



Installation, Operation & Maintenance Manual

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SAFETY

The following Instructions must be adhered to prior to commencement of any such work on Additive Equipment.

- 1) Ensure all Material Safety Data Sheets are issued and are current for additives in use.
- 2) Ensure all Health and Safety Procedures are adhered to and all protective clothing/equipment is clean and fully operational.
- 3) Ensure a copy of the handbook is available.
- 4) Ensure all site safety requirements are conformed to.
- 5) Electrical enclosures contain potentially lethal voltages. Only suitably qualified personnel are to be allowed internal access.
- 6) Instructions provided on warning plates are to be observed at all times.
- 7) Ensure all wasted materials are disposed of in the correct manner.

WARNING NOTE

It will be necessary to bleed the pump(s) in accordance with instructions, but if the working pump vernier setting is low, it will be advantageous to increase the vernier setting to above 50% during the bleeding operation.

It is essential that the vernier setting is returned to its required value before the dosing system is allowed to discharge into the product.

If, when resetting the vernier, it becomes hard to turn, do not force but turn the gearbox by hexagon nut on the shaft end with a ring spanner. (or use a pump timing tool on the end pump).

Do not wind vernier below 0% or above 100%.

Never run the turbine assembly against closed valves.

Always ensure check valves removed for maintenance are reinstated in the correct orientation.

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CHAPTER 1 GENERAL INFORMATION

1.1 Description of Product Function

The Enraf MeQ-Pak Self-Powered, Turbine Additive Injection Assembly has been designed and developed to permit the addition of a prescribed additive, in the correct quantity, to a main product line fluid. This is achieved using a turbine (impeller driven by the main product flow) to drive, via a gearbox, pump unit(s) which supply the additive. Dependent on the requirement, the turbine to gearbox assembly can be selected from a variety of sizes (2", 4", 6", 8", 10" units), whilst one or more pump units may be used. These are also sized according to the requirement and may be used in a combination of sizes.

The MeQ-Pak 'Turbine Driven Injector' is capable of handling a wide range of product flows and can inject from as little as 0.2ppm up to 2500ppm of product. Its mechanical simplicity and rugged design will provide a reliable system requiring minimal maintenance. If necessary the turbine can be supplied as a skid assembly enabling the unit to be used as a mobile device.

Available in five sizes

- Self-contained with all system components ready for easy installation.
- Simple and cost-effective to install.
- Can be applied to any pipeline configuration with a simple cut-in.
- The turbine affords virtual free power, with high accuracy & repeatability.
- Comprehensive range of options.
- Turbine installation into any pipe work configuration.

1.2 Applications

- Petroleum Product
- Additives
- Anti-Static Additives
- Corrosion Inhibitors
- Aircraft Fuel Icing Inhibitors
- Anti-Foam Additives
- Ethyl Mercaptan
- Dyes & Markers

The MeQ-Pak 'Turbine Driven Injector' is extremely cost effective to install, requiring only a simple pipeline cut-in, in any pipeline configuration.

This Product is designed for use in a Zone 1 Hazardous Area.

1.3 Mechanical Principles of the Assembly

The mechanical principles of the assembly are as follows:

- a) An impeller, in the turbine drive unit, is driven by the fluid being pumped through the main product supply pipe-work.
- b) The impeller, in turn, drives pulsing metering pump(s) through a gearbox.
- c) One stroke of the metering pump generally represents 7 or 10 revolutions of the impeller.
- d) The length of stroke of the metering pump can be adjusted by means of a vernier attached to the pump stroke mechanism. A vernier setting of 100% provides the maximum stroke length and, therefore, maximum additive quantity.
- e) The number of strokes of the metering pump is proportional to the impeller speed.
- f) The additive pump output is proportional to the length of the pump stroke and vernier setting.

1.4 Instructions for Lifting and Transport

1.4.1 Equipment in Un-Opened Case

Case incorporates a pallet for forklift handling. Ensure orientation symbols are correct.

Forklift truck should be minimum capacity of 1 ton.

Ensure that forks completely span the pallet.

Following transportation, set down on firm level ground ensuring orientation symbols are correct, support/ stabilise if necessary.

1.4.2 Equipment Free of Case

NOTE: If lifting from case/pallet, follow, "Instructions for Unpacking, Inspection and Storage".

Lift with a forklift truck or mobile crane, minimum capacity 1 ton.

Using a suitable ½ ton shackle with 1 ton strop connect to lifting eye provided on turbine case.

Lift vertically slowly.

Beware: tilting due to unbalanced support. Restrain equipment from swinging and rotating do not stand or place feet below pump.

Following transport, set down on angle irons on firm level ground.

1.5 Instructions for Preservation During Transport and Storage Before and After Installation

1.5.1 Preservation During Transport

Encased equipment should be sited on firm level surface and located to ensure that the case cannot be ruptured.

Ensure orientation symbols are correct.

Maximum top weight stated on the case is not exceeded.

All temporary supports for the equipment are within the casing.

Equipment is finished for locating in exterior environment. Additional preservation is not necessary.

1.5.2 Equipment Finish

Equipment is finished for locating in exterior environment. Additional preservation is not necessary.

Equipment Finish

Manufacturer's standard.

Stainless Steel - Natural

1.6 Instructions for Unpacking, Inspection and Storage

1.6.1 Unpacking, Inspection

Encased equipment should be transported to the unpacking location following the recommendations given in "Instructions for Lifting and Transport".

Ensure case is sited on firm level ground with correct orientation of symbols.

Inspect case. If there are signs of serious damage, advise supervisor and await instructions.

Remove top of case with claw hammer or crow bar. **Safety:** Remove nails from top.

Inspect contents. If there are signs of bracing/supports out of place or damage, advise supervisor and await instructions.

Remove cross bracing (if fitted, nailed/screwed into position).

If deemed necessary, remove the case sides.

Unbolt stabilising angle irons (2 off) from the internal case beams.

Note: leave angle irons attached to turbine flanges.

To lift equipment (and transport), follow the recommendations given in, "Instructions for Lifting and Transport".

1.6.2 Recommended Tools for Unpacking

- Claw Hammer
- Crow Bar
- Nail Puller
- 10" Adjustable Spanner

1.6.3 Storage

Equipment is constructed suitable for external location when in use.

Equipment to be stored should be sited on firm level ground with the lifting eye uppermost and located to minimise risk of damage to pumps and small bore piping.

The stabilising angle irons fitted to the main flanges (or refitted) must be secure to prevent any possibility of toppling.

Ensure that main flanges and small bore supply piping end are fitted with proper blanks/plugs.

Storage preservation recommendations should be applied in accordance with "Instructions for Preservation during Transport and Storage before and after Installation".

1.6.4 Storage Inspection

Equipment in storage should be inspected every 12 months. This must include:

Removal of collected debris.

Visual Inspection of all surface conditions.

Visual inspection for external damage.

Rotation check – rotate the turbine and pumps. This can only be achieved by turning the wheel of the turbine by hand. Movement of the pump(s) is visible. Small bore piping and pumps will contain a residual amount of the testing medium – mineral oil.

NOTE: There is no known limitation of storage life.

Preparation for Use

Preparation for use after storage is recommended in:

CHAPTER 3 INSTALLATION

CHAPTER 4 COMMISSIONING

CHAPTER 6 METERING PUMP INSTRUCTIONS

CHAPTER 2 OPERATION AND CONSTRUCTION

2.1 Turbine

The characteristic of the turbine assembly indicates that the fluid being metered passes a helical chamber across which is a concentrically mounted vane impeller.

The helical chamber, formed by the two-part casing, is of uniform cross-section, and as the impeller is mounted in the centre plane, the fluid flow path is inclined with respect to the impeller.

In progressing through the chamber, the fluid also passes simultaneously through the blade area in a circumferential and axial direction.

The resultant rotation of the impeller causes each blade to traverse the conduit in an axial direction, exposing it to all fluid velocities across the section of the conduit to give high accuracy and repeatability.

The rotational speed acquired by the impeller provides sufficient torque at the shaft to drive, through a coupling and reduction gearbox, a number of positive displacement metering pumps.

2.2 MGH-1 Mechanism Assembly

The MGH-1 is a mechanical device that converts rotary motion of the gearbox output shaft into reciprocating motion that's then used to drive the pumphead. The main external body of the MGH-1 is manufactured in cast iron.

The pumphead drive is through a roller bearing fitted to a cam on the main shaft. The cam drives a hardened and ground steel crosshead with spring return. Two lengths of stroke are available. 15mm standard 7.5mm optional. Short stroke units can be mixed with long stroke unit to give a wider choice of pump outputs.

The crosshead is guided by bushes at the front and back of the casing to ensure correct alignment. The stroke length is adjusted by using a special fine pitch screw, operated by a "micrometer" knob that is part of the micrometer box assembly, located on the back end MGH-1. The knob is pushed in and rotated to make adjustment and released to lock in place after adjusting. The knob can be rotated through 10 turns to give full adjustment from 0 – 100%.

The actual stroke percentage setting is indicated by a digital counter in the micrometer box assembly. The stroke length can generally be adjusted either when the pump is operating or stationary. However sometimes when stationary the knob maybe difficult to turn, depending on the size of pump fitted and its final resting position.

A twelve tooth splined coupling system is used for initial and interconnecting drives, so that deliveries can be phased to suit specific

process requirements. Where PS65 pumpheads are used a spacer unit is required between mechanisms.

Mechanisms, spacers and intermediate gearboxes are grease packed on assembly and no regular attention is necessary. These have a design life of 22,000 hours.

CHAPTER 3 INSTALLATION

CAUTION

The turbine assembly is only to be lifted using the lift points provided. Any other lift points used will seriously damage the assembly. Care is to be taken to ensure that no weights or undue pressures are applied to the drive gearbox, additive pump unit(s) or pipe work.

Installation of the assembly is relatively straightforward. The gearbox and pump unit(s) is mounted to one side of the turbine drive. The mounting design is such that for normal operation no further support is required once the assembly is mounted in the pipeline.

The direction of flow through the turbine drive unit is by-directional as indicated by an arrow cast on the side of the casing. The additive injection point is normally at the inlet end of the turbine drive unit, thus ensuring optimum mixing of the additive and product fluids by the turbulence created through the turbine wheel. However the injection point can be positioned on either side of the turbine if required, allowing the additive to blend into the product while continuing through the pipe-work after the turbine.

A Witches hat strainer is supplied with the Turbine and should be fitted at the inlet to the turbine. This is fabricated from 1.5mm stainless steel sheet and will need to have a gasket fitted to both sides. Allowance for this should be made when determining the space required for fitting the turbine into the pipeline.

NOTE: It is imperative that the turbine drive unit is installed with the metering pump plungers in a horizontal position, and the pump head inlet and outlet valves in the vertical position.

In the event that the inlet and outlet flange and bore sizes of the turbine drive unit do not match those of the product supply pipe work, then tapered reducers are to be fitted both upstream and downstream of the unit. These items can be fitted immediately adjacent to the unit.

Although the turbine drive unit is not susceptible to directional flow, either before the inlet or after the discharge, it is recommended that if a directional flow change is necessary adjacent to the unit, swept bends are used in preference to angle bends.

It is also recommended that the turbine drive unit is locally isolated to permit removal, overhaul and repair. Full bore valves should be used to achieve this.

When fitting pump heads, care is to be taken to ensure that the delivery valve is vertically above the suction valve.

The bore of the additive supply pipe work is dependent on the following factors

- a) Maximum quantity flow of the additive fluid.
- b) Viscosity of additive fluid at the lowest expected temperatures.

- c) Minimum head from the additive fluid storage tank.
- d) Length of supply pipe work.
- e) Pressure drop across any fittings in the supply pipe work.

3.1 Installation Procedure

Installation of the assembly will be between product line flanges. The additive(s) supply from the storage tank(s) is connected to stainless steel pipe fitting(s).

Access clearance to installation location will depend on the type and size of lifting/transport facility adopted.

Check suction product line for any debris.

Flush product tank discharge line to ensure that pipe is free of any debris, construction waste, scale, etc.

Flush additives supply tank discharge line(s) from storage tank to point of connection to the turbine assembly pump(s).

Dimensions, tolerances, General Arrangement Drawing MQP1/04/001.

Check flange to flange dimensions are within tolerance.

Lift assembly, (see CHAPTER 1 INSTRUCTIONS FOR LIFTING AND TRANSPORT)

Remove flange caps from turbine, check bore of suction and discharge for any debris.

Remove stabilising storage angles from flanges.

Clean flanges of assembly and product pipes.

Check rotation of turbine blades and movement of pumps.

Fit a 'Witches Hat Strainer' in the inlet of the MeQ-Pak. A gasket is required on both sides of the strainer.

Locate assembly between pipeline flanges.

Insert gasket(s)

Insert flange bolts and fit nuts.

Tighten up bolts progressively by rotation around flange, operating on diametrically opposite bolts in turn.

Remove plug(s) from pump suction line(s).

Connect the additives tank(s) discharge line(s) to the appropriate pump suction fitting.



WARNING: *A protection device needs to be fitted in the pipeline to prevent inadvertent over pressurisation of the MeQ-Pak. This device should also protect the MeQ-Pak from over pressurisation from external fire.*

3.2 Installation Checklist

- Assembly is correct for the location.
- Flange sizes and type are matched.
- Product line has been flushed and cleared of debris.
- Turbine assembly is clear of debris. Assembly is free to rotate.
- Flange faces are clean.
- Gaskets are fitted.
- All flange bolts are fitted and have been tightened evenly.
- Additive tank discharge line(s) have been flushed.
- Additive tank discharge lines are connected to the turbine pump(s) suction line(s).
- Flange joints are secure.
- Small bore joints are secure.
- Ensure that all injection pumps are provided with a flooded suction at all times. Plunger pumps will be damaged if run dry.
- If a calibration jar is fitted the vent on top of the calibration jar should be piped so that the top of the vent is higher than the top of the additive supply tank if possible.

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CHAPTER 4 COMMISSIONING

On the successful installation of the assembly, commissioning can take place.

CAUTION

The isolation hand valve, located in the discharge pipe between additive pump and the turbine, must be to OPEN position before the assembly is operated for additive purposes.

NOTE: Before operating the assembly ensure that the additive storage tank is full and all supply valves are open.



WARNING: SAFETY MEASURES CONCERNING THE PRODUCTS BEING USED IN THE MAIN PIPELINE AND THE ADDITIVE PIPELINE SHOULD BE STRICTLY ADHERED TO. REFER TO THE ADDITIVE MATERIAL SAFETY DATA SHEET (MSDS) FOR HEALTH AND SAFETY INFORMATION.



WARNING: The pump vernier setting is 0 - 100%. **NEVER** adjust the vernier below 000 or above 100. Any figure below 000 or above 100 should be ignored as it will be ineffective and will cause severe damage to the pump mechanism.

4.1 Pump Bleeding

NOTE: Refer to the MSDS for the additive and take the appropriate measures to contain any spillages. This should be kept to a minimum.

Each pump has a check valve set a 1 bar on its discharge. This is fitted to stop additive flowing through the pump under gravity.

All the additive pumps should be bled before commencing operation. Proceed as follows:

1. Open up the additive supply from the storage tank and vent the supply line if possible.
2. Loosen the output pipe work at the pump delivery valve below the check valve mounted on the pump assembly head. (4 bolts PS15 – PS65) (Hex PS6 – PS10)
3. Gravity must be enough to bleed the pumps otherwise pumping problems will occur. Bleed the pumps until a free flow of additive is seen to be flowing from the pump delivery valve below the check valve.
4. Retighten the pipe work.
5. If a flowmeter has been fitted refer to the flowmeter manual for commissioning instructions.
6. If a calibration point has been fitted in the pump discharge, this can be used to bleed the pipe-work up to this point with the pumps running.

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CHAPTER 5 MAINTENANCE

The maintenance aspects of the assembly are described separately under each major component.



WARNING: SAFETY MEASURES CONCERNING PRODUCTS BEING USED IN THE MAIN PIPELINE AND THE ADDITIVE PIPELINE SHOULD BE STRICTLY ADHERED TO. REFER TO THE ADDITIVE MATERIAL SAFETY DATA SHEET (MSDS) FOR HEALTH AND SAFETY INFORMATION.

5.1 Turbine Drive Unit

No service is required to the turbine drive unit. However, periodic checks should be made during normal operating conditions to check for mechanical seal failure. A telltale hole is drilled in the mounting spool between the turbine housing and the gearbox for this purpose.

In the event that the mechanical seal should require replacement, proceed as follows:

1. Close the isolation valves, situated on each side of the turbine.
2. Drain the turbine drive unit.
3. Disconnect the necessary pipes from the pump(s).
4. Remove the pumps and gearbox.
5. Remove the half-coupling from the turbine shaft.
6. Remove eight bolts holding the spool piece to the turbine case and remove the spool spice and stationary seal holder.
7. Refer to the instructions with the mechanical seal for fitting. New nyloc grub screws are to be used in the coupling, and a new O ring fitted between the spool piece and the stationary seal holder.
8. After seal replacement, follow the above instructions in reverse order to re-assemble.
9. Follow the pump bleeding procedure before putting the unit back into service.

NOTE: It is recommended that the turbine case assembly is pressure tested following seal replacement to ensure correct installation. Also depending on the age of the turbine and the work load it has been subjected to, consideration for a complete overall may be need. The turbine will need to be removed from the pipeline for this to be carried out.

5.2 Gearbox

The gearbox is oil filled and is sealed for life. No maintenance is required, however it should be periodically inspected and the unit should be replaced if defective.

5.3 Filter

A filter is fitted into the additive supply line and requires regular 3 monthly inspections.

5.4 Check Valves

EFT Check valves are used for the following.

5.5 Loading Valves

A stainless steel loading valve is fitted to each pumphead to ensure that the pumphead is continuously charged with the correct amount of injection fluid from a flooded suction. However, it will hold any excess pressure between the additive head and the product pressure. This valve will normally be set at 1 bar.

5.6 Anti-syphon Valve

The injection point is fitted with a stainless steel anti-syphon valve. This valve is normally set at 3 bar, and prevents additive being drawn into the system by vacuum, or any venturi effect created when the system is run and additive is not required.

5.7 Relief Valve

Each additive system is fitted with a stainless steel relief valve. These valves can be piped either back to the pump suction or back to the additive tanks. They will normally be set at 15bar. If the relief valve returns back to the pump suction (normal configuration) then an open, non restrictive line should be maintained to and from the supply tank.

No check valves fitted in this supply line.

CAUTION

Extreme care should be taken maintaining the check valves as any failure could result in the incorrect mixing of additive into the product line or vice versa.

5.8 Safety of Equipment Returned for Service

In the event of any equipment being returned for service, the following points are to be noted:

- a) All pumps and accessories returned are to be in a clean and safe condition.
- b) Details of all the fluids that have been pumped including cleaning and flushing must be clearly marked on a label tied to the unit and a MSDS for each must be provided.
- c) Action to be taken in the event of inadvertent contact with any residual fluid is also to be advised.

CHAPTER 6 METERING PUMP INSTRUCTIONS

6.1 Safety Requirements

Read this section before carrying out any work on the EFT Metering Pump.

The pump **must** be installed, operated and maintained in accordance with this manual.

Do not run the pump against closed valves or blocked delivery lines. Failure to comply with this precaution will result in damage to the pump or its associated equipment with the possibility of personal injury.

All chemicals, mixtures and pumped media **must** be handled strictly in accordance with their manufacturer's instructions. Any harmful liquids must not come into contact with operators or other personnel. Refer to Material Safety Data Sheet MSDS.

Before carrying out any work on a metering pump:

1. It **must** be stopped and electricity/mechanically isolated. (Product pump)
2. Harmful products **must** be flushed out of the system.

6.2 Range of Pump

On EFT Turbine unit all pumps are mounted onto a MGH1 Mechanism. (see CHAPTER 2).

This metering pump has been designed as a robust, adaptable and powerful tool for accurate metered pumping of various media.

A wide standard range of mechanisms/pumpheads are available in stainless steel construction with a choice of seals. (PTFE are standard)

Plunger pumpheads are available in 6mm, 10mm, 15mm, 20mm, 30mm, 40mm and 50mm and 65mm diameters.

Hydraulic Diaphragm pumpheads are available in 6mm, 10mm, 20mm and 30mm diameters. All diaphragms are made from PTFE.

Multiple pumpheads may be fitted and interconnected to give flow with reduced pulsations. Each additional pumphead requires a "mechanism" to give stroke control and mechanisms can be bolted directly together when using plunger pumpheads.

(If a PS65 is used then a spacer is also required to allow for the width of the pumphead).

The standard stroke length of all pumps is 15mm **except** for the 50mm diaphragm pump which has a stroke length of 7.5mm. If required 7.5mm stroke units are available as an option on all pumps.

Flow ranges from 0.45 litres /hour to 295 litres /hour (0.09 - 65gph) and maximum discharge pressure from 12 bar to 680 bar. (175 - 10,000psi). Relief valves are normally set at 15bar. Some seal arrangements do not allow maximum pressure to be achieved.

Variation in pump output is achieved by setting a digital “micrometer”. The micrometer has an adjustable scale that reads 0 – 999, however this should only be operated between 0 – 100. This represents the appropriate percentage of full stroke length (or output). Generally pump performance will remain linear from 10% to 100% although diaphragm pumpheads will not operate to the same high accuracy as plunger pumpheads.

Pumps may be ganged to give full use of power available and to allow for the pumping of “cocktails” to suit the user’s process. A maximum of nine pumpheads may be fitted to a single drive unit and full rated pressure is available with up to three pumpheads suitable phased. When more than three pumpheads are fitted, maximum pressure has to be de-rated.

For further information, please contact Enraf Fluid Technology Ltd.

6.2.1 Drive Units

Mechanisms, spacers and intermediate gearboxes are grease packed on assembly and no regular attention is necessary. These have a design life of 22,000 hours.

6.3 Operation

NOTE: Running the turbine is required to operate the pumps. As this will require the transfer/movement of product this should be organised and controlled by site staff.

Ensure that all safety instructions in this handbook and those from manufacturers of pumped media, etc are followed **implicitly**.

Ensure compliance with all system design and operation requirements.

Check that there are no closed valves in the delivery line.

Bleed the pumps.

Start the pump. Remember that the pumps with low outputs may take some time to fill a system. If liquid flow is not detected, stop the pump, re-vent and try starting again. Repeat as necessary. (Set up the micrometer to 100% to assist start-up).

Adjust the micrometer to obtain the required output from the pump. Push in the micrometer knob and rotate until the desired percentage of output is shown in the window. Release the knob and allow it to spring back and lock in position. See pump data sheet for the output of a specific pump at 100% stroke setting. (All pumps are tested on water at the manufactures with a slave motor. It is likely that pump performance will improve during the first few hours/days of service as valves and seals “bed in”).

NOTE: As the EFT METERING pump is capable of delivering high pressure, it is not always possible to adjust the stroke length when the drive unit is stationary.

6.4 Pump Capacity

The pump(s) capacity is to be checked every three months or as required by site specifications. It can be checked against the meter, if fitted. The unit and the meter can be checked against a measuring vessel. A sample point is fitted after the flow meter. It is recommended that the pump vernier(s) are set to 100% during the test and the pump(s) strokes per minute counted during the test period. The quantity flow should be in accordance with the pump(s) output given below:

6.5 Example

1 in number PS 50 pump.

Strokes per minute during test - 75 (counted).

Duration of tests – 1 minute.

Quantity flow – 2.0litres.

1 X PS 50 delivers 160 litres/hour at 100% strokes at 100 strokes/minute. (Nominal)

1 X PS 50 delivers 120 litres/hour at 100% strokes at 75 strokes/minute. (Nominal)

The pumps should give 2.0 litres ± 1% in 1 minute.

After the test reset the vernier to the required setting.

6.6 Additive Rate Setting (Example Only)

NOTE: When performing this calculation it is essential that the client refers to the individual pump(s) calibration data. Pump strokes/min should be counted for a known product flow rate. Nominal figures are shown below.

In order to establish the vernier setting for the assembly, proceed as follows:

- a) Check turbine size and pump configuration.
- b) Measure turbine speed against a constant flow rate i.e. a 10" unit will have a turbine speed of 645 RPM @ 800 M³/hour.
- c) Check gearbox ratio i.e. 7:1.
- d) Pump strokes per minute @ 800 M³/hour will be 92 optimum.
- e) Dosing rate required =
$$\frac{\text{ppm}}{1000000} \times \text{Product Flow rate (lph)} = \text{Litres per hour}$$

Metering Pump Instructions

For 340 ppm = $\frac{340}{1000000} \times 800000 = 272$ L.P.H

f) Pump output PS 50 @ 100 s.p.m = 160 L.P.H

g) Pump output 2 x PS 50 @ 100 s.p.m = 320 L.P.H

h) Pump output 2 x PS 50 @ 92 s.p.m = 294 L.P.H

i) **Vernier Setting** $\frac{272}{294} \times 100 = \mathbf{92\%}$

CHAPTER 7 SERVICE AND INSPECTION SCHEDULES

1 Refer to the relevant Material Safety Data Sheets (MSDS) for both the additive and the product before starting work. Adhere to all the necessary safety requirements.

2 Special Equipment Clean protective clothing - gloves, goggles required.

NOTE: Protective clothing must be full - no short sleeves.
Safety glasses do not give sufficient protection.

3 Operational interference Dosing facilities out of service.

4 Tools Required Hand Tools.

5 Cleanliness High standard essential.

6 Materials Required Cleaning cloths (Clean only with a damp cloth).

7.1 Weekly

Visually inspect turbine unit and installation, Checking for:-

- 1 Sufficient additive in the supply tank.
- 2 Leaks on pipe-work between supply tank and turbines.
- 3 Leaks from turbine pumps and associated pipe-work.
- 4 Turbine is turning when product is flowing.
- 5 Pumps are stroking to full setting.
- 6 Meter is operating. (If fitted)
- 7 No additional noise from turbine.
- 8 No additional noise from pumps.

NOTE: If any concern is felt on 3 to 8 investigate problem and rectify as necessary.

9 Check meter reading (if fitted) and quantify dosing rate against product flow. If not in accordance with required setting, liaise with site staff and investigate the problem and rectify as necessary.

7.2 3-Monthly

- 1 Carry out weekly routine.
- 2 Check meter reading (If fitted) and quantify dosing rate against product flow. Investigate if the readings show that the turbine unit isn't operating as required.

- 3 Check tightness of all pump heads, assembly nuts, bolts and screws.
- 4 Check tightness of holding down bolts of the gearbox and pumps.
- 5 FILTER - Check cleanliness of additive supply filter by removing the element. Wash out in suitable solvent and replace. If seal or joint is damaged, replace with new.
- 6 Remove guard over coupling between the gearbox and the first pump and inspect for damage. Replace coupling if required then ensure that it is operating smoothly. Replace guard.

7.3 6-Monthly

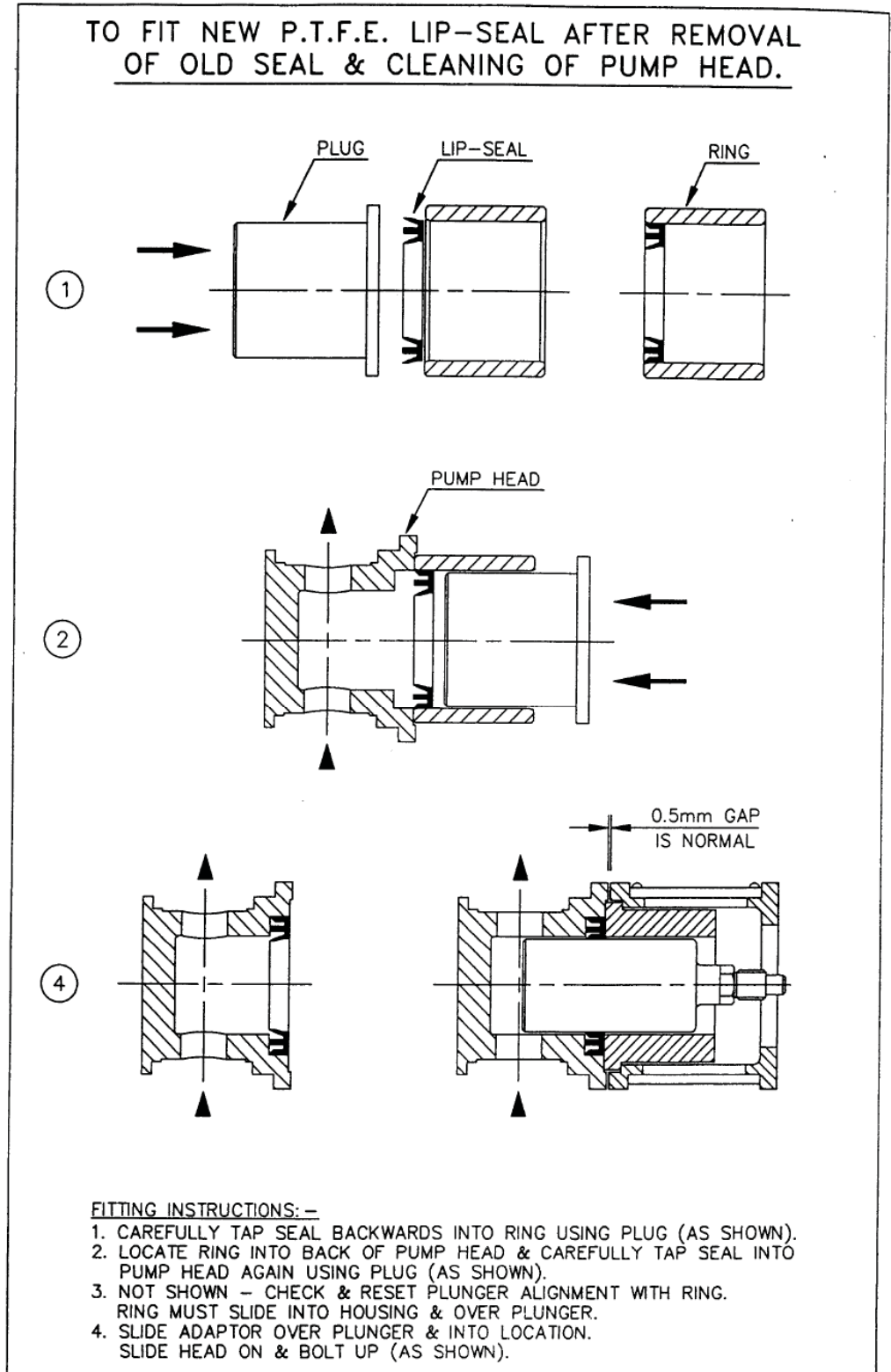
- 1 Carry out weekly and 3-monthly routines.
- 2 With unit running, check all valves, unions and pipe lines for leaks.
- 3 TURBINE DRIVE UNIT - Using the tell-tale hole (in the spool piece between the turbine housing and the gearbox, and capped with a red plug), check for seal failure (in the event of seal failure, see instruction manual, maintenance section or call in Enraf Fluid Technology Ltd.).
- 4 PUMP UNIT(S) - Clean down metering pump(s) and inspect the pumphead(s) for any leakages at the plunger gland.
- 5 If the plunger gland/seal appears to be leaking,
 - i If a packing gland is fitted, (PS6 & PS10) try to tighten the gland and see if this stops the leak. If not repack the gland.
 - ii If a lip seal is fitted this will need to be replaced. (see instruction manual, maintenance section or call in Enraf Fluid Technology Ltd.).

NOTE: If the gland/seal needs to be replaced the plunger should also be inspected for any damage and replaced as necessary.

- 6 METER – Check the meter by using the appropriate size calibration jar. Log check figures in appropriate record.

NOTE: This is not an approved fiscal check and will only give an indication that the flow-meter is working correctly. Should an approved calibration be required, the flow-meter will need to be removed from the turbine assembly and sent to an approved flowmeter test/calibration house.

7.4 Lip Seal Fitting Instructions



CAD FILE No.PTFE-SK

7.5 Plunger Removal and Refitting

To remove plunger this will require the suction and discharge pipe-work to be disconnected from the pumphead and the pumphead removed from the pump assembly. The turbine should be made safe in accordance with site requirements before any maintenance work is started.

7.5.1 Removal

1. Isolate the turbine unit so that it can't start.
2. Refer to the relevant Material Safety Data Sheets for both the additive and the product before starting work. Adhere to all the necessary safety requirements.
3. Isolate the additive supply.
4. Shut the additive supply valve at the turbine injection point.
5. Disconnect the additive supply and discharge pipe-work from the pumphead. Use an appropriate container to catch any additive and then plug the pipe-work to stop any drips.
6. Remove the pumphead carefully from the plunger box.
7. Remove window from top of plunger box.
8. Using 17mm A/F spanner through window hole, undo and remove plunger. **DO NOT REMOVE PLUNGER BOX.**
9. Inspect plunger. If scored in area of seal operation, it must be replaced.

7.5.2 Reassembly

1. Remove plunger nut and split collets from drive end of plunger.
2. Slide plunger nut back up new plunger and fit collets back into groove, smallest diameters towards plunger nut. Space collets equally around shaft and slide plunger nut over collets. Tap the cullet end of the plunger gently on a firm surface to hold in position on the shaft. This will assist with the assembly when connecting onto the cross-head on the Mech.
3. Locate end of plunger into cross head and tighten plunger nut through window hole. Be careful not to disturb the collets on the plunger.
4. When the nut is tight, loosen it slightly and tap the end of the plunger with a copper or leather hammer to free the collets.
5. Using a plunger centring ring over the plunger and, located in the front face of the plunger box, nip up plunger nut and check that ring slides freely in and out. If the ring remains free, plunger is in correct position.
6. It is likely that plunger will not be in correct position at first attempt. If this is the case, slacken plunger nut slightly and tap end of plunger with copper or leather hammer to free collets. Twist plunger back and forth and try re-tightening. Check position with centring ring.

7. Repeat this operation until plunger is central and then fully tighten plunger nut; re-check again. When centring ring slides easily in and out of plunger box, the plunger is in correct position.

NOTE: If plunger is not central, chevron seals and lip seals (particularly PTFE/carbon PTFE) will only last a few hours in service.

8. Refit pump head and associated pipe-work.
9. De-isolate and reinstate pump in system according to operating position.
10. Remove the isolation from the turbine. Operate the turbine and monitor the pump for any leaks during its first few minutes of running and then on regular basis until you are satisfied that the pump is running correctly.

NOTE: Running the turbine is required to operate the pumps. As this will require the transfer/movement of product this should be organised and controlled by site staff.

Ensure that all safety instructions in this handbook and those from manufacturers of pumped media, etc are followed **implicitly**.

7.6 Trouble Shooting

In the unlikely event of the pump not operating correctly, refer to this section. Before working on the pump, observe the “Safety Requirements” section.

Check that the suction strainer, if fitted, is not blocked. If so, clean out the element. Ensure that the suction line isolating valve is open.

Suction hose check that it is not collapsing under the operating conditions.

Increase the stroke setting to 100% to improve the start-up/venting performance.

Ensure that any air collecting in the delivery pipe-work is vented. Pumps will not prime or run if air locked. This is particularly important for 6mm and 10mm plunger pumpheads.

If the pump has been installed with a suction lift (**never recommended**) try raising the supply tank, or using any other safe method to wet the pumphead and valve gear.

Check for seal leakage. If the seal allows liquid to pass out of the pump, it will allow air into the pumphead on suction stroke. Replace the seal or diaphragm if leakage is occurring.

Sometimes loose particles lodge on the suction valve seat causing temporary loss of pumping. Tap the pumphead firmly with a hide mallet or similar tool - this will often solve the problem.

7.6.1 If all else fails

Consider attention to the valve gear. Check for any blockage or foreign matter (swarf from pipework, etc) trapped at the valve seats and clean it

off. Inspect the seating faces; if damaged, replace the seals and balls. Re-assemble carefully - see the pumphead drawing for details.

If the valve gear is re-assembled incorrectly, a hydraulic lock may occur and cause major damage to the pump.

7.7 Spares and Service Kits

7.7.1 Drive Unit and Mechanisms

A sectional drawing is enclosed for reference purposes only. Special tools are required for dismantling and re-assembly. Contact Enraf Fluid Technology Ltd.

7.7.2 Pumpheads

All pumpheads have a type number shown on the front label. Always quote this number when ordering spare parts. Please also quote Turbine serial number.

Refer to the relevant pumphead drawing and quoted ballooned item numbers as required, together with the description from its parts list.

7.8 Standard Pumphead Service Kits

7.8.1 Diaphragm Pumpheads

1 x diaphragm
2 x valve seats
2 x valve balls
6 x "O" rings

7.8.2 Plunger Pumpheads (Lip Seal)

1 x lip seal (including back-up ring, if necessary)
2 x valve seats
2 x valve balls
6 x "O" rings

7.8.3 Plunger Pumpheads (Chevron/packed Seals)

3 x chevron rings **or**
1 set packing rings & anti-extrusion rings
2 x valve seats
2 x valve balls
6 x "O" rings

7.9 Turbine General Spares List

Description	Part no	Qty fitted
WHEEL -4" TURBINE (FABRICATED)	10-00-09	1
WHEEL -6" TURBINE (FABRICATED)	10-00-10	1
WHEEL -8" TURBINE (FABRICATED)	10-00-07	1
WHEEL -10" TURBINE (FABRICATED)	10-00-08	1
GEARBOX HUB SHAFT RMI40 (2965/18 Issue C)	10-20-07	1
GEARBOX 7:1 RATIO C/W SHAFT TDRMI40-7:1	10-40-03	1
GEARBOX RMI40-10:1 D63-B5 + OUTPUT SHAFT	10-40-04	1
TURBINE SHAFT 4" 6" & 8" (DRG: 2965/19 Issue D)	10-20-08	1
TURBINE SHAFT 10" (2965/20 Issue D)	10-20-09	1
RADIAL BALL BEARING S/STEEL	10-40-02	2
MECHANICAL SEAL ½" VITON	10-40-01	1
COUPLING HALVE ROTEX-19 (11 x 4) STEEL	10-60-01	2
COUPLING HALVE ROTEX-19 (19 x 6) STEEL	10-60-02	2
O-RING VITON (SPOOL ASSEMBLY)	2-042	1
O-RING BS278 VITON (4 "TURBINE)	2-278	1
O-RING BS280 VITON (6" TURBINE)	2-280	1
O-RING BS284 VITON (8" TURBINE)	2-284	1
O-RING VITON - 10" TURBINE	2-390	1
RELIEF VALVE 3-50PSI ADJUSTABLE (43737 Issue E)	10-50-02	As required
RELIEF VALVE SPRING 4-400PSI	10-50-10	As required
CHECK VALVE END 12mm (43737 Issue G Sheet 5)	10-50-03	As required
CHECK VALVE END ½"NPT S/STEEL	10-50-04	As required
CHECK VALVE END ½"BSPT (43737/C Issue B)	10-50-13	As required
STANDPIPE END 12mm OD (43737/D Issue C)	10-50-14	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS4)	10-90-001	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS6P)	10-90-02	As required
PUMP MECHANISM & HEAD + LIP SEAL (MGH1 + PS6L)	10-90-02A	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS10P)	10-90-04	As required
PUMP MECHANISM & HEAD + LIP SEAL (MGH1 + PS10L)	10-90-04A	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS15)	10-90-06	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS20)	10-90-08	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS30)	10-90-012	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS50)	10-70-11	As required
PUMP MECHANISM & HEAD PTFE (MGH1 + PS65)	10-70-06	As required
BALL VALVE ½"NPT(F) S/STEEL (NO LOCK)	20-60-001	2
BALL VALVE ¼"NPT(F) S/STEEL	20-60-05	1
12mm FERRULE SET	SS12Ferrules	As required
12mm NUT	SS12Nuts	As required

Special Tools are Required for Plunger and Seal Replacement		
Examples of typical tools are shown below. Contact EFT for exact requirements.		
PLUNGER ALIGNMENT TOOL PS4	10-71-10	
PLUNGER ALIGNMENT TOOL PS10	10201/10	
PLUNGER ALIGNMENT TOOL PS30	10-71-10A	
PLUNGER ALIGNMENT TOOL PS40	10201/40	
PLUNGER ALIGNMENT TOOL PS50	10201/50	
SEAL FITTING TOOL - PS40	10207/40	
SEAL FITTING TOOL - PS50	10207/50	

7.10 Typical Commissioning Spares and Service Kits

Example PS50 Pumphead Commissioning Spares

Description	Part no	Qty per pump
O-RING PTFE	B2045	6
PLUNGER LIP SEAL 50mm PTFE	B2032	1

PS50 Pumphead 2 Year Operating Spares

Description	Part no	Qty per pump
O-RING PTFE	B2045	6
PLUNGER LIP SEAL 50mm PTFE	B2032	1
PLUNGER - 50MM	15889	1
VALVE BALL SIZE 22 (1038293)	B5032	2
VALVE SEAT 22mm S/STEEL (1038290)	10008	2

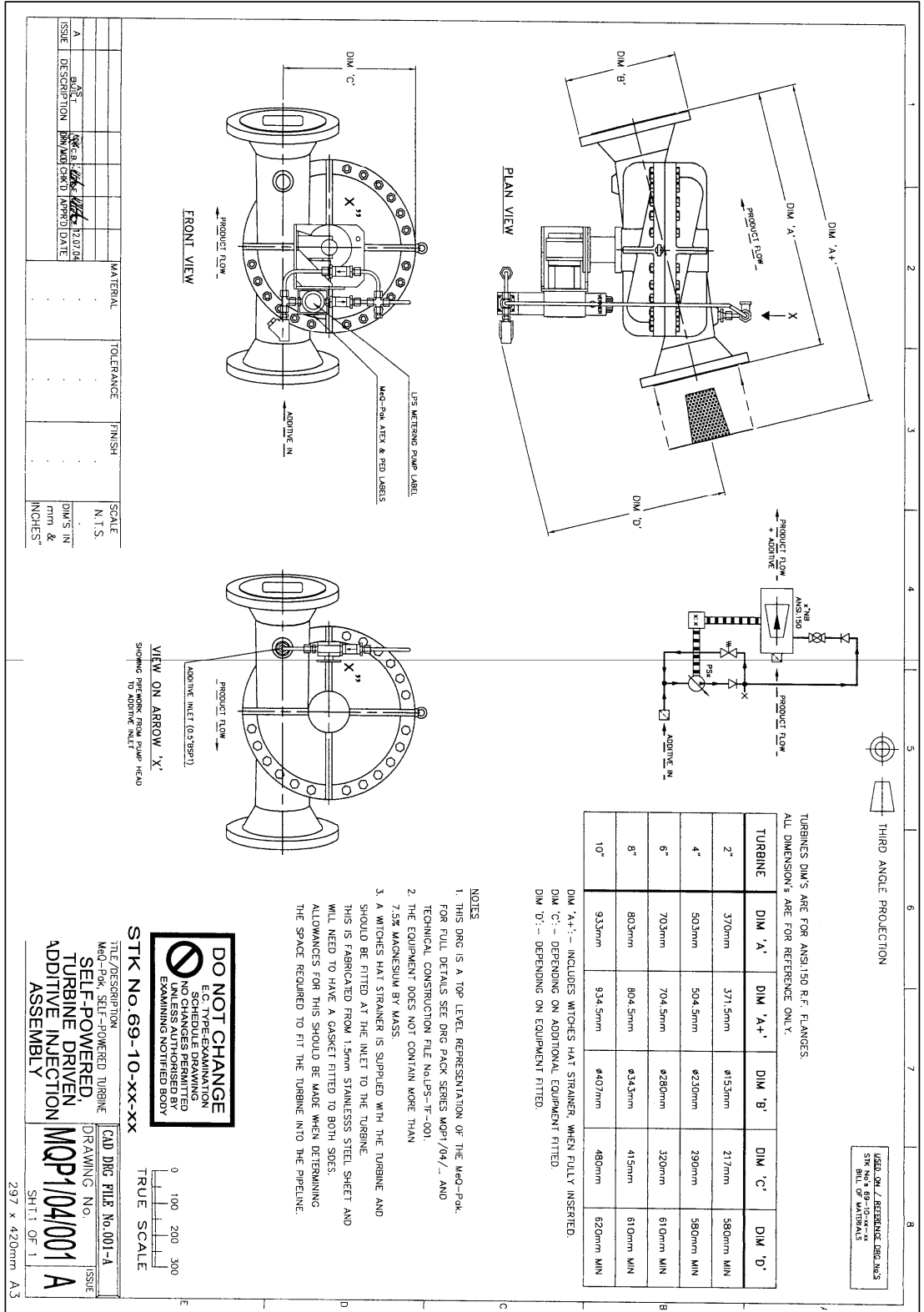
NOTE: When ordering spares always quote the turbine unit Serial Number and pumphead size as parts may vary between units.

CHAPTER 8 DRAWING/PARTS LIST

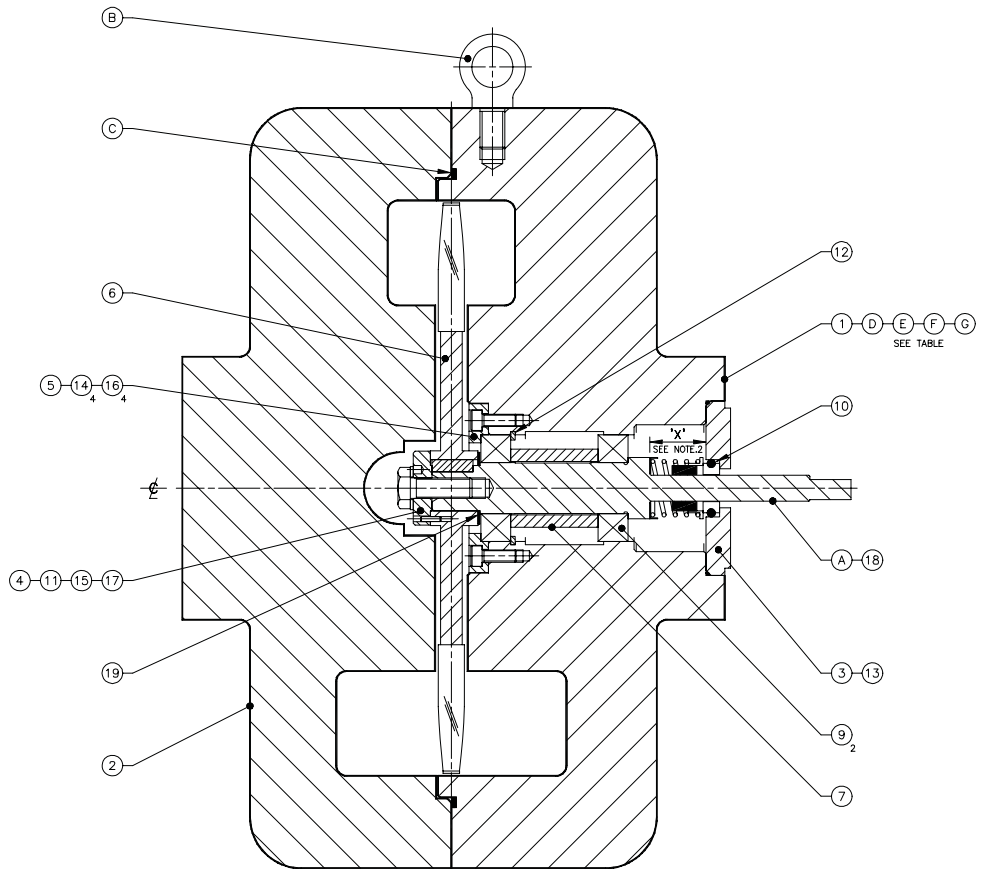
Drawing Ref.

MQP1/04/001	TURBINE GENERAL ARRANGEMENT		
2965/51	4" 6" 8" & 10" TURBINE CASE ASSEMBLY		
MGH-1	MECHANISM ASSEMBLY	&	Parts List
METERING PUMPHEAD	TYPE PS 4 6L 10L	&	Parts List
METERING PUMPHEAD	TYPE PS 6P 10P	&	Parts List
METERING PUMPHEAD	TYPE PS15/20/30/40/50	&	Parts List
METERING PUMPHEAD	TYPE PS 65	&	Parts List

8.1 MeQ-Pak General Arrangement



Drawing/Parts List



COMMON PARTS				
ITEM	DRG No.	TITLE/DESCRIPTION	MANU.	QTY.
1	2965/1 SEE NOTE.3	TURBINE CASE, SIDE 'X' MACHINING DETAIL	i	1
2	2965/2 SEE NOTE.3	TURBINE CASE, SIDE 'B' MACHINING DETAIL		1
3	2965/6	STATIONARY SEAL HOLDER		1
4	2965/41	LOCKING DISC		1
5	2965/42	BEARING RETAINING RING		1
6	2965/54	TURBINE WHEEL ASSEMBLY		1
7	2965/55	BEARING SPACER		1
9		BEARING, DEEP GROOVE BALL DES. No. SS-NSK-6205-RS	SKF/BSL	2
10		SEAL, MECHANICAL TYPE 0127/22-W/3544	NORTON WELLS	1
11		WASHER, TAB, M10 PART No. SP42J	B.A.S. AIRCRAFT	1
12		CIRCLIP, BASIC TYPE INT. SERIES D3000, RING CODE 052	FASTENERS CENTRE	1
13		O-RING, BS.1806 REF.084	HYD. S'MARKET	1
14		SCREW, SKT. HD. ST/STEEL M6 x 16 LG.		4
15		SCREW, HEX. HD. ST/STEEL M10 x 30 LG.		1
16		WASHER, PLAIN, ST/STEEL M6		4
17		SPLIT ROLL PIN 3/32" x 10mm LG.		1
18		KEYSTEEL, ST/STEEL, STD. 6mm SQ.		A/R
19		SHIM (0.005", 0.010" & 0.015")		A/R
20				

- NOTES:-
 1. SEE BUILD DETAILS FOR ASSEMBLY INFORMATION.
 2. DIMENSION 'X' ON ASSEMBLY TO BE 25mm
 3. TURBINE CASE DETAIL MACHINING DRAWING No'S VARY WITH FLANGE CLASS & TYPE.
 4. ALL O-RING SEALS TO BE 'VITON'

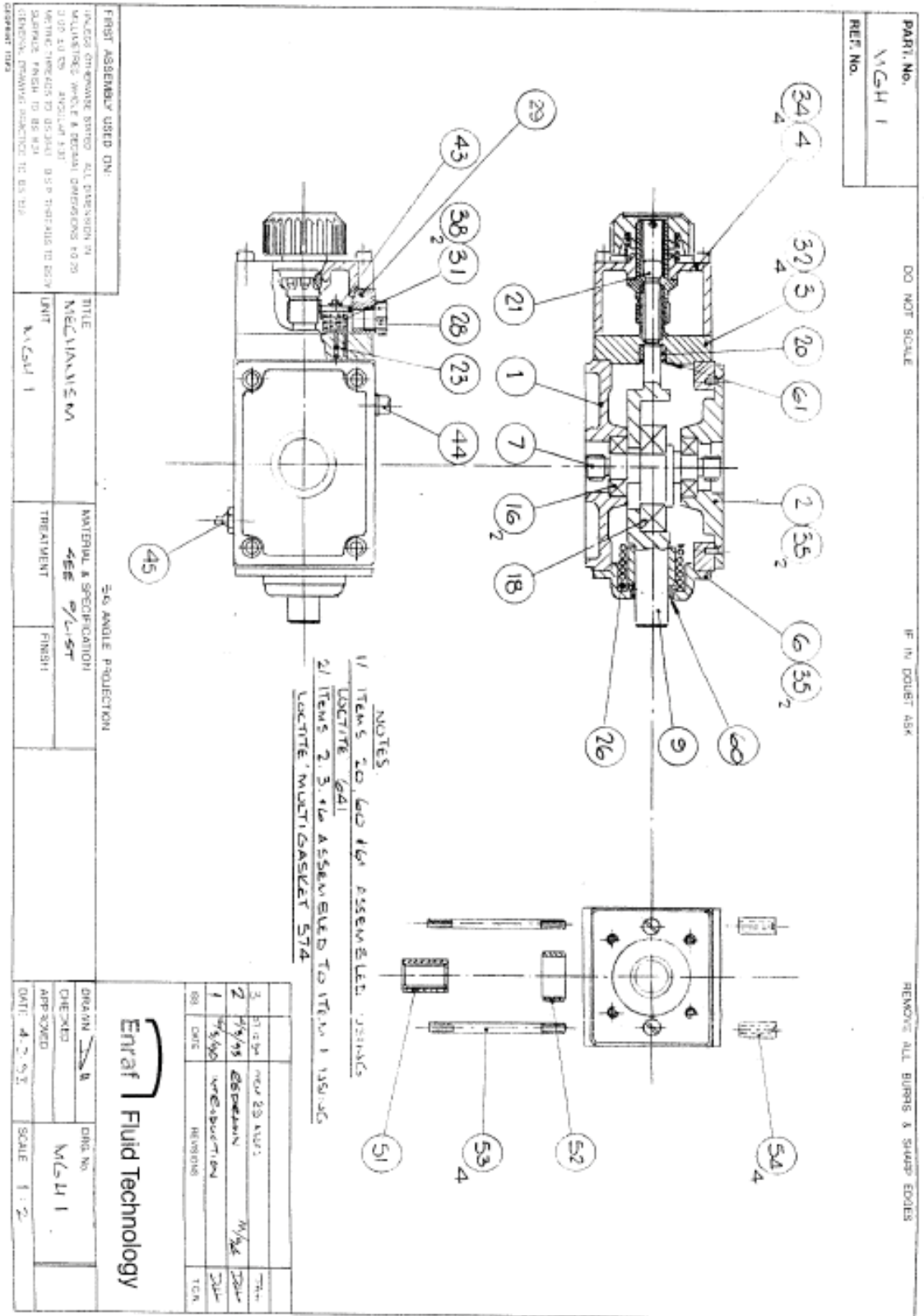
ADDITIONAL PARTS					
ITEM	TITLE/DESCRIPTION	4" TURBINE	6" TURBINE	8" TURBINE	10" TURBINE
A	TURBINE SHAFT	DRG No. 2965/19	DRG No. 2965/19	DRG No. 2965/19	DRG No. 2965/20
B	LIFTING EYE, COLLARED	M12	M12	M12	M16
C	O-RING, BS.1806	REF.278	REF.280	REF.284	REF.390
D	SCREW, HEX. HD. ST/STEEL	M16 x 75 LONG 15-OFF	M16 x 75 LONG 18-OFF	M20 x 100 LONG 18-OFF	M24 x 130 LONG 15-OFF
E	WASHER, PLAIN, M/STEEL	M16 35-OFF	M16 42-OFF	M20 42-OFF	M24 35-OFF
F	NUT, ORD. FULL, M/STEEL	M16 20-OFF	M16 24-OFF	M20 24-OFF	M24 20-OFF
G	STUD BAR, M/STEEL, ZINC PLATED	M16	M16	M20	M24

Drawing/Parts List

8.2 MGH-1 Mechanism Assembly

PARTS LIST					
		MGH-1	MECHANISM ASSEMBLY	CAST IRON	
ITEM	PART NO	DESCRIPTION	MATERIAL	QTY	
1	10147	MECHANISM CASING	Cast Iron Grade 250	1	
2	15846	MECHANISM END CAP	Cast Iron Grade 250	1	
3	15843	MICROMETER END CAP ASSEMBLY	Cast Iron Grade 250 & Stainless Steel 316S11/31	1	
4	10163	MICROMETER BOX SUB ASSEMBLY COMPRISING ITEMS 4a to 4f		1	
4a	15844	MICROMETER BOX	Cast Iron Grade 250	1	
4b	15847	MICROMETER KNOB	Stainless Steel 304	1	
4c	15859	MICROMETER ADJUSTING SHAFT	Brass, Zinc plated and full passivated	1	
4d	15863	COMPRESSION SPRING	Music Wire to BS5216 M4, Zinc plated to BS1706 ZN2	1	
4e	15864	BLANKING DISC	Delrin	1	
4f	B5004	ROLL-PIN DIA 3 x 45 LONG	Carbon, Spring Steel	1	
6	15839	PLUNGER SPRING HOUSING	Cast Iron Grade 250	1	
7	15865	MECHANISM SHAFT	Steel 605M36	1	
9	15850	CROSSHEAD	Steel 080M15	1	
16	B1003	BALL BEARING	Deep groove ball bearing, single row, with seal 6202-2RS	2	
18	B1005	ROLLER BEARING	Single row, cylindrical roller bearing, NUP206ECP	1	
20	15860	MICROMETER BUSH	25% Carbon PTFE	1	
21	15858	MICROMETER SPINDLE	Stainless Steel 302S31	1	
23	B5003	DOWEL PIN	Steel, BS1804 part 2, Grade 1	1	
26	15857	PLUNGER SPRING	Music Wire to BS5216 M4	1	
28	B5063	PIPE PLUG ¼"	Polyethylene	1	
31	B5002	MECHANICAL COUNTER	Plastic	1	
32	B0004	SHCS M6 x 25 SS	Stainless Steel 304S15	4	
34	B0005	SHCS M6 x 45 SS	Stainless Steel 304S15	4	
35	B0020	SCREW, CSK M4 x 10 PLATED	Mild Steel, plated	2	
38	B0022	SCREW, SELF TAPPING, POZIPAN	Mild Steel, plated	2	
43	B5022	CIRCLIP EXTERNAL, NO-GROOVE	Steel, self coloured	1	
44	B5006	PLUG, HEX-HEAD ¼" BSPT	Stainless Steel 316	1	
45	B5012	GREASE NIPPLE, ¼" BSP	Mild Steel, plated	1	
51	15873	SPLINED CONNECTOR BUSH	Steel 220M07, Zinc plated and passivated	1	
52	15872	LOCATING RING	Steel 220M07, Zinc plated and passivated	1	
53	10249	LINK STUD	Stainless Steel 303	4	
54	15870	LINK STUD BUSH	Steel 220M07, Zinc plated and passivated	4	
60	B2002	LIP SEAL	Flouro Rubber (FPM)	1	
61	B 2003	LIP SEAL	Nitrile (NBR)	1	
29	10148	WINDOW BLOCK	White Delrin	1	
	16178	COUNTER INPUT GEAR	Black Delrin	1	

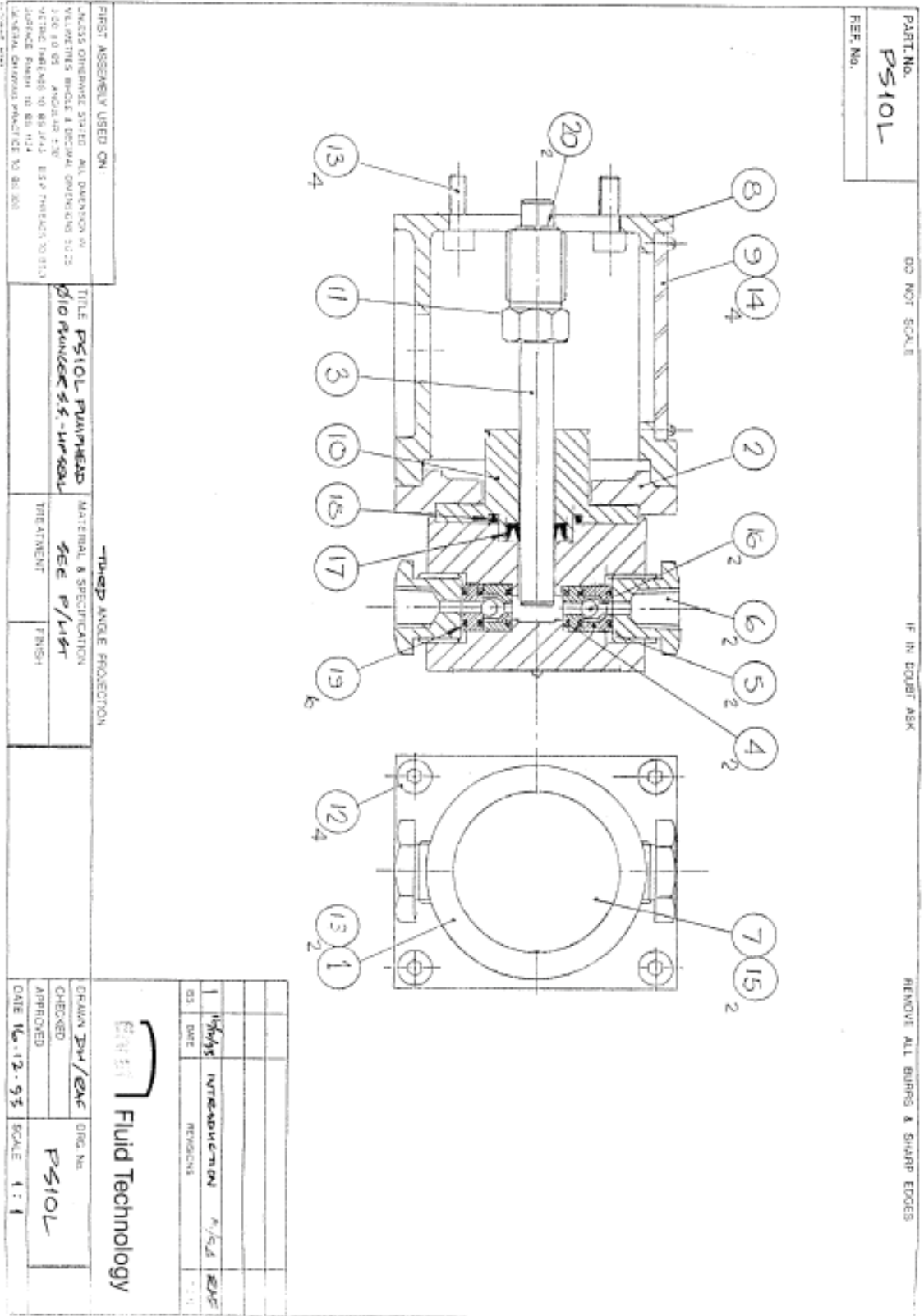
8.2 MGH-1 Mechanism Assembly



8.3 Metering Pumphead Type PS 4 6L 10L

PARTS LIST				
METERING PUMPHEAD TYPE PS 4 6L 10L			STAINLESS STEEL/P.T.F.E. LIP SEAL	
ITEM	PART NO	DESCRIPTION	MATERIAL	QTY
1	10238 10332 10170	PUMHEAD DIA 4 PUMHEAD DIA 6 PUMHEAD DIA 10	316S11/316S31 Stainless Steel	1
2	15897	ADAPTOR PLATE	Grade 250 Cast Iron	1
3	10240 15880 15970	PLUNGER DIA 4 PLUNGER DIA 6 PLUNGER DIA 10	316S11/316S31 Stainless Steel & Tungsten Carbide	1
4	16196	VALVE SEAT DIA 5MM	316S11/316S31 Stainless Steel	2
5	16195	VALVE CAGE DIA 5MM	316S11/316S31 Stainless Steel	2
6	16194	VALVE RETAINER DIA 5MM	316S11/316S31 Stainless Steel	2
7		PUMP HEAD LABEL		
8	15842	PLUNGER BOX	Grade 250 Cast Iron	1
9	15871	WINDOW, PLUNGER BOX	Clear Acrylic	1
10	10239 10333 10171	ADAPTOR PS 4 ADAPTOR PS 6 ADAPTOR PS 10	316S11/316S31 Stainless Steel	1
11	15856	PLUNGER LOCK BUSH	431S29 Stainless Steel	1
12	B0002	SHCS M6X16	304S15 (A2) Stainless Steel	6
13	B0003	SHCS M6X18	304S15 (A2) Stainless Steel	6
14	B0021	SCREW POZIPAN M3X8	304S15 (A2) Stainless Steel	4
15	B0023	DRIVE SCREW RD HEAD	NOT FITTED	2
16	B5030	SIZE 5 VALVE BALL	316 Stainless Steel	2
17	B2017 B2007 B2024	4MM SEAL PTFE 6MM SEAL PTFE 10MM SEAL PTFE	Glass & Molly Filled PTFE	1
18	B2067	O-RING-PTFE	PTFE	1
19	B2043	O-RING-PTFE	PTFE	6
20	B5015	COLLET	Low Carbon Steel	2

8.3 Metering Pumphead Type PS 4 6L 10L



8.4 Metering Pumphead Type PS 6P 10P

PARTS LIST				
METERING PUMPHEAD TYPE PS 6P 10P			STAINLESS STEEL/P.T.F.E. LIP SEAL	
ITEM	PART NO	DESCRIPTION	MATERIAL	QTY
1	16126 16128	PUMHEAD DIA 6 PUMHEAD DIA 10	316S11/316S31 Stainless Steel	1
2	15897	ADAPTOR PLATE	Grade 250 Cast Iron	1
3	15880 15970	PLUNGER DIA 6 PLUNGER DIA 10	316S11/316S31 Stainless Steel & Tungsten Carbide 316S11/316S31 Stainless Steel, Hard Chrome Plated	1
4	16196	VALVE SEAT DIA 5MM	316S11/316S31 Stainless Steel	2
5	16195	VALVE CAGE DIA 5MM	316S11/316S31 Stainless Steel	2
6	16194	VALVE RETAINER DIA 5MM	316S11/316S31 Stainless Steel	2
7		PUMP HEAD LABEL		
8	15842	PLUNGER BOX	Grade 250 Cast Iron	1
9	15871	WINDOW, PLUNGER BOX	Clear Acrylic	1
10	B0002	SHCS M6X16	304S15 (A2) Stainless Steel	6
11	B0003	SHCS M6X18	304S15 (A2) Stainless Steel	4
12	B0021	SCREW POZIPAN M3X8	304S15 (A2) Stainless Steel	4
13	B0023	DRIVE SCREW RD HEAD	NOT FITTED	2
14	10382 10144	FRONT A.X. RING DIA 6 FRONT A.X. RING DIA 10	Carbon Filled PTFE	1
15	10140 10145	PACKING RING DIA 6 PACKING RING DIA 10	PTFE & Graphite Packing	3
16	10168 10146	REAR A.X. RING DIA 6 REAR A.X. RING DIA 10	Carbon Filled PTFE	1
17	B2043	O-RING-PTFE	PTFE	6
18	B5030	SIZE 5 VALVE BALL	316 Stainless Steel	2
19	16125 16129	SEAL RETAINER 6MM RETAINER CHEVERON 10MM	316S11/316S31 Stainless Steel	1
20	15856	PLUNGER LOCK BUSH	431S29 Stainless Steel	1
21	B5015	COLLET	Low Carbon Steel	2

Drawing/Parts List

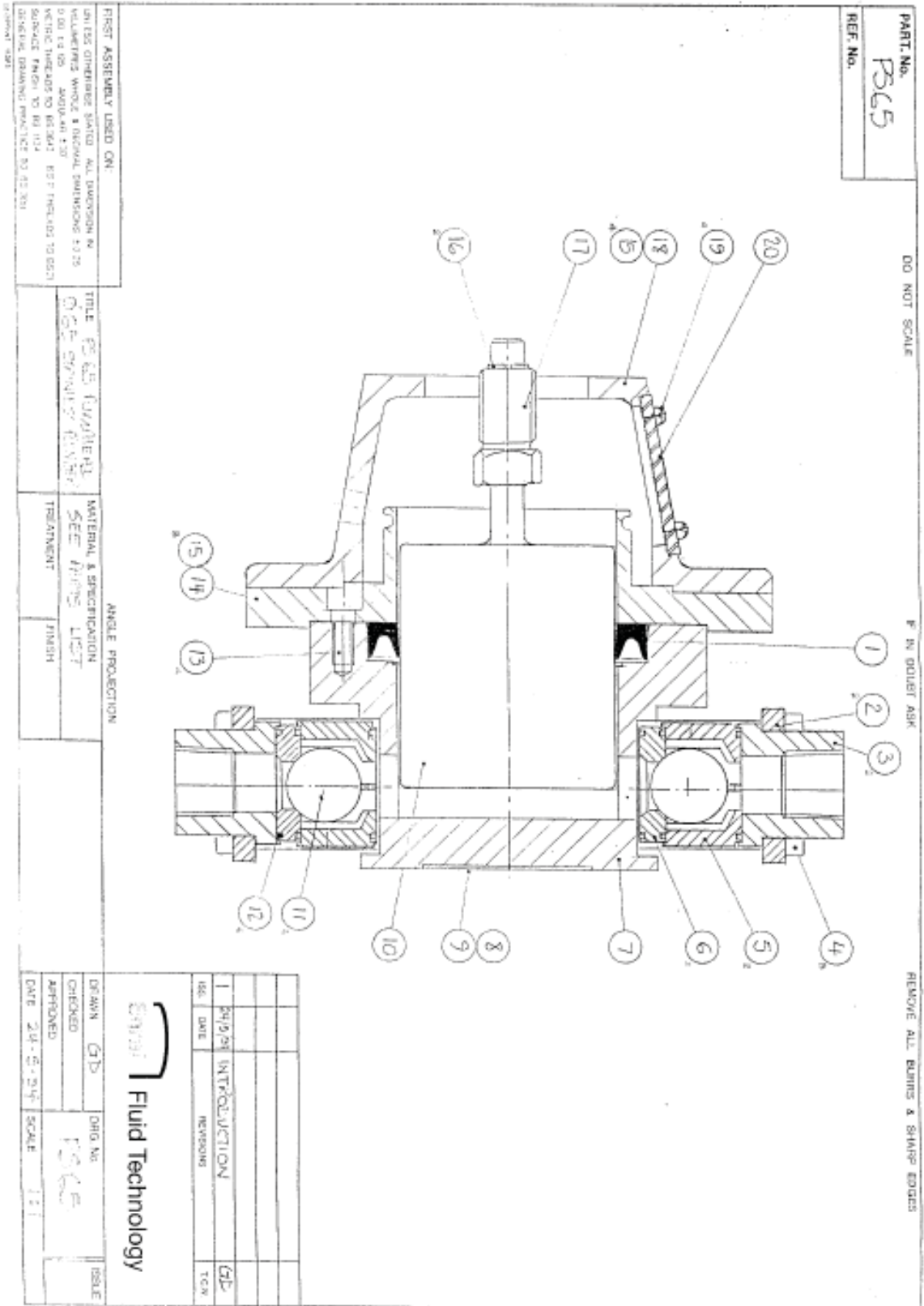
8.5 Metering Pumphead Type PS15/20/30/40/50

PARTS LIST				
METERING PUMPHEAD TYPE PS15/20/30/40/50			STAINLESS STEEL/P.T.F.E. LIP SEAL	
ITEM	PART NO	DESCRIPTION	MATERIAL	QTY
1	10204	PUMHEAD DIA 15	316S11/316S31 Stainless Steel	1
	10036	PUMHEAD DIA 20		1
	10241	PUMHEAD DIA 30		1
	10027	PUMHEAD DIA 40		1
	10026	PUMHEAD DIA 50		1
2	10205	ADAPTOR PLUNGER 15	316S11/316S31 Stainless Steel	1
	10037	ADAPTOR PLUNGER 20		1
	10242	ADAPTOR PLUNGER 30		1
	10029	ADAPTOR PLUNGER 40		1
	10028	ADAPTOR PLUNGER 50		1
3	10206	PLUNGER DIA 15	316S11/316S31 Stainless Steel Hard Chrome Plated	1
	15977	PLUNGER DIA 20		1
	10243	PLUNGER DIA 30		1
	15886	PLUNGER DIA 40		1
	15889	PLUNGER DIA 50		1
4	10032	VALVE SEAT 12MM-15/20	316S11/316S31 Stainless Steel	2
	10008	VALVE SEAT 22MM-30/40/50		2
5	10033	VALVE CAGE 12MM-15/20	316S11/316S31 Stainless Steel	2
	10009	VALVE CAGE 22MM-30/40/50		2
6	10034	CONNECTOR 12MM-15/20	316S11/316S31 Stainless Steel	2
	10010	CONNECTOR 22MM-30/40/50		2
7	10011	VALVE BRIDGE 22MM	316S11/316S31 or Cast ANC 3A Stainless Steel	2
8		PUMPHEAD LABEL		1
9	15842	PLUNGER BOX	Grade 250 Cast Iron	1
10	15871	WINDOW, PLUNGER BOX	Clear Acrylic	1
11	B0002	SHCS M6X16 304S15 (A2)	Stainless Steel	4
12	B0003	SHCS M6X18 304S15 (A2)	Stainless Steel	4
13	B0009	SHCS M6X40-15/20	304S15 (A2) Stainless Steel	8
	B0008	SHCS M6X50-30		8
	B0012	SHCS M6X53 S.ST-40/50		8
14	B0021	SCREW POZIPAN M3X8	304S15 (A2) Stainless Steel	4
15	B0023	DRIVE SCREW RD HEAD-15/20	NOT FITTED	2
	B2023	DRIVE SCREW RD HEAD-30/40/50		2
16	B2016	15MM SEAL PTFE	Glass & Molly Filled PTFE	1
	B2019	20MM SEAL PTFE		1
	B2031	30MM SEAL PTFE		1
	B2030	40MM SEAL PTFE		1
	B2032	50MM SEAL PTFE		1
17	B2044	O-RING-PTFE 15/20	PTFE	6
	B2045	O-RING-PTFE 30/40/50		6
18	B5033	SIZE 12 VALVE BALL 15/20	316S31 Stainless Steel	2
	B5032	SIZE 22 VALVE BALL 30/40/50		2
19	15856	PLUNGER LOCK BUSH	431S29 Stainless Steel	1
20	B5015	COLLET	Low Carbon Steel	2

8.6 Metering Pumphead Type PS 65

PARTS LIST				
METERING PUMPHEAD TYPE PS 65		STAINLESS STEEL/P.T.F.E. LIP SEAL		
ITEM	PART NO	DESCRIPTION	MATERIAL	QTY
1	B2025	15MM SEAL PTFE	Glass & Molly Filled PTFE	1
2	10011	VALVE BRIDGE 22MM	316S11/316S31 or Cast ANC 3A Stainless Steel	2
3	10010	CONNECTOR 22MM	316S11/316S31 Stainless Steel	2
4	B0008	SHCS M6X50	304S15 (A2) Stainless Steel	8
5	10009	VALVE CAGE 22MM	316S11/316S31 Stainless Steel	2
6	10008	VALVE SEAT 22MM	316S11/316S31 Stainless Steel	2
7	10198	PUMHEAD DIA 65	316S11/316S31 Stainless Steel	1
8		PUMPHEAD LABEL		1
9	B0023	DRIVE SCREW RD HEAD	NOT FITTED	2
10	10197	PLUNGER DIA 65	316S11/316S31 Stainless Steel Hard Chrome Plated	1
11	B5032	SIZE 22 VALVE BALL	316 Stainless Steel	2
12	B2045	O-RING-PTFE	PTFE	6
13	B0002	SHCS M6X16	304S15 (A2) Stainless Steel	4
14	10199	ADAPTOR PLUNGER 65	316S11/316S31 Stainless Steel	1
15	B0003	SHCS M6X18	304S15 (A2) Stainless Steel	12
16	B5015	COLLET	Low Carbon Steel	2
17	15856	PLUNGER LOCK BUSH	431S29 Stainless Steel	1
18	10200	PLUNGER BOX	Grade 250 Cast Iron	1
19	B0021	SCREW POZIPAN M3X8	304S15 (A2) Stainless Steel	4
10	16082	WINDOW, PLUNGER BOX	Clear Acrylic	1

8.6 Metering Pumphead Type PS 65



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