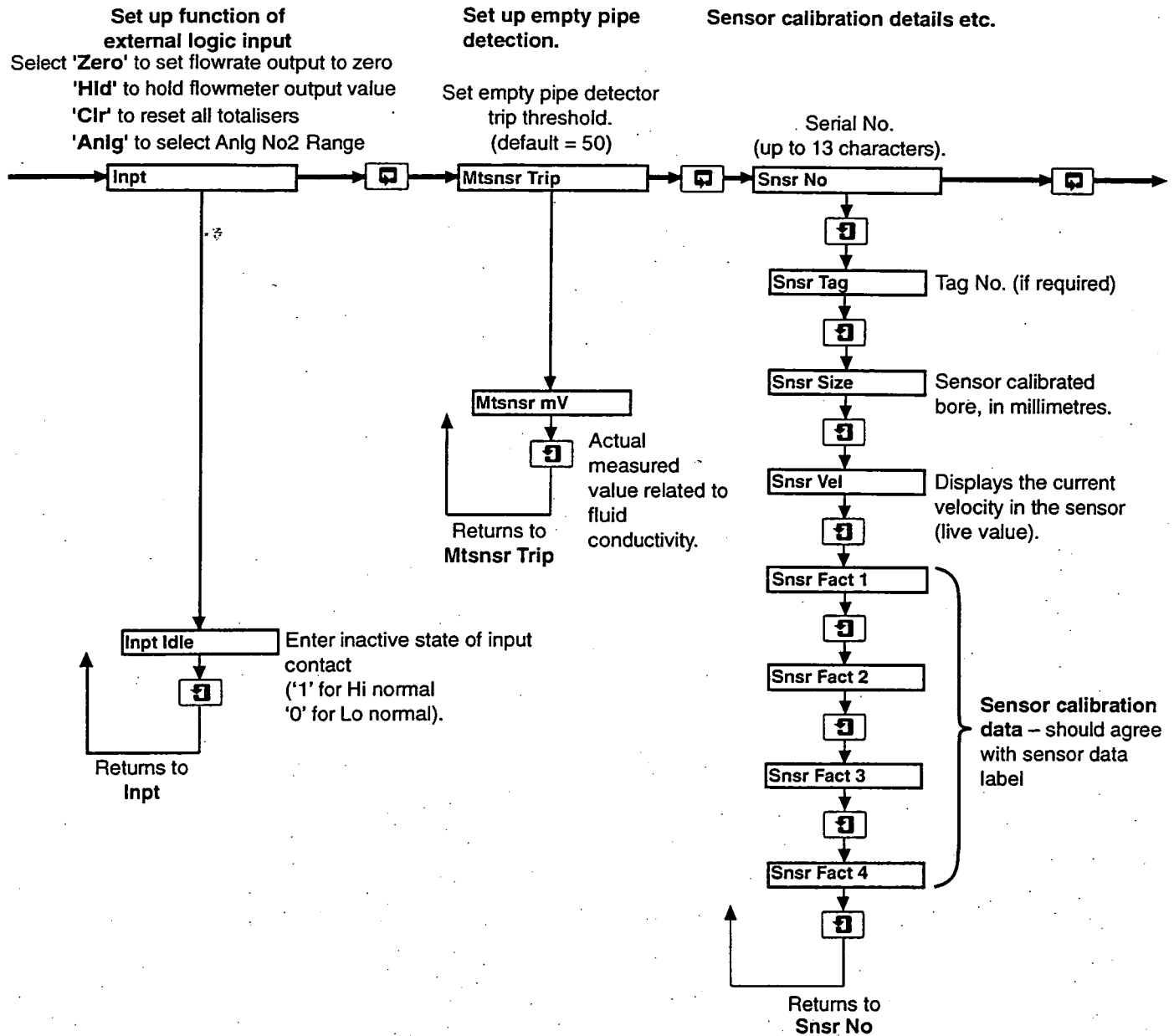
Identical to, but independent of, Alarm 1

##### Select high and low flow alarm trip points.

High flow alarm trip point as % of range (default = +110%).

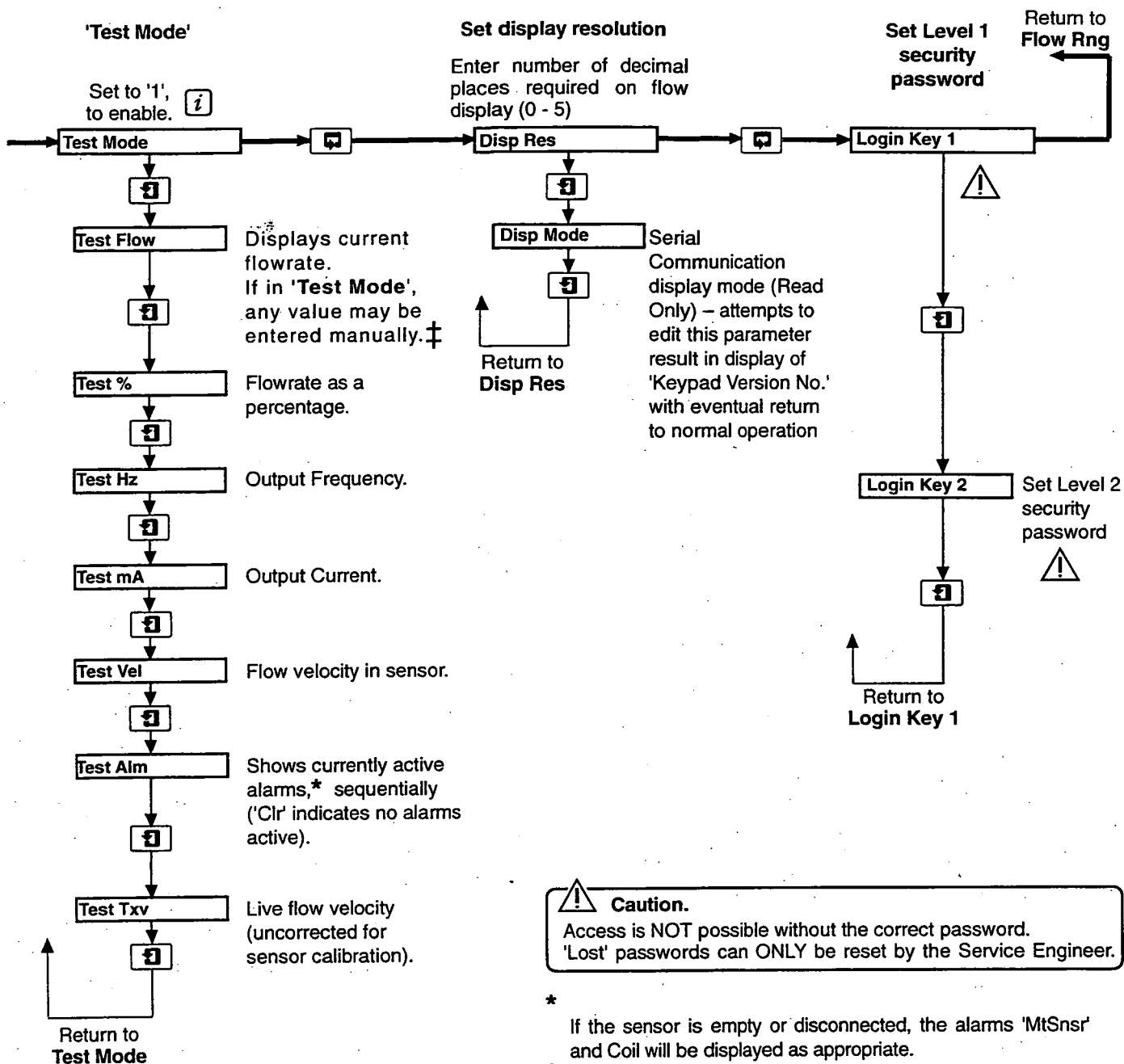


## ...3.5 Parameter Access and Change



### ...3 OPERATION

#### ...3.5 Parameter Access and Change



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## **100T AUTO JET WET PACKAGE**

**c/w**

**3m<sup>3</sup> MINI BULK HOPPER  
and DOSING SKID**

## **INSTALLATION, OPERATION & MAINTENANCE MANUAL**

**ALLIED COLLOIDS REF NO: - Q1250  
EQUIPMENT NO: - 100T/061, BS/0128**



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## **ALLIED COLLOIDS (AUST) PTY. LIMITED**

### **1. INTRODUCTION**

#### **1.0 PREAMBLE**

Allied Colloids is a major producer and world wide supplier of dry and liquid polymer products and has extensive knowledge and experience in the handling and use of these chemicals.

The "Auto Jet Wet" systems are a range of self contained package units for the fully automatic batch preparation of flocculant solutions designed by our engineers to enable maximum efficiency to be obtained from the product conveniently, safely and economically.

Developed independently in Australia to meet the requirement and standards of Australian Industry, extensive field testing and plant experience around Australia has proved the reliability of the Jet Wet Disperser and the Auto Jet Wet System.

The system may, for ease of functional explanation, be identified as four separate sections as follows:

##### **1.0.1 Powder Product Delivery and Bulk Storage System**

Receiving and storage of powder grade flocculants.

##### **1.0.2 Powder Product Metering and Pneumatic Transfer System**

Metering and pneumatic transfer of powder grade flocculant.

##### **1.0.3 Polymer Dissolving and Integrated Storage System**

Dispersion (of powder product), mixing, storage of homogeneous solution and addition to plant process.

##### **1.0.4 Dosing and Dilution System**

Metering and dilution into Client's process

## **2. POWDER PRODUCT DELIVERY AND BULK STORAGE SYSTEM**

### **2.0 INTRODUCTION**

#### **2.0.1 Preamble**

Your powder flocculant bulk handling system is designed to receive, transfer and store powder grade flocculants.

These materials are hygroscopic (moisture absorbing) and it is necessary to ensure the product remains as dry as possible. The following system has been developed to minimise moisture ingress.

#### **2.0.2 System Concept**

The powder flocculant is conveyed in a transportable bin (Pneumodespatcher) which is filled within the confines of the supplier's warehouse. Each bin has a usable capacity of approximately 1.5m<sup>3</sup>.

At the site the truck driver, following the correct instructions and unloading procedures can discharge the contents of the Pneumodespatcher into the Bulk Powder Storage Hopper. Simply, the Pneumodespatcher is pressurised with air from the truck mounted blower to the calculated design pressure for the delivery system and, following the operating procedure, can discharge the Pneumodespatcher in approximately 20 minutes. The Powder Storage Hopper together with its dust filter, ensures that the product is kept dry and free flowing to maintain a flooded head to the powder metering unit situated directly beneath its outlet.

The aforementioned system enables products to be handled in bulk from the warehouse to the Auto Jet Wet with minimum contact being made with the product by human hands. This promotes a clean and dust free operation.

#### **2.0.3 Scope of Supply**

- a) Bulk Powder Hopper - 3m<sup>3</sup> capacity, mild steel construction c/w filler pipe.
- b) Hopper Dust Filter Unit - DCE Vokes Unimaster UMA 70V
- c) Hopper Vibrator Motor - Invicta BK05-2/2
- d) Hopper Low Level Detector - BELL Rotary Paddle Switch
- e) Hopper Discharge Isolation Valve - Turnflo 150NB Knife Gate Valve

## 2.1 DESCRIPTION OF EQUIPMENT

### 2.1.1 Hopper Dust Filter Unit

A DCE Vokes Unimaster UMA70V venting unit is provided to remove suspended dust from the bulk hopper during filling. The DCE Unimaster is a compact filter designed to give efficient, trouble-free service, providing the following instructions are adhered to:

#### Filter Cleaning

Ensure that static air conditions are present before starting the shaker motor; eg. the Pneumodespatcher's blower must be stopped and the pressure inside the hopper allowed to return to atmospheric pressure. This will take approximately 2 minutes.

Energise the shaker motor by pushing the start button on the Auto Jet Wet electrical panel. The shaker will run for a set time then stop (approx 5 minutes).

A weather cowl is available for Venting Units situated outside. When hygroscopic dust (such as is the case with flocculant powder) is being handled or where there is a risk of condensation forming, the Venting Unit should be enclosed in an insulated, weather-proofed housing fitted with suitable louvres.

### 2.1.2 Hopper Vibrator

The Bulk Hopper Vibrator is an asymmetrically weighted vibrator motor mounted on the cone of the bulk hopper which runs whenever the Screw Feeder runs. Its function is to ensure that the Screw Feeder has a constant supply of powder flocculant by preventing "bridging" of the powder across the bulk hopper's outlet.

### 2.1.3 Hopper Low Level Detector

A BELL Rotary Paddle Switch has been provided to give Mini Bulk Hopper low level indication. It is located on the bottom cone of the hopper. The unit consists of a geared motor assembly enclosed in a water-tight housing which is fastened to the wall of the hopper. When the unit is switched on, the paddle rotates at 1 RPM, unless the material in the hopper covers the paddles and inhibits rotation. A built-in slip clutch permits the paddle to be manually rotated in any direction without stripping gears in the shaft of the motor drive.

#### ELECTRICAL SPECIFICATIONS

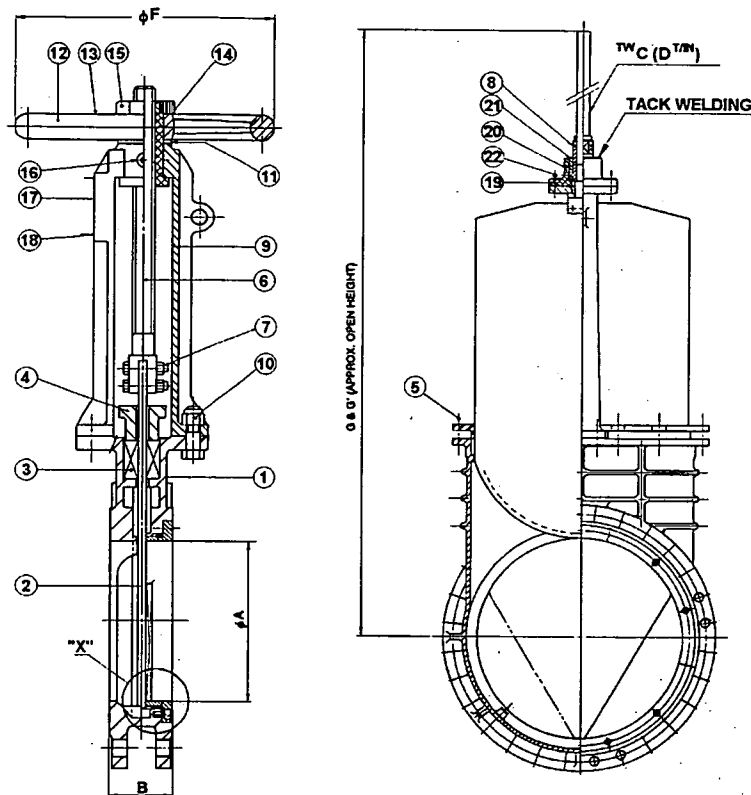
SUPPLY VOLTAGE:	240V AC
MOTOR F.L.C.:	20mA
SWITCH RATINGS:	480 VAC @ 15A
CONFIGURATION:	1 x S.P.D.T.

## 2.1.4 Hopper Discharge Isolating Valve

A Turnflo Knife Gate Valve is fitted to the outlet of the Bulk Hopper to isolate the hopper from the Powder Metering Unit located below it. Knife gate valves feature "pocketless" construction, fluid tightness, bi-directionality, full bore dimensions and high quality finish.

### Dimensions :

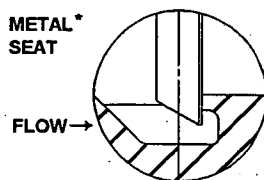
### List of Components:



- 1 Body
- 2 Disc
- 3 Packing
- 4 Gland
- 5 Gland Bolt & Nut
- 6 Stem
- 7 Disc Bolt & Nut
- 8 Yoke Sleeve
- 9 Yoke
- 10 Yoke Bolt & Nut
- 11 Thrust Bearing Washer
- 12 Hand Wheel
- 13 Name plate I
- 14 Lock Washer
- 15 Wheel Nut
- 16 Grease Nipple
- 17 Name Plate II
- 18 Rivet
- 19 Bearing Housing
- 22 Bearing Housing Bolt & Nut
- 25 Body Seat Ring (Teflon)
- 26 'O' Ring (Rubber)
- 27 Body Seat Ring Gland
- 28 Cap Screw

### DETAIL 'X' - SEAT OPTIONS

METAL\*  
SEAT



VALVE SIZE	HEIGHT	6to Top	BORE	FACE-FACE
150 NB	675mm	715mm	152mm	57mm

Diagram 2



## Materials of Construction :

The valves are constructed from the following materials:

Handwheel :	Cast Iron, Grade 14
Bearing Housing :	Stainless Steel, Grade 304
Stem :	Stainless Steel, Grade 304
Thrust Race :	Ball Race, Double sealed
Yoke :	Stainless Steel, Grade 304
Gland :	Ductile Iron, Grade CF8
Wheel Nut :	Stainless Steel, Grade 304
Body Fixing Screws :	H.T. Socket Cap Screws

## Construction Details :

**Body** These valves feature full Stainless Steel construction, comprising of a one piece body with a machined recess for the O-ring seal. The top packing gland is secured using stainless steel bolts and nuts and leakage from the valve stem is prevented by compression of the Packing by the Gland.

**Gate** The gate is made of Stainless Steel with a generous thickness to ensure freedom from flexing under high pressure differentials. The Knife Gate has a machined bevel on the leading edge, with a small land area at its base. When closed, the chamfered knife edge compresses the rubber O-Ring seal, giving drop-tight shut-off. The gate edges are polished to ensure smooth, drop-tight sealing at the Gate/O-Ring interface.

A heavy-duty drive nut transmits Handwheel rotation to the gate, which is fully supported at both sides and centre throughout its stroke. At the point of closing into the seat, the gate is then supported around its entire circumference, ensuring a rigid, bubble-tight closure in the most arduous service.

**Seal** The replaceable seal is a central feature of these valves. This time-proven method of sealing knife-gate valves provides drop-tight closure against relatively high differential pressures and can be easily and inexpensively replaced at site. A retaining groove is machined to precise dimensions in the body and the seal is inserted.

**Operators** Handwheels are normally fitted to these valves, with stems having single-start thread-form which is slower in operation than double-start, but requires lower handwheel torques for a given valve size.

### 3. **POWDER PRODUCT METERING & PNEUMATIC TRANSFER SYSTEM**

#### 3.0 **INTRODUCTION**

##### 3.0.1 **Preamble**

The following equipment is provided to discharge flocculant powder at a constant rate from the hopper and to then pneumatically deliver the powder to the Jet Wet Disperser on the Flocculant Dissolving System.

##### 3.0.2 **System Concept**

The powder metering unit is a compact package arrangement designed to give positive control over delivery quantities and rate of powder product to the Auto Jet Wet preparation unit.

Powder flocculant is fed from the hopper via the Screw Feeder at a constant rate into the air stream from the Flocculant Blower. Air then conveys the powder flocculant to the Jet Wet Disperser Head.

The Powder Metering Unit consists of:

- Screw Feeder.
- Flocculant Blower.
- Heated Receiver Hopper.
- Venturi Ejector.

##### 3.0.3 **Scope of Supply**

- a) Screw Feeder - c/w SEW Eurodrive gearmotor 36RPM, 415V, 50Hz, 0.18KW.
- b) Flocculant Blower - Siemens ELMO-G Model 2BH1-600, 3.0 kW.
- c) Receiver Hopper - fitted with anti-condensation heater.
- d) Venturi Ejector Assembly - c/w TJS Couplings.
- e) 50NB Anti-static Transfer Hose.

### 3.1 DESCRIPTION OF EQUIPMENT

#### 3.1.1 Screw Feeder

The screw feeder is a constant pitch, fixed-speed Auger type unit. The Auger is a stainless steel solid spiral which is supported at the drive end by a reduced 20 - 25 mm flanged bearing and enclosed in a stainless steel tube at its discharge end. The Auger is direct coupled to a SEW Eurodrive double reduction gear motor unit by a mini-flex coupling.

#### 3.1.2 Flocculant Blower

The Siemens ELMO-G blower plays an important part in the system, in that it supplies the necessary air volume and pressure to ensure effective pickup and delivery of the powder flocculant (via the venturi ejector and anti-static hose) to the disperser head on the Flocculant Mixing System facility.

The blower has been designed and constructed with only one moving part - the impeller - which rotates within the housing and draws in air as it passes the inlet port. The air is compressed by the rotation of the impeller and forced out of the discharge port and, because the impeller rotates without making contact with the housing, abrasion does not occur so outlet filters therefore are not required.

The compression system is 100% oil-free as the bearings are located outside the impeller housing. The inlet/outlet connections incorporate noise dampers so that silencers or a hood are not necessary.

Before commencing reassembly all parts should be thoroughly cleaned, reworked if necessary and inspected before re-use.

**Note:** Before beginning any work on ELMO gas-ring blower, ensure that it is visibly disconnected from the electrical supply system.

#### 3.1.3 Heated Receiver Hopper

The heated receiver hopper is provided to funnel the powder product and warm/dry air from the Screw Feeder discharge to the open orifice of the venturi ejector. The hopper consists of a folded cone within a cone with a cavity of approximately 15mm left between the two cone sections, into which approximately two metres of heating tape has been wound, around the inner cone. A layer of insulation material is then applied over the heating tape to ensure that the majority of the heat is transmitted to the internal air space of the hopper, heating and drying the air within. The assembly is a sealed unit, with the connections to the heater element being made in a junction box mounted on the outside of the hopper.

The heated hopper has been provided with a lid to prevent large amounts of moist air, debris, etc. from entering the hopper, but to allow access for screw feeder calibration and the provision for the venturi ejector to draw air as required. (see Diagram 3 overleaf)

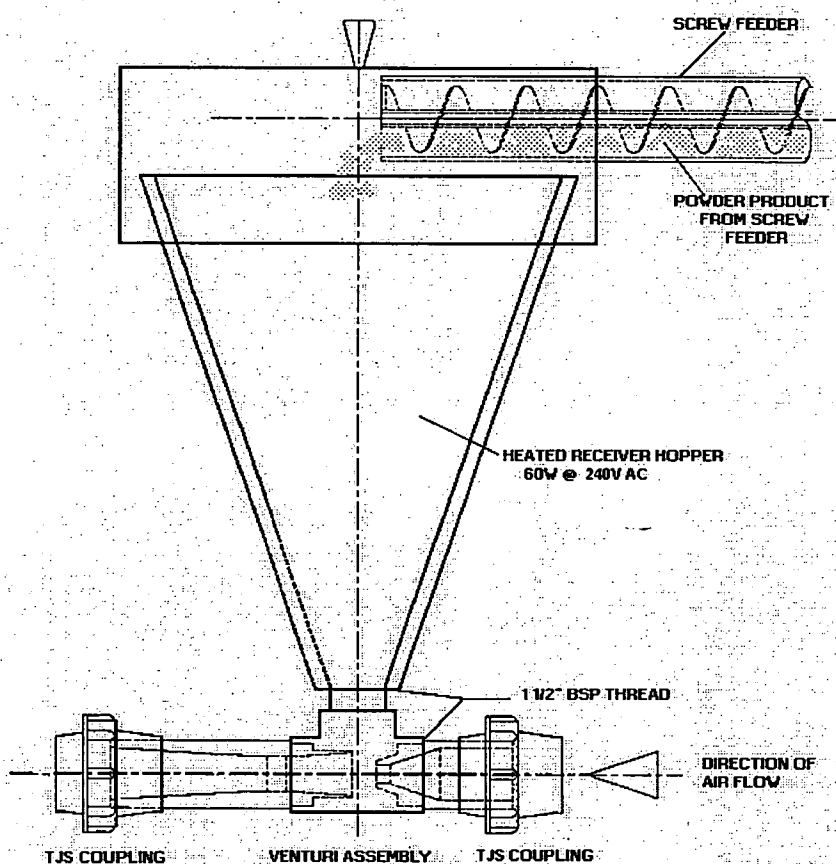
### 3.1.4 Venturi Ejector

This device is affixed to the outlet of the Heated Receiver Hopper and is incorporated into the exhaust piping from the blower to accept the volume of air flow from it. The powder product in the hopper is drawn into the venturi orifice by utilising the principles of entrainment, thereby inducing fluidability and the required velocity to the product to enable it to be conveyed to the mixing facility.

The venturi ejector should be kept clean and free from all contaminants which may produce any form of blockage or interference to flow. Regular checks should be carried out to ensure the venturi is clear. (see Diagram 2 on this page)

**Note:** If the venturi ejector is removed for maintenance it is essential that all connections etc., be sealed against air/product loss on reassembly.

#### HEATED RECEIVER HOPPER (240V AC) AND VENTURI ASSEMBLY



**Diagram 2**

### 3.2 CALIBRATING THE POWDER METERING UNIT'S SCREW FEEDER

1. Isolate screwfeeder as per site requirements.
2. Remove the heated receiver hopper lid.
3. Arrange for the output from the screw feeder to be caught in a suitable container of known weight. Ensure that the container for catching the powder is empty, clean and dry.
4. Ensure that the Bulk Hopper is partly full of powder flocculant.
5. Open the Bulk Hopper Discharge Isolation Valve.
6. Start the screw feeder. **Beware of the rotating feeder scroll in the feed tube.**
7. As soon as powder starts to be dispensed from the feed tube of the screw feeder, start timing the powder discharge. Allow the unit to run for one minute, then stop the screw feeder and isolate the motor.
8. Weigh the container and powder and calculate the weight of powder delivered by subtracting the weight of the empty container (step 3) from the total weight.
9. Measure the **working** volume of the Mixing Tank i.e. the volume between the low level setpoint and the high level setpoint.
10. Calculate the weight of powder required to make up the desired solution strength in the working volume.

$$\text{Weight of powder required (kg)} = \text{Working volume (litres)} \times \frac{\text{Solution strength (\%)}}{100}$$

**Do not exceed the maximum solution strength recommended by Allied Colloids without first seeking further advice.**

11. Calculate the time period required for the screw feeder to deliver the required weight of powder (as per calibration calculation) and set the Screw Feeder time in the DCS control system accordingly. Write this value in the space provided at Section 5.4.5 of this manual.
12. Set the mixer timer to time period desired. Write this value in the space provided at Section 5.4.5 of this manual.
13. Replace the heated hopper lid.

## 4. **POLYMER DISSOLVING AND INTEGRATED STORAGE SYSTEM**

### 4.0 **INTRODUCTION**

#### 4.0.1 **Preamble**

The Auto Jet Wet Polymer Dissolving Unit is used to efficiently disperse a solid grade of polymer, and to mix it into a homogeneous solution which will be transferred into a storage facility ready for addition to the plant process as required. This solution may be relatively concentrated (as recommended by ALLIED COLLOIDS) in which case further in-line dilution is required during addition to process. Alternatively, it can be added to the process without further in-line dilution.

The system has been designed to operate on a continuous hourly cycle, but this may be altered to suit (further advice should be sought from ALLIED COLLOIDS prior to any change being made).

#### 4.0.2 **System Concept**

Pressurised air conveys the flocculant from the Powder Metering Unit to the Jet Wet disperser on the Flocculant Mixing System. The flocculant/water mix then falls into the agitated Mixing Tank where it is further mixed by the Agitator. After a predetermined time, the flocculant solution is transferred to the Storage Tank.

The cycle is then repeated.

Sequence control is achieved using level probes and timers, with all associated control equipment being housed in a waterproof control cabinet.

#### 4.0.3 **Scope of Supply**

The following items are supplied as a package to automatically prepare flocculant solution, transfer it to the incorporated storage facility and dose to the customer's process line:

- a) Mixing Tank - 1000 litre capacity, mild steel c/w drain and overflow connection.
- b) Storage Tank - 2000 litre capacity, mild steel c/w drain and overflow connection.
- c) Water supply controls comprising: Pressure gauge - RB (0-1000 kPa); Flow Switch - Ultra F25B; Water Supply Solenoid valve; Manual Isolating ball valve.
- d) Jet Wet Disperser - stainless steel head and clear acrylic tube.
- e) Agitator - Lightnin XJ43, slow speed stainless steel shaft and dual impellers.
- f) Level control probes and Floatless Level Switches - Omron 61F-GP-N.
- g) Transfer Valve - Burkert 3001 Motorised Valve, 50NB, 240VAC

## 4.1 DESCRIPTION OF EQUIPMENT

### 4.1.1 Jet Wet Disperser

The essential component of the automatic Polymer Dissolving System is the patented Allied Colloids Jet Wet Disperser. This unit ensures complete dispersion of solid grade flocculants in water without the formation of lumps, and features a reliable self-cleaning action essential for effective operation of a continuous automatic flocculant preparation system.

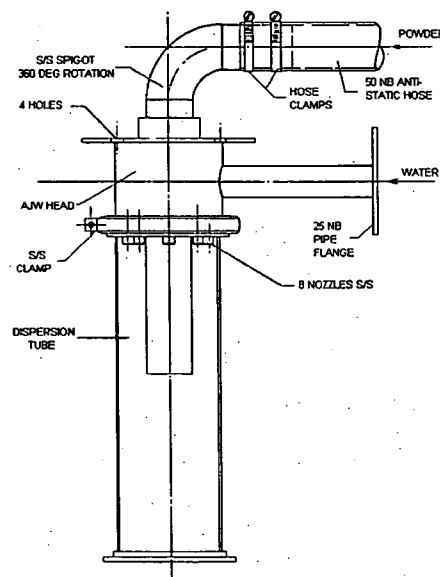
Every particle of flocculant delivered to the Jet Wet Disperser by the high velocity air stream from the Venturi Ejector is wetted in an internal spray pattern produced by nozzles set in the stainless steel head. Simple in construction, it comprises a single cavity designed to distribute the required volume/pressure of water via a predetermined pattern of eight x 6 mm diameter nozzles. These create a complete curtain of water through which the powder particles must pass.

The transition from the 50 mm nominal bore anti-static hose to the Disperser head is achieved via the Disperser Spigot. The spigot is designed to provide a constant delivery point for the powder at the water curtain and, at the same time, induce a slight venturi action which assists in drawing the powder product into the water curtain.

The disperser spigot should be descaled externally and wire brushed internally to clear powder buildup and prevent possible contamination.

The entire water/powder combination is funnelled, via the Disperser Tube, to the Mixing Tank below the Jet Wet Disperser. The tube is constructed of clear acrylic which enables an easy viewing situation for the operator and maintenance personnel to view the operational state of the disperser and control equipment.

The disperser tube should be washed clean using light detergent and always be kept clean.



ALLIED COLLOIDS  
25mm JET WET DISPERSER

Diagram 3

#### 4.1.2 Water Supply Control Valve

A Burkert 240 Volt electrically-actuated solenoid valve has been selected for the water control valve. The valve body is made of brass and the solenoid is protected to IP65. As such, these valves are extremely reliable and eliminate the need to run instrument air to the area, which often can be an expensive exercise.

The valve operates on the fail-safe principle (i.e. closes on de-energising), therefore eliminating problems due to power failure.

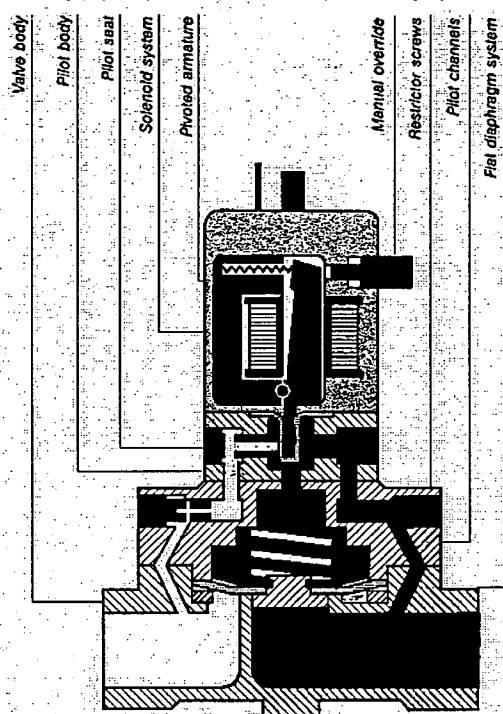


Diagram 4

#### 4.1.3 Water Supply Flow Switch

The Ultra F25-B Flow Switch has been specifically developed to fill the need for a flow sensor, capable of working reliably in applications which metal flow switches fail. The switch is made from glass reinforced polypropylene and glass coupled polycarbonate. It has been specifically designed to integrate into plastic piping systems and to enhance the advantages of such systems. Total avoidance of metal components, in the fluid stream, has been achieved.

#### 4.1.4 Agitator

A Lightnin XJ43 slow speed, single-impeller fixed agitator is provided to further mix the flocculant solution. The agitator is mounted off-centre in the Mixing Tank so as to generate a similar flow pattern to that achieved by a baffled tank but without using baffles, thus preventing shear problems associated with flocculants. One fixed-pitch impeller is fitted and its rotation set so as to provide a downwards pumping action.



#### 4.1.5 Level Control Probes and Floatless Level Switches

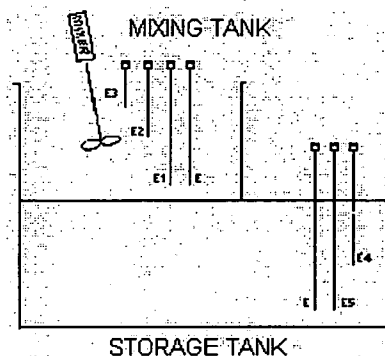
##### a) Description of Probes and their Functions

The level control probes each consist of a molded head and a stainless steel electrode.

The probe head is manufactured by Allied Colloids Australia as a two-part arrangement, allowing electrical personnel access for connection but, once sealed, maintaining a moisture-tight cavity. Electrical cable entry is provided via "Liqua-tite" connectors.

The electrodes are manufactured by Allied Colloids Australia from stainless steel hollow tube with outside diameter of 19mm and are sheathed with heatshrink tubing down to 30mm from the tip of the probe. The length of a particular probe is determined by the operational task which it is to perform.

**Diagram 5**



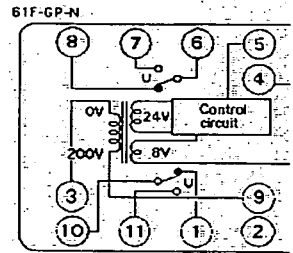
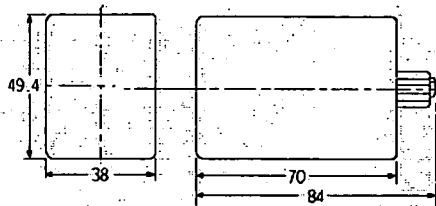
- |    |   |   |    |   |   |
|----|---|---|----|---|---|
| E  | - | Earth Probe (same length as E1)                                 | E4 | - | Starts transfer when level drops below probe. Note : this zone must be able to accept a complete batch without overflowing the tank. (Transfer will not start until after mixing time has elapsed.) |
| E1 | - | Starts batch, opens water valve, starts blower                  | E5 | - | Optional - to stop dosing pump (if fitted) from running dry.  |
|    | - | Stop transfer, complete batch (approx 20mm above suction pipe). |    |   |   |
| E2 | - | Set above lower agitator propeller                              |    |   |   |
|    | - | Starts screw feeder & agitator, initiates screw feeder timer.   |    |   |   |
| E3 | - | Closes water valve, stops blower, initiates agitator timer.     |    |   |   |

##### b) Omron Level Controller :

An Omron 61F-GP-N Floatless Level Switch is connected to each of the level probes to provide switching functions for the control circuitry of the Flocculant Mixing System. Unlike ordinary level switches that use a float for level detection, the 61F switch uses probes to electrically detect the liquid level. The electronic amplifier contained in the switch drives a changeover relay to provide the switching function, with the relay energising when the liquid covers the end of the probe and de-energising when the liquid subsides below the probe. (see Diagram 6)

**Diagram 6****Connections :**

- |                   |                    |
|-------------------|--------------------|
| 1 OUTPUT 1 N.C.   | 7 OUTPUT 2 N.O.    |
| 2 NOT USED        | 8 OUTPUT 2 N.C.    |
| 3 CONTROL NEUTRAL | 9 CONTROL ACTIVE   |
| 4 PROBE GROUND    | 10 OUTPUT 1 COMMON |
| 5 PROBE E1        | 11 OUTPUT 1 N.O.   |
| 6 OUTPUT 2 COMMON |                    |

**Diagram 7****Dimensions :****4.1.6 Transfer Valve**

A Burkert 3001 electrically actuated 50mm full bore ball valve is provided to control the transfer of solution from the Mixing Tank to the Storage Tank below it. The Rotary Actuator is a compact, high-performance long-life drive element, featuring an epoxy resin body and a fully encapsulated motor. The choice of materials and the unit's construction ensure that the units require no maintenance, even in aggressive atmospheres and that thermal loadings are minimised by efficient dissipation of heat.

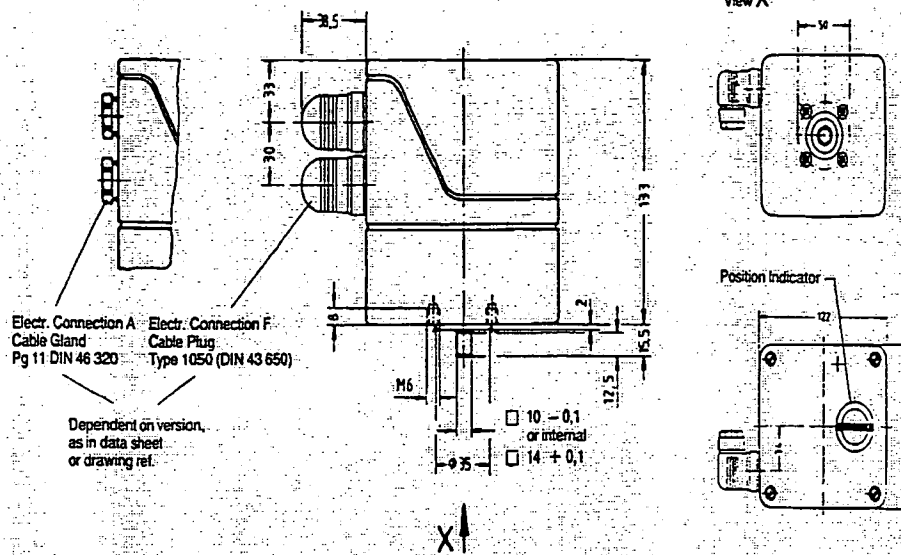
The electric actuator consists of a maintenance-free epoxy-encapsulated AC capacitor motor mounted to a spur gearbox which is lubricated for life. The motor, gearbox and electrical controls are hermetically enclosed in an impact-resistant, square body with a "Makrolon" cover which is removed in order to make the internal connections or to adjust the positioning cams. PG-11 threaded cable glands to DIN 43650 are provided for the electrical connections.

The maximum instantaneous torque output is 60 (150) Nm. Rotation times are 7, 14 and 28 seconds for 90° rotation. The actuator is directly operated by the supply voltage via a changeover contact, the actuator switching itself off once the desired rotation limit has been reached. Two internal single-pole changeover type limit switches are provided for determining the rotation limits. These can also serve simultaneously as basic feedback signallers, since the second contact of the changeover limit switch not required for motor control is wired to the terminal block. The limit switches are operated by means of cams mounted on a camshaft within the actuator housing, this camshaft being driven simultaneously along with the main drive shaft. The operating points of the cams are adjusted by means of an 11mm A/F open ended spanner.

The Rotary Actuator incorporates an integral temperature cut-out, which protects the actuator from overheating, and a built-in motor brake for the rest position, rated at 60 Nm. The actuator is provided with a standard flange interface to ISO 5211/1 for mounting to a 50mm full bore ball valve.

**Diagram 8**

Dimensions:



## **5.0 DOSING AND DILUTION SYSTEM**

### **5.0.1 SYSTEM CONCEPT**

Three dosing pumps c/w in-line systems are provided to regulate the flow and concentration of the final product. The dilution water is set manually via an adjustable globe valve and rotameter.

### **5.0.2 SCOPE OF SUPPLY**

- a) Three (3) CBO21 Monobloc pumps c/w three (3) 0.75kW, 4 pole, 415V electric motors.
- b) Common suction manifold c/w individual manual ball valves.
- c) Individual discharge manifolds c/w non-return valves.
- d) Individual in-line dilution systems, complete with water isolation ball valve, non return valve, adjustable globe valve, rotameter and static mixer.

## 5.1 DESCRIPTION OF EQUIPMENT

### 5.1.1 Dosing Pump

Three Monobloc CBO21 dosing pumps on a common skid are provided for dosing the flocculant solution from the storage facility to the plant process.

The Mono Pump utilises an extremely simple pumping mechanism comprising of a resilient stator in the form of a double internal helix and a single helical rotor as shown below. The rotor maintains a constant seal across the stator, and this seal travels continuously through the pump, giving a uniform positive displacement. The single helical rotor rolls in the stator with a slight eccentric motion.

**Diagram 13**

Operating principle of a mono pump showing its helical rotor in the stator.



The pump employs only one gland; there are no valves or gearing and lubrication of the rotor and stator elements is provided by the liquid being pumped. The steady continuous rotation and the exceptionally low velocity of flow through the pump contribute towards freedom from wear and, when maintenance is eventually required, replacement parts can be quickly and simply fitted.

### **5.1.2 Dilution System**

Each dilution consists of the following main components:-

- 40 NB Ball Valve - Brass
- 40 NB Burkert Solenoid Valve Brass 240 VAC
- 40 NB Adjustable Glove Valve - Brass
- 65 NB Stubbe Rotameter 1500-15000L/hr
- 40 NB Non Return Valve - Brass
- 50 NB Static In-line Mixer – Sardik 050-162

## 6. **INSTALLATION AND COMMISSIONING OF EQUIPMENT**

### 6.0 **RECEIPT AND STORAGE INSTRUCTIONS**

#### 6.0.1 **Receipt**

Upon delivery to site all items should be inspected for any damage or loss than may have occurred during transit. All items are described on the General Arrangement Drawings.

If any items are found to be missing or damaged immediately notify:-

Allied Colloids (Aust) Pty Ltd Engineering Department -

Phone: (02) 4350 3200

Fax: (02) 4352 1697

#### 6.0.2 **Storage**

If the equipment is required to be stored for less than six months prior to installation, there are no special precautions to be taken except where some components have been wrapped for transport. The bubble wrap used is not UV stable and if the equipment is to be stored outside it would be advisable to cover the bubble wrap with an ultra violet stable plastic.

As the equipment has been designed for outdoor use there are no special requirements for storage for periods greater than twelve months except as stated above. When the equipment is taken out of storage it would be advisable to follow the individual Manufacturer's instructions for each drive, detailed elsewhere in this manual.

### 6.1 **RESPONSIBILITIES OF CLIENT**

#### 6.1.1 **Provision of Services**

It is the responsibility of the client to provide all services to the equipment. This includes electrical power supply, water supply and compressed air supply as required to operate the equipment.

#### 6.1.2 **Connection of Free-Standing Equipment**

It is the responsibility of the client to carry out any field wiring between the Flocculant Mixing System's control panel and any piece of free-standing equipment not mounted on the system's framework, such as Bulk Powder Hoppers, Transfer Pumps and Dosing Pumps.

### 6.2 **SAFETY PRECAUTIONS**

All site installation is to be carried out subject to relevant site standard regulations, safety practices and as per approved vendor drawings.

#### 6.2.1 **Potential Hazards**

As with any process equipment there are potential hazards to be aware of. These include high voltages, moving parts, toxic materials, etc. Hazards associated with individual items (eg Screw Feeder, Agitator, Flocculant Blower, etc) are covered in the Manufacturer's information in Section 6.5 of this manual.

General hazards to be aware of are:

**a) High Voltages - 415V AC, 3 Phase, 50Hz**

The main supply for the Flocculant Mixing System will be fed from Distribution Board \_\_\_\_\_, Fuses \_\_\_\_ A, B and C and it is from this point that power to the entire system should be isolated prior to any work being carried out.

There are three different voltages in use in the control panel, they are 415V (motor supplies), 110V (control) and 8V AC (level probes). The control panel is fitted with a main switch which is padlockable in the "OFF" position.

**b) Moving Parts**

The main items which pose this hazard are the Flocculant Blower, the Screw Feeder, the Agitator and the Dosing Pump. If any work is to be performed on these items they must be isolated by turning off and padlocking the Main Switch. Test that isolation is effective before working on them:

**C** - Check that everyone is clear of the equipment.

**R** - Run the drive to check all other interlocks are not operative.

**I** - Isolate the equipment by turning off the Main Isolator.

**P** - Prove the isolation by trying to start the equipment - it should not operate.

**T** - Tag and padlock the isolator switch.

**c) Confined Spaces**

Follow the approved Confined Spaces Safety Procedures before entering the Bulk Hopper or the Mixing Tank as there are specific hazards, namely moving parts, ingress of product and possible air contamination, associated with these vessels.

### 6.3 PRECOMMISSIONING

Prior to start up of the equipment, all drives should be first turned by hand to ensure free movement of rotating equipment. All electrical cabling should have an insulation test carried out using a Megger tester.

All drives should then be bump tested (on/off) to ensure that they are rotating in the correct direction as per manufacturer's specifications. The checkboxes in Section 3.2 of this manual should be filled in as each drive is tested.

Once the direction checks have been completed the next step will be to calibrate the Screw Feeder and set the timer to suit the desired batch strength. This is done via the Screw Feeder timer.

The procedure for calibrating the Screw Feeder is set out in Section 3.2 of this manual. At the same time the Feeder timer is set, the Agitator timer should be set to a minimum thirty minutes. The values should be recorded in the spaces provided in Section 6.2.5 of this manual.



**6.4 PRE-COMMISSIONING CHECKS OF EQUIPMENT****Oil/Lubrication Levels:-**

Flocculant Blower .....

Screw Feeder gearbox .....

Agitator .....

Dosing Pump .....

**6.4.2 Direction of rotation of drives:-**

Hopper Dust Filter Shaker .....

Hopper Vibrator .....

Flocculant Blower .....

Screw Feeder .....

Agitator .....

Dosing Pump .....

**6.4.3 Protection Devices and Fuses:-****CORRECT INSTALLED  
RATING**

Control Circuit Supply .....

Hopper Dust Filter Shaker .....

Hopper Vibrator .....

Flocculant Blower .....

Screw Feeder .....

Agitator .....

Dosing Pump .....

**6.4.4 Operability of Equipment:-**

**Hopper Isolating Valve operates freely.....**

**Screw Feeder auger turns freely in box.....**

**6.4.5 Equipment Timers Presets:-**

**Screw Feeder Timer \_\_\_\_\_**

**Agitator Timer \_\_\_\_\_**

## 6.5 MANUFACTURER'S INSTALLATION AND COMMISSIONING INFORMATION

### 6.5.1 Hopper Vibrator

#### a) Mechanical

Inspect vibrator for any physical damage and check that rotor shaft rotates freely. ALL mounting surfaces **MUST** be free of paint, dirt and scale. Fixing bolts should be tightened as recommended below and tightness checked after initially running the vibrator. Bolts and nuts should not be reused. **BK 02 - BK 40:** Use Grade 8.8 bolts with Grade 8 "Polystop" nuts, torqued to values below. Figures apply with lightly oiled threads.

SIZE	TORQUE (kg.m)		TENSION (kg)	
	Cap-Screws	Bolts	Cap-Screws	Bolts
M10	6.9	5.7	3,660	2,821
M12	13.0	9.8	5,380	4,111

The above figures should also be used for out of balance weight and bearing housing setscrews/capscrews for the whole series.

#### b) Electrical

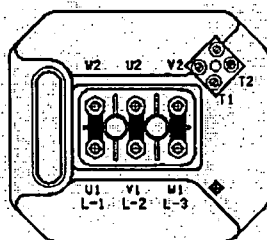
Check insulation resistance and, if less than 1 megohm **DO NOT USE**, consult a qualified electrician.

Flexible cable and suitable cable glands must be used to connect between vibrator and supply junction box. Supply must be suitably fuse protected. 4 core cable is to be used with flexible conductors type 50/0.25 (BK 05 - BK 40). Flexible conductors must be terminated with crimp-on ring terminals for L1, L2, L3 and earth and plain soldered ends for thermistor connections T1 and T2. If thermistors are not required leave the blanking plug in the cable entry hole.

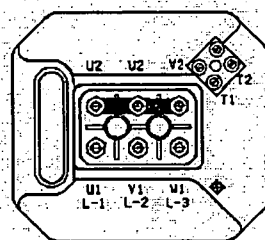
Electrically suitable non-setting compound should be packed around leads in terminal and junction boxes to prevent damage through vibration. Starting can be direct on line, via inverter or soft start.

**Diagram 15**

Vibrator Terminal Box  
Field Connections



DELTA



STAR

## **6.5.2 Hopper Low Level Detector**

Refer Manufacturers Manual in Appendix B

## **6.5.3 Hopper Discharge Isolating Valve**

Since the valve is being used with dry material and is horizontally mounted, the gate chamfer must point downwards for optimum closing performance. When tightening the gland bolts ensure they are evenly adjusted to avoid binding of the gland against the gate.

## **6.5.3 Screw Feeder Gearmotor**

Refer Manufacturers Manual in Appendix B

#### 6.5.4 **Flocculant Blower**

Refer Manufacturers Manual in Appendix B

### 6.5.5 **Agitator**

Refer Manufacturers Manual in Appendix B

### 6.5.7 **Transfer Valve**

The actuator can be installed in any position, but it is preferable to have the shaft axis vertical. Ensure that sufficient space is left above and around the actuator for removal of the cover and access for wiring connections, as well as for manual operation and observation of the optical position indicator (approx. 15-20 cm).

The shafts of the actuator and valve should be brought into compatible positions, then the actuator is mounted to the interface and secured with M6 screws. The use of force should be avoided. The standard interface is to ISO 5211/1 (connection dimensions); 5211/2 (torque up to 125Nm), and the coupling dimension is to DIN 3337 (14mm internal square drive). The internal square drive permits all the required coupling variations.

The supply voltage and frequency must correspond with the details on the actuator label (Note - versions labelled 220V are also suitable for use with 240V). The circuit diagram for wiring of the actuator can be found on the inside of the cover which is removed by loosening the 4 screws. Finally, the unit should be wired via the gland entry.

### 6.5.5 **Agitator**

Refer Manufacturers Manual in Appendix B

### 6.5.7 **Transfer Valve**

The actuator can be installed in any position, but it is preferable to have the shaft axis vertical. Ensure that sufficient space is left above and around the actuator for removal of the cover and access for wiring connections, as well as for manual operation and observation of the optical position indicator (approx. 15-20 cm).

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## 6.5.8 Dosing Pump

Refer Manufacturers Manual in Appendix B



## 6.6 COMMISSIONING CHECK OF EQUIPMENT

(See Section 4.1.5 of this manual for Level identification.)

Commencing with an empty Mixing Tank, the unit is now test run to ensure all drives and interlocking circuits work correctly. Ensure hopper isolation is closed and there is no powder in feeder

- a) Open the water supply isolating valve and check that there is sufficient water pressure to the Jet Wet.
- b) Set the Screw Feeder time in the DCS Control System to 1 minute and the Agitator time in the DCS Control System to 5 minutes.
- c) Select "Auto" mode in the DCS Control System.
- d) The water supply solenoid valves should open, allowing water to flow into the Mixing Tank via the Dispersion Head, and Rapid Fill Line. The Flocculant Blower should start simultaneously.
- e) The Mixing Tank will continue to fill with water. When the water reaches medium level setpoint both the Agitator and the Screw Feeder should start automatically and the rapid fill solenoid should close.
- f) The Screw Feeder should run for 1 minute then stop. The rapid fill solenoid should then re open.
- g) When the water in the Mixing Tank reaches high level setpoint the water supply solenoid and the rapid fill solenoid valves should close and the Flocculant Blower should stop. The Agitator will continue to run for the five minutes then stop.
- h) At this point the Transfer Pump should start, after the Agitator run time has elapsed. The contents of the Mixing Tank should transfer to the Flocculant Solution storage facility until the level in the Mixing Tank falls below low level setpoint, when the Transfer Pump stops and the cycle re starts from Point (d).
- i) When the Wet Test is completed empty the water from the Mixing Tank and Storage Tank. Set the Screw Feeder time and the Agitator time in the DCS Control System to the values shown in Section 5.4.5 of this manual.

## 7. **OPERATION OF EQUIPMENT**

### 7.1 **POWDER PRODUCT METERING AND PNEUMATIC TRANSFER SYSTEM**

#### 7.1.1 **Starting Procedure**

- a) Ensure the Bulk Hopper contains flocculant.
- b) Open the Bulk Hopper's discharge isolation valve.
- c) Turn on the power supply.

#### 7.1.2 **Sequence of Operation (AUTO OPERATION)**

- a) Turn on the power supply and select AUTO mode.
- b) The Flocculant Blower and Screw Feeder both start.
- c) Powder flocculant flows from the Bulk Hopper into the Screw Feeder under gravity. It is then metered by the auger into the Heated Receiver Hopper.
- d) The Hopper Vibrator runs whenever the Screw Feeder is running to ensure a constant flow of powder flocculant into the feeder.
- e) The Flocculant Blower forces air through the venturi where it entrains the powder flocculant in the Heated Receiver Hopper.
- f) The Screw Feeder runs for the desired preset period before stopping.
- g) The powder is carried through the transfer piping to the Dispersion Head on the Flocculant Make-up Unit.

### 7.2 **POLYMER DISSOLVING SYSTEM**

#### 7.2.1 **Starting Procedure**

- a) Open the water supply isolating valve and check that there is sufficient water pressure to the Jet Wet by observing the pressure gauge reading.
- b) Refer to Section 7.1.1 for Powder Product Metering and Pneumatic Transfer System Starting Procedure which form part of this procedure.

#### 7.2.2 **"Automatic" Mode Sequence of Operation**

Commencing with an empty Mixing Tank and assuming that water pressure to the Jet Wet is constantly greater than 150 kPa:

(See Diagram 7 of this manual for Level Probe identification.)

- a) Turn on the power supply and select AUTO mode. The electrically actuated solenoid valve on the water supply line opens, allowing water to flow into the Mixing Tank via the Dispenser head. The Flocculant Blower starts simultaneously.
- b) The Mixing Tank continues to fill until the water level reaches level probe E2. At this stage both the Agitator and the Screw Feeder will start.
- c) The Screw Feeder continues to run for a pre-determined timed period. Powder product delivery complete, the feeder stops but the Blower and Agitator continue to operate.
- d) When liquid level in Mixing Tank reaches level probe E3, the Water Supply solenoid valve closes and the Blower stops, but the Agitator continues to operate for its

- e) Once the time period for mixing is completed, the Transfer Valve will open and the batch of solution will be transferred to the Storage Tank. **Note:-** In the event of the Storage Tank being at capacity, the solution will be held in the Mixing Tank until liquid level has subsided below Storage Tank probe E4.
- f) During any cycle, should the unit be shut down due to a reduction in water pressure or power failure, it is essential that, in either case, the system re-commences at the point in the cycle where the failure occurred. This will eliminate the possibility of a double strength mixture.

## 7.2.3

**"MANUAL" Mode Sequence of Operation**

In "MANUAL" mode, all of the drives can be operated individually regardless of water pressure. This is desirable for testing and emergency operation purposes only and, under normal circumstances, the equipment should be run in "AUTO" mode so as to enable the correct sequencing of functions and level control interlocking.

To prepare a batch of solution manually:-

- a) Turn on the power supply and select MANUAL mode. Start the Flocculant Blower by turning its selector switch to "MANUAL".
- b) Open the water supply line isolating valve and dispersion head solenoid valve.
- c) When the water level in the Mixing Tank covers the bottom impeller blades of the mixer.
- d) Turn the Screw Feeder on for the pre-determined length of time recorded in Section 6.4.5 of this manual.
- e) When the level in the Mixing Tank reaches the High Level probe, shut off the water supply by closing the dispersion head solenoid valve and water supply valve.
- f) Stop the Flocculant Blower.
- g) Continue mixing the solution in the Mixing Tank for approximately 30 minutes then stop the Agitator.
- h) Open the Transfer Valve and leave it open until the solution level in the Mixing Tank is below the low level probe E1, and then close the valve.

## 7.3

**SYSTEMS SHUTDOWN PROCEDURE**

## 7.3.1

**Emergency Shutdown**

In the event of an emergency, the Auto Jet Wet can be disabled by isolating the power supply to the unit. The system timers will hold their current values so that on restarting, the sequence will continue from the point at which it was interrupted. This ensures that a double strength mixture will not result.

## 7.3.2

**Planned Shutdown**

To ensure proper resetting of the system timers, wait till the end of the transfer cycle/start of re-batching cycle then turn the unit off, followed by isolating the power supply.

### 7.4.1 Flocculant Blower

Refer Manufacturers Manual in Appendix B

### 7.4.2 Agitator

Refer Manufacturers Manual in Appendix B

### 7.4.3 Transfer Valve

#### a) Commissioning

For initial commissioning, the actuator should be set to an intermediate position by means of the manual override, located near the optical position indicator. The actuator incorporates a shaft which enables the unit to be operated manually in an emergency. Access the shaft by removing the cover then, using a screwdriver, depress the manual override in the direction of the gearbox until it engages and rotate in the required direction. The manual override shaft operates in the same rotational sense as the optical indicator and main drive shaft. With the standard actuator (7s, 90°) approximately 37 turns of the manual override shaft are required for 90° rotation of the main drive shaft.

Rotational direction is then checked by observing the indicator movement whilst briefly applying the respective control input. If the direction is incorrect, check all the connections and interchange as appropriate. Finally, operate the actuator to its limit positions, checking always that the rotation is terminated at the required point and that the optical indicator is showing this position correctly.

#### b) Adjustment Instructions

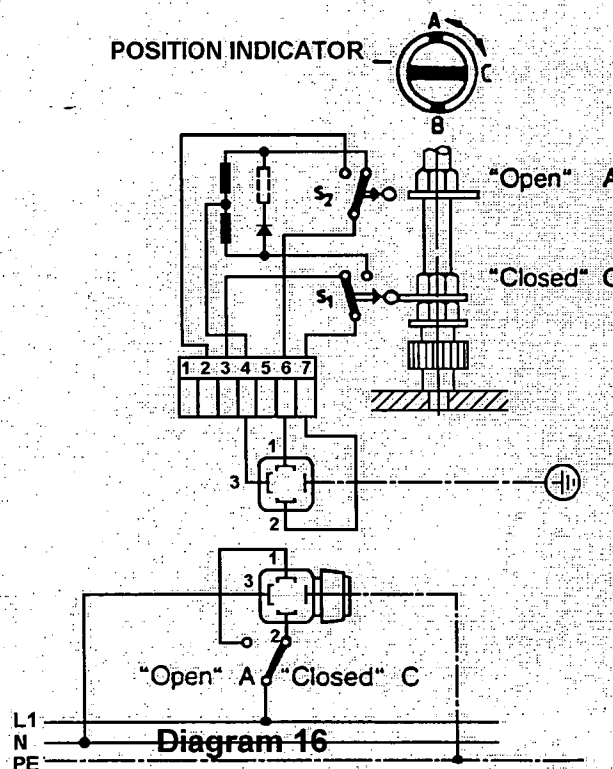
The Rotary Actuators are supplied factory-set. These adjustment instructions are provided to enable the user to alter the factory settings as required, for example, when matching the limit positions of a valve with those of its actuator.

The voltage applied to the motor is, according to rotation direction, switched via limit switches S1 and S2. (see Diagram 16) At the operating point, the cam depresses the operating level of the appropriate limit switch and thus interrupts the applied motor voltage.

To check rotation limits, connect power via limit switch S1 to the motor until rotation limit is reached. During this movement, the cam for S1 is set such

that the limit switch is not depressed by the cam until the end position is reached, thus interrupting the motor voltage. To check the other rotation limit, connect power via limit switch S2.

If rotation limits require adjustment the cams and position indicator are set by means of an 11mm A/F open-ended spanner. Reconnect power via S1 to the motor



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and when the desired rotation limit is reached (valve open) switch off the power. Simultaneously observe the rotation direction of the cams. If S1 switches the motor off too soon, adjust the operating cam for S1 in the **opposite** direction to the rotation just observed, such that the desired rotation limit can now be attained. Switch the power on again and check that S1 now operates as required. If not, readjust accordingly. If resetting of the optical position indicator is then required, this can be performed by rotating the indicator head using the spanner. To set the other rotation limit, apply power via S2, and adjust the cam for S2 in the same way as for S1 above.

#### 7.4.4      **Dosing Pump**

Refer Manufacturers Manuals in Appendix B

**8. MAINTENANCE OF EQUIPMENT****8.1 MAINTENANCE SCHEDULE****Weekly**

- Clean Jet Wet Head Acrylic Cylinder
- Check / Clean Jet Wet Head Nozzles and Spigot
- Check / Clean Heated Hopper and Venturi

**Monthly**

- Clean all motor fan cowlings for flocculant build-up
- Clean / Check Water Controls - Valves
- Grease Spiral Shaft Drive Bearing

**Every 2500 Hours**

- Check Transfer Valve operation

**Every 20,000 Hours**

- Change Oil in Agitator Gearbox, check seals

**RECOMMENDED SPARE PARTS****100T AUTO JET WET PACKAGE**

<b>QTY</b>	<b>DESCRIPTION</b>	<b>A.C.A. PART NO.</b>
1	Clamp for Acrylic Cylinder Ø 100	225000
1	Clear Acrylic Cylinder Ø 100	226000
2m	Anti-static Hose	234500
1	Screw Feeder Spiral - Solid	257600
1	Linatex Sleeve - 150mm	259000
1	Omron Floatless Level Switch - 61F-GP-N	267500
1	Ultra Flow Switch F25B	291800



**8.3.1 Hopper Dust Filter Unit**

**Routine Maintenance:** Operate the dust filter shaker periodically.

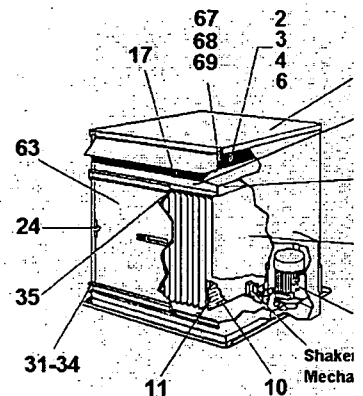
**Preventative Maintenance:** (Refer to Diagram 17 below)

**a) To remove filter assembly:**

- Isolate electrical controls and remove door
- Fully slacken the filter assembly securing wing nuts located on top of the unit
- Withdraw filter assembly
- Remove wire mesh frames from individual filter bags
- Detach filter bag assembly from supporting frame

**b) To replace filter assembly:**

- Refit filter bag assembly to supporting frame, feeding individual filter bags between locating bars; fold collar over peripheral sealing flange
- Replace wire mesh frames into filter bags
- Slide filter assembly into unit in the guides until bottom of filter bags abut onto shaker bar
- Locate individual bags in shaker bar
- Slide filter assembly fully home and tighten, securing wing nuts
- Replace door

**DUST FILTER PARTS LIST****Diagram 17**

ITEM NO.	PART No.	DESCRIPTION	QTY/UNIT
2	21996-530	Wing nut M10	4
3	21183-416	Wing nut retainer	4
4	35132-303	Rubber washer	4
6	31531-704	Washer - 12mm I/D	4
7	44824-928	Complete Filter Assembly - Top frame, inserts, insert edgings and multiple filter bag - Polypropylene UMA70	1
8	41124-015	Mattress runner - UMA70	2
9	44824-305	Multiple filter bag - Polypropylene UMA70	1
10	42772-503	Insert edgings - Polypropylene UMA70	12
11	41353-003	Bag inserts - UMA70	12
12	27572-902	Shaker motor 0.18kW, 3ph, 50Hz, 380/420V; 71 Frame	1
17	18165-470	Door sealing rubber for UMA70 fan chamber door, 1850mm	1
24	41121-112	Door fastener parts, complete set	1
31	31417-308	M10 x 50 long hexagon head setscrew	1
32	21996-530	Wing nut M10	1
33	21176-246	Washer M10	1
34	32131-504	Stud plate	1
35	41155-021	Mattress frame sealing rubber - UMA70	1
63	42322-520	Mattress door - UMA70	1
65	34621-131	UMA70V lid	1
66	18165-458	Sealing rubber UMA70V lid, 20mm x 5mm x 2500mm lg	1
67	22532-558	Toggle fastener	1
68	22532-596	Toggle hook	1
69	21167-603	Rivet	4

Routine Maintenance:

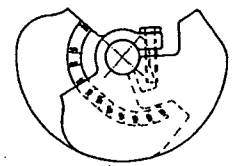
Not required as BK05-2/2 Vibrator is fitted with shielded ball bearings greased for life.

Preventative Maintenance:

- a) **Removal and fitting of bearings.** The BK05-2/2 uses 6304ZZ bearings which can be removed by the use of bearing pullers. Remove end covers and out of balance weights, first marking the relative weight setting position in order to obtain the original centrifugal force on re-assembly. Remove motor endshields, thereby exposing bearings on shaft. Remove old bearings and fit new ones. Refit the motor endshields and make sure the shaft turns freely. Next refit out of balance weights and end covers and test run motor.

**N.B.** Due to the increased radial clearance in the bearings it is normal for vibrators to emit a certain amount of noise and this doesn't necessarily indicate worn bearings

- b) **Checking out of balance weights.** Remove end covers and check that out of balance weights are tightly fastened to motor shaft. If loose, realign weights and tighten clamp bolts. When adjusting out of balance weights, slacken screw in INNER weight only. Adjust inner weight to required force on percentage scale and retighten screw. Adjust opposite end to the same percentage force.

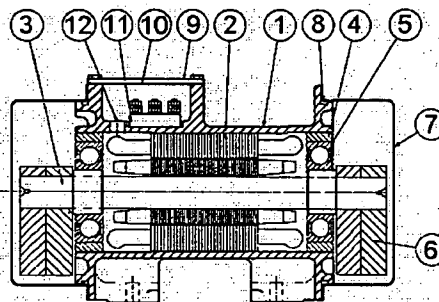


**Diagram 18**

**N.B.** It is important that both ends are the same and in line - clamping screws must always be on the same side of the vibrator.

**Diagram 19**

Cross sectional view of vibrator motor. (see Parts List below)



**VIBRATOR MOTOR PARTS LIST**

Part	Component	Qty	Part	Component	Qty
1	Stator frame	1	7	End cover	2
2	Stator unit	1	8	'O' ring seal	2
3	Rotor shaft assembly	1	9	Terminal box lid	1
4	Bearing housing	2	10	Terminal box lid gasket	1
5	Bearing	2	11	Terminal block	1
6	Out of Balance Weight assembly	2	12	Grommet	1

### **8.3.3 Hopper Low Level Detector**

Refer Manufacturers Manual in Appendix B

### 8.3.4 Screw Feeder Gearmotor

Refer Manufacturers Manual in Appendix B

### 8.3.5 Heated Receiver Hopper

#### Routine Maintenance:

The hopper should be cleaned out regularly to prevent build-up of flocculant powder on the sides and at the exit point to the venturi.

#### Preventative Maintenance:

The hopper is a sealed unit and the heating element is inaccessible for maintenance purposes. In the event of a failure of the element, the entire hopper must be replaced.

### 8.3.6 Flocculant Blower

Refer to manufacturers Manual in Appendix B

### 8.3.7 Jet Wet Disperser

#### Routine Maintenance:

As this is a self-cleaning apparatus, routine maintenance is not required.

#### Preventative Maintenance:

The Jet Wet Disperser should be cleaned as per Section 3.1

### 8.3.8 Water Supply Control Valve

#### Routine Maintenance:

Not applicable to this equipment.

#### Preventative Maintenance:

These units are not designed to be repaired. If it fails during service it should be replaced.

### 8.3.9 Water Supply Flow Switch

#### Routine Maintenance:

Not applicable to this equipment.

#### Preventative Maintenance:

These units are not designed to be repaired. If it fails during service it should be replaced.

### 8.3.10 Agitator

Refer Manufacturers Manuals in Appendix B

### 8.3.11 Mixing Tank Probes and Floatless Level Controllers

#### Routine Maintenance:

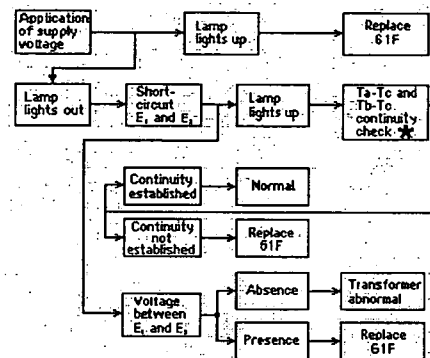
Not applicable to this equipment.

#### Preventative Maintenance:

The probes should be cleaned of any build-up of flocculant which may cause shorting out of the probe and, hence, incorrect operation of the equipment. The electronic level controllers cannot be repaired in the field and, if they fail during service, should be replaced. To check for correct operation of the floatless-level controller refer to Diagram 20 below.

**Diagram 20**

Fault finding  
flow chart for  
Omron 61F-GP-N  
Floatless Level  
Controller



The continuity between  
Tb and Tc is established  
when the built-in relay  
turns off.

8.3.12 **Transfer Valve****Routine Maintenance:**

Not applicable to this equipment.

**Preventative Maintenance:**

The Actuators leave the factory in a fully checked and tested condition. Some problems which arise can be attributed to causes other than the Actuator itself and may concern the application details or result from a conversion. The trouble-shooting procedure and diagram below should assist you in determining potential sources of malfunction.

**TRANSFER VALVE TROUBLE SHOOTING GUIDE**

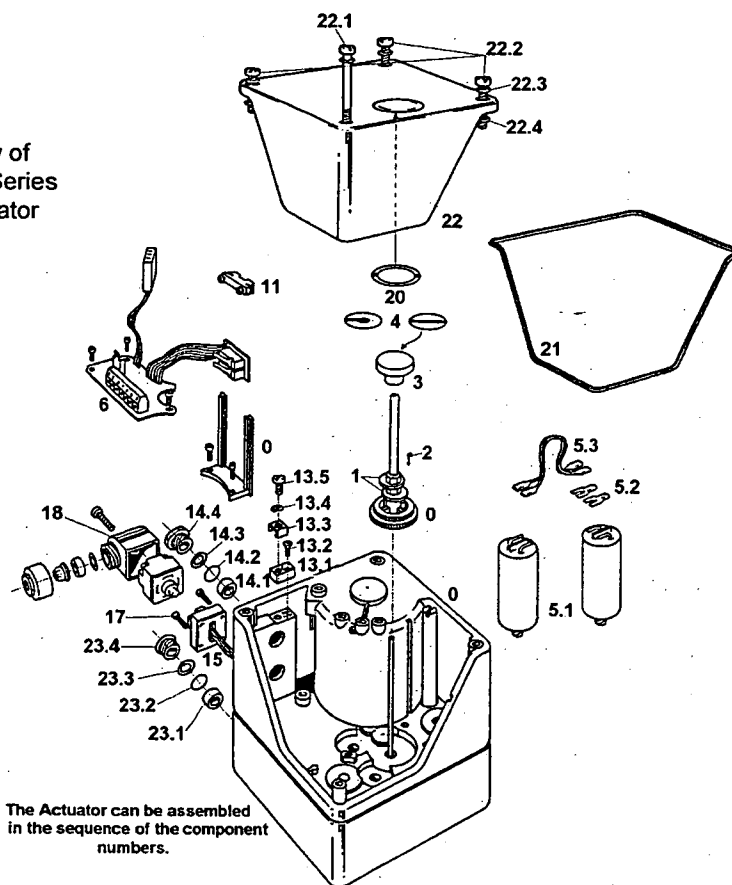
<b>Problem</b>	<b>Check</b>	<b>Fault</b>	<b>Remedies</b>
1. Motor does not operate	Has the fuse blown? Yes.	See 2 below	See 2 below.
1.1 No humming	Is the socket from the Printed Circuit Board connected to the motor terminal pins? No	No voltage supply at motor	Connect socket
	Is there power at the Printed Circuit Board? No.	Power supply faulty	Connect power supply and/or rectify fault.
	Is the motor overheated? Yes.	Thermal switch has cut out, since the motor has been overloaded.	Wait until the motor cools down and avoid further overloading.
	Are cams adjusted as prescribed? No.	Appropriate limit switch is incorrectly set and is switching the motor off.	Adjust cams as prescribed.
1.2 Motor hums	Is there voltage at the capacitor? Yes.	Capacitor possibly faulty.	Replace capacitor.
	Actuator can't be operated manually or rotation very stiff? Yes.	Gearbox or motor jammed.	Return actuator to factory for checking.
2. Fuse blows	Is actuator connected correctly? No.	Short circuit due to wiring error.	Ensure wiring is correct. If necessary replace any defective components.
	Motor winding resistance outside tolerance range.	Defective winding.	Return actuator to factory.
3. Motor continues running	Are cams operating limit switches? No	Limit switch actuator lever bent.	Replace PCB and limit switch assembly.
g	Is limit switch audibly operating? No.	Limit switch mechanically defective. Limit switch operating too late.	Replace PCB and limit switch assembly. Adjust cams as prescribed.

**BURKERT 3001 ACTUATOR PARTS LIST**

ITEM No	QTY	PART No	DESCRIPTION	ITEM No	QTY	PART No	DESCRIPTION
0			Actuator Assembly Complete	14.1	1	6-9x16.5	Grommet - Cable Entry
1	2	3001 - 29.1	Cam	14.2	1	3001 - 189	Blanking Disk - Cable Entry
2	2	3001 - 28	Leaf Spring	14.3	1	8 Pg11 - St	Washer
3	1	3001 - 32	Position Indicator	14.4	1	1 Pg11 - FS	Gland Screw
4	1	3001 - 34.1	Sticker a 90°	15	1	3001 - 1171	Plug Base
5.1	1	3001 - 170.3	Capacitor (110V/50Hz)	17	2	M3x12 DIN 84	Cheese Head Screw
5.2	2	3001 - 150	Terminal Connector	18	1	1050-1S.211	Cable Plug
5.3	2	3001 - 149	Capacitor Connection Leads	21	1	1050-22S.211	Cover Seal
6	1	3001 - 3100.11	Printed Circuit Board	22	1	3001 - 1022	Cover
10	3	M4x12 DIN 84	Cheese Head Screw 4.8 A2L	22.1	1	M5x65 DIN 84	Cheese Head Screw 4.8 A2L
11	1	3001 - 1046	Limit Switch Clamp	22.2	3	M5x16 DIN 84	Cheese Head Screw 4.8 A2L
13.1	1	3001 - 69	Terminal Bar	22.3	4	5100 - 42	Washer
13.2	1	M3x8 DIN 963	Bar Retaining Screw	22.4	4	3001 - 37	Screw Retainer
13.3	1	531 - 20	Terminal Clamp	23.1	1	6-9x16.5	Grommet DIN 46320
13.4	1	B4 DIN 127	Spring Washer A2L	23.2	1	3001 - 189	Blanking Disc
13.5	1	M4x8 DIN 963	Cheese Headed Screw	23.3	1	8 Pg11 - St	Washer DIN 46320
				23.4	1	N Pg11 - FS	Gland Screw DIN 46320

**Diagram 21**

Exploded View of  
Burkert 3001 Series  
Motorised Acuator



### 8.3.13 **Dosing Pump**

**Refer to Manufacturers Manual in Appendix B**



**8.4 LUBRICATION SCHEDULES****8.4.1 Equipment Description: Flocculant Blower**

No Lubrication Required. Sealed for Life

**8.4.2 Equipment Description: Screw Feeder Drive Gearbox****a) Product Description:**

E.P. Grease

**b) Equivalent Grades Supplied by Oil Companies:**

ESSO Unirex N3 Grease

**c) Service Application:**

Change upon Disassembly.

**d) Frequency of Charge:**

Change upon Disassembly

**e) Quantity Per Charge:**

0.3 litres.

## 8.4.3

**Equipment Description: Agitator**

## a) Product Description:

G.P. Grease

## b) Equivalent Grades Supplied by Oil Companies:

Mobil SHC 32

## c) Service Application:

Refill reduction box on agitator disassembly.

## d) Frequency of Charge:

When required (see above).

## e) Quantity Per Charge:

1.25 lbs

## 8.4.4

**Equipment Description: Spiral Shaft Drive Bearing**

## a) Product Description:

G.P. Grease (High Temperature)

## b) Equivalent Grades Supplied by Oil Companies:

Esso Unirex N3 Grease

## c) Service Application:

Clean and Regrease

## d) Frequency of Charge:

Monthly

## e) Quantity Per Charge:

As Required

**TROUBLESHOOTING GUIDE**

<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>ACTION</b>
Mixing unit batching water or reduced strength mixture	Powder Product hopper empty	Refill Hopper
	Blockage in screw feeder unit, venturi or spigot	Disassemble and clean as necessary.
	Timer function for feeder non-operational	Check sequence by manual means. Replace timer if faulty.
	Drive on screw feeder or blower not running.	Check by manual means, energise motor and replace if faulty.
Mixing unit not following correct sequence.	Level controller failure.	Check function of switch by manual means and replace if faulty.
	Level probes in Mixing Tank shorted out.	Clean probes and all mounted connections, ensure that no thin trails or hairs of flocculant or product remain.
Lump formation in Mixing Tank or block of partly dispersed product in acrylic tube.	Low or fluctuating water pressure/flow.	Check incoming water pressure and flow rate.
	Agitator not functioning or not coming in for timed sequence.	Check motor function by manual means and replace motor if faulty.
		Check timer and sequence operation by manual means.
Mixing Tank taking too long to fill.	Main water supply valve not opening.	Test solenoid operation manually and check for power supply to solenoid.
	Loss of water pressure or flow.	Check water supply pressure.
Non-transfer of prepared liquid product from Mixing Tank to Storage Tank.	Transfer Valve not opening.	If valve motor is not being energised, check motor supply fuse and motor. Replace any if faulty.
	Transfer Valve opening but product not transferring to Storage Tank.	Disassemble valve and check for blockages. Clean and reassemble.
Non-transfer of prepared liquid product from Storage Tank to Process	Dosing Pump motor not running	If pump motor is not being energised, check motor supply fuses, overload and motor. Replace any if faulty.
	Dosing Pump not pumping	Disassemble pump and replace stator if worn. Ensure pump suction is flooded when unit is re-energised.

## 9. **SPECIFICATIONS OF EQUIPMENT**

### 9.1 **Hopper Filter Unit**

Equipment Description: HOPPER FILTER UNIT	
Manufacturer: DCE VOKES	Model: UMA 70V
Type: UNIMASTER VENTING TYPE DUST CONTROL UNIT - FILTER BAG SHAKER	
Application: HOPPER VENTING DURING PNEUMATIC POWDER FILLING	
Filtration Area: 6.23m <sup>2</sup>	Pressure Limit: 300mm W.G.
Filter Bags: POLYPROPYLENE REMOVABLE	
Material of Construction: STEEL PAINTED	Weight: 75kg
Dimensions: Length: 575 mm Width: 575 mm Height: 680 mm	
Clearances for Installation/Removal: 560 mm	
Operating Speed: 1000 rpm	Drive Method: ELECTRIC MOTOR
Ambient Temperature: -10°C.... +40°C MAX	

Motor Equipment Description	
Manufacturer: LEROY SOMER	Model: MOT3NLS71
Output Power Rating (kW): 0.18 Kw	Type: SQUIRREL CAGE INDUCTION
Frame Size: (AS1360.10) 71	Voltage: 415/440 VAC @ 50 Hz
Motor Mass:	Rotor Inertia: kg/m <sup>2</sup>
Motor Speed: 1000 RPM	No. of Poles: SIX
Enclosure Type: TOTALLY ENCLOSED	Mounting: FOOT MOUNTING
Terminal Box Location Viewed from DE: 12 O'CLOCK	Direction of Rotation Viewed From DE: CW
No. of Phases: THREE	Insulation Type: F
Rated Full Load Current: 0.9 AMPS	IP Rating (AS1939): 55
Method of Cooling: FAN COOLED	Frame Material: ALUMINIUM
Bearing Details: DE NDE:	
Method of Lubrication: SEALED BEARINGS	
Efficiency at Full Load: 60%	Power Factor at Full Load: 0.66
Ambient Temperature: -10°C.... +40°C MAX	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE

**Hopper Vibrator**

Equipment Description: HOPPER VIBRATOR	
Manufacturer: TECO INVICTA	Model: BK05-2/2
Type: OUT OF BALANCE WEIGHT ADJUSTMENT	
Gearbox Ratio: NOT APPLICABLE	Mounting: FOOT MOUNTING
Application: AID IN POWDER FLOW TO POWDER METERING UNIT	
Output Power Rating: 120 WATTS	Centrifugal Force: 200kg / 1962 NEWTONS
Working Moment: 4.3 kg.cm.	
Material of Construction: ALUMINIUM	Weight: 7.5 KG
Dimensions: Length: 224 mm Width: 132 mm Height: 157 mm	
Clearances for Installation/Removal: mm	
Operating Speed: 2880 rpm	Drive Method: ELECTRIC MOTOR
Ambient Temperature: +40°C MAX	

Motor Equipment Description POWDER HOPPER VIBRATOR	
Manufacturer: TECO INVICTA	Model: BK05-2/2
Output Power Rating (kW): 0.2 kW	Type: SQUIRREL CAGE INDUCTION
Frame Size: (AS1360.10) N/A	Voltage: 415 VAC @ 50 Hz
Motor Mass: (INTEGRAL PART OF VIBRATOR)	Rotor Inertia: kg/m <sup>2</sup>
Motor Speed: 2880 RPM	No. of Poles: TWO
Enclosure Type: TOTALLY ENCLOSED	Mounting: INTEGRAL PART OF VIBRATOR
Terminal Box Location Viewed from DE: 12 O'CLOCK	Direction of Rotation Viewed From DE: C/WISE
No. of Phases: THREE	Insulation Type: F
Rated Full Load Current: 0.5 AMPS	IP Rating (AS1939): 56
Method of Cooling: CONDUCTION	Frame Material: ALUMINIUM
Bearing Details: DE 6301ZZ NDE: 6301ZZ	
Method of Lubrication: SEALED	
Efficiency at Full Load:	Power Factor at Full Load:
Ambient Temperature: +40°C MAX	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE

## 9.3 Volumetric Screw Feeder

Equipment Description: <b>VOLUMETRIC SCREW FEEDER</b>	
Manufacturer: ALLIED COLLOIDS (AUST)	Model: 2.0kg/MINUTE
Type: SOLID FLIGHT SPIRAL	Size: 50NB
Application: METERING OF FLOCCULANT POWDER	
Design Capacity: 2.0kg/MINUTE	
Material of Construction: 304 STAINLESS STEEL	Weight: 12 kg
Screw Material: 304 STAINLESS STEEL	Type of Screw: SOLID FLIGHT
Shaft Material: 304 STAINLESS STEEL	Shaft Diameter: 19mm
Direction of Rotation: CLOCKWISE	Coupling Type: MINIFLEX
Method of Lubrication: GREASED BEARING	Lubricant: G.P. GREASE
Dimensions Including Motor: Length: 670 mm Width: 300 mm Height: 203 mm	
Clearances for Installation/Removal: 80 mm BEHIND MOTOR	
Operating Speed: 36 rpm	Drive Method: ELECTRIC MOTOR

Motor Equipment Description: <b>VOLUMETRIC SCREW FEEDER GEARMOTOR</b>	
Manufacturer: SEW EURODRIVE	Model: RF32DT63L6
Output Power Rating (kW): 0.18 kW	Type: SQUIRREL CAGE INDUCTION
Frame Size: (AS1360.10) DT63L6	Voltage: -415 VAC @ 50 Hz
Motor / Gearbox Mass: 12 kg	Rotor Inertia: 0.00068 kg/m <sup>2</sup>
Motor Speed: 870 rpm	No. of Poles: SIX
Gearbox Ratio: 24.33:1	Output Speed: 36 rpm
Enclosure Type: TOTALLY ENCLOSED	Mounting: FLANGE MOUNTING
Terminal Box Location Viewed from DE: 12 O'CLOCK	Direction of Rotation Viewed From DE: CLOCKWISE
No. of Phases: THREE	Insulation Type: F
Rated Full Load Current: 0.75 AMPS	IP Rating (AS1939): 55
Method of Cooling: FAN COOLED	Frame Material: CAST IRON
Bearing Details: DE 6303-Z-J NDE: 6202-J	
Method of Lubrication: SEALED BEARINGS	
Gear Box Lubrication: 0.3kg GREASE	Lubricant: ENERGREASE HT-EP-OO
Efficiency at Full Load: 0.63 %	Power Factor at Full Load: 0.73
Ambient Temperature: 0°C TO 40 °C	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE

## 9.4 Flocculant Blower

<b>Equipment Description: FLOCCULANT BLOWER</b>	
Manufacturer: SIEMENS – AG	Model: ELMO-G 2BH1600
Type: REGENERATIVE	
Gearbox Ratio: NOT APPLICABLE	Mounting: FOOT MOUNTING
Application: PNEUMATIC TRANSFER	
Design Capacity: 30.56 Litres/second	Design Pressure: 260 mBar
Inlet Pressure: ATMOSPHERIC	Discharge Pressure (Max): 280 mBar
Blower Displacement: 110 m <sup>3</sup> /hour	Noise Level: 72dB
Material of Construction: CAST IRON	Weight: 34 kg
Impeller material: ALUMINIUM	Type of Impeller: BLADED-FORWARD
Shaft material: STAINLESS STEEL	
Direction of Rotation: COUNTER CLOCKWISE - VIEWED FROM MOTOR FAN END	Coupling Type: DIRECT COUPLED
Method of Lubrication: LONG LIFE GREASE PACKED	Lubricant: UNIREX N3 GREASE (ESSO)
Dimensions: Length: 364 mm Width: 380 mm Height: 382 mm	
Clearances for Installation/Removal: mm	
Operating Speed: 2895 rpm	Drive Method: ELECTRIC MOTOR
Ambient Temperature: +40°C MAX	

<b>Motor Equipment Description FLOCCULANT BLOWER MOTOR</b>	
Manufacturer: SIEMENS AG	ELMO-G 2BH1600
Output Power Rating (kW): 3.0 kW	Type: SQUIRREL CAGE INDUCTION
Frame Size: 100L	Voltage: 415/440 VAC @ 50 Hz
Motor Mass: (INTEGRAL PART OF BLOWER)	Rotor Inertia: 0.023 kg/m <sup>2</sup>
Motor Speed: 2895 rpm	No. of Poles: TWO
Enclosure Type: TOTALLY ENCLOSED	Mounting: INTEGRAL PART OF BLOWER
Terminal Box Location Viewed from DE: 12 O'CLOCK	Direction of Rotation Viewed From DE: C/WISE
No. of Phases: THREE	Insulation Type: F
Rated Full Load Current: 6 AMPS	IP Rating (AS1939): 55
Method of Cooling: FAN COOLED	Frame Material: ALUMINIUM
Bearing Details: DE 6206-Z-J-C3 NDE: 6205-Z-J-C3	
Method of Lubrication: GREASE PACKED	
Efficiency at Full Load: 86.4 %	Power Factor at Full Load: 0.9
Ambient Temperature: +40°C MAX	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE

## 9.5 Agitator

Equipment Description: <b>AGITATOR</b>	
Manufacturer: LIGHTNIN MIXERS	Model: XJ43
Type: IMPELLER	
Gearbox Ratio: 4.55:1	Mounting: FOOT RISER MOUNTING
Application: AGITATION OF FLOCCULANT SOLUTION	
Method of Agitation: FIXED PITCH SINGLE IMPELLER - DIAMETER 300mm	
Material of Construction: CAST IRON - WET PARTS 316S/S	Weight: 32 kg
Impeller Attachment: HUB	Impeller Removable (Y/N): YES
Direction of Rotation: CLOCKWISE	Coupling Type: DIRECT COUPLED CHUCK
Method of Lubrication: SPLASH / BATH	Lubricant: MOBIL SCH 600
Motor / Gear Box Dimensions: Length: 254 mm Width: 311 mm Height: 622 mm	
Clearances for Installation/Removal: 235 mm	
Operating Speed: 290 rpm	Drive Method: ELECTRIC MOTOR
Ambient Temperature: 20 °C	

Motor Equipment Description: <b>AGITATOR MOTOR</b>	
Manufacturer: BROOK ..	Model: SPECIAL TO LIGHTNIN
Output Power Rating (kW): 0.25 kW	Type: SQUIRREL CAGE INDUCTION
Frame Size: (AS1360.10) SPECIAL TO LIGHTNIN	Voltage: 400/440 VAC @ 50/60 Hz
Motor Mass: 15 kg	Rotor Inertia: N/A
Motor Speed: 1440 / 1720 rpm	No. of Poles: FOUR
Enclosure Type: TOTALLY ENCLOSED	Mounting: FLANGE MOUNTING
Terminal Box Location Viewed from DE: RHS	Direction of Rotation Viewed From DE: CW
No. of Phases: THREE	Insulation Type: CLASS "F" CLASS "B" RISE
Rated Full Load Current: 0.75 / 0.68 AMPS	IP Rating (AS1939): IP55
Method of Cooling: FAN COOLED	Frame Material: ROLLED STEEL CASE, CAST IRON END SHIELDS
Bearing Details: DE: 6203 NDE: 6203	
Method of Lubrication: SEALED BEARINGS	Shaft Diameter: 5/8"
Efficiency at Full Load: 78%	Power Factor at Full Load: NA
Ambient Temperature: - 20 °C TO + 40 °C	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE



## 9.6 Dosing Pump

Equipment Description: DOSING PUMP	
Manufacturer: MONO	Model: CB021
Type: POSITIVE DISPLACEMENT – HELICAL	Size: 40NB PN16 FLANGE
Gearbox Ratio: NOT APPLICABLE	Mounting: FOOT MOUNTING
Application: DOSING FLOCCULANT SOLUTION FROM THE STORAGE TANK	
Design Capacity: 0.67 Litres/second	Design Pressure: 2 Bar
Inlet Pressure: POSITIVE	Discharge Pressure (Max): 4 Bar
Pump Displacement: 2.4 m <sup>3</sup> /hour	
Material of Construction: CAST IRON	Weight: 30 kg
Stator material: INDUSTRIAL NITRILE	Starting Torque: 16Nm
Rotor material: BDS HCP TOOL STEEL	Type of Rotor: HELICAL ROTOR
Shaft material: 220M07 HCP MILD STEEL	Shaft Diameter: 24mm
Direction of Rotation: COUNTER CLOCKWISE	Coupling Type: FENNER HRC 90
Method of Lubrication: SEALED BEARING	Lubricant: SEALED FOR LIFE
Dimensions: Length: 610 mm Width: 150 mm Height: 195 mm	
Clearances for Installation/Removal: 220mm	
Operating Speed: 703 rpm	Drive Method: ELECTRIC MOTOR
Fluid Pumped: POLYELECTROLYTE	

Motor Equipment Description DOSING PUMP	
Manufacturer: TECO	Model: AEED
Output Power Rating (kW): 0.75 kW	Type: SQUIRREL CAGE INDUCTION
Frame Size: (AS1360.10) D112M	Voltage: 415 VAC @ 50 Hz
Motor Mass: 42 kg	Rotor Inertia: 0.060 kg/m <sup>2</sup>
Motor Speed: 703 RPM	No. of Poles: EIGHT
Enclosure Type: TOTALLY ENCLOSED	Mounting: FOOT
Terminal Box Location Viewed from DE: 3 O'CLOCK	Direction of Rotation Viewed From DE: CW
No. of Phases: THREE	Insulation Type: F
Rated Full Load Current: 4.18 AMPS	IP Rating (AS1939): 55
Method of Cooling: FAN COOLED	Frame Material: CAST IRON
Bearing Details: DE 6306ZZ NDE: 6306ZZ	
Method of Lubrication: SEALED BEARINGS	Shaft Diameter: 28mm
Efficiency at Full Load: 74.7 %	Power Factor at Full Load: 0.67
Ambient Temperature: -20°C TO +45°C	
Thermistors Fitted? (Y/N) NO	Thermistor Type: NOT APPLICABLE

**9.7 Hopper Powder Level Switch**

Equipment Description: HOPPER POWDER LEVEL SWITCH	
Manufacturer: BELL	Model: RP100X
Duty: POWDER HOPPER LOW LEVEL DETECTION	Size: NA
Type: ROTARY PADDLE SWITCH	
Housing - Material of Construction: ALUMINIUM	
Housing IP Rating: 55	Weight: 1.2 kG
Operating Voltage: 240VAC	Signal Type: On/Off
Operating Current: 40mA	Electrical Connection:
Max Switching Voltage: 480VAC	Max Switching Current: 15A
Dimensions: Length: 210 mm Dia: 100 mm	
Max Ambient Temperature: -20°C... +60°C	

**9.8 Water Supply Pressure Gauge**

Equipment Description: <b>WATER SUPPLY PRESSURE GAUGE</b>	
Manufacturer: RB	Model:
Duty: PRESSURE	
Mounting: 1/4" BSP DIRECT MOUNT – BOTTOM ENTRY	
Type: BOURDON TUBE – BRASS	Range: 0-1000 kPa
Size: 50 mm DIAMETER	Weight: 100 GRAMS
Case Material: STAINLESS STEEL	
Bourdon Tube: PHOSPHOR BRONZE	
Dimensions: Diameter: 58 mm Depth: 28 mm	

**9.9 Water Supply Flow Switch**

Equipment Description: <b>WATER FLOW PRESSURE SWITCH</b>	
Manufacturer: ULTRASWITCH	Model: F25
Duty: FLOW DETECTION	Size: 1"BSP
Type: REED SWITCH S.P.S.T. PADDLE OPERATED	
Housing - GLASS REINFORCED POLYPROPYLENE	
Cover - GLASS REINFORCED POLYPROPYLENE	
Housing IP Rating: IP56	Signal Type: On/Off
Operating Voltage: VOLTAGE FREE	Electrical Connection:
Max Switching Voltage: 240 VOLTS AC	Max Switching Current: 1 AMPS
Dimensions: Length: 74 mm Width: 51 mm Height: 107 mm	
Min Operating Temperature: 4 °C	Max Operating Temperature: 80 °C

**9.10 Floatless Level Switch**

<b>Equipment Description: MIXING AND STORAGE TANK LEVEL CONTROLLERS</b>	
<b>Manufacturer: OMRON</b>	<b>Model: 61F-GP-N FLOATLESS LEVEL</b>
<b>Duty: TANK LIQUID LEVEL</b>	<b>Mounting: PLUG IN</b>
<b>Type: CONDUCTIVE PROBE AMPLIFIER</b>	<b>IP Rating (AS1939): 00</b>
<b>Supply Voltage: 110V AC 50Hz</b>	<b>Weight: 305 GRAMS</b>
<b>Operating Voltage Range: 85 to 110%</b>	<b>Power Consumption: 3.2VA</b>
<b>Interelectrode Voltage (Secondary Voltage of Transformer) 8VAC</b>	
<b>Response Time: OPERATE 80ms MAX. RELEASE 160ms MAX</b>	
<b>Control Output: 3 AMP @ 240V AC (RESISTIVE LOAD) RELAY CONTACTS</b>	
<b>Insulation Resistance: 100MW MAX (at 500VDC)</b>	
<b>Dimensions: Length: 84 mm Width: 38 mm Height: 50 mm</b>	
<b>Ambient Temperature: -10°C to 55°C</b>	

## **APPENDIX A: DRAWINGS LIST**

Q125000	100T AUTO JET WET PACKAGE GENERAL ARRANGMENT
Q125001	3M <sup>3</sup> MINI BULK POWDER HOPPER GENERAL ARRANGEMENT
Q125081	100T AUTO JET WET PACKAGE JUNCTION LAYOUT
Q125082	3M <sup>3</sup> MINI BULK POWDER JUNCTION BOX LAYOUT

# APPENDIX B: MANUFACTURERS MANUALS

MONO

CB021 FLOCCULANT DOSING PUMP

SIEMENS

2BH1600 FLOCCULANT BLOWER

SEW

RF32DT63N4 SCREWFEEDER MOTOR

LIGHTNIN

XJ-43 AGITATOR

DCE

UMA70V DUST FILTER

**Mono<sup>®</sup>**

**English**

# **Installation, Operation and Maintenance Instructions**

**Monobloc B (Sizes 0X and below)**

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**OMMP/010/01/R1**

**Mono Pumps**

**DRESSER**

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<b>SECTION 4:</b>	DISMANTLING AND ASSEMBLY PICTORIAL DIAGRAMS EXPLODED VIEWS TORQUE TIGHTENING FIGURES





# **INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**

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## **INSTALLATION**

### **1.1 INSTALLATION AND SAFETY RECOMMENDATIONS**

In common with other items of process plant a pump must be installed correctly to ensure satisfactory and safe operation. The pump must also be maintained to a suitable standard. Following these recommendations will ensure that the safety of personnel and satisfactory operation of the pump is achieved.

#### **1.2.1. GENERAL**

When handling harmful or objectionable materials, adequate ventilation must be provided in order to disperse dangerous concentrations of vapours. It is recommended that wherever possible, Mono pumps should be installed with provision for adequate lighting, thus ensuring that effective maintenance can be carried out in satisfactory conditions. With certain product materials, a hosing down facility with adequate draining will simplify maintenance and prolong the life of pump components.

#### **1.2.2. SYSTEM DESIGN AND INSTALLATION**

At the system design stage, consideration must be given to provision of filler plugs, and the installation of non-return and / or isolating valves. Mono pumps are normally installed in a horizontal position with baseplates mounted on a flat surface, grouted in and bolted, thus ensuring firm fixing and a reduction in noise and vibration.

The unit should be checked after bolting down to ensure that the alignment of the pump to its prime mover is correct.

If the pump is to be mounted in any other way confirmation of the installation must be agreed with Mono Pumps Limited. All the pipework should be independently supported.

### **1.3.1 HANDLING**

During installation and maintenance, attention must be paid to the safe handling of all items. Where a pump or its components weigh in excess of 20 kg (45lb) it is recommended that suitable lifting tackle should be used to ensure that personal injury or damage to components does not occur.

For safe handling of both bareshaft pumps and pump units (pump / gearbox / motor etc) ideally slings should be used. The position of the slings will depend upon the specific pump / unit construction and should be carried out by personnel with the relevant experience to ensure that the pump is not damaged and injury to personnel does not occur.

If eye bolts do exist then these should only be used for lifting the individual components for which they are supplied.

### **1.3.2 STORAGE**

#### **SHORT TERM STORAGE**

Where a pump has to be stored for 6 months or less then the following steps are advised:-

1. Store pump inside wherever possible or if this is not feasible then provide protective covering. Do not allow moisture to collect around the pump.
2. Remove the drain plug, if fitted. Any inspection plates fitted should also be removed to ensure that the suction housing can drain and dry completely.
3. Loosen the packing gland and inject sufficient grease into the stuffing box. Tighten the gland nut hand tight. If a water flush system is to be used do not grease, a small amount of light oil is recommended for these.
4. See Manufacturers' Instructions for motor / gearbox / drive instructions for storage procedures.

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## **LONG TERM STORAGE**

If the pump is to be kept in storage for more than six months then in addition to the above the following procedures should be carried out regularly (every 2 - 3 weeks if possible):

1. If practicable rotate the pump at least three quarters of one revolution to avoid the rotor setting in the stator.
2. Note, however, that the pump is not to be rotated for more than two revolutions each time because damage could be caused to the rotor / stator elements.

## **IMMEDIATELY PRIOR TO INSTALLATION AND STARTING**

**Before installing the pump please ensure that all plugs and inspection plates are replaced and that excess grease / oil is removed from the stuffing box.**

### **1.4 ELECTRICAL**

Electrical connection should only be made using equipment suitable for both rating and environment. Where any doubts exist regarding the suitability of equipment, Mono Pumps Limited, should be consulted before proceeding. Normally the Mono pump should be installed with starting equipment arranged to give direct on line starting. Earthing points will be provided on electric drives (if supplied) and it is essential that these are correctly connected. When the motor is being wired and checked for rotation, the start / stop sequence must be instantaneous to prevent dry running or pressurising upstream equipment. **(Check direction arrow on pump nameplate).** The electrical installation should include appropriate isolating equipment to ensure that the pump unit is safe to work on.

### **1.5 RELIEF VALVES / OVER PRESSURISATION/NON-RETURN VALVES**

1. It is recommended that a suitable safety device is installed on the discharge side of the pump to prevent over-pressurisation of the system.
2. It is also recommended that a non-return valve is installed on the discharge side of the pump to prevent reverse flow through the system.

When both are installed it is advised that the relief valve is positioned closer to the pump than the non-return valve.

## **IMPORTANT**

The pump must never run against a closed inlet or outlet valve, as this could result in mechanical failure.

### **1.6 GENERAL SAFETY**

**GREAT CARE MUST BE TAKEN TO PROTECT ALL ELECTRICAL EQUIPMENT FROM SPLASHING WHEN HOSING DOWN. WHERE MONO PUMPS LIMITED, HAVE SUPPLIED A BARESHAFT PUMP THE ONUS IS ON THE USER TO FIT ADEQUATE GUARDS IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT REGULATIONS.**

All nuts and bolts, securing flanges and base mounting fixtures must be checked for tightness before operation. To eliminate vibration, the pump must be correctly aligned with the drive unit, and all guards must be securely fixed in position. When commissioning the plant, all joints in the system must be checked thoroughly for leakage. If, when starting, the pump does not appear to operate correctly, the plant must be shut down immediately and the cause of the malfunction established before operations are recommenced. It is recommended that depending upon plant system operation, either a combined vacuum and pressure gauge, or a vacuum gauge

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only be fitted to the pump inlet port, and a pressure gauge fitted to the outlet port, these will then continuously monitor the pump operating conditions.

## 1.7 DUTY CONDITIONS

Pumps should only be installed on duties for which Mono Pumps Limited have specified the materials of construction, flow rates, pressure, temperature, speed etc. Where dangerous materials are to be pumped, consideration must be given to the safe discharge from relief valves, gland drains etc.

IF THE DUTY SHOULD BE CHANGED MONO PUMPS LIMITED SHOULD BE CONTACTED AND THEIR RECOMMENDATIONS SOUGHT IN THE INTEREST OF APPLICATION, SAFETY OF PLANT, EFFICIENCY AND PUMP LIFE.

## 2. START-UP PROCEDURE

Pumps must be filled with liquid before starting. The initial filling is not for priming purposes, but to provide the necessary lubrication of the stator until the pump primes itself.

When the pump is stopped, sufficient liquid will normally be trapped in the rotor / stator assembly to provide lubrication upon re-starting. If, however, the pump has been left standing for an appreciable time, moved to a new location, or has been dismantled and re-assembled, it must be refilled with liquid and given a few turns before starting. The pump is normally somewhat stiff to turn by hand owing to the close rotor / stator fit. However, this stiffness disappears when the pump is running normally against pressure.

### 2.1 DRY RUNNING

NEVER RUN THE PUMP IN A DRY CONDITION EVEN FOR A FEW REVOLUTIONS OR THE STATOR WILL BE DAMAGED IMMEDIATELY. CONTINUAL DRY RUNNING COULD PRODUCE SOME HARMFUL OR DAMAGING EFFECTS.

## 2.2 ROTATION

### PUMP ROTATION DETAILS

<u>PUMP RANGE BI-DIRECTIONAL</u>		<u>COMMENT</u>
E	Yes	-----
Monobloc B	Yes	-----
Merlin Industrial	Yes	-----
S	Yes	-----
LF	Yes	-----
W	No	**
Merlin Widethroat	No	**
Merlin Monobloc	Yes	-----
MM ML	No	*
MS	No	**
G	No	*
SB	No	*
Placer	No	**
Grout Injection	No	*

\* Clockwise when viewed from drive end.

\*\* Anti-clockwise when viewed from drive end.

### NOTE

Check with Mono Pumps Limited or Authorised Distributor if rotation direction is to be changed.

BEFORE THE DIRECTION OF ROTATION IS CHANGED MONO PUMPS LIMITED MUST BE CONSULTED SO THAT THEY CAN CONFIRM THE SUITABILITY OF THE PUMP WHEN OPERATING ON THE NEW DUTY.

### 2.3.1. GLAND PACKING

Where a pump is supplied fitted with gland packing (manufactured from a non asbestos material) the gland will require adjustment during the initial running in period. Under normal working conditions a slight drip from the gland under pressure does not harm and assists in lubricating the packing. A gland drip is however, undesirable when handling corrosive, degreasing, or abrasive materials. Under these conditions the gland must be tightened the minimum



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amount whilst the pump is running to ensure satisfactory sealing when under pressure, or to stop entry of air when under suction conditions.

Provision of a gland drain should be considered, especially for the leakage of hazardous products.

CARE IS REQUIRED WHEN ADJUSTING THE GLAND WHILST PUMP IS RUNNING.

## 2.3.2 MECHANICAL SEALS - ALL PUMPS

When a mechanical seal is fitted to the pump it may be necessary to provide a barrier fluid to some part of the seal. This should be provided in line with the seal manufacturers instructions.

## 2.4. GUARDS

In the interests of safety, and in accordance with the U.K. Health and Safety at Work Act 1974, all guards must be replaced after necessary adjustments have been made to the pump.

## 2.5 WARNING / CONTROL DEVICE

Prior to operating the pump if any warning or control devices are fitted these must be set in accordance with their specific instructions.

## 2.6 PUMP OPERATING TEMPERATURE

The range of temperatures the pump surfaces will develop is dependent upon factors such as product temperature and ambient temperature of the installation. There may be instances where the external pump surface can exceed 50 C.

In these instances personnel must be made aware of this and suitable warnings / guarding employed.

## 2.7 NOISE LEVELS

1.The noise sound pressure level will not exceed 85dB at one metre distance from the pump. This is based on a typical installation and does not necessarily include noise from other sources or any contribution from building reverberation.

2.For noise levels on the following pumps please refer to the box below for the specific sound pressure level.

### Pump Sizes

E092, E102, E122, E152  
E121, E151, E201  
E074, E084, E094, E104, E124  
E076, E086  
E068, E078, E088

Sound Pressure Level is

## 2.8 LUBRICATION

Pumps fitted with bearings should be inspected periodically to see if grease replenishment is necessary and if so, grease should be added until the chambers at the ends of the bearing spacer are approximately one third full.

Periodic bearing inspection is necessary to maintain optimum bearing performance. The most expedient time to inspect is during periods of regular scheduled equipment downtime - for routine maintenance or for any other reason.

Under tropical or other arduous conditions, however, a more frequent examination may be necessary. It is therefore advisable to establish a correct maintenance schedule or periodic inspection.

BP Energrease LC2 or its equivalent must be used for replenishment.



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### 2.9 PUMP UNITS

Where a pump unit is dismantled and re-assembled consideration must be given to ensure that where appropriate the following steps are covered.

1. Correct alignment of pump / gearbox
2. Use appropriate couplings and bushes
3. Use of appropriate belts and pulleys correctly tensioned.

### 2.10 PUMPS FOR FOOD USE

#### CLEANING PRIOR TO OPERATION

When a pump has been supplied for a food application it is important to ensure that the pump is clean prior to initial operation of the pump. Therefore, it is important that a clean-in-place treatment is executed on the pump at the following times.

1. When the pump is first commissioned for use.
2. When any spare components are fitted into the wetted area of the pump.

A recommended CIP procedure is as follows:

1. 2.5% W/V sodium hydroxide for 20 mins at 80 C
2. Towns water for 20 mins at 80 C
3. 2.0% V/V nitric acid for 20 mins at 80 C
4. Towns water for 20 mins at 80 C

The four stages constitute one cycle and we recommend that this cycle is used to clean the pump before use on food.

Once the pump has been commissioned the cleaning process will depend upon the application. The user must therefore ensure that their cleaning procedures are suitable for the duty for which the pump has been purchased.

### 2.11 WIDETHROAT PUMPS

Specific pumps may have auger feed screws, with or without a bridge breaker system to feed the pumping element. If the pump installation required that these cannot be enclosed, care must be taken to ensure personnel cannot gain access whilst the pump is operating. If this is not possible an emergency stop device must be fitted nearby.

### 2.12 EXPLOSIVE PRODUCTS / HAZARDOUS

In certain instances the product being pumped may well be of a hazardous nature.

In these installations consideration must be given to provide suitable protection and appropriate warnings to safeguard personnel and plant.

### 2.13 ACCESS PORTS

Where access ports are fitted then the following steps must be followed:

1. Pump must not be operating and the electrical supply isolated.
2. Protective clothing should be worn, especially if the pumped product is obnoxious.
3. Remove access plated with care utilising where possible drip trays to collect product leakage.
4. Access ports are included to assist in removing blockages and to allow a visual check on the components within the suction chamber.

It is not to be considered as an additional method in dismantling the pump.

5. Re-assembly of the plate should be completed using new gaskets prior to the pump being switched on.



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## **2.14 ADJUSTABLE STATORS**

If adjustable stators are fitted then the following steps must be followed for adjusting the clamping devices.

The adjustable stator assembly is designed to give an even compression around the stator circumference. It is designed to be used when pump performance reduces through wear to an unacceptable level, to restore the required flow rate.

The stator compression is increased using the following steps:-

1. Release the six locking screws 1/2 a turn.
2. Tighten the eight clamp screws until adjustment allowed by releasing the lock screws has been taken up.
3. Repeat steps 1 and 2 until the pump performance has been restored to its former level.

### **NOTE**

It is imperative that when adjusting the stator that only sufficient pressure is placed on the stator to enable the capacity of the pump to be reinstated. Over tightening of the stator could easily result in damage to the driver by overload and so extreme care must be taken when carrying out these adjustments. It is therefore advisable to make the adjustment while the pump is running and power readings can be monitored.

## **REMOVAL OF ADJUSTABLE STATOR**

The procedure for removal of an adjustable stator is the same as that of a standard except it is necessary to remove the clamp plates before the stator can be twisted off the rotor. This can be done by undoing the clamp screws; then releasing the clamp plate by using the locking screws as jacking screws to remove the clamp plates.

Re-assembly will be done using the reverse procedure.

## **2.15 MAINTENANCE OF WEARING COMPONENTS**

### **2.15.1 ROTOR AND STATOR**

The wear rate on these components is dependent on many factors, such as product abrasivity, speed, pressure etc.

When pump performance has reduced to an unacceptable level one or possibly both items will need replacing.

### **2.15.2 DRIVE SHAFT - PACKED GLAND**

The wear rate of the gland area is dependent on many factors such as product abrasivity and speed.

Regular gland maintenance will maximise the life of the shaft. Replacement of both the gland packing and shaft will be necessary when shaft sealing becomes difficult to achieve.

### **2.15.3 COUPLING ROD JOINTS**

Regular maintenance and lubrication will maximise life of the joints.

Replacement of one or both joint assemblies and possibly the coupling rod maybe necessary when wear is apparent.

It is essential to replace all the joint items with genuine Mono parts to ensure maximum life.

### **2.15.4 FLEXISHAFT DRIVE PUMPS**

With this design there are no wearing items to replace in the drive train, however, if during routine inspection, the shaft is visibly damaged / distorted or the protective coating damaged, then this item should be replaced to avoid unexpected breakdowns.



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### 3.0 ASSEMBLY AND DISMANTLING

Section 4 contains the steps to dismantle and re-assemble the pump. All fastenings must be tightened securely and when identified the appropriate torque figures should be used.

#### 3.1 USE OF ITEMS NOT APPROVED OR MANUFACTURE BY MONO PUMPS LIMITED

The pump and its components have been designed to ensure that the pump will operate safely within the guidelines covered by the legislation. As a consequence Mono Pumps Limited have declared the machine safe to use for the duty specified as defined by the Declaration of Incorporation or Conformity that is issued with this Instruction Manual.

The use of replacement items that are not approved by or manufactured by Mono Pumps Limited may affect the safe operation of the pump and it may therefore become a safety hazard to both operators and other equipment. In these instances the Declaration provided will, therefore become invalid.

The guarantee referenced in the Terms and Conditions of Sale will also be invalidated if replacement items are used that are not approved by or manufactured by Mono Pumps Limited.

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		DIAGNOSTIC CHART			
SYMPTOMS				POSSIBLE CAUSES	
<div><div>1.</div><div>NO DISCHARGE</div></div> <div><div>2.</div><div>LOSS OF CAPACITY</div></div> <div><div>3.</div><div>IRREGULAR DISCHARGE</div></div> <div><div>4.</div><div>PRIMING LOST AFTER START</div></div> <div><div>5.</div><div>PUMP STALLS AT START UP</div></div> <div><div>6.</div><div>PUMP OVERHEATS</div></div> <div><div>7.</div><div>MOTOR OVERHEATS</div></div> <div><div>8.</div><div>EXCESSIVE POWER ABSORBED BY PUMP</div></div> <div><div>9.</div><div>NOISE AND VIBRATION</div></div> <div><div>10.</div><div>PUMP ELEMENT WEAR</div></div> <div><div>11.</div><div>EXCESSIVE GLAND OR SEAL WEAR</div></div> <div><div>12.</div><div>GLAND LEAKAGE</div></div> <div><div>13.</div><div>SEIZURE</div></div>				<div><div>1. 2. 3. 7. 26. 28. 29.</div></div> <div><div>3. 4. 5. 6. 7. 8. 9. 10. 11. 13. 16. 17. 21. 22. 23. 29.</div></div> <div><div>3. 4. 5. 6. 7. 8. 13. 15. 29.</div></div> <div><div>3. 4. 5. 6. 7. 8. 13. 15.</div></div> <div><div>8. 11. 24.</div></div> <div><div>8. 9. 11. 12. 18. 20.</div></div> <div><div>8. 11. 12. 15. 18. 20.</div></div> <div><div>8. 11. 12. 15. 18. 20.</div></div> <div><div>3. 4. 5. 6. 7. 8. 9. 11. 13. 15. 18. 19. 20. 22. 23. 27. 31.</div></div> <div><div>9. 11.</div></div> <div><div>12. 14. 25. 30.</div></div> <div><div>13. 14.</div></div> <div><div>9. 11. 12. 20.</div></div>	
LIST OF CAUSES				REMEDIAL ACTIONS	
<div><div>1.</div><div>INCORRECT DIRECTION OF ROTATION</div></div> <div><div>2.</div><div>PUMP UNPRIMED</div></div> <div><div>3.</div><div>INSUFFICIENT N.P.S.H. AVAILABLE</div></div> <div><div>4.</div><div>PRODUCT VAPOURISING IN SUPPLY LINE</div></div> <div><div>5.</div><div>AIR ENTERING SUPPLY LINE</div></div> <div><div>6.</div><div>INSUFFICIENT HEAD ABOVE SUPPLY VESSEL OUTLET</div></div> <div><div>7.</div><div>FOOTVALVE / STRAINER OBSTRUCTED OR BLOCKED</div></div> <div><div>8.</div><div>PRODUCT VISCOSITY ABOVE RATED FIGURE</div></div> <div><div>9.</div><div>PRODUCT TEMP ABOVE RATED FIGURE</div></div> <div><div>10.</div><div>PRODUCT VISCOSITY BELOW RATED FIGURE</div></div> <div><div>11.</div><div>DELIVERY PRESSURE ABOVE RATED FIGURE</div></div> <div><div>12.</div><div>GLAND OVERTIGHT</div></div> <div><div>13.</div><div>GLAND UNDERTIGHT</div></div> <div><div>14.</div><div>GLAND FLUSHING INADEQUATE</div></div> <div><div>15.</div><div>PUMP SPEED ABOVE RATED FIGURE</div></div> <div><div>16.</div><div>PUMP SPEED BELOW RATED FIGURE</div></div> <div><div>17.</div><div>BELT DRIVE SLIPPING</div></div> <div><div>18.</div><div>COUPLING MISALIGNED</div></div> <div><div>19.</div><div>INSECURE PUMP / DRIVE MOUNTING</div></div> <div><div>20.</div><div>SHAFT BEARING WEAR / FAILURE</div></div> <div><div>21.</div><div>WORN PUMP ELEMENT</div></div> <div><div>22.</div><div>RELIEF VALVE CHATTER</div></div> <div><div>23.</div><div>R.V. INCORRECTLY SET</div></div> <div><div>24.</div><div>LOW VOLTAGE</div></div> <div><div>25.</div><div>PRODUCT ENTERING PACKING AREA</div></div> <div><div>26.</div><div>DRIVE TRAIN BREAKAGE</div></div> <div><div>27.</div><div>NEGATIVE OR VERY LOW DELIVERY HEAD</div></div> <div><div>28.</div><div>DISCHARGE BLOCKED / VALVE CLOSED</div></div> <div><div>29.</div><div>STATOR TURNING</div></div> <div><div>30.</div><div>STUFFING BOX "EATS" PACKING</div></div> <div><div>31.</div><div>VEE - BELTS</div></div>				<div><div>1.</div><div>REVERSE MOTOR</div></div> <div><div>2.</div><div>BLEED SYSTEM OF AIR / GAS</div></div> <div><div>3.</div><div>INCREASE SUCTION HEAD OR REDUCE SPEED / TEMP</div></div> <div><div>4.</div><div>INCREASE N.P.S.H. AVAILABLE ( SEE 3 ABOVE )</div></div> <div><div>5.</div><div>CHECK PIPE JOINTS / GLAND ADJUSTMENT</div></div> <div><div>6.</div><div>RAISE VESSEL / INCREASE PIPE SIZE</div></div> <div><div>7.</div><div>CLEAN OUT SUCTION LINE / VALVES</div></div> <div><div>8.</div><div>DECREASE PUMP SPEED / INCREASE TEMP</div></div> <div><div>9.</div><div>COOL THE PRODUCT</div></div> <div><div>10.</div><div>INCREASE PUMP SPEED / REDUCE TEMP</div></div> <div><div>11.</div><div>CHECK FOR BLOCKAGES IN DELIVERY LINE</div></div> <div><div>12.</div><div>ADJUST GLAND SEE O &amp; M INSTRUCTIONS</div></div> <div><div>13.</div><div>ADJUST GLAND SEE O &amp; M INSTRUCTIONS</div></div> <div><div>14.</div><div>CHECK FLUID FLOWS FREELY INTO GLAND</div></div> <div><div>15.</div><div>DECREASE PUMP SPEED</div></div> <div><div>16.</div><div>INCREASE PUMP SPEED</div></div> <div><div>17.</div><div>RE - TENSION BELTS</div></div> <div><div>18.</div><div>CHECK AND ADJUST ALIGNMENT</div></div> <div><div>19.</div><div>CHECK AND TIGHTEN ALL PUMP MOUNTINGS</div></div> <div><div>20.</div><div>REPLACE BEARINGS</div></div> <div><div>21.</div><div>FIT NEW PARTS</div></div> <div><div>22.</div><div>CHECK CONDITION OF VALVE / RENEW</div></div> <div><div>23.</div><div>RE - ADJUST SPRING COMPRESSION</div></div> <div><div>24.</div><div>CHECK VOLTAGE / WIRING SIZES</div></div> <div><div>25.</div><div>CHECK PACKING CONDITION AND TYPE</div></div> <div><div>26.</div><div>CHECK AND REPLACE BROKEN COMPONENTS</div></div> <div><div>27.</div><div>CLOSE DELIVERY VALVE SLIGHTLY</div></div> <div><div>28.</div><div>REVERSE PUMP/RELIEVE PRESSURE/CLEAR BLOCKAGES</div></div> <div><div>29.</div><div>REPLACE WORN PARTS / TIGHTEN UP STATOR BOLTS</div></div> <div><div>30.</div><div>CHECK FOR WORN SHAFT AND REPLACE</div></div> <div><div>31.</div><div>CHECK AND ADJUST TENSION OR REPLACE</div></div>	

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Mono Pumps 

MONO PUMPS LIMITED

# **INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**

SECTION 3

PAGE 1

DATE JULY 1995

**B RANGE  
0X AND BELOW**
**DRAWING REFERENCE NUMBERS**
**DRG  
REF.**
**DESCRIPTION**
**DRG  
REF.**
**DESCRIPTION**

01A BODY  
01B BODY ADAPTOR  
06A NAMEPLATE (SOG)  
06B NAMEPLATE (DOG)  
08A GLAND FOLLOWER  
10A GLAND PACKING  
10B MECHANICAL SEAL  
15A THROWER GUARD  
20A GASKET - GLAND  
20B GASKET - STATOR SUPPORT RING  
20C GASKET - STATOR SUPPORT RING  
22A STATOR  
23A SUCTION CHAMBER  
23B SUCTION CHAMBER EXTENSION  
24A END COVER  
25A ROTOR  
26A FLEXISHAFT  
32A SHAFT  
42A THROWER  
47A STATOR SUPPORT RING  
47B STATOR SUPPORT RING  
62A SUPPORT FOOT  
62B SUPPORT FOOT  
65A GLAND SECTION  
75A SLEEVE ROTOR  
76A ADAPTOR FLANGE  
95A TIE ROD

P501 PLUG  
P502 PLUG  
P503 PLUG  
P504 HEXAGON NUT  
P505 SPRING WASHER  
P506 PLAIN WASHER  
P507 HEXAGON NUT  
P508 SPRING WASHER  
P509 PLAIN WASHER  
P510 HEXAGON HEAD BOLT  
P511 HEXAGON NUT  
P512 SPRING WASHER  
P513 PLAIN WASHER  
P514 SEAL  
P515 SEAL

P101 HEX HD SCREW  
P102 PLAIN WASHER  
P103 RD HD DRIVE SCREW  
P104 HEX HD BOLT  
P105 HEX NUT  
P106 PLAIN WASHER  
P107 SPRING WASHER  
P108 SPRING WASHER  
P109 HEX NUT

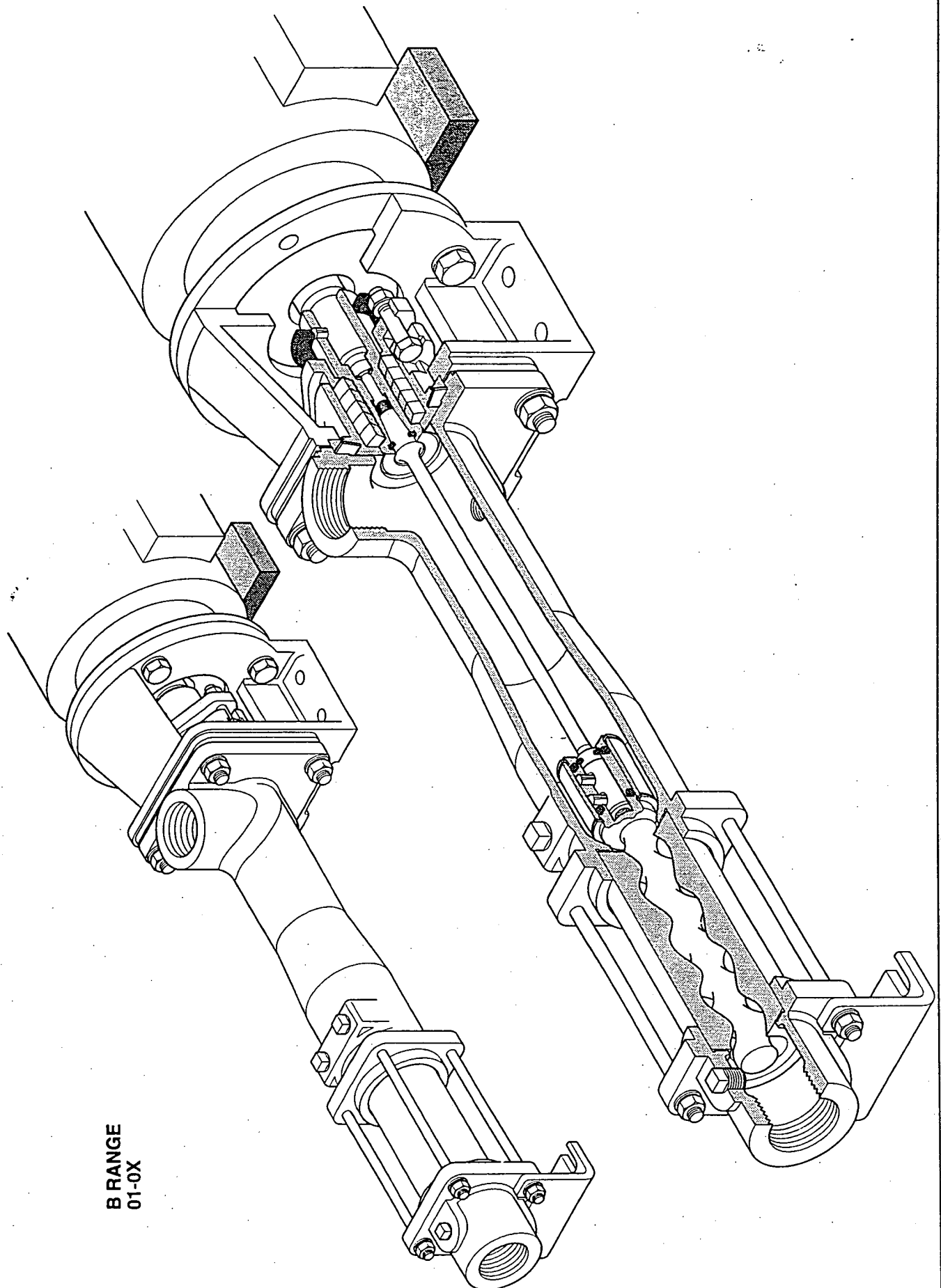
P201 HEX HD BOLT  
P202 HEX NUT  
P203 PLAIN WASHER

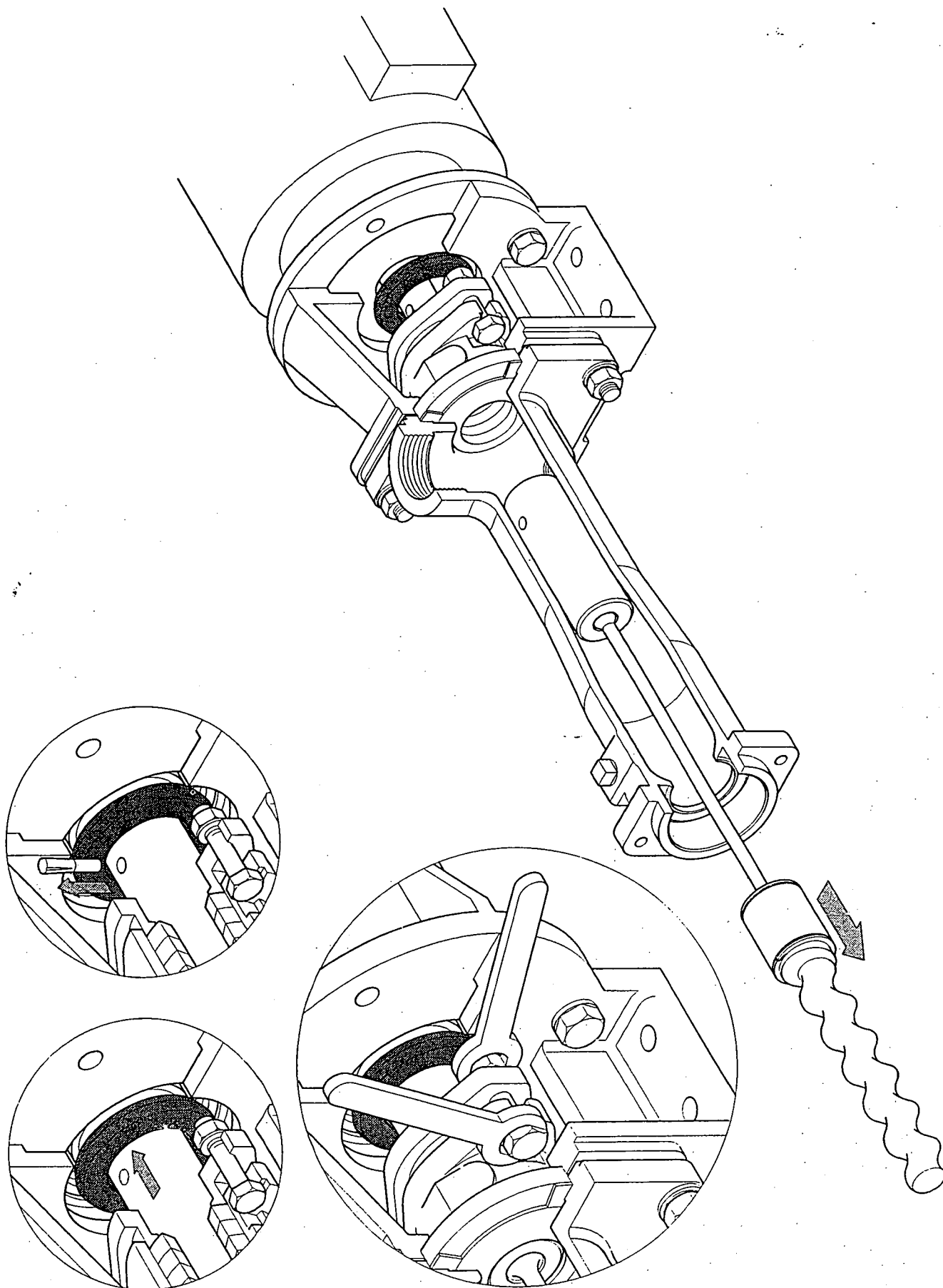
P401 PIN  
P402 SEAL  
P403 SEAL  
P404 SEAL  
P405 CAPSCREW  
P406 PLAIN WASHER  
P407 SPIRAL RET. RING  
P408 PIN

## **IMPORTANT NOTE**

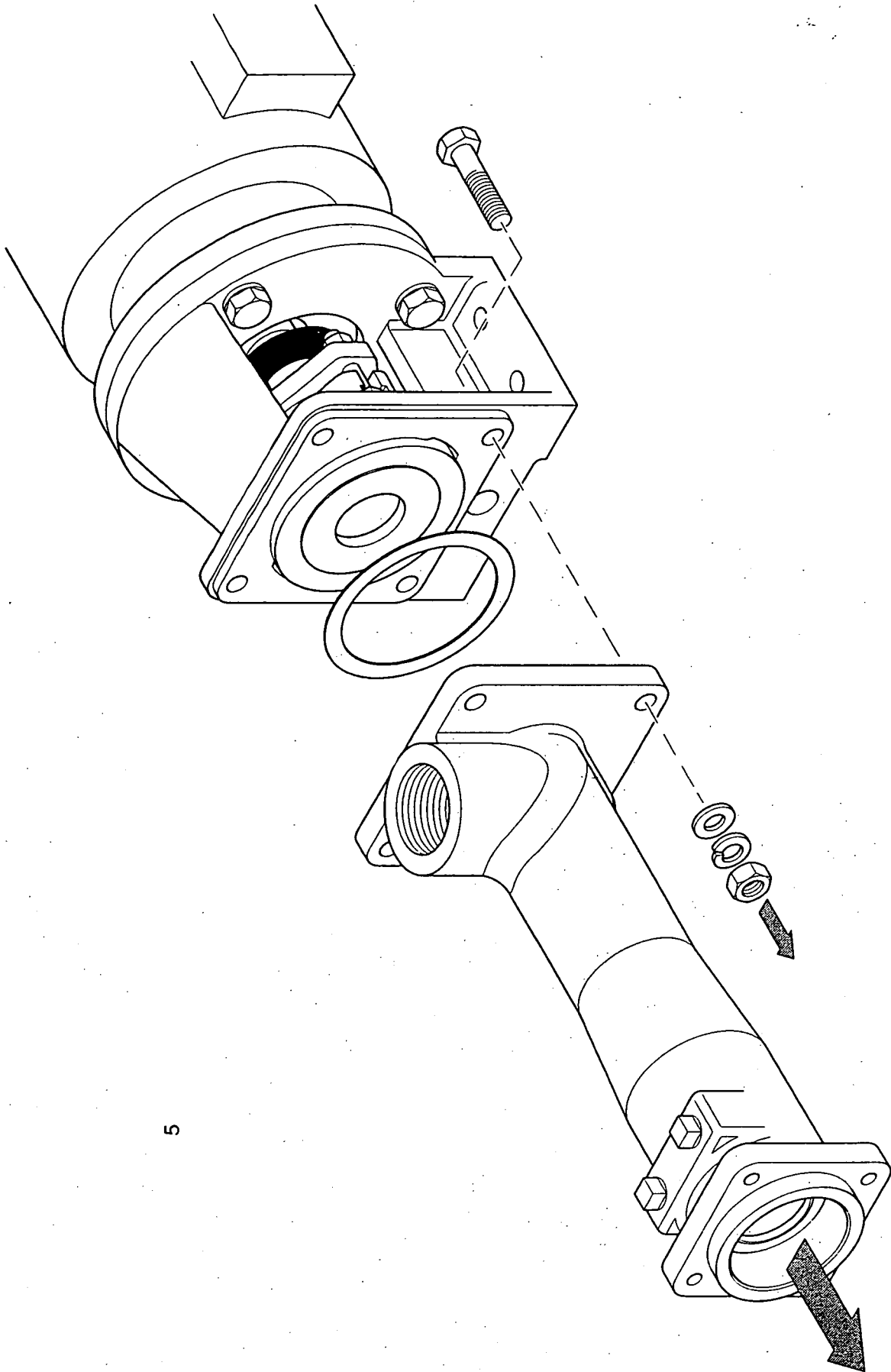
THE DRAWING REFERENCES SHOWN GIVE THE DESCRIPTION OF ALL THE PARTS  
DETAILED ON THE SECTIONAL DRAWINGS IN THIS SECTION OF THE BOOK.  
THEREFORE SOME OF THE REFERENCES MAY NOT BE SHOWN ON ANY ONE

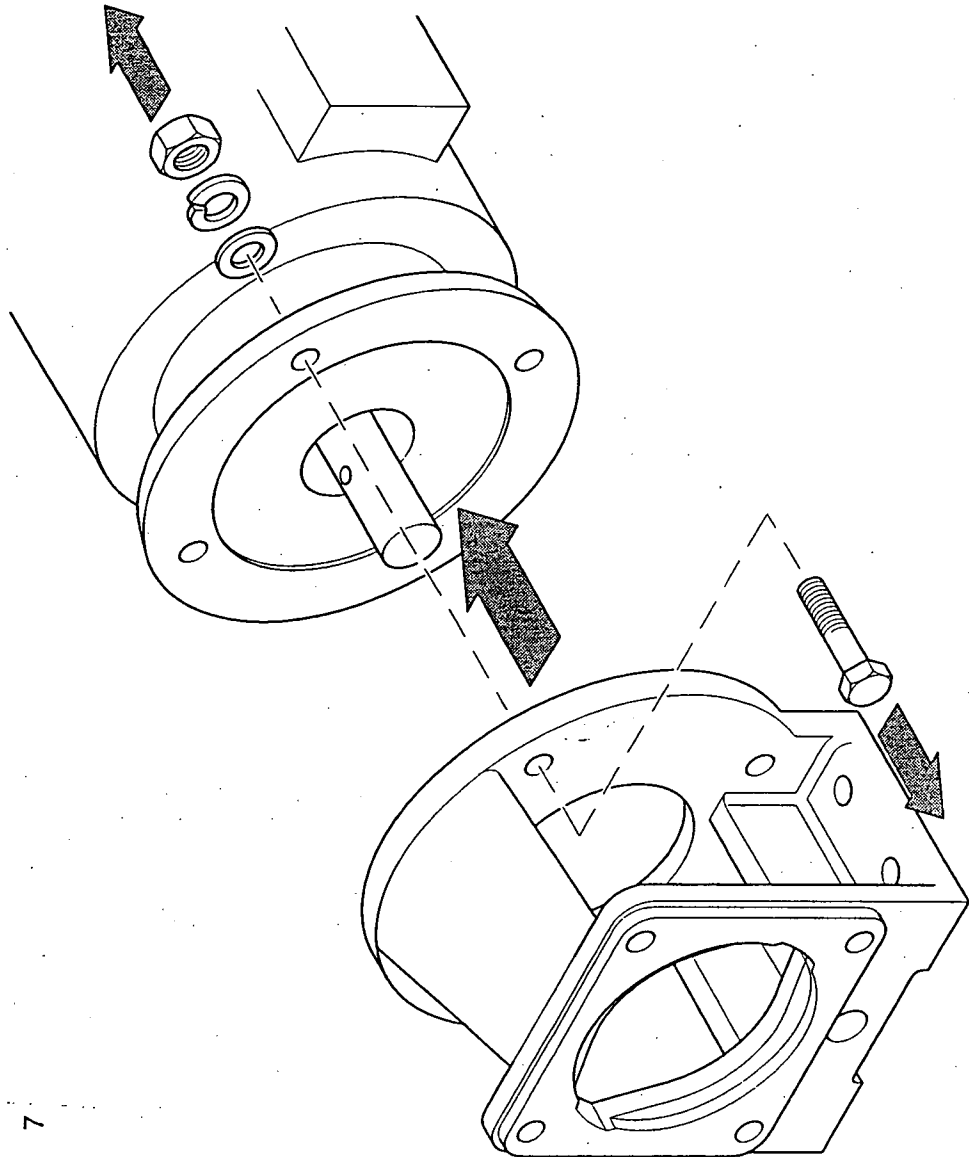
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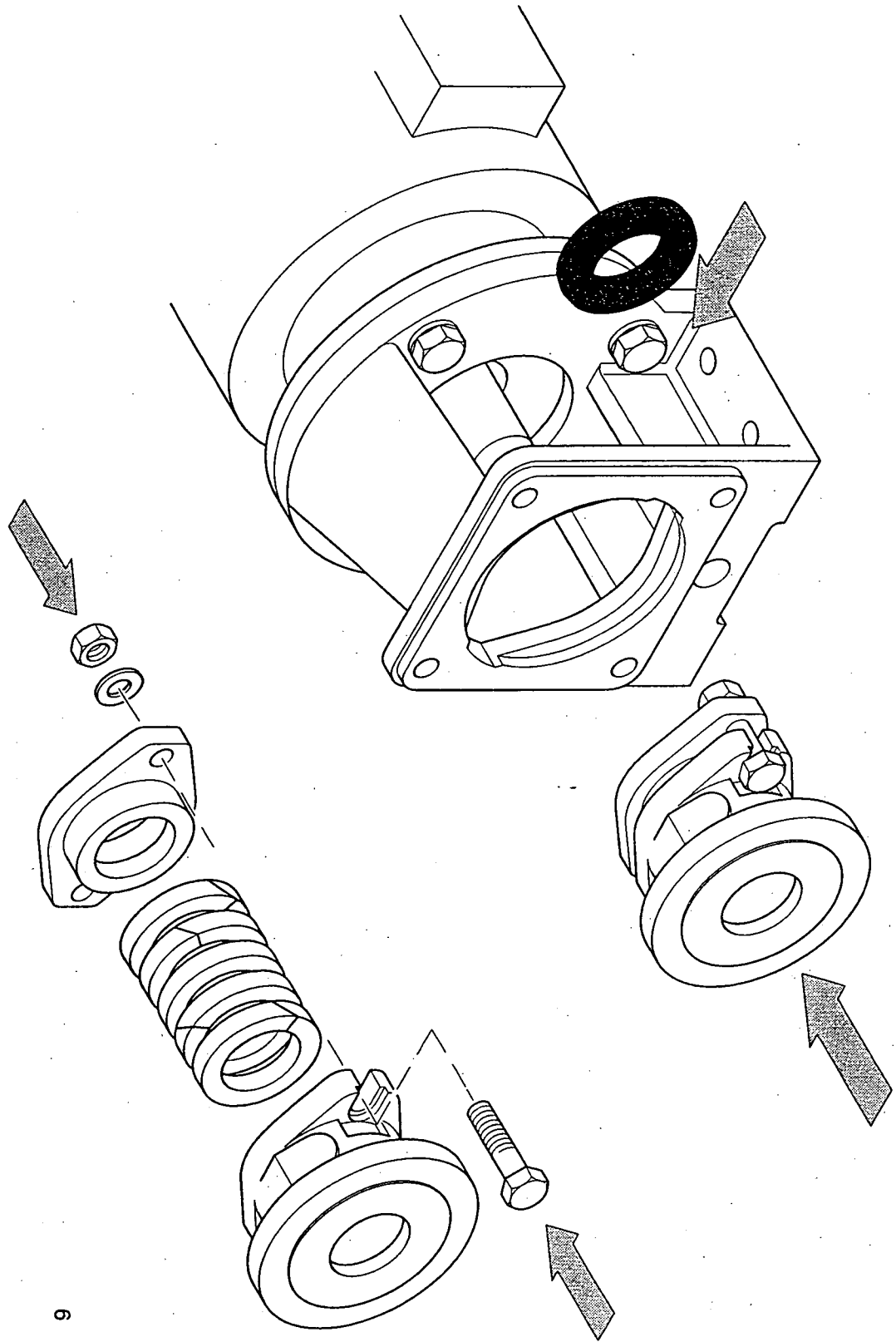




3





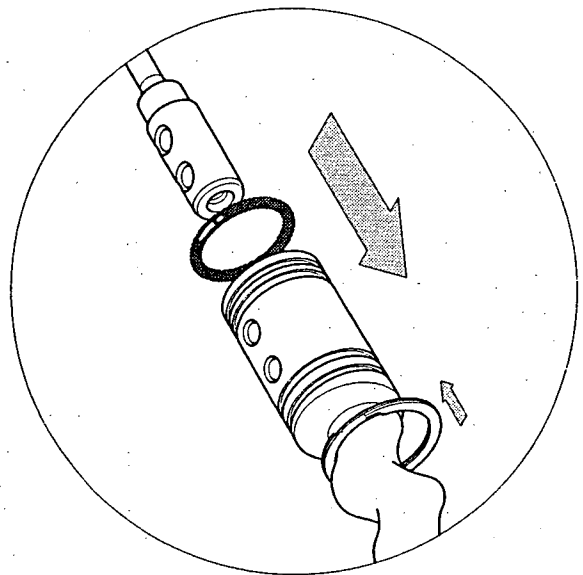
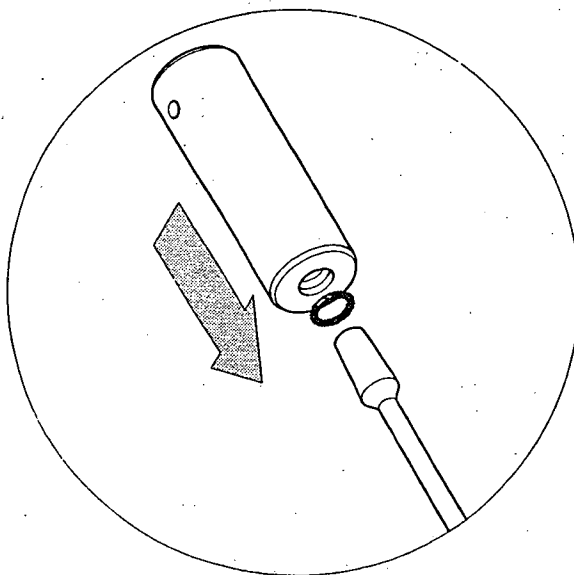
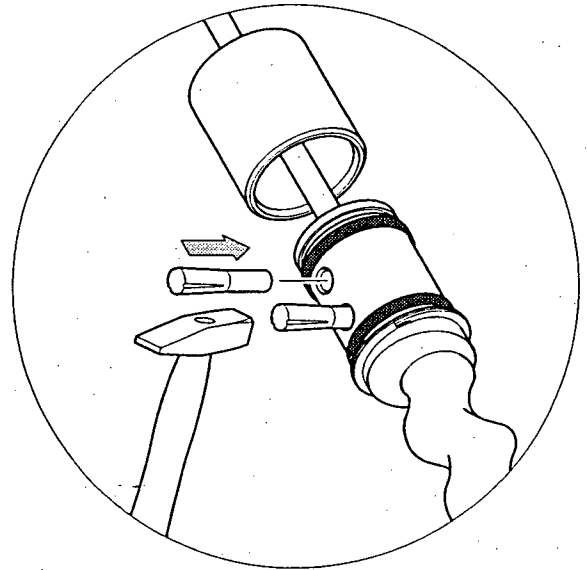
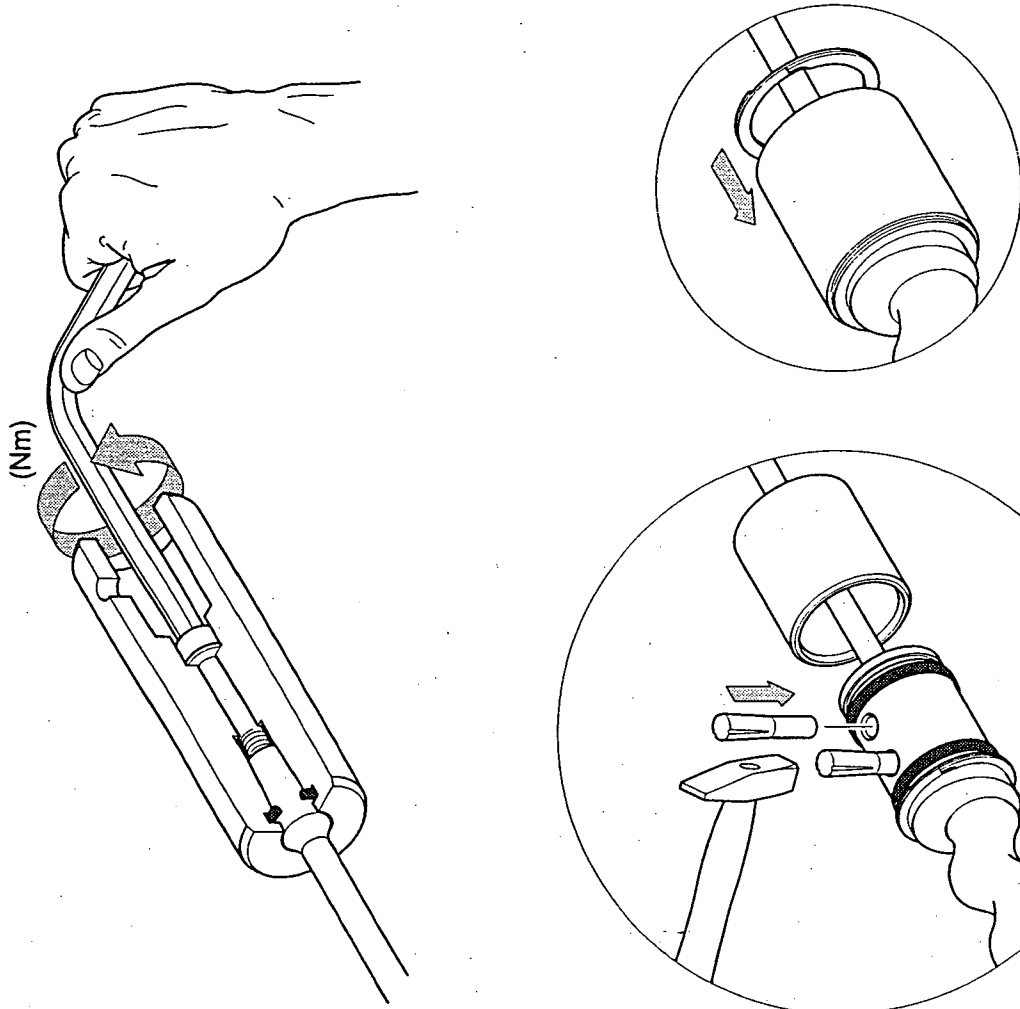


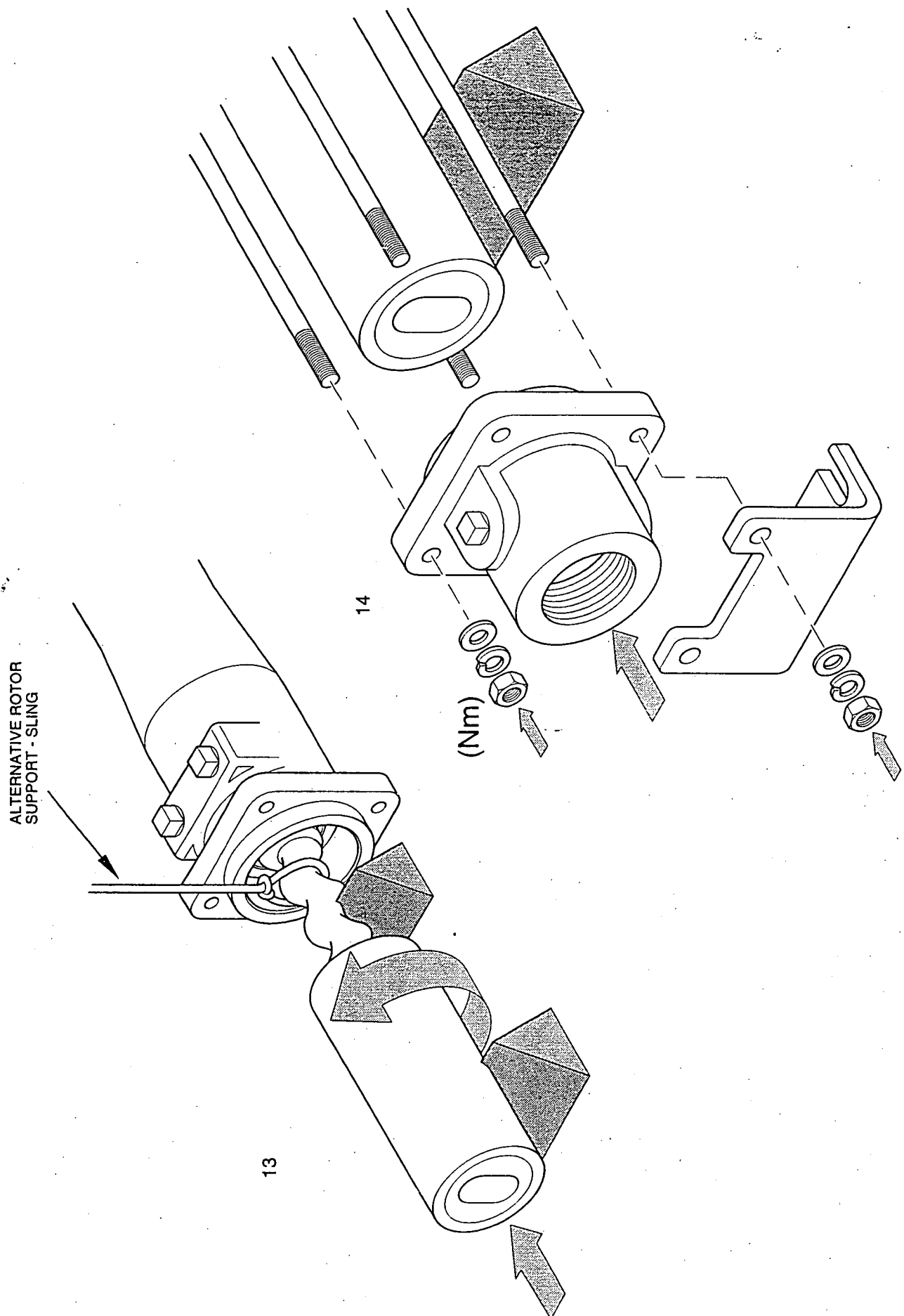
**Mono Pumps****DRESSER****INSTALLATION, OPERATION  
& MAINTENANCE INSTRUCTIONS**  
**B RANGE (01-0X)**

SECTION: 4

PAGE: 11

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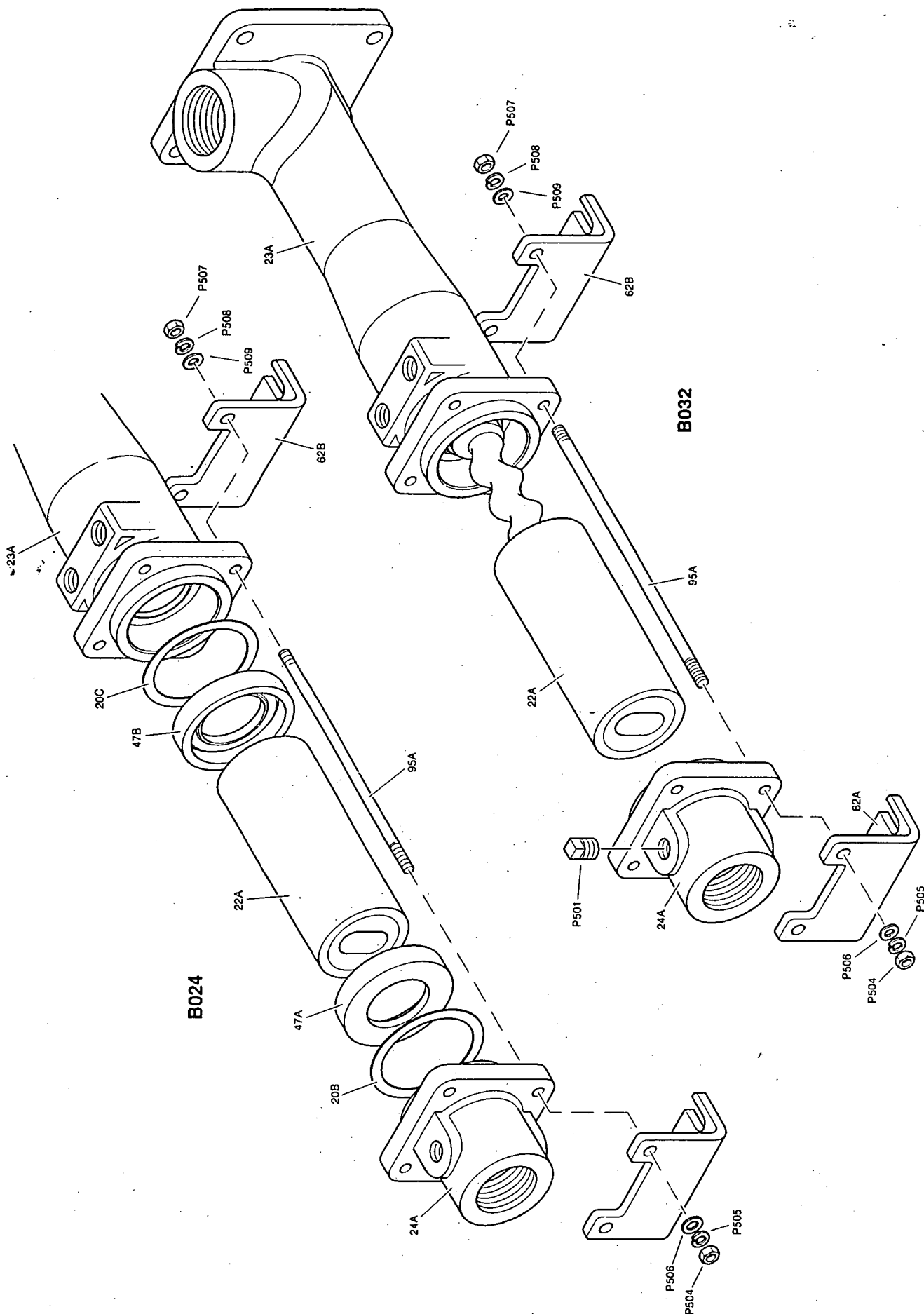
DRESSER

# **INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS** **B RANGE (01-0X)**

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**Mono Pumps**

# **INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**

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**B RANGE  
01 - 0X**

## **TORQUE TIGHTENING TABLE FOR FASTENERS**

PUMP SIZE	SUCTION CHAMBER/ SUCTION EXT.	STATOR TIE BAR	DRIVE END FLEXISHAFT CAP SCREW
	Nm P105	Nm P504, P507	Nm P405
B012	10	4	9
B014	10	4	9
B021	10	4	9
B022	10	4	9
B024	10	4	9
B031	10	4	9
B032	10	4	9
B0X1	10	10	9

**Note:** Torque tolerances are +/- 5% of stated nominal figures.

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## ELMO-Gasring-Vakuumpumpen /-Kompressoren

ELMO gas ring vacuum pumps/compressors

Pompes / compresseurs à vide annulaires de gaz ELMO

Bombas de vacío / compresores hidrorrotativos ELMO para gases

Pompe / compressori a vuoto con anello a gas ELMO

ELMO Gasring-vakuumpump/-kompressor

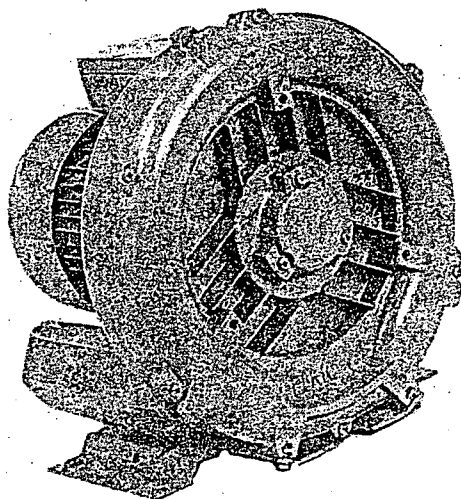
Betriebsanleitung  
Instructions

2BH1 3..

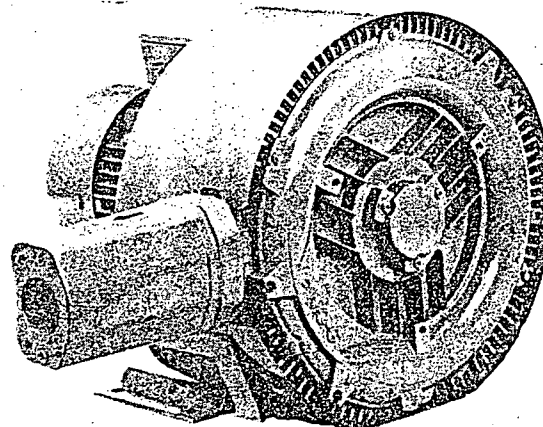
2BH1 4..

2BH1 5..

2BH1 6..



Einstufige Ausführung  
Single-stage design  
Version monoétagée  
Modelo de una etapa  
Esecuzione ad uno stadio  
Enstegs-utförande



Zweistufige Ausführung  
Two-stage design  
Version à 2 étages  
Modelo de dos etapas  
Esecuzione a due stadi  
Tvåstegs-utförande

**General notes**

Machines marked **CE**, if used as intended, satisfy the requirements of the EC Directive relating to machinery 89/392/EEC (see EC Conformity Declaration, Fig. 5).

**WARNING**

Due attention must be given to the information and instructions contained in all operating and other instructions. This is essential for the avoidance of hazards and damage! The attached supplementary safety bulletin (610.43083.21/yellow) contains further safety information.

Special versions and design variants may differ in technical details. In case of doubt, you are urged to consult the manufacturer, quoting the type designation and serial number (No E ..., see rating plate), or to arrange for maintenance to be carried out by a Siemens service centre.

## 1 Description

### 1.1 Application

**Intended use:** The single-stage and multi-stage gas ring vacuum pumps/compressors (ELMO-G) are suitable for handling air and other non-flammable, non-corrosive and non-explosive gases.

ELMO-G units are designed for continuous operation. In the case of frequent switching or high ambient temperatures, pay attention to the maximum permissible temperature rise. Details on request.

Solids and impurities must be eliminated before entering ELMO-G units (intake filter).

*ELMO-G units with EEx e drive motors may be used in rooms occasionally exposed to explosive gases. Explosive gases must not be conveyed. Please note the temperature class indicated on the rating plate.*

### 1.2 Suction and compression pressures

The drive motors can be loaded to the total differential pressures given (Fig. 1.1 to Fig. 1.4) at +25°C and +40°C gas inlet and ambient temperatures. Fit a pressure control valve in the intake line or discharge line for heavy throttling.

The total differential pressure values given apply only if the cooling system of the ELMO-G unit is functioning perfectly.

The highest permissible pressure inside the ELMO-G

$$p_{\text{int max}} = 2 \text{ bar abs.}$$

At this pressure, the performance of ELMO-G units may suffer considerably.

### 1.3 Measuring surface sound pressure level

For information about the measuring surface sound pressure level, see Fig. 1.1 to Fig. 1.4.

### 1.4 Temperatures

The maximum permissible ambient temperature and gas temperature at the inlet is +40°C (ELMO-G units for warmer gases available on request).

## 2 Operation

### 2.1 Transport, storage

When lifted by crane, ELMO-G units must be secured at the eye-bolt on the pump casing.

**Pay attention to the load-bearing capacity of the hoisting equipment!** For ELMO-G weight data, see Fig. 1.1 to Fig. 1.4.

The rolling-contact bearings should be regreased, or enclosed, rolling-contact bearings should be replaced with new ones if more than four years have elapsed between delivery and machine commissioning under favourable circumstances (storage in a dry, dust-free and vibration-free room). Under unfavourable circumstances, this period is considerably reduced.

### 2.2 Installation

ELMO-G units can be installed and mounted in any axial position. Quiet vibration-free running is achieved by means of firm foundation or stable mounting conditions. Do not obstruct the cooling system. Keep ventilation gratings and openings clear. The direction of flow is indicated by an arrow. Opposite direction of rotation and thus opposite direction of flow available on request.

If the compressor is mounted on its cover 2.030 (Fig. 2) or near to a wall, the minimum clearance to the front of the cover should be for:

2BH 13..	20 mm
2BH 14..	20 mm
2BH 15..	20 mm
2BH 16..	30 mm

On the discharge side, the cover 2.030, centre section 2.072, graded tube 8.049 and silencer casing 8.403 must not come into contact with flammable materials (wood, etc.).

After installation, the eye-bolts must be tightened or removed.

The flow noise is reduced by built-in silencers. In the case of free gas intake or exhaust, the noise can be further reduced by attaching additional silencers (available as accessories). In order to reduce noise emission even further, ELMO-G units should not be attached to components that conduct or radiate sound (such as thin walls, metal plates, etc.). If necessary, provide intermediate sound-absorbent layers.

Piping must be installed so as to avoid strain on the ELMO-G unit.

### 2.3 Electrical connection



**WARNING** The electric power must be disconnected before any work is performed on the equipment.

The system voltage and frequency must be the same as stated on the rating plate. ±5% voltage - and / or ±2% frequency deviations from the rated values are permitted without the necessity of derating the output. The links should be arranged and connected according to the circuit diagram in the terminal box. The protective earth conductor should be connected to the terminal.

The terminal box is made of non-conductive plastic material. Because of this, the cable entries for motors up to 2.2 kW/50 Hz and 2.55 kW/60 Hz must be fitted with cable glands or screw plugs of non-conductive material. (Does not apply to EEx e drive motors).

2BH13.. - 2BH14.. 50 Hz		Zulässige Gesamtdruckdifferenz		Motorbemes- sungsleistung		Erwärmung <sup>c)</sup>	Meßflächenschall- druckpegel <sup>e)</sup>	Gewicht
Vakuumpumpe/ Kompressor Vacuum pump/ Compressor Pompe à vide/ Compresseur Bomba de vacío/ Compresores Pompa a vuoto/ Compressore Vakuumpump/ Kompressor		Permissible total differential pressure Pression différentielle admissible Diferencia total admisible de la presión Pressione differenziale totale ammissibile Tillåten total tryckdifferens		Rated motor output Puissance nomin- ale du moteur Potencia nominal del motor Potenza di tar- atura del motore Motorns- märkeffekt		Temperature rise <sup>c)</sup> Echauffe- ment <sup>c)</sup> Calenta- miento <sup>c)</sup> Riscald- amento <sup>c)</sup> Uppvärm- ning <sup>c)</sup>	Measuring-surface sound- pressure level <sup>e)</sup> Niveau de pression acoustique <sup>e)</sup> Nivel de intensidad acústica en la superficie <sup>e)</sup> Livello di pressione acustica delle superfici di misura <sup>e)</sup> Ljudtrycksnivå <sup>e)</sup>	Weight Poids Peso Peso Vikt
		[bar]		[kW]		ΔT [K]	[ dB (A) ]	[kg]
Typ/Type/Tipo		+ 25°C	+ 40°C	+ 25°C	+ 40°C	ca.	ca.	ca.
Einstufige Ausführung Single-stage design Version monostagie Modelo de una etapa Esecuzione ad uno stadio Enstages-utförande	2BH1300 -1. C 0.	0,10 <sup>a)</sup>	0,10 <sup>a)</sup>	0,11	0,10	0,25	32	8
	-1. C 1.	0,12 <sup>a)</sup>	0,12 <sup>a)</sup>	0,13 <sup>a)</sup>	0,13 <sup>a)</sup>	0,40	32	10
	-1.. 2. EEx e II	-	0,11	-	0,13	0,36	32	10
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstages-utförande	2BH1310 -1. C 2.	0,205	0,18	0,24	0,20	0,77	50	14
	-1. C 4.	0,22	0,19	0,27	0,23	1,10	60	17
	-1.. 4. EEx e II	-	0,19	-	0,25	0,71	55	18
Einstufige Ausführung Single-stage design Version monostagie Modelo de una etapa Esecuzione ad uno stadio Enstages-utförande	2BH1400 -1. C 0.	0,14	0,12	0,14	0,11	0,76	37	13
	-1. C 1.	0,165	0,15	0,18	0,15	0,90	54	14
	-1. H 2.	0,175	0,16	0,20	0,19	1,10	65	16
	-1.. 2. EEx e II	-	0,17	-	0,20	1,00	66	16
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstages-utförande	2BH1410 -1. C 3.	0,28	0,25	0,325	0,25	1,75	68	24
	-1. C 4.	0,28	0,28	0,37	0,36	2,20	83	27
	-1.. 4. EEx e II	-	0,28	-	0,30	1,60	60	27

- a) vollständige Drosselung ist kurzzeitig zulässig  
a) Fullthrottling is permissible for a short period  
a) Etranglement total admissible pour une courte durée  
a) Se permite una estrangulación total durante un breve periodo  
a) Uno strozzamento completo è ammesso per tempi brevi  
a) Fullständig strypning är tillåten för kort tid

- b) Vakuumpumpe: Absaugung von Luft mit 15°C am Saugstutzen und 1013 mbar am Druckstutzen  
b) Kompressor: Verdichtung von Luft mit 15°C und 1013 mbar am Saugstutzen  
b) Vacuum pump: Air extraction at 15°C intake temperature and 1013 mbar discharge pressure  
b) Compressor: Air compression at 15°C intake temperature and 1013 mbar intake pressure  
b) Pompe à vide: température d'air à l'entrée 15 °C - pression d'air à la sortie 1013 mbar  
b) Compresseur: température d'air à l'entrée 15 °C - pression d'air à l'entrée 1013 mbar  
b) Bomba de vacío: Aspiración de aire a 15 °C en la tubería de aspiración y a 1013 mbar en la de presión  
b) Compresor: Compresión del aire a 15 °C y 1013 mbar en la tubería de aspiración  
b) Pompa a vuoto: Aspirazione dell'aria a 15 °C al bocchettone di aspirazione e 1013 mbar al bocchettone di pressione  
b) Compressore: Concentrazione dell'aria a 15 °C e 1013 mbar al bocchettone di aspirazione  
b) Vakuumpump: Utsugning av luft vid 15°C vid sugstutsen och 1013 mbar vid tryckstutsen  
b) Kompressor: Luft komprimeras vid 15 °C och 1013 mbar vid sugstutsen

- c) Erwärmung von Gehäuse und Luftaustritt gegenüber Umgebungstemperatur bei Betrieb mit zulässiger Gesamtdruckdifferenz und Luftdruck 1013 mbar; niedrigere Drücke erhöhen diese Erwärmung!  
c) Temperature rise of housing and air outlet as against ambient temperature during operation at the permissible total pressure difference and at an air pressure of 1013 mbar; this temperature rise increases at lower pressures.  
c) Echauffement du corps et de l'entrée d'air par rapport à la température ambiante en fonctionnement avec la pression différentielle totale admissible et à la pression atmosphérique de 1013 mbar; une pression inférieure entraîne une augmentation de l'échauffement!  
c) Calentamiento de la carcasa y de la salida del aire respecto a la temperatura ambiente cuando se opera con la diferencia total admisible de la presión y una presión atmosférica de 1013 mbar. ¡Con presiones inferiores el calentamiento es mayor!  
c) Riscaldamento della carcassa e del gas all'uscita rispetto alla temperatura ambiente in caso di esercizio con pressione differenziale totale ammessa e pressione dell'aria pari a 1013 mbar; pressioni inferiori contribuiscono ad aumentare il riscaldamento.  
c) Uppvärmning av huset och luftutsläppet jämfört med omgivningstemperaturen vid drift med tillåten totaltryckdifferens och lufttryck 1013 bar; lägre tryck ökar denna uppvärmning!

Fig. 1.1 2BH13.. - 2BH14.. 50 Hz


The machines are also employed in **non-industrial** applications, however, i.e. in commercial or private sectors (e.g. the trades, farming, home and garden, etc.). If the safety precautions according to rating plate data and certificates are not adequate for these or special industrial applications due to special safety regulations or requirements, the operator of this machine or the manufacturer of the system, unit or device in which the machine is installed must make certain that these special safety regulations and requirements are complied with (e.g. by ordering special models of the machines, installing additional protective equipment, appropriate installation, etc.).

## TRANSPORT, STORAGE


**NOTE:** Certain machines must be picked up only at the main lifting fittings provided for this purpose, at lifting lugs for example. Use hoisting tackle appropriate in terms of machine weight. Use suitable cable guides or spreading devices if the machine in the delivery state has any attachments, etc. fitted (see Operating Manual).

## OPERATION AND MAINTENANCE

### General Safety Notes


 **WARNING** To be safe, operation and servicing of the machine or device must be performed properly by qualified personnel who observe the warnings in these and other operating and repair manuals supplied and the notes on the machines and devices.

In particular, the general standards for installation and safety (DIN and VDE for example), are to be followed for work on power installations, as are the standards for the proper use of lifting tackle and equipment and the use of personal protective equipment such as safety goggles, etc.


 **DANGER** Do not reach into the machine through air intake or discharge ports: The rotor is very dangerous. Keep in mind that, due to its rotating mass, the machine may continue to turn several minutes after being shut off. If the gas in the system has not expanded, the machine can start to rotate due to leakage through shut-off units.

The rotor can cause injury even when the machine is switched off if the rotor is rotated manually.

### INSTALLATION

 **CAUTION** Under unfavourable operating conditions, parts of the housing may reach temperatures of over 80 °C, possibly necessitating the use of a touch guard - depending on the installation conditions. Note, too, that material being handled can be ejected at these temperatures through discharge ports and pressure control valves. Site these openings so that they are not directed towards personnel and flammable or explosive materials. Temperature-sensitive parts such as cables or electronic components are not to be placed next to or attached to parts of the housing or incoming or outgoing piping.

The machines can be installed in a dusty or damp location. The insulation is tropic-proof. Normally, no special protective measures are required to protect the machines against the weather when they are properly stored or installed out of doors. When installing machines with the shaft in the vertical position, EEx-e motors require a cover to prevent foreign bodies from falling into the motor fan cowl (see


 **WARNING** Ensure that water cannot enter the motor.

Attention is drawn to the general requirements for protection against contact with moving parts such as pulleys.


### CONNECTIONS


Comply with data in the manuals supplied. Connection cables must be selected according to the type of use and to the voltages and current levels at hand. Connect machine in accordance with the circuit diagram in the terminal box or - if the machine has no terminal box - in accordance with the separate circuit diagram.

Tighten the connection terminals of the machines to the torques stated in the terminal box.

 **CAUTION** To avoid danger, the feeder cables in the terminal box must be professionally connected. In particular, this means that:

- the inside of the terminal box is clean and contains no cable remains
- protective conductor or protective earthing is connected
- all terminal lugs are tight
- the minimum clearances in air are adhered to (beware of protruding wire ends)
- unused penetrations are sealed and the cover elements are screwed in tight
- all sealing surfaces of the terminal box are in a proper state to maintain the type of protection. If tightness of the joints is achieved only with metal sealing surfaces, these have to be cleaned and then lightly lubricated.
- Before the initial start-up, connect liquid pumps and liquid ring pumps to the pipes provided so that no fluid can reach energized components.
- The material and dimensioning of all pipes, containers and fittings must be matched to the pressure and temperature conditions involved and must be suitable for the type of material to be conveyed.

 **CAUTION** There is a danger of bursts if the machine is subjected to impermissibly high pressure from the plant. Where applicable, suitable pressure-relief devices must be used to prevent this.

 **CAUTION** Where pumps or compressors are involved which conduct hot or dangerous gases, vapours or liquids, or are operated with dangerous working liquids, or have to be emptied at temperatures over 60 °C, all drain connections must be equipped with shut-off fittings and the material conveyed and/or the working liquids must be taken away in closed systems.

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<b>Terminology</b>	5	<b>Qualified personnel</b> are persons who, due to their training, experience and instruction and their knowledge of pertinent standards, specifications, accident prevention regulations and operating conditions, have been authorized by the party responsible for the safety of the system to carry out the activities necessary in each case and are capable of recognizing and avoiding possible inherent dangers in doing so. Among other skills, a knowledge of first aid is required.
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## TERMINOLOGY

In accordance with all supplied operating and repair manuals and the warnings on the machines and devices themselves.

### Operation

encompasses the installation, commissioning (preparation for use) and controls by operator (actuation, switching on and off, etc.).

### Servicing

encompasses the testing and preventive maintenance (inspections and overhauls), maintenance, corrective maintenance (troubleshooting with repair).



### ...WARNING NOTICES



#### DANGER

means that death, grievous injury or extensive damage to property will occur if the appropriate precautions are not taken.



#### WARNING

means that death, grievous injury or extensive damage to property may occur if the appropriate precautions are not taken.



#### CAUTION

means that minor injury or damage to property may occur if the appropriate precautions are not taken.

**NOTE** means that particular attention is drawn to the interaction of technical processes because they may not be obvious even to qualified personnel.

Even though not specifically mentioned, compliance with transport, assembly, operating and maintenance notes and technical data (in the operating manuals, the product documents or on the machine itself) is, however, equally crucial in order to avoid disruptions which might in turn directly or indirectly cause grievous injury or serious damage to property.

## GENERAL NOTE

In the interest of clarity and in view of the possible wealth of information, these operating and repair manuals do not detail every bit of information and, in particular, cannot discuss every possible operational or servicing-related situation.

If you wish additional information, or if specific problems arise which are not dealt with in sufficient detail in the operating and repair manuals supplied, you can request the information required through your local Siemens office.

The contents of these operating and repair manuals are neither part of, nor are they intended to alter a former or existing agreement, commitment or legal relationship. All obligations on Siemens' part arise from the pertinent purchase agreement, which also contains the complete and sole valid warranty terms. These contractual warranty terms are neither extended nor restricted by the statements made in these operating and repair manuals.

## GENERAL INFORMATION, DESCRIPTION

### Basic Information about Safety



#### DANGER

Due to their function-related electrical and mechanical properties, the machines can cause extremely serious damage to health and property if they are not used, operated and serviced as intended or if they are tampered with. It is therefore assumed that planning and execution of all mechanical and electrical facilities and transport, operation and servicing will be executed and supervised by responsible, qualified personnel.



#### WARNING

When electric machines or devices are running some of their components are conducting dangerous electricity and/or are subjected to mechanical stress. The persons working on the machine and/or the device must be appropriately qualified. They must be thoroughly acquainted with the contents of these and all other operating and repair manuals provided. Correct, safe use of this machine and the device requires proper transport, proper storage, operation as intended and careful servicing. All notes and information on the machines or devices must be observed.

## APPLICATIONS, DESIGN, OPERATING MODE

**NOTE:** The electrical machines for which these operating manuals are intended are component parts of electrical power installations, units and equipment chiefly for industrial applications and have been constructed in accordance with the information specified on their rating and other plates, in certificates, order documents and catalogs, e.g. VDE 0530, IEC 34-1. Accordingly, the operating manuals contain basically only information pertaining to safety which must be observed when used as intended in industrial applications. The pertinent applicable national, local and system-specific specifications and requirements must also be taken into account.

## CORRECTIVE MAINTENANCE

## Sommaire

Page



## WARNING

Repairs to EEx-e motors must be carried out in Siemens shops or acceptance-tested by an officially recognized expert.

## DISMANTLING

Sectional diagrams and representations in operating manuals and other manuals contain information regarding the technical design of normal machines and assemblies. However, special models and versions may deviate in technical details. If any uncertainty exists, we strongly recommend that you contact us, stating the machine type and serial number, or that you have the maintenance work performed at a SIEMENS service centre.



## CAUTION

After fastening screws/bolts are removed, some parts are just held in centring fits. Even during proper dismantling it is still possible that some

heavy parts may therefore suddenly become loose and drop off, possibly causing injuries and damage. Take suitable measures to secure all parts being worked on.

## ASSEMBLY

Joints that are sealed due to stringent requirements for type of connection must be resealed during assembly with a suitable non-hardening sealant (type: consult the proper operating and repair manuals).

If gaskets and sealing elements are installed to ensure the degree of protection, they must be examined and replaced if they are no longer effective.



## CAUTION

Tightening torques are specified in the terminal box for bolted connections of electrical terminals. If these are not complied with, some cables

may become loose and pose a danger.

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## TERMINOLOGIE

Au sens des instructions de service et de dépannage accompagnant le produit ainsi que des marques d'avertissement figurant sur les machines et les appareils mêmes :

## Exploitation

concerne la mise en place, la mise en service (préparatifs pour l'utilisation) et l'utilisation (manoeuvres, mise en marche et à l'arrêt, etc.)

## Maintenance

concerne le contrôle (inspections, révisions), l'entretien et le dépannage (localisation du défaut et réparation).



## ... MARQUES D'AVERTISSEMENT



## DANGER

signifie que la non-application des mesures de précaution appropriées conduit à la mort, à des lésions corporelles graves ou à un dommage matériel important.



## ATTENTION

signifie que la non-application des mesures de précautions appropriées peut conduire à la mort, à des lésions corporelles graves ou à un dommage matériel important.



## AVERTISSEMENT

signifie que la non-application des mesures de précautions appropriées peut conduire à des lésions corporelles légères ou à un dommage matériel.

**NOTA** attire l'attention sur des interdépendances techniques qui ne sont pas toujours évidentes, mêmes aux yeux des personnes compétentes.

Afin d'éviter les incidents susceptibles d'occasionner directement ou indirectement des lésions corporelles graves ou des dommages matériels importants, il importe aussi de respecter les autres instructions de transport, de montage, d'exploitation et d'entretien, qui ne sont pas mises spécialement en relief, de même que les caractéristiques techniques (figurant dans les instructions de service, dans la documentation des produits et sur la machine même).



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2BH13.. - 2BH14.. 60 Hz		Zulässige Gesamtdruckdifferenz				Motorbemes- sungsleistung	Erwärmung <sup>c)</sup>	Meßflächenschall- druckpegel <sup>e)</sup>	Gewicht
Vakuumpumpe/ Kompressor Vacuum pump/ Compressor Pompe à vide/ Compresseur Bomba de vacío/ Compresores Pompa a vuoto/ Compressore Vakuumpump/ Kompressor		Pressione differenziale totale ammissibile Pression différentielle admissible Diferencia total admisible de la presión Permissible total differential pressure Tillåten total tryckdifferens				Rated motor output Puissance nomi- nale du moteur Potencia nominal del motor Potenza di tar- atura del motore Motorns märkeffekt	Temperature rise <sup>c)</sup> Echauffe- ment <sup>c)</sup> Calenta- miento <sup>c)</sup> Riscald- amento <sup>c)</sup> Uppvärm- ning <sup>c)</sup>	Measuring-surface sound- pressure level <sup>e)</sup> Niveau de pression acoustique <sup>e)</sup> Nivel de intensidad acústica en la superficie <sup>e)</sup> Livello di pressione acustica delle superfici di misura <sup>e)</sup> Ljudtrycksnivå <sup>e)</sup>	Weight Poids Peso Peso Vikt
		[bar]				[kW]	ΔT [K]	[dB (A)]	[kg]
Typ/Type/Tipo		+ 25°C	+ 40°C	+ 25°C	+ 40°C		ca.	ca.	ca.
Einstufige Ausführung Single-stage design Version monostage Modelo de una etapa Esecuzione ad uno stadio Enstags-utförande	2BH1300 -1. C 0.	0,11	0,10	0,11	0,10	0,29	25	61	8
	-1. C 1.	0,15 <sup>a)</sup>	0,15 <sup>a)</sup>	0,17	0,14	0,50	60	61	10
	-1.. 2. EEx e II	-	0,15	-	0,15	0,53	40	61	10
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstags-utförande	2BH1310 -1. C 2.	0,25	0,20	0,25	0,20	0,89	60	66	14
	-1. C 4.	0,28	0,24	0,34	0,28	1,3	80	66	17
	-1.. 4. EEx e II	-	-	-	-	-	-	-	18
Einstufige Ausführung Single-stage design Version monostage Modelo de una etapa Esecuzione ad uno stadio Enstags-utförande	2BH1400 -1. C 0.	0,135	0,11	0,135	0,10	0,93	30	64	13
	-1. C 1.	0,18	0,15	0,18	0,14	1,15	50	64	14
	-1. H 2.	0,21	0,19	0,23	0,21	1,50	75	64	16
	-1.. 2. EEx e II	-	0,20	-	0,20	1,25	63	64	16
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstags-utförande	2BH1410 -1. C 3.	0,325	0,24	0,315	0,23	2,15	65	69	24
	-1. C 4.	0,35	0,34	0,43	0,39	2,55	82	69	27
	-1.. 4. EEx e II	-	0,30	-	0,30	2,00	65	69	27

- d) Fettwechselfrist in Betriebsstunden (abweichend von der allgemeinen Empfehlung 20 000 Betriebsstunden)  
Lubrication intervals in hours of operation (deviating from the general recommendation of 20 000 )  
d) Périodicité de regraissage (heures de service; écarts par rapport aux 20 000 heures recommandées )  
d) Intervalos para la lubricación en horas de servicio (difiere de la recomendación general de 20 000 horas de servicio)  
d) Intervalli di lubrificazione in ore d'esercizio (divergenti dalle raccomandazioni generali di 20 000 ore d'esercizio)  
d) Fettbytesintervall uttryckt i drifttimmar (undantag från den allmänna rekommendationen 20 000 drifttimmar)

- e) Meßflächenschalldruckpegel (DIN 45 635 Teil 13), gemessen in 1 m Abstand in einem Betriebspunkt bei etwa 2/3 der zulässigen Gesamtdruckdifferenz mit angeschlossenen Schlauchleitungen ohne Vakuum- bzw. Druckbegrenzungsventil
- e) Measuring-surface sound-pressure level (DIN 45 635 Part 13) measured at a distance of 1 m and at an operating point of about 2/3 of the permissible total differential pressure, with hoses attached, but without vacuum or pressure limiting valve
- e) Niveau de pression acoustique (DIN 45 635, partie 13) mesuré à une distance de 1 m pour un fonctionnement à environ 2/3 de la pression différentielle totale admissible, avec conduits flexibles, sans soupapes de limitation du vide ou de la pression.
- e) Nivel de intensidad acústica en la superficie (DIN 45 635 parte 13) medido a 1 m de distancia en un punto de servicio con aproximadamente 2/3 de la diferencia total admisible de la presión, y tuberías conectadas sin válvula de vacío o reguladora de presión.
- e) Livello di pressione acustica delle superfici di misura (DIN 45 635, parte 13), misurato a 1 m di distanza a circa 2/3 della pressione differenziale totale con tubi flessibili allacciati e senza valvola di vuoto o limitazione della pressione.
- e) Ljudtrycksnivå [dB (A)] (DIN 45 635 del 13), mätt på 1 meters avstånd vid c:a 2/3 av totalt tillåten tryckdifferens med anslutna slangar utan vakuum- resp. tryckbegränsningsventil.

Fig. 1.2 2BH13.. - 2BH14.. 60 Hz

2BH15.. - 2BH16.. 50 Hz		Zulässige Gesamtdruckdifferenz				Motorbemes- sungsleistung	Erwärmung <sup>c)</sup>	Meßflächenschall- druckpegel <sup>e)</sup>	Gewicht
Vakuumpumpe/ Kompressor		Pressione differenziale totale ammissibile				Rated motor output	Temperature rise <sup>c)</sup>	Measuring-surface sound- pressure level <sup>e)</sup>	Weight
Vacuum pump/ Compressor		Pression différentielle admissible				Puissance nomin- ale du moteur	Echauffe- ment <sup>c)</sup>	Niveau de pression acoustique <sup>e)</sup>	Poids
Pompe à vide/ Compresseur		Diferencia total admisible de la presión				Potencia nominal del motor	Calenta- miento <sup>c)</sup>	Nivel de intensidad acústica en la superficie <sup>e)</sup>	Peso
Bomba de vacío/ Compresores		Permissible total differential pressure				Potenza di tar- atura del motore	Riscald- amento <sup>c)</sup>	Livello di pressione acustica delle superfici di misura <sup>e)</sup>	Peso
Pompa a vuoto/ Compressore		Tillåten total tryckdifferens				Motor- märkeffekt	Uppvärm- ning <sup>c)</sup>	Ljudtrycksnivå <sup>e)</sup>	Vikt
Vakuumpump/ Kompressor		[bar]				[kW]	ΔT [K]	[ dB (A) ]	[kg]
		Vakuumpumpe <sup>b)</sup> Vacuum pump <sup>b)</sup> Pompe à vide <sup>b)</sup> Bomba de vacío <sup>b)</sup> Pompa a vuoto <sup>b)</sup> Vakuumpump <sup>b)</sup>		Kompressor <sup>b)</sup> Compressor <sup>b)</sup> Compresseur <sup>b)</sup> Compresor <sup>b)</sup> Compressore <sup>b)</sup> Kompressor <sup>b)</sup>					
		Umgebungstemperatur/Ambient temperature Température ambiante/Temperatur ambiente Temperatura ambiente/Omgivningstemperatur							
Typ/Type/Tipo		+ 25°C	+ 40°C	+ 25°C	+ 40°C		ca.	ca.	ca:
Einstufige Ausführung Single-stage design Version monoétage Modelo de una etapa Esecuzione ad uno stadio Enstegs-urfordande	2BH1500 -1.C 0.	0,13	0,12	0,12	0,11	0,75	30	70	18
	-1.C 1.	0,18	0,17	0,18	0,17	1,1	46	70	20
	-1.C 2.	0,21	0,19	0,22	0,21	1,5	59	70	21
	-1.C 3.	0,22	0,21	0,27	0,26	2,2	95	70	24
	-1.. 3. EEx e II	-	0,17	-	0,23	1,39/1,65	63	70	24
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstegs-urfordande	2BH1510 -1.C 4.	0,35	0,34 13 000 d)	0,42	0,41	3,0	88	74	38
	-1.C 5.	0,37	0,35 14 000 d)	0,50 10 000 d)	0,47 10 000 d)	4,0	90	74	55
	-1.. 5. EEx e II	-	0,33 14 000 d)	-	0,40 10 000 d)	2,45/3,10	84	74	55
Einstufige Ausführung Single-stage design Version monoétage Modelo de una etapa Esecuzione ad uno stadio Enstegs-urfordande	2BH1600 -1.C 0.	0,13	0,12	0,13	0,12	1,5	27	72	26
	-1.C 1.	0,23	0,22	0,22	0,21	2,2	63	72	29
	-1.C 2.	0,26	0,25	0,28	0,27	3,0	77	72	34
	-1.C 3.	0,27	0,27	0,34	0,32	4,0	107	72	49
	-1.. 3. EEx e II	-	0,22	-	0,28	2,65/3,25	67	72	49
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstegs-urfordande	2BH1610 -1HC 1.	0,22	0,20	0,20	0,18	2,2	33	75	42
	-1HC 2.	0,28	0,27	0,27	0,25	3,0	54	75	46
	-1HC 3.	0,36	0,34	0,38	0,35	4,0	80	75	52
	-1HC 4.	0,41	0,39 16 000 d)	0,53	0,48	5,5	105	74	70
	-1HC 5.	0,41	0,39 18 000 d)	0,58 18 000 d)	0,50	7,5	120	75	77
	-1H. 5. EEx e II	-	0,41 18 000 d)	-	0,49	4,65/5,60	95	75	86
Zweifluge Ausführung Double-flow design Version 2 étages parallèle Modelo de dos etapas Esecuzione a due stadi paralellkopplad	2BH1640 -1GC 3.	0,13	0,13	0,13	0,13	4,0	20	76	51
	-1GC 4.	0,20	0,20	0,22	0,22	5,5	35	76	73
	-1GC 5.	0,24	0,24	0,28	0,28	7,5	44	76	86
	-1G. 5.	-	0,18	-	0,28	4,40/5,50	44	76	86

a) b) c) d) e) siehe / see / voir / véase / vedi / se Fig. 1.1; Fig. 1.2

Fig. 1.3 2BH15.. - 2BH16.. 50 Hz

2BH15.. - 2BH16.. 60 Hz		Zulässige Gesamtdruckdifferenz				Motorbemes- sungsleistung	Erwärmung <sup>c)</sup>	Meßflächenschall- druckpegel <sup>e)</sup>	Gewicht
Vakuumpumpe/ Kompressor		Pressione differenziale totale ammissibile				Rated motor output	Temperature rise <sup>c)</sup>	Measuring-surface sound- pressure level <sup>e)</sup>	Weight
Vacuum pump/ Compressor		Pression différentielle admissible				Puissance nomi- nale du moteur	Echauffe- ment <sup>c)</sup>	Niveau de pression acoustique <sup>e)</sup>	Poids
Pompe à vide/ Compresseur		Diferencia total admisible de la presión				Potencia nominal del motor	Calenta- miento <sup>c)</sup>	Nivel de intensidad acústica en la superficie <sup>e)</sup>	Peso
Bomba de vacío/ Compresores		Permissible total differential pressure				Potenza di tar- atura del motore	Riscald- amento <sup>c)</sup>	Livello di pressione acustica delle superfici di misura <sup>e)</sup>	Peso
Pompa a vuoto/ Compressore		Tillåten total tryckdifferens				Motor- märkeffekt	Uppvärm- ning <sup>c)</sup>	Ljudtrycksnivå <sup>e)</sup>	Vikt
Vakuumpump/ Kompressor		[bar]				[kW]	ΔT [K]	[ dB (A) ]	[kg]
		Vakuumpumpe <sup>b)</sup> Vacuum pump <sup>b)</sup> Pompe à vide <sup>b)</sup> Bomba de vacío <sup>b)</sup> Pompa a vuoto <sup>b)</sup> Vakuumpump <sup>b)</sup>		Kompressor <sup>b)</sup> Compressor <sup>b)</sup> Compresseur <sup>b)</sup> Compresor <sup>b)</sup> Compressore <sup>b)</sup> Kompressor <sup>b)</sup>					
		Umgebungstemperatur/Ambient temperature Température ambiante/Temperatur ambiente Temperatura ambiente/Omgivningstemperatur							
Typ/Type/Tipo		+ 25°C	+ 40°C	+ 25°C	+ 40°C		ca.	ca.	ca.
Einstufige Ausführung Single-stage design Version monoétages Modelo de una etapa Esecuzione ad uno stadio Enstegs-utförande	2BH1500 -1. C 0.	0,12	0,11	0,11	0,10	0,86	22	73	18
	-1. C 1.	0,17	0,16	0,16	0,15	1,3	36	73	20
	-1. C 2.	0,20	0,20	0,20	0,20	1,75	50	73	21
	-1. C 3.	0,26	0,25	0,30	0,29	2,55	82	73	24
	-1.. 3. EEx e II	-	0,20	-	0,19	1,95	52	73	24
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstegs-utförande	2BH1510 -1. C 4.	0,41 7 000 d)	0,38 10 000 d)	0,42	0,42	3,45	80	77	38
	-1. C 5.	0,42 11 000 d)	0,40 14 000 d)	0,53 14 000 d)	0,45	4,6	94	77	55
	-1.. 5. EEx e II	-	0,40 14 000 d)	-	0,32	3,50/3,40	90	77	55
Einstufige Ausführung Single-stage design Version monoétages Modelo de una etapa Esecuzione ad uno stadio Enstegs-utförande	2BH1600 -1. C 0.	0,12	0,11	0,11	0,11	1,73	20	75	26
	-1. C 1.	0,22	0,21	0,20	0,18	2,55	40	76	29
	-1. C 2.	0,28	0,27	0,27	0,25	3,45	80	76	34
	-1. C 3.	0,32	0,29	0,33	0,30	4,6	85	76	49
	-1.. 3. EEx e II	-	0,26	-	-	3,80	75	76	49
Zweistufige Ausführung Two-stage design Version à 2 étages Modelo de dos etapas Esecuzione a due stadi Tvåstegs-utförande	2BH1610 -1HC 1.	0,20	0,18	0,15	0,13	2,55	30	79	42
	-1HC 2.	0,27	0,25	0,22	0,20	3,45	48	79	46
	-1HC 3.	0,38	0,37	0,35	0,34	4,6	75	79	52
	-1HC 4.	0,43	0,40 15 000 d)	0,53	0,48	6,3	88	79	70
	-1HC 5.	0,45	0,40 15 000 d)	0,68	0,53	8,6	130	79	77
	-1H. 5. EEx e II	-	0,40 15 000 d)	-	0,54	5,80/7,70	90	79	86
Zweiflüchtige Ausführung Double-flow design Version 2 étages en parallèle Modelo de dos etapas Esecuzione a due stadi parallelkopplad	2BH1640 -1GC 3.	-	-	-	-	-	-	-	-
	-1GC 4.	0,18	0,18	0,17	0,17	6,3	30	80	73
	-1GC 5.	0,26	0,26	0,26	0,26	8,6	42	80	86
	-1G. 5.	-	0,21	-	0,23	6,50/7,80	34	80	86

Fig. 1.4 2BH15.. - 2BH16.. 60 Hz

**Ersatzteile (Fig. 2); vom Werk lieferbar**  
(s. Bestellbeispiel)**Spare parts (Fig. 2), available from**  
the works (see order example)

1.010 Lagerdeckel, komplett  
1.033 Dichtung (O-Ring)  
1.078 Scheibe

1.010 Bearing cover, complete  
1.033 O-ring seal  
1.078 Disc

2.002 Kompressorgehäuse  
2.027 Laufrad  
2.030 Kompressordeckel  
2.072 Mittelkörper  
2.073 Bolzenschraube  
2.087 Kompressorhaube  
2.127 Scheibe  
2.129 Verschluss  
2.134 Hülse  
2.135 Verschlusshaken

2.002 Compressor housing  
2.027 Impeller  
2.030 Compressor cover  
2.072 Centre section  
2.073 Threaded rod  
2.087 Compressor cowl  
2.127 Disc  
2.129 Clip  
2.134 Sleeve  
2.135 Locking hook

3.005 Motorläufer  
3.095 Filzring  
3.096 Wellendichtring

3.005 Motor rotor  
3.095 Felt ring  
3.096 Shaft sealing ring

4.001 Ständer, komplett  
4.011 Spiralstift  
4.040 Leistungsschild  
4.041 Schraube  
4.044 Abdeckung  
4.062 Fuß  
4.065 Hülse  
4.080 Schraube  
4.082 Erdungswinkel  
4.083 Kontaktwinkel

4.001 Stator, complete  
4.011 Spiral pin  
4.040 Rating plate  
4.041 Screw  
4.044 Cover  
4.062 Foot  
4.065 Sleeve  
4.080 Screw  
4.082 Earthing bracket  
4.083 Contact bracket

6.009 Paßscheibe  
6.018 Federscheibe  
6.450 Lagerschild  
6.455 Federband

6.009 Disc  
6.018 Resilient preloading ring  
6.450 Endshield  
6.455 Spring strip

7.039 Toleranzring  
7.500 Lüfterhaube  
7.501 Außenlüfter  
7.503 Schraube  
7.505 Paßfeder für Außenlüfter

7.039 Tolerance ring  
7.500 Fan cowl  
7.501 External fan  
7.503 Screw  
7.505 Featherkey for external fan

8.034 Flansch  
8.035 Flansch  
8.037 Verschlusskappe  
8.048 Stufenrohr, saugseitig  
8.049 Stufenrohr, druckseitig  
8.054 Dichtung  
8.055 Dichtung  
8.130 Füllstück  
8.131 Gewindestift  
8.132 Füllstück  
8.156 Füllstück  
8.403 Schalldämpfergehäuse  
8.413 Schalldämpfereinsatz  
8.433 Dichtung  
8.446 Bolzenschraube  
8.990 Schalldämpfer, komplett

8.034 Flange  
8.035 Flange  
8.037 Plug  
8.048 Graded tube, intake side  
8.049 Graded tube, discharge side  
8.054 Gasket  
8.055 Gasket  
8.130 Filler  
8.131 Setscrew  
8.132 Filler  
8.156 Filler  
8.403 Silencer casing  
8.413 Silencer insert  
8.433 Gasket  
8.446 Threaded rod  
8.990 Silencer, complete

**Bestellbeispiel****Order example****Exemple de commande****Ejemplo de pedido****Esempio di ordinazione****Beställningsexempel**

2BH1 300 - 1AC 12

No E F2 7 45688 70 010 /95

Laufrad 2.027

Normteile sind nach Abmessung, Werkstoff und Oberfläche im freien Handel zu beziehen.

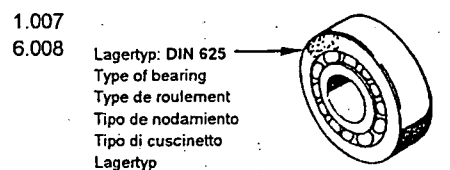
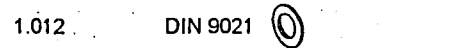
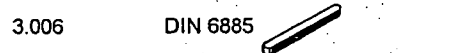
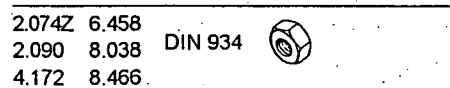
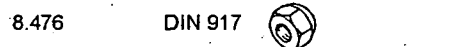
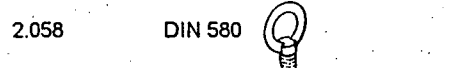
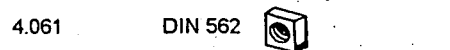
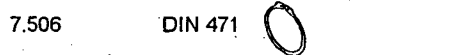
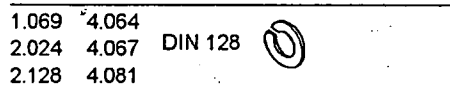
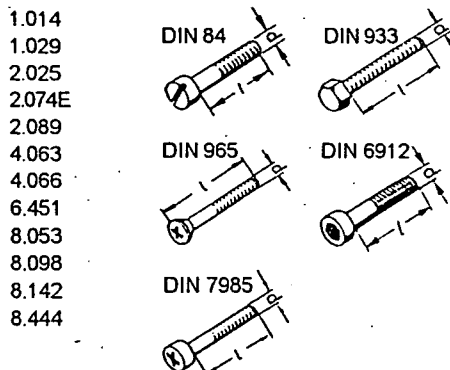
Standard commercially available parts are to be purchased in accordance with the specified dimensions, material and surface finish.

Les pièces normalisées peuvent être obtenues dans le commerce d'après leurs dimensions, le matériau et l'état de surface.

Las piezas estándar se comprarán en comercios del ramo según las dimensiones, material y superficie especificados.

Le parti standard sono reperibili sul mercato secondo le dimensioni, il materiale e la finitura della superficie.

Normerade detaljer kan erhållas i öppna handeln, och skall specificeras beträffande storlek, material och ytbehandling.



**Einstufige Ausführung**  
**Single-stage design**  
**Version mono-étage**  
**Modelo de una etapa**  
**Esecuzione ad uno stadio**  
**Enstegs-utförande**

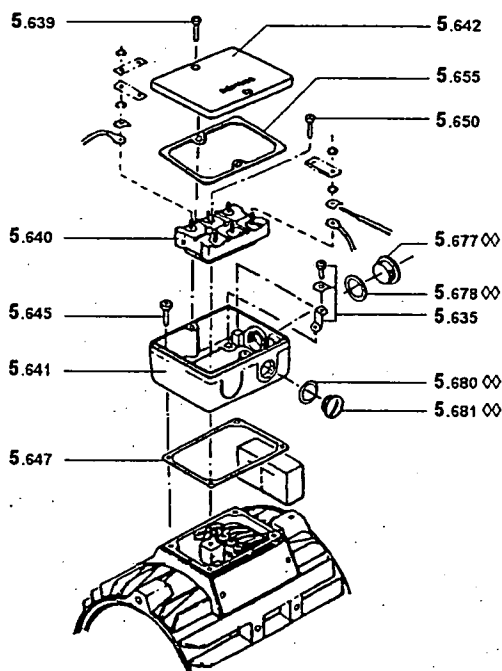
**Zweistufige Ausführung**  
**Two-stage design**  
**Version à 2 étages**  
**Modelo de dos etapas**  
**Esecuzione a due stadi**  
**Tvåstegs-utförande**

Fig. 2

Klemmenkasten s. Fig. 3.1, Fig. 3.  
 Terminal box s. Fig. 3.1, Fig. 3.2  
 Boîte à bornes v. Fig. 3.1, Fig. 3.2  
 Caja de bornes v. Fig. 3.1, Fig. 3.2  
 Scatola morsetti v. Fig. 3.1, Fig. 3.2  
 Uttagslåda s. Fig. 3.1, Fig. 3.2

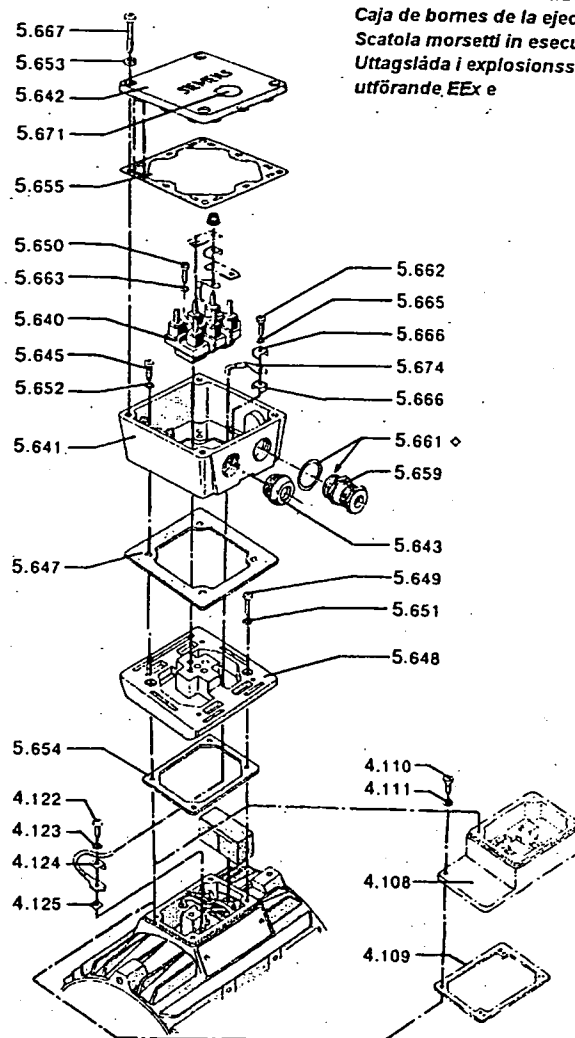


Klemmenkasten in Normalausführung  
Terminal box in standard design  
Boîte à bornes en exécution normale  
Caja de bornes en ejecución normal  
Scatola morsetti in esecuzione normale  
Uttagslåda in normalt utförande



- ∞ Nur Teile aus elektrisch nicht leitendem Material verwenden.
- ∞ Use only parts of electrically non-conductive material.
- ∞ Ne poser que des pièces en matériau non-conducteur du courant.
- ∞ Usar solo piezas de material no conductor.
- ∞ Impiegare solo pezzi di materiale non conduttore.
- ∞ Använd bara delar i elektriskt ej ledande material

Klemmenkasten in EEx e-Ausführung  
Terminal box in EEx e design  
Boîte à bornes in exécution EEx e  
Caja de bornes de la ejecución EEx e  
Scatola morsetti in esecuzione EEx e  
Uttagslåda i explosionsskyddat utförande EEx e



- ◇ Wahlweise Teflonband für Gewinde
- ◇ Alternatively use Teflon tape for thread
- ◇ En variante, utiliser un ruban de Teflon pour le filetage
- ◇ A elección, cinta de Teflon para roscas
- ◇ A scelta si può anche impiegare nastro di Teflon per la filettatura
- ◇ Alternativ: Teflonband istället för gänga

**Fig. 3.1 Klemmenkasten für Motorbaugröße ≤ 90L (Klemmenkastenoberteil um 180° gedreht dargestellt)**

**Terminal box for motors of frame sizes ≤ 90L (Top section of terminal box shown rotated through 180°)**

**Boîte à bornes pour moteur de désignation de carcasse ≤ 90 L (partie supérieure représentée tournée de 180°)**

**Caja de bornes para motores de tamaño ≤ 90L (parte superior de la caja girada en 180°)**

**Scatola morsetti per grandezza costruttiva ≤ 90L (la parte superiore della scatola morsetti è ruotato di 180°)**

**Uttagslåda för motorstorlek ≤ 90L (uttagslådans överdel ritad vriden 180°)**

Normteile sind nach Abmessung, Werkstoff und Oberfläche im freien Handel zu beziehen.

Standard commercially available parts are to be purchased in accordance with the specified dimensions, material and surface finish.

Les pièces normalisées peuvent être obtenues dans le commerce d'après leurs dimensions, le matériau et l'état de surface.

Las piezas estándar se comprarán en comercios del ramo según las dimensiones, material y superficie especificados.

Le parti standard sono reperibili sul mercato secondo le dimensioni, il materiale e la finitura della superficie.

Normerade detaljer kan erhållas i öppna handeln, och skall specificeras beträffande storlek, material och ytbehandling.

4.111 5.653  
4.123 5.663  
5.651 5.665  
5.652 5.673

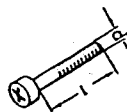
DIN 128



DIN 7981



DIN 7985



5.661 0  
5.678 00  
5.680 00

DIN 46320



5.677 00  
5.681 00

DIN 46320  
Bl. 4



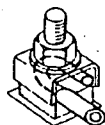
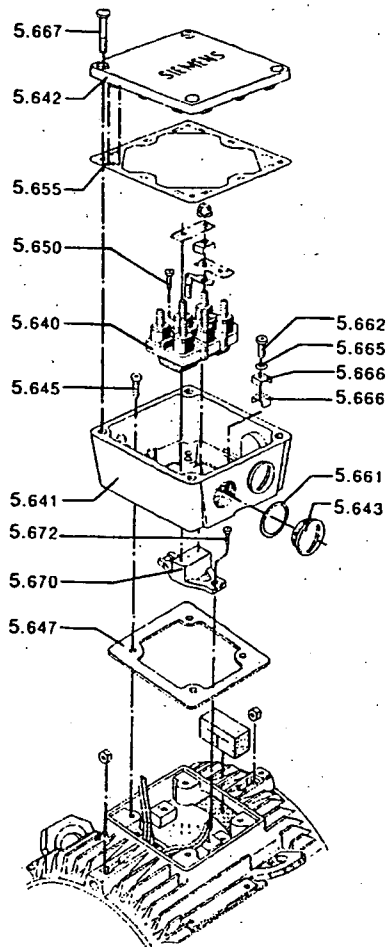
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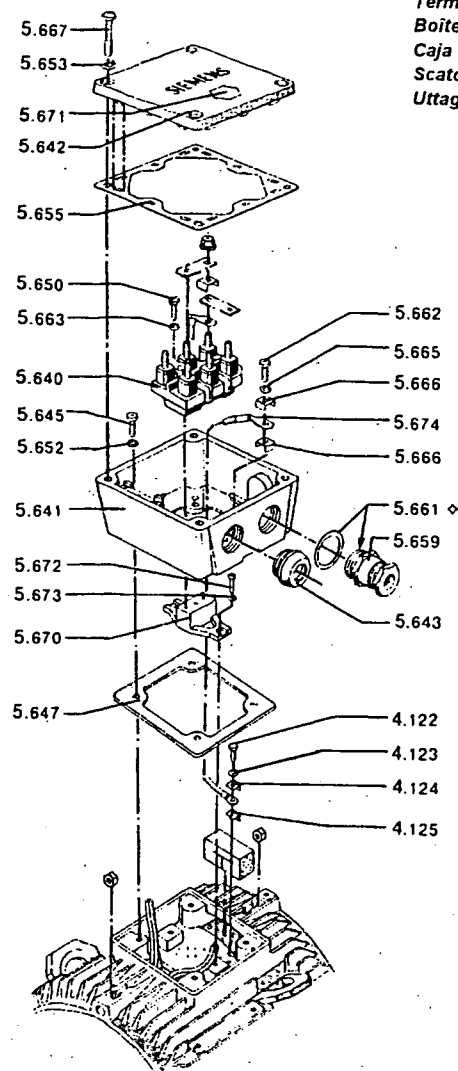


Klemmenkasten in Normalausführung  
Terminal box in standard design  
Boîte à bornes en exécution normale  
Caja de bornes en ejecución normal  
Scatola morsetti in esecuzione normale  
Uttagslåda in normalt utförande



Anschluß eines einzelnen Leiters mit Klemmbügel.  
Connecting a single conductor with a terminal clip.  
Raccordement d'un seul conducteur à une borne à étrier.  
Conexión de un solo conductor con un estribo.  
Allacciamento di ogni singolo conduttore con morsetto di serraggio.  
Anslutning av en enkelledare med klämbügel

Klemmenkasten in EEx e-Ausführung  
Terminal box in EEx e design  
Boîte à bornes in exécution EEx e  
Caja de bornes de la ejecución EEx e  
Scatola morsetti in esecuzione EEx e  
Uttagslåda i explosionsskyddat utförande EEx e



**Fig. 3.2 Klemmenkasten für Motorbaugröße  $\geq 100L$**  (Klemmenkastenoberteil um 180° gedreht dargestellt)  
**Terminal box for motors of frame sizes  $\geq 100L$**  (Top section of terminal box shown rotated through 180°)  
**Boîte à bornes pour moteur de désignation de carcasse  $\geq 100L$**  (partie supérieure représentée tournée de 180°)  
**Caja de bornes para motores de tamaño  $\geq 100L$**  (parte superior de la caja girada en 180°)  
**Scatola morsetti per grandezza costruttiva  $\geq 100L$**  (la parte superiore della scatola morsetti è ruotata di 180°)  
**Uttagslåda för motorstorlek  $\geq 100L$**  (uttagslådans överdel ritad vriden 180°)

## DEUTSCH

## ENGLISH

## FRANÇAIS

Ersatzteile (Fig. 3), vom Werk lieferbar  
(s. Bestellbeispiel)Spare parts (Fig. 3), available from  
the works (see specimen orders)Pièces de rechange (Fig. 3), livrables par l'usine  
(voir exemple de commande)

4.108 Zwischenplatte  
4.109 Dichtung  
4.122 Schraube  
4.124 Erdungswinkel  
4.125 Klemmscheibe

4.108 Intermediate plate  
4.109 Gasket  
4.122 Screw  
4.124 Earthing bracket  
4.125 Clamping washer

4.108 Plaque intercalaire  
4.109 Joint  
4.122 Vis  
4.124 Equerre de mise à la terre  
4.125 Rondelle de serrage

5.042 Klemmenkasten, komplett  
5.635 Erdungswinkel, komplett  
5.640 Klemmenbrett, komplett  
5.641 Klemmenkastenoberteil  
5.642 Klemmenkastendeckel  
5.643 Verschlussstopfen  
5.647 Dichtung  
5.648 Zwischenplatte  
5.654 Dichtung  
5.655 Dichtung  
5.662 Schraube  
5.666 Klemmbügel  
5.667 Schraube  
5.670 Zwischenstück  
5.671 Schild (Schutzzeichen)  
5.674 Leitung, komplett

5.042 Terminal box, complete  
5.635 Earthing bracket, complete  
5.640 Terminal board, complete  
5.641 Upper part of terminal box  
5.642 Cover for terminal box  
5.643 Plug  
5.647 Gasket  
5.648 Intermediate plate  
5.654 Gasket  
5.655 Gasket  
5.662 Screw  
5.666 Terminal clip  
5.667 Screw  
5.670 Centre piece  
5.671 Protection mark  
5.674 Cable, complete

5.042 Boîte à bornes, complète  
5.635 Equerre de mise à la terre, complète  
5.640 Plaque à bornes, complète  
5.641 Partie supérieure de la boîte à bornes  
5.642 Couverture de la boîte à bornes  
5.643 Elouchon  
5.647 Joint  
5.648 Plaque intercalaire  
5.654 Joint  
5.655 Joint  
5.662 Vis  
5.666 Etrier de serrage  
5.667 Vis  
5.670 Pièce intercalaire  
5.671 Symbole (de protection)  
5.674 Câble, complet

## ESPAÑOL

## ITALIANO

## SVENSKA

Piezas de recambio (Fig. 3); suministro  
desde fábrica (véase ejemplo de pedido)Parti di ricambio (Fig. 3), fornibili dalla fabbrica  
(vedi esempio)Reservdelar (Fig. 3), tillgängliga från  
fabriken (se Beställningsexempel)

4.108 Pieza intermedia  
4.109 Junta  
4.122 Tornillo  
4.124 Angulo de puesta a tierra  
4.125 Arandela de retención

4.108 Piastra intermedia  
4.109 Guarnizione  
4.122 Vite  
4.124 Angolare di collegamento a terra  
4.125 Rondella di fissaggio

4.108 Mellanplatta  
4.109 Packing  
4.122 Skruv  
4.124 Jordningsvinkel  
4.125 Kjämbrička

5.042 Caja de bornes, completa  
5.635 Angulo de puesta a tierra, completo

5.042 Scatola morsetti, completa  
5.635 Angolare di collegamento a terra,  
completo

5.042 Uttagslåda, komplett  
5.635 Jordningsvinkel, komplett

5.640 Tablero de bornes, completo  
5.641 Parte superior de la caja de bornes  
5.642 Tapa de la caja de bornes  
5.643 Tapón  
5.647 Junta  
5.648 Pieza intermedia  
5.654 Junta  
5.655 Junta  
5.662 Tornillo  
5.666 Estribo de fijación  
5.667 Tornillo  
5.670 Pieza intermedia  
5.671 Símbolo de protección  
5.674 Conductor completo

5.640 Morsettiera, completa  
5.641 Parte superiore della scatola morsetti  
5.642 Coperchio della scatola morsetti  
5.643 Tappo  
5.647 Guarnizione  
5.648 Piastra intermedia  
5.654 Guarnizione  
5.655 Guarnizione  
5.662 Vite  
5.666 Cavallotto di serraggio  
5.667 Vite  
5.670 Pezzo intermedio  
5.671 Simbolo di protezione  
5.674 Cavetto completo

5.640 Kopplingsplint, komplett  
5.641 Uttagslåda, överdel  
5.642 Lock till anslutningslåda  
5.643 Avslutningspropp  
5.647 Packing  
5.648 Mellanplatta  
5.654 Packing  
5.655 Packing  
5.662 Skruv  
5.666 Kjämbygge  
5.667 Skruv  
5.670 Mellanstycke  
5.671 Skyddsmärke  
5.674 Ledning, komplett

Bestellbeispiel	2BH1 300 - 1AC 12
Order example	No E F2 7 45688 70 010 /95
Exemple de commande	Klemmenkastenoberteil 5.641
Ejemplo de pedido	
Esempio di ordinazione	
Beställningsexempel	

Störungen	Ursache	Abhilfe
Motor läuft nicht an, kein Laufgeräusch	Unterbrechung in mindestens zwei Leitungen der Stromversorgung	Unterbrechung durch Sicherungen, Klemmen bzw. Zuleitungen beseitigen
Motor läuft nicht an, Brummgeräusch	Unterbrechung in einer Leitung der Stromversorgung; Laufgrad sitzt fest  Laufgrad defekt Motorlager defekt	Siehe "Motor läuft nicht an, kein Laufgeräusch"; Deckel öffnen, Fremdkörper entfernen, säubern; ggf. Laufgrad-Spalteinstellung prüfen bzw. korrigieren. Laufgrad ersetzen Lager ersetzen
Motorschutzschalter löst nach Einschalten wieder aus, Leistungsaufnahme zu hoch	Kurzschluß in der Wicklung  Motor überlastet  Verdichter sitzt fest	Wicklung prüfen lassen  Betriebsdruck verringern, evtl. Filter, Schalldämpfer, Anschlußrohre reinigen Siehe "Motor läuft nicht an, Brummgeräusch".
Es wird kein Vakuum oder zu geringes Vakuum erzeugt	Undichtheit in der Anlage, falsche Drehrichtung  falsche Frequenz Verdichter zu klein Wellendichtung defekt abweichende Dichte des Fördergases Veränderung des Schaufelprofils, durch Verschmutzung	Anlage abdichten; Drehrichtung ändern (Vertauschen von 2 elektr. Anschlußleitungen); Frequenz korrigieren; größeren Verdichter einsetzen; Wellendichtung erneuern; Umrechnung der Druckwerte berücksichtigen; Laufgrad reinigen, wenn verschlissen, austauschen
Anomale kreischende Geräusche	Zu hohe Strömungsgeschwindigkeit; Schalldämpfer verschmutzt Kugellager entfettet bzw. defekt	Rohrquerschnitt vergrößern, reinigen; Schalldämpfereinsätze reinigen, wenn nötig erneuern; Kugellager nachfetten bzw. erneuern
Verdichter undicht	Dichtungen defekt	Dichtungen überprüfen

Fig. 4 Beseitigung von Störungen

## ENGLISH

Fault	Cause	Remedy
Motor does not start, no rotor noise	At least two power supply conductors interrupted	Eliminate interruption by means of fuses, terminals or feeder leads
Motor does not start, humming noise	Interruption in one power supply conductor; impeller jammed  Impeller defective Motor bearing defective	See "Motor does not start, no running noise"; open cover, remove foreign matter, clean; if necessary check impeller gap adjustment and correct if necessary. Fit new impeller Fit new bearing
Motor protective circuit-breaker trips again after motor is switched on, power consumption too high	Short-circuit in the winding  Motor overloaded  Compressor jammed	Arrange for winding to be inspected  Reduce operating pressure, clean filter, silencer, connecting pipes if necessary See "Motor does not start, humming noise"
No vacuum or too weak a vacuum is produced	Leak in the system, wrong direction of rotation  Wrong frequency Compressor too small Shaft seal defective Varying density of delivery gas Change of blade profile due to fouling	Make system air-tight; Change direction of rotation (changeover to electrical supply leads); correct frequency; use larger compressor; fit new shaft seal; pay attention to conversion of pressure values; Clean impeller, replace worn impeller with a new one
Abnormal squeaking noises	Too high a flow rate; Silencer dirty Ball bearing lacks grease or is defective	Increase pipe cross-section, clean; clean silencer inserts, fit new ones if necessary; regrease ball bearing or fit new one
Compressor not air-tight	Gaskets defective	Inspect gaskets

Fig. 4 Trouble-shooting

**SIEMENS**

## EG-Konformitätserklärung

EC declaration of conformity / Déclaration de conformité CE / Declaración de conformidad CE  
Dichiarazione di conformità alle direttive CE / EG-deklaration om överensstämmelse

Hersteller / Manufacturer / Constructeur / Fabricante / Costruttore / Tillverkare

**Siemens AG** Geschäftsgebiet Antriebstechnik / Motors and Drive Systems Division  
Geschäftszweig Niederspannungsmotoren / Low-Voltage Motors  
D-97615 Bad Neustadt / Saale

Produktbezeichnung / Product name / Désignation du produit / Designación del producto / Denominazione del prodotto / Produktbeteckning

**ELMO-Gasring-Vakuumpumpen /-Kompressoren** / ELMO gas ring vacuum pumps/compressors  
**Pompes / compresseurs à vide annulaires de gaz ELMO** / Bombas de vacío / compresores hidrorrotativos ELMO para gases  
**Pompe / compressori a vuoto con anello a gas ELMO** / ELMO Gasring-vakuumpump/-kompressor

**Typ / Type / Tipo** 2BH1 3.., 2BH1 4.., 2BH1 5.., 2BH1 6..

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

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El producto designado cumple con las prescripciones de las siguientes directrices europeas:

Il prodotto denominato corrisponde alle normative delle seguenti direttive CE:

Produkten i fråga överensstämmer med följande EU-riktlinje:

- 89/392/EWG** Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedsstaaten für Maschinen geändert durch 91/368/EWG, 93/44/EWG und 93/68/EWG
- 89/392/EEC** Council Directive on the approximation of the laws of the Member States relating to machinery amended by 91/368/EEC, 93/44/EEC and 93/68/EEC
- 89/392/CEE** Directive du Conseil visant l'harmonisation des législations des pays membres relatives aux machines modifiée par 91/368/CEE, 93/44/CEE et 93/68/CEE
- 89/392/CEE** Directrices del Consejo para la armonización de la legislación de los estados-miembro, relativa a maquinaria modificada por 91/368/CEE, 93/44/CEE y 93/68/CEE
- 89/392/EWG** Direttiva del Consiglio per l'unificazione delle normative dei paesi CE sulle macchine modif. da 91/368/EWG, 93/44/EWG e 93/68/EWG
- 89/392/EEC** Rådets riktlinje för anpassning av medlemsstaternas rättsföreskrifter, ändrad genom 91/368/EEC, 93/44/EEC och 93/68/EEC

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Conformity with the requirements of this Directive is testified by complete adherence to the following standards:

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**EN 292-1**    **EN 292-2**    **EN 294**    **EN 60204-1/16**    **EN 60034-5**    **EN 1012-1**    **EN 1012-2**    **EN563**

Nationale Normen / National Standards / Normes nationales / Normas nacionales / Norme nazionali / Nationella standarder

**DIN VDE 0530-1**

**Siemens AG**

**Produktionseinheit Strömungsmaschinen**

**Development and Manufacturing Vacuum Pumps and Compressors**

Bad Neustadt / Saale, 17.10.94

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(Karlheinz Lottig)

*Norbert Aust*

(Dr. Norbert Aust)

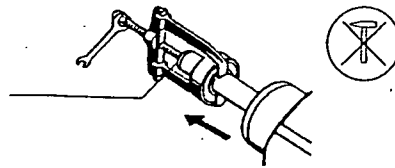
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**Fig. 5**

Zwischenscheibe (Schutz der Zentrierung im Wellenende)  
Spacer washer (to protect centring bore in shaft end)  
Rondelle (protection du centrage en bout d'arbre)  
Disco intermedio (protege el centrado en el extremo del eje)  
Spessore (protezione della centratura sull'estremità d'albero)  
Distansbricka (skydd av centrerings i axeltappen)



**Fig. 6 Lagerwechsel / Changing bearings**  
**Remplacement des roulements / Cambio de cojinetes**  
**Sostituzione del cuscinetto / Lagerbyte**

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angeführten Sprachen angefordert werden!

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Driftsinstruksens tekst kan bestilles på følgende  
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Driftsvejledningen kan rekvireres på de  
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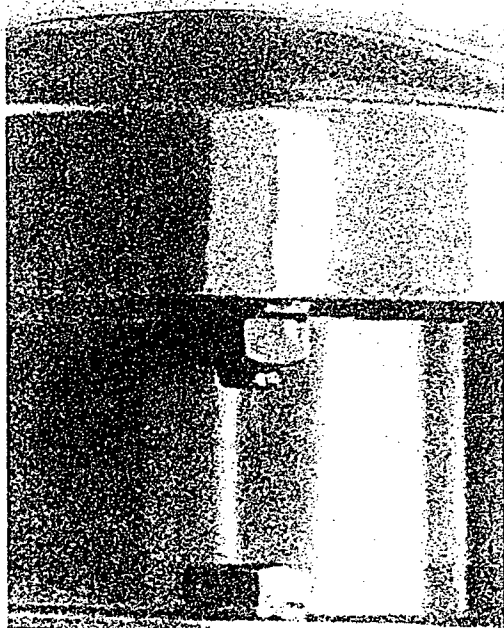
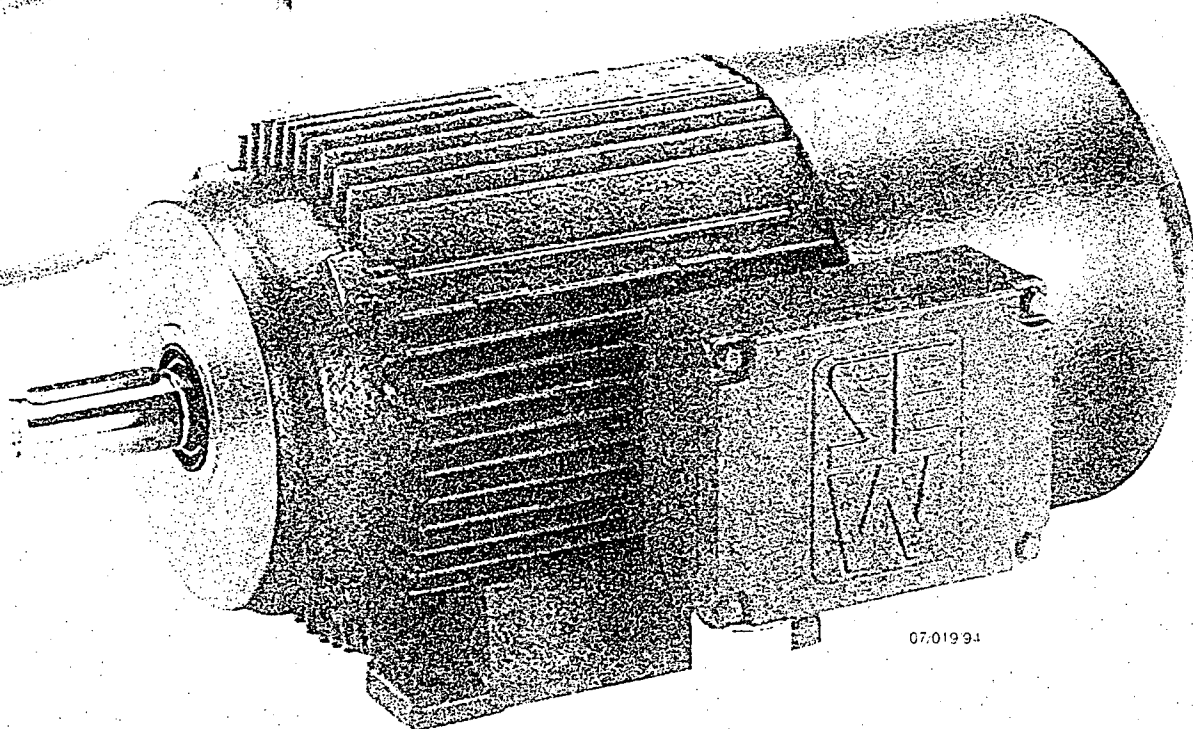


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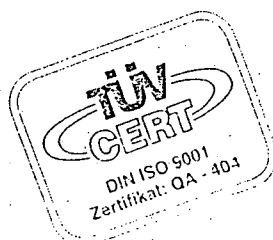
# AC Squirrel-Cage and Single-Phase AC Motors, Torque Motors with and without Brakes and Accessories

Installation, Commissioning and Maintenance

Edition 10/95



09222413:1095



# SEW EURODRIVE

## Safety Instructions

- Be careful never to operate damaged products !
- Read these operating instructions carefully before begin set-up and installation.
- Always follow the relevant safety instructions. They are marked as follows:



Electrical hazard, e.g. when working with live voltage.



Mechanical hazard, e.g. when working on hoists.



Important instructions for safe and fault-free operation, e.g. pre-setting before commissioning.

### WARNING:



Live voltages and moving parts of electrical machines can cause serious or fatal injuries.

Installation, connection, commissioning, maintenance and repair work may only be carried out by qualified staff taking into account

- these instructions
- all other project planning documentation, instructions and wiring diagrams for commissioning relating to the drive
- current national/regional regulations (safety/accident prevention regulations)

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## Preliminary Remarks

### Preliminary remarks (guarantee, storage, disposal, etc.)

- A requirement of fault-free operation and fulfilment of any rights to claim under warranty is that these instructions and notes are followed.
- Each motor is manufactured and tested to current SEW-EURODRIVE technical specifications, subject to alterations of technical data and designs made in respect to further technical progress.
- Check the delivery for possible damage which may have occurred during transportation as soon as you receive it. Inform the carrier of any damage immediately.
- If the motor is not being installed immediately, store it in a dry, dust-free room.
- **Disposal (Please observe the applicable waste disposal regulations) :**  
Depending on the material they are made of stator and rotor are to be disposed of in accordance with the applicable waste disposal regulations for:
  - steel scrap
  - aluminium
  - copper
  - plastic

#### Note

In these instructions, cross-references are marked with a →  
("→ section x.x" means: further information can be found in section x.x)

## 1 Installation

### 1.1 Before you begin

The drive may only be assembled if:



- The entries on the name plate match the mains power supply
- The drive is undamaged (no damage caused by transport or storage)
- It is certain that the following requirements have been fulfilled:

**Standard motors:** Ambient temperature between  $-25\text{ °C}$  and  $+40\text{ °C}$  <sup>1)</sup>  
 No oil, acid, gases, vapours, radiation, etc.  
 Installation height max. 1000 metres above mean sea level.

**Special designs:** Drive made in accordance with the ambient conditions.

### 1.2 Preparatory work after an extended period of storage

Check whether the motor has absorbed any moisture during the extended period of storage. For this purpose the insulation resistance must be measured (test voltage 500 V) (Fig. 1).

#### Note:

The insulation resistance is heavily dependent on the temperature.

If the insulation resistance is insufficient, the motor must be dried as follows:

1. Warm up the motor (to a max. of  $80\text{ °C}$ )
  - using warm air or
  - using an isolating transformer
    - connect the windings in series (Fig. 2)
    - auxiliary AC voltage max. 10% of  $U_N$  at max. 20% of the rated current.
2. End the drying process when the minimum insulation resistance is exceeded (Fig. 1)
3. Check the terminal boxes/plug connectors to ensure that:
  - the insides are clean and dry
  - connecting and mounting components are free of corrosion
  - joint seals are in order
  - screwed cable glands are tight

If not, clean or replace it.

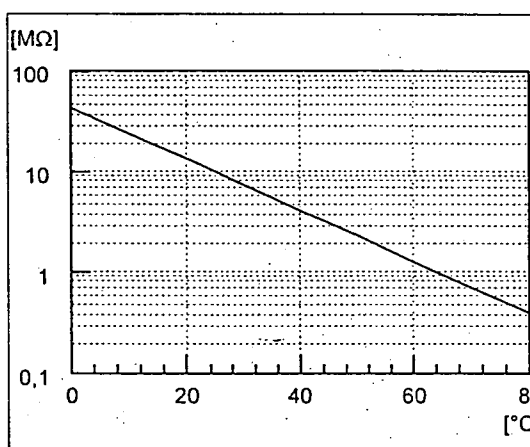


Fig. 1 Minimum Insulation Resistance

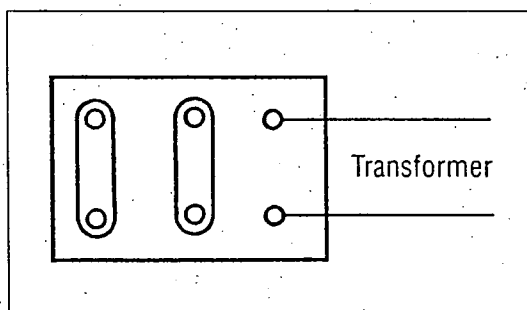


Fig. 2

<sup>1)</sup> Minimum temperature for motors with back stop:  $-15\text{ °C}$ :  
 Remember that the temperature range of the gear unit may also be restricted  
 → Installation and Commissioning Instructions for the gear unit

# 1 Installation

## 1.3 Installing the motor

The motor or geared motor may only be mounted or installed in the specified position on a level, vibration-free and torsionally rigid support structure.

- Thoroughly remove anti-corrosion agents from the shaft ends (use a commercially-available solvent). Do not allow the solvent to penetrate the bearings - this could cause material damage.
- Carefully align the motor and the driven machine, to avoid placing any unacceptable strain on the motor shafts (observe permissible overhung load and axial thrust data).
- **Protect motors in vertical mounting positions from objects or fluid entering with an appropriate cover.**
- Ensure an unobstructed cooling air supply.
- Balance components for subsequent mounting on the shaft without key.
- **Any condensation drain holes will be sealed by plastic plugs and must only be opened when necessary. Open condensation drain holes are not permissible, as this would invalidate higher classes of enclosure.**
- **Note (for IG1/2 and IG5/6 encoder mounting)**  
Foot-mounted motors DT71, DT90, DV132M and DV160L must be supported underneath, as the fan guard radius exceeds the shaft height.



### 1.3.1 Installation in damp areas or in the open air

- Mount the terminal box so that the cable inlets point downwards if possible
- Use suitable screwed cable glands for the supply leads (use reducing adapters if necessary).
- Coat the threads of screwed cable glands and sealing plugs with sealant and tighten them well, then coat them again.
- Seal the cable inlets well.
- Clean the sealing faces of terminal boxes and their covers well before reassembly; gaskets must be cemented in on one side. Replace brittle gaskets.
- Restore the anticorrosive coating if necessary.
- Check the type of enclosure.

## 1.4 Installation works

Shaft ends	Flanges
Diametric tolerances in accordance with DIN 748 – ISO k6 for dia. ≤ 50 mm – ISO m6 for dia. > 50 mm (Centre hole in accordance with DIN 332, shape D)	Centring shoulder tolerances in accordance with DIN 42948 – ISO j6 for dia. ≤ 230 mm – ISO h6 for dia. > 230 mm

→ “Geared motors” catalogue, section on “Notes on the Dimension Sheets”

## 2 Electrical connection

- The rated voltage and frequency of the AC squirrel-cage motor must agree with those of the mains supply. If necessary, the motor must be switched from star to delta connection (lower voltage).
- Switch contacts in duty class AC-3 in accordance with IEC 158 must be used for switching the motor and brake.

### 2.1 Specific features

#### 2.1.1 Characteristics specific to hazardous duty type motors (EExe and EExed enclosure types)

- All AC squirrel-cage motors with inverse-time protection (with  $t_E$  time)  
Use motor protective devices with the following classification:
  - In accordance with DIN VDE 0660, approved by PTB or another authorized testing agency
  - With inverse time delay operation  
(Tripping time in relation to the starting current ratio  $I_A/I_N$  less than the locked-rotor time  $t_E$  of the motor - see nameplate) at an ambient temperature of 20 °C
- Fit multi-speed motors with a separate motor protection (mutually interlocked!) for each pole number. Use a tripping unit in accordance with the classification below in the case of supplementary protection by PTC thermistor.
- AC squirrel cage and AC squirrel cage brake motors with direct temperature monitoring TF (with  $t_A$  time)  
Motor protection is by PTC thermistors in the winding or brake. Use a tripping unit with the following classification:
  - PTB test mark 3.53 PTC A
  - Response/cutout time within the  $t_A$  time (see motor nameplate)

#### Note:

- Observe the information on temperature monitoring in the conformity certificate and the applicable regulations on explosion protection.
- In the case of intermittent duty or start/stop operation or high-inertia starting - starting time considerably longer than 1.7 x the locked-rotor time  $t_E$  - check the design data.

#### 2.1.2 Characteristics of single phase AC motors

Remember that SEW single-phase AC motors are supplied without accessories, such as capacitors, starting relays or centrifugal switches. The requisite components must be purchased through the trade and connected in accordance with the relevant instructions and circuit diagrams.

#### 2.1.3 Characteristics of torque motors and low speed motors

High induction voltages may occur when torque motors or low speed motors will be switched off. Therefore we recommend to use a varistor as protection. The size of the varistor depends on the starting frequency besides other influences - please take care of the design.

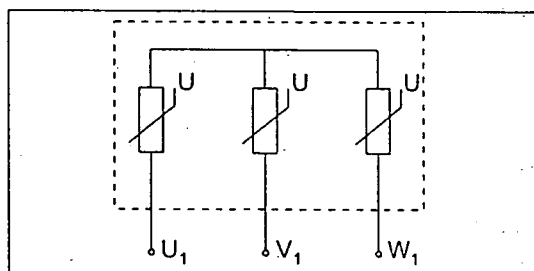


Fig. 3

## 2.2 Before you begin

### Tools/resources required

- Standard tools
- Mounting jig, if applicable
- If end ferrules are used:  
Crimper and end ferrules (without insulating sleeve, DIN 46228 part 1, material E-Cu, Fig. 4)

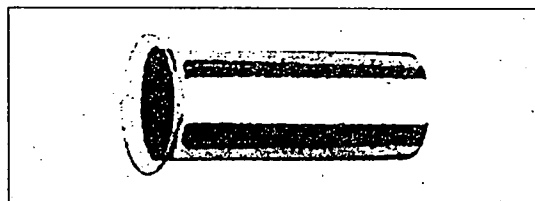


Fig. 4

## 2

**Electrical Connection****2.3 Connecting the motor**

If using electronic control units, the relevant commissioning instructions/circuit diagrams must be observed.

**2.3.1 Connection via terminal boxes****2.3.1.1 Preparation of motors size 63 - knockout (Fig. 5)**

Caution:

Use eye protection - danger by fractional parts !

1. Fit the terminal box cover, insert screws.
2. Determine the necessary cable entries.
3. Open the determined cable entries with
  - a chisel or similar (apply at an angle like Fig. 5),
  - a light hammer blow

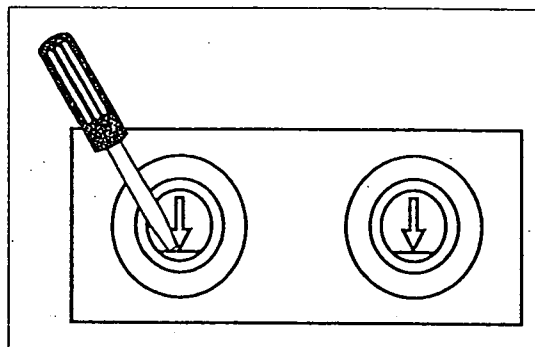


Fig. 5 Knockout cable entries



Caution: Do not allow penetration into the terminal box !

4. Open the terminal box, remove the slug if necessary.
5. Secure the cable gland with the enclosed locking nut.

**2.3.1.2 Connection via terminal boxes**

1. Connect the motor
  - in accordance with the circuit diagram (enclosed)
  - check the cross-sections of the cables
  - fit the terminal links correctly
  - screw the cable and protective conductor connections tightly

**2.3.2 Connection via the IS connector****2.3.2.1 Description/Technical data**

The IS integrated connector facilitates rapid connection of the motor by the end user. It also facilitates dismantling and reconnection of the motor for inspection, maintenance and repair work.

The lower section of the IS connector is fully wired ex works, including accessory features such as the brake rectifier. The client must connect the upper section of the connector in accordance with the circuit diagram.

The connector corresponds to DIN VDE 0110 with a rated voltage of 690 V and fouling factor 3. When the connector is closed, its class of enclosure corresponds to that of the motor. It has CSA approval up to 600 V.

(Instruction for applications according to CSA regulations: terminal screws M3 tighten with 0.5 Nm).

**Cross-section of the cable**

Ensure that the type of cable meets the requirements of the relevant regulations. The name plate specifies the rated currents. Usable cable cross-sections are as follows:

Without variable terminal link	With variable terminal link	Jumper wire	Double connection (Motor and brake/SR)
0.25 - 4.0 mm <sup>2</sup>	0.25 - 4.0 mm <sup>2</sup>	max. 1.5 mm <sup>2</sup>	max. 1 x 2.5 and 1 x 1.5 mm <sup>2</sup>
23 - 12 # AWG	23 - 14 # AWG	max. 16 # AWG	max. 1 x 14 and 1 x 16 # AWG

### 2.3.2.2 Wiring the upper section of the connector

#### General preparatory work

1. Unscrew the screws of the housing cover and remove the cover.
2. Unscrew the screws of the upper section of the connector and remove it from the cover.
3. Remove the sheath from the connecting cable and strip the insulation about 9 mm from the connecting leads.
4. Thread the cable through the cable gland.

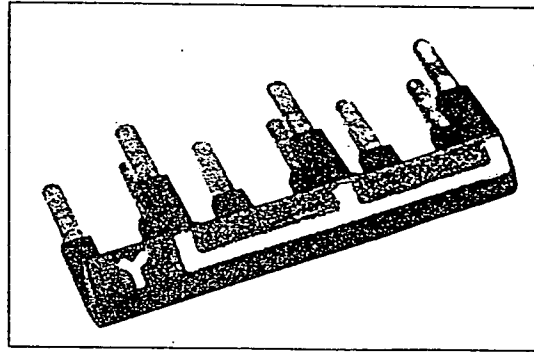


Fig. 6

#### Wiring in accordance with circuit diagram DT 82 or DT 83

1. Connect the leads in accordance with the circuit diagram.
2. Install the connector → section 2.3.2.3.

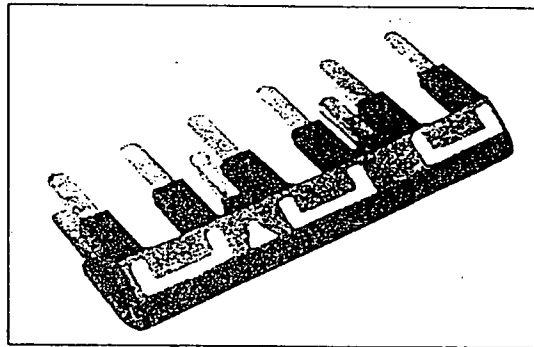


Fig. 7

#### Wiring in accordance with circuit diagram DT81

##### Wiring in accordance with DT 81 for Y/Δ starting

1. Connect with 6 wires to motor contactor in switch cabinet.
2. Install the connector → section 2.3.2.3.

##### Wiring in accordance with DT 81 for Y or Δ operation

1. Connect in accordance with circuit diagram.
2. In accordance with the desired motor operating mode (Y or Δ) install variable terminal link (Figs. 6 and 7).
3. Install the connector → section 2.3.2.3.

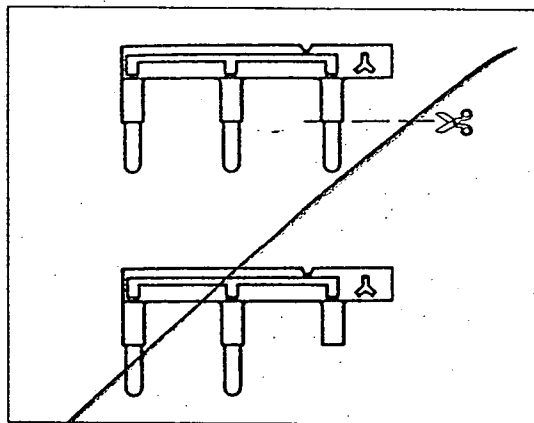


Fig. 8

##### BSR brake control unit - prepare variable terminal link

1. For Y mode  
Cut off only the shiny metal pin of the marked prong on the Y side of the variable terminal link horizontally-shock-hazard protection (Fig. 8).

##### For Δ mode

Cut off the two marked prongs on the Δ side of the variable terminal link horizontally (Fig. 9).

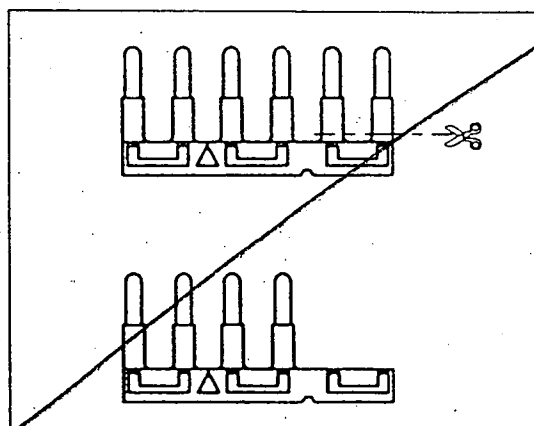


Fig. 9

## 2 Electrical Connection

Wiring in accordance with DT 81 for Y or  $\Delta$  mode with double terminal connection (Figs. 10 and 11)

1. At the terminal at which the two connections are to be made:
2. Insert the jumper wire in the variable terminal link according to the type of operation required.
3. Install the variable terminal link.
4. At the terminal to be double wired:  
Connect the motor lead above the variable terminal link.
5. Connect the remaining leads in accordance with the circuit diagram.
6. Install the connector → section 2.3.2.3

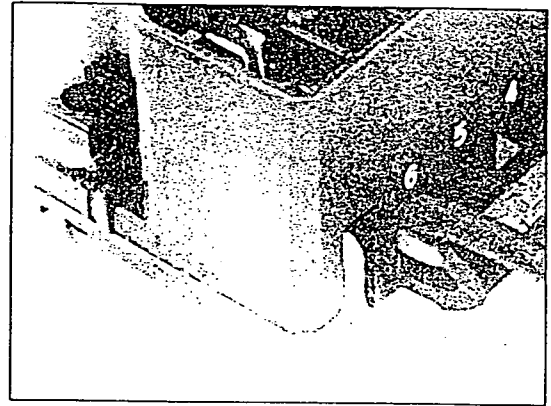


Fig. 10

### 2.3.2.3 Installing the connector

The housing cover of the IS integrated connector can be screwed to the lower section of the connector in accordance with the desired cable position. The upper section of the connector must first be installed in the housing cover, in accordance with the position of the lower section of the connector.

1. Establish the required mounting position.
2. Screw the upper section of the connector into the housing cover in accordance with the mounting position (Fig. 12).
3. Mate the connector.
4. Screw the housing cover to the lower section.
5. Tighten the screwed cable gland.

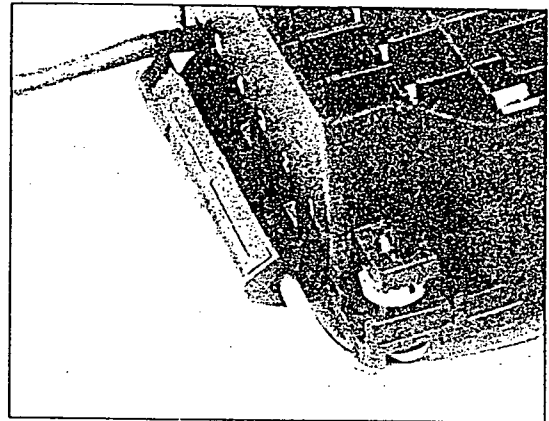


Fig. 11

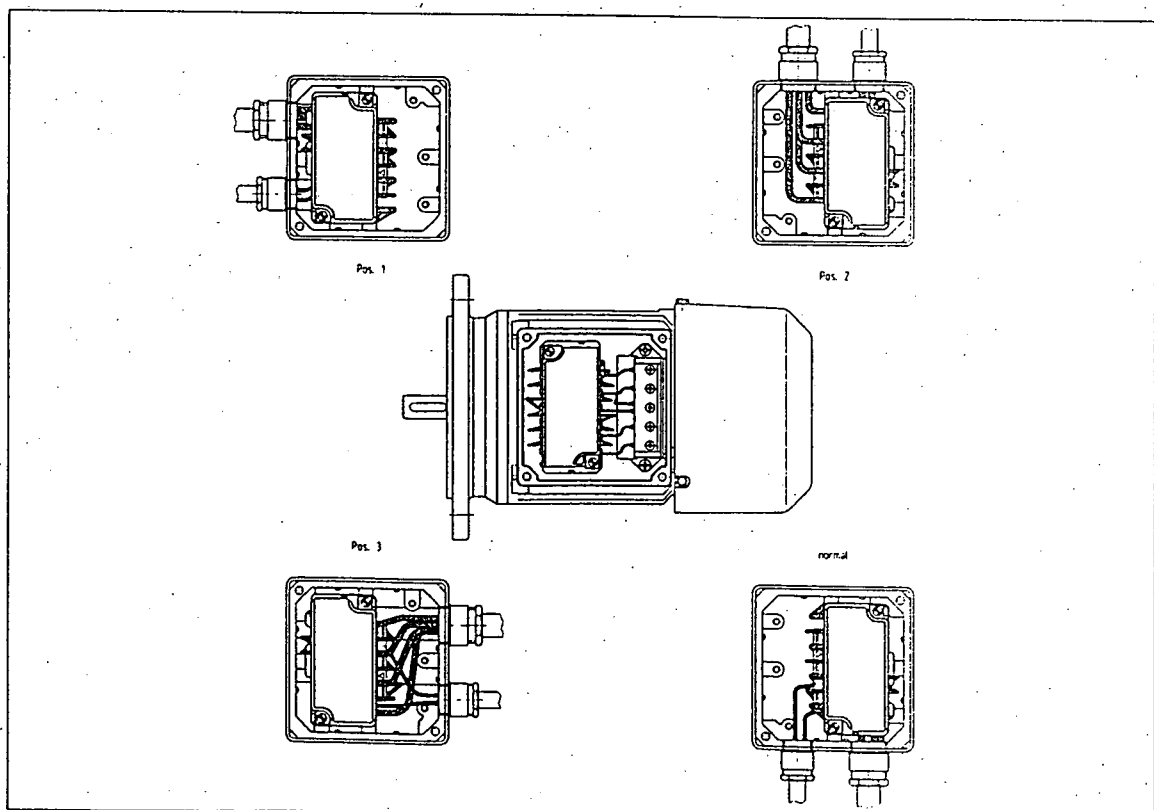


Fig. 12

## 2.4 Connecting the brake

The brake is released electrically. Braking takes place mechanically when the power supply has been switched off.

Explosion protected brakes must be connected to the AC terminals through an SEW brake rectifier housed in a switch cabinet outside the hazardous area. The connecting terminals for the brakes and their PTC thermistors are located in separate terminal boxes.

1. Connect the brake in accordance with the respective circuit diagram (enclosed).

**Note:** To allow for the DC voltage to be switched and the high current load, either special braking contactors or AC contactors with contacts in duty class AC-3 as per IEC 158 must be used.

2. Version with manual brake release option:

If necessary, screw in the hand lever (in the version with self-reengaging manual brake release) or stud (in the version with lockable manual brake release).

**Note:**

Observe the applicable instructions of the responsible employers' liability insurance associations on phase failure protection and the allied circuits/modifications to circuits.

### 2.4.1 Connecting the brake control unit

The DC disc brake is fed from a brake rectifier/control unit with a suppressor circuit, which is either housed in the terminal box or must be installed in the switch cabinet.

1. Connect the brake control unit in accordance with the circuit diagram supplied.

**Note:**

- Check the cross-section of the cables - see appendix for brake currents A3, A4.
- For motors in insulation class H: install the brake rectifier in the switch cabinet!

## 2.5 Connecting accessories

Connect the accessories supplied in accordance with the circuit diagrams enclosed.

### Temperature sensor TF

**Do not apply power supply to the terminals !**

The temperature sensor TF meets DIN 44082.

Check the resistance (meter with  $U \leq 2.5 \text{ V}$ )

Measurement per sensor: cold resistance 20 - 250  $\Omega$ ; Warm resistance > 4,000  $\Omega$ .

### Thermostats TH (Table 1)

The thermostats are connected in series as standard and open (break) when the permissible temperature in the winding is exceeded. They can be connected in the drive monitoring loop. The version with closing contacts must be connected in parallel.

	$V_{AC}$		$V_{DC}$	
Voltage U [V]	250	400	60	24
Current ( $\cos \varphi = 1.0$ ) [A]	2.5	0.75	1.0	1.6
Current ( $\cos \varphi = 1.0$ ) [A]	1.6	0.5		
Contact resistance max. 1 Ohm with 5 VDC/1 mA				

Table 1

### Forced cooling fans V, VS

Connect fan type V in accordance with the name plate and type VS in accordance with the circuit diagram.



### 3 Commissioning

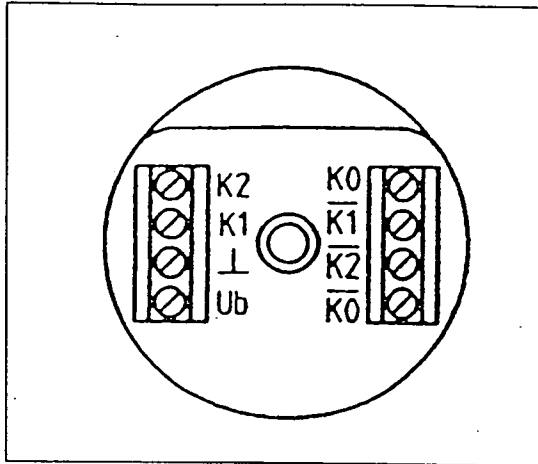


Fig. 14

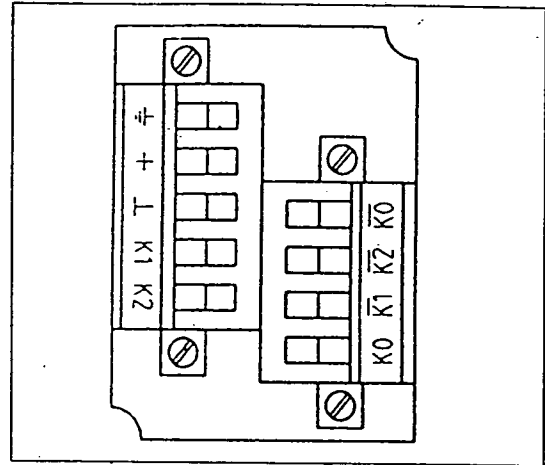


Fig. 15

### 3 Commissioning

#### 3.1 Before you begin

**Before** commissioning, ensure that:



- all the connections have been made correctly
- the motor/gear motor is running in the right direction (for clockwise motor running: U, V, W after L<sub>1</sub>, L<sub>2</sub> L<sub>3</sub>)

**Note:**

Avoid starting in the blocked direction for motors with a back stop.

If necessary, the direction in which the back stop operates must be changed (→ section 3.2).

- the drive is not blocked.
- the self-reengaging manual brake release is being used in hoist drives
- no other hazards are present.

**During** commissioning, ensure that:



- the motor is running perfectly (no variations in speed, loud noise, etc.). Problems → section 5
- with explosion protected motors: all motor protection equipment is configured for the rated motor current.



**Note:**

In brake motors with a self-reengaging manual brake release, the hand lever must be removed after commissioning. A bracket is provided for it on the outside of the motor.

## 5 Troubleshooting

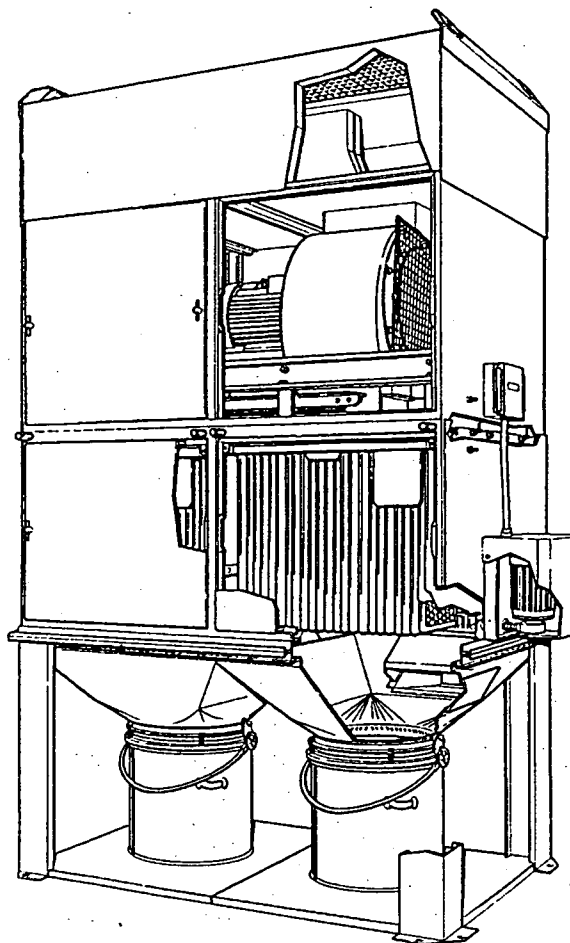
### 5.1 Problems with the motor

Problem	Possible cause	Remedy
Motor will not start	Lead broken	Check and restore the connections
	Fuse blown	Replace the fuse
	Circuit-breaker tripped	Check that the circuit-breaker is set correctly; adjust if necessary
	Motor contactor does not trip, control system fault	Check the motor contactor control system; rectify the fault if necessary
Motor will not start, or starts with difficulty	Starting capacitor will not switch or is too small (single phase motor)	Rewire; choose a larger starting capacitor
	Motor designed for delta connection, but is wired in star connection	Change connection
	Voltage or frequency differ greatly from the settings, at least when switching on	Ensure that the supply voltage conditions are improved; check the cross-section of the leads
Motor will not start in star connection, only in delta connection	Insufficient torque in star connection	If the delta starting current is not too high, switch on directly; otherwise use a larger motor or special design, after consultation
	Faulty contact in star/delta switch	Rectify the fault
Wrong direction of rotation	Motor incorrectly wired	Change over two phases
Motor hums and has high power consumption	Faulty winding	Motor must be repaired by trained service specialists
	Rotor fouling	
Fuses blow or circuit-breaker trips immediately	Short circuit in the cable	Repair the short circuit
	Short circuit in the motor	Have the fault repaired in the specialist workshop
	Cables incorrectly connected	Correct the connections
	Short circuit to earth at the motor	Have the fault repaired by trained service specialists
Pronounced speed reduction under load	Overload	Measure the power and use a larger motor or reduce the load if necessary
	Voltage drop	Increase the cross-section of the leads
Motor overheats (check temperature)	Overload	Measure the power and use a larger motor or reduce the load if necessary
	Inadequate cooling	Adjust the cooling air supply, or clear the cooling air passage. Fit forced cooling fan if necessary.
	Forced cooling fan not operating	Check the connection and correct it if necessary
	Ambient temperature too high	Reduce the power
	Starting capacitor will not disconnect (single phase motor)	Check the circuit and adjust it if necessary
	Auxiliary phase (single phase motor) fails	Check the connection and auxiliary phase, and correct it if necessary
	Motor delta connection, instead of star as intended	Change connection
	Loose lead (intermittent two phase operation)	Repair the loose contact
	Fuse blown	Determine the cause (see above) and rectify it. Replace the fuse.

Service and  
spare parts

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# DUST CONTROL UNIT

[illegible][illegible]

UNIMASTER DUST CONTROL UNIT USER MANUAL UNIMASTER DUST CONTROL UNIT  
USER MANUAL UNIMASTER DUST CONTROL UNIT USER MANUAL UNIMASTER DUST  
CONTROL UNIT USER MANUAL UNIMASTER DUST CONTROL UNIT USER MANUAL

# SERIES UMA 40-750

# USER MANUAL

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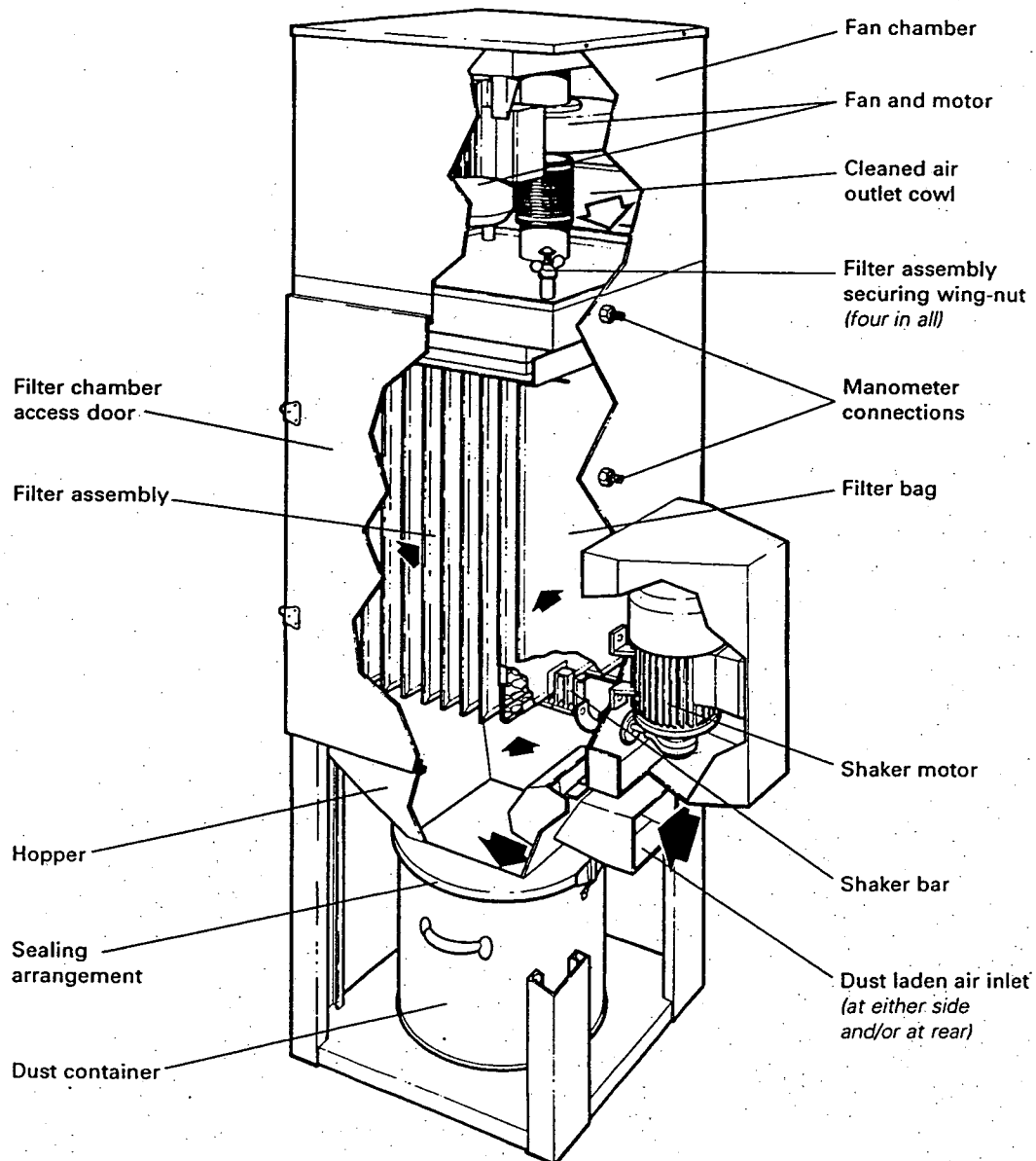


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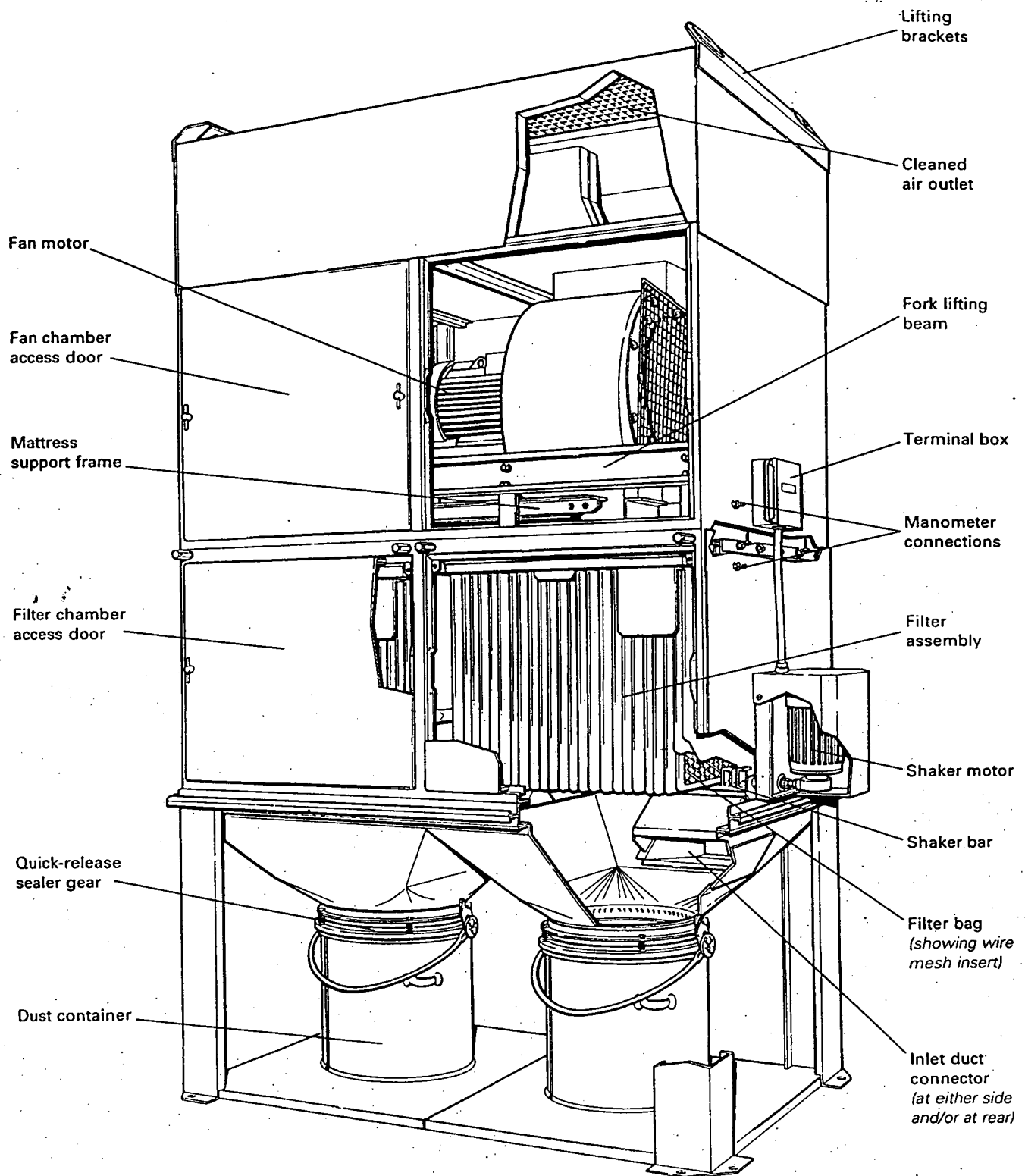
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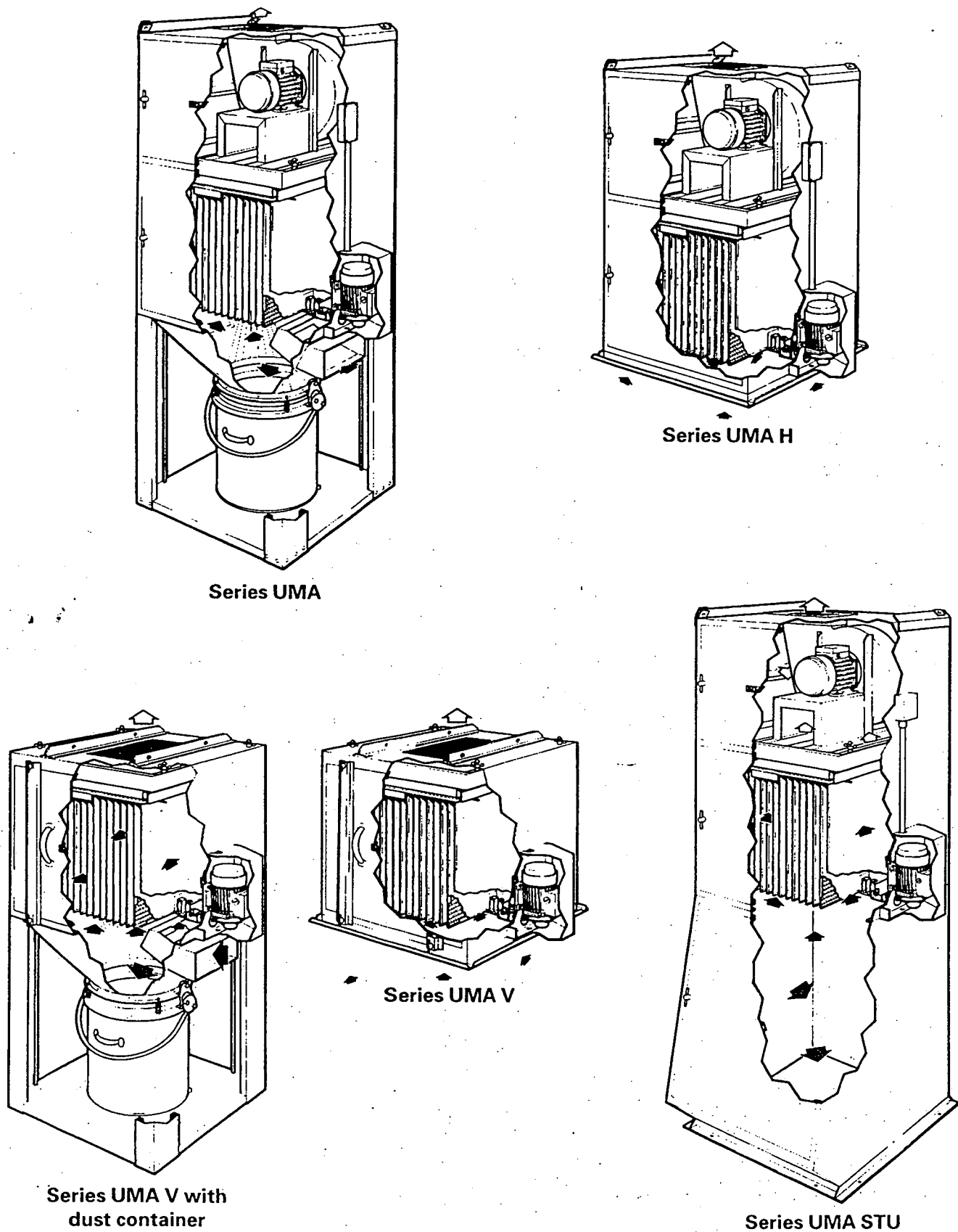


*Fig. 1 Unimaster dust control unit  
Model UMA 40MM illustrated, having a total filtration area of 3.7m<sup>2</sup>*





**Fig. 2 Unimaster dust control unit**  
**Model UMA 758 illustrated, having a total filtration area of 70m<sup>2</sup>**



**Fig. 3 Unimaster Range**



## Description and range

The Unimaster dust control unit is a compact, completely self contained fabric filter designed for intermittent duty, with filter cleaning automatically activated when the dust unit is turned off. The Unimaster is based on seven fabric areas between 4m<sup>2</sup> and 70m<sup>2</sup> with a range of standard components and accessories which can be assembled in over 500 different combinations.

### Range

#### Series UMA

Standard integral dust control unit complete with fan, easy-access filter assembly, triple-inlet hopper and dust container with quick-release sealer gear.

#### Series UMA H

Dust control unit with fan and filter assembly only, the base is flanged and can be bolted directly onto a purpose made dust container or hopper.

#### Series UMA STU

For use in sack tipping operations the STU is a dust control unit with fan, filter assembly and material discharge hopper incorporating quick release 'tipping' door.

#### Series UMA V

Filter assembly only, in flanged case, specifically designed for venting silos and other storage vessels or process machinery which are under positive pressure.

#### Series UMA V with dust container

Dust control unit UMA V may be supplied with hopper and dust container when siting is required away from the dust source.

### Accessories

#### Acoustic diffuser

The UMA 40-250 can be fitted with an acoustic diffuser to reduce noise levels. (The UMA 450 and 750 have acoustic diffusers fitted as standard). They are mounted on top of the units except on the UMA 40 and 40MM where the diffuser is mounted at the rear (or side when the UMA 40 or 40MM has explosion relief).

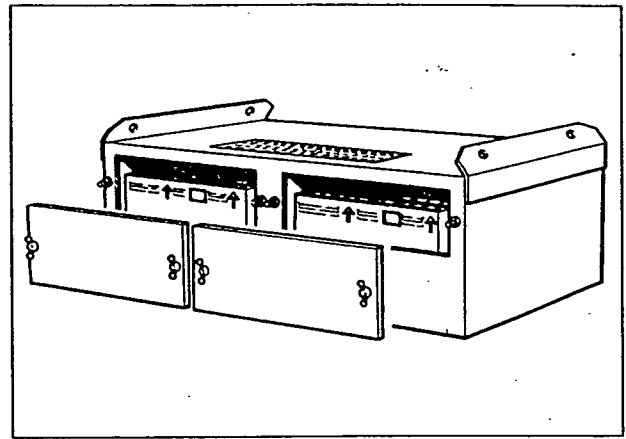


Fig. 4 Secondary filter assembly for UMA 450

#### Secondary filter

A secondary filter (see Fig. 4) can be fitted to Unimasters handling hazardous dusts, enabling filtered air to be recirculated safely back into the working area. It also acts as a fail-safe device should the main filter element become damaged. For special applications, absolute (HEPA) filters are available (details on request). With certain dusts the filtered air must not be recirculated—if in doubt refer to DCE or the appropriate Health and Safety authorities. Each secondary filter panel is inserted through the front access door of its housing and sealed tightly in position by the locating mechanism.

Secondary filters when fitted to UMA 100, 150, 250 and 450 also provide the same noise reduction as an acoustic diffuser.

A secondary filter monitor can be supplied to measure the pressure drop across the filter elements which will indicate the filter condition, and when maintenance is required.

#### Pressure balance pipe

To assist in the safe removal of toxic or noxious dusts the dust container may be lined with a polythene bag which can be closed and sealed before lifting out of the container. Parallel sided containers are supplied for this purpose. They are fitted with a detachable pressure balance pipe to prevent the bag from being drawn up into the unit.

#### Explosion relief

Most carbonaceous dusts, plastics, fertilisers, pharmaceuticals, fossil fuels, chemicals, foodstuffs and certain metallic dusts present an explosion hazard for which explosion relief panels must be fitted. Expert advice must be sought from Health and Safety authorities where dust is thought to be explosive and toxic.



The Unimaster explosion relief panels consist of an antistatic membrane – (DCE Membrex) – with supporting mesh fitted to the rear of the dirty side of each unit.

**Note:** For applications where the dust control unit is to be installed in a potentially explosive atmosphere, the electrical specification will be upgraded to suit. i.e. EEx motors, cabling and terminal box.

The classification of the hazard (Zone) must be specified when ordering the unit to ensure that it is to the correct specification.

### Static earthing

An earthing arrangement can be fitted to units to prevent the build up of static charge within the unit – particularly important for reducing the risk of fires or explosions when handling flammable or explosive dusts.

### Weather bends and cowls

Weather bends and cowls are available to fit over unit outlets for outside locations.

### Left-hand shaker

All the standard range of Unimaster dust control units have the shaker motor and mechanism on the right-hand side of the unit when viewed from the front.

When site conditions call for units to be positioned side by side or there are space limitations, units may be supplied with the shaker motor positioned on the left-hand side when viewed from the front.

### Half bags

On some Unimaster applications, for instance, when handling paper or cotton fluff, a filter element with every other pad removed may be advantageous to enable the filter to clean down more effectively. This reduces the cloth area of the unit by 50% and the unit designation is changed. e.g. The designation UMA 250H K3 becomes UMA 250/125H K3 – the figure 125 signifying the reduced cloth area in sq.ft.

### Castors

The standard UMA 40-250 units inclusive are available with the unit base mounted on castors. This makes the unit suitable for portable applications and would generally require single phase motors. In which case, it should be noted that the maximum fan size available with a single phase motor is the K3, 1.5 kW (2 HP).

## Components

### Filter assembly

The filter assembly consists primarily of a filter bag which can be made from a variety of materials to suit the application. The top of the bag is wrapped around a top frame which provides support and a rigid sealing face. The bag also has inserts placed in each individual pocket to maintain bag shape and help dislodge dust during the cleaning cycle.

### Seal frame

The seal frame is a rigid structure fabricated out of sheet steel with a rubber seal attached to its underside. This provides a clamping face and seal for the filter assembly. The filter assembly clamping is provided by two mattress runners which fit underneath the top frame, each having two threaded bars protruding through the seal frame. These are secured on UMA 40-450 units by using wing nuts (see Fig. 5), and on the UMA 750 by a clamping device, which is operated by extended nuts protruding through the door frame (see Fig. 6).

### Shaker assembly

The shaker assembly is situated on the side of the unit. This consists of a motor which turns an eccentric mechanism to vibrate a shaker bar. The shaker bar has locators which fit either side of each filter pad, thus, vibrating the filter assembly clean.

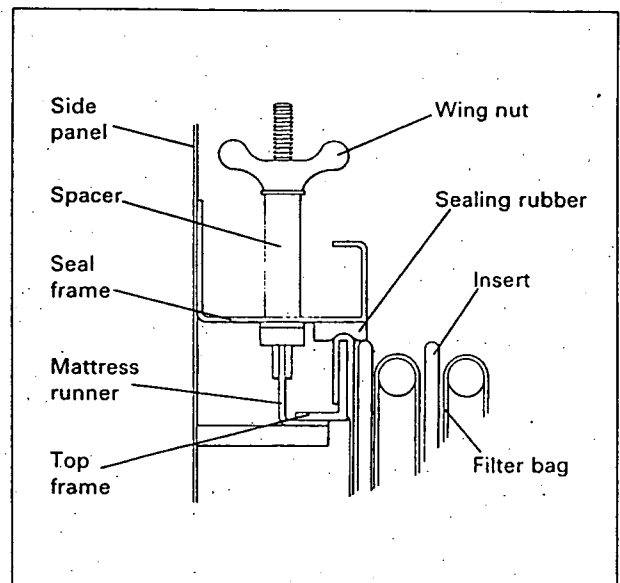


Fig. 5 Filter assembly clamping arrangement for UMA 40-450



### Fan (not supplied on venting type units)

The fan assembly is fitted above the filter assembly. All fans have electrical connections via a terminal box on the side of the unit, except for the UMA 40 where electrical connection is made directly to the motor. All fan impellers are directly driven except for the UMA 40MM where it is belt driven.

### Controller

A controller, if required, is provided for remote mounting to suit site requirements (see 'electrical requirements' on page 19).

### Sealer gear (bin units only)

The sealer gear is fitted to the bottom of the hopper and, by lifting the handle, provides a quick-release seal on the bin.

## Specification

### Noise levels

Machinery noise levels are an important consideration in the design and selection of new equipment. Several EC Directives and National Laws/Regulations adopting these directives make reference to airborne noise emissions. Actions that employers are required to comply with if employees are subjected to a daily personal noise exposure  $L_{p,d}$  of 85 dB(A) or more are also specified.

All Unimaster dust control units, when fitted with acoustic diffuser, secondary filter or absolute filter, operating on 8 hour shift, are below this action limit.

### Pressure limitations

All units fitted with their own fan assembly are limited to the figures taken from the respective fan performance curve shown in the relevant data sheet. The readings were obtained from volume and pressure readings taken at the unit inlet with the filter fabric clean.

Venting type units, both with or without dust containers, have a negative pressure limit of  $-300$  mm w.g. (12") and a positive pressure limit of  $+250$  mm w.g. (10")

### Temperature limitations

All the standard units have a temperature limitation of  $-10^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  ( $+14^{\circ}\text{F}$  to  $+100^{\circ}\text{F}$ ).

### Maximum impeller speeds

UMA 40-750 direct driven fan (50Hz) = 3000 rpm

UMA 40-750 direct driven fan (60Hz) = 3600 rpm

UMA 40MM belt driven fan (50 and 60Hz) = 10000 rpm

UMA 40-750 maximum shaker motor speed (50Hz) = 1000 rpm

UMA 40-450 maximum shaker motor speed (60Hz) = 1200 rpm

UMA 750 maximum shaker motor speed (60Hz) = 900 rpm

### UMA 40MM maximum volume

The UMA 40MM is designed to handle a limited amount of air. If too much air is handled there is a serious danger of overloading the motor. The maximum volume handled should not exceed  $425\text{ m}^3/\text{h}$ .

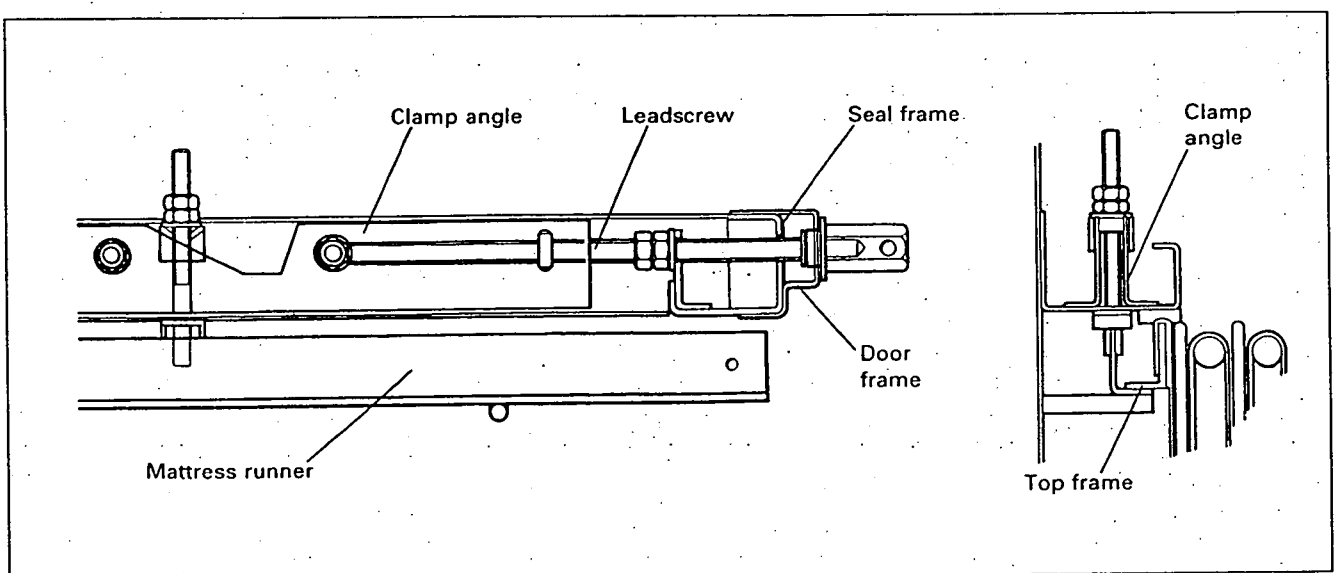


Fig. 6 Filter assembly clamping arrangement for UMA 750

**Unit designation**

Unimaster	=	UMA
Unit size	=	40, 70, 100, 150, 250, 450, 750
Dust container	=	2, 3, 4, 6, 8
Hopper type	=	H
Venting type	=	V
Sack tipping	=	STU
Fan size	=	G1, K3, ...K21
Acoustic diffuser	=	AD
Secondary filter	=	SF
Absolute filter	=	AB
Weather cowl	=	W/C

**Examples**

UMA 73V	=	Unimaster, size 70, 80 litre (3 cu.ft.) bin, Venting type
UMA 250 STU	=	Unimaster, size 250, Sack Tipping Unit type, (modified K3 fan fitted as standard)
UMA 458 K11 SF	=	Unimaster, size 450, 2 x 110 litre (4 cu.ft.) bins, K11 fan, secondary filter

**TABLE 1 — FAN OPTIONS AND NOISE LEVELS***(for unit performance curves see appropriate data sheet)*

Unit type	Filtration area	Fan types	Fan motor	Weighted sound pressure levels*			
				Unit only	With acoustic diffuser	With secondary filter	With absolute filter
UMA 40	3.70m <sup>2</sup>	STD.	0.55kW	80dB(A)	75dB(A)	—	—
UMA 40MM	3.70m <sup>2</sup>	STD.	1.10kW	80dB(A)	75dB(A)**	—	75dB(A)**
UMA 70	6.23m <sup>2</sup>	G1	0.75kW	82dB(A)	65dB(A)	—	—
UMA 100	9.29m <sup>2</sup>	G1	0.75kW	82dB(A)	65dB(A)	—	—
		K3	1.50kW	84dB(A)	67dB(A)	67dB(A)**	67dB(A)**
		G1	0.75kW	82dB(A)	65dB(A)	—	—
		K3	1.50kW	84dB(A)	67dB(A)	67dB(A)**	67dB(A)**
UMA 150	13.94m <sup>2</sup>	K5	2.20kW	86dB(A)	68dB(A)	68dB(A)**	68dB(A)**
		G5	3.00kW	90dB(A)	71dB(A)	71dB(A)**	71dB(A)**
		G5	3.00kW	90dB(A)	71dB(A)	71dB(A)**	71dB(A)**
UMA 250	22.67m <sup>2</sup>	G1	0.75kW	82dB(A)	65dB(A)	—	—
		K3	1.50kW	84dB(A)	67dB(A)	67dB(A)**	67dB(A)**
		K5	2.20kW	86dB(A)	68dB(A)	68dB(A)**	68dB(A)**
		G5	3.00kW	90dB(A)	71dB(A)	71dB(A)**	71dB(A)**
UMA 450	42.00m <sup>2</sup>	G8	5.50kW	90dB(A)	72dB(A)	72dB(A)**	72dB(A)**
		G10	5.50kW	—	75dB(A)	75dB(A)**	75dB(A)**
		K11	7.50kW	—	76dB(A)	76dB(A)**	76dB(A)**
UMA 750	70.00m <sup>2</sup>	K15	11.00kW	—	77dB(A)**	77dB(A)**	77dB(A)**
		K18	15.00kW	—	79dB(A)	79dB(A)**	79dB(A)**
		K21	18.50kW	—	80dB(A)**	80dB(A)**	80dB(A)**

\*All readings were taken in normal industrial areas, i.e. semi-reverberant surroundings, with local equipment silent. Measurements were taken at maximum air flow conditions at 1.0 metre radius from the equipment housing and 1.6 metres above base level, using a precision sound level meter and octave filter. Noise measurements of installed equipment may vary due to site conditions.

\*\* Estimated Value

— = Non-available option

## Dust containers

Dust containers available	Approx. weights (empty)
20 litre (0.75 cu.ft.)	3kg
55 litre (2 cu.ft.)	5kg
80 litre (3 cu.ft.)	7kg
110 litre (4 cu.ft.)	8kg

Unit	Dust container size
UMA 40, 40MM	20 litre
UMA 70	55, 80 or 110 litre
UMA 100, 150, 250, 450	55, 80 or 110 litre
UMA 750	110 litre

**Note:** The UMA 450 and 750 dust control units are supplied with two dust containers.

**Note:** The 110 litre bin varies in shape across the Unimaster range. On the UMA 100-450 inclusive the 110 litre bin has taper sides and because of this is not suitable for use with a pressure balance pipe.

## Construction

The Unimaster unit is constructed of sheet steel. Access to the various chambers, where necessary, is provided by removable front access doors. The sack tipping base also has the option of having a swing door. The fan chamber is mounted above the filter chamber with the discharge arrangements i.e. the bin or sack tipping base positioned below. The shaker assembly is usually mounted on the right hand side of the filter chamber when looking from the front with access via a removable cover.

Acoustic diffusers are mounted above the fan section on all units except for the UMA 40 and 40MM where it is mounted at the rear or side.

Secondary and absolute filters are also mounted above the fan section on all units except for the UMA 40MM and 750 where they are mounted between the filter chamber and the fan chamber. The secondary filter monitor, when supplied, is mounted on the right-hand side.

Units with explosion relief have an explosion vent at the rear and additional door straps for added strength.

The controller is supplied for remote mounting. On fan units the controller is connected to the fan and shaker motors via a terminal box usually mounted on

the right-hand side of the fan chamber. On the venting unit, controller connection is made directly to the shaker motor.

**Note:** The controller must not be mounted on the side of the unit.

On bin type units (units with dust containers) the contaminated air inlet is in the hopper and can be positioned at the rear or either side (two inlets are required on the UMA 450 and 750). The cleaned air outlet is at the top on all units except for the UMA 40 and 40MM, where it is at the rear or side, and the UMA V with a weather cowl, where it is at the side.

## Operation

### UMA and UMA H

Contaminated air from the dust generation source is drawn through the inlet to the unit by the fan. Initially some pre-separation takes place as heavier dust particles lose momentum and fall into the collection bin or hopper. Finer dusts are carried up to the filter elements where they are retained on the outer surface of the filter fabric. The cleaned air is then passed through the filter fabric into the fan chamber and discharged. When the fan is switched off the filter fabric cleaning cycle is automatically activated. The collected dust is then dislodged from the filter elements and falls into the collection bin below. On most applications the optimum interval between cleaning cycles would be four hours.

### UMA STU

When the quick-release sack tipping door is removed from the hopper, the unit fan can be switched on. Air is entrained through the hatch preventing dust escaping while sacks are being emptied. Airborne dust is carried up and retained on the filter fabric. On completion of the sack tipping, the fan may then be switched off and the door replaced. The cleaning cycle mechanism will then automatically be activated – depositing the collected dust directly into a hopper chute or conveyor beneath. Units fitted with explosion relief are fitted with a swing door that does not require removal.

### UMA V

The series UMA V operates above atmospheric pressure. No fan is supplied as the air flow is

provided by the blower or fan associated with the system. The product laden air should enter the silo bin or pressure vessel in a way that allows pre-separation of the bulk product from the conveying air before it reaches the filter. Dust is collected on the filter fabric as previously described. On completion of the delivery operation, the blower or fan must be allowed to run down before the cleaning mechanism is operated. Collected dust is deposited directly into the silo or dust container.

For series UMA V with dust container the dust will be deposited in the collection facility for disposal later.

### Cleaning

Approximately every four hours or when operating pressure drop reaches 100-150mm wg, depending on dust type and volume, the filter assembly should be cleaned.

On all units, fans or blowers should be allowed to run down before cleaning mechanism operation, otherwise dust penetration of the filter cloth can occur, necessitating filter removal and special cleaning by hand. The DCE controllers for UMA, UMA H and UMA STU units have an automatic time delay after the cleaning cycle has been initiated. The controllers on the UMA V do not have this facility due to their functional requirements. It is therefore the customers responsibility to ensure that sufficient time is allowed for the air flow to have ceased before cleaning is initiated, fitting interlocks if necessary.

Before restarting the unit, the dust container, if fitted, should be checked for dust quantity and emptied if necessary. For safe handling of the dust container an assessment must be made to satisfy the requirements of the European Directive 90/269/EEC on manual handling.

### Dust disposal

#### UMA 40 and 40MM

Dust container :

- Release the dust container by undoing the two toggle fasteners located at the sides of the container and slide it out.
- Remove and empty the container.
- Replace container by sliding it back to the locating stops.
- Reseal the container by fastening the toggle clips.

Dust container with bin balance :

- Release the dust container by undoing the two toggle fasteners located at the sides of the container and slide it out.
- The polythene bag liner can be sealed in a manner to suit the toxicity of the dust and then removed.
- Fit a new polythene bag into the dust container and slide the container back to the locating stops.
- Reseal the container by fastening the toggle clips.

#### UMA 70 to UMA 750

Dust container :

- Release the container fully by raising the sealer gear handle.
- Remove and empty the container.
- To replace, slide the container back to the locating stops.
- Lower the sealer gear handle.

Dust container with bin balance :

- Release the container fully by raising the sealer gear handle and slide the container out.
- The polythene bag liner can be sealed in a manner to suit the toxicity of the dust and removed.
- Fit a new polythene bag into the dust container and slide the container back to the locating stops.
- Lower the sealer gear handle.

## Installation

Explosion relief panels, if fitted, should be vented to a safe area. Where it is necessary to fit a vent duct to vent to a safe area, the duct must be of sufficient strength to withstand the explosion pressure and conform to any local guidelines. In these instances reference must be made to DCE to confirm that the additional pressure created by the vent duct is acceptable.

All units are despatched in crates and may be delivered to site either upright or laid on their side, in one piece or in a number of pieces depending on their configuration.



Lifting brackets are provided on all units except the UMA 40 and 40MM. They are also fitted to the UMA 450 and 750 bottom assemblies when supplied separate to the main filter case. Where headroom is restricted a fork lifting option is available on all units except for the UMA 750V. The UMA 750 fan type units have a lifting beam within the fan chamber whilst the smaller units are lifted from underneath the seal frame after filter assembly removal.

### General guidance to lifting

- During all lifting operations a crane or fork lift with an adequate SWL (safe working load) must be used (refer to lifting labels located adjacent to lifting fixture for weight of equipment supplied by DCE).
- It may be necessary to guide the unit during lifting to prevent excessive swing.
- If a fork lift is used to lift using the lifting brackets, a suitable lifting attachment must be used to prevent the chains slipping off the forks (see Fig. 7).
- If chains or slings are used they must have an adequate SWL (safe working load). (Refer to lifting labels located adjacent to lifting brackets for weight of equipment supplied by DCE).

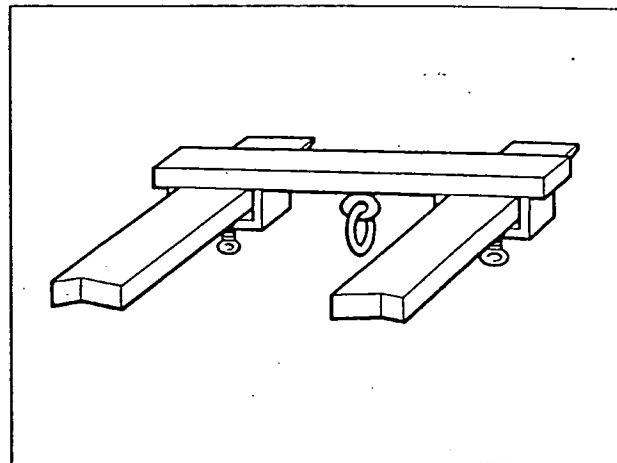


Fig. 7 Fork lifting attachment

### Two-point lifting method

The two-point lifting method should be used to lift the following units from the horizontal to the vertical position:

UMA 70	UMA 250
UMA 100	UMA 450
UMA 150	

The lifting points are located on top of the unit at the sides. The units must be lifted as shown in Fig. 8, following the 'General guidance to lifting' mentioned previously.

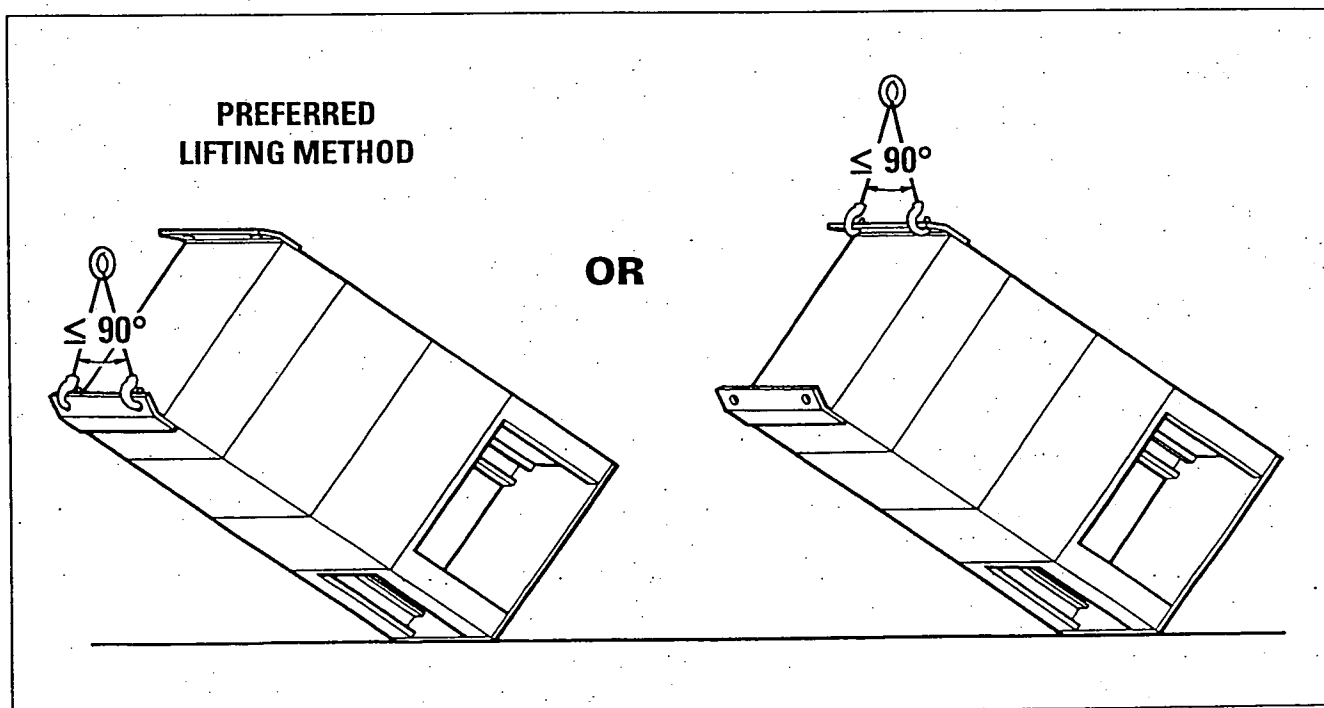
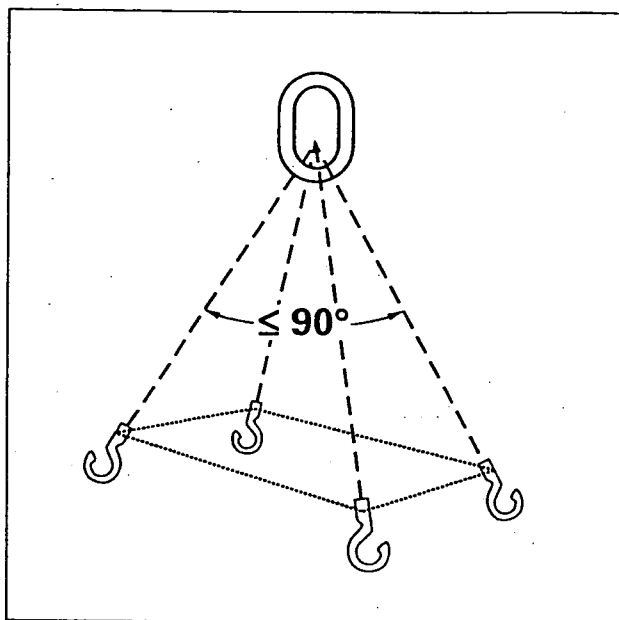


Fig. 8 Two-point lifting arrangement



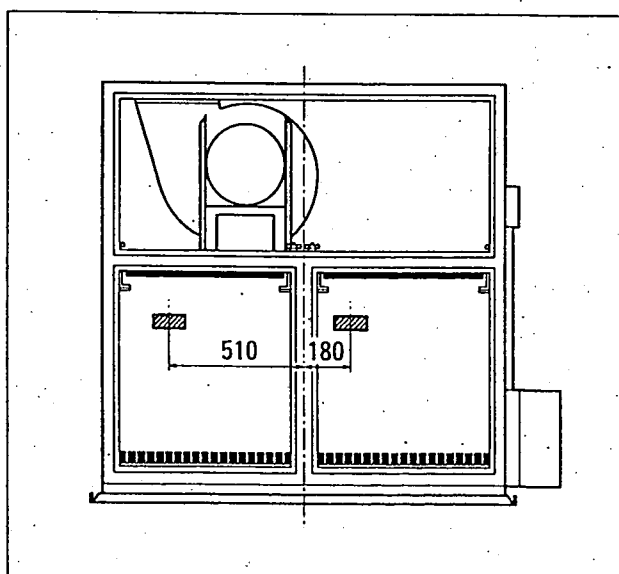
**Fig. 9 Four-point lifting arrangement**

### Four-point lifting method

The four-point lifting method can be used for all units except the UMA 40 and UMA 40MM.

The lifting points are located on top of the unit in all cases except for the UMA V when fitted with a side outlet box (in this case the lifting points for the unit are located within the outlet box and are accessed by removing the top access door). The unit must be lifted following the general guidance to lifting.

Chains must be long enough to ensure that the included angle between diagonal chains is not greater than 90° (see Fig. 9).

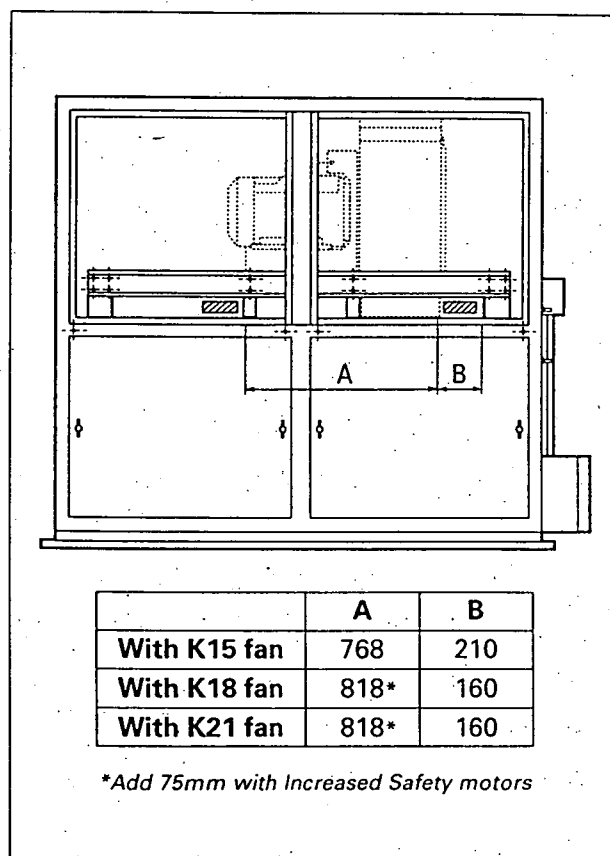


**Fig. 10 Fork lift positions for UMA 450**

### Fork lifting method

#### UMA 40 to 450

- 1 Dismantle crate and lift unit to an upright position if appropriate (see 'Two-point lifting method' on page 15).
- 2 Remove filter assembly as described on page 32.
- 3 If the unit is fitted with a static earthing arrangement, the earthing bar attached to the seal frame will also need removing.
- 4 The unit can now be lifted, using a fork lift by positioning the forks underneath the seal frame. Care should be taken not to damage the seal frame rubber seal and the back of the unit. The forks used should be long enough to reach the back of the unit and set as wide as possible. On the UMA 40-250 units the forks should be positioned centrally across the front. On the UMA 450 the forks should be positioned as shown in Fig. 10.
- 5 After positioning unit, replace static earthing bar if applicable.
- 6 Replace filter assembly as described on page 33.



**Fig. 11 Fork lift positions for UMA 750**

**UMA 750**

(Fan type unit only – the UMA 750V has no fork lifting facility).

- 1 Dismantle crate.
- 2 Remove both fan access doors and the mattress support frame from its storage position.
- 3 The unit can now be lifted using a fork lift, positioning the forks underneath the lifting beams as shown in Fig. 11.
- 4 After positioning the unit replace mattress support frame in its storage position and replace both fan access doors.

**Site assembly – UMA V, UMA H and UMA STU**

- 1 Using the sealant provided, apply two beads of sealant to the site seating flange, one each side of the fixing holes, as shown in Fig. 12.
- 2 Lift the unit, using one of the methods described in the lifting section, onto the site seating flange.
- 3 Secure the joint with fixings to suit the application and remove excess sealant.

**Site assembly – UMA 450 and 750**

UMA 450 and 750 fan units with bins are supplied with their bottom assemblies separate for site assembly as follows:

- 1 Dismantle crating.
- 2 With a four-point lift, lift the bottom assembly into position, using the lifting brackets provided.
- 3 The UMA 750 units must be bolted to the floor (see 'Securing the UMA bottom assembly to the floor' following on this page).
- 4 Remove the lifting brackets from the joint flange.
- 5 Using the sealant provided, apply two beads of sealant to the bottom assembly joint flange, one each side of the fixing holes.
- 6 Lift the fan and filter section, using one of the methods described in the lifting section, onto the bottom assembly.
- 7 Secure the two sections with the nuts and bolts provided and remove excess sealant.

**Securing the UMA 750 bottom assembly to the floor**

- a Using plumb lines and spirit levels, line up supports both horizontally and vertically, using shims under legs where required.
- b Drill through base holes and insert suitable expandable bolts.
- c Tighten holding down expandable bolts.

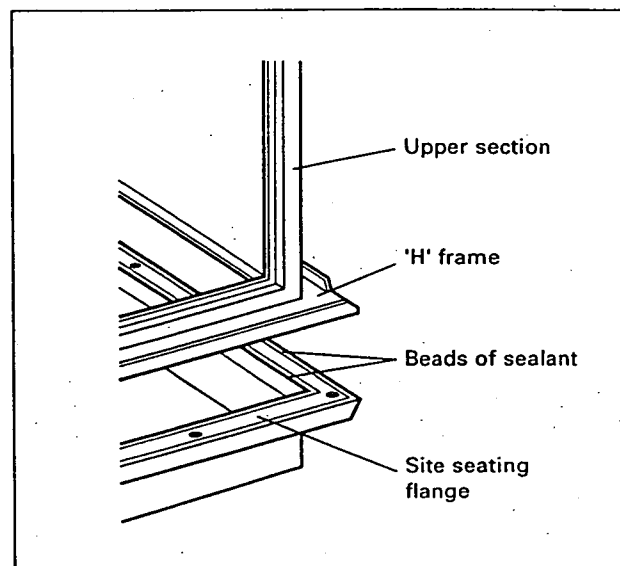


Fig. 12 Applying sealant to site seating flange

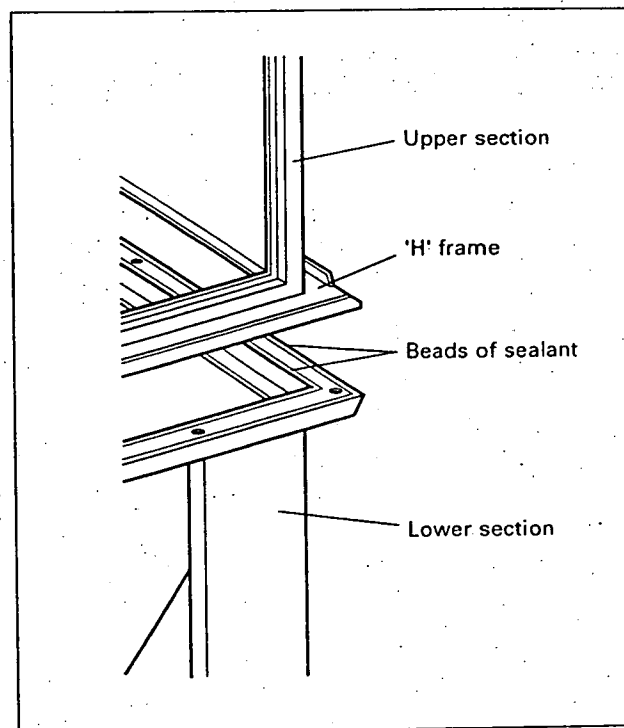


Fig. 13 Applying sealant to bottom assembly

### Site assembly of an acoustic diffuser

When a UMA 750 is supplied with a secondary or absolute filter, due to height restrictions, the acoustic diffuser is supplied separately for site assembly as follows:

- 1 Dismantle crating from around filter and fan section and from around acoustic diffuser.
- 2 With the aid of a colleague, lift the acoustic diffuser onto its back, taking care not to damage paintwork.
- 3 Using the sealant supplied in the fixing pack, seal all around the underside of the seating flange (see Fig. 14).
- 4 Lay the acoustic diffuser down so that the lifting brackets are uppermost.
- 5 Using a four-point lift, lift the acoustic diffuser into position on top of the fan section so that the diffuser outlet is in the front, right-hand corner of the top plate (see Fig. 15).
- 6 The acoustic diffuser can now be fixed in position using M10 self locking nuts, washers and bolts at the sides, and self tapping screws at front and rear.

### Weather bends and cowls

The weather bend, if required, is supplied as a separate piece for site assembly. It should be secured around unit outlet with self tapping screws

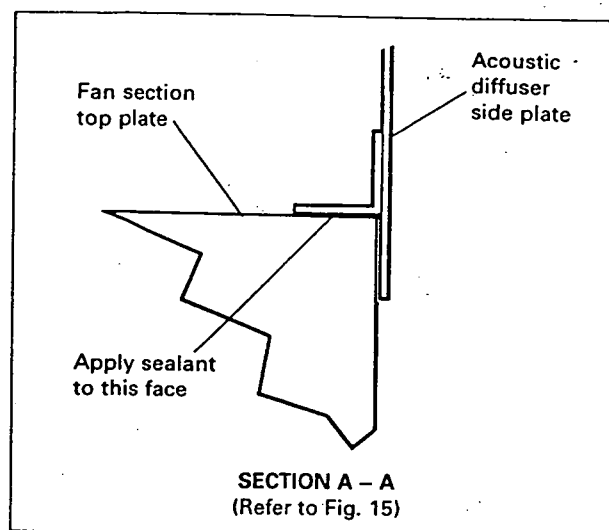


Fig. 14 Applying sealant to acoustic diffuser

and sealed around the joint. On certain units the lifting brackets need to be removed to facilitate assembly.

Weather cowls on venting type units are factory fitted.

### Castor bases

UMA 40 and 40MM units are supplied with the castor base fitted.

UMA 70-250 units should be lifted into the castor frame using one of the methods described previously (see page 15). No additional fixing is required.

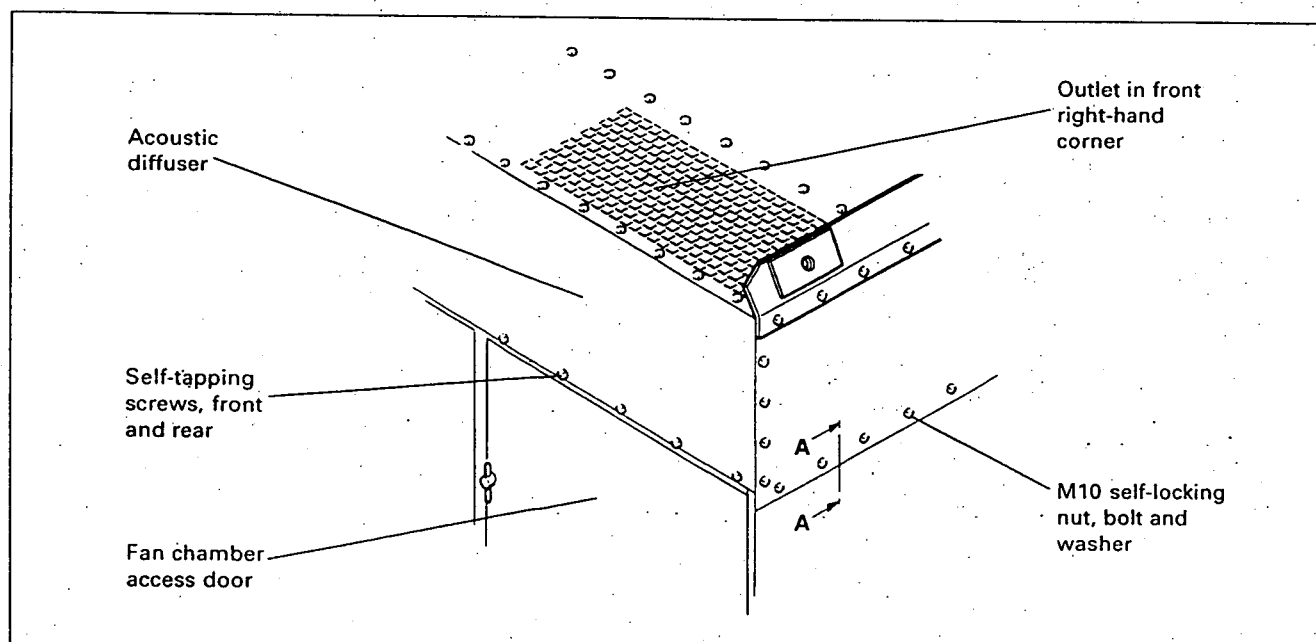


Fig. 15 Fitting of UMA 750 acoustic diffuser

## Electrical Requirements

**Note:** It is a requirement of the Supply of Machinery (Safety) Regulations 1992 to provide adequate isolation and emergency stop facilities. Due to the varied nature of site installations this cannot be provided by DCE but instead is the responsibility of the installer.

**Note:** All electrical work should be carried out by competent personnel.

## Controllers

### Introduction

The Unimaster dust control unit can be supplied with a controller, which is designed to operate the fan and/or shaker in the correct sequence, to ensure that effective cleaning of the filter fabric is achieved.

The controller contains either a direct-on-line (type ECT or UC) or star/delta (type ECTSD or UCSD) fan starter, dependant on fan size, and a direct-on-line shaker starter. Star/delta versions are standard for the UMA 750.

Controllers (types ECTV and UCV) for venting type units, contain a shaker starter only.

### Installation

Mount the controller independently of the Unimaster dust control unit on a vertical surface free of vibration. Bring the incoming mains via a switch-fuse unit (preferably 'on-load' type) to the terminal block (see Table 2 for the fuse rating). Ensure that the cable glands used have an IP rating equal or better than the IP rating of the controller box.

### Overload Setting

**IMPORTANT** – Before start-up, the overload relay calibration levers must be set at the value given by motor full load current in Table 3.

On ECTSD and UCSD controllers the overload F1 should be set to the scale marked Y/Δ.

**TABLE 2 — FUSE RATING**

FLC amps	HRC* amp rating	Fuse wire amp rating
0.00 – 0.44	2	6
0.45 – 0.94	4	8
0.95 – 1.50	6	12
1.51 – 3.90	10	16
4.00 – 6.25	16	30
6.26 – 7.75	20	Fuse wire not recommended
7.76 – 10.00	25	
10.01 – 12.20	32	
12.21 – 17.20	40	
17.21 – 21.60	50	
21.61 – 29.00	63	

STAR/DELTA START FLC amps	Amp rating (HRC-type fuse)*
13.51 – 17.50	32M40
17.51 – 21.00	32M40
21.10 – 29.00	32M50
30.00 – 45.00	63M80

\*HRC = High rupturing capacity

HRC Fuses: BS 88 Part 2 1975 Class Q1 I.E.C. 2169-2

Fuse wire size based upon six times full load current.

**TABLE 3 — MOTOR CURRENT**

Fan motors				
kW	Single Phase		Three Phase	
	230V	230V	230V	400V
0.50	3.3	–	–	–
0.55	–	2.40	1.40	–
0.75	4.7	3.10	1.80	–
1.10	6.5	4.30	2.50	–
1.50	9.2	6.05	3.50	–
2.20	–	8.13	4.70	–
3.00	–	10.72	6.20	–
4.00	–	14.00	8.10	–
5.50	–	18.50	10.70	–
7.50	–	25.90	15.00	–
11.00	–	36.30	21.00	–
15.00	–	48.40	28.00	–
18.50	–	58.80	34.00	–
Shaker motors				
kW	Single Phase			
	110V	220V	230V	230V
0.18	4.4A	2.2A	2.2A	–
0.55	6.3A	4.2A	4.4A	–
kW	Three Phase			
	200V	230V	400V	440V
0.18	1.4A	1.2A	0.7A	0.65A
0.55	3.1A	3.0A	1.7A	1.6A
Figures given refer to full load current in amps for motors of average power factor and efficiency.				
Spaces marked (–) indicate Unimaster controller not suitable for application.				

## Controllers ECTV and UCV

### Operating range

The controllers are suitable for use on a range of 3 phase, 50 and 60Hz operating voltages, with single phase available as an option. The controllers must be used with the shaker motors normally fitted to Unimaster venting type units.

### Specification

#### ECTV

The equipment is housed in a rigid PVC box designed to IP65 protection, with cable entries at top and bottom. It comprises:

- A double-wound transformer with a selection of input tapplings to suit the incoming supply and giving an output of 24V AC.
- Motor starter.
- A pre-set electronic timer module.

Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

#### UCV

The equipment is housed in a rigid polycarbonate box designed to IP65, with cable entries at the bottom. It comprises:

- A double-wound transformer with a selection of input tapplings to suit the incoming supply and giving an output of 24V AC.
- Motor starter with overload fitted.
- A pre-set electronic timer module.

Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

## Operation

### ECTV and UCV

Having first ensured that static air conditions prevail in the Venting Unit, press 'CLEAN' push button:

- Timer switches on and contactor is energised; shaker motor runs for approximately 45 seconds.
- Shaker motor contactor is de-energised and the timer resumes inactive state.

A 'fail-safe' feature ensures that if the power supply fails while the timer is performing a cycle, then re-applying the power will not cause the cycle to be completed. If necessary, re-pressing the 'CLEAN' button will start a fresh cleaning cycle.

### Interlocks

To avoid damage to the Unimaster venting type unit, it is recommended that the controller coil circuit be interlocked with associated electrical equipment and, where possible, wiring should be arranged so that:

- 1 Unimaster is cleaned only in static air conditions.
- 2 Air flow will not re-start during cleaning period.

## Controllers ECT and UC 9, 12, 23 and 30

Both these ranges of controller are suitable for use on a range of 3 phase 50-60Hz operating voltages with single phase available as an option. They are suitable for fan motors rated up to and including some at 11kW. A variance of  $\pm 10\%$  is allowable on transformer input tapplings.

### Specification ECT 9, 12, 23 and 30

The equipment is housed in a rigid PVC box, designed to IP65 protection, with cable entries at top and bottom. Functioning as a dual direct-on-line starter, it comprises:

- A double-wound transformer with a selection of input tapplings for the incoming supply, giving an output of 24V AC.
- Two contactors labelled K1 and K2 (electrically interlocked to prevent simultaneous operation) to control the fan and shaker motors.
- A thermal overload relay with single phase protection for the fan motor (no protection being supplied for the shaker motor except where required by national regulations, e.g. France).
- A pre-set electronic timer module controlling the 'fan run-down' and 'cleaning' periods. These components are all mounted on a baseplate within the box.

Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

#### *Specification UC9, 12, 23 and 30*

The equipment is housed in a rigid polycarbonate box, designed to IP65 protection, with cable entries at top and bottom. Functioning as a dual direct-on-line starter, it comprises:

- A double-wound transformer with a selection of input tapplings for the incoming supply, giving an output of 24V AC.
- Two contactors labelled K1 and K2 (electrically interlocked to prevent simultaneous operation) to control the fan and shaker motors.
- A thermal overload relay with single phase protection for the fan motor and shaker motor.
- Shaker motor fuses.
- A pre-set electronic timer module controlling the 'fan run-down' and 'cleaning' periods.

Control circuit fuses are fitted to the 24V AC supply. These components are all mounted on a baseplate within the box.

Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

#### *Operation*

- 1 **START** (average operating period for fan, 4 hours)  
Press 'START' button:

- Fan contactor K1 is energised; timer module sets and fan motor runs.

- 2 **CLEAN** Press 'CLEAN' button:

- Fan contactor K1 is de-energised and the timer energised.
- After approximately 90 seconds shaker motor contactor K2 is energised; shaker motor now runs for approximately 45 seconds.
- Shaker motor contactor is de-energised and the timer resumes inactive state.

Before a cleaning cycle can be initiated by pressing the 'CLEAN' button, the fan contactor K1 must have remained energised for at least 30 seconds.

A 'fail-safe' feature ensures that if the power supply fails while the timer is performing a cycle, then re-applying the power will not cause the cycle to be completed. Instead, the controller will automatically re-set ready for the fan to be restarted.

#### **Controllers ECTSD and UCSD**

##### *Operating range*

The standard controller is suitable for use on a 3 phase, 50-60 Hz supply, with fan motors rated up to and including 18.5 kW.

A variance of  $\pm 10\%$  is allowable on transformer input tapplings.

##### *Specification*

##### **ECTSD**

The controller combines a STAR/DELTA starter to operate the fan motor with a DIRECT-ON-LINE starter to operate the shaker motor.



The STAR/DELTA starter comprises three contactors, labelled K1, K2 and K3, with a mechanical interlock between K2 and K3 to prevent the simultaneous connection of the Star and Delta modes. The change-over 'delay' period is governed by an adjustable electronic timer, K4, with a setting range of 1 to 20 seconds (typically set at 6 seconds). A thermal overload relay with single phase protection is provided for the fan motor.

The contactor K5 operates the shaker motor and is controlled by a pre-set electronic timer module to provide the 'fan-run-down time' and 'cleaning time'.

To prevent the simultaneous operation of the fan and shaker motors, contactor K5 is electrically interlocked with the contactors K1, K2 and K3.

The control circuits operate on 24V AC, which is provided by a double-wound transformer within the controller.

All components are mounted in a rigid plastic box designed to IP55 protection, with cable entries provided at the top and bottom. Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

### Specification

#### UCSD

The controller combines a STAR/DELTA starter to operate the fan motor with a DIRECT-ON-LINE starter to operate the shaker motor.

The STAR/DELTA starter comprises three contactors, labelled K1, K2 and K3, with a mechanical interlock between K2 and K3 to prevent the simultaneous connection of the Star and Delta modes. The change-over 'delay' period is governed by an adjustable electronic timer, K4, with a setting range of 1 to 20 seconds. A thermal overload relay with single phase protection is provided for the fan motor and shaker motor. Shaker motor fuses are also provided for additional safety.

The contactor K5 operates the cleaner motor and is controlled by a pre-set electronic timer module to provide the 'fan-run-down time' and 'cleaning time'.

To prevent the simultaneous operation of the fan and shaker motors, contactor K5 is electrically interlocked with the contactors K1, K2 and K3.

The control circuits operate on 24V AC, which is provided by a double-wound transformer within the controller which is protected by fuses.

All components are mounted in a rigid polycarbonate box designed to IP65 protection, with cable entries provided at the top and bottom. Timer ambient temperature range is  $-5^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

### Operation

#### 1 START (average operating period for fan, 4 hours) Press 'START' button:

- Fan contactors K1 and K3 are energised; timer K4 begins 'delay' period (Star-connected).
- After delay period (typical setting: 9 seconds), K4 de-energises K3.
- K4 resets and energises K2, (Delta-connected).

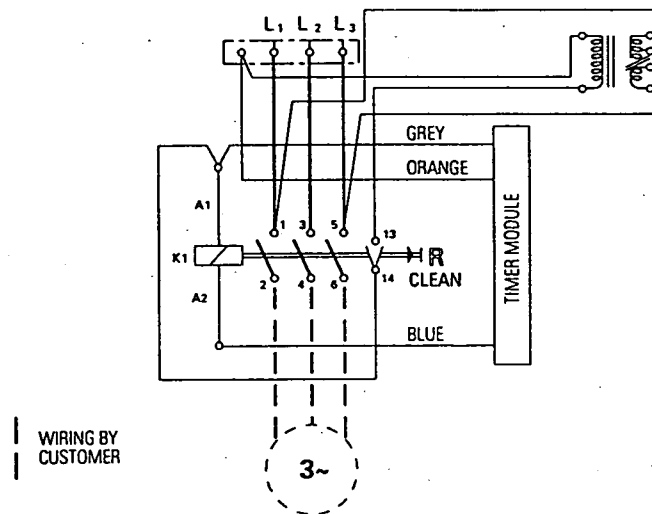
#### 2 CLEAN Press 'CLEAN' button:

- Fan contactors K1 and K2 are de-energised and timer K6 is energised.
- After approximately 90 seconds shaker motor contactor K5 is energised; shaker motor runs for approximately 45 seconds.
- Shaker motor contactor is de-energised and timer K6 resumes inactive state.

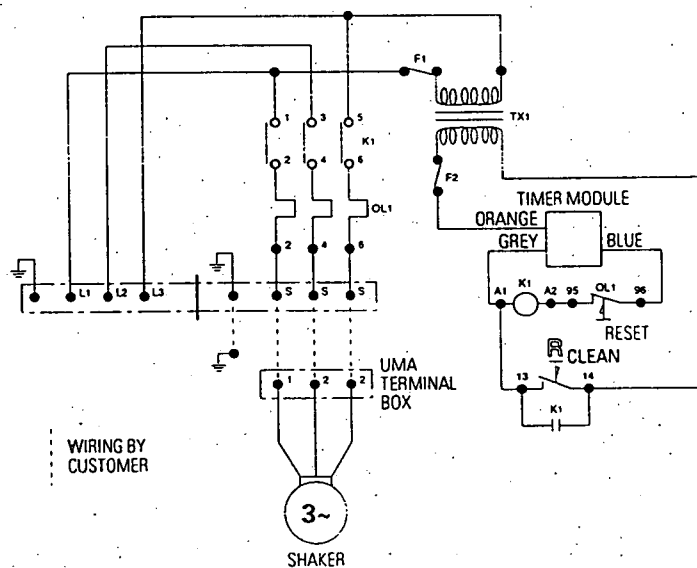
Before a cleaning cycle can be initiated by pressing the 'CLEAN' button, the fan contactors K1 and K2 must have remained energised for at least 30 seconds.

A 'fail-safe' feature ensures that if the power supply fails while the timer is performing a cycle, then re-applying the power will not cause the cycle to be completed. Instead, the controller will automatically reset ready for the fan to be restarted.





**Fig. 16 Standard wiring diagram, type ECTV (3-wire supply)**  
If controller differs from this, refer to diagram in lid



**Fig. 17 Standard wiring diagram, type UCV (3-wire supply)**  
If controller differs from this, refer to diagram in lid

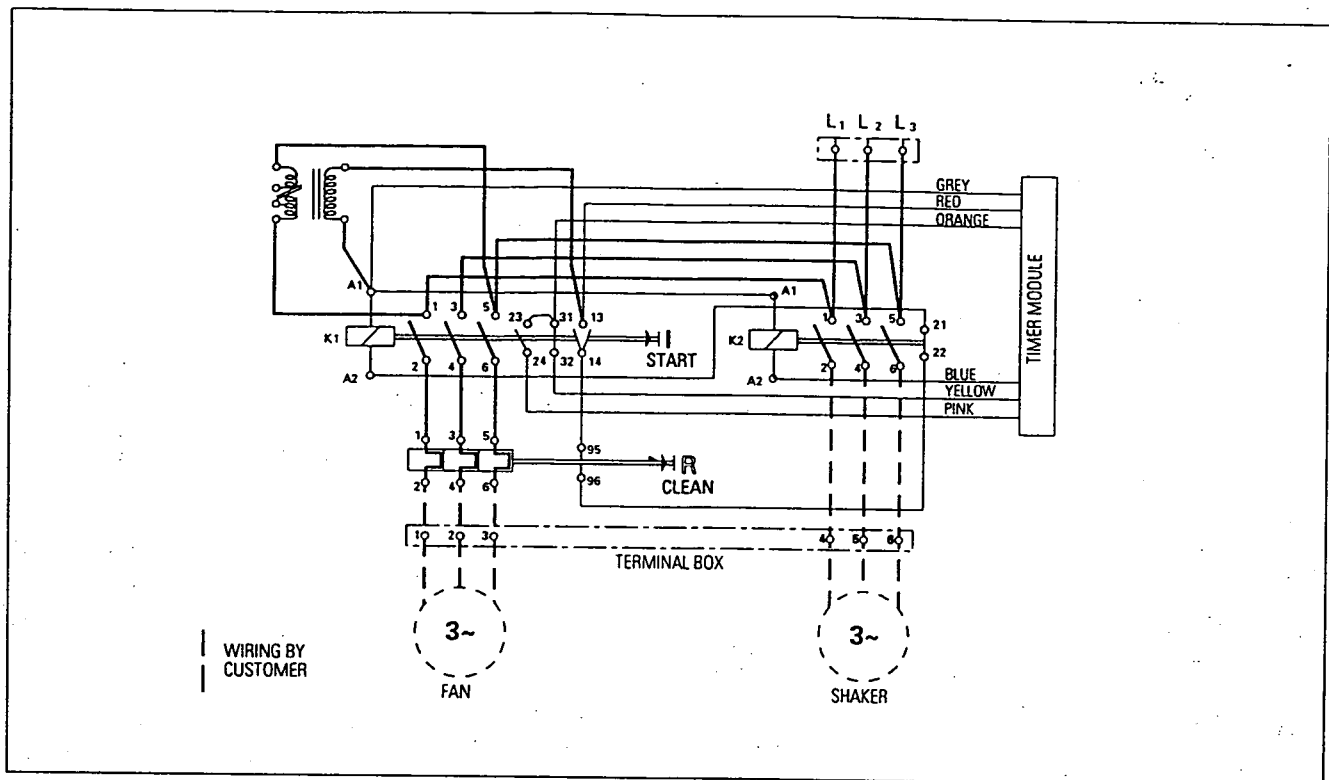


Fig. 18 Standard wiring diagram, types ECT 9 and ECT 12 (3-wire supply)  
If controller differs from this, refer to diagram in lid

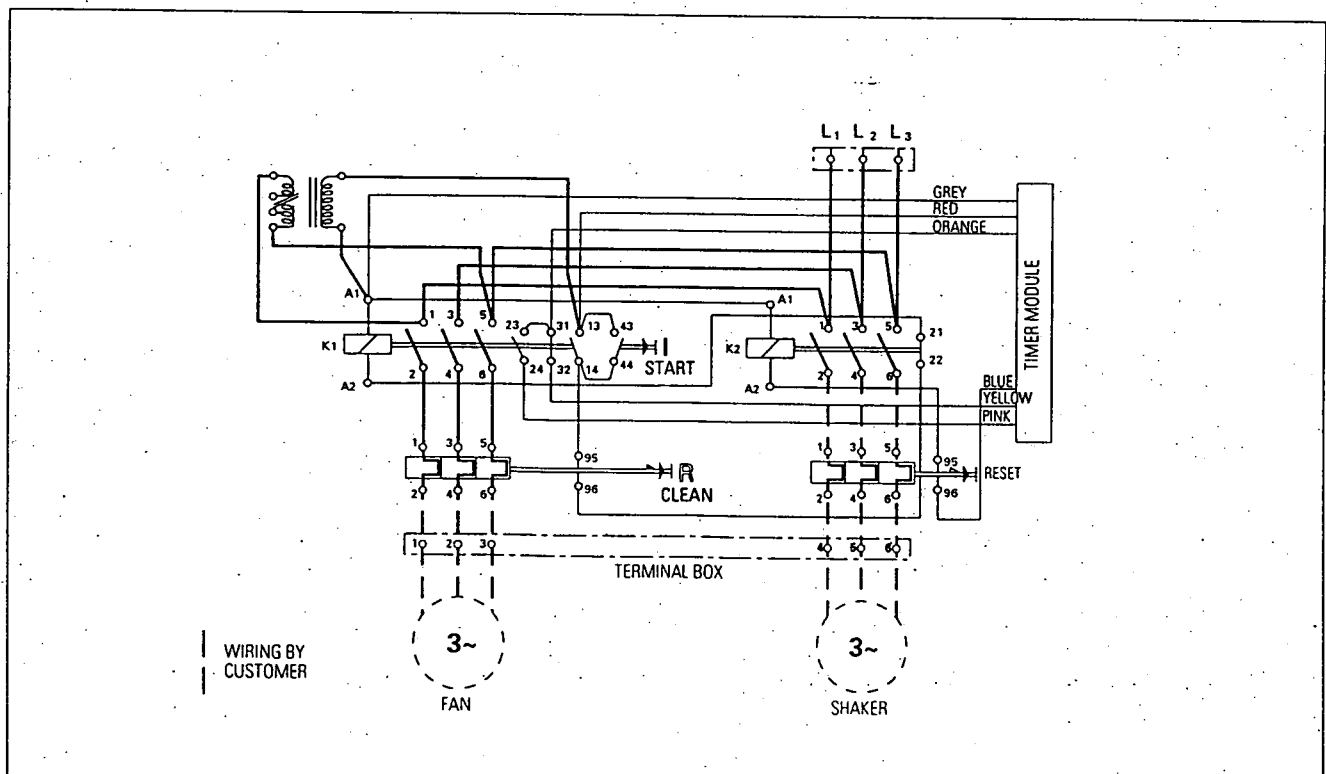
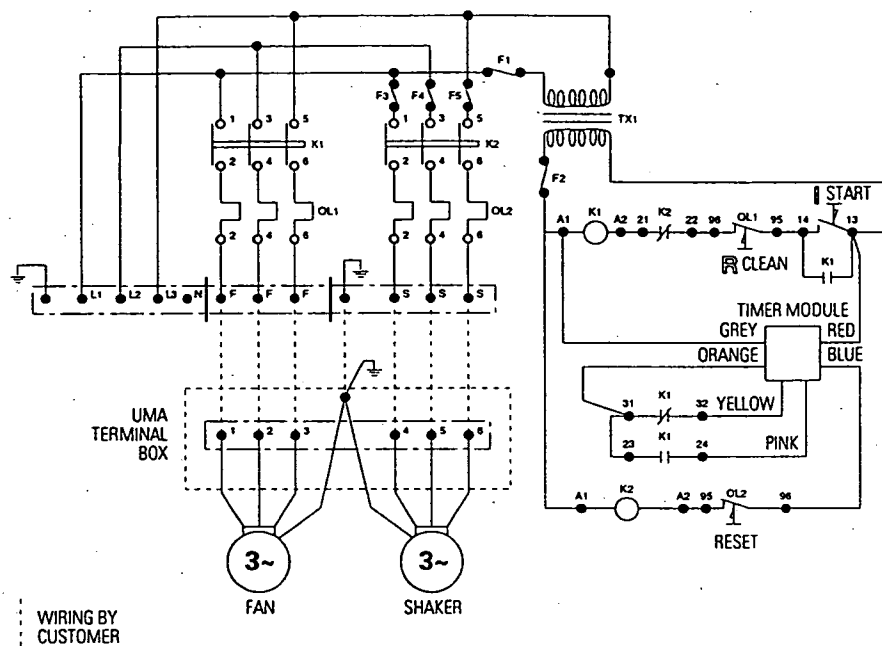
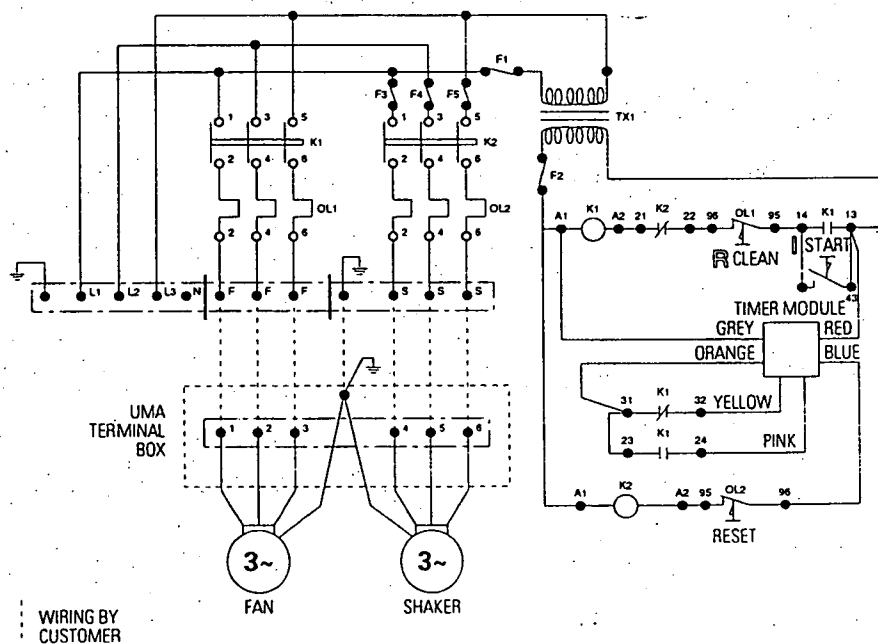


Fig. 19 Standard wiring diagram, types ECT 23 and ECT 30 (3-wire supply, with two overloads)  
If controller differs from this, refer to diagram in lid



**Fig. 20** Standard wiring diagram, types UC 9 and UC 12 (3-wire supply)  
If controller differs from this, refer to diagram in lid



**Fig. 21** Standard wiring diagram, types UC 23 and UC 30 (3-wire supply)  
If controller differs from this, refer to diagram in lid

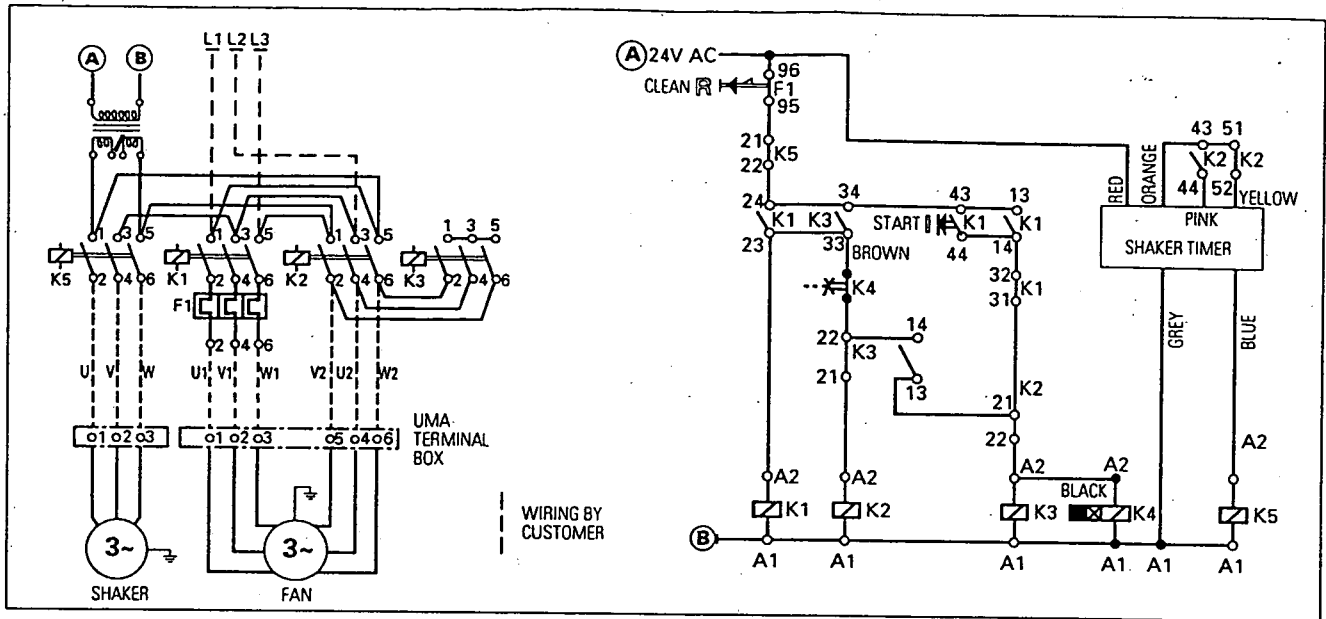


Fig. 22 Standard wiring diagram, type ECTSD (single overload)  
If controller differs from this, refer to diagram in lid

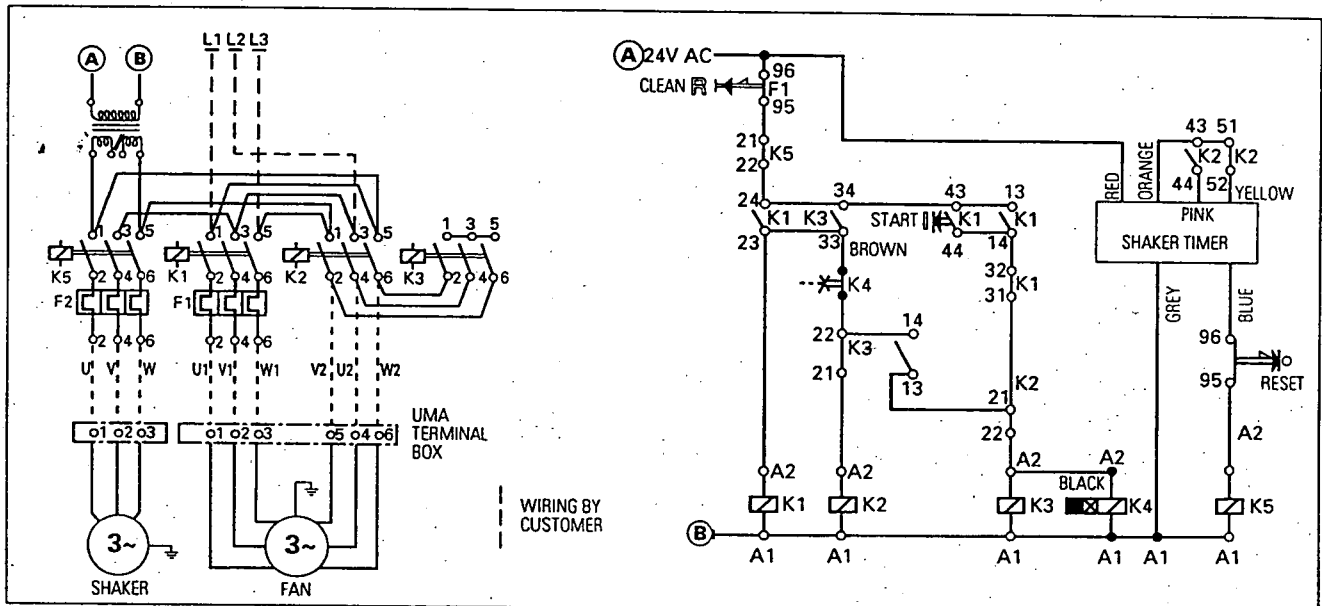


Fig. 23 Standard wiring diagram, type ECTSD (dual overload)  
If controller differs from this, refer to diagram in lid

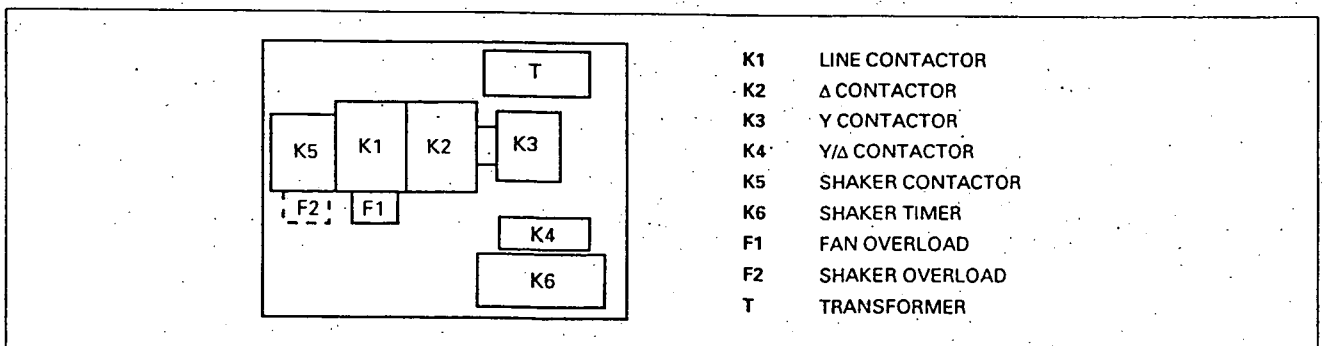


Fig. 24 Panel layout, type ECTSD

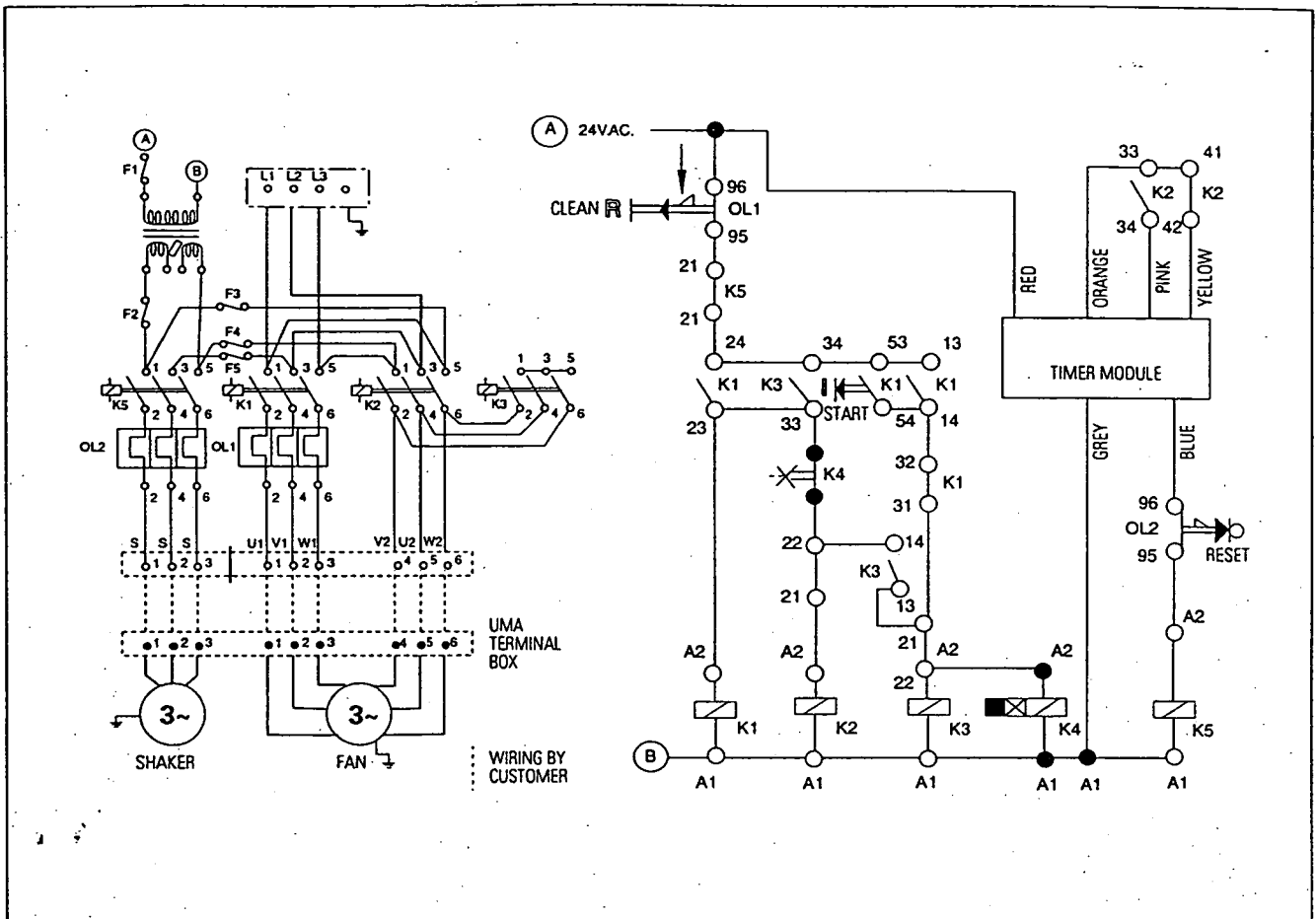


Fig. 25 Standard wiring diagram, type UCSD  
If controller differs from this, refer to diagram in lid

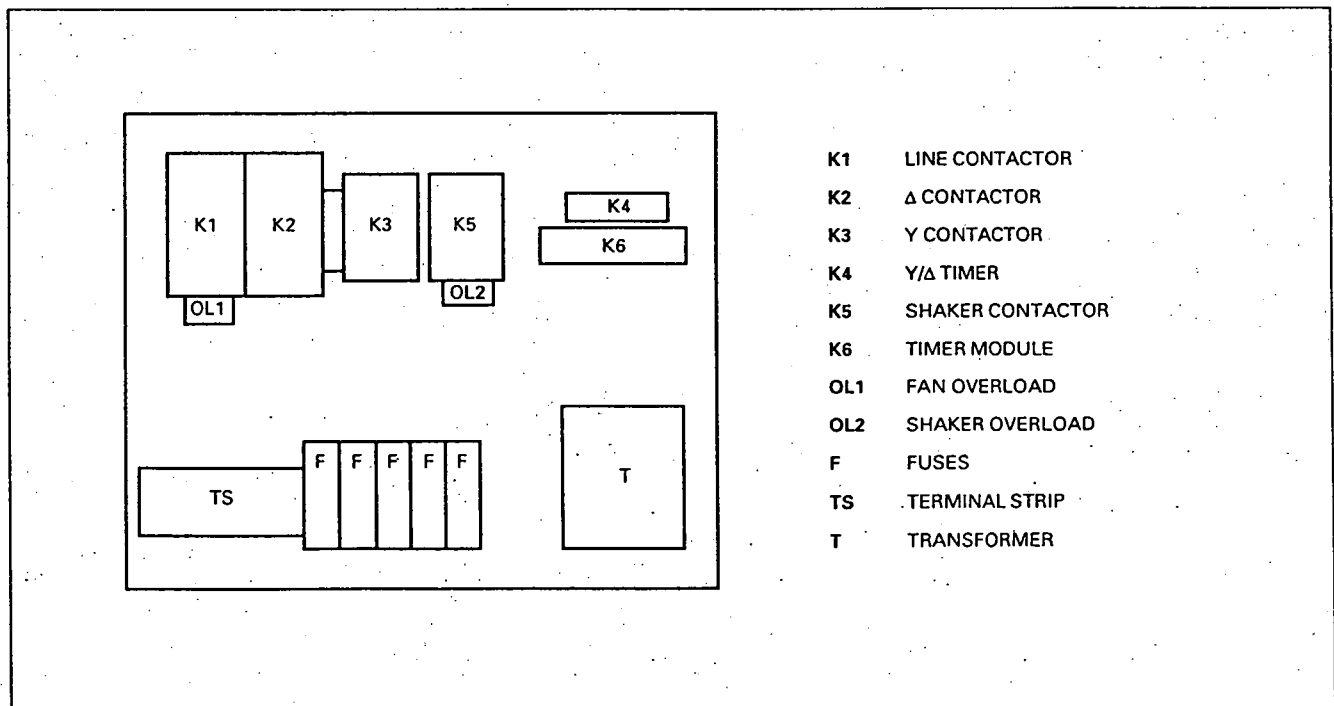


Fig. 26 Panel layout, type UCSD



## Secondary Filter Monitor

This monitor is designed to act as an illuminated 'bar-graph' to give a constant picture of the operating condition of the Unimaster secondary filter.

Arranged in a vertical column, eleven LEDs show through the clear polycarbonate cover of the monitor. These are operated by a differential pressure transducer, which senses the difference in air pressure between the dirty side of the filter and the ambient atmosphere, for all Unimasters, except UMA 750 and UMA 40MM, where a differential pressure is measured between the primary and

secondary clean chambers. Reading upwards from the bottom, the first LED is amber and lights up when the power is switched on. The next two are red and will indicate, if either light up, that the filter assembly is missing or not properly sealed. The next six are green and the lowest of these will light up when a clean filter assembly is in place and correctly sealed. As the pressure drop across the filter increases, due to the resistance of the accumulating dust, the next LED will light up, gradually followed by the next and so on up the column. The top two LEDs are red and when these are reached the filter assembly is clogged and must be replaced.

The monitor is housed in a two-part IP65 moulded polycarbonate box, with a transparent cover for sight of the illuminated 'bar-graph', and access to the monitor wiring connections.

Two volt-free contacts are fitted in the box for connection to a remote control panel if required. A signal from the one marked RLB will indicate a leak path; a signal from the other, marked RLA will indicate that the filter assembly is blocked and needs replacing.

**Note:** *Contacts are closed in alarm state.*

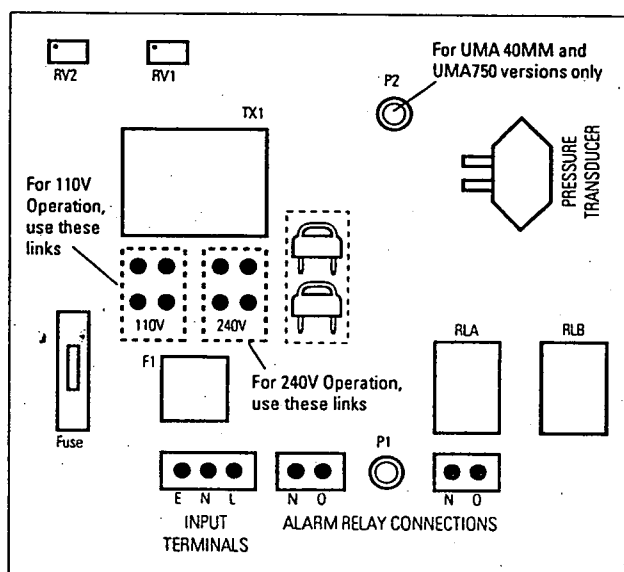
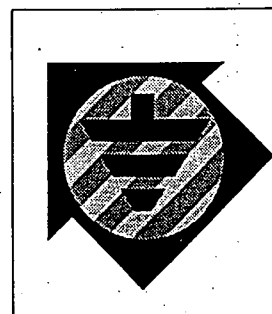
The monitor is suitable for use on either 110V AC or 240V AC, 47-63 Hz and must be protected by a 1 amp HRC (high rupturing capacity) fuse in the supply. The PCB mounted fuse is 100 mA HRC.

**Note:** *Ensure voltage links are set for incoming supply before connecting the monitor.*

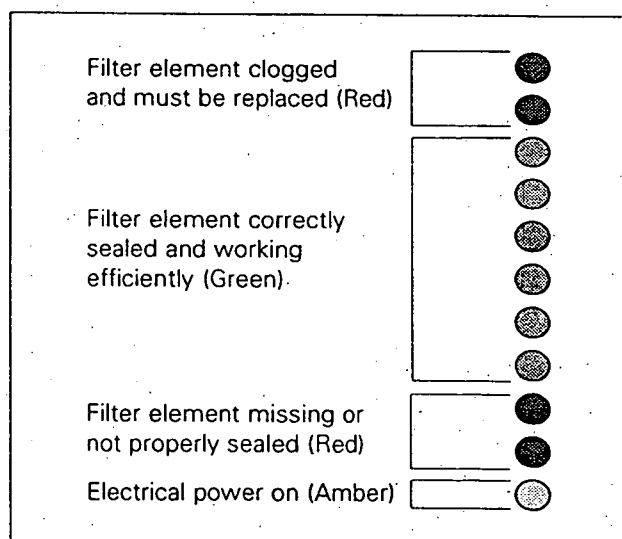
The working ambient temperature range is  $-10^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . For temperatures outside these limits please refer to DCE.

### Antistatic earthing

It is particularly important on units having antistatic features that the earthing boss is properly connected to earth, using the brass screw provided (located adjacent to the symbol, shown opposite) to prevent any static build-up.



**Fig. 27** Secondary filter monitor wiring connections



**Fig. 28** Illuminated 'bar-graph' key

## Commissioning

### Preliminary checks

Before putting the Unimaster dust control unit into service the following items should be checked. Similar checks, as appropriate, should be made after any major overhaul.

- 1 Ensure controller overloads are correctly set. (See 'Electrical requirements' on page 19). To conform with electrical regulations the sheet steel mounting plate inside the controller should be earthed to the screw provided.
- 2 Ensure that all unit section joints made on site are secure and that UMA 750 bin type units are securely bolted to the floor.
- 3 Ensure that all ducting is complete and all detachable panels are in position and fixed guards are secure.
- 4 If the filter assembly has been removed for site assembly, ensure that it has been replaced and clamped correctly (check top frame is against sealing rubber, Figs. 5 and 6).
- 5 Ensure all access door seals are intact then replace and secure all doors.
- 6 Check sealer gear seal, then replace bin and close sealer gear.
- 7 Ensure electric power is available.
- 8 Check fan motor for correct rotation (*refer to fan rotation label located on the fan case*).
- 9 Verify the operation of any interlocks, and visual or audible warning systems fitted.

### Start-up sequence

#### Fan type units

The unit is started by depressing the 'start' button on the controller; the fan will then run.

#### Venting type units

There is no start function for a venting unit as the air flow is generated by external sources.

### Shut-down sequence

#### Fan type units

The unit shut down sequence is initiated by depressing the 'clean' button on the controller. This will stop the fan and allow a time delay for fan run down. The cleaning cycle will then operate automatically and, when finished, the unit is off and ready for re-starting.

#### Venting type units

There is no shut down operation for the venting unit; however it should be cleaned at regular intervals by depressing the 'clean' button on the controller.

**Note:** *Still air conditions must exist inside the venting unit for effective cleaning.*

For controller operation see 'Electrical requirements' on page 19.

## Maintenance

**Note:** *Always isolate the electrical controls before servicing.*

**Note:** *Consideration should be given to the nature of the dust being handled and appropriate clothing and safety equipment should be worn.*

### Routine inspection

To maintain the optimum performance of any Unimaster dust control unit a routine inspection should be made to minimise down-time in the event of equipment malfunction.

Any abnormal change in pressure absorbed across the filter assembly indicates a change in operating conditions and a fault to be rectified. For example, a fault in the cleaning mechanism will cause an excessive build-up of dust on the filter bags, resulting in a greatly increased pressure drop.

Filter resistance can be checked by connecting a U-tube manometer or differential-type pressure gauge to the tapping points provided on the unit casing (see Fig. 1). This will give a continuous indication of the state of the filter. Normally a resistance of 75 to 125mm (3" to 5") water gauge may be expected for all units except the UMA 750,



depending on the type and volume of dust being handled, increasing slightly until the unit is cleaned. For the UMA 750 a resistance of 125 to 175mm (5" to 7") water gauge may be expected.

The secondary filter monitor, if fitted, will provide a constant indication of the state of the secondary filter element.

Do not operate the unit above the recommended pressure as this will reduce the life of components.

### Servicing schedule

A record of all pressure checks should be kept in a log book to aid the speedy diagnosis of faulty operation.

The UMA 40MM fan belt tension should be checked after the first day's operation.

#### Weekly

Connect a manometer to the tapping points and measure the pressure drop across the filter. Record the figure in the log book. If the pressure drop increases significantly over two or three successive checks, e.g. 50% (a variation of up to 10% is permissible) check the filter as described in the fault location chart on page 35.

If the unit is fitted with a secondary or absolute filter then the pressure drop across this filter should also be checked if a secondary filter monitor is not fitted. The filter should be changed when the pressure drop reaches 100mm (4") water gauge.

Unimaster units fitted with explosion relief should be inspected to ensure that the bursting panels are intact and clear of obstruction. During winter, particular care must be taken to prevent build-up of snow or ice on explosion panels.

#### 6 monthly

Every 1000 working hours the following parts should be checked:

- Filter bag – for wear
- Rubber seals – for tears and overcompression
- Shaker mechanism (see Fig. 29) with particular attention to:
  - tightness of mounting bolts
  - play in eccentric
  - splits in diaphragm
  - broken locators on shaker bar
  - torn shaker bar support straps

Any defective parts should be replaced.

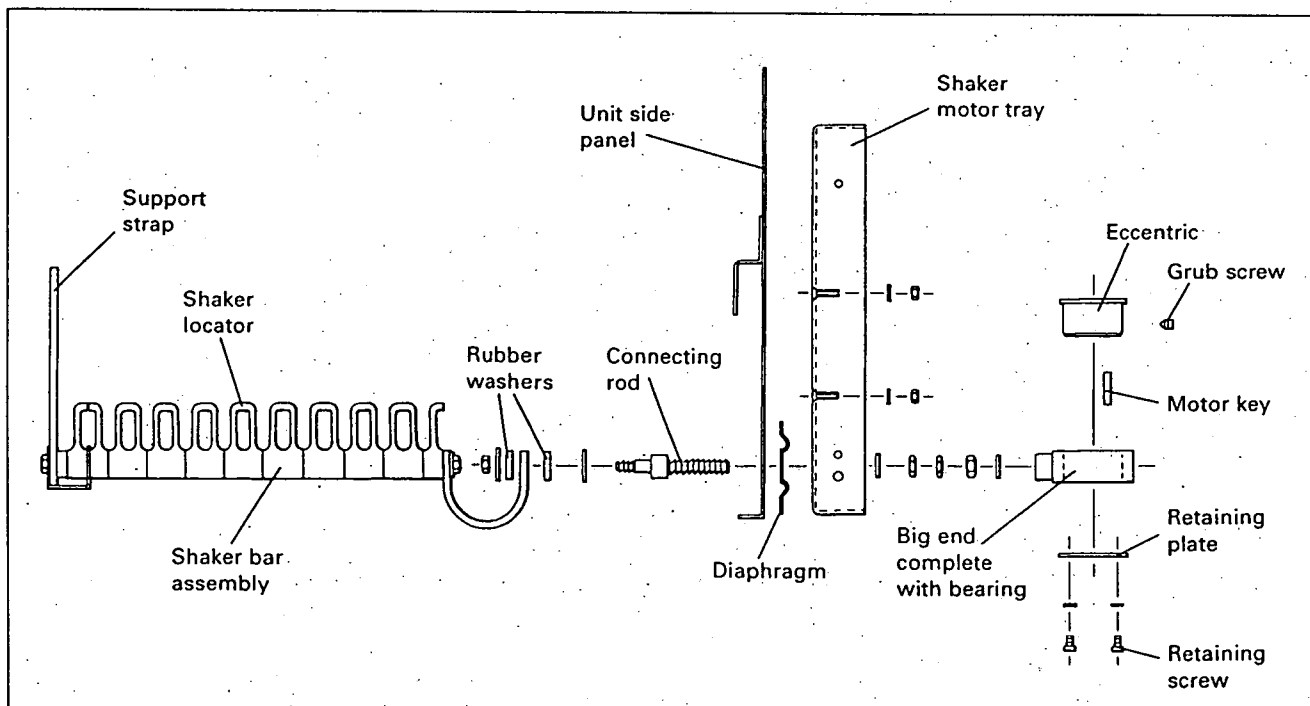


Fig. 29 Exploded diagram of standard UMA shaker assembly with motor and cover removed



### Yearly

The calibration of the secondary filter monitor, if fitted, should be checked as follows:

- 1 Apply a positive pressure of 1" (25mm) water gauge.
- 2 Adjust RV1 and RV2 until the first green LED is lit and RLA changes over.
- 3 Apply a positive pressure of 4" (100mm) water gauge.
- 4 Adjust RV1 until the first of the red filter blocked LEDs lights and RLB changes over.
- 5 Repeat steps '1 to 4' until both set-points are stable without further adjustment.
- 6 Wait 10 minutes.
- 7 Repeat step '5' to ensure no significant temperature drift has occurred. If temperature drift has occurred the unit has failed the test.
- 8 Switch off.

### 3 Yearly

**Lubrication.** Under normal operating conditions the UMA 40MM power unit will operate for 6,000 hours (or approximately three years at 40 hours per week) without attention. After this period the fan bearings should be re-packed with Shell Alvania ET3 grease (or equivalent) to ensure reliability.

**Note:** The motor bearings are sealed and therefore do not require lubrication.

### UMA 40MM

#### Filter assembly removal:

- 1 Isolate electrical supply and remove filter chamber access door.
- 2 To gain access to the four wing nuts securing the filter assembly, which are located in the fan chamber, remove the cleaned air outlet cowl or, where fitted, the absolute filter.
- 3 Fully slacken the wing nuts and withdraw the filter assembly horizontally through the front of the unit.
- 4 Remove wire mesh insert frames from individual filter pockets. These should be checked for

broken mesh and worn material edgings, especially around the area of any filter bag damage.

- 5 Detach filter bag assembly from supporting frame.

#### Filter assembly replacement:

- 1 Fit new filter bag assembly into supporting frame, feeding individual filter bags between locating bars, and fold collar over peripheral sealing flange.
- 2 Prior to fitting wire mesh inserts, any material edgings that need replacing should be fitted around the three edges of the insert that do not have the insert frame joint. The inserts should then be fitted, edging first, into the filter bags.
- 3 Slide filter assembly into unit in the guides until the bottoms of the filter bags make contact with the shaker bar.
- 4 Position individual bags in shaker bar locators.
- 5 Slide filter assembly fully home and tighten securing wing nuts to form an air-tight seal. Check top frame is against sealing rubber (see Fig. 5).
- 6 Replace access door and discharge cowl (or, if fitted, the absolute filter).

#### V-belt drive tensioning

The Polyvee drive belt has been pre-stretched and tensioned during assembly but will require checking for correct tension after the first day of operation, when it will have fully seated into its grooves. Tension should be as shown in Fig. 30 and is adjustable by loosening (not removing) the three bolts securing the motor. Slot holes in the motor baseplate permit the necessary adjustment.

**Note:** Incorrect tensioning can be harmful to the belt and also impair the operating efficiency of the dust control unit itself.

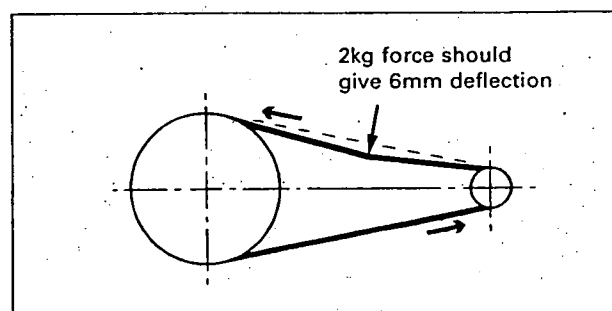


Fig. 30 V-belt tensioning

### Renewal of fan bearings (see Fig. 31)

- 1 Isolate electrical supply and remove fan chamber lid.
- 2 Disconnect electrical wiring to terminal box.
- 3 Remove the four bolts securing the motor drive bed-plate and withdraw the complete assembly from the unit case.
- 4 Loosen, but do not remove, the four socket screws in the base flange and withdraw drive cover.
- 5 Remove drive belt.
- 6 Remove the six nuts securing flange of bearing housing to the bed-plate and withdraw the housing.

- 7 Remove fan pulley and the six bolts securing the fan case.
- 8 Remove fan impeller and fan case.
- 9 Remove end caps and spacers from fan bearing housing.
- 10 Remove fan bearings.
- 11 Fit new bearings, ensuring that the fan end bearing is flush with bearing housing.
- 12 Flush out bearings with a degreasing solvent (a special high temperature grease is required as step '14').
- 13 When inside of bearings is dry, apply a small amount of light oil to the bearings and spin the shaft round.
- 14 Repack with Shell Alvania ET3 grease (or equivalent) as shown in Fig. 31.
- 15 Secure bearing end caps and re-assemble all other items to shaft, tightening up securely.
- 16 Refit fan unit to bed-plate. (Air discharge towards motor).
- 17 Tension drive belt as shown in Fig. 30.
- 18 Replace drive cover and tighten four socket screws.
- 19 Reconnect electrical wiring to terminal box.
- 20 Recheck fan rotation (see Fig. 30).

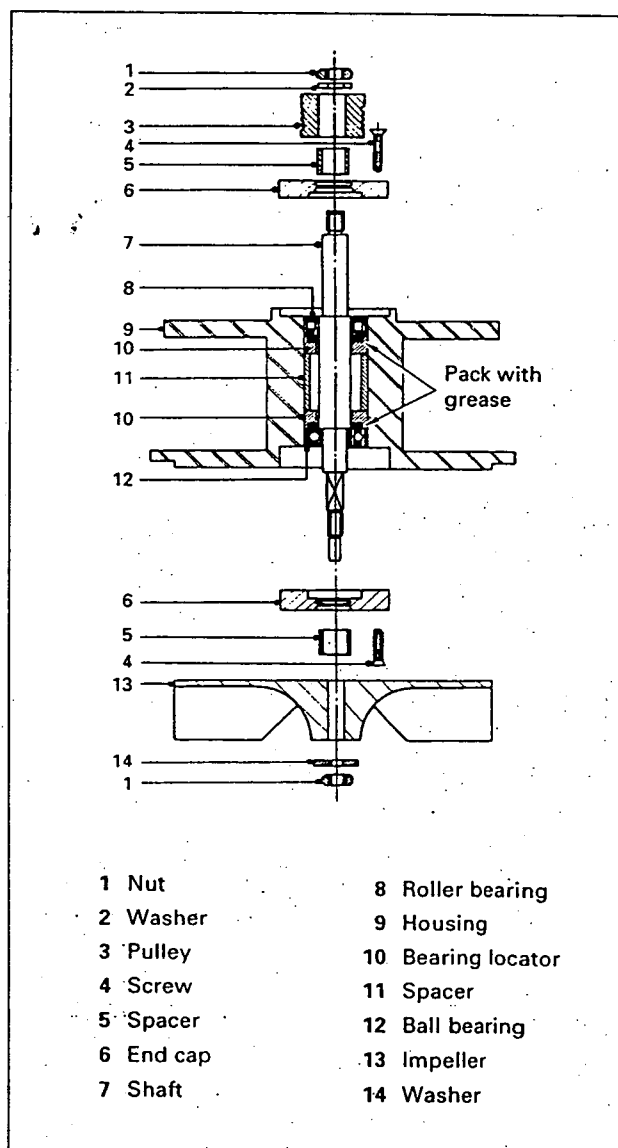


Fig. 31 Section through fan assembly

### UMA 40-450

#### Filter assembly removal:

- 1 Isolate electrical controls and remove fan and filter chamber access doors.
- 2 Fully slacken the four captive wing-nuts located in the fan chamber, on venting unit top plate or in side outlet box.
- 3 With the aid of a colleague, withdraw the complete filter assembly through the front of the filter chamber.
- 4 Remove wire mesh insert frames from individual filter pockets. These should be checked for broken mesh and worn material edgings, especially around the area of any filter bag damage.
- 5 Detach filter bag assembly from supporting frame.

**Filter assembly replacement:**

- 1 Fit filter bag assembly into supporting frame, feeding individual filter bags between locating bars, and fold collar over peripheral sealing flange.
- 2 Prior to fitting wire mesh inserts, any material edgings that need replacing should be fitted around the three edges of the insert that do not have the insert frame joint. The inserts should then be fitted, edging first, into the filter bags.
- 3 With the aid of a colleague, slide filter assembly into the guides until bottom corners of filter bags make contact with the shaker bar.
- 4 Locate individual filter bags in shaker bar.
- 5 Slide filter assembly fully home and tighten wing-nuts to form air-tight seal. Check top frame is against sealing rubber (see Fig. 5).
- 6 Replace and fasten access doors.

- 2 Remove the mattress support frame from its fixings in the fan chamber or on the venting unit top plate and assemble into door frame (see Fig. 32).
- 3 Lower the mattress assembly using the extended nuts on the front of the door frame.
- 4 Slide the mattress assembly out of the unit onto the mattress support frame.
- 5 Remove wire mesh insert frames from individual filter bags. These should be checked for broken mesh and worn material edgings, especially around the area of any filter bag damage.
- 6 Detach filter bag assembly from supporting frame.

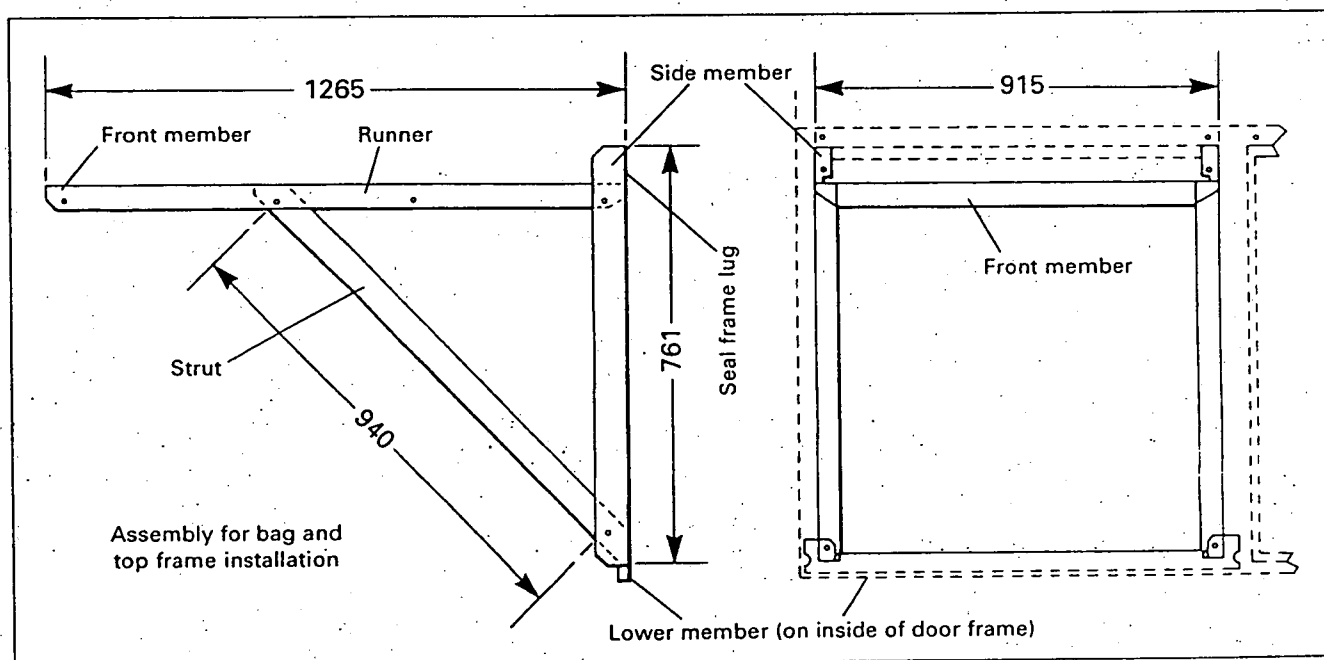
**Filter assembly replacement:**

- 1 Fit filter bag assembly into top frame, feeding individual filter bags between locating bars and fold collar over peripheral sealing flange.
- 2 Prior to fitting wire mesh inserts, any material edgings that need replacing should be fitted around the three edges of the insert that do not have the insert frame joint. The inserts should then be fitted, edging first, into the filter bags.
- 3 Slide filter assembly into the guides until bottom corners of filter bags make contact with the shaker bar.
- 4 Locate individual filter bags in shaker bar.

**UMA 750****Filter assembly removal:**

**Note:** Due to the weight of the mattress assembly, it should not be removed without using the support frame provided.

- 1 Isolate electrical controls and remove front access doors.



**Fig. 32** UMA 750 filter support frame assembly



- 5 Slide filter assembly fully home and raise mattress assembly with extended nuts to form an air-tight seal. Check top frame is against sealing rubber (see Fig. 6).
- 6 Dismantle mattress support frame and replace in storage position.
- 7 Replace and fasten access doors.

### **Secondary or absolute filter replacement**

- 1 Remove secondary/absolute filter door.
- 2 UMA 40MM: Lift bar to release sealing mechanism.  
  
UMA 100-450: Undo clamping nuts or clips as appropriate and remove retaining mesh or frame.  
  
UMA 750: Undo clamping nuts sufficient to allow element removal.
- 3 Remove used element, place it directly into a plastic bag and then seal the bag.
- 4 Slide the new element into the housing, with the element seal against the secondary/absolute filter seal frame, until it reaches the backstop.
- 5 Clamp element in position using the arrangement provided.
- 6 Replace secondary/absolute filter door.
- 7 If in doubt regarding the safe disposal of the used element, consult your Environmental Health Officer.

## Fault location

There are three basic indications of loss of Unimaster dust control unit performance:

- 1 Part loss of suction (excessive pressure differential)
- 2 Total loss of suction

### 3 Effluent in the clean air outlet

Some of the reasons for the faults may be common to all three.

Service engineers should rectify any incipient faults they may find during their investigations. For example, loose terminals should be tightened, perished door seals replaced etc.

Symptom	Possible Cause	Action
1 Part loss of suction	1.1 Filter blocked	<ol style="list-style-type: none"> <li>a Filter not cleaned regularly enough. Initiate cleaning sequence.</li> <li>b Filter cleaned while fan in motion. Remove filter bag and clean by hand.</li> <li>c Check sec/abs filter elements if fitted. Replace if necessary</li> <li>d Defective cleaning, check operation of cleaner mechanism check controller.</li> </ol>
	1.2 Motor speed low.	<ol style="list-style-type: none"> <li>a Check line voltage, phases, motor connections. For Star/Delta applications, check motor is in Delta.</li> </ol>
	1.3 Incorrect fan motor rotation	<ol style="list-style-type: none"> <li>a Check electrical connections and transpose if necessary.</li> </ol>
2 Total loss of suction	2.1 Fan motor stopped	<ol style="list-style-type: none"> <li>a Check controller</li> <li>b Check motor connections and windings.</li> </ol>
	2.2 Filter blocked	<ol style="list-style-type: none"> <li>a Filter not cleaned regularly enough. Initiate cleaning sequence.</li> <li>b Filter cleaned while fan in motion. Remove filter bag and clean by hand.</li> <li>c Check sec/abs filter elements if fitted. Replace if necessary.</li> <li>d Defective cleaning, check operation of cleaner mechanism check controller.</li> </ol>
	2.3 Ducting blocked	<ol style="list-style-type: none"> <li>a Check throughout and clear.</li> </ol>
3 Visible effluent in clean air outlet	3.1 Filter assembly not properly sealed.	<ol style="list-style-type: none"> <li>a Check tightness of filter assembly clamping nuts.</li> </ol>
	3.2 Damaged sealing gasket or filter bag	<ol style="list-style-type: none"> <li>a Identify and replace defective component(s) by following the procedure given on page 30 under the section 'Servicing schedule'.</li> </ol>



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 (F) DCE SA, Paris (E) DCE IBERICA SA, Barcelona (DK) DCE SCANDINAVIA A/S, Copenhagen (USA) DCE, Inc., Jeffersontown, Ky  
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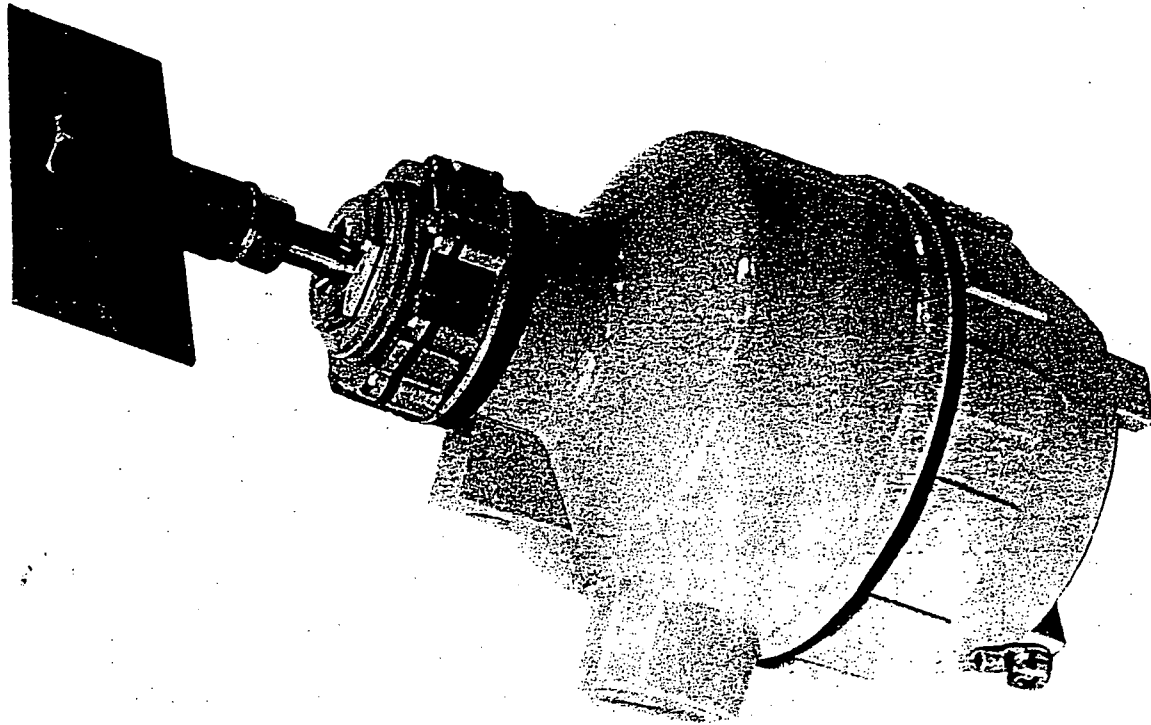
Represented in principal countries throughout the world

**dust control equipment for industry**

**Unimaster®** quality dust control units **Dalomatic®** automatic reverse jet filters **Sintamatic™** advanced technology dust filtration  
 DCE reserve the right to alter design without notice. Freedom from patent restrictions must not be assumed

# ROTATING PADDLE TYPE LEVEL SENSOR FOR SOLIDS

## BI Controls



### APPLICATIONS

The rotating paddle is suitable for the following applications —

1. Powder: Cement, fine coal dust, gypsum, glass material, plastic powder, slaked lime, carbon, iron oxide, earth and sand, sugar, flour, collected dust, feed, powder milk, soap, moulding sand.
2. Granule: Plastic pellet, metal pellet, chemical fertilizer, medicine (chemical), grain, foods (rice, bean etc).
3. Lump: Coal, lime stone, coke, ore, aggregate etc.

### PRINCIPLE OF OPERATION

With no powder/granules surrounding the Paddle, the driving motor turns the shaft.

When powder/granules surround the Paddle a braking torque is applied and the switch operating mechanism turns against a retaining spring.

If the switch is actuated the motor is stopped and an alarm contact opens/closes. When the load is removed from the Paddle the retaining spring resets the motor switch and alarm. The motor then starts turning the paddle again.

### FEATURES

1. Totally-enclosed type, hence good for use also outdoors.
2. Easy torque adjustment with the cover removed.
3. Unique construction by the use of oil seals and Teflon thrust packings for perfect prevention of ingress of powder along the shaft.
4. Compact and light, hence easy to install.
5. Slip mechanism prevents damage to the motor even in the event of an undue load on the Paddle.
6. Maintenance and replacement of the inside components is possible without demounting from the tank.

### OPTIONS

**Flanges:** Various mounting flanges are available.

**Paddles:** Various paddle shapes are available to meet the needs of different types of solids.

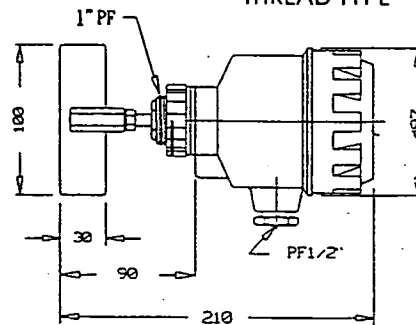
**Shafts:** A range of shaft lengths and types e.g. flexible or with protective tube fitted are available.



## ROTARY PADDLE LEVEL SWITCH

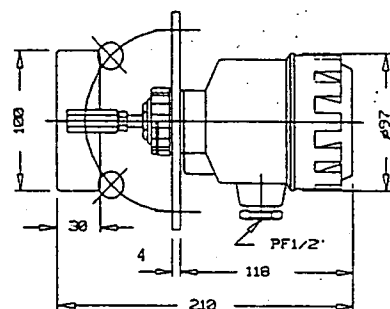
1. Power supply : 110V(A), 220V(B), 240V(C), 50/60Hz
2. Power Consumption : 3W
3. Contact rating : AC 250V, 5A 1SPDT
4. Rotary speed : 1 R.P.M.
5. Torque : 0.5~1.0 kg-cm
6. Connecting : 1" PF screw
7. Operation temperature : 60°C (Tank inside temp.)
8. Housing material : Aluminum (IP65)
9. Conduit : PF 1/2"
10. Weight : 1.2 kg

MODEL: RP10A/B/C  
THREAD TYPE



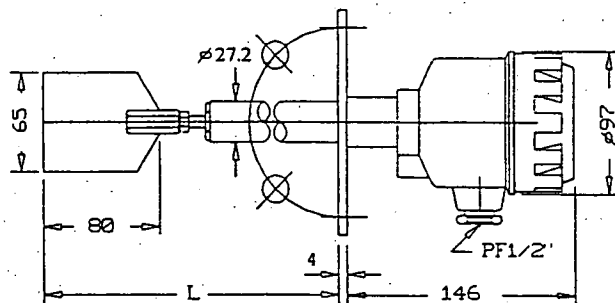
1. Power supply : 110V(A), 220V(B), 240V(C), 50/60Hz
2. Power Consumption : 3W
3. Contact rating : AC 250V, 5A 1SPDT
4. Rotary speed : 1 R.P.M.
5. Torque : 0.5~1.0 kg-cm
6. Connecting : JIS 2-1/2" x 5 kg/cm<sup>2</sup>
7. Operation temperature : 60°C (Tank inside temp.)
8. Housing material : Aluminum (IP65)
9. Conduit : PF 1/2"
10. Weight : 1.7 kg

MODEL: RP11A/B/C  
FLANGE TYPE



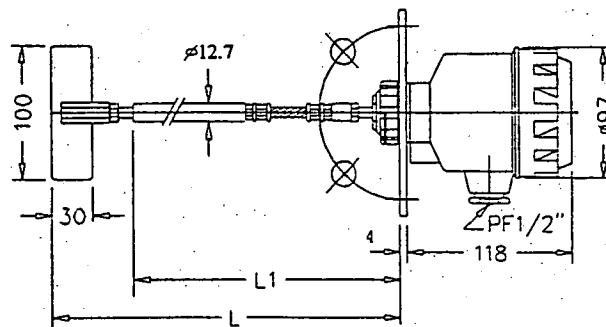
1. Power supply : 110V(A), 220V(B), 240V(C), 50/60Hz
2. Power Consumption : 3W
3. Contact rating : AC 250V, 5A 1SPDT
4. Rotary speed : 1 R.P.M.
5. Torque : 0.5~1.0 kg-cm
6. Connecting : JIS 2-1/2" x 5 kg/cm<sup>2</sup> flange SUS 304
7. Operation temperature : 60°C (Tank inside temp.)
8. Housing material : Aluminum (IP65)
9. Conduit : PF 1/2"
10. Weight :  
 RP20 (L=250mm) : 2.2kg  
 RP21 (L=500mm) : 2.5kg  
 RP22 (L=750mm) : 2.8kg

MODEL: RP20A/B/C  
SHAFT PROTECTIVE TUBE TYPE



1. Power supply : 110V(A), 220V(B), 240V(C), 50/60Hz
2. Power Consumption : 3W
3. Contact rating : AC 250V, 5A 1SPDT
4. Rotary speed : 1 R.P.M.
5. Torque : 0.5~1.0 kg-cm
6. Connecting : JIS 2-1/2" x 5 kg/cm<sup>2</sup>
7. Operation temperature : 60°C (Tank inside temp.)
8. Housing material : Aluminum (IP65)
9. Conduit : PF 1/2"
10. Weight :  
 RP30 (L=450~650mm) : 2.5kg  
 RP31 (L=650~1000mm) : 2.8kg  
 RP32 (L=750~1200mm) : 3.0kg

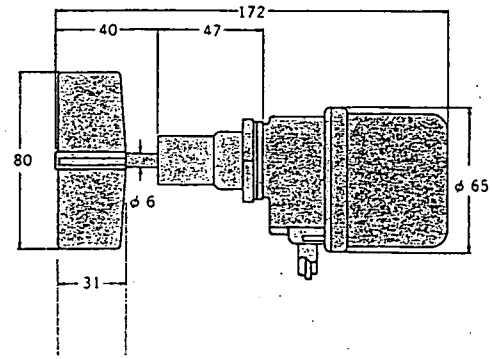
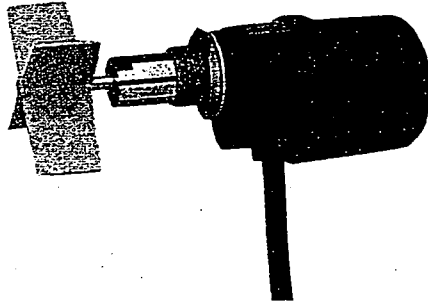
MODEL: RP30A/B/C  
SHAFT LENGTH ADJUSTABLE TYPE



## 小型葉片開關 *Mini Paddle Type Powder Level Switch*

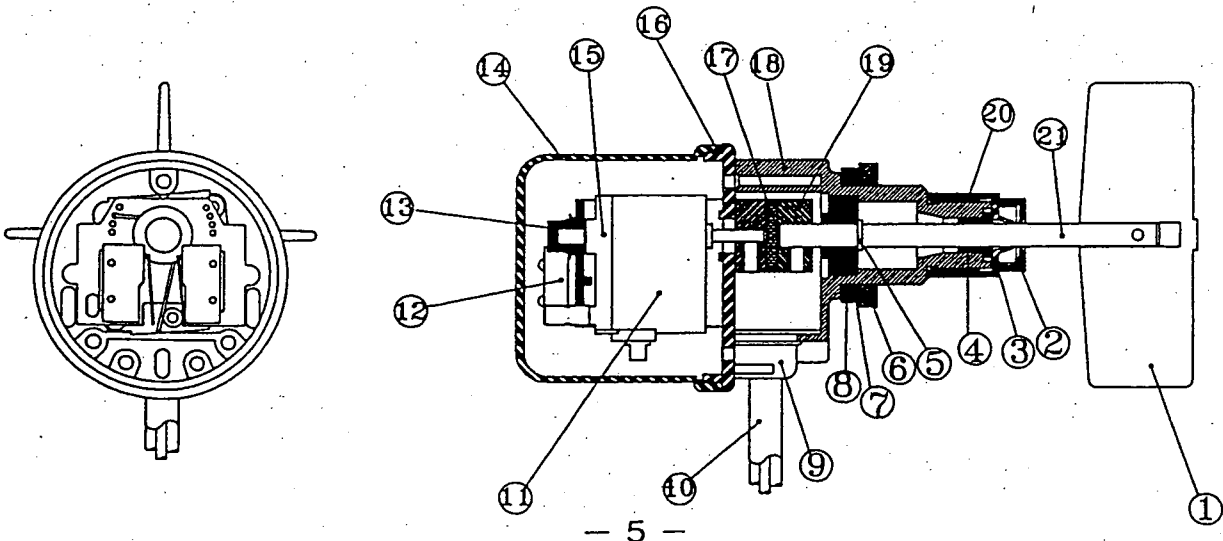
**MODEL: RP-500C-X**

十字型 /Cross-like 4 blade paddle



### 材質, COMPONENT PARTS AND MATERIAL

1.	葉片 Paddle	PC	12.	微動開關 Mico switch	
2.	華司 Washer	TEFLON	13.	扭力彈簧 Torque spring	SUS301
3.	油封 Oil seal	NBR	14.	外殼 Case	PC
4.	軸承 Bearing	TEFLON	15.	開關座 Switch base	PC
5.	扣環 Retainer ring		16.	馬達座 Motor base	PC
6.	銅螺母 Nut	Brass	17.	離合器 Cluth mechanism	
7.	華司 Washer	Aluminum	18.	本體 Body	ADC12
8.	華司 Washer	NBR	19.	離合器座 Cluth mechanism base	
9.	電纜 Cable head 固定頭	PVC	20.	銅套 Brass cover	Brass
10.	電纜線 Cable 0.75mm*5C	PVC	21.	軸 Shaft	
11.	馬達 Motor				



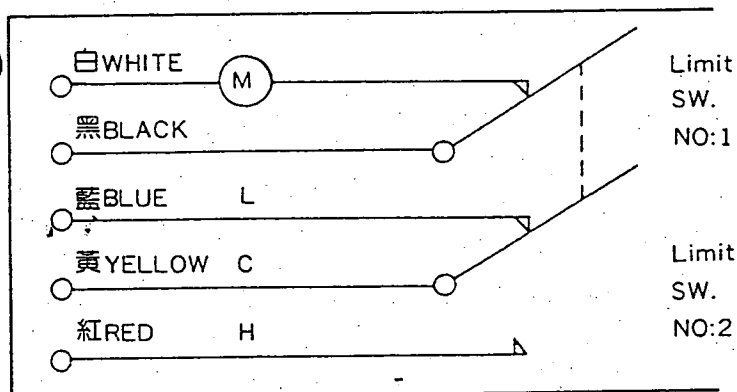
## 標準規格

電 源 : 110V or 220V 50Hz/60Hz  
 消耗電力 : 1.5W  
 接點容量 : AC 250V 3A UL  
 葉片轉速 : 1 R.P.M.  
 結 構 : 防塵  
 使用溫度 :  $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$   
 電纜長度 : 30cm  
 扭 力 : 30 ~ 100g-cm  
 重 量 : 350g

## SPECIFICATION

Power: AC 110V or 220V 50Hz/60Hz  
 Power consumption: 1.5W  
 Contact capacity: AC 250V 3A UL  
 Paddle revolving speed: 1 R.P.M.  
 Construction: Dust proof.  
 Service temp:  $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$   
 Cable Length: 30cm  
 Torque measurable: 30 ~ 100g-cm  
 Weight: 350g

## 電纜出線圖 CABLE WIRING DIAGRAM



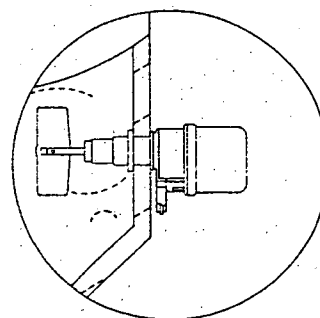
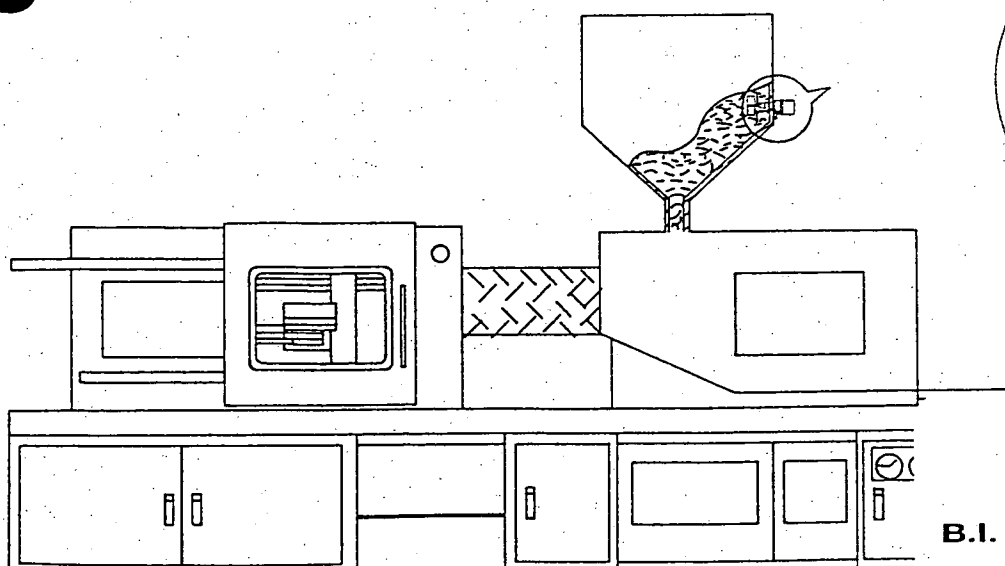
1. 當馬達運轉葉片上沒有阻力時表示(C.L.)線路接通。當馬達線路被切斷且葉片上有阻力時表示(C:L.)是斷路，(C.H.)是通路。

1. When the synchronous motor is turning but material isn't touching the paddles, the (C, L) stands for "terminal point connected". When material is touching the paddles (C, L) stands for "cut-off". (C, H) stands for "connected" when the synchronous motor's current is to be cut off.

2. 當葉片上阻力消失，馬達重新轉動時表示(C.L.)線路接通，又重新開始動作。

2. When the material drops away from the paddles the synchronous motor is started again, and the terminal point is connected, (C, L) shows that the cycle has begun again.

## 現場按裝實例 EXAMPLE



**B.I. CONTROLS PTY LIMITED**  
 A.C.N. 003 442 402

Unit 12, Centre West,  
 108 Silverwater Road,  
 Silverwater, NSW 2128  
 Telephone: (02) 9748 2955  
 Facsimile: (02) 9748 2904

4 Rennick Street,  
 Preston, Victoria 3072  
 Telephone: (03) 9480 0111  
 Facsimile: (03) 9480 5320

**Distributors in all states and New Zealand**



FLUID MIXING  
SPECIALISTS

IT-1977F  
6-15-94

A UNIT OF GENERAL SIGNAL

**LIGHTNIN**

# OPERATING INSTRUCTIONS

## **LIGHTNIN<sup>®</sup>**

### **PORTABLE MIXERS**

A LIGHTNIN Portable Mixer is a precision machine of the highest quality. They are designed to operate satisfactorily under all the conditions normally encountered.

This is a completely proven design — a product of LIGHTNIN Research and Development.

Among its features are:

**MAXIMUM MIXING EFFICIENCY**  
**ENERGY EFFICIENT DURA-MIX<sup>TM</sup> MOTORS**  
**CONVENIENCE OF HANDLING**  
**UNIQUE POSITIVE DRIVE CHUCK**  
**POSITIVE CLAMPING AND POSITIONING**  
**HIGH TECHNOLOGY IMPELLERS**  
**MAINTENANCE FREE OPERATION**  
**MODERN DESIGN STYLING**

*With proper care this LIGHTNIN Portable will give years of trouble-free service. If you should have any questions regarding its operation which are not answered in this manual, call your authorized LIGHTNIN Mixer Sales Engineer. Their telephone numbers are listed on the back cover.*

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**ROTATING  
PARTS**

**LIGHTNIN®  
MIXER  
CAUTION!**

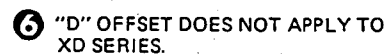
**OPEN AND LOCK  
THE MASTER POWER SWITCH BEFORE  
WORKING ON OR NEAR THE MACHINE**

### SAFETY CHECK LIST

#### IMPORTANT

ALL **LIGHTNIN®** MIXERS AND AERATORS ARE PROVIDED WITH PROPERLY DESIGNED LIFTING DEVICES AND SAFETY COVERS TO AVOID POTENTIAL INJURY AND/OR EQUIPMENT DAMAGE. THE FOLLOWING SAFETY CHECK LIST SHOULD BE THOROUGHLY REVIEWED AND ADHERED TO BEFORE OPERATING OR PERFORMING MAINTENANCE ON THE MIXER.

1. USE ONLY THE LIFTING DEVICES PROVIDED ON YOUR UNIT TO INSTALL THE MIXER. USE SHOULDERED EYEBOLTS AND TIGHTEN SECURELY TO HANDLE COMPONENT PARTS. WE STRONGLY RECOMMEND THAT THE EYEBOLTS OR HOIST RINGS BE OF THE SAFETY SWIVEL TYPE WITH 360° ROTATIONAL CAPABILITY.
2. DO NOT CONNECT THE PRIME MOVER TO THE POWER SOURCE UNTIL ALL COMPONENTS ARE ASSEMBLED, THE MIXER IS INSTALLED AND ALL HARDWARE IS TIGHTENED TO THE PROPER TORQUE WHICH IS SPECIFIED IN THE OPERATION AND MAINTENANCE MANUALS SUPPLIED BY **LIGHTNIN®**.
3. DO NOT OPERATE SHAFT SEALING DEVICES AT TEMPERATURES OR PRESSURES HIGHER THAN THOSE SPECIFIED IN THE MANUAL OR ON NAMEPLATES.
4. PRIOR TO SERVICING MIXER, ELECTRICALLY DISCONNECT POWER.
5. DO NOT TOUCH ROTATING MIXER PARTS.
6. DO NOT OPERATE MIXER FOR SERVICE OTHER THAN ITS INTENDED USE.
7. DO NOT MAKE ANY FIELD CHANGES OR MODIFICATIONS (HORSEPOWER, OUTPUT SPEED, SHAFT LENGTHS, IMPELLERS, ETC.) WITHOUT REVIEWING THE CHANGE WITH YOUR **LIGHTNIN®** SALES REPRESENTATIVE OR THE **LIGHTNIN®** CUSTOMER SERVICE DEPARTMENT.
8. BEFORE OPERATING THE MIXER, IT IS VERY IMPORTANT TO CHECK THE FOLLOWING ITEMS:
  - A) MAKE SURE MIXER IS PROPERLY GROUNDED.
  - B) ENSURE ALL PROTECTIVE GUARDS AND COVERS ARE INSTALLED.
  - C) ENSURE ALL DETACHABLE COMPONENTS ARE SECURELY COUPLED TO THE MIXER.
  - D) THOROUGHLY REVIEW AND COMPREHEND THE MIXER OPERATION INSTRUCTIONS, SUPPLIED BY **LIGHTNIN®**.
  - E) ENSURE THE DRIVE OR SEAL SHAFT ROTATES FREELY BY HAND.
  - F) ENSURE ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF ROTATING PARTS.
  - G) ENSURE ALL EXTERNAL CONNECTIONS (ELECTRICAL, HYDRAULIC, PNEUMATIC, ETC.) HAVE BEEN COMPLETED PER THE APPLICABLE CODES.
9. DO NOT ENTER THE MIXING VESSEL UNLESS:
  - A) THE MIXER POWER SUPPLY IS LOCKED OUT.
  - B) THE MIXER SHAFT IS FIRMLY ATTACHED TO THE MIXER DRIVE OR THE SHAFT IS SUPPORTED SECURELY FROM BELOW.



**SECTION 1****INITIAL INSPECTION, SHIPPING ARRANGEMENTS  
AND STORAGE**

- 1-1. As soon as you have uncrated your mixer, check it for shipping damage and report any damage immediately to the carrier and to our factory.
- 1-2. Mixer and impellers are packed together. The mixer shaft is packed in a separate container. Carbon steel mixer shafts and impellers are wrapped with Shell VPI-coated paper for domestic shipment. For foreign shipment these parts are coated with a rust inhibitor that is easily removed with kerosene, or similar solvents.
- 1-3. Do not remove wrappings or protective coating if the mixer is to be stored before it is placed in operation. Store the mixer in a clean, dry location, with circulating air, free from wide or rapid variations in temperature. When gear drive models have been stored for more than a year, the condition of the gear lubricant should be checked before the mixer is installed. (See lubrication instructions.)

**SECTION 2 MOUNTING**

- 2-1. Lift the mixer from its crate by the motor handle. Set the clamp squarely on the mounting surface so that both vertical and horizontal lines of clamp contact bare evenly. **Remove the hex key wrench stored in the clamp** and tighten the clamp screw securely. The wrench has been sized to properly tighten the clamp screw, 3/8-inch for XD or XJ 174 thru 350, 7/32-inch for XD or XJ 30 thru 117. **DO NOT IMPACT THE WRENCH OR USE AN EXTENSION.**
- 2-2. Impeller rotation must be according to the arrow on the mixer nameplate.
  - a. Single phase totally enclosed motors are wired at our factory for correct rotation.
  - b. All three phase and explosion proof motors must be field wired for proper rotation. If rotation does not agree with nameplate reverse any two line leads.
  - c. Dual voltage motors must be wired for the desired voltage. Refer to the connection diagrams provided on the motor nameplate or inside the conduit cover.

**SECTION 3 MOTOR CONNECTIONS**

- 3-1. **LIGHTNIN** Portables are equipped with ball bearing chemical plant motors specifically designed for mixer service in totally enclosed or explosion-proof construction.
  - a. Constant speed mixers are furnished with **LIGHTNIN DURA-MIX™** energy efficient motors unless otherwise specified.
  - b. For variable speed mixers with electronic or air driven motors, refer to supplementary instructions for motor control data and connection requirements.
- 3-2. **SINGLE PHASE MOTORS FOR XD/XJ30 THRU 87** (or motors nameplated 1/4 thru 1 Horsepower)
  - a. Totally enclosed motors are furnished with eight-foot cords fitted with UL approved three prong grounded plugs suitable for the correct voltage.
  - b. Explosion proof motors are furnished with a pipe tap connection and suitable leads. A conduit box with internal switch is available for explosion proof service.
  - c. All **DURA-MIX™** single phase motors are equipped with an internal over-temperature device with manual reset. If the thermal trips,

wait (15) fifteen minutes and depress the reset button on the motor body. A click indicates re-set.

**3-3. THREE PHASE MOTORS**

- a. All totally enclosed motors are equipped with a conduit box and suitable leads.
- b. All explosion proof motors are furnished with a pipe tap connection and suitable leads.

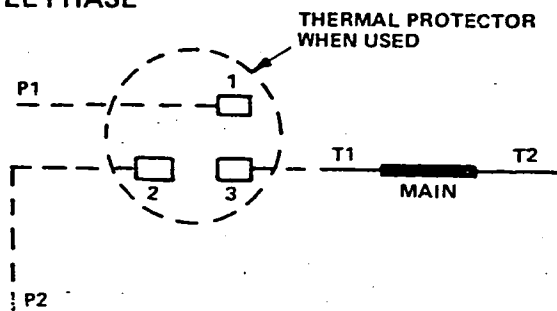
**IMPORTANT: ALL THREE PHASE MOTORS** (Except explosion proof on XD/XJ 30 thru 65 or other XP motors nameplated 3/4 horsepower and below) are equipped with over-temperature thermostats which are designed to interrupt current in the holding coil of magnetic starters only. The motor thermostats will reset themselves, but the control panel "start" button must be depressed to start the motor.

**EXPLOSION PROOF MOTORS ON XD/XJ 30 THRU 65** or XP motors nameplated 3/4 horsepower and below are equipped with automatic over-temperature circuits which can trip and reset themselves after the motor cools **TO AVOID INJURY DUE TO UNEXPECTED STARTUP, DISCONNECT FROM POWER UNTIL THE MOTOR COOLS.**

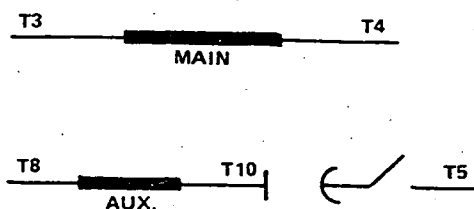


## CONNECTION DIAGRAM FOR SINGLE PHASE MOTORS ON LIGHTNIN® PORTABLE AND FIXED MOUNTING MIXERS

### SINGLE PHASE

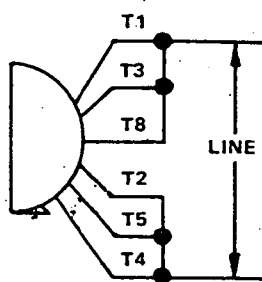


### DUAL VOLTAGE REVERSIBLE WITH OR WITHOUT THERMAL PROTECTOR

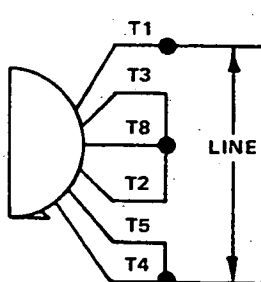


### 6 LEADS WITHOUT THERMAL PROTECTOR

#### LOW VOLTAGE

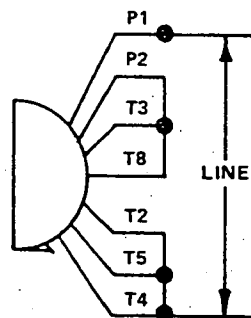


#### HIGH VOLTAGE

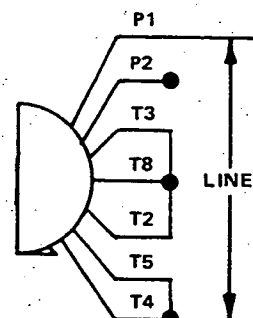


### 7 LEADS WITH THERMAL PROTECTOR

#### LOW VOLTAGE



#### HIGH VOLTAGE



TO REVERSE ROTATION, INTERCHANGE LEADS T5 AND T8

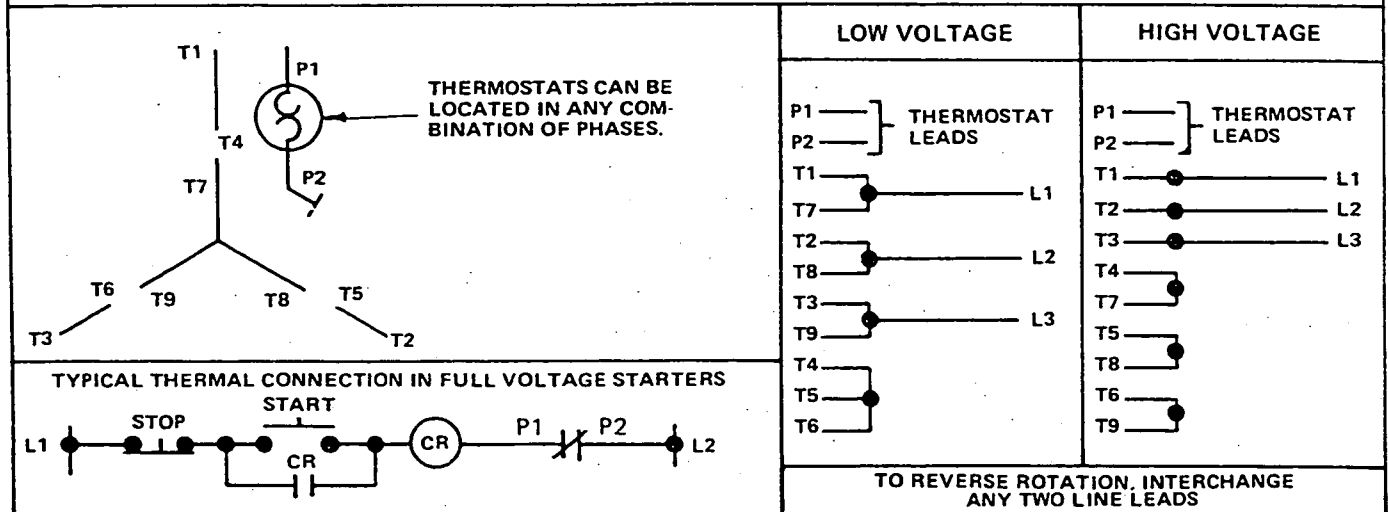
**NOTE:** All LIGHTNIN DURA-MIX™ totally enclosed or explosion proof single phase motors are equipped with an internal overtemperature device with manual reset. If the motor overheats and the thermal circuit trips, wait (15) fifteen minutes and depress the reset button on the motor body. An audible click indicates re-set.

NON DURA-MIX™ motors may or may not have internal thermal protection depending on construction.

For three phase connections diagrams, see page 7.

## CONNECTION DIAGRAMS FOR THREE PHASE MOTORS ON LIGHTNIN®. PORTABLE AND FIXED MOUNTING MIXERS

### FIGURE 1A – CONNECTION DIAGRAM

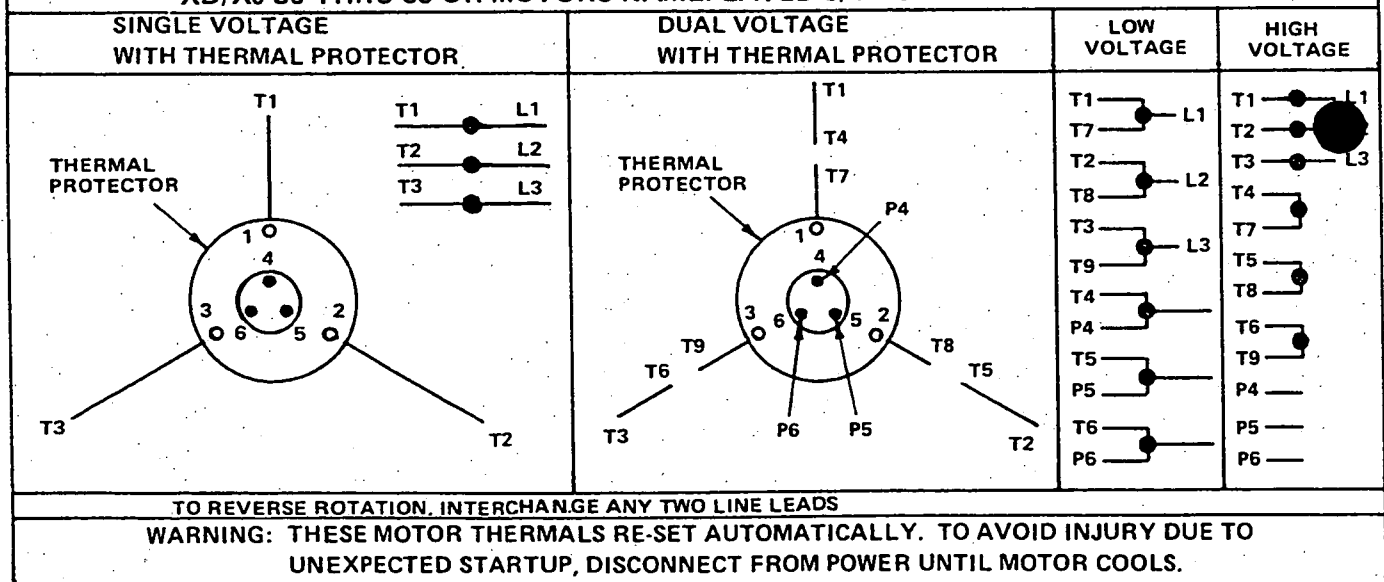


**NOTES:** ① The diagram in Figure 1A pertains to:

- a. **TOTALLY ENCLOSED** three phase motors used on XD/XJ Series 30 thru 350, XL 100 thru 500 & SXJ/SXJS 174 & 230 with DURA-MIX™ energy efficient motors or other totally enclosed motors nameplated 1/4 thru 5 horsepower.
- b. **EXPLOSION PROOF** three phase motors used on XD/XJ Series 87 thru 350, XL 100 thru 500 & SX/SXJS 174 & 230 with DURA-MIX™ energy efficient motors or other explosion proof motors nameplated 1 thru 5 horsepower. For XP motors used on XD/XJ Series 30 thru 65 and XP motors nameplated 3/4 H.P. and less, see Figure 1B.

② The thermostats in above motors are designed to interrupt current only in the holding coil of magnetic starters and must be wired into the motor control circuit. The thermostats re-set themselves after the motor cools, but the motor must be re-started by depressing the start button on the starter panel.

### FIGURE 1B – CONNECTIONS FOR THREE PHASE EXP. PROOF MOTORS ON XD/XJ 30 THRU 65 OR MOTORS NAMEPLATED 3/4 HORSEPOWER OR LESS



## SECTION 4

### MIXER SHAFT INSTALLATION

- 4-1. Position the impeller(s) on the mixer shaft. Refer to the specification sheet for recommended dual impeller spacing. The larger wedge shaped portion of the hub body must face up towards the mixer. The top of the hub is stamped "UP". Refer to Figure 2 for general orientation reference.

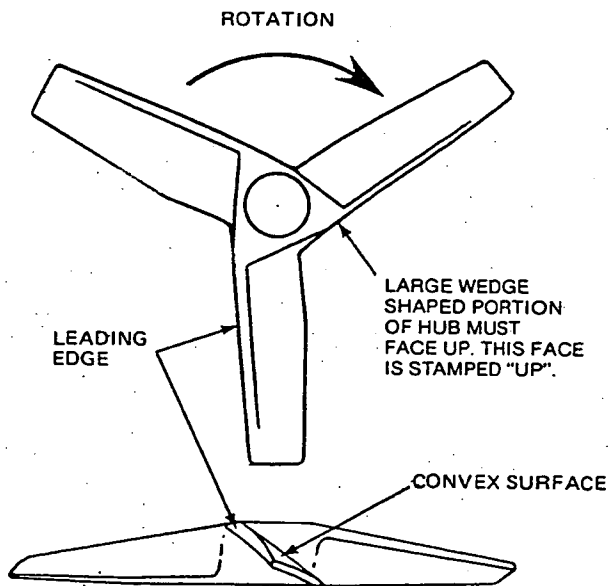


FIGURE 2. IMPELLER ORIENTATION

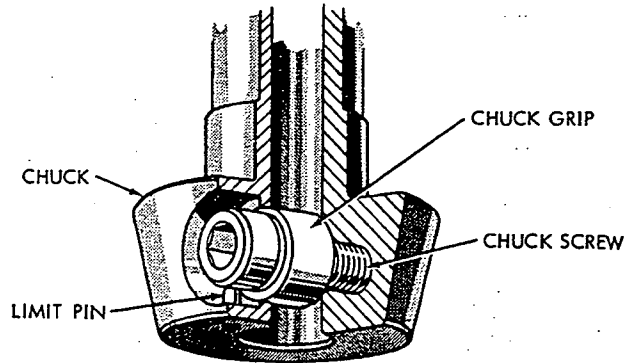


FIGURE 3. CHUCK DETAILS

- 4-2. To install the mixer shaft, back off the chuck screw (refer to Figure 3) as far as the limit pin will allow. **DO NOT FORCE.** Insert the mixer shaft into the chuck bore as far as it will go. For stepped shafts, make sure the shaft shoulder seats tightly against the chuck face. Draw up the chuck screw with the wrench provided, rotating the shaft slightly back and forth to make sure that the chuck grip seats against the flat of the shaft. Tighten the chuck screw with the wrench provided. The wrench has been properly sized to tighten the screw. **DO NOT IMPACT THE WRENCH OR USE AN EXTENSION.** NOTE: A safety feature is provided by a slight taper in the flat on the mixer shaft. The shaft cannot drop out unless the grip is intentionally released.

## SECTION 5

### POSITIONING

- 5-1. The positioning device of the mixer combines a vertical index on the ball of the housing and a horizontal index on the ram of the clamp socket. Mixing positions are established by referencing one index against the other. Figure 4 shows the indexes in D-5 position, a typical setting. To change the mixing position, loosen the wedge screw, adjust the mixer by its motor handle, and tighten the wedge screw. The wedge screw has a limited amount of travel before the wedge bottoms against the king bolt. If the wedge does eventually bottom, readjust the wedge assembly per 8-9, Step e.
- 5-2. The correct position for the mixer will vary in individual cases. Use Table I to position the mixer in relation to tank diameter and height for normal applications. In operation, some adjustment of position may be desirable for best results.

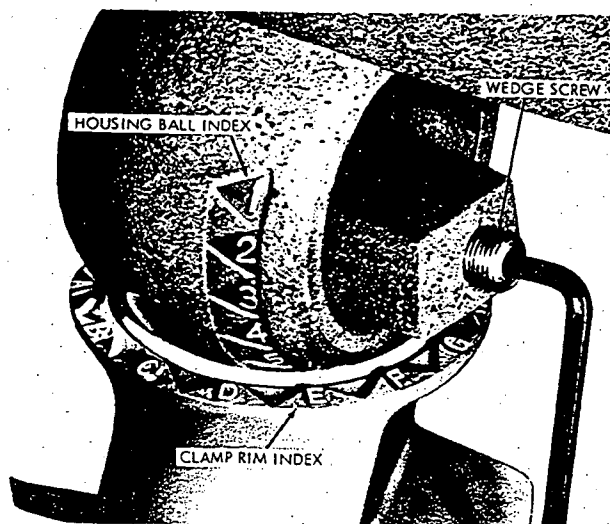


FIGURE 4. POSITIONING INDEXES

TABLE 1

MIXING PATTERN	Batch Height (Z)	CLAMP RIM INDEX (HORIZONTAL ANGLE)	HOUSING BALL INDEX (VERTICAL ANGLE)
	Tank Diameter (T)		
NORMAL MIXING Off-center position Top to bottom turnover No swirling	Z/T less than 1	D	5
	Z/T greater than 1	D	6
VORTEXING On-center position	Z/T less than 1	E	5
	Z/T greater than 1	E	6
SWIRLING Off-center position Usually vortexing	Z/T less than 1	F	6
	Z/T greater than 1	F	7

Swirling and vortexing positions may be useful for surface introduction of solids, liquids, or gases.

## SECTION 6

### MIXER OPERATION

- 6-1. LIGHTNIN MIXERS are designed to operate continuously at normal and low liquid levels and in air. **IMPORTANT:** Variable speed drives sometimes have critical ranges where the unit should not be operated during drawoff or in air. These ranges will be indicated on a warning decal at the speed control. It is not good practice to operate any mixer continuously when extreme vortexing or surging occurs.
- 6-2. Turn on the mixer. Allow time enough for the mixing pattern to be established, then make any required adjustment of position.
- 6-3. At the end of two weeks service, check the housing cap screws, clamp screw, wedge screw, and chuck screw for tightness.
- 6-4. At the end of the mixing cycle, it is good practice to turn off the mixer before the tank has been drained to a level which will result in excessive splashing.
- 6-5. The gear drive models (XJ) include a built-in shock load feature. The grip springs (See Figure 5) provide a keyless friction drive between the gear and the drive shaft, and the springs will slip before the mixer is damaged. Therefore, if the mixer shaft does not rotate when the motor is on, remove the motor (41) from the housing (36), per Paragraph 9-1, and tighten the grip spring locknut (10) securely. (Table 4 on Page 18 lists the recommended tightening torques for this locknut. If a torque wrench is not

available, be sure locknut is tightened sufficiently to prevent grip spring slippage.)

NOTE: Item 70, Oil Seal and Item 71, Slinger are furnished on XJ 174 thru 350 only.

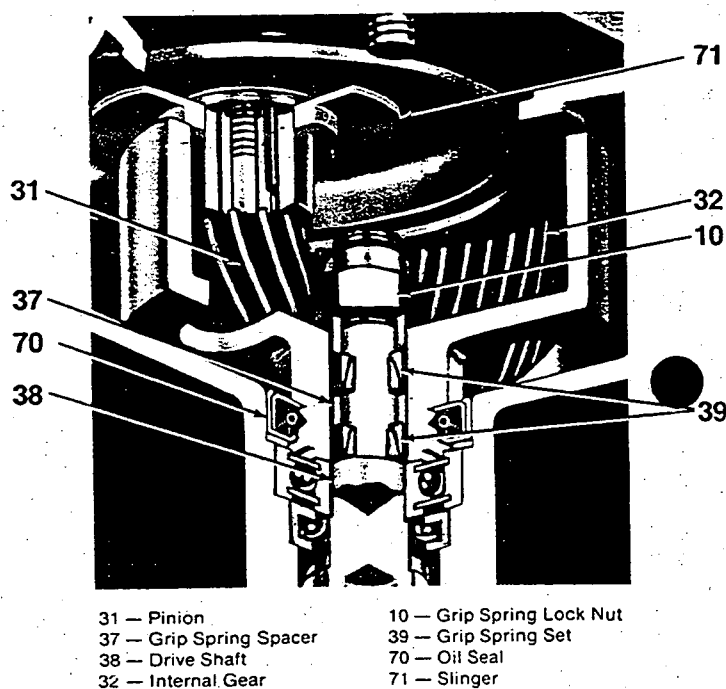


FIGURE 5. GRIP SPRING ASSEMBLY

## SECTION 7

### LUBRICATION

- 7-1. Your LIGHTNIN mixer has been lubricated at the factory with the correct type and amount of high quality lubricants. Lubricant cleanliness is protected by properly designed closures.
- 7-2. All mixer bearings are sealed type with contact rubbing seals and are pre-packed with lubricant. Relubrication of these bearings is not necessary.
- 7-3. The gear chamber in XJ series models has been factory filled with a grease suitable for an ambient temperature range of +50°F to +200°F. Under normal operating conditions, this lubricant need not be changed until the unit has been dismantled for some reason.

Under adverse operating conditions, periodic changes of lubricant may be necessary. Adverse conditions are defined as operating in very humid, dust laden or chemical atmospheres, or where wide variations in ambient temperature occurs. Such adverse conditions can lead to deterioration of lubricant compounds and additives and it is recommended that the condition of the grease be checked within six months after startup. Reputable lubricant suppliers can analyze the grease and recommend economical, safe change schedules.

#### 7-4. CHANGING GEAR LUBRICANT

- a. Make sure the mixer housing is vertical to prevent spillage.
- b. Remove the housing to motor capscrews and lift off the motor by its handle.
- c. Remove all old grease from the gear chamber and wipe clean.
- d. Pack the chamber with fresh grease. (See notes ① and ②). Paddle the grease to fill voids and remove air pockets, rotating the shaft and shaking the housing while paddling.
- e. Check the "O" ring in the flange of the motor and replace if it is deformed, cut or deteriorated.
- f. Carefully align the motor rabbet and guide into the housing bore. Guide the pinion into mesh with the gear and make sure the "O" ring is properly seated in the groove.

- g. Check for free movement of all components by rotating the drive shaft.
- h. If satisfactory, replace the housing to motor hardware and tighten securely.

#### 7-5. GEAR LUBRICANT RECOMMENDATION

Use only a lubricant suitable for the temperature and operating conditions. See Table 2.

**GREASE LUBRICANT**

Ambient Temp. Range	NLGI#	Soap Base	Min. Oil Viscosity S.S.U.	Max. Operating Temp.
50°F to 200°F	0	Sodium or Lithium	4,000 @ 100°F 150 @ 210°F	200°F

**TABLE 2**

For operation in ambient temperatures below +50°F, we recommend use of a synthetic (Mobil SHC 32 or equal) compounded only with synthesized hydrocarbon fluids. This grease is suitable for a wide range of ambient temperatures between -30°F and +200°F and should be considered where seasonal lubricant changes are necessary.

**GEAR CHAMBER CAPACITY**

MODEL	GREASE-LBS.
XJ 30 & 43	1.25 ①
XJ 65 THRU 117	2.5 ①
XJ 174 THRU 350	6.0 ②

**TABLE 3**

- ① PACK CHAMBER FLUSH WITH TOP OF THE INTERNAL GEAR.
- ② PACK CHAMBER TO WITHIN 3/4" OF TOP OF INTERNAL GEAR.

**LIGHTNIN • 135 Mt. Read Blvd. • Rochester, N.Y. 14611****A UNIT OF GENERAL SIGNAL****MIXER PARTS • MODEL(S) XD-30, XD-43, XDA-33/ NC-4, NS-1, NAR-33**

PARTS PRICING BOOK			SEC.	2	PAGE	6.00	DATE	03/12/84
ITEM NO.	IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)		
				DWG NO.	MAT'L			
NOTE: Reference Drawing No(s). L-16708, L-16710, L-15892, & L-15951								
1		Hex Head Cap Screw	2	100126	CPS			
1		Hex Head Cap Screw	2	100126	316			
2		Hex Head Cap Screw	2	100297	CPS			
2		Hex Head Cap Screw	2	100297	316			
3		King Bolt	1	100328	CPG			
3		King Bolt	1	100328	174			
4		Shaft Screw	1	102007	STL			
5		Clamp Screw (include 15 & 15A when ordering)	1	105413	CPR			
5		Clamp Screw (include 15 & 15A when ordering)	1	105413	174			
6		Wedge Screw	1	105414	CPR			
6		Wedge Screw	1	105414	174			
7	E	Hex Head Cap Screw (For Motor Handle)	2	100122	STL			
	(1)	Hex Nut	2	107004	CPS			
	C	Chuck Screw	1	105861	GR5			
8	C	Chuck Screw	1	105861	174			
11	C	Limit Pin	1	108504	PSP			
12		Plain Washer	1	112007	CPS			
12		Plain Washer	1	112007	316			
15		Cup Washer	1	112409	CPS			
15		Cup Washer	1	112409	316			
15A		Retaining Ring	1	205445	PSP			
16		Wedge Bottom	1	112531	BRZ			
16		Wedge Bottom	1	112531	316			
17		Wedge Top	1	112532	ALM			
17		Wedge Top	1	112532	316			
17		Wedge Top	1	112532	STL			
17	(2)	Wedge Top	1	112532	BRZ			
18	C	Chuck Washer	1	112756	S16			
18	C	Chuck Washer	1	112756	175			
20		Washer	1	112762	BRS			
20		Washer	1	112762	316			
21		Snap Ring	1	114276	302			
22	*	Retaining	1	114280	PSP			
24	*	Oil Seal	1	115382	PSP			
27	*	Ball Bearing	1	116223	PSP			
32		Hex Key Wrench	1	127210	BPF			
48		Lockwasher	1	115012	PSP			

○ Identity Code: \*Recommended Spare Parts: (1) For New Style Motor Design  
(2) Non Stock

C-Use with Chuck Drive Shaft (E) Use with Elec.Motor, (R) Use with Rigid Cplg. Drive Shaft

BLANK CODE DENOTES COMMON PARTS

Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.

PLATE

ISSUE  
REVISEDIT- 2038  
SHEET 1 of 2

LIGHTNIN • 135 Mt. Read Blvd. • Rochester, N.Y. 14611

A UNIT OF GENERAL SIGNAL

## MIXER PARTS • MODEL(S) XD-30, XD-43, XDA-33/NC-4, NS-1, NAR-33

PARTS PRICING BOOK				SEC.	2	PAGE	6.01	DATE	03/12/84
ITEM NO.	IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)			
				DWG NO.	MAT'L				
NOTE: Reference Drawing No(s) L-16708, L-16710, L-15892 & L-15951									
33A		Tank Clamp Assy.	Includes	ALM	1	800057	PSP		
	(2)		Items	316	1	800058	PSP		
	(2)		3, 5, 6, 12	BRZ	1	800059	PSP		
	(2)		15, 15A, 16	STL	1	800060	PSP		
	(2)		17, 32, 33, 40	NAM	1	800061	PSP		
33		Clamp			1	129020	ALM		
33		Clamp			1	129020	316		
33		Clamp			1	129020	BRZ		
33		Clamp			1	129020	STL		
33		Clamp			1	129020	NAM		
33B		Cup Plate Assy.	Includes	ALM	1	801194	PSP		
	(2)		Items	316	1	801195	PSP		
	(2)		3, 6, 12	BRZ	1	801196	PSP		
	(2)		16, 17, 32	STL	1	801197	PSP		
	(2)		33, 40	NAM	1	801192	PSP		
33		Cup Plate			1	129208	ALM		
33		Cup Plate			1	129208	316		
33	(2)	Cup Plate			1	129208	BRZ		
33		Cup Plate			1	129208	STL		
33		Cup Plate			1	129208	NAM		
34	C	Chuck Grip			1	130013	316		
35	E	Handle Kit - Electric Motor				Consult Factory			
		Housing			1	136144	ALF		
36	(2)	Housing			1	136157	316		
36		Housing			1	136144	NAL		
36		Housing			1	136157	CIR		
36	(2)	Housing			1	136144	BRZ		
38	C	Drive Shaft with Chuck			1	143788	NPS		
38	C	Drive Shaft with Chuck			1	143786	316		
38	R	Drive Shaft with Coupling			1	199338	41L		
38	R	Drive Shaft with Coupling			1	199338	316		
40		Vibration Pad			1	150332	DUK		
41	E	Electric Motor			1	See Sec.	1-C		
42		Mixer Shaft			1	See Sec.	1-D		
43	E	Plain Washer			2	112005	STL		
44/45		Impeller & Set Screw				See Sec.	1-D		
46		Motor Shaft Key			1	114196	STL		
47		Washer (for motor shaft screw)			1	112786	STL		

Identity Code: \*RECOMMENDED SPARE PARTS/ (2) Non Stock  
 C - Use with Chuck Drive Shaft/ E- Use with Elec.Motor  
 R - Use with Rigid Coupling Drive Shaft

Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.

BLANK CODE DENOTES COMMON PARTS

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**LIGHTNIN • 135 Mt. Read Blvd. • Rochester, N.Y. 14611****A UNIT OF GENERAL SIGNAL****MIXER PARTS • MODEL(S) XD-65 XD-87, XD-117, XDA-100 NS-2, NS-3 NS-4A, NAR-100****PARTS PRICING BOOK****SEC.****2****PAGE 7.00****DATE 3/12/84**

ITEM NO.	IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
				DWG NO.	MAT'L	
NOTE: Reference Drawing No(s). L-16708, L-16710, L-15892, & L-15951						
1		Hex Head Cap Screw	2	100325	CPS	
1		Hex Head Cap Screw	2	100297	316	
2		Hex Head Cap Screw	2	100324	CPS	
2		Hex Head Cap Screw	2	100324	316	
3		King Bolt	1	100329	CPG	
3		King Bolt	1	100329	174	
4		Shaft Screw	1	102009	CPS	
5		Clamp Screw (include 15 & 15A when ordering)	1	105412	CPR	
5		Clamp Screw (include 15 & 15A when ordering)	1	105412	174	
6		Wedge Screw	1	105414	CPR	
6		Wedge Screw	1	105414	174	
7	E	Hex Head Cap Screw (For motor handle)	2	100122	CPS	
	(1)	Hex Nut	2	107004	CPS	
8	C	Chuck Screw	1	105861	CPG	
8	C	Chuck Screw	1	105861	174	
11	C	Limit Pin	1	108504	420	
12		Plain Washer	1	112013	STL	
12		Plain Washer	1	112013	316	
15		Cup Washer	1	112407	CPS	
15		Cup Washer	1	112407	316	
15A		Retaining Ring	1	205446	PSP	
16		Wedge Bottom	1	112529	BRZ	
16		Wedge Bottom	1	112529	316	
17		Wedge Top	1	112530	ALM	
17		Wedge Top	1	112530	316	
17		Wedge Top	1	112530	STL	
17	(2)	Wedge Top	1	112530	BRZ	
18	C	Chuck Washer	1	112756	S16	
18	C	Chuck Washer	1	112756	175	
20		Washer	4	112762	BRH	
20		Washer	4	112762	316	
21	C	Snap Ring	1	114276	302	
22	*	Retaining Ring	1	114280	PSP	
24	*	Oil Seal	1	115382	PSP	
27	*	Ball Bearing	1	116223	PSP	
32		Hex Key Wrench	1	127210	BPF	
48		Lockwasher	1	115013	PSP	

PLATE 5109

○ Identity Code: \*Recommended Spare Parts : (1) For New Style Motor Design:  
 (2) Non Stock: E - With Elec.Motor  
 C - Use with Chuck Drive Shaft R - Use with Rigid Cplg.Dr.

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**A UNIT OF GENERAL SIGNAL**

XD-65

NS-2, NS-3

MODEL(S) XD-87, XD-117, XDA-100

NS-4A, NAR-100

## SEC. 2

PAGE 7.01

DATE 3/12/84

**NOTE:** Reference Drawing No(s). L-16708, L-16710, L-15892, & L-15951

E - Use with Electric Motor

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## A UNIT OF GENERAL SIGNAL

## MIXER PARTS •

XDA-150, XDA-300    NS-5, NS-6, NS-7

MODEL(S) XD-174, XD-230, / NM-1, NM-3

DATE 3/12/84

NOTE: Reference Drawing No(s). L-16708, L-16710, L-15878, & L-15921

**NOTE:** Reference Drawing No(s). L-16708, L-16710, L-15878, & L-15921

PLATE 5105

C - Use With Chuck Drive Shaft: R- Use with Rigid Drive Shaft

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**A UNIT OF GENERAL SIGNAL**

XDA-150.XDA-300 NS-5,NS-6,NS-7

MIXER PARTS • MODEL(S)

XD-174, XD-230 / NM-1, NM-3

## PARTS PRICING BOOK

SEC. 2

PAGE 8.01 DATE 3/12/84

DATE 3/12/84

ITEM NO.		IDENT. CODE		DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
						DWG NO.	MAT'L	

NOTE: Reference Drawing No(s). L-16708, L-16710, L-15878, & L-15921

QTY	UNIT	DESCRIPTION	INCLUDES	ALM	1	800067	PSP
3A		Tank Clamp Assy.	Includes	ALM	1	800067	PSP
	(2)		Items	316	1	800068	PSP
	(2)		3, 5, 6, 12	BRZ	1	800069	PSP
	(2)		15, 15A, 16, 17	STL	1	800070	PSP
	(2)		32, 33, 40	NAM	1	800071	PSP
3		Clamp			1	129408	ALM
3		Clamp			1	129408	316
3		Clamp			1	129408	BRZ
3		Clamp			1	129408	CST
3		Clamp			1	129408	NAL
3B		Cup Plate Assy.	Includes	ALM	1	801202	PSP
			Items	316	1	801203	PSP
			3, 6, 12, 16	BRZ	1	801204	PSP
			17, 32, 33, 40	STL	1	801205	PSP
				NAM	1	801206	PSP
3		Cup Plate			1	129206	ALM
3		Cup Plate			1	129206	316
3	(2)	Cup Plate			1	129206	BRZ
3		Cup Plate			1	129206	CIR
3		Cup Plate			1	129206	NAM
4	C	Chuck Grip			1	130010	316
6		Housing			1	136146	ALF
3	(2)	Housing			1	136152	316
3	(2)	Housing			1	136146	BRZ
3	(2)	Housing			1	136152	CIR
3		Housing			1	136146	NAL
3	C	Drive Shaft with Chuck			1	143775	NPS
3	C	Drive Shaft with Chuck			1	143778	316
3	R	Drive Shaft with Coupling			1	143809	41L
3	R	Drive Shaft with Coupling			1	143809	316
1		Vibration Pad			1	150331	DUK
1	E	Electric Motor			1	See Sec.	1-C
3		Mixer Shaft			1	See Sec.	1-D
1/45		Impeller & Set Screw			1	See Sec.	1-D
3		Motor Shaft Key			1	190750	STL

**Identity Code: \*Recommended Spare Parts:**

(2) Non Stock:

C- Use with Chuck Drive Shaft

R- Use with rigid coupling dr.shaft. <sup>E-</sup> Use with Electric Motor

E- Use with Electric Motor

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**LIGHTNIN • 135 Mt. Read Blvd. • Rochester, N.Y. 14611****A UNIT OF GENERAL SIGNAL****MIXER PARTS • MODEL(S) XJ-30, XJ-43, XJA-33 ND-1, ND-1A, NAG-33****PARTS PRICING BOOK****SEC. 2****PAGE 9.00****DATE 3/12/84**

DATE 5/12/84

ITEM NO.	IDENT. CODE	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
				DWG NO.	MAT'L	
NOTE: Reference Drawing No(s). L-16709 & L-16711						
2		Hex Head Cap Screw	4	100326	CPS	
2		Hex Head Cap Screw	4	100326	316	
3		King Bolt	1	100328	CPG	
3		King Bolt	1	100328	174	
4		Shaft Screw	1	102007	CPS	
5		Clamp Screw	1	105413	CPR	
5		Clamp Screw	1	105413	174	
6		Wedge Screw	1	105414	CPR	
6		Wedge Screw	1	105414	174	
7	E	Hex Head Cap Screw (For Motor Handle)	2	100122	CPS	
8	C	Chuck Screw	1	105861	CPG	
8	C	Chuck Screw	1	105861	174	
10	*	Crip Spring Locknut	1	107717	STL	
11	C	Limit Pin	1	108504	420	
12		Plain Washer	1	112007	CPS	
12		Plain Washer	1	112007	316	
15		Cup Washer	1	112409	CPS	
15		Cup Washer	1	112409	316	
15A		Retaining Ring	1	205445	PSP	
16		Wedge Bottom	1	112531	BRZ	
16		Wedge Bottom	1	112531	316	
17		Wedge Top	1	112532	ALM	
17		Wedge Top	1	112532	316	
17		Wedge Top	1	112532	STL	
17	(2)	Wedge Top	1	112532	BRZ	
18	C	Chuck Washer	1	112756	S16	
18	C	Chuck Washer	1	112756	175	
20		Washer	4	112762	BRH	
20		Washer	4	112762	316	
21	C	Snap Ring	1	114276	302	
22	*	Retaining Ring	1	114278	PSP	
23	*	Retaining Ring	2	114282	PSP	
24	*	Oil Seal	1	115355	PSP	
25	*	Oil Seal	1	115358	PSP	
26	*	"O" Ring	1	115766	BUN	
27	*	Ball Bearing	1	116243	PSP	
28	*	Outer Ring And Roller Assy.	1	117027	PSP	
29		Inner Ring (sold as set with item 28)	1	117028	PSP	

PLATE S109

○ Identity Code: \*Recommended Spare Parts: (2) Non Stock - Consult Factory:  
 E- Use with Electric Motor  
 C- Use with Chuck Drive Shaft R- Use with Rigid Coupling Drive Shaft

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## MIXER PARTS • MODEL(S) XJ-30, XJ-43, XJA-33 ND-1, ND-1A, NAG-33

## PARTS PRICING BOOK

SEC. 2

PAGE 9.01 DATE 3/12/84

ITEM NO.		IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
					DWG NO.	MAT'L	
NOTE: Reference Drawing No(s). L-16709 & L-16711							
1/31			Gear and Pinion (Set Only)	1	119869	PSP	
2			Hex Key Wrench	1	127210	BPF	
3A			Tank Clamp Assy. Includes	1	800057	PSP	
	(2)		Items	1	800058	PSP	
	(2)		3, 5, 6, 12, 15	1	800059	PSP	
	(2)		15A, 16, 17,	1	800060	PSP	
	(2)		32, 33, 40	1	800061	PSP	
			Clamp	1	129020	ALM	
			Clamp	1	129020	316	
	(2)		Clamp	1	129020	BRZ	
			Clamp	1	129020	STL	
			Clamp	1	129020	NAL	
3B			Cup Plate Assy. Includes ALM	1	801194	PSP	
	(2)		Items 316	1	801195	PSP	
	(2)		3, 6, 12, 16 BRZ	1	801196	PSP	
	(2)		17, 32, 33, CIR	1	801197	PSP	
	(2)		40 NAM	1	801192	PSP	
			Cup Plate	1	129208	ALM	
			Cup Plate	1	129208	316	
	(2)		Cup Plate	1	129208	BRZ	
	(2)		Cup Plate	1	129208	CIR	
			Cup Plate	1	129208	NAM	
	C		Chuck Grip	1	130012	316	
	E		Motor Handle Kit - Electric Motor	1	Consult Factory		
			Housing	1	136142	ALF	
			Housing	1	136156	316	
			Housing	1	136142	BRZ	
			Housing	1	136156	CIR	
			Housing	1	136142	NAL	
			Grip Spring Spacer	1	138808	STL	
	C		Drive Shaft with Chuck	1	143796	NPS	
	C		Drive Shaft with Chuck	1	143794	316	
	R		Drive Shaft with Coupling	1	143851	41L	
	R		Drive Shaft with Coupling	1	143851	316	
	*		Grip Spring Set	2	147031	PSP	
			Vibration Pad	1	150332	DUK	
	E		Electric Motor	1	See Sec.	1-C	
			Mixer Shaft	1	See Sec.	1-D	

Identity Code: \* Recommended Spare Parts: (2) Non Stock Consult Factory

- Use with Chuck Drive Shaft E - Use with Electric Motor

R - Use with Rigid Coupling Drive Shaft

Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.

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PLATE 5109

E - Use with Electric Motor

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A UNIT OF GENERAL SIGNAL

XJ-65/87/117

MIXER PARTS • MODEL(S) XJA-100

ND-2, ND-2A, ND-3A  
NAG-100

PARTS PRICING BOOK SEC. 2 PAGE 10.00 DATE 3/12/84

ITEM NO.	IDENT. CODE	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
				DWG NO.	MAT'L	

NOTE: Reference Drawing No(s). L-16709, L-16711, L-15893, L-15952, L-15920

2		Hex Head Cap Screw	4	100327	CPS	
2		Hex Head Cap Screw	4	100327	316	
3		King Bolt	1	100329	CPG	
3		King Bolt	1	100329	174	
4		Shaft Screw	1	102009	CPS	
5		Clamp Screw (Includes 15 & 15A)	1	105412	CPR	
5		Clamp Screw (Includes 15 & 15A)	1	105412	174	
6		Wedge Screw	1	105414	CPR	
6		Wedge Screw	1	105414	174	
7		Motor Eye Bolt	2	105620	PCS	
8	C	Chuck Screw	1	105861	GR5	
8	C	Chuck Screw	1	105861	174	
10	*	Grip Spring Locknut	1	107716	STL	
11	C	Limit Pin	1	108504	420	
12		Plain Washer	1	112013	STL	
12		Plain Washer	1	112013	316	
15		Cup Washer	1	112407	CPS	
15		Cup Washer	1	112407	316	
15A		Retaining Ring	1	205446	PSP	
16		Wedge Bottom	1	112529	BRZ	
16		Wedge Bottom	1	112529	316	
17		Wedge Top	1	112530	ALM	
17		Wedge Top	1	112530	316	
17		Wedge Top	1	112530	STL	
17	(2)	Wedge Top	1	112530	BRZ	
18	C	Chuck Washer	1	112756	S16	
18	C	Chuck Washer	1	112756	175	
20		Washer	4	112762	BRH	
20		Washer	4	112762	316	
21	C	Snap Ring	1	114276	302	
22	*	Retaining Ring	1	114279	PSP	
23	*	Retaining Ring	2	114283	PSP	
24	*	Oil Seal	1	115356	PSP	
25	*	Oil Seal	1	115357	PSP	
26	*	O Ring	1	115766	BUN	
27	*	Ball Bearing	1	116222	PSP	
28	*	Outer Ring And Roller Assy	1	117025	PSP	
29	*	Inner Ring (Set with 28)	1	117026	PSP	

○ Identity Code: \* Recommended Spare Parts: (2) Non Stock - Consult Factory  
E - Use with Electric Motor  
C - Use with Chuck Drive Shaft R - Use with Rigid Coupling Drive Shaft

\*Recommended Spare Parts

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A UNIT OF GENERAL SIGNAL

MIXER PARTS • MODEL(S)

XJ-65, XJ-87

ND-2, ND-2A

XJ-117, XJA-100

ND-3A, NAG-100

PARTS PRICING BOOK			SEC.	2	PAGE	10.01	DATE	3/12/84
ITEM NO.	IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)		
				DWG NO.	MAT'L			
NOTE: Reference Drawing No(s). L-16709, L-16711, L-15893, L-15952, L-15920								
30/31		* Gear and Pinion (set only)	1	119866	PSP			
32		Hex Key Wrench	1	127210	BPF			
33A		Tank Clamp Assy Includes ALM	1	800062	PSP			
	(2)	Items 316	1	800063	PSP			
	(2)	3, 5, 6, 12, 15 BRZ	1	800064	PSP			
	(2)	15A, 16, 17, STL	1	800065	PSP			
	(2)	32, 33, 40 NAM	1	800066	PSP			
33		Clamp	1	129019	ALM			
33		Clamp	1	129019	316			
33	(2)	Clamp	1	129019	BRZ			
33		Clamp	1	129019	STL			
33		Clamp	1	129019	NAL			
33		Cup Plate Assy. Includes ALM	1	801198	PSP			
	(2)	Items 316	1	801199	PSP			
	(2)	3, 6, 12 BRZ	1	801200	PSP			
	(2)	16, 17, 32, STL	1	801201	PSP			
	(2)	33, 40 NAM	1	801193	PSP			
33		Cup Plate	1	129207	ALM			
33		Cup Plate	1	129207	316			
33	(2)	Cup Plate	1	129207	BRZ			
33		Cup Plate	1	129207	STL			
33		Cup Plate	1	129207	NAL			
34	C	Chuck Grip	1	130011	316			
35		Motor Handle Kit - Electric Motor	1	consult factory				
36		Housing	1	136143	ALF			
36		Housing	1	136155	316			
36		Housing	1	136143	BRZ			
36		Housing	1	136155	CIR			
36		Housing	1	136143	NAL			
36		Grip Spring Spacer	1	138810	STL			
38	C	Drive Shaft with Chuck	1	143784	NPS			
38	C	Drive Shaft with Chuck	1	143782	316			
38	R	Drive Shaft with Coupling	1	143850	41L			
38	R	Drive Shaft with Coupling	1	143850	316			
39	*	Grip Spring Set	2	147030	PSP			
40		Vibration Pad	1	150333	DUK			
41	E	Electric Motor	1	See Sec.	1-C			
42		Mixer Shaft	1	See Sec.	1-D			

○ Identity Code: \* Recommended Spare Parts: (2) Non Stock Consult Factory  
 E - Use with Electric Motor  
 C - Use with Chuck Drive Shaft R - Use with Rigid Coupling Drive Shaft

\*Recommended Spare Parts

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MIXER PARTS • MODEL(S)

ND-2, ND-2A

ND-3A, NAG-100

SEC.

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PAGE 10.03

DATE 3/12/84

NOTE: Reference Drawing No(s). L-16709, L-16711 , L-15893, L-59952, L-15920

Identity Code: \_\_\_\_\_

\*Recommended Spare Parts

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## A UNIT OF GENERAL SIGNAL

## MIXER PARTS • MODEL(S) XJ-174, XJ-230, XJ-350

ND-3, ND-4

ND-4A, ND-4B

## PARTS PRICING BOOK

SEC. 2

PAGE 11.00

DATE 3/12/84

ITEM NO.		IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
					DWG NO.	MAT'L	
NOTE: Reference Drawing No(s). L-16709, L-16711							
1			Hex Head Cap Screw	2	100306	CPS	
1			Hex Head Cap Screw	2	100306	316	
2			Hex Head Cap Screw	2	100506	CPS	
2			Hex Head Cap Screw	2	100506	316	
3			King Bolt	1	100318	CPG	
3			King Bolt	1	100318	174	
4			Pinion Cap Screw	1	102560	GR5	
5			Clamp Screw (Includes 15 & 15A)	1	105411	CPR	
5			Clamp Screw (Includes 15 & 15A)	1	105411	174	
6			Wedge Screw	1	105410	CPR	
6			Wedge Screw	1	105410	174	
7			Motor Eye Bolt - For 3hp.Motor	2	105619	CPS	
8		C	Chuck Screw	1	105860	CPG	
9		C	Chuck Screw	1	105860	174	
10		*	Grip Spring Locknut	1	107715	STL	
11		C	Limit Pin	1	108504	420	
12			Plain Washer	1	112017	STL	
12			Plain Washer	1	112017	316	
15			Cup Washer	1	112408	STL	
15			Cup Washer	1	112408	316	
15A			Retaining Ring	1	205447	PSP	
16			Wedge Bottom	1	112527	BRZ	
16			Wedge Bottom	1	112527	316	
17			Wedge Top	1	112528	ALM	
17			Wedge Top	1	112528	316	
17			Wedge Top	1	112528	STL	
17		(2)	Wedge Top	1	112528	BRZ	
18		C	Chuck Washer	1	112750	316	
18		C	Chuck Washer	1	112750	175	
19			Washer	4	112761	BRS	
20			Washer	4	112761	316	
21		C	Snap Ring	1	114273	302	
22		*	Retaining Ring	1	114274	PSP	
23		*	Retaining Ring	2	114284	PSP	
24		*	Oil Seal	1	115349	PSP	
25		*	Oil Seal	1	115350	PSP	
26		*	"O" Ring	1	115763	BUN	
27		*	Ball Bearing	1	116677	PSP	
28		*	Outer Ring and Roller Assy.	1	117023	PSP	
29		*	Inner Ring	1	117024	PSP	

○ Identity Code: \* Recommended Spare Parts: (2) Non Stock - Consult Factory  
 C - Use with Chuck Drive Shaft:  
 R - Use with Rigid Coupling Drive Shaft

BLANK CODE DENOTES COMMON PARTS

Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.

DATE

ISSUE  
REVISEDIT-2043  
SHEET 1 of 3

A UNIT OF GENERAL SIGNAL

## MIXER PARTS • MODEL(S) XJ-174, XJ-230, XJ-350

ND-3, ND-4

ND-4A, ND-4B

## PARTS PRICING BOOK

SEC. 2

PAGE 11.01

DATE 3/12/84

ITEM NO.	IDENT. CODE ○	DESCRIPTION	REQ'D. PER UNIT	PART NO.		PRICE (EACH)
				DWG NO.	MAT'L	
NOTE: Reference Drawing No(s). L-16709 L-16711						
30/31	*	Gear and Pinion Set-Available in Set	1	119863	PSP	
		Form only includes items 30 & 31				
32		Hex Key Wrench	1	127209	BPF	
33A		Tank Clamp Assy	1	800067	PSP	
		Includes	1	800068	PSP	
		Items	1	800069	PSP	
		3,5,6,15,15A	1	800070	PSP	
		16,17,32,	1	800071	PSP	
		33,40	1			
33		Clamp	1	129408	ALM	
33		Clamp	1	129408	316	
33		Clamp	1	129408	BRZ	
33		Clamp	1	129408	CST	
33		Clamp	1	129408	NAL	
33B		Cup Plate Assy	1	801202	PSP	
	(2)	Includes	1	801203	PSP	
	(2)	Items	1	801204	PSP	
	(2)	3,6,12,	1	801205	PSP	
	(2)	16,17,32,	1	801206	PSP	
	(2)	33,40	1			
33		Cup Plate	1	129206	ALM	
33		Cup Plate	1	129206	316	
33	(2)	Cup Plate	1	129206	BRZ	
33		Cup Plate	1	129206	CIR	
33	(2)	Cup Plate	1	129206	NAM	
34	C	Chuck Grip	1	130010	316	
35		Motor Handle	1	135213	STL	
36		Housing	1	136145	ALF	
36		Housing	1	136153	316	
36		Housing	1	136145	BRZ	
36		Housing	1	136153	CIR	
36		Housing	1	136145	NAL	
37		Grip Spring Spacer	1	138812	STL	
38	C	Drive Shaft with Chuck	1	143773	NSP	
38	C	Drive Shaft with Chuck	1	143777	316	
38	R	Drive Shaft with Rigid Coupling	1	143852	41L	
38	R	Drive Shaft with Rigid Coupling	1	143852	316	
39	*	Grip Spring Set	2	147029	PSP	
40		Vibration Pad	1	150331	DUK	
41		Motor	1	See Sec.	1-C	
42		Mixer Shaft	1	See Sec.	1-D	

○ Identity Code: \* Recommended Spare Parts: (2) Non Stock -Consult Factory  
 C - Use with Chuck Drive Shaft  
 R - Use with Rigid Coupling Drive Shaft

BLANK CODE DENOTES COMMON PARTS

Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.

PLATE

ISSUE  
REVISEDIT- 2043  
SHEET 2 OF 2

## A UNIT OF GENERAL SIGNAL

**MIXER PARTS •** MODEL(S) XJ-174, XJ-230, XJ-350 ND-4A, ND-4B

## SEC. 2

PAGE 11.02 DATE 3/12/84

**PLATE 5109**

**Identity Code:**

### \*Recommended Spare Parts

**Consult your local LIGHTNIN Sales Office for terms of sale, ordering information and delivery.**

BLANK CODE DENOTES COMMON PARTS

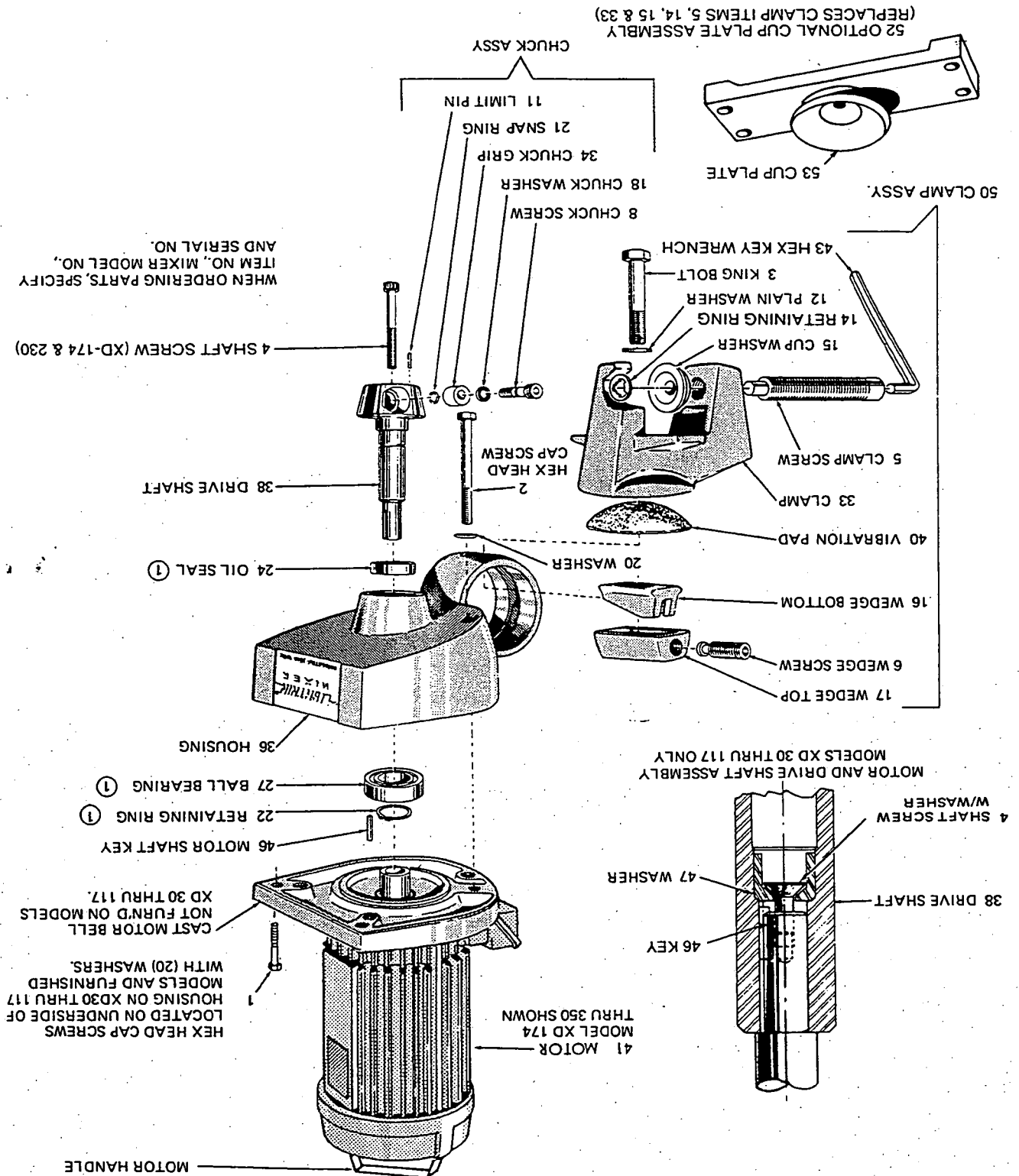
# PLATE

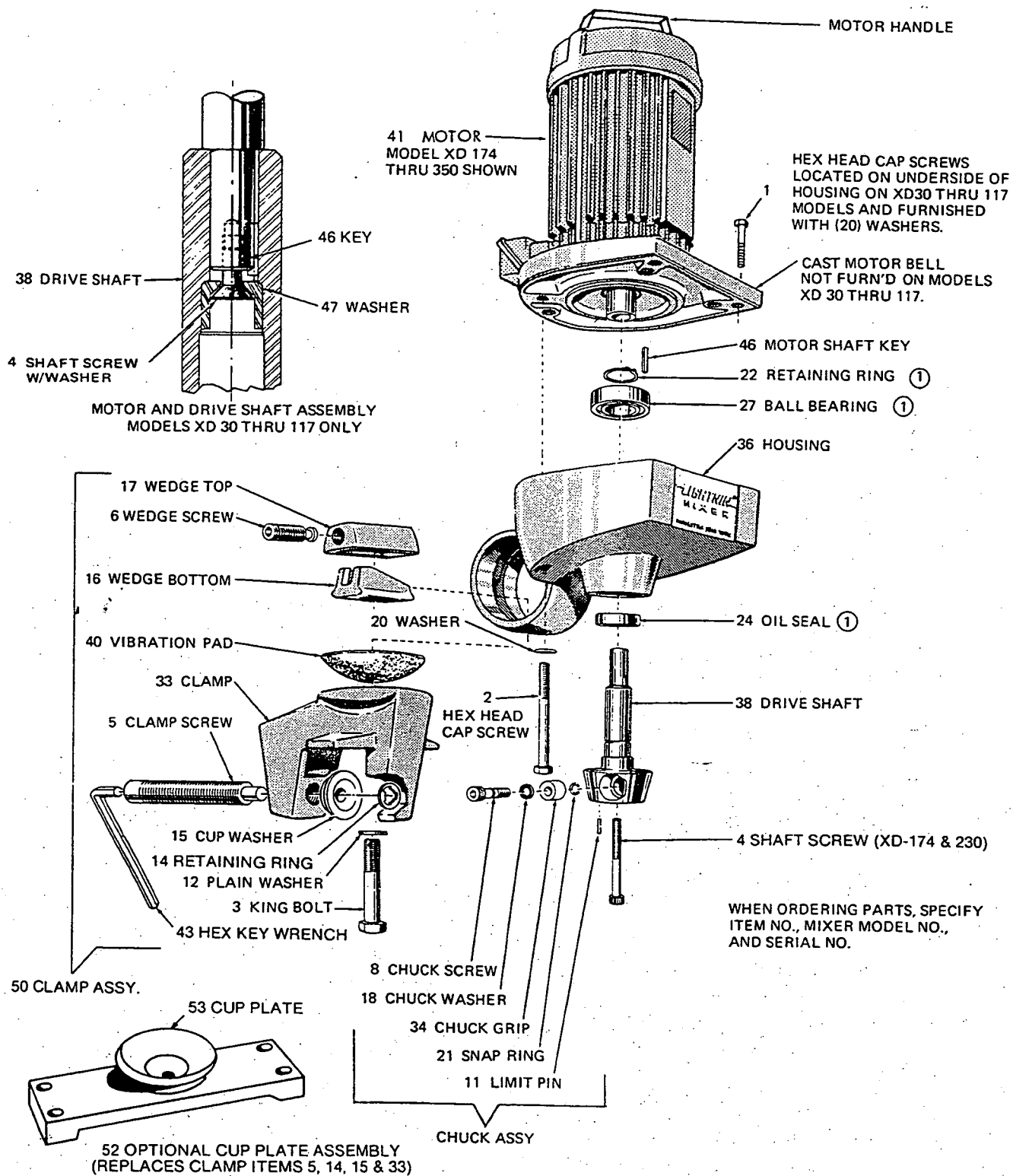
ISSUE  
REVISED

IT- 2043  
SHEET 3 OF 3

EXPLODED VIEW OF DIRECT DRIVE -  
MODEL XD SERIES

① RECOMMENDED SPARE PARTS





**8-5. PREPARING FOR ASSEMBLY**

- a. Clean all parts thoroughly.
- b. Inspect for the following defects.
  1. Cracks or damage of the housing.
  2. Dents, gouges, or scoring of the drive shaft, housing bore, and particularly the mating faces of the motor and housing.
  3. Wear or deterioration of the vibration pad.
- c. Repair or replace defective parts. It is good practice to replace an oil seal which has been removed from the housing. Apply a small quantity of bearing grease to the housing bore and around the oil seal lip to provide lubrication and to make the seal more effective.
- d. Replace the ball bearing if it shows indications of wear.

**8-6. ASSEMBLING THE DRIVE SHAFT IN THE HOUSING**

- a. Mount the housing (36) in an arbor press, large end up.
- b. Press the ball bearing (27) on its outer race to the shoulder of the housing bore.
- c. Turn the housing large end down and press the oil seal (24), sealing lip inward, flush with the lower end of the housing.
- d. Support the housing, large end down, by resting the inner race of the ball bearing on a suitable sleeve.
- e. Grease the lip of the oil seal and press the drive shaft (38) into the ball bearing until the shoulder of the shaft registers against the inner race of the bearing.
- f. Use Waldes Truarc No. 4 pliers to install retaining ring (22) in the shaft groove.
- g. Turn the housing large end down and press the drive shaft until the chuck head contacts the small end of the housing.

**8-7. ASSEMBLING THE CHUCK**

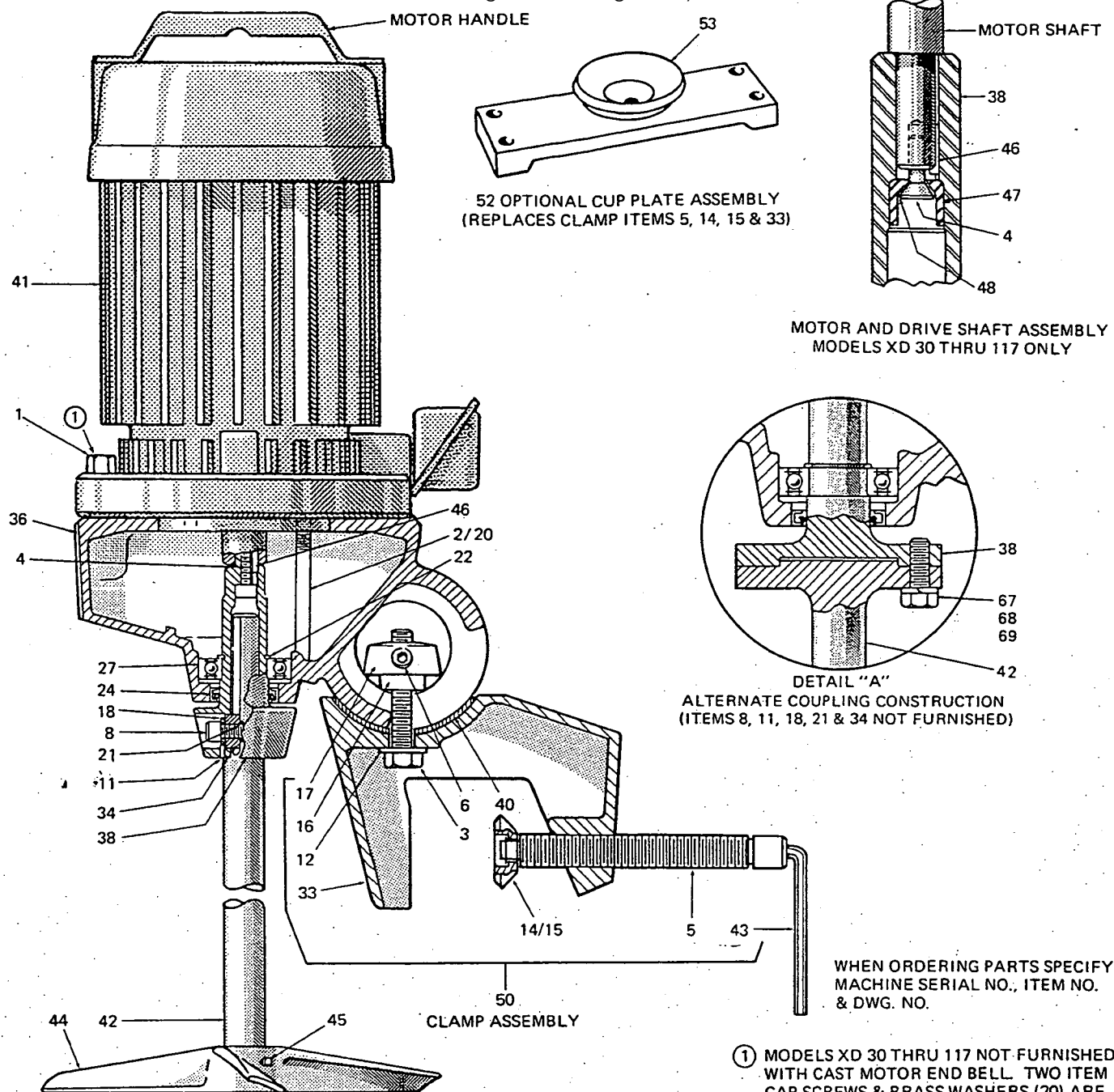
- a. Assemble chuck washer (18), chuck grip (34), and snap ring (21) on chuck screw (8).
- b. Thread the chuck screw into the chuck end of the drive shaft far enough to insert the limit pin (11) so that the end of the pin is 3/16 of an inch under flush.

**8-8. ASSEMBLING THE MOTOR TO THE HOUSING**

- a. If the drive shaft has not been removed from the housing, repeat step g, Paragraph 8-6.
- b. Install the motor shaft key (46).
  1. On Models XD 174 thru 350 — Install key in drive shaft keyway.
  2. On Models XD 30 thru 117 — If the key has been removed, clean key and motor shaft keyway and apply Loctite Sealant, Grade E. (American Sealants Co.) to both items before reassembling.
- c. Apply a light film of oil to both shafts. Align the mating keyways and insert one shaft into the other, without forcing, until the shafts are securely butted. There will be a small gap between the motor face and housing face.
- d. Align the motor and housing so that the switch conduit box, or junction box of the motor and the ball of the housing are on the same side.
- e. Align the screw holes and install the housing cap screws and washers (1, 2 and 20).
- f. Draw up the screws evenly until the housing face is just snug with the motor face, but do not completely tighten the screws.
- g. Insert the Allen wrench in the chuck screw to keep the drive shaft from turning, then thread in and tighten the shaft screw (4).
- h. Tighten the four housing cap screws evenly.

**8-9. ASSEMBLING THE CLAMP**

- a. Thread the clamp screw (5) through the outer arm of the clamp (33). Slide the cup washer (15) over the end of the clamp screw. Slide the retaining ring (14) onto the clamp screw. Position the retaining ring approximately 3/16" from the end of the clamp screw to allow free movement of the cup washer.
- b. Assemble wedge top (17), wedge screw (6), and wedge bottom (16) and set the assembly in place in the ball of the housing.
- c. Assemble clamp, vibration pad (40), king bolt (3), and washer (12).
- d. Pass king bolt through the slot in the ball of the housing and thread it loosely into the wedge top.
- e. Back off the wedge screw all the way, then advance it two turns. With the wedge bottom in this position, tighten the king bolt until the clamp socket can just be moved on the housing ball.



ITEM NO.	PART NAME	REQUIRED	ITEM NO.	PART NAME	REQUIRED
1	HEX HEAD CAP SCREW } XD-174 &	2	21	SNAP RING	1
2	HEX HEAD CAP SCREW } (350 Only)	2	22	RETAINING RING, EXTERNAL	1
2	HEX HEAD CAP SCREW XD 30-117 Only	4	24	OIL SEAL	1
3	KING BOLT	1	27	BALL BEARING	1
4	SHAFT SCREW (XD 174-350 only)	1	33	CLAMP	1
4	SHAFT SCREW & LOCKWASHER		34	CHUCK GRIP	1
5	XD 30-117 only	1	35	MOTOR HANDLE	1
5	CLAMP SCREW	1	36	HOUSING	1
6	WEDGE SCREW	1	38	DRIVE SHAFT	1
8	CHUCK SCREW	1	40	VIBRATION PAD	1
11	LIMIT PIN	1	41	MOTOR	1
12	PLAIN WASHER	1	42	MIXER SHAFT	1
14	RETAINING RING	1	43	HEX KEY WRENCH	1
15	CUP WASHER	1	44	IMPELLER	Per Order
16	WEDGE BOTTOM	1	45	SET SCREW	Per Order
17	WEDGE TOP	1	46	MOTOR SHAFT KEY	1
18	CHUCK WASHER	1	47	WASHER (XD 30-117 Only)	1
20	WASHER (XD 30-117 Only)	4	48	LOCKWASHER (XD 30-117 Only)	1
20	WASHER (XD 174-350 Only)	2	67	HEX HEAD CAP SCREW	4
			68	LOCKWASHER	4
			69	HEX NUT (XD 30-43 Only)	4

When ordering parts, specify item number, machine model number and serial number.



## SECTION 9

### ASSEMBLY & DISASSEMBLY INSTRUCTIONS

#### — GEAR DRIVE — XJ SERIES

##### 9-1. REMOVING THE MOTOR FROM THE HOUSING

- a. Set the mixer in a vertical position to prevent spilling the gear lubricant.
- b. Remove four housing cap screws and washers (1, 2, and 20).
- c. Raise motor (41) by its motor handle to separate motor and housing (36).
- d. Remove "O" ring (26).

##### 9-2. REMOVING THE PINION FROM THE MOTOR

- a. Hold the pinion (31) from turning and remove the pinion cap screw (4) in one of the following ways.
  1. XJ 30 thru 117 — Use a Phillips screwdriver.
  2. XJ 174 thru 350 — Use a 5/16-inch Allen wrench.
  3. For XJ 174 thru 350 — With nylon slinger, the slinger must be removed by breaking it. Place a wooden block under the slinger and strike the opposite side with a chisel.
- b. Remove the pinion with a bearing puller.

##### 9-3. REMOVING DRIVESHAFT, BEARINGS, AND OIL SEALS FROM THE HOUSING

- a. Remove the lubricant from the gear chamber.
- b. Remove the grip spring locknut (10) from the upper end of the drive shaft. Use one of the following methods to hold the drive shaft from turning.
  1. XJ 30 thru 117 — Insert an Allen wrench (43) in the chuck screw.
  2. XJ 174 thru 350 — Remove the chuck assembly. (See paragraph 8-4). Insert a 1-foot length of 1-inch diameter bar in the chuck grip bore.
- c. Thread a nut on the end of the drive shaft to protect the threads when pressing out the shaft.
- d. Mount the housing in an arbor press, large end upward, and press the drive shaft clear of the internal gear bore.
- e. Remove the internal gear (30), the two grip spring sets (39), and the grip spring spacer (37).
- f. Remove the drive shaft, with the bearing inner ring (29) in place, through the lower opening of the housing.
- g. If it is necessary to remove the bearing inner ring, start it from its seat with a thin screwdriver or wedge, then remove it from the drive shaft with a bearing puller.
- h. XJ 174 thru 350 only — Pry the oil seal (70) from the housing bore as shown in Figure 6.
  1. Insert a 7/8 bolt into the ball bearing (27) bore.
  2. Use the bolt head as a fulcrum and pry out the oil seal (70) with pliers.

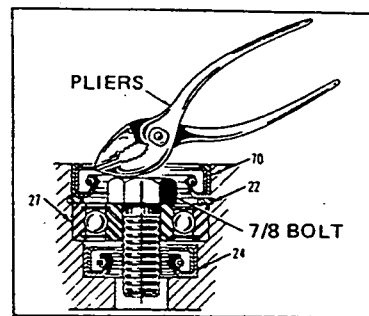


FIGURE 6

- i. Use Walde Truarc No. 4 pliers to remove internal retaining ring (22).
- j. Remove ball bearing (27) and upper oil seal (24) through the upper opening of the housing.
- k. Remove internal retaining rings (23).
- l. Mount the housing, large end upward, in an arbor press and press out oil seal (25) and outer ring and roller assembly (28).

##### 9-4. DISASSEMBLING THE CLAMP (See Paragraph 8-3).

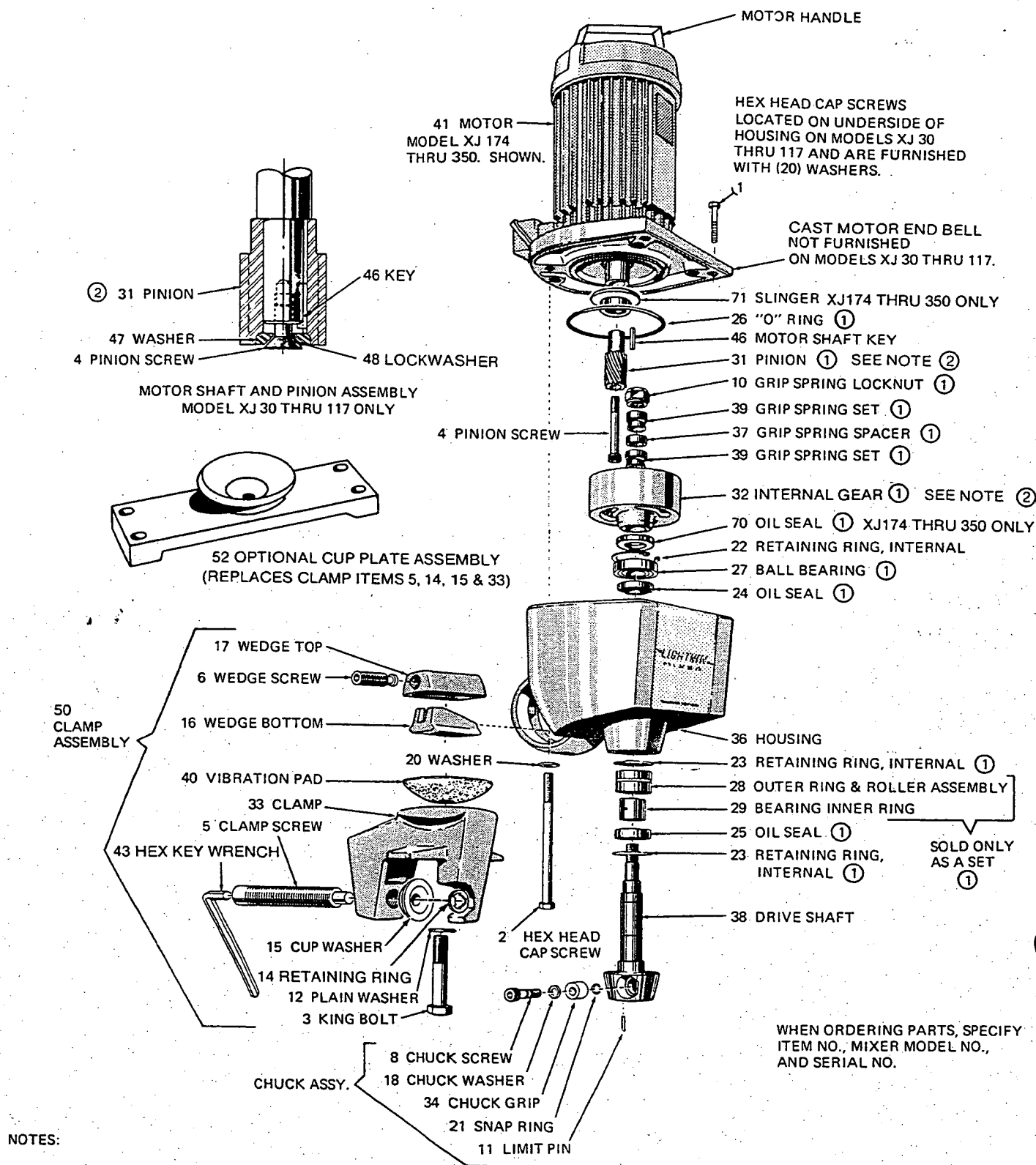
##### 9-5. DISASSEMBLING THE CHUCK (See Paragraph 8-4).

##### 9-6. PREPARATION FOR ASSEMBLY

- a. Clean all parts thoroughly.
- b. Inspect for the following defects.
  1. Cracks or damage of the housing.
  2. Dents, gouges, or scoring of the drive shaft, housing bore, and particularly the mating faces of the motor and housing.
  3. Wear or deterioration of the vibration pad.
- c. Repair or replace defective parts. It is good practice to replace an oil seal which has been removed from the housing. Apply a small quantity of bearing grease to the housing bore and around the oil seal lip to provide lubrication and to make the seal more effective.
- d. Replace the "O" ring if it is cut, deformed, or deteriorated.
- e. Replace the ball bearing and roller bearing (including the bearing inner ring) if they show indications of wear.

##### 9-7. ASSEMBLING THE DRIVE SHAFT IN THE HOUSING

- a. Mount the housing (36) in an arbor press, large end upward.
- b. Press the upper oil seal (24), sealing lip upward, approximately 1/8-inch below the shoulder of the bore.
- c. Press the ball bearing (27) on its outer race against the shoulder of the bore.



EXPLODED VIEW OF GEAR DRIVE MIXER XJ SERIES

## d. Install retaining ring (22).

## e. XJ 174 thru 350 Only

1. Apply a heavy coating of ball bearing grease to the top of the ball bearing (27).
2. Apply a coating of Loctite "Bearing Mount" grade to the outside of a new oil seal (70).
3. Press the oil seal (70), sealing lip up, into the housing until it seats on the retaining ring (22).

## f. Turn the housing large end down in the press and install the inner of the two lower retaining rings (23).

## g. Pack the outer ring and roller assembly (28) with a suitable bearing grease and press it into the housing bore until it registers against the retaining ring.

## h. Press oil seal (25), with its sealing lip towards the large end of the housing, against the outer ring and roller assembly.

## i. Install outer retaining ring.

## j. If the bearing inner ring (29) has been removed from the drive shaft (38), press it in place.

k. Apply a thin film of light oil on the tapered surfaces *only* of each grip spring set. CAUTION: For proper operation of the grip springs, oil *must not* get between the grip spring driving surfaces and the drive shaft or gear bore.

## l. Install the inner ring of the lower grip spring set (39) so that the thicker edge seats against the shaft shoulder.

## m. Place the housing on its side and grease the lips of the oil seals.

## n. Hold the internal gear (32) in place in the gear chamber and pass the drive shaft through its bearings as far as it will go into the hub of the gear.

## o. With the gear on the end of the shaft, turn the housing large end down and press the shoulder of the drive shaft against the inner race of the ball bearing (27).

## p. Turn the housing large end up. Center the internal gear on the drive shaft and install the external ring of the lower grip spring set (39), grip spring spacer (37), and upper grip spring set (39). Both grip spring sets should be installed with the thicker edge of the external ring upward. (See Figure 5 on page 9).

## q. Apply a thin coating of light oil on the threads of the drive shaft and the bottom surface of the grip spring locknut.

## r. Thread the grip spring locknut (10) onto the end of the drive shaft (finger tight). Rotate the internal gear (32) by hand and at the same time tighten down on the locknut until the internal gear can no longer be rotated. Tighten the locknut securely. (Table 4 lists the recommended tightening torques for this locknut. If a torque wrench is not available, be sure locknut is tightened sufficiently to prevent grip spring slippage.) Use one of the following methods to prevent the drive shaft from turning while performing this operation.

## 1. XJ 30 thru 117 — Reassemble the chuck assembly. (See Paragraph 8-7.) Insert an Allen wrench in the chuck screw.

## 2. XJ 174 thru 350 — With the chuck assembly removed from the drive shaft, insert a 1-foot length of 1-inch diameter bar in the chuck grip bore.

## 9-8. ASSEMBLING THE PINION ON THE MOTOR SHAFT

## a. XJ 174 thru 350 only

If the slinger has been removed, reinstall on the motor shaft.

## 1. For units with aluminum slinger, allow 1/32 to 3/32 gap between the motor oil seal and top of slinger. Check shaft end play and rotate to make sure slinger rotates freely. Coat the set screw threads with Loctite and tighten the set screw securely.

## 2. For units with nylon slinger, position on the motor shaft.

## b. Apply a thin film of grease to the motor shaft or pinion shaft.

## c. Make sure that the motor shaft key (46) is in place in the motor shaft keyway.

## d. Assemble the pinion on the motor shaft by driving it into place with light strokes of a mallet. For units with nylon slinger, be sure the pinion teeth mesh with slinger teeth.

## e. Make sure that pinion and motor shaft butt securely, then install and tighten the pinion screw (4) with lockwasher (48).

## 9-9. ASSEMBLING THE CHUCK

(See Paragraph 8-7).

## 9-10. ASSEMBLING THE MOTOR TO THE HOUSING

## a. Fill the gear chamber of the housing (36) level with a suitable lubricant. (See Section 7.) Make sure that grease is solidly packed without air pockets by paddling the grease, rotating the drive shaft by hand, tapping or shaking the housing.

## b. Clean the mating surfaces of the motor (41) and housing.

## c. Place the "O" ring (26) on the motor.

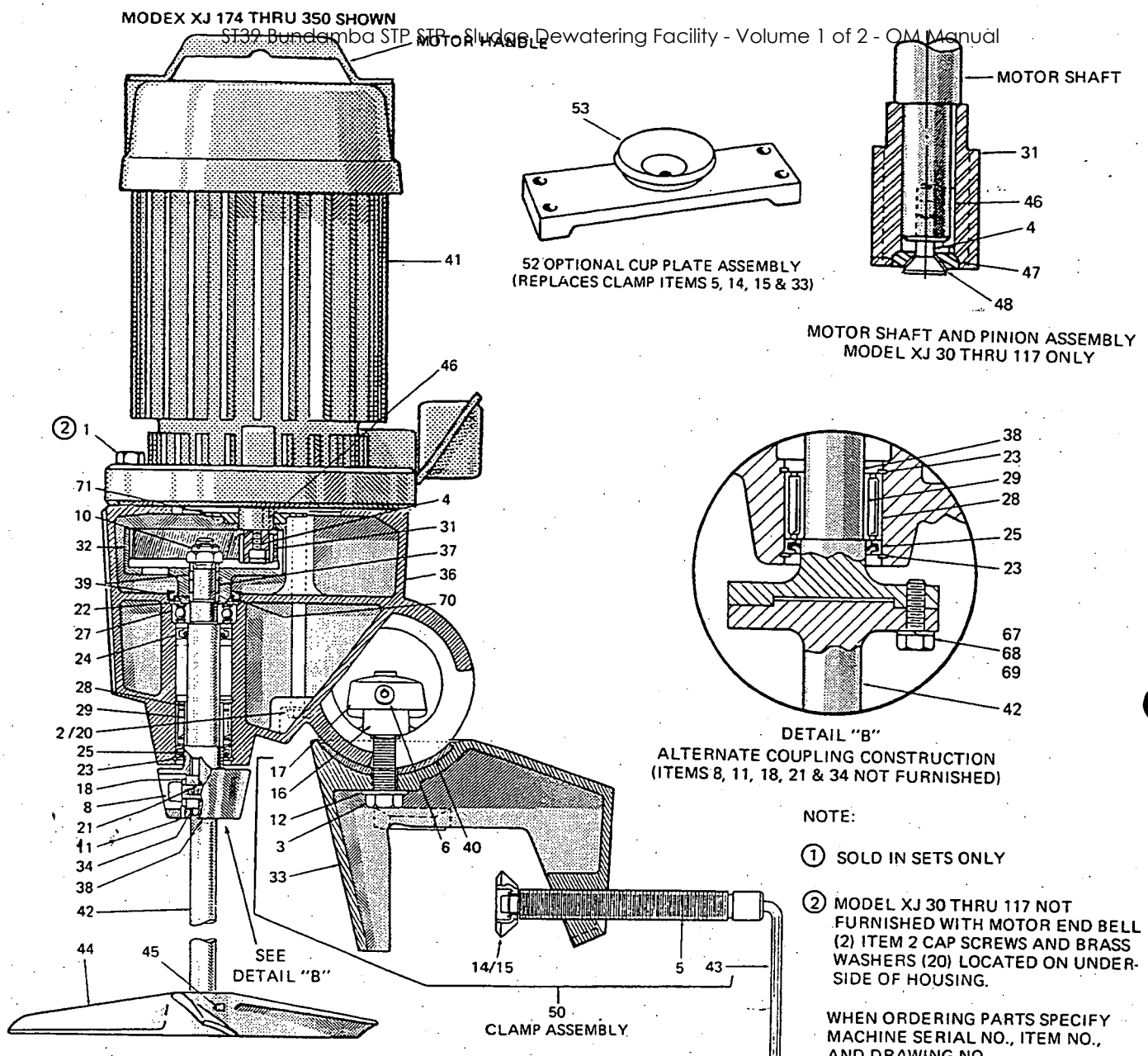
## d. Align motor rabbet with the opening of the housing and lower motor into place using care so as not to damage the "O" ring.

## e. Align the motor and housing so that the switch, conduit box, or junction box of the motor and the ball of the housing are on the same side.

## f. Align the screw holes and install the housing cap screws and washers (1, 2, and 20).

## g. Rotate the drive shaft several revolutions by hand to make sure that all parts are running freely.

## 9-11. ASSEMBLING THE CLAMP. (See Paragraph 8-9.)



ITEM NO.	PART NAME	REQUIRED	ITEM NO.	PART NAME	REQUIRED
1	HEX HEAD CAP SCREW } XJ 174 thru	2	28	OUTER RING & ROLLER } SOLD ONLY	1
2	HEX HEAD CAP SCREW } 350 only	2	29	ASSEMBLY	AS A SET
2	HEX HEAD CAP SCREW (XJ 30-117 only)	4	30	BEARING INNER RING	1
3	KING BOLT	1	31	GEAR/PINION SETS } SOLD IN	1
4	PINION CAP SCREW (XJ 174-350)	1	32	PINION	SETS ONLY
4	PINION SCREW (XJ 30-117 only)	1	33	INTERNAL GEAR	1
5	CLAMP SCREW	1	34	CLAMP	1
6	WEDGE SCREW	1	35	CHUCK GRIP	1
8	CHUCK SCREW	1	36	MOTOR HANDLE	1
10	GRIP SPRING LOCKNUT	1	37	HOUSING	1
11	LIMIT PIN	1	38	GRIP SPRING SPACER	1
12	PLAIN WASHER	1	39	DRIVE SHAFT	1
14	RETAINING RING	1	40	GRIP SPRING SET	2
15	CUP WASHER	1	41	VIBRATION PAD	1
16	WEDGE BOTTOM	1	42	MOTOR	1
17	WEDGE TOP	1	43	MIXER SHAFT	1
18	CHUCK WASHER	1	44	HEX KEY WRENCH	1
20	WASHER (XJ 30-117)	4	45	IMPELLER	Per Order
20	WASHER (XJ 174-350)	2	46	SET SCREW	Per Order
21	SNAP RING	1	47	MOTOR SHAFT KEY	1
22	RETAINING RING, INTERNAL	1	48	WASHER (XJ 30-117 only)	1
23	RETAINING RING, INTERNAL	2	49	LOCKWASHER (XJ 130-117 Only)	1
24	OIL SEAL	1	67	HEX HEAD CAP SCREW	4
25	OIL SEAL	1	68	LOCKWASHER	4
26	"O" RING	1	69	HEX NUT (XJ 30-117 only)	4
27	BALL BEARING	1	70	OIL SEAL } XJ 174 thru	1
			71	SLINGER } 350 only	1

TABLE 4 RECOMMENDED TIGHTENING TORQUES FOR GRIP SPRING LOCKNUT

MODEL	XJ 30	XJ 43	XJ 65	XJ 87 XJ 117	XJ 174	XJ 230 XJ 350
Tightening Torque in Foot-Pounds	20	20	50	50	125	125

# SERVICE RECORD

DATE INSTALLED \_\_\_\_\_ BY \_\_\_\_\_

LOCATION (Tank no., Etc. \_\_\_\_\_)

PROCESS \_\_\_\_\_

RELOCATED	DATE	LOCATION
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

## MAINTENANCE SCHEDULE

REPACK

(Motor)

LUBRICATE

(Mixer)

OVERHAUL \_\_\_\_\_

REPAIRS \_\_\_\_\_

REMARKS \_\_\_\_\_

# The Lightnin Guarantee

LIGHTNIN guarantees that in the case of a failure of any mixer, which you feel is our responsibility, we will repair or replace it to your satisfaction or we will refund the purchase price. This guarantee applies for the first full year you use your mixer, or 18 months after we ship it, whichever comes first.

Portable mixers were the very first Lightnin products back in 1923. We still occasionally discover an original model going strong after 50 years' service or more.

Every day, we see Lightnin Mixers operating continuously around the clock after 20 years or more. But that's how we build them. For years and years of non-stop mixing.

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*They can save you time and money and provide you with mixers and aerators guaranteed to do the job.*

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Los Angeles, CA	818-760-4100		
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Milwaukee, WI	414-774-4050		

**Or call us at  
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**LIGHTNIN**

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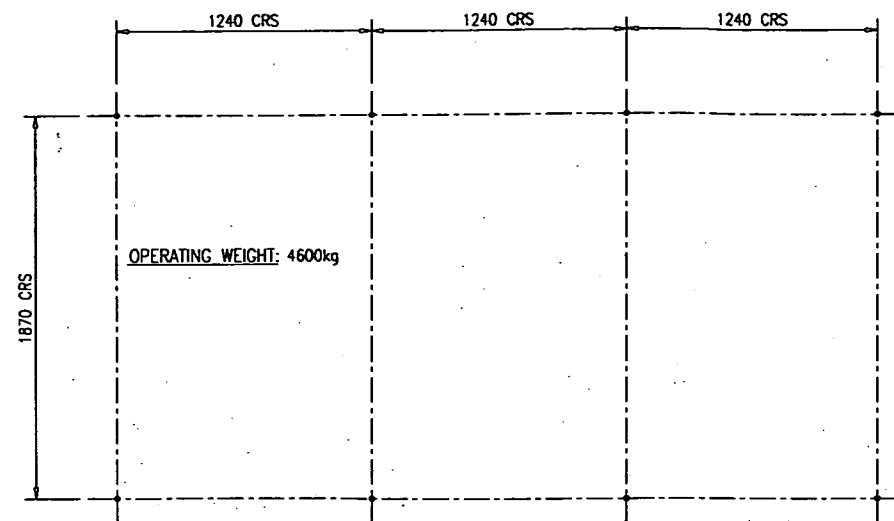
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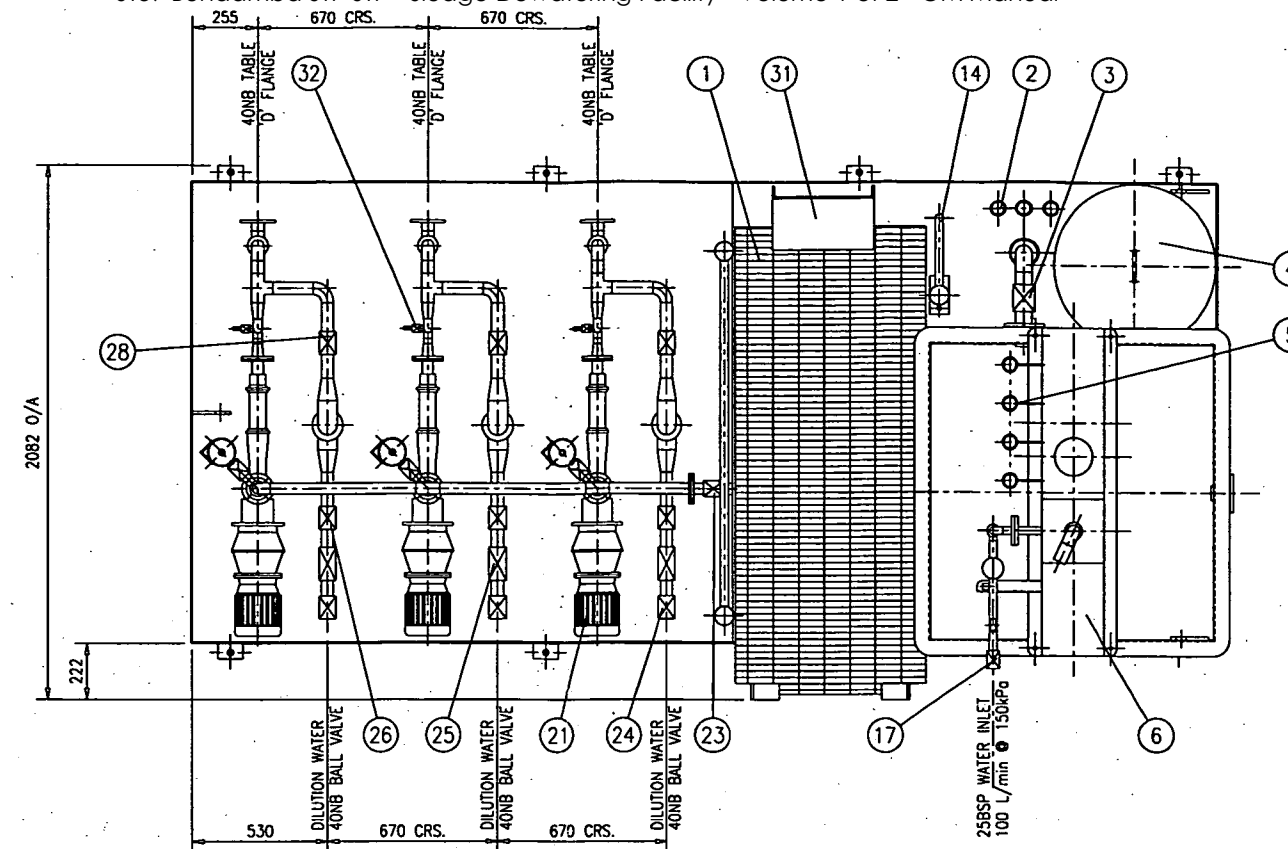
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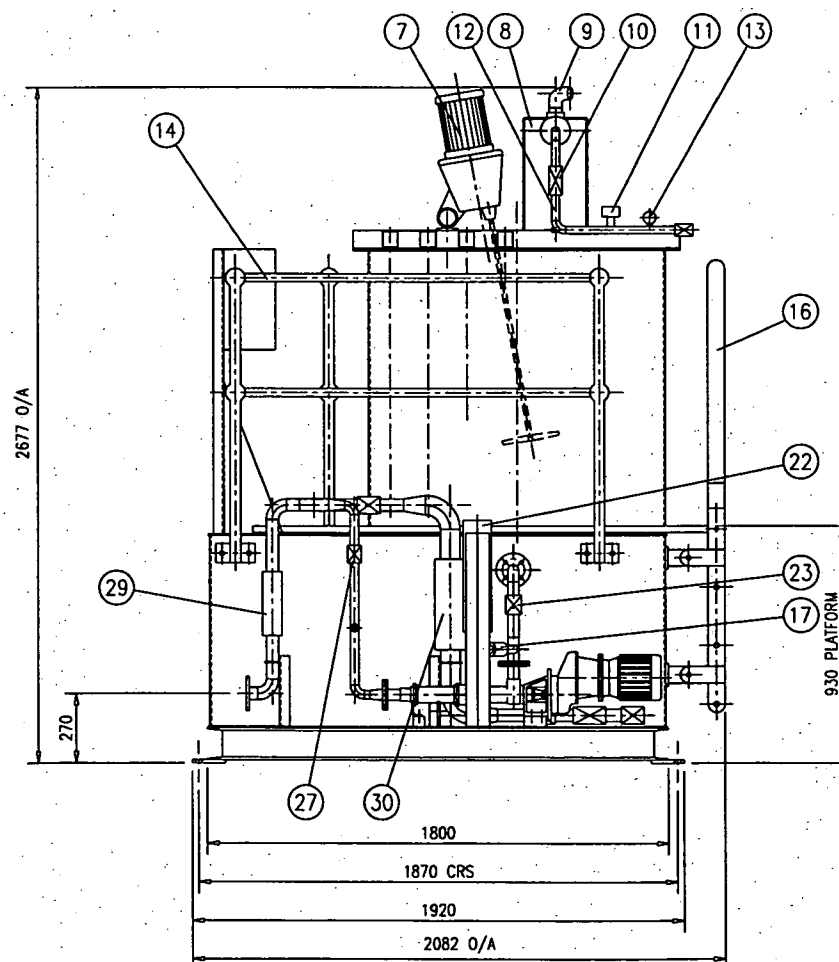
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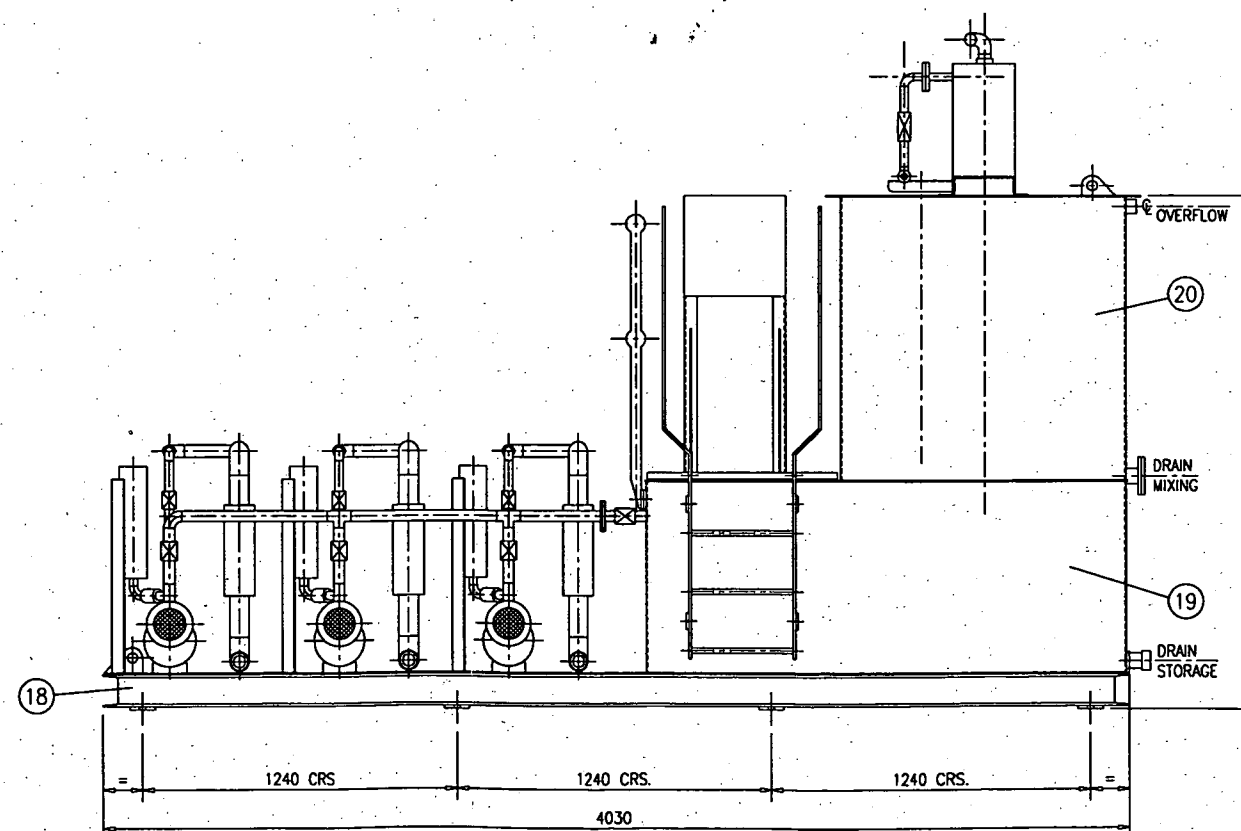
HOLD DOWN BOLT DETAIL  
(8 x M20 BOLTS)



PLAN  
(MIXER NOT SHOWN THIS VIEW)



END ELEVATION

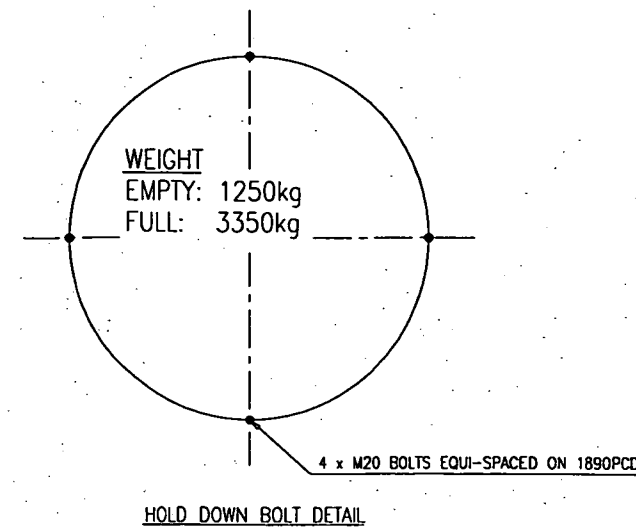
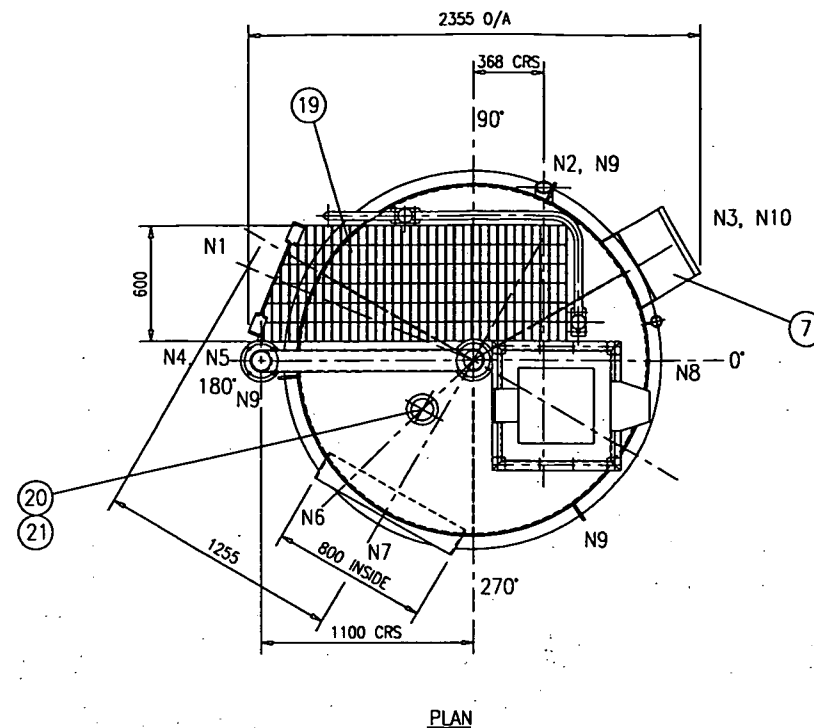


ELEVATION

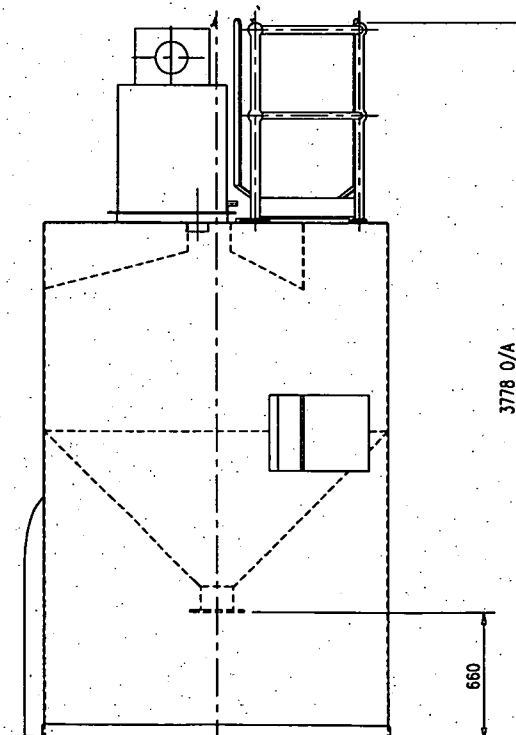
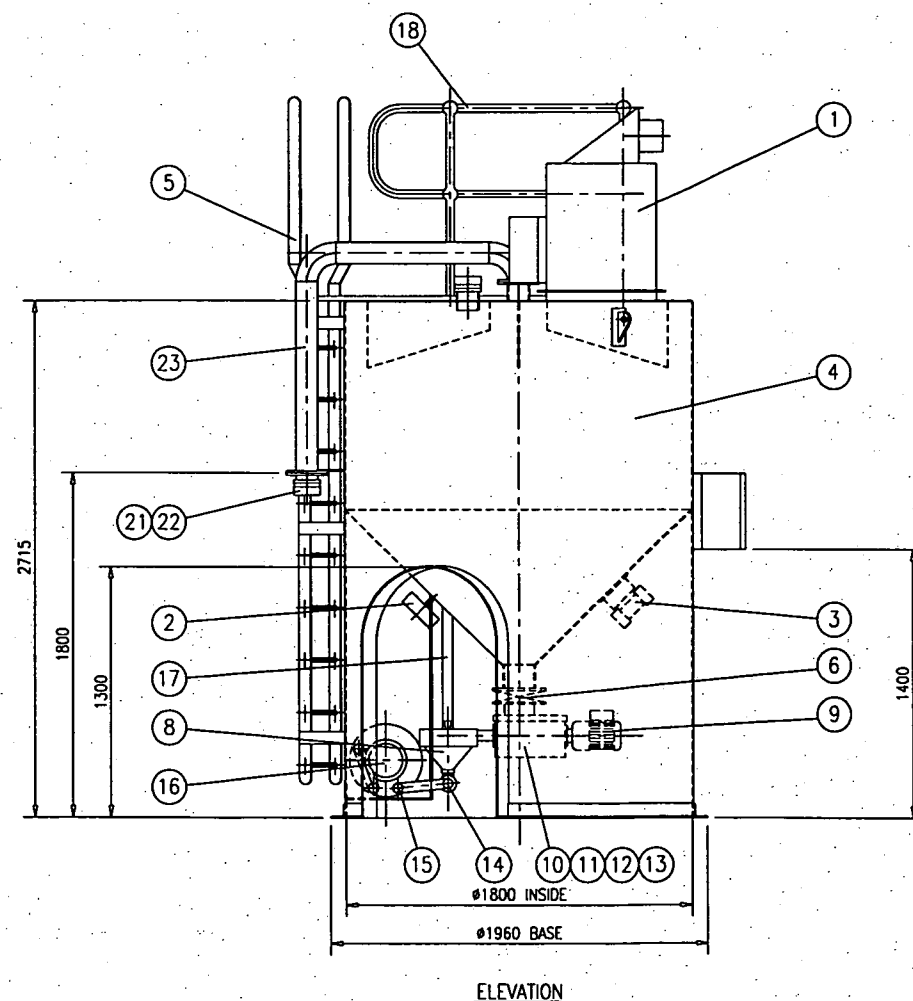
J&T	32		3	RB	15NB BALL VALVE BRASS
J&T				3	15NB HOSE TAIL
J&T	31			B&R	JUNCTION BOX 400x400x200
J&T	30		1	STUBBE	65NB ROTAMETER 1500-15000L/hr
CIBA	295000		6		65NB ROTAMETER ADAPTOR
J&T	29		3	SARDIK	STATIC INLINE MIXER MODEL 050-162
J&T	28	281200	3		40NB NON RETURN VALVE BRASS
J&T	27	281000	3		25NB NON RETURN VALVE BRASS
J&T	26	280200	3		40NB GLOBE VALVE BRASS
J&T	25		3	BURKERT	40NB SOLENOID VALVE 240VAC BRASS
J&T	24	285500	3	RB	40NB BALL VALVE BRASS
J&T	23	285600	4	RB	32NB BALL VALVE BRASS
J&T	22	217900	3		3L CALIBRATION CYLINDER
J&T	21		3	MONO	MONOBLOC CB021 PUMP 240-1200L/hr
					0.75kW 4pole 415V 3ph 50Hz c/w
					MECHANICAL SEAL
J&T	20		1		MILD STEEL MIXING TANK 1000L
J&T	19		1		MILD STEEL STORAGE TANK 2000L
J&T	18		1		BASEFRAME MILD STEEL
J&T	17	286000	4	RB	25NB BRASS BALL VALVE
J&T	16		1		ACCESS LADDER
J&T	15				
J&T	14		2	MONOWILLS	HANDRAIL
J&T	13	231000	1	RB	PRESSURE GAUGE 0-1000KPA S/S
J&T	12		1		25NB WATER PIPEWORK 304 S/S
J&T	11		1	ULTRA	FLOWSWITCH F25B
J&T	10		1	BURKERT	25NB BRASS SOL VALVE 240VAC
J&T	9	223500	1		DISPERSION SPIGOT 304 S/S
J&T	8				DISPERSION ASSEMBLY c/w
CIBA	220500		1		DISPERSION HEAD 25/50 304 S/S
J&T	226000		1		DISPERSION TUBE 100NB (PERSPEX)
CIBA	221000		8		DISPERSION NOZZLE 1/4" 304S/S
CIBA	225000		1		DISPERSION TUBE CLAMP 100NB 304 SS
J&T	7	239400	1	LIGHTNIN	AGITATOR XJ43 2 PROPS 415v 3ph 50Hz 0.25kW c/w STABISATOR RING
J&T	6		1	HOT DIP	HEAD FRAME MILD STEEL
J&T	5	242000	4		PROBE HEAD - "MIXING TANK"
J&T	4	242100	4		PROBE STUD
J&T	4		1		INSPECTION HATCH
J&T	3		1	BURKERT	50NB BRASS BALL VALVE 3001 240VAC
J&T	2	242000	3		PROBE HEAD - "STORAGE TANK"
J&T		242100	3		PROBE STUD
J&T	1		1		ACCESS PLATFORM
STORE	ITEM	ACA P/No:	REQ'D	MANUFACTURER	DESCRIPTION

## CONSTRUCTION DRAWING LIST

30030510	HOPPER ROLLS
Q125010	HOPPER WELDMENT
Q125020	BLOWER & PMU MOUNTING
30030571	LADDER DETAIL
30030580	JUNCTION PANEL LAYOUT
OR306000	LIFTING LUG DETAILS
OR301000	VIBRATOR MOUNT
OR304000	FILTER MOUNT
OR306500	PADDLE SWITCH MOUNT
OR305000	HOPPER SUPPORT PLATE



ORIENTATION SCHEDULE					
ITEM	DESCRIPTION	RATING	ORIENTATION	RADIAL DISTAN.	HEIGHT FROM U/S BASE
N1	LADDER		157.5°	1105	
N2	POWDER PIPE TO AJW	50NB HOSE		950	
N3	ELECTRICAL PANEL	400x400x270	30°	955	1400
N4	POWDER DELIVERY PIPE	100NB KAMLOC	180°	1100	1800
N5	PADDLE SWITCH		180°	440	1150
N6	INSPECTION CAP	100NB KAMLOC	224°	364	
N7	ACCESS WAY	1300x800	240°		0
N8	VIBRATOR	100NB	0°	440	1150
N9	LIFTING LUGS	ø40	65°, 185°, 305°	963	2615
N10	CABLE ENTRY	80NB	30°		1400



J&T	23		1	100NB FILLER PIPE	
J&T	22		1	KAMLOK 100NB TABLE 'D' ADAPTOR 633LA	
J&T	21		2	KAMLOK 100NB DUST CAP 634B	
J&T	20		1	KAMLOK 100NB BSP ADAPTOR 633F	
J&T	19		1	WEBFORGE GRIDMESH WALKWAY	
J&T	18		1	MONOWILLS GUARD RAIL c/w KICK PLATE	
J&T	17	590500		POWDER PIPE UPPER	
J&T		590400		POWDER PIPE LOWER	
J&T		234500	5m	50NB ANTI-STATIC HOSE	
J&T	16	205000	1	SIEMENS BLOWER 2BH1600	
				415V 3ph 50Hz 3.0kW	
J&T		590000	1	BLOWER OUTLET PIPE - 1.1/3.0 kW	
J&T	15	589700	1	BLOWER INLET PIPE - 1.1/3.0kW	
J&T	14	289000	1	VENTURI ASSEMBLY 15mm 304 S/S	
J&T		217700	2	TJS COUPLING	
J&T	13	257700	1	POWDER METERING BOX 50mm	
J&T		258500	1	PMU LID 150NB S/S	
J&T	12	257600	1	50NB SPIRAL SOLID - 19mm DRIVE	
J&T	11	200500	1	SCREW FEEDER BEARING 3/4"	
J&T	10	217800	1	SCREW FEEDER COUPLING	
J&T	9	256400	1	SEW SCREW FEEDER MOTOR - .36rpm	
				415V 3ph 50Hz 0.18kW	
△ J&T	8	232600	1	MINI HEATED RECEIVER HOPPER	
				240V 50Hz 60WATT	
J&T		233000	1	HEATED HOPPER SCREEN	
J&T	7	580200	1	B&R JUNCTION PANEL IP65 400x400x200	
J&T	6	284500	1	TURNFLO 150mm KNIFE GATE VALVE	
J&T	5		1	INSPECTION LADDER	
J&T	4		1	HOPPER SHELL - MILD STEEL	
J&T	3	290500	1	INVICTA VIBRATOR - BK05-2/2	
				415V 3ph 50Hz 0.18kW 2880rpm	
△ J&T	2		1	BELL ROTARY PADDLE SWITCH	
				240VAC 50HZ	
J&T	1	226100	1	DCE VOKES DUST FILTER UMA 70V	
				415V 3ph 50Hz 0.18kW VIBRATOR	
STORE	ITEM	ACA P/No:	REQ'D	MANUFACTURER	DESCRIPTION

FASTENER SPECIFICATION:	SURFACE PREPARATION & PAINTING SPECIFICATION:	AMEND No.	DESCRIPTION
ZINC PLATED GRADE 4.6 FOR STEEL TO STEEL	FOR FULL SPECIFICATION REFER TO: ACA SP-2 REV.4	Rev. A	First Drawing Issue
STAINLESS STEEL 304 WHEN IN CONTACT WITH STAINLESS	ABRASIVE BLAST CLEANING TO CLASS 2-1/2 AS1627.4	Rev. B 20.3.98	LADDER, PANEL AND POWDER PIPE MIRRORRED
FLAT WASHER UNDER BOLT HEAD AND SPRING WASHER	AJW TANK INTERNAL: AMERLOCK 400. 375-400um	Rev. C 26.3.98	VOLTAGE REVISED RHAR
UNDER NUT, MINIMUM 1-1/2 THREADS SHOWING.	AJW TANK EXTERNAL: WHITE TWO PACK URETHANE GLOSS		
USE "ANTI-SEIZE" COMPOUND ON ALL THREADS.	BULK POWDER HOPPER INTERNAL / EXTERNAL:		
	WHITE: TWO PACK URETHANE GLOSS		
	ANCILLARY EQUIPMENT: ALLIED COLLOIDS BLUE		
	BASE & HEAD FRAMES: HOT DIP GALVANIZED TO AS1650		

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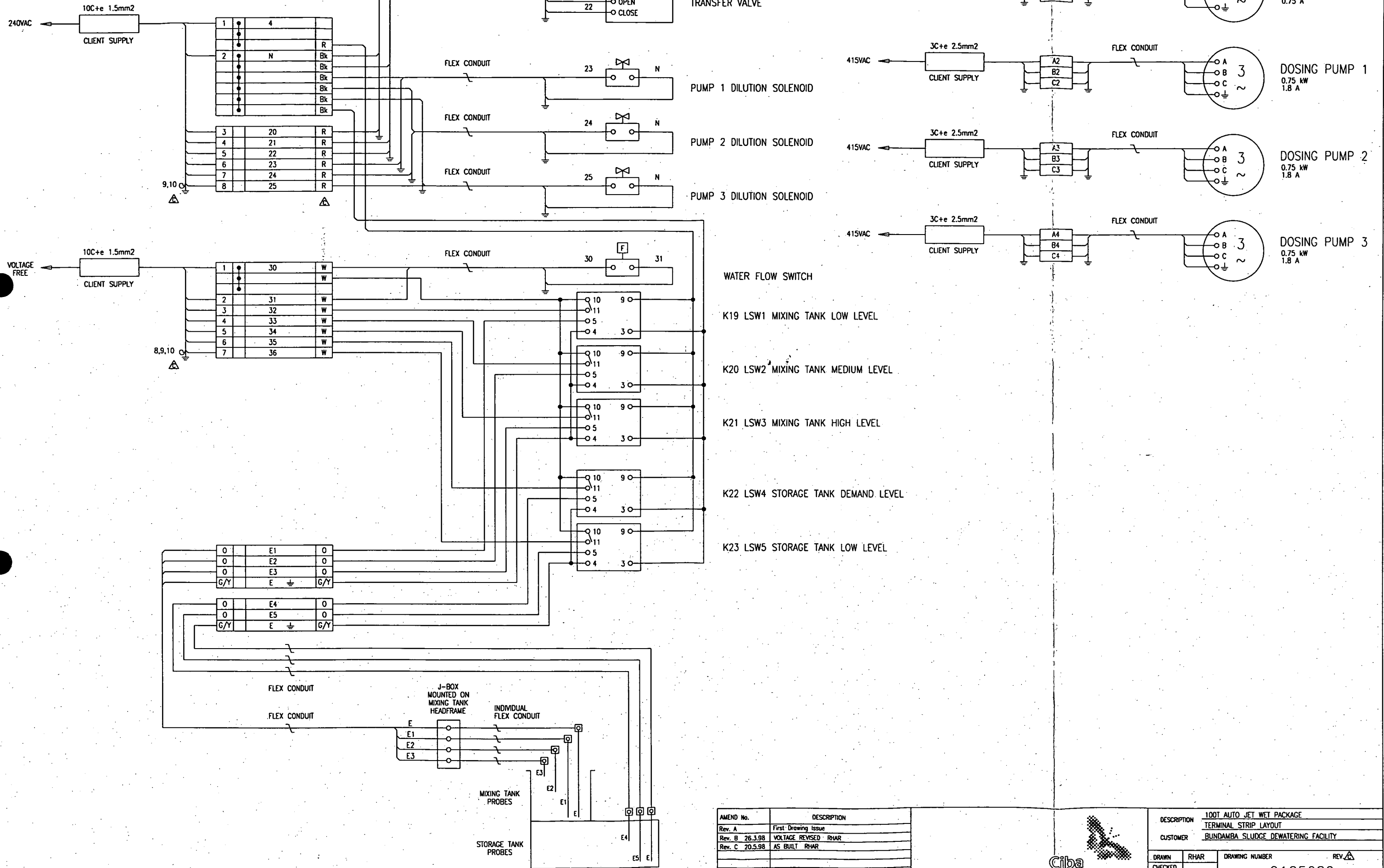
Ciba

DESCRIPTION		3m3 MINI BULK POWDER HOPPER	
CUSTOMER		GENERAL ARRANGEMENT	
		BUNDAMBA SLUDGE DEWATERING FACILITY	
DRAWN	RHAR	DRAWING NUMBER	REV. A
CHECKED			
DATE	10.3.98		
SCALE	1:20 A1		

Q125001

CIBA EQUIPMENT No. BS/0128



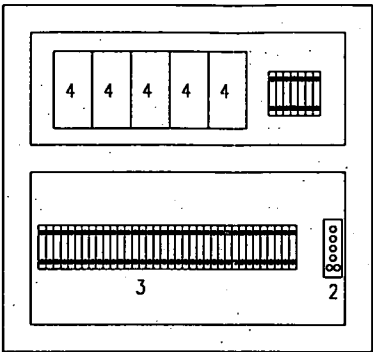


AMEND No.	DESCRIPTION
Rev. A	First Drawing Issue
Rev. B 26.3.98	VOLTAGE REVISED - RHAR
Rev. C 20.5.98	AS BUILT - RHAR

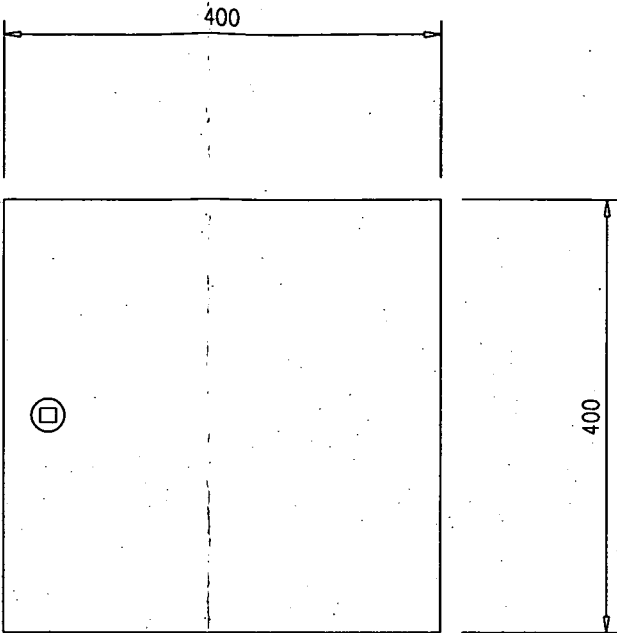
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DESCRIPTION	100T AUTO JET WET PACKAGE
TERMINAL STRIP LAYOUT	
CUSTOMER	BUNDAMBA SLUDGE DEWATERING FACILITY
DRAWN	RHAR
CHECKED	
DATE	12.3.98
SCALE	NTS A1
DRAWING NUMBER	Q125080
REV. A	
CIBA EQUIPMENT No.	



EQUIPMENT PANEL LAYOUT



DOOR EQUIPMENT LAYOUT

LABELS

INTERNAL  
2 PLEX, BLACK LETTERING ON WHITE  
BACKGROUND. MINIMUM LETTER HEIGHT 5MM  
ADHESIVE BACKED

EXTERNAL  
2 PLEX, BLACK LETTERING ON WHITE  
BACKGROUND. MINIMUM LETTER HEIGHT 20MM  
FIXED WITH STAINLESS STEEL FASTENERS

WIRING SIZES AND COLOURS


415VAC 3 PHASE	RED, WHITE, BLUE	2.5mm	(7/0.67) V75
EARTH CONNECTIONS	GREEN/YELLOW	2.5mm	(7/0.67) V75
DOOR EARTH CONNECTIONS	GREEN/YELLOW	1.5mm	(7/0.50) V75
240VAC CONTROL ACTIVE	RED	1.0mm	(32/0.20) V75
240VAC CONTROL NEUTRAL	BLACK	1.0mm	(32/0.20) V75
VOLTAGE FREE CONTACTS	WHITE	1.0mm	(32/0.20) V75
PROBE WIRES	ORANGE	1.0mm	(32/0.20) V75

CONSUMEABLE LIST

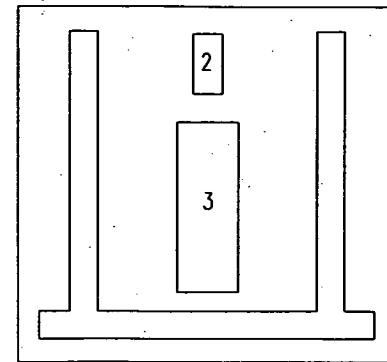
DIN RAIL	NHP	NDRA-35
SLOTTED DUCT 25x60 c/w COVER	NHP	T1-25-60
BOOT LACE PIN LUGS	CABLE ACCESSORIES	
WIRE FERRULES	CRITCHLEY	Z TYPE CABLE MARKER
CABLE WRAP	NHP	P2
CABLE TIE BASES	THOMAS & BETTS	28x28 TC5345A
CABLE TIES	THOMAS & BETTS	90x3 TY23M

J&T	4	61F-GP-N	5	OMRON	FLOATLESS LEVEL CONTROLLER 240VAC
J&T		PF113A-E	5	OMRON	BASESTO SUIT 61F-GP-N RELAYS
J&T	3	SAK4/SAK6		KLIPPON	TERMINAL STRIP & ACCESSORIES
J&T	2	L6P	1	CLIPSAL	EARTH BAR
J&T	1	NI 04042	1	B&R	ENCLOSURE IP66 POWDERCOATED STEEL
					400x400x200
STORE	ITEM	ACA P/No:	REQ'D	MANUFACTURER	DESCRIPTION

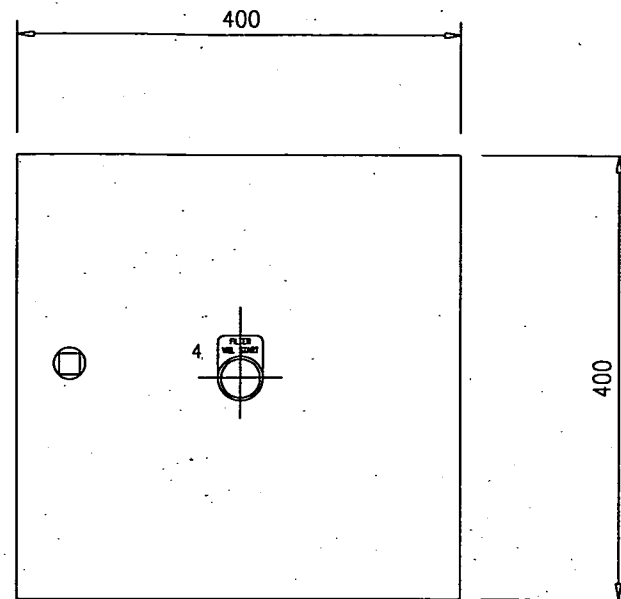
AMEND No.	DESCRIPTION
Rev. A	First Drawing Issue
Rev. B 26.3.98	VOLTAGE REVISED RHAR
Rev. C 20.5.98	AS BUILT RHAR

<div> <div>Ciba</div> <div>  </div> </div>	
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DESCRIPTION	100T AUTO JET WET PACKAGE		
	JUNCTION BOX LAYOUT		
CUSTOMER	BUNDAMBA SLUDGE DEWATERING FACILITY		
DRAWN	RHAR	DRAWING NUMBER	REV. A
CHECKED			
DATE	12.3.98		
SCALE	1:5 A2	CIBA EQUIPMENT No.	Q125081



EQUIPMENT PANEL LAYOUT



DOOR EQUIPMENT LAYOUT

**LABELS****INTERNAL**

2 PLEX, BLACK LETTERING ON WHITE  
BACKGROUND. MINIMUM LETTER HEIGHT 5MM  
ADHESIVE BACKED

**EXTERNAL**

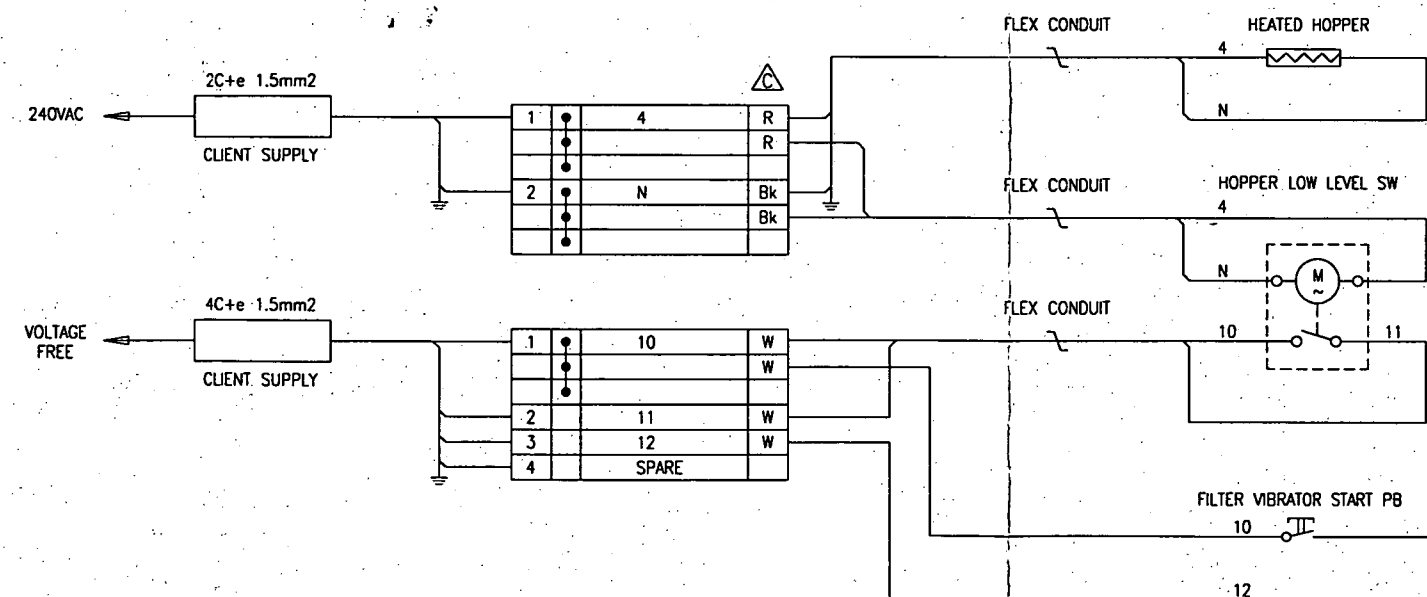
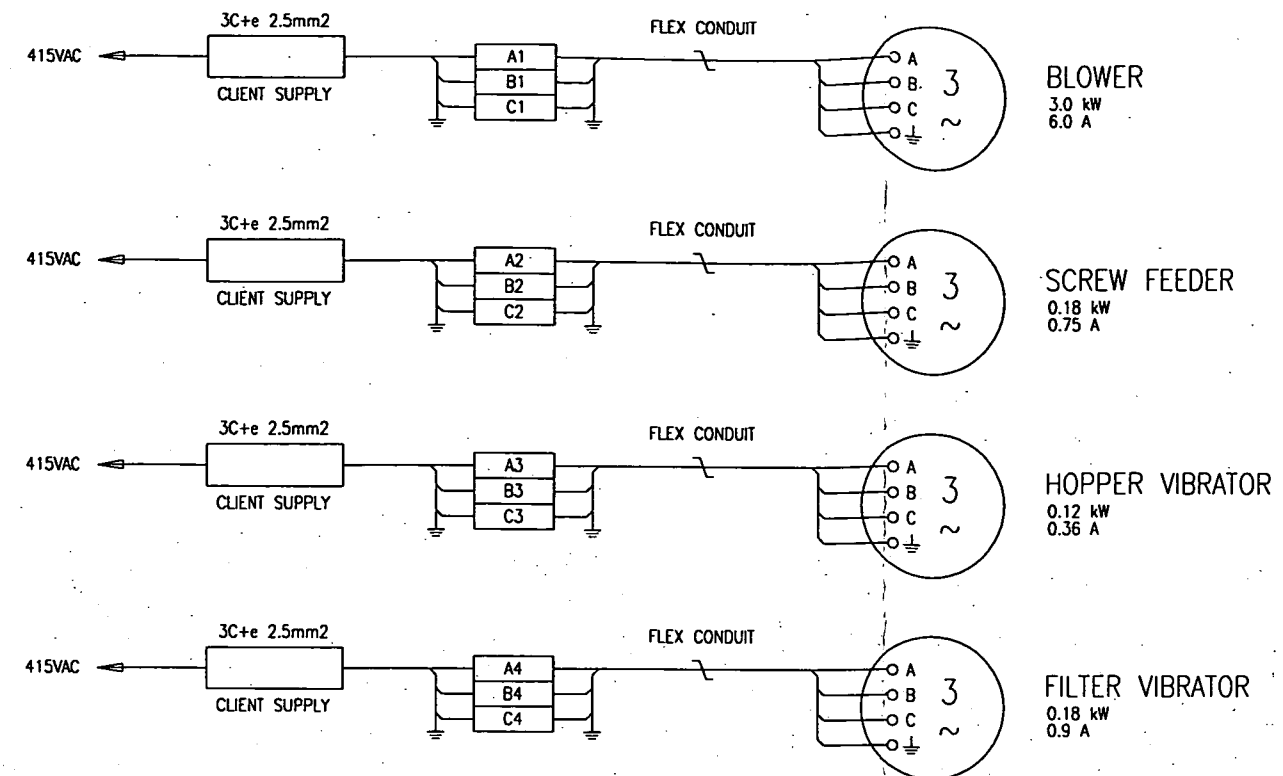
2 PLEX, BLACK LETTERING ON WHITE  
BACKGROUND. MINIMUM LETTER HEIGHT 20MM  
FIXED WITH STAINLESS STEEL FASTENERS

**WIRING SIZES AND COLOURS**

415VAC 3 PHASE	RED, WHITE, BLUE	2.5mm	(7/0.67) V75
EARTH CONNECTIONS	GREEN/YELLOW	2.5mm	(7/0.67) V75
DOOR EARTH CONNECTIONS	GREEN/YELLOW	1.5mm	(7/0.50) V75
240VAC CONTROL ACTIVE	RED	1.0mm	(32/0.20) V75
240VAC CONTROL NEUTRAL	BLACK	1.0mm	(32/0.20) V75
VOLTAGE FREE CONTACTS	WHITE	1.0mm	(32/0.20) V75

**CONSUMEABLE LIST**

DIN RAIL	NHP	NDRA-35
SLOTTED DUCT 25x60 c/w COVER	NHP	T1-25-60
BOOT LACE PIN LUGS	CABLE ACCESSORIES	
WIRE FERRULES	CRITCHLEY	Z TYPE CABLE MARKER
CABLE WRAP	NHP	P2
CABLE TIE BASES	THOMAS & BETTS	28x28 TC5345A
CABLE TIES	THOMAS & BETTS	



J&T	4	TOC-G-NPA	1	NHP	PUSHBUTTON GREEN
J&T					LEGEND "FILTER VIBRATOR START"
J&T	3			KLIPPON	TERMINAL STRIP & ACCESSORIES
J&T	2	L6P	1	CLIPSAL	EARTH BAR
J&T	1	NIO4042	1	B&R	ENCLOSURE IP65 - PAINTED STEEL
					400x400x200
STORE	ITEM	SUPPLIER	P/No:	REQ'D	MANUFACTURER

AMEND No.	DESCRIPTION
Rev. A	First Drawing Issue
Rev. B 26.3.98	VOLTAGE REVISED RHAR
Rev. C 20.5.98	AS BUILT RHAR

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DESCRIPTION	3M3 BULK HOPPER		
	JUNCTION BOX LAYOUT		
CUSTOMER	BUNDAMBA SLUDGE DEWATERING FACILITY		
DRAWN	RHAR	DRAWING NUMBER	REV. <u>C</u>
CHECKED		Q125082	
DATE	12.3.98		
SCALE	1:5 A2		
		CIBA EQUIPMENT No.	

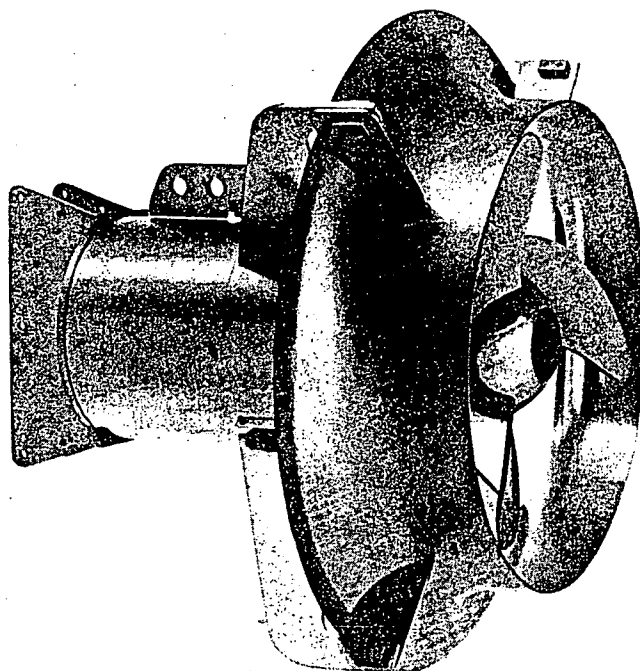
Q125082



**FLYGT**

**4630.410**  
**4640.410**

## **INSTALLATION, CARE AND MAINTENANCE**



## GUARANTEE

Flygt undertakes to remedy faults in products sold by Flygt provided:

- that the fault is due to defects in design, materials or workmanship;
- That the fault is reported to Flygt or Flygt's representative during the guarantee period;
- That the product is used only under conditions described in the care and maintenance instructions and in applications for which it is intended;
- that the monitoring equipment incorporated in the product is correctly connected;
- that all service and repair work is done by a workshop authorized by Flygt;
- that genuine Flygt parts are used.

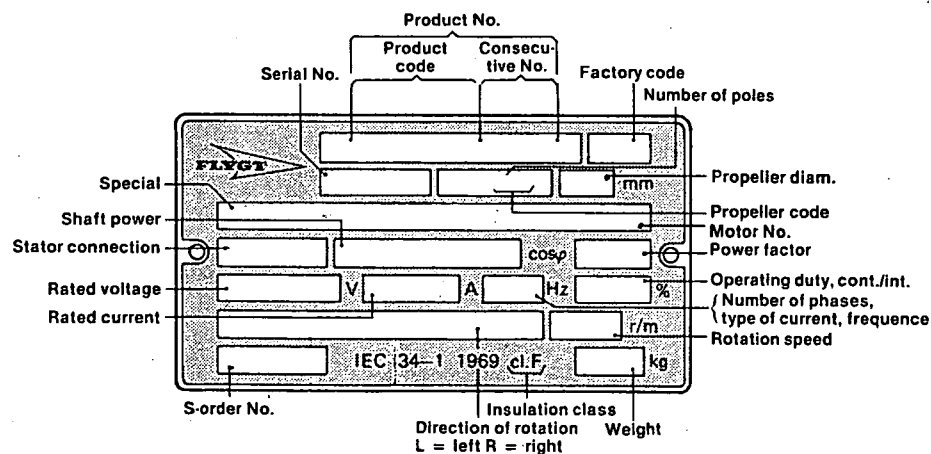
Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

Flygt assumes no liability for either bodily injuries, material damages or economic losses beyond what is stated above.

Flygt guarantees that a spare parts stock will be kept for 15 years after the manufacture of this product has been discontinued.

The manufacturer reserves the right to alter performance, specification or design without notice.

## DATA PLATE INTERPRETATION



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# PRODUCT DESCRIPTION

## General Description

The submersible mixers in the 4600-series have the below features:

- direct driven electric multipole motors.
- propellers with different diameters and blade angle.
- different materials.
- different seals.
- different installation modes.

### Applications

The mixer is intended to be used for:

- sewage plants: sludge tanks and aeration basins, anaerobic or oxygen saturated water, presence of rags etc.
- industrial processes: heavy environments with high demands of operational security, water with usually metallic salt, paper pulp and cellulose, food and chemical industry.
- industrial sewage processes: some wearing, presence of rags and metallic salt.
- mineral slurries with high wearing characteristics, presence of rags acceptable.
- fish farms and current creating in dams: oxygen supply, demands of environmental approved materials. Sweet, brackish or salt water.
- liquid manure: presence of straw, strings, board-pieces etc, floating sludge with a thickness of up to 1 meter (3.3 ft).

**The pH of the liquid:** 1—12.

**Liquid temperature:** max. 40°C (105°F)

The mixer is designed for use in many different situations where high flow capacity in relation to power consumption is required.

The mixing effect is dependent upon the density and the viscosity of the liquid and on the volume/shape of the tank.

More than one mixer is required for larger tanks.

**Depth of immersion:** max. 40 m (130 ft).

The mixer should always work completely submerged in the liquid.

### WARNING!

**The mixer must not be used in explosive or flammable environments or with flammable liquids.**

For other applications, contact your nearest Flygt representative for information.

## Design

### Cable entry

The cable entry has two compressible rubber bushings to seal off and to relieve the cable.

### 1. Junction box

The junction box is completely sealed off from the surrounding liquid and the stator casing.

### 2. Motor

Squirrel-cage 3-phase induction motor for 50 Hz or 60 Hz.

The motor is started by means of direct on-line start.

The motor can be run continuously or intermittently with a maximum of 15 evenly spaced starts per hour.

The stator is insulated in accordance with class F (155°C, 310°F). The motor is designed to supply its rated output at  $\pm 5\%$  variation of the rated voltage. Without overheating the motor,  $\pm 10\%$  variation of the rated voltage can be accepted provided that the motor does not run continuously at full load. The motor is designed to operate with a voltage imbalance of up to 2 % between the phases.

### 3. Monitoring equipment

The stator incorporates two thermal switches connected in series.

The thermal switches open at 125°C (260°F).

**NOTE!** The thermal switches should not be connected when the liquid temperature is above 40°C (105°F).

See also "Electrical connections" and separate instructions for starter equipment.

### 4. Shaft

The motor shaft is delivered with the rotor as an integral part.

The motor shaft is completely sealed off and will not get in contact with the liquid.

### 5. Shaft seals

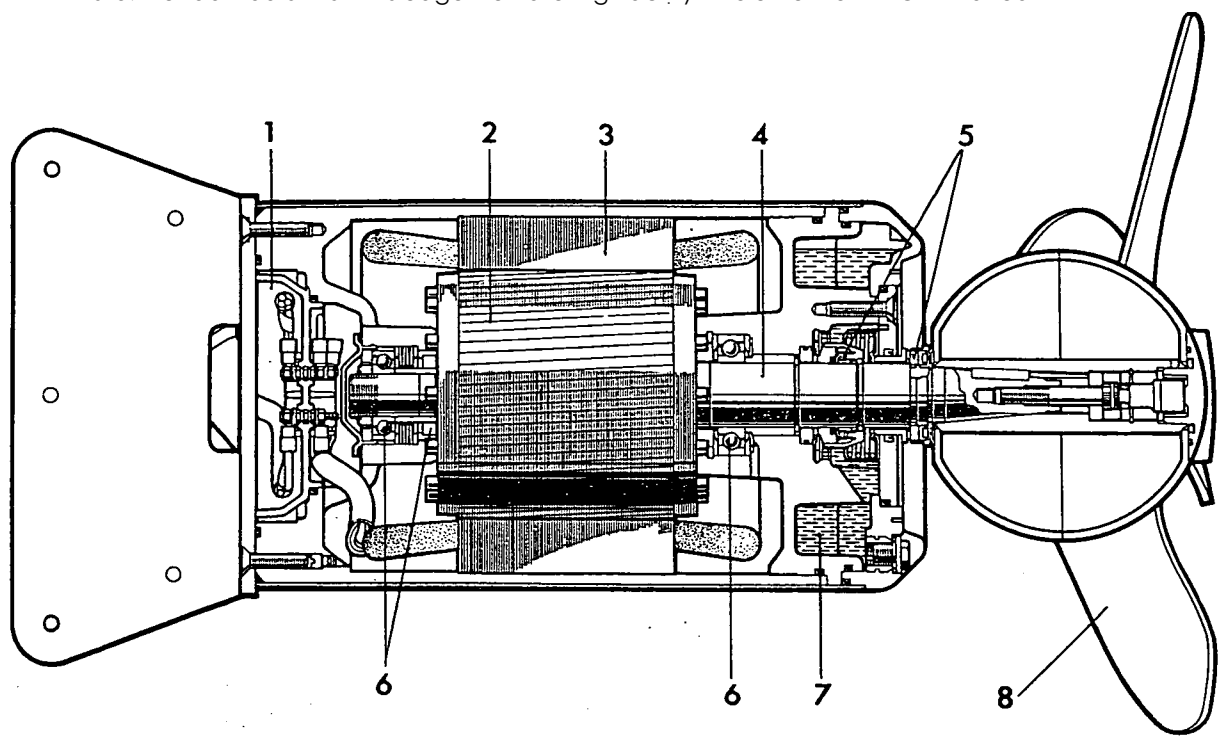
The outer mechanical seal seals between the surrounding liquid and the oil casing. Two types of seals are available: Flygt seal Type S or Type T. The inner seal, which is a mechanical seal or a lip seal, seals between the oil casing and the stator casing. The seals cavity is made very versatile in order to meet every application with high effective seal arrangement related to cost/performance.

### 6. Bearings

The shaft is carried in one single-row angular contact ball bearing and a single-row cylindrical roller bearing together with a single-row angular contact ball bearing.

The mixer's bearings are calculated for more than 100 000 hours of operation.





### 7. Oil casing

The oil lubricates and cools the seals and acts as an additional barrier against penetrating liquid.

Pressure build-up within the oil casing is reduced by means of a built-in air volume.

### Cooling

The stator is cooled by the surrounding liquid.

### 8. Propeller

The propeller is three-bladed with an outside diameter of 360 mm (14.2") or 390 mm (15.4").

The propeller blades have a large width, a thin profile, a smooth surface and are back-swept. This gives a highly efficient and almost clog-free operation.

### Flush protection

The mixer can be equipped with accessories for water or air flushing systems. Flushing the propeller hub area and the outer seal reduces the risk of sticking when mixing reactive slurries.

### Jet ring

The mixer can be used with or without jet ring. The jet ring improves the efficiency and directs the jet.

#### NOTE.

Operation without jet ring affects the power consumption.

## Motor data

### 4630.410

50 Hz, 1.5 kW, 3 phase  
8 pole, 705\* r/min

Voltage V	Rated current A	Starting current A
220	7.1	24
380	4.1	14
415	3.8	12
500	3.2	11
550	2.9	9
660	2.4	7
1000	1.7	6

\* 380 V

60 Hz, 1.9 kW (2.5 hp),  
3 phase, 8 pole, 855\*\* r/min

Voltage V	Rated current A	Starting current A
200	9.1	29
230	8.0	25
460	4.1	13
575	3.2	10
600	3.2	12
1100	1.7	6

\*\* 460 V

### 4640.410

50 Hz, 2.5 kW, 3 phase  
8 pole, 705\* r/min

Voltage V	Rated current A	Starting current A
220	12	41
380	6.8	23
415	6.2	21
500	5.1	17
550	4.7	16
660	3.9	13
1000	2.7	9

\* 380 V

60 Hz, 3.0 kW (4.0 hp),  
3 phase, 8 pole, 860\*\* r/min

Voltage V	Rated current A	Starting current A
220	14	50
230	13	41
460	6.3	20
575	5.1	17
600	5.0	19
1100	2.7	9

\*\* 460 V

## Materials

		DIN	BS	AISI/ ASTM
Major castings:	Cast iron	1691 GG 25G	1452 Grade 260	A48 No 35B
Protective sleeve, Propeller, Jet ring, Support, Fixing plate, Lifting device:	Carbon steel	17100 RST 37-2	4360 Grade 40B	A284 Grade D A 573
	Stainless steel	17440 X5CrNiMo 18 12	970 316 S16	Grade 65 316
	Proacid 254	—	—	UNS S31254
Shaft:	Stainless steel	17440 X20Cr13	970 420 S37	420
Oil housing, Propeller cover, Guiding rollers:	Vynylester DMC glass-fiber	—	—	—
O-rings, Cable entry bushings:	Nitrile rubber (NBR) 70°IRH (black) Fluorinated-rubber (FPM) 70°IRH (green or black with a violet dot) Hydro-genated nitrile rubber (HNBR) 71°IRH (black with three blue dots)	—	—	—
Screws:	Stainless steel	17440 X5CrNiMo 18 12	970 316 S16	316
	Proacid 254	—	—	UNS S31254
Inner seals:	Mechanical face seals Ceramic/Carbon ( $Al_2O_3/Csb$ ) Ceramic/Cemented carbide ( $Al_2O_3/WCCo$ ) Lip seal Nitrile rubber (NBR) 70°IRH	—	—	—
Outer seals:	Cemented carbide/Cemented carbide (WCCo/WCCo) Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide (WCCR/WCCR) Silicon carbide/Silicon carbide (RSiC/RSiC)	—	—	—

## Weights

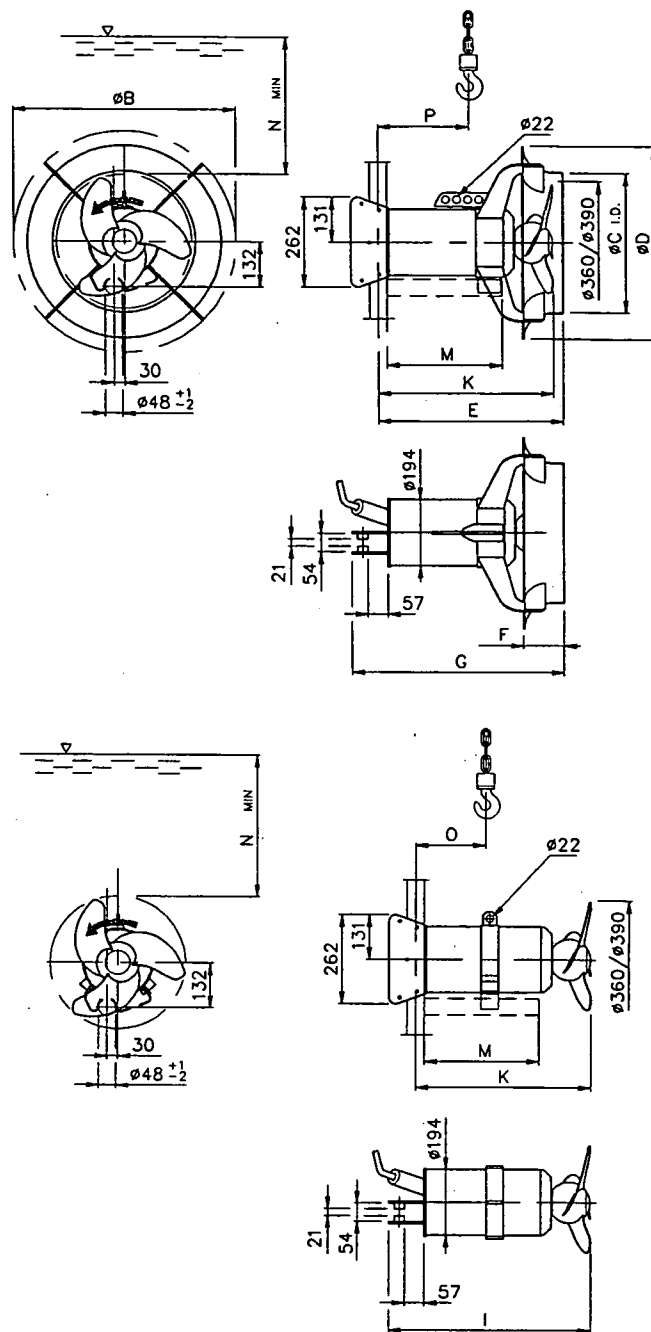
\*Weight without motor cable:

**4630** 56 kg (123 lb), with jetring  
47 kg (104 lb), without jetring

**4640** 64 kg (141 lb), with jetring  
55 kg (121 lb), without jetring.

## Dimensions

All dimensions are in mm.



### 4630

PROP.	B	C	D	E	F	G	I	K	M	N	O	P
Ø360	595	375	517	486	106	564	544	466	292	700	200	250
Ø390	642	405	559	494	117	573						

### 4640

PROP.	B	C	D	E	F	G	I	K	M	N	O	P
Ø360	595	375	517	523	106	602	584	506	332	800	200	250
Ø390	642	405	559	534	117	613						

# TRANSPORTATION AND STORAGE

The mixer may be transported and stored in a vertical or horizontal position. Make sure that it cannot roll or fall over.

## WARNING!

Always lift the mixer by the lifting eye,  
never by the motor cable.

# INSTALLATION

## Safety precautions

In order to minimize the risk of accidents in connection with the service and installation work, the following rules should be followed:

1. Never work alone. Use a lifting harness (part No. 84 33 02), a safety line (part No. 84 33 03) and a respirator (part No. 84 33 01), as required. Do not ignore the risk of drowning!
2. Make sure that there is sufficient oxygen and that there are no poisonous gases present.
3. Check the explosion risk before welding or using electric hand tools.
4. Do not ignore health hazards. Observe strict cleanliness.
5. Bear in mind the risk of electrical accidents.
6. Make sure that the lifting equipment is in good condition.
7. Provide a suitable barrier around the work area, for example a guard rail.
8. Make sure that you have a clear path of retreat!
9. Use a safety helmet, safety goggles and protective shoes.
10. All personnel who work with sewage systems should be vaccinated against diseases that can occur.
11. A first-aid kit must be handy.

Follow all other health and safety rules and local codes and practices.

## NOTE!

In order to avoid accidents, warning signs, for rotating propellers and machines that start automatically must be positioned visibly.

The area in the proximity of the machines should be fenced off.

## Handling equipment

Lifting equipment is required for handling the mixer.

The lifting device should not have a lifting capacity which is greater than twice the weight of the mixer.

Oversized lifting equipment could cause damage if the mixer gets stuck when being lifted.

Make sure that the lifting equipment is securely anchored.

## WARNING!

Keep clear of suspended loads.

## Installation alternatives

Flygt supplies equipment for a method of installation which permits mixing over the horizontal and the vertical plane.

Avoid installations where:

- there are obstacles in front of the mixer,
- the flow on the suction side of the mixer is obstructed due to the design of the tank,
- the propeller can suck down air.

This is an absolute requirement for continuously operating mixers.

The mixer can be mounted on fixed structures, pillars, stands, gratings, on an anchored raft etc.

When installing, keep in mind the reaction force of the mixer, which can be up to 1600 N for 4630 and 900 N for 4640.

### NOTE!

**All welded joints must be pickled and polished before they come into contact with the liquid.**

In all installations, make sure that the motor cable cannot be drawn into the propeller.

Run the cables so that they do not have any sharp bends and are not pinched.

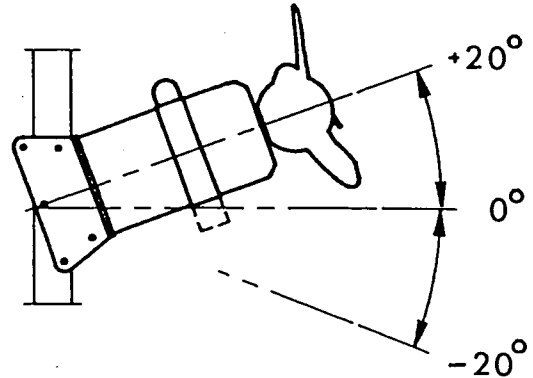
NOTE! The end of the cable must not be submerged. Leads have to be above flood level, as water may penetrate through the cable into the junction box or the motor.

Consult your nearest Flygt representative regarding:

- choice of peripheral equipment.
- other problems in connection with installation.

## Installation in horizontal or angle position on the guide bar

The mixer can be installed on the guide bar in horizontal position or with standard angle of approx  $\pm 10^\circ$  or  $\pm 20^\circ$ . For other angles contact Flygt.



Always test that the mixer will go easily up and down on the guide bar, before the mixer has been lowered to the desired working depth.

### NOTE

**If the mixer is operated without jet ring there must be a stop function on the guide bar to avoid the propeller from being swung into the wall during operation.**

# ELECTRICAL CONNECTIONS

All electrical work shall be carried out under the supervision of an authorized electrician.

Local codes and regulations must be observed.

## WARNING!

**All electrical equipment must be earthed (grounded). This concerns the machine as well as any control or monitoring equipment. It is an extreme danger to life not to follow the above warning. Ensure that the ground connection is actually completed back to ground by testing the ground circuit.**

Check that the voltage and frequency on the data plate agree with your actual power supply.

The motor cannot be connected for different voltages. If intermittent operation is prescribed (see data plate), the mixer should be provided with control equipment that provides such operation.

Under no circumstances may the starting equipment be installed in direct connection with the tank.

To avoid leakage into the mixer, check:

- that the cable entry seal sleeve and washers conform to the outside diameter of the cable. See the parts list. Always measure the cable diameter.
- that the outer sheath on the cable is not damaged. When refitting a cable which has been used before, **always** cut off a short piece of the cable so that the cable entry sleeve does not seal onto the cable at the same point again.

**NOTE!** For safety reasons, the earth lead should be longer than the phase leads. If the motor cable is jerked loose by mistake the earth lead should be the last to come loose from its terminal. This applies to both ends of the cable.

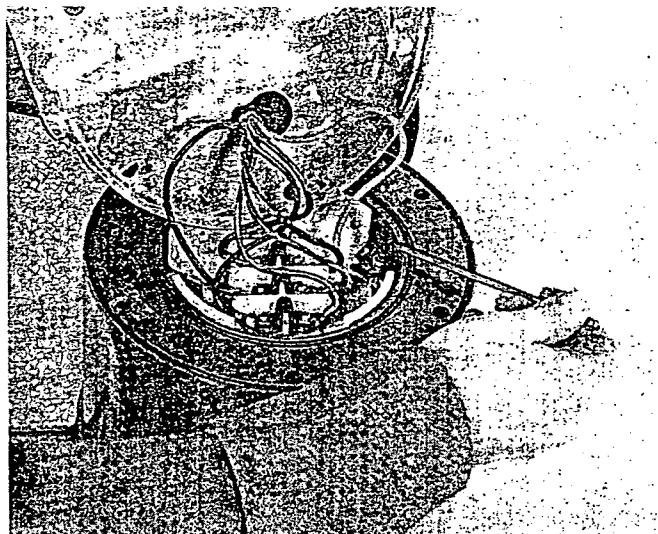
Check on the data plate which connection, Y or , is valid for the voltage supply. Then, depending on voltage, arrange the connection on the terminal board in accordance with Y.

## Motor cable

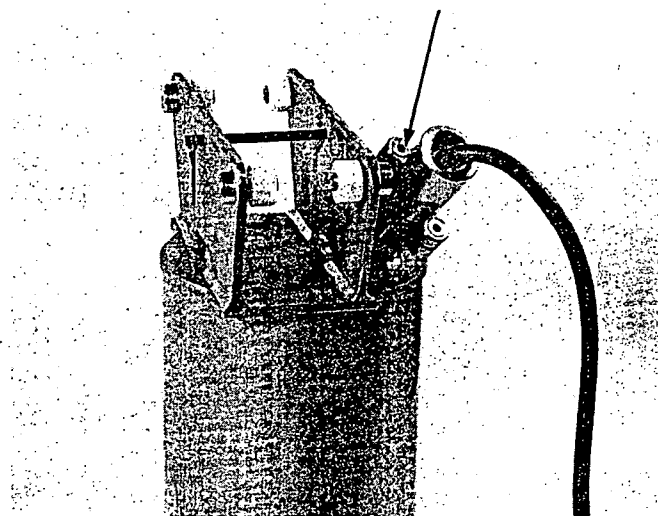
The motor cable is a SUBCAB, SUBCAB AWG or a chemically resistant cable type HCR.

Connect the motor cable to the terminal board as illustrated in the figure "Direct on line start".

Connect the leads from the motor control circuit to T1 and T2.



Make sure that the mixer is correctly earthed (grounded).



Tighten the screws (6) so that the cable entry unit forms an effective seal.

Connect the motor cable to the starter equipment. Check the direction of rotation, see "Before starting".

If the direction of rotation is wrong, transpose two of the phase leads.

Remember that the starting surge can be up to 3.5 times higher than the rated current. Make sure that the fuses or circuit breakers are of the proper amperage.

The table (see "Product Description") gives rated current and starting current. Fuse amperage and cable must be selected in accordance with local rules and regulations.

**NOTE!** With long cables, the voltage drop must be taken into consideration, since the motor's rated voltage is the voltage measured at the terminal board in the mixer.

The overload protection (motor protection breaker) shall be set to the motor's rated current as given on the data plate.

With a clockwise phase sequence L1-L2-L3 (R-S-T), the propeller will rotate correctly, i.e. clockwise as viewed from the motor side. Check the phase sequence in the main (line) using a phase sequence indicator.

### Stator connection

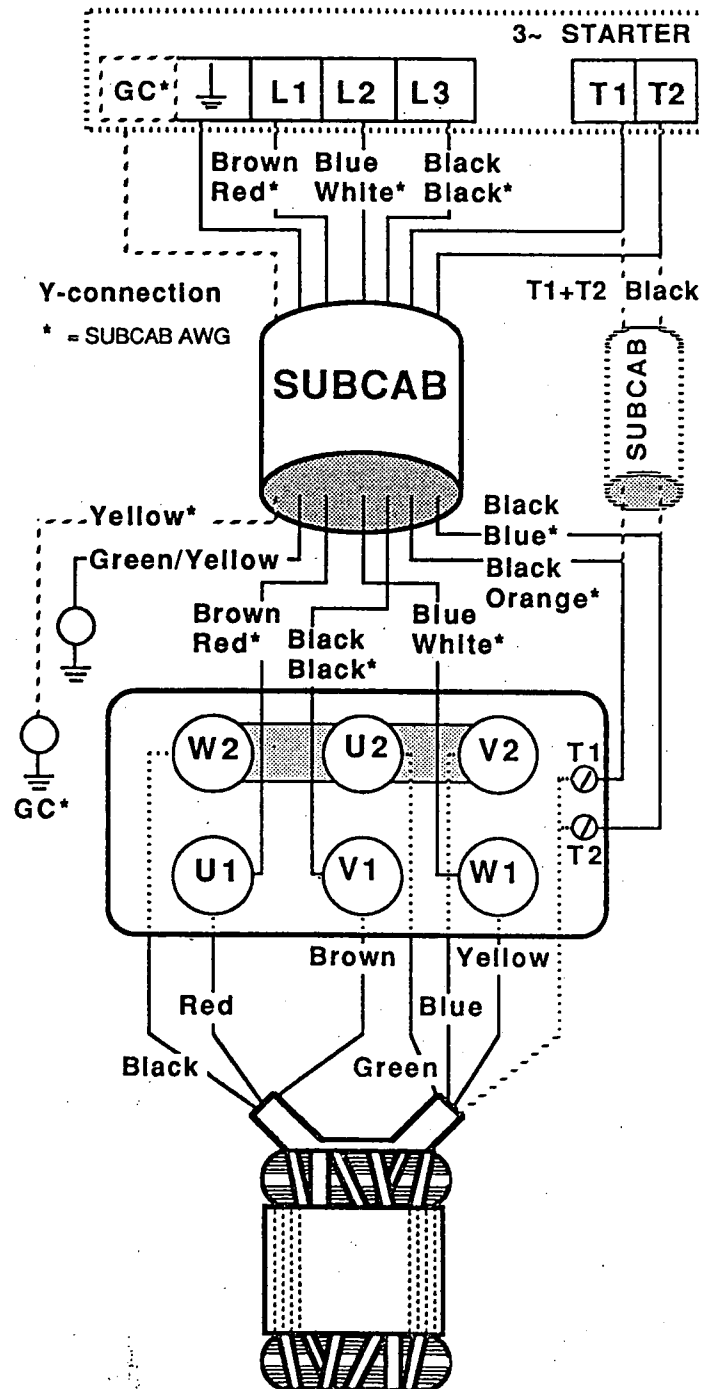
The stator leads are colour-marked as follows:

U1—red	V1—brown	W1—yellow
U2—green	V2—blue	W2—black
U5—red	V5—brown	W5—yellow
U6—green	V6—blue	W6—black

Two thermal switches are incorporated in the stator and are normally closed. The thermal switches can be connected to maximum of 250 volts, breaking of 4 amps. current at maximum.

**Leads not in use must be isolated.**

### Direct on line start



# OPERATION

## Before starting

Check that the oil level reaches up to the oil hole.

Remove the fuses or open the circuit breaker and check that the propeller can be rotated by hand.

Check that the cable entry is securely tightened.

Check that the monitoring equipment (if any) works.

Check the direction of rotation. See the figure. The propeller should rotate clockwise, as viewed from the motor side.

**NOTE!** Propeller rotating in wrong direction reduce life time of the mixer.

The mixer shall be fixed to the guide bar during test start.

## During operation

**WARNING!** Watch out for the propeller in rotation. The mixer is intended to operate with or without jet ring, due to its main application area. Operating without jet ring means that strict carefulness must be observed at test starting and in operation.

Test-run the mixer and note the current surge during start-up. At the instant of starting, it is normal for the current to exceed the operating current by 10—20 % for a few seconds. The steady-state current should be less than the rated current.

Excessive current consumption may be caused by high viscosity or density of the liquid or an improperly adjusted mixer.

Check excessively that the mixer does not vibrate. Vibration can occur when mixing is too vigorous in a small tank volume, or when the inflow or outflow of liquid is impaired, by unbalanced propellers or by air sucked down by the propeller.

Vibration can also occur due to interference between several mixers.

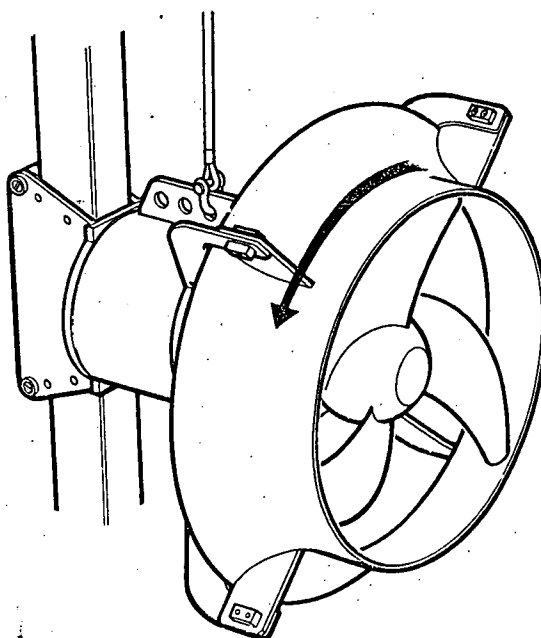
For another operating direction for the mixer, contact Flygt.

Make sure that the mixer works completely submerged in the liquid.

In continuous operation, air must not be drawn down by the propeller (a vortex must not form).

### WARNING!

Watch out for the propeller and for the starting jerk, which can be powerful.



# CARE AND MAINTENANCE

The numbers in parentheses are item numbers and refer to the exploded view on the inside cover.

## Safety precautions

**Warning!**  
Before starting work on the mixer, make sure that the mixer is isolated from the power supply and cannot be energized.

To prevent injury watch out for damaged and worn parts.

NOTE! This applies to the control circuit as well.

The following points are important in connection with work on the mixer:

- make sure that the mixer has been thoroughly cleaned.
- observe good personal hygiene.
- beware of risk of infection.
- follow local safety regulations.

The mixer is designed for use in liquids which can be hazardous to health. In order to prevent injury to the eyes and skin, observe the following points when working on the mixer:

- Always wear goggles and rubber gloves.
- Rinse the mixer thoroughly with clean water before starting work.
- Rinse the components in water after disassembly.
- Hold a rag over the oil casing screw (124) when removing it. Otherwise, pressure that may have built up in the mixer due to leakage of liquid into the mixer may cause splatter into the eyes or onto the skin.

Proceed as follows if you get hazardous chemicals in your eyes:

- rinse immediately in running water for 15 minutes. Hold your eyelids apart with your fingers.

— contact an eye doctor.

on your skin:

- remove contaminated clothes.
- wash skin with soap and water.
- seek medical attention if required.

## Inspection

### Inspections and service intervals

Regular inspection and preventive maintenance ensure more reliable operation. The maintenance schedule below gives the recommended period of time when the mixer should pass inspection and major

overhaul.

The maintenance schedule is divided into two groups

Group	Temperature	Wearing	Inspection	Major overhaul
A	40°C (104°F)	None or moderate	Every 8000 hours or once a year	Once every five years or every 50 000 hours
B	40°C - 90°C (104°F-194°F)	None or moderate	Every 4000 hours or twice a year	Once every two years or every 20 000 hours or when inspect. indicates.

A and B depending on temperature and wearing.

Major overhaul of the mixer should be made in a service workshop.

Tendency to clog can easily be observed by means of an amperemeter.

NOTE! Check the propeller. If the propeller is hard worn, the motor can be overloaded.

### Inspection

Inspection involve that following will be checked and measured if required;

- replacement of all worn components.
- check all screw connections.
- check quantity and condition of the oil.
- check if there is liquid in the stator casing.
- check the cable entry and the cable.
- functional check of the start equipment.
- functional check of monitoring equipment.
- check of direction of rotation.
- check the lifting device and guide bars (check for play and wear).
- check of electrical insulation.
- replacement all O-rings with are removed for inspection.
- check and rinse the space around the seals. See also "Recommended inspection"

### Workshop overhaul

This requires special tools and should be done by an authorized service shop. Workshop overhaul involves in addition to the inspection, that the following will be measured; replacement of bearing, replacement of shafts seals, replacement of oil, replacement of O-rings, replacement of seals in cable entry and move the entry position of the cable, replacement of cable.

### Service contract

Flygt or its agent normally offers service agreements in accordance with a preventive maintenance plan. For further information, please contact your Flygt representative.



## Recommended inspections

Inspection of	Action
Visible parts on mixer and installation	<p>Replace or fix worn and damaged parts.</p> <p>Make sure that all screws, bolts and nuts are tight.</p> <p>Check the condition of lifting device/lifting eyes, chains and wire ropes.</p> <p>Check that the guide bar is vertical.</p> <p>Replace worn parts if they impair function.</p>
Oil quantity	<p><b>WARNING.</b> If the seal leaks, the oil casing may be under pressure. Hold a rag over the oil casing screw in order to prevent splatter. See "Safety precautions" for additional information.</p> <p>Check that the oil reaches up to the oil plug, when the mixer is horizontal.</p> <p>A check of the condition of the oil can show whether there has been an increased leakage. Check the oil by removing the oil drainage screw. Leave the oil filling screw in place in order to restrict the flow. As the oil separates the water, the liquid coming out first will tell the leakage. Tap until clear oil is coming out.</p> <p>If the leakage is less than 0.05 ml/h, the seal functions normally. Refill the tapped volume.</p> <p>If the leakage is more than 0.05 ml/h, refill the oil. Run the mixer for one week and check the oil again. If leakage is more than 0.05 ml/h the fault may be:</p> <ul style="list-style-type: none"> <li>— that the outer mechanical seal (85) is damaged. Contact a Flygt service shop.</li> </ul> <p>Unscrew the counter socket screw marked "INSP" and the stator inspection plug (125). Be careful, not to damage the O-ring (25). Check if there are any liquid in the stator casing.</p>
Liquid in the stator casing	<p><b>WARNING.</b> If there has been leakage, the stator casing may be under pressure. Hold a rag over the inspection screw to prevent splatter. See "Safety precautions" for additional information.</p> <p>Remove the counter socket screw marked "INSP". Remove the inspection plug (125) and the O-ring (25). Be careful, not to damage the O-ring (25).</p> <p>Tilt the mixer so that any liquid in the stator casing can run out through the hole.</p> <p>If there is liquid in the stator casing:</p> <ul style="list-style-type: none"> <li>— check that the inspection screw "INSP" is sufficiently tight.</li> <li>— check if the cable entry is leaking.</li> <li>— check if there is water in oil.</li> </ul> <p>Check stator inspection plug again after one week. If the stator casing contains liquid again, the fault may be:</p> <ul style="list-style-type: none"> <li>— that the inner seal (80) is damaged.</li> </ul> <p>Contact a Flygt service shop.</p>

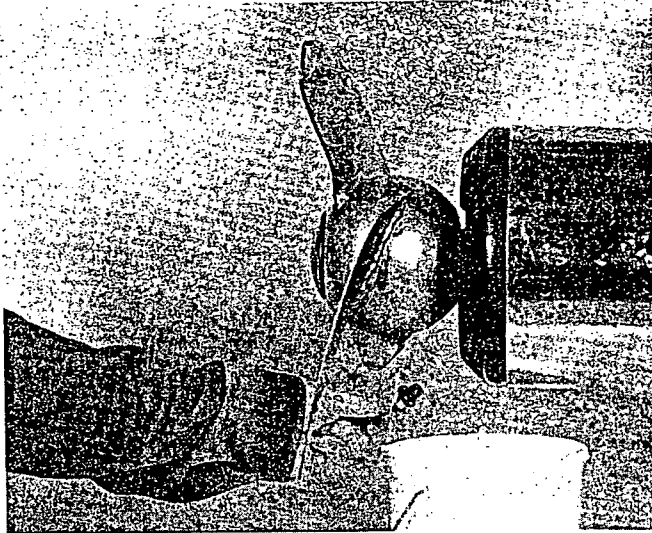
Inspection of	Action
Cable entry	<p>Make sure that the cable clamps are tight.</p> <p>If the cable entry leaks:</p> <ul style="list-style-type: none"> <li>— check that the entry is tightened and forms an effective seal.</li> <li>— cut a piece of the cable off so that the seal sleeves (112) seals onto a new position on the cable.</li> <li>— replace the seal sleeves (112).</li> <li>— check that the gasket (111), seal sleeves (112) and the washers (113), conform to the outside diameter of the cable.</li> </ul>
Cable	<p>Replace the cable if the outer sheath is damaged.</p> <p>Make sure that the cables do not have any sharp bends and are not pinched.</p> <p>Starter equipment If faulty, contact an electrician.</p>
Monitoring equipment (should be checked often)	<p>Follow the instructions for monitoring equipment.</p> <p>Check:</p> <ul style="list-style-type: none"> <li>— signals and tripping function.</li> <li>— that relays, lamps, fuses and connections are intact.</li> </ul> <p>Replace defective equipment.</p>
Rotation direction of propeller (requires voltage)	<p>Transpose two phase leads if the propeller does not rotate clockwise as viewed from the motor side. Rotation in the wrong direction reduces the capacity of the mixer and the motor may be overloaded. Check the direction of rotation every time the mixer is reconnected.</p>
Insulation resistance in the stator	<p>Use insulation tester. With a 1000 V-DC megger the insulation between the phases and between any phase and earth (ground) should be less than 1 MΩ.</p>

## Changing the oil

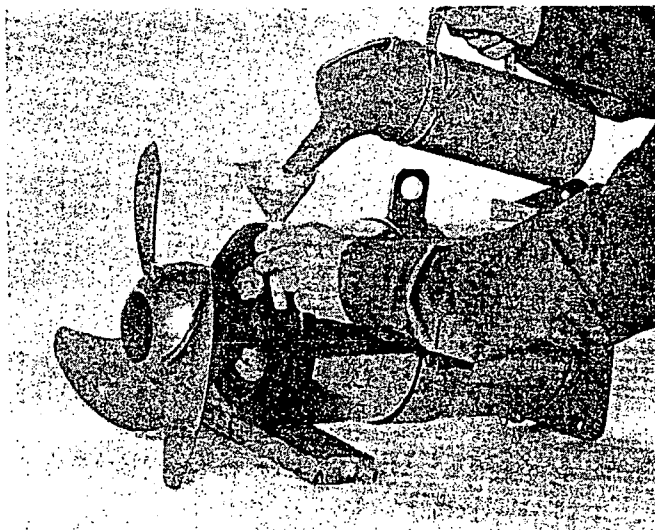
**WARNING.** If the seal leaks, the oil casing may be under pressure. Hold a rag over the oil casing screw to prevent splatter — unscrew the screw.

Lay the mixer over two supports or suspend the mixer horizontally from an overhead crane.

Keep a container underneath the screw to catch the oil when the screw is removed.



Unscrew the oil draining screw (124).  
Put the oil casing screw back.  
It is easier to drain the oil if the oil filling hole screw is also removed.



Fill up with new oil (0.6 litres) in the oil filling hole, the mixer should be in a horizontal position. Always replace the O-rings (24) of the oil hole screws. Put the screws back and tighten them. Tightening torque 10 - 20 Nm (7.4 - 15 ft lb).

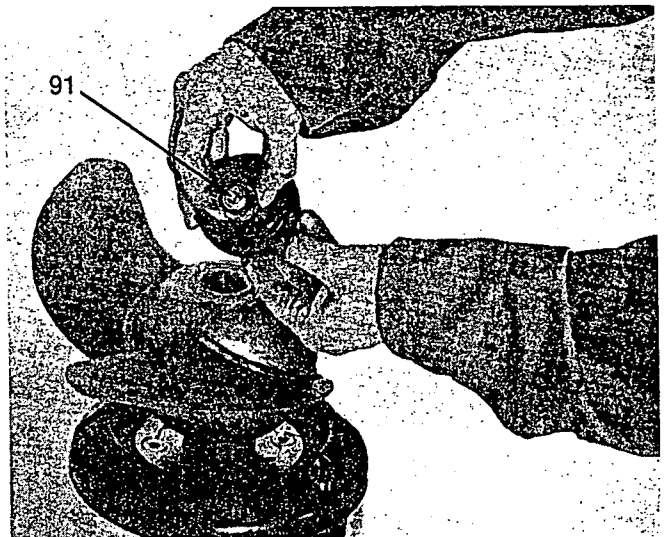
A paraffin oil approved by authorities is recommended (the mixer is delivered from factory with Mobil Whiterex 309).

In applications where more poisonous properties of mineral oil is of less concern, a mineral oil without additives and with viscosity less than ISO VG32 can be used.

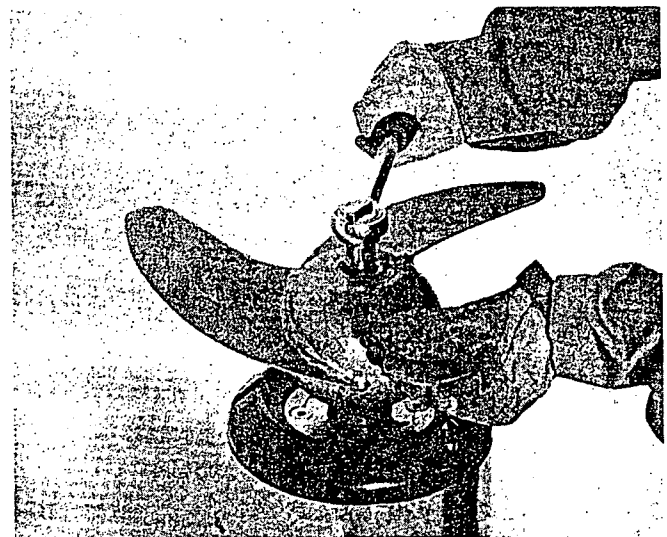
## Replacing the propeller

### Removing the propeller

**WARNING!** Worn propeller often has very sharp edges.



Remove the protective cover (94) and the O-ring (26).  
NOTE, the socket wrench (91). (You need it for all counter socket screws).

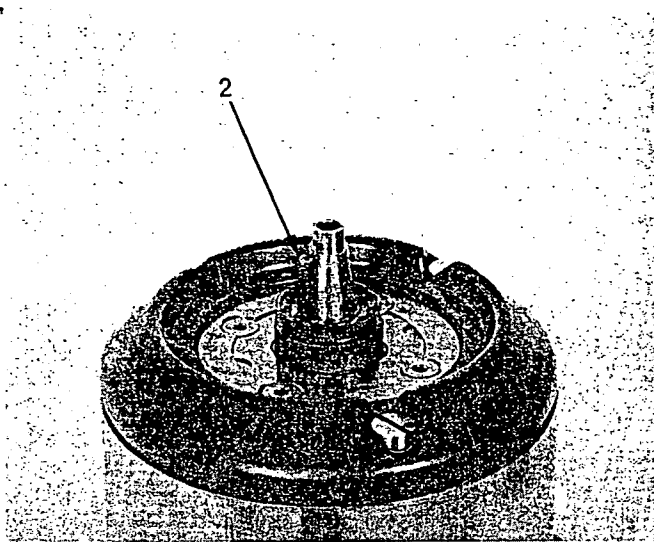


Unscrew the propeller screw (8). The propeller is self pulling.

Lift off the propeller

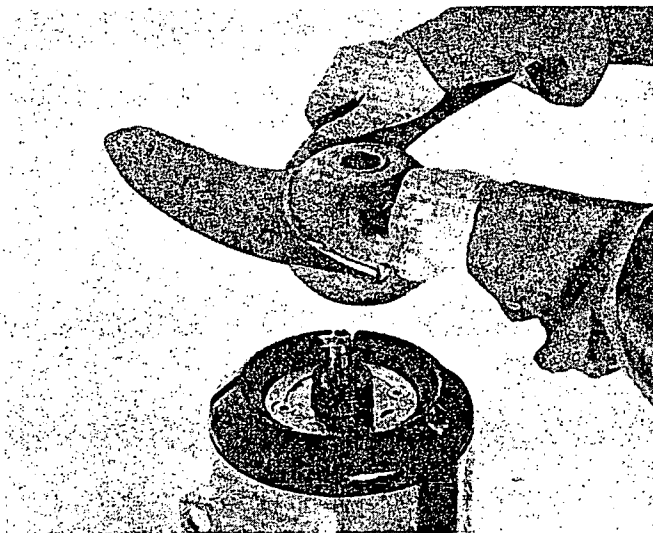
## Installing the propeller

Make sure that the end of the shaft is clean and free of burrs. Polish off any flaws with fine emery cloth. Grease the end of the shaft and the propeller hub.

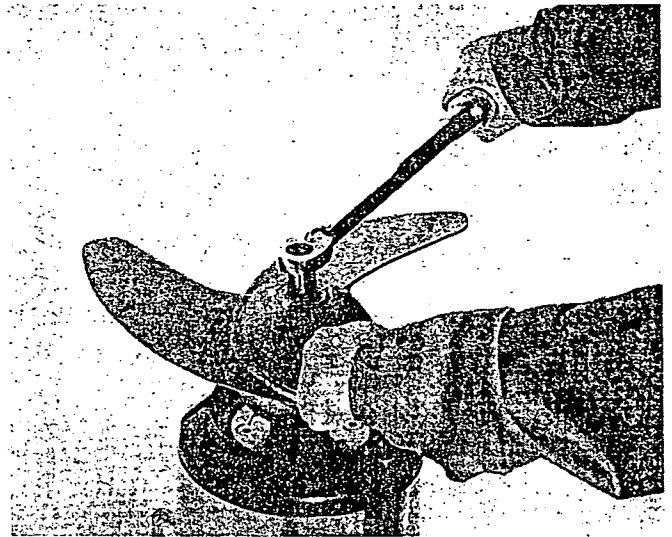


Check:

- that the parallel key (2) is seated in the key way on the shaft.
- that the seal ring (80) is correctly positioned.

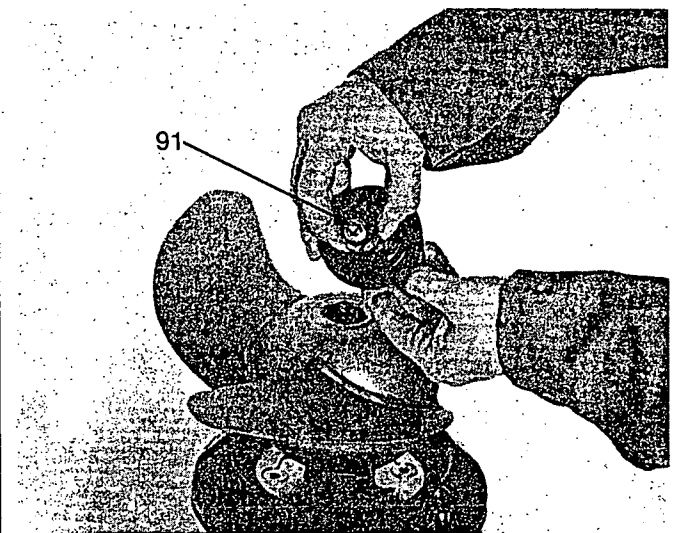


Push the propeller onto the shaft.



Place the washer (93) onto the propeller screw. Fit the propeller screw. Mount the washer (92) and secure it by a circlip (41). If the washers and the propeller screw already are assembled, all you need to do is to tighten the propeller screw.

Tightening torque 136 Nm (100 ft lb).

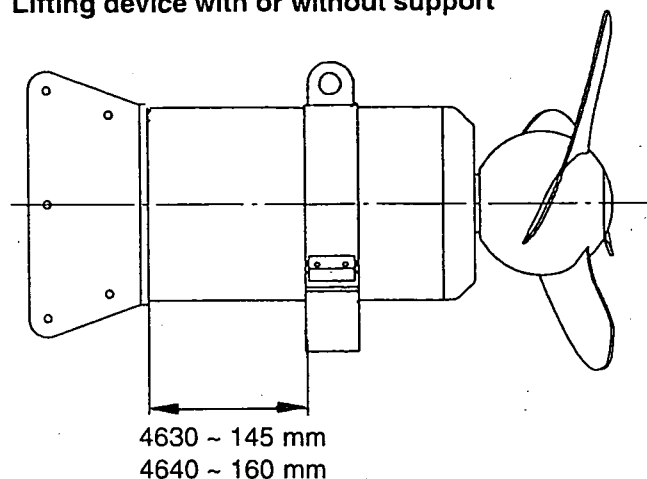


Fit the O-ring (26) and mount the protection cover (94). Don't forget to put the socket wrench (91) back. Check that the propeller can be rotated by hand.

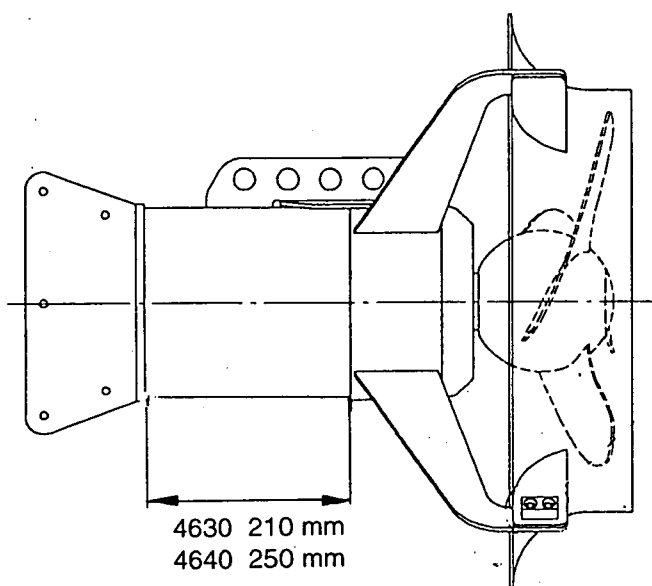
Tightening torque for all the socket head screws are 44 Nm (33ft lb). Screw threads shall be lubricated with grease (90 18 00) before assembly.

In all applications the screws will be tightened alternatively so that maximum measure difference between the both sides not exceed 2 mm.

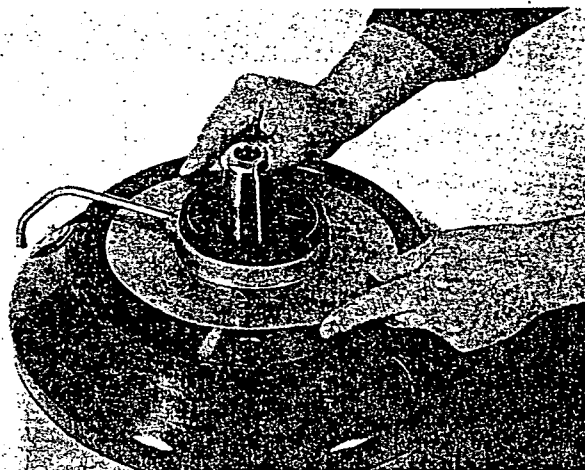
## Lifting device with or without support



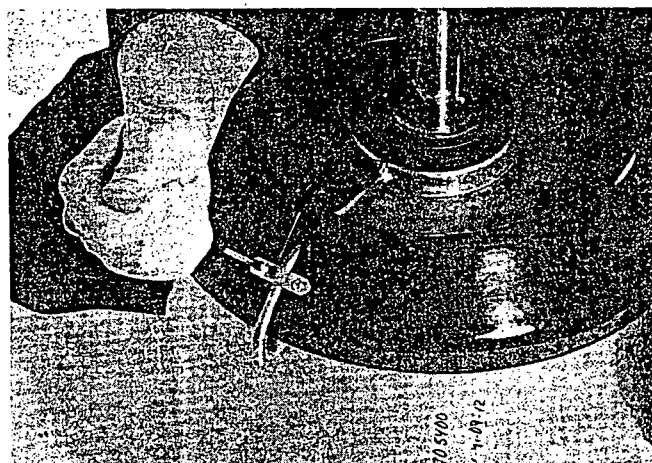
## Lifting device and jet ring with or without support



## Installing of flushing device



NOTE. Install the flushing device before the propeller. Mount the cover (142) and the seal ring (141) and tighten the screws (140).



Mount the clamp (143) and connect a hose. An armoured hose size 1/4" is recommended for flushing.

## ACCESSORIES AND TOOLS

### Flushing media/volume

The flush protected propeller hub can be flushed with air, water or other suitable media.

Recommended minimum flow for continuous flushing is:

Flow media	Flow l/min	
	min	max
Water	0.5	—
Air	10	20

It is important for the result to keep the minimum flow. Use a flow regulator.

For more information contact Flygt.

### Start and control equipment

Flygt has suitable starting and control equipment for the mixer. Contact Flygt for further information.

#### Tools

Besides ordinary standard tools, the following tools are required in order to perform the necessary care and maintenance of the mixer:

Order No.	Description
84 20 30	Socket wrench
84 15 66	Torque wrench 0 - 137 Nm (0 - 101 ft lb)
84 15 64	Torque wrench 50 - 225 Nm (37 - 166 ft lb)

For further information on tools, see Flygt's Tool Catalogue.

## Fault Tracing (Troubleshooting)

A universal instrument (VOM), a test lamp (continuity tester) and a wiring diagram are required in order to carry out fault tracing on the electrical equipment.

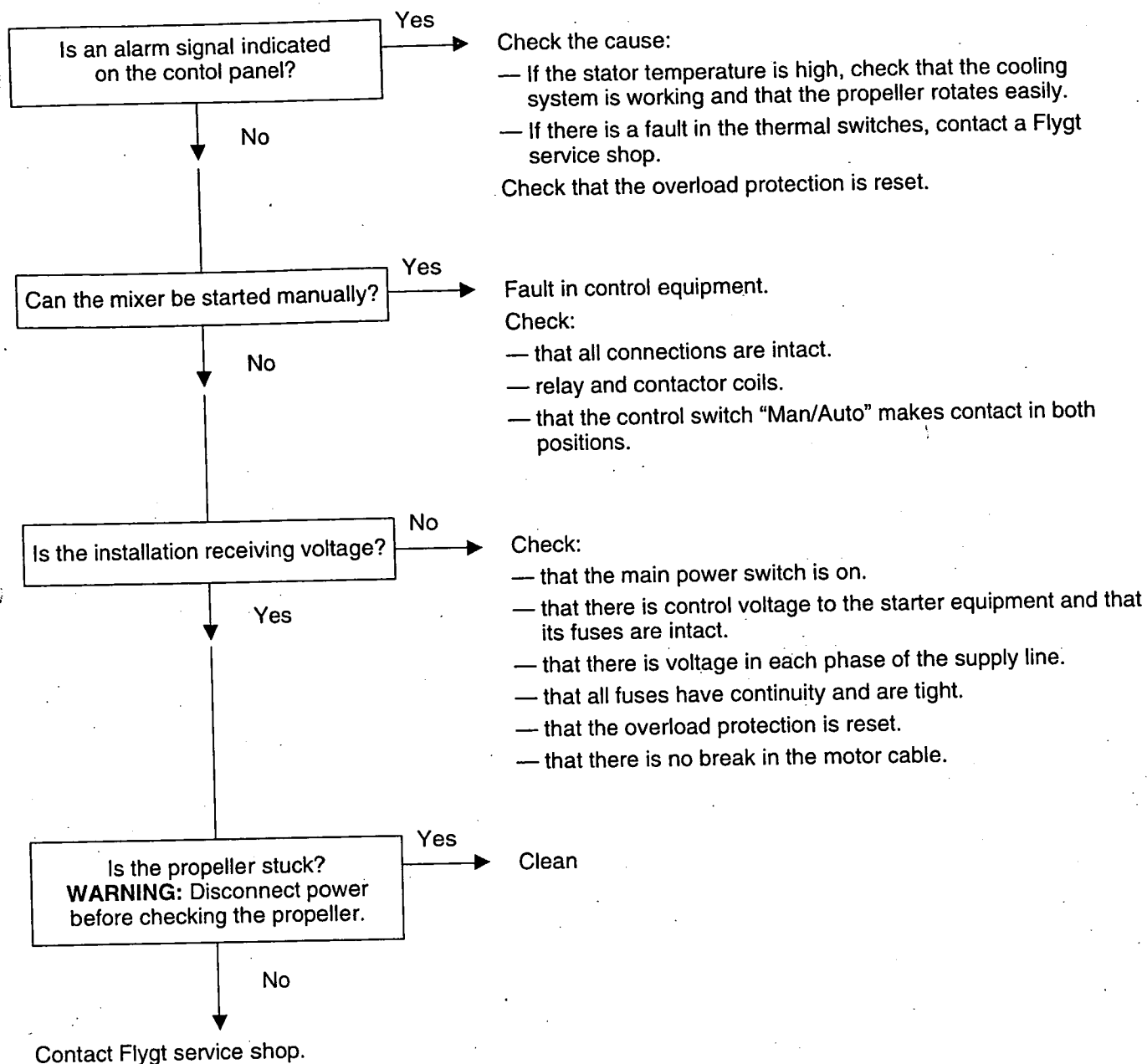
Fault tracing should be done with the power supply disconnected and locked off, except for those checks which cannot be performed without voltage.

Always make sure that there is no one near the mixer when the power supply is turned on.

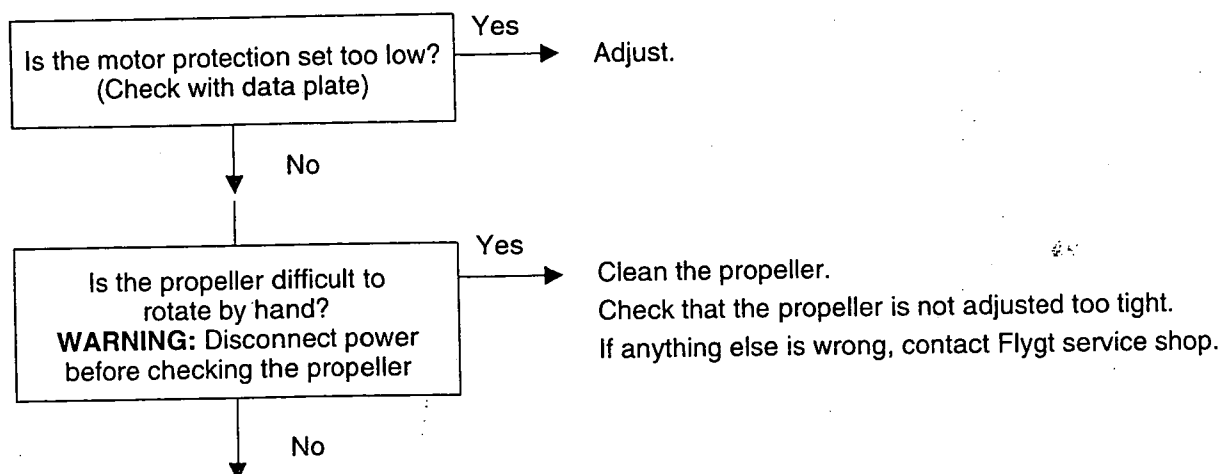
Use the following checklist as an aid to fault tracing. It is assumed that the mixer and installation have formerly functioned satisfactorily.

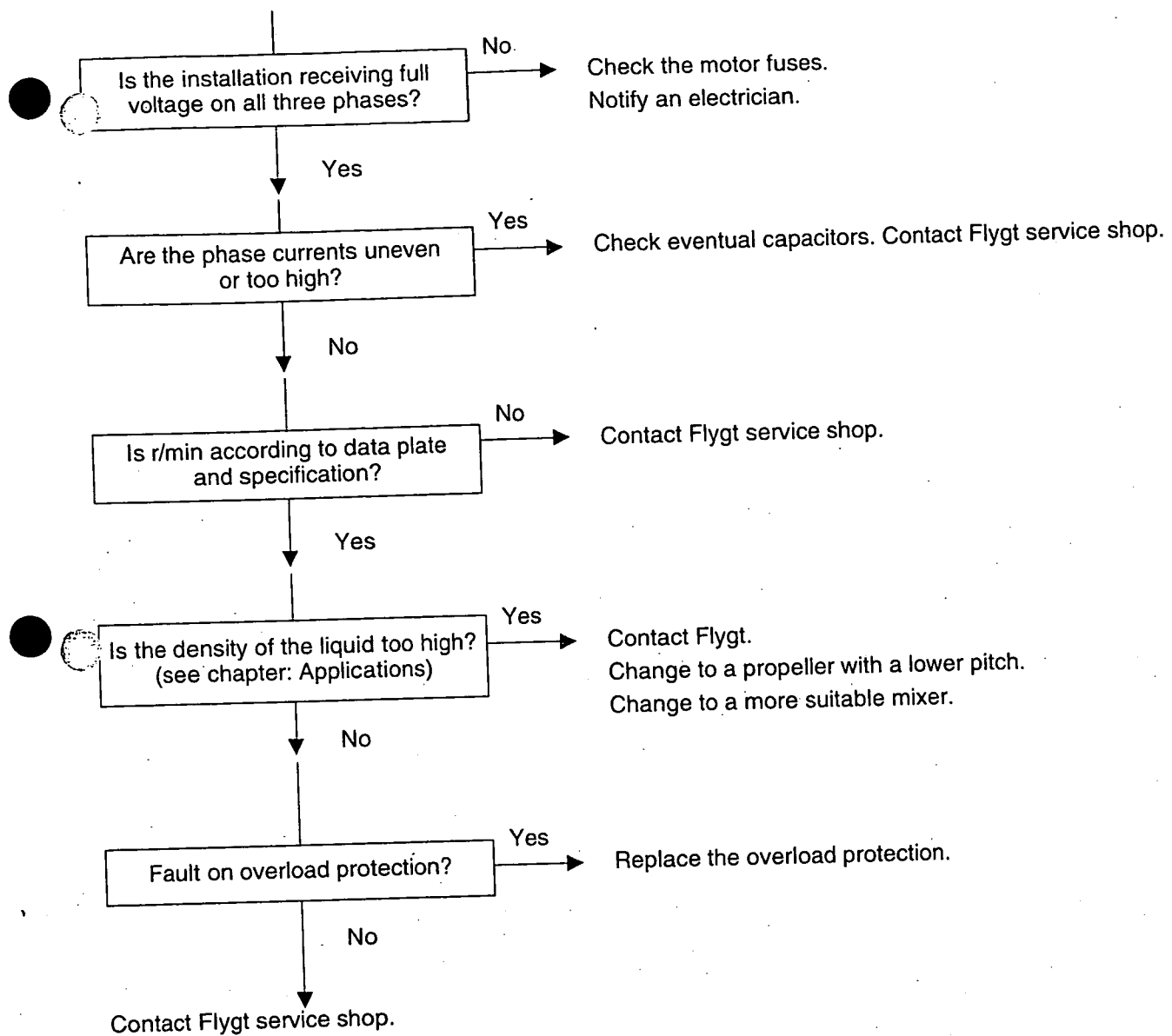
Electrical work should be performed by an authorized electrician.

Follow local safety regulations and observe recommended safety precautions.

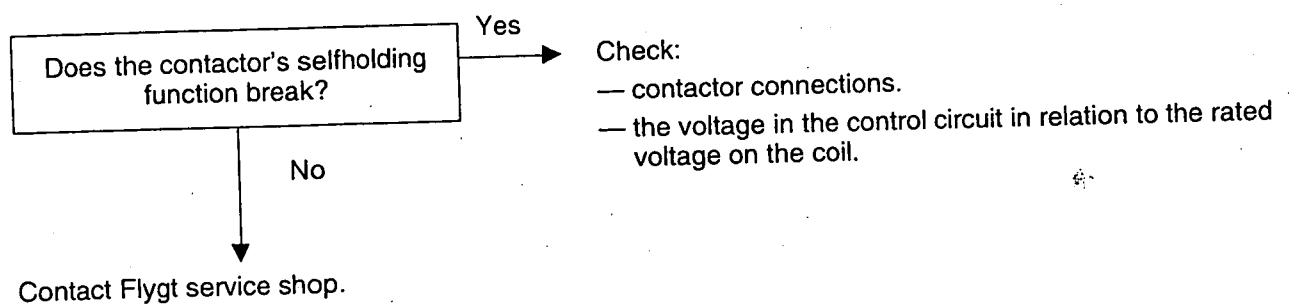


## 2.The mixer starts but motor protection trips





### 3.The mixer starts-stops-starts in rapid sequence

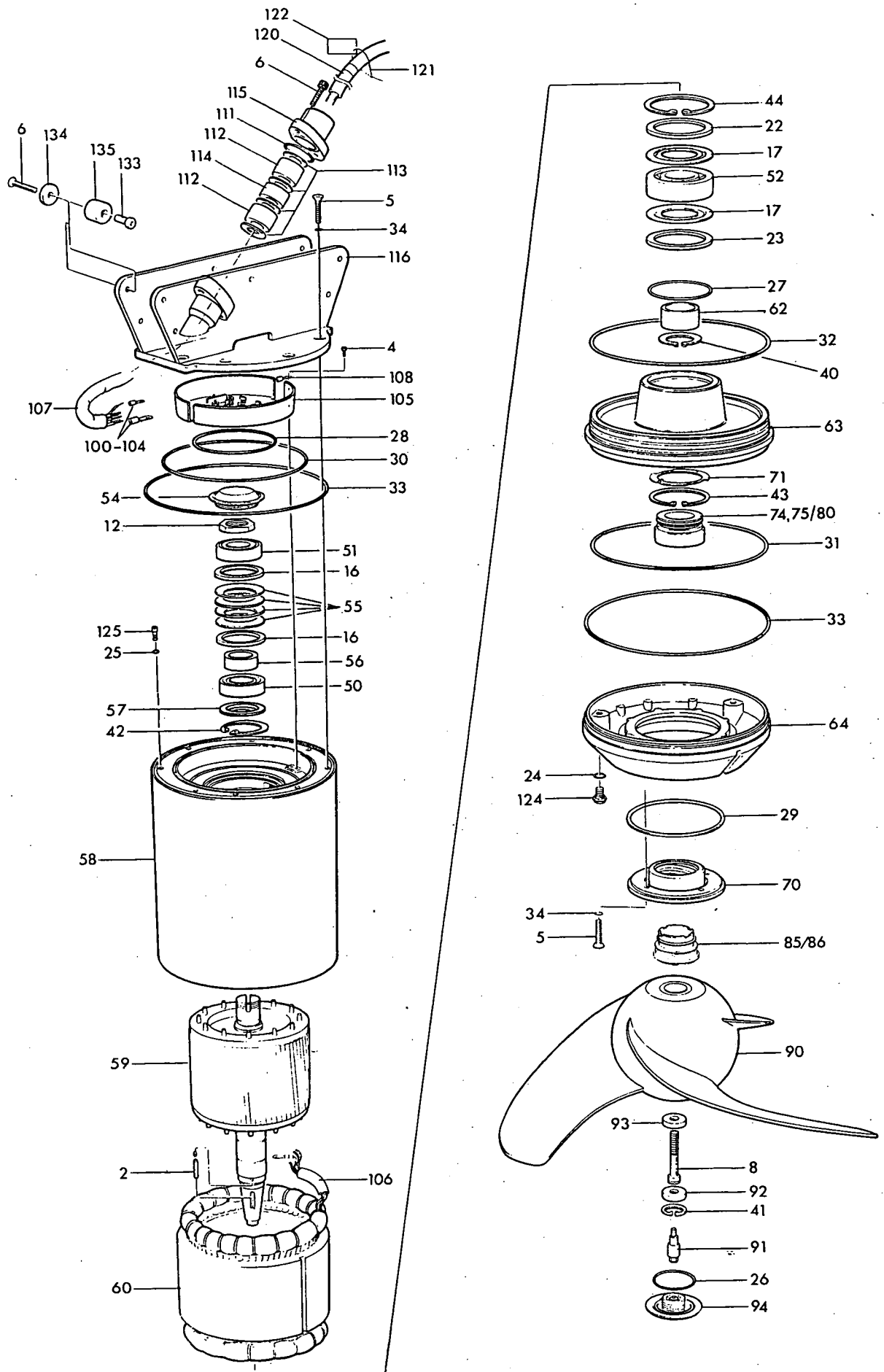


**Do not override the motor protection repeatedly if it has tripped.**



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The logo for FLYGT, featuring the word "FLYGT" in a bold, sans-serif font, followed by a stylized arrow pointing to the right.

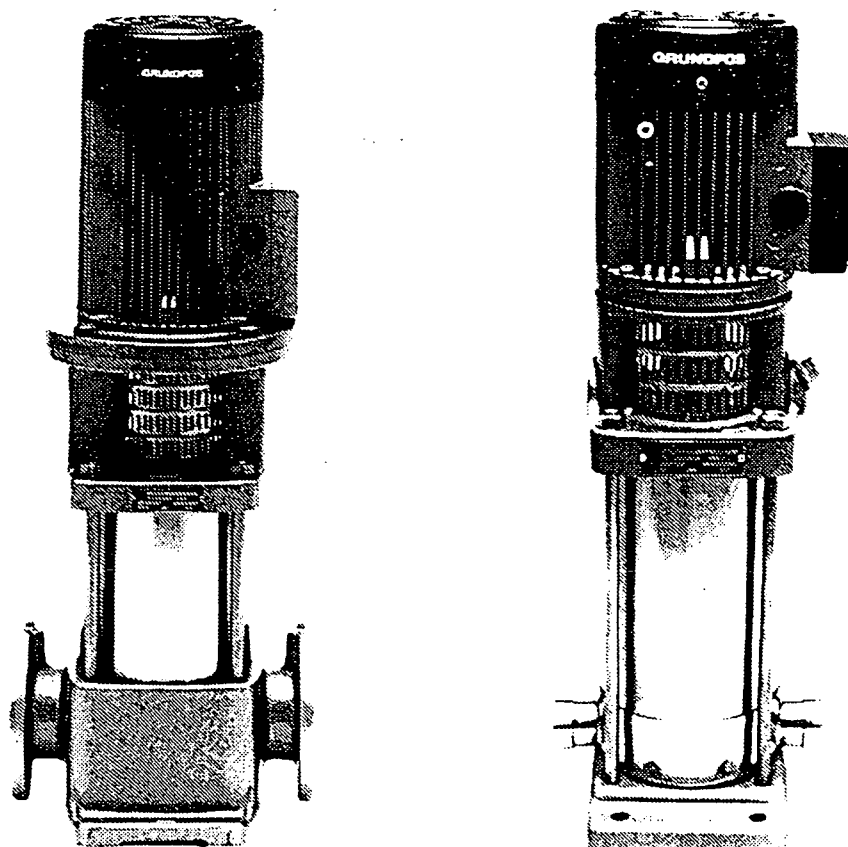
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# CR and CRN

## Installation and Operating Instructions



**GRUNDFOS®**



## General Information

- Isolating valves should be fitted either side of the pump to prevent the system being drained in case it is necessary to clean or repair the pump.
- If pumps are installed in concrete buildings or close to living accommodation, it is advisable to fit anti-vibration mountings on the suction and discharge sides of the pump and between foundation and pump to prevent vibration being transmitted through the pipework.
- Install the pump so that it is not stressed or strained by the pipework, especially tension caused by variation in the water temperature.
- If the pumps are installed in long pipes, these should be adequately supported before and after the pump.
- If there is any danger of the pump running against a closed valve in the discharge pipe, a bypass should be fitted on the discharge side of the pump to ensure that adequate cooling and lubrication water is circulated through the pump (a minimum flow equal to 10% of the nominal flow is needed at all times).
- If the pump is to be drained for a long period of inactivity, remove one of the coupling guards to inject a few drops of silicone oil on the shaft between the pump head and the coupling. This will prevent the shaft seal faces from 'sticking' when the pump is to be used again.

Subject to alterations.

## Applications

GRUNDFOS multistage in-line centrifugal pumps, types CR and CRN, are designed for a wide range of applications:

### CR

Transfer and boosting of cold and hot clean water in water supply systems, irrigation systems, wash-down systems, fire fighting systems and boiler feed and condensate systems. Pumping of water/glycol mixtures up to 50% solution.

### CRN

Transfer and boosting of cold and hot clean water, softened water, demineralised water, brackish water, sea water (not badly polluted sea water, e.g. harbour water) and pool water.

When pumping liquids with densities higher than that of water, motors with correspondingly higher outputs must be used.

## Operating Range

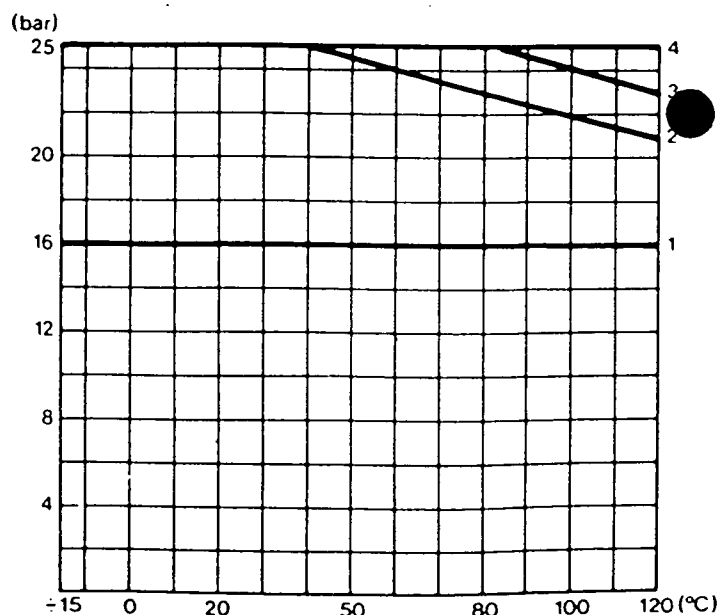
Ambient

Temperature: Up to 40°C.

Liquid

Temperature: – 15°C to + 120°C, see fig. 1, which indicates the relationship between liquid temperature and maximum operating pressure.

Fig. 1





**Maximum Permissible Operating****Pressure:** See fig. 1.

- Curve 1:** CR 2 with oval flanges  
 CR 4 with oval flanges  
**50 Hz:** CR 8-20/1 to CR 8-120  
 CRN 8-20/1 to CRN 8-120  
 CR 16-30/2 to CR 16-80  
 CRN 16-30/2 to CRN 16-80  
 CR 30-10 to CR 30-80  
 CR 60 all sizes  
**60 Hz:** CR 8-20/1 to CR 8-80  
 CRN 8-20/1 to CRN 8-80  
 CR 16-30/2 to CR 16-80  
 CRN 16-30/2 to CRN 16-80  
 CR 30-10 to CR 30-50  
 CR 60 all sizes

- Curve 2:** CR 2 with round flanges  
 CRN 2 all sizes  
 CR 4 with round flanges  
 CRN 4 all sizes

- Curve 3:** **50 Hz:** CR 8-140 to CR 8-200  
 CRN 8-140 to CRN 8-200  
 CR 16-100 to CR 16-160  
 CRN 16-100 to CRN 16-160  
**60 Hz:** CR 8-100 to CR 8-160  
 CRN 8-100 to CRN 8-160  
 CR 16-100  
 CRN 16-100

- Curve 4:** **50 Hz:** CR 30-110/9 to CR 30-160  
**60 Hz:** CR 30-80

**Minimum Inlet**

**Pressure:** According to the NPSH curve  
 + a safety margin of minimum  
 0.5 metres, see fig. 2, 3, 4, 5, 6  
 or 7.

The minimum inlet pressure (H) required at the pump suction flange to avoid cavitation is calculated as follows:

$$H = H_b - \text{NPSH} - H_f - H_D - H_s$$

$H_b$  = Barometric pressure in metres.  
 (In closed systems,  $H_b$  indicates  
 the system pressure in metres).

$$H_b = \frac{p_b}{\rho \times g} \text{ [m].}$$

$p_b$  = Barometric pressure in Pa.

$\rho$  = Density of liquid in kg/m<sup>3</sup>.

$g$  = Acceleration due to gravity  
=  $9.81 \text{ m/s}^2$ .

NPSH = Net Positive Suction Head  
(to be read from the NPSH curve in  
fig. 2, 3, 4, 5, 6 or 7 at the highest  
flow the pump will be delivering).

$H_f$  = Friction loss in suction pipe  
in metres.

$$H_f = \frac{\Delta p}{\rho \times g} \text{ [m]}.$$

$\Delta p$  = Loss of pressure in suction  
pipe in Pa.

$\rho$  = Density of liquid in  $\text{kg/m}^3$ .

$g$  = Acceleration due to gravity  
=  $9.81 \text{ m/s}^2$ .

$H_D$  = Vapour pressure (see fig. 8).

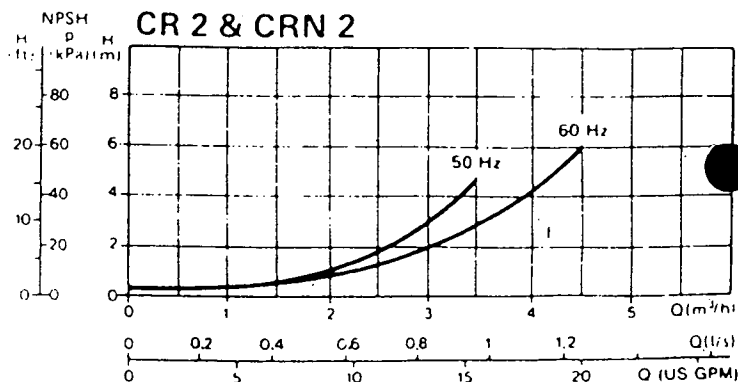
$H_S$  = Safety factor = 0.5 metres.

If the calculated  $H$  is positive, the pump can operate at a suction lift without cavitation.

If the calculated  $H$  is negative, the pump must operate at a static inlet pressure of  $H$  metres to avoid cavitation.

There must be a pressure equal to the calculated  $H$  during operation.

**Fig. 2** CR 2 & CRN 2



**Fig. 3** CR 4 & CRN 4

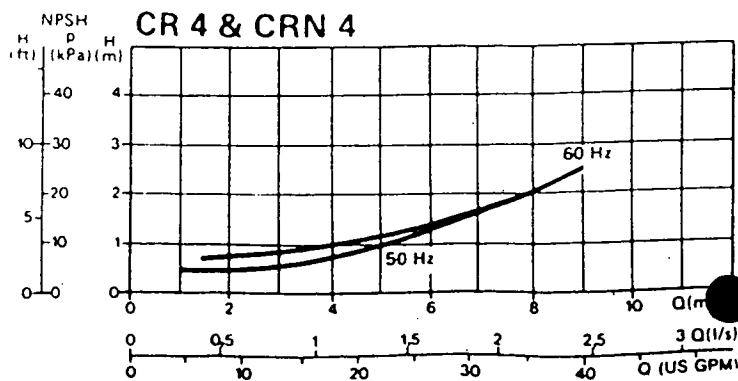


Fig. 4

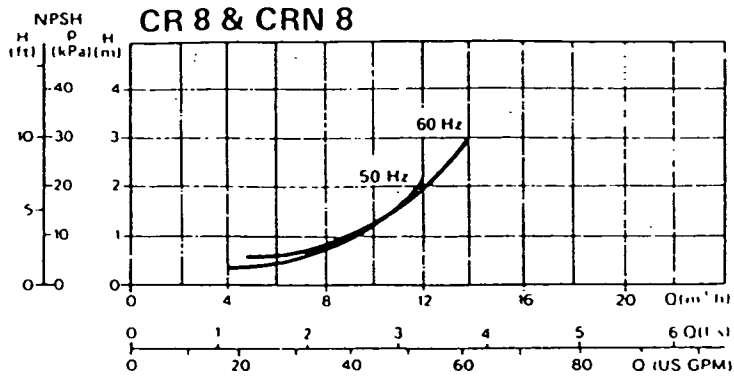


Fig. 5

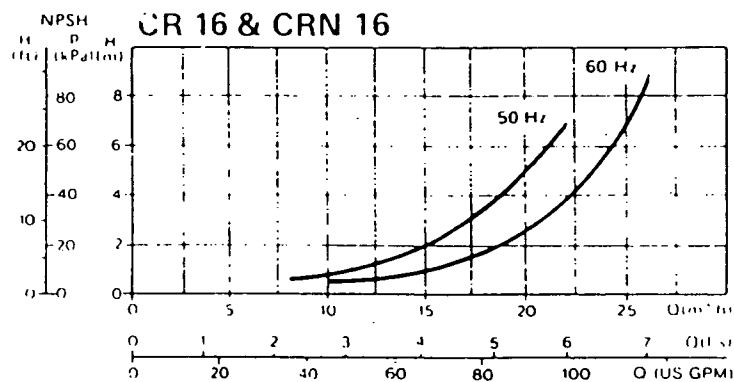


Fig. 6

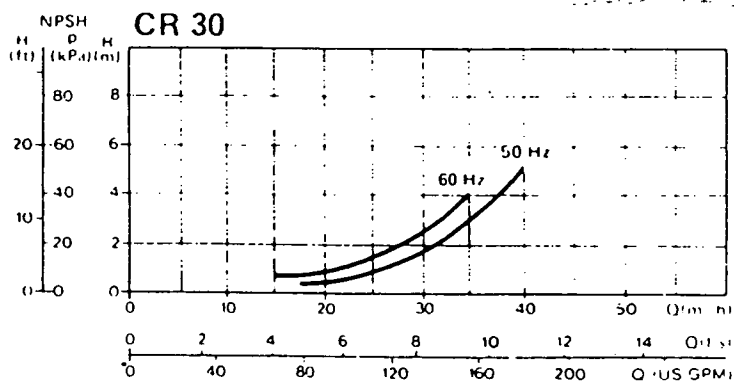


Fig. 7

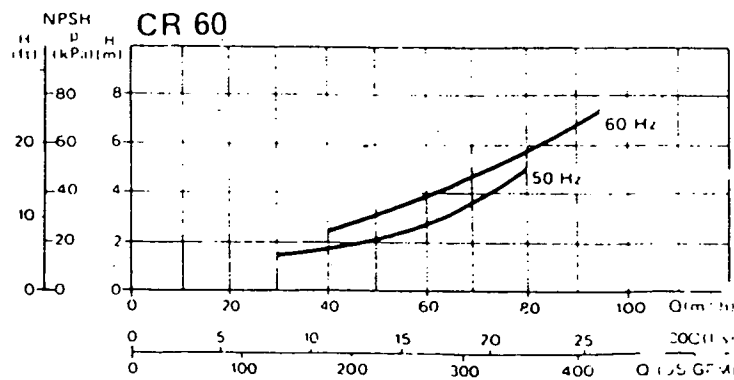
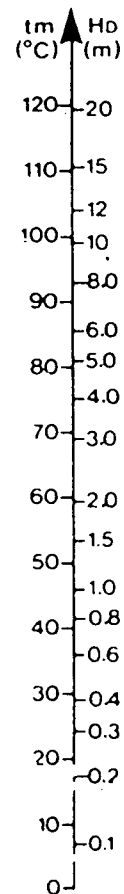


Fig. 8



**Example:**

$$p_b = 1013 \text{ mbars} = 101300 \text{ Pa.}$$

$$\rho = 965 \text{ kg/m}^3.$$

Pump type: CR 16.

Flow rate: 16 m<sup>3</sup>/h.

$$\Delta p = 0.3 \text{ bars} = 30000 \text{ Pa.}$$

NPSH (from fig. 5) = 1.7 metres.

Liquid temperature: 90°C.

H<sub>D</sub> (from fig. 8): 7.2 metres.

$$H_b = \frac{p_b}{\rho \times g} = \frac{101300}{965 \times 9.81} = 10.7 \text{ metres.}$$

$$H_f = \frac{\Delta p}{\rho \times g} = \frac{30000}{965 \times 9.81} = 3.2 \text{ metres.}$$

$$H = H_b - \text{NPSH} - H_f - H_D - H_s [\text{m}].$$

$$H = 10.7 - 1.7 - 3.2 - 7.2 - 0.5 = -1.9 \text{ metres.}$$

$$\text{Required pressure in Pa: } H \times \rho \times g = -1.9 \times 965 \times 9.81 = -18000 \text{ Pa.}$$

$$\text{Required pressure in bars: } -18000 \times 10^{-5} = -0.18 \text{ bars.}$$

This means that a static inlet pressure of 1.9 metres (18000 Pa = 0.18 bars) is required during operation.

**Maximum Inlet Pressure:**

Inlet pressure + head at closed valve ≤ maximum permissible operating pressure.

<b>CR 2, 50 Hz</b>	<b>0.5 – 3.5 m<sup>3</sup>/h</b>
CR 2-20	7 bars
CR 2-30 to CR 2-110	10 bars
CR 2-130 to CR 2-260	15 bars
<b>CRN 2, 50 Hz</b>	<b>0.5 – 3.5 m<sup>3</sup>/h</b>
CRN 2-20	7 bars
CRN 2-30 to CRN 2-110	10 bars
CRN 2-130 to CRN 2-260	15 bars
<b>CR 2, 60 Hz</b>	<b>0.5 – 4.5 m<sup>3</sup>/h</b>
CR 2-20 to CR 2-60	10 bars
CR 2-70 to CR 2-180	15 bars
<b>CRN 2, 60 Hz</b>	<b>0.5 – 4.5 m<sup>3</sup>/h</b>
CRN 2-20 to CRN 2-60	10 bars
CRN 2-70 to CRN 2-180	15 bars

<b>CR 4</b>	<b>2 – 7 m<sup>3</sup>/h</b>	<b>7 – 8 m<sup>3</sup>/h</b>
CR 4-20/1 to CR 4-20 CR 4-30 to CR 4-220	6 bars 10 bars	6 bars 6 bars
<b>CRN 4</b>	<b>2 – 7 m<sup>3</sup>/h</b>	<b>7 – 8 m<sup>3</sup>/h</b>
CRN 4-20/1 to CRN 4-20 CRN 4-30 to CRN 4-220	6 bars 10 bars	6 bars 6 bars
<b>CR 8</b>	<b>6 – 12 m<sup>3</sup>/h</b>	
CR 8-20/1 to CR 8-30 CR 8-40 to CR 8-200	6 bars Limited by the maximum pressure limits, see fig. 1	
<b>CRN 8</b>	<b>6 – 12 m<sup>3</sup>/h</b>	
CRN 8-20/1 to CRN 8-30 CRN 8-40 to CRN 8-200	6 bars Limited by the maximum pressure limits, see fig. 1	
<b>CR 16</b>	<b>8 – 26 m<sup>3</sup>/h</b>	
CR 16-30/2 to CR 16-30 CR 16-40 to CR 16-160	6 bars Limited by the maximum pressure limits, see fig. 1	
<b>CRN 16</b>	<b>8 – 26 m<sup>3</sup>/h</b>	
CRN 16-30/2 to CRN 16-30 CRN 16-40 to CRN 16-160	6 bars Limited by the maximum pressure limits, see fig. 1	
<b>CR 30</b>	<b>15 – 40 m<sup>3</sup>/h</b>	
CR 30-10 to CR 30-160	Limited by the maximum pressure limits, see fig. 1	
<b>CR 60</b>	<b>30 – 95 m<sup>3</sup>/h</b>	
CR 60-20 to CR 60-80	Limited by the maximum pressure limits, see fig. 1	

## Installation

The pump should be installed with the motor shaft vertical, see fig 9, and so that an adequate air supply reaches the motor cooling fan.

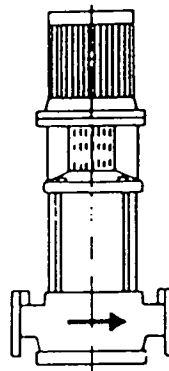


Fig 9.

Arrows on the pump base show the direction of flow of water through the pump.

For all other configurations please consult your GRUNDFOS office.

Install the pipes so that air locks are avoided, especially on the suction side of the pump. Shown in figure 10.

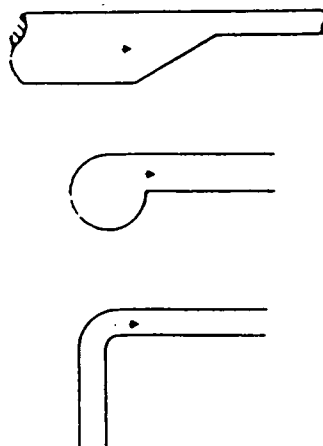


Fig 10.

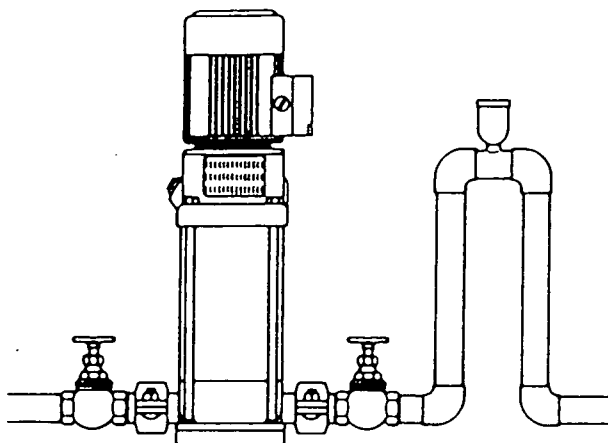
The pipes should be fitted so that any tension caused by variations in temperature does not affect the pump.

A loop with a vacuum valve can be fitted close to the pump if the discharge pipe is installed horizontally, or it slopes downwards away from the pump, which can or must be drained in certain periods, e.g. during periods of frost, see fig. 11

The highest point of the loop should at least be flush with the lower edge of the pump motor.

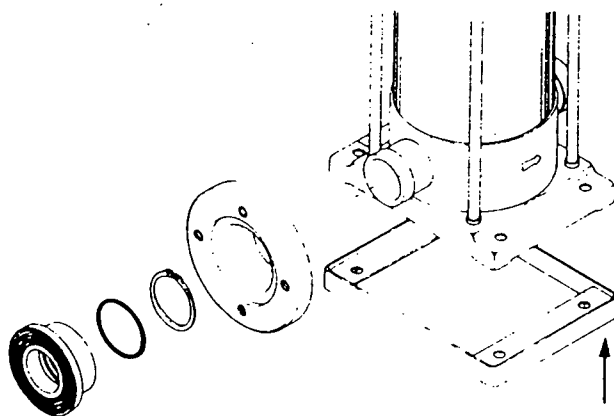
The discharge pipe can then be drained independently of the pump and vice versa.

**Fig. 11**



The pipes are connected to CRN pumps by means of DIN flanges, fig. 13, or PJE couplings, fig. 13. The PJE coupling kit is available with threaded sockets or sockets for welding.

**Fig. 13**



**Fig. 14**

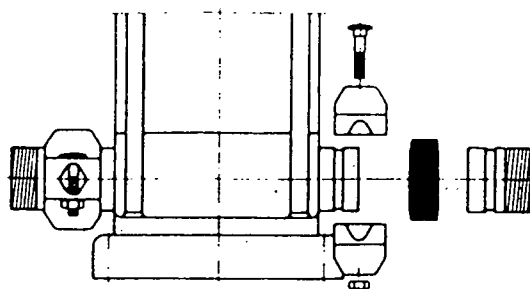


Fig. 15



## Electrical Connections

The electrical connections should be carried out by an authorised electrician in accordance with local regulations.

The operating voltage and frequency are marked on the nameplate. Make sure that the motor is suitable for the electricity supply on which it will be used.

Single phase motors have a thermal switch incorporated and require no further motor protection.

Three-phase motors must be connected to an approved motor starter.

The terminal box can be turned to four positions, in 90° steps. Remove the coupling guards, which are kept in position by spring tension. Remove the bolts holding the

pump and motor together. Turn the motor to the required

position. Replace and tighten the bolts. Refit the coupling guards.

Do not start the pump until it has been filled with liquid. The motor should be connected to the supply in accordance with the motor rating plate and the diagram in the terminal box cover with special attention to the frequency, voltage and direction.

Correct direction of rotation is always clockwise at the drive shaft end (coupling), fig 15.

## Starting

### Priming

Do not start the pump until it has been filled with liquid. **In closed systems** or open systems where liquid level is above the pump inlet, close the discharge isolating valve and remove the priming plug from the pump head, see fig. 16.

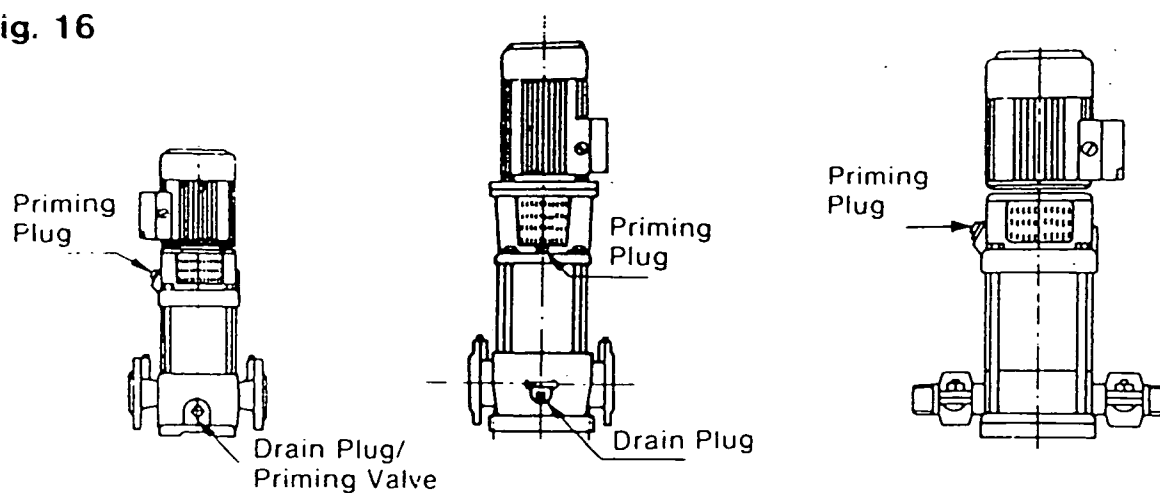
Gradually open the isolating valve in the suction pipe until

a steady stream of liquid runs out of the priming port.

Replace the priming plug and tighten securely.

Completely open the isolating valve(s).



**Fig. 16**

CR 2, CR 4

CR 8, CR 16, CR 30, CR 60

CRN

**In open systems** where the liquid level is below the pump inlet, the suction pipe must be filled with liquid and vented before the pump is started.

**CR 2, CR 4:** Close the discharge isolating valve. Slacken the small screw (spanner size 11) of the priming valve and pull it out against stop, see fig. 17.

Remove the priming plug. Pour liquid through the priming hole until the suction pipe and the pump are completely filled with liquid, see fig. 18. Push in and tighten the screw, see fig. 19.

**CR 8, CR 16, CR 30, CR 60 and all CRN pumps:** Close the discharge isolating valve. Remove the priming plug. Pour liquid through the priming hole (use a funnel) until the suction pipe and the pump are completely filled with liquid.

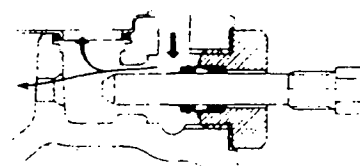
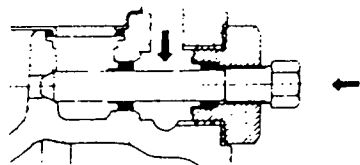
Air must be purged from the suction pipe while the pump is being filled if the suction pipe does not incline gradually away from the pump to the liquid level.

Filling may take place at the highest point of the suction pipe if this is above the priming plug of the pump.

Replace the priming plug and tighten securely.

## Checking Direction of Rotation

The correct direction of rotation is shown by arrows on the pump head and on a label on the motor fan cover. The pump should rotate counter-clockwise when viewed from above.

**Fig. 17****Fig. 18****Fig. 19**

## Frequency of Starts and Stops

Motors smaller than 4 kW should not start more than 100 times per hour.

Other motors should not start more than 20 times per hour.

## Maintenance

Pump bearings and shaft seal are maintenance-free.

Motors which are not fitted with grease nipples have prefilled bearings and do not require any separate lubrication.

Motors fitted with grease nipples should be lubricated with a lithium based grease.

## Frost Protection

Pumps which are not being used during periods of frost should be drained to avoid damage.

Remove the priming plug in the pump head and the drain plug/priming valve in the base and allow the pump to drain. In the case of CRN pumps, separate the pipes from the pump.

Do not replace the plugs and connect the pipes until the pump is to be used again.

Before refitting the priming valve in CR 2 and CR 4 pumps, slacken the small screw of the valve (spanner size 11) and pull it out against stop.

The valve is then fitted by tightening the large union nut (spanner size 27).

## Fault Finding Chart

Fault	Cause
1. Motor does not start when the motor starter is operated.	a) Supply failure. b) Fuses blown. c) Motor starter overload has tripped out. d) Main contacts in starter are not making contact or the coil is faulty. e) Control circuit fuses are defective.
2. Starter overload trips out immediately when supply is switched on.	a) One fuse is blown. b) Contacts in overload are faulty. c) Cable connection is loose or faulty. d) Motor winding is defective. e) Pump stiff and not free to run. f) Overload setting too low.
3. Motor starter overload trips out occasionally.	a) Overload setting too low. b) Periodic supply failure. c) Low voltage at peak times.
4. Pump does not run when starter is operated.	a) Check 1 a), b), d) and e).
5. Pump capacity not constant.	a) Suction pipe is too small. b) Insufficient water is available at the pump inlet. c) Water level is too low. d) Water level above the pump is too low in relation to water temperature, loss in pipes and required quantity of water. e) Suction pipe partly blocked by impurities. f) Pump takes in air.
6. Pump runs but gives no water.	a) Suction pipe blocked by impurities. b) Foot or non-return valve blocked in closed position. c) Leakage in suction pipe. d) Air in suction pipe or pump.
7. Pump runs backwards when switched off.	a) Leakage in suction pipe. b) Foot/non-return valve defective. c) Foot valve blocked in open or partly open position. d) Air pockets in suction pipe.
8. Noise and/or leakage in shaft seal.	a) Pump shaft positioned too low.

**GRUNDFOS®**  
Leaders in Pump Technology



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# SERVICE MANUAL

## Screw Compressor

**Model: SX 3 / 7,5 bar**

Part No.: 1.7227.20200

Serial No.: .....

Index: 050215

GL-Nr.: BA-SX3.L-1.7227.20200-00

**KAESER KOMPRESSOREN GmbH**

D-96410 Coburg • Postfach 2143 • Tel. (09561) 640-0 • Fax.(09561) 640-130

**Declaration of Conformity**  
within the meaning of machinery directive 89/392/EU, appendix II A**D****We hereby declare that the machine/unit of****type:** stationary screw compressor unit  
(with electric motor drive)**part number:** 1.7227.20200**make:** Kaeser**serial number:****model:** SX 3**conforms, in the specification supplied by us, to the following relevant conditions, in particular:**

89/392/EU: Directive for machinery

73/23/EU: Directive for low voltage

87/404/EU: Directive concerning simple unfired pressure vessels

89/336/EU: Directive concerning electromagnetic compatibility

**Harmonised standards applied, in particular:**

prEN 1012-1: Compressors - safety requirements

EN 292-1 and 2: Safety of machinery

EN 294: Safety of machinery - safety distances

EN 286-1: Simple unfired pressure vessels

EN 60204-1: Safety of machinery - electrical equipment

EN 50081-2: Electromagnetic compatibility - radio interference transmission

EN 50082-2: Electromagnetic compatibility - radio interference suppression

**National technical standards and specifications applied, in particular:**

- Equipment safety act

- Equipment safety act regulations

Coburg

30.11.1994

Location

Date

  
Executive signature  
(Dipl.-Wi.-Ing. Thomas Kaeser)

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# Technical Specification

## 1 Technical Specification

### 1.1 Compressor Unit

Permissible gauge working pressure ..... 7,5 bar  
 Operating temperature approx. .... 75 – 85 °C  
 Weight ..... 110 kg

#### Drawings:

Dimensional drawing ..... T 7495.5  
 P & I flow chart ..... FSX3STL-0495/00001  
 (Pipework and instrument flow chart)  
 Electrical diagram ..... SX3-0195/00113

### 1.2 Sound Pressure Level

#### Operational state of the compressor unit:

Full load, the compressor unit runs at: rated speed, rated pressure, rated capacity.

#### Setting up conditions:

Free field measurement

#### Statement of sound pressure level:

Measurement to DIN 45635 (measurement of noise on machines, compressors)

- 1 m distance
- 1.6 m height
- Related point of measurement: centrally in front of the cooling air inlet

Highest sound pressure value ..... 67 dB (A)

### 1.3 Motor

#### Compressor motor:

Rated power ..... 2,2 kW  
 Rated speed ..... 1500 min<sup>-1</sup>  
 Specification class ..... IP 54  
 Max. cut-in frequency per hour ..... 15 times

#### V belt set:

Part number ..... 6.2575.0

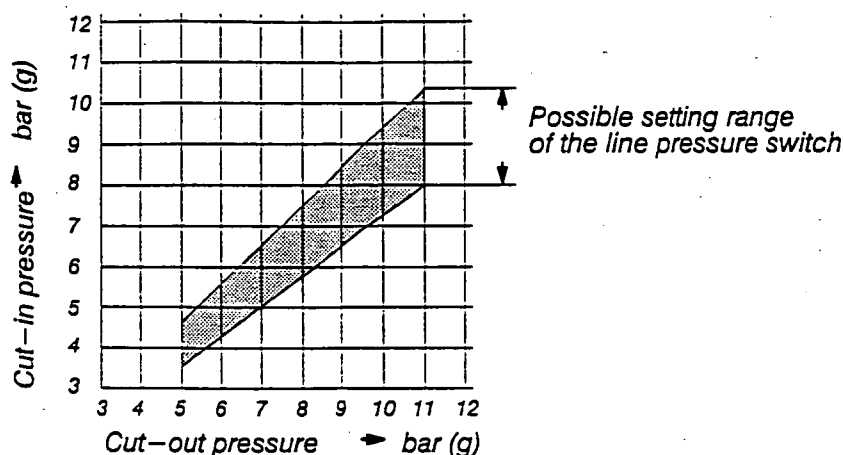
### 1.4 Electrical Connection

Mains voltage ..... 415 V 3~/PE  
 Frequency ..... 50 Hz  
 Max. mains fusing (slowblow or gl class) ..... 10 A  
 Power supply cable core cross-section ..... 4 x 1,5 mm<sup>2</sup>  
 (CU multiple core cable)

## Technical Specification

 Maximum rated current  $I_N$  ..... 6 A

### 1.5 Setting Value of the Mains Pressure Switch



#### Settings made at the works:

Cut-in pressure ..... 7 bar  
 Cut-out pressure ..... 7,5 bar  
 Differential pressure  $\Delta p$  ..... 0,5 bar

### 1.6 Setting Value of the Safety Relief Valve

Activating pressure ..... 9 bar

### 1.7 Installation Requirements

Max. height above sea level of the place of installation .. 1000 m  
 Min. ambient temperature ..... 3 °C  
 Max. ambient temperature ..... 40 °C  
 Min. cooling air/inlet air temperature ..... 3 °C  
 Max. cooling air/inlet air temperature ..... 40 °C  
 Air inlet opening ..... 0,1 m<sup>2</sup>  
 Exhaust air for solution A (see chapter 6.1):  
 Forced ventilation with exhaust ventilator ..... 1000 m<sup>3</sup>/h at 10 mm WS  
 Exhaust air for solution B (see chapter 6.1):  
 Exhaust air used for space heating:  
 Heating duct b x h ..... 150 x 340 mm

### 1.8 Oil Volumes

Total volume of oil ..... 2 l

#### After oil change or after long period of storage

Part volume for topping up the airend ..... 0,1 l

## Technical Specifications

### 1.9a Oil Recommendations - Synthetic S-460

KAESER screw compressors are filled with the following suitable type of cooling oil. Synthetic Oil can be used as an alternative to Kaeser Mineral Oil M-460. Compressors can be supplied with synthetic oil for an extra charge. If extended warranty applies synthetic lubricant S-460 must be used. The use of other synthetic lubricants will void the warranty.

#### **KAESER SIGMA-screw compressor oil S 460**

This cooling oil can also be recommended for use under extreme operating conditions such as gaseous contamination of the inlet air and at high ambient temperatures above 45°.

#### **Topping up the oil:**

Always use the same type of oil from the same producer

#### **Oil change and change of oil type:**

Drain all the oil from the oil separator tank, cooler and oil lines.

When changing from another cooling oil to KAESER SIGMA-screw compressor oil S 460, ensure that the compressor unit is completely drained before refilling with new oil. As far as possible, any deposits in the system should be removed. After changing to KAESER SIGMA-screw compressor oil S 460 it is possible that existing oil deposits are dissolved by the cleaning effect of the new oil. It is therefore recommended that the oil separating cartridge is changed after a short period. This additional procedure is only necessary once after changing to the new oil. The oil filter must also be changed.

**KAESER SIGMA-Screw Compressor oil S 460 has the following properties:**

Viscosity	40°C, cSt	43.8
	100°C, cSt	6.9
Viscosity Index	°C (°F)	115
Flash Point	°C (°F)	240 (465)
Pour Point	1200 RPM, 75°C, 40 kg, 1hr (mm)	-51 (-60)
Four Ball wear		0.6
Four Ball Weld Point	(kg)	315
Demulsibility:	ml oil H <sub>2</sub> O/emulsion/min.	40/40/0/5
Foaming Tendency Sequence I, II, III		nil
Specific Gravity	16°C (60°F)	0.872

Kaeser Synthetic Oil lasts approximately 3 times longer than the Mineral Oil. Even after this time samples can be taken and Kaeser can extend the running time of the oil depending on the result of the test.

**NOTE:** In the case of synthetic oil being used, Kaeser recommends only the above synthetic oil. The use of other brands will void the warranty.

## Technical Specifications

**KAESER**  
**COMPRESSORS**

### 1.9b Oil Recommendations - Mineral Oil M-460

KAESER screw compressors are filled with the following suitable type of cooling oil:

**KAESER SIGMA-screw compressor oil M 460**

#### Topping up the oil:

Always use the above oil.

#### Oil change and change of oil type:

Drain all the oil from the oil separator tank, cooler and oil lines.

When changing from another cooling oil to KAESER SIGMA-screw compressor oil M 460, ensure that the compressor unit is completely drained before refilling with new oil. As far as possible, any deposits in the system should be removed. After changing to KAESER SIGMA-screw compressor oil M 460 it is possible that existing oil deposits are dissolved by the cleaning effect of the new oil. It is therefore recommended that the oil separating cartridge is changed after a short period. This additional procedure is only necessary once after changing to the new oil. The oil filter must also be changed.

**KAESER SIGMA-Screw Compressor oil M 460 has the following properties:**

Viscosity Group		VG 68
Viscosity at +40°C	DIN 51562	67 mm <sup>2</sup> /s
Viscosity at +100°C	DIN 51562	8,75 mm <sup>2</sup> /s
Flash point	DIN ISO 2592	≥ +240°C
Setting point	DIN 51597	-30°C
Sulphate pocket	DIN 51575	0.9g
Ageing characteristics (Δ-CCT)	DIN 51352/1	0,44g
Froth tendency Seq.11	ASTMD 892-89	10/0 ml
Behaviour of parts subject to wear (FZG-test)	DIN 51354	Stage 12
Demulsifying characteristics	DIN 51599	41/30/0/40 min
High thermal and oxidative ageing resistance		
Low coking tendency and deposit formation		
High dispersion properties		
High wear and corrosion protection		
Compatibility with gaskets and paints		
Disposal	No special procedures necessary normal, can be recycled	

Oil change intervals under normal conditions are every 2,500 hrs or once a year, whichever comes first. On request Kaeser can supply alternative brands.

**Note:** The use of oil other than Kaeser recommended oil will void the warranty.

## Technical Specifications

---

### 1.10 Greasing the Electrical Motor

Renew the compressor motor gearing:

Under normal operating conditions, after.....12000 h\*  
(ambient temperature up to 25°C)

Under unsuitable conditions, after.....6000 h\*  
(ambient temperature up to 40°C)

but at the latest after.....3 Years  
\*operating hours

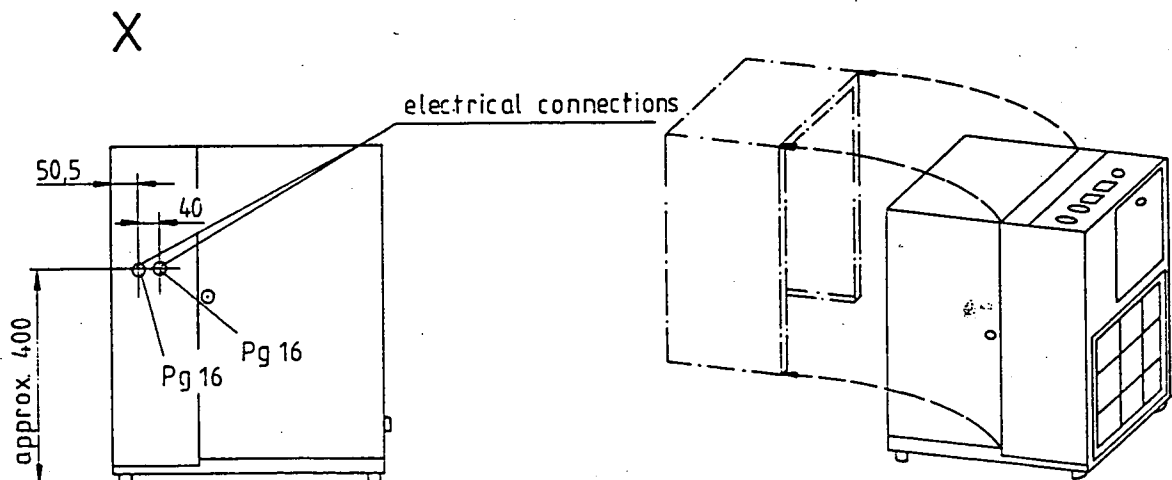
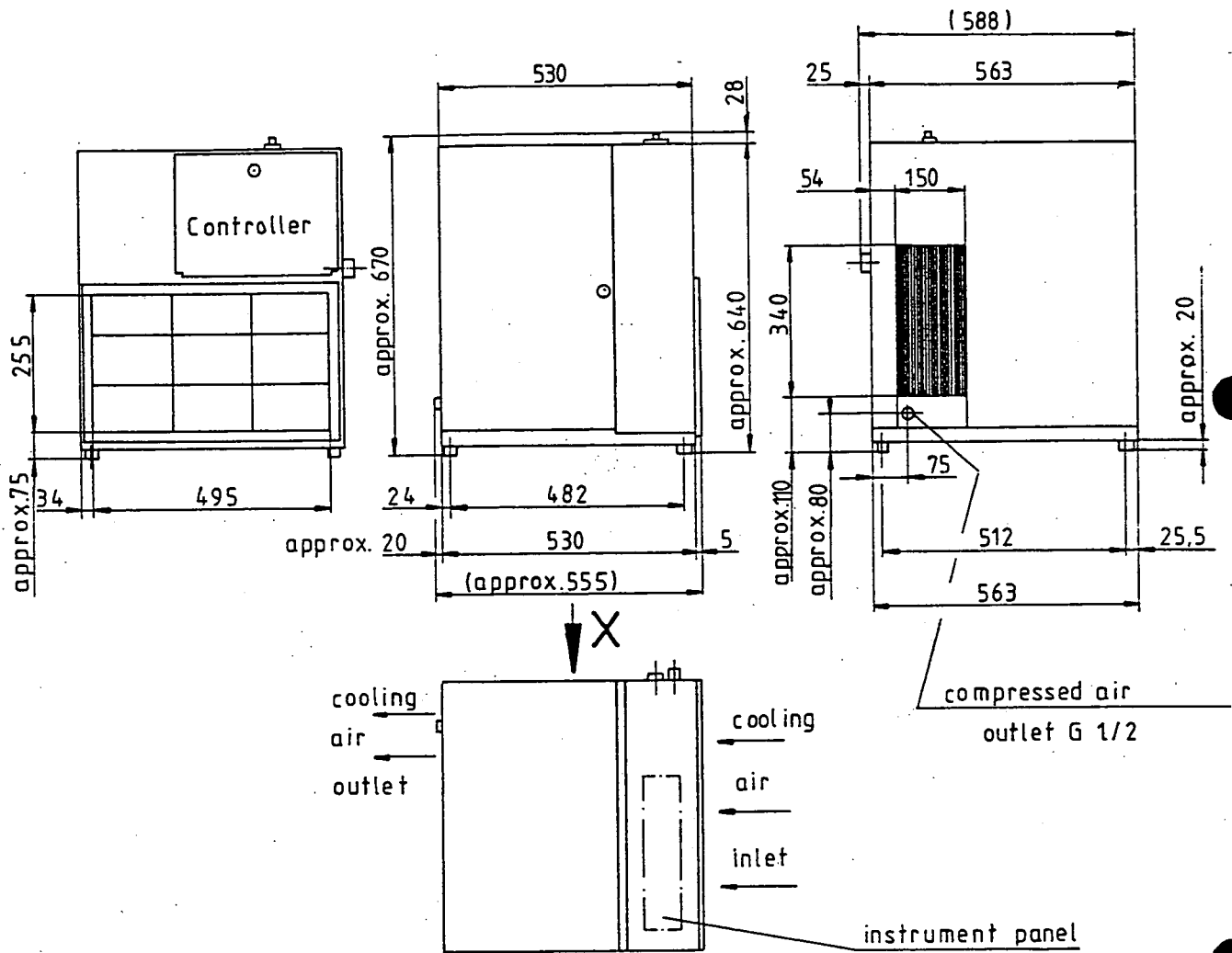
### 1.11 Dimensional Drawing

(see following page)

**KAESER**  
KOMPRESSOREN

SX3/SX4/SX6

T7495.4e

26.3.92 *Vöhr*gepr.: *Kackler*

M 1:15

## Safety Regulations

## 2 Safety Regulations

Read this service manual carefully and observe cautionary references before putting this compressor unit into operation and before carrying out any maintenance on the unit.

### 2.1 Explanation of Symbols and References



This symbol is placed before all references to safety where danger to life and limb can occur during work. It is especially important that these rules are observed and that extreme care is taken in these cases. For their own protection, inform all other users of these safety rules. Observe general safety and accident prevention regulations as well as the safety rules laid down in this service manual.

#### Attention!

This symbol is at points where considerable attention must be paid so that recommendations, regulations, references and correct sequence of work are adhered to and that damage and/or destruction of the compressor unit and/or other equipment is prevented.



This symbol indicates operations to be carried out by the operator or service technician.

- This bullet identifies listings.

#### Abbreviations:

VBG	Association of Employers Liability Insurers (AELI)
UVV	Accident Prevention Regulations (APR)

### 2.2 General Notes on Accident Prevention Regulations

The terms "UVV" and "VBG" are abbreviations and refer to specific accident prevention regulations of the Federal Republic of Germany.

Should any one of the regulations referred to in this service manual not conform to local, lawful regulations then the stricter regulation applies.

Users of compressor units outside the Federal Republic of Germany are therefore obligated to check the valid accident prevention regulations concerning the compressor unit in the country of use. If these regulations are stricter than German regulations, corresponding measures must be taken before the compressor unit is put into operation.

### 2.3 Accident Prevention Regulation 10.0 "Power Driven Work Units" (VBG 5)

#### Attention!

According to the German accident prevention regulations VBG 5, paragraph 12 (DIN VDE 0113 Part 1 or IEC 204 – 1 and European Standard EN 60204 – 1) the operator of a compressor station is obligated to carry out the following measures:

Compressor units fitted with a drive motor of drive power 3 kW or more and a current rating of 16 ampere or more must be installed with a lockable mains isolating switch (DIN VDE 0660, DIN VDE 0100) and cut-out fuses.

See chapter 1.4 for details of the mains isolating switch, core cross-sections and fuses.



## Safety Regulations

### 2.4 Accident Prevention Regulations 13.4 "Compressors" (VBG 16)

**Attention!**

We refer especially to paragraph 12: General installation and condition of the installation space.

We also recommend observation of the following:

- Allow no open flame and flying sparks in the place of installation.
- During any necessary welding on the compressor unit or nearby ensure that sparks or high temperatures cannot cause fire or explosion.
- Ensure that the compressor unit is fed with clean air without any damaging components.
- Do not allow the maximum ambient temperature to be exceeded (see chapter 1.7), otherwise special measures must be agreed between the manufacturer and the customer.
- Carry out oil changes according to the service manual but at least once annually.
- Do not mix cooling oils of different types.
- To avoid build-up of condensate in the oil circulation, maintain and monitor the operating temperature according to the manufacturer's specifications.
- Use only cooling oils recommended by the manufacturer.
- If maintenance work is carried out on any part of the oil circulation system, top up the oil in the oil separator tank to the maximum level, run the compressor and keep it under constant observation for a short period. Check the oil level again and top up with oil to replace the oil taken up by the piping and the cooling system.

### 2.5 General References



Work on power driven systems may only be carried out by trained or specialised personnel (see UVV 10.0).

Before work is carried out on electrical systems, carry out the following measures in the sequence shown.

1. Switch off all phases
2. Ensure the unit cannot be switched on again
3. Check that no voltage is present

Discharge or shut off pipework under pressure if not stated otherwise in the service manual.

**Attention!**

Any alterations or reconstruction carried out without consultation with and without the previous consent of KAESER KOMPRESSOREN will invalidate the warranty.

### 2.6 Spare Parts

Safe and reliable operation of the compressor unit is guaranteed only with KAESER original spare parts and KAESER SIGMA compressor oil.

### 2.7 Compressed Air Station

If a compressed air station is extended or changed, check the blowoff pressure of the safety valves on the air receiver tanks and in the pipework before the new compressor unit is installed.

If the blowoff pressure is too low, fit a safety valve with correspondingly higher blowoff pressure.

## General

### 3 General

#### 3.1 Correct use of the Compressor

The compressor unit is intended solely for the purpose of generating compressed air. Any further use outside of this purpose is considered incorrect. The manufacturer cannot accept liability for any damage caused by such incorrect use; the user alone is liable for any risks incurred.

Correct use of the compressor also encompasses adherence to the installation, removal, commissioning, operational and maintenance conditions laid down by the manufacturer.

#### 3.2 Incorrect use



**Never direct compressed air toward persons. Compressed air is a concentrated form of energy and as such is dangerous to life.**

#### 3.3 Compressed Air Treatment



**Never use compressed air from oil injected compressor units for breathing purposes and production methods where the air has direct contact with food, without subjecting the compressed air to additional treatment.**

#### 3.4 Copyright

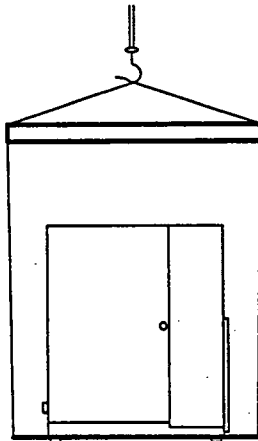
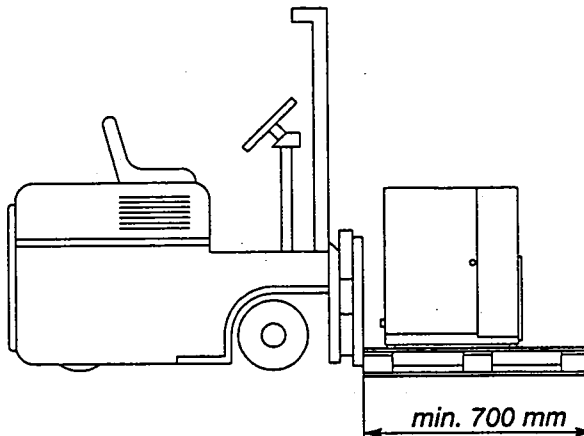
The copyright of this service manual is the property of the firm of KAESER KOMPRESSOREN. This service manual is intended for operating personnel, maintenance personnel and supervisory personnel use only. It contains instructions and technical diagrams that may not be copied, either completely or partly, distributed or evaluated by unauthorised persons for the purpose of competition, or divulged to any other third party.

## Transport

### 4 Transport

#### 4.1 Transport Instructions

We recommend a fork lift truck or lifting equipment for transporting the compressor unit to avoid damage to the cabinet and framework.



*Do not exert any side forces on the compressor unit when transporting with lifting equipment !*

#### 4.2 Packaging

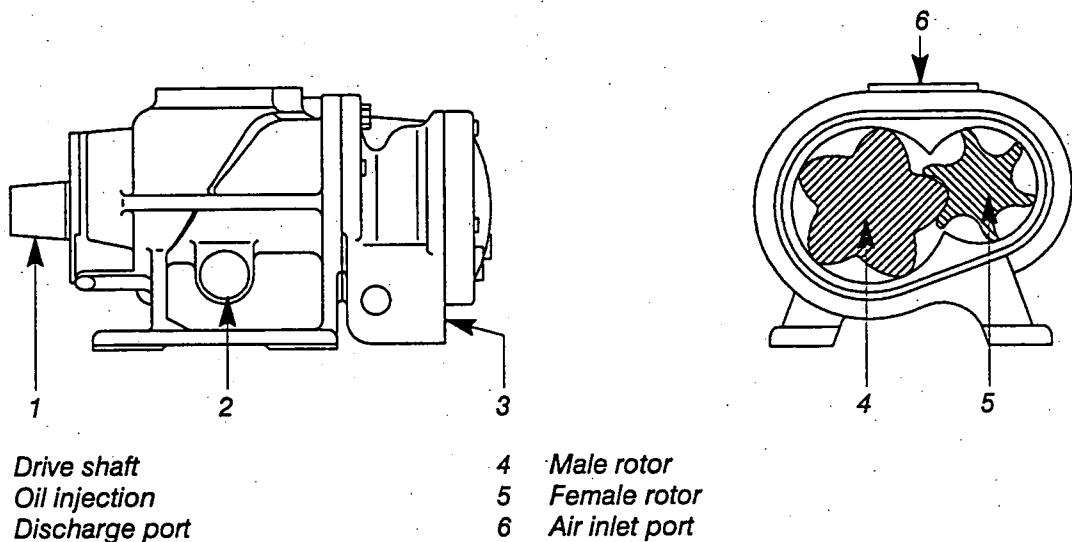
A decisive factor in the type of packaging is the transport route. The packaging conforms to the packaging regulations laid down by the German Federal Association of Wood, Pallet and Export Packaging (HPE), and by the Association of German Mechanical Engineering Institutes (VDMA), if not otherwise contractually agreed.

## Construction and Operation

### 5 Construction and Operation

#### 5.1 Principle of Compression

The stationary compressor unit is fitted with a single stage, oil-injected air end. Two rotors, the driven male rotor and the female rotor, both mounted in roller bearings, are fitted into the air end. As the rotors rotate, air is drawn into the upper side through the inlet port and is compressed on the lower side. The oil that is injected into the lower side absorbs heat generated by compression, prevents metallic contact between the rotors, seals the rotors and the housing from each other and also lubricates the roller bearings. The compressed air and oil mixture leaves the air end via the discharge port.



#### 5.2 Short Description

The compressor block is driven via V-belts from an electric motor.

An oil separating cartridge is fitted into the oil separating tank allowing practically oil free compressed air supply.

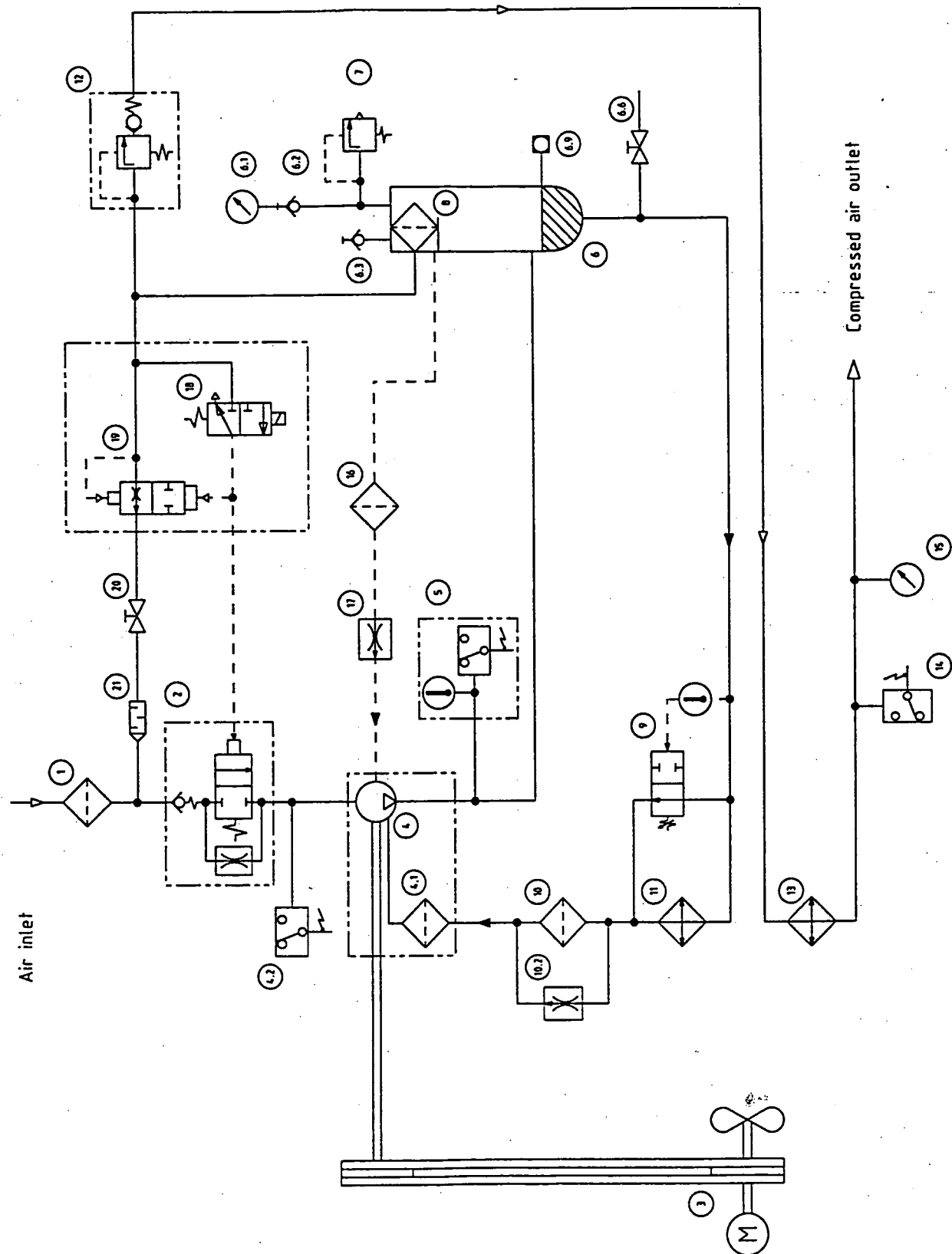
The regulation of the compressor unit ensures that compressed air is generated within the set pressure limits.

A safety function protects the compressor unit against failure of important systems through automatic shut-down.

The fan ensures ventilation of the compressor unit and also sufficient cooling air for the air-cooled oil cooler and air cooler.

#### 5.3 Pipe and Instrument Flow Diagram (P & I Diagram)

(see following pages)

P-I Diagram  
SX 3KAESER  
KOMPRESSOREN

Ursprung

Ersatz für:

Ersatz durch:

Datum 15.01.1998 P.I.  
Bearb. / Gepr. / Norm

Änderung Datum Name

FSX3STL-0495/00001

Blatt 1

1	2	3	4	5	6	7	8
1	Air filter						
2	Inlet valve						
3	Driving motor						
4	Air end						
4.1	Strainer						
4.2	Pressure switch - Wrong direction of rotation						
5	Temperature gauge switch + Indication						
6	Oil separator tank						
6.1	Pressure gauge						
6.2	Hose coupling (oil end)						
6.3	Hose coupling (air end)						
6.6	Stopcock - Oil drain						
6.9	Oil level sight glass: minimum/maximum oil level						
7	Safety valve						
8	Oil separator cartridge						
9	Oil temperature controller						
10	Oil filter						
10.2	Main flow nozzle						
11	Oil cooler						
12	Minimum pressure check valve						
13	Air cooler						
14	Air main pressure switch (Full load-off load running)						
15	Pressure gauge - Control panel						
16	Dirt trap						
17	Nozzle						
18/19	Combined control/vent valve						
18	Control valve						
19	Vent valve						
20	Stopcock - Vent line						
21	Silencer						

P-I Diagram legend  
SX 3KAESER  
KOMPRESSOREN

Ursprung

Ersatz für:

Ersatz durch:

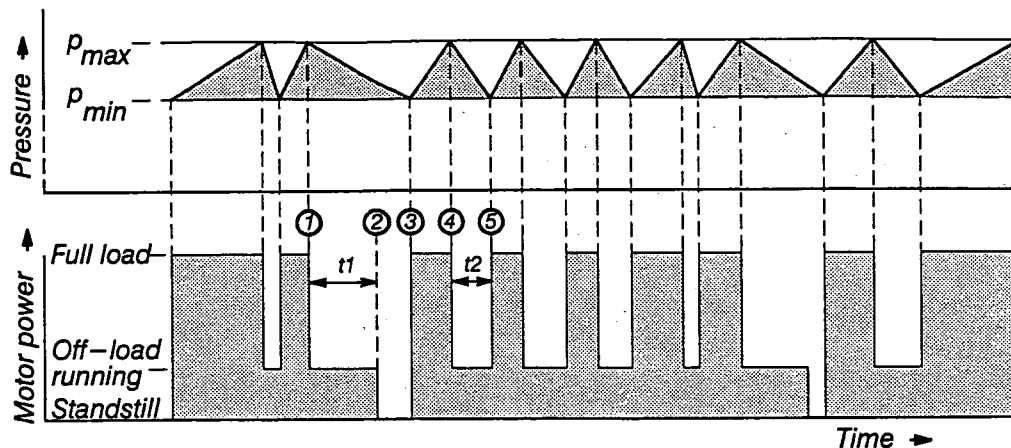
Datum 25.04.2005 Pl.  
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Gepr. *Handwritten*Änderung  
a  
b  
c  
Name  
Datum

FSX3STL-04,95/00001

Blatt 2

## Construction and Operation

### 5.4 DUAL Control



In DUAL Control (combined off-load running and intermittent control) the compressor normally runs at **full-load** and **off-load running** or **standstill**.

Operation is controlled by a pressure switch within set limits (see chapter 1.5) between **full-load** and **off-load running**.

If the compressor runs for longer than a preset time period, (1) to (2) e.g.  $t_1 = 6$  min, in off-load running, the electric motor switches off completely (2). When the low pressure switching point  $p_{min}$  (3) is reached the motor will restart automatically. The pressure now rises to the high switching point  $p_{max}$  (4) and the compressor runs in off-load running. Should, however, the pressure drop within a shorter time period (4) to (5) e.g.  $t_2 = 3$  min again to  $p_{min}$  (5), the compressor will automatically switch from off-load running to full-load.

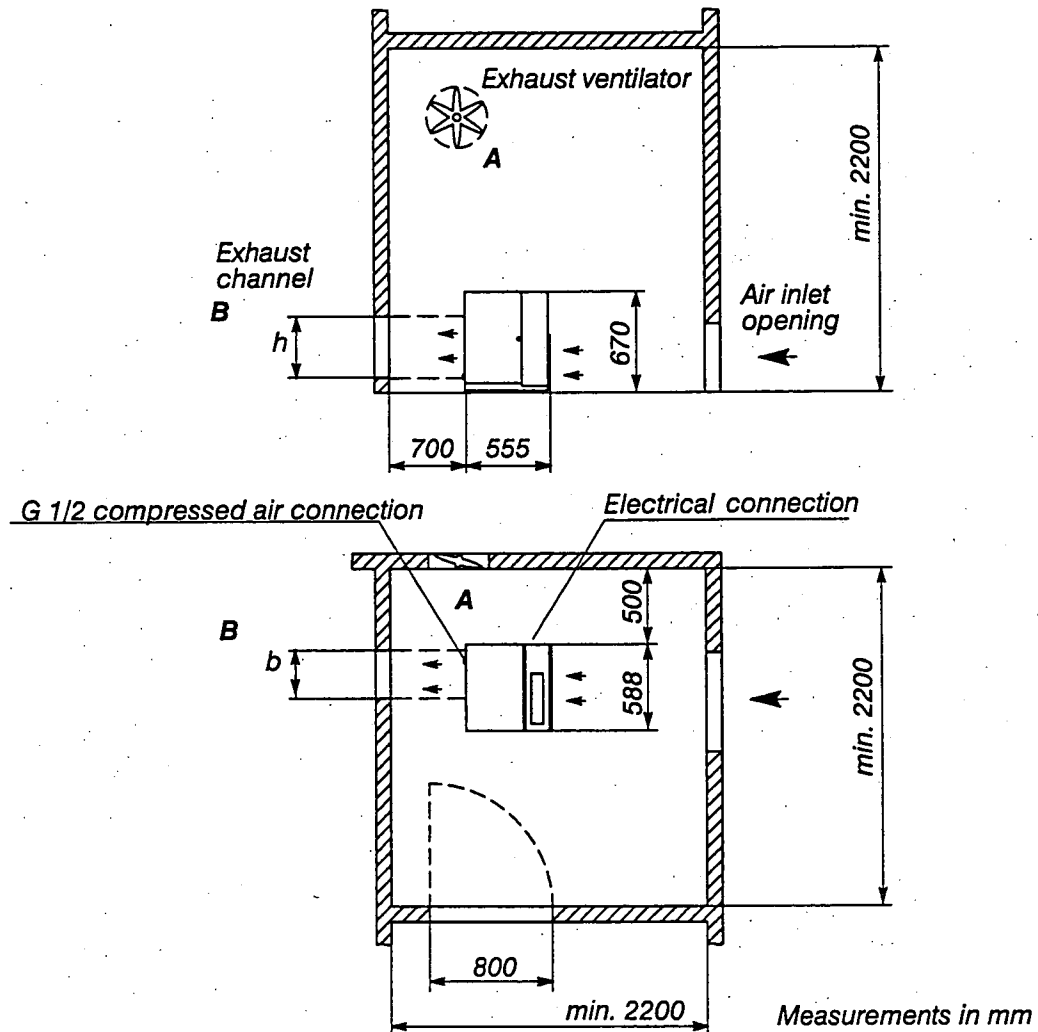
## Installation

### 6 Installation

#### 6.1 Installation Requirements

Install the compressor according to the following diagram. Keep to the minimum distances shown to allow free access to the compressor unit.

Adequate ventilation of the compressor space is ensured only if the minimum values (see chapter 1.7) are adhered to.



#### Solution A: Forced Ventilation

The ventilator intended for the compressor room must provide adequate ventilation in relation to the size of the compressor unit (see chapter 1.7).

#### Solution B: Exhaust Air used for Space Heating

The hot air is forced through a conduit (see chapter 1.7) into the room to be heated.

#### Attention!

Consult the manufacturer with regard to length of conduit and number of pipe bends for respective compressor units.

Safe operation of the compressor unit is guaranteed only if the temperature limits (see chapter 1.7) of the ventilating air are kept to.



## Installation

### 6.2 Connection of the Compressed Air Supply

The unit is set up ready to operate. Connect the discharge outlet to the user pipework using a flexible connection hose.

### 6.3 Electrical Connection



**The connection to the electrical main supply and the protective measures taken are to be carried out to DIN VDE regulations and the regulations of the local Electrical Supply Authority by an authorized electrician.**

The compressor is wired ready for connection to the main supplies. Feed the supply cable with cores marked L1, L2, L3 and PE through the cable inlet in the base frame into the control box and connect to the terminals marked L1, L2, L3 and PE in this box.

Terminals for changeover switching and voltless contacts "Motor Running" and "Compressor ON – No Fault" are fitted as standard (voltless contacts are normally open and breakproof).

**Attention!**

**According to the German accident prevention regulations VBG 5, paragraph 12 (DIN VDE 0113 Part 1 or IEC 204 – 1 and European Standard EN 60204 – 1) the operator of a compressor station is obligated to carry out the following measures:**

**Compressor units fitted with a drive motor of drive power 3 kW or more and a current rating of 16 ampere or more must be installed with a lockable main isolating switch (DIN VDE 0660, DIN VDE 0100) and cut-out fuses.**

**The construction of the main switch is dependent on the max. nominal current  $I_N$  according to operational category AC 23 (see chapter 1.4).**

**The recommended cross sections of the necessary cables and the ratings of the fuse cut-outs are given in chapter 1.4.**

**Attention!**

**The cross-section of the supply cable and fuse ratings are specified according to DIN VDE 0100 part 430 and 523 for an ambient temperature of 30°C. For other operating conditions, e.g. higher ambient temperatures or longer supply lines (over 50 m) check and determine the cross-section of the cable and the fuse ratings according to DIN VDE 0100 and the local Electrical Supply Authority regulations.**

## Putting into Operation

### 7 Putting into Operation

#### 7.1 Points to be Observed before Putting into Operation

Every compressor unit is given a test run in the factory and carefully checked before shipment. The test run confirms that the compressor unit conforms to the specification data and runs perfectly. However, independent of the checks made at the factory, the compressor unit could be damaged during transport. For this reason, we recommend that the compressor unit is examined for such possible damage. Observe the compressor unit carefully during the first hours of operation for any possible malfunction.

**Attention!**

Important functional components in the compressor unit (such as minimum pressure check valve, safety relief valve, inlet valve and combination valve) are adjusted and fitted to precise setting up regulations. Alterations to these components are not allowed without previous consultation with the manufacturer.



The minimum pressure check valve, safety relief valve and inlet valve are spring biased.

#### 7.2 Points to be Observed before Starting the Compressor Unit



**ANY NON-OBSERVANCE OF THIS OR OTHER REFERENCES (WARNING; ATTENTION) CAN LEAD TO ACCIDENTS CAUSING INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.**

The compressor unit restarts automatically after a power failure if the air main pressure is lower than the pressure set on the air main pressure switch.

Do not operate the compressor with the maintenance hood open as injury to persons could occur through the drive belts and electrical equipment.

- ✎ Remove all packaging materials, tools and transport securing devices on and in the compressor unit.
- It is expected that the user employs safe working techniques and that all lawful operating and safety regulations are followed when operating this compressor unit.
- The operator of this compressor unit is responsible for its safe operating condition.
- Do not operate this compressor unit in spaces where heavy dust conditions, toxic or inflammable gases could exist.
- Do not connect the compressor unit to a supply voltage other than that stated on the nameplate.
- Install the compressor unit in a space not subject to freezing temperatures, whereby the air temperature conditions at the air intake must be complied with (see chapter 1.7).
- If exhaust ducting is provided, this must be at least the cross section of the cooler exhaust area in size and may not exceed the max. admissible pressure-loss defined by the manufacturer.
- During installation of the compressor unit, ensure that a distance of at least 0.5 metre is kept between the air intake of the unit and any wall.

## Putting into Operation

- ☞ Check the oil level in the oil separator tank (see chapter 9.7).
- ☞ Check the tension of the drive belts (see chapter 9.3).
- ☞ The shut-off valve (6.6, see chapter 5.3) must be closed.
- ☞ The shut-off valve (20, see chapter 5.3) must be open.



**Carry out the following work only when power is removed from the compressor unit.**

**Check all screws on the electrical connections for tightness and tighten if necessary (carry out this check again after 50 operating hours).**

- Check that the airend rotates in the correct direction (see chapter 7.3).
- Do not switch the compressor unit off with the main supply switch when running under load (see chapter 8.2).
- This compressor is fitted with a running-in oil filter cartridge. Replace the filter cartridge after the running-in period of 200 hours has elapsed (see chapter 9.6).

### 7.3 Direction of Rotation Check

**Attention!**

**The compressor is wired for connection to a clockwise phase sequence.**

A check of the direction of rotation can be made by testing the phase sequence.

Arrows showing the direction of rotation are located on the motor and on the air end housing.

If the direction of rotation is incorrect, change over the supply conductors L1 and L2.

**Attention!**

**If the air end rotates in the wrong direction, the compressor is automatically shut down by the pressure switch (4.2, see chapter 5.3).**

### 7.4 Setting up the Overload Protection



**Disconnect the supply voltage to the unit by switching off and locking out the main switch before any adjustments are carried out on the compressor unit. See chapter 2.3 for the main switch.**

The overload protection is set to the standard adjustment at the factory.

**Compressor motor: direct on-line starting**

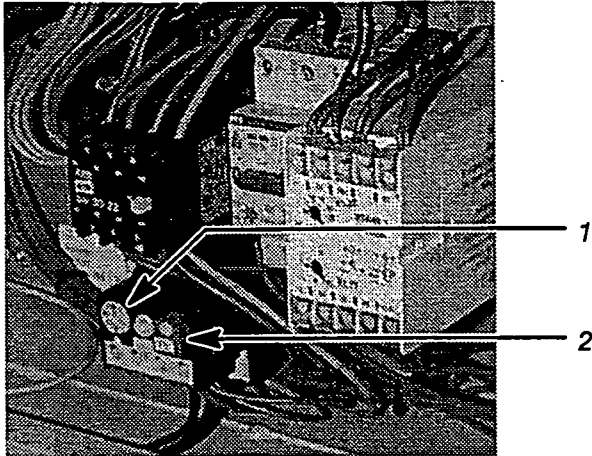
In direct on-line starting the rated motor current is fed via the overload protection trigger.

See the nameplate for the rated motor current.

**Setting-up values:**

The setting can be up to a maximum of 10% higher than the rated motor current to prevent the overload protection tripping under voltage fluctuations.

## Putting into Operation



- 1 Motor phase current adjustment  
 2 Reset button

### 7.5 Initial Measures before Putting the Compressor Unit into Operation



Disconnect the supply voltage to the unit by switching off the main supply switch and ensure that the switch cannot be switched on again before any adjustments are carried out on the compressor unit. See chapter 2.3 for the main supply switch.

#### Extension of start period during the first start-up

- ☐ Increase the period of the timing relay K1.1T to 20 seconds when starting the compressor for the first time. This avoids compression of the intake air during the start procedure. Shortly before the end of the 20 second period, switch off the compressor unit (see chapter 8.2).
- ☐ Set the timing relay K1.1T back to the normal starting period of 6 seconds before operating the compressor any further.

This procedure ensures that the oil cooler and all oil pipes are filled with oil without endangering the compressor air end.



The compressor unit starts automatically again after a power failure providing the line pressure is lower than setting on the line pressure switch.

### 7.6 Setting up the Off-Load Running Timing Relay for Off-Load Running – Intermittent Control



Disconnect the supply voltage to the unit by switching off the main supply switch and ensure that the switch cannot be switched on again before any adjustments are carried out on the compressor unit. See chapter 2.3 for the main supply switch.

The off-load running timing relay is situated in the control cabinet (range of adjustment 1.5 to 30 minutes). The off-load running phase should be set so that the maximum cut-in frequency of the motor (see chapter 1.3) is not exceeded.

### 7.7 Setting up the Line Pressure Switch



Disconnect the supply voltage to the unit by switching off the main supply switch and ensure that the switch cannot be switched on again

## Putting into Operation

**before any adjustments are carried out on the compressor unit. See chapter 2.3 for the main supply switch.**

Setting the switching differential on the pressure switch for limiting the cut-in frequency.

**The cut-in frequency from on-load to off-load running is limited to max. twice per minute.**

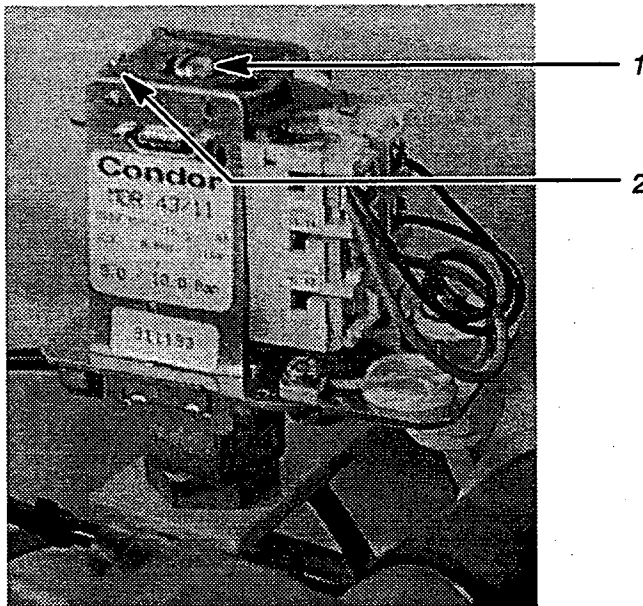
The cut-in frequency can be reduced to a limited degree by increasing the switching differential.

If this measure is insufficient, install a larger series connected air receiver to provide more buffer capacity.

See chapter 1.5 for the factory setting of the pressure switch and the pressure diagram.

**Attention!**

**The pressure adjustment is possible on a fitted, pressurised switch only.**



- 1 Adjusting screw "P"
- 2 Adjusting screw " $\Delta p$ "



**Replace the cover after every adjustment to the pressure switch and before switching on the compressor.**

**Increase cut-out pressure:**

- ☞ Remove the cover of the pressure switch.
- ☞ Turn the adjusting screw (1) clockwise with a screwdriver. The red pin on the pressure scale indicates the pressure.
- ☞ Replace the cover of the pressure switch.

**Decrease cut-out pressure:**

- ☞ Remove the cover of the pressure switch.
- ☞ Turn the adjusting screw (1) anticlockwise with a screwdriver. The red pin on the pressure scale indicates the pressure.
- ☞ Replace the cover of the pressure switch.

## Putting into Operation

**To increase the pressure differential between cut-in and cut-out:**

- ☞ Remove the cover of the pressure switch.
- ☞ Turn the adjusting screw (2) clockwise with a screwdriver. The black pin on the differential pressure scale moves towards "max."
- ☞ Replace the cover of the pressure switch.

**To decrease the pressure differential between cut-in and cut-out:**

- ☞ Remove the cover of the pressure switch.
- ☞ Turn the adjusting screw (2) anticlockwise with a screwdriver. The black pin on the differential pressure scale moves towards "min."
- ☞ Replace the cover of the pressure switch.

### 7.8 Putting into Operation again after an Oil Change or Temporary Storage



**Switch off the main switch and secure against switch-on.**

Carry out the following measures after an oil change or a non-operative period of three months or longer before starting the compressor:

**Filling a small quantity of oil into the air inlet connection**



**The oil may only be added when the compressor unit is in a non-pressurised state.**

- ☞ When the compressor unit is stationary, pour a quantity of oil (see chapter 1.8) into the air intake port of the air end and manually rotate the air end in an anticlockwise direction with the drive belts.
- ☞ To pour in the oil, unscrew the inlet valve above the air end and then pour the prescribed quantity of oil into the air end.
- ☞ Screw the inlet valve back on again.

**Attention!**

**This oil must be of the same type as the oil used to operate the compressor (see label near the oil filler plug on the oil separator tank).**

**If no additional oil is available, then remove this amount of oil from the oil separating tank. See chapter 9.10 for this procedure.**

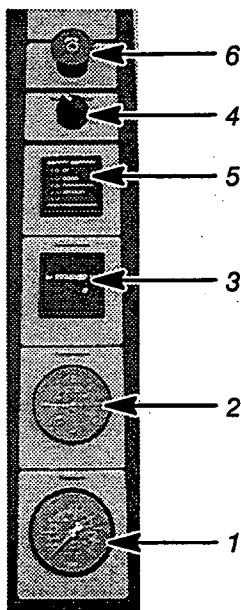
**If the compressor unit was stationary for longer than 12 months, further special measures must be carried out before putting the unit back into operation. In this case, consult the manufacturer first.**

**Before starting the compressor unit, carry out the measures described in chapter 7.5.**

## Operation

### 8 Operation

#### 8.1 Control Panel



- |                              |                                 |
|------------------------------|---------------------------------|
| 1 Pressure gauge             | 4 "Start / Stop" control switch |
| 2 Remote contact thermometer | 5 KAESER-CONTROL                |
| 3 Service hours counter      | 6 EMERGENCY STOP pushbutton     |

#### 8.2 Starting and Stopping the Compressor Unit

##### Starting:

**Attention!**

The compressor will start only if the line pressure is lower than the pressure set on the line pressure switch.

- ☐ Switch on the main supply switch.
- ☐ Turn the control switch (4) to the "Start" position.

##### Stopping:

**Attention!**

Do not stop the compressor unit with the main supply switch. Always start and stop the compressor unit principally with the control switch (4).

- ☐ Turn the control switch (4) to the "Stop" position.
  - ☐ Switch off the main supply switch and secure against switch-on.
- See chapter 2.3 for the main supply switch.

#### 8.3 Safety System: KAESER CONTROL

The green light emitting diode "1" is illuminated if the compressor unit is running or ready for operation. It is extinguished if a fault is apparent.

A fault detected by the control functions 2, 3, 4 and 5 will shut down the compressor unit immediately, accompanied by an appropriate alarm indication.

## Operation



- 2 Overload trip of the compressor motor  
shuts down with excess motor current.  
When the fault is removed, press the overload trip reset button.
- 3 Remote contact thermometer for detection of excess discharge temperature (5, see chapter 5.3).  
The compressor unit is shut down if a discharge temperature of 100°C is reached.
- 4 Pressure switch (4.2, see chapter 5.3)  
shuts down the compressor unit if the drive belts slip off the pulley or break and at incorrect direction of rotation.
- 5 Spare.

### "EMERGENCY STOP Pushbutton"

If the EMERGENCY STOP pushbutton is pressed, the compressor unit is shut down and all LED's on the KAESER CONTROL or all recording LED's illuminate (see chapter 11.1).

Reset the compressor unit after the fault is removed.

- Reset the EMERG. STOP push button by turning the latched push button in the direction of the arrow.
- Reset the compressor by turning the control switch (see chapter 8.1) from "Start" to "Stop".

The compressor unit is now ready to restart.

## 8.4 Remote Contact Thermometer

If the discharge temperature directly after the air end reaches 100°C, the remote contact thermometer (5, see chapter 5.3) activates.

Activation of the remote contact thermometer causes a compressor unit shut-down, coupled with appropriate indication on the KAESER CONTROL (see chapter 8.3).

- Search for and remove the cause of the fault.

### Possible causes of the fault:

- Low oil
- Cooling system fault
- Ambient temperature too high or too low
- Clogged filter mat, oil filter or cooler
- When the fault is removed, reset the compressor unit by turning the control switch (see chapter 8.1) from "Start" to "Stop".

Then restart the compressor unit again (see chapter 8.2).



## Maintenance

### 9 Maintenance

#### 9.1 Observe the following instructions during all maintenance and servicing work:



Work on power driven equipment may only be carried out by trained or specialised personnel, see UVV 10.0 (VBG 5) or local accident prevention regulations.

The compressor unit restarts automatically after a power failure if the air main pressure is lower than the pressure set on the air main pressure switch.

Switch off and lock out the mains supply switch to secure against switch-on (see chapter 2.3 for mains supply switch).

Ensure that no maintenance personnel are working on the compressor unit, that all panels are screwed back on again and all access doors are closed before restarting the compressor unit.

To start the compressor unit see chapter 8.2.

The venting nozzle required to vent the oil separating tank (for maintenance work such as topping up the oil, oil change and filter change) is fitted to the hose coupling (2, see chapter 9.7).

#### 9.2 Regular Maintenance

Period	Work to be done	see chapter
24 hours after first putting into operation	Check the belts	9.3
50 hours after first putting into operation	Check all electrical screw connections for tightness and tighten if necessary	
100 to 300 hours	Clean the filter mats*	9.5
200 hours after first putting into operation	Change the oil filter	9.6
Weekly	Check the oil level	9.7
500 hours	Check the tension of the drive belts	9.3
	Clean or change the air filter*	9.12
1000 hours	Check the oil cooler and air cooler for contamination	9.8
1000 to 2000 hours	Change the oil filter*	9.6
2000 to 3000 hours	Change the oil separator cartridge*	9.13
2000 to 3000 hours or at least annually	Change the oil*	9.10

## Maintenance

Period	Work to be done	see chapter
Annually	Check all electrical screw connections for tightness and tighten if necessary	
	Check the safety valve	9.11
6000/12000 hours or at least within three years	Have the compressor motor bearings renewed by the KAESER Service*	9.9

\* The maintenance period can vary depending on the cut-in frequency and environmental conditions.

We urgently recommend that a record is kept of the maintenance work done (see chapter 11.2).

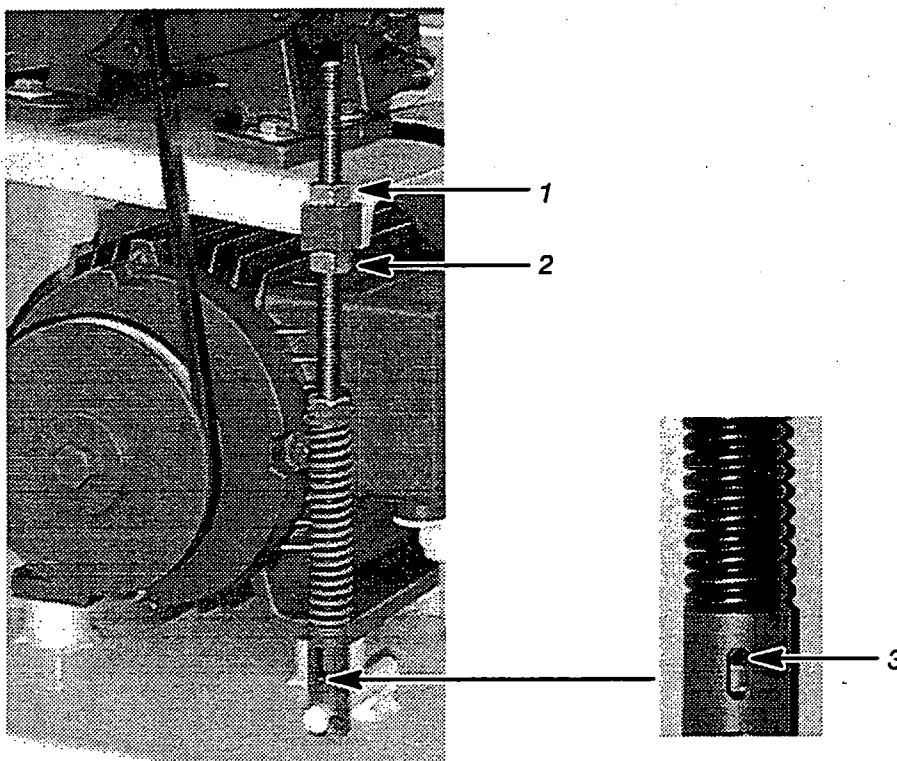
### 9.3 Checking the Drive Belt Tension

☐ Switch off the compressor unit (see chapter 8.2).



**Switch off the main supply switch and secure against switch-on to prevent accidents during maintenance.**

Check the tension of the belt drive after the first 24 hours of operation and thereafter every 500 hours of operation.



- 1 Hexagonal nut
- 2 Hexagonal nut
- 3 Marking pin

The belt tension is automatically adjusted within a limited range by the compression spring of the belt tensioning device.

Re-tension the belt if it has stretched to the point where the marking pin (3) is situated at the top end of its indicator slot.

## Maintenance

If this is the case, proceed as follows:

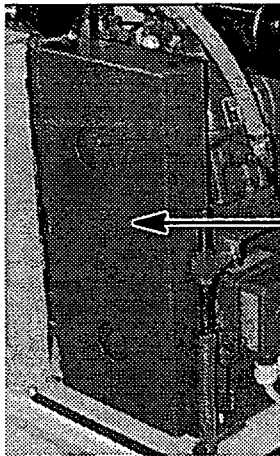
- ☞ Remove the maintenance hood.
- ☞ Loosen the hexagonal nut (1).
- ☞ Tension the belt with the hexagonal nut (2) until the marking pin (3) is situated at the bottom end of its indicating slot.
- ☞ Tighten the hexagonal nut (1) again.
- ☞ Replace the maintenance hood.

### 9.4 Drive Belt Change

- ☞ Switch off the compressor unit (see chapter 8.2).



**Switch off the main supply switch and secure against switch-on to prevent accidents during maintenance.**



1 V- belt guard

- ☞ Remove the maintenance hood
- ☞ Loosen the hexagonal nut (1, see chapter 9.3) of the swing frame.
- ☞ Screw the hexagonal nut (2, see chapter 9.3) clockwise until the V belt is loose.
- ☞ Remove the V belt.
- ☞ Place the new V belt over the motor and compressor pulleys without straining it.
- ☞ Set the belt drive tension (see chapter 9.3).
- ☞ Replace the maintenance hood.
- ☞ Check the belt drive tension after two hours of operation and then again after 24 hours of operation, as experience shows that the belt stretches mostly during this period.

**Attention!**

**It is essential that replacement belt is absolutely oil-proof. For this reason we recommend that only original KAESER drive belts are used.**

### 9.5 Cleaning or Renewing the Filter Mat

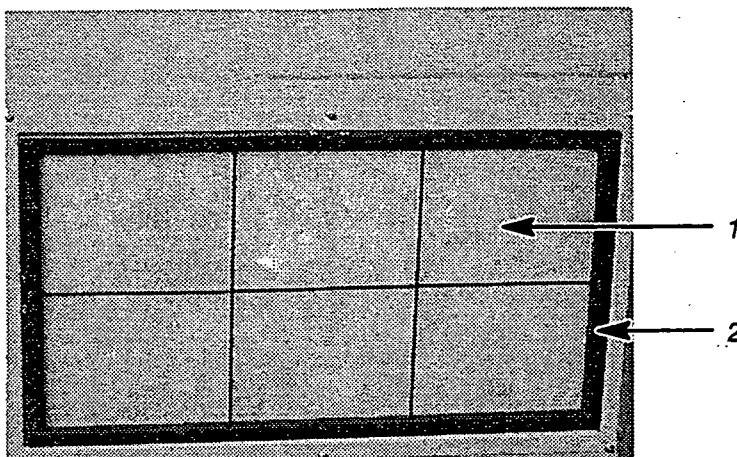
Clean the filter mat every 100 to 300 service hours depending on the dust content of the inlet air.

- ☞ Switch off the compressor (see chapter 8.2).

## Maintenance



Switch off and lock out the main switch to prevent an accidental compressor run.



- 1 Filter mat  
2 Holding frame

- ☐ Remove the holding frame.
- ☐ Open and close with a screwdriver.
- ☐ The clamping frame sits securely after turning the snap fasteners by a ¼ turn.

### Cleaning:

Rinse the mat in water of approximately 40°C, if necessary with a mild washing powder. The mat can also be tapped with the palm of the hand, cleaned with a vacuum cleaner or blown out with compressed air. Rinse out oily dust with warm water using a mild solvent additive.

#### Attention!

If the mat is heavily soiled or has been cleaned often (max. 5 times), replace it.

## 9.6 Oil Filter Change



Hot oil; beware of scalding.

During the running in period, a running-in oil filter cartridge is fitted to clean the oil system.

#### Attention!

Replace the running-in oil filter cartridge with the standard oil filter cartridge after approximately 200 operating hours.

It is recommended that further oil filter cartridge changes are made every 1000 to 2000 operating hours but always at every oil change.

### Removal and replacement of the oil filter cartridge:

- ☐ Switch off the compressor with the control switch (see chapter 8.2).



Switch off and lock out the main switch to prevent an accidental compressor run.

- ☐ Close the shut-off valve between the compressor and the air main.

## Maintenance

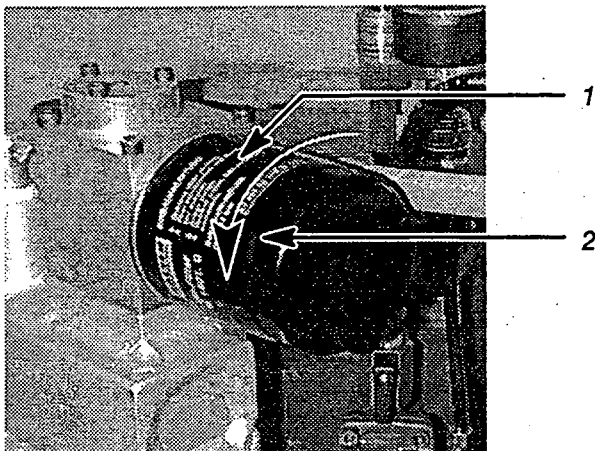
The oil circulation system of the compressor vents automatically.

- ✎ Remove the maintenance hood.
- ✎ The pressure gauge on the oil separator tank must indicate zero bar.



**Oil mist can escape during venting of the oil separating tank.**

- ✎ Insert the venting nipple (2, see chapter 9.7) in the hose coupling on the oil separator tank (the residual pressure in the oil separator tank escapes).



- 1 Oil filter cartridge
- 2 Turn in this direction to unscrew the cartridge

- ✎ Twist the used or contaminated oil filter anticlockwise to remove and catch escaping oil in a suitable container. Dispose of the oil according to environmental regulations.
- ✎ Clean the facing of the junction with lint free cloth.
- ✎ Lightly oil the gasket of the new filter cartridge before screwing into position.
- ✎ Screw in the new filter clockwise by hand until the gasket fits tightly.

**Attention!**

**Do not use a tool as this may cause damage to the oil filter cartridge and the gasket.**

- ✎ Check the oil level (see chapter 9.7).
- ✎ Remove the venting nipple from the hose coupling on the oil separator tank.
- ✎ Replace the maintenance hood.
- ✎ Open the shut-off valve between the compressor unit and the air main.



**Carry out a trial run.**

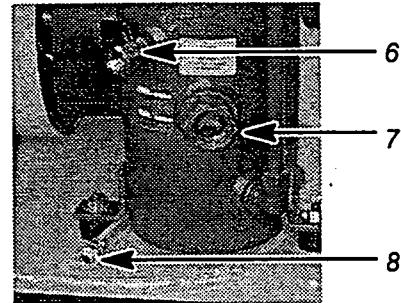
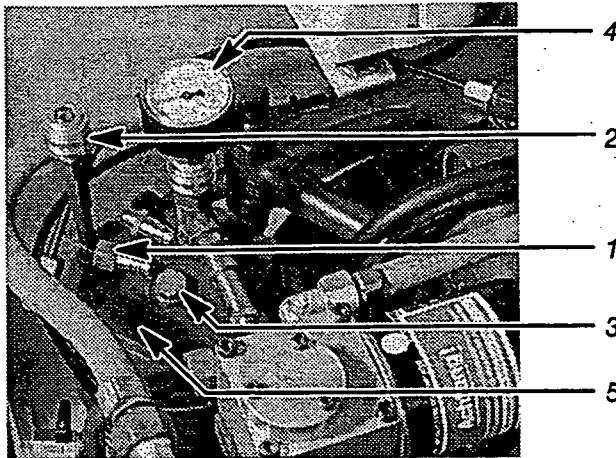
**When the operating temperature is reached (see chapter 1.1) shut down the compressor (see chapter 8.2) and lock out the main switch to prevent an accidental compressor run.**

**Carry out a visual check for leaks.**

### 9.7 Oil Top Up

Check the oil level weekly with the oil level sight gauge when the compressor is shut down. If necessary, top up the oil to the maximum level. Do not exceed the maximum level.

## Maintenance



- |                            |   |
|----------------------------|---|
| 1 Nozzle                   | 5 Oil separator tank                    |
| 2 Hose coupling            | 6 Shut-off cock                         |
| 3 Filler stud (Oil top-up) | 7 Oil level sight glass minimum-maximum |
| 4 Pressure gauge           | 8 Oil drain hose                        |

### Venting the Compressor Unit:

- ☐ Shut down the compressor unit (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☐ Close the shut-off valve between the compressor unit and the air main.
- The oil circulation system of the compressor unit vents automatically.
- ☐ Remove the maintenance hood.
  - ☐ The pressure gauge on the oil separator tank must indicate zero bar.



**Oil mist can escape during venting of the oil separator tank.**

- ☐ Insert the venting nipple (1) in the hose coupling (2) on the oil separator tank (the residual pressure in the oil separator tank escapes).

### To top up the oil:



**Before unscrewing the oil filler plug (3) on the oil separator tank it is imperative that the compressor unit is vented.**

- ☐ Unscrew the oil filler plug (3) on the oil separator tank.
- ☐ Top up the oil to the maximum mark.
- ☐ Check the gasket ring of the filler plug (3) for damage and then screw in the filler plug (3).
- ☐ Remove the venting nipple (1) from the hose coupling (2).
- ☐ Replace the maintenance hood.
- ☐ Open the shut-off valve between the compressor and the air main.

### Attention!

**After carrying out the oil change or oil cooler cleaning procedures run the compressor unit up to operating temperature to ensure that the combination valve closes and that the oil cooler is filled with oil.**

## Maintenance

Subsequently, vent the compressor unit and top up the oil again.

**Attention!**

Always use the same brand and type of oil when topping up the oil.  
(see label on the oil separator tank).

If the type of oil is changed, drain the old oil completely and renew the oil filter.

Never use differing oil types.

### 9.8 Cleaning the Air/Oil Cooler

Check the air/oil cooler for contamination at least every 1000 operating hours. Heavy contamination could lead to excessive temperature in the oil circulation system.

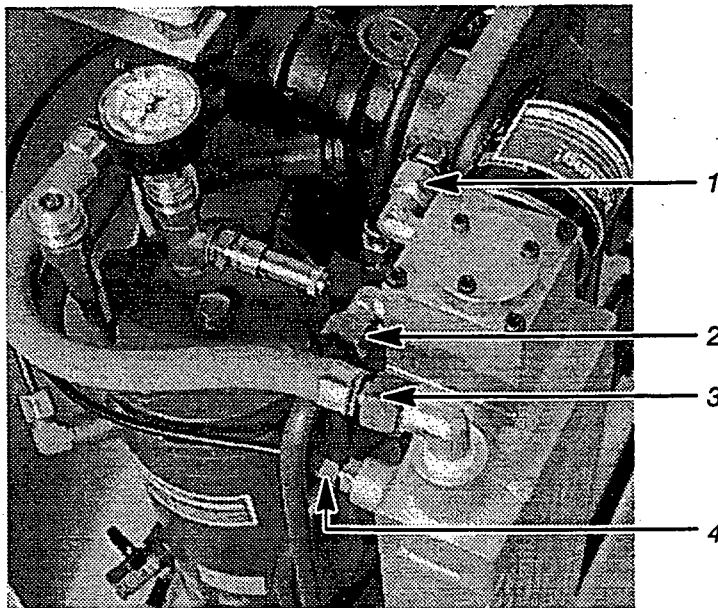
#### Removal of and cleaning the air/oil cooler:

- ☐ Switch off the compressor unit (see chapter 8.2).



Switch off and lock out the main switch to prevent an accidental compressor run.

- ☐ Vent the compressor unit (see chapter 9.7).



- 1 Hose fitting
- 2 Elbow fitting
- 3 Hose fitting
- 4 Pipe fitting

- ☐ Remove the maintenance hood.

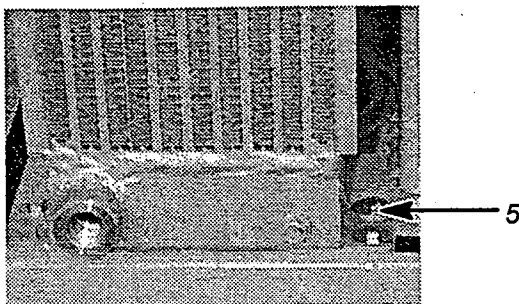


When the compressor unit is vented, pressure is present in the pipe-work system up to the minimum pressure check valve. For this reason the compressor must be isolated from the compressed air main by closing the shut-off valve between the compressor unit and the air main. The air cooler can subsequently be vented by cautiously loosen-

## Maintenance

ing the pressure line from the compressed air connection (4). If no shut-off valve is available, vent the pipework completely. The pressure gauge on the control panel must show zero bar.

- ✎ Unscrew the hose fitting (1) and the elbow fitting (2) from the combination valve.
- ✎ Loosen the hose fitting (3) on the air/oil cooler.
- ✎ Close up the pipes and openings on the combination valve, air cooler and oil cooler.



5 Hexagonal bolt

**Attention!** Before unscrewing the hexagonal bolts (5) prop up the air/oil cooler.

- ✎ Unscrew the hexagonal bolts (5).
- ✎ Take out the air/oil cooler.

**Attention!** A washing area provided with a waste water oil separator is required when cleaning the air/oil cooler.

- ✎ Clean the cooler cells with compressed air, water or steam jet.
- ✎ Reassemble in the reverse order.
- ✎ Replace the maintenance hood.
- ✎ See chapter 9.7 for oil top up.



Carry out a trial run.

When the operating temperature is reached (see chapter 1.1) shut down the compressor unit (see chapter 8.2) and lock out the main supply switch to prevent an accidental compressor run.

Subsequently carry out a visual check for leaks.

- ✎ Open the shut-off valve between the compressor and the air main.

### 9.9 Greasing the Electric Motor

**Compressor motor:**

The electrical motor bearings are permanently greased.

**Attention!** Have the motor bearings replaced using the KAESER Service in accordance with the maintenance schedule (see chapter 1.10).

### 9.10 Oil Change (Oil Separating Tank and Oil Cooler)

Carry out the oil change with the compressor at running temperature.



## Maintenance



### Danger of scalding with hot oil.

Change the oil every 2000 to 3000 operating hours, depending on the contamination of the inlet air, or at least annually.

If the compressor unit operates in ambient temperatures close to the maximum admissible ambient temperature (see chapter 1.7), change the oil more often (e.g. after 1000 to 1500 operating hours).

**Attention!**

Drain the oil out of the oil separating tank, cooler and the oil pipes completely. See chapter 7.5 for putting back into operation.

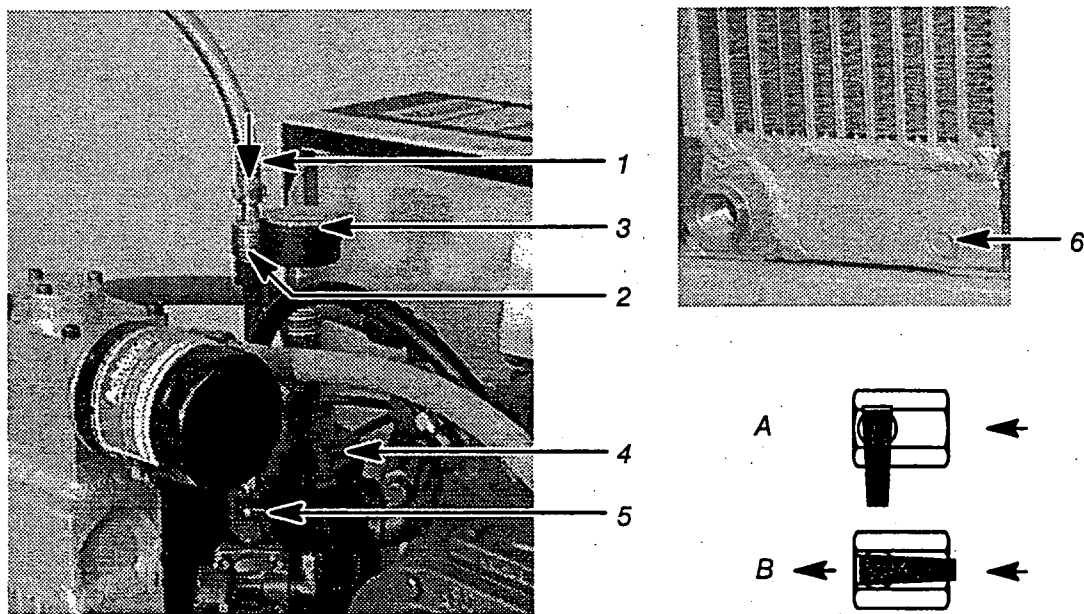
### Oil change using separate pressurisation:

- Switch off the compressor unit (see chapter 8.2).



Switch off the main supply switch and secure against switch-on to prevent an accidental compressor run.

- Close the shut-off valve between the compressor and the user pipework system.
- The oil circulation system of the compressor unit vents automatically.



- 1 Separate pressurization
- 2 Hose coupling
- 3 Pressure gauge
- 4 Oil separator cartridge

- 5 Shut-off cock  
A closed  
B open
- 6 Oil draining plug (oil cooler)

- Remove the maintenance hood.
- The pressure gauge (3) on the oil separator tank (4) must indicate zero bar.
- Close the shut-off valve (5).



Oil mist can escape during venting of the oil separator tank.

- Insert the nipple (1, see chapter 9.7) into the hose coupling (2) on the oil separator tank (4).

## Maintenance

- ☞ Charge the tank via the nipple with external compressed air until the pressure gauge (3) on the oil separator tank (4) indicates approximately 3 bar.
- ☞ Remove the nipple from the hose coupling (2) on the oil separator tank (4).
- ☞ Prepare an oil container to catch the escaping oil.

**Attention!**

**Check that the container is large enough for the total oil capacity of the compressor unit (see chapter 1.8).**

- ☞ Screw the oil drain hose (8, see chapter 9.7) into the shut-off valve (6, see chapter 9.7).
- ☞ Hang the oil drain hose into the container and secure.
- ☞ Slowly open the ball valve (6, see chapter 9.7). The pressure in the oil separator tank forces the oil out. When air escapes, close the ball valve immediately.
- ☞ Remove the oil drain hose.
- ☞ Open the shut-off valve (5).
- ☞ The pressure gauge (3) on the oil separator tank (4) must indicate zero bar.



**Oil mist can escape during venting of the oil separator tank.**

- ☞ Insert the nipple (1, see chapter 9.7) into the hose coupling (2) on the oil separator tank (4) (the residual pressure in the oil separator tank escapes).
- ☞ Prepare an oil container to catch the oil from the oil cooler.
- ☞ Slowly unscrew the oil drain plug (6). The oil drains under the force of gravity.
- ☞ Screw the oil drain plug (6) back in tightly.

See chapter 9.7 for oil top up.

See chapter 1.8 for the oil capacity.

- ☞ Replace the maintenance hood.
- ☞ Open the shut-off valve between compressor unit and the air main.
- ☞ Dispose of the used oil according to environmental regulations.



**Carry out a trial run.**

**When the operating temperature is reached (see chapter 1.1) shut down the compressor unit (see chapter 8.2) and lock out the main switch to prevent an accidental compressor run.**

**Afterwards, carry out a visual check for leaks.**

### Oil Change using own Compressed Air:

- ☞ Switch off the compressor unit with the control switch (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☞ Close the shut-off valve between the compressor unit and the air main.
- The compressor unit oil circulation system vents automatically.
- ☞ Remove the maintenance hood.

## Maintenance

- ☞ The pressure gauge (3) on the oil separator tank (4) must indicate zero bar.
- ☞ Close the shut-off valve (5).
- ☞ Replace the maintenance hood
- ☞ Start the compressor unit (see chapter 8.2) and allow to run for approximately 30 seconds.
- ☞ Stop the compressor unit (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☞ Remove the maintenance hood.
- ☞ Check the actual pressure on the pressure gauge (3). Open the shut-off valve (5), let the pressure on the pressure gauge (3) sink to approximately 3 bar and then close the shut-off valve (5) again.
- ☞ Prepare an oil container in readiness to catch the oil.

**Attention!**

**Check that the container is large enough for the total oil capacity of the compressor unit (see chapter 1.8).**

- ☞ Screw in the oil drain hose (8, see chapter 9.7) into the shut-off valve (6, see chapter 9.7).
- ☞ Hang the oil drain hose into the container and secure.
- ☞ Slowly open the ball valve (6, see chapter 9.7). The pressure in the oil separator tank forces the oil out. When air escapes, close the ball valve immediately.
- ☞ Remove the oil drain hose.
- ☞ Open the shut-off valve (5).
- ☞ The pressure gauge (3) on the oil separator tank (4) must indicate zero bar.



**Oil mist can escape during venting of the oil separator tank.**

- ☞ Insert the nipple (1, see chapter 9.7) into the hose coupling (2) on the oil separator tank (4). The remaining pressure in the oil separator tank escapes
- ☞ Prepare the oil container in readiness to catch the oil from the oil cooler
- ☞ Slowly unscrew the oil drain plug (6). The oil drains under the force of gravity.
- ☞ Screw the oil drain plug (6) back in tightly.

See chapter 9.7 for oil top up.

See chapter 1.8 for the oil capacity.

- ☞ Replace the maintenance hood.
- ☞ Open the shut-off valve between compressor unit and the air main.
- ☞ Dispose of the used oil according to environmental regulations.



**Carry out a trial run.**

**When the operating temperature is reached (see chapter 1.1) shut down the compressor unit (see chapter 8.2) and lock out the main switch to prevent an accidental compressor run.**

**Afterwards, carry out a visual check for leaks.**

## Maintenance

### 9.11 Testing the Safety Valve on the Oil Separator Tank

To test the activating pressure of the safety valve the compressor must be driven into a higher discharge pressure than the maximum pressure set on the on the air main pressure switch.

See chapter 1.6 for the safety valve activating pressure.

To avoid maladjustment of the air main pressure switch, carry out the test as outlined below.

- ☐ Switch off the compressor unit (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☐ Close the shut-off valve between the compressor and the air main.
- ☐ Remove the maintenance hood.
- ☐ Close the shut-off valve (5, see chapter 9.10) in the venting line.
- ☐ Replace the maintenance hood.
- ☐ Start the compressor unit (see chapter 8.2) and allow to switch from full load to off load running.

Because the venting line is closed, the pressure in the oil separator tank climbs slowly to the activating pressure of the safety valve. The activating pressure is read on the pressure gauge in the control panel.

- ☐ Stop the compressor unit (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☐ Remove the maintenance hood.
- ☐ Open the shut-off valve (5, see chapter 9.10) in the venting line again.
- ☐ Replace the maintenance hood.
- ☐ Open the shut-off valve between the compressor unit and the user's pipework.

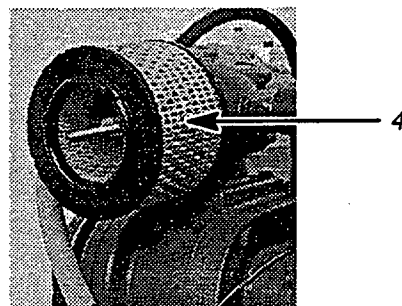
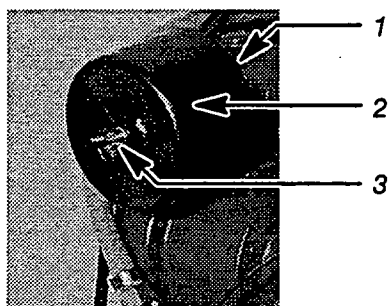
### 9.12 Cleaning or Renewing the Air Filter

Clean the air filter after every 500 service hours.

- ☐ Stop the compressor unit (see chapter 8.2).



**Switch off and lock out the main switch to prevent an accidental compressor run.**



- 1 Air filter
- 2 Air filter cap
- 3 Wing nut for opening air filter housing
- 4 Air filter cartridge

## Maintenance

### To open the air filter housing:

- ☞ Remove the maintenance hood.
- ☞ Unscrew the wing nut (3) and remove the air filter cap (2) and the filter cartridge (4).
- ☞ Clean the air filter cap and sealing surfaces.

### Cleaning the air filter cartridge (4) by tapping:

- ☞ Tap the air filter cartridge several times on the front with the ball of the hand.

**Attention!** Do not use force otherwise the air filter cartridge may be damaged.

- ☞ Clean all sealing surfaces.

### Cleaning the air filter cartridge with compressed air:

- ☞ Blow dry compressed air at a pressure of not more than 5 bar at a slant from the inside to the outside of the air filter cartridge surfaces.

**Attention!** Do not clean the air filter cartridge with fluids. If the air filter cartridge is heavily contaminated or was already cleaned several times (max. five times), renew.

### To close the filter housing:

- ☞ Insert the filter cartridge (4) and replace the air filter cap (2).
- ☞ Screw on the wing nut (3) tightly.
- ☞ Replace the maintenance hood.

## 9.13 Changing the Oil Separator Cartridge

Change the oil separator cartridge every 2000 to 3000 service hours.

The life of the oil separator cartridge is strongly influenced by the degree of contamination of the inlet air and the duration of the maintenance period for the air and oil filter cartridges.

- ☞ Stop the compressor (see chapter 8.2).

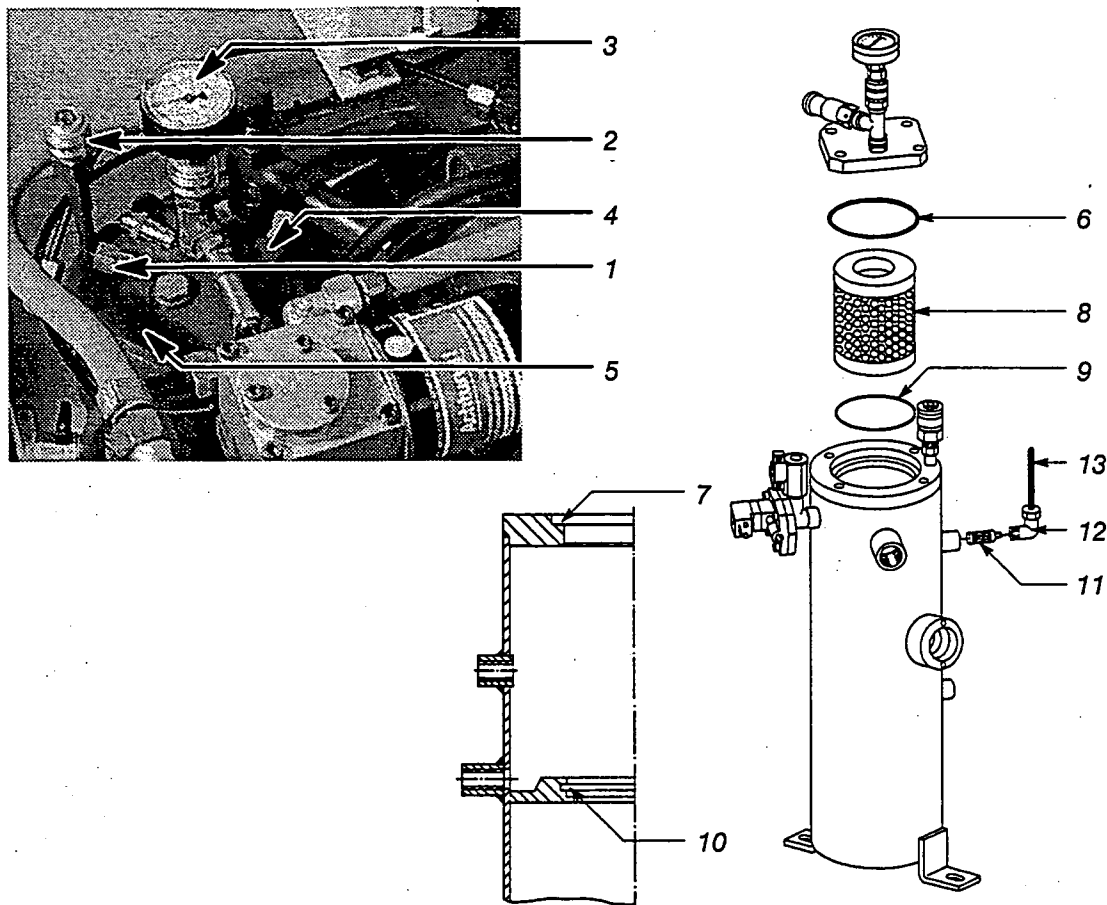


**Switch off and lock out the main switch to prevent an accidental compressor run.**

- ☞ Close the shut-off valve between the compressor and the user's pipework.

The compressor unit oil circulation system vents automatically.

## Maintenance



- |                  |                            |                            |
|------------------|----------------------------|----------------------------|
| 1 Nozzle         | 6 O-Ring (dia.80x8)        | 11 Dirt trap screen filter |
| 2 Hose coupling  | 7 Groove                   | 12 Elbow fitting           |
| 3 Pressure gauge | 8 Oil separating cartridge | 13 Control line            |
| 4 Hexagonal nut  | 9 O-Ring (dia.80x3,5)      |                            |
| 5 Cover          | 10 Groove                  |                            |

- ✎ Remove the maintenance hood.
- ✎ The pressure gauge on the oil separator tank must indicate zero bar.



**Oil mist can escape when the oil separator tank is vented.**

- ✎ Insert the nipple (1) into the hose coupling (2) on the oil separator tank (the tank is thus vented).
- ✎ Unscrew the hexagonal bolts (4) and remove the cover plate (5).
- ✎ Take out the old oil separator cartridge (8) with the O ring (6) and O ring (9) and dispose of according to environmental regulations.
- ✎ Clean the sealing surfaces of the oil separator tank.

**Attention!**

**The oil separating cartridge is disposable and cannot be cleaned.**

- ✎ Insert the new O ring (9) into the groove (10) in the oil separator tank.
- ✎ Insert the new oil separator cartridge (8) and then insert the new O ring (6) into the groove (7).
- ✎ Fit the cover plate (5) and tighten down with the hexagonal bolts (4).

## Maintenance

- ✎ Unscrew the union nut of the elbow fitting (12) and pull out the control air pipe (13).
- ✎ Unscrew and remove the elbow fitting (12) from the oil separator tank together with the dirt trap strainer (11).
- ✎ Replace the old dirt trap strainer with a new one.
- ✎ Wrap teflon tape around the outside thread of the elbow fitting (12) and screw back into the oil separator tank.
- ✎ Insert the control air pipe (13) into the elbow fitting (12) and tighten up the union nut.
- ✎ Pull the nipple (1) out of the hose coupling (2).
- ✎ Replace the maintenance hood.
- ✎ Open the shut-off valve between the compressor unit and the air main.



**Carry out a trial run.**

**When the operating temperature is reached (see chapter 1.1) shut down the compressor unit (see chapter 8.2) and lock out the main switch to prevent an accidental compressor run.**

**Afterwards, carry out a visual check for leaks.**

## Spare Parts and After Sales Service

### 10 Spare Parts and After Sales Service

#### 10.1 Service parts and expendable parts

Description	No. off	Order No.
Oil filter	1	6.1901.0
Air filter cartridge	1	6.0215.0
Filter mat	1	6.1892.0
Oil separator cartridge, complete set, Comprising: Separating cartridge O Ring Dirt trap screen filter	1 1 2 1	6.2018.0
Hose pipe from the minimum pressure check valve to the air/oil cooler	1	8.0873.00010
Hose pipe from the air/oil cooler to the compressor air end	1	8.1232.0

<b>KAESER</b> <b>KOMPRESSOREN</b>			KAESER KOMPRESSOREN GMBH Carl-Kaaser-Str. 28, D-98450 Coburg Germany, Tel.: (0 95 61) 640-0 Fax.: (0 95 61) 640-130		
Model	Year	kW	Rated power		
Part No.	min <sup>-1</sup>				
Serial No.	bar				
		Permiss. gauge working press.			

#### Important for all queries:

☐ Enter the data on the compressor name plate in the name plate shown above.

**Always quote the data on the name plate when making a query or ordering spare parts.**

#### Attention!

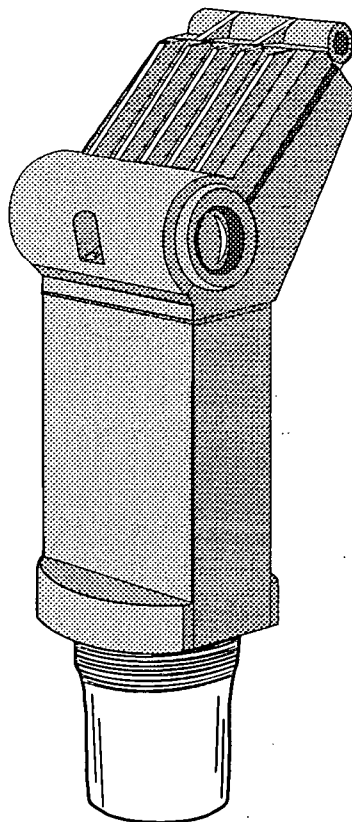
**Always order original spare parts from the compressor manufacturer to avoid lower quality spare parts in your compressor unit.**





# THE PROBE

## LEVEL MONITOR



**PL-425**

**March 1994**



*Canada*  
**(705) 745-2431**

*England*  
**(0905) 748404**



*U.S.A.*  
**(817) 277-3543**

*France*  
**(16) 42.65.69.00**

33454250  
PRR 1.0

## INTRODUCTION

The Probe is an ultrasonic level monitor combining sensor and electronics in a single package. It is designed to measure liquid levels in open or closed vessels. The process part (sensor) is Tefzel<sup>®</sup>, allowing The Probe to be used in a wide variety of industries, especially food and chemical.

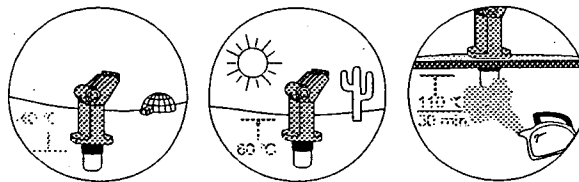
The sensor houses the ultrasonic transducer and temperature sensing element. The Probe emits a series of ultrasonic pulses from the transducer. Each pulse is reflected as an echo from the material and sensed by the transducer. The echo is processed by The Probe using Millitronic's proven 'Sonic Intelligence' techniques. Filtering is applied to help discriminate between the true echo from the material, and false echoes from acoustical and electrical noises and agitator blades in motion. The time for the pulse to travel to the material and back is temperature compensated and then converted into distance for display, mA output and relay actuation.

## INSTALLATION

### ENVIRONMENTAL

The Probe should be mounted in an area that is within the temperature range specified and that is suitable to the housing rating and materials of construction. The front lid should be accessible to allow programming, wiring and display viewing.

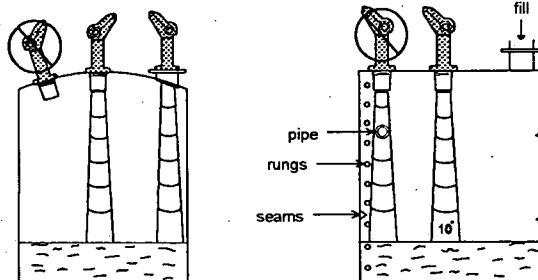
It is advisable to keep The Probe away from high voltage or current runs, contactors and SCR control drives.



### LOCATION

Locate The Probe so that it will have a clear sound path perpendicular to the liquid surface.

The Probe's sound path should not intersect the fill path, rough walls, seams, rungs, etc.



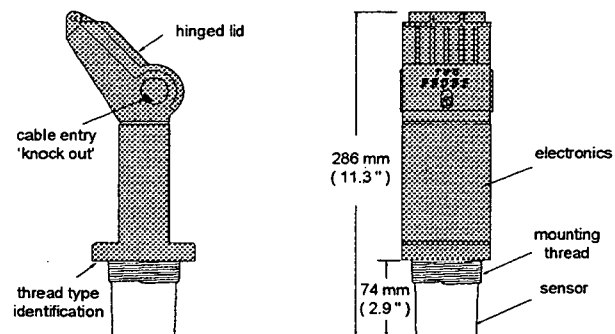
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## MOUNTING

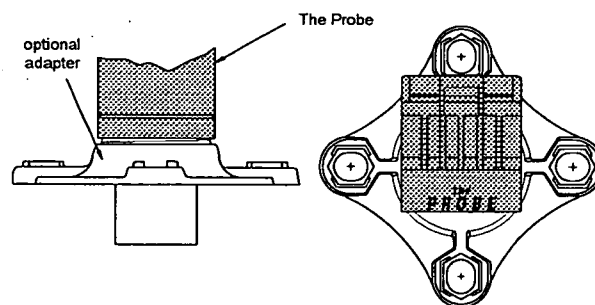
*Mount The Probe so that the face of the sensor is at least 25 cm above the highest anticipated level.*

The Probe is available in three thread types: 2" NPT, 2" BSP or PF2



*Before inserting The Probe into its mounting hole, insure that the threads are of the same type to avoid damaging The Probe threads.*

The Probe can be fitted with the optional 75 mm (3") flange adapter for mating to 3" ANSI, DIN 65PN10 and JIS 10K3B flanges.

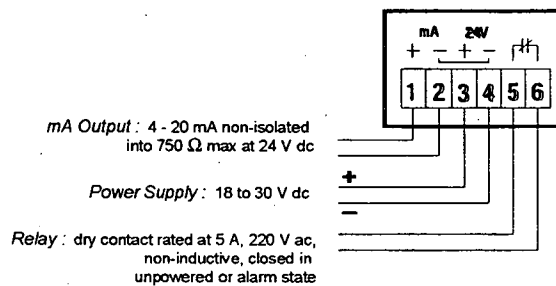
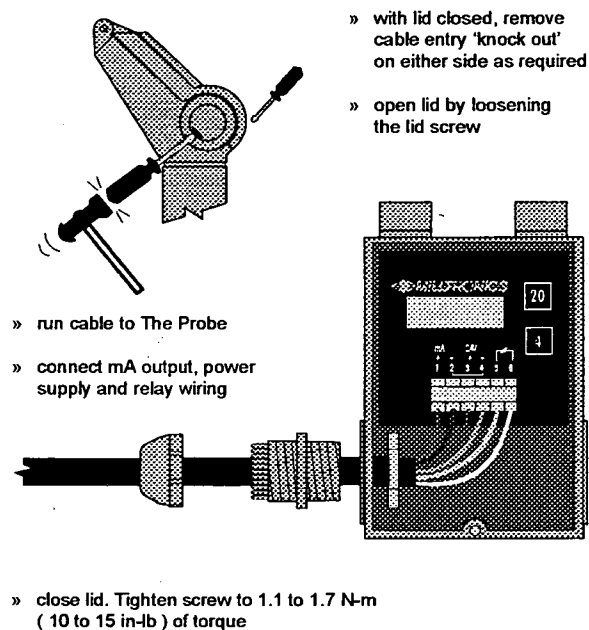


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## INTERCONNECTION

*Wiring must be done in accordance with all governing regulations. Separate cables and conduits may be required to conform to standard instrumentation wiring practices or electrical codes.*



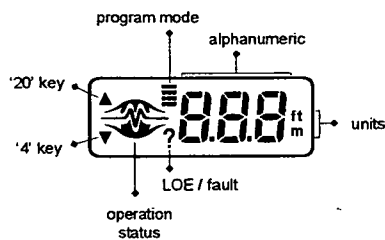
*Power supply input is reverse polarity protected.*

## OPERATION

### STARTUP

With The Probe correctly installed (or aimed at a wall 0.25 to 5 m away), apply power.

The Probe starts up displaying:



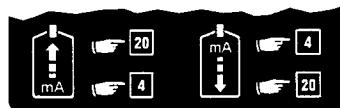
and then defaults to the Run mode, which is the measurement reading of the distance from the transducer face to the material level in the units indicated:



If the default display differs from that shown, refer to Operation Status.

### CALIBRATION

The calibration of the mA output may be done such that its span will be either proportional or inversely proportional to the material level.



*proportional span :*

high level = 20 mA  
low level = 4 mA

*inversely proportional span :*

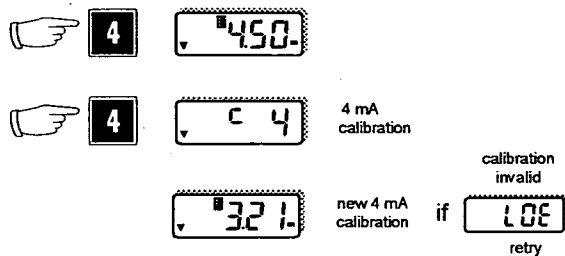
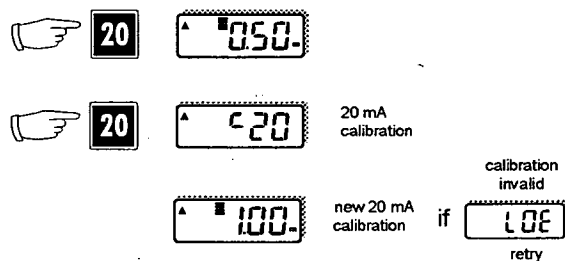
high level = 4 mA  
low level = 20 mA

*The 4 and 20 mA levels may be calibrated in any order.*

#### Calibration: Reference Method

With the vessel (or a target) at a distance corresponding to the desired calibration value, press the respective "4" or "20" key. A viewing sequence of the stored value is automatically initiated. During this time a calibration can be done by pressing the key a second time. After viewing or calibrating, Probe operation automatically reverts to the Run mode (6 sec).

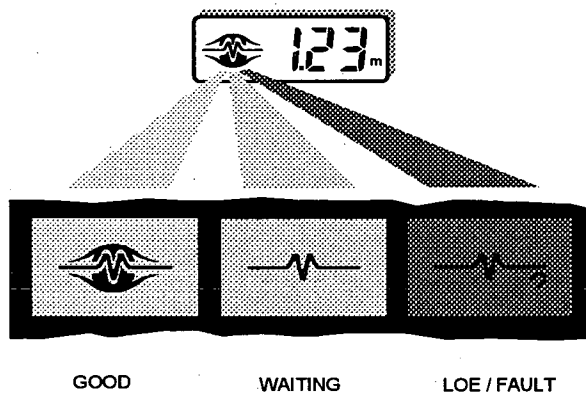
The calibration value is referenced from the face of The Probe sensor, in the units displayed.

**4 mA calibration****20 mA calibration**

*Calibration bypasses the measurement response rate.*

**OPERATION STATUS**

The graphic portion of the display gives the user a visual indication of The Probe's operating status. Viewing the graphic can assist the user in properly locating and installing The Probe to achieve optimum performance.



The logo will change from full to partial to indicate operation status. After the 'Waiting' period the contact will close (relay de-energizes) for an 'LOE / FAULT' indication. When a valid echo is again received, the full logo will be displayed and the contact opened. Refer to Troubleshooting.

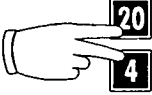
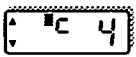

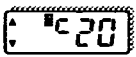

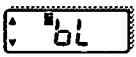

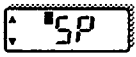



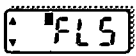
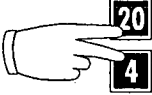
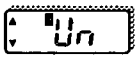

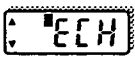
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## ADJUSTMENTS

There are several operating adjustments that can be made to The Probe.

To access the operating adjustments, simultaneously press the "4" and "20" keys until the desired adjustment is obtained. A viewing sequence of the stored value is automatically initiated. During this time the value can be changed by pressing either the "4" or "20" key. After viewing or changing, operation automatically reverts to the Run mode (6 sec).

		4 mA calibration, scrolling
		20 mA calibration, scrolling
		blanking
		speed of response
		alarm
		fail-safe
		units
		for Milltronics use

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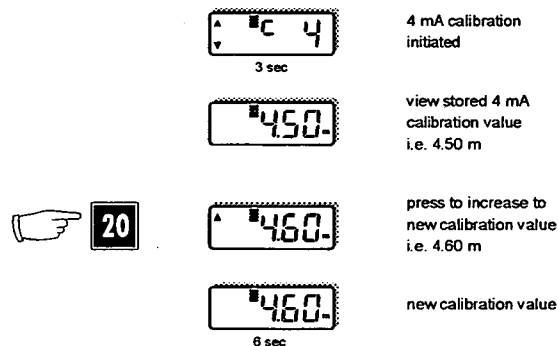
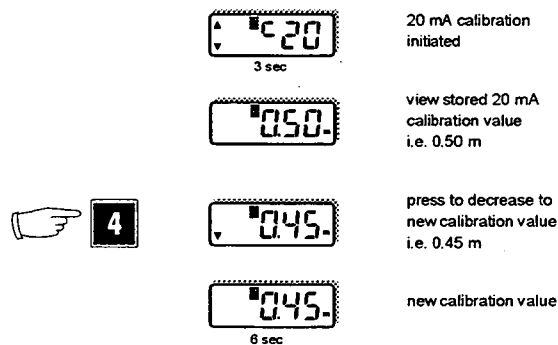
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**CALIBRATION: SCROLLING METHOD**

The 4 and 20 mA calibration values can be selected where reference levels, either from the material in the vessel or from a target, cannot be provided. This method can also be used to trim the output levels obtained by the Reference Method (see page 4).

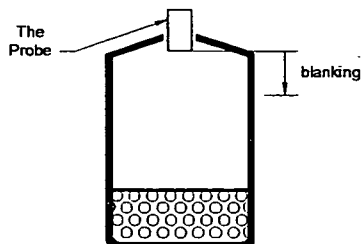
To change the stored calibration value, obtain the '4' or '20' display. The calibration value may be increased by pressing the "20" key or decreased by pressing the "4" key. When the display has scrolled to the desired value, stop pressing the key. The display automatically reverts to the Run mode (6 sec).

**4 mA calibration****20 mA calibration**

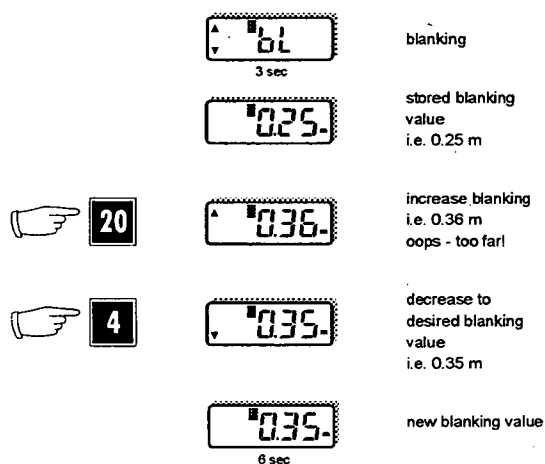
*For faster scrolling, hold the key depressed during the calibration adjustment and release when desired value is obtained.*

**BLANKING**

Blanking is used to ignore the zone in front of the transducer where false echoes are at a level that interfere with the processing of the true echo. It is measured outward from the sensor face. The minimum recommended blanking value is 0.25 m (0.82 ft) but can be increased in order to extend the blanking.



To change the stored blanking value, obtain the 'bl' display. The blanking value may be increased by pressing the "20" key or subsequently decreased by pressing the "4" key. When the display has scrolled to the desired value, stop pressing the key. The display automatically returns to the Run mode (6 sec).



*For faster scrolling, hold the key depressed during the blanking adjustment and release when desired value is obtained.*

#### SPEED OF RESPONSE

The speed of response adjustment allows the user to collectively set a number of operating parameters.

##### measurement response :

is the limit to which The Probe will be able to keep up with rates of change

If The Probe measurement cannot keep up with the rate of level change, set the adjustment from '1' to '2'. If The Probe still cannot keep up with the rate of level change, set the adjustment option to '3'. Avoid choosing an option that is too fast for your application.

##### agitator discrimination :

discriminates between agitator blades in motion and the material (target) surface.

##### filter :

discriminates between false echoes from acoustical and electrical noise and the material (target) surface.

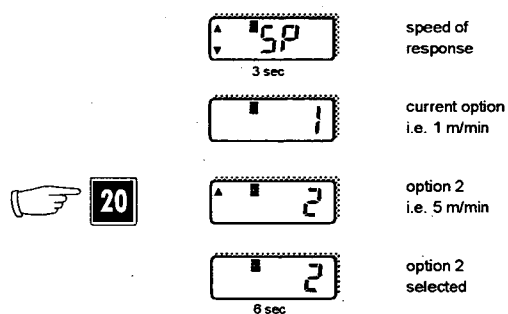
fail-safe timer:

establishes the 'Waiting' period from the time a loss of echo or operating fault condition starts until the fail-safe default is effected.

SP	measurement response	agitator discrimination	filter	FLS timer
1 V	1 m/min (3.3 ft/min)	on	on	10 min
2	5 m/min (16.4 ft/min)	on	on	3 min
3	immediate	off	off	3 min

V = factory setting

To change the speed of response, obtain the 'SP' display. Scroll forward through the options (1-2-3) by pressing the "20" key. Scroll backward through the options (3-2-1) by pressing the "4" key. When the desired option is displayed, stop pressing the key. The display will automatically return to the Run mode (6 sec).



#### ALARM

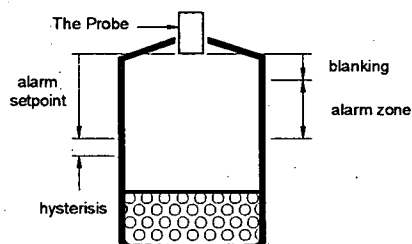
The alarm adjustment assigns one of the following functions to the relay.

0 = loss of echo / fault alarm (factory setting)

The relay is energized with the contacts open during normal operation (see Fail-safe).

g = process alarm

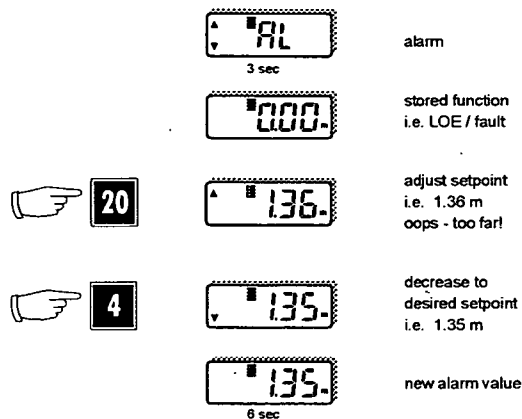
The non zero value entered becomes the alarm setpoint, referenced to The Probe's sensor face. The relay de-energizes and the contacts close when the material is within the alarm zone. There is a hysteresis equivalent to 5% of the empty calibration distance.



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To change the alarm function or setpoint, obtain the 'AL' display. The setpoint may be increased by pressing the "20" key or subsequently decreased by pressing the "4" key. When the display has scrolled to the desired value, stop pressing the key. The display automatically returns to the Run mode (6 sec).



*For faster scrolling, hold the key depressed during the setpoint adjustment and release when the desired value is obtained.*

#### FAIL-SAFE

In the event a loss of echo or fault condition exceeds the 'Waiting' period (see Speed of Response), the '?' icon appears and one of the following fail-safe defaults is immediately effected.

FLS	default	mA <sup>p</sup>	mA <sup>i</sup>	relay <sup>*</sup>	reading
1	full	22	3.8	close	hold
2	empty	3.8	22	open	hold
3 <sup>∇</sup>	hold	hold	hold	hold	hold

p = proportional span

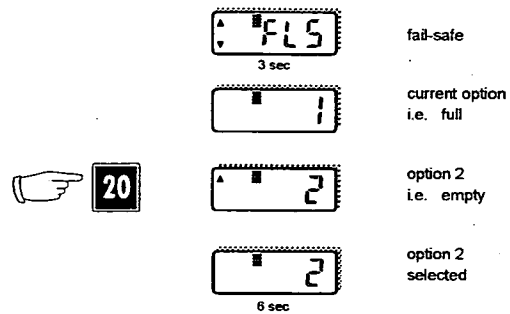
i = inversely proportional span

\* = alarm adjustment set for process alarm.

If set for LOE / fault, relay closes for all defaults.

∇ = factory default

To change the fail-safe default obtain the 'FLS' display. Scroll forward through the options (1-2-3) by pressing the "20" key. Scroll backward through the options (3-2-1) by pressing the "4" key. When the desired option is displayed, stop pressing the key. The display will automatically return to the Run mode (6 sec).



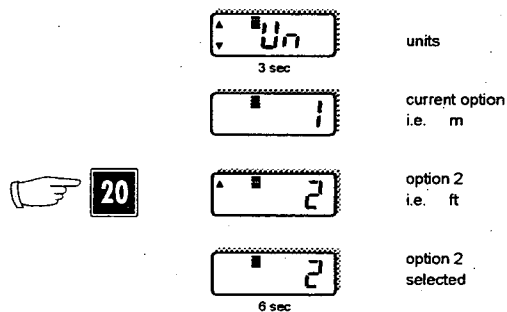
#### UNITS

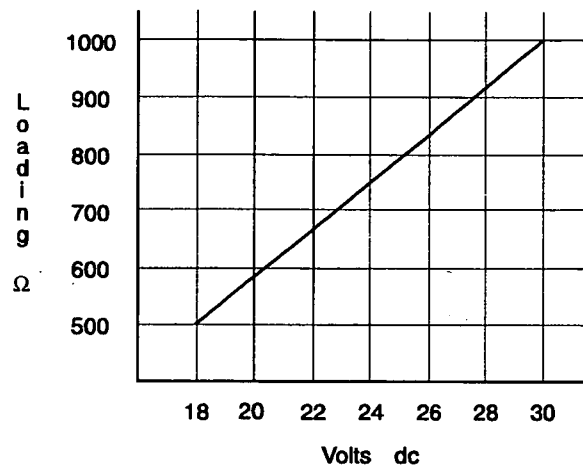
The units of the measurement reading can be selected as follows:

- 1 = metres, m (factory setting)
- 2 = feet, ft

The selected units are also applicable to the 'Blanking' and 'Alarm' adjustments.

To change the units obtain the 'Un' display. Scroll forward through the options ( 1 - 2 ) by pressing the "20" key. Scroll backward through the options ( 2 - 1 ) by pressing the "4" key. When the desired option is displayed, stop pressing the key. The display will automatically return to the Run mode (6 sec).



**SUPPLEMENT****mA OUTPUT****Loading vs Supply Voltage****TROUBLESHOOTING****WAITING**

The echo is not reliable and The Probe is waiting for a valid echo before updating the measurement.

Probable causes are:

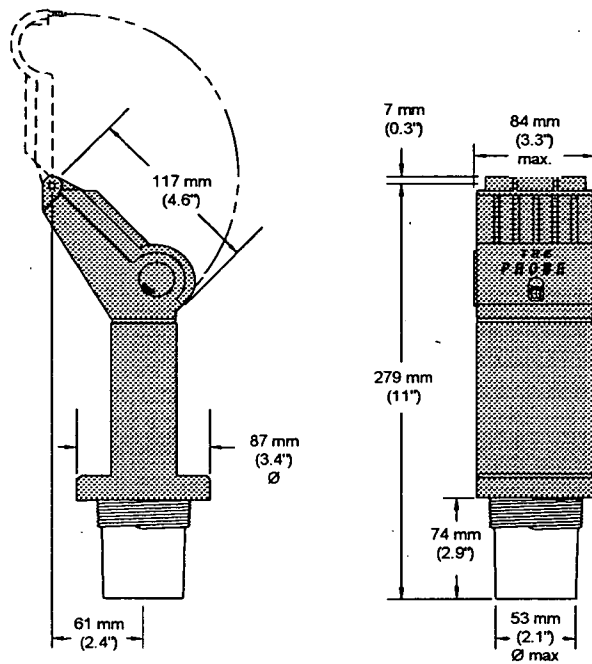
- » material or object in contact with sensor face
- » The Probe is too close to the fill point
- » The Probe is not perpendicular to the liquid surface
- » change in level too fast
- » measurement out of range
- » foam on liquid surface
- » high level of vibration in the mounting structure
- » level inside the blanking zone

**LOE / FAULT**

The 'Waiting' period has expired. Investigate the probable causes listed above.

Refer to Adjustments \ Speed of Response for duration of 'Waiting' periods.

## DIMENSION DETAILS



## TEFZEL®

Tefzel® is a fluoropolymer inert to most chemicals. For exposure to specific environments, check with chemical compatibility charts before installing and operating The Probe in your application.

Tefzel® is a registered trade mark of DuPont.

## PATENTS

Instrument Housing Design:

- » Canada: 70345
- » U.S.A.: 07/858/707
- » Germany: M9202272
- » U.K.: 2021748
- » France: 921873

Electronics / Sensor:

- » U.S.A.: 5,267,219
- » patent applications in U.K., Canada, Europe, Africa, Australia

## SPECIFICATIONS

Power:	» 18 to 30 V dc, 0.2 A max
Range:	» series 861: 0.25 to 5 m ( 0.8 to 16.4 ft )
(liquids only)	» series 862: 0.25 to 10 m ( 0.8 to 32.8 ft )
Beam Angle:	» 10 ° at -3 dB boundary
Memory:	» non-volatile EEPROM, no battery required
Programming:	» 2 tactile keys
Operating Temperature:	» continuous: – 40° to 60 °C ( – 40° to 140 °F )
	sensor: 110 °C (230 °F) max for 30 minutes ( steam only )
	* – 20 °C ( – 5 °F ) if metal mounting device
Temperature Compensation:	» built-in to compensate over the operating range
Display:	» liquid crystal
	» three 9 mm (0.35") digits for reading of distance between sensor face and material
	» multisegment graphic for operation status
mA Output:	» range: 4 – 20 mA
	» span: proportional or inversely proportional
	» accuracy: 0.25% of full scale
	» resolution: 3 mm (0.125")
	» loading: 750 ohms max at 24 V dc supply
Pressure: (vessel)	» 200 KPa ( 2 bar or 30 psi ) max above atmosphere
Relay (fault):	» 1 normally closed contact rated at 5 A at 220 V ac non-inductive or 24 V dc
	» fault on power, application or device failure
	» relay is certified for use in equipment where the short circuit capacity of the circuits in which they are connected is limited by fuses having ratings not exceeding the rating of the relays.
Construction:	» combined sensor and electronics package
» sensor housing:	» material: » Tefzel <sup>®</sup>
	» mounting: » 2" NPT, 2" BSP or PF2
	» optional: » flange adapter
» electronics housing:	» material: » PVC
	» access: » hinged lid
	» 22 mm (0.87") dia. 'knock out' for conduit entrance, 2 places
	» 6 screw terminal block for 2.5 mm <sup>2</sup> (14 ga) solid wire / 1.5 mm <sup>2</sup> (16 ga) stranded wire max
Enclosure Rating :	» IP 65 / NEMA 4 / CSA Type 4
	The non-metallic enclosure does not provide bonding between conduit connectors. The use of approved watertight conduit hubs/glands is required for IP 65 / NEMA 4 / CSA Type 4 (outdoor) applications.
Weight:	» 1.5 Kg (3.3 lb)
Approvals:	» CSA, FM





**Mono Pumps**



**Aquatec Maxcon**

**Leichardt Ipswich Qld.**

**YOUR REF  
40776**

**OUR REF  
Q125712**

**CT205GBW9B2**

# **MANUAL**

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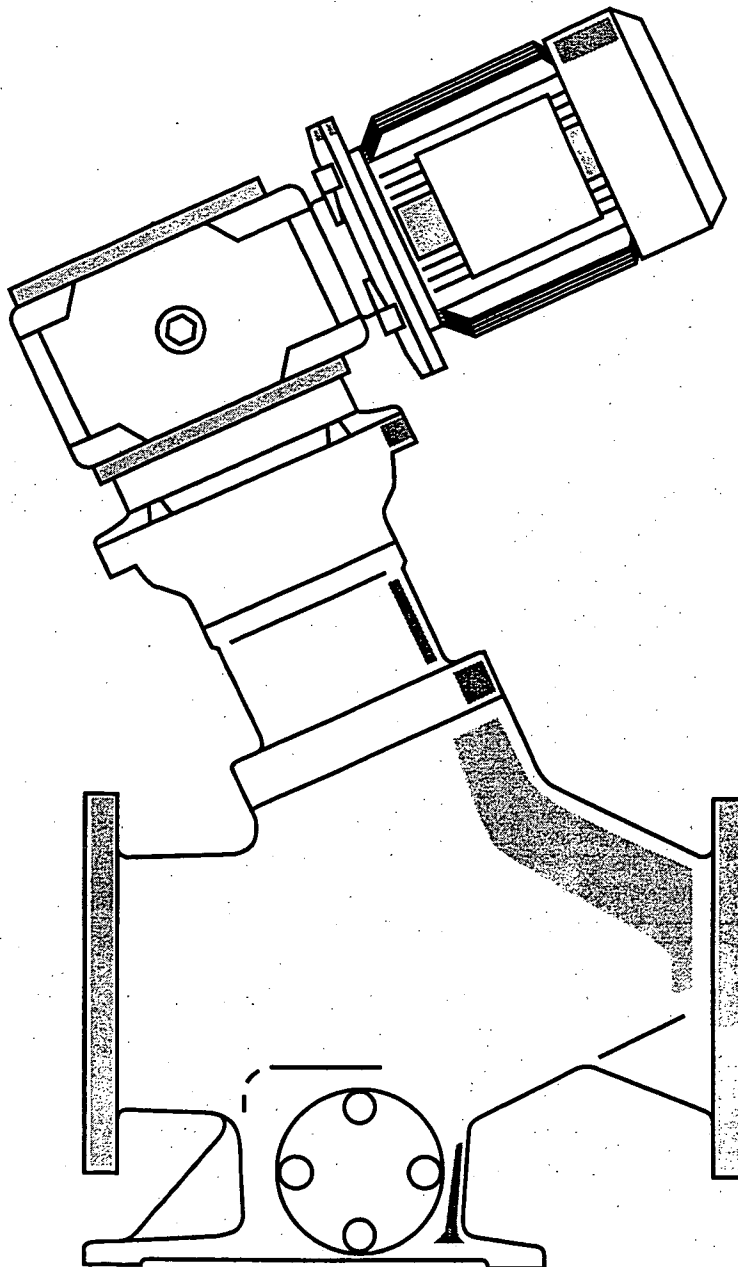
- 1. 'TR' Muncher Details**
- 2. Operation & Installation Instruction**
- 3. Reynold Gear Motor Details**
- 4. General Arrangement Drawings**
- 5. Spare Parts Listing**

# Mono<sup>®</sup>

## WASTE-TEC PRODUCTS

### TR MUNCHER

#### INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



# TR MUNCHER

This information, and all the information contained herein, is the exclusive property of Mono Pumps Ltd., and contains information of a proprietary nature. It is provided for the sole purpose of transmitting the information contained to the designated recipient.

This information is to be used only as specified in the instrument of transmittal. It is not to be reproduced, copied in whole, or in part, nor is information it contains to be disclosed in any manner without the written consent of Mono Pumps Ltd. Its use for any other reason than the specified shall be in violation of the agreement with the recipient concerning the legal rights of Mono Pumps Ltd.

Mono Pumps Ltd, reserves the right to make changes which may obsolete certain parts of this manual.

This manual gives a guide to the operation and maintenance of the TR Muncher given that all Health and Safety and good engineering practices are observed.

The information below is for Contract No.

and gives the duty for which the equipment is supplied.

<b>MONO®</b>	
<b>WASTE-TEC PRODUCTS</b>	
<b>The Muncher</b>	
MODEL No	<input type="text"/>
CONTRACT No/DATE	<input type="text"/>
DUTY/LIQUID	<input type="text"/>
Martin Street Audenshaw Manchester M34 5DQ Tel: 0161 339 9000 Fax: 0161 344 0727	
MADE IN GREAT BRITAIN	 

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Note On Special Control Equipment Refer To The Drawing Enclosed In The Control Panel

## 1.0 TYPICAL CONSTRUCTION SPECIFICATION

### CASING.

Can be in cast ductile iron, stainless steel or gun metal dependant on application.

### SHAFTS.

High specification alloy steel hexagon section for cutter and spacer location.

The shafts are geared at differential speeds to promote the most efficient handling of solids.

### CUTTERS AND SPACERS.

Are of chromium molybdenum alloy steel, hardened tempered and ground.

### MECHANICAL SEALS.

Specially developed tungsten carbide mechanical seals having a maximum working pressure of 6 Bar.

### TRANSMISSION.

Hardened carbon steel spur gears.

### FINISH.

Standard paint finish is to be 1 coat primer and 1 coat hammer finish enamel gloss, to provide a long term effective surface protection from the environment.

### CONTROL PANELS.

Are supplied with conventional stop / start equipment complete with a PLC based control system which will:-

a. Sense an overload condition (jam) and momentarily reverse the cutters to clear the condition and then return to normal rotation. Maintain normal operation if the overload is cleared.

b. If a second overload (jam) occurs within 60 seconds of the first. reverse the machine again, to release the jam.

c. If a third overload (jam) occurs within 60 seconds of the first automatically shut down the machine in reverse mode and energise an alarm circuit.

The logic is capable of differentiating between locked rotor overload requiring instant reversal and an allowable periodic low level overload allowing an ongoing running period before reversal mode is engaged.

### 1.1 NOISE LEVEL.

The airborne noise emission of the TR Muncher does not exceed 70 dB(A).

## 2.0 OPERATING PRINCIPLES.

Designed to operate in the water and waste water industries the TR Muncher is a slow speed, high torque grinder, having two shafts operating at differential speeds. Each shaft is fitted with identical interleaving cutters and spacers. The cutter stack is positioned at 25 degrees to the vertical so that any heavy foreign objects will fall into the trash trap.

## 3.0 STORAGE AND PROTECTION RECOMMENDATIONS

The TR Munchers are dispatched from our factory the cutter chamber sprayed with a moisture repellent coating ready for immediate installation and operation.

Should the machine be stored or left stationary for any length of time it is recommended that the cutter bank is resprayed with anti-rust lubricant and that the shafts are rotated weekly.

This can most easily and safely be done by removing the motor fan cowl and turning by hand.

Failure to do this may result in a higher frequency of reversals and in extreme cases the machine to seize due to tight running clearances of the individual cutting elements during commissioning and initial start-up.

The starter panel should be stored in a controlled dry environment to prevent moisture build up causing corrosion of contractors and other metallic component.

**Note:-** Extreme care should be observed when handling either the panel or the machine to prevent damage to paintwork etc.

These units should be lifted in accordance with the recommendations given in this manual (4.3)

## 4.0 INSTALLATION.

### 4.1 EXPLOSIVE ATMOSPHERES.

When installed in a potentially explosive atmosphere always ensure it complies with all local Health and Safety and Factories Acts requirements, as well as any relevant Hazardous Area Classifications.

### 4.2 PIPELINE MODELS.

These units are designed for horizontal installation only. Pipework to and from the unit should be independently supported and not rely on the TR Muncher. The inlet of the TR Muncher is on the opposite side to the motor fan cowl. The trash trap should be cleaned as and when necessary, this will depend on the amount of heavy solids in the flow. This can be easily done by isolating the machine from the flow and removing the inspection covers, alternatively this can be automated utilising both inspection ports on a pneumatic line.

### NOTE:-

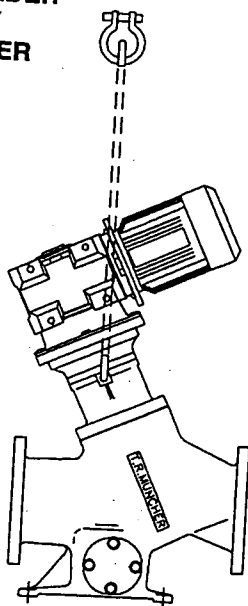
When installing in conjunction with a Mono pump unit it is essential that all pipework, joints etc. on the suction side are vacuum tight otherwise damage to the pump may occur.

### 4.3 LIFTING RECOMMENDATIONS.

Machines should be lifted by designated lifting points only using certified equipment. Minimum requirements are given below:-

Machine Code	kW Rating	Max. Weight(Kg)
CT203C	1.5	290
CT203D	1.5	290
CT203E	1.5	290
CT205F	1.5	345
CT205G	1.5	345
CT203C	2.2/4.0	340
CT203D	2.2/4.0	340
CT203E	2.2/4.0	340
CT205F	2.2/4.0	390
CT205G	2.2/4.0	390

FIG. 1  
TYPICAL SPREADER  
BAR ASSEMBLY  
FOR TR MUNCHER



NOTE:-  
Extreme caution should be observed for personnel safety when lifting heavy objects

### START-UP PROCEDURE.

Always observe the safety instruction card provided with the machine, and ensure that the machine is guarded to local Health and Safety and Factories Acts regulations before any attempt is made to operate.

Once the machine is installed in its correct operating position the gearbox should be checked for the correct amount of oil. Refer to section 6 for oil quantities and recommended lubricants.

Due to the nature of the equipment and its operating environment the TR Muncher can be an extremely dangerous machine if the manufacturers instructions are followed correctly.

On start-up check the direction of rotation of the motor. This is most easily done by removing the motor cover, the motor should rotate clockwise when looking from the outlet side of the machine.

This work should only be carried out by qualified personnel.

### NOTE:-

This machine is only recommended for use in a suitably rated pipeline installation, with a working pressure not exceeding 6 Bar.  
Do not insert hands or objects into the machine while the inspection covers are removed.

### 6.0 LUBRICATION SCHEDULE

#### 6.1 TR MUNCHER UNIT

Shaft bearings are of the sealed for life type and do not require any lubrication. The drive gears are furnished with lithium grease which should not be mixed with other bases. Use only recommended lubricants as shown below for the TR Muncher drive gears.

#### RECOMMENDED LUBRICANTS

Shell Alvania No. 2EP (-90°C to 820°C) or  
BP Energol LC2 (-30°C to 180°C)  
Viscosity rating not applicable.

Mechanical seals are of the sealed cartridge type and do not require any lubrication or maintenance

#### 6.2 GEARED MOTOR UNIT

The geared motor units are supplied filled with the correct amount of lubricant. When changing use only manufacturers recommendations. See component parts list in section 15.0.

The motor lubricant should be changed after 10,000 hours of operation or 2 years whichever is the sooner.

#### RECOMMENDED LUBRICANTS

Burmah Castrol Alpha SYN-T-320  
Century Oils Century SGG  
Mobil Oil Co. SHC 320  
Mobil Oil Co. SHC 632

Gearbox Type jPM30 - 2 Litres  
Gearbox Type PM35 - 4.5 Litres

### 25 DEGREE MOUNTING

## 9.0 SCHEDULED MAINTENANCE

REFERENCE DRAWING NUMBER T000 9820

Caution, when servicing the TR Muncher be certain the main line breaker is open and tagged. Serious injury could result from accidental start up. Disconnect and tag motor leads in the motor terminal box. Care should be taken when handling cutters, and protective gloves should be worn.

### BEARING AND SEAL INSPECTION.

Every 12 months bearings, gears and seals should be inspected for signs of wear. The TR Muncher pipeline should be isolated by closing line valves before and after the machine.

## 10.0 TR MUNCHER DISASSEMBLY

REFERENCE DRAWING NUMBER T000 9820

Caution when servicing the TR Muncher be certain the main line breaker is open and tagged. Serious injury could result from accidental start up. Disconnect and tag motor leads in the motor terminal box. Care should be taken when handling cutters, and protective gloves should be worn.

The TR Muncher pipeline should be isolated by closing line valves before and after the machine.

(1) Remove the cutter stack by removing screws P102 from the bearing housing 0100 and extract the entire assembly using suitable lifting gear.

(2) Replace the pull back assembly with the maintenance period screen (MPS) if required. Replacing gasket 2000 if necessary.

(3) Steam clean the pull back assembly. Do not steam clean the motor or gear unit.

### BEARINGS AND SEALS

(1) Remove screws P501 from the top cover plate 1100 and extract the gear unit.

(2) Remove drive key P500 from shaft 3200

(3) Remove screws P113 and P114 and shaft end caps 3650

Ensure the correct direction is employed when untightening i.e.:-

**P113 CLOCKWISE**

**P114 ANTI-CLOCKWISE**

### NOTE:-

It is good practice to note the stacking procedure at this point. Close attention to stacking during disassembly will ease the restacking of the shafts.

(4) Remove cutters 2500 and spacers 3500 from shafts 3200 and 3250.

(5) Remove screws P101, lipseal P106 and top cover plate 1100 and extract dowel P109.

(6) Remove shaft circlips P104

(7) Remove drive gear 7800 and driven gear 7801. Inspect for signs of wear and replace if necessary.

(8) Remove datum tubes 0200

(9) Remove shafts 3200 and 3250

(10) Remove seal retaining washer 4750.

(11) Remove seal assemblies. Inspect for signs of wear and replace if necessary.

(12) Remove circlip P103 from top cover plate 1100 and extract bearings P111. Inspect for signs of wear and replace if necessary.

### CLEAN AND INSPECT

(1) Steam clean and disinfect all parts of the TR Muncher. Do not steam clean the motor or gear drive unit.

(2) Remove any gasket material from joint faces.

(3) Housings must be thoroughly cleaned.

(4) Inspect all parts for damage, excessive wear etc. and replace if necessary.

(5) Clean top bearing and inspect for wear. Sealed bearings cannot be regreased, replace if necessary.

(6) Inspect 'O' rings, lipseals, and mechanical seals for wear and replace if necessary.

(7) Inspect gears for wear and damage and replace if necessary.



## 11.0 TR MUNCHER ASSEMBLY

### REFERENCE DRAWING NUMBER T000 9820

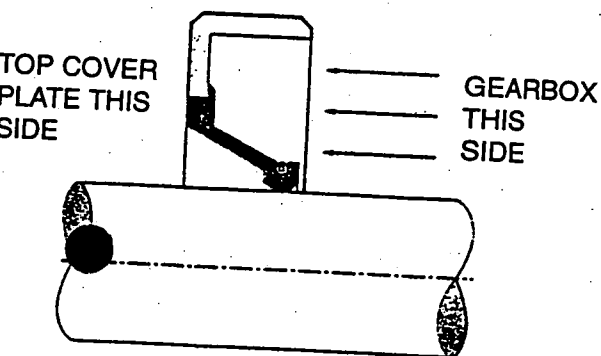
**Caution when servicing the TR Muncher be certain the main line breaker is open and tagged. Serious injury could result from accidental start-up. Disconnect and tag motor leads in the motor terminal box.**

The TR Muncher pipeline should be isolated by closing line valves before and after the machine.

### BEARING HOUSING ASSEMBLY.

- (1) Fit mechanical seal P112 into housing 0100 and secure with seal retaining washer 4750.
- (2) Fit shafts 3200 and 3250 into housing and through seal.
- (3) Fit datum tubes 0200 to top of shafts 3200 and 3250
- (4) Fit key P105 and gears 7800 and 7801 to shafts.
- (5) Fit shaft retaining circlips P104 to shafts.
- (6) Fit bearings P111 into top cover plate 1100 and secure with circlips P103.
- (7) Fit rotary shaft lipseal P106 into top cover plate 1100.

**Fig. 1  
P106 SINGLE LIPSEAL (Top Cover Plate)**



- (8) Fit dowel P109 into bearing housing 0100.
- (9) Fit top cover plate 1100 onto bearing housing 0100 and secure using fasteners P101 and P107.
- (10) Stack shafts with cutters 2500 and spacers 3500. See rotating parts table for stack quantities.
- (11) Fit shaft end caps 3650 to end of shafts and secure with screws P113 and P114.

Tighten to a Torque of 248 NM.

Ensure the correct direction is employed when tightening i.e.:-

**P113 ANTI - CLOCKWISE  
P114 CLOCKWISE**

- (12) Fit pull back assembly to main body casting 0300 with gasket 2000 and secure using fasteners P102 and P115.

- (13) Fit key P500 to drive shaft 3200.

### REPLACEMENT OF GEARED MOTOR UNIT

#### REFERENCE DRAWING NUMBER T000 9820

#### WARNING

**When servicing the TR Muncher or motor controller be certain the main line breaker is open and tagged. Serious injury could result from accidental start-up. Disconnect and tag motor leads in the motor terminal box.**

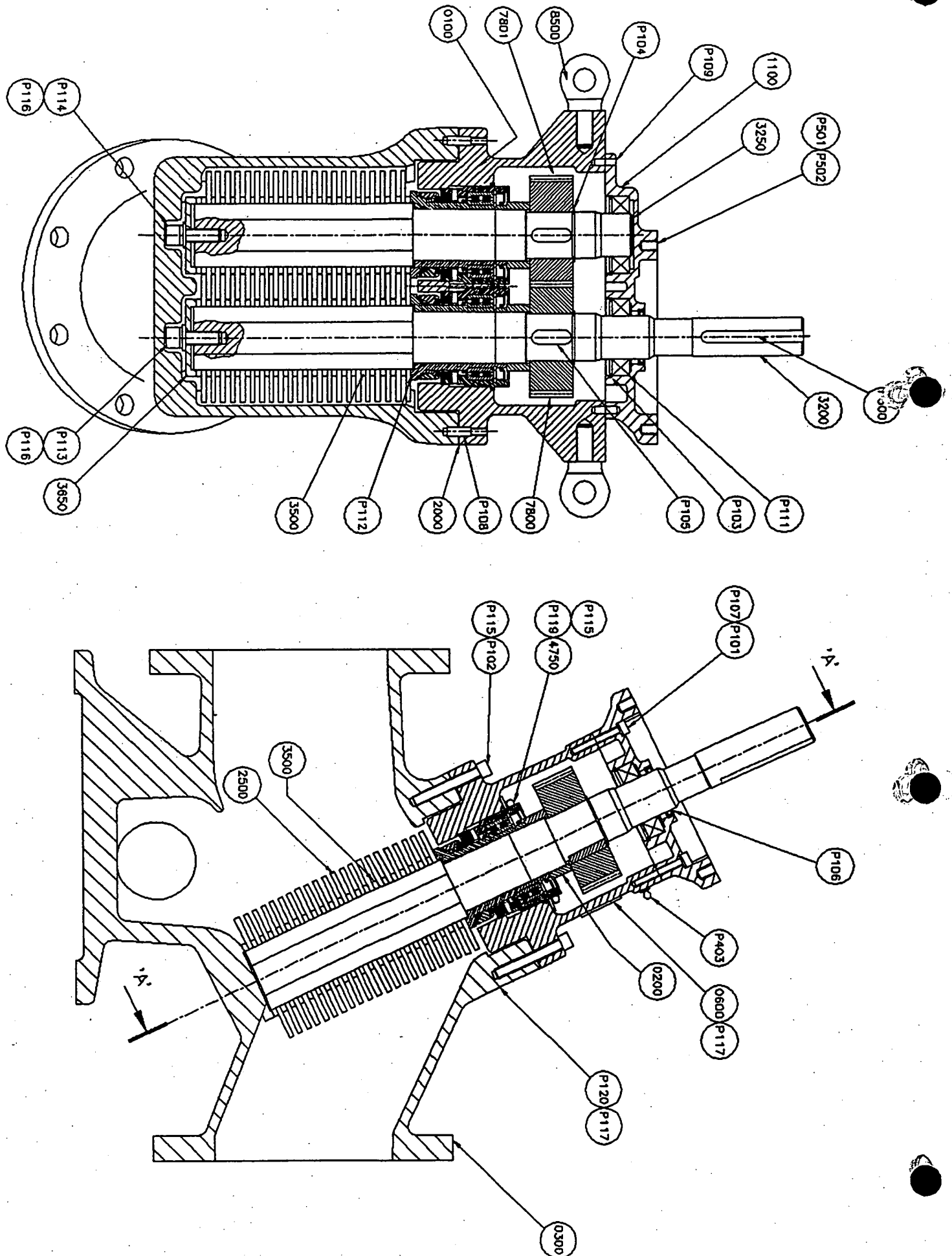
- (1) The TR Muncher may be left installed if required. Disconnect and tag main lines in breaker upstream of controller.
- (2) Disconnect and tag motor leads in motor terminal box.
- (3) Remove fasteners P501 and P502 and lift geared motor unit from the TR Muncher using suitable lifting equipment.
- (4) Replace with new geared motor unit on TR Muncher and secure with fasteners P501 and P502.
- (5) Reconnect motor leads. Verify motor leads are connected for proper voltage and start the TR Muncher. Check for correct direction of rotation.

#### NOTE:

**In order to gauge correct cutter rotation the motor fan cowl should be removed. The fan should rotate clockwise when looking from the outlet side of the machine. Do not insert hands or objects into the machine while the inspection covers are removed.**

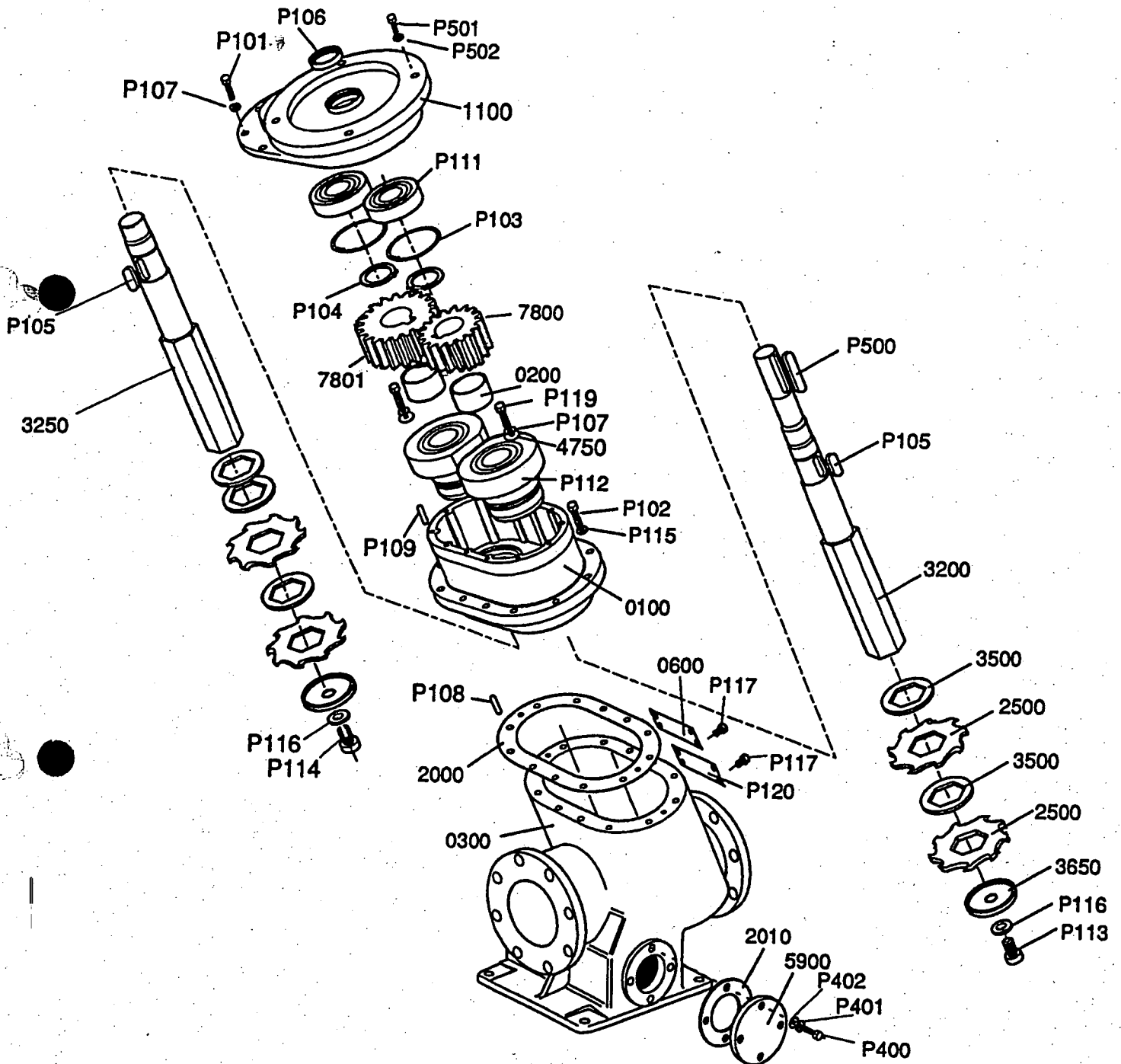
**12.0 SECTIONAL ARRANGEMENT**

DRAWING NUMBER T000 9800



**13.0 EXPLODED VIEW OF PIPELINE UNIT**

DRAWING NUMBER T000 9820



**13.0 TR MUNCHER PARTS LIST****BODY PARTS (See Drawing T000 9820)**

ITEM	QTY	DESCRIPTION	CODE	PART No.
0100	1	Bearing Housing	CD	T000 0101
0200	2	Datum Tube	MT	T000 0201
0600	1	Nameplate	AA	A02A 0600
1100	1	Top Cover Plate jPM30	CD	T000 1100
1101	1	Top Cover Plate PM35	CD	T000 1101
2000	1	Main Body Gasket	OO	T000 2000
3650	2	Shaft Endcap	SF	T000 3650
4750	2	Bearing Retaining Washer	MB	T000 4701
7800	1	Drive Gear 17 Tooth	MQ	T000 7800
7801	1	Drive Gear 20 Tooth	MQ	T000 7801
P101	6	M8 x 55Lg Hex Soc Capscrew		A113311F
P102	12	M12 x 50Lg Hex Soc Capscrew		A115302F
P103	2	Internal Circlip 90mm		C102790P
P104	2	External H/D Circlip 55mm		C104550P
P105	2	Rect Par Key 16 x 10 x 47mm		K101647P
P106	1	Rotary Shaft Lipseal 45 x 65 x 8		S361501P
P107	8	M8 Spring Washer		W113252F
P108	2	Grade 1 Dowel 10 x 25mm		P152222P
P109	2	Grade 1 Dowel 8 x 25mm		P151222P
P111	2	Ball Bearing 50 x 90 x 20		A160502B
P112	2	Mechanical Seal Assembly		M060130G
P113	1	M16 x 45Lg Soc HD Cap Scr RH		A117292F
P114	1	M16 x 45Lg Soc HD Cap Scr LH		A147292F
P115	14	M12 Spring Washer		W115251F
P116	2	M16 Spring Washer		W117251F
P117	8	No.0 x 3/16" Drive screws		R101082F
P118	2	M8 x 30Lg Hex Soc Capscrew		A113242F
P119	2	M12 x 25Lg Hex Hd Screw		F115222F
P120	1	Warning Label	AA	52/C13230

**13.0 TR MUNCHER PARTS LIST****MAIN BODY ASSEMBLY PARTS (See Drawing T000 9820)**

ITEM	QTY	DESCRIPTION	CODE	PART No.
0300	1	Main Body 100 Dia. PN16	CF	T03C 0300
0300	1	Main Body 150 Dia. PN16	CF	T03D 0300
0300	1	Main Body 200 Dia. PN16	CF	T03E 0300
0300	1	Main Body 4" Dia. A.N.S.I.	CF	T03P 0300
0300	1	Main Body 6" Dia. A.N.S.I.	CF	T03Q 0300
0300	1	Main Body 8" Dia. A.N.S.I.	CF	T03R 0300
0300	1	Main Body 250 Dia. PN16	CF	T05F 0300
0300	1	Main Body 300 Dia. PN16	CF	T05G 0300
0300	1	Main Body 10" Dia. A.N.S.I.	CF	T05S 0300
0300	1	Main Body 12" Dia. A.N.S.I.	CF	T05T 0300
2010	2	Inspection Cover Gasket PN16	ZG	T000 2010
2011	2	Inspection Cover Gasket A.N.S.I.	ZG	T000 2011
5900	2	Inspection Cover PN16	MB	T000 5900
5901	2	Inspection Cover A.N.S.I.	MB	T000 5901
400	8	M16 x 25Lg Hex Head Screw		F117222F
P401	8	M16 Plain Washer		W117050F
P402	8	M16 Spring Washer		W117251F
P403	1	1/8" BSP Grease Nipple		L120032P

**ROTATING PARTS (See Drawing T000 9820)**

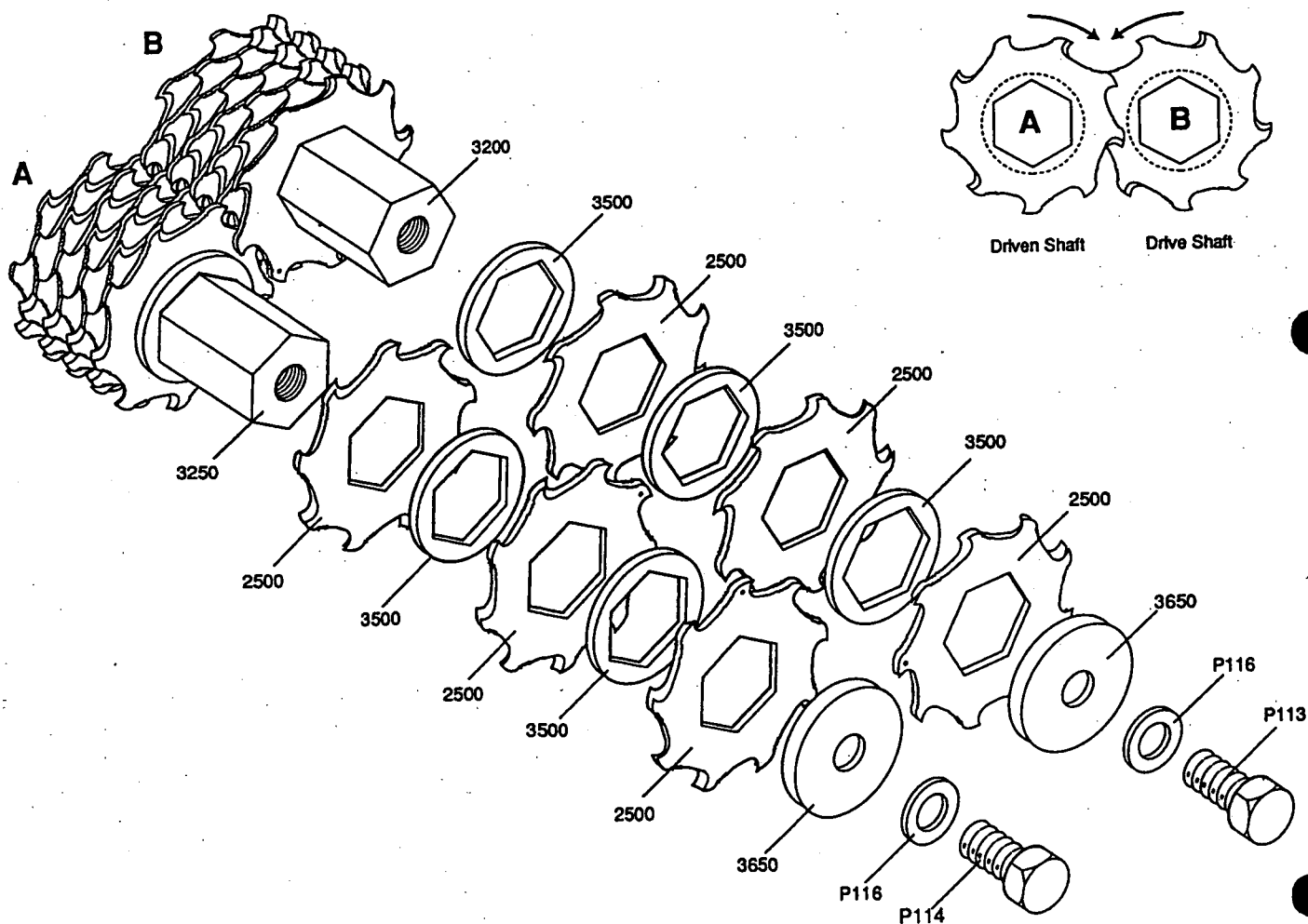
ITEM	QTY	DESCRIPTION	CODE	PART No.
2500	See Table	11 Tooth 5mm Thick Cutter	LE	T000 2500
2501	See Table	9 Tooth 8mm Thick Cutter	LE	T000 2501
3200	1	300 Throat Drive Shaft	MJ	T030 3201
3200	1	500 Throat Drive Shaft	MJ	T050 3201
3250	1	300 Throat Driven Shaft	MJ	T030 3251
3250	1	500 Throat Driven Shaft	MJ	T050 3251
3500	See Table	5mm Thick Spacer	LE	T000 3500
3501	See Table	8mm Thick Spacer	LE	T000 3501

**DRIVE PARTS (See Drawing T000 9820)**

ITEM	QTY	DESCRIPTION	CODE	PART No.
P500	1	Rect Par Key 14 x 9 x 65mm		K101465P
P501	4	M12 x 30Lg Hex Head Screw		F115241F
P502	4	M12 Spring Washer		W115251F
8500	2	M20 Eyebolt		M119257F

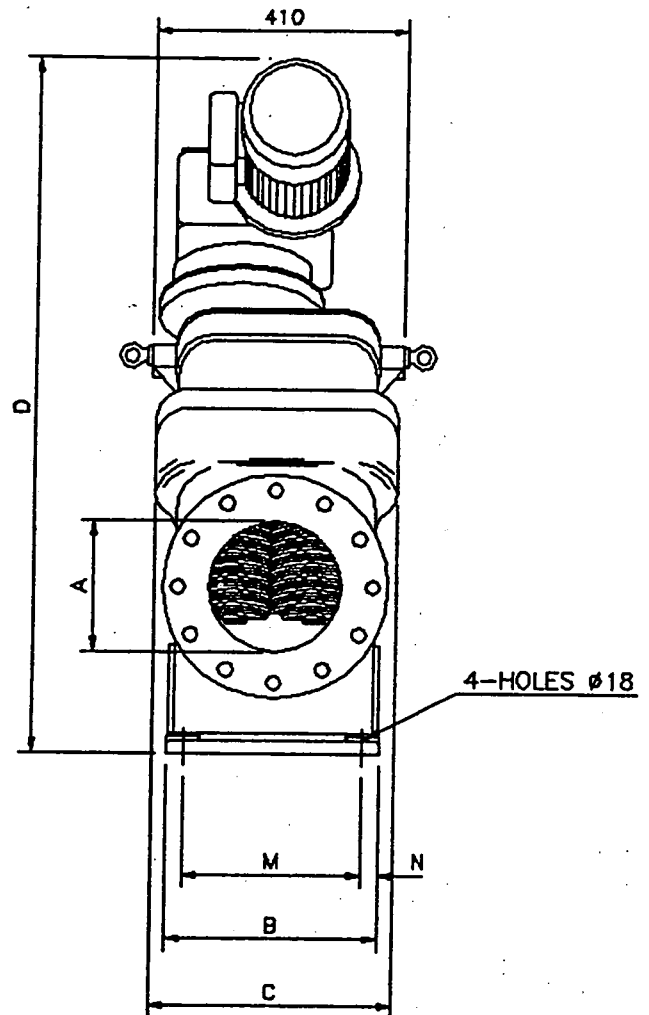
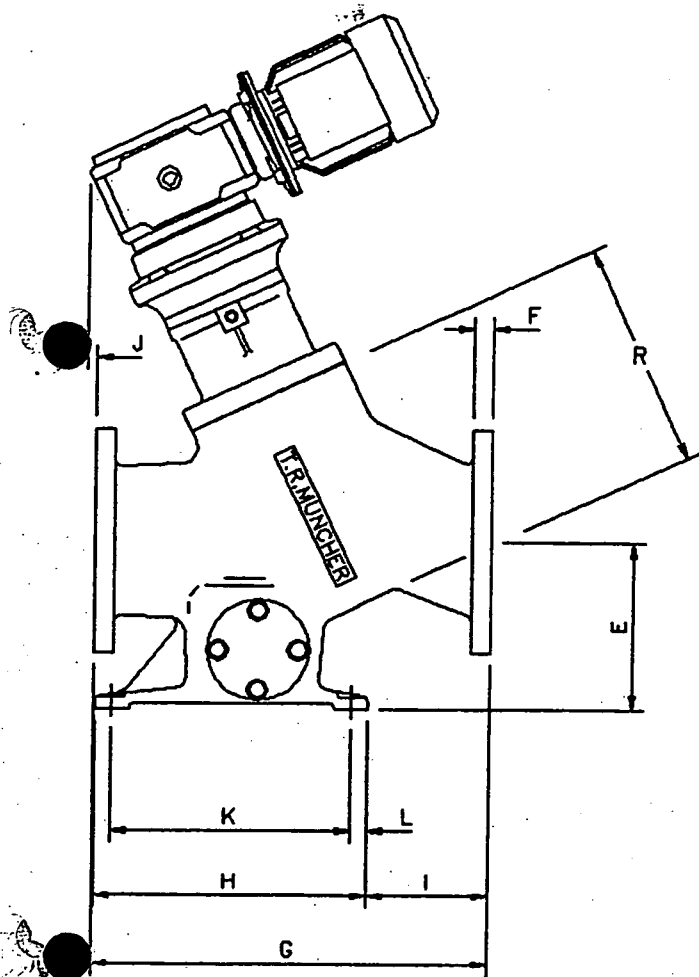
**ROTATING PARTS QUANTITY TABLE (See Drawing T000 9821)**

DRIVE SHAFT			DRIVEN SHAFT	
MODEL	CUTTERS	SPACERS	CUTTERS	SPACERS
CT203-W1A2	22 Off T000 2500	23 Off T000 3500	21 Off T000 2500	23 Off T000 3500
CT203-W9B2	15 Off T000 2501	16 Off T000 3501	15 Off T000 2501	16 Off T000 3501
CT205-W1A2	36 Off T000 2500	36 Off T000 3500	35 Off T000 2500	37 Off T000 3500
CT205-W9B2	26 Off T000 2501	25 Off T000 3501	25 Off T000 2501	26 Off T000 3501

**EXPLODED VIEW OF SHAFTS (Drawing Number T000 9821)**

**14.0 GENERAL ARRANGEMENTS****14.1 1.5 kW IP55 PIPELINE UNITS**

DRAWING NUMBER T000 9900

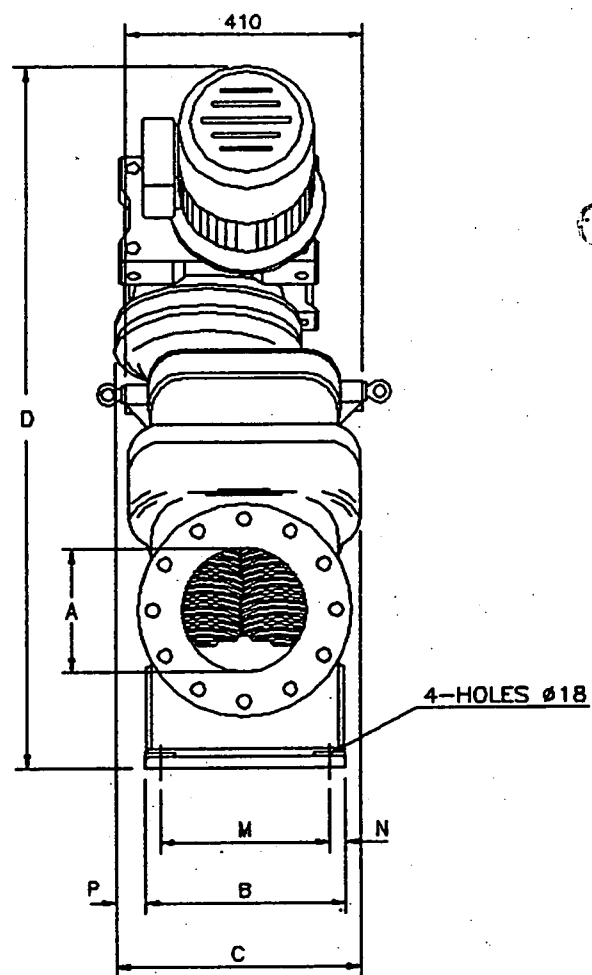
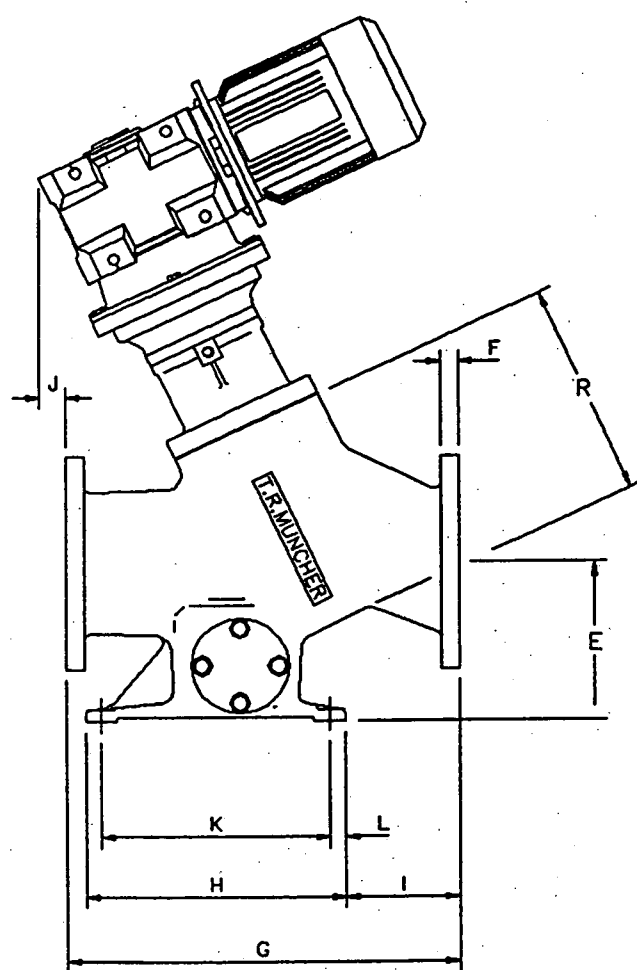
**1.5 kW IP55 MOTOR (DIMS IN mm)**

MODEL No	A	B	C	D	E	F	G	H	I	J	K	L	M	N	R	Wt kg
CT203C	100	320	370	1020	205	24	489	410	99	140	360	25	270	25	250	290
CT203D	150	320	370	1050	230	25	540	410	155	40	360	25	270	25	250	290
CT203E	200	320	370	1050	256	29	591	410	205	16	360	25	270	25	250	290
CT205F	250	320	370	1190	281	32	692	460	205	30	410	25	270	25	450	345
CT205G	300	320	370	1190	332	32	794	460	263	17	410	25	270	25	450	345

(FLANGES DRILLED TO BS4504 PN16)

**14.0 GENERAL ARRANGEMENTS****14.2 2.2 & 4.0 KW IP55 PIPELINE UNITS**

DRAWING NUMBER T000 9901

**2.2 & 4.0 kW IP55 MOTOR (DIMS IN mm)**

MODEL No	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	Wt kg
CT203C	100	320	395	1130	205	24	489	410	99	169	360	25	270	25	20	250	340
CT203D	150	320	395	1170	230	25	540	410	155	97	360	25	270	25	20	250	340
CT203E	200	320	395	1170	256	29	591	410	205	72	360	25	270	25	20	250	340
CT205F	250	320	395	1310	281	32	692	460	205	87	410	25	270	25	20	450	390
CT205G	300	320	395	1310	332	32	794	460	263	40	410	25	270	25	20	450	390

(FLANGES DRILLED TO BS4504 PN16)



**15.0 COMPONENT PARTS FOR GEARBOXES**

ITEM	QTY	DESCRIPTION	PART NO.
1	1	Gearcase	6300001
2	1	Wormshaft brg	6993012
3	2	Wormshaft brg	7540800
4	1	Wormshaft blanking plug	1833200
5	1	Wormshaft	30/PM/XX/ 1
6	1	Worm brg circlip	1043400
7	1	Worm brg circlip	1005400
8	VAR	Wormline shim	5366000
9	1	Motor adaptor	
10	4	Motor adaptor screws	1861600
11	1	Motor	
12	1	Motor screws	
13	1	Motor shaft bush	
14	1	Wormshaft sleeve	0659000
15	1	Wormshaft oil seal	6993014
16	1	Wormwheel shaft	30/PM/XX/ 2
17	2	Wormshaft oil seal	6993013
18	2	Wheelshaft brg	6993011
19	2	Wheelshaft cap	6300008
20	1	Skt hd plug	1036400
21	1	Washer for plug	1036500
22	VAR	Wheeline shim	5365000
23	8	Wheelshaft capscrews	1962400
24	1	Wheelshaft output key	2A 6035
25	1	Nameplate	
26	2	Wheelcap 'o' ring	1114000
27	1	Wormshaft	30/PM/XX/ 1R
28	1	Wormshaft extn key	1036700
29	1	Wormshaft oil seal	6993015
30	1	Worm brg circlip	6930001
31	1	Loose foot	6300061
32	4	Loose foot screws	1026300
33	1	B5 flange	6300019
34	1	Vertical skirt	6300021
35	4	B5 Vert skirt screws	1864100
36	2	B5 Vert skirt dowels	1026200
37	1	Wheelshaft blanking plug	6993016
38	1	Plug in shaft circlip	1029600
39	1	Plug in wheelshaft std extn	6300046
40	1	Plug in wheelshaft dbl extn	6300047
41	1	Plug in wheelshaft output key	1962700
42	1	Torque arm bracket	6300075
43	2	Unit brkt screw	0970900
44	1	Unit brkt pivot pin nut	1975500
45	1	Unit brkt pivot pin washer	1878200
46	1	Unit brkt pivot pin	1039100
47	1	Turnbuckle	6930004
48	1	Locknut rh	1039400
49	1	Locknut lh	1039500
50	1	Torque bar rh	6930002
51	1	Torque bar lh	6930003
52	1	Foot Bracket	6930006
53	1	Foot Bracket pivot pin	1039200
54	2	Foot Bracket pivot pin circlip	1039300
55	1	Unit brkt pivot pin	1039300

## 16.0 GENERAL DESCRIPTION OF STANDARD CONTROL PANEL

The panel has been designed to incorporate the kind of flexibility required for a modern sewage station.

It can be supplied in various forms, from a standard TR Muncher panel to a chassis or a stand alone P.L.C. with or without a back plate.

The unit has been produced to provide protection for a single or three-phase D.O.L. motor and at the same time protect the TR Muncher by continuously monitoring the motor power. It has been designed to ensure both electrical and mechanical versatility by use of a microprocessor, with its virtually infinite range of program options. Mechanically, it gains versatility by its modular and expandable construction, which allows easy field service and also allows different interface boards to be used to fulfil particular requirements.

The inputs and Outputs can be programmed to cater for virtually any particular customer's requirements.

The unit normally requires 3 phase input. One motor leg being taken through a C.T., the output of this and also the 3 phases are used by the electronics to monitor motor power. All the functions of the unit except motor overload can be tested by either supplying phase 1 and phase 2 of the supply, or if the control circuit is from an external supply by switching this supply on.

The unit monitors the motor power, and if the TR Muncher jams, the controller will reverse the motor direction, in an attempt to unblock the TR Muncher, if after 3 attempts within a period of 1 minute the TR Muncher is still blocked the unit will trip out.

There are 3 L.E.D.'s on the control unit. These are to indicate the units condition. L.E.D. No. 1 indicates seal fail if fitted, L.E.D. No. 2 indicates motor should be running. L.E.D. No. 3 indicates the motor is overloaded and will flash on and off when unit has tripped out after 3 reversals.

The reverse time is adjustable with a potentiometer mounted on the PLC. If the TR Muncher is overloaded three times in less than a minute the electronics will trip out the motor contactors, therefore stopping the TR Muncher. This will then bring on a trip lamp. To restart, it is first necessary to press the stop/reset button, or to switch off the isolator, or press any stop button and then press the start button. There is a button on the control panel, this allows for driving the TR Muncher in reverse for as long as the button is pressed.

The electronics will monitor the motor power whether the motor is running forward or reverse and will trip out if overload conditions occur. They also monitor the motor power during starting. If the motor takes start or stall power for more than approximately 3 seconds the electronics will make the motors trip out. The contactor coils are normally 110v A.C. and mounted at the bottom right hand side of the control panel.

**WARNING; This unit should only be installed and serviced by qualified personnel.**

### 16.1 INSTALLATION.

1. The TR Muncher and control panel must be installed in compliance with all local codes and all appropriate parts of I.E.E. rules and regulations.

2. All wiring from the controller to the motor must be adequately rated for motor size and voltage.

3. All wiring from the controller to any remote control station or telemetry unit should be run separately from mains cables to prevent the unit being triggered by spurious electrical noise. In the event of controller malfunction in such way **Mono Pumps Ltd shall not be liable for any damage incurred.**

4. An isolating switch fuse should be installed on the incoming supply with fuses adequately rated for motor size and voltage.

5. Verify that the line voltage agrees with the information given on the label of the motor and control panel. The panel kW and motor kW are correct.

6. Mount the controller in a vertical position by using the four clearance holes provided, preferably on a surface not subject to vibration.

7. Open the front cover and connect controller as indicated on appropriate drawings as supplied in panel.

8. Check thermal overload and fuse ratings and settings are correct for motor size.

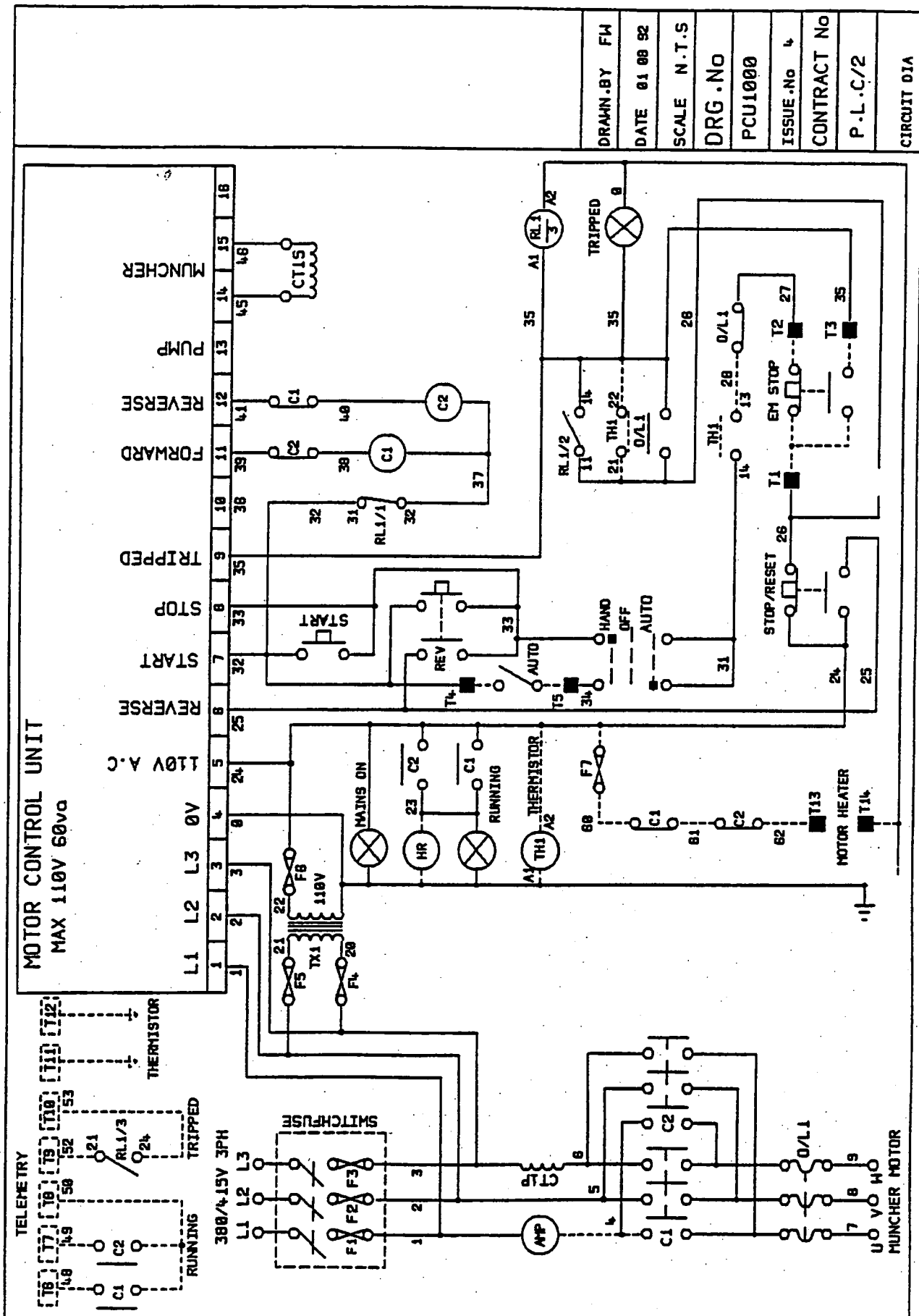
9. Keep all wire clippings etc, out of the controller enclosure: wire clippings can damage the operation of the controller.

### 16.2 MAINTENANCE INSTRUCTIONS

The control panel has been designed and constructed to reduce the maintenance to a minimum. The only moving parts being the forward and reverse and push buttons. It is therefore not necessary to carry out routine maintenance, provided that the environment is clean. If the unit is in a particularly dirty, dusty or corrosive environment, the control panel should be cleaned and inspected for corrosion on a six monthly basis and components changed as required.

**WARNING; This unit should only be installed and serviced by qualified personnel.**

## 17.0 CONTROL PANEL PARTS LIST (Where Supplied)





**17.3 ELECTRICAL REPORT SHEET**

FIELD SERVICE REPORT		PLEASE FAX THIS REPORT TO THE FOLLOWING	
CUSTOMER		MONO PUMPS	
ADDRESS		CONTACT SERVICE DEPT.	
POST CODE		TEL No. 0161 339 9000	
CONTACT		FAX No. 0161 343 4315	
TEL No.	CONTRACT No.	SERIAL No.	
FAX No.			

**MACHINE TYPE**

<b>MOTOR SIZE</b> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px 10px;">KW</div> <div style="border: 1px solid black; padding: 2px 10px;">A</div> </div>	<b>SUPPLY VOLTAGE</b> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px 10px;">VOLTS</div> <div style="border: 1px solid black; padding: 2px 10px;">PHASE</div> <div style="border: 1px solid black; padding: 2px 10px;">HZ</div> </div>	<b>CONTROL VOLTAGE</b> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px 10px;">24v A.C.</div> <div style="border: 1px solid black; padding: 2px 10px;">24v D.C.</div> <div style="border: 1px solid black; padding: 2px 10px;">55v</div> <div style="border: 1px solid black; padding: 2px 10px;">110v</div> <div style="border: 1px solid black; padding: 2px 10px;">240v</div> </div>
--	---	---

MOTOR CONNECTIONS    STAR ☐    DELTA ☐    CAP START INDUCTION RUN ☐    CAP START CAP RUN ☐

**PANEL DETAILS**

AMMETER ☐    VOLT METER ☐    HOUR COUNTER ☐    THERMISTOR ☐    HEATER ☐    VOLT FREE CONTACTS ☐    D.O.L. ☐

- 1/ CHECK MAINS AT PANEL ISOLATOR
- 2/ IS MAINS LAMP ON
- 3/ IS CONTROL VOLTAGE CORRECT
- 4/ HAVE YOU FOLLOWED FAULT FINDING CHART (ATTACHED)
- 5/ WITH P.L.C UNPLUGGED WHAT VOLTAGE DID YOU FIND ON THE FOLLOWING TERMINALS OF P.L.C BASE
 

WITH NO PUSH BUTTON PRESSED	4 - 5 <input type="checkbox"/>	4 - 6 <input type="checkbox"/>	4 - 7 <input type="checkbox"/>	4 - 8 <input type="checkbox"/>
WITH STOP BUTTON PRESSED	4 - 5 <input type="checkbox"/>	4 - 6 <input type="checkbox"/>	4 - 7 <input type="checkbox"/>	4 - 8 <input type="checkbox"/>
WITH REVERSE PUSH BUTTON PRESSED	4 - 5 <input type="checkbox"/>	4 - 6 <input type="checkbox"/>	4 - 7 <input type="checkbox"/>	4 - 8 <input type="checkbox"/>
WITH START PUSH BUTTON PRESSED	4 - 5 <input type="checkbox"/>	4 - 6 <input type="checkbox"/>	4 - 7 <input type="checkbox"/>	4 - 8 <input type="checkbox"/>
- 6/ WITH P.L.C PLUGGED IN DOES THE REVERSE CONTACTOR ENERGIZE WHEN THE REVERSE PUSH BUTTON IS PRESSED ☐
- 7/ DOES THE FORWARD CONTACTOR ENERGIZE WHEN THE START BUTTON IS PRESSED ☐
- 8/ DOES THE RUN LIGHT WHEN THE START BUTTON IS PRESSED ☐
- 9/ IS THE TRIP LIGHT ON OR FLASHING (IF SO RESET) ☐
- 10/ IS THERMAL OVERLOAD OR THERMISTOR TRIPPED (IF SO RESET) ☐
- 11/ IS THE THERMAL OVERLOAD SET CORRECTLY ☐
- 12/ WHAT IS THE MOTOR CURRENT IN EACH MOTOR LEG ☐
- 13/ IS THE MOTOR CONNECTED CORRECTLY ☐

14/ DESCRIBE SYMPTOMS

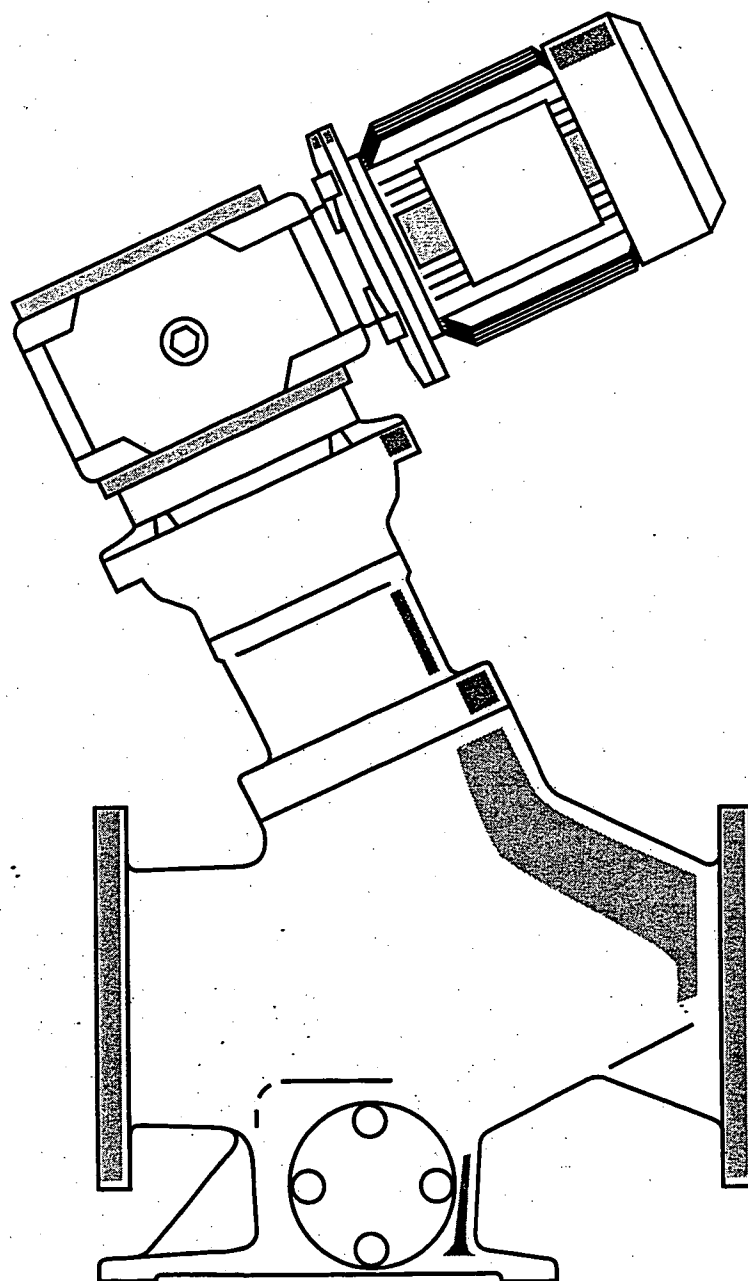
15/ DESCRIBE STEPS TAKEN TO CURE FAULT

16/ WHAT COMPONENTS WERE CHANGED TO CURE PROBLEM

**WARNING**  
 ONLY QUALIFIED PERSONNEL SHOULD CARRY OUT THESE TEST  
 AND THE P.L.C SHOULD ONLY BE UNPLUGGED/PLUGGED IN WITH THE MAINS OFF



Mono Pumps Limited,  
Martin Street,  
Audenshaw, Manchester  
England M34 5DQ

Tel: 0161 339 9000 Fax: 0161 344 0727

**PowerMaster**

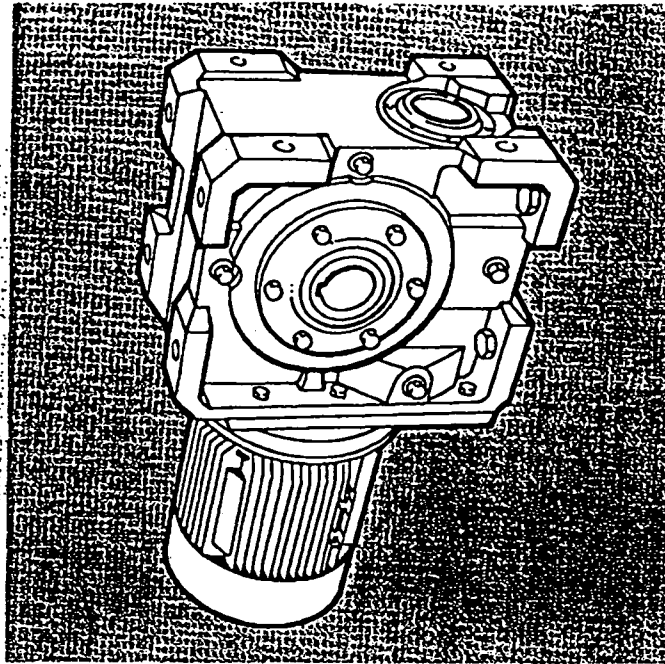
**RENOLD GEARS**  
**HOLROYD GEAR WORKS**  
 MILNROW, ROCHDALE.  
 OL16 3LS  
 TELEPHONE: (0706) 47491  
 TELEX: (63170 RENOLD G)  
 TELEFAX: (0706) 42515  
**/PM WORM GEARED MOTORS**  
 1.1"-3.5"  
**POWERMASTER HELICAL/**  
**WORM GEARED MOTORS**  
 3.5"-5"  
**WORM GEAR UNITS 4"-8"**  
**TITAN HEAVY DUTY WORM**  
**GEAR UNITS 10"-28"**  
**HOLROYD WORM GEAR SETS**  
 1.1"-28"  
**HOLROYD BESPOKE WORM**  
**GEAR SETS UP TO 42"**

**RENOLD GEARS**  
**CARTER GEAR WORKS**  
 THORNSBURY, BRADFORD.  
 BD3 8NJ  
 TELEPHONE: (0274) 682161  
 TELEX: 517127 RENOLD G  
 TELEFAX: (0274) 668037  
**RITESPEED HELICAL GEARED**  
**MOTORS**  
**CARTER HYDROSTATIC**  
**VARIATORS**  
**RENOVAR BELT VARIATORS**

**RENOLD GEARS**  
 P.O. BOX 57, CURRAN ROAD,  
 CARDIFF, CF1 1UQ  
 TELEPHONE: (0222) 460560  
 TELEX: 497596 RENOLD G  
 TELEFAX: (0222) 488847  
**SPRAG CLUTCHES**  
**CROFTAIR CLUTCHES**  
**FLUID COUPLINGS**  
**TORQUE LIMITERS**  
**INTERNAL GEAR**  
**COUPLINGS**  
**CHAIN COUPLINGS**  
**SPIDER COUPLINGS**  
**DISC COUPLINGS**  
**TYRE COUPLINGS**  
**CROWN PIN COUPLINGS**

**RENOLD**  
**PowerMaster**

**Helical/Worm Geared Motors**  
**and Speed Reducers**



**I N S T R U C T I O N S**

**RENOLD**  
**GEARS**

**RENOLD**  
**GEARS**

**STORAGE**

All worm gear units stored or left inactive for long periods should be adequately protected, particularly those on exposed sites and those operating in corrosive or salty atmospheres.

The following precautions will generally be adequate, but advice on the protection of particular units will be given, if required.

If empty of oil: Spray the gear case interior with rust preventative oil compatible with lubricant recommended for service conditions.

If filled with oil: Operate at full speed once per month for not less than 10 minutes to ensure liberal coating of all internal parts with oil.

For indefinite storage: Completely fill unit with oil ensuring complete submersion of all internal components. When unit is returned to service, drain and refill with new oil to correct level.

**LUBRICATION****FIRST FILLING**

A first filling of oil is available from Renold Gears at the time of supplying the unit and to ensure the correct grade and quality is obtained we strongly recommend this service is used.

This is a synthetic type lubricant and to ensure correct functioning of the unit to the catalogued powers the oil supplied by Renold Gears must be obtained.

There may be occasions where it is not practicable to obtain this and in the circumstances we suggest one of the following can be utilised.

MANUFACTURER	LUBRICANT
Burmah Castrol	Alpha SYN-T 320 (-34)
Century Oils	Century SGG (-30)
Mobil Oil Co	SHC 320 (-37)
	or SHC 632 (-37)

The figure in brackets indicates the lowest ambient temperature in °C in which the lubricant is usable for this specific purpose.

Mineral oils can be used as the lubrication medium in the Powermaster range but this may result in a reduction in the power capacity. If this should be the intention please contact Renold Gears who will be pleased to advise.

When installed and before running, the unit should be filled with new lubricant to the correct level. With the gear stationary, remove the filler and breather plug and the oil level plug. Fill until the lubricant is visible or overflowing at the oil level opening.

Wait for a full minute to ensure that the level is static, top up if necessary, and when this situation is stabilised replace and secure both plugs.

Care should be taken to avoid overfilling.

RENOLD GEARS

**PowerMaster**

RENOLD GEARS

**PowerMaster**

PLAN	DESCRIPTION	OIL CAPACITIES					
		PM35	PM40	PM50	PM60	PM70	PM80
0.00 3.00	UNDERDRIVEN	1.13 1.98	1.90 3.35	2.90 5.11	4.93 8.69	7.38 13.00	9.00 15.85
1.00 4.00	OVERDRIVEN	2.77 4.98	3.82 6.72	6.70 11.80	11.36 20.00	16.33 28.75	20.00 35.21
2.00 5.00	VERTICAL OUTPUT	2.95 5.13	4.30 7.57	6.70 11.80	11.51 20.26	17.04 30.00	24.00 42.25
7.00	VERTICAL INPUT (HEL BELOW)	3.33 5.86	4.70 8.27	8.25 14.52	13.63 24.00	19.88 35.00	26.00 45.77
6.00 8.00	VERTICAL INPUT (HEL TOP)	5.03 8.85	7.35 12.94	12.75 22.45	23.57 41.50	33.51 59.00	42.00 73.94

UPPER VALUE IN LITRES

LOWER VALUE IN PINTS

RENOLD GEARS

30 APR '98 13:57

RENOLD GEARS

61 3 9560 7578

PAGE.03



Where a unit is supplied without the motor or input housing fitted and yet is intended to operate as a self-contained gear unit it will be necessary to fit the pinion to the motor or input housing shaft and the wheel to the wormshaft.

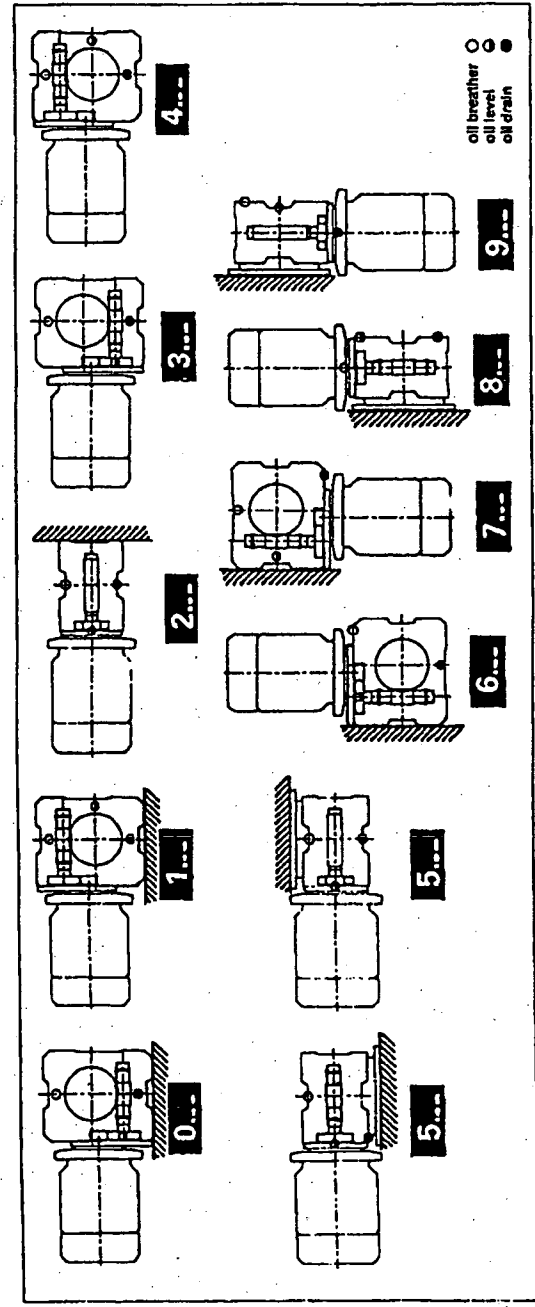
The position of the helical wheel is fixed since this is assembled onto the keyed extension on the wormshaft, which has a locating shoulder, and secured axially with a circlip.

The position of the pinion however is more critical since both the motor and input housing can be used for various ratios and gear face widths.

Prior to fitting the pinions must be heated evenly to about 230°C to cause expansion of the bore sufficient to fit on the shaft. A naked flame must not be used for this purpose, an induction heater is much preferred.

The key must be fitted and when it is found the pinion can be assembled onto the shaft it must be positioned as shown relative to the mating components listed below. Once it is in place the grub screw is tightened and the pinion allowed to cool.

When assembling the motor or input housing to the main gear case the mating machined faces must be coated with a silicone based sealant example Molyseal.



RENOLD GEARS  
PowerMaster

INITIAL RUNNING

**STARTING UP**

All units are subjected to a short running test before despatch, but many hours of running under full load are necessary for a unit to attain its highest efficiency. The gear may if necessary be put to work immediately on full load, but if circumstances permit it is better for the ultimate life of the gear to run it in under gradually increasing load attaining the full load after about 20 to 40 hours.

Reasonable precautions should, however, be taken to avoid overloads in the early stages of running.

**ROUTINE MAINTENANCE**

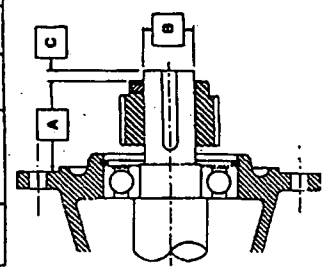
The oil level in the unit should be regularly maintained and should be checked at least once a month. To avoid false readings examination of the oil level should be made with the gear stationary and to maintain free ventilation of the unit under all conditions the breather hole in the filler cap should be kept clear at all times.

**CHANGING OIL**

Oil should be changed completely at intervals dependent upon working conditions.

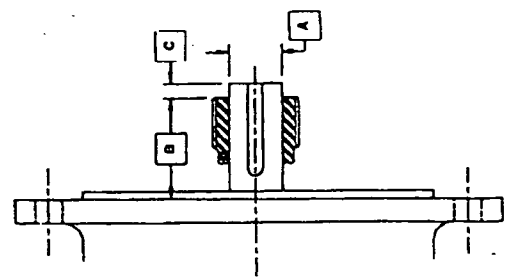
RENOLD GEARS  
PowerMaster

UNIT	MOTOR REF	DIMENSIONS IN mm		
		A	B	C
PM35	D80F165	19	41	1
	D90F165	24	41	9
	D100F215	28	58	2
	D112F215	28	58	2
	D132F265	38	71	9
PM40	D90F165	19	46	4
	D100F215	28	63	3
	D112F215	28	63	3
	D132F265	38	79	4
	D150F300	48	91	9
PM50	D112F215	28	69	9
	D132F265	38	82	2
	D150F300	48	92	2
	D160F350	58	104	4
	D180F400	68	115	25
PM60	D120F215	28	62	2
	D132F265	38	84	4
	D160F300	48	92	18
	D180F350	58	104	4
	D200F400	68	115	25
PM70	D120F215	28	62	2
	D132F265	38	84	4
	D160F300	48	92	18
	D180F350	58	104	4
	D200F400	68	115	25
PM80	D120F215	28	62	2
	D132F265	38	84	4
	D160F300	48	92	18
	D180F350	58	104	4
	D200F400	68	115	25



RENOLD GEARS  
PowerMaster

UNIT	FACING REF	DIMENSIONS IN mm		
		A	B	C
PM35	D80F165	19	50.5	ZERO
	D90F165	28	60	6
PM40	D80F165	19	50.5	ZERO
	D90F165	28	60	6
PM50	D80F165	19	50.5	ZERO
	D90F165	28	60	6
PM60	D100F215	28	76	ZERO
	D110F215	28	76	ZERO
PM70	D100F215	28	76	ZERO
	D110F215	28	76	ZERO
PM80	D100F215	28	76	ZERO
	D110F215	28	76	ZERO



RENOLD GEARS  
PowerMaster

# **C.M.G. ELECTRIC MOTORS**

**AN AUSTRALIAN COMPANY - ESTABLISHED 1948**

**INSTALLATION & MAINTENANCE INSTRUCTIONS**

**SQUIRREL-CAGE MOTORS**

October 1993

## C.M.G. ELECTRIC MOTORS

### Installation, Operation and Maintenance

**DELIVERY:** Upon receipt the unit should be thoroughly inspected for any damage sustained during transit. Any equipment damage or shortfall should be immediately advised to your nearest CMG office.

**STORAGE:** If the machine is not to be installed immediately, it should be stored in a clean, dry and preferably warm environment. Shafts of stored motors should be rotated occasionally. Specific vibration during storage may lead to "brinelling" of the bearings, therefore motors that are subject to extended storage, where vibration exists, should be fitted with bearing locks.

**INSTALLATION:** All motors must be installed in such a manner as to ensure the air intake is not obstructed. Refer dimension 'BL' in catalogue. Bed plates or slide rails should be firmly fixed to a solid, level foundation to ensure the motor remains rigid and vibration free. Shims or packers (if required) must be of adequate size and placed adjacent to and between base fixings. Protective transport coatings on shafts and/or flanges must be removed prior to connection to the driven load. A light coating of grease to shafts and/or flanges will inhibit corrosion during service and assist removal of pulleys or couplings.

**COUPLING DRIVE:** In fitting couplings or pulleys to the motor shaft care must be taken to ensure the roller/ball bearings are not damaged. Tapped holes are provided in shaft extensions to assist in the fitment of couplings and/or pulleys. Under no circumstances should couplings and/or pulleys be driven onto the shaft.

**ALIGNMENT:** Great care must be taken in aligning the complete machine, since misalignment can cause rapid deterioration of bearings and lead to other mechanical failures due to the stress produced. After final tightening of foundation bolts machine alignment should be rechecked as bed plates could distort. No end thrust should be applied to the motor without express approval. Motors installed with the shaft vertically up or vertically down must be securely mounted to ensure even thrust distribution on the bearings.

**ELECTRICAL CONNECTION:** Ensure all electrical connections are solid and continuous. Check motor starter and overloads for correct rating and trip setting. All circuit breakers, HRC fuses or protective devices associated with the motor must be rated, to suit motor running current and starting characteristics.

**INITIAL****START UP:**

Prior to initial start up the following steps must be taken: =

- A. Insulation resistance test.

On machines up to 600 volt the minimum value should be 1 Megohm.

- B. Thermistors if fitted, should be checked for continuity with a multimeter and never meggered.

- C. Ensure supply voltage and frequency correspond to the motor name plate ratings.

- D. Ensure shaft turns freely before initial start.

- E. Measure stator resistance and record in Log Book.

OPERATION

Standard motors are designed for a 415 volt (+/- 5%) 3 phase, 50 Hertz supply. Use of standard motors on other supply systems should be verified with our office prior to installation. All units are SI rated to AS1359 and associated standards, for operation below 1000 metres at a maximum ambient of 40°C.

For operation in conditions other than the above please refer to your nearest CMG office.

Electric motor starting imposes severe thermal stress on the motor, the frequency of starting should be minimised to ensure optimum machine life.

The number of starts per hour is dependant on the inertia of the driven load and the load torque demand. A guide to generally acceptable starts per hour would be:-

<u>Frame</u>	<u>Starts per hour</u>			
	<u>2 pole</u>	<u>4 pole</u>	<u>6 pole</u>	<u>8 pole</u>
80	20	40	40	--
90 - 112	16	30	40	40
132 - 160	10	20	25	25
180	8	15	20	20
200	6	12	12	12
225	5	10	10	10
250	4	8	8	8
280	3	6	6	6
315	3	4	4	4

PERMITTED STARTING TIME

In respect to the temperature rise of the motor, starting time (i.e., from rest to operational speed) should not exceed the time indicated in the following table. Motor must be allowed to cool prior to each start.

FRAME	STARTING METHOD	MAX. STARTING TIME IN SECONDS			
		2 POLE	4 POLE	6 POLE	8 POLE
80	D.O.L.	11	15	31	
90	D.O.L.	14	17	20	30
100	D.O.L.	14	14	22	29
112	D.O.L.	14	14	17	27
132	D.O.L.	15	15	18	25
160 - 315	D.O.L.	15	15	20	20
160 - 315	STAR/DELTA	24	36	54	75

## MAINTENANCE INSTRUCTION

To obtain maximum service life from your electric motor, it is recommended the following maintenance procedure be implemented and recorded in a plant log book.

- A. Ensure air intake space is unobstructed.
- B. On a weekly basis use an air hose to ensure all airways are clear and free of dust.
- C. Do not wash the motor down unless it is IP56D rated or higher.
- D. On a quarterly basis ;

- i) Check motor terminals for tightness and contact.
- ii) If terminal lug/lugs are discoloured, reterminate.
- iii) Check operation of starting equipment ensuring all terminations are tight.
- iv) Check mechanical operation of thermal overload.
- v) Check mechanical operation of thermistor relay (if fitted).
- vi) Check operation of space heaters (if fitted).

E. On a six (6) monthly basis, in addition to the items in 'D' -

- i) Check stator resistance (compare to original and enter in Log book)
- ii) Check supply voltage at motor terminals
- iii) Check bearings for noise/overheating

F. On an annual basis, in addition to the items in 'D and E' -

- i) Regrease bearings in line with attached chart.

N.B. As indicated in the attached chart, some bearings may require more frequent grease replacement.

- ii) Strip motor down and clean thoroughly.
- iii) Check bearings for wear/damage - replace as necessary.
- iv) Check all machine bolts for cracks or damage - replace as necessary.
- v) Check all holding bolts for signs of fatigue/damage - replace as necessary.
- vi) After re-assembly, check and record:-  
Full Load Current  
Full Load Voltages  
Full Load Speed

- vii) Measure cooling air velocity and record.

G. Ensure plant log book records all commissioning data and compare maintenance data with original.

**SEALED BEARINGS****RECOMMENDED REPLACEMENT INTERVALS (HOURS)**

Based on a maximum grease service life of 20,000 hours.

MM		RPM							
BEARING NO	BEARING BORE	3000 BALL	ROLLER	1500 BALL	ROLLER	1000 BALL	ROLLER	750 BALL	ROLLER
6203/6303	17	11200	5600	20000	11400	20000	17900	20000	20000
6204/6304	20	10000	5000	20000	10400	20000	15600	20000	20000
6205/6305	25	8700	4350	18400	9920	20000	14000	20000	18200
6206/6306	30	7600	3800	16500	8250	20000	12400	20000	16400
6207/6307	35	6800	3400	15000	7500	20000	11400	20000	15000
6208/6308	40	6050	3025	13800	6900	20000	10500	20000	14000
6209/6309	45	5400	2700	12600	6300	19500	9750	20000	13000
6210/6310	50	4800	2400	11700	5850	18200	9100	20000	12200
6211/6311	55	4300	2150	10900	5450	17100	8550	20000	11500

**OPEN (REGREASABLE) BEARINGS****RECOMMENDED RELUBRICATION INTERVALS (HOURS)**

Based on maximum grease service life of 20,000 hours.

MM		RPM							
BEARING NO	BEARING BORE	3000 BALL	ROLLER	1500 BALL	ROLLER	1000 BALL	ROLLER	750 BALL	ROLLER
6212/6312	60	3800	1900	10100	5050	16000	8000	20000	10800
6213/6313	65	3400	1700	9400	4700	15100	7500	20000	10300
6214/6314	70	3000	1500	8800	4400	14300	7150	19500	9750
6215/6315	75	2570	1285	8200	4100	13500	6750	18500	9250
6216/6316	80	2200	1100	7600	3800	12800	6400	17700	8850
6217/6317	85	1800	900	7100	3550	12100	6050	16800	8400
6218/6318	90	1500	750	6600	3300	11500	5750	16000	8000
6220/6319	100	830	415	5700	2850	10300	5150	14600	7300
6222/6322	110	-	-	4800	2400	9200	4600	13400	6700
6224/6324	120	-	-	4000	2000	8200	4100	12200	6100
6226/6326	130	-	-	3200	1600	7300	3650	11200	5600

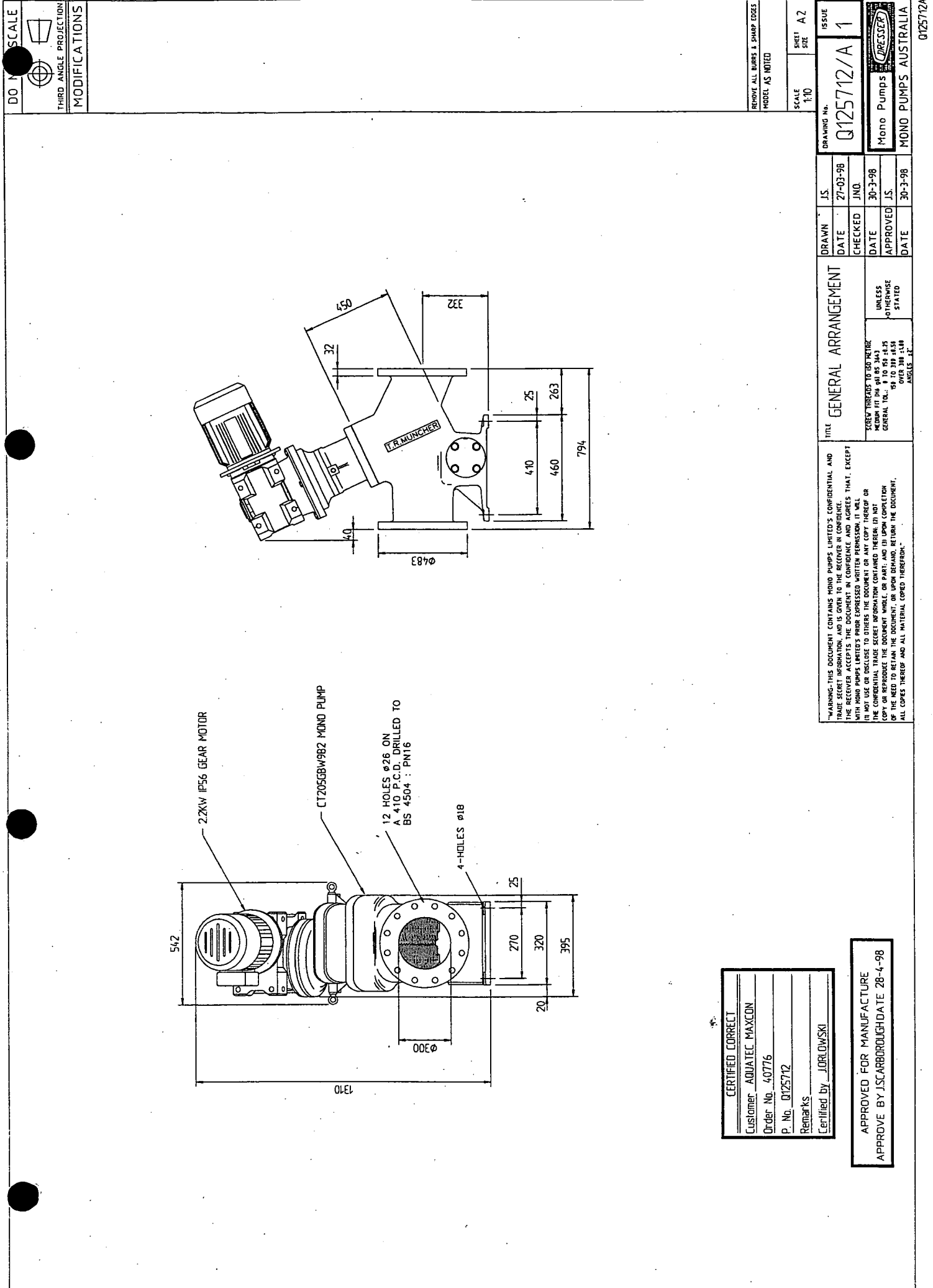
It should be noted that for motors fitted with Ball and Roller bearings, the lubrication intervals for both bearings, should be based on the roller bearing data.

The relubrication intervals recommended are calculated on the basis of normal working conditions.

Replenishment of grease media should be by means of a hand held grease gun whilst motor is running, with relief plate removed.

Note: Air operated grease guns should not be used.

S91/058/GM





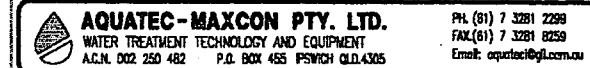
## MONO PUMPS (AUS) SPARE PARTS LISTING

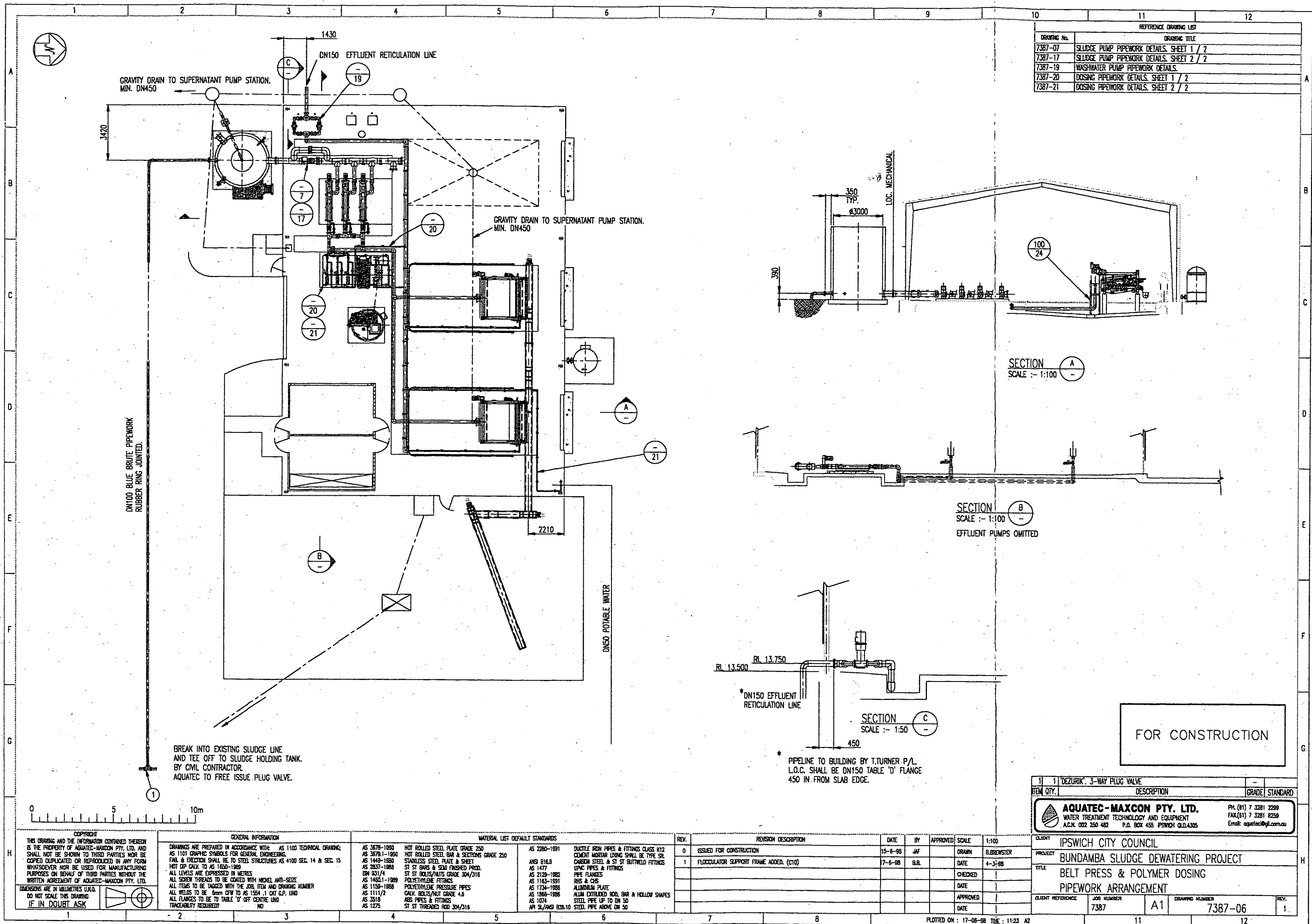
DATE 30/04/98

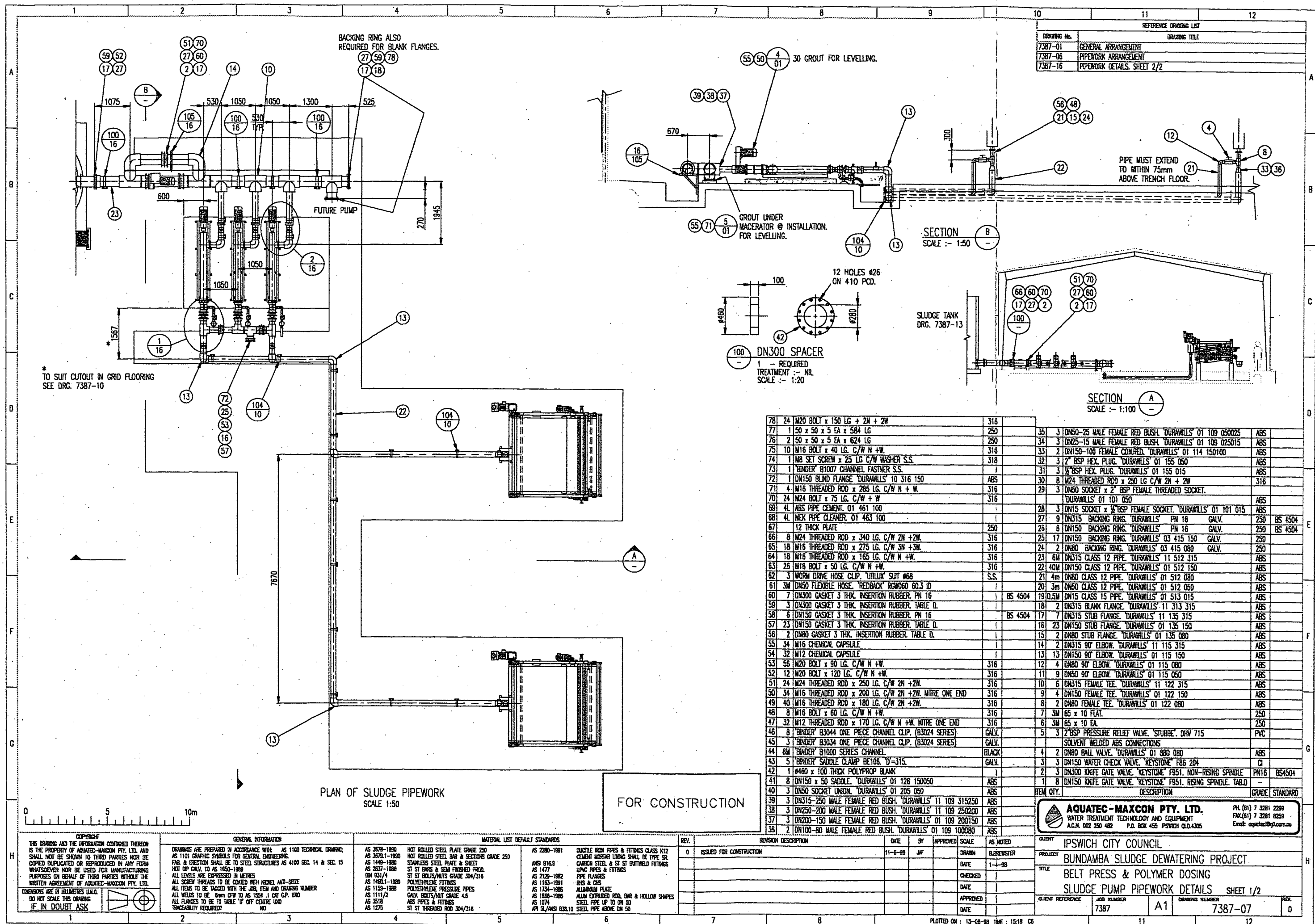
ORDER Q125712 CUSTOMER NEW SLUDGE DEWATERING  
 SELECTED PUMP CT205GBW9B2 TR MUNCHER

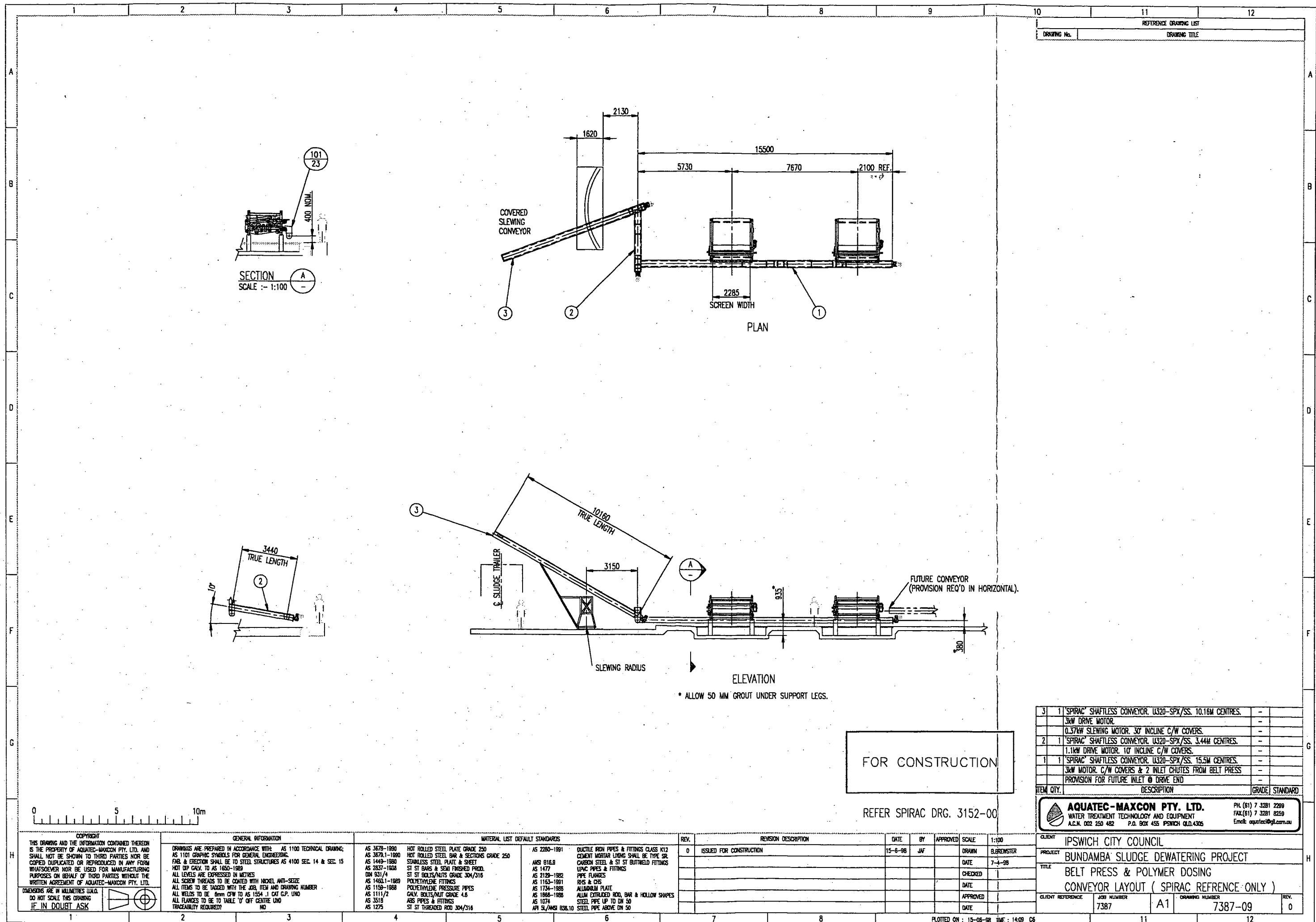
PAGE 1

Item Number	Description	Qty Per
A113311F	H.T. STL.SOC.CAP SCREW M8 X 55	6
W113252F	SNGL.COIL SPR.WASHER M8 (BOND)	6
A113241F	H.T.STL.SOC.CAP SCREW M8 X 30	4
W113252F	SNGL.COIL SPR.WASHER M8 (BOND)	4
A115301F	H.T.STL SOC.CAP SCREW M12 X 50	12
W115252F	SNGL.COIL SPR.WASHER M12(BOND)	12
C102790P	CIRCLIP INTERNAL 90MM	2
C104550P	CIRCLIP EXTERNAL 55MM	2
K101647P	RECT. PARALLEL KEY 16X10X98	2
S361501P	ROTARY SHAFT LIPSEAL 50X65X8	1
P112722F	10 X 25 PAR DOWEL PIN BS1804 P	2
P151222F	DOWEL PIN GD1 8 X 25 LG BS1804	2
A160502B	BALL BEARING 50X90X20	2
M060130G	MECHANICAL SEAL (40748)	2
A117262F	ST.STL SOC.CAP SCREW M16X35	1
W117251F	ST.STL.SNGL.COIL SPR.WASHR.M16	1
A147262F	ST.STL.SOC.CAP.SCRW.LH.M16X35	1
W117251F	ST.STL.SNGL.COIL SPR.WASHR.M16	1
F115222F	STL.HEX.HD.SCREW M12 X 25	2
W115252F	SNGL.COIL SPR.WASHER M12(BOND)	2
AA 52/C13230	WARNING LABEL TR MUNCHER	1
R101082F	STL.RD.HD.DRIVESCREW NO.0X3/16	4
R101082F	STL.RD.HD.DRIVESCREW NO.0X3/16	4
L120032P	STR HYD NIPPLE 1/8" BSP	1
CD T000 0101	BEARING HOUSING TR MUNCHER MK2	1
MR T000 0201	DATUM TUBE TR MUNCHER MK2	2
AA A02A 0600A	NAMEPLATE MUNCHER	1
CD T000 1101	TR MUNCHER COVER PLATE JPM35	1
ZG T000 2000	MAIN BODY GASKET TR MUNCHER	1
SF T000 3650	SHAFT ENDCAP	2
W815505F	WASHER-TR MK2 SEAL RETAINER WA	2
MQ T000 7800	DRIVE GEAR, 17 TOOTH	1
MQ T000 7801	DRIVEN GEAR, 20 TOOTH	1
BP T000 2551	CUTTER 9 TOOTH 8MM THK.	51
M T050 3201	TRM DRIVE SHAFT	1
MJ T050 3251	TRM DRIVEN SHAFT	1
BP T000 3551	SPACER 8MM THK FINE BLANK	51
F117222F	M16X25 HEX HD SCRW STL BS3692-	8
W117050F	RECT PAR KEY 14 X 9 X 105 FORM	8
W117251F	ST.STL.SNGL.COIL SPR.WASHR.M16	8
CF T05G 0300	MAIN BODY, T SERIES MUNCHER,	1
ZG T000 2010	INSP.COVER GASKET TRM NP16	2
MB T000 5900	INSPECTION COVER TR MUNCHER	2
K101477P	RECT PAR KEY 14 X 9 X 105 FORM	1
F115242F	STL.HEX.HD.SCREW M12X30 (BOND)	8
W115252F	SNGL.COIL SPR.WASHER M12(BOND)	8
N119257F	M20X32 COLLAR EYE BOLT FIG 1 B	2

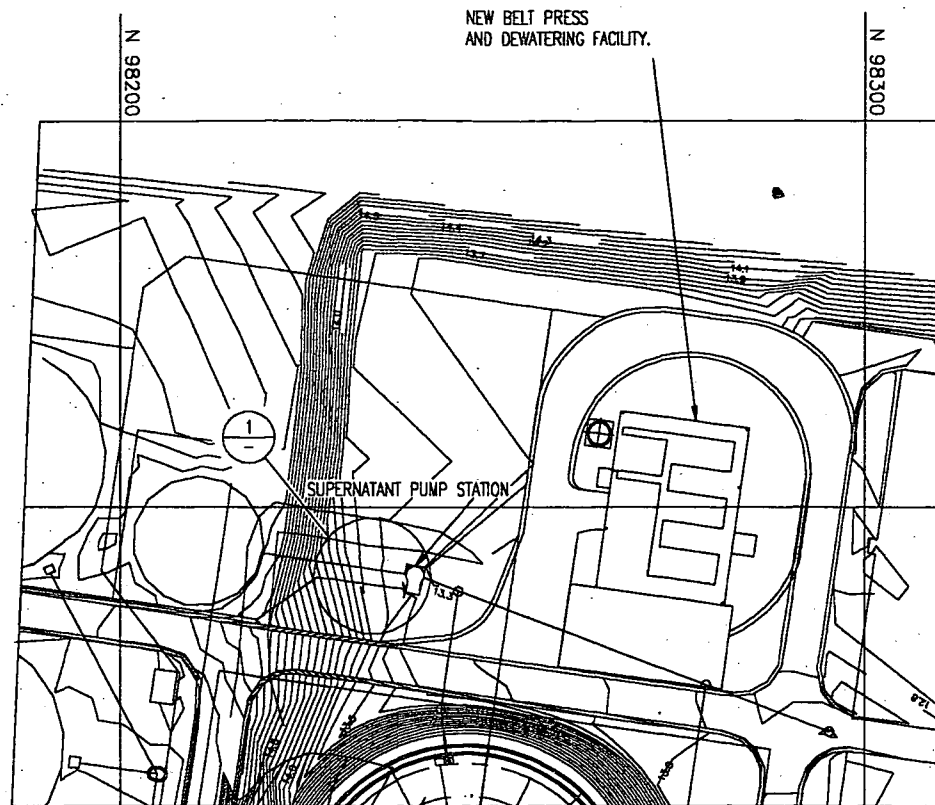




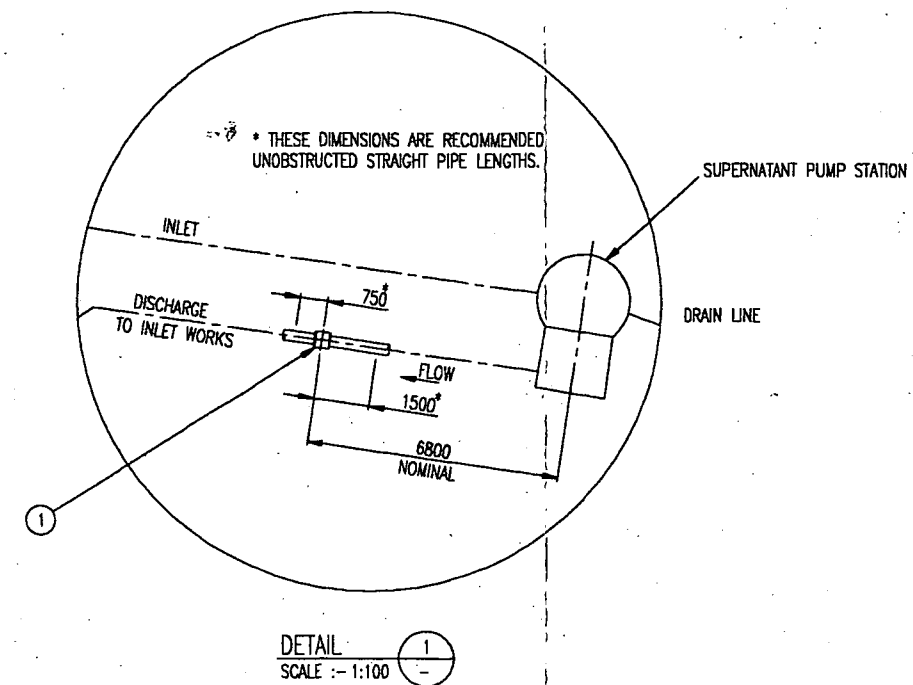




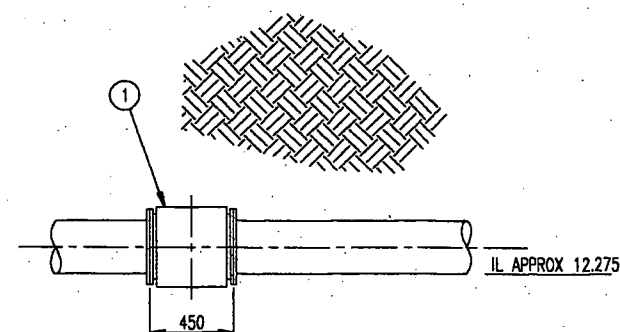
REFERENCE DRAWING LIST	
DRAWING No.	DRAWING TITLE
7387-01	GENERAL ARRANGEMENT
7387-04	OVERALL SITE PLAN



PARTIAL PLAN OF SITE  
SCALE 1:500  
REFER DRG.No. 7387-04



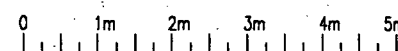
GROUND LEVEL APPROX 13.80



ELEVATION OF FLOWMETER INSTALLATION.  
SCALE 1:20

FOR CONSTRUCTION

NOTE:  
FLOWMETER BY AM.  
PIPE, BOLTS, GASKETS, ADAPTOR FLANGES ETC, BY T.TURNER P/L



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IF IN DOUBT ASK

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**MATERIAL LIST DEFAULT STANDARDS**

AS 3678-1990 AS 3679.1-1990 AS 1448-1980 AS 2837-1986 DN 831/4 AS 1460.1-1989 AS 1159-1988 AS 1111/2 AS 3518 AS 1275	HOT ROLLED STEEL PLATE GRADE 250 HOT ROLLED STEEL BAR & SECTIONS GRADE 250 STAINLESS STEEL PLATE & SHEET ST ST BARS & SEMI FINISHED PROOL ST ST BOLTS/NUTS GRADE 304/316 POLYETHYLENE FITTINGS POLYETHYLENE PRESSURE PIPES GALV. BOLTS/NUT GRADE 4.6 ABS PIPES & FITTINGS ST ST THREADED ROD 304/316	AS 2280-1991 ANSI B16.9 AS 1477 AS 2129-1982 AS 1163-1991 AS 1734-1986 AS 1866-1986 AS 1074 API 5L/ANSI B36.10	DUCTILE IRON PIPES & FITTINGS CLASS K12 CEMENT MORTAR LINING SHALL BE TYPE SR. CARBON STEEL & ST ST BUTTWELD FITTINGS UPVC PIPES & FITTINGS PIPE FLANGES RHS & CHS ALUMINIUM PLATE ALUM EXTRUDED ROD, BAR & HOLLOW SHAPES STEEL PIPE UP TO DN 50 STEEL PIPE ABOVE DN 50
---	---	--	--

REV.	REVISION DESCRIPTION	DATE	BY	APPROVED	SCALE	1:500
0	ISSUED FOR CONSTRUCTION	15-6-98	JAF		DRAWN	B.BREWSTER
					DATE	23-4-98
					CHECKED	
					DATE	
					APPROVED	
					DATE	

1	1	DN250 FLOWMETER. ABB MACMASTER WATER/WASTE FLOWMETER / TRANSMITTER MODEL MF/F251F4110A005ER1301111	-	-
ITEM	QTY.	DESCRIPTION	GRADE	STANDARD
<b>AQUATEC-MAXCON PTY. LTD.</b> WATER TREATMENT TECHNOLOGY AND EQUIPMENT A.C.N. 002 250 482 P.O. BOX 455 IPSWICH QLD 4305 PH (61) 7 3281 2299 FAX (61) 7 3281 8258 Email: aquatec@igi.com.au				

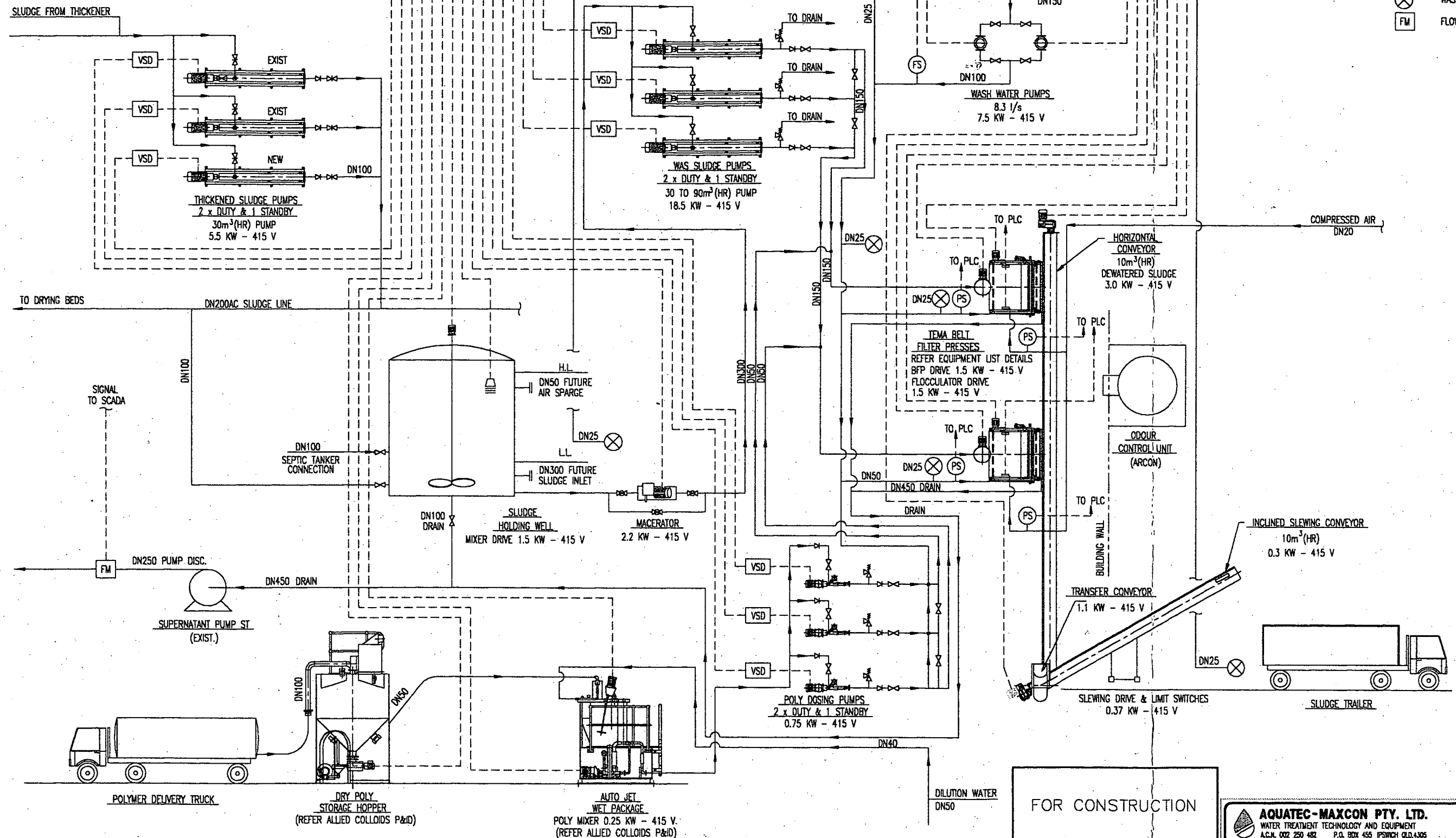
CLIENT	IPSWICH CITY COUNCIL		
PROJECT	BUNDAMBA SLUDGE DEWATERING PROJECT		
TITLE	BELT PRESS & POLYMER DOSING FLOWMETER INSTALLATION DETAILS		
CLIENT REFERENCE	JOB NUMBER	DRAWING NUMBER	REV.
7387	A1	7387-14	0

PLOTTED ON: 15-06-98 TIME: 15:30 C6



## LEGEND

- |  |                       |
|--|-----------------------|
|  | GATE VALVE            |
|  | PRESSURE RELIEF VALVE |
|  | CHECK VALVE           |
|  | FLOW SWITCH           |
|  | WASHDOWN STATION      |
|  | FLOW SWITCH           |



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**GENERAL INFORMATION**  
DRAWINGS ARE PREPARED IN ACCORDANCE WITH: AS 1100 TECHNICAL DRAWING; AS 1101 GRAPHIC SYMBOLS FOR GENERAL ENGINEERING; AS 1449-1980 FAB & ERECTION SHALL BE TO STEEL STRUCTURES AS 4100 SEC. 14 & SEC. 15; AS 2837-1986 HOT DIP GALV. TO AS 1554-1989; AS 1460-1989 ALL LEVELS ARE EXPRESSED IN METRES; AS 1159-1988 ALL SCREW THREADS TO BE COATED WITH NICKEL ANTI-SEIZE; ALL ITEMS TO BE TAGGED WITH THE JOB, ITEM AND DRAWING NUMBER; AS 1111/2 ALL WELDS TO BE 6mm C/PW TO AS 1554.1 CAT G.P. UNO; AS 3518 ALL FLANGES TO BE TO TABLE 'Y' OFF CENTRE UNO; AS 1275 TRACEABILITY REQUIRED? NO

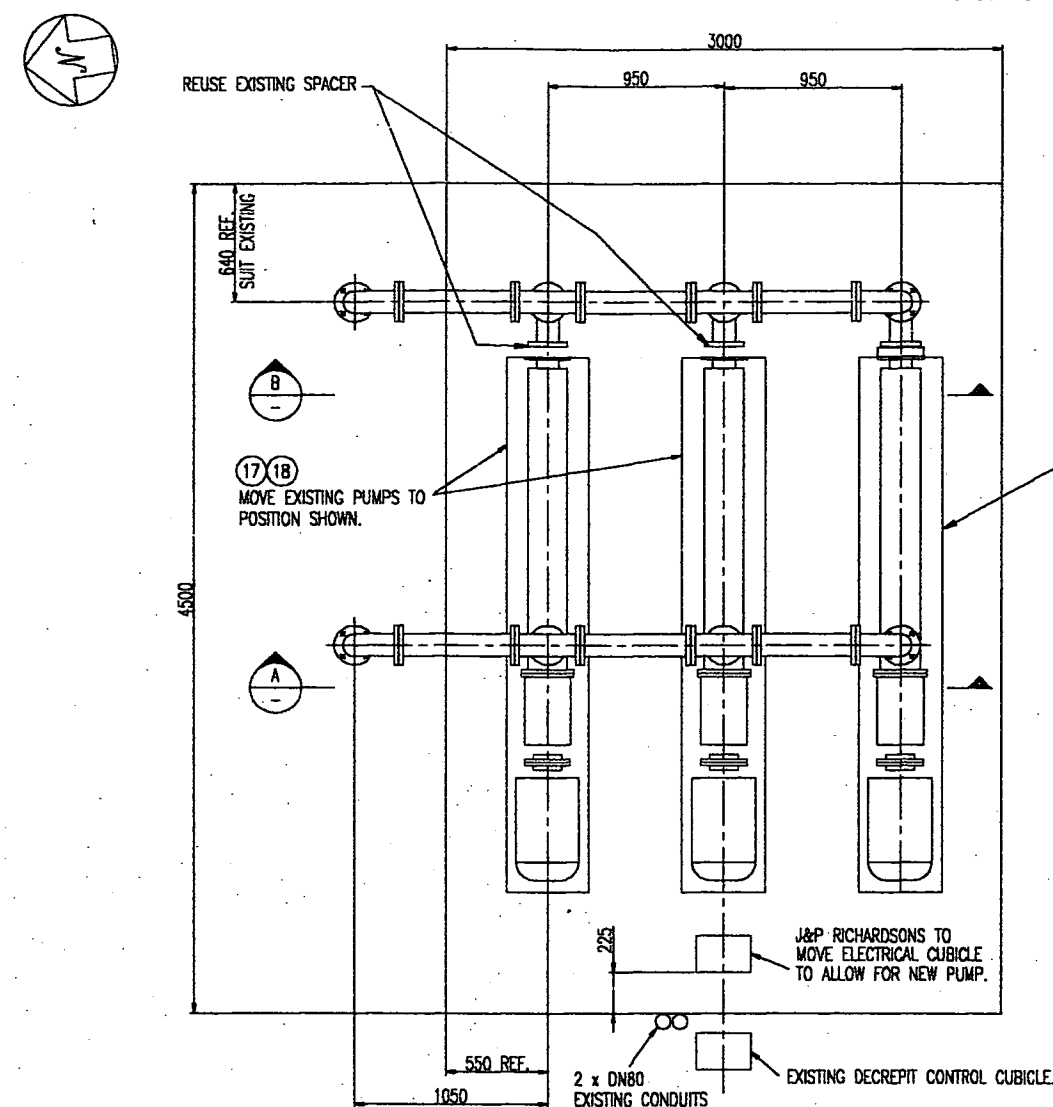
**MATERIAL LIST DEFAULT STANDARDS**  
AS 3678-1990 HOT ROLLED STEEL PLATE GRADE 250  
AS 3679-1990 HOT ROLLED STEEL BAR & SECTIONS GRADE 250  
AS 1449-1980 STAINLESS STEEL PLATE & SHEET  
AS 2837-1986 ST ST BARS & SEMI FINISHED PROOL  
AS 831/4 ST ST BOLTS/NUTS GRADE 304/316  
AS 1460-1989 POLYETHYLENE FITTINGS  
AS 1159-1988 POLYETHYLENE PRESSURE PIPES  
AS 1111/2 GALV. BOLTS/NUT GRADE 4.6  
AS 3518 ABS PIPES & FITTINGS  
AS 1275 ST ST THREADED ROD 304/316

**REVISION DESCRIPTION**  
0 ISSUED FOR CONSTRUCTION

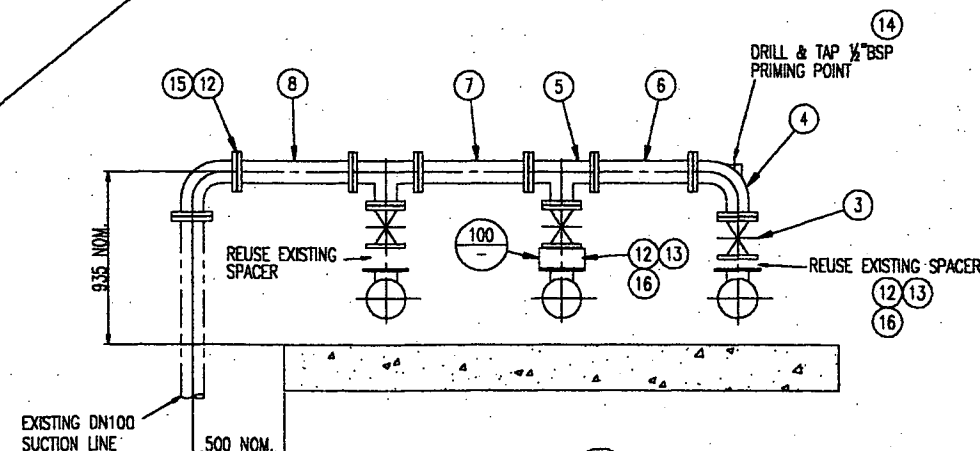
**DATE** 5-08-98  
**BY** JAF  
**APPROVED**  
**SCALE** DRAWN  
**NTS** A.M. DEVERES  
**DATE** 25-05-98  
**CHECKED**  
**APPROVED**  
**DATE**

**CLIENT** IPSWICH CITY COUNCIL  
**PROJECT** BUNDAMBA SLUDGE DEWATERING PROJECT  
**TITLE** BELT PRESS & POLYMER DOSING  
**P & ID**  
**CLIENT REFERENCE** 7387  
**JOB NUMBER** A1  
**DRAWING NUMBER** 7387-15  
**REV.** 0

**PLOTTED ON** 15-06-98 **TIME** 12:52 **C6**

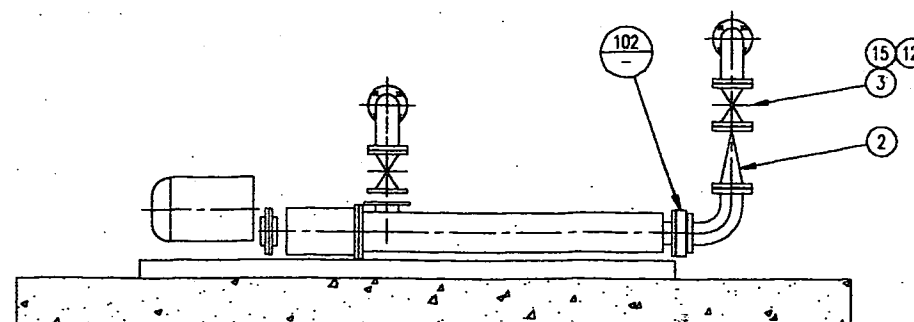


PLAN ARRANGEMENT OF SLUDGE PUMP STATION

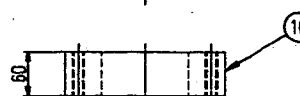
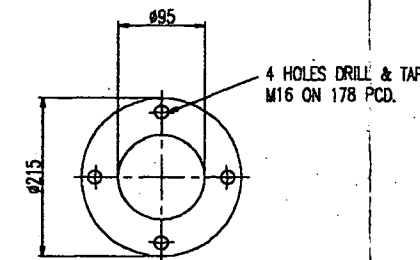


SECTION A

SCALE :- 1:20



VIEW 1

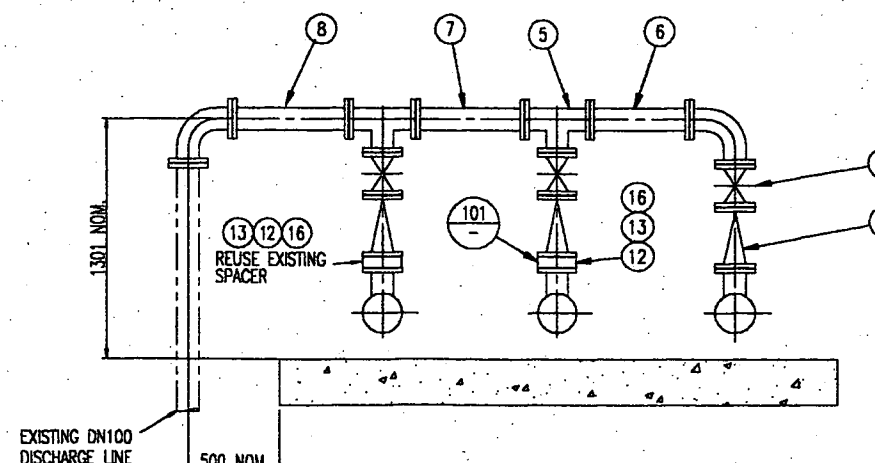
SCALE :- 1:20  
ROTATED 90°

SPACER

1 - REQUIRED  
TREATMENT :- BITUMEN COAT  
SCALE :- 1:5

INSTALLATION NOTE:  
REUSE EXISTING TEE'S, VALVES, ELBOWS AND SPACERS.  
USE NEW GASKETS & BOLTS.

PRIME PUMPS BEFORE RUNNING.  
DO NOT ALLOW PUMPS TO RUN WITHOUT  
PRIMING SUCTION LINES WITH WATER (OR  
STATOR DAMAGE WILL RESULT!)

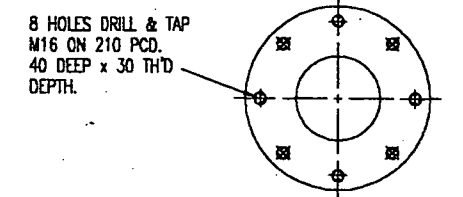
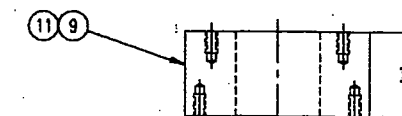
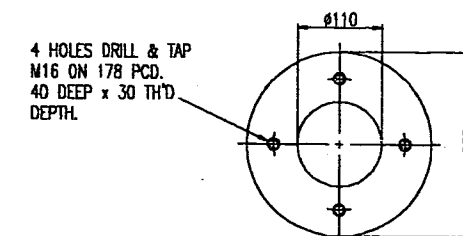


SECTION B

SCALE :- 1:20

FOR CONSTRUCTION

REFERENCE DRAWING LIST	
DRAWING No.	DRAWING TITLE
7387-04	OVERALL SITE PLAN

ADAPTOR SPACER.  
SCALE 1:5  
SEE TABLE

ITEM No.	DIMENSION 'X'	QUANTITY
100	115	1
102	55	1

SURFACE PROTECTION:  
DCL PIPE, FITTINGS & CHECK VALVE, ITEM 2, TO BE PRIMED  
BY MANUFACTURER.  
FINISH COATING TO BE DARK GREY N64 TWO PACK EHB WATYLL  
EXISTING PIPEWORK & FITTINGS ON SITE TO BE OVERCOATED  
WITH DARK GREY AS ABOVE.

18	24	M16 CHEMICAL CAPSULE		
17	24	M16 THREADED ROD x 170 LG. + N + W. MITRE ONE END	316	
16	100	M16 BOLT x 55 LG	316	
15	100	M16 BOLT x 75 LG. + N + W	316	
14	1	1/2 BSP. HEX PLUG.		CAL. MALL
13	6	DN125 BS4504 PN16 GASKET, 3 THK INSERTION RUBBER.		
12	34	DN100 GASKET, TABLE D, 3 THK INSERTION RUBBER.		
11	1	DN100-125 SPACER FLANGE x 115LG. SEE TABLE		DI
10	1	DN100-125 SPACER FLANGE x 60LG.		DI
9	1	DN100-125 SPACER FLANGE x 55LG. SEE TABLE		DI
8	2	DN100 FL-FL. PIPE x 625LG. TABLE D		DICL
7	2	DN100 FL-FL. PIPE x 588LG. TABLE D		DICL
6	2	DN100 FL-FL. PIPE x 525LG. TABLE D		DICL
5	2	DN100 FL-FL. TEE, TABLE D		DICL
4	1	DN100 FL-FL. 90° ELBOW, TABLE D, C/W TAPPING BOSS 1/2" BSP		DICL
3	2	DN100 JOHN SLICIE VALVE, FIG 630 CL16, TABLE D.		
2	1	DN100 JOHN CHECK VALVE, FIG 404, TABLE D, C/W COUNTERWEIGHT		
1	1	MONO PUMP CED71MSTRB/C406, 441RPM, IP56, 5.5 KW MOTOR		
		C/W VFD & MECHANICAL SEAL, FRAME 161-0132		
ITEM	QTY.	DESCRIPTION	GRADE	STANDARD

ITEM QTY.	DESCRIPTION	GRADE	STANDARD

<b>AQUATEC-MAXCON PTY. LTD.</b>	PH (61) 7 3281 2280
WATER TREATMENT TECHNOLOGY AND EQUIPMENT	FAX (61) 7 3281 8259
A.C.N. 002 250 482	P.O. BOX 455 IPSWICH QLD 4305
	Email: aquatec@maxcon.com.au

PROJECT	BUNDAMBA SLUDGE DEWATERING PROJECT					
TITLE	BELT PRESS & POLYMER DOSING NEW SLUDGE PUMP PIPEWORK DETAILS					
CLIENT REFERENCE	JOB NUMBER	A1	DRAWING NUMBER	7387-18	REV.	0

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PURPOSES ON BEHALF OF THIRD PARTIES WITHOUT THE  
WRITTEN AGREEMENT OF AQUATEC-MAXCON PTY. LTD.

GENERAL INFORMATION  
DRAWINGS ARE PREPARED IN ACCORDANCE WITH:  
AS 1101 GRAPHIC SYMBOLS FOR GENERAL ENGINEERING  
FAB. & DETAILING SHALL BE TO STEEL STRUCTURES AS 4100 SEC. 14 & SEC. 15  
HOT DIP GALV. TO AS 1550-1988  
ALL LEVELS ARE EXPRESSED IN METRES  
ALL SCREW THREADS TO BE COATED WITH NICKEL ANTI-SEIZE  
ALL ITEMS TO BE TAGGED WITH THE JOB, ITEM AND DRAWING NUMBER  
ALL WELDS TO BE TO TABLE 6mm CFW TO AS 1554.1 CAT G.P. UNO  
ALL FLANGES TO BE TO TABLE 'D' OFF CENTRE UNO  
TRACEABILITY REQUIRED? NO

MATERIAL LIST DEFAULT STANDARDS  
AS 3678-1990 HOT ROLLED STEEL PLATE GRADE 250  
AS 3678.1-1990 HOT ROLLED STEEL BAR & SECTIONS GRADE 250  
AS 1448-1980 STAINLESS STEEL PLATE & SHEET  
AS 2837-1988 ST ST BARS & SEM FINISHED PROD.  
DN 931/4 ST ST BOLTS/NUTS GRADE 304/316  
AS 1480.1-1989 POLYETHYLENE PRESSURE PIPES  
AS 1159-1988 GALV. BOLTS/NUT GRADE 4.8  
AS 1111/2 ABS PIPES & FITTINGS  
AS 3518 ST ST THREADED ROD 304/316  
AS 1275

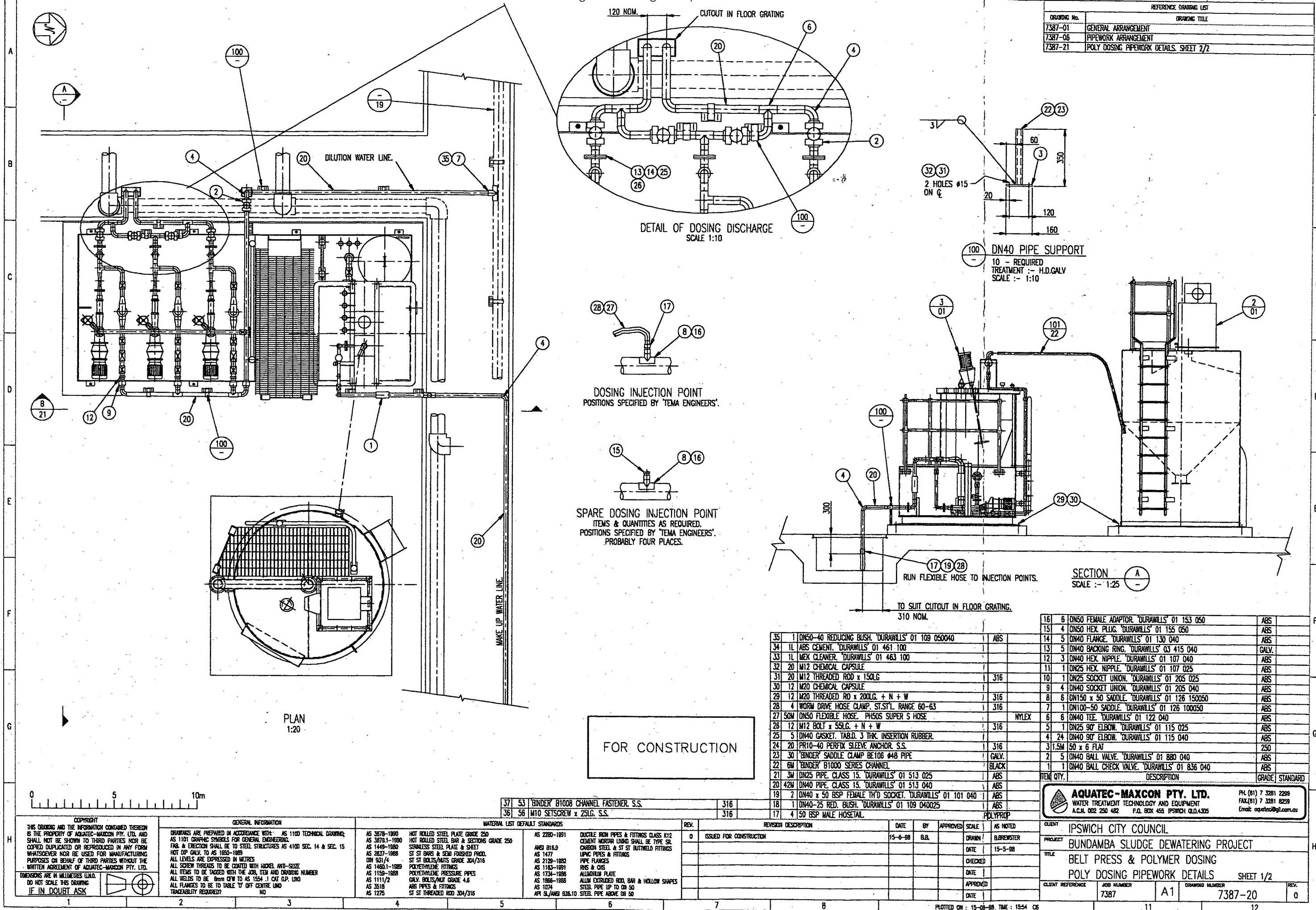
AS 2280-1991 DUCTILE IRON PIPES & FITTINGS CLASS N12  
CEMENT MORTAR LINING SHALL BE TYPE SR  
CARBON STEEL & ST ST BUTTWELD FITTINGS  
UPVC PIPES & FITTINGS  
AS 2129-1982 PIPE FLANGES  
AS 1163-1991 RVS & CHS  
ALUMINUM PLATE  
AS 1734-1988 ALUM EXTRUDED ROD, BAR & HOLLOW SHAPES  
AS 1868-1988 STEEL PIPE UP TO DN 50  
API 5L/ANSI 606.10 STEEL PIPE ABOVE DN 50

REV.	REVISION DESCRIPTION	DATE	BY	APPROVED	SCALE
0	ISSUED FOR CONSTRUCTION	21-5-88	B.B.		1:20

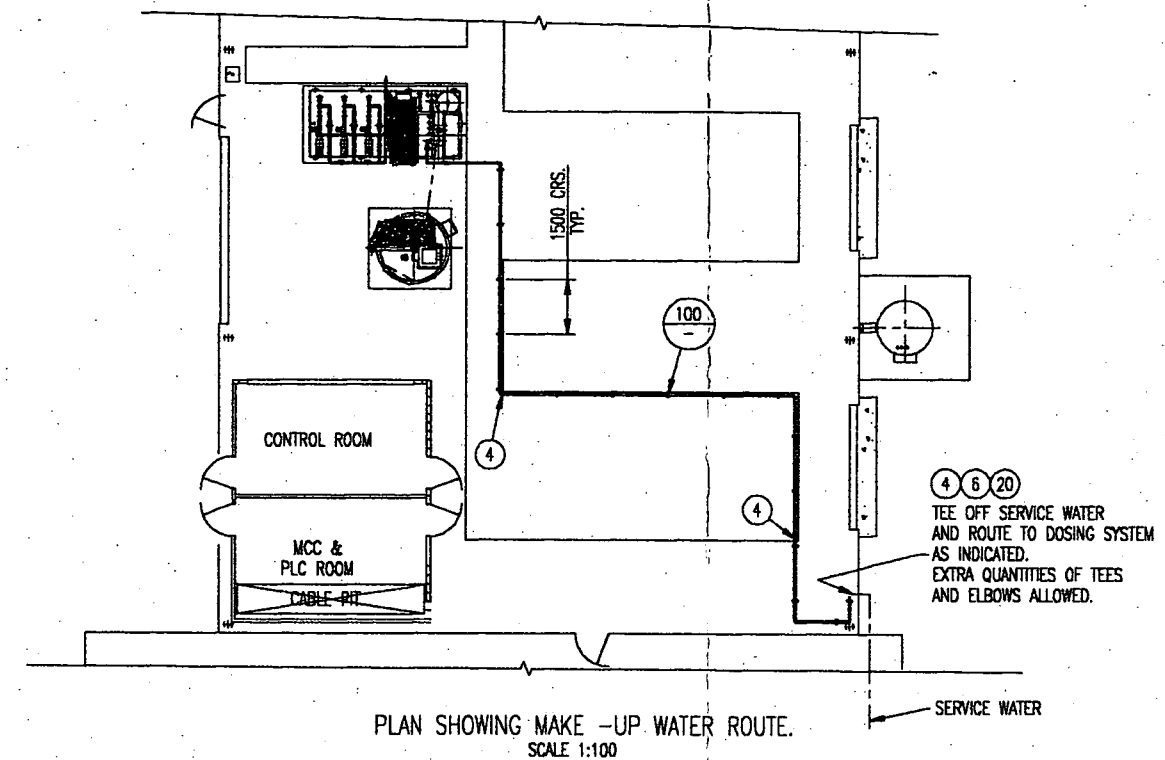
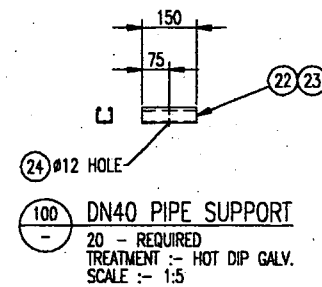
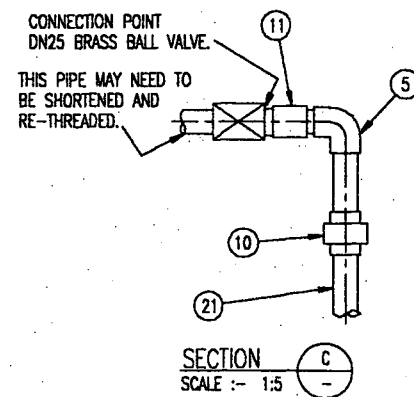
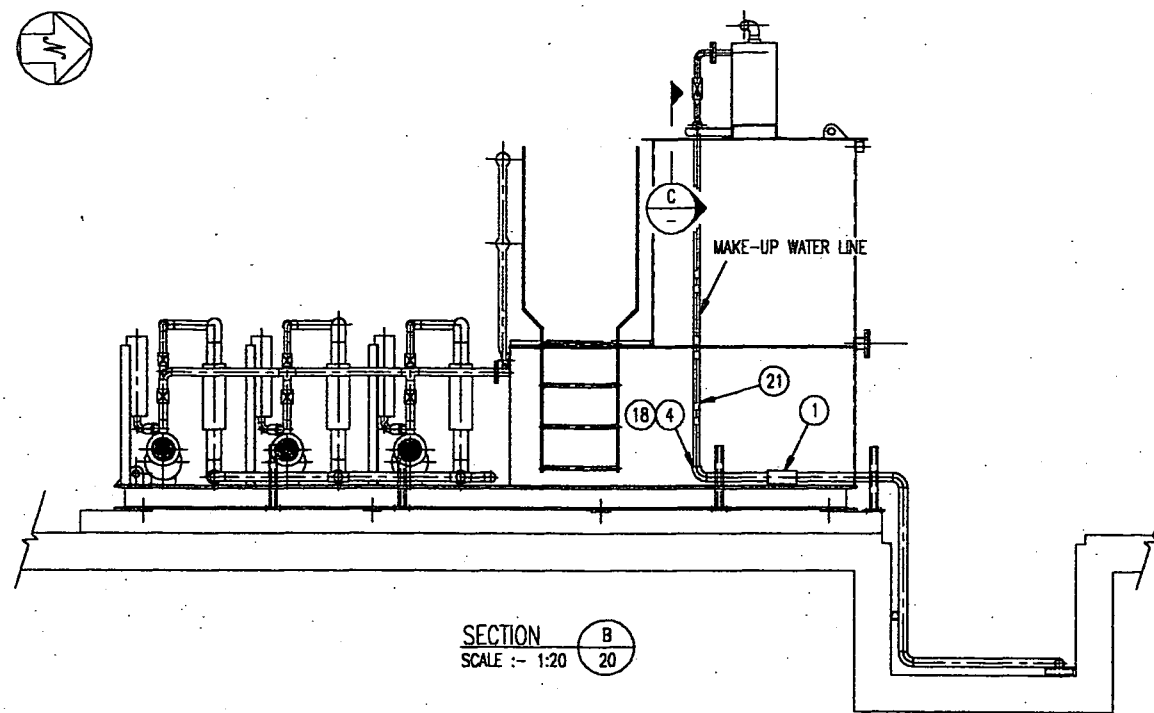
PLOTTED ON: 21-05-88 TIME: 15:20 A2



REFERENCE DRAWING LIST	
DRAWING NO.	DRAWING TITLE
7387-01	GENERAL ARRANGEMENT
7387-06	PIPEWORK ARRANGEMENT
7387-21	POLY DOSING PIPEWORK DETAILS SHEET 2/2



REFERENCE DRAWING LIST	
DRAWING No.	DRAWING TITLE
7387-01	GENERAL ARRANGEMENT
7387-06	PIPEWORK ARRANGEMENT
7387-20	POLY DOSING PIPEWORK DETAILS, SHEET 1/2



FOR CONSTRUCTION

ITEM QTY.	DESCRIPTION	GRADE	STANDARD
1 ALL ITEMS LISTED ON 7387-20, SHEET 1/2			
<b>AQUATEC-MAXCON PTY. LTD.</b> WATER TREATMENT TECHNOLOGY AND EQUIPMENT A.C.N. 002 250 482 P.O. BOX 455 IPSWICH QLD 4705 PH (61) 7 3281 2259 FAX (61) 7 3281 8259 Email: aquatec@qpl.com.au			
CLIENT IPSWICH CITY COUNCIL			
PROJECT BUNDAMBA SLUDGE DEWATERING PROJECT			
TITLE BELT PRESS & POLYMER DOSING POLY DOSING PIPEWORK DETAILS SHEET 2/2			
CLIENT REFERENCE	JOB NUMBER	DRAWING NUMBER	REV.
7387	A1	7387-21	0

PLOTTED ON: 15-06-08 TIME: 10:29 C6



CLIENT		IPSWICH CITY COUNCIL	
PROJECT		BUNDAMBA SLUDGE DEWATERING PROJECT	
TITLE		BELT PRESS & POLYMER DOSING COMPRESSED AIR DETAILS	
CLIENT REFERENCE	JOB NUMBER	A1	DRAWING NUMBER 103-05
			REV.

