OPERATING AND MAINTENANCE MANUAL

Plant Type	B1 - RO
Ref. No ROP	739
Issue No	14

B1 R.O. DAIRY PLANT

LANDTEKNIKK

FOR

KOLVEREIDMEIERI

PCI R.O.DIVISION

Paterson Candy International Ltd.

Reverse Osmosis Division

Laverstoke Mill, Whitchurch,
Hampshire RG28 7NR.

Telephone: 0256 82 2360
Telex: 858128 PCI LAV G
Telegrams: Clarify, Whitchurch, Hants.

Portals Water Treatment

CHAPTER FIVE

B1 MODULE MAINTENANCE

SUBJECT	LOCATION
TOOLS REQUIRED	SECTION 5.1.
PRE-TREATMENT	SECTION 5.2.
MODULE DISMANTLING/MEMBRANE REMOVAL	SECTION 5.3.
RE-MEMBRANING/RE-ASSEMBLY	SECTION 5.4.
SHROUD CHANGING	SECTION 5.5.

CHAPTER FIVE

SECTION 5.1.

TOOLS REQUIRED

Table 5.1.1. - details the normal tool requirement for maintaining the modules, including their dismantling and reassembly in the course of remembraning.

Item No.	Part No.	S if Supplied	Description	Qty
1.	2203007533	S	Spanner, special box, 5/8 in. B.S.F.	1
2.	2203007033	S	Spanner, special two pin	1
3.	3303701603	S	Screwdriver	1
4.	3302302003	S	Pliers, slim nosed	1
5.	2203009033	S	Probe, seal insertion (White PTFE)	1
6.	3303301003	S	Scalpel	1
7.	2203009533	S	Tool, membrane insertion	1
8.	2203008033	S	Shroud Puller	1
9.	2203010033	S	Hook Membrane	1
10.	-	S	Spanner, Torque	1
11.	-	S	Socket, 5/8in. BSF (to fit torque spanner Item 12)	1
12.	-	-	Spanner, ⅞" A/F	1
13.	-	-	Bucket (or other suitable receptacle)	1

CHAPTER FIVE

SECTION 5.2.

MODULE MAINTENANCE - PRE-TREATMENT

This section is intended to contain details of any processes which may assist in the removal of membranes.

It will be completed when these procedures have been tested and approved.

CHAPTER FIVE

SECTION 5.3.

MODULE DISMANTLING/MEMBRANE REMOVAL - PROCEDURE

Introduction

5.3.1. The procedure for dismantling the modules in which the membranes are to be replaced is detailed below.

5.3.2. Under certain conditions some pre-treatments may be required to ease membrane removal. These procedures may be obtained from PCI Ltd., as necessary.

Note: Before removing and replacing membranes, the plant must have been cleaned and sterilised.

CAUTION: THE PERMEATE SIDE BACK PRESSURE MUST NEVER BE ALLOWED TO BE AT A GREATER PRESSURE THAN THAT OF THE FEED SIDE OF THE MEMBRANE TUBES, OTHERWISE THE MEMBRANE TUBES WILL IMPLODE. THIS SITUATION CAN OCCUR WHEN THE MODULE END CAPS ARE REMOVED WITHOUT PRIOR DRAINING OF THE PERMEATE SIDE.

5.3.3. Before dismantling the module ensure that the appropriate shroud drain valve is/are fully open and that ALL permeate fluid has drained from the modules to be serviced. The module end caps or module connections must NOT be loosened while water remains in the shroud-side of the module.

5.3.4. Before dismantling, isolate the fluid and electrical supplies to the plant. In a multi-stage plant it may also be possible to isolate the Module pack to which access is required.

5.3.5. The bracketed item numbers refer to the Tool List at Section 5.1.

Module Dismantling

5.3.6. Loosen the end cap nut on each module to be serviced (on the opposite end of the module to where the feed and concentrate manifolds are connected) as detailed below.

(a) Fit the special two pin spanner (Table 5.1.1., Item 2) over the end cap nut with the pins locating in the two recesses in the pressure plate.

(b) Using the special box spanner (Item 1), loosen the end cap nut.

(c) Place a bucket (Item 15) under the end of the module and gradually unscrew the end nut so that the water in the module is allowed to flow out gradually. DO NOT REMOVE THE END CAP NUT AT THIS STAGE.

5.3.7. At the Feed/Concentrate end, remove the module connections by unscrewing the four 3/16 in. B.S.W. round headed screws, using the screw-driver (Item 3) provided. Put the couplings, screws and exposed 'O' ring seals carefully to one side.

Note: When indivudual modules are being tested using flixible hoses, it will be necessary to disconnect the hoses using the $\frac{7}{8}$" A/F spanner (Item 13).

5.3.8. Loosen the end cap nut on the feed and concentrate manifold end of each module to be serviced as detailed in operation 5.3.6. (a) (b) and (c).

5.3.9. Remove end cap nut, washer and end cap from each end of the modules and put them safely to one side for refitting later. Note that end-cap faces can easily be chipped, if mishandled, making them useless. Individual end-caps must be identified to the particular module end from which they were removed and stored separated with polythene film in a strong box. The tube seal support disc. and ends of the eighteen black tube seals will now be exposed at the ends of each module.

5.3.10. With a slim nosed pliers (Item 4), grip one of the tube seals and gently twist the pliers until the seal starts to pucker, then pull out the seal. Turning the seal in this way allows easy removal. Repeat this operation for the remaining thirty-five seals fitted to the module, and the thirty-six seals fitted to each module being serviced. Discard these seals.

5.3.11. Carefully remove the tube support discs (shim plate) from each end of the modules. Examine the shim plates as they are removed, and discard if the seal material is peeling from the stainless steel backing plate.

5.3.12. Insert the scalpel (Item 6) between one of the membrane tubes and its supporting tube, (normally at the feed end-cap end of the module), and fold the membrane tube so that it can be gripped and extracted by the slim nosed pliers. Repeat for the remainder of the membrane tubes that are to be removed.

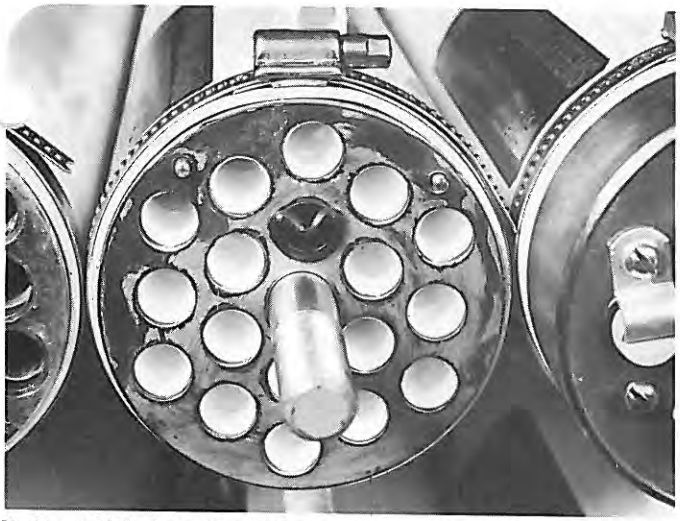
5.3.13. Extract each membrane tube using the slim nosed pliers (Item 4) and throw the membrane away. The modules are now ready for the fitting of new membranes.

Note: When extracting membranes using the pointed nosed pliers, the membranes should be twisted in a clockwise direction to extract them more easily. This assumes that the membranes have been installed correctly (See Paragraph 5.4.8.) and that removal and re-membraning are being carried out at the same end of the module.

5.3.14. If the membranes cannot be removed easily, it may be necessary to use the Membrane Hook (Item 11). It is also worth trying removal of the membrane tube from the other end of the module, if any difficulty is encountered.

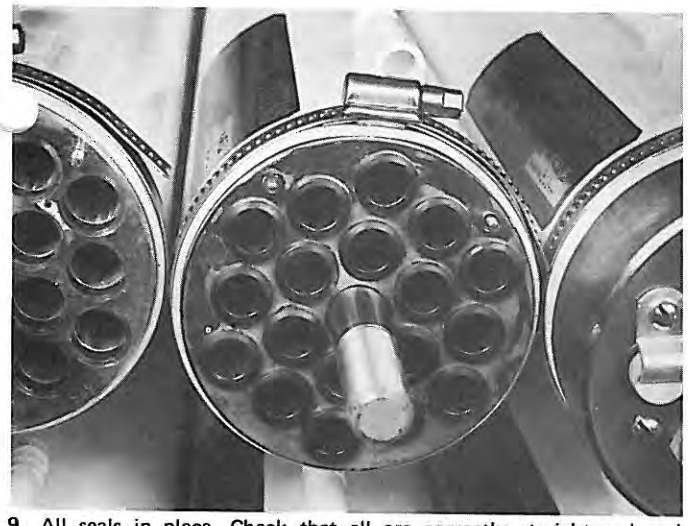
5.3.15. Thoroughly clean the module tubes with a hose to remove any debris or growths and to thoroughly wet the membrane support tubes.

5.3.16. Proceed to remembrane the modules. See Section 5.4. for procedure.

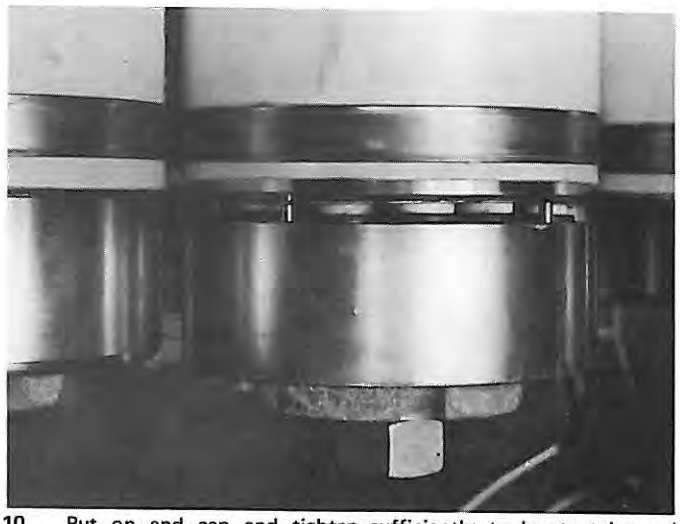


7. Insert kinked seal in membrane tube so that the flange of the tube seal remains outside the tube.

8. Straighten seal with tool provided. Chamfer on tool enables seal to held in place as tool is withdrawn.



9. All seals in place. Check that all are correctly straightened and seated. (Use hand lamp for inspection.)



10. Put on end cap and tighten sufficiently to locate tube seal flanges in recesses in end cap. Repeat 5 to 10 at other end of module.

11. Tighten end caps to correct torque using 2-pin tool to prevent rotation of module. Correct tightening torque is 20lb. ft. (2.8 kg.m) for pressures up to 40 kg/cm^2 and 60lb. ft. (8.3 kg.m) for pressures up to 80 kg/cm^2.

12. Module stack completely reassembled.

REVERSE OSMOSIS DIVISION

Paterson Candy International Limited
Laverstoke Mill Whitchurch Hampshire RG8 7NR

Tel.: 0256 82 2360 Cables: Clarify Whitchurch Hants Telex: 858128

Portals Water Treatment

CHAPTER FIVE

SECTION 5.4.

REMEMBRANING AND RE-ASSEMBLY - PROCEDURE

Introduction

5.4.1. The module tube assembly must be completely clean before remembraning. The module support tubes should be wet.

5.4.2. Reference should be made to P.C.I. leaflet 3162.1 opposite, during this procedure.

5.4.3. The bracketed references to item numbers refer to the Tool List at Section 5.1.

5.4.4. If plant layout permits, new membranes should be inserted from the feed end plate end of the module.

Procedure

5.4.5. Fit the hexagonal perspex plate (Item 8) to one end of the module (This is normally the end with too little space to change membranes). Fit the Spacing Tube (Item 9) and the end cap nut.

5.4.6. Adjust the position of the end cap nut until the gap between the perspex plate and the module tube plate is:

Module Length

1200 mm	2440 mm	3660 mm
3 mm	3 mm	5 mm

CAUTION: GREAT CARE IS NEEDED DURING THE FOLLOWING OPERATION AS THE PERFORMANCE OF THE MODULE DEPENDS ON THE CORRECT INSTALLATION OF THE MEMBRANE TUBES. IT IS ADVISABLE FOR TWO PEOPLE TO WORK TOGETHER WHEN INSERTING THE NEW MEMBRANES.

WARNING: THE MEMBRANES CONTAIN A PROXEL GXL PRESERVATIVE WHICH IS AN EYE AND SKIN IRRITANT. EYE PROTECTION AND GLOVES SHOULD BE WORN DURING REMEMBRANING.

5.4.7. Note the number on the plug end of the box of replacement membranes, together with the number on the module to be remembraned. Record these numbers for future quality control reference.

5.4.8. Remove the lid from both ends of the plastic tube of replacement membranes. Carefully open the polythene bag at both ends. Identify the end of the membrane which has a code stamp near the end. Membrane tubes should always be inserted code stamp end first. This enables them to be removed more easily at a later date.

5.4.9. With one person holding the cardboard membrane tube, in line and level with the module, carefully withdraw a new membrane tube and gently feed it into one of the outer 12 support tubes in the module.

Note 1: If any membrane tube is kinked at all during the insertion process. It must be discarded.

5.4.10. Continue pushing the membrane tube into the support tube (taking care not to kink it) until 10 to 12 mms are left exposed. Take the coloured plastic inserting tube (Item 7) supplied and fit it into the end of the tube, then ease the remaining 10 to 12 mms against the perspex plate.

Note 2: If a membrane tube is particularly difficult to insert, withdraw it and ensure that the module tube has not dried out. Re-lubricate with water if required. If the membrane tube is still difficult to insert, try it in another support tube.

5.4.11. Insert two more membrane tubes into 2 of the outer 12 support tubes in the module, spaced so as to square up the hexagonal perspex plate. (See leaflet 3162.1 Figs. 2 and 3). Re-check that the gap between the perspex plate and the module tube plate is still as specified in Para. 5.4.6.

5.4.12. Insert the remaining 15 membrane tubes into the module. Ensure that they all register against the perspex plate. The spacing at this end of the module should be the same as that allowed at the perspex plate end i.e. 3 or 5 mms (as applicable). If any membrane tube is 2 mms or more over length, cut it to correct length using sharp scissors. If the tube is 2 mms or more under length remove it and advise PCI Ltd. (But see IMPORTANT note on previous page).

5.4.13. On the opposite end of the module to which the hexagonal perspex plate is fitted, carefully place a tube support disc (shim plate) in position. Ensure that the rubber coated surface on the support disc is placed facing the module end plate (i.e. inwards) and that the two locating holes in the disc are over the locating pins (see Leaflet No. 3162.1 figure 5).

5.4.14. Insert one of the tube seals into the end of a membrane tube by folding it along its length and slipping it into the tube so that just the flange is showing. Release the seal and ease the flange into its correct shape, then smooth the remaining ridge with the white P.T.F.E. probe (Item 5). The seal should now be firmly sprung against the walls of the membrane (see Leaflet No. 3162.1, Figure 6, 7, and 8).

Note: It will be found much easier to insert tube seals if they are warm (30°C). All seals are pre-lubricated to assist insertion but liquid detergents are not effective and commercial greases must not be used.

IT IS ESSENTIAL TO USE NEW TUBE SEALS WHEN NEW SETS OF MEMBRANES ARE INSTALLED.

5.4.15 Repeat the above for the remaining seventeen tube ends at this end of the module and check that all tube seals are correctly seated (see Leaflet No. 3162.1 Figure 9).

Use a strong light and examine each seal individually.

5.4.16. Fit the particular end cap removed from the module being serviced, washers and end cap nuts to the end of the module, rotating the end cap very slightly back and forth until the seal flanges fit into the recesses. Tighten the end cap nut "Hand tight" (see Leaflet No. 3162.1, Figure 10).

5.4.17. Remove the hexagonal perspex disc, spacing tube and end cap nut from the other end of the module. Repeat Paras. 5.4.13. to 5.4.16. inclusive for that end of the module.

5.4.18. Repeat Paras. 5.4.5. to 5.4.17. inclusive for all other modules being remembraned.

5.4.19. Torque load the end cap nuts to 75 lbs/ft (10.4 kg/metre) using the torque spanner (Item 11) fitted with a ⅝" B.S.F. socket (Item 12), holding the end cap firmly in position using the special two pin spanner (Item 2) (see Leaflet 3162.1, Figure 11).

5.4.20. Refit the 'O' rings and module couplings with the four 3/16" round head screws retained in operation 5.3.7. (c) using the scredriver (Item 3) provided.

5.4.21. Close the shroud drain valve. This completes the remembraning procedure (see Leaflet 3162.1. Figure 12).

CAUTION: MEMBRANED MODULES AND MEMBRANES MUST NOT BE ALLOWED TO DRY OUT. REMEMBRANING OF A MODULE MUST IF POSSIBLE BE COMPLETED WITHOUT INTERRUPTION.

IF REMEMBRANING CANNOT BE COMPLETED THE PLASTIC BAG CONTAINING THE REMAINING MEMBRANES MUST BE RESEALED AND THE MODULE KEPT MOIST.

RE-MEMBRANED MODULES SHOULD BE REFILLED WITH WATER TO THE FOLLOWING SPECIFICATION AS SOON AS POSSIBLE:-

See Section 1.3

5.4.22. Recommissioning the Plant

After remembraning the following procedures MUST be completed before the plant is re-run on process fluid.

(a) Air Lock Removal

(b) Leak Check

(c) Proxel GXL Removal

*(d) Formaldehyde pre-sterilisation and displacement of sterilant. (CA membranes only NOT ZF99)

(e) Sodium Hypochlorite or Hydrogen Peroxide Sterilisation and displacement of sterilant.

(f) Pre-heating (if required).

* Required if 36 or more membranes are replaced (CA membranes only NOT ZF99)

CHAPTER FIVE

Section 5.5

SHROUD REPLACEMENT

Introduction

5.5.1. This procedure should be carried out as quickly as possible to prevent the membranes drying out.

Preliminary Operations

5.5.2. The following preliminary operations must be carried out prior to shroud removal.

(a) Ensure that the plant is clean, with only fresh, clean water in the pipework.

(b) Isolate the fluid and electrical connections to the plant.

Dismantling

5.5.3. Dismantle the module in which the shroud is to be removed as detailed at Section 5.3.

CAUTION: THE PERMEATE SIDE BACK PRESSURE MUST NEVER BE ALLOWED TO BE AT THE GREATER PRESSURE THAN THAT OF THE FEED SIDE OF THE MEMBRANE TUBES, OTHERWISE THE MEMBRANE TUBES WILL IMPLODE. THIS SITUATION CAN OCCUR WHEN THE MODULE END CAPS ARE REMOVED WITHOUT PRIOR DRAINING OF THE PERMEATE SIDE.

(a) Ensure that the permeate outlet valve is fully open and ALL permeate fluid has drained from the modules. Disconnect the permeate tubing from the shroud

(b) With the slim nosed pliers (item 4) grip one end of the tube seal and gently twist the pliers until the seal starts to pucker, then pull out the seal, repeat this operation for the remaining 35 seals and remove the shims. Discard the tube seals.

(c) Fit the shroud puller (item 10) on the tube end plate stud, refit washer and $\frac{5}{8}$" BSF plain nut.

5.5.3. (d) Tighten the nut until the end plate is pulled clear of the shroud, remove the puller and 'O' ring seal. Discard the 'O' ring seal.

(e) Repeat operation (c) and (d) for the opposite end ensuring that the other end of the shroud is centrally placed over the tube end plate.

(f) Remove the tube assembly from the shroud and place on a suitable rack. Discard the shroud if unserviceable.

Reassembly

(g) Place a serviceable shroud on the frame and insert the tube assembly into the shroud until the front face of the tube end plate abuts on the shroud.

(h) Fit a new 'O' ring into the goove in the tube end plate. Lubricate the 'O' ring with true soap solution (no detergents). Press in the tube assembly by hand until the taper on the shroud traps the 'O' ring in its groove and the two spigots on the end plate are uppermost in relation to the permeate outlet on the shroud.

(j) Fit the shroud puller, washer and $\frac{5}{8}$" BSF plain nut on the tube end plate stud at the opposite end of the module.

(k) Tighten the nut and at the same time ensuring the 'O' ring remains firmly bedded in its groove. Continue tightening the nut until the tube assembly is pulled through the shroud far enough to expose the seal groove in the end plate.

CAUTION: The tube assembly must not be pulled through the shroud further than to expose the seal groove in the end plate. This will prevent the 'O' ring on the opposite end being cut by the recess in the shroud formed by the permeate off-take.

(l) Remove the shroud puller and refit at the opposite end of the module.

(m) Fit a new 'O' ring into the groove in the tube end plate, lubricated as in (l) above.

5.5.3. (n) With one operator guiding the tube end plate and 'O' ring into the shroud, tighten the $\frac{5}{8}$" BSF plain nut on the shroud puller ensuring the 'O' ring remains firmly bedded in its groove.

(o) Continue tightening the nut until the tube assembly is centralised in the shroud. Remove the puller

(p) Refit shims, tube seals and end caps as per PCI Leaflet No. 3162.1 and Section 5.4.

(q) Torque load the end cap nuts to the figure at Section 5.4.

(r) Refit the module couplers and new 'O' rings connecting the module to be serviced to the adjoining module or pipework and tighten securely.

(s) Reconnect the permeate tubing to the shroud.

Re-commissioning the Plant

5.5.4. The shroud replacement is now complete. Before restarting the plant on process fluid, the following commissioning procedures must be completed

(a) Air lock removal

(b) Leak check.

MAIN CONTENTS

CHAPTER ONE

INTRODUCTION TO REVERSE OSMOSIS	SECTION 1.1
PLANT DATA	SECTION 1.2
VALVE SETTINGS CHART	SECTION 1.3

CHAPTER TWO

COMMISSIONING - GENERAL	SECTION 2.1.
" - AIR LOCK REMOVAL	SECTION 2.2
" - LEAK CHECK	SECTION 2.2
" - PRESERVATIVE REMOVAL	SECTION 2.2
" - FLUX CHECK	SECTION 2.3
" - DOSING PUMP CALIBRATION	SECTION 2.4

CHAPTER THREE

PLANT OPERATION - GENERAL	SECTION 3.0
" - DISPLACE PRESERVATIVE	SECTION 3.1
" - PRE-HEATING	SECTION 3.2
" - START UP ON PROCESS	SECTION 3.3
" - DISPLACE PROCESS FLUID	SECTION 3.4
" - SHUT-DOWN EMERGENCY/MANUAL	SECTION 3.5

CHAPTER FOUR

MEMBRANE CLEANING - GENERAL	SECTION 4.1
" - SEQUENCE OF OPERATIONS	SECTION 4.2
" - NITRIC ACID CLEANING	SECTION 4.3
" - SODIUM HYDROXIDE CLEANING	SECTION 4.4
" - STERILISATION	SECTION 4.5
" - PRESERVATION	SECTION 4.6

CHAPTER FIVE

MODULE MAINTENANCE - TOOLS REQUIRED	SECTION 5.1
" - PRE-TREATMENT	SECTION 5.2
" - MODULE DISMANTLING/ MEMBRANE REMOVAL	SECTION 5.3
" - RE-MEMBRANING/RE ASSEMBLY	SECTION 5.4
" - SHROUD CHANGING	SECTION 5.5
" - ELECTRICAL ALARMS	SECTION 5.6
" - SUB-CONTRACTORS LITERATURE	SECTION 5.7

/CHAPTER SIX

CHAPTER SIX

FREEZE/PRESERVATION	- GENERAL	SECTION 6.1
"	- SOLUTION PREPARATION	SECTION 6.2
"	- PROCEDURE	SECTION 6.3
"	- SOLUTION REMOVAL	SECTION 6.4

CHAPTER SEVEN

PERFORMANCE TESTING	- PLANT DATA RECORDING	SECTION 7.1
"	- TESTS REQUIRED	

CHAPTER EIGHT

CHEMICAL SAFETY LEAFLETS

CHAPTER NINE

B1 PLANT, MODULES AND MEMBRANES - HANDLING, STORAGE AND SAFETY PRECAUTIONS. SECTION 9.1

CHAPTER ONE

GENERAL

SUBJECT	LOCATION
INTRODUCTION TO REVERSE OSMOSIS	SECTION 1.1.
PLANT DATA	SECTION 1.2.
VALVE CHART	SECTION 1.3.

MSR C

CHAPTER ONE

SECTION 1.1

INTRODUCTION TO REVERSE OSMOSIS THEORY

1.1.1. To understand the principle of reverse osmosis first consider natural osmosis. At Fig. 1a below, pure water is separated from a salt solution by a semi permable membrane through which water will pass, but dissolved salts cannot pass. —

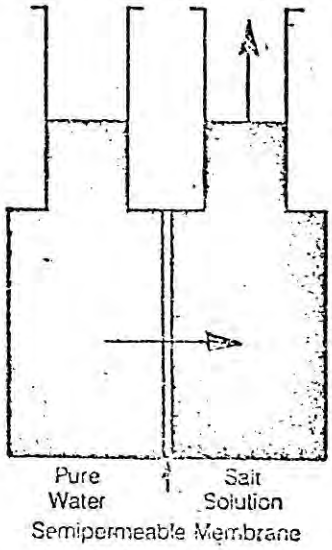


Fig. 1a/Osmotic Flow

1.1.2. Water flows through the membrane from the dilute solution to the more concentrated solution until the pressure generated by the osmotic head is equal to the osmotic pressure of the salt solution as in Fig 1b.

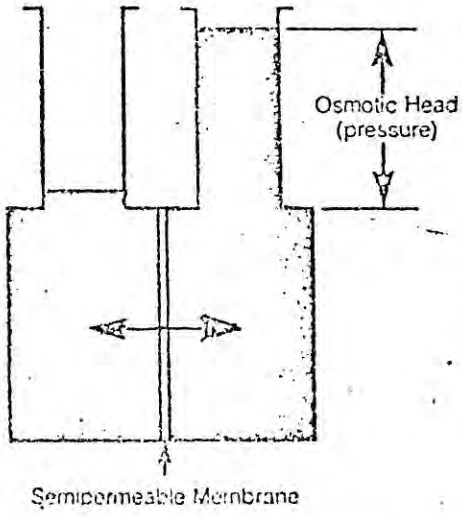


Fig. 1b/Osmotic Equilibrium

1.1.3. When a pressure in excess of the natural osmotic pressure is applied to a solution in contact with a semi-permeable membrane, pure water will flow through the membrane. This phenomenon is called Reverse Osmosis. (See Fig 1c below).

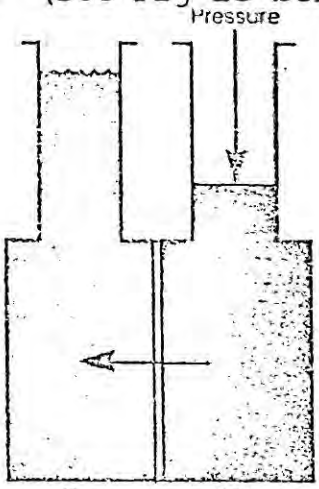
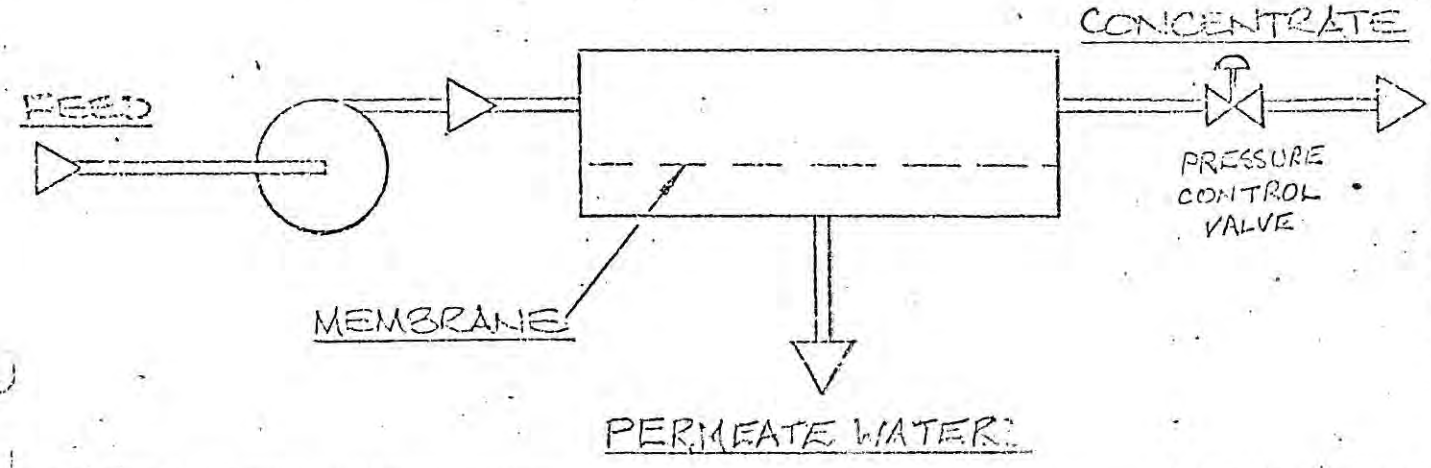


Fig. 1c/Reverse Osmosis

1.1.4. As well as removing dissolved salts from a solution, a reverse osmosis membrane is capable of removing bacteria, pyrogens and most organic materials found in natural waters.

1.1.5. The process is continuous, without the need for regeneration, and separates the feed into two streams, a pure water stream (permeate) and a concentrate stream which contains the constituents of the feed in a more concentrated solution. The process introduces little or no additional chemicals to the feed and the concentrate can be used, or easily disposed of if it has not value.

1.1.6. A Reverse Osmosis plant consists essentially of a high pressure pump, the membrane and a pressure control device. Operating pressures range from 28 to 80 bar (400 to 1200 lb/sq. in.)



1.1.7. The feed must be made to flow past the membrane at a sufficiently high velocity to give good mixing between the bulk flow and the fluid next to the membrane. Without this mixing, a layer of concentrated solution forms at the membrane surface (concentration polarisation) which impairs performance.

VASK AV RØ.-ANLEGG:

SKYLLING 5 min

↓

SYREVASK 15+30 min

↓

SKYLLING 5 min

↓

LUTVASK 15+30 min

↓

SKYLLING 5 min

↓

STERELISERING 15+15 min

↓

SKYLLING 5 min

↓

KONSERVERING

CHAPTER ONE

SECTION 1.2.

PLANT DATA

1.2.1. Plant Capacity

This plant is designed to operate hours/day to concentrate 4,05 (5,63) m^3 of Cheese whey per hour.

Feed Flow = 4,05 (5,63) m^3/hour (67,5 (94) litre/min)

Concentrate Flow = 1,97 (2,83) m^3/hour (33 (47) litre/min)

Recycle Flow (Max) = 2,25 (2,5) m^3/hour (37,5 (42) litre/min)

Feed pH 5,8 - 6,2

Operating Temperature Range (Process) = 28°C to 32°C.

Operating Pressure Range (Process)= 45 to 55 bar.

1.2.2. Plant Operating Temperature Limits

MINIMUM = 10°C

MAXIMUM = 80°C

1.2.3. Plant Feed Pressure

The plant Feed Pressure refers to the operating pressure, measured on the delivery side of the Main R.O. pump just before entering the membrane stack. The pressures to be used are given in the appropriate procedure Sections.

For procedures where operating pressure is shown as minimum, the plant is run with the concentrate pressure control valve (PCV) and bypass valve fully open.

Normal indicates that the PCV and bypass valve are adjusted to obtain the required concentrate and permeate flows.

WARNING: THE PLANT MUST NEVER BE OPERATED AT A MODULE INLET PRESSURE HIGHER THAN THAT REQUIRED TO PRODUCE THE DESIGN PERMEATE CAPACITY.

1.2.3. (Contd.)

Flux Pressure is a specific pressure used for the calculation of water flux rate or to provide a suitable working pressure when using cleaning or sterilising fluids.

WARNING: THIS PRESSURE MUST BE USED AS HIGHER PRESSURE WILL CAUSE OVER-CONCENTRATION OR SCALING OF THE MEMBRANES.

The operating pressure is always reduced to minimum (PCV and bypass fully open) before the plant is stopped.

1.2.4. Plant Inlet Feed Pressure Limits

Minimum 2 bar
Maximum 5 bar

1.2.5. Temperature/Pressure Limits Switch Settings

R.O. Pump Inlet Temperature Switch = 35°C (PROCESS)
R.O. Pump Inlet Pressure Switch = 1 bar
R.O. Pump Outlet Pressure Switch = 59 bar

1.2.6. Power Requirements

220 Volt, 3 phase neutral and Earth 50 Hz.

1.2.7. Main Pump R.O.

~~Pump type LP 4-3-50~~ Tetra Pak TA 25
kW, 220 Volt, 3 phase 50 Hz motor.

1.2.8. Plant Weight (Working)

/ kg (approximately)

1.2.9. Plant Dimensions

Length 3850 mm
Width 1150 mm
Height 2050 mm

1.2.10. Membrane Area

3660 mm B1 Module = 2.609 m^2

Membrane area for plant = 42 x 2.609 = 109.6 m^2 54 x 2.609 = 141 m^2.

1.2.11. Plant Configuration

One module pack consisting of 54 (42) B1 modules in 9 (7) parallel rows of 6 modules in series.

1.2.12. Membrane Type

P.C.I. Ltd. Type ZF 99

1.2.13. Service Water Specification

Service water must meet the following specification:-

pH 3 - 7.5 for CA membranes

3 - 11 for Non CA membranes

SiO_2 - 10 mg/litre

Colloids - 0 (SDI less than 3 of Millipore test)

Suspended solids - 0

Chlorine (free) - 0.5 mg/litre

Fe - 0.05 mg/litre

Carbonate hardness - 50 mg/litre if pH is 6.

If water meets the specification except for Carbonate Hardness the water can still be used with detergents formulated for use on hard waters but it would then have to have 5 - 10 mg/litre of Sodium Hexametaphosphate (Calgon) added to the sterilising solution.

1.2.14. Plant Hold-up Volumes (42 Modules)

	Tubeside	Total
Modules Tubeside	353	353
Modules Shroudside	-	840
Plant Pipework	50	50
Water/Permeate in CIP Tank	500	500
	903 litre	1743 litre

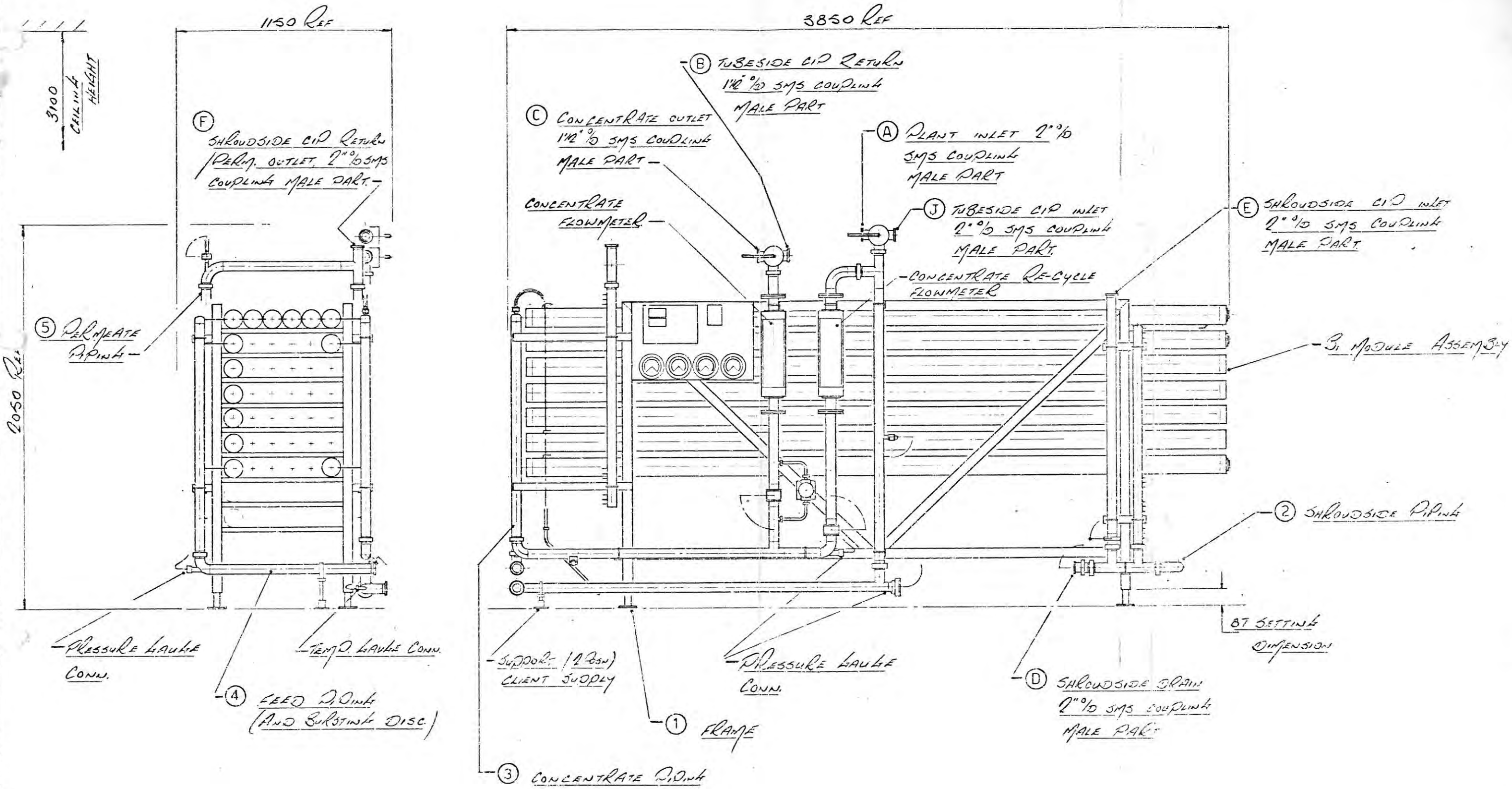
1.2.14 Cont...

For calculation purposes, these volumes are:-

Tubeside	900	litre
Total	1750	litre

1.2.15 When plant is fitted with 54 modules the volumes will be:-

Tubeside	1000	litre
Total	2100	litre



RoP 739/1 FLOW DIAGRAM
RoP 739/2 BLOCK DIAG.

by	date	amendment	
JWJ	6/12/89	First issue	A

PCT waterwise
Paterson Candy International Ltd
21 The Mall Ealing London W5 2PU England
Telephone: 01 579 1311 Telex: 27239
Portals Water Treatment

LANDTEKNIKK — KOLVEREID

drawn JWJ
traced
checked
approved
date 5-12-89
scale 1:10

GENERAL ARRANGEMENT

DRG. NO. RoP 739/4 A

A1

LIST OF RELEVANT PCI DRAWINGS

Flow Diagram		ROP 739/1.
General Arrangement		ROP 739/4
Block Plan		ROP 739/2.
~~Wiring Diagram~~		~~ROP /~~
Wiring Diagram		ROP 739/502 (4 Sheets)
Control Panel	General Arrangement	ROP 739/503
Control Panel	Internal Arrangement	ROP 739/504
Control Panel	External Connections	ROP 739/501

CHAPTER TWO

COMMISSIONING

SUBJECT			LOCATION
COMMISSIONING	-	GENERAL	SECTION 2.1.
COMMISSIONING	-	AIR LOCK REMOVAL	SECTION 2.2.
COMMISSIONING	-	LEAK CHECK	SECTION 2.2.
COMMISSIONING	-	PRESERVATIVE REMOVAL	SECTION 2.2.
COMMISSIONING	-	FLUX CHECK	SECTION 2.3.
COMMISSIONING	-	DOSING PUMP CALIBRATION	SECTION 2.4.

WARNING

C H L O R I N E

ZF 99 MEMBRANES WILL BE DAMAGED IF EXPOSED TO CHLORINE AT A CONCENTRATION HIGHER THAN 0.5 MG/LITRE

CHAPTER TWO

SECTION 2.1.

COMMISSIONING - GENERAL

WARNING: TO PREVENT LOSS OF PRESERVATIVE DURING TRANSIT AND ERECTION, A PLASTIC BLANKING DISC HAS BEEN FITTED IN THE ½" ILC CONNECTION ON THE MANIFOLD END OF ALL THE MODULE/MANIFOLD CONNECTORS TO BOTH FEED AND CONCENTRATE MANIFOLDS.

THESE DISCS MUST BE REMOVED BEFORE STARTING UP THE PLANT

ALSO SEE CHLORINE WARNING SHEET AT FRONT OF CHAPTER TWO.

Introduction

2.1.1. After the plant has been installed, various procedures must be performed before running the plant on process fluid. It may also be necessary to repeat some of these procedures after an extended plant shut-down or after certain maintenance work has been carried out. The following paragraphs explain the necessity for each procedure.

2.1.2. Air Lock Removal

After installation of the plant, or after certain maintenance work such as membrane replacement the modules and plant pipework will contain a certain amount of trapped air. This air must be bled from the system before the R.O. main pump is started, or expensive damage to the membranes and tube seals may occur. (See Section 2.2).

2.1.3. Leak Check

When the plant is first installed, or after maintenance work such as membrane replacement there is a possibility that all pipe connections etc., may not have been correctly made. It is therefore necessary to run the plant at the maximum permitted operating pressure for water and check for major leaks. (See Section 2.2.).

2.1.4. Proxel GXL Preservative Solution Removal

New modules are protected against bacteriological attack by a Proxel GXL solution. New membranes (fitted during maintenance are also protected with Proxel GXL. As products from the plant must not be used for human or animal consumption unless the Proxel content has been reduced to a safe level, the plant must be thoroughly flushed out before it is run on process fluid.
(See Section 2.2.).

2.1.5. Commissioning Water Flux, and Separation Performance Check

In order that a good comparison between operation of the plant when clean and newly installed, and operation after running for a period on process fluid, can be made; a Water Flux, Solute Passage and Retention Check is included as part of the plant commissioning. (See Section 2.3.).

2.1.6. Calibration of Dosing Pumps

Because it is essential that chemicals are accurately dosed into the plant, it is important that the calibration of all dosing pumps is checked and the results recorded. (See Section 2.4.).

CAUTION: WHEN THE PLANT CONTROL SWITCH IS SET TO "CLEAN" ANY PUMPS NOT REQUIRED TO RUN, i.e. DOSING PUMPS, SHROUD CIP PUMP MUST HAVE THE ASSOCIATED HAND/OFF/AUTO SWITCH SET TO THE "OFF" POSITION.

CHAPTER TWO

SECTION 2.2.

COMMISSIONING - AIR LOCK REMOVAL

LEAK CHECK AND PRESERVATIVE REMOVAL

AIR LOCK REMOVAL

WARNINGS: TO PREVENT LOSS OF PRESERVATIVE DURING TRANSIT AND ERECTION, A PLASTIC BLANKING DISC HAS BEEN FITTED IN THE ½" ILC CONNECTION ON THE MANIFOLD END OF ALL THE MODULE/MANIFOLD CONNECTORS TO BOTH FEED AND CONCENTRATE MANIFOLDS.

THESE DISCS MUST BE REMOVED BEFORE STARTING UP THE PLANT

IT IS ESSENTIAL THAT ALL AIR LOCKS ARE REMOVED BEFORE THE R.O. MAIN PUMP IS STARTED. FAILURE TO DO THIS COULD RESULT IN SERIOUS DAMAGE TO THE MEMBRANE OR TUBE SEALS.

AS AIR LOCKS CAN OCCUR AT ANY TIME THIS PROCEDURE MUST ALSO BE CARRIED OUT AFTER MODULE CHANGES, WHEN ANY MAINTENANCE WORK HAS BEEN CARRIED OUT AND ALSO AFTER EVERY CHANGE OF FLUID. (PARTICULAR EMPHASIS MUST BE PLACED ON THE REMOVAL OF AIR LOCKS, AFTER FLUID CHANGES, DURING THE CLEANING PROCESS).

2.2.1. Preliminary Checks

Before starting the plant for the first time the following preliminary checks must be made:-

(a) Ensure that the pumps contain the correct grade and quantity of lubricating oil.

(b) Ensure that cooling/seal water is available to the HP main pump (if required) ~~and recirculation pump (approximatley 3 litres minute at 0.5 bar maximum).~~

This plant requires HP main pump water at 3 litre/minute.

Ensure that cooling water is available to the Heat Exchangers (if applicable). See Section 3.3.

(c) Ensure that the CIP tank is clean and empty and that the tank and pipework are free from debris.

CHAPTER ONE

SECTION 1.3

VALVE SETTINGS CHART

1.3.1. A chart showing how the plant valves should be set at the start of each procedure is attached overleaf.

1.3.2. Any changes in valve positions during the procedure are detailed in the procedure itself.

2.2.1. Preliminary Checks (Continued)

(d) Ensure that the setting of the HP main pump inlet and outlet pressure switches have been adjusted to shut down the plant should the inlet/delivery pressures become too low/high (See Section 1. Plant Data).

(e) Ensure that bursting discs of the correct type are fitted in the HP pump outlet and concentrate holders (as required).

(f) Ensure that the temperature switches are set correctly.

(g) Ensure that the Flow Control Valve and bypass are fully open.

Procedure

WARNING: WHEN NEW MODULES/MEMBRANES HAVE BEEN FITTED (AFTER THE PLANT HAS BEEN FIRST INSTALLED OR AFTER MAINTENANCE HAS BEEN CARRIED OUT) THE PLANT WILL CONTAIN A PROXEL/GXL SOLUTION WHICH IS TOXIC AND IRRITATES THE EYES AND NOSE. CARE MUST BE TAKEN TO AVOID CONTACT WITH THIS SOLUTION, ESPECIALLY AS LEAKS MAY BE PRESENT IN THE MODULES AND/OR PLANT PIPE-WORK.

2.2.2. Turn on make-up water (10 - 30°C) to the cleaning tank and fill it with clean fresh water to the specification at Section 1.2. - pH correct if necessary.

2.2.3. Set the plant valves for 'Air Lock Removal' on the Valve Chart at Section 1.3. The concentrate and permeate must go directly to drain not via CIP tank. The drain used must be approved for the disposal of waste solutions.

2.2.4. Set the HAND/OFF/AUTO switches for all pumps to OFF. Then set the CIP pump switch only to AUTO.

2.2.5. Set the main supply Isolator switch on the Electrical Control Panel to ON.

Open the Module Stack Air Release Valve (v 6).

2.2.5. Continued....

Press the 'INITIATE' pushbutton to start eh CIP pump only.

2.2.6. As air is dispelled from the system, close the Air Release Valve.

Note: On larger plants it may be necessary to open and close the Air Release Valves, one or two at a time.

2.2.7. With the plant still running, proceed to the LEAK CHECK procedure. Reset plant valves for this procedure.

2.2.8. Procedure

CAUTION: THE AIR LOCK REMOVAL PROCEDURE MUST BE PERFORMED BEFORE CARRYING OUT THIS PROCEDURE. THIS IS TO PREVENT POSSIBLE DAMAGE TO THE MODULES.

WARNING: WHEN NEW MODULES HAVE BEEN FITTED, THE PLANT WILL CONTAIN PROXEL GXL SOLUTION WHICH IS TOXIC AND IRRITATES THE EYES AND NOSE. AS LEAKS MAY BE PRESENT IN THE MODULES AND/OR PLANT PIPEWORK, CARE MUST BE TAKEN TO AVOID CONTACT WITH THIS SOLUTION.

2.2.9. Ensure that the cleaning tank is still being filled with clean fresh water.

2.2.10. Set the HAND/OFF/AUTO switches on the HP Main Pump, to AUTO.

2.2.11. The HP Main Pump will start and its RUNNING lamp will light. ~~When the pump is runnong, press the "START RECIRC. PUMPS" pushbutton~~. Set HP Main Pump speed to Maximum). (If applicable).

2.2.12. ~~Set the AUTO/MANUAL station by the 3 term Controller to MANUAL and~~ adjust the Flow Control Valve and bypass until HP Pump outlet gauge reads the plant 'Flux Pressure'. This will be the maximum suitable pressure when operating the plant on water. The actual pressure will be calculated and advised by the Commissioning Engineer.

CAUTION: IF ANY LEAKS ARE FOUND DURING THE FOLLOWING OPERATION, THE PLANT MUST BE STOPPED AT ONCE.

2.2.15. When ruuning at 'Flux Pressure' check all modules and pipework for leaks.

2.2.16. If any major leaks are found, the fault must be rectified and both the air lock removal and leak check procedures repeated.

2.2.17. When the leak check has been completed:-

Fully open the Flow Control Valve (V 7) and bypass (V 8)

Reset the HP Main Pump to the correct speed setting for 'plug flow' operation (if applicable).

PRESERVATIVE REMOVAL

Procedure

2.2.18. The air lock removal and leak check procedures must be completed prior to removing the preservative solution.

2.2.19. Ensuring that sufficient water always remains in the cleaning tank, run the plant (operating at 'Displacement Pressure') until the Proxel GXL content has fallen to a safe level.

(This will require a minimum of 20 litres of water to be pumped through each module).

2.2.20. Stop the plant (See Section 3.5. for procedure).

2.2.21. Proceed to Water Flux and Permeate Conductivity Checks, (See Section 2.3.).

CHAPTER TWO

SECTION 2.3.

COMMISSIONING - WATER FLUX AND PERMEATE CONDUCTIVITY CHECKS

Introduction

2.3.1. When commissioning the plant; this procedure should be carried out after the Air Lock, Leak Check and preservative removal procedures have been completed.

2.3.2. Set the cold make-up water into the cleaning tank (See Section 1. for specification). Temperature 10 - 30°C.

2.3.3. Set the plant valves for "Water Flux" check on the Valve Chart at Section 1. . The concentrate should go to drain. The permeate line should go to the permeate tank for measurement.

2.3.4. Set the following pump HAND/OFF/AUTO switches to 'OFF':-

(a) Shroud C.I.P. pump
~~(b) Nitric Acid dosing pump~~
~~(c) Sodium Hydroxide dosing pump~~
(d) Hydrogen Peroxide dosing pump

2.3.5. Set the Plant Control Switch to "CLEAN"

2.3.6. Start the plant by pressing the INITIATE ~~followed by the "START RECIRCULATION PUMPS"~~ pushbuttons.

2.3.7. Close the flow control valve and bypass HP Main Pump output pressure gauge reads 15 bar. 'Flux Pressure'. It is important that the same pressure is always used for this procedure to ensure consistent results.

2.3.8. Ensuring that there is always sufficient water in the Cleaning Tank, run the plant until the permeate flow has stabilised.

2.3.9. Read and record the :-

(a) Feed Temperature

2.3.9. (b) Feed Flow. If a feed flowmeter is not fitted. read concentrate flow (Feed flow = concentrate flow plus permeate flow). H.P. pump speed should also be recorded (if applicable).

(c) Permeate Flow. Unless plant instruments have recently been calibrated, measure the permeate flow using a container and a stop-watch.

(d) Module Inlet Pressure

(e) Modules Outlet Pressure (if pressure gauge is fitted).

(f) Feed Conductivity

(g) Permeate Conductivity

2.3.10. Stop the plant. (See Section 3.5.)

2.3.11. Using the permeate flow at Flux Pressure and the Total membrane area for the plant, calculate the Flux Rate as follows:-

$$\text{Flux Rate (litres/m}^2\text{/hour)} = \frac{\text{Permeate Flow Rate l/m} \times 60}{\text{Membrane Area (m}^2\text{)}}$$

Correct to 15°C using the Table overleaf

NOTE: To produce comparable results, it is important that the same operating pressure is always set when flux checks are being performed.

2.3.12. Record the Flux Rate for future reference.

2.3.13. Using the permeate and feed conductivity readings calculate either the Solute Passage (S.P.) or the Retention as follows:-

$$\text{S.P.} = \frac{\text{Permeate Conductivity}}{\text{Feed Conductivity}} \times 100$$

$$\text{Retention} = 100 - \text{S.P.}$$

2.3.14. Record these results for future reference.

TABLE

FLUX/TEMPERATURE CORRECTION FACTORS (Kt).

(Base 15°C)

Temperature	Kt
30	0.642
29	0.656
28	0.677
27	0.699
26	0.723
25	0.741
24	0.761
23	0.789
22	0.811
21	0.835
20	0.860
19	0.887
18	0.915
17	0.945
16	0.966
15	1.000
14	1.036
13	1.062
12	1.103
11	1.132
10	1.162
9	1.194
8	1.246
7	1.284
6	1.323
5	1.365
4	1.410
3	1.433

CHAPTER TWO

SECTION 2.4.

CALIBRATION OF DOSING PUMPS

2.1.4. Because it is essential that chemicals are accurately dosed into the plant, it is important that the calibration of the dosing pump is checked and recorded during commissioning.

2.4.2. The dosing times and settings for each pump and process are described in Chapters Three and Four of this manual. These settings are, however, based on the theoretical pump performances only and, if necessary corrected figures must be inserted by the commissioning engineer.

2.4.3. The calibration of each dosing pump should be checked by filling the dosing tank with water, disconnecting the delivery hose at the injection point, downstream of the loading valve, and measuring the pump output flow at a range of settings from 5 - 100% using a suitable container and a stop-watch.

2.4.4. The results should be recorded on graph paper and compared with the makers specification. A copy should be left on site for future comparison.

2.4.5. The operation of the dose duration and interval timers should also be checked and the timers set to their operational positions.

CHAPTER THREE

PLANT OPERATION

SUBJECT	LOCATION
GENERAL	SECTION 3.0.
DISPLACE PRESERVATIVE	SECTION 3.1.
PRE-HEATING	SECTION 3.2.
START UP ON PROCESS	SECTION 3.3.
DISPLACE PROCESS FLUID	SECTION 3.4.
SHUT-DOWN EMERGENCY/NORMAL	SECTION 3.5.

CHAPTER THREE

Section 3.0

PLANT OPERATION - GENERAL

3.0.1. The complete sequence of daily operations is as follows:-
(It is assumed that the plant and pipework contain a bacteriological solution) after a weekend shut-down:-

(a) Displace the Preservation solution - See Section 3.1.

(b) Pre-heat the plant (if required) - See Section 3.2.

(c) Start-up on process fluid - See Section 3.3.

(d) Displace process fluid - See Section 3.4.

(e) Nitric Acid Clean - See Section 4.3.

(f) Sodium Hydroxide and Ultrasil 10 (UF20) clean - See Section 4.4. (If required)

(g) Sterilise plant - See Section 4.5.

(h) Preserve plant (if required) See Section 4.6. or Chapter Six.

CHAPTER THREE

Section 3.1.

DISPLACEMENT OF PRESERVATIVE (SODIUM METABISULPHITE)

3.1.1. Ensure that an adequate supply of water/permeate is available at the CIP tank (At a temperature of 10 - 45°C).

Ensure that the Feed/Concentrate temperature switch is correctly set for the temperature of water/permeate to be used for this procedure.

3.1.2. Set the plant valves for "Preservation Displacement" on the Valve Settings Chart. Set the following pump HAND/OFF/AUTO switches to 'OFF' :-

(a) Shroud CIP pump

~~(b) Nitric Acid dosing pump~~

~~(c) Sodium Hydroxide dosing pump~~

(d) Hydrogen Peroxide dosing pump

3.1.3. Set the PROCESS-SHUTDOWN-CLEAN to CLEAN. Press the INITIATE button only.

Plant fitted with Variable Speed HP Main Pump

Set this pump to the recommended speed for this procedure.

3.1.4. Operating at "Minimum" pressure displace the preservative from the tube side for 2-3 minutes, to ensure that the 'slug' of clean water will precede the process fluid during start-up on process fluid.

3.1.5. Stop the plant (see Section 3.5.). Ensure that the shrouds have drained completely.

3.1.6. Proceed to:-

(a) Pre-heating (if required) - see Section 3.2.

(b) Start-up on Process Fluid - see Section 3.3.

CHAPTER THREE

SECTION 3.2.

PRE-HEATING (IF REQUIRED)

3.2.1. In some cases it may be an advantage to pre-heat the plant before operating on hot dairy feed.

3.2.2. If instructed by P.C.I. Ltd to use this procedure set the plant valves for Displacement on the Valve Setting Chart. Set the hot water/permeate supply to the CIP tank. Set all dosing pump and Shroud CIP pump switches to OFF. Ensure that the temperature switches are set to the correct temperature for this procedure.

NOTE: If applicable, set the variable speed pump to the setting agreed by the Commissioning Engineer for this procedure.

3.2.3. Start the plant with Feed, HP Main Pumps running.

3.2.4. Run the plant at "Minimum" pressure for about 10 minutes.

3.2.5. Stop the plant. Proceed to "start-up on Process Fluid".

CHAPTER THREE

SECTION 3.3.

PLANT OPERATION - START UP ON PROCESS FLUID

3.3.1. Starting-up the plant on process fluid is carried out in two stages:-

(a) The plant is run using the feed/CIP pump only with the concentrate drain valve (v22) open to drain until the water in the modules and plant pipework has been displaced with process fluid.
Air bleeding is performed during this phase.

(b) The concentrate drain valve (v22) is closed. The plant is then run normally at the appropriate flow rate until the required quantity of process fluid has been concentrated.

3.3.2. If so advised, the plant should be pre-heated before start-up. (See Section 3.2.).

Pre-Start Checks

3.3.3. Before starting the plant on process fluid, the following checks must be made:-

(a) The pumps must contain the correct grade and quantity of lubricating oil (where applicable) - See chapter five for details.

(b) ~~Check that seal/cooling water is available for the Recirculation pumps (litre/minute at bar max.) and to the HP Main Pump (if applicable).~~ For this plant HP Main Pump water is/~~not~~ required at 3 litre/minute.

~~(c) Check that cooling water is available for the heat~~ exchangers. For this plant water at °C ~~is required~~ at the following flow rates:-

No 1	Stack Heat Exchanger		litre/minute
No 2	"	"	litre/minute
No 3	"	"	litre/minute
~~No 4~~	"	"	~~litre/minute~~

(d) Check that the permeate recycle dosing tank contains sufficient solution and that the dosing pump output is correctly set. (See procedure at end of this Section).

(e) Check that the Feed dosing Acid tank is sufficiently filled and the dosing pump is correctly set. (See procedure following this Section - if applicable).

(f) Check that the Carbon Dioxide dosing equipment contains sufficient gas and that the gas controls are correctly set. (See procedure at the end of this Section - if applicable).

(g) Check that the HP Main Pump Inlet/outlet pressure switches and the Feed and Concentrate temperature switches are correctly set.

(h) Check that the Flow Control Valve and bypass are fully open.

3.3.4. Start-up Procedure

Set the plant valves for the 'Start-up on process fluid' procedure in the Valve Settings Chart at Section 1...

3.3.5. Set all pump, 3-position HAND-OFF-AUTO switches to AUTO, except the Main HP Pump switch. Set this switch to OFF.

3.3.6. Close the Isolator switch on the electrical control panel and ensure that the 'SUPPLY ON' lamp lights.

Note: When the Isolator switch is closed, all the (red) alarm lamps light and the audible alarm sounds. Press the 'ACKNOWLEDGE' button to silence the audible alarm and then the RESET button to extinguish the ALARM lamps and reset the circuits. (For the details of alarm systems see Section 5.8.).

3.3.7. The plant is started up to displace water and fill with process fluid as follows:-

(a) Set the PROCESS-SHUTDOWN-CLEAN switch to PROCESS.

(b) Press the INITIATE button. Ensure that the Feed pump starts and its running lamp lights.

(c) Open the "Conc" air release valve and Shroud Air release valve (v 6 and v 21).

(d) Close the Concentrate Air Release valve (V 6) as air is expelled.

(e) When the shrouds have filled, close the Shroud air release valve (V 21).

(f) Set the HP Main pump HAND/OFF/AUTO switch to AUTO. Ensure that this pump starts and its RUNNING lamp lights, check that the seal cooling water solenoid opens and water flow is correct - (if applicable).

Note: For pumps fitted with variable speed control set the HP pump speed to the setting agreed by the Commissioning Engineer (if applicable).

(g) Run the plant at "Minimum" pressure, until whey appears at the Concentrate Outlet Drain valve (V 22).

(h) Reset V10 to the Concentrate Tank and close the Concentrate Drain valve (V 22). Open Recycle Valve (V11)

3.3.8. For pumps fitted with variable speed control, set the HP Main pump speed to the required process flow rate (if applicable).

3.3.9. Slowly, over a period of about 30 minutes close the Flow Control valve (V 7) and bypass (V 8) until the concentrate flowmeter reads the correct outlet flow (see Plant Data (Section 1.2.).

DO NOT OPERATE THE PLANT ABOVE THE PRESSURE REQUIRED TO MAINTAIN THE DESIGN FLOW RATES.

3.3.10. If, during the process run, the operator decides to stop using the recycle system, the recycle valve must not be fully closed. To prevent bacterial growth a minimum flow of 10 litres/minutes must be maintained.

DOSING OF RECIRCULATING PERMEATE

Dosing of the recirculating permeate with Hydrogen Peroxide is carried out at the same rate as that used for Sterilisation during the cleaning process. (See Chapter Four, Section 4.5. for dosing pump setting).

The procedure is as follows:

The PERMEATE STERILISATION switch is set to TIMED and the Hydrogen Peroxide 3-way switch to AUTO. When the last recirculation pump has started a 0-2 hour timer starts.

This timer is normally set to 15-30 minutes and it inhibits the Shroud CIP pump until permeate is being produced and the CIP tank is about 1/3 full.

When the Shroud CIP pump starts the Hydrogen Peroxide dosing pump also starts, runs for 10 minutes (timer controlled) and then stops. The Shroud CIP pump runs continuously.

As long as the PERMEATE STERILISATION switch is set to timed and the plant is operating on process. The Hydrogen Peroxide dosing pump will run for 10 minutes every 6 hours.

CHAPTER THREE

SECTION 3.4.

PLANT OPERATION - DISPLACEMENT OF PROCESS FLUID

3.4.1. After completing a process run the plant will contain a quantity of process fluid which should be displaced into the concentrate tank (or elsewhere if required).

3.4.2. If a sight-glass is fitted in the concentrate line, completion of the displacement process may readily be observed. Otherwise a sample valve or the actual concentrate output termination should be used.

3.4.3. If the observation point is not the actual concentrate output termination, note how much later clean water/permeate appears at the concentrate outlet and allow this time to elapse before stopping the plant.

3.4.4. Permeate may be used for displacing the process fluid.

3.4.5. The shrouds should not be drained, as the permeate is required for cleaning of the shroud side. (See Chapter Four).

3.4.6. Set the plant valves to the 'Displace Process Fluid' operation on the Valve Settings Chart at Section 1.3. Ensure that the Flow Control Valve is fully open. Set water/permeate supply to CIP tank at feed fluid temperature.

3.4.7. Set the Plant Control switch to 'CLEAN'. Set the HAND/OFF/AUTO switches on the following pumps to 'OFF':-

(a) Shroud CIP Pump

(b) Nitric Acid Dosing Pump (if fitted)

(c) Sodium Hydroxide Dosing Pump (if fitted)

(d) Hydrogen Peroxide Dosing Pump

3.7.8. Start the plant by depressing the INITIATE pushbutton only.

Plant Fitted with Variable Speed HP Main Pump

Set the HP Main Pump to the correct speed for this procedure.

3.7.9. Run the plant at minimum pressure until only clean water/permeate appears at the observation point. Stop the plant. (See Section 3.5.)

3.7.10. Proceed to Nitric Acid cleaning (See Chapter Four).

CHAPTER THREE

SECTION 3.5

PLANT OPERATION - SHUTDOWN

3.5.1. IN AN EMERGENCY SUCH AS A FIRE OR PIPE FRACTURE:-

(A) PRESS THE EMERGENCY STOP BUTTON

(B) SHUT OFF PROCESS FLUID SUPPLY

(C) OPEN THE PLANT MAINS SUPPLY ISOLATOR SWITCH

(D) IF POSSIBLE ISOLATE MAINS POWER SUPPLIES BEFORE THEY REACH THE RO PLANT.

DO NOT RECONNECT FLUID OR ELECTRICAL SUPPLIES UNTIL THE FAULT CONDITION HAS BEEN IDENTIFIED AND RECTIFIED.

3.5.2. FOR NORMAL SHUTDOWN

(A) Set the Plant Control PROCESS/SHUTDOWN/CLEAN switch to SHUTDOWN.

(B) When all pumps have stopped, fully open the Flow Control valve. (and Bypass)

Note

If, for any reason, a plant containing process fluid is stopped, and remains stopped for more than 30 minutes, the plant must be flushed. Use 'Displace Process Fluid' procedure - (see Section 3.4) Permeate or water may be used.

~~CA Membranes Only If the level of residual Chlorine in the permeate exceeds 2mg/litre it must not be used in the RO plant for any purpose.~~

3.5.3. If the plant is stopped at the end of a process run, then:-

(A) Displace the process fluid (See Section 3.4).

(B) Clean and sterilise the plant (See Chapter Four)

(C) If the plant is to be shut-down for more than 2 hours after cleaning/sterilisation, circulate a bacteriological or preservative solution (See Chapter Four or Chapter Six).

CHAPTER FOUR

MEMBRANE CLEANING

SUBJECT	LOCATION
GENERAL	SECTION 4.1.
SEQUENCE OF OPERATIONS	SECTION 4.2.
NITRIC ACID CLEANING	SECTION 4.3.
SODIUM HYDROXIDE CLEANING	SECTION 4.4.
STERILISATION	SECTION 4.5.
PRESERVATION	SECTION 4.6.

WARNING

C H L O R I N E

ZF 99 MEMBRANES WILL BE DAMAGED IF EXPOSED TO CHLORINE AT A CONCENTRATION HIGHER THAN 0.5 MG/LITRE

5 ppm

CHAPTER FOUR

SECTION 4.1.

MEMBRANE CLEANING - GENERAL

4.1.1. B1 Reverse Osmosis plant are normally operated for up to 20 hours/day and then cleaned with a Nitric Acid solution and a Sodium Hydrogen/Ultrasil 10 solution, followed by the circulation of a sterilisation solution.

4.1.2. The cleaning procedures and solution preparation are outlined in the following sections of this Chapter.

4.1.3. These procedures are for guidance only, specific cleaning methods are produced for individual plants to suit the particular process and to take account of any particular requirements of the plant owner.

CHAPTER FOUR

Section 4.2

MEMBRANE CLEANING - SEQUENCE OF OPERATIONS

4.2.1. Daily Cleaning The sequence of operations during the daily membrane cleaning process is typically:-

(a) Displace the process fluid with water/permeate. See Section 3.4.

(b) Circulate a Nitric Acid solution through the tubeside only. See Section 4.3.

(c) Displace the acid solution with water/permeate. See Section 4.3.

(d) Circulate a Sodium Hydroxide/Ultrasil 10 (UF 20) solution through the tubeside of the modules only. (This procedure may not be required every day). See Section 4.4.

(e) Displace the cleaning solution with water/permeate. See Section 4.4.

(f) Sterilise the plant with Hydrogen Peroxide solution circulated through both tube and shroud sides. See Section 4.5.

(g) If the plant is going back on process within 2 hours leave the plant full of clean water/permeate.

OR

(h) If shutdown will be between 2 hours and 3 days, circulate a Sodium Metabisulphite solution through the tube and shroud sides and leave in the plant. See Section 4.6.

OR

(j) If shutdown will be between 3 days and 30 days circulate a more concentrated Sodium Metabisulphite solution through the tube and shroud sides and leave in the plant. See Section 4.6.

/4.2.1. (k)

4.2.1. (k) If shutdown will exceed 30 days, or for any shut down period if plant may be exposed to freezing conditions, circulate a Proxel GXL (with Glycerol) solution through tube and shroud sides and leave in the plant. See Chapter Six.

P.C.I. Ltd are not responsible for any events arising from the use of this schedule without their written authorisation.

MANUAL DOSING OF NITRIC ACID/SODIUM HYDROXIDE

If the Nitric acid/Sodium hydroxide dosing pump sets are not available, it will be necessary to dose these chemicals manually into the CIP tank during the cleaning process.

The procedure to be used is as follows:-

WARNING: NITRIC ACID/SODIUM HYDROXIDE CAN BURN AND AFFECT THE SKIN, EYES, ETC. WEAR FACE PROTECTION, GLOVES, BOOTS AND PROTECTIVE CLOTHING WHEN HANDLING NITRIC ACID/ SODIUM HYDROXIDE. (SEE CHEMICAL SAFETY LEAFLET AT CHAPTER EIGHT)

a) Set the plant valves for "Cleaning".

b) Have available near the CIP tank the required quantity of Nitric Acid/Sodium Hydroxide in suitable safe containers.

The quantities for the plant are:-

Nitric Acid		42 MODULES	54 MODULES
70%	litre	5,25	6
40° Baume 63%	litre	6	7,5
36° Baume 53%	litre	7,5	9.

Sodium Hydroxide (47% liquid)			
	litre	6,25	7,5
POWDER	KG	4,4	5,25

c) With modules and pipework full of water/permeate and 500 litres in the CIP tank (Temperature 40 - 45°C for Nitric Acid, 45 - 50°C for Sodium Hydroxide), set and start up the plant as at Section 4.3./4.4..

d) Slowly and carefully add the Nitric Acid/Sodium Hydroxide to the CIP tank contents over a period of 15 minutes preferably using a transfer pump. DO NOT USE THE SAME TRANSFER PUMP FOR NITRIC ACID AND SODIUM HYDROXIDE (SEE CHEMICAL SAFETY LEAFLETS AT CHAPTER EIGHT FOR OTHER PRECAUTIONS REQUIRED).

e) When Nitric Acid/Sodium Hydroxide is thoroughly circulated through the plant, continue the cleaning procedure described at Section 4.3./4.4.

Note: If Nitric Acid dosing pump is not fitted, see note preceeding Section 4.3. for manual dosing.

SUMMARY

	TUBESIDE	TOTAL
HOLD UP VOLUMES:		
MODULES TUBESIDE	353	353
MODULES SHROUDSIDE	—	840
PLANT PIPEWORK	50	50
CIP TANK	1.000	1.000
	1.400 LITRES	2.250 LITRES

17850

SHROUDSIDE VOLUME = 850 l. THEREFORE FILL CIP TANK TO 1850 l BEFORE FILLING SHROUDS: HEAT SIMULTANEOUSLY.

CHEMICALS:

- ACID: 53% HNO_3 — 7,5 l (9.5 l.) 45°C, 30 MINS
- ALKALI: NaOH POWDER — 4,4 KG. (2.25 KG.) } 45°C, 30 MINS
  VITRASIL 10 POWDER — 2,25 KG. }
- STERILISATION: 20% PEROXIDE — 1,4 l, 10-30°C, 20 MINS

PRESERVATION:

2 HRS – 3 DAYS: METABISULPHITE POWDER — 2,25 KG } 10-30°C, ISM
3 DAYS – 30 DAYS: METABISULPHITE POWDER — 5,6 KG }

CHAPTER FOUR

Section 4.3

NITRIC ACID CLEANING

4.3.1. Ensure that the modules (tube and shroud side) and pipework are filled with water/permeate and that there are 500 litres of water/permeate in the C.I.P. tank. The temperature of the water/permeate must be 40 - 45°C.

Ensure that the Feed and Concentrate temperature switch is set to 45°C for this procedure as if set too low the temperature alarms will stop the plant, If set too high, damage may occur.

4.3.2. Set the plant valves for "Cleaning" on the Valve Settings Chart.

Solution Preparation

WARNING: NITRIC ACID CAN BURN AND AFFECT THE SKIN AND EYES ETC. WEAR FACE PROTECTION, GLOVES, BOOTS AND PROTECTIVE CLOTHING WHEN HANDLING (SEE CHEMICAL SAFETY LEAFLET AT CHAPTER EIGHT).

4.3.3. This procedure uses a 0.3% w/w solution of 100% Nitric Acid calculated into the total hold-up volume of the plant.

4.3.4. Normally 70% Nitric Acid is used and dosed over a period of 15 minutes at a rate of 3 ml/litre of total hold-up volume. (In this case litres).

$$\frac{3 \times \quad}{1000} = \quad \text{litres}$$

SEE NOTE ON MANUAL DOSING

Dosed in 15 minutes = X4 = litre/hour

Dosing pump Maximum Output = 90 litres/hour

Pump Setting = $\frac{\quad}{90} \times 100 = \quad \%$

See Special Note to Section 4.3. if 70% Nitric Acid is not available.

Note: If Nitric Acid dosing pump is not fitted, see note preceeding Section 4.3. for manual dosing.

Cleaning Procedure

4.3.5. Check that the Nitric Acid tank contains sufficient solution, that the dosing pump output is correctly set to – % and that the dosing duration timer is set for minutes or have sufficient Nitric Acid available near the CIP tank.

4.3.6. Set the plant valves for "Cleaning" on the Valve Settings Chart.

4.3.7. Set the following pump HAND/OFF/AUTO switches to 'OFF':-

(a) Shroud CIP pump

(b) Sodium Hydroxide dosing pump (if fitted)

(c) Hydrogen Peroxide dosing pump.

4.3.8. Set the Plant Control switch to "CLEAN". Depress the "INITIATE" pushbutton to start the water/permeate circulating. The Nitric Acid dosing pump (if fitted) will start after the MAIN HP pump has started. Operate at Minimum Pressure.

Plant fitted with Variable Speed HP Main Pump

Set this pump to the recommended speed for this procedure.

4.3.9. During the Nitric Acid dosing, operate the steam heating system in the CIP tank. Shut off the steam when temperature gauge reads 40 - 45°C.

4.3.10. Bleed air from the plant by opening (V V6 V –, and V –). Close then when the air has been expelled. Open Recycle valve (V 11).
~~"START RECIRCULATION PUMPS" pushbutton.~~

4.3.11. Adjust the Flow Control Valve and bypass until the pressure at the HP main pump outlet gauge reads 15 bar.

4.3.12. Continue to circulate the solution for a further 30 minutes.

4.3.13. Stop the plant - See Section 3.5.

Displacement of Cleaning Solution

4.3.14. Set the plant valves for "Displace Nitric Acid" on the Valve Settings Chart. Set the following pump HAND/OFF/AUTO switches to "OFF":-

(a) Shroud CIP pump

(b) Nitric Acid dosing pump (if fitted)

(c) Sodium Hydroxide dosing pump (if fitted)

(d) Hydrogen Peroxide dosing pump

4.3.15. Drain the shrouds. Note that the shrouds will take about 15 minutes to drain completely.

4.3.16. Set the Plant Control switch to "CLEAN". Ensure that the supply of water/permeate is available at the CIP tank.

4.3.17. Press the INITIATE pushbutton. Displace the Nitric Acid solution from the tube side for 10 minutes. Operate at "Minimum" pressure.

Plant Fitted with Variable Speed HP Main Pump

Set the pump to the speed recommended for this procedure.

4.3.18. Stop the plant. Ensure that the shrouds have drained.

4.3.19. Proceed to:-

(a) Sodium Hydroxide/Ultrasil 10 (UF20) cleaning (if required) - See Section 4.4.

or

(b) Hydrogen Peroxide sterilisation - see Section 4.5.

CHAPTER FOUR

Section 4.4

SODIUM HYDROXIDE/ULTRASIL 10 (UF 20) CLEANING

4.4.1. This procedure may not be necessary every day on all MSR plants. P.C.I. Ltd., will advise how often Sodium Hydroxide cleaning is needed for particular plant.

4.4.2. At the start of this procedure ensure that the modules (tube and shroud side) and pipework are filled with water/permeate and that there are 500 litres of water/permeate in the CIP tank. The temperature of the water/permeate must be 45 - 50°C.

Ensure that the Feed temperature switch set to 50°C for this procedure. If set too low, the temperature alarms will stop the plant. If set too high, damage may occur.

4.4.3. Set the plant valves for "Cleaning" on the Valve Settings Chart (see Section 1. .)

SOLUTION PREPARATION - SODIUM HYDROXIDE

WARNING: SODIUM HYDROXIDE HAS A CORROSIVE ACTION ON BODY TISSUE, WEAR GOGGLES, GLOVES, BOOTS AND PROTECTIVE CLOTHING WHEN HANDLING (SEE ALSO CHEMICAL SAFETY LEAFLET AT CHAPTER EIGHT).

4.4.4. This procedure uses a 0.25% (weight/weight) solution of 100% Sodium Hydroxide, calculated into the total hold-up volume of the plant (in this case litres).

4.4.5. Normally, 47% liquid Sodium Hydroxide is used and dosed over a period of minutes at a rate of 3.55 ml/litre of total hold-up volume. SEE NOTE ON MANUAL DOSING

$$= \frac{3.55 \times \quad}{1000} = \quad \text{litres}$$

Dosed in 15 minutes = x 4 = litre/hr

Dosing pump maximum output = litre/hr

Pump Setting = __ x 100 = __%

Note: If Sodium Hydroxide dosing pump is not fitted see note preceeding Section 4.3. for manual dosing.

SOLUTION PREPARATION - ULTRASIL 10 (UF 20)

WARNING: ULTRASIL 10 (UF 20) CONTAIN CAUSTIC SUBSTANCES. SEE WARNING FOR SODIUM HYDROXIDE ABOVE.

4.4.6. This procedure uses a 0.25% (weight/weight) solution of Ultrasil 10 (UF 20) added to the Sodium Hydroxide solution in the CIP tank.

4.4.7. The 0.25% solution is calculated into the tube side hold-up volume only (in this case 900/1000 litres) at the rate of 2500 mg/litre.

$$= \frac{2500 \times 900/1000}{1.000,000} = \frac{2,25}{2,5} \text{ kg} \quad (42 \text{ MODULES}) \ (54 \text{ MODULES})$$

4.4.8. Place 5 litres of water/permeate in a clean 10 litre bucket. Slowly add half the quantity of Ultrasil 10 (UF 20) required. Mix thoroughly until all the Ultrasil 10 (UF 20) is dissolved. Place a further 5 litres of water/permeate into a second 10 litre bucket. Add the remaining Ultrasil 10 (UF 20) and mix thoroughly until all the Ultrasil 10 (UF 20) is dissolved.

Cleaning Procedure

4.4.9. Check that the Sodium Hydroxide tank contains sufficient solution that the dosing pump output is correctly set to % and that the dosing duration timer is set for minutes or have sufficient 4 7% liquid Sodium Hydroxide available near the CIP tank.

Ensure that the required quantity of Ultrasil 10 (UF 20) is available in solution.

4.4.10. Set the following pump HAND/OFF/AUTO switches to "OFF":-

(a) Shroud CIP pump

(b) Nitric Acid dosing pump (if fitted)

(c) Hydrogen Peroxide dosing pump.

4.4.11. Set the PROCESS-SHUTDOWN-CLEAN switch to CLEAN. Depress the INITIATE pushbutton to start the water/ permeate circulating. The Sodium Hydroxide dosing pump (if fitted) will start after the R.O. Main H.P. pump has started. Operate at "Minimum" Pressure.

Plant fitted with Variable Speed HP Main Pump

Set this pump to the recommended speed for this procedure.

4.4.12. During the Sodium Hydroxide dosing operate the steam heating system in the CIP tank. Shut off the steam when temperature gauge reads 45 - 50°C.

4.4.13. Bleed air from the plant by opening (V 6 , V —, and V —). Close them when air has been expelled. Open Recycle Valve (V 11).

4.4.14. While the Sodium Hydroxide is being dosed, slowly add the Ultrasil 10 (UF 20) solution to the CIP tank, (if service water not permeate is being used start to add Ultrasil 10 immediately.

4.4.15. Adjust the Flow Control Valve and bypass until the pressure at the HP Main pump outlet reads 15 bar.

4.4.16. Continue to circulate the solution for a further 30 minutes.

4.4.17. Stop the plant. See Section 3.5.

Displacement of the Sodium Hydroxide Solution

4.4.18. For displacement procedure, see Section 4.3. paras. 4.3.14 to 4.3.18.

4.4.19. Proceed to Hydrogen Peroxide Sterilisation. See Section 4.5.

Note: If plant is going back onto process immediately after Sodium Hydroxide clean, sterilisation is not required.

CHAPTER FOUR

Section 4.5

HYDROGEN PEROXIDE STERILISATION

4.5.1. At the start of this procedure, ensure that the modules (tube and shroud side) and pipework are filled with water/permeate and that there are 500 litres in the CIP tank. The temperature of the water/permeate must be 10 - 30 °C

Ensure that the Feed temperature switch is set to the correct temperature for this procedure (30°C).

4.5.2. Set the plant valves for "Sterilisation" on the Valve Settings Chart.

Solution Preparation - Hydrogen Peroxide

WARNING: HYDROGEN PEROXIDE CAN SEVERELY IRRITATE EYES AND SKIN. WEAR FACE PROTECTION, NITRILE GLOVES, BOOTS AND PROTECTIVE CLOTHING. (SEE CHEMICAL SAFETY LEAFLET AT CHAPTER EIGHT).

4.5.3. This procedure uses a 0.05% w/w 500 mg/litre solution of 35% Hydrogen Peroxide used as supplied and not corrected to 100% active chemical.

4.5.4. The 0.05% solution is calculated into the total hold-up volume of the plant (in this case 1750 2100 litres).

4.5.5. The 35% Hydrogen Peroxide is dosed over a period of 15 minutes at a rate of 0.45 ml/litre of the total hold-up volume.

$$= \frac{0.45 \times 1750\ 2100}{1000} = 0,8\ 0,95 \text{ Litre}$$ 21 MODULES 24 MODULES

/Dosed in 15.....

Co. Ltd.

Paterson Candy International Limited	REF. RoP 739	PAGE 1
CALCULATIONS RE Sterilisation	MADE BY JB	DATE 23·11·83

Available Hydrogen Peroxide is only 20% not 35%

∴ Quantity required for sterilisation

	35%		20%	
42 modules	0,8	× 0.35/0.20	1.4	Litre
54 modules	0,95		1.7	

Dosed in 15 minutes dosing rate needs to be $\left.\begin{matrix}1.4\\1.7\end{matrix}\right\} \times 4 = \begin{matrix}5.6\\6.8\end{matrix}$ litres/hour

Dosing pump rated at 9 litres/hour

∴ Setting needs to be $\left.\begin{matrix}5.6\\6.8\end{matrix}\right\} / 9 \times 100 = \begin{matrix}62\ \text{for 42}\\75\%\ \text{for 54}\end{matrix}$

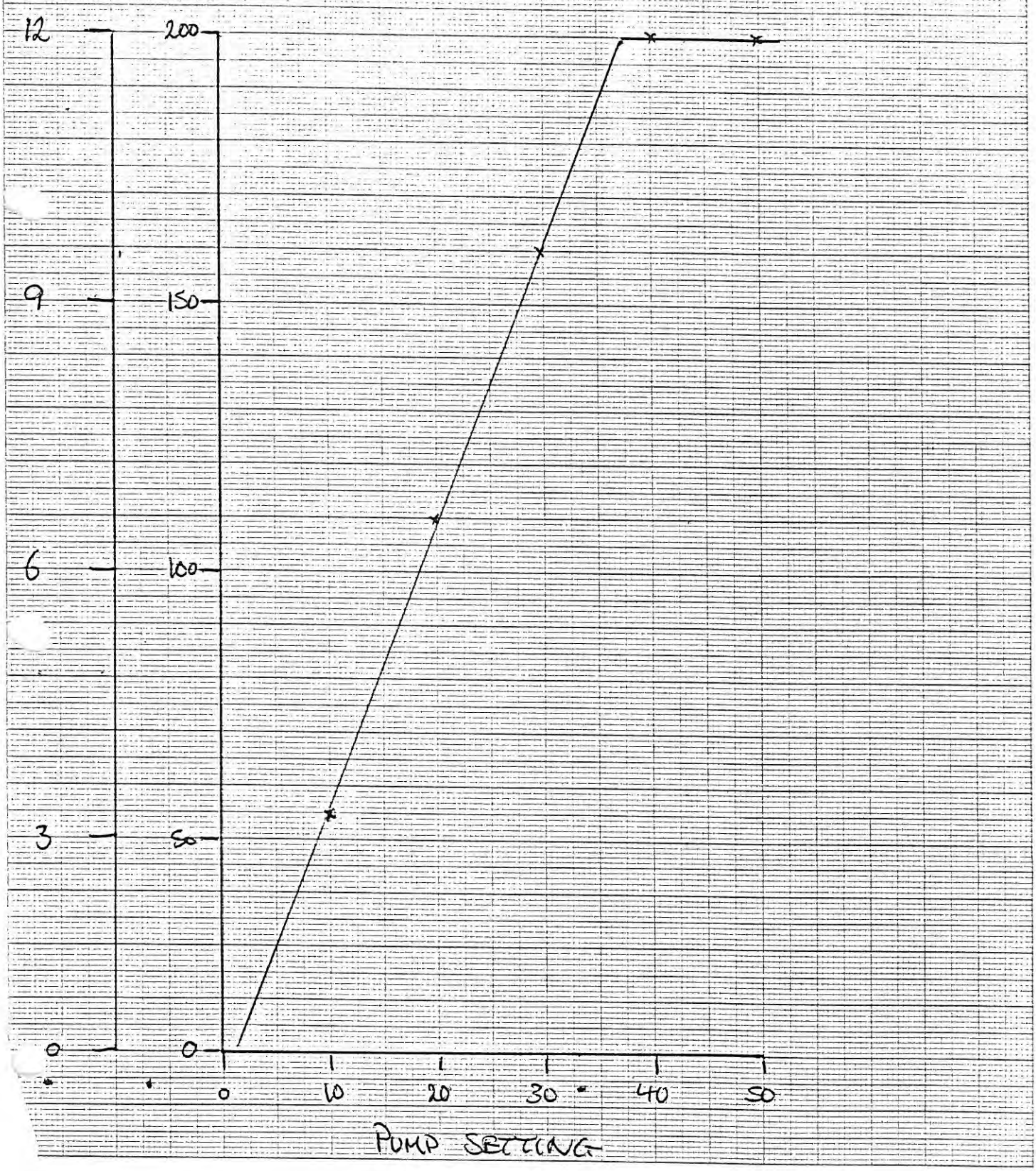
From calibration graph

5.6 l/hr = 18% Stroke setting

ROP 739 – LANDTEKNIKK FOR KOLVEREID DAIRY

CALIBRATION OF HYDROGEN PEROXIDE DOSING PUMP

24.11.83



Dosed in 15 minutes = 0,8 / 0,95 x 4 = 3,2 / 3,8 litres/hour

Dose pump max. output = 9 litres/hour

Dose pump setting = 3,2 / 3,8 / 9 x 100 = 36 % - 42 MODULES / 42 % - 54 MODULES

Sterilisation Procedure SEE NOTE

4.5.6. Check that the Hydrogen Peroxide tank contains sufficient solution, that the dosing pump output is correctly set to 36/42% and that the dosing duration timer is set for 15 minutes. BY HAND.

4.5.7. Set the following pump HAND/OFF/AUTO switches to "OFF":-

(a) Shroud CIP pump

(b) Nitric Acid dosing pump

(c) Sodium Hydroxide dosing pump

4.5.8. Set the PROCESS-SHUTDOWN-CLEAN switch to CLEAN. Depress the INITIATE button. The Hydrogen Peroxide pump will start after the main H.P. pump starts. Operate at "Minimum" pressure.

Plant Fitted with Variable Speed H.P. Main Pump

Set this pump to the speed recommended for this procedure.

4.5.9. Bleed air from the plant by opening V 6, V —, and V —. Close then when air has been expelled. Open Recycle valve (V 11).

4.5.10. Adjust the Flow Control Valve and bypass until the pressure gauge at the HP Main pump outlet reads 15 bar.

4.5.11. Start the Shroud CIP pump by setting its HAND/OFF/AUTO switch to AUTO.

4.5.12. Circulate the solution through both tube and shroud sides for 40 minutes.

4.5.13. Stop the plant.

Displacement of Sterlisation Solution

4.5.14. Set the plant valves for "Displacement of Sterilant". Displace the solution as described at Section 4.3., paras 4.3.14 to 1.3.18.

4.5.15. Stop the plant. Proceed to:-

(a) Start-up on Process Fluid

or

(b) If plant is to be shutdown for up to 2 hours - leave plant filled with Water/Permeate.

(c) If shutdown will exceed 2 hours - carry out Preservation procedure (see Section 4.6. or Chapter Six).

CHAPTER FOUR

Section . 4.6

PRESERVATION - SODIUM METABISULPHITE

4.6.1. Ensure that the modules (tube and shroud sides) and pipework are filled with water/permeate and that the CIP tank contains 500 litres of water/permeate. The temperature of the water/permeate must be 10-30°C. Ensure that the Temperature Switch is set to 30°C for this operation.

4.6.2. Set the plant valves for "Preservative Procedure" on the "Valve Setting" Chart.

Solution Preparation

WARNING: SODIUM METABISULPHITE CAN SERIOUSLY AFFECT THE SKIN AND EYES. WEAR GOGGLES, DUSK MASK, GLOVES ETC., WHEN HANDLING. KEEP AWAY FROM ACIDS AS SODIUM METABISULPHITE REACTS VIGOROUSLY TO PRODUCE SULPHUR DIOXIDE.
(SEE CHEMICAL SAFETY LEAFLET AT CHAPTER EIGHT).

4.6.3. For shutdown periods of 2 hours to 3 days, this procedure uses a 0.1% w/w (1000 mg/litre) solution of Sodium Metabisulphite used as received, that is, not corrected to 100% active chemical.

4.6.4. The solution is calculated sgainst the total hold-up volume at a rate of 1 gm/litre (total hold-up volume = 1750 litres).

$$= \frac{1 \times 2100}{1000} = 2{,}1 \text{ kg}$$ 1750 1,75 42 MODULES, 2100 54 MODULES

4.6.5. For shutdown periods of 3 days to 30 days, this procedure uses a 0.25% w/w (2500 mg/litre) solution of Sodium Metabisulphite used as received, that is, not corrected to 100% chemical.

4.6.6. The solution is calculated against the total hold-up volume at a rate of 2.5 gm/litre (total hold-up volume = 1750 litres).

$$= \frac{2.5 \times 2100}{1000} = 5{,}25 \text{ kg}$$ 1750 4,5 42 MODULES. 2100 54 MODULES

4.6.7. Dissolve the Sodium Metabisulphite in water/permeate in a clean 10 litre bucket.

4.6.8. Set the Plant Control switch to 'CLEAN".
Depress the 'INITIATE' pushbutton to start the water/permeate circulating. Operate at minimum pressure.

Plant with Variable Speed HP Main Pump

Set the HP Main pump to the correct speed for this procedure.

/4.6.9.

4.6.9. Bleed air from the plant by opening V 6, V —, V . Close them when air has been expelled. Open Recycle valve (V 11).

4.6.10. Slowly add the Sodium Metabisulphite solution to the water/permeate in the CIP tank.

4.6.11. When the Sodium Metabisulphite has been thoroughly mixed through the plant adjust the FlowControl valve and bypass until the pressure at the HP Main Pump outlet is 15 bar. Start the Shroud CIP pump by setting its HAND/OFF/AUTO switch to AUTO. .

4.6.12. Continue to circulate the solution for a further 15 minutes.

4.6.13. Stop the plant. See Section 3.5.

Displacement of Sodium Metabisulphite

4.6.14. Displacement of the Sodium Metabisulphite solution is described at Section 3.1.

CHAPTER FIVE

B1 MODULE MAINTENANCE

SUBJECT	LOCATION
TOOLS REQUIRED	SECTION 5.1.
PRE-TREATMENT	SECTION 5.2.
MODULE DISMANTLING/MEMBRANE REMOVAL	SECTION 5.3.
RE-MEMBRANING/RE-ASSEMBLY	SECTION 5.4.
SHROUD CHANGING	SECTION 5.5.
ELECTRICAL	SECTION 5.6.
SUB-CONTRACTOR'S LITERATURE	SECTION 5.7.

CHAPTER FIVE

SECTION 5.6,

ELECTRICAL

Information on Electrical, General, Operation and alarms is contained in the Electrical Duty Specification overleaf.

LANDTEKNIKK

for

KOLVEREID DAIRY, NORWAY

SWEET WHEY CONCENTRATION

(Feed booster pump, main pump, tubeside CIP pump, shroudside CIP pump, hydrogen peroxide dosing pump)

ELECTRICAL DUTY SPECIFICATION

Issue:	1	2	3
Date:	4-11-82	21-12-82	21-1-83

Std: A. 1-11-82

REVISIONS

1.	4.11.82.	First Issue	
2.	21.12.82.	2.1.2. (c)	FEED BOOSTER PUMP was: FEED PUMP
			MAIN PUMP was: MAIN PISTON PUMP
			INITIATE PROCESS was: INITIATE
		3.1.7.	KW ratings and flc's added
3.	21. 1.83	2.1.1.	Panel was wall mounting
		2.1.2. (l)	4.2.1. (iv), 4.2.3. (iv), 4.3.1. -- OUTLET PRESSURE LOW ADDED
		2.1.5.	Top access was bottom access

CONTENTS

	SECTION
INTRODUCTION	1.
ELECTRICAL CONTROLS	2.
Electrical Control Panel	2.1
OPERATION	3.
General	3.1
Normal Process Operation	3.2
Permeate Sterilisation	3.3
Displacement and Cleaning (CIP)	3.4
Plant Shutdown: Normal	3.5
Plant Shutdown: Alarm	3.6
Plant Shutdown: Emergency	3.7
Pump Interlocks	3.8
Pump HAND/OFF/AUTO Switches	3.9
ALARMS	4.
General	4.1
Plant Shutdown Alarms	4.2
Alarm Contacts	4.3
CIP TANK MIXER	5.
FEED TANK & CIP TANK LEVEL SWITCHES	6.
Feed Tank: Low Level	6.1
CIP Tank	6.2
PUMPS	7.
Feed Pump	7.1
Tubeside CIP Pump	7.2
Shroudside CIP Pump	7.3
Starters	7.

1. INTRODUCTION

1.1. Sweet whey concentration - Flow Diagram, drawing No. ROP 739/1

1.2. The whey feed pump draws whey from the feed tank and delivers it to the main pump.

Cooling water is fed to the main pump via the solenoid valve, V3.

The main pump delivers the whey feed to the B1 modules. The concentrate is routed via valves V4 and V7; the permeate flows either to the CIP tank, or via valve V14 to drain. Shrouds to run full.

1.3. During normal operation there is provision for dosing hydrogen peroxide via valve V9 into the permeate through the module shrouds; the hydrogen peroxide pump runs only when the main pump and shroudside CIP pump are running.

1.4. For cleaning purposes the tubeside CIP pump draws cleaning fluid from the CIP tank and delivers it to the main pump. The hydrogen peroxide pump does not run during cleaning.

The CIP tank mixer is complete with a local starter (not supplied by PCI).

1.5. There are a number of alarms associated with the RO plant - these are detailed in Section 4.

1.6. Initially the RO plant will consist of 7 x 6 rows of modules but will increase at a later date to 9 x 6 rows; the main piston pump motor to be sized fir the increased duty - pulleys and belts to be sized for the initial duty.

1.7. The feed pumps, tubeside CIP pump and shroudside CIP pump are not in PCI's supply - see Section 7.

2. ELECTRICAL CONTROLS

2.1. Electrical Control Panel

2.1.1. The electrical control panel is to be a mild steel, free standing panel, and will contain the starter gear for the feed, RO main, tube side and shroud side CIP pumps, and hydrogen peroxide dosing pump, and control and alarm relays and timers, together with low voltage power supply unit and fuses, and numbered terminals for the external connection to the pump starters and pressure switches etc.

2.1.2. Mounted on the front of the control panel are:-

(a) Door interlocked ISOLATOR

(b) SUPPLY ON lamp, white

(c) 3 position switches: HAND-OFF-AUTO,
RUNNING lamps, green,
FAILED lamps, red,
for:-

(i) FEED BOOSTER PUMP
(ii) MAIN PUMP
(iii) TUBESIDE CIP PUMP
(iv) SHROUDSIDE CIP PUMP
(v) HYDROGEN PEROXIDE DOSING PUMP

(d) INITIATE PROCESS pushbutton.

(e) HOURS RUN meter (for main pump).

(f) 3 position PLANT CONTROL switch: PROCESS-SHUTDOWN-CLEAN

(g) 2 position PUMPS switch: MANUAL-AUTO (associated with pumps HAND-OFF-AUTO switches).

(h) 3 position PERMEATE STERILISATION switch: TIMED-OFF-CONTINUOUS

/(j) ACKNOWLEDGE

2.1.2. continued

(j) ACKNOWLEDGE pushbutton, black.

(k) RESET pushbutton, black.

(l) ALARM lamps, red, for:-

(i) INLET TEMPERATURE HIGH
(ii) INLET PRESSURE LOW
(iii) OUTLET PRESSURE HIGH
(iv) FEED TANK LEVEL LOW
(v) CIP TANK LEVEL LOW
(vi) OUTLET PRESSURE LOW

(m) EMERGENCY STOP pushbutton, red.

2.1.3. All facia engraving to be in Norwegian.

2.1.4. Starters to be Klockner Moeller. Circuit breakers to be Brown Boveri (fuses not permitted)

2.1.5. There is top access for the external connections.

The three phase supply connects directly to the isolator; motor and pressure switch etc., cables connect to individually numbered terminals.

Isolating terminals to be provided for any "foreign" supplies into the panel.

2.1.6. Audible alarm (by PCI) suitable for wall mounting.

/3. OPERATION

3. OPERATION

3.1. General

3.1.1. Electrical Supply:-

Electrical control panel: 220V, 50 Hz, 3 phases, Earth

3.1.2. Control voltage for relays, lamps and timers: 24V dc generated from transformer/rectifier in electrical control panel.

Starter operate coils to be suitable for: 48V ac

Hours run meter to be suitable for: 48V ac

Solenoid valve for cooling water to be suitable for: 220V ac

3.1.3. HAND-OFF-AUTO switches: should any HAND-OFF-AUTO switch be set to OFF at any time the associated pump stops. See also paragraph 3.8 for pump interlocks. For normal operation (PROCESS or CLEAN) the relevant switches should all be set to AUTO.

3.1.4. It must be assumed that the hand operated valves have been opened or closed, as required, for correct hydraulic operation of the plant.

3.1.5. The starting and running of the R.O. Plant is dependent on all the alarm circuits being healthy - see Section 4.

3.1.6. The SUPPLY ON lamp glows when the ISOLATOR is set to ON.

3.1.7. Electrical equipment under control:-

(i) 1 off whey feed pump, 1.1 kW direct on line start, flc 5A

(ii) 1 off main piston pump, 18.5 kW star delta start, flc 69A

(iii) 1 off tubeside CIP pump, 2.6 kW direct on line start, flc 10.5A

(iv) 1 off shroudside CIP pump, 1.1 kW direct on line start, flc 5A

/3.1.7. (v)

3.1.7. continued

(v) 1 off hydrogen peroxide dosing pump, 0.18 kW direct on line start, flc 1.04A

(vi) 1 off inlet temperature switch - high temperature -upstream of the main piston pump.

(vii) 1 off inlet pressure switch - low pressure - upstream of the main piston pump.

(viii) 1 off outlet pressure switch - high and low pressure - downstream of the main pump.

(ix) 1 off level switch - low level - in the feed tank (see Section 6.1.)

(x) 1 off level switch - low level in the CIP tank (see Section 6.2.)

(xi) 1 off solenoid valve for the cooling water for the main pump, 220V ac, 50 Hz, 10 W: energise to open.

All items, except (ix) and (x), are supplied by PCI RO Division. (Items (ix) and (x) are to be supplied by Landteknikk/Kolvereid).

3.1.8. All times mentioned in paragraphs 3.2., 3.3. and 3.5. are typical only and the associated timer should be adjustable, for instance, 15 seconds should be a 0-30 seconds timer.

3.1.9. Valve V7 is a flow control valve and is manually adjusted - there are no electrics associated with this valve.

/3.2. Normal Process Operation

3.2. Normal Process Operation

3.2.1. Set concentrate 3 way valve so that the concentrate is routed to the concentrate outlet.

3.2.2. Set the feed 3 way valve so that the feed pump is able to draw process fluid from feed tank.

3.2.3. Set the PROCESS-SHUTDOWN-CLEAN switch to PROCESS and then depress the INITIATE pushbutton. The feed pump starts and its RUNNING lamp lights. Also main piston pump cooling valve is opened.

3.2.4. 15 seconds later the main piston pump starts, and its RUNNING lamp lights.

3.2.5. The plant is now running.

3.2.6. During normal process operation the operation of the tubside CIP pump is inhibited.

3.2.7. See Section 3.3. for operation of shroudside CIP pump and hydrogen peroxide dosing pump - Permeate Sterilisation.

3.3. Permeate Sterilisation

3.3.1. Permeate sterilisation is a necessary part of normal process operation; its purpose is to destroy harmful bacteria in the shrouds of the modules - if there is no danger of harmful bacteria the STERILISATION CONTROL SWITCH should be set to OFF, and paragraphs 3.3.2. to 3.3.5. ignored.

3.3.2 Once the main piston pump has started (paragraph 3.2.4.) and the rate of flow of concentrate, (via concentrate control valve) is approximately correct, permeate will be produced and it is routed to the CIP tank: the tank starts to fill.

3.3.3. The PERMEATE STERILISATION switch would previously have been set to TIMED and thus when the main piston pump has started a 0-2 hours timer starts (typically 15-30 minutes); at the end of this time the shroudside CIP pump starts and its RUNNING lamp lights. (By this time the CIP tank should be approximately one third full of permeate).

At the same time as the shroudside CIP pump starts the hydrogen peroxide pump starts (its RUNNING lamp lights).

/3.3.4. The shroudsid.

3.3.4. The shroudside CIP pump runs continuously, but the hydrogen peroxide pump runs for a timed period, 0-1 hours (typically 10 minutes) then stops for 0-9 hours (typically 6 hours). This 10 minutes run (duration) and 6 hours stopped (interval) cycle continues until either:-

(a) the PERMEATE STERILISATION switch is set to OFF

or

(b) the PLANT CONTROL switch is set to SHUTDOWN.

At this point the shroudside CIP pump and hydrogen peroxide pump both stop - see paragraphs 3.3.6. (a) and 3.5.1.

3.3.5. If it is known that sterilisation of shroudside is to cease some hours before the end of a shift, or process cycle, the STERILISATION CONTROL switch should be set to OFF at the appropriate time, that is:

END OF SHIFT MINUS N HOURS

3.3.6. When the PERMEATE STERILISATION switch is set to:

(a) OFF - the hydrogen peroxide pump stops and the timers in paragraph 3.3.4. reset.

(b) CONTINUOUS - the shroudside CIP pump and hydrogen peroxide dosing pump both start together once the 0-2 hours timer (paragraph 3.3.3.) has timed out. The timers in paragraph 3.3.4. do not run and are ineffective.

3.3.7. During sterilisation permeate is recirculated through the shrouds and returns to the CIP tank; any excess permeate is discharged to drain via the overflow.

3.3.8. It should be noted that the TIMED position of the STERILISATION switch is effective only when the PLANT CONTROL switch is set to PROCESS.

/3.4. Displacement

3.4. Displacement and Cleaning - CIP

3.4.1. The feed three way valve is set so that the feed pump is able to draw from the CIP tank.

The CIP tank is filled with hot or cold water/permeate, as required.

The CIP tank mixer is under hand control - see Section 5.

The concentrate three way valve is positioned, as necessary, that is, coentrate outlet when product is to be displaced, and to tubeside CIP return when the tubeside is to be routed to the CIP tank.

3.4.2. When the PLANT CONTROL switch is set to CLEAN and the INITIATE pushbutton is depressed, the plant starts as detailed in paragraphs 3.2.3. and 3.2.4. Once the main piston pump has started the shroudside CIP pump starts - if it is not required to run it would previously have had its HAND-OFF-AUTO switch set to OFF.

3.4.3. At the end of each stage of the cleaning cycle the PLANT CONTROL switch is set to SHUTDOWN - see paragraph 3.5.1.

3.4.4. The hydrogen peroxide dosing pump does not run during displacement or cleaning.

3.4.5. For cleaning purposes the chemicals are put directly into the CIP tank.

3.5. Plant Shutdown: Normal

3.5.1. When the PLANT CONTROL switch is shifted to SHUTDOWN (from either PROCESS or CLEAN) the shroudside CIP pump and dosing pump stop immediately; their RUNNING lamps are extinguished.

15 seconds later the main piston pump stops (its RUNNING lamp is extinguished), and 15 seconds after that the feed pump stops (its RUNNING lamp is extinguished).

3.5.2. The concentrate flow control valve should remain open.

/3.6. Plant Shutdown: Alarm

3.6. Plant Shutdown: Alarm

3.6.1. Should any of the alarms detailed in paragraphs 4.2.1. and 4.2.2. be initiated all the pumps stop immediately, without any delays. All the timers automatically reset.

3.6.2. As soon as possible after the stoppage has occurred the concentrate flow control valve should be fully opened.

3.7. Plant Shutdown - Emergency

3.7.1. When the EMERGENCY STOP pushbutton is depressed all the pumps stop immediately, without any delays; all the timers reset automatically.

The concentrate valve operation should be fully opened.

3.7.2. It should be emphasised that this emergency shutdown procedure should not be adopted as the normal shutdown procedure.

/3.8. Pump Interlocks

3.8. Pump Interlocks - PLANT CONTROL switch set to PROCESS or CLEAN

3.8.1. Feed pump - runs when PLANT CONTROL switch is set to PROCESS only, and the INITIATE pushbutton has been depressed.

3.8.2. Main piston pump - runs when feed pump or tubeside CIP pump has started.

3.8.3. Tubeside CIP pump - runs when the PLANT CONTROL switch is set to CLEAN only, and the INITIATE pushbutton has been depressed.

3.8.4. Shroudside CIP pump - runs only when either the:

(a) PLANT CONTROL switch is set to CLEAN and the main piston pump is running.

or

(b) PLANT CONTROL switch is set to PROCESS, and PERMEATE STERILISATION switch is set to TIMED or CONTINUOUS - see also paragraph 3.3.3. for two hour timer - and the main piston pump is running.

3.8.5. Hydrogen peroxide dosing pump - runs only when the :

Shroudside CIP pump is running and PLANT CONTROL switch is set to PROCESS, and PERMEATE STERILISATION switch is set to TIMED or CONTINUOUS - see paragraph 3.3.4. for duration and interval timers.

/3.9. Pump HAND-OFF-AUTO

3.9. Pump HAND-OFF-AUTO Switches set to OFF

3.9.1. Feed pump - stops all pumps (when PLANT CONTROL switch is set to PROCESS).

3.9.2. Main piston pump - stops that pump together with the shroudside CIP pump and dosing pump.

3.9.3. Tubeside CIP pump - stops all pumps (when PLANT CONTROL switch is set to CLEAN).

3.9.4. Shroudside CIP pump - stops that pump and:-

(a) if PLANT CONTROL switch is set to PROCESS, stops hydrogen peroxide dosing pump also.

or

(b) if PLANT CONTROL switch is set to CLEAN that pump only.

3.9.5. Hydrogen peroxide dosing pump - stops only that pump.

/4. ALARMS

4. ALARMS

4.1. General

4.1.1. When an alarm is initiated the appropriate ALARM lamp lights, all the pumps stop immediately and the audible alarm sounds; depress the ACKNOWLEDGE pushbutton to silence the audible alarm.

4.1.2. When the fault has been rectified, it is necessary to press the RESET ALARM pushbutton; this then re-sets the alarm circuits and allows the plant to be re-started.

4.2. Plant Shutdown Alarms

4.2.1.
(i) INLET PRESSURE LOW
(ii) INLET TEMPERATURE HIGH
(iii) OUTLET PRESSURE HIGH
(iv) OUTLET PRESSURE LOW

(v) PUMP OVERLOADS
- (a) Feed pump
- (b) Main piston pump
- (c) Tubeside CIP pump
- (d) Shroudside CIP pump
- (e) Hydrogen peroxide dosing pump

(vi) FEED TANK LEVEL LOW
(vii) CIP TANK LEVEL LOW: see paragraph 4.2.2. below.

4.2.2. When the PLANT CONTROL switch is set to CLEAN then should a CIP TANK LEVEL LOW alarm be initiated all the pumps stop immediately. If the switch is set to PROCESS then the CIP TANK LEVEL LOW alarm stops only the shroudside CIP pump and hydrogen peroxide dosing pump.

4.2.3. Alarms 4.2.1. (ii), (iii) and (v) are allowed at all times - any one being initiated causes all the pumps to stop immediately.

/4.2.3. Alarms 4.2.1.

4.2.3. continued

Alarms 4.2.1. (i), (iv), (vi), (vii) are overridden at certain times, but when the override has been removed then, should that alarm be initiated, all the pumps stop immediately:-

(i) INLET PRESSURE LOW - overridden when the main piston pump is not running.

(iv) OUTLET PRESSURE LOW - overridden when the main piston pump is not running, and also for a period (0-30 seconds) following the start of the main piston pump.

(vi) FEED TANK LEVEL LOW - overridden when PLANT CONTROL switch is set to SHUTDOWN or CLEAN.

(vii) CIP TANK LEVEL LOW - overridden:-

(a) when the PLANT CONTROL switch is set to SHUTDOWN.

(b) when the PLANT CONTROL switch is set to PROCESS and the PERMEATE STERILISATION switch is set to OFF.

(c) when the PLANT CONTROL switch is set to PROCESS and prior to the expiration of the time set on the 0-2 hours timer referred to in paragraph 3.3.3.

(d) see also paragraph 4.2.2.

4.3. Alarm Contacts

4.3.1. The contacts of the alarms detailed in paragraph 4.2.1. (i), (ii), (iii), (iv), (vi), (vii), are closed under normal conditions, and open should the temperature, pressure etc., drift outside the pre-set limit; even a broken wire or loose connection will initiate an alarm.

4.3.2. Motor starter overloads detailed in paragraph 4.2.1. (v) are each equipped with a normally closed contact which opens should a motor overload condition occur; this contact is connected to the PCI alarm circuit.

/5. CIP TANK MIXER

5. CIP TANK MIXER

5.1. PCI are not responsible for the mixer in the CIP tank, nor the associated starter.

It is recommended that the starter is mounted on a wall close to the mixer - it is then convenient for the operator to start and stop the mixer (by means of the START and STOP pushbuttons) local to the CIP tank as the various cleaning chemicals are put into the tank.

6. FEED TANK & CIP TANK LEVEL SWITCHES

6.1. Feed Tank: Low Level

6.1.1. PCI are not responsible for the low level switch in the feed tank; it is necessary for the FEED TANK LEVEL LOW alarm - paragraphs 2.1.2 (iv) and 4.2.1. (v).

6.1.2. Below low level the switch contact is to open; above the low level point the contact is to close.

6.1.3. The contact may be a float switch or relay associated with level probes; it must be suitable for an inductive load, 24V dc, 200mA.

6.2. CIP TANK

6.2.1. A low level switch is required for the CIP TANK LEVEL LOW alarm. As with the feed tank, in Section 6.1. above, PCI are not responsible for the switch (float switch or level probes); the switch, to be open below low level and closed above low level, must be suitable for an inductive load, 24V dc, 200mA.

6.2.2. If automatic control of the hot/cold water supply is required, level probes - earth, high and intermediate level (to give "differential" switching) - are recommended. The level probes and associated control unit are not in PCI's supply.

/7. PUMPS

7. PUMPS

7.1. Feed Pump - not supplied by PCI.

7.2. Tubeside CIP Pump - not supplied by PCI.

7.3. Shroudside CIP Pump - not supplied by PCI.

7.4. PCI will advise Landteknikk/Kolvereid of the above duties, and in their turn Landteknikk/Kolvereid are to advise PCI of the kilowatt ratings and full load current, so that PCI are able to provide the correct size starters.

It is assumed that the above 3 off pump motors will all be suitable for 380V, 50Hz, 3 phase supply, direct on line start.

The main piston pump and hydrogen peroxide dosing pump (and the associated starters) are in PCI supply.

CHAPTER FIVE

SECTION 5.7.

SUB-CONTRACTORS' LITERATURE

R.O. Main Pump	-	Rannie Model 63 - 50 (LP)
Hypochlorite Dosing Set	-	Precision Model R409
Flowmeters	-	Fischer & Porter Model 10A 3500/3600 Flowrator
Pressure Control Valve	-	IV Pressure Controls
Centrifugal pumps	-	ALFA LAVAL.

ALFA-LAVAL

INSTRUKTION OCH DELFÖRTECKNING FÖR CENTRIFUGALPUMP TYP FM-0

Nr IM 70223-S2
Reg. 37235
8003

F M - 0
C E N T R I F U G A L P U M P A R

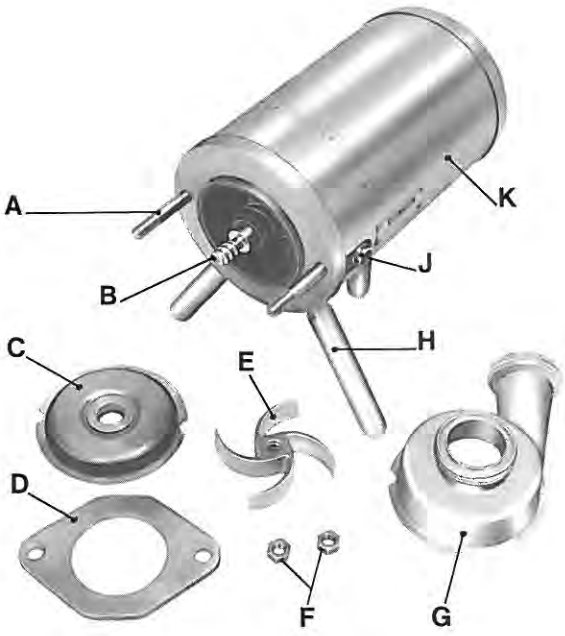
ANVÄNDNING

Centrifugalpump FM-0 är lämpad för användning inom livsmedels-, kemiska och andra industrier, där syrafast rostfritt stål är resistent mot förekommande vätskor.

Pumpen är försedd med ett pumphjul som tillsammans med pumphuset ger en effektiv pumpning och skonsam behandling av vätskan.

PUMPPRINCIP

Vätskan leds via frontanslutningen in i centrum av det roterande pumphjulet. De bakåtböjda skovlarna på pumphjulet sätter vätskan i rotation.
Centrifugalkraften gör att vätskan lämnar pumphjulet med större tryck och hastighet än den hade vid inloppet och slungas ut mot periferin, varifrån den trycks ut genom utloppet (toppanslutningen).



ALLMÄNT

En rätt vald centriufgalpump är driftsäker och fordrar jämförelsevis ringa skötsel.

För att få ett gott driftsresultat är det emellertid viktigt att pumpen monteras och sköts enligt anvisningarna i denna instruktion.

Pumpguide

Vi hänvisar även till ALFA-LAVAL's Pumpguide där en fyllig information ges beträffande val, drift, skötsel, installation mm av pumpar.

Pumpguiden kan om så önskas beställas från ALFA-LAVAL AB.
Beställningsnummer: PM 60472

A Pinnskruv
B Pumpaxel
C Bakplåt med pumphuspackning
D Ok
E Pumphjul
F Muttrar för ok
G Pumphus
H Ben
J Elektrisk uttagslåda
K Kåpa

UPPSTÄLLNING

Pumpen levereras som en färdig enhet och ingen uppriktning är nödvändig.

Pumpen skall ställas upp på ett sådant sätt att den blir åtkomlig för tillsyn och skötsel. Se till att det finns tillräckligt med utrymme för demontering och montering och ta hänsyn till förläggningen av rörledningarna.

RÖRSYSTEM

Sug- respektive tryckledningar skall ha minst samma diameter som respektive anslutning. Rörkrökarna bör vara så få som möjligt och ha stor radie.
Tätheten hos sugledningen bör kontrolleras genom provtryckning.

Vid avvikelse, t ex p g a kapacitet, viskositet, vätskehastighet etc bör koniska övergångar användas. Vid övergång från större sugledning anslutes med excentriskt övergångsstycke med den raka sidan uppåt.

RÖRLEDNINGAR - ANSLUTNING

Pumpen skall monteras så att vätskan leds in i frontanslutningen (sugsidan) och ut i toppanslutningen (trycksidan).

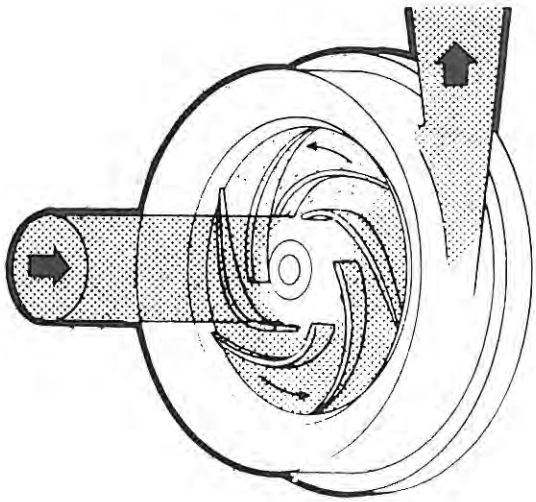
PUMPEN SKALL MONTERAS SÅ ATT DEN INTE SUGER LUFT!

Rörledningarna skall ha sådan passning till pumpens in- och utlopp att inga drag- eller tryckspänningar överförs till pumphuset vid åtdragning av anslutningarna.

Rörledningarna skall vara monterade och fastsatta på ett sådant sätt att rören inte förorsakar spänningar i pumphuset vid värmeutvidgning.

Pumpen kan deformeras t ex vid för stora vibrationer, vid värmeutvidgning av långa raka rör, vid svetsning nära pumpen, eller vid onormal belastning t ex genom att någon ställer sig på en rörledning.

ALFA-LAVAL SVARAR INTE FÖR DE FÖLJDER SOM ORSAKAS AV OTILLFREDSSTÄLLANDE MONTERING GJORD AV KUNDEN.



MOTORER

Motorerna levereras normalt för 220/380 V, 50Hz, trefas växelström.

Övriga spänningar och 60 Hz motorer leveraras på speciell beställning.

Nätanslutning

Motorn jämte erforderliga startapparater, motorskydd etc skall anslutas av elektriker till nätet.

KONTROLL FÖRE START

1 Kontrollera att pumphuset är rätt monterat och åtdraget.

FEL MONTERING KAN FÖRORSAKA ALLVARLIGA OLYCKOR!

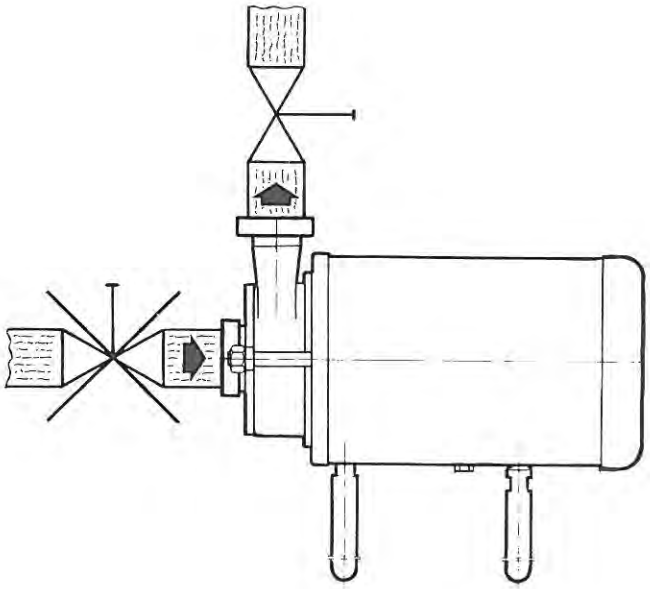
2 Kontrollera att pumphjulet roterar åt rätt håll - moturs, sett från inloppet - genom en så kort start som möjligt av motorn.

KÖR INTE PUMPEN MED FEL ROTATIONSRIKTING DEN KAN DÅ TA SKADA!

VIKTIGT!

KONTROLLERA ROTATIONSRIKTNINGEN MED AVTAGET PUMPHJUL.

START

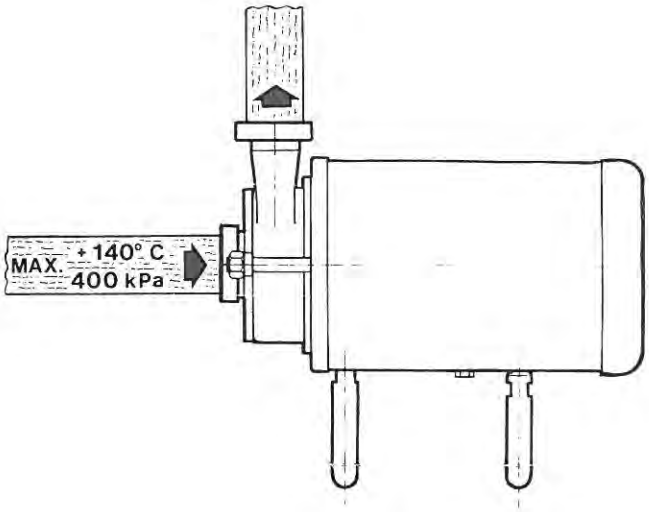


STRYP ALDRIG PÅ PUMPENS INLOPPSSIDA.
REGLERING AV PUMPEN SKALL ALLTID SKE MED STRYPNING PÅ UTLOPPSSIDAN, GENOM NEDSVARVNING AV PUMPHJULETS DIAMETER, ELLER MED VARVTALSREGLERING.

VÄTSKETEMPERATURER

Pumpen kan användas för vätsketemperaturer upp till +140°C. Vid temperaturer över +110°C rekommenderas dubbel axeltätning med vattenkylning.
Är pumpen försedd med nitrilpackningar bör temperaturen inte överstiga +100°C eftersom packningarna då åldras snabbt.

PUMPEN BÖR INTE KÖRAS TORR UNDER LÄNGRE TID, DÅ AXELTÄTNINGEN SNABBT SLITS NER.



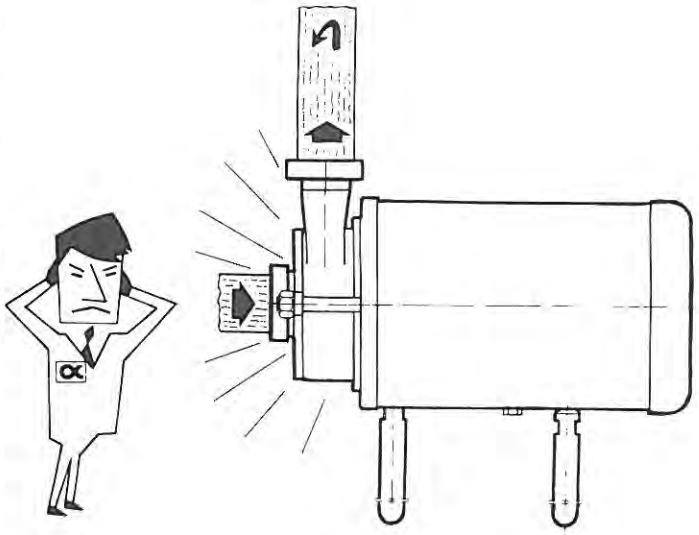
INLOPPSTRYCK

Max inloppstryck: 400 kPa (4 bar).

KAVITATION

Risk finns för att pumpen kaviterar om den arbetar med alltför lågt inloppstryck, och speciellt om vätsketemperaturen är hög.

ALFA-LAVAL's pumpar är tillverkade av syrafast rostfritt stål och därför innebär kavitationen ingen risk för erosion. Däremot minskar pumpens uppfordringshöjd, som kan gå ner till noll vid kraftig kavitation. Pumpens ljudnivå ökar betydligt (knastrande ljud) vid kavitation och lagren slits snabbare.



DEMONTERING OCH MONTERING

AXELTÄTNING - ENKEL

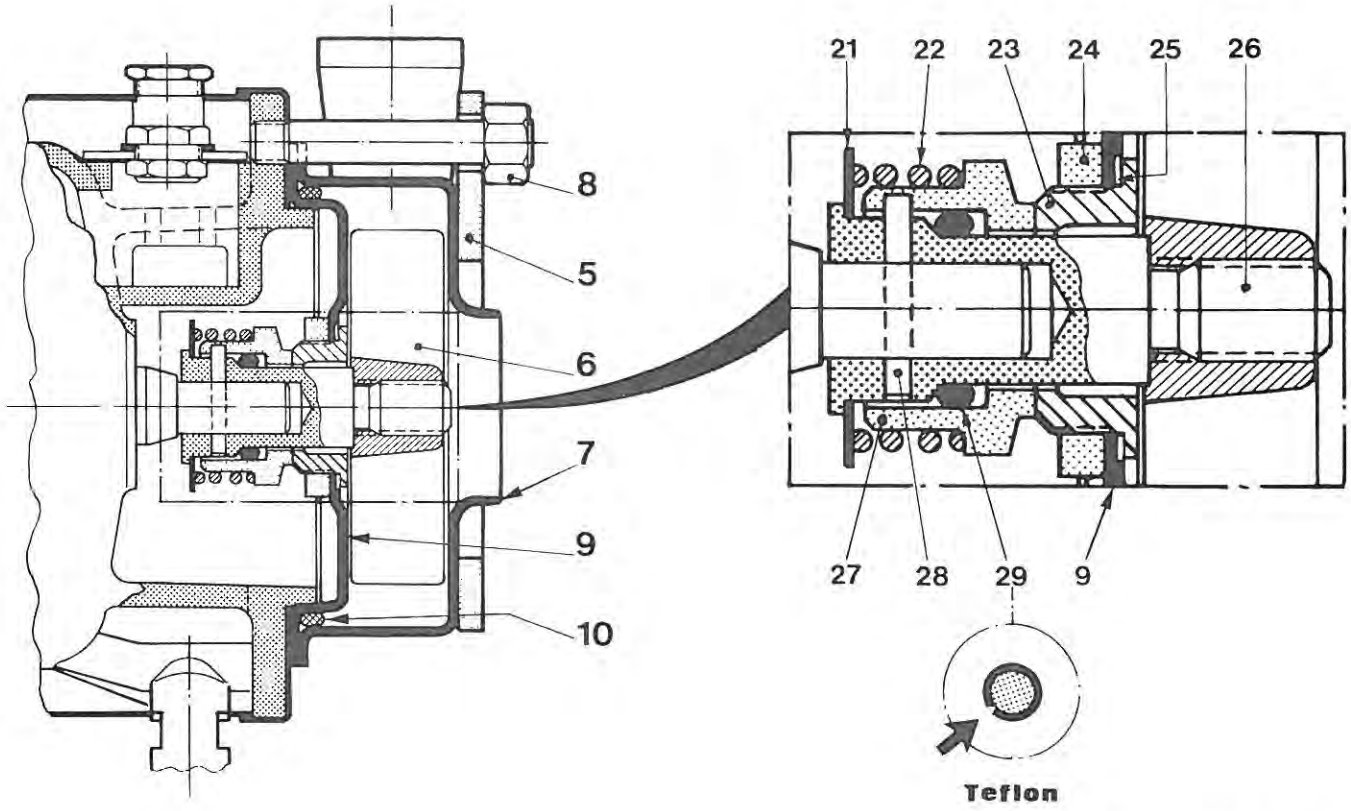


Fig. 1

DEMONTERING
(Siffrorna hänvisar till fig 1)

Vid isärtagning av pumpen, vid byte av delar i axeltätningen samt vid motorbyte förfares på följande sätt:

1 Skruva av muttrarna 8 och tag bort oket 5, pumphuset 7 och pumphuspackningen 10.

Om pumphuset sitter fast:
Slå lätt på utloppet med en gummiklubba.

2 Lossa pumphjulet 6 från axeln genom att vrida det moturs.

Om pumphjulet sitter hårt:
Slå ett par lätta slag med en gummiklubba.

3 Drag ut bakplåten 9 varvid hela axeltätningen blir åtkomlig för inspektion eler byte.

4 Skruva av muttern 24 och tag bort tätningsringen 23 och packningen 25 från bakplåten. (Muttern är vänstergängad och skall lossas medurs.)

5 Drag av resterande tätningsdetaljer från axeln.

6 Tag bort pinnen 28 och drag av avkastaren 21 och pumpaxeln 26.

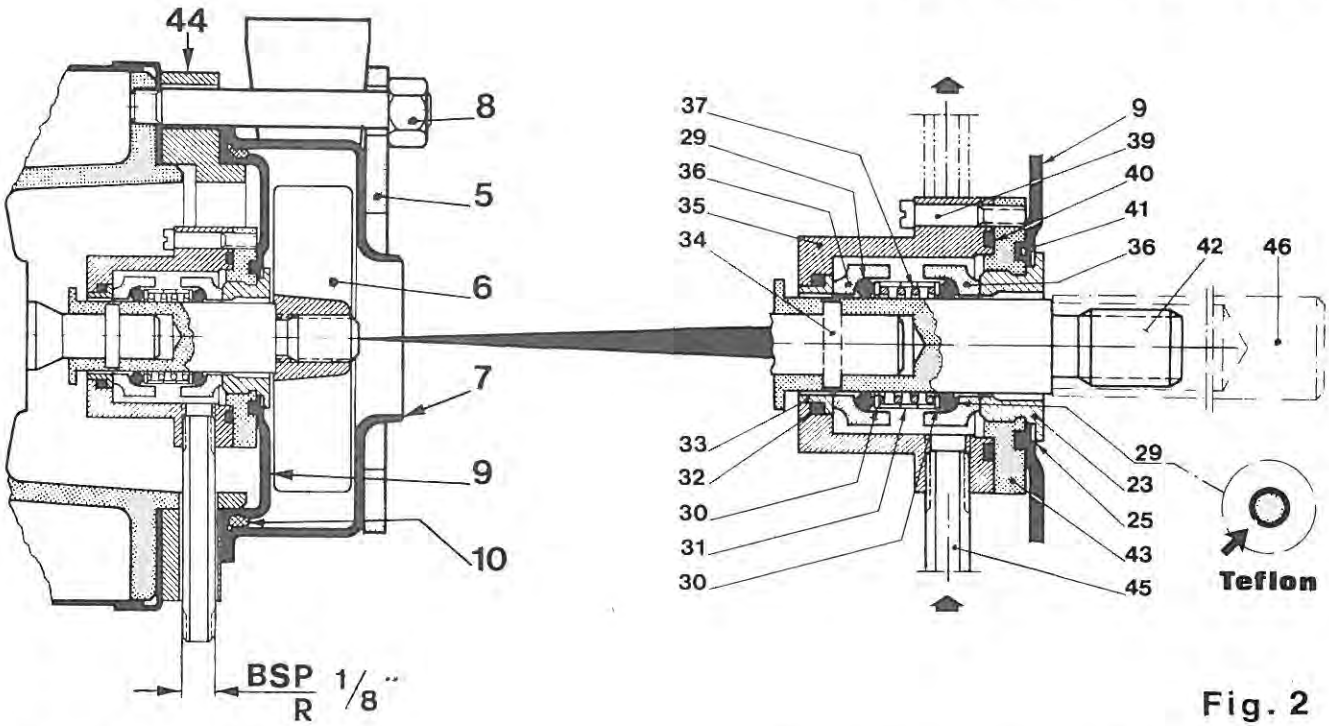


Fig. 2

TÄTNINGSVATTEN RESP ÅNGA

Vatten

Regleringen av vattnet skall alltid ske på inloppsröret till tätningen. Vatten utan föroreningar skall användas.

Vattenåtgång: ca 0,5 - 1 l/min
Vattentryck: max 50 kPa (0,5 bar)

OVAN ANGIVNA VATTENTRYCK FÅR INTE ÖVERSKRIDAS!

Ånga

Regleringen av ångmängden skall alltid ske på inloppsröret till tätningen. Ångtrycket får inte överstiga atmosfärstrycket, alltså motsvarande en temperatur av 100°C. Vid högre tryck kan ångan bli torr, varvid tätningen slits snabbt.

DEMONTERING
(Siffrorna hänvisar till figur 2)

Vid isärtagning av pumpen, vid byte av delar i axeltätningen, samt vid motorbyte förfares på följande sätt:

1 Skruva av muttrarna 8 och tag bort oket 5, pumphuset 7 och pumphuspackningen 10.

Om pumphuset sitter hårt:
Slå ett par lätta slag med en gummiklubba.

2 Lossa pumphjulet 6 från axeln genom att vrida det moturs.

Om pumphjulet sitter hårt:
Slå ett par lätta slag med en gummiklubba inne vid navet.

3 Drag ut bakplåten 9 varvid hela den dubbla axeltätningen och mellanflänsen 44 följer med ut.

4 Tag bort rören 45 till tätningen.

5 Lossa tätningshuset 35 från bakplåten 9 genom att gänga av det vid fästbrickan 43. (Fästbrickan lossans medurs.) Tag bort tätningsringen 23 och packningen 25 från bakplåten.

6 Skruva av skruvarna 39 varefter alla tätningsdetaljerna blir åtkomliga för inspektion eller byte.

7 Tag bort pinnen 34 och drag av pumpaxel 42.

ALFA-LAVAL

DELFÖRTECKNING

BESTÄLLNING AV RESERVDELAR

Vid beställning av reservdelar skall följande alltid anges:

- Pumptyp
- Tillverkningsnummer
- Detaljens benämning
- Antal
- Fullständigt detaljnummer

För motorreservdelar skall även anges:

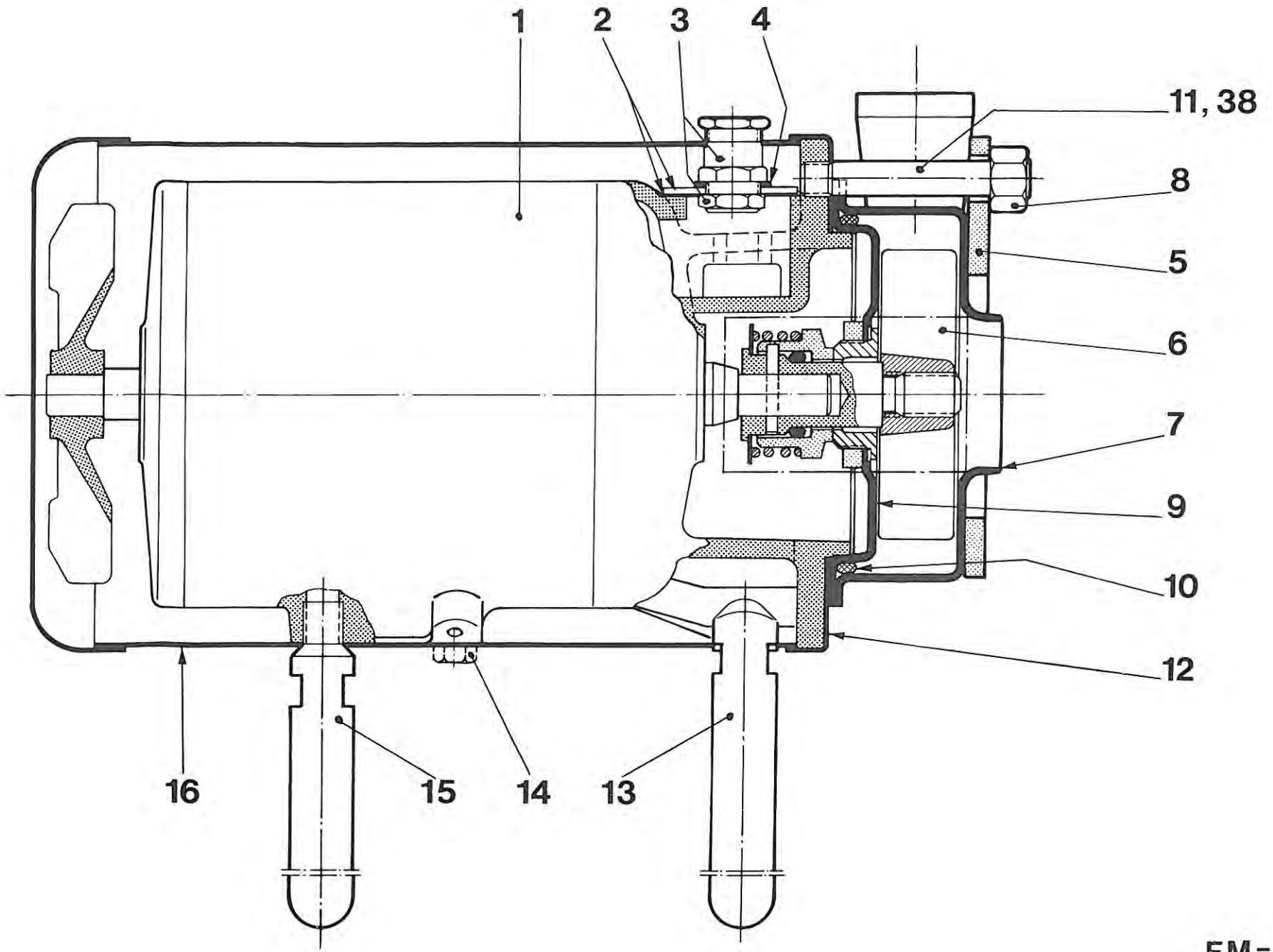
- Motorfabrikat
- Motornummer
- Motorns typbeteckning och andra data som framgår av motorskylten

Av praktiska skäl är inga motordetaljer specificerade i delförteckningen, varför tydlig beskrivning skall anges vid beställning av sådana detaljer.

Om så är möjligt; ange även nummer, beteckning etc som finns på den defekta detaljen.

DELFÖRTECKNING FÖR CENTRIFUGALPUMP TYP FM-0

Nr SP 70223-S2
Reg. 37235
8003



FM-0

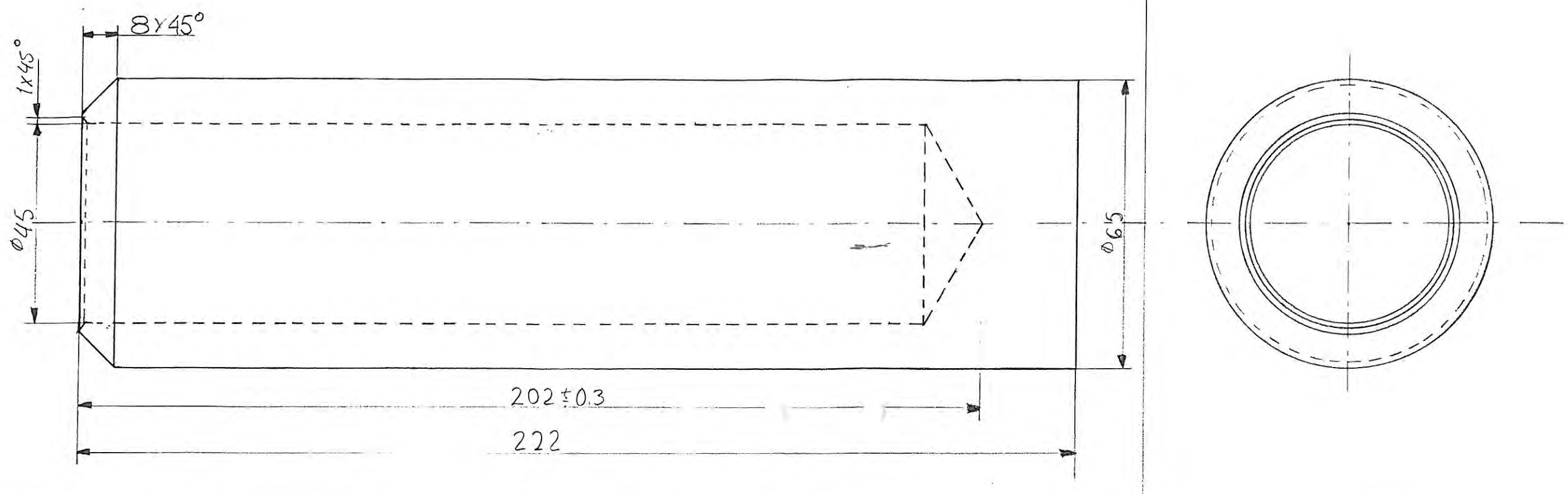
DETALJER VID ENKEL AXELTÄTNING

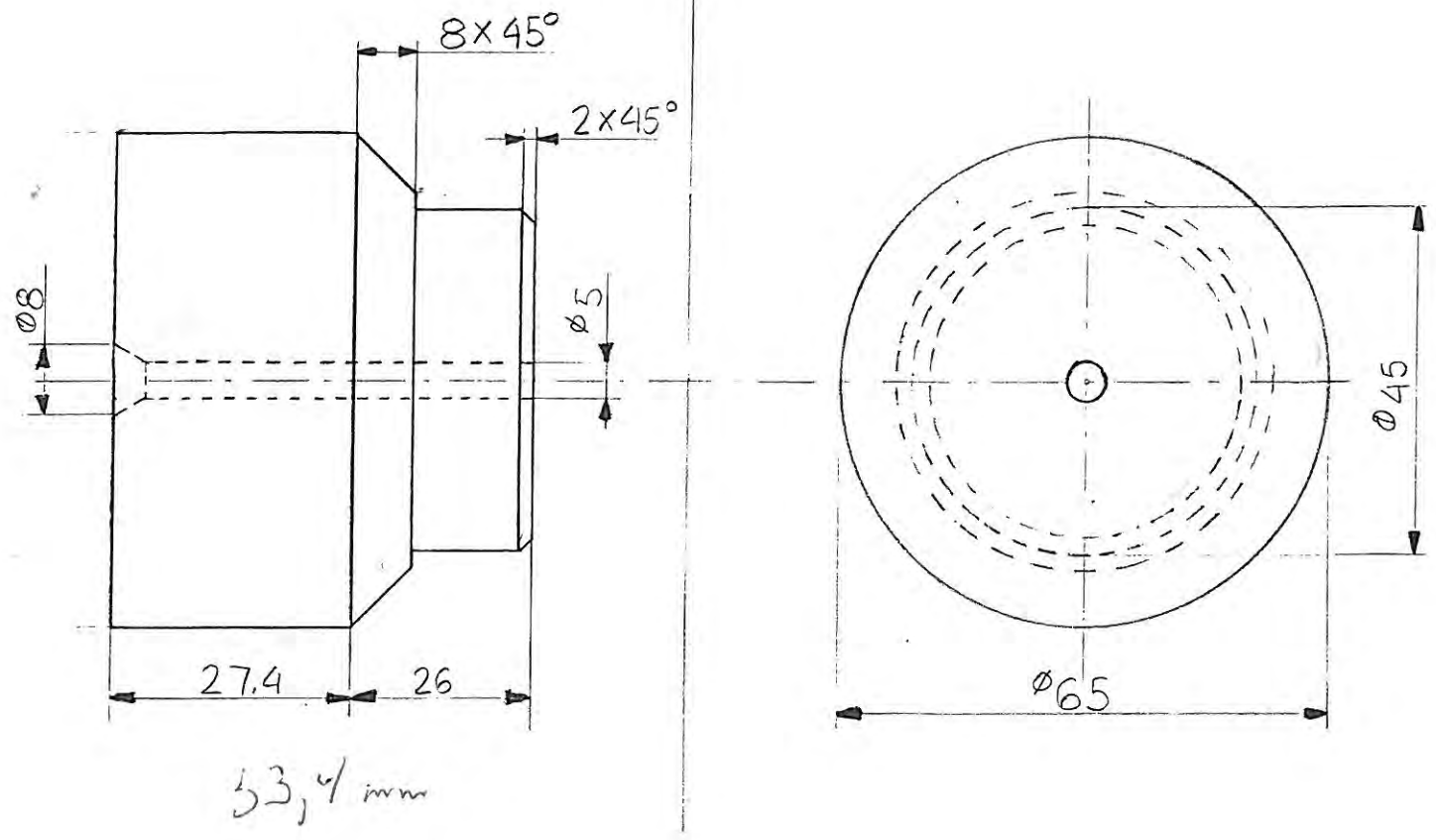
Pos	Antal	Benämning	Alfa-Laval Detaljnummer
11	2	Pinnskruv	31457-0051-1
21	1	Avkastare	31457-0025-1
24	1	Mutter	31437-0120-1
26	1	Pumpaxel, FM-O och FM-OM	31457-0015-1
	1	Pumpaxel, FM-OS och FMI-O	31457-0064-1
28	1	Fjädrande rörpinne	260313-47
		Tätningssats Nitril (standard), komplett	31439-0164-1
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Nitril	31437-0121-1
27	1	Tätningsring, roterande	31439-0165-1
29	1	O-ring, Nitril	31439-0168-1
		Tätningssats, EPDM, komplett	31439-0164-4
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31437-0165-1
29	1	O-ring, EPDM	31439-0168-4
		Tätningssats Viton, komplett	31439-0164-5
22	1	Fjäder	31458-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31437-0165-1
29	1	O-ring, Viton	31439-0168-5
		Tätningssats Teflon, komplett	31439-0164-3
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31439-0165-1
29	1	O-ring, Teflon	31439-0168-3
		Alternativa tätningsringar	
27	1	Tätningsring, roterande, av Rulon	31439-0165-2
		Vid slitande vätskor	
23	1	Tätningsring, stationär, kromoxidbelagd	31437-0210-1
27*	1	Tätningsring, roterande, kromoxidbelagd	31439-0183-1

LÄMPLIGA RESERVDELAR

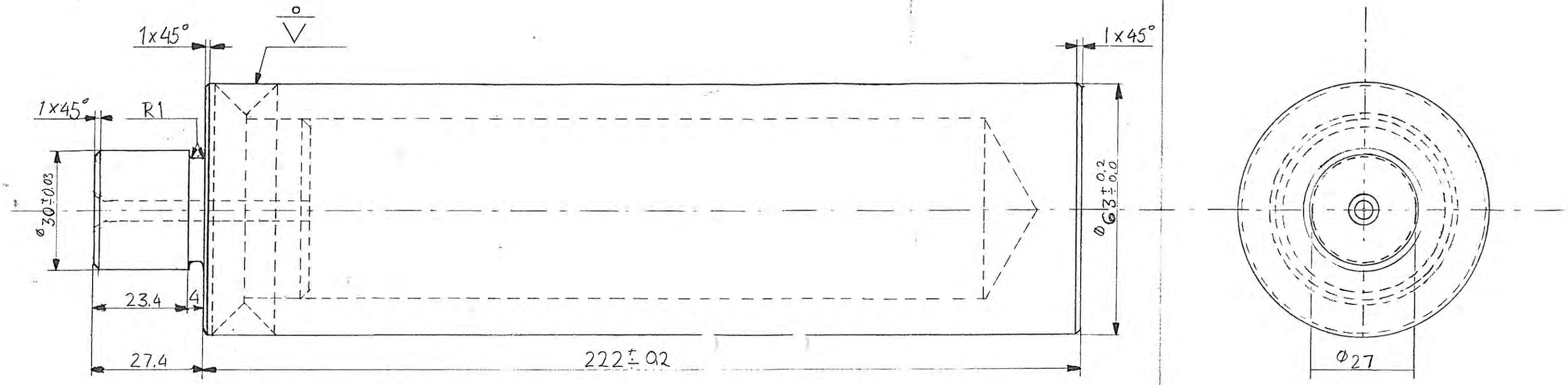
Kompletta tätningssatser

* Den kromoxidbelagda roterande tätningsringen får inte användas tillsammans med en stationär tätningsring av rostfritt stål.





53,4 mm



K.D

SANITARY PULSATION DAMPENER

ASSEMBLY, INSTALLATION AND OPERATING INSTRUCTIONS

AMINE YOUR SHIPMENT. ANY
FILED WITH THE CARRIER

TS ON THE FOUR INCH CLAMP
-INCH GASKET (ITEM 2). THE
O THE SCREEN (ITEM 5)

M. IF IT CONTAINS A VALVE
TH A TIRE VALVE WRENCH
WAS USED ONLY FOR TESTING
FACTURE). INSERT THE VALVE
THE FOUR INCH ADAPTER
ING (ITEM 9) IN THE GROOVE
R. WRAP THE STEM THREADS
O THE THREADS WITH A
CREW THE ADAPTER (ITEM 8)
UG IT UP AGAINST THE
TIGHTEN BECAUSE THE
MAGED. PLACE THE SHOCK
ITEM 7) ON THE SHOCK
(ITEM 6) AND SCREW THE
R. DO NOT OVERTIGHTEN

. PLACE THE FOUR INCH
RRULE, INSERT THE DAMP
HE HOUSING AND CENTER
E GASKET GROOVE. INSERT
THE SCREEN AND POSITION
FERRULE. ASSEMBLE THE
THIS IS A TIGHT FIT AND MAY
AP ON EACH FERRULE HALF
R SEATING. ASSEMBLE THE
EN.

INSTALLATION

THE DAMPENER ASSEMBLY SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO THE DISCHARGE OF THE HOMOGENIZER OR PUMP. THE PRODUCT FLOW SHOULD ENTER THE CLAMP TYPE FITTING LOCATED AT THE END OF THE DAMPENER HOUSING, OPPOSITE THE AIR VALVE.

CAUTION: WHEN USED WITH PRODUCT LINE PRESSURES IN EXCESS OF 200 PSIG, A TRI CLOVER 13 MHP HIGH-PRESSURE CLAMP *MUST* BE USED. DO NOT USE HIGH-PRESSURE CLAMPS OF OTHER MANUFACTURE AS THEY ARE NOT COMPATIBLE WITH THE DAMPENER FERRULES, AND SERIOUS DAMAGE OR INJURY COULD RESULT.

WARNING

DO NOT EXCEED 800 PSIG LINE PRESSURE UNDER ANY CONDITIONS.

OPERATION

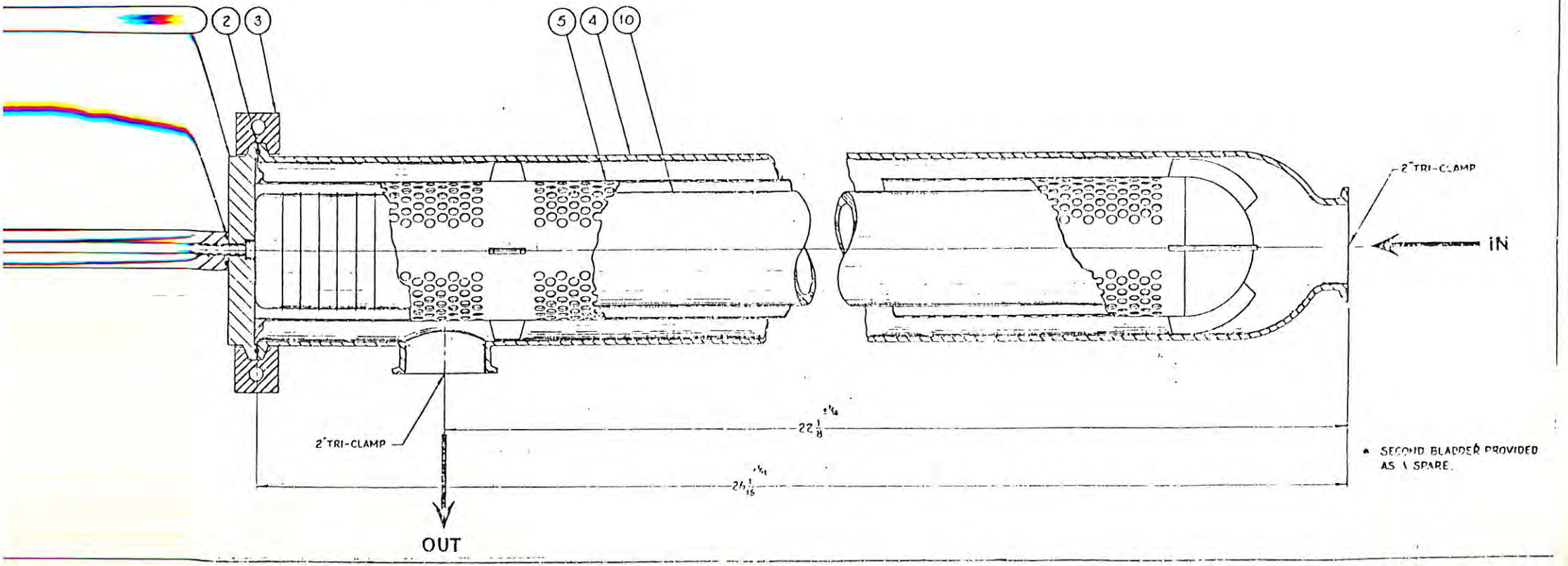
1. INSTALL AN AIR LINE WITH A PRESSURE REDUCING VALVE AND A TIRE INFLATING CHUCK (AVAILABLE AT AUTO SUPPLY STORES) IN CLOSE PROXIMITY TO THE DAMPENER LOCATION.
2. USING SHOP AIR, CHARGE THE BLADDER TO 100 PSI OR THE MAXIMUM SHOP AIR PRESSURE AVAILABLE. DO NOT EXCEED 100 PSI MAXIMUM.
3. START THE SYSTEM ON WATER IN THE NORMAL OPERATING MODE. BLEED AIR FROM THE BLADDER UNTIL THE LINES STOP VIBRATING USING A TRUCK TIRE GAUGE, READ THE BLADDER PRESSURE. SET THE AIR PRESSURE REGULATOR TO THIS VALUE.
4. USING THE TIRE INFLATING CHUCK, CHARGE THE BLADDER DAILY, PRIOR TO STARTING THE HOMOGENIZER OR PUMP.

CAUTION: DO NOT CONNECT A PERMANENT AIR LINE TO THE DAMPENER, OR ATTEMPT TO CHECK THE PRESSURE DURING OPERATION. THE BLADDER PRESSURE DURING OPERATION WILL BE THE SAME AS THE BACK PRESSURE IN THE SYSTEM.

DISASSEMBLY

TO PREVENT INJURY, RELEASE ALL AIR PRESSURE FROM THE BLADDER BEFORE DISASSEMBLING THE UNIT. THEN, PROCEED IN THE REVERSE ORDER SHOWN IN THE ASSEMBLY INSTRUCTIONS.

ITEM	REQ'D	PART NO	DESCRIPTION
	1	899625	DAMPENER HOUSING ASSY
1	1	899624	ADAPTER PLATE
2	1	899648	CLAMP GASKET
3	1	899239	CLAMP SUB-ASSY.
4	1	899626	DAMPENER HOUSING
5	1	899622	DAMPENER SCREEN
6	1	899643	SHOCK ABSORBER VALVE ASSY
7	1	801693	SHOCK ABSORBER VALVE O-RING
8	1	899644	ADAPTER
9	1	801680	ADAPTER O-RING
10	2 *	899647	BLADDER



* SECOND BLADDER PROVIDED AS A SPARE.

SANITARY PULSATION DAMPENER

ASSEMBLY, INSTALLATION AND OPERATING INSTRUCTIONS

ASSEMBLY

1. CAREFULLY UNPACK AND EXAMINE YOUR SHIPMENT. ANY DAMAGE CLAIMS SHOULD BE FILED WITH THE CARRIER.
2. REMOVE THE NUTS AND BOLTS ON THE FOUR INCH CLAMP (ITEM 3). REMOVE THE FOUR INCH GASKET (ITEM 2), THE ADAPTER PLATE (ITEM 1) AND THE SCREEN (ITEM 5).
3. EXAMINE THE BLADDER STEM. IF IT CONTAINS A VALVE CORE, REMOVE THE CORE WITH A TIRE VALVE WRENCH AND DISCARD IT (THE CORE WAS USED ONLY FOR TESTING THE BLADDER AFTER MANUFACTURE). INSERT THE VALVE STEM THROUGH THE HOLE IN THE FOUR INCH ADAPTER PLATE AND PLACE THE O-RING (ITEM 9) IN THE GROOVE MACHINED INTO THE ADAPTER. WRAP THE STEM THREADS WITH TEFLON TAPE, OR COVER THE THREADS WITH A GOOD QUALITY PIPE DOPE. SCREW THE ADAPTER (ITEM 8) OVER THE THREADS, AND SNUG IT UP AGAINST THE ADAPTER PLATE. DO NOT OVERTIGHTEN BECAUSE THE O-RING COULD BECOME DAMAGED. PLACE THE SHOCK ABSORBER VALVE O-RING (ITEM 7) ON THE SHOCK ABSORBER VALVE ASSEMBLY (ITEM 6) AND SCREW THE ASSEMBLY INTO THE ADAPTER. DO NOT OVERTIGHTEN.
4. STAND THE HOUSING ON END, PLACE THE FOUR INCH GASKET ON THE HOUSING FERRULE, INSERT THE DAMPENER SCREEN (ITEM 5) INTO THE HOUSING AND CENTER THE SUPPORTING RING IN THE GASKET GROOVE. INSERT THE BLADDER (ITEM 10) INTO THE SCREEN AND POSITION THE ADAPTER PLATE IN THE FERRULE. ASSEMBLE THE CLAMP OVER THE FERRULE. THIS IS A TIGHT FIT AND MAY REQUIRE A LIGHT HAMMER TAP ON EACH FERRULE HALF IN ORDER TO ATTAIN PROPER SEATING. ASSEMBLE THE BOLTS AND NUTS, AND TIGHTEN.

INSTALLATION

THE DAMPENER ASSEMBLY SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO THE DISCHARGE OF THE HOMOGENIZER OR PUMP. THE PRODUCT FLOW SHOULD ENTER THE CLAMP TYPE FITTING LOCATED AT THE END OF THE DAMPENER HOUSING OPPOSITE THE AIR VALVE.

CAUTION: WHEN USED WITH PRODUCT LINE PRESSURES IN EXCESS OF 200 PSIG, A TRI-CLOVER 13 MHP HIGH PRESSURE CLAMP *MUST* BE USED. DO NOT USE HIGH PRESSURE CLAMPS OF OTHER MANUFACTURE AS THEY ARE NOT COMPATIBLE WITH THE DAMPENER FERRULES, AND SERIOUS DAMAGE OR INJURY COULD RESULT.

WARNING

DO NOT EXCEED 400 PSIG LINE PRESSURE UNDER ANY CONDITIONS.

OPERATION

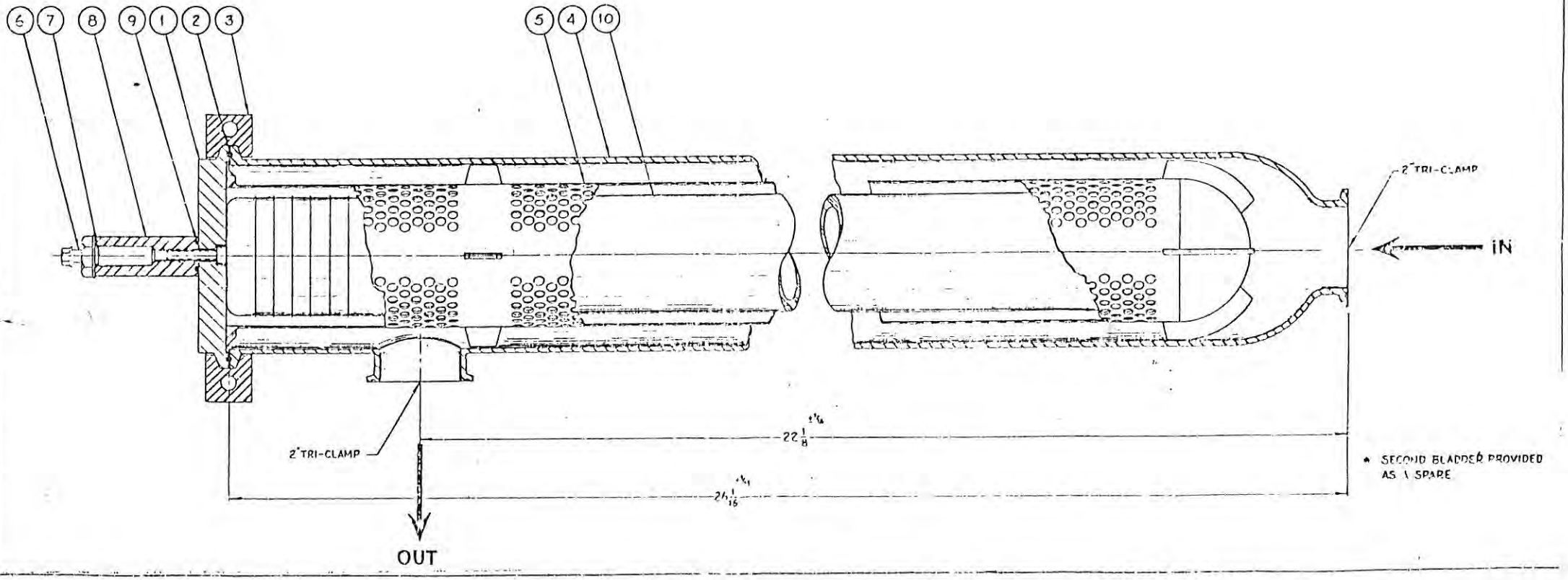
1. INSTALL AN AIR LINE WITH A PRESSURE REDUCING VALVE AND A TIRE INFLATING CHUCK (AVAILABLE AT AUTO SUPPLY STORES) IN CLOSE PROXIMITY TO THE DAMPENER LOCATION.
2. USING SHOP AIR, CHARGE THE BLADDER TO 100 PSI OR THE MAXIMUM SHOP AIR PRESSURE AVAILABLE. DO NOT EXCEED 100 PSI MAXIMUM.
3. START THE SYSTEM ON WATER IN THE NORMAL OPERATING MODE. BLEED AIR FROM THE BLADDER UNTIL THE LINES STOP VIBRATING. USING A TRUCK TIRE GAUGE, READ THE BLADDER PRESSURE. SET THE AIR PRESSURE REGULATOR TO THIS VALUE.
4. USING THE TIRE INFLATING CHUCK, CHARGE THE BLADDER DAILY, PRIOR TO STARTING THE HOMOGENIZER OR PUMP.

CAUTION: DO NOT CONNECT A PERMANENT AIR LINE TO THE DAMPENER, OR ATTEMPT TO CHECK THE PRESSURE DURING OPERATION. THE BLADDER PRESSURE DURING OPERATION WILL BE THE SAME AS THE BACK PRESSURE IN THE SYSTEM.

DISASSEMBLY

TO PREVENT INJURY, RELEASE ALL AIR PRESSURE FROM THE BLADDER BEFORE DISASSEMBLING THE UNIT. THEN, PROCEED IN THE REVERSE ORDER SHOWN IN THE ASSEMBLY INSTRUCTIONS.

ITEM	REQ'D	PART NO	DESCRIPTION
	1	899625	DAMPENER HOUSING ASSY
1	1	899624	ADAPTER PLATE
2	1	899648	CLAMP GASKET
3	1	899239	CLAMP SUB-ASSY.
4	1	899626	DAMPENER HOUSING
5	1	899622	DAMPENER SCREEN
6	1	899643	SHOCK ABSORBER VALVE ASSY
7	1	801693	SHOCK ABSORBER VALVE O-RING
8	1	899644	ADAPTER
9	1	801680	ADAPTER O-RING
10	2 *	899647	BLADDER



* SECOND BLADDER PROVIDED AS A SPARE

CHAPITRE 5

ALINEA 5.19

AMORTISSEUR DE PULSATION SANITAIRE

5.19.1 L'amortisseur de pulsation sanitaire (accumulateur) qui est monté sur la tuyauterie d'alimentation de la pompe type R.O. à haute pression, est fabriqué par "Manton-Gaulin".

5.19.2 L'information technique est jointe à la fin du chapitre.

AVERTISSEMENTS

1. EN AUCUN CAS DEPASSER 55 BAR DE PRESSION DE LA CONDUITE.
2. NE CONNECTER PAS UNE LIGNE D'AIR PERMANENTE A L'AMORTISSEUR.
3. NE PAS TACHER DE VERIFIER LA PRESSION DE LA CHAMBRE A AIR DURANT LE FONCTIONNEMENT DE L'INSTALLATION, CAR LA CHAMBRE A AIR SERA EXACTEMENT COMME LA PRESSION DERRIERE DU SYSTEME.

PROCEDURE

5.19.3 Installer près de l'amortisseur une ligne d'air contenant un détendeur et un adapteur à gonfler.

5.19.4 Utilisant cette ligne d'air charger la chambre à air par la valve jusqu'à la pression maximale disponible.
NE DEPASSER PAS LA PRESSION DE 690 KPa DANS LA CHAMBRE A AIR.

5.19.5 Mise en marche normale de l'installation.

Si la pression de fonctionnement de l'installation est correcte, purger lentement le clapet de la chambre à air jusqu'à ce que la vibration de la conduite est réduite.

NOTA Si la pression de la chambre à air est réduite à un niveau trop bas, arrêter l'installation, repressuriser la chambre à air (moins de 690 KPa). Répéter la procédure de l'alinéa 5.19.5 jusqu'à ce que le niveau de la vibration est correct.

5.19.6 Si la pression de la chambre à air produit un niveau de vibration correcte, arrêter la pompe R.O. à haute pression. Vérifier la pression de la chambre à air en utilisant un manomètre de gonflage. Régler le régulateur de la pression d'air à cette pression (si disponible).

5.19.7 Fréquemment - journellement si nécessaire - charger la chambre d'air à la pression correcte, avant de mettre en marche la pompe principale R.O. à haute pression.

SANITARY PULSATION DAMPENER

ASSEMBLY, INSTALLATION AND OPERATING INSTRUCTIONS

ASSEMBLY

1. CAREFULLY UNPACK AND EXAMINE YOUR SHIPMENT. ANY DAMAGE CLAIMS SHOULD BE FILED WITH THE CARRIER.
2. REMOVE THE NUTS AND BOLTS ON THE FOUR INCH CLAMP (ITEM 3), REMOVE THE FOUR INCH GASKET (ITEM 2), THE ADAPTER PLATE (ITEM 1) AND THE SCREEN (ITEM 5).
3. EXAMINE THE BLADDER STEM. IF IT CONTAINS A VALVE CORE, REMOVE THE CORE WITH A TIRE VALVE WRENCH AND DISCARD IT (THE CORE WAS USED ONLY FOR TESTING THE BLADDER AFTER MANUFACTURE). INSERT THE VALVE STEM THROUGH THE HOLE IN THE FOUR INCH ADAPTER PLATE AND PLACE THE "O" RING (ITEM 9) IN THE GROOVE MACHINED INTO THE ADAPTER. WRAP THE STEM THREADS WITH TEFLON TAPE, OR COVER THE THREADS WITH A GOOD QUALITY PIPE DOPE. SCREW THE ADAPTER (ITEM 8) OVER THE THREADS, AND SNUG IT UP AGAINST THE ADAPTER PLATE. DO NOT OVERTIGHTEN BECAUSE THE "O" RING COULD BECOME DAMAGED. PLACE THE SHOCK ABSORBER VALVE "O" RING (ITEM 7) ON THE SHOCK ABSORBER VALVE ASSEMBLY (ITEM 6) AND SCREW THE ASSEMBLY INTO THE ADAPTER. DO NOT OVERTIGHTEN.
4. STAND THE HOUSING ON END, PLACE THE FOUR-INCH GASKET ON THE HOUSING FERRULE, INSERT THE DAMPENER SCREEN (ITEM 5) INTO THE HOUSING AND CENTER THE SUPPORTING RING IN THE GASKET GROOVE. INSERT THE BLADDER (ITEM 10) INTO THE SCREEN AND POSITION THE ADAPTER PLATE IN THE FERRULE. ASSEMBLE THE CLAMP OVER THE FERRULE. THIS IS A TIGHT FIT AND MAY REQUIRE A LIGHT HAMMER TAP ON EACH FERRULE HALF IN ORDER TO ATTAIN PROPER SEATING. ASSEMBLE THE BOLTS AND NUTS, AND TIGHTEN.

INSTALLATION

THE DAMPENER ASSEMBLY SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO THE DISCHARGE OF THE HOMOGENIZER OR PUMP. THE PRODUCT FLOW SHOULD ENTER THE CLAMP-TYPE FITTING LOCATED AT THE END OF THE DAMPENER HOUSING, OPPOSITE THE AIR VALVE.

CAUTION: WHEN USED WITH PRODUCT LINE PRESSURES IN EXCESS OF 200 PSIG, A TRI-CLOVER 13 MHP HIGH PRESSURE CLAMP *MUST* BE USED. DO NOT USE HIGH PRESSURE CLAMPS OF OTHER MANUFACTURE AS THEY ARE NOT COMPATIBLE WITH THE DAMPENER FERRULES, AND SERIOUS DAMAGE OR INJURY COULD RESULT.

WARNING

DO NOT EXCEED 800 PSIG LINE PRESSURE UNDER ANY CONDITIONS.

OPERATION

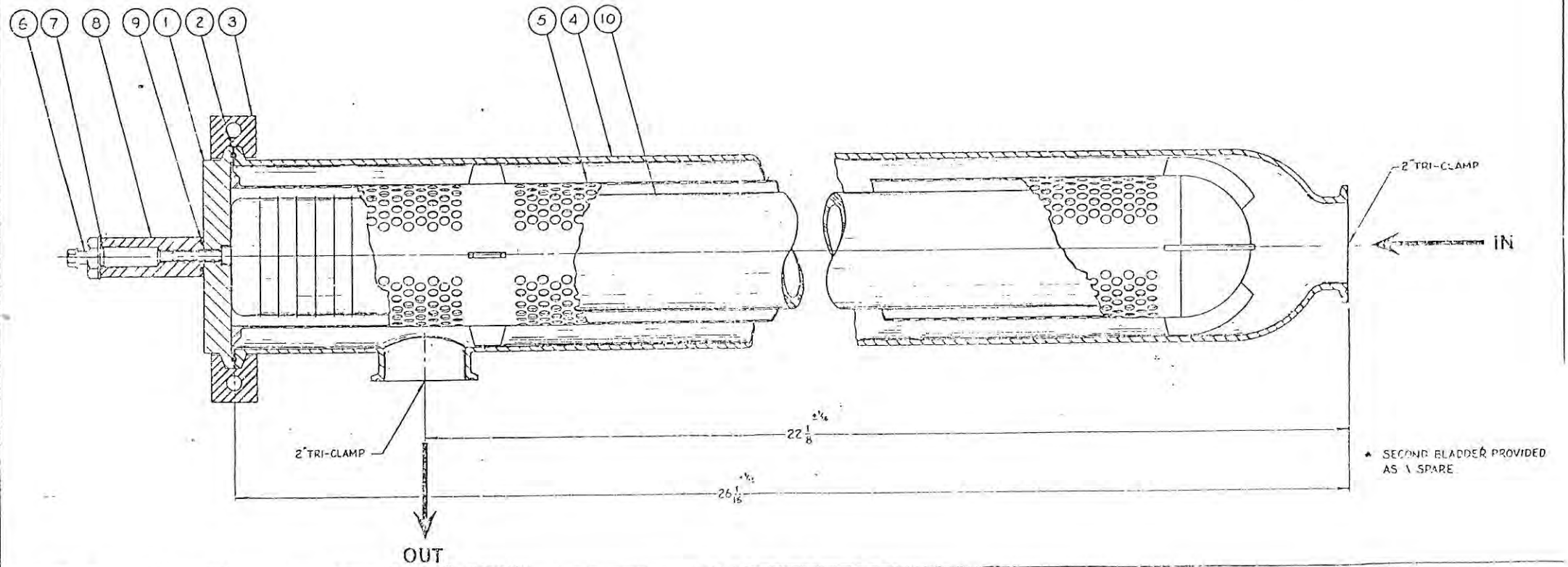
1. INSTALL AN AIR LINE WITH A PRESSURE REDUCING VALVE AND A TIRE INFLATING CHUCK (AVAILABLE AT AUTO SUPPLY STORES) IN CLOSE PROXIMITY TO THE DAMPENER LOCATION.
2. USING SHOP AIR, CHARGE THE BLADDER TO 100 PSI OR THE MAXIMUM SHOP AIR PRESSURE AVAILABLE. DO NOT EXCEED 100 PSI MAXIMUM.
3. START THE SYSTEM ON WATER IN THE NORMAL OPERATING MODE. BLEED AIR FROM THE BLADDER UNTIL THE LINES STOP VIBRATING USING A TRUCK TIRE GAUGE, READ THE BLADDER PRESSURE. SET THE AIR PRESSURE REGULATOR TO THIS VALUE.
4. USING THE TIRE INFLATING CHUCK, CHARGE THE BLADDER DAILY, PRIOR TO STARTING THE HOMOGENIZER OR PUMP.

CAUTION: DO NOT CONNECT A PERMANENT AIR LINE TO THE DAMPENER OR ATTEMPT TO CHECK THE PRESSURE DURING OPERATION. THE BLADDER PRESSURE DURING OPERATION WILL BE THE SAME AS THE BACK PRESSURE IN THE SYSTEM.

DISASSEMBLY

TO PREVENT INJURY, RELEASE ALL AIR PRESSURE FROM THE BLADDER BEFORE DISASSEMBLING THE UNIT. THEN, PROCEED IN THE REVERSE ORDER SHOWN IN THE ASSEMBLY INSTRUCTIONS.

ITEM	REQ'D	PART NO	DESCRIPTION
	1	899625	DAMPENER HOUSING ASSY
1	1	899624	ADAPTER PLATE
2	1	899648	CLAMP GASKET
3	1	899239	CLAMP SUB-ASSY
4	1	899626	DAMPENER HOUSING
5	1	899622	DAMPENER SCREEN
6	1	899643	SHOCK ABSORBER VALVE ASSY
7	1	801693	SHOCK ABSORBER VALVE O-RING
8	1	899644	ADAPTER
9	1	801680	ADAPTER O-RING
10	2 *	899647	BLADDER



* SECOND BLADDER PROVIDED AS A SPARE.

SANITARY PULSATION DAMPENER

ASSEMBLY, INSTALLATION AND OPERATING INSTRUCTIONS

ASSEMBLY

1. CAREFULLY UNPACK AND EXAMINE YOUR SHIPMENT. ANY DAMAGE CLAIMS SHOULD BE FILED WITH THE CARRIER.
2. REMOVE THE NUTS AND BOLTS ON THE FOUR INCH CLAMP (ITEM 3). REMOVE THE FOUR-INCH GASKET (ITEM 2), THE ADAPTER PLATE (ITEM 1) AND THE SCREEN (ITEM 5).
3. EXAMINE THE BLADDER STEM. IF IT CONTAINS A VALVE CORE, REMOVE THE CORE WITH A TIRE VALVE WRENCH AND DISCARD IT (THE CORE WAS USED ONLY FOR TESTING THE BLADDER AFTER MANUFACTURE). INSERT THE VALVE STEM THROUGH THE HOLE IN THE FOUR INCH ADAPTER PLATE AND PLACE THE "O" RING (ITEM 9) IN THE GROOVE MACHINED INTO THE ADAPTER. WRAP THE STEM THREADS WITH TEFLON TAPE, OR COVER THE THREADS WITH A GOOD QUALITY PIPE DOPE. SCREW THE ADAPTER (ITEM 8) OVER THE THREADS, AND SNUG IT UP AGAINST THE ADAPTER PLATE. DO NOT OVERTIGHTEN BECAUSE THE "O" RING COULD BECOME DAMAGED. PLACE THE SHOCK ABSORBER VALVE "O" RING (ITEM 7) ON THE SHOCK ABSORBER VALVE ASSEMBLY (ITEM 6) AND SCREW THE ASSEMBLY INTO THE ADAPTER. DO NOT OVERTIGHTEN.
4. STAND THE HOUSING ON END. PLACE THE FOUR-INCH GASKET ON THE HOUSING FERRULE. INSERT THE DAMPENER SCREEN (ITEM 5) INTO THE HOUSING AND CENTER THE SUPPORTING RING IN THE GASKET GROOVE. INSERT THE BLADDER (ITEM 10) INTO THE SCREEN AND POSITION THE ADAPTER PLATE IN THE FERRULE. ASSEMBLE THE CLAMP OVER THE FERRULE. THIS IS A TIGHT FIT AND MAY REQUIRE A LIGHT HAMMER TAP ON EACH FERRULE HALF IN ORDER TO ATTAIN PROPER SEATING. ASSEMBLE THE BOLTS AND NUTS, AND TIGHTEN.

INSTALLATION

THE DAMPENER ASSEMBLY SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO THE DISCHARGE OF THE HOMOGENIZER OR PUMP. THE PRODUCT FLOW SHOULD ENTER THE CLAMP TYPE FITTING LOCATED AT THE END OF THE DAMPENER HOUSING, OPPOSITE THE AIR VALVE.

CAUTION: WHEN USED WITH PRODUCT LINE PRESSURES IN EXCESS OF 200 PSIG, A TRI-CLOVER 13 MHP HIGH-PRESSURE CLAMP *MUST* BE USED. DO NOT USE HIGH-PRESSURE CLAMPS OF OTHER MANUFACTURE AS THEY ARE NOT COMPATIBLE WITH THE DAMPENER FERRULES, AND SERIOUS DAMAGE OR INJURY COULD RESULT.

WARNING

DO NOT EXCEED 800 PSIG LINE PRESSURE UNDER ANY CONDITIONS.

OPERATION

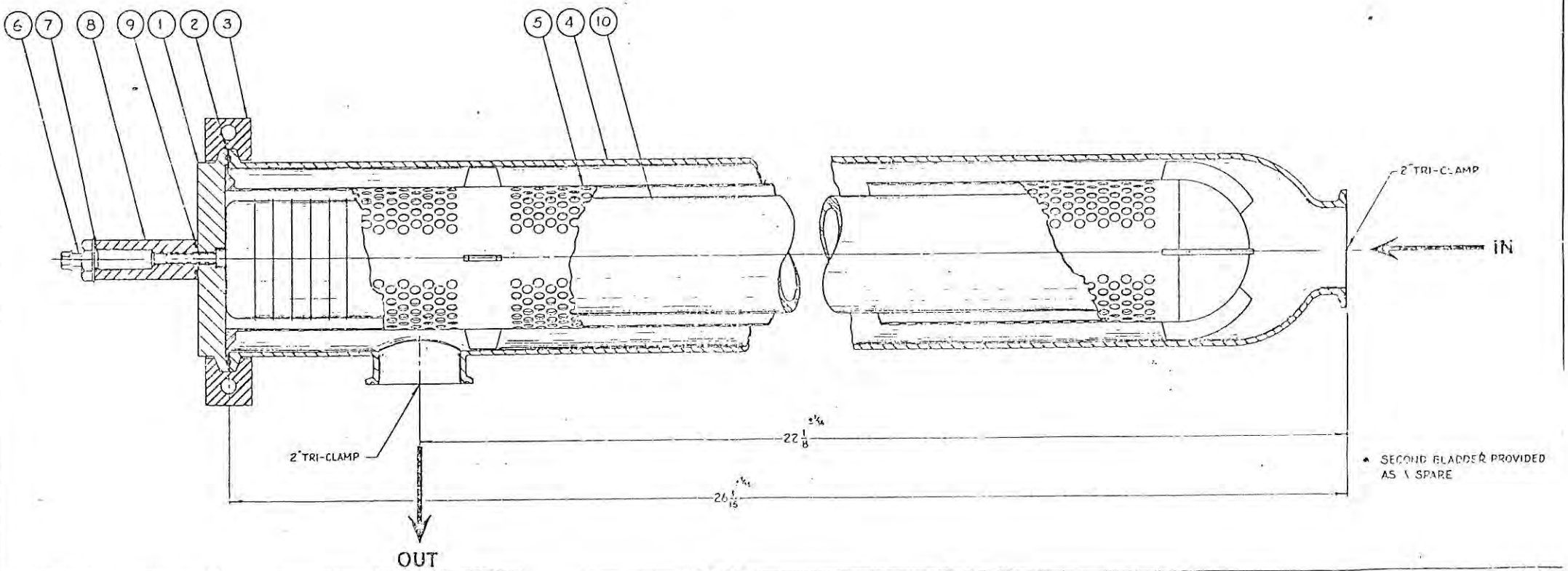
1. INSTALL AN AIR LINE WITH A PRESSURE REDUCING VALVE AND A TIRE INFLATING CHUCK (AVAILABLE AT AUTO SUPPLY STORES) IN CLOSE PROXIMITY TO THE DAMPENER LOCATION.
2. USING SHOP AIR, CHARGE THE BLADDER TO 100 PSI OR THE MAXIMUM SHOP AIR PRESSURE AVAILABLE. DO NOT EXCEED 100 PSI MAXIMUM.
3. START THE SYSTEM ON WATER IN THE NORMAL OPERATING MODE. BLEED AIR FROM THE BLADDER UNTIL THE LINES STOP VIBRATING USING A TRUCK TIRE GAUGE, READ THE BLADDER PRESSURE. SET THE AIR PRESSURE REGULATOR TO THIS VALUE.
4. USING THE TIRE INFLATING CHUCK, CHARGE THE BLADDER DAILY, PRIOR TO STARTING THE HOMOGENIZER OR PUMP.

CAUTION: DO NOT CONNECT A PERMANENT AIR LINE TO THE DAMPENER, OR ATTEMPT TO CHECK THE PRESSURE DURING OPERATION. THE BLADDER PRESSURE DURING OPERATION WILL BE THE SAME AS THE BACK PRESSURE IN THE SYSTEM.

DISASSEMBLY

TO PREVENT INJURY, RELEASE ALL AIR PRESSURE FROM THE BLADDER BEFORE DISASSEMBLING THE UNIT. THEN PROCEED IN THE REVERSE ORDER SHOWN IN THE ASSEMBLY INSTRUCTIONS.

ITEM	REQ'D	PART NO	DESCRIPTION
	1	899625	DAMPENER HOUSING ASSY
1	1	899624	ADAPTER PLATE
2	1	899648	CLAMP GASKET
3	1	899239	CLAMP SUB-ASSY
4	1	899626	DAMPENER HOUSING
5	1	899622	DAMPENER SCREEN
6	1	899643	SHOCK ABSORBER VALVE ASSY
7	1	801693	SHOCK ABSORBER VALVE O-RING
8	1	899644	ADAPTER
9	1	801680	ADAPTER O-RING
10	2 *	899647	BLADDER



* SECOND BLADDER PROVIDED AS A SPARE

KOI 739

INSTALLATION - MAINTENANCE

AND

OPERATING INSTRUCTIONS

PRECISION DOSING PUMPS LIMITED,
Alma Park Road,
GRANTHAM,
Lincs.,
NG31 9SE

GENERAL INFORMATION

SPARES

When ordering spares please give following information:-

1. The pump type and number as shown on the mechanism nameplate.
2. The correct item number from the data sheet.
3. The part description from the data sheet.
4. Original order number (if known).
5. The PDP reference number from the nameplate.

GUARANTEE

All equipment is guaranteed against defective material and workmanship for a period of twelve months.

INSTRUCTION MANUALS

An instruction manual is supplied with each plant. This manual should be put in the possession of the person responsible for the operation of the plant in order that the unit can be given the correct attention and that correct parts can be ordered - should any replacements be necessary.

SERVICE

Service staff are available to attend to any problems that may occur with the equipment during service, either on site, or at the factory. Our technical staff are available to help and advise prospective customers in the selection and use of our product in relation to particular site or operational problems.

PRECISION DOSING PUMPS LIMITED,
ALMA PARK ROAD,
GRANTHAM,
LINCOLNSHIRE.

Telephone: 0476-77677 Telex: 37538 PREDOS

INSTALLATION: GENERAL INFORMATION

LOCATION

It is important that consideration be given to the position of the pump in relation to the suction vessell and delivery point. Where possible the pump should have "flooded suction" and the distance between the pump and the suction vessel should be kept to a minimum. If "flooded suction" is not practical it is preferable to use a foot valve at the connection to the suction vessel.

Ideally the position chosen should be dry, temperate, well lit, reasonably free from airborne grit, and should not be subject to the cumulative effects of spillage from any adjacent chemical tanks.

ACCESSIBILITY

Convenient access must be provided for operating the stroke change control and also for the pump valves and suction strainer which might occasionally require dismantling for cleaning.

FOUNDATIONS

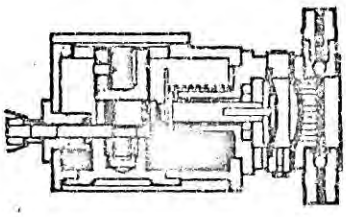
The pump must stand on a level surface which should be of the plinth type allowing approximately 6" below the base of the pump for the installation of the suction pipework.

ELECTRICAL CONNECTIONS

Check that the winding details given on the motor plate correspond with the mains supply, and connect the motor through a suitable starter with overload protection. Refer to the pump data sheet for information on motor rotation.

LUBRICATION

All pumps are despatched with oil. The oil level should be checked by means of the sight glass on the pump gearbox. Any oil needed to top up to the required level should be added. The recommended lubricant is on the individual pump data sheet. There is a breather vent on the gearbox, and this is plugged for transport purposes and it is important that this plug or label is removed before operation or excessive pressure will be developed within the gearbox resulting in oil leaks.



Precision Dosing Pumps Ltd

Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538

PUMP TEST SHEET PUMP TYPE: R409W SERIAL NO: 104353

Ordered by: Paterson Candy International Limited

Order No: LR1508ROP739
PDP Ref. No: 3782
Job No: 63959-8111/104353

MOTOR DATA:

Make: Baumuller Type: 2.DF56b-4S5508 No: 1059986003
Volts: 220/380 Amps: 0.7/0.4 KW: 0.09
HP: Rpm: 1370 Cycles/Sec: 50
Type of Protection: IP55 Insulation Class B

PUMP DATA:

Connections: O/GF R 5/8" with 12 Ø Hosetail
Pump Body: PVC with Integral Relief Valve - Hypalon faced
Valve Heads: PVC tested at 3 Bar
Valve Seats: PVC
Valve Balls: Glass
Intermediate Diaphragm: Hypalon
Working Diaphragm: Viton W Piston:
Stroke: 6mm Cylinder:
Buffer Fluid: 8.5ccm D. Ring:
Lubricant for Working Membrane:
Hydrolic Fluid (for KM Pump)

OUTPUT (with water)

Where N = 50 L/H = 10.2
Suction Head: 3mWS Delivery Head: 100mWS
Leak Test Conducted at: 10 Bar
Pumping Medium as per order:

Oil to be used in Gear Box: SAE 90

Checked and Tested on: 11/1/82

By: ENDRESZ

Notes:

PRECISION DOSING PUMPS LIMITED

Signed:.....

Precision Dosing Pumps Ltd

Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538

PP/GH

HEALTH & SAFETY AT WORK ACT

Every care is taken, as far as is reasonably practical, to ensure that our products are safe and without risk to health when correctly applied and operated in accordance with the instructions provided.

Your attention is drawn to the fact that it is essential before installation that such matters as the application, mounting position, maximum pressure ratings, chemical compatibility of the components, electrical supply details and other matters are thoroughly investigated and checked against details of the equipment provided.

If any question of doubt should arise regarding safety or the application of the equipment, please contact our Technical Department at the above address.

PRECISION DOSING PUMPS LIMITED

Precision Dosing Pumps
The Heart of the System

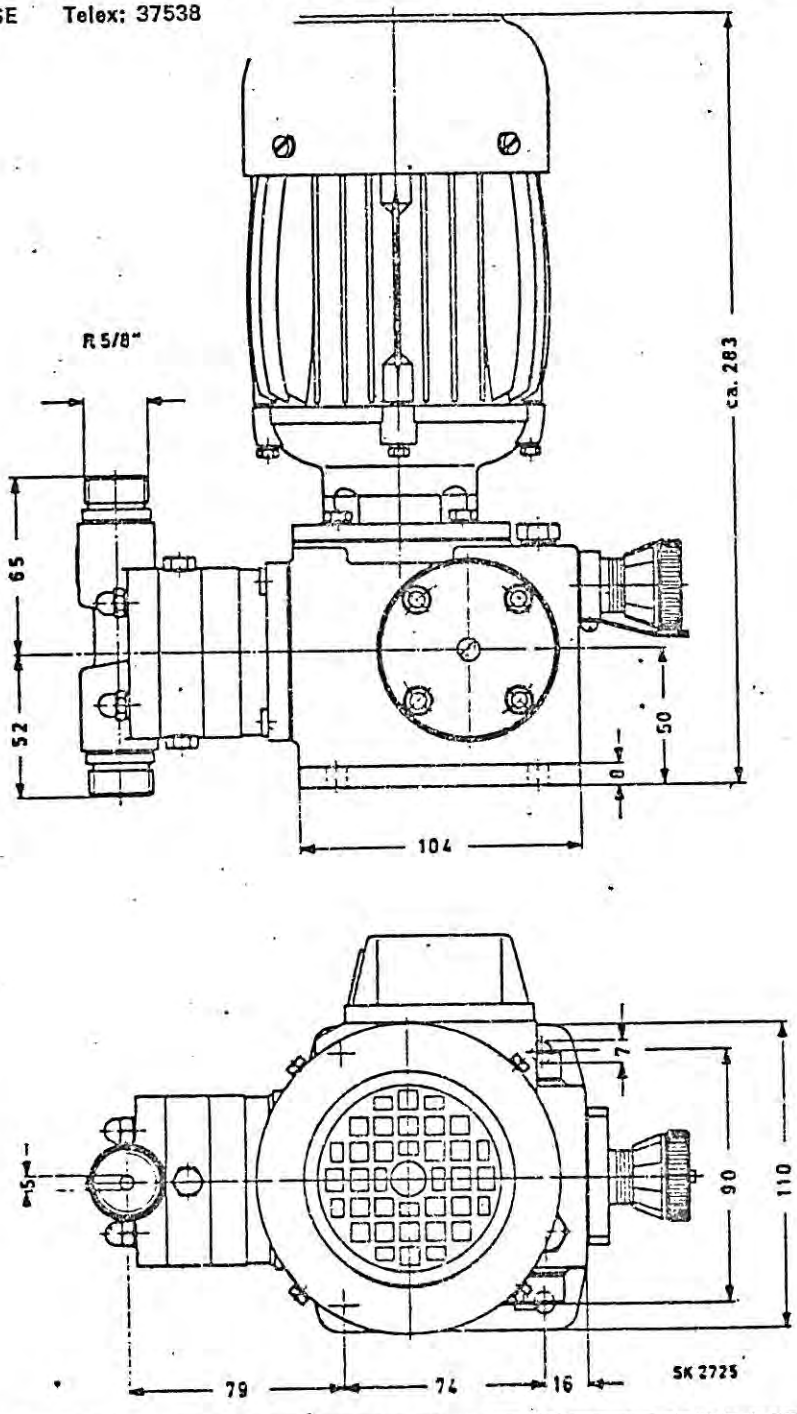
Precision Dosing Pumps Ltd

TYPE R 409 W

Double Diaphragm Pump

Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538



TECHNICAL INFORMATION:

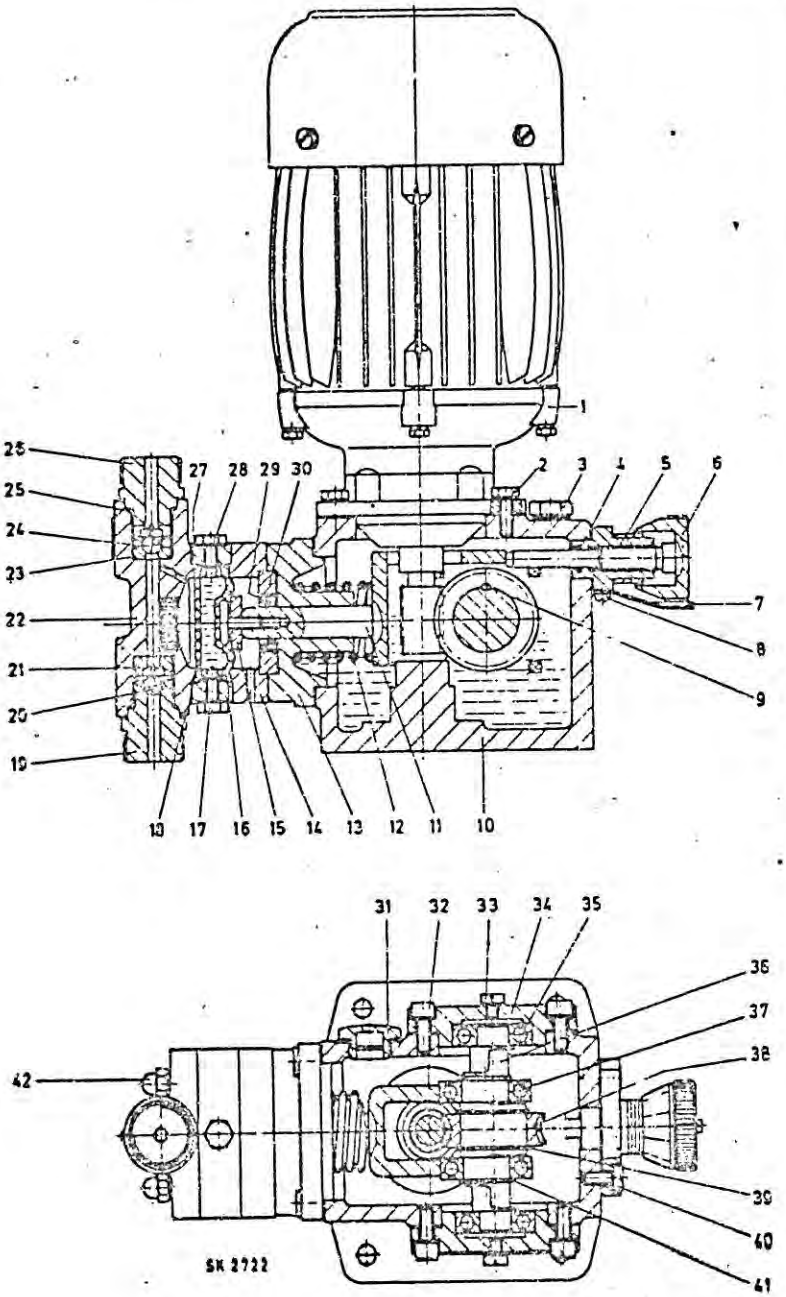
CAPACITY	- 0-18 l/h approx. (by adjusting length of stroke)
NUMBER OF STROKES	- 100/min.
Hs MAN.	- 3m WS
Hd MAN.	- 100m WS
STROKE	- 6mm
NOMINAL SIZE	- 5mm
BUFFER FLUID	- 9.5 cm^3
MOTOR OUTPUT	- 0,23 HP

Precision Dosing Pumps Ltd
Alma Park Road
Grantham
Lincs. NG31 9SE
Telephone: 0476 77677
Telex: 37538

TYPE B409W

Double Diaphragm Pump

PARTS LIST AND INSTRUCTIONS



POS.	NO.	DESCRIPTION OF PART
1	1	MOTOR
2	4	MOTOR FIXING SCREW
3	1	OIL FILLER PLUG
4	1	'O' RING
5	1	MICROMETER ADAPTER FLANGE
6	1	MICROMETER THIMBLE
7	1	HOLDING BRACKET
8	2	SET SCREW
9	1	SHAFT KEY.
10	1	GEARBOX HOUSING
11	1	CONNECTING ROD
12	1	SPRING
13	1	GEARBOX PUMPHEAD ADAPTER
14	1	PUMPHEAD SPACER RING
15	1	WORKING DIAPHRAGM SUPPORT
16	1	WORKING DIAPHRAGM
17	1	GLYCERINE DRAIN PLUG
18	1	CHEMICAL MEMBRANE
19	1	SUCTION VALVE SEAT CONNECTOR
20	2	VALVE BALL
21	1	SUCTION VALVE STOP
22	1	PUMP BLOCK
23	2	'O' RING
24	1	VALVE SEAT
25	2	'O' RING
26	1	VALVE STOP CONNECTOR
27	1	GLYCERINE CHAMBER RING
28	1	GLYCERINE FILLER PLUG
29	1	SEAL
30	1	CLAMPING RING
31	1	OIL SIGHT GLASS
32	8	FIXING SCREW
33	2	LOCKING SCREW
34	2	BEARING PLATE CLAMP FLANGE
35	2	BEARING
36	1	ECCENTRIC SHAFT
37	2	BEARING
38	1	WORM WHEEL
39	2	SECURING CLIP
40	2	FIXING SCREW
41	3	SECURING CLIP
42	4	PUMP HEAD CLAMPING STUD

OIL SAE 90

GLYCERINE QUANTITY 9.5 cms^3

MAINTENANCE INSTRUCTIONS:

The pump is ready for use when delivered and only requires connection by a qualified electrician.

Oil should be changed after 3000 working hours.

To avoid obstruction in valve assemblies, it is advisable to fit a strainer in the suction line.

To exchange working(18) or chemical (18) diaphragm:-

Remove filler plug(28)and drain plug(17) and drain off glycerine.

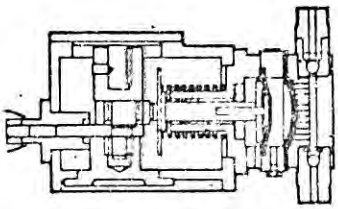
Remove the four nuts(42) in the front of the pump body(22)and then the pump body.

The chemical diaphragm and ring can be removed from the four cladding bolts.

The working diaphragm is removed from the connecting rod(11)by turning counter clockwise.

Fit new diaphragms and re-assemble in reverse order.

Re-fit glycerine drain plug. Turn micrometer thimble(6)to max setting. Fill with EXACT quantity of glycerine. Turn micrometer slowly clockwise until glycerine shows on upper edges of filler plug hole. Re-fit filler plug.



Precision Dosing Pumps Ltd

Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538

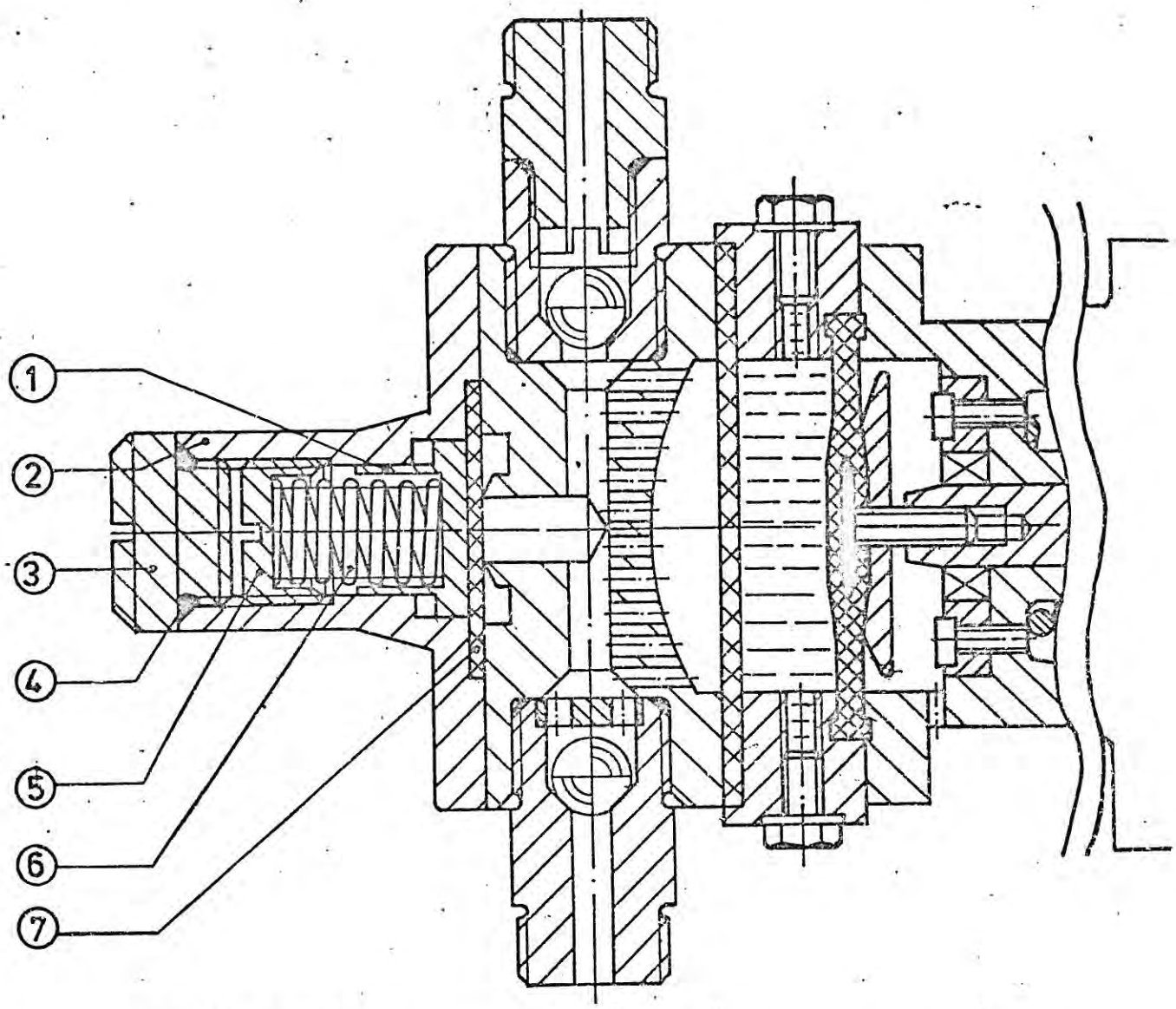
MAINTENANCE INSTRUCTIONS FOR DOUBLE DIAPHRAGM PUMP HEADS

The pump is ready for use when delivered, and requires connection by a qualified electrician. It is suggested that oil should be changed after every 3,000 - 4,000 working hours and should be filled until visible in the sight glass or to instructions provided.

To avoid obstructions in valve assemblies it is advisable to fit a strainer in the suction line.

To exchange the working or chemical diaphragm first remove the four pump head clamping nuts. The pump head, chemical diaphragm and buffer fluid chamber can then be withdrawn from the four studs. The working diaphragm can be unscrewed and removed from the connecting rod by turning counter-clockwise. Check the working diaphragm, replace or renew. To return the working diaphragm to the fully backward position set the micrometer at zero and turn the motor by hand to ensure the fully backward position is reached. After checking the chemical diaphragm the buffer fluid chamber, chemical diaphragm and pump head can be replaced. After reassembly fit the drain plug in the buffer fluid chamber and with a syringe refill the chamber with the exact quantity of buffer fluid (this is stamped on the pump name-plate and stated on the pump Test Certificate). Now turn the micrometer very slowly clockwise until the buffer fluid shows on the upper edges of the filler plug. This expels all air from the chamber. Refit the filler plug. The pump is now ready for use.

As the pump has then been out of service it is always advisable before re-commissioning to check the valve assemblies throughly to ensure that the valve balls and seats are free of particles and undamaged.



PARTS LIST.

DRAWING No: SA/0005/

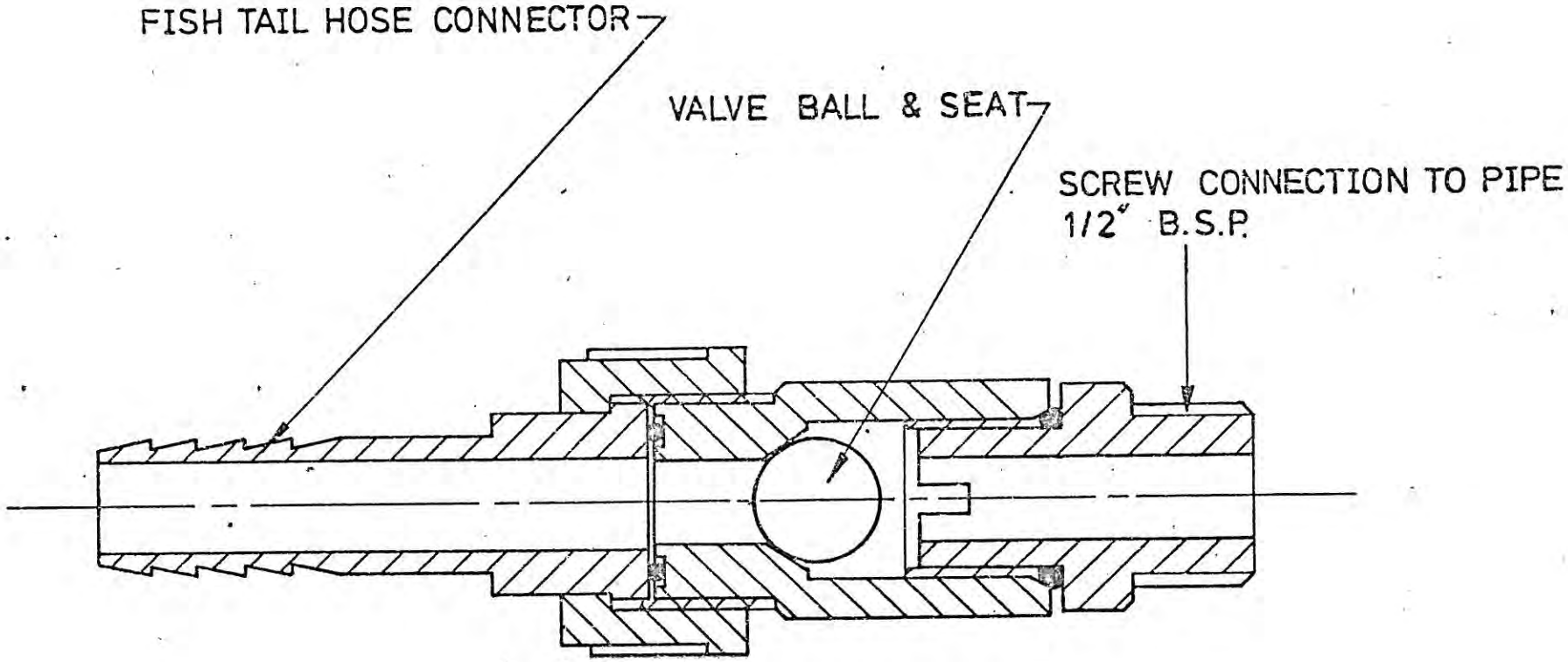
1. PRESSURE PLATE.
2. COVER.
3. TOP.
4. 'O' RING.
5. ADJUSTING SCREW.
6. PRESSURE SPRING.
7. RELIEF VALVE DIAPHRAGM.

SECTIONAL DRAWING SHOWING INTEGRAL RELIEF VALVE FITTED TO PUMP HEAD.

PRECISION DOSING PUMPS LTD.

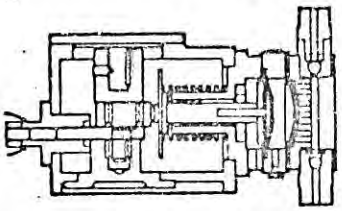
Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538



INJECTION FITTING TYPE 661. IN P.V.C.

PRECISION DOSING PUMPS Ltd.
DRAWING No: SA/0001/



Precision Dosing Pumps Ltd

Alma Park Road
Grantham
Lincs. NG31 9SE

Telephone: 0476 77677
Telex: 37538

INSTRUCTIONS FOR MICROMETER OPERATION

This instruction sheet is designed to assist the operation and stroke setting of a Precision Dosing Pump. As each gearbox varies in it's capacity, the stroke length will vary in accordance with the eccentric.

The drawing indicates that the delivery stroke length of the pump is positive whereas the return or suction stroke is spring assisted. The micrometer spindle protrudes into the gearbox and therefore governs the length of stroke movement. The micrometer thimble and the number of turns of the barrel coincide with zero and maximum operation, and in most cases follow a straight linegraph.

Although the Precision Dosing Pump is tested prior to despatch, the graph can only be constructed relative to site conditions, and therefore it is advisable to test the pump in situ. This then takes into account any losses in pipework due to changes in suction conditions which can effect the overall efficiency of the valve assembly.

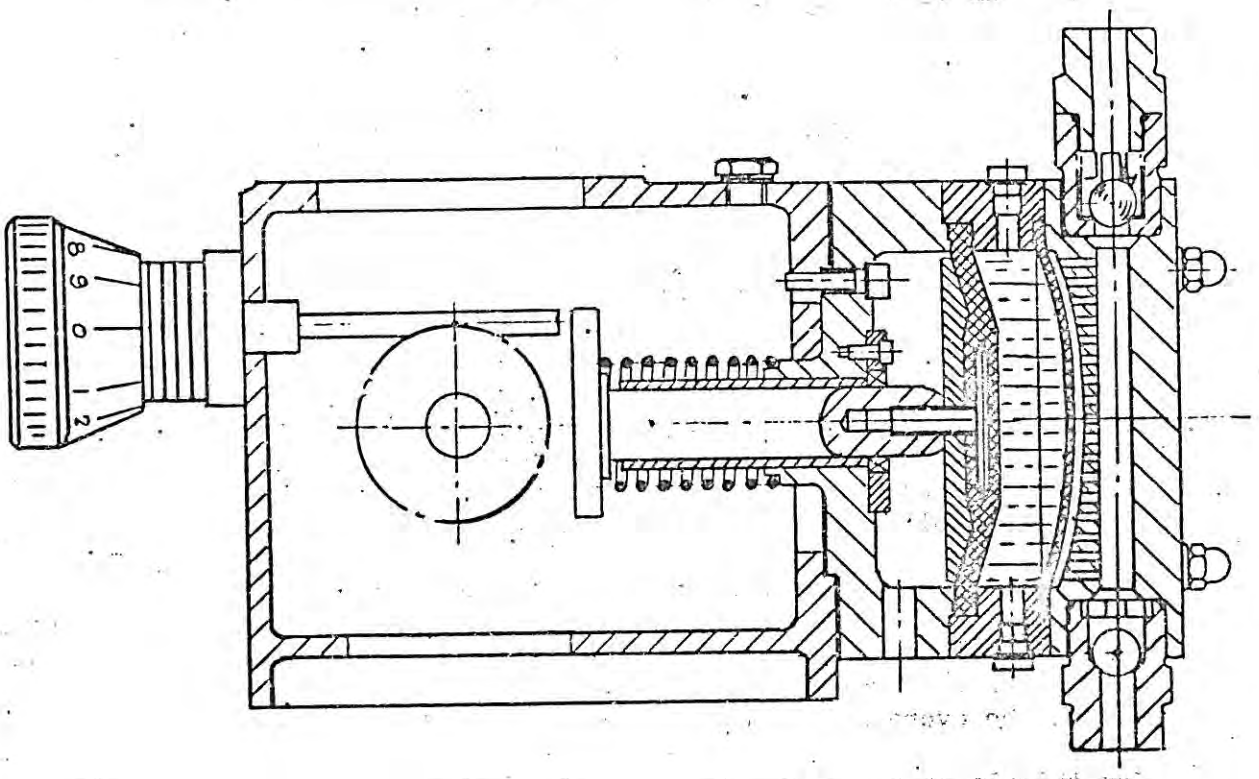
The thimble is divided into ten graduations and the barrel is also engraved to indicate the number of revolutions from zero to maximum. The attached table gives the information applicable to each pump. In addition the test figure is given on the test certificate which accompanies the pump.

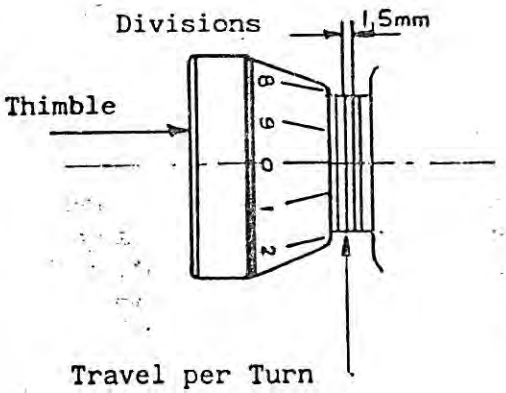
The design of the micrometer and the thimble arrangements have been simplified for general applications. However, for extremely accurate dosing an alternative stroke system is available. This is fitted in place of the existing micrometer and provides the most precise method of control. Accuracy and repeatability are assured with a Precision Dosing Pump, but equally important is the siting of the equipment, and ensuring that a strainer is fitted to the suction side of the pump to prevent particles obstructing the valve assemblies.

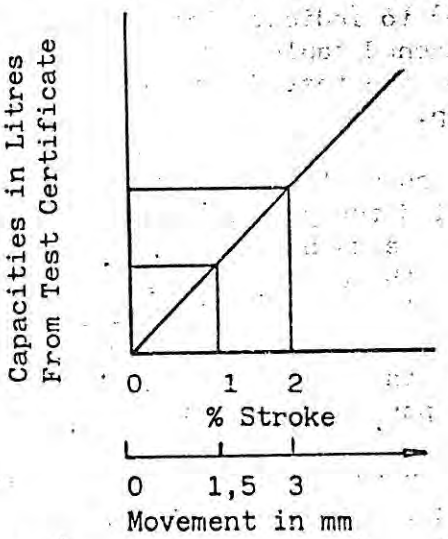
To give an example of the micrometer adjustment, four revolutions are required to take the R408 from zero to maximum, i.e. 0-5 litres per hour. Half capacity can be achieved by rotating the thimble two revolutions.

To reduce the capacity of the pump the micrometer should be turned in a clockwise direction, and to increase the capacity turned in an anti-clockwise direction.

Precision
Dosing
Pumps Ltd







Precision Dosing Pump	Stroke Length mm	Thimble Revolutions
R408P	4	4
R409W	6	4
R409P, R409K, R409KM	8	5.33
R410	8	5.33
R411, R411K, R411KM	10	6.66
R412, R412So	13	8.66
R412K, R412KM	15	10

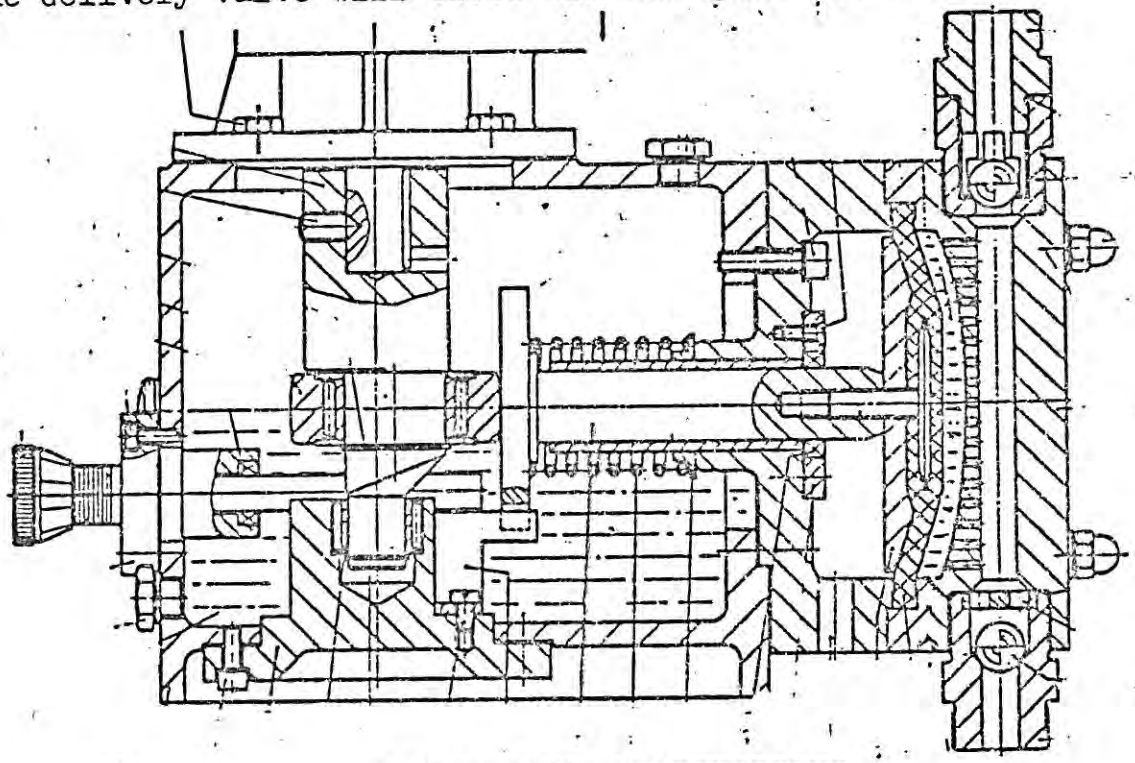
When drawing graph to show the relationship of capacity over stroke the figures given in Column 2 headed "Thimble Revolutions" should be used. This will therefore enable the user to read off from the graph the required capacity against the correct stroke setting.

PRINCIPLE OF OPERATION

As can be seen from the attached drawing the piston or diaphragm on the suction stroke and when travelling towards the gearbox will cause a partial vacuum to occur within the pump head. This will lift the suction valve ball and cause the liquid to flood into the head. The pressure within the delivery pipework will retain the delivery valve ball tight against the seat and prevent any liquid passing through the pump or returning from the delivery pipework.

As the piston or diaphragm reaches the fully backward position and commences the forward or delivery stroke the pump head will be full of liquid and the suction valve ball will be forced back onto the seat. As the pressure in the pump head increases a point will be reached when this pressure will be greater than that in the delivery line and the liquid will be forced through the delivery valve.

When the piston or diaphragm reaches the fully forward position the delivery valve will close and the cycle recommence.



MAINTENANCE INSTRUCTIONS

The pump is ready for use when delivered and only requires connections to be made to the pump head and to the motor.

Please ensure that any of the packaging material has not been trapped within the pump head connections.

If the valve gear has to be dismantled for any reason care should be taken to ensure that the valve balls are not dropped and lost or damaged. The order for re-assembly should be noted when dismantling.

The valves seats should not be recut or tampered with in any way as this will alter the valve lift and impair the efficiency of the pump.

Oil - this should be of the type indicated on the test certificate and should be changed every 3000 hours unless otherwise stated.

PIPING INSTALLATION

SUCTION

When using a dosing pump it is particularly important that the suction conditions are satisfactory. To enable a pump to deliver an accurate and repeatable quantity the liquid being pumped must be able to completely fill the pump cylinder on the suction stroke. The ideal arrangement is for the liquid to flow by gravity into the pump.

If the pump is situated higher than the liquid to be pumped the partial vacuum produced during the suotion stroke must be relied upon for inducing the liquid into the pump. This is usually s satisfactory for suction lifts of around 4ft but may give problems on starting, if the fluid is liable to gassing, or is viscous.

Suction pipework should be of as large a bore as practicable unless a slurry is being handled where it may be necessary to maintain a higher flow velocity.

The pipework between the vessel and the pump should be kept as short as possible and the minimum of restrictions i.e. bends and bore changes, to avoid unnecessary pressure drops.

If the pump is being used on a suction lift duty flexible tubing should not be used as the partial vacuum condition existing in the tube can cause it to collapse and restrict the flow to the pump. It is important that a suitable strainer be fitted in the suction line to stop foreign particles passing through and possibly being trapped in the pump head. These can cause damage to pistons, seals, valve gear etc. casuing leakage and pump inaccuracy.

It is important not to draw the liquid from the lowest point of the suction vessel as this is where sediment is likely to collect.

DELIVERY

The size of pipe bore on the delivery side of the pump is not so critical as the plunger or diaphragm will displace the liquid. The maximum pressure at the pump head should not exceed the maximum rating of the particular pump head.

The delivery pipework must be arranged so that there is a positive head or pressure against which the pump can operate. If the pump is required to feed a vessel on a lower level than the suction vessel with no delivery pressure being created, then either the delivery pipework must be looped upward to above the height of the suction vessel and vented before being dropped to the delivery point, or a loading valve must be installed in the delivery line to create an artificial back pressure to prevent gravity flow. Loading valves are available at preset pressures but can be adjusted if required.

It must be remembered that if delivering into a pressure vessel or main, the sum of the loading valve and vessel pressure must be taken into account when selecting the maximum pump rating.

A relief valve should be installed in the delivery line if the line is liable to blockage or if a shut off valve is installed. This should be located upstream of these possible restrictions and the liquid can either be pumped back to the suction vessel or to the suction pipework forming a "loop".

It is advisable, when injecting into a pressurized main or vessel, to install an injection fitting at the point of injection. This is a non-return valve and prevents this pressure backing up the pump delivery line when the pump is not in operation.

A single pump unit gives a pulsed flow and in most instances this is perfectly acceptable, but when a more continuous flow is required, pulsation dampers or a multi-headed pump must be utilised.

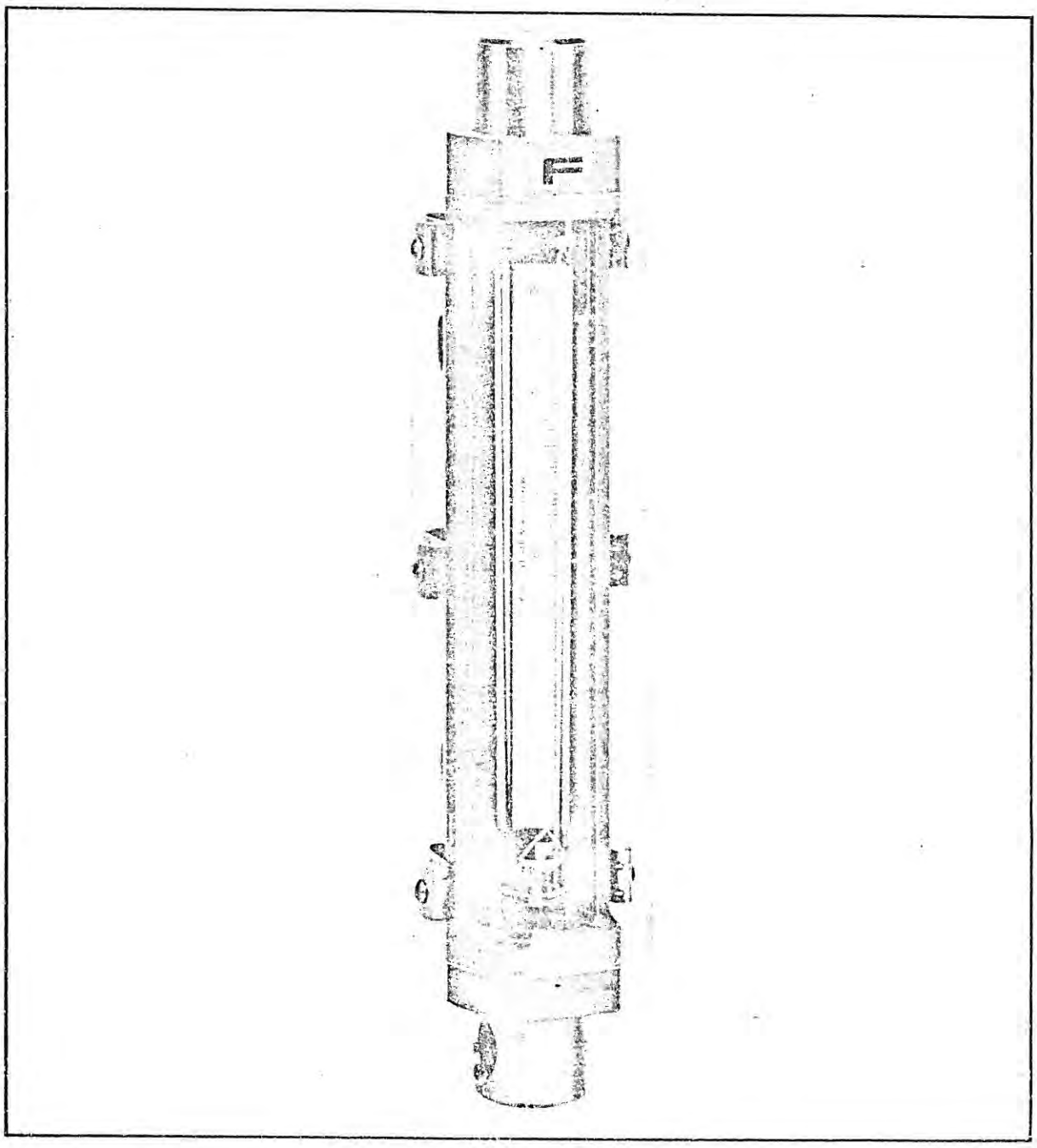
A pulsation damper usually consists of a simple air chamber in which the trapped air absorbs part of the pump output on the delivery stroke and feeds it back into the system as the pump is on the suction stroke.

A multi-headed pump is capable of reducing the pulses in a delivery line. This is done by "phasing" the pump heads i.e. one on suction stroke - one on delivery thus giving two pulses per 360° rotation of pump shaft.

FISCHER PORTER

Instruction Bulletin

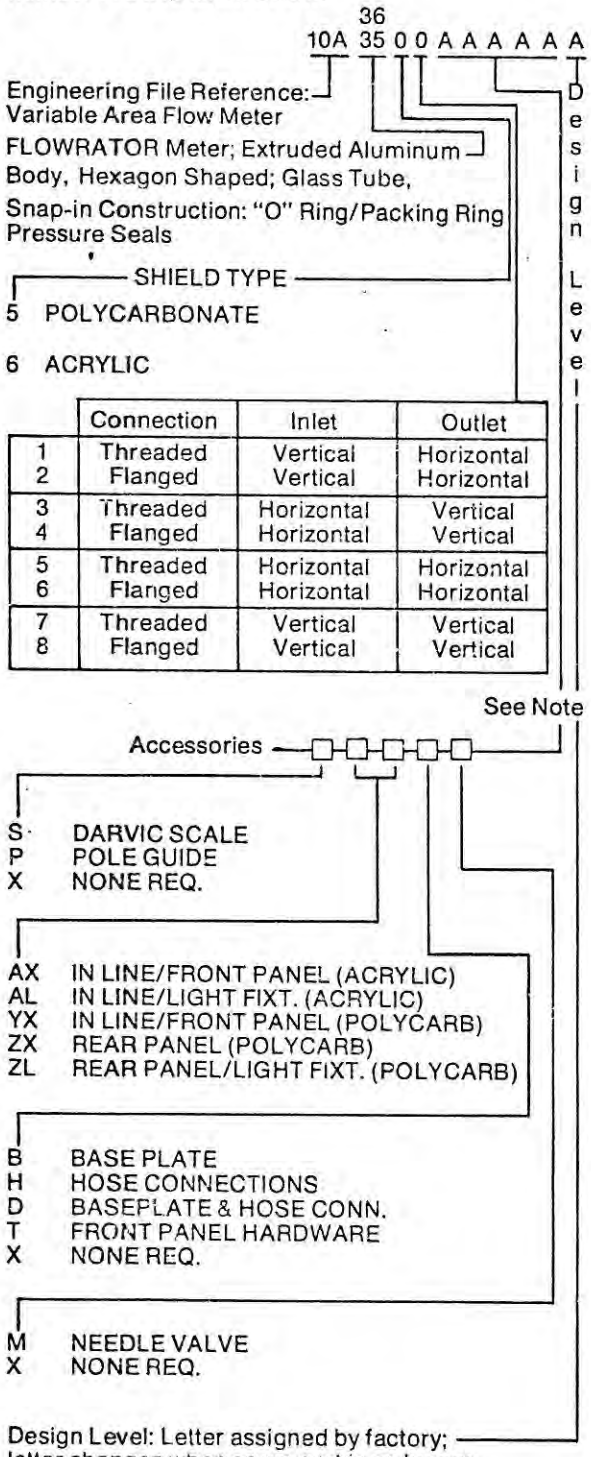
INSTRUCTION BULLETIN for SERIES 10A3500 & 10A3600 FLOWRATOR METERS



SERIES 10A $^{35}_{36}$00 FLOWRATOR METERS

Model Numbering

Refer to the Fischer & Porter data sheet or the meter nameplate for the specific model number of the equipment furnished. The details of a specific model number are explained below.



	Connection	Inlet	Outlet
1	Threaded	Vertical	Horizontal
2	Flanged	Vertical	Horizontal
3	Threaded	Horizontal	Vertical
4	Flanged	Horizontal	Vertical
5	Threaded	Horizontal	Horizontal
6	Flanged	Horizontal	Horizontal
7	Threaded	Vertical	Vertical
8	Flanged	Vertical	Vertical

Note:
Prior to Jan. '76 the model number was normally 8 digits long; the 8th digit being used to designate accessories. When more than one accessory was furnished, a letter was added in alphabetic order. Design Level designation was added at that time.

Specifications

Performance
Accuracy
Standard ..... ±2% of max. flow.
Calibrated ..... ±1% of max. flow.
Range ..... 12-1/2 to 1.

Temperature Rating
Minimum fluid temperature..... 32°F (0°C).
Maximum fluid temperature..... 250°F (120°C).

Materials Available
Glass meter tube "O" rings (Std.)
Buna N
Butyl
Viton
EPR (Ethylene Propylene Rubber)

Packing
Neoprene
Teflon (W/Neoprene Back-up Rings)

Float stops
(5" Scale) 300 Stainless Steel
(10" Scale) Teflon[1]/Polypropylene

Tube rest gaskets
Durabla[2]
Teflon

End Fittings
Brass
316 Stainless Steel

Meter tube
Borosilicate glass

Operator Protection Shield
Polycarbonate

Tube Shield
Acrylic

Pressure Rating, Meter Tube 100°F (38°C)

*MAXIMUM DESIGN PRESSURE, IN psig AND (MPa)				
F&P Meter Size	Meter Tube Inlet Size in inches	All Connections	Material of 150 lb. ANSI Flange Connection	
			316 SST	Brass
08	1/16	450 (3.1)	275 (1.9)	225 (1.6)
02	1/8	450 (3.1)	275 (1.9)	225 (1.6)
2	1/4	450 (3.1)	275 (1.9)	225 (1.6)
4	1/2	300 (2.1)	275 (1.9)	225 (1.6)
5	3/4	200 (1.4)	200 (1.4)	200 (1.4)
6	1	200 (1.4)	200 (1.4)	200 (1.4)
8	1-1/2	130 (.89)	130 (.89)	130 (.89)
9	2	100 (.69)	100 (.69)	100 (.69)

* For pressure rating at other temperatures, consult Fischer & Porter Ltd.

[1] T.M. E.I. duPont deNemours Co., Inc.
[2] T.M. Durabla Mfg., Co.

IMPORTANT

It is imperative that the following precautionary measures be observed in order to minimize, and hopefully eliminate, the possibility of operator injury.

1) Glass meter tubes have been designed to operate up to maximum design working pressures listed herein. This is not to be construed as a certification that the tubes will not break at any pressure. Inherent material limitations can result in tube breakage due to conditions beyond our control. For example; glass is a brittle material which may break upon impact; glass if subjected to thermal shock may break; glass is what is called notch sensitive in that scratches, nicks or cracks may result in breakage when pressurized; incorrect installation or faulty operating methods can cause tube breakage regardless of operating pressure.

2) Glass meter tubes are not recommended for either hot or strong alkalies, flourine, hydrofiouric acid, steam or water over 200°F (93°C). Glass meter tubes should be periodically inspected for signs of wear. Erosion, stress cracks, nicks or deep scratches provide early warning for tube replacement. With certain fluids, the glass may erode evenly so wear is not visibly noticeable. If wear is suspected, the tube should be replaced in order to eliminate this potential cause of meter tube breakage.

3) It is important that all materials of construction be compatible with the service to which the meter is applied. It is especially important that "O" ring material be compatible with the process fluid. Glass meter tube breakage can occur in those meters using an "O" ring as an internal seal if the improper material is used. For example: VITON "O" RINGS MUST NEVER BE USED FOR AMMONIA SERVICE; THE CORROSIVE ATTACK OF AMMONIA ON VITON IS EXTREME, CAUSING THE "O" RING TO SWELL TO THE EXTENT OF BREAKING THE GLASS METER TUBE. Refer to F&P Ltd. Catalogue 10A 1023. Flowrator Selection Guide, material selection.

4) The Meter should never be subjected to excessive vibration. Avoid the use of quick acting devices in the fluid stream in order to prevent shock waves, associated with such devices, from damaging the meter.

5) The use of a pressure relief valve and/or a rupture disc is recommended in the pipeline containing the Flowmeter and located such to preclude glass meter tube breakage in the event of an overpressurization of the line.

6) When applied to a high pressure gas cylinder, at least two stepdown pressure regulators are to be used between the Flowmeter and the cylinder.

7) Remove pressure from the Flowmeter before attempting to remove the meter tube.

8) Be sure the set screws that serve to lock the meter end fittings in place are secure. This should be checked before the Flowmeter is put into service or returned to service after maintenance. Loose end fittings may result in glass meter tube breakage.

9) The glass meter tube should be periodically inspected and replaced if cracked, nicked, scratched or worn.

10) Do not operate the Flowmeter without the shield in place. To eliminate operator injury we recommend using polycarbonate shielding.

11) If the Flowmeter has packing glands to seal the tube to the end fittings, they should be tightened evenly to avoid strains on the glass tube. Tighten the packing glands only as tight as necessary to prevent leaks.

SERIES 10A3500 & 10A3600 FLOWRATOR METERS

Description

Both the Fischer & Porter Series 10A3500 and 3600 Flowrator meters operate on the variable area principle to measure and indicate instantaneous fluid flow rate. Series 10A3500 Flowrators have "O" ring seals and Series 10A3600 Flowrators are sealed by conventional packing methods. The meters have an extruded aluminium body that retains inlet and outlet end fittings. These end fittings hold the meter tube and are designed to permit rapid removal of the meter tube for range changes or cleaning, yet permit operation under pressure or vacuum conditions. Figs. 6 & 8 illustrate both series of meters and provide model number identification.

Both series Flowrator meters are available with a 10" scale in the larger sizes and a 5" scale in the smaller sizes. The meter size is designated as $\frac{1}{4}$" x $\frac{1}{4}$", $\frac{3}{4}$" x 1", etc. The first dimension denotes the meter connection size, in inches, and the second dimension is the diameter of the meter tube inlet, in inches.

$\frac{3}{4}$" x $\frac{3}{4}$" and larger size meters use different type float stops than the $\frac{1}{2}$" x $\frac{1}{2}$" and smaller meters and the meter is modified accordingly. Fig. 6 is a cut-away view of a $\frac{1}{2}$" x $\frac{1}{2}$" Flowrator with "O" ring seals. Notice in this illustration that the float stops are held by the meter tube end bells. Fig. 8 is a cut-away of a $\frac{3}{4}$" x $\frac{3}{4}$" Flowrator meter that employs packing. In this case, the upper float stop is held by the outlet end fitting. The $\frac{3}{4}$" x $\frac{3}{4}$" and larger meters use two different styles of inlet float stops depending upon the type of meter float. When a float having a tail guide is used, the raised portion of the inlet float stop is removed and a hole drilled to accept the float tail guide at low flow rates.

In both series, the meter tube may be removed without disassembling the meter or removing the process connections. With the exception of Flowrator meters having steel end fittings, the meter tube is held against the inlet fitting by a spring loaded washer in the outlet fitting. This spring and washer are outside of the flow stream to prevent fluid contamination. In the steel end fitting meter, the tube is held securely by the packing material.

New meters are provided with "O" rings and packing of the material specified at the time of purchase. Should the requirements of the fluid being metered demand a change in either the "O" ring or packing material being used, they may be easily changed in the field. The inlet and outlet float stops are made of *Teflon or polypropylene.

The elevation of the float in the tapered glass meter tube is proportional to the instantaneous fluid flow rate, and readings are taken from the scale that is etched on the meter tube or a Darvic scale alongside of the tube. The scale may be graduated to provide one of four readings: diameter ratio (Dt/Df), percent of maximum flow, millimeter, or direct reading.

Meter tubes may be one of three types: $\frac{1}{4}$" tubes (inlet diameter) and smaller are Tri-flats; $\frac{1}{2}$" and larger tubes may be either bead guide type or straight taper. When required, a Tri-flat variable area flowmeter handbook and/or a calibration curve is furnished.

INSTALLATION

I. General

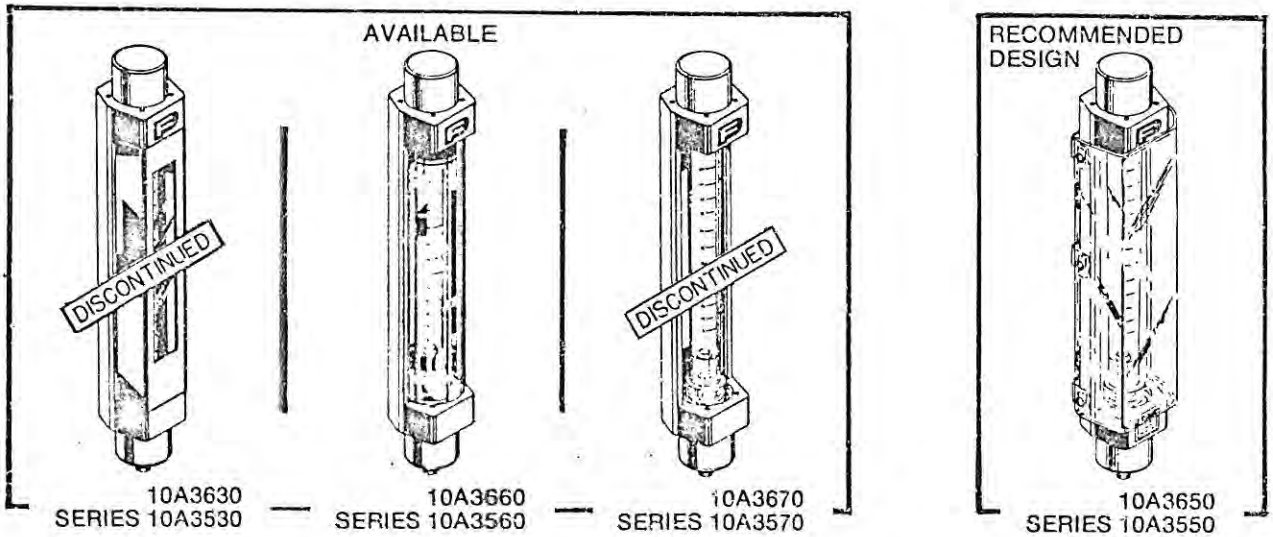
Except with small meters, the meter float is usually packaged separately and must be installed before the meter is placed in operation. Often a float is protected during shipment by a strip of rubber tape that is wrapped around the reading edge of the float. Remove this protective tape just before installing the float. The float may be installed in the Flowrator after it is installed in the pipe line by following a simple procedure discussed in the Maintenance Section.

II. Orienting the End Fittings

Flowrator meters are shipped from the factory with the end fitting connections oriented as ordered. If piping requirements demand a change, both the inlet and outlet fittings of the Series 10A3500 or 10A3600 Flowrators may be rotated horizontally a full 360°. However, on the Series 10A3600 meter, the end fitting connections should not be stopped in a position where the head of the packing compression screws will interfere with the process piping.

As shown in Fig. I, a short length of dowel stick or any other similar material may be inserted into the

*Trademark of E.I. duPont de Nemours & Co., Inc.



end fitting (or in the case of flange connections, a pipe may be threaded into a companion flange) to be used as a lever to turn the end fittings to the desired position.

Note
Series 10A3600 Packing Type Meters – loosen packing gland compression screws that extend beyond the meter body before attempting to rotate the end fittings.

III. Surge Chambers and Accumulators

A variable area Flowrator is less likely to be damaged and most accurately read when the flow of liquid is smooth. However, it is occasionally necessary to install a meter in a line where reciprocating pumps or compressors are used. In these cases, surge chambers or accumulators are recommended to damp the shock wave in the line.

Surge chambers, when used for liquid service, may have a gas padding pressure applied to the top of the chamber. When it is objectionable to have a gas in contact with the liquid, accumulators are used. Accumulators are similar to surge chambers except that they include a rubber bag (or other suitable material) in the top of the chamber that seals the gas from the liquid. The rubber bag in the accumulator is usually filled and sealed in the factory with a suitable gas to a pressure approximately 60% of the pumping pressure.

IV. Mounting and Piping

A. General

The Series 10A3500 & 10A3600 Flowrators may be installed directly in the pipe line or mounted on an instrument panel with optional mounting hardware. Regardless of the mounting method, the meter must be installed vertically with the outlet (highest scale graduation) at the top. Use a spirit level or plumb bob to check the vertical alignment.

If possible, choose a location to mount the Flowrator that is well lighted so that the meter float is easily seen. The Flowrator should never be subjected to excessive vibration. Avoid the use of quick acting devices in the fluid stream to prevent shock waves from damaging the meter. It is recommended that a conventional three valve manifold be installed around the meter. This manifold permits the process to be operated while the meter is being cleaned. Fig. 4 and Fig. 3 illustrate typical piping installations of the Flowrator.

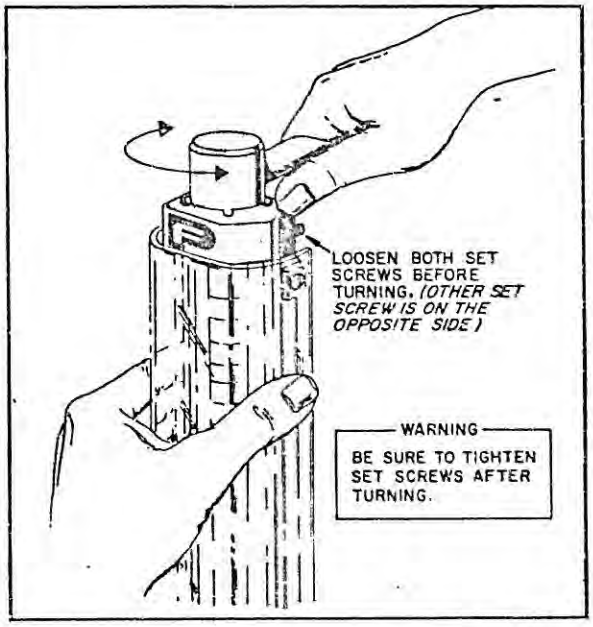


Fig. 1 – Rotating the end fittings

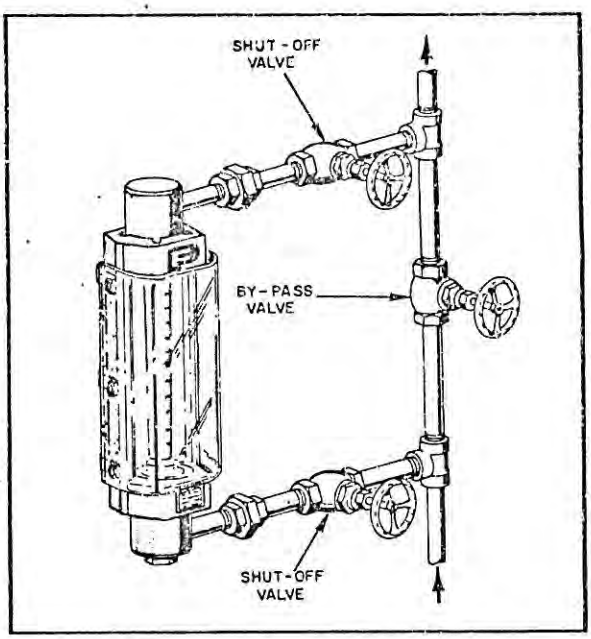


Figure 2 – Typical Installation – vertical flow line – gas or liquid applications

B. Liquid Service

When the Flowrator is used for liquid service, the inlet piping should be kept as large as economically practical; i.e., either the same size as the meter connection or one pipe size larger.

Control valves may be used in the inlet or discharge piping without regard to the distance from the meter.

C. Gas Service

When the Flowrator is used for gas service, the inlet piping should be kept to a minimum; i.e., either the same size as the meter connection or one pipe size smaller.

If a control valve is to be installed, it should be located in the meter outlet piping, as close to the meter outlet connection as possible.

D. Pipe Mounting

If the pipe lines are adequately supported, the Flowrator can be supported by the connecting piping. Refer to Parts B and C above for pipe line sizes.

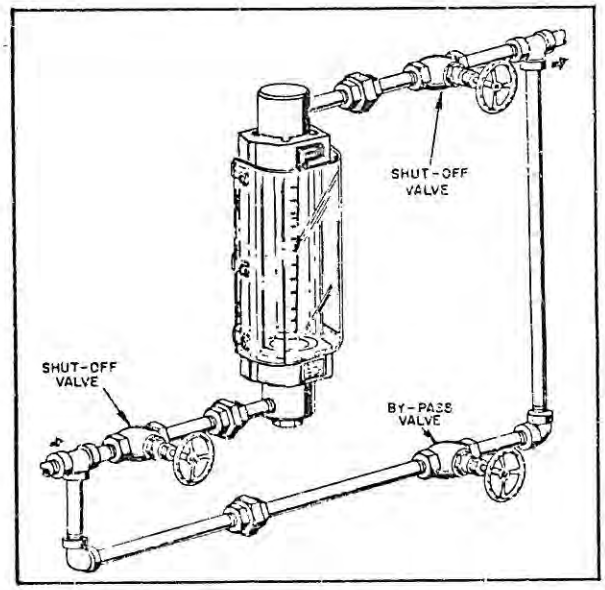


Fig. 3 – Typical Installation – horizontal line – for gas or liquid

E. Panel Mounting

1. General

The Flowmeter may be mounted on either the front or rear of the panel. Rear panel mounting as shown in Figure 4, has the advantage of affording protection for the meter and piping and in addition presents a neat appearance. When the Flowmeter is to be rear panel mounted, secure the necessary hardware and panel cut-out dimension drawings from Fischer & Porter Ltd.

When the Flowmeter is to be front panel mounted, nuts, bolts and lockwashers for this use may be furnished by Fischer & Porter Ltd., when specified, or purchased locally. All meter bodies are drilled with mounting holes. These holes are tapped so that the bolts may be inserted from the rear of the panel, if desired.

2. Rear Panel Installation

A meter that is to be mounted on the rear of a panel (i.e., flush mounting) requires a cut-out and holes drilled to secure the meter, operator protection shield and bezel. The panel should be rigid, vertical and free from severe vibration. The minimum distance between adjacently mounted meters is determined by the piping requirements and the meter size.

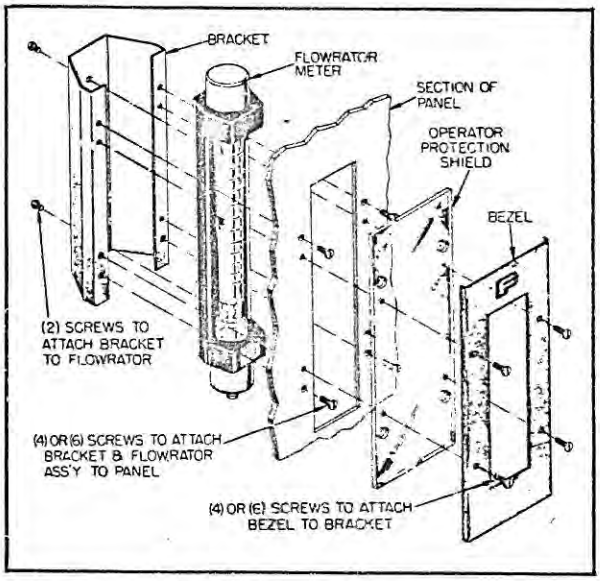


Fig. 4 – Rear panel mounting a flowrator meter

Refer to certified dimension drawings, make the necessary cut-out and holes. Refer to Figure 4 and proceed as follows:

1) Fasten the bracket to the meter using two screws that thread into the tapped holes on the rear of the meter.

2) Hold the Flowmeter-bracket assembly against the rear of the panel. Insert the four mounting screws from the front of the panel. These mounting screws thread into fasteners that are permanently attached to the bracket.

3) Fasten the operator protection shield and bezel to the front of the panel. The attaching screws go through the bezel, shield and panel then thread into the bracket.

4) Connect the process piping to the meter to complete the installation. Piping for liquid service is discussed in Part B and gas service is discussed in Part C.

PLACING IN OPERATION

I. General

Prior to placing the meter into operation the meter float must be installed as discussed in the Maintenance Section.

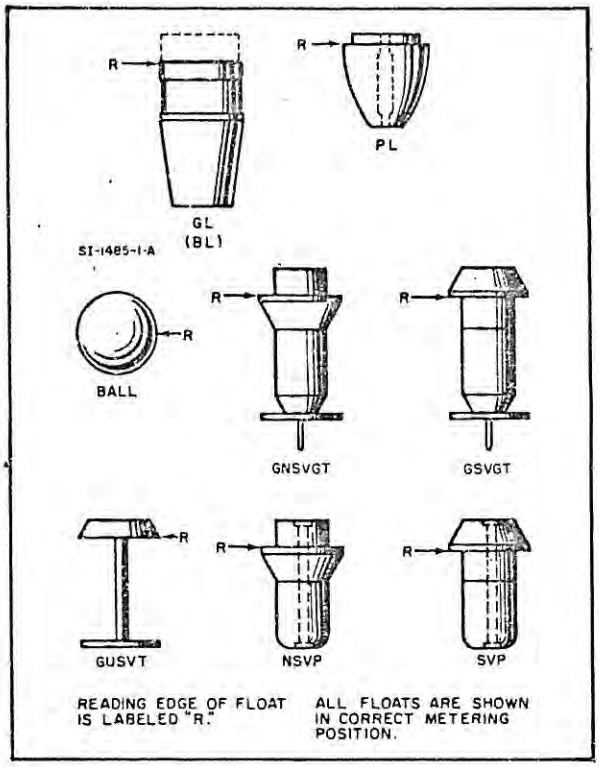


Fig. 5 – Float reading edges

Meter readings must be taken from the scale at the graduation that coincides with the reading edge of the float. Fig. 5 illustrates various types of floats and their reading edges.

II. Liquids

To prevent meter tube breakage or damage to the meter float, the flow of liquid through the meter should be started gradually. Assume that both the inlet and outlet shut-off valves are closed and that the by-pass valve is open, proceed as follows:

1) Slowly open the shut-off valve at the meter inlet to equalize the static pressure, then open the valve all the way.

2) Slowly open the shut-off valve at the meter outlet approximately $\frac{1}{2}$ turn and allow the float to stabilize.

3) Gradually close the by-pass valve and simultaneously open the shut-off valve at the meter outlet.

The shut-off valve at the meter outlet may be used to throttle the fluid flow if desired. When it is desired to protect the meter from full line pressure or from pressure shock, the shut-off valve at the meter inlet may be used to throttle the flow.

III. Gases

The same start up procedures apply for gas service as for liquid service (as discussed in Part II above) with one exception. That is, the shut-off valve at the meter inlet should **never be used** to throttle the flow. Always use the shut-off valve at the meter outlet to throttle flow.

Meters are designed for specific service conditions. However, if the meter is applied to a new gas service and float bounce occurs, it may be the result of; 1) extreme low pressure operation; 2) long range tube and float combinations; 3) heavy floats; 4) operation near tube zero (at very low diameter ratios); or 5) large piping volumes between upstream and downstream throttling points. Refer service problems of this nature to the local Fischer & Porter Ltd. service engineer.

MAINTENANCE

I. General

The only maintenance required is the occasional cleaning of the tube and float. The meter should be

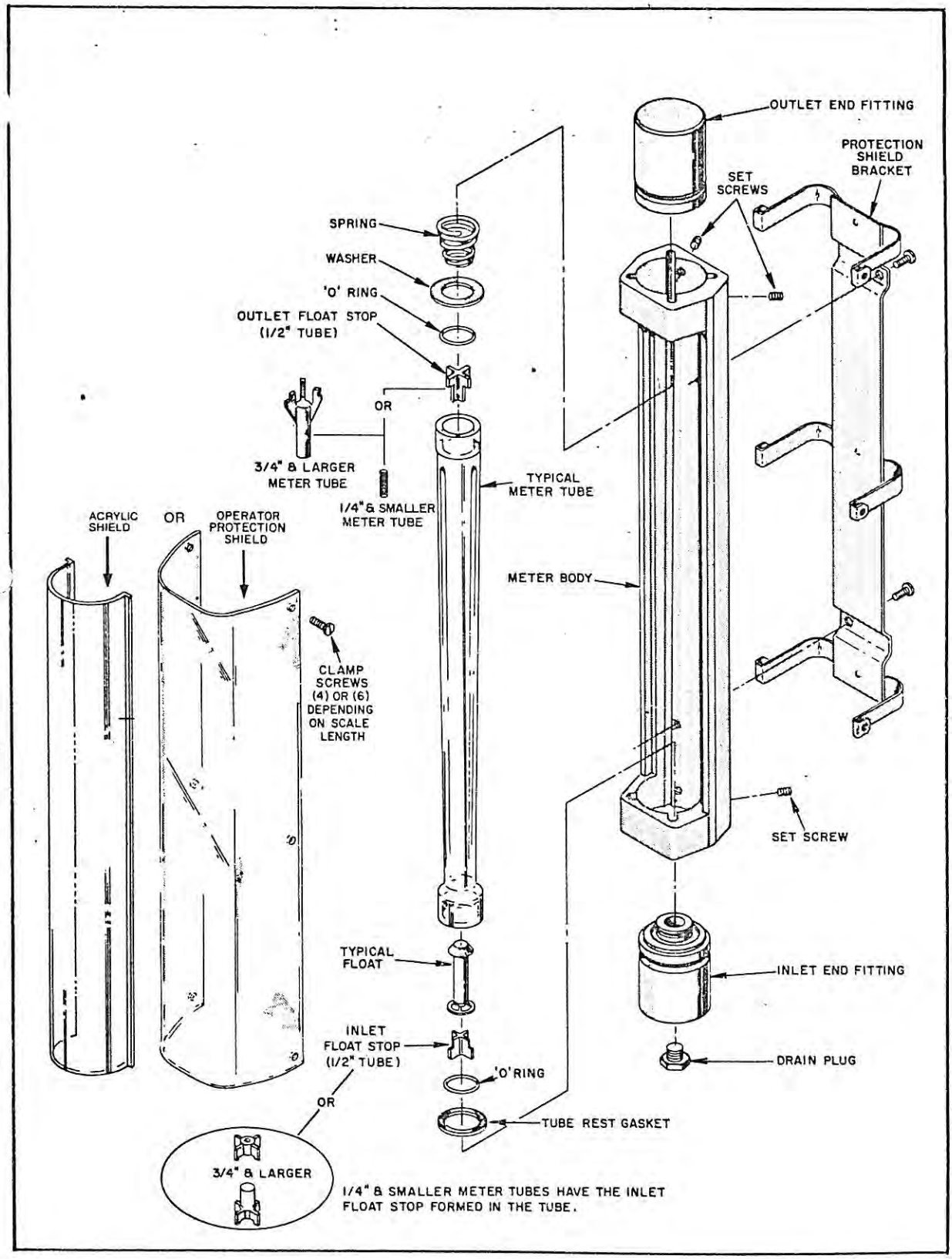


Fig. 6 – Exploded view of meter ($\frac{1}{2}$" x $\frac{1}{2}$" size illustrated)

MODEL 10A3500 SERIES

cleaned frequently enough to preserve the accuracy and float visibility.

The meter tube and the float are precision manufactured parts. Never subject the meter tube to unnecessary shock or strain. When removing the tube, be careful not to drop the meter float. Handle the float with care as a nick or scratch will destroy the meter's accuracy.

II. Series 10A3500 Flowrators

A. Tube & Float Removal

To remove the meter tube and float, proceed as follows:

1) Remove the acrylic shield by squeezing its sides inward to release it from the body slots. If the meter has a Darvic scale, squeeze only the side opposite the scale, or remove screws holding polycarbonate shield.

WARNING

Remove pressure from meter before attempting to remove the meter tube.

2) If the meter is full of liquid, remove the drain plug on the bottom of the inlet fitting.

3) Grasp the meter tube and slowly but firmly, push the tube upwards into the spring loaded outlet end fitting, as shown in Fig. 7 until the bottom of the tube clears the inlet end fitting. When the tube is clear, move the bottom of the tube forward and then lower the meter tube from the outlet end fitting.

4) Remove the float by inverting the tube. Meters with a ½" tube have an outlet float stop pressed into the outlet end bell that must be removed first. In all other sizes, the outlet float stop is held in the outlet end fitting.

5) Clean the meter tube and float with a mild detergent and water or a suitable solvent. A soft cloth or a tube brush (available from F & P) may be used to clean the tube, except for the 1/16" and 1/8" tube, where a pipe cleaner may be used.

B. Tube & Float Installation

To install a tube and float, proceed as follows:

1) Inspect the "O" rings on the end fittings for nicks or cuts. Replace any defective "O" rings. The "O" rings should be coated sparingly with a silicone grease to prevent damage at installation. Check to see that the tube rest gasket is in place on the inlet end fitting.

2) Install the inlet float stop, the float, and the outlet float stop (½" tube only) into the tube. Check Fig. 5 to see that the float is correctly oriented.

3) Place the end of the meter tube with the highest scale graduation against the spring loaded washer in the outlet end fitting and push the tube upward until the bottom of the tube will clear the inlet end fitting.

NOTE

On 5" scale meters push the tube upward with a slight twisting motion to prevent the spring loaded washer from binding in the outlet fitting.

Move the bottom of the tube in until it is centred over the inlet end fitting, then allow the tube to move downward over the "O" ring on the inlet fitting. Rotate the tube as required to make the etched scale visible. Make certain that the tube is firmly seated on the inlet fitting tube rest gasket.

4) Replace the drain plug and the shield to complete the installation.

C. Disassembly

To completely disassemble the meter, disconnect the process piping; remove the meter from the panel or other support. Refer to Fig. 6, an exploded view of the "O" ring seal meter and proceed as follows:

1) Remove the tube and float as discussed in Part A, preceding.

2) Separate the inlet and outlet end fittings from the meter frame by removing the ends of the meter frame) using a hex key wrench. The inlet and outlet end fittings may then be pulled from the meter frame.

III. Series 10A3600 Flowrators

A. Tube & Float Removal

To remove the tube and float proceed as follows:

1) Remove the polycarbonate shield, or snap in shield the later by squeezing its sides inward to release it from the body slots. If the meter has a Darvic scale, squeeze only the side opposite the scale.

WARNING

REMOVE PRESSURE FROM METER BEFORE ATTEMPTING TO REMOVE THE METER TUBE.

2) If the meter is full of liquid, remove the drain plug on the bottom of the inlet fitting.

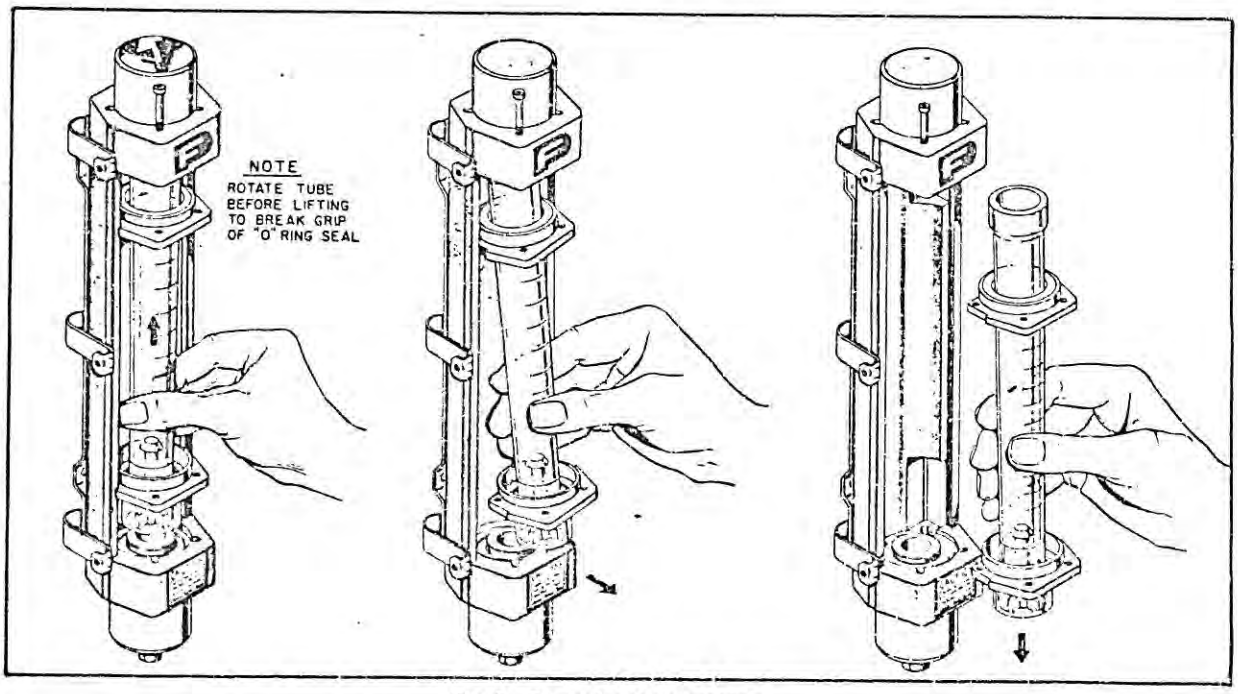


Fig. 7 – Removing the meter tube

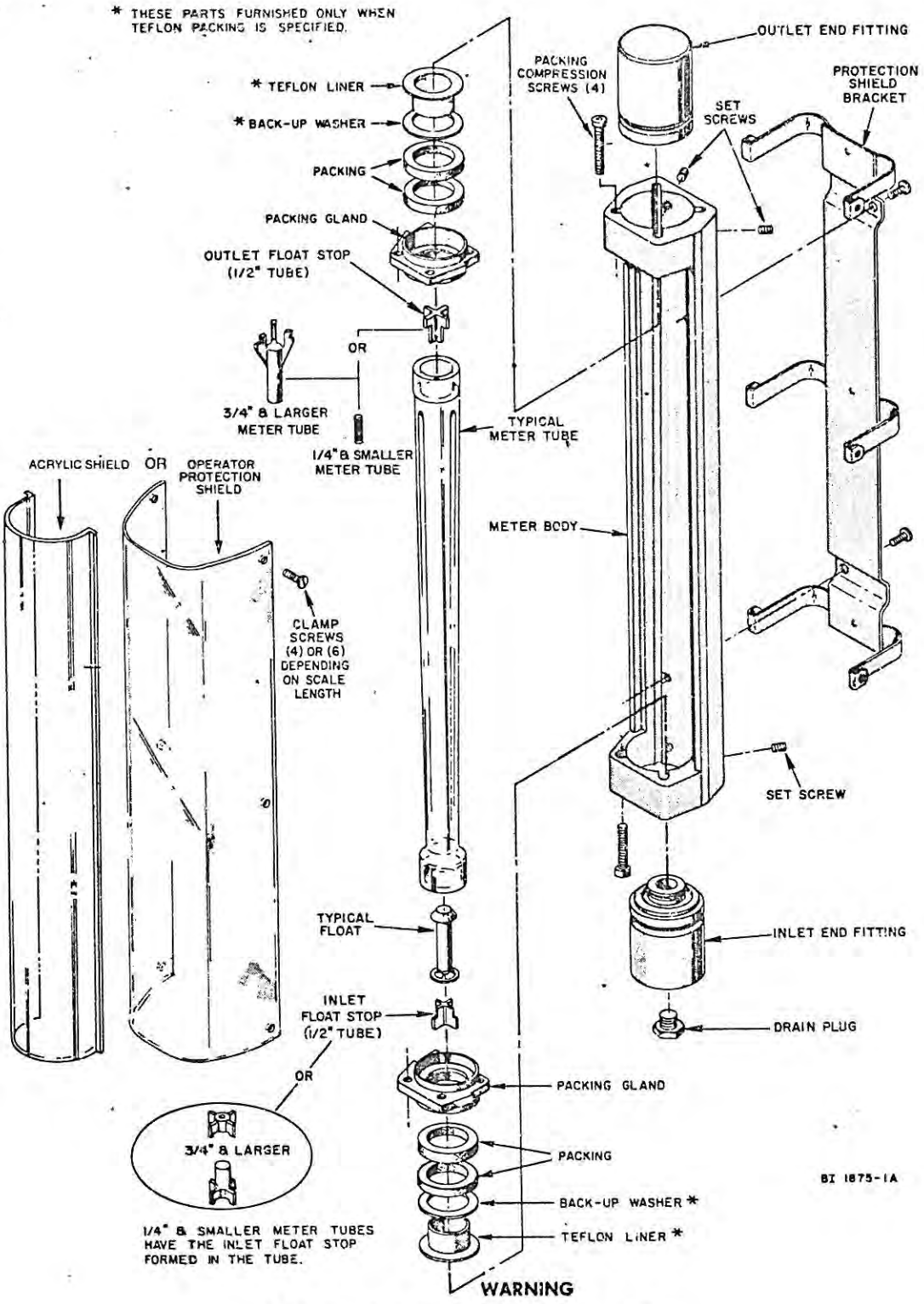


Fig. 8 – Exploded view of meter ($\frac{3}{4}$" x $\frac{3}{4}$" size illustrated)

MODEL 10A3600 SERIES

3) Remove the four (4) packing gland compression screws from each end of the meter. Move and hold the packing glands away from the end fittings. If the packing moves away with the packing glands from the ends of the tube, proceed to step 3; if not pull the packing free of the end fitting with a packing hook.

4) Grasp the meter tube, and slowly but firmly, push the tube upwards into the spring loaded outlet end fitting, as shown in Fig. 7, until the bottom of the tube clears the inlet end fitting. When the tube is clear, move the bottom of the tube forward and then lower the meter tube from the outlet end fitting.

5) Remove the meter float by inverting the tube. Meters with a ½" tube have an outlet float stop pressed into the outlet end bell that must be removed first. In all other sizes, the outlet float stop is held in the outlet end fitting.

6) Clean the meter tube and float with a mild detergent and water or a suitable solvent. A soft cloth or a tube brush (available from F & P) may be used to clean the tube, except for the 1/16" and 1/8" tube where a pipe cleaner may be used.

B. Tube & Float Installation

To install a tube and float, proceed as follows:

1) Inspect the "O" rings on the end fitting, if present, for nicks or cuts. Meters that have steel end fittings do not have "O" rings or the spring loaded washer. Replace any defective "O" rings. The "O" rings should be coated sparingly with a silicone grease to prevent damage at installation. Remove the packing from the meter tube and inspect for damage. When replacing, the packing rings should be lightly coated with silicone grease to prevent them from sticking to the meter tube. Two packing rings may be used separately or the rings may be lined with a Teflon liner, the latter being called Teflon packing. When the Teflon liner is used, a metal washer is used to back-up the liner flange. Inspect the inlet fitting to see that the tube rest gasket is in place.

2) Install the upper float stop, the float and the inlet float stop (½" tube only) into the tube. Check Fig. 7 to see that the float is correctly oriented.

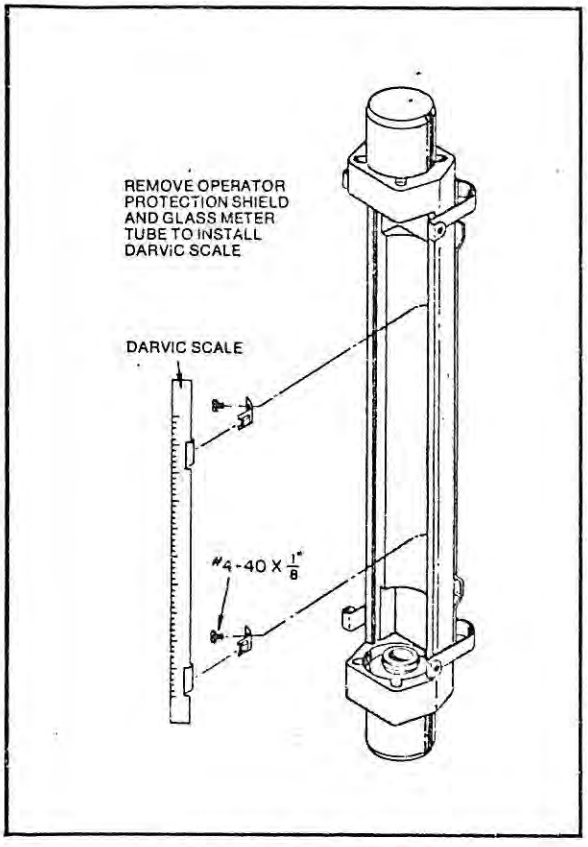


Fig. 9 – Darvic scale installation for ¼" & smaller meters

3) Place the packing glands and packing rings on the meter. Refer to Fig. 8, an exploded view of the packing type meter for the proper sequence of parts. Place the end of the meter tube with the highest scale graduation against the spring loaded washer in the outlet end fitting and push the tube upward until the bottom of the tube will clear the inlet fitting.

NOTE

On 5" scale meters, install the meter tube with a slight twisting motion to prevent the washer from binding in the outlet end fitting.

The washer is made of 302 stainless steel and the spring is made of 17-7PH stainless steel. Although the spring and washer are out of the normal flow stream it is possible that a faulty "O" ring could permit fluid to enter the cavity between the "O" ring and packing seal. If fluid contamination from these materials cannot be tolerated, the spring and washer may be removed without affecting the operation of the Flowrator. If the spring and washer are removed there is no loading to push the tube against the inlet fitting when installing the tube.

Move the bottom of the tube in until it is centered over the inlet end fitting, then allow the tube to move downward over the "O" ring on the inlet fitting. If the spring and washer are not present, manually seat the tube on the inlet fitting tube rest gasket. Rotate the tube as required to make the etched scale visible.

4) Push packing and retainers into end fittings and install packing compression screws. Tighten inlet gland screws first so that tube does not pull up from inlet tube rest gasket. Pull up screws evenly but do not overtighten as tube breakage may result.

5) Replace the drain plug and the safety shield, to complete the installation.

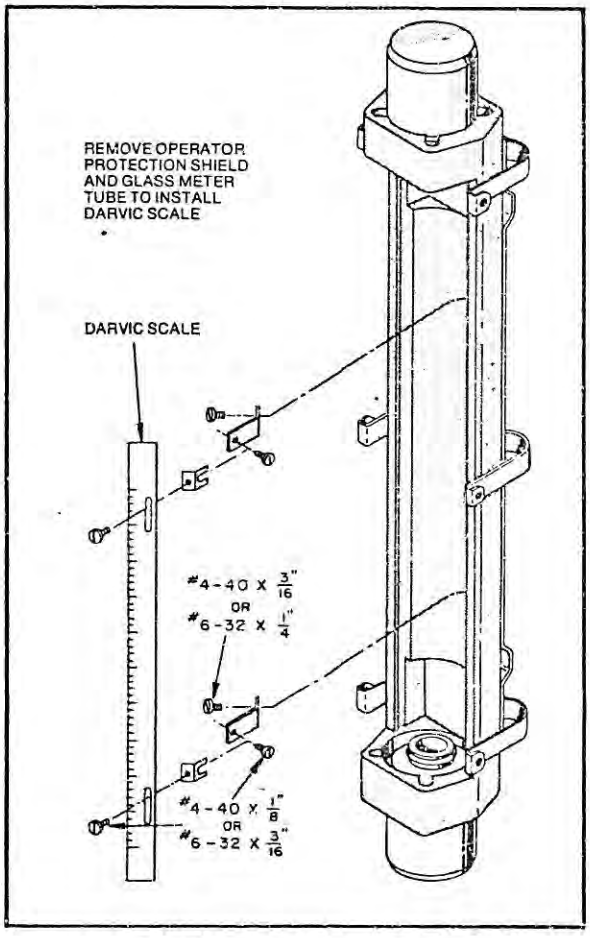


Fig. 10 – Darvic scale installation for ½" & larger meters

C. Dissembly

To disassemble the meter completely disconnect the process piping; remove the meter from the panel or other support. Refer to Fig. 8, an exploded view of e packing type meter and proceed as follows:

1) Remove the tube and float as discussed in Part A, preceding.

2) Separate the inlet and outlet end fittings from the meter frame by removing the set screws (2 on either end of the meter frame) using a hex key wrench. The inlet and outlet end fittings may then be pulled from the meter frame.

IV. Addition of Darvic Scales

Both the Series 10A3500 and 3600 Flowrator meter bodies are drilled and tapped to accommodate the installation of Darvic scales without body modification. The Darvic scale is usually used to provide direct reading, but can be provided with any desired calibration. To install the Darvic scale, refer to Fig. 9 for $\frac{1}{4}$" & smaller meters or Fig. 10 for $\frac{1}{2}$" & larger meters. The meter tube must be removed from the meter, as previously discussed, to install the scales. Line up the reference mark (lowest scale graduation) on the Darvic scale with the corresponding mark on the glass meter tube.

OPERATING AND MAINTENANCE INSTRUCTIONS FOR
MODEL 177 BACK PRESSURE VALVE

1.0. GENERAL DESCRIPTION

This valve is a manually controlled variable pressure relief valve and covers a wide range of applications from sensitive instrumentation to heavy duty pressure. The valve is suitable for use with high pressure fluids or gases and will relieve with extreme accuracy over a wide variable range. This is achieved by the incorporation of a number of alternative piston/diaphragm assemblies in conjunction with various loading springs. The standard valve is NOT suitable for use with oxygen, a special version incorporating oxygen compatible materials is available for use with this hazardous medium.

2.0. PRINCIPLE OF OPERATION

Ensure that valve is correctly fitted into pressure line with regards to inlet and outlet ports. When the control knob is turned fully anti-clockwise thereby relaxing all pressure on the main loading spring the main valve is kept on its seat only by a small return spring. Therefore introduction of pressure through the inlet port will act upon the underside of the piston or diaphragm and raise the valve from its seat permitting flow to take place to the outlet port. Turning the control knob clockwise will tension the main spring and prevent pressure passing to the outlet port until such time as the load exerted on the underside of the piston or diaphragm exceeds that of the main spring thus permitting the valve to rise from its seat and relieve off excess pressure past the set point of the valve. Flow will continue to take place until the inlet pressure drops sufficiently to allow the greater pressure exerted by the loading spring to close the main valve on to its seat thereby stopping flow taking place to the outlet port. To increase the desired relief pressure turn the control knob clockwise, conversely to decrease relief pressure turn the control knob anti-clockwise.

3.0. PISTON/DIAPHRAGM ASSEMBLIES AND SPECIFICATION

To enable the valve to be used for various pressure ranges the following piston/diaphragm assemblies are available.

RELIEF PRESSURE RANGES

PSI	KG CM2	ASSEMBLY	CODE
½ to 25	0.035 to 1.75	Diaphragm	S
25 to 150	1.75 to 10.56	Diaphragm or piston	T
100 to 300	7.03 to 21.09	Piston	V
100 to 750	7.03 to 52.73	Piston	W
200 to 1000	14.06 to 70.30	Piston	X
200 to 1500	14.06 to 105.46	Piston	Y
300 to 2000	21.09 to 140.62	Piston	M
1000 to 3500	70.30 to 246.00	Piston	Z

Maximum permissible inlet pressure 3500 p.s.i. (246 KG CM2)
Hydrostatic test pressure 5250 p.s.i. (370 KG CM2)
Inlet and outlet ports tapped 3/8" B.S.P. parallel.
Body Material: Nickel Aluminium Bronze Spec: DGS.8452
Spring Housing: Brass
Main Valve: Stainless Steel.
Valve Seat: Plastic (Delrin)
1/4" Diameter valve seat supplied as standard, 1/8" and 3/16" diameter available to special order.
Please state relief pressure or code required when ordering.

4.0. MAINTENANCE

The simple construction of the valve ensures long and trouble free life. The only parts liable to deterioration are the valve seat, 'O' rings and diaphragm if fitted.

5.0. FAULT DIAGNOSIS

	EFFECT	CAUSES	REMEDY
5.1.	Constant leak from outlet port before set relief point is reached.	(a) Damaged or pitted valve seat or valve stem.	(a) Fit new valve seat or valve stem.
		(b) Dirty valve seat or valve stem.	(b) Remove, clean with soft lint free rag.
5.2.	Constant leak of pressure into spring housing discharging through vent tapping.	(a) Damaged or ruptured diaphragm (if fitted).	(a) Renew diaphragm.
		(b) Damaged 'O' ring if piston assy. fitted.	(b) Renew 'O' ring.
5.3.	Valve will not relieve at set point.	(a) Valve stem sticking in seat retainer.	(a) Remove valve stem from retainer and clean both items.
		(b) Control knob needs re-adjusting.	(b) Re-adjust control knob.

	EFFECT	CAUSES	REMEDY
5.4.	Total inability of valve to control.	(a) Broken main spring.	(a) Renew main spring.

6.0. PROCEDURE FOR GAINING ACCESS TO DIAPHRAGM/PISTON ASSEMBLY AND MAIN VALVE AND SEAT

6.1. Ensure that inlet stop valve is closed, turn control knob fully anti-clockwise to exhaust any pressure in system before attempting any remedial action.

6.2. Unscrew body locking nut which holds spring housing to body. Lift off spring housing complete with body locking nut and control knob. Remove main spring which is now exposed.

6.3. Lift out piston or diaphragm assembly from body, this also withdraws main valve stem from seat retainer as main valve stem is attached to piston/diaphragm assembly. Inspect for wear etc.

6.4. Access to valve seat is obtained by unscrewing seat retainer from body, valve seat is held in position by this component and will probably come away with seat retainer. If seat is still left in valve body it can be removed easily with a screwdriver or similar pointed tool and will drop away from the body if this is inverted. Inspect for wear etc., replace if necessary.
Re-assemble all parts in reverse order to above.

I.O. 49112.	ITEM No.	PART No.	DESCRIPTION	No. Off	REMARKS	MAT'L
	1	AU.17760.	BODY ASSY.	1	COMPRISING.	
		B.17761.	BODY	1		ST. ST'L EN.58J.
		A.17762	LUG	2		ST. ST'L EN.58.
	2	A.13702.	BODY LOCKING NUT.	1	STANDARD. FINISH ELECTRO-TIN.	AL. BRONZE DGS. 8452
	3	AU.133111.	SPRING HOUSING ASSY.	1	STANDARD	BRASS.
	4	B.133471.	CONTROL KNOB.	1	STANDARD.	AL: ALLOY
✓	5.	AU.17708/SPCL.	PRESSURE PLATE ASSY.	1	COMPRISING.	
		A.17712/4/SPCL.	PISTON.	1		ST. ST'L EN.58J.
		A.352244.	SPRING.	1	STANDARD.	ST. ST'L EN.58A.
		OS.15.	'O' RING	1	STANDARD.	HIGH NITRILE 80° S.H.
		A.13333/SPCL.	PISTON PLATE	1		ST. ST'L EN.58J.
		A.17710/SPCL	VALVE STEM RETAINER	1		ST. ST'L EN.58J.
		A.17711/SPCL	NEEDLE VALVE	1.		ST. ST'L EN.58J.
✓	8.	EW 1/2.	THRUST RACE	1	STANDARD.	STEEL.
	9.	A.133348.	LOADING NUT.	1	STANDARD	MEEHANITE
	10.	A.133311	LOADING STEM.	1	STANDARD.	AL: BRONZE DGS.8452
	11	A.13344.	SPECIAL NUT.	1	STANDARD.	BRASS.
	12.	A.17703/SPCL.	SEAT RETAINER	1		ST. ST'L EN.58J.
✓	13.	A.17702	VALVE SEAT.	1	STANDARD	DELRIN.
✓	14.	A.21732	GUIDE BUTTON	1.	STANDARD	BRASS.
	15.	SP.55-N.	SPRING COIL WASHER.	1	STANDARD.	SPRING STEEL.
	16.	A.133143	THRUST WASHER	1	STANDARD	M. ST'L
	17.	A.133302	RETAINING CAP.	1	STANDARD	AL: ALLOY.
	18.	A.133301.	RETAINING NUT.	1.	STANDARD.	M. ST'L.
✓	20.	A.352106	LOADING SPRING	1	STANDARD.	ST. ST'L EN.58A.
✓	24.	WALKER 17045	'O' RING.	1	STANDARD	HIGH NITRILE 80° S.H.
✓	25.	OS.7.	'O' RING	1	STANDARD	HIGH NITRILE 80° S.H.
	26.		CHEESE HEAD SCREW. OBA x 3/8"	1	STANDARD	M. ST'L CAD PLATE
	27	A.133313	SPECIAL SCREW	1	STANDARD.	M. ST'L.
	28	TYPE 'U'	P.K. DRIVE SCREW SIZE 00 x 3/16"	2	STANDARD	STEEL.

✓ INDICATES RECOMMENDED SPARES

CHECKED

I.V. PRESSURE CONTROLLERS LTD.

DRAWN GRD.

MOD.	
ISSUE	1
DATE	8.4.70

APPROVED

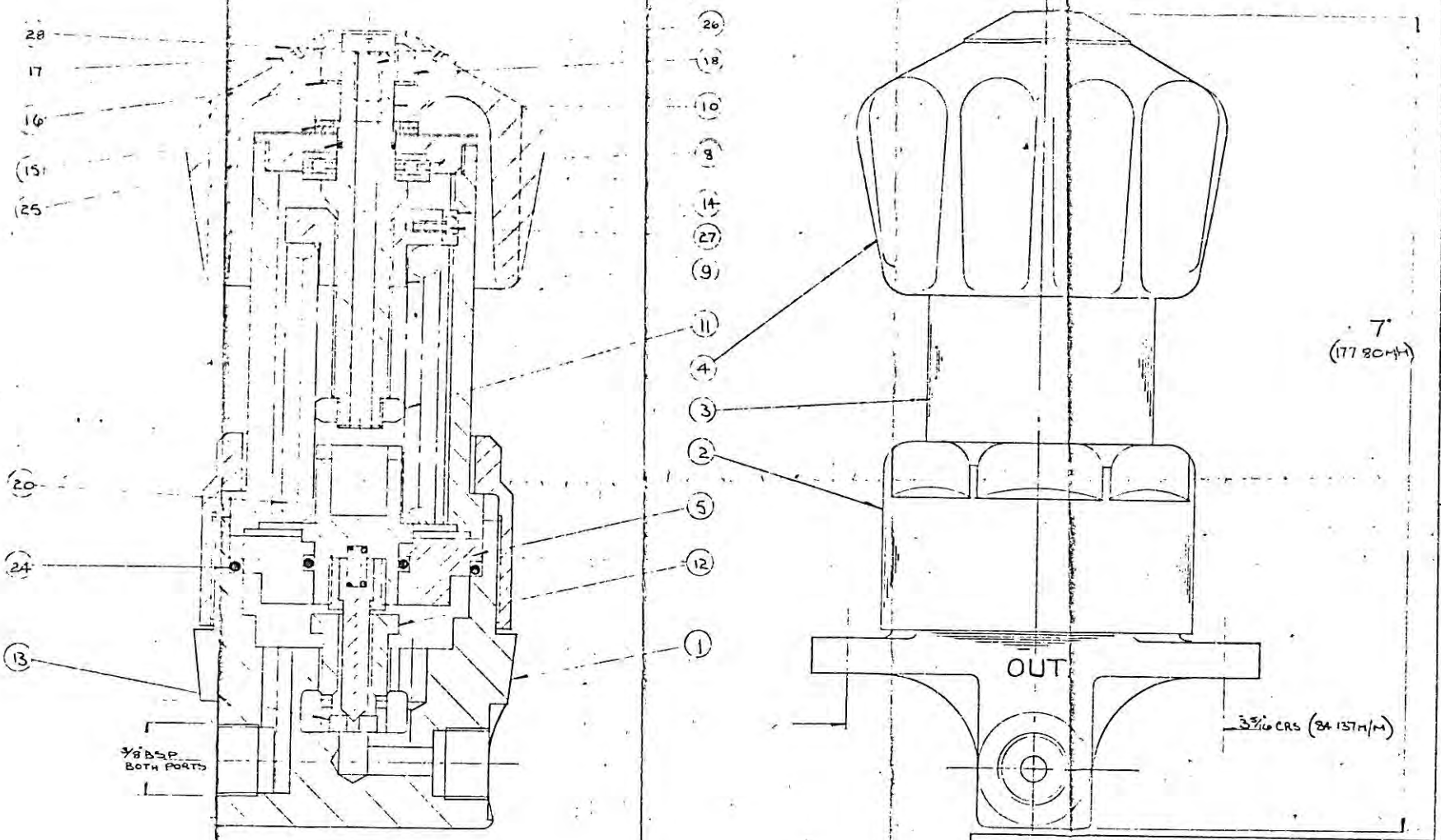
TITLE: BACK PRESSURE VALVE

SHEET 1 OF 1

CU. 177/Y/2090

DRAWING N° CU 177

THIRD ANGLE PROJECTION



I. V. PRESSURE CONTROLLERS LTD.

MATL:-	APPROVED	MOD.	
SPEC:-	CERTIFIED	ISSUE	6 7 8 9
FINISH:-	SEALED	DATE	

NOTES:-

MAX INLET 3500 PSI
(247 100 KG/CM²)

SCALE:- 2:1
DIMNS IN:- INCHES
TOLERANCES:-
DECIMAL DIMNS ± .005"
FRACTIONS ± 1/64"

TITLE:- TYPE 'PISCO' BACK PRESSURE VALVE

DRAWING No. CU177

ALFA-LAVAL

INSTRUKTION OCH DELFÖRTECKNING FÖR CENTRIFUGALPUMP TYP FM-0

Nr IM 70223-S2
Reg. 37235
8003

INNEHÅLL

BESKRIVNING

INSTALLATION

UNDERHÅLL

DRIFTSANVISNING

DEMONTERING OCH MONTERING

DELFÖRTECKNING

F M - 0
C E N T R I F U G A L P U M P A R

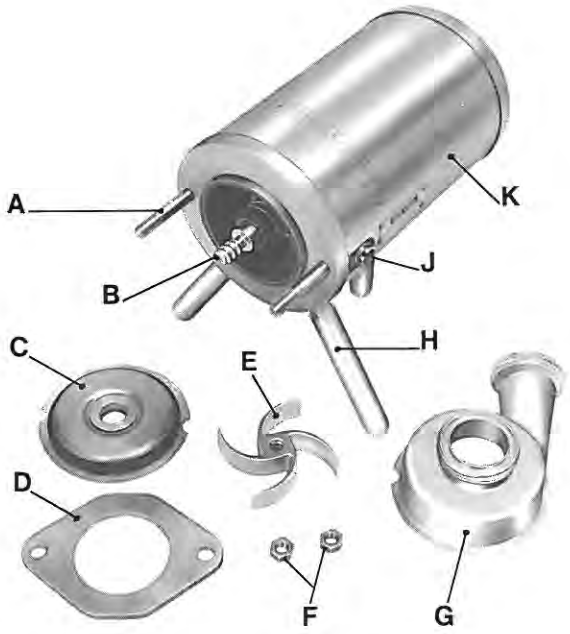
ANVÄNDNING

Centrifugalpump FM-0 är lämpad för användning inom livsmedels-, kemiska och andra industrier, där syrafast rostfritt stål är resistent mot förekommande vätskor.

Pumpen är försedd med ett pumphjul som tillsammans med pumphuset ger en effektiv pumpning och skonsam behandling av vätskan.

PUMPPRINCIP

Vätskan leds via frontanslutningen in i centrum av det roterande pumphjulet. De bakåtböjda skovlarna på pumphjulet sätter vätskan i rotation.
Centrifugalkraften gör att vätskan lämnar pumphjulet med större tryck och hastighet än den hade vid inloppet och slungas ut mot periferin, varifrån den trycks ut genom utloppet (toppanslutningen).



ALLMÄNT

En rätt vald centriufgalpump är driftsäker och fordrar jämförelsevis ringa skötsel.

För att få ett gott driftsresultat är det emellertid viktigt att pumpen monteras och sköts enligt anvisningarna i denna instruktion.

Pumpguide

Vi hänvisar även till ALFA-LAVAL's Pumpguide där en fyllig information ges beträffande val, drift, skötsel, installation mm av pumpar.

Pumpguiden kan om så önskas beställas från ALFA-LAVAL AB.
Beställningsnummer: PM 60472

A Pinnskruv
B Pumpaxel
C Bakplåt med pumphuspackning
D Ok
E Pumphjul
F Muttrar för ok
G Pumphus
H Ben
J Elektrisk uttagslåda
K Kåpa

BESKRIVNING

STANDARDUTFÖRANDE

Material

Alla vätskeberörda delar, dvs pumphus, pumphjul, pumpaxel och bakplåt är utförda av syrafast stål, AISI 316.

Kåpa, ben, ok, skruvar och muttrar av rostfritt stål AISI 304.
Packningar av oljebeständigt Nitrilgummi.

Axeltätning - Enkel

Axeltätningen är en fjäderbelastad balanserad plantätning, med en fast stationär tätningsring av syrafast stål och en roterande tätningsring av kol.

Anslutningar

Anslutningarna kan förses med önskad anslutning. Se tabell nedan.

Motor

Direktkopplad specialflänsmotor 1,1 kW (1,5hk) 3 000 r/min, trefas växelström 50 Hz, 220/380 V.

TILLÄGGSUTRUSTNING

Axeltätning - Dubbel

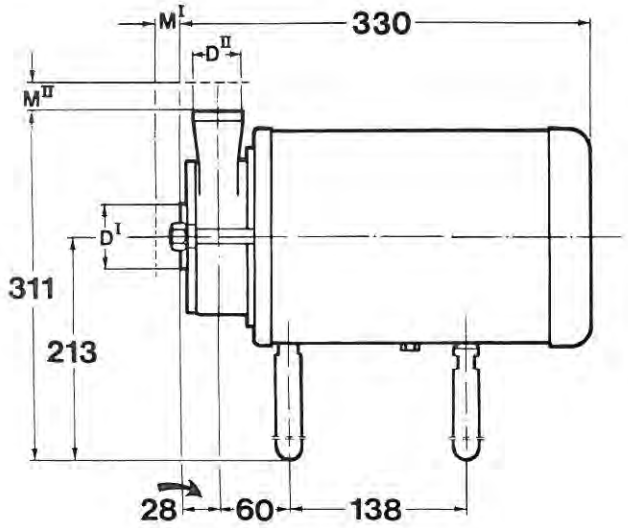
Denna typ av tätning, vattenspolad, kan bli aktuell vid pumpning av slitande vätskor, kristalliserande vätskor, eller när vattenkylning av tätningen erfordras.

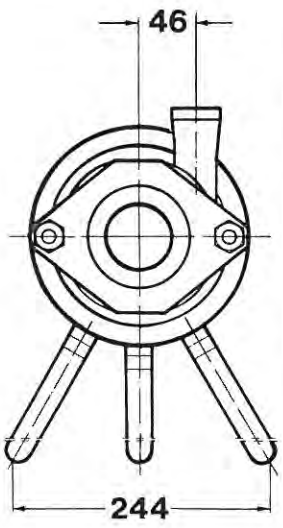
Vid pumpning av sterila vätskor kan ånga användas för att förhindra infektion genom tätningen.

Övrig tilläggsutrustning

- Pumphjul med reducerad diameter
- Annan spänning och frekvens än standard eller motor med ökad säkerhet
- Packningar av åldringsbeständigt EPDM-gummi
- Packningar av viton för aggressiva vätskor
- Packningar av teflonklätt gummi
- Kromoxidbelagd stationär tätningsring
- Kromoxidbelagd roterande tätningsring

DIMENSIONER





ANSLUTNINGAR

D^{I} 51 D^{II} 51	Mått M^{I}	 M^{II}
ISO fläns-hylsa	21,5	21,5
ISO nippel	21,5	21,5
SMS nippel	20	20
DIN nippel	22	24
BS nippel	24	20

UPPSTÄLLNING

Pumpen levereras som en färdig enhet och ingen uppriktning är nödvändig.

Pumpen skall ställas upp på ett sådant sätt att den blir åtkomlig för tillsyn och skötsel. Se till att det finns tillräckligt med utrymme för demontering och montering och ta hänsyn till förläggningen av rörledningarna.

RÖRSYSTEM

Sug- respektive tryckledningar skall ha minst samma diameter som respektive anslutning. Rörkrökarna bör vara så få som möjligt och ha stor radie.
Tätheten hos sugledningen bör kontrolleras genom provtryckning.

Vid avvikelse, t ex p g a kapacitet, viskositet, vätskehastighet etc bör koniska övergångar användas. Vid övergång från större sugledning anslutes med excentriskt övergångsstycke med den raka sidan uppåt.

RÖRLEDNINGAR - ANSLUTNING

Pumpen skall monteras så att vätskan leds in i frontanslutningen (sugsidan) och ut i toppanslutningen (trycksidan).

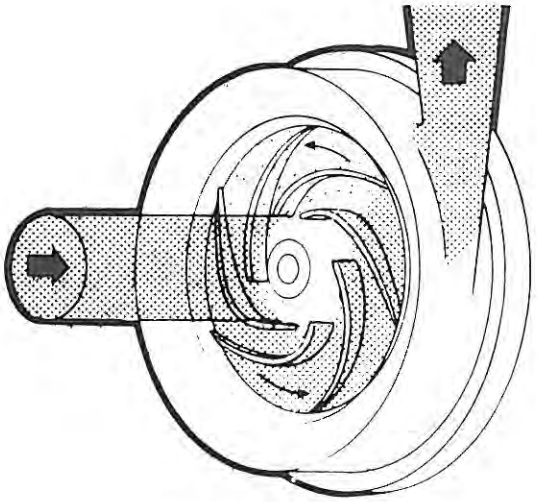
PUMPEN SKALL MONTERAS SÅ ATT DEN INTE SUGER LUFT!

Rörledningarna skall ha sådan passning till pumpens in- och utlopp att inga drag- eller tryckspänningar överförs till pumphuset vid åtdragning av anslutningarna.

Rörledningarna skall vara monterade och fastsatta på ett sådant sätt att rören inte förorsakar spänningar i pumphuset vid värmeutvidgning.

Pumpen kan deformeras t ex vid för stora vibrationer, vid värmeutvidgning av långa raka rör, vid svetsning nära pumpen, eller vid onormal belastning t ex genom att någon ställer sig på en rörledning.

ALFA-LAVAL SVARAR INTE FÖR DE FÖLJDER SOM ORSAKAS AV OTILLFREDSSTÄLLANDE MONTERING GJORD AV KUNDEN.



MOTORER

Motorerna levereras normalt för 220/380 V, 50Hz, trefas växelström.

Övriga spänningar och 60 Hz motorer leveraras på speciell beställning.

Nätanslutning

Motorn jämte erforderliga startapparater, motorskydd etc skall anslutas av elektriker till nätet.

KONTROLL FÖRE START

1 Kontrollera att pumphuset är rätt monterat och åtdraget.

FEL MONTERING KAN FÖRORSAKA ALLVARLIGA OLYCKOR!

2 Kontrollera att pumphjulet roterar åt rätt håll - moturs, sett från inloppet - genom en så kort start som möjligt av motorn.

KÖR INTE PUMPEN MED FEL ROTATIONSRIKTING DEN KAN DÅ TA SKADA!

VIKTIGT!

KONTROLLERA ROTATIONSRIKTNINGEN MED AVTAGET PUMPHJUL.

UNDERHÅLL

UNDERHÅLL

Axeltätningen, gummipackningarna och motorlagren är normalt de enda detaljer som kräver underhåll.

ALFA-LAVAL rekommenderar att kontroll av ovanstående detaljer utförs efter tolv (12) månaders enskiftsdrift.

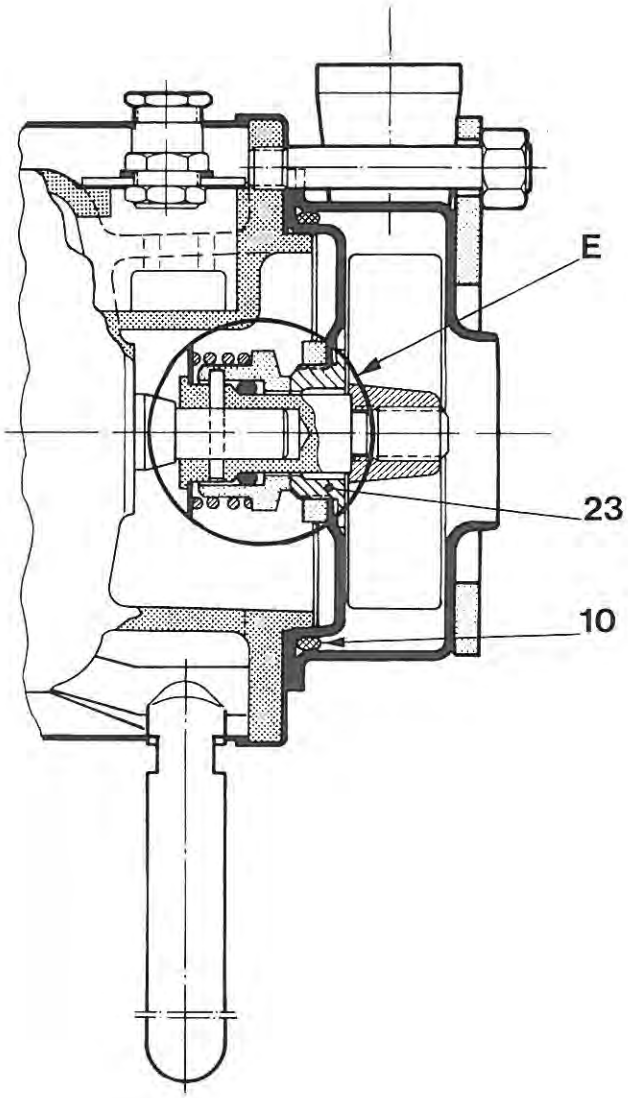
OBS!
Tolv månader gäller vid ideala förhållanden. Vid mera krävande installationer bör kontrollen utföras med kortare tidsintervall.

AXELTÄTNING

Axeltätningen E är den del av pumpen som är känsligast. Det är mycket svårt att ange normal driftstid eftersom den beror på pumpat medium, driftstemperatur m m. Erfarenheter vid drift får alltså visa hur långa serviceintervall som erfordras.

OM TÄTNINGEN ÄR FELFRI SKALL INGET DROPPLÄCKAGE UPPSTÅ UNDER DRIFT.

Om axeltätningen till följd av förslitning inte längre tätar, bör normalt hela tätningssatsen bytas ut.
Den stationära tätningsringen 23 kan dock användas igen om den är helt blank och felfri.



Slitande vätskor

Vid pumpning av slitande vätskor skall den stationära tätningsringen 23 vara kromoxidbelagd (ev även den roterande tätningsringen).

SE ALLTID TILL ATT RESERVTÄTNINGAR LAGERHÅLLS.

Beträffande tätningssatser:
Se DELFÖRTECKNING.

GUMMIPACKNINGAR

Efter demontering skall pumphuspackningen 10 kontrolleras och vid behov bytas.

SE ALLTID TILL ATT RESERVPACKNINGAR LAGERHÅLLS!

Beträffande val av packningsmaterial:
Se tabell under DRIFTSANVISNING.

MOTORER

Kontrollera eventuellt oljud från motorlagren.

Oljud kan innebära att lagren behöver bytas. Lagren är slutna och permanentsmorda och byts när de börjar bli slitna.

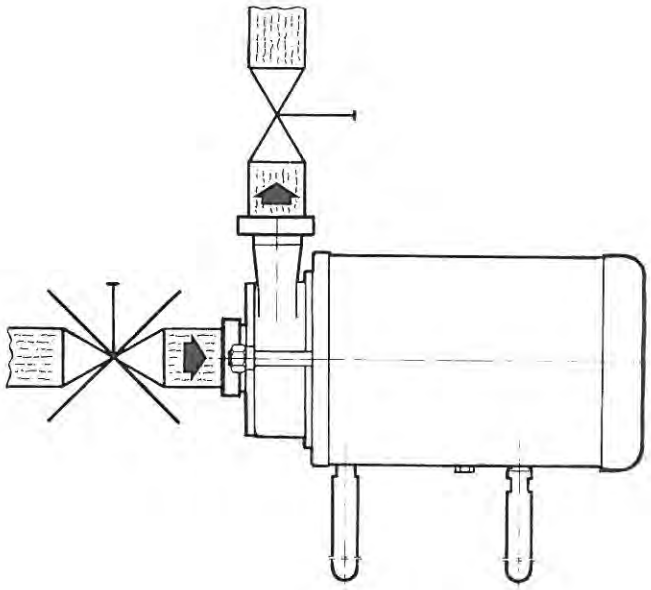
OM ELMOTORN HAR BLIVIT UTBYTT ELLER TILLGÄLLIGT HAR FRÅNKOPPLATS, ÄR DET VIKTIGT ATT FÖRE IGÅNGKÖRNINGEN KONTROLLERA ROTATIONSRIKTNINGEN (MOTURS) GENOM EN SÅ KORT START SOM MÖJLIGT!

Se KONTROLL FÖRE START under kapitel INSTALLATION.

Beträffande isärtagning av pumpen:
Se under DEMONTERING.

START

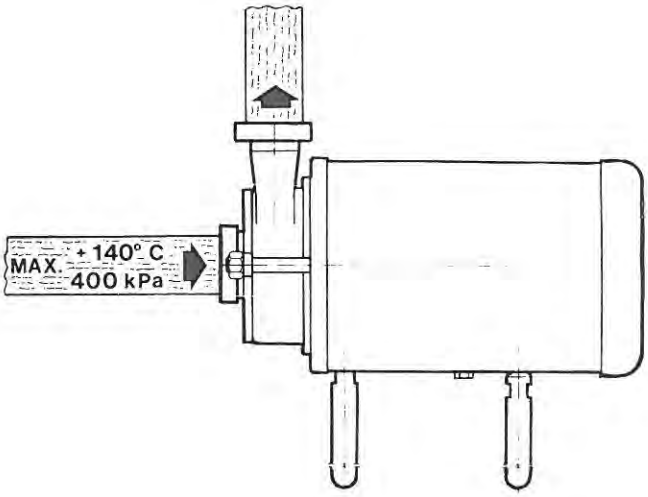
STRYP ALDRIG PÅ PUMPENS INLOPPSSIDA.
REGLERING AV PUMPEN SKALL ALLTID SKE MED STRYPNING PÅ UTLOPPSSIDAN, GENOM NEDSVARVNING AV PUMPHJULETS DIAMETER, ELLER MED VARVTALSREGLERING.



VÄTSKETEMPERATURER

Pumpen kan användas för vätsketemperaturer upp till +140°C. Vid temperaturer över +110°C rekommenderas dubbel axeltätning med vattenkylning.
Är pumpen försedd med nitrilpackningar bör temperaturen inte överstiga +100°C eftersom packningarna då åldras snabbt.

PUMPEN BÖR INTE KÖRAS TORR UNDER LÄNGRE TID, DÅ AXELTÄTNINGEN SNABBT SLITS NER.



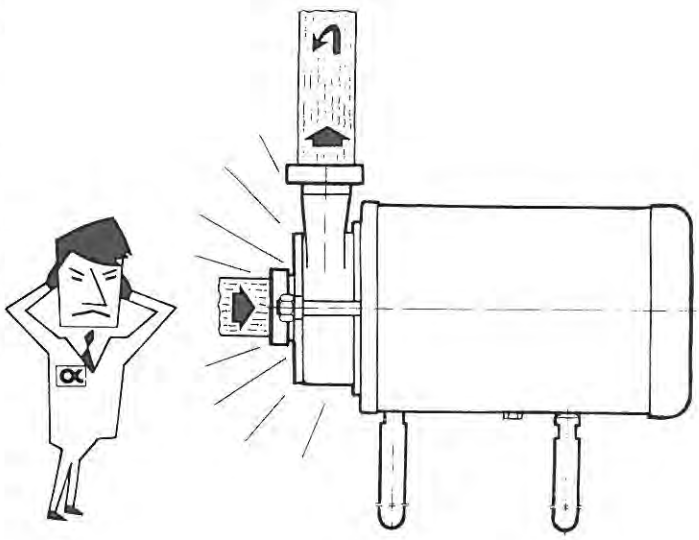
INLOPPSTRYCK

Max inloppstryck: 400 kPa (4 bar).

KAVITATION

Risk finns för att pumpen kaviterar om den arbetar med alltför lågt inloppstryck, och speciellt om vätsketemperaturen är hög.

ALFA-LAVAL's pumpar är tillverkade av syrafast rostfritt stål och därför innebär kavitationen ingen risk för erosion. Däremot minskar pumpens uppfordringshöjd, som kan gå ner till noll vid kraftig kavitation. Pumpens ljudnivå ökar betydligt (knastrande ljud) vid kavitation och lagren slits snabbare.



DRIFTSANVISNING

MATERIAL - VÄTSKOR

Pumpens vätskeberörda metalldelar är tillverkade av syrafast stål, AISI 316.

Packningarna kan erhållas i olika gummimaterial.
Nedanstående tabell ger en indikation om gummits användningsområden.

KONCENTRATION, TEMPERATUR ETC, KAN HA STOR INVERKAN PÅ GUMMIT OCH TABELLEN GER ENDAST RIKTVÄRDEN.

KONTAKTA ALFA-LAVAL I TVEKSAMMA FALL.

DISKNING

Pumpen kan rengöras i disksystem (t ex CIP) med normalt förekommande diskmedelskoncentrationer.

OBS!
Vid för kraftig dosering med salpetersyra kan gummimaterialet svärta.

ÖVERBELASTNING

Effektförbrukningen i pumpdiagrammen* gäller för pumpning av vätskor med densitet och viskositet som vatten.

Vid pumpning av vätskor med högre densitet och/eller viskositet stiger effektförbrukningen med risk för överbelastning av motorn.

Pumpar för vissa ändamål har inte motorer som är tillräckligt stora för pumpens hela kapacitetsområde. Om trycket efter en sådan pump minskas, kan motorn överbelastas. Vid ändrade driftförhållanden måste detta kontrolleras, t ex med pumpdiagrammet eller med mätning av strömstyrkan, som då jämföres med angiven strömstyrka på motorskylten.

Kapaciteten kan begränsas genom avsvarvning av pumphjul, fast förstrypning, kapacitetsregulator, varvtalsreglering, etc.

MOTOR (IEC metrisk standard)

MOTORN SKALL VARA FÖRSEDD MED DRÄNERINGSHÅL.

OM ELMOTORN HAR BLIVIT UTBYTT ELLER HAR TILLFÄLLIGT FRÅNKOPPLATS, ÄR DET VIKTIGT ATT FÖRE IGÅNGKÖRNINGEN KONTROLLERA ROTATIONSRIKTNINGEN (MOTURS) GENOM EN SÅ KORT START SOM MÖJLIGT.

Se KONTROLL FÖRE START under kapitel INSTALLATION.

* Pumpdiagram kan beställas från ALFA-LAVAL AB.

Gummi-kvalitet	Väder-ozon	Mjölk Grädde	Varmvatten Vattenånga Svaga syror Alkalier	Starka och oxide-rande syror	Bensin olja fett (ej mjölk och grädde)	Lösnings-medel
Nitril (stand)	Mindre god	God	God	Mindre god	God	Dålig
EPDM	Utmärkt	God	Utmärkt	God	Dålig	Dålig
Viton	Utmärkt	-	Utmärkt	God	Dålig	God (EPDM för aceton)
PTFE (Teflon)	Utmärkt	Utmärkt	Utmärkt	Utmärkt	Utmärkt	Utmärkt

DEMONTERING OCH MONTERING

AXELTÄTNING - ENKEL

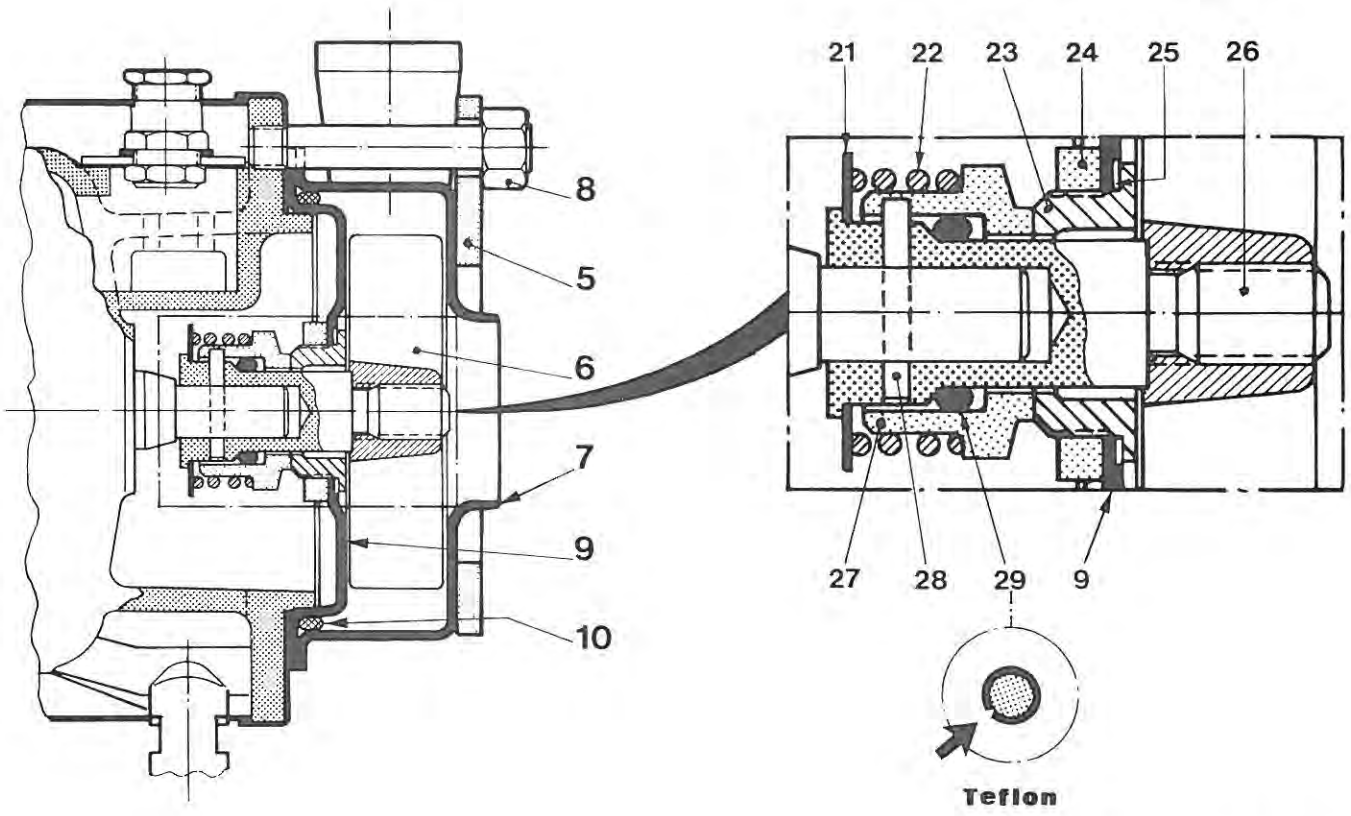


Fig. 1

DEMONTERING
(Siffrorna hänvisar till fig 1)

Vid isärtagning av pumpen, vid byte av delar i axeltätningen samt vid motorbyte förfares på följande sätt:

1 Skruva av muttrarna 8 och tag bort oket 5, pumphuset 7 och pumphuspackningen 10.

Om pumphuset sitter fast:
Slå lätt på utloppet med en gummiklubba.

2 Lossa pumphjulet 6 från axeln genom att vrida det moturs.

Om pumphjulet sitter hårt:
Slå ett par lätta slag med en gummiklubba.

3 Drag ut bakplåten 9 varvid hela axeltätningen blir åtkomlig för inspektion eler byte.

4 Skruva av muttern 24 och tag bort tätningsringen 23 och packningen 25 från bakplåten. (Muttern är vänstergängad och skall lossas medurs.)

5 Drag av resterande tätningsdetaljer från axeln.

6 Tag bort pinnen 28 och drag av avkastaren 21 och pumpaxeln 26.

DEMONTERING OCH MONTERING

AXELTÄTNING - ENKEL

MONTERING
(Siffrorna hänvisar till fig 1)

1 Kontrollera att tätningsdetaljernas packningsspår och tätningsytor är väl rengjorda, i annat fall kan läckage uppstå.

2 Smörj följande detaljer med silikonfett:

Ytterytan på pumpaxeln 26, innerytan på den roterande tätningsringen 27, O-ringen 29 och pumphuspackingen 10.

3 Placera avkastaren 21 på pumpaxeln 26. Montera pumpaxeln på motoraxeln och lås den med pinnen 28.

4 Trä O-ringen 29 på axeln. (Observera skarvens läge vid teflontätning.)

5 Placera fjädern 22 på tätningsringen 27. Skjut tätningsringen över O-ringen 29 och mot ansatsen, så långt det går, några gånger så att O-ringen ställer sig i rätt läge. Se till att spåret i tätningsringen kommer mittför medbringarpinnen.

6 Montera packningen 25 och tätningsringen 23 i bakplåten 9 samt spänn ihop enheten ordentligt med muttern 24.

7 Montera bakplåten 9 med tätningsdetaljer på motorn.

*8 Montera pumphjulet 6 med den rundade änden av navet **vänd** utåt.

9 Montera pumphuspackningen 10 och pumphuset 7.

10 Montera oket 5 och muttrarna 8 samt spänn ordentligt.

KONTROLLERA ATT PUMPHUSET ÄR RÄTT MONTERAT OCH ÅTDRAGET. FEL MONTERING KAN FÖRORSAKA ALLVARLIGA OLYCKOR!

FM-OM (MIXER)

*8 Montera pumphjulet 6 med den rundade änden av navet vänd inåt.

PUMPHJULET SKALL MONTERAS "BAKVÄNT" PÅ PUMP FM-OM, JÄMFÖRT MED FM-O.

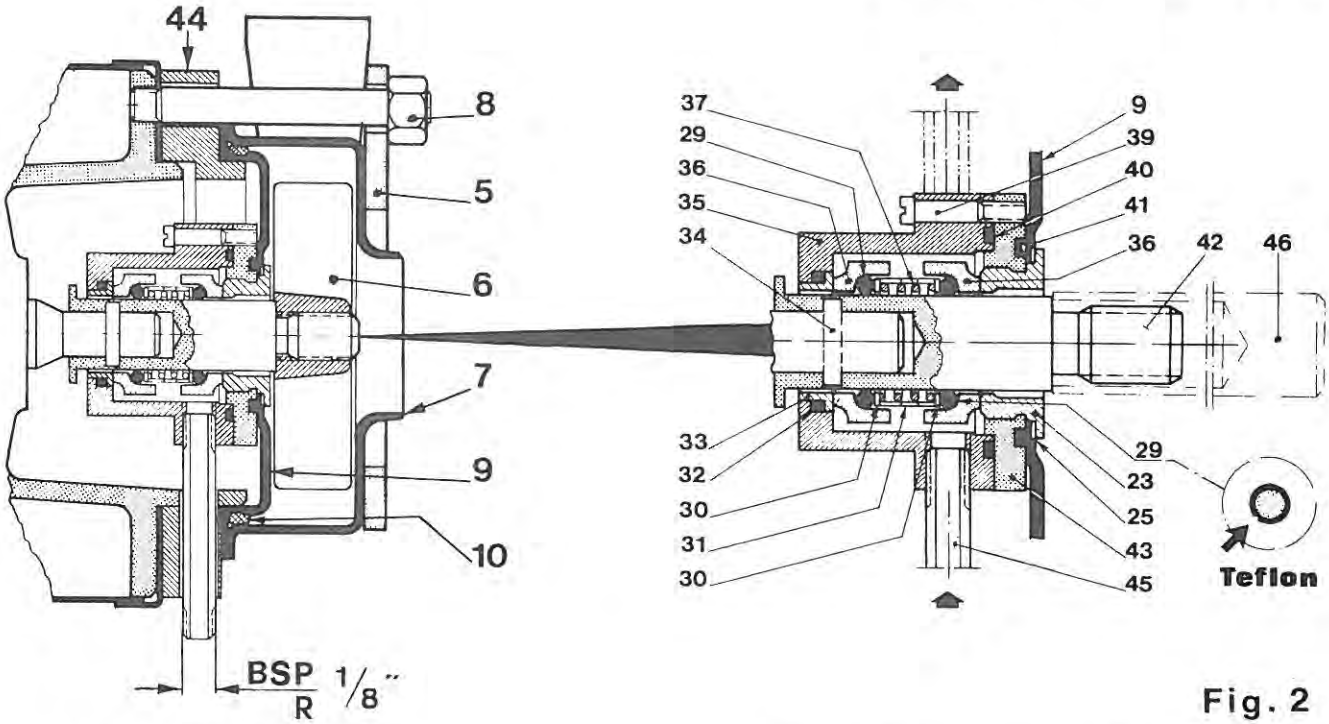


Fig. 2

TÄTNINGSVATTEN RESP ÅNGA

Vatten

Regleringen av vattnet skall alltid ske på inloppsröret till tätningen. Vatten utan föroreningar skall användas.

Vattenåtgång: ca 0,5 - 1 l/min
Vattentryck: max 50 kPa (0,5 bar)

OVAN ANGIVNA VATTENTRYCK FÅR INTE ÖVERSKRIDAS!

Ånga

Regleringen av ångmängden skall alltid ske på inloppsröret till tätningen. Ångtrycket får inte överstiga atmosfärstrycket, alltså motsvarande en temperatur av 100°C. Vid högre tryck kan ångan bli torr, varvid tätningen slits snabbt.

DEMONTERING
(Siffrorna hänvisar till figur 2)

Vid isärtagning av pumpen, vid byte av delar i axeltätningen, samt vid motorbyte förfares på följande sätt:

1 Skruva av muttrarna 8 och tag bort oket 5, pumphuset 7 och pumphuspackningen 10.

Om pumphuset sitter hårt:
Slå ett par lätta slag med en gummiklubba.

2 Lossa pumphjulet 6 från axeln genom att vrida det moturs.

Om pumphjulet sitter hårt:
Slå ett par lätta slag med en gummiklubba inne vid navet.

3 Drag ut bakplåten 9 varvid hela den dubbla axeltätningen och mellanflänsen 44 följer med ut.

4 Tag bort rören 45 till tätningen.

5 Lossa tätningshuset 35 från bakplåten 9 genom att gänga av det vid fästbrickan 43. (Fästbrickan lossans medurs.) Tag bort tätningsringen 23 och packningen 25 från bakplåten.

6 Skruva av skruvarna 39 varefter alla tätningsdetaljerna blir åtkomliga för inspektion eller byte.

7 Tag bort pinnen 34 och drag av pumpaxel 42.

DEMONTERING OCH MONTERING

AXELTÄTNING - DUBBEL

MONTERING
(Siffrorna hänvisar till fig 2)

Vid monteringen skall monteringsdornen 46 användas (en sådan medlevereras varje ny pump med dubbel axeltätning).

1 Kontrollera att tätningsdetaljernas packningsspår och tätningsytor är väl rengjorda, i annat fall kan läckage uppstå.

2 Smörj följande detaljer med silikonfett: Ytterytan på pumpaxeln 42, innerytorna på de roterande tätningsringarna 36, O-ringarna 29 och pumphuspackningen 10.

3 Montera pumpaxeln 42 på motoraxeln och lås den med pinnen 34.

4 Montera packningen 25, O-ringen 41, tätningsringen 23 och fästbrickan 43 på bakplåten 9, samt spänn ihop enheten ordentligt.

5 Trä bakplåten med monterade tätningsdetaljer (enligt punkt 4) över dornen 46.

6 Montera därefter (i den ordning figuren visar) tätningsringarna 36, O-ringarna 29, brickorna 30, fjädern 37 och distanshylsan 31. (Observera skarvens läge - på främre O-ringen 29 - vid teflontätning.)

7 Montera O-ringarna 32 och 40, samt tätningsringen 33 i tätningshuset 35. Skruva fast huset i fästbrickan 43 med skruvarna 39.

8 Montera mellanflänsen 44 på bakplåten och skruva i rören 45.

9 Trä dornen med tätningsdetaljer över pumpaxeln mot ansatsen för pumphjulet, och skjut in hela axeltätningen, med bakplåt och mellanfläns, till sitt rätta läge på axeln.

*10 Montera pumphjulet 6 med den rundade änden av navet vänd utåt.

11 Montera pumphuspackningen 10 och pumhuset 7.

12 Montera oket 5 och muttrarna 8 samt spänn ihop ordentligt.

KONTROLLERA ATT PUMPHUSET ÄR RÄTT MONTERAT OCH ÅTDRAGET. FEL MONTERING KAN FÖRORSKA ALLVARLIGA OLYCKOR!

FM-OM (MIXER)

*10 Montera pumphjulet 6 med den rundade änden av navet vänd inåt.

PUMPHJULET SKALL MONTERAS "BAKVÄNT" PÅ PUMP FM-OM, JÄMFÖRT MED FM-O.

ALFA-LAVAL

DELFÖRTECKNING

BESTÄLLNING AV RESERVDELAR

Vid beställning av reservdelar skall följande alltid anges:

- Pumptyp
- Tillverkningsnummer
- Detaljens benämning
- Antal
- Fullständigt detaljnummer

För motorreservdelar skall även anges:

- Motorfabrikat
- Motornummer
- Motorns typbeteckning och andra data som framgår av motorskylten

Av praktiska skäl är inga motordetaljer specificerade i delförteckningen, varför tydlig beskrivning skall anges vid beställning av sådana detaljer.

Om så är möjligt; ange även nummer, beteckning etc som finns på den defekta detaljen.

DELFÖRTECKNING FÖR CENTRIFUGALPUMP TYP FM-0

Nr SP 70223-S2
Reg. 37235
8003

DELFÖRTECKNING

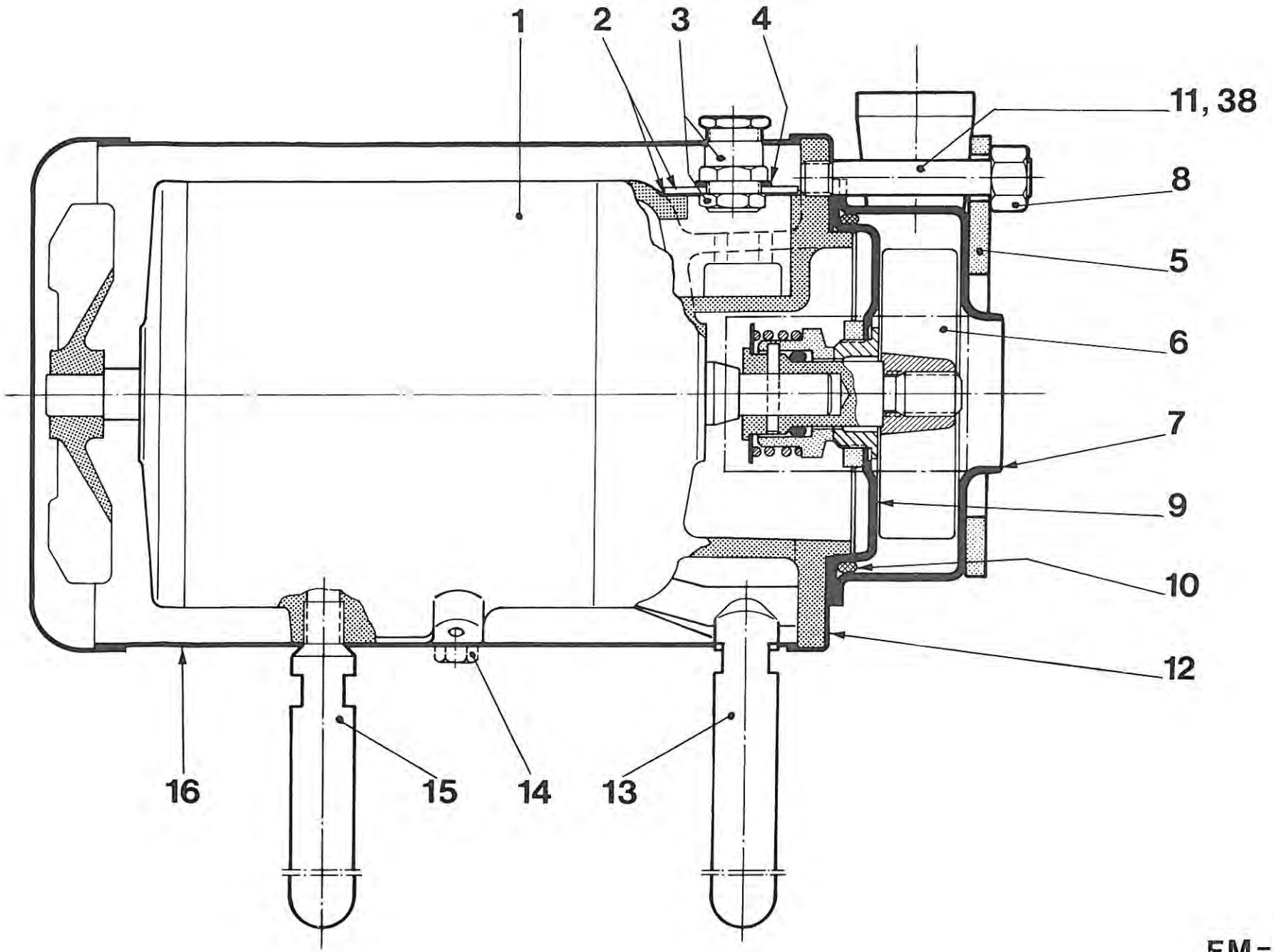
GEMENSAMMA DETALJER

Pos	Antal	Benämning	Alfa-Laval Detaljnummer
1	1	Motor 1,1 kW (1,5 hk) 220/380 V (standard)	31801-0060-1
	1	Motor 1,1 kW (1,5 hk) 240/420 V	31801-0060-2
2	1	Lock	31457-0023-1
		Packning för pos 2	31457-0024-1
	2	Skruv för pos 2	221120-04
	1	Stoppskruv för jordkabel	221533-09
3	1	Tätningshylsa 18,6 mm	31801-0154-3
	1	Kontramutter för pos 3	31801-0221-2
4	1	Packning	31457-0052-1
5	1	Ok	31457-0050-1
6*	1	Pumphjul, ø 95 mm	31457-0016-1
	1	Pumphjul, ø 115 mm	31457-0018-1
7	1	Pumphus, ISO skruv	31457-0038-1
	1	Pumphus, SMS	31457-0038-2
	1	Pumphus, DIN	31457-0038-3
	1	Pumphus, ISO clamp	31457-0038-4
	1	Pumphus, BS	31457-0038-5
8	2	Mutter	221803-22
9	1	Bakplåt	31456-0035-1
10	1	Pumphuspackning, Nitril (standard)	223412-75
	1	Pumphuspackning, EPDM	2234121-75
	1	Pumphuspackning, Viton	223412-76
	1	Pumphuspackning, Teflon	31456-0060-1
11,38	-	Se DELFÖRTECKNING A och B över AXELTÄTNING	
12	1	Beklädnad	31457-0013-1
13	2	Ben, främre	31457-0037-1
14	2	Skruv	2210936-43
15	1	Ben, bakre	31457-0037-2
16	1	Kåpa	31457-0049-1

* 60 Hz: Se separata pumpdiagram. (Kan beställas från Alfa-Laval AB) Ibland reducerad pumphjulsdiameter. Kontrollera originalhjulets diameter.

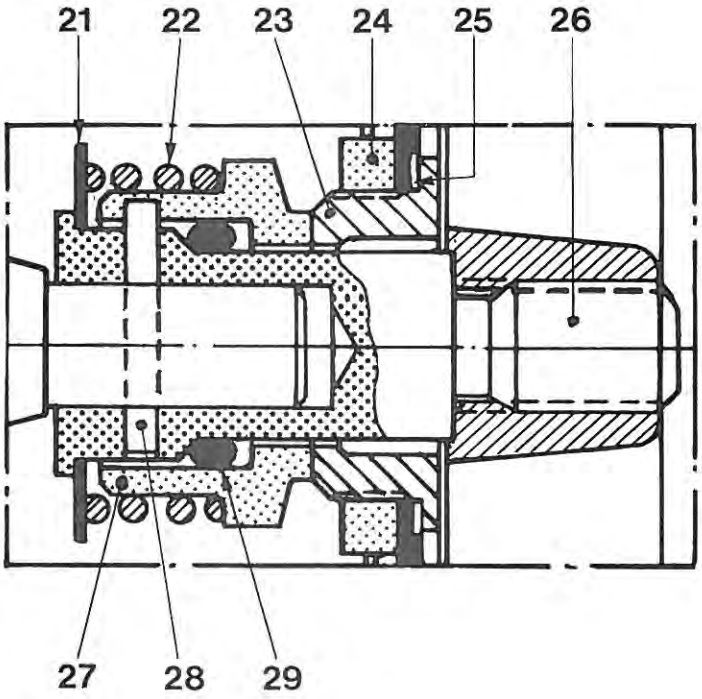
LÄMPLIGA RESERVDELAR

Position 10 samt tätningssatser för axeltätningen.

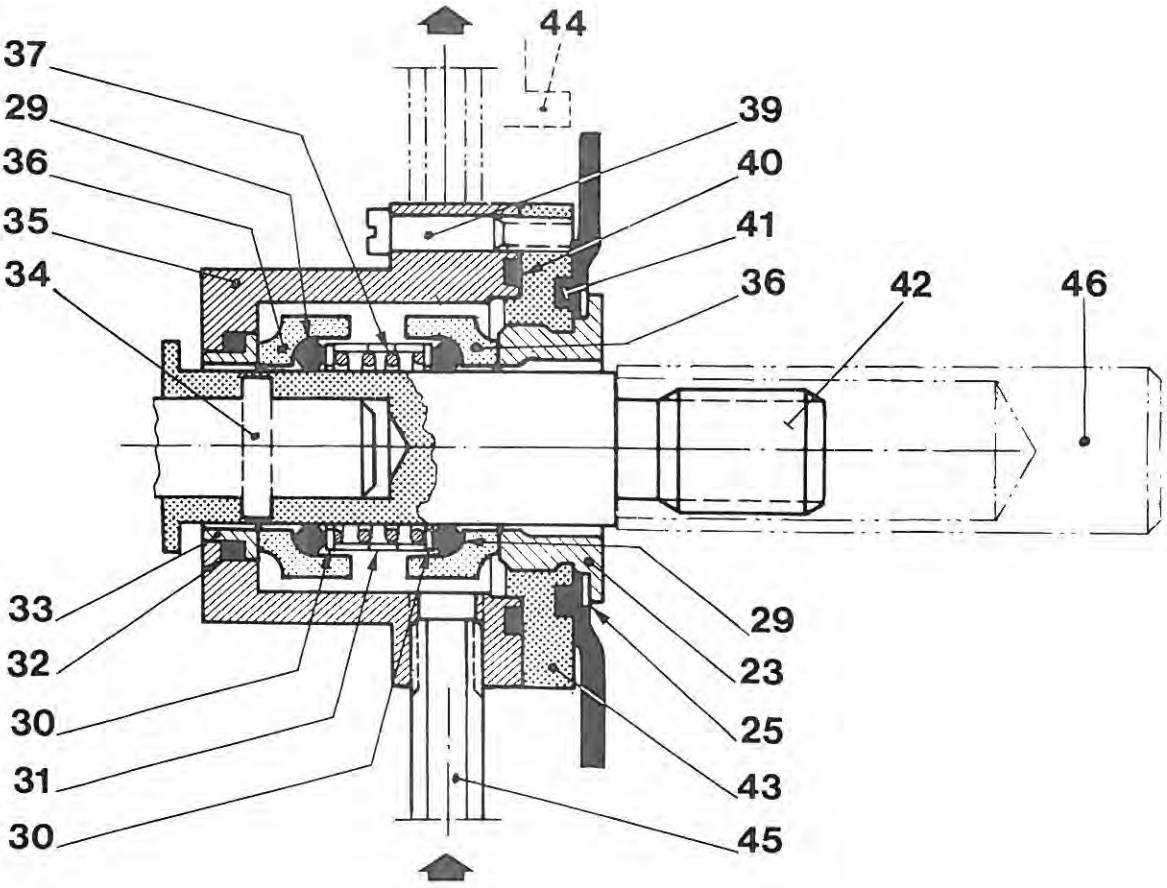


FM-0

A


21
22
23
24
25
26
27
28
29

B


44
37
29
36
35
34
39
40
41
36
42
46
33
32
30
31
30
29
23
25
43
45

DELFÖRTECKNING

A

DETALJER VID ENKEL AXELTÄTNING

Pos	Antal	Benämning	Alfa-Laval Detaljnummer
11	2	Pinnskruv	31457-0051-1
21	1	Avkastare	31457-0025-1
24	1	Mutter	31437-0120-1
26	1	Pumpaxel, FM-O och FM-OM	31457-0015-1
	1	Pumpaxel, FM-OS och FMI-O	31457-0064-1
28	1	Fjädrande rörpinne	260313-47
		Tätningssats Nitril (standard), komplett	31439-0164-1
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Nitril	31437-0121-1
27	1	Tätningsring, roterande	31439-0165-1
29	1	O-ring, Nitril	31439-0168-1
		Tätningssats, EPDM, komplett	31439-0164-4
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31437-0165-1
29	1	O-ring, EPDM	31439-0168-4
		Tätningssats Viton, komplett	31439-0164-5
22	1	Fjäder	31458-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31437-0165-1
29	1	O-ring, Viton	31439-0168-5
		Tätningssats Teflon, komplett	31439-0164-3
22	1	Fjäder	31438-0057-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
27	1	Tätningsring, roterande	31437-0165-1
29	1	O-ring, Teflon	31439-0168-3
		Alternativa tätningsringar	
27	1	Tätningsring, roterande, av Rulon	31439-0165-2
		Vid slitande vätskor	
23	1	Tätningsring, stationär, kromoxidbelagd	31437-0210-1
27*	1	Tätningsring, roterande, kromoxidbelagd	31439-0183-1

LÄMPLIGA RESERVDELAR

Kompletta tätningssatser

* Den kromoxidbelagda roterande tätningsringen får inte användas tillsammans med en stationär tätningsring av rostfritt stål.

DELFÖRTECKNING
B

DETALJER VID DUBBEL AXELTÄTNING

Pos	Antal	Benämning	Alfa-Laval Detaljnummer
30	4	Bricka	104125
31	1	Distanshylsa	31437-0212-1
34	1	Fjädrande rörpinne	222119-20
35	1	Tätningshus	31439-0114-1
37	1	Fjäder	104154
38	2	Pinnskruv	31457-0051-2
39	4	Skruv	221121-51
42	1	Pumpaxel, FM-O och FM-OM	31457-0055-1
	1	Pumpaxel, FM-OS och FMI-O	31457-0068-1
43	1	Fästbricka	31439-0113-1
44	1	Mellanfläns (placerad mellan mellandelen och bakplåten)	31457-0054-1
45	2	Rör	31457-0056-1
46	1	Monteringsdorn	31439-0118-1
		Tätningssats Nitril (standard) komplett	31439-0166-1
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Nitril	31437-0121-1
29	2	O-ring, Nitril	31439-0168-1
32	1	O-ring, Nitril	223406-51
33	1	Tätningsring, stationär	31450-0007-1
36	2	Tätningsring, roterande	31437-0211-1
40	1	O-ring, Nitril	223406-60
41	1	O-ring, Nitril	223406-58
		Tätningssats EPDM, komplett	31439-0166-4
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
29	2	O-ring, EPDM	31439-0168-4
32	1	O-ring, Nitril	223406-51
33	1	Tätningsring, stationär	31450-0007-1
36	2	Tätningsring, roterande	31437-0211-1
40	1	O-ring, Nitril	223406-60
41	1	O-ring, Nitril	222406-58
		Tätningssats Viton, komplett	31439-0166-5
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
29	2	O-ring, Viton	31439-0168-5
32	1	O-ring, Nitril	223406-51
33	1	Tätningsring, stationär	31450-0007-1
36	2	Tätningsring, roterande	31437-0211-1
40	1	O-ring, Nitril	223406-60
41	1	O-ring, Nitril	223406-58
		Tätningssats Teflon, komplett	31439-0166-3
23	1	Tätningsring, stationär	31437-0119-1
25	1	Packning, Teflon	31437-0121-3
29	1	O-ring främre, Teflon	31439-0168-3
	1	O-ring bakre, Nitril	31439-0168-1
32	1	O-ring, Nitril	223406-51
33	1	Tätningsring, stationär"	31450-0007-1
36	2	Tätningsring, roterande	31437-0211-1
40	1	O-ring, Nitril	223406-60
41	1	O-ring, Nitril	223406-58
		Alternativa tätningsringar Vid slitande vätskor	
23	1	Tätningsring, stationär, kromoxidbelagd	31437-0210-1
36*	1	Tätningsring, roterande, kromoxidbelagd	31437-0223-1

LÄMPLIGA RESERVDELAR

Kompletta tätningssatser.

* Den kromoxidbelagda roterande tätningsringen får inte användas tillsammans med en stationär tätningsring av rostfritt stål.