wright flow TECHNOLOGIES

INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR THE

CONCEPT SQ

RANGE OF PUMPS

IDEX FLUID & METERING

INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR THE CONCEPT SQ RANGE OF ROTARY LOBE PUMPS

1.0 Safety Information

INCORRECT INSTALLATION, OPERATION OR MAINTENANCE OF EQUIPMENT MAY CAUSE SEVERE PERSONAL INJURY AND/OR EQUIPMENT DAMAGE AND MAY INVALIDATE THE WARRANTY.

THIS INFORMATION MUST BE READ FULLY BEFORE COMMENCING INSTALLATION, OPERATION OR MAINTENANCE AND MUST BE KEPT WITH THE PUMP. SUITABLY TRAINED OR QUALIFIED PERSONS MUST UNDERTAKE ALL INSTALLATION AND MAINTENANCE ONLY.

Safety instructions given in this manual non-compliance with which would affect safety are identified by the symbol:

Safety instructions which shall be considered for reasons of safe operation of the pump or pump unit and/or protection of the pump or pump unit itself are marked:

WARNING

DANGER

DO NOT OPERATE PUMP IF:

- THE FRONT COVER IS NOT INSTALLED CORRECTLY.
- ANY GUARDS ARE MISSING OR INCORRECTLY INSTALLED.
- THE SUCTION OR DISCHARGE PIPEWORK IS NOT CONNECTED.

DO NOT PLACE FINGERS ETC INTO THE PUMPING CHAMBER OR ITS CONNECTION PORTS OR INTO ANY PART OF THE GEARBOX IF THERE IS ANY POSSIBILITY OF THE PUMP SHAFTS BEING ROTATED. SEVERE INJURY WILL OCCUR.

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those for which the pump was originally supplied, without confirming its suitability for the new duty. Running of the pump outside of its operation envelope can cause mechanical contact in the pump head, excessive heat and can represent a serious risk to health and safety.

Installation and operation of the pump must always comply with health and safety regulations.

WARNING

A device must be incorporated into the system or drive to prevent the pump exceeding its stated duty pressure. It must be suitable for both directions of pump rotation where applicable. Do not allow pump to operate with a closed/blocked discharge unless a pressure relief device is incorporated.

The mounting of the pump or pump unit should be solid and stable. Pump orientation must be considered in relation to drainage requirements. Once mounted, shaft drive elements must be checked for correct alignment. Rotate pump shaft by at least one full revolution to ensure smoothness of operation. Incorrect alignment will produce excessive loading and will create high temperatures and increased noise emissions. It may also be necessary to earth the pump to avoid the build up of a potential charge difference that could cause a spark

The installation must allow safe routine maintenance and inspection (to replenish lubricants, check for leakage, monitor pressures, etc) and provide adequate ventilation necessary to prevent overheating.

WARNING

Fill with the recommended grades and quantities of lubricant see section 3.4. Beware of over/under filling the gearbox as this could cause the pump to overheat and mechanical damage to occur.

WARNING

Before operating the pump, ensure that it and all parts of the system to which it is connected are clean and free from debris and that all valves in the suction and discharge pipelines are fully opened. Ensure that all pipe work connecting to the pump is fully supported and aligned with its relevant connections. Misalignment and/or excess loads will cause severe pump damage. This could result in unexpected mechanical contact in the pump head and has the potential to be a source of ignition.

WARNING

Ensure that pump rotation is correct for the desired direction of flow; (see section 3.4)

WARNING

Do not install the pump into a system where it will run dry (i.e. without a supply of pumped media) unless it is equipped with a flushed shaft seal arrangement complete with a fully operational flushing system. Mechanical seals require a thin fluid film to lubricate the seal faces. Dry running can cause excessive heat and seal failure.

WARNING

Install pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

Caution must be taken when lifting the pump. Suitable lifting devices should be used as appropriate. If pump is baseplate mounted, the base plate must be used for all lifting purposes, not any part of the pump. If slings are used for lifting, they must be safely and securely attached. For weights of bare shaft pumps refer to section 5.5.

DO NOT attempt any maintenance or disassembly of the pump or pump unit without first ensuring that:

- The pump is fully isolated from the power source (electric, hydraulic, pneumatic).
- The pumping chamber and any shaft seal support system, front cover barrier support system, and rotorcase port barrier support system are de-pressurised and purged.
- Any temperature control devices (jackets, heat-tracing, etc) are fully isolated, that they are de-pressurised and purged, and components allowed to reach a safe handling temperature.

DO NOT loosen or undo the front cover, any connections to the pump, shaft

seal housings, barrier support systems, temperature control devices, or other components, until sure that such action will not allow the unsafe escape of any pressurised media.

WARNING

Use only genuine Wright Flow Technologies parts.
All certification, standards, guarantees & warranties originally supplied with this pump will be invalidated by the use of non-genuine Service Parts.

Pumps and/or drives can produce sound pressure levels exceeding 85-dB (A) under certain operating conditions. When necessary, personal protection against noise must be taken. See section 5.8 for typical noise emission data.

Avoid any contact with hot parts of pumps and/or drives, which may cause injury. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc), bad installation, or poor maintenance can all promote high temperatures on pumps and/or drives.

WARNING

When cleaning, either manually or by CIP method, the operator must ensure that a suitable procedure is used in accordance with the system requirements. For CIP cleaning requirements, refer to section 3.3.2. The exterior of the pump should be cleaned periodically.

Surface temperature of pump is also dependent on the temperature of pumped medium.

1.1 Risk assessment relating to the use of Wright Flow Technologies Limited. Concept SQ rotary lobe pumps and pump units in potentially explosive atmospheres.

Note:- For a feature to be suitable for an application, The feature must be fit for its designated purpose and also suitable for the environment where it is to be installed.

Source Of Hazards	Potential Hazards	Frequency Of Hazards	Recommended Measures
Unvented cavities	Build up of explosive gas	**Very Rare**	Ensure that pump is totally filled. Consider mounting ports vertically. **See Chapter 1.0**
Rotorcase / Rotors / Front Cover	Unintended mechanical contact	**Rare**	Ensure that operating pressures are not exceeded. Ensure that suffcient NPSH to prevent cavitation. **See Chapter 1.0/3.4.1** Service plan.
Pump external surfaces	Excess temperature. Electrostatic charging	**Rare**	User must ensure temperature limits. Do not overfill gearboxes with lubricant. Provide a ground contact for pump. **See Chapter 1.0/6.3** / Service plan.
Cover 'O' ring	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Check selection of elastomers are suitable for application. Ensure cover retaining nuts are tight. Service plan.
Pump casing / cover	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Stainless steel, Corrosion resistant.
Shaft seals	Excess temperature. Unintended mechanical contact. Leakage. Build up of explosive gas.	**Rare**	Selection of seal system must be suitable for application. **See Chapter 5.0**. Service plan. Seals must never run dry.
Auxiliary system for shaft sealing	Pump liquid leakage. Build up of explosive gas.	**Rare**	Selection of auxiliary seal system must be suitable for application. Seals must never run dry.
Rotation direction test	Excess temperature	**Very Rare**	If flushed seals are installed ensure that flush is applied to seal assemblies. Only allow pump to run for minimum period - just a few seconds.
Closed valve condition	Excess Temperature. Excess Pressure. Mechanical contact.	**Rare**	Can cause excessive pressue, heat and mechanical contact. **See Chapter 1.0**
Shaft	Random induced current	**Very Rare**	Provide a ground contact for pump. **See Chapter 1.0.**
Mechanical shaft coupling (Torque Protection)	Temperature from friction Sparks from break up of shear pins. Electrostatic charging	**Rare**	Coupling selection must suit application. **See Chapter 1.0.**
Mechanical shaft coupling (standard)	Break up of spider. Unintended mechanical contact. Electrostatic charging	**Rare**	Coupling selection must suit application. Service plan. **See Chapter 1.0.**

2.0 Introduction

2.1 General

The range of Concept SQ rotary lobe pumps are manufactured and distributed, refer to section 2.2, by Wright Flow Technologies Limited, Eastbourne, England.

This manual includes all the necessary information for the Concept SQ pump range and should be read prior to commencing installation, operation or maintenance.

When asking for assistance please quote the pump model and serial number. This information can be obtained from the pump nameplate which is located on the top of the pump gearbox cover, refer to section 2.6.

Should the nameplate be unreadable or missing, the pump serial number is also stamped on the rear face of the rotorcase, refer to section 2.6, Figs 2 & 3.

If it is proposed to modify the system or change the characteristics of the product to be pumped from that for which the pump was originally selected, Wright Flow Technologies Limited or their authorised distributor should be consulted.

2.2 Wright Flow Technologies Limited Distributors

Wright Flow Technologies Limited distributes their products internationally via a network of authorised distributors. Throughout this manual where reference is made to Wright Flow Technologies Limited, any authorised distributor will also provide service and assistance. Should you require any additional information regarding the Concept SQ range of pumps contact Wright Flow Technologies Limited or their local authorised distributor.

2.3 Receipt and Storage

On receipt of the pump, immediately examine for any signs of visible damage. If any damage is noted, contact Wright Flow Technologies Limited and clearly mark upon the carriers paperwork that the goods have been received in a damaged condition, with brief description of damage.

If the pump is not required for immediate installation then it should be stored within a suitable environment.

2.4 Cleaning

The Concept SQ pump range is suitable for manual cleaning, CIP (Cleaning In Place) and SIP (Sterilisation In Place) refer to section 3.3.2.

The mechanical seals are mounted directly behind the rotor and are designed and to minimise product entrapment and maximise the effects of cleaning.

This strategic positioning of the mechanical seals, combined with their ease of access provides an arrangement that can be more effectively cleaned by both manual and CIP/SIP procedures.

It is recommended that the exterior of the pump be cleaned periodically.

2.5 Pump Model Designation

The designation of pump models in the Concept SQ range is as follows: -

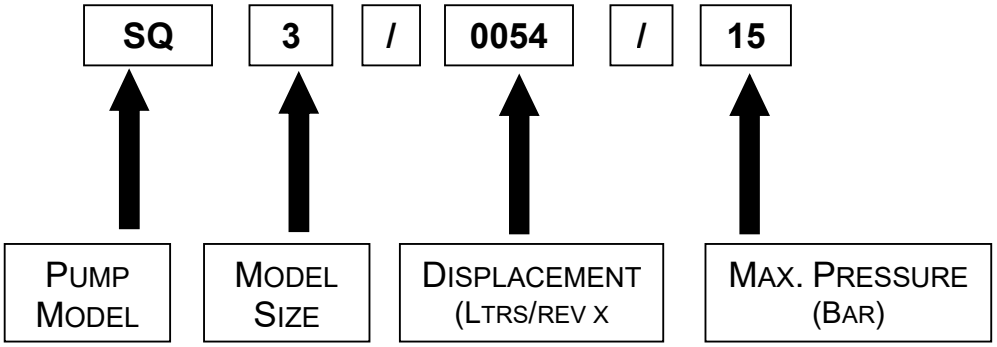
SQ1/0004/12 (SQ1S)	SQ3/0054/15 (SQ3S)
SQ1/0007/06 (SQ1L)	SQ3/0103/07 (SQ3L)
SQ2/0017/15 (SQ2S)	SQ4/0160/15 (SQ4S)
SQ2/0030/07 (SQ2L)	SQ4/0303/07 (SQ4L)

This, together with the pump serial number, should be quoted when requesting additional information on the pump or when ordering spare parts. The pump serial number is stamped on the pump nameplate and the rear face of the rotorcase, refer to section 2.6, Figs 2 and 3.

For an explanation of pump model designations see Fig 1.

For the maximum operating pressures, temperatures and speeds refer to section 3.2, Fig 6.

Fig 1 (European Designation)



2.5.1 ATEX Information

ATEX Pump Requirements

Mechanical seals are a source of heat and must never be allowed to run dry. We would recommend provision be made to ensure that there is always flow or fluid around the pump seals. If there is a risk of the supply being interrupted, then a temperature monitoring system must be applied to ensure the pump does not exceed the Atex rating. The surface temperature of the pump is dependent on the temperature of the pumped fluid and a due account of this should be taken whilst undertaking your risk assessment of the installation. These pumps are Atex rated T3.

WARNING — Only use genuine spare parts that have been designed and verified Atex compliant by Wright Flow Technologies, failure to use genuine spare parts will invalidate the Atex certification.

WARNING — Pumps that have the Atex certification will have an earthing point on the front cover, this needs to be electrically earthed before use.

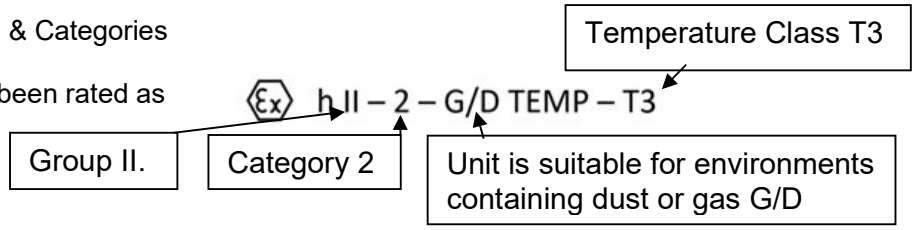
WARNING — The service and maintenance intervals are increased on certified Atex units, refer to section 3.6.1 for the required routine maintenance. Failure to maintain the pumps to these intervals will result in the Atex certification being invalidated.

WARNING — When installing the unit make sure so far as reasonably practicable that the pump is aligned within 5 degrees to the horizontal – failure to align the unit could adversely affect the gearbox lubrication and could cause heat to build up.

It is the end user's responsibility to ensure that the Atex rating of the equipment supplied meets the requirements of the installation.

2.5.2 Equipment Groups & Categories

The pump range has been rated as



Equipment-groups (Annex I of the EC-Directive 94/9/EC)							
Group I (mines, mine gas and dust)		**Group II** (other explosive atmospheres gas/dust)					
Category M		**Category 1**		**Category 2**		**Category 3**	
1	**2**	**G** (gas) **(Zone 0)**	**D** (dust) **(Zone 20)**	**G** (gas) **(Zone 1)**	**D** (dust) **(Zone 21)**	**G** (gas) **(Zone 2)**	**D** (dust) **(Zone 22)**
for equipment providing a very high level of protection when endangered by an explosive atmosphere	for equipment providing a high level of protection when likely to be endangered by an explosive atmosphere	for equipment providing a very high level of protection when used in areas where an explosive atmosphere is very likely to occur		for equipment providing a high level of protection when used in areas where an explosive atmosphere is likely to occur		for equipment providing a normal level of protection when used in areas where an explosive atmosphere is less likely to occur	

2.6 Pump Model and Serial Number

Should you require any information regarding your Concept SQ rotary lobe pump contact Wright Flow Technologies Limited quoting the pump model and serial number as stated on the pump nameplate, see Fig 2, which is fixed to the pump gearbox cover,

Should this be damaged or missing, the pump serial number is also stamped on the rear face of the rotorcase, see Fig 3.

Fig 2

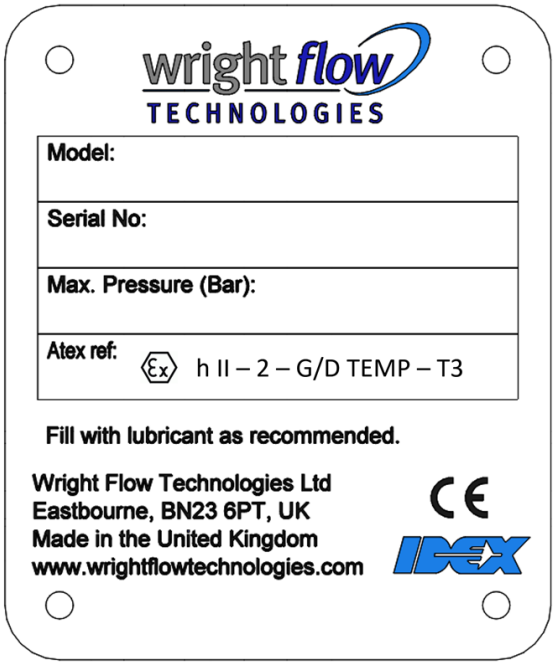
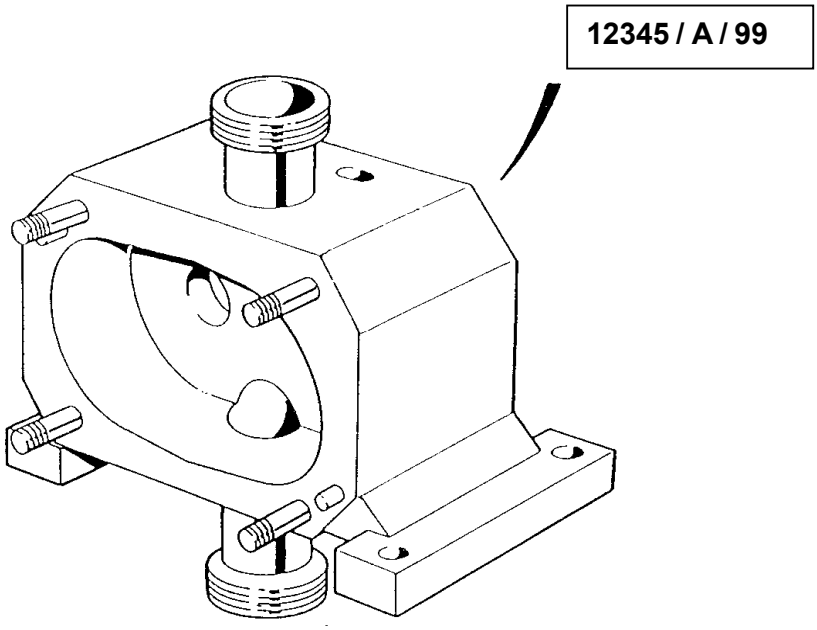
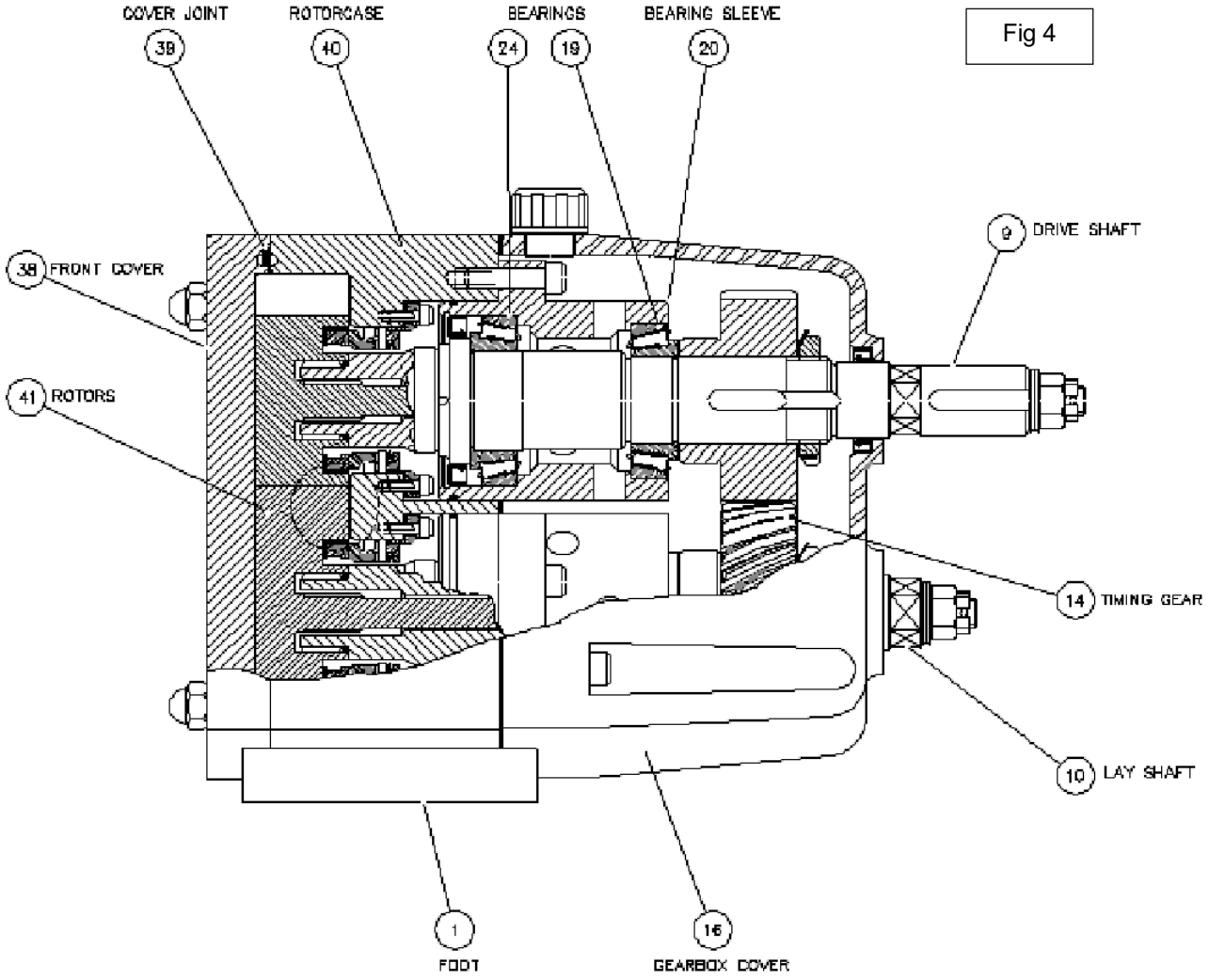


Fig 3



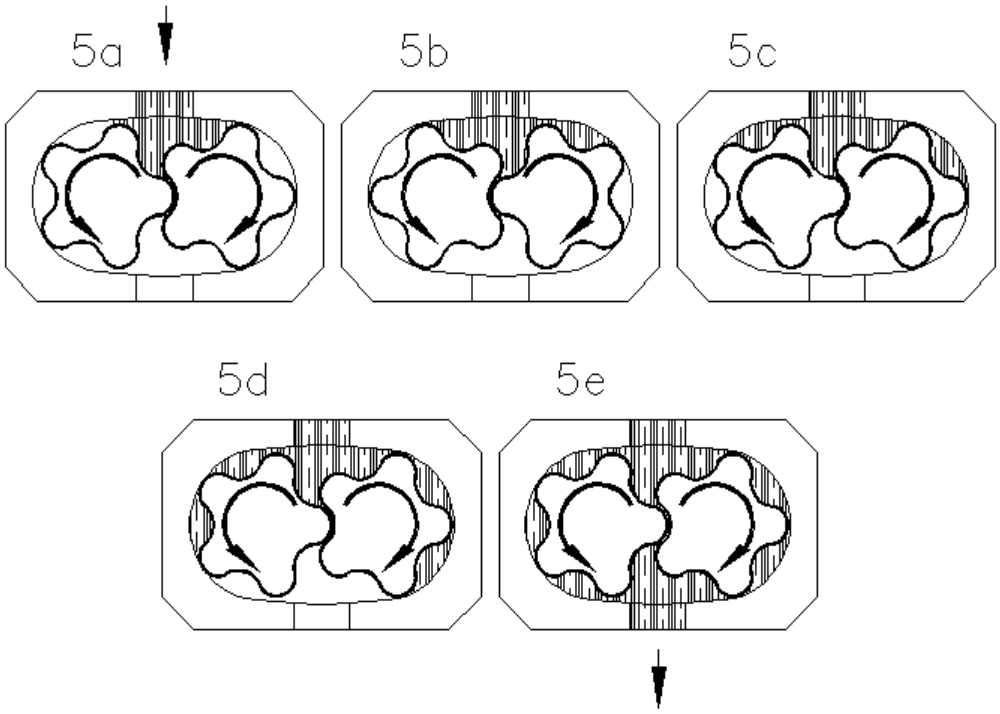
2.7 Standard Pump Component Terms



3.0 General

3.1 Concept SQ Range Pumping Principle
see Fig 5

Fig 5



The pumping action of the rotary lobe pump principle is generated by the contra-rotation of two pumping elements (rotors) within a chamber (rotorcase), see Fig 5. The rotors are located on shafts, which in turn are held within two cartridge assemblies. The shaft cartridge assemblies comprise the shaft support bearings and the timing gears. The timing gears transfer the drive from the driven shaft to the lay shaft, synchronising the rotors such that they rotate without contact with each other.

As the rotors pass the suction port, see Fig 5a, the cavity generated increases creating a pressure decrease, which induces the media to be pumped to flow into the rotorcase.

The pumped media is carried around the rotorcase by the rotors, see Fig 5b and 5c, to the discharge side of the pump, Fig 5d. Here the cavity decreases and the pumped medium is discharged from the rotorcase, Fig 5e.

For pump component terms see Fig 4.

3.2 Concept SQ Range Operating Parameters

Fig 6

Concept SQ Model	Displacement			Connection Size (International Standards)		Differential Pressure (Maximum)		Maximum Speed (Continuous)	Maximum Temperature (Continuous)	
	litres / rev	I gal / 100 rev	US gal / 100 rev	mm	Inches	Bar	lbf/in²	rev / min	°C	°F
SQ1/0004/12	0.04	0.88	1.06	25	1.0	12	175	1000	150	300
SQ1/0007/06	0.07	1.76	2.11	25	1.0	6	85	1000	150	300
SQ2/0017/15	0.17	3.74	4.49	40	1.5	15	215	850	150	300
SQ2/0030/07	0.30	6.60	7.93	50	2.0	7	100	850	150	300
SQ3/0054/15	0.54	11.88	14.27	50	2.0	15	215	700	150	300
SQ3/0103/07	1.03	22.66	27.21	80	3.0	7	100	700	150	300
SQ4/0160/15	1.60	35.20	42.27	80	3.0	15	215	600	150	300
SQ4/0303/07	3.03	66.66	80.06	100	4.0	7	100	600	150	300

The maximum pressure and speed operating parameters are given in Fig 6. In practice these may be limited due to the nature of the product to be pumped and/or design of the system in which the pump is to be installed and / or the process.

WARNING

If it is proposed to modify the system/duty, or change the characteristics of the product to be pumped from that for which the pump was originally selected Wright Flow Technologies Limited should be consulted.

The pump should not be subjected to sudden temperature changes to avoid the risk of damage through expansion/contraction of components. Care should be taken when selecting pumps for handling liquids containing abrasive particles as these may cause wear of pump head components, for advice and assistance contact Wright Flow Technologies Limited.

3.3 System Design

3.3.1 System Design and Installation

When incorporating any pump into a system it is considered good practice to minimise pipework runs and the number of pipe fittings (tees, unions, bends etc.) and restrictions. Particular care should be taken in designing the suction line, which should be as short and straight as possible with the minimum of pipefittings to minimise restricting product flow to the pump. The following should be considered at the design stage of any system.

WARNING

a) Ensure ample room is provided around the pump to allow for: -
   ii) Access to the pump and drive for routine inspection and maintenance, for example to replenish pump or drive lubricant, remove pump front cover and rotors.
   iii) Ventilation of the drive to prevent over heating.

b) The pump must not be used to support pipework; all pipework to and from the pump unit must be independently supported. Failure to observe this may cause distortion of the pump head components or assembly and serious consequential damage to the pump.

c) Valves should be provided adjacent to the pump suction and discharge connections to allow the pump to be isolated from the system for routine inspection and maintenance.

d) Rotary lobe pumps are of the positive displacement type and therefore an overload protection device must be provided. This can take the form of:-
   i) An in-line pressure relief system, i.e. external to the pump.
   ii) Inclusion of a torque limiting device in the drive system.
   iii) Rupture disc incorporated in the discharge pipework.

e) Where pump rotation and hence flow is to be reversed during normal operation the overload device must be capable of protection for both directions of rotation/flow.

WARNING

f) It is considered good practice to ensure all pipework and associated plant from the suction vessel to the discharge point is thoroughly cleaned before installation of the pump to avoid the possibility of debris entering the pump and causing damage.

WARNING

g) Pressure gauges should be installed adjacent to the pump suction and discharge connections such that system pressures can be monitored. These gauges will provide a clear indication of changes in operating conditions and where a relief valve is incorporated in the system, will be necessary for setting and checking the functioning of the valve.

h) Suction Conditions

WARNING

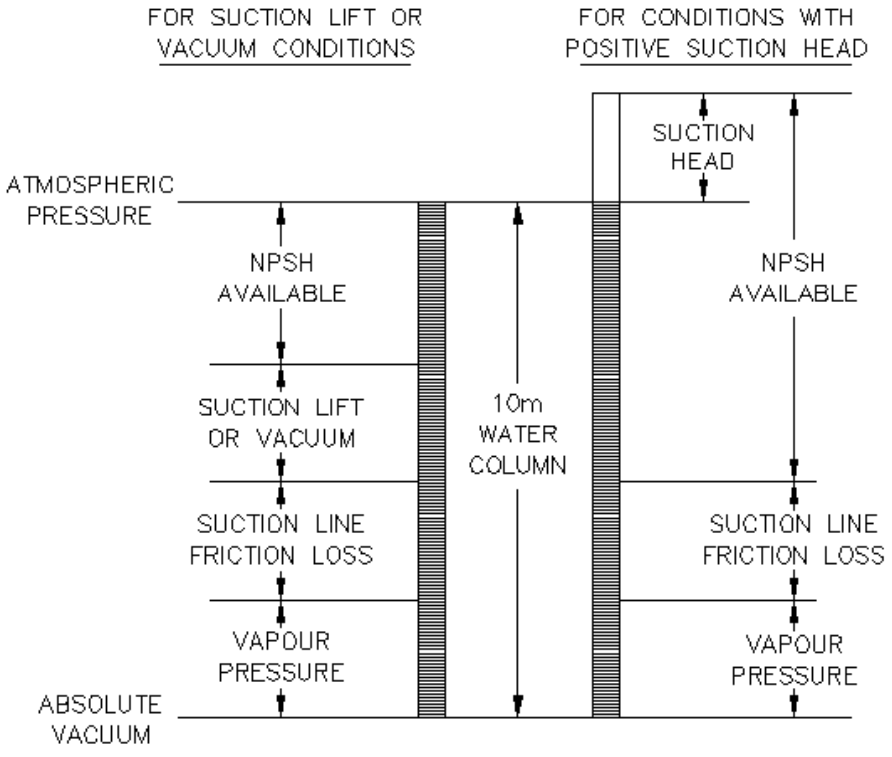
It is imperative that the suction condition at the pump inlet meets the Net Positive Suction Head Required (NPSHR) by the pump. Failure to observe this could cause cavitation, resulting in noisy operation, reduction in flow rate and mechanical damage to the pump and associated equipment.

WARNING

The Net Positive Suction Head Available (NPSHA) from the system must always exceed the Net Positive Suction Head Required (NPSHR) by the pump. Observing the following general guidelines should ensure the best possible suction condition is created.

- Suction pipework is at least the same diameter as the pump connections.
- Suction pipework is straight for a distance of at least the equivalent of 10 pipe diameters immediately before pump.
- The length of suction pipework is kept to the absolute minimum.
- The minimum number of bends, tees and pipework restrictions are used.
- That calculations to determine system NPSHA are carried out for the worst condition, see Fig 7.
- Should advice on pump or system NPSH characteristics be required contact Wright Flow Technologies Limited.

Fig 7



i) When installing a pump complete with baseplate, motor and drive the following guidelines must be observed:

- The preferred drive arrangement for any rotary lobe pump is in-line direct coupled. If an alternative is required please contact Wright Flow Technologies Limited.

- Flexible couplings must always be incorporated and correctly aligned. To check coupling alignment rotate the shaft by at least one full revolution and ensure that the shaft rotates smoothly.

Fig 8

To check for and correct angular misalignment, use a calliper to check the measurement across the hubs. Adjust position of pump or drive as necessary until the measurement is the same at all points around the hubs.

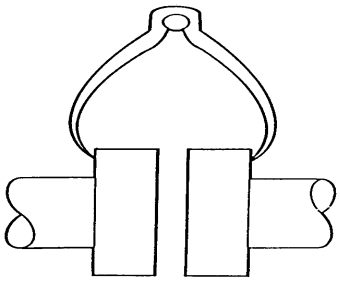
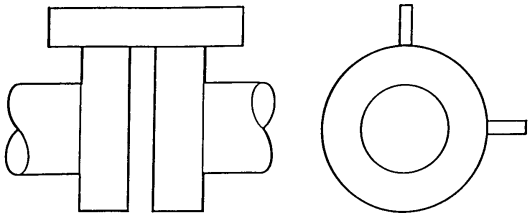


Fig 9

To check for and correct parallel offset, place a straightedge across the hub flanges in two positions at 90 Degrees to each other. Adjust position of pump or drive as necessary until the straightedge lays flat on both sides.



<u>Note:</u>

Some couplings are able to withstand gross angular and/or parallel misalignment. However, the above methods of reduce these effect to an absolute minimum is required to avoid placing excessive loads onto pump and/or drive components. The table below gives details of maximum parallel and angular misalignments allowed.

CONCEPT SQ MODEL	MAXIMUM PARALLEL MISALIGNMENT (MM).	MAXIMUM ANGULAR MISALIGNMENT (DEGREES)
SQ1	0.05	0.5
SQ2	0.075	0.5
SQ3	0.10	1.0
SQ4	0.15	1.0

Couplings of a non-flexible design must never be used.

- Couplings must always be enclosed in a suitable guard to prevent contact with rotating parts, which could result in personal injury. Guards should be of suitable material, see below and of sufficiently rigid design to prevent contact with rotating parts under normal operating conditions.

Note: The guard must be designed such that it fully covers the projecting part of the lay shaft of the pump.

- When installing pump sets in flammable or explosive environments, or for handling flammable or explosive materials. Special consideration must be given to the safety aspects of the drive unit enclosure and also to the materials used for both the coupling and the guard to eliminate the risk of producing sparks.

- Baseplates must be secured to a flat level surface such that distortion and misalignment are avoided. Once baseplates are fastened in position the drive alignment must be re-checked.

- When using electric motor drives ensure that the electrical supply is compatible with the drive and controls and that the method of wiring is correct for the type of starting required by the motor i.e. Direct On Line, Star Delta etc. Ensure all components are correctly earthed.

3.3.2 Installations with CIP/SIP Systems

WARNING

The Concept SQ pump range has been designed to be effectively cleaned by the CIP procedures recommended for in place cleaning of process plant. To assist in maximising the effectiveness of cleaning within the pump head it is recommended that during the cleaning cycle a flow rate equivalent to a velocity of 1.5 metres per second; in a pipe of equal diameter to the rotorcase connections is achieved. With a differential pressure of 2 to 3 bar being developed across the pump head.

For applications where maximum drainage of the pump head is required, for example in the handling of ‘Agri-Foodstuffs’ and / or where CIP is employed, the pump should be mounted with the rotorcase connections in the vertical orientation. A procedure must be determined to ensure that the pump is effectively cleaned. It is recommended that this cycle would typically include a combination of some or all of the following: Acidic or Caustic based Detergents, ‘Sanitisers’, Disinfectants and Water rinses. These must be appropriate to both the products being handled and the materials of construction of the pump.

The Concept SQ pump range is also suitable for SIP treatment.

3.4 Start Up Procedure

WARNING

- Check all pipework and associated equipment is clean and free from debris and that pipe connections are secure and leak free.

WARNING

- For pumps installed with flushed mechanical seals check all auxiliary services are in place and connected and provide sufficient flow and pressure for flushing purposes, refer to section 4.5.7.

WARNING

- For pumps installed with Fluid Barrier devices on Front Cover / Rotorcase joint and Rotorcase port connections, check all auxiliary services are in place and connected and provide sufficient flow and pressure, refer to sections 3.8 and 3.9.

WARNING

- Ensure lubrication is provided for both pump and drive. Concept SQ pumps are despatched without oil and should be filled to the level of the oil sight glass which must be installed in the upper tapped hole in the side of the gearbox cover, refer to section 5.3 for pump oil capacities and grades.

WARNING

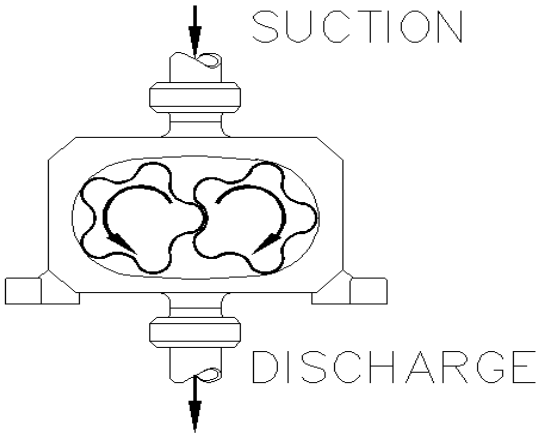
- Check that, if an external relief valve is incorporated in the system, it is set correctly. For commissioning purposes it is considered good practice to set the relief valve lower than the system design pressure. On completion of commissioning the relief valve should be reset to the required setting for the application. The required setting should never exceed the lower of either the pumps maximum pressure rating or the system design pressure.

WARNING

- Ensure both suction and discharge valves are fully open, and pipework is free from all obstructions. Concept SQ pumps are of the positive displacement type and should therefore never be operated against a closed valve as this would result in pressure overload, resulting in damage to the pump and possibly the system.

- Ensure rotation of the drive shaft is correct for the direction of flow required (see Fig 10).

Fig 10



WARNING

- Ensure product is available in the suction vessel before starting pump, this is very important for pumps installed with single mechanical seals not being serviced with a quench or flush as these sealing arrangements must never be allowed to run dry.

- Before commencing operation it is considered good practice to momentarily start/stop the pump to check the direction of rotation and ensure that the pump is free of obstructions. Once this has been carried out commence operation keeping a visual check on suction and discharge pressure gauges and monitor pump temperature and power absorbed where possible.

3.5 Shutdown Procedure

When shutting the pump down, close both the suction and discharge valves and ensure that the necessary safety precautions are taken: -

- The prime mover power source has been isolated.

- That, where employed, mechanical seal flush, rotorcase port connection barrier flush and front cover barrier flush auxiliary services have been isolated, de-pressurised and fully drained.

- That, where employed, heating / cooling devices have been isolated, de-pressurised and fully drained.

- Pump head and pipework have been drained and purged.

3.6 Routine Maintenance – Non Atex units.

Oil

WARNING

- Check oil levels regularly.
- Change the oil every 12 months or 3000 operating hours, whichever is the sooner.

For lubricant capacities and grades refer to section 5.3.

Seal Replacement Interval:

It is recommended that the Rotor Retainer O-ring seal is replaced every 12 months to maintain a bacteria-tight seal.

Rotor Retainer Seal Inspection:

Periodically inspect the Rotor Retainer O-ring seal for any discolouration, nicks, or cracks. If any of the defects above are noticed, the O-ring seal must be replaced. Inspection and replacement refer to the seal replacement procedure.

3.6.1 Additional Routine Maintenance – Atex units.

Oil

WARNING

- Check oil levels on startup.
- Check for any signs of overheating.
- Change the oil every 6 months or 1500 operating hours, whichever is the sooner.

For lubricant capacities and grades refer to section 5.3.

WARNING

After 14000 hours of use, the pump will need a general overhaul and it will need to be re-certified for use within the Atex environment.

A general overhaul must include a full disassembly of all components and the following work carried out.

- Clean all pump components
- Examination of all components for damage/wear
- Replacement of all taper roller bearings
- Replacement of all elastomeric components
- Replacement of all seals, radial seals, and Gamma rings

The general overhaul must be carried out by qualified personnel in a specialist workshop with the appropriate equipment. Re-certification must then be carried out.

We highly recommend that the general overhaul is carried out by Wright Flow Technologies

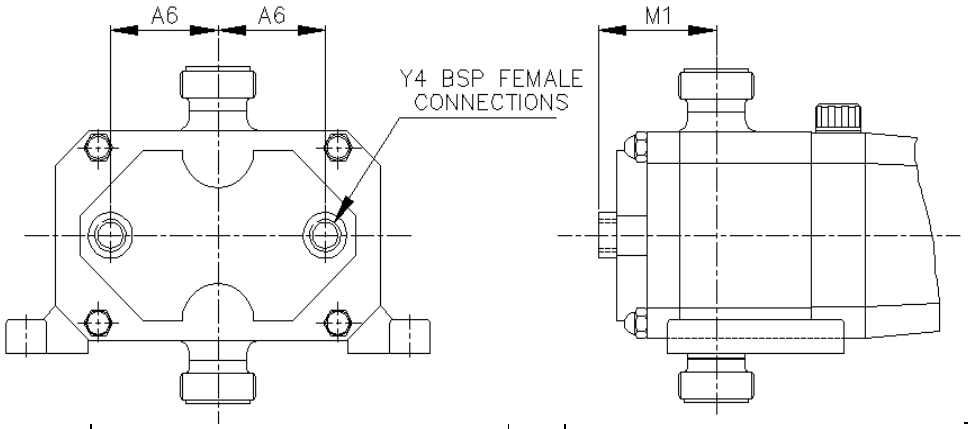
3.7 Heating and Cooling Devices
See Figs 11 & 12

All models in the Concept SQ range can be supplied with a jacketed front cover and, with the exception of the SQ1 series pumps, rotorcase with ports for circulation of a heating/cooling media. The jacketed cover and rotorcase heating and cooling ports are strategically positioned such that the thermal effect acts on the pump chamber and seal area.

The pressure rating of the Concept SQ range jacketed front cover and rotorcase heating/cooling ports is 3.5 bar g (50 PSI) and this should not be exceeded without first making reference to Wright Flow Technologies Limited.

Heating/cooling of the pump head is used to maintain, rather than increase/decrease, the temperature of the pumped media and should be used as part of a complete system where suction and discharge lines and vessels are also heated/cooled.
Where heating/cooling devices are employed the heating/cooling media should be circulated 15-20 minutes prior to pump start-up and also for a similar period of time after the pump has been shutdown. Where a CIP or SIP cycle is employed as part of the process, the heating/cooling media should continue to be circulated during the cleaning cycle.

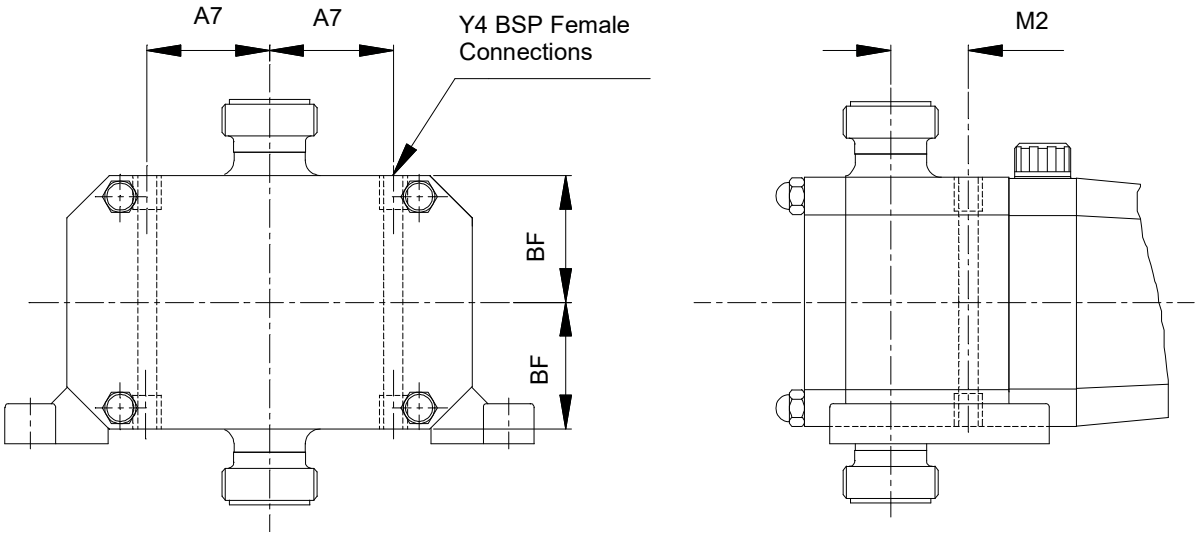
Fig 11 Dimensions of Front Cover Jacket for Heating/Cooling



Concept SQ Model	Millimetres			Inches		
	A6	M1	Y4 (Inches)	A6	M1	Y4
SQ1/0004/12	38.0	58.0	¼	1.50	2.28	¼
SQ1/0007/06	38.0	60.5	¼	1.50	2.38	¼
SQ2/0017/15	54.0	77.5	½	2.13	3.05	½
SQ2/0030/07	54.0	82.0	½	2.13	3.23	½
SQ3/0054/15	90.0	101.0	½	3.54	3.98	½
SQ3/0103/07	90.0	110.0	½	3.54	4.33	½
SQ4/0160/15	142.5	120.0	½	5.61	4.72	½
SQ4/0303/07	142.5	140.0	½	5.61	5.51	½

Note: For all other dimensions see section 5.5, Foundation Dimensions

Fig 12 Dimensions for Rotorcase Ports for Heating/Cooling

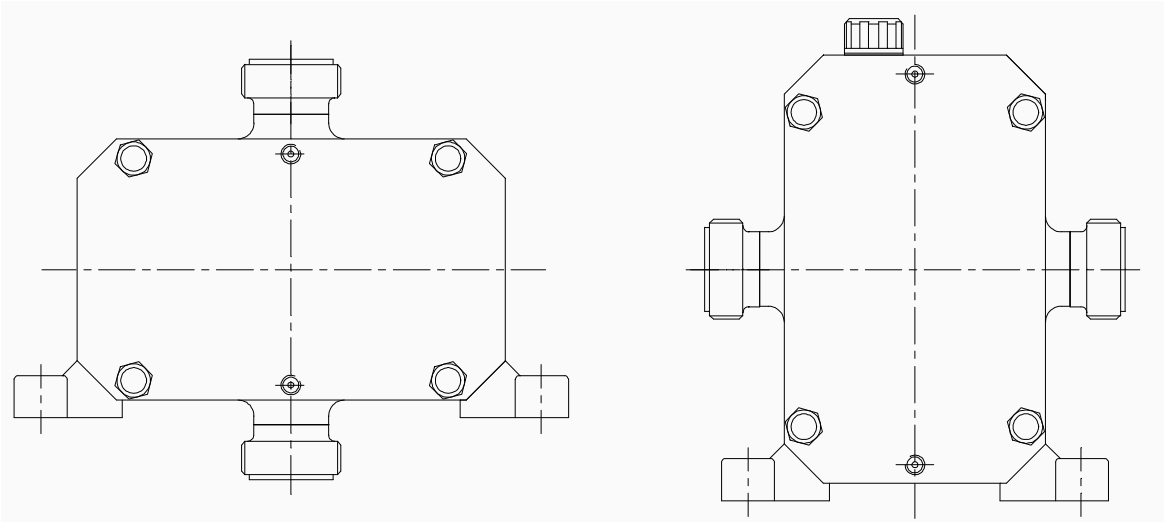


Concept SQ Model	Millimetres				Inches			
	A7	BF	M2	Y5 (Inches)	A7	BF	M2	Y5
SQ1/0004/12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SQ1/0007/06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SQ2/0017/15	80	66.5	14	1/8	3.15	2.62	0.55	1/8
SQ2/0030/07	80	66.5	36	1/8	3.15	2.62	1.42	1/8
SQ3/0054/15	102.5	90.5	16	1/8	4.04	3.56	0.63	1/8
SQ3/0103/07	102.5	90.5	49	1/8	4.04	3.56	1.93	1/8
SQ4/0160/15	140	137	22	1/8	5.51	5.39	0.87	1/8
SQ4/0303/07	140	137	64	1/8	5.51	5.39	2.52	1/8

Note: For all other dimensions see section 5.5, Foundation Dimensions and Weights.

3.8 Front Cover/Rotorcase Joint with Fluid Barrier

Fig 13



WARNING

The product to atmosphere interface between front cover and rotorcase can be provided with a fluid barrier to prevent either the ingress of microbiological and other contaminants, or the egress of pumped media to atmosphere. The fluid must be compatible with the media being pumped and the materials of construction of any pump components with which it comes into contact.

WARNING

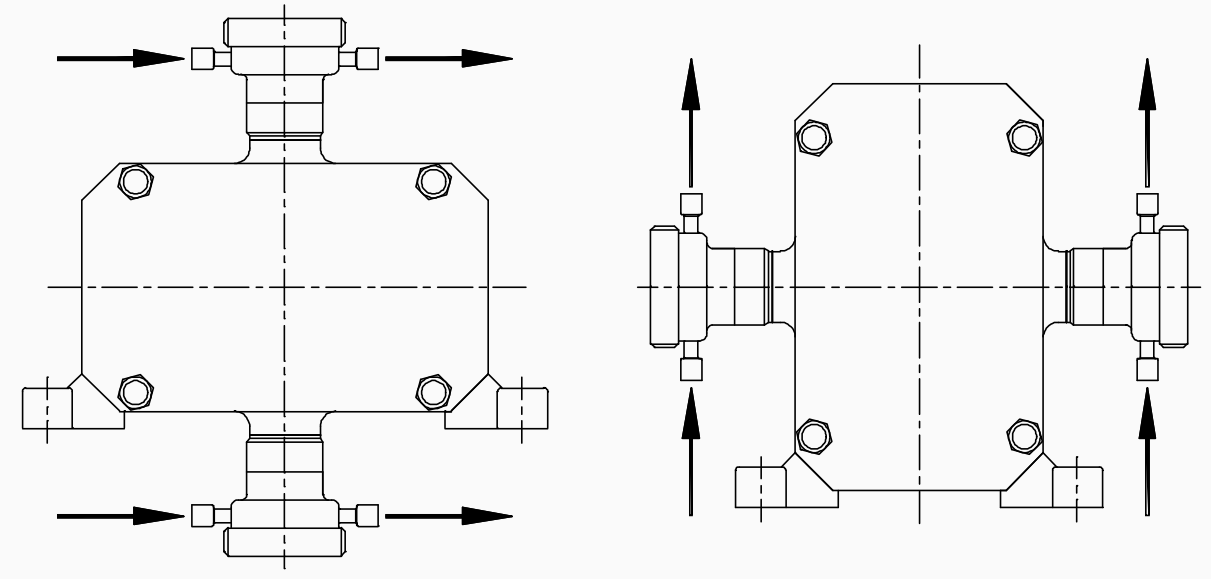
Where pumps are equipped with this feature, two tapped holes are located in the front cover forming the connections for the supply of the barrier fluid, see fig 13. The position of the holes is dependant upon the orientation of the pump, but in either case, the lower tapped hole must be used for the fluid inlet so that air is naturally vented out via the upper tapped hole. Barrier liquids should be supplied at a flow rate of approximately 0.5 to 1 litres per minute. Barrier gasses can be either static or flowing as applicable.

The pressure rating of the Concept SQ range front cover / rotorcase joint with fluid barrier is 3.0 bar g (43.5 PSI) and this should not be exceeded without first making reference to Wright Flow Technologies Limited.

The position of the holes is dependent upon the orientation of the pump.

3.9 Rotorcase Port Connections with Fluid Barrier

Fig 14



The product to atmosphere interface between the rotorcase port connections and the suction and discharge pipework can be provided with a fluid barrier to prevent either the ingress of microbiological and other contaminants, or the egress of pumped media to atmosphere, when the applicable port connections are installed.

Where pumps are equipped with this feature, two tapped holes are located on each of the connection male parts which are welded to the rotorcase forming the connections for the supply of the barrier fluid, see Fig 14.

In the standard orientation, which is with the rotorcase ports in the vertical plane, either tapped hole can be used as the fluid inlet. If the barrier media is a liquid, the flow should be raised to approximately 2 litres per minute for the first few minutes to allow venting of any gas or air trapped in the barrier chamber of the lower connection assembly. The flow can then be reduced to zero if required, or maintained at a value between 0 and 1 litres per minute. If the barrier media is a gas, it should be made to flow for the first few minutes to allow removal of air, and then the flow can be reduced to zero if required.

WARNING

In the optional orientation, which is with the connection ports in the horizontal plane, the lower tapped hole should be used for the fluid inlet so that air or gas trapped in the barrier chambers is naturally vented out via the upper tapped hole. If the barrier media is a liquid, the flow should be raised to approximately 2 litres per minute for the first few minutes to allow venting of any air or gas. The flow can then be reduced to zero if required, or maintained at a value between 0 and 1 litres per minute. If the barrier media is a gas, it should be made to flow for the first few minutes to allow removal of air, and then the flow can be reduced to zero if required

WARNING

The pressure rating for the fluid barrier of these port connections is 3.0 Bar g (43.5 PSI) and this must not be exceeded under any circumstances.

4.0 Concept SQ Dismantling / Assembly

Before undertaking any work on the pump the recommended Shutdown Procedure should be followed, refer to section 3.5.

Certain components of the pump are only usable once. It is essential to be certain that new replacement components are available for re-assembly. These are the split pins used to secure the castellated nuts, and the o-rings located between the rotors and shafts.

Whilst dismantling or assembling the pump it is essential to ensure that the pump and/or components are secured to provide adequate stability.

Large pump components or sub assemblies should be lifted using suitable devices.

During dismantling or before assembly all components should be inspected for fit, wear and damage. If worn or damaged the components should be replaced on assembly.

Special attention should be paid to the surface condition of the rotorcase, rotors, front cover and shaft seal components where damage, no matter how slight (for example scratches), may not only affect the mechanical operation, but may also cause a reduction in pump cleanability.

Note: The rotorcase and front cover both have sealing grooves which must be preserved in perfect condition to ensure correct operation.

WARNING

It is recommended that the joint ring located between the front cover and rotorcase is replaced with a new one each time that the front cover is removed. If the old one is to be considered for re-use, it should be checked for any signs of surface imperfections and if it is found to be damaged in any way it must be replaced. When removing and replacing the joint ring, take care not damage it.

WARNING

Where measuring devices are required to be used, exercise extreme care not to scratch or otherwise damage the surfaces of pump components.

The position of all parts should be identified as they are removed to ensure they are reinstalled in the same position.

O-rings are incorporated within the shaft cartridge assemblies on SQ2; SQ3 and SQ4 models and lipseals are incorporated within the shaft cartridge assemblies on SQ2, SQ3 and SQ4 models. The Mounting Plate on SQ1 models and in the gearbox covers on all models to contain the lubricant for the bearings and timing gears.

Regular inspection and correct maintenance of these items will ensure that the lubrication is sustained and contribute to maximum working life being achieved. It is extremely important that care is taken when extracting and reinstalling o-rings and lipseals. When removing and replacing lipseals ensure that the location bore for the outside diameter and the seat for the back of the lipseal are not damaged as this may create a leak path for the lubricant.

When removing lipseals or o rings care should be taken to avoid cutting or tearing the sealing faces as they pass over keyways, splines, threads or other potentially sharp or abrasive edges. All lipseals and o-rings should be carefully examined and if damaged in any way, be replaced on assembly.

All o-rings and sealing lips of lipseals should be lightly lubricated with a suitable lubricant before installing.

When installing lipseals do not allow the rear face to come into contact with rotating parts of bearings.

Prior to commencing assembly, ensure all parts are clean and free from burrs or damage. Where a vice is to be used then this should be installed with protective jaws to avoid damage to components. Do not hammer or apply undue force to install or position components.

WARNING

All fixings are required to be tightened to the required torque setting during assembly, refer to section 5.2.

The preferred method of installing bearing cones is that they are heated to approximately 125 °C (250°F) prior to installing, during this operation protective gloves should be used. Once bearing cones are installed in correct position they should be allowed to cool before proceeding with assembly. As an alternative bearing cones may be pressed into position providing always that suitable equipment is employed and the necessary procedures are adopted to prevent component damage.

Under no circumstances should bearing cones or cups be hammered into position.

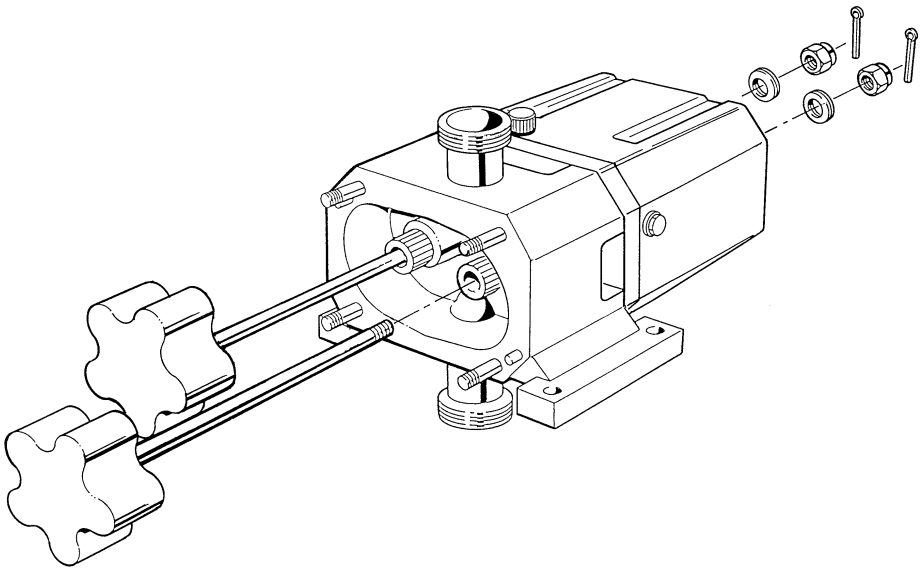
For torque settings for fixings and shaft rolling torque settings see section 5.2.

Rotors for Concept SQ pumps are only supplied in pairs and should be installed as such.

4.1 SQ1 Series Pumps - Dismantling

4.1.1 Front Cover and Rotor Removal

Fig 15



Removal of the rotors will necessitate gaining access to the end of both the drive and lay shafts by removal of the coupling guard and drive coupling assembly. It will depend upon the specific arrangement of components that have been used as to whether or not the pump will need to be removed from its mounting to allow this.

- Follow recommended Shutdown Procedure refer to section 3.5.

- Gradually loosen front cover retaining dome nuts (36), care should be taken as there may still be residual product and pressure in the pump head and as the dome nuts are loosened this will vent to atmosphere.

- Remove dome nuts (36).

- Remove front cover (38), using lever slots where necessary, and the front cover joint ring (39), taking care not to damage the sealing grooves in the rotorcase (40) and front cover (38). Note that front cover (38) is located by dowels (80).

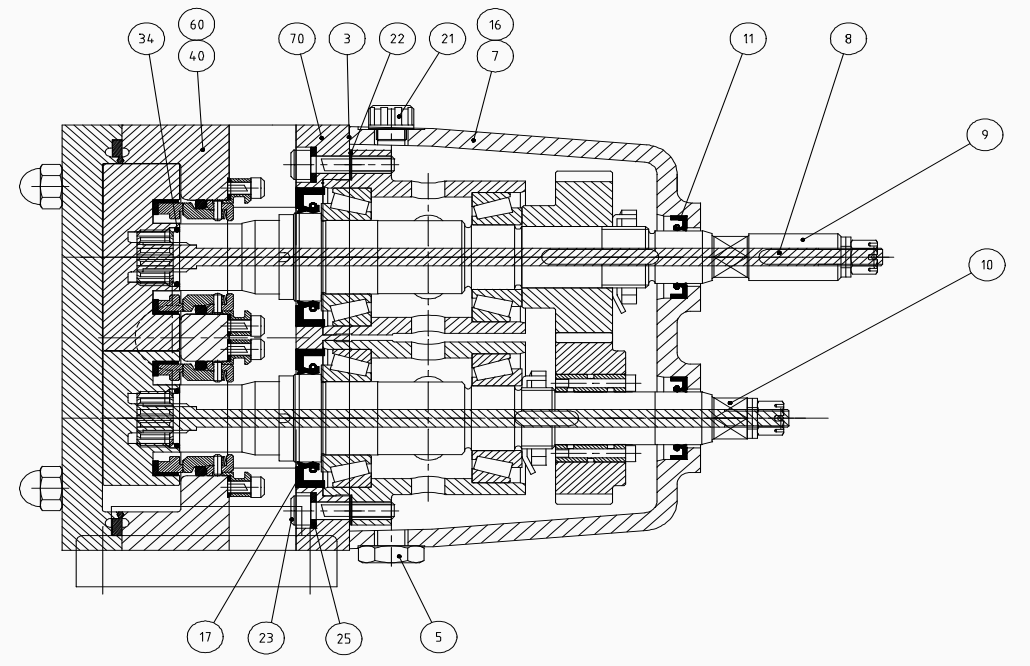
- Remove split pins (82) from rotor (41) draw bolts, and discard, as they are not re-useable.

- Remove castellated nuts (81) from rotor (41) draw bolts. Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended spanner to stop shafts (9 &10) turning.

- Remove disc springs (83) from rotor (41) draw bolts, noting orientation.

- Remove rotors (41) from shafts (9 and 10) by gently tapping on ends of draw bolts with a soft-faced mallet, then pulling out. Note that each rotor (41) has its own integral draw bolt permanently attached. Take care not to damage the mechanical seal faces which are located in the back face of each rotor (41).

4.1.2 Cartridge Removal
(after completing 4.1.1) - see Fig 16



Before proceeding with cartridge removal, remove mechanical seals, see section 4.5.

- Remove o-rings (34) from shafts (9 &10) and discard, do not re-use.
- Remove drive coupling from drive shaft (9), if not already removed.
- Remove drive key (8).
- Remove gearbox assembly retaining screws (7).
- Remove gearbox assembly from rotorcase (40), using levers in slots if necessary. Note that mounting plate (70) is located onto by dowel (60).
- Remove oil drain plug (5) and breather (21), drain oil into suitable container and retain if later inspection is required.
- Remove gearbox cover retaining screw (74) and sealing washer (25).
- Remove gearbox cover (16) and gasket (3) from mounting plate (70).
- Remove lipseals (11) from gearbox cover (16).
- Remove cartridge assembly retaining screw (23) & sealing washer (25).
- Extract shaft cartridge assemblies from mounting plate (70) take care not to damage the shim (22). Keep shims in sets and identify position.

WARNING

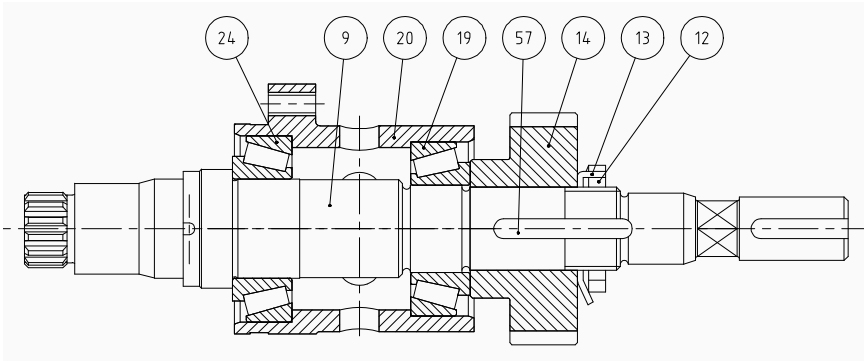
Note: Shims (22) may be different for each cartridge and therefore must be kept with their respective cartridge.

- Remove front oil seals (17) from mounting plate (70).

4.1.3 Cartridge Dismantling

4.1.3.1 Drive Shaft Cartridge Dismantling

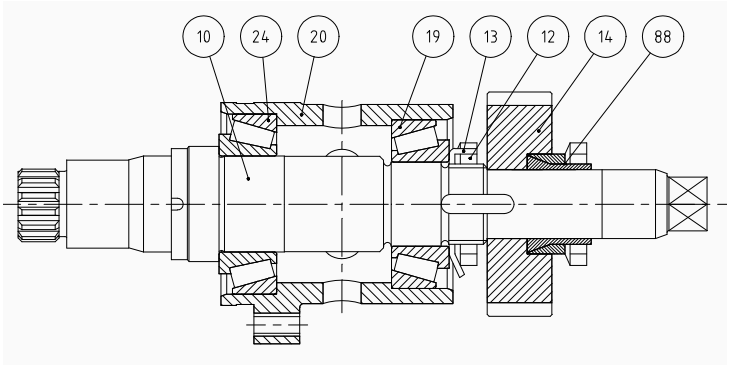
Fig 17



- Remove locknut (12) and tab washer (13).
- Remove timing gear (14) and gear key (57).
- Remove drive shaft (9) from bearing sleeve (20).
- Remove bearing (24) inner cone from drive shaft (9).
- Remove bearing (19 & 24) cups from bearing sleeve (20).

4.1.3.2 Lay shaft Cartridge Dismantling

Fig 18



- Release the clamping screws of the torque lock assembly (88) gradually in a diagonal sequence until free.

WARNING

Never completely undo one screw after another as this would cause the last screw to be subjected to the total spring back force exerted by the torque lock assembly (88) causing it to block.

- Remove timing gear (14) and torque lock assembly (88).
- Remove locknut (12) and tab washer (13).
- Remove lay shaft (10) from bearing sleeve (20).
- Remove bearing (24) inner cone from lay shaft (10).
- Remove bearing (19 & 24) cups from bearing sleeve (20).

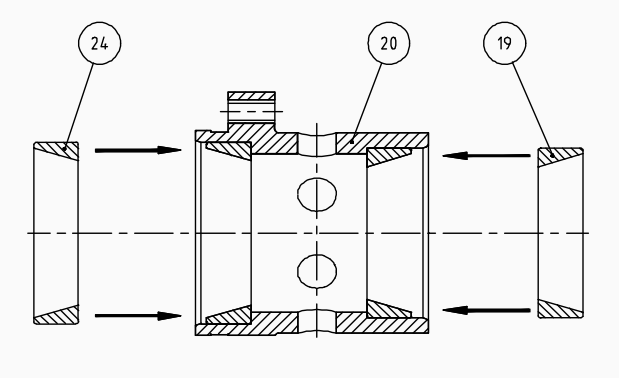
4.2 SQ1 Series Pumps - Assembly

4.2.1 Cartridge Assembly

4.2.1.1 Drive Shaft Cartridge Assembly

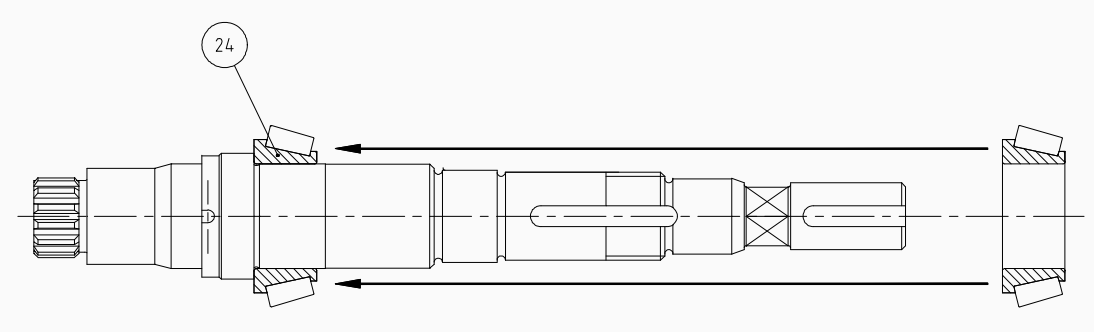
- Install bearing (19 & 24) cups to bearing sleeve (20), see Fig 19.

Fig 19



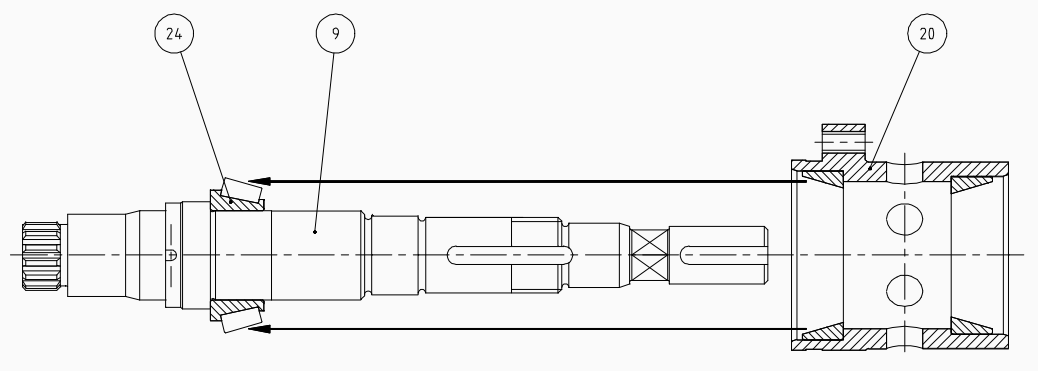
- Install front bearing (24) cone onto drive shaft (9) see Fig 20.

Fig 20



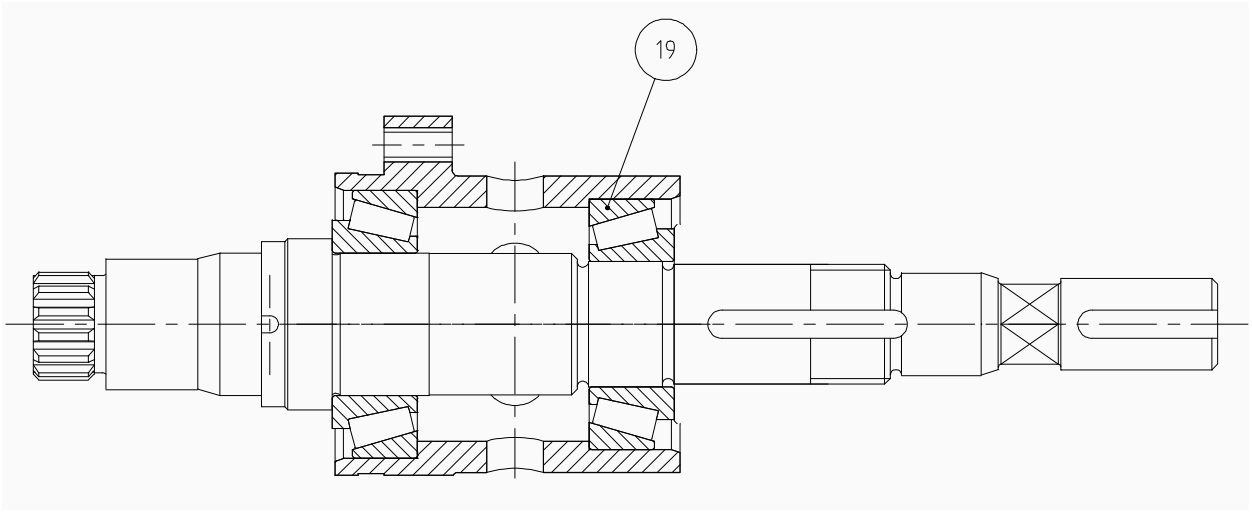
- Install bearing sleeve (20) to drive shaft (9) with securing lugs towards the spline end of the shaft so that the bearing (24) cup locates with the cone see Fig 21.

Fig 21



- Install rear bearing cone (19) to drive shaft (9) see Fig 22. Do not use excessive pressure as rolling torque is achieved by adjusting rear lock nut (12).

Fig 22



- Install gear key (57) and gear (14) into position ensuring gear boss abuts with rear bearing (19) cone.

- Install tab washer (13) and lock nut (12). Do not secure tab washer (13).

- Install rotor (41) to the cartridge assembly, securing with castellated nut (81) (it's not necessary to install springs (83) or pin (82) for this operation).

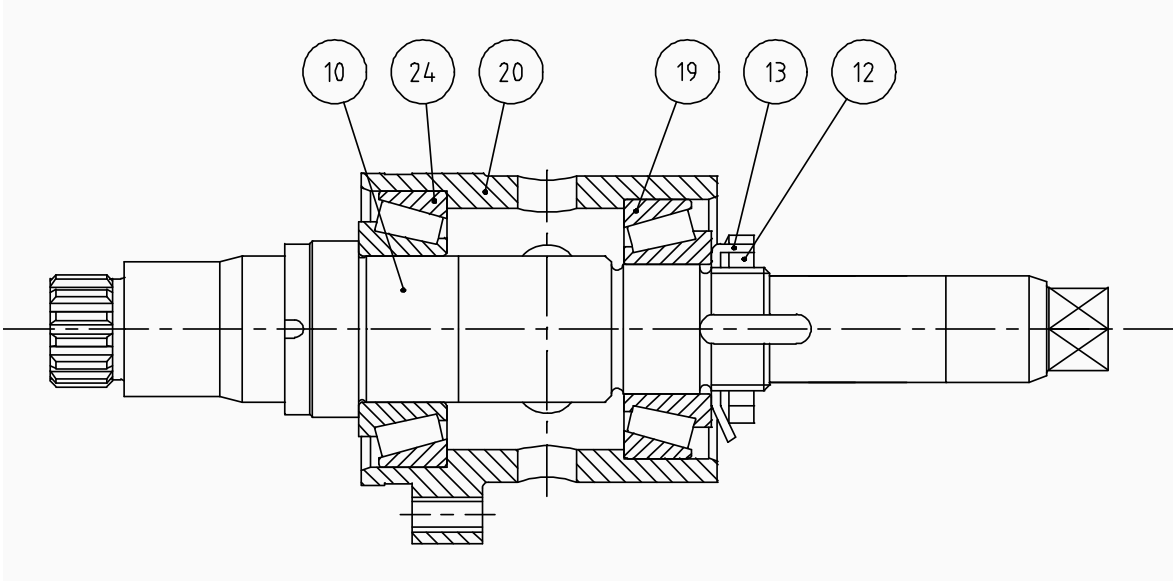
- Carefully mount the cartridge/rotor assembly into a vice horizontally, gripping on the bearing sleeve (20). Do not over tighten the vice, the bearing sleeve (20) is a precision component and should not be distorted.

- Tighten lock nut (12) and adjust to achieve correct rolling torque, refer to section 5.2. Measure the rolling torque using a torque meter, which can conveniently drive onto the castellated nut (81) by use of a socket. If the rolling torque does not correspond to the required setting, for rolling torque settings refer to section 5.2, adjust the lock nut (12). Secure tab washer (13).

- Remove castellated nut (81) and rotor (41).

4.2.1.2 Lay shaft Cartridge Assembly

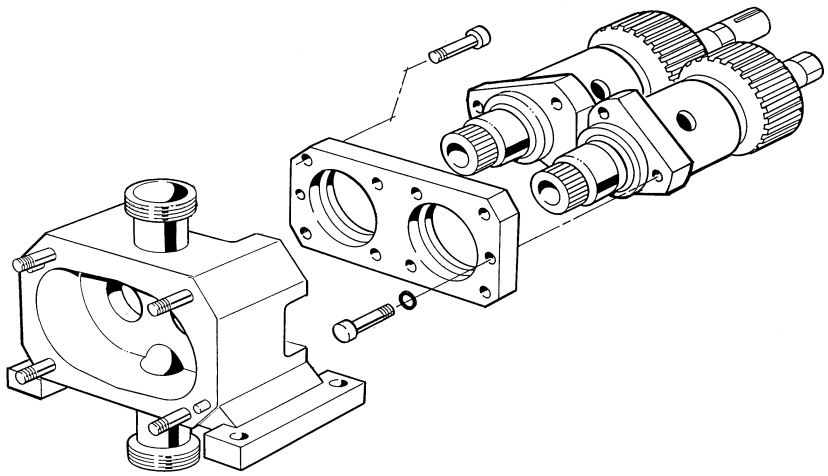
Fig 23



- Install bearing (19 & 24) cups to bearing sleeve (20), as in Fig 19.
- Install front bearing cone (24) onto lay shaft (10), as in Fig 20.
- Install bearing sleeve (20) to lay shaft (10) with securing lugs towards the spline end of the shaft so that the bearing (24) cup locates with the cone, as in Fig 21.
- Install rear bearing (19) cone to lay shaft (10), as in Fig 22. Do not use excessive pressure as rolling torque is achieved by adjusting rear lock nut (12).
- Install tab washer (13) and lock nut (12). Do <u>not</u> secure tab washer (13).
- Install rotor (41) to the cartridge assembly, securing with castellated nut (81) (it is not necessary to install disc springs (83) or split-pin (82) for this operation).
- Carefully mount the cartridge/rotor assembly into a vice in horizontal plane, gripping on the bearing sleeve (20). Do not over tighten the vice as the bearing sleeve (20) is a precision component and should not be distorted.
- Tighten lock nut (12) and adjust to achieve correct rolling torque, refer to section 5.2. Measure the rolling torque using a torque meter, which can conveniently drive onto the castellated nut (81) by use of a socket. If the rolling torque does not correspond to the required setting, for rolling torque settings refer to section 5.2, adjust the lock nut (12). Secure tab washer (13).
- Remove castellated nut (81) and rotor (41).

4.2.2 Cartridge/Mounting Plate/Rotorcase Assembly

Fig 24



- If not already installed, install feet (1) to rotorcase (40) using cap head screws (2).

Note: If necessary for the hygienic requirements of the installation, the feet (1) should be sealed to the rotorcase (40) with a suitable sealing agent.

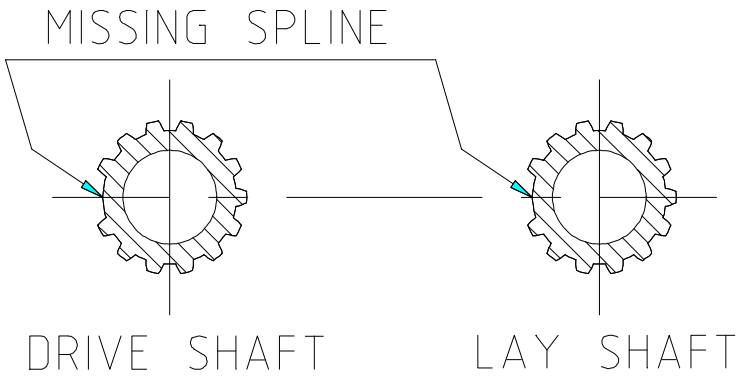
- If not already installed, install the mechanical seal housing (28) with gasket (27) to the rear of the rotorcase (40) and secure with screw (26).

- Assemble cartridges into mounting plate (70) rear bores securing with cap head screws (23) (tightening to correct torque, refer to section 5.2) and sealing washers (25), which are located under heads of screws (23). Do not install shims (22) at this stage.

- Ensure mating faces are totally clean, then install mounting plate (70) to rotorcase (40), (noting that it locates onto dowels (60)), securing with cap head screws (74) (which are actually the screws used to finally install gearbox cover (16)).

- Rotate shafts (9 & 10) so as to position the gaps made by the missing splines in positions shown in Fig 25.

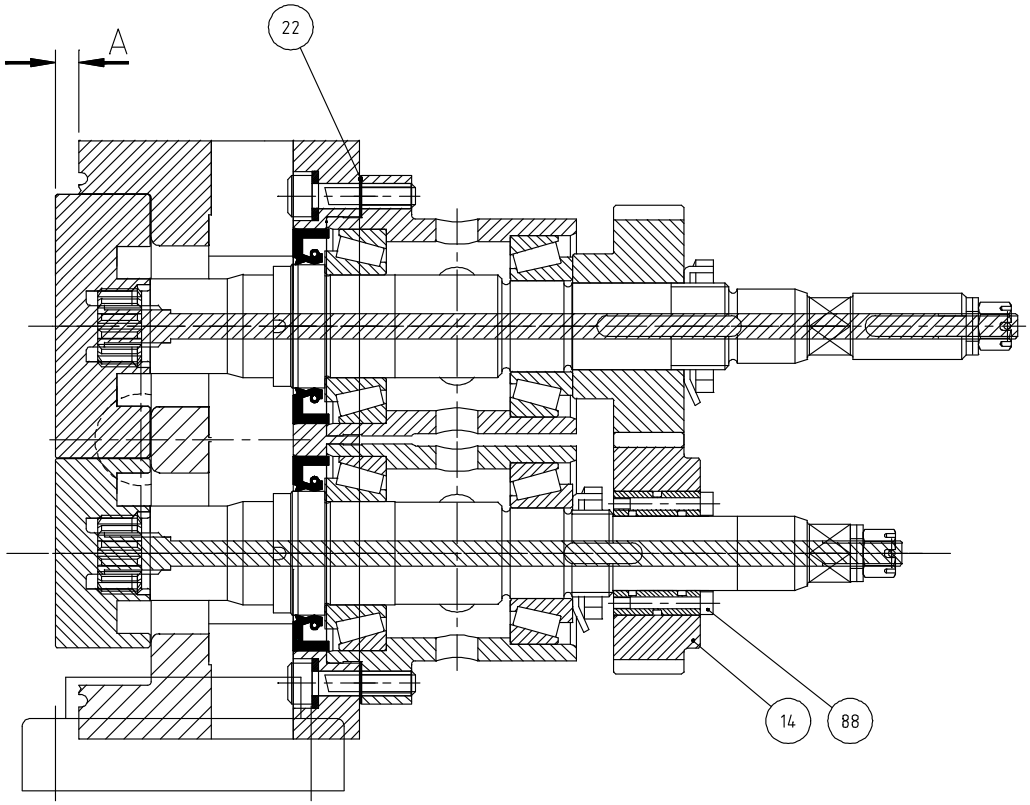
Fig 25



- Install rotors (41), securing with castellated nuts (81), tightening to correct torque refer to section 5.2. Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended wrench in association with a torque wrench on the castellated nut (81). (It is not necessary to install disc springs (83) or split-pins (82) for this operation).

- Taking care not to cause any scratching or other damage of components, use a depth micrometer or similar device measure "actual" rotor front protrusion, this is the protrusion of the rotor in front of the front face of the rotorcase. Select "required" front protrusion (A) from the Clearance Chart, refer to section 5.1, see Fig 26. The difference between the "actual" measured protrusion and the "required" protrusion, as given on the Clearance Chart, is the amount of shim (22) that needs to be added.

Fig 26



- Having determined the amount of shim (22) to be added, remove castellated nuts (81) and rotors (41). Remove cap head screws (74) and mounting plate (70) from rotorcase (40). Remove cap head screws (23) and cartridge assemblies from mounting plate (70). Add appropriate amount of shim between mounting plate (70) and nose of bearing sleeves (20).

- Install lipseals (17) to mounting plate (70).

- Re-assemble cartridge assemblies, rotorcase (40) and mounting plate (70), (ensuring mating faces are totally clean). With shafts positioned as Fig 25, re-install rotors (41) and re-check rotor front protrusion dimensions.

- Install torque lock assembly (88) to lay shaft (10).

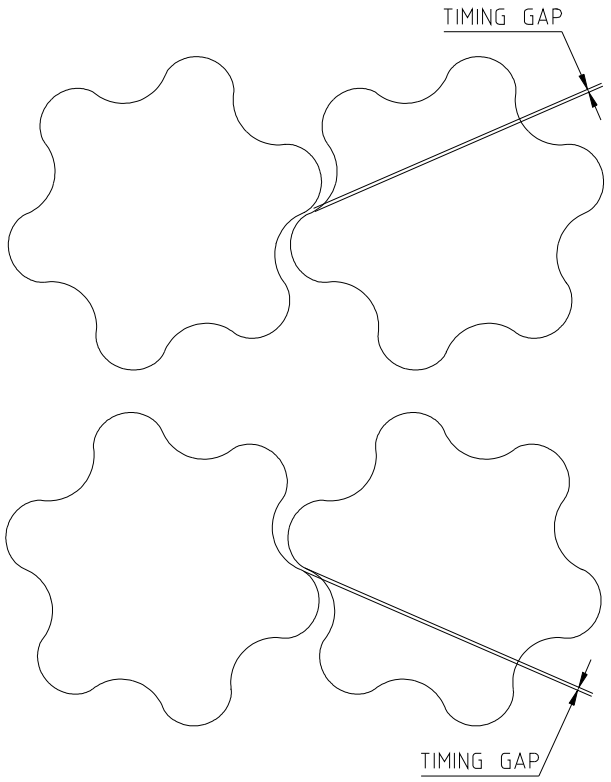
- Install timing gear (14) to torque lock assembly (88) such that the timing gears (14) are fully engaged and aligned. The mating face of torque lock assembly (88) should not protrude on either side of the lay timing gear (14).

- Tighten the clamping screws of the torque lock assembly (88) evenly in diagonal order until all play is eliminated.

- Tighten the clamping screws slightly further such that the timing gear (14) is just retained on lay shaft (10).

4.2.3 Setting Rotor Timing

Fig 27



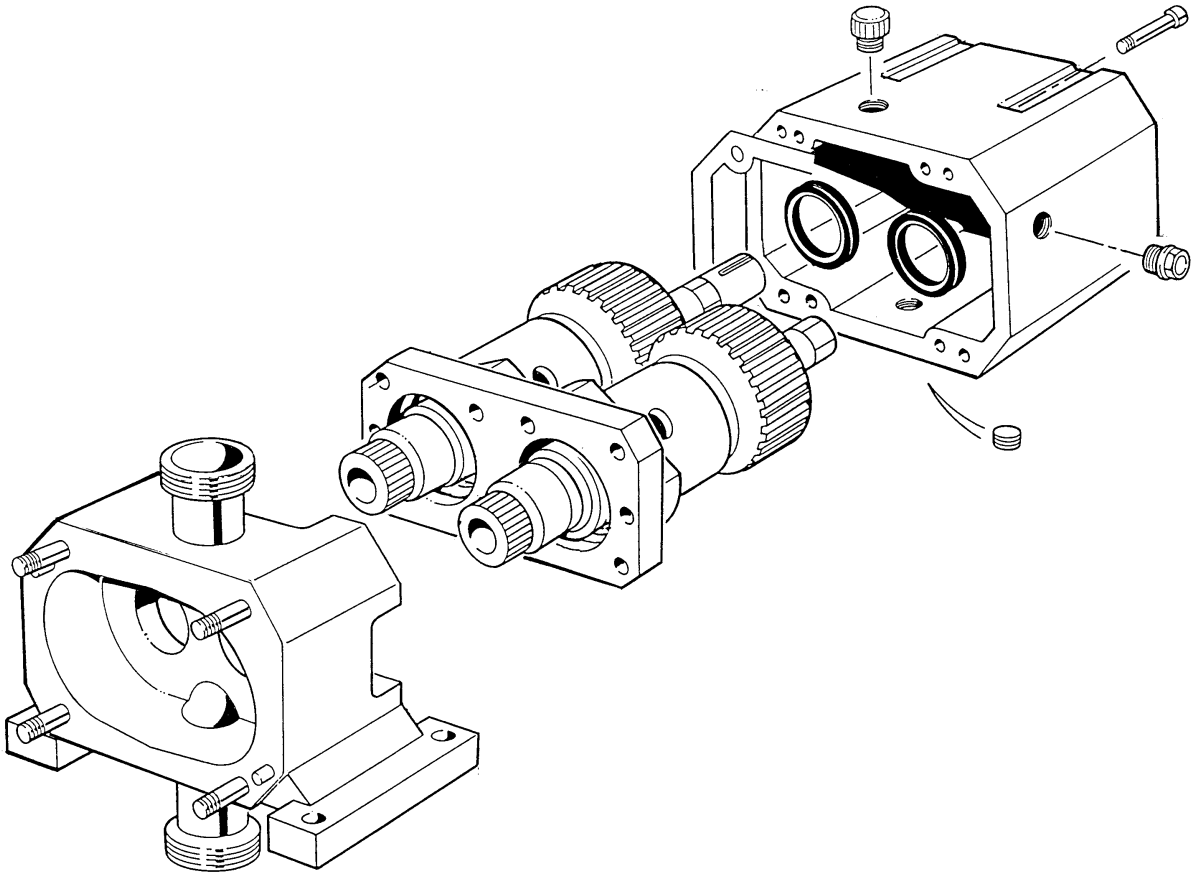
- The timing clearances for the rotors must be equalised and can be adjusted by turning shafts (9 & 10) in relation to each other. Once timing clearances have been optimised, the clamping screws of torque lock assembly (88) can be tightened gradually in diagonal sequence to correct torque, refer to section 5.2.

- After tightening of torque lock assembly (88) the timing clearances for the rotors should be re-checked.

- Once timing clearances have been optimised; remove castellated nuts (81) and rotors (41).

- Remove screws (74) and mounting plate (70) from rotorcase (40).

4.2.4 Gearbox Assembly
Fig 28



- Install lipseals (11) to gearbox cover (16).

- Install breather (21); drain plugs (5) and sight glass (6) in required position in gearbox cover (16).

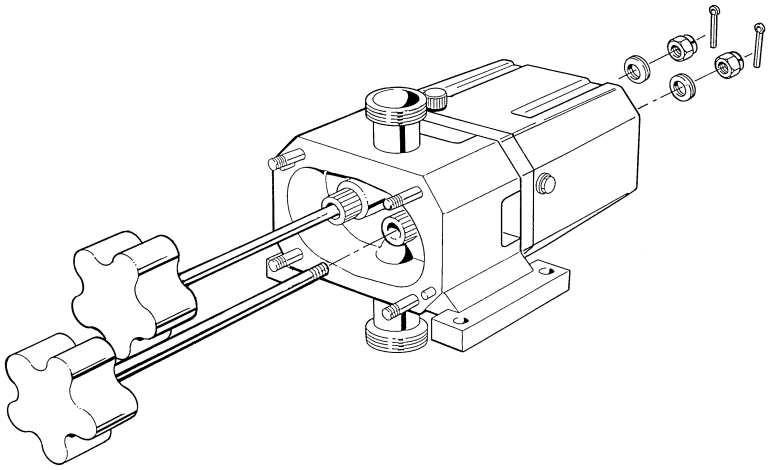
Note: The sight glass (6) must be installed in the upper tapped hole in the side of the gearbox cover (16). Remember to fill the gearbox with oil prior to start up. For recommended lubricant capacities and grades refer to section 5.3.

- Install gearbox cover (16) with gasket (3) to mounting plate (70) securing with screws (74) (tightening to correct torque, refer to section 5.2) and sealing washers (25), which are located under heads of screws (74).

- Install gearbox cover (16) / mounting plate (70) assembly to rotorcase (40) (noting that it locates onto dowels (60)), securing with screws (7), tightening to correct torque, refer to section 5.2.

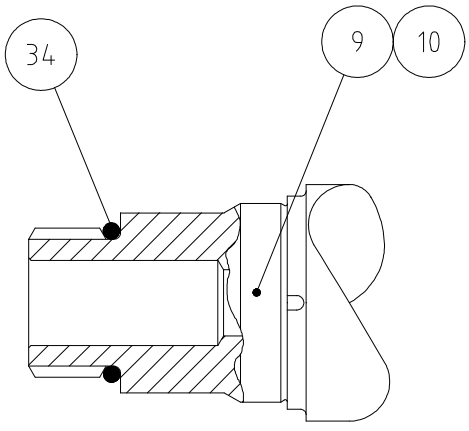
4.2.5 Rotor Assembly and Checking Clearances

Fig 29



- Do not install mechanical seals at this point.
- Install rotors (41) to shafts (9 and 10) in rotorcase (40).
- Install castellated nuts (81) to rotor (41) draw bolts, tightening to correct torque, refer to section 5.2. Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended spanner in association with a torque wrench acting on the castellated nut (81).
- Using a depth micrometer or similar device measure "actual" rotor front protrusion (A), this is the protrusion of the rotor in front of the front face of the rotorcase and check that this corresponds to the appropriate protrusion as indicated on the Clearance Chart, refer to section 5.1.
- If the front protrusion (A) is incorrect, adjustment of the shims (22) between the mounting plate and cartridge is required, refer to section 4.2.2 Cartridge / Mounting Plate / Rotorcase Assembly.
- With rotors (41) installed, check all clearances, front (A), radial (C), rear (B) and mesh (D), against the Clearance Chart refer to section 5.1.
- Remove castellated nuts (81) and rotors (41).
- Install mechanical seals; refer to section 4.5 Mechanical Seal Installation and Removal.
- Install new o-rings (34) to shafts (9 & 10) see Fig 30.

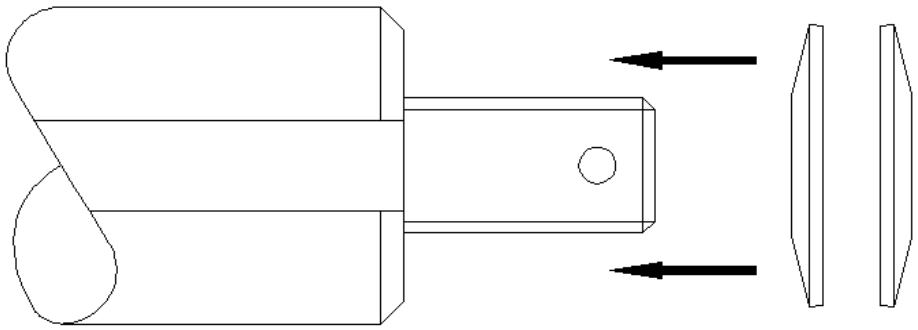
Fig 30



- Install rotors (41) to shafts (9 and 10) in rotorcase (40).

- Install disc springs (83) (ensuring correct orientation, see Fig 31) and castellated nuts (81) to rotor (41) draw bolts, tightening to correct torque, refer to section 5.2.

Fig 31

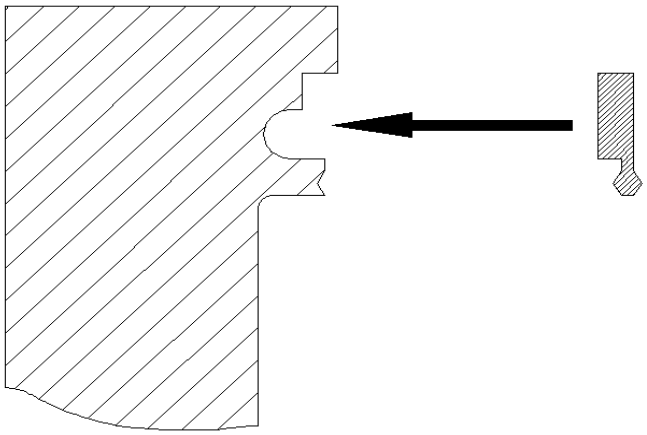


- Install joint ring (39) to front cover (38).

WARNING

Note: Joint Ring (39) must be installed the right way round, see Fig 32. The Joint Ring (39) "clips" into place on the register. Make sure that the Joint Ring (39) is correctly located around its entire circumference before proceeding.

Fig 32



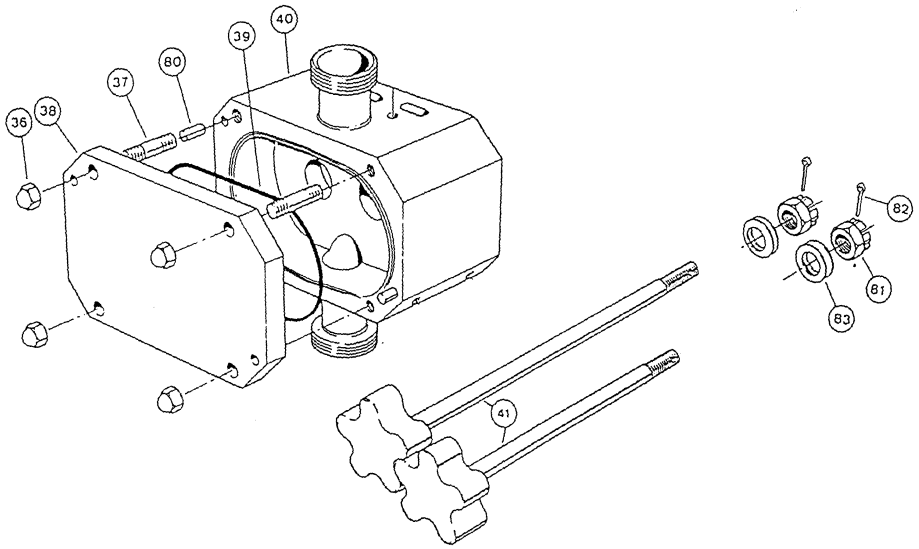
- Install front cover (38) to rotorcase (40) (noting that it locates onto dowels (80)), securing with dome nuts (36), tightening to correct torque, refer to section 5.2. Make certain that the joint ring (39) is not dislodged from its correct position during the installing operation.

- Install new split pins (82) through castellations of castle nuts (81) and drilled holes in rotor (41) draw bolts. It may be found necessary to loosen castellated nut (81) fractionally to align holes. Bend ends of split-pins (82) over to secure, ensuring that ends will not interfere with drive coupling hub when it is reinstalled to drive shaft (9).

4.3 SQ 2, 3, 4 - Dismantling

4.3.1 Front Cover and Rotor Removal

Fig 33

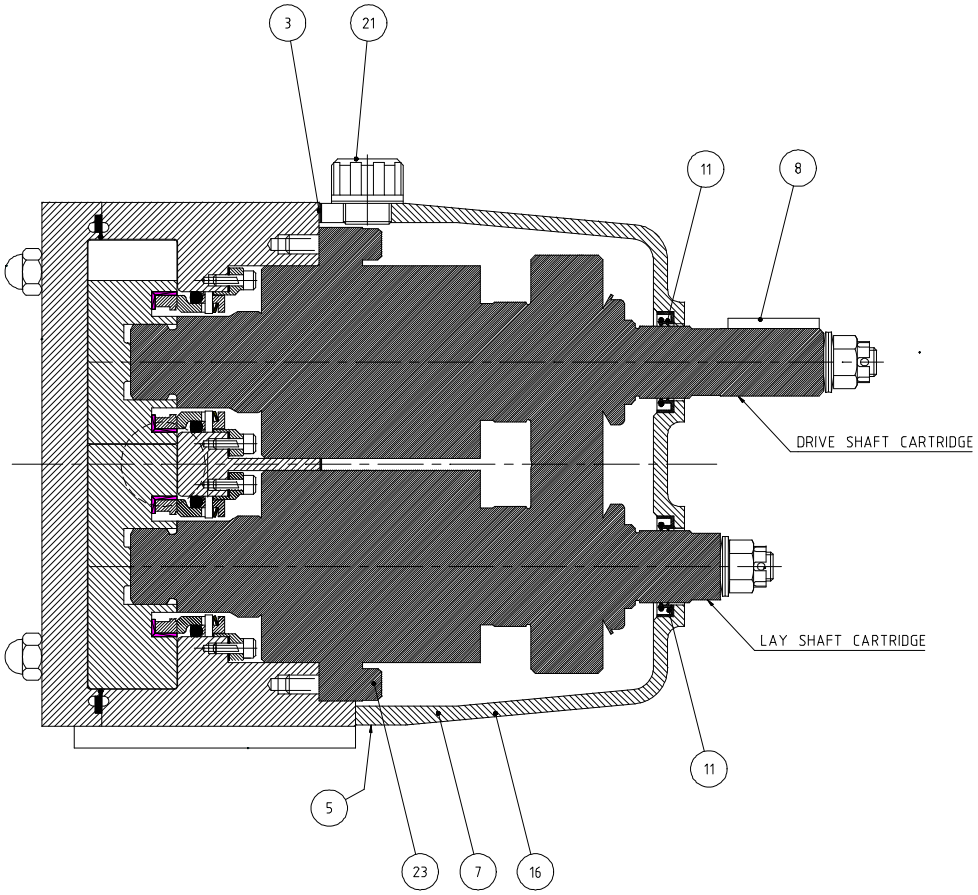


Removal of the rotors will necessitate gaining access to the end of both the drive and lay shafts by removal of the coupling guard and drive coupling assembly. It will depend upon the specific arrangement of components that have been used as to whether or not the pump will need to be removed from its mounting to allow this.

- Follow recommended Shutdown Procedure - refer to section 3.5.
- Gradually loosen front cover retaining dome nuts (36), care should be taken as there may still be residual product and pressure in the pump head and as the dome nuts are loosened this will vent to atmosphere.
- Remove dome nuts (36).
- Remove front cover (38), using lever slots where necessary, and the front cover joint ring (39), taking care not to damage the sealing grooves in the rotorcase (40) and front cover (38). Note that front cover (38) is located by dowels (80).
- Remove split pins (82) from rotor (41) draw bolts, and discard, as they are not re-useable.
- Remove castellated nuts (81) from rotor (41) draw bolts. Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended spanner to stop shafts (9 &10) turning.
- Remove disc springs (83) from shafts, noting their orientation
- Remove rotors (41) from shafts (9 and 10) by gently tapping on ends of draw bolts with a soft-faced mallet, then pulling out. Note that each rotor (41) has its own integral draw bolt permanently attached. Take care not to damage the mechanical seal faces which are located in the back face of each rotor (41).

4.3.2 Cartridge Removal (after completing 4.3.1)

Fig 34



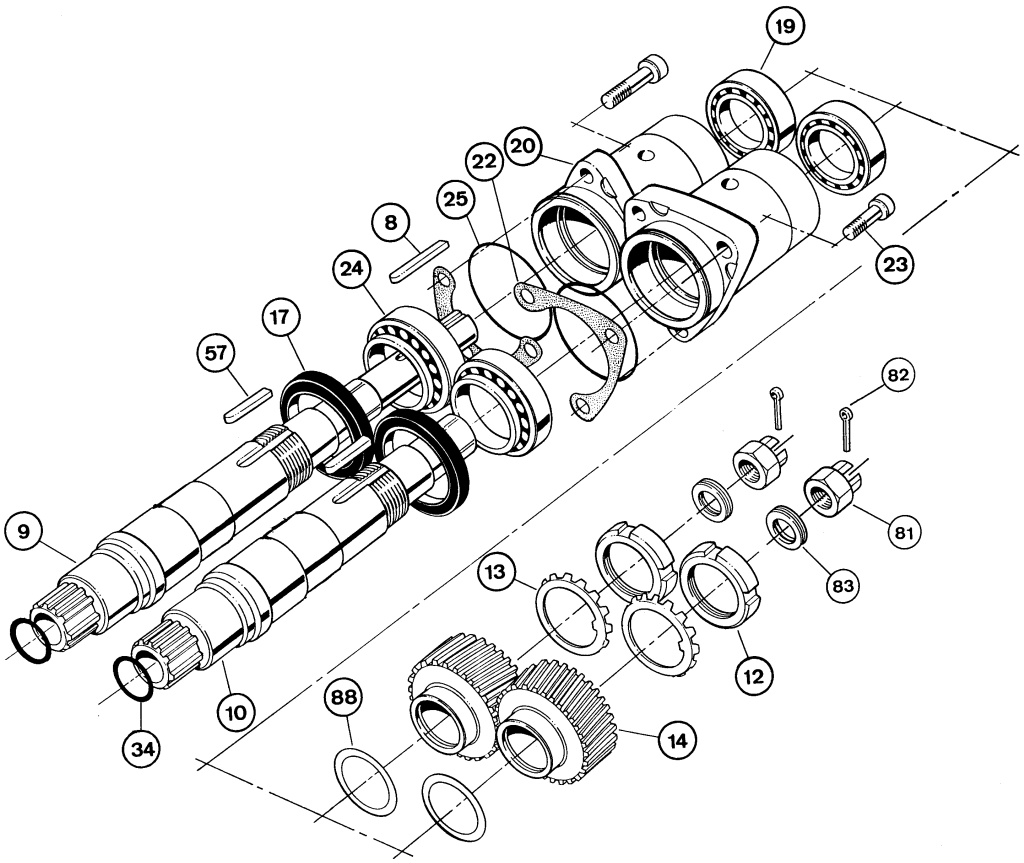
The following procedures assume the pump has been removed from the baseplate. Before proceeding with cartridge removal remove mechanical seals see section 4.5.

- Remove o-rings (34) from shafts (9 &10) and discard they are not re-useable.
- Remove oil drain plug (5) and breather (21), drain oil into suitable container and retain if later inspection is required.
- Remove drive coupling, if not already removed.
- Remove drive key (8).
- Remove gearbox cover retaining screws (7).
- Remove gearbox cover (16) and gasket (3).
- Remove lipseals (11) from gearbox cover (16).
- Remove shaft cartridge retaining screws (23).
- Extract shaft cartridge assy using lever slots if necessary taking care not to damage shims (22). Keep shims (22) in sets and identify position.

WARNING **Note: Shims (22) may be different for each cartridge and therefore must be kept with their respective cartridge.**

4.3.3 Cartridge Dismantling

Fig 35



- Remove o rings (25) from bearing sleeves (20)
- Remove locknut (12) and tab washer (13).
- Remove timing gear (14) noting that the drive shaft gear (stamped D) has a right hand helix and the lay shaft gear (stamped L) a left hand helix.
- Remove shims (88) from shafts (9 & 10). Keep in sets and identify positions.

WARNING

Note: Shims (88) may be different for each cartridge and therefore must be kept with their respective cartridge.

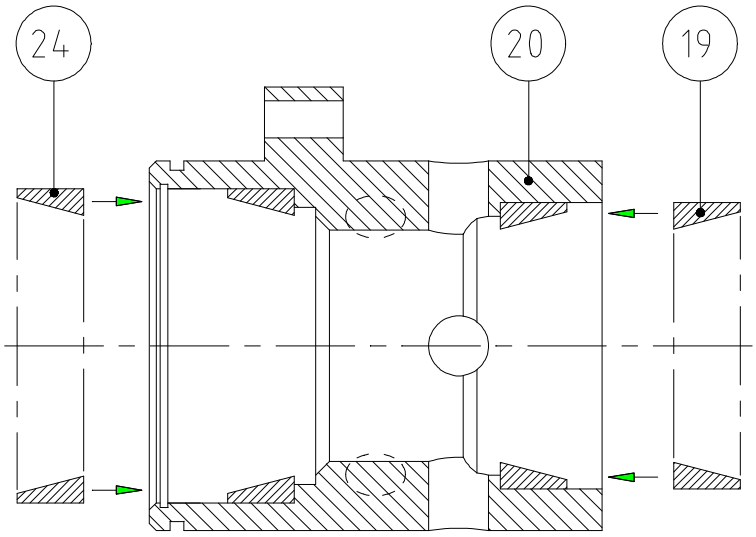
- Remove gear key (57).
- Remove front oil seal (17).
- Remove shaft (9 or 10) from bearing sleeve (20).
- Remove bearing (24) inner cones from shafts (9 and 10).
- Remove bearing (24) cups from bearing sleeves (20).

4.4 SQ 2, 3, 4 - Assembly

4.4.1 Cartridge Assembly

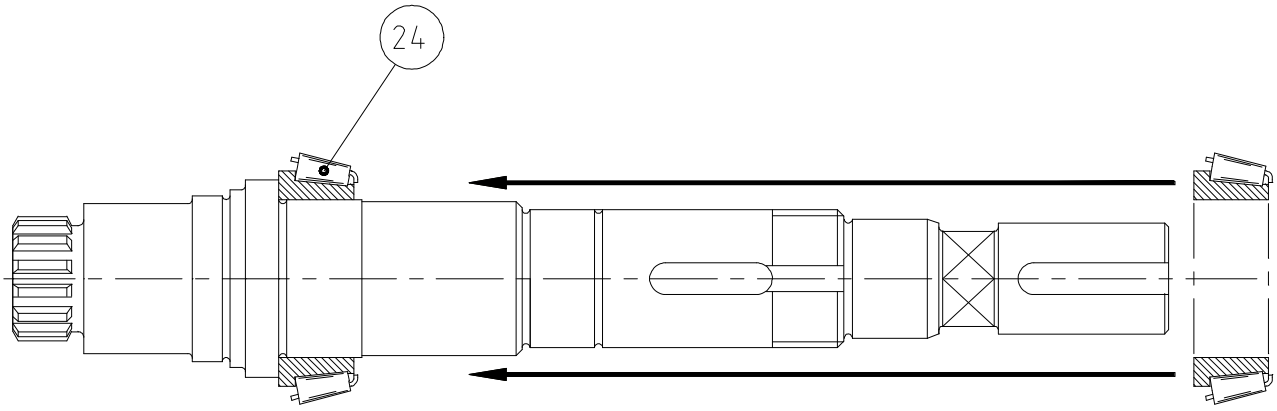
- Install bearing (19 & 24) cups to bearing sleeves (20), see Fig 36.

Fig 36



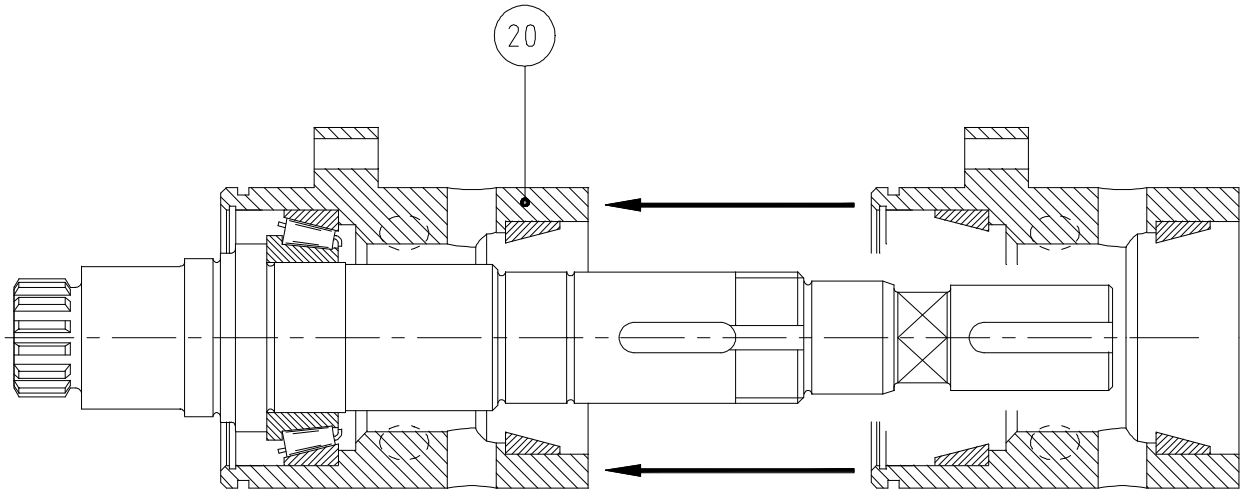
- Install front bearing (24) cones onto shafts (9 and 10) see Fig 37.

Fig 37



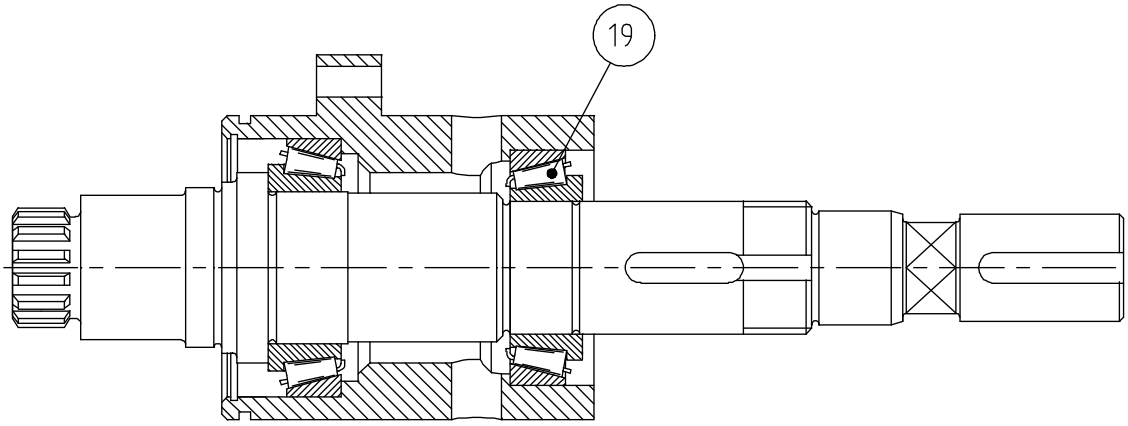
- Install bearing sleeves (20) to shafts (9 and 10) with securing lugs towards the spline end of the shaft so that the bearing (24) cup locates with the cone (24) see Fig 38.

Fig 38



- Install rear bearing (19) cones to shafts (9 and 10) see Fig 39. Do not use excessive pressure as rolling torque is achieved by adjusting rear lock nuts (12).

Fig 39



- Install gear keys (57) and gears (14) into position ensuring gear boss abuts with rear bearing (19) cone.

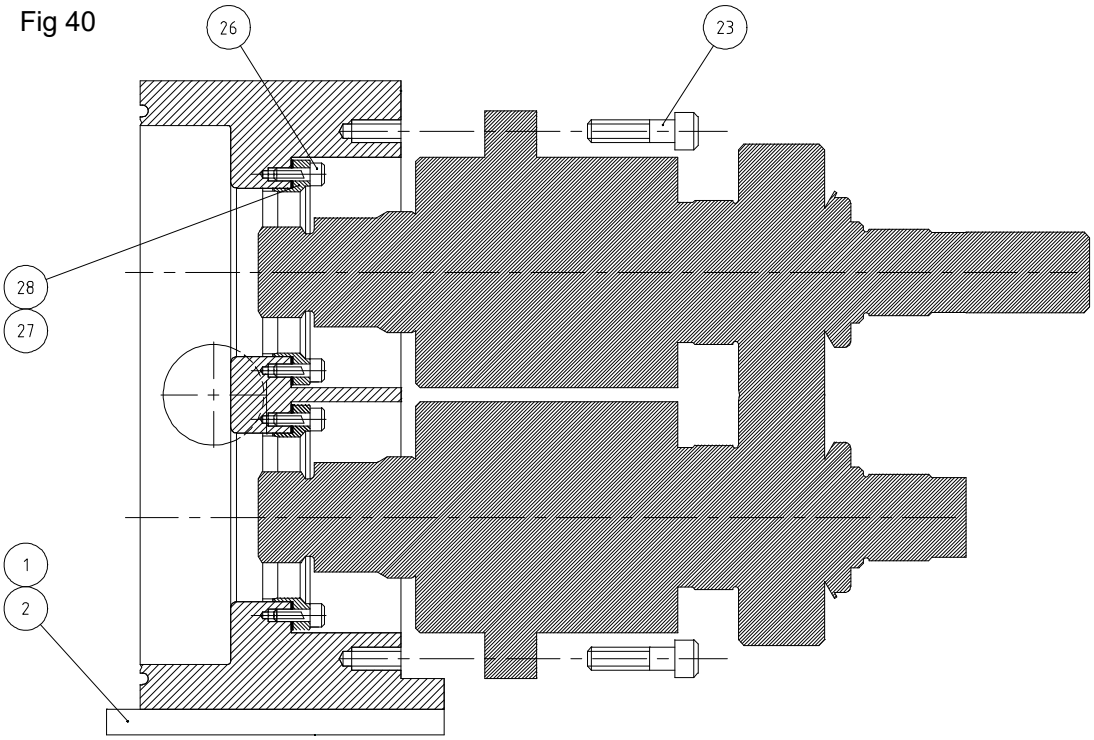
Note: Right hand helix for drive shaft gear (stamped D), left hand helix for lay shaft gear (stamped L).

Note: When ordering spare timing gears it is essential to purchase and install these as a pair.

- Install tab washers (13) and nuts (12). Do <u>not</u> secure tab washers (13).

4.4.2 Cartridge to Rotorcase Assembly

Fig 40



- If not installed, secure feet (1) to rotorcase (40) using cap screws (2).

Note: If necessary for the hygienic requirements of the installation, the feet (1) should be sealed to the rotorcase (40) with a suitable sealing agent.

- If not already installed, install the mechanical seal housing (28) with gasket (27) on SQ2 models or o-ring (27) on SQ3 & SQ4 models to the rear of the rotorcase (40) and secure with screws (26).

- Install rotors (41) to the individual cartridge assemblies, securing with castellated nuts (81) (it is not necessary to install disc springs (83) or split-pins (82) for this operation).

- Carefully mount one of the cartridge/rotor assemblies into a vice in horizontal plane, gripping on the bearing sleeve (20). Do not over tighten the vice as the bearing sleeve (20) is a precision component and should not be distorted.

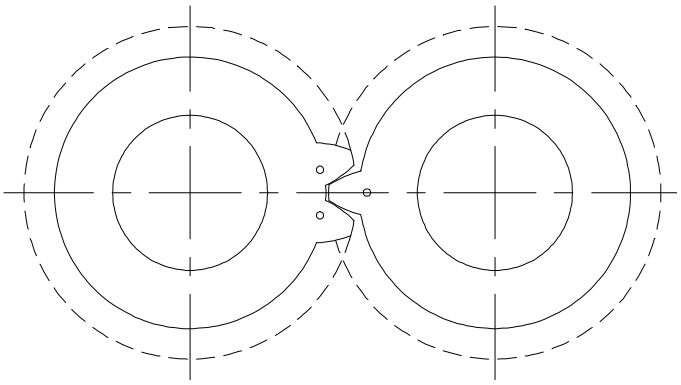
- Tighten lock nut (12) and adjust to achieve correct rolling torque, refer to section 5.2. Measure the rolling torque using a torque meter, which can conveniently drive onto the castellated nut (81) by use of a socket. If the rolling torque does not correspond to the required setting, for rolling torque settings refer to section 5.2, adjust the lock nut (12). Do not secure tab washers (13).

- Remove castellated nuts (81) and rotors (41).

- It is not necessary to install o-rings (25) to front diameter of bearing sleeves (20) at this stage.

- Assemble cartridges into rotorcase (40) rear bores ensuring that timing marks on the timing gears (14) are in mesh (single dot on drive shaft gear, two dots on lay shaft gear). The timing gears are in correct mesh when the single dot on the drive shaft gear is between the two dots on the lay shaft gear, see Fig 41.

Fig 41

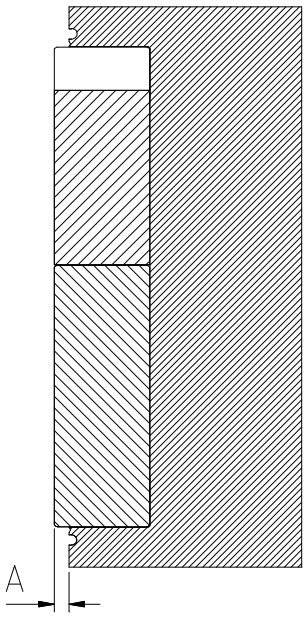


- Secure cartridges to rotorcase (40) with cap head screws (23), tightening to correct torque, refer to section 5.2. No shims (22) should be installed at this stage.

- Install rotors (41), securing with castellated nuts (81), tightening to correct torque, refer to section 5.2. Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended spanner in association with a torque wrench acting on the castellated nut (81). (It is not necessary to install disc springs (83) or split-pins (82) for this operation).

- Taking care not to cause any scratching or other damage of components, use a depth micrometer or similar device measure "actual" rotor front protrusion, (A), this is the protrusion of the rotor in front of the front face of the rotorcase. Select "required" front protrusion (A) from the Clearance Chart, refer to section 5.1, see Fig 42. The difference between the "actual" measured protrusion and the "required" protrusion, as given on the Clearance Chart, is the amount of shim (22) that needs to be added.

Fig 42



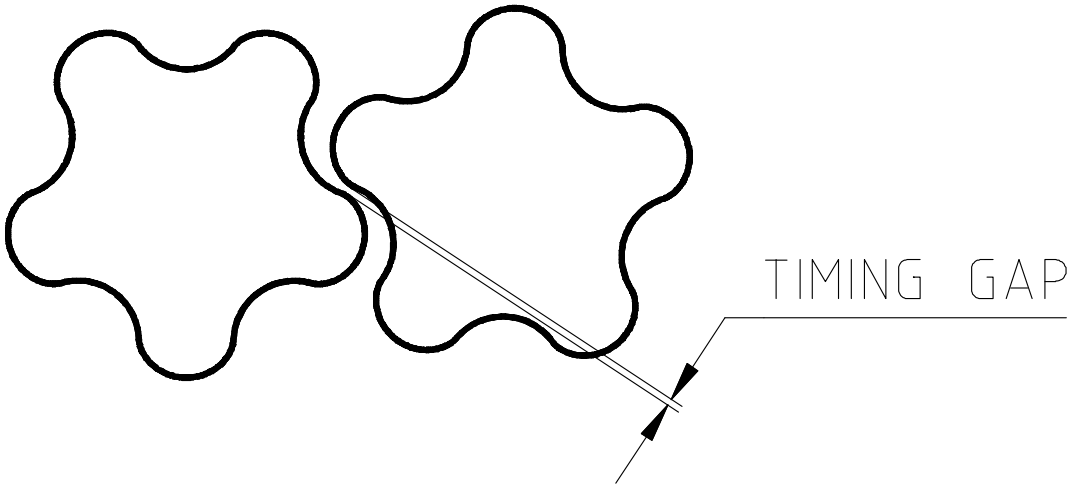
- Having determined the amount of shim (22) to be added, remove castellated nuts (81) and rotors (41). Remove cap head screws (23). Ease cartridge from rotorcase (40) using lever slots to create a gap to allow installation of shims (22). Add appropriate amount of shim between rotorcase (40) and shaft cartridge flange. Shims are either marked with their thickness or are colour coded as follows:

Blue	=	0.050 mm (0.002”) thick
Green	=	0.075 mm (0.003”) thick
Clear	=	0.150 mm (0.006”) thick
White	=	0.250 mm (0.010”) thick

- Secure cartridges to rotorcase (40) with cap head screws (23) tightening to correct torque refer to section 5.2.

4.4.3 Setting Rotor Timing

Fig 43



- Install rotors (41) to cartridge assemblies, secure with castellated nuts (81) (not necessary to install springs (83) or split-pins (82) for this operation).

- If timing clearance, see fig 43, is larger on the upper side compared with the lower side (when viewed on rotor fronts), shim (86) must be added between boss of timing gear (14) and inner cone of bearing (19) of the lay shaft (10). (As a guide to the thickness of shim required, to change timing gap by 1 unit (say 0.1mm) shims of 3 units thickness (say 0.3 mm) would be required.) Installation of shims (86) will necessitate removal of castellated nuts (12), rotors (41), lock nuts (12), tab washers (13) and timing gears (14). Having installed the correct amount of shim (86), re-assemble timing gears (14), tab washers (13), lock nuts (12), rotors (41) and castellated nuts (12).

- Once timing clearances have been confirmed as being equalised, remove castellated nuts (81) and rotors (41).

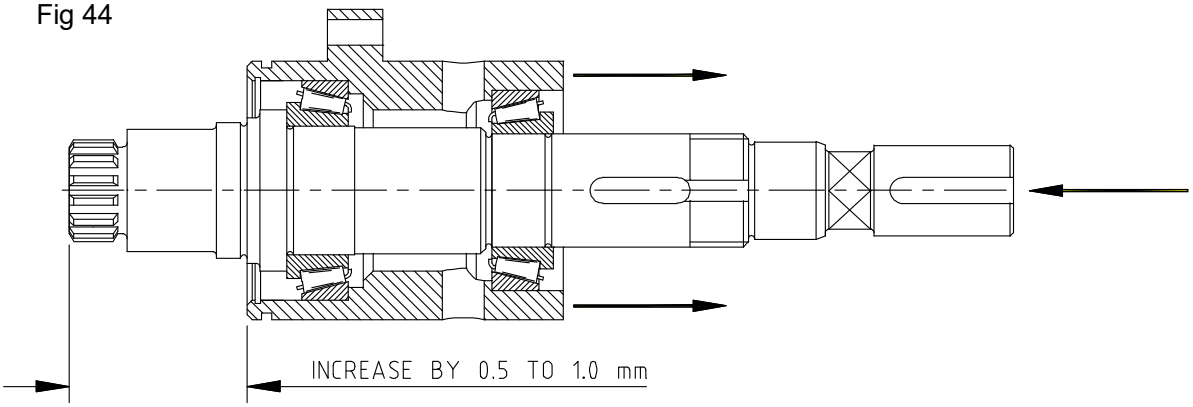
- Remove cartridge assemblies from rotorcase (40) to allow final setting of rolling torque refer to section 4.4.4. Keep shims (22) in sets and identify position.

4.4.4 Final Setting of Cartridge Rolling Torque

- Remove lock nuts (12) and tab washers' (13) from cartridge assemblies.

- To ensure that the correct final rolling torque is applied, it is necessary to remove any existing pre-load on bearings (19 & 24). This can be achieved by pressing shaft (9 or 10) through the bearing sleeve (20) by a distance of 0.5 to 1.0 mm, see Fig 44.

Fig 44



- Install tab washers (13) and lock nuts (12). Do not secure tab washers (13).

- Install rotors (41) to the individual cartridge assemblies, securing with castellated nuts (81) (it is not necessary to install disc springs (83) or split-pins (82) for this operation).

- Carefully mount one of the cartridge/rotor assemblies into a vice in horizontal plane, gripping on the bearing sleeve (20). Do not over tighten the vice as the bearing sleeve (20) is a precision component and should not be distorted.

- Tighten lock nut (12) and adjust to achieve correct rolling torque, refer to section 5.2. Measure the rolling torque using a torque meter, which can conveniently drive onto the castellated nut (81) by use of a socket. If the rolling torque does not correspond to the required setting, for rolling torque settings refer to section 5.2, adjust the lock nut (12).

- Secure tab washer (13) after setting correct rolling torque.

- Repeat rolling torque adjustment for other cartridge/rotor assembly.

- Remove castellated nuts (81) and rotors (41) from cartridge assemblies. Install lipseals (17) to bearing sleeves (20) and install o rings (25) to front outer diameter of bearing sleeves (20)

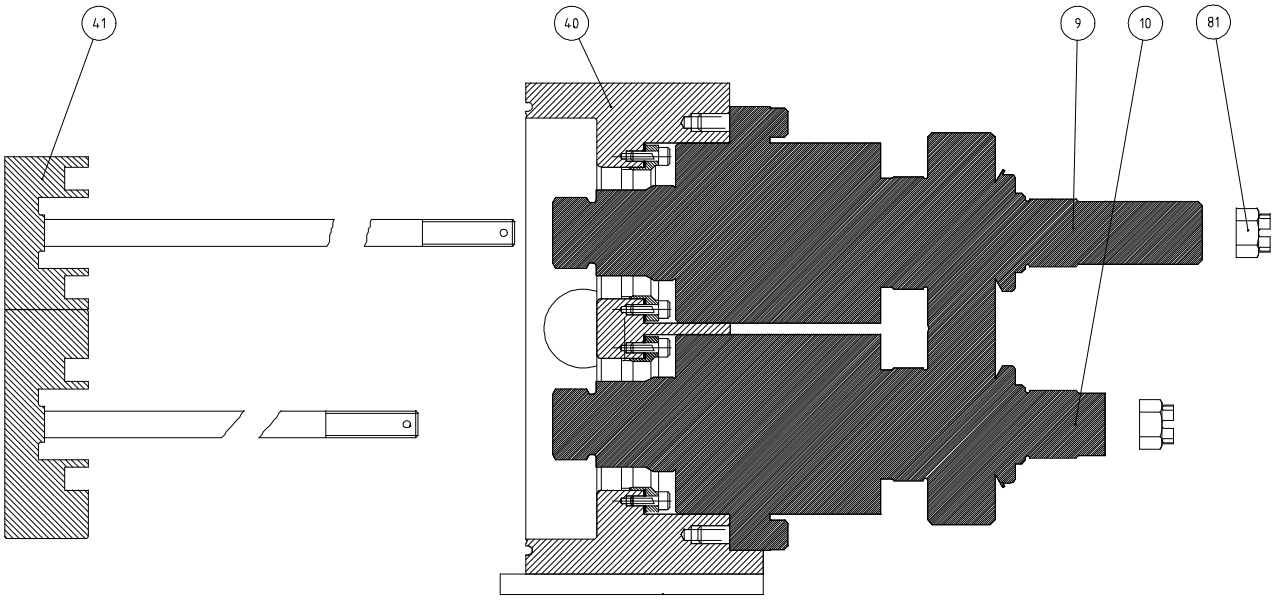
- Assemble cartridges into rotorcase (40) rear bores ensuring that timing marks on the timing gears (14) are in mesh (single dot on drive shaft gear, two dots on lay shaft gear). The timing gears are in correct mesh when the single dot on the drive shaft gear is between the two dots on the lay shaft gear.

- Install shim (22) sets, as determined in section 4.4.2, between rotorcase (40) and shaft cartridge flange.

- Secure cartridges to rotorcase (40) with cap head screws (23), tightening to correct torque refer to section 5.2.

4.4.5 Rotor Assembly and Setting Rotor Clearances

Fig 45



WARNING **Note: Spare rotors are supplied in pairs & should be installed as such.**

- Do not install mechanical seals at this point.

- Install rotors (41) to shafts (9 and 10) in rotorcase (40).

- Install castellated nuts (81) to rotor (41) draw bolts, tightening to correct torque, refer to section 5.2. (It is not necessary to install disc springs (83) or split pins (82) for this operation.) Hexagonal sections are provided on the shafts (9 & 10) to allow use of an open ended spanner in association with a torque wrench acting on the castellated nut (81).

- Using a depth micrometer or similar device measure rotor front protrusion (A), this is the protrusion of the rotor in front of the front face of the rotorcase, see Fig 39, and check that this corresponds to the appropriate clearance as indicated on the Clearance Chart, refer to section 5.1.

- If the front protrusion (A) is incorrect, adjustment of the shims (22) between the rotorcase and cartridge is required, refer to section 4.2.2 Cartridge to Rotorcase Assembly.

WARNING **Note: If shims (22) are adjusted to correct any error in rotor front protrusion, it is essential that rotor timing is checked and adjusted as necessary, refer to section 4.4.3. Failure to ensure rotor timing is**

correct will cause severe pump damage.

- With rotors (41) installed, check all clearances, front (A), radial (C), rear (B) and mesh (D), against the Clearance Chart refer to section 5.1.

- Remove castellated nuts (81) and rotors (41).

- Install mechanical seals; refer to section 4.5 Mechanical Seal Installation and Removal.

- Install new o-rings (34) to shafts (9 & 10) see Fig 28.

- Install rotors (41) to shafts (9 and 10) in rotorcase (40).

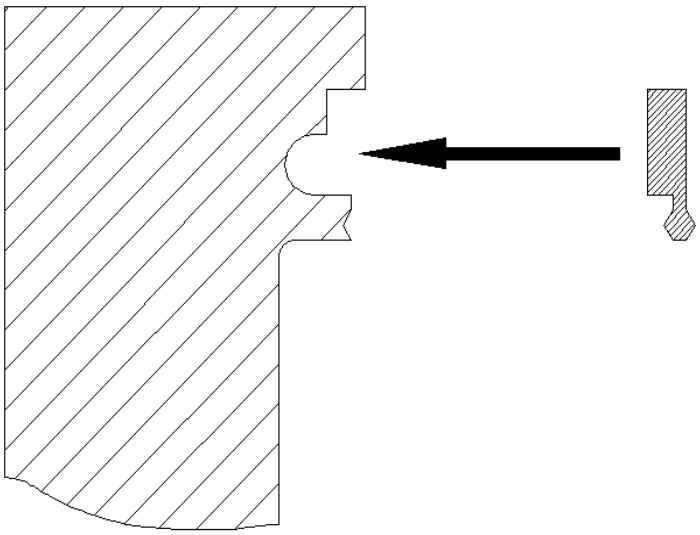
- Install disc springs (83) (ensuring correct orientation) and castellated nuts (81), tightening to correct torque, refer to section 5.2.

- Install joint ring (39) to front cover (38).

WARNING

Note: Joint Ring (39) must be installed the right way round, see Fig 46. The Joint Ring (39) "clips" into place on the register. Make sure that the Joint Ring (39) is correctly located around its entire circumference before proceeding.

Fig 46

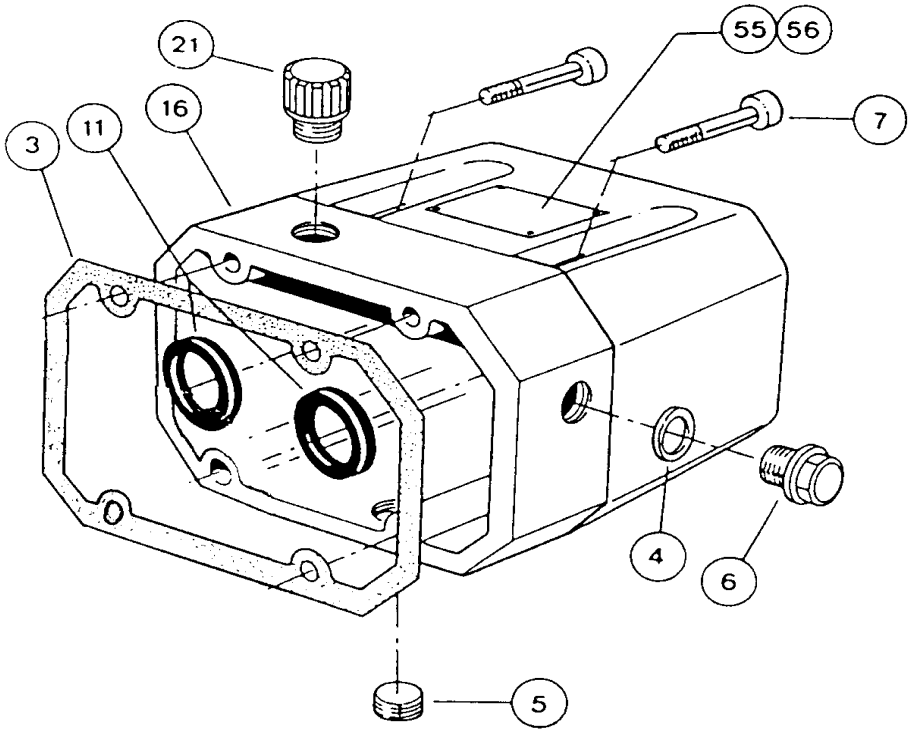


- Install front cover (38) to rotorcase (40) (noting that it locates onto dowels (80)), securing with dome nuts (36), tightening to correct torque, refer to section 5.2. Make certain that the joint ring (39) is not dislodged from its correct position during the installation operation.

- Install new split pins (82) through castellations of castle nuts (81) and drilled holes in rotor (41) draw bolts. It may be found necessary to loosen castellated nut (81) fractionally to align holes. Bend ends of split-pins (82) over to secure, ensuring that ends will not interfere with drive coupling hub when it is reinstalled to drive shaft (9).

4.4.6 Gearbox Cover Assembly

Fig 47



- Install lipseals (11) to gearbox cover (16).

- Install breather (21); drain plugs (5) and sight glass (6) in required position in gearbox cover (16).

WARNING

Note: The sight glass (6) must be installed in the upper tapped hole in the side of the gearbox cover (16). Remember to fill the gearbox with oil prior to start up. For recommended lubricant capacities and grades refer to section 5.3.

- Install gearbox cover (16) with gasket (3) to rotorcase (40) securing with screws (7), tightening to correct torque, refer to section 5.2.

4.5 Mechanical Seal Installation and Removal

4.5.1 Procedures for Installing Mechanical Seals

"Quick summary" of mechanical seal installation.

- Mechanical seals are precision-engineered assemblies incorporating finely lapped seal faces and seats. They must therefore be handled with care and will not give optimum performance unless installed carefully and according to instructions.

- Where mechanical seals are to be re-used ensure seal components are kept in their appropriate sets.

- Do not mix old and new seal faces on the same seal.

- Remove any sharp corners and burrs that may damage any elastomers such as o rings or lip seals.

- Ensure that all seal component installation bores and housings are thoroughly cleaned before installation.

- The seal faces and seats must be handled with care and cleaned thoroughly before installation.

- Ensure that seal faces are undamaged and that the o rings, Squad rings (position 30) and L-Cups (position 32) are not cut, swollen or cracked. It is recommended that new Squad rings are installed each time that the static seal faces are removed from the rotorcase and that new L-Cups are installed each time that the rotary seal faces are removed from the rotors.

- All elastomeric components should be lightly lubricated with a suitable lubricant before installing, but ensure there is no excessive amount of lubricant especially around the seal face area.

- When cleaning seal faces with solvent based cleaner, avoid getting solvent onto rubber components.

- Ensure static seal faces are mounted squarely in the rotorcase and the rotary seal faces are mounted squarely in the rotors.

- Do not use any excessive force to install a mechanical seal. If it is difficult to position and assemble the seal then something is wrong.

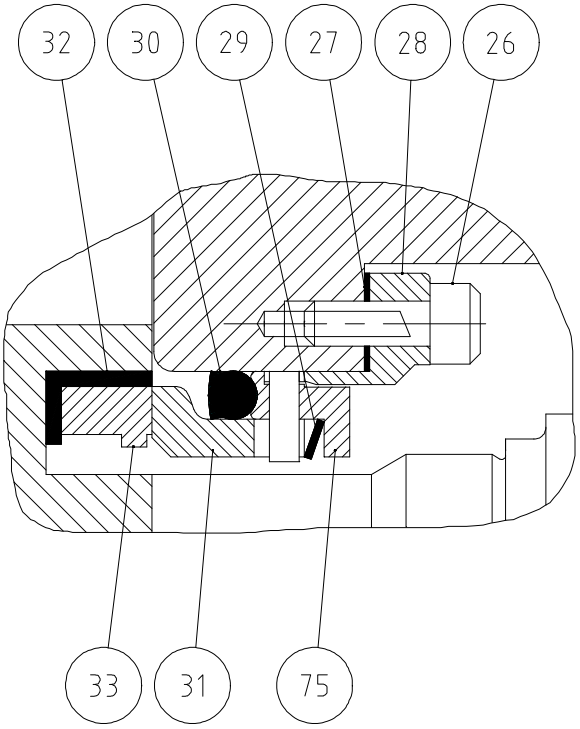
- If you drop or damage a seal, do not install it before an inspection has been carried out.

WARNING

- Do not run a mechanical seal dry.

4.5.2 Single Mechanical Seal

Fig 48

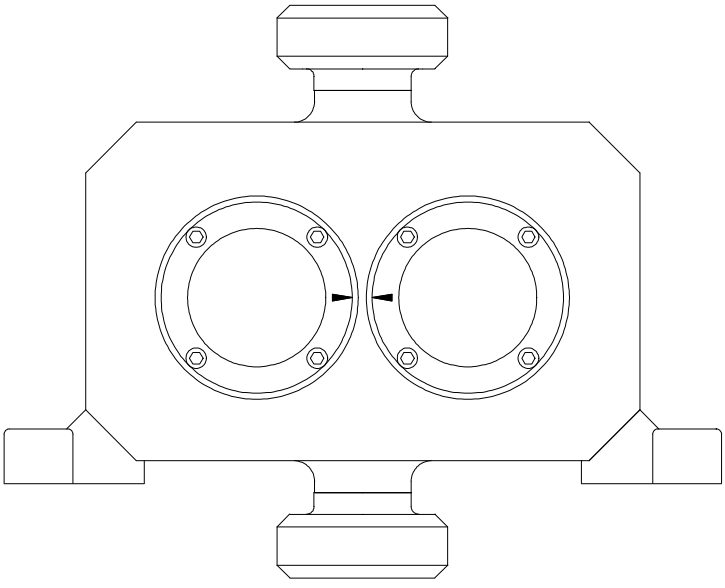


- Read the General Procedures to prepare for seal installation, refer to section 4.5.1.

- If only the seal faces are being replaced, the seal housings (28) and gaskets (27) or o rings (27) will already be in place.

- Install seal housings (28) with gasket (27) on SQ1 and SQ2 models or o ring (27) on SQ3 and SQ4 models to rotorcase (40) ensuring arrows on seal housings (28) align, see Fig 49, securing with screws (26) tightened to correct torque, refer to section 5.2.

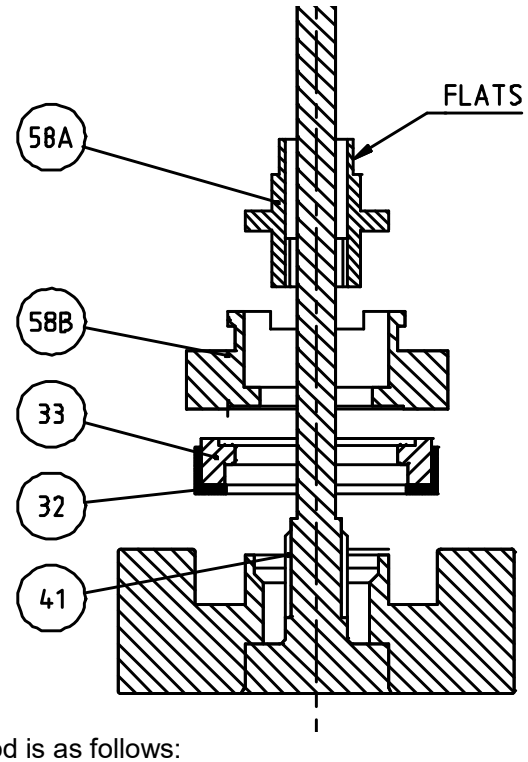
Fig 49



- Install rotary seal faces (33) into L-Cups (32).

- Install L-Cups (32) with rotary seal faces (33) into rotors (41) using tools (58A & 58B) see Fig 50**.**

Fig 50



The correct method is as follows:

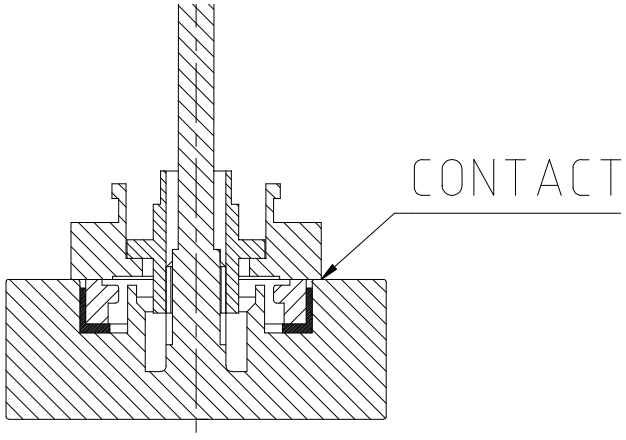
- Position rotary seal face (33) and L-Cup (32) assembly into place over counterbore in rotor (41). Install tool (58B) so that flat face of tool (58B) abuts against working face of rotary seal face (33). Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until its driving face abuts with tool (58B), then continue screwing until rotary seal face (33) and L-Cup (32) assembly has been pushed fully into place. This is achieved when face of tool (58B) contacts rear face of rotor (41), see fig 51.

WARNING

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

Fig 51

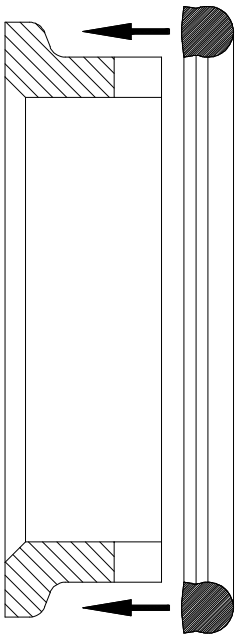


- Remove tools (58A & 58B).

- Make sure the L-cups (32) are located correctly with the seal faces (33) sitting squarely in them.

- Install Squad rings (30) to stationary seats (31), ensuring correct orientation, see Fig 52.

Fig 52



- Install seal carriers (75) to seal housings (28) ensuring drive pins and slots are correctly engaged.

- Gently push the stationary seat (31) and Squad ring (30) assemblies into the seal carriers (75), ensuring correct engagement of drive pins into slots.

- You should now be able to feel the resistance being generated by the wave springs (29).

- Before final assembly, check that the seal faces are absolutely clean, use a soft tissue and a suitable solvent based, non-abrasive, cleaner for best results.

Dismantling of Single Mechanical Seals

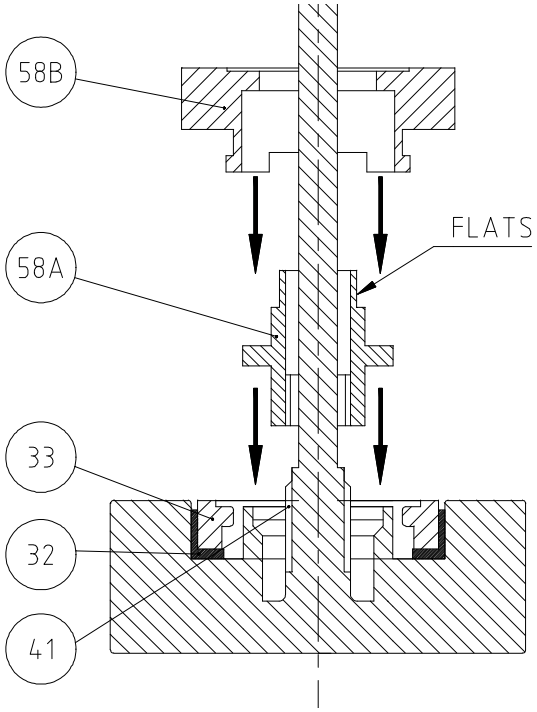
- Ensure pump is fully shutdown refer to section 3.5.

WARNING

Note: If seals are being reinstalled, ensure that seal faces remain matched.

- Remove rotary seal faces (33) from rotors (41) using extraction tools (58A & 58B). To dismantle, reverse above procedure using extraction tools supplied to aid in the removal of the seal faces, see Fig 53.

Fig 53



WARNING

The correct method is as follows:

- Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until it is fully home, but DO NOT TIGHTEN. Install tool (58B) so the lugs of tool (58B) engage into recesses in rotary seal face (33). Rotate tool (58B) through 90 degrees such that its driving dogs are located beneath the dogs in inside of rotary seal face (33). Unscrew tool (58a), whilst holding tool (58b), so as to cause tool (58B) to pull rotary seal face (33) out of L-Cup (32).

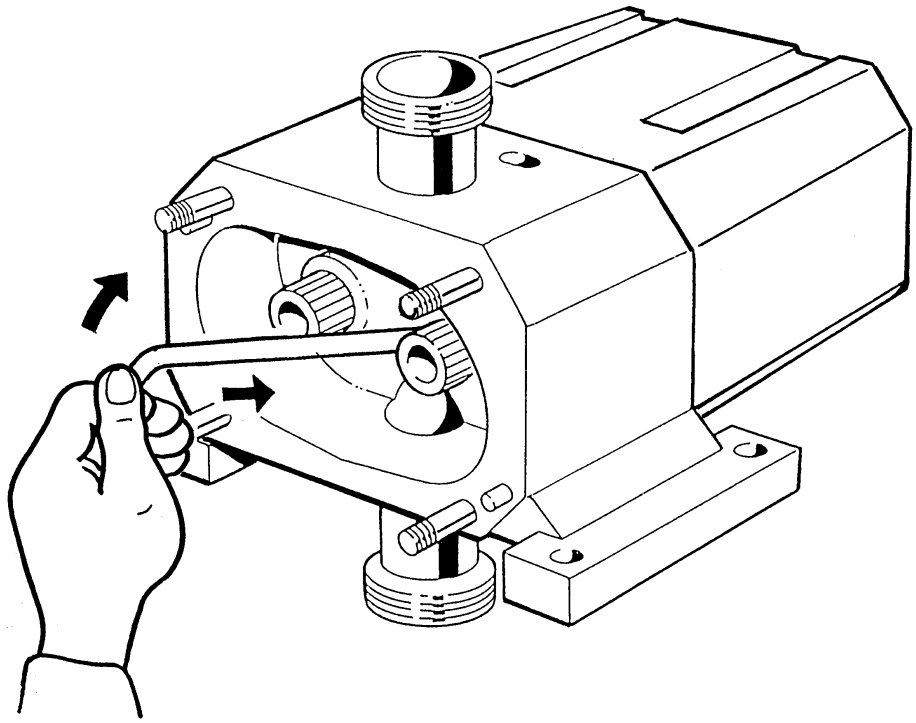
- Remove L-cups (32) from rotors (41).

- The static faces (31) can be removed by use of tool (58C) see Fig 54.

WARNING

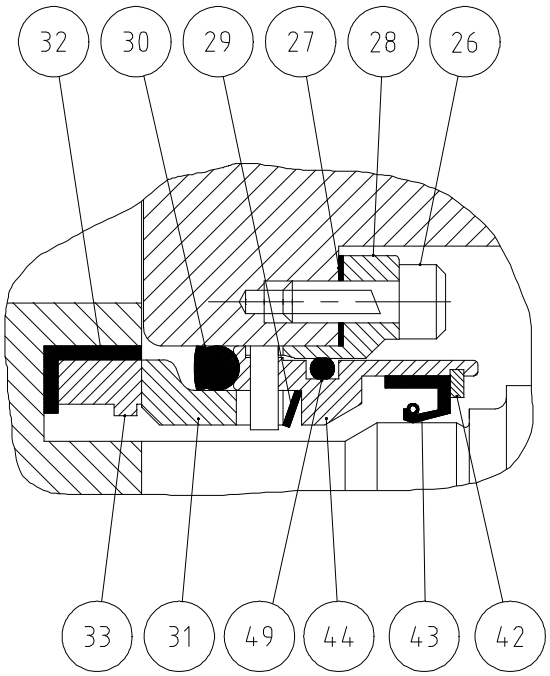
Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

Fig 54



4.5.3 Single Mechanical Seal (low-pressure flush / quench).

Fig 55



Read the General Procedures to prepare for seal installation, refer to section 4.5.1

If only the seal faces are being replaced, the housings (28 & 44), lipseals (43) and o-rings (49) will already be in place.

- Install seal housings (28) with gasket (27) on SQ2 models or o ring (27) on SQ3 & SQ4 models to rotorcase (40) ensuring arrows on seal housings (28) align, see Fig 49, securing with screws (26) tightened to correct torque, refer to section 5.2.

- Install rotary seal faces (33) into L-cups (32).

- Install L-cups (32) with rotary seal faces (33) into rotors (41) using tools (58A & 58B) see Fig 50**.**

The correct method is as follows:

- Position rotary seal face (33) and L-Cup (32) assembly into place over counterbore in rotor (41). Install tool (58B) so that flat face of tool (58B) abuts against working face of rotary seal face (33). Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until its driving face abuts with tool (58B), then continue screwing until rotary seal face (33) and L-Cup (32) assembly has been pushed fully into place. This is achieved when face of tool (58B) contacts rear face of rotor (41), see Fig 51.

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

- Remove tools (58A & 58B).

- Make sure the L-Cups (32) are located correctly with the seal faces (33) sitting squarely in them.

- Install Squad rings (30) to stationary seats (31), ensuring correct orientation, see Fig 52.

- Install lipseals (43) to flushed housings (44), securing in place with retainers (42).

- Install o-rings (49) to flushed housings (44).

- Install flushed housings (44) to seal housings (28), ensuring correct location of drive pins into slots.

- Gently push the stationary seat (31) and Squad ring (30) assemblies into the flushed housings (44), ensuring correct location of drive pins into slots.

- You should now be able to feel the resistance being generated by the wave springs (29).

- Before final assembly, check that the seal faces are absolutely clean, use a soft tissue and a suitable solvent based, non-abrasive, cleaner for best results.

Dismantling of Single Mechanical Seals for Quench / Flush

Ensure pump is fully shutdown refer to section 3.5.

WARNING

Note: If seals are being reinstalled, ensure that seal faces remain matched.

- Remove rotary seal faces (33) from rotors (41) using extraction tools (58A &58B).

- To dismantle, reverse the above procedure using the extraction tools supplied to aid in the removal of the seal faces.

The correct method is as follows, see Fig 53.

- Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until it is fully home. DO NOT TIGHTEN. Install tool (58B) so the lugs of tool (58B) engage into recesses in rotary seal face (33). Rotate tool (58B) through 90 degrees such that its driving dogs are located beneath the dogs in inside of rotary seal face (33). Unscrew tool (58a), whilst holding tool (58b), so as to cause tool (58B) to pull rotary seal face (33) out of L-Cup (32).

WARNING

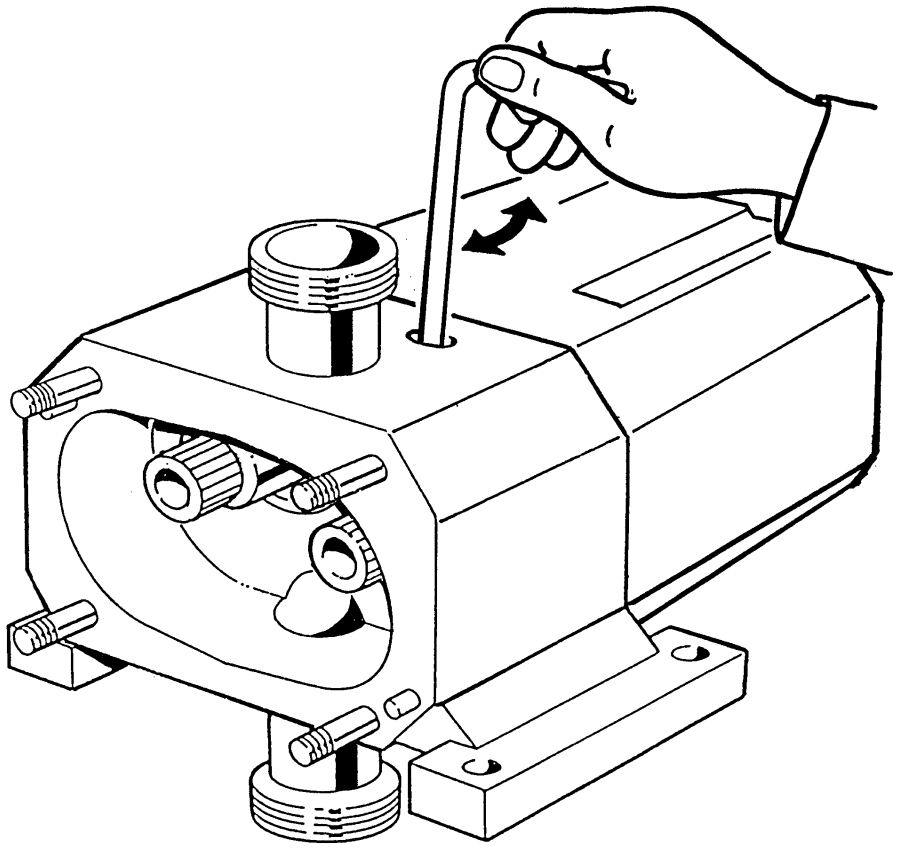
Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

- Remove L-cups (32) from rotors (41).

- The static seal faces (31) can be removed by using tool (58C) see Fig 54.

- Remove flushed housing / wave spring / lipseal (44 / 29/ 43) assemblies from shafts (9 & 10). This can be achieved by inserting the extraction tool (58C) through the drain/leakage detection holes in the sides of the rotorcase (40) and applying a twisting action, see Fig 56.

Fig 56



- Remove o-rings (49) from flushed housings (44).

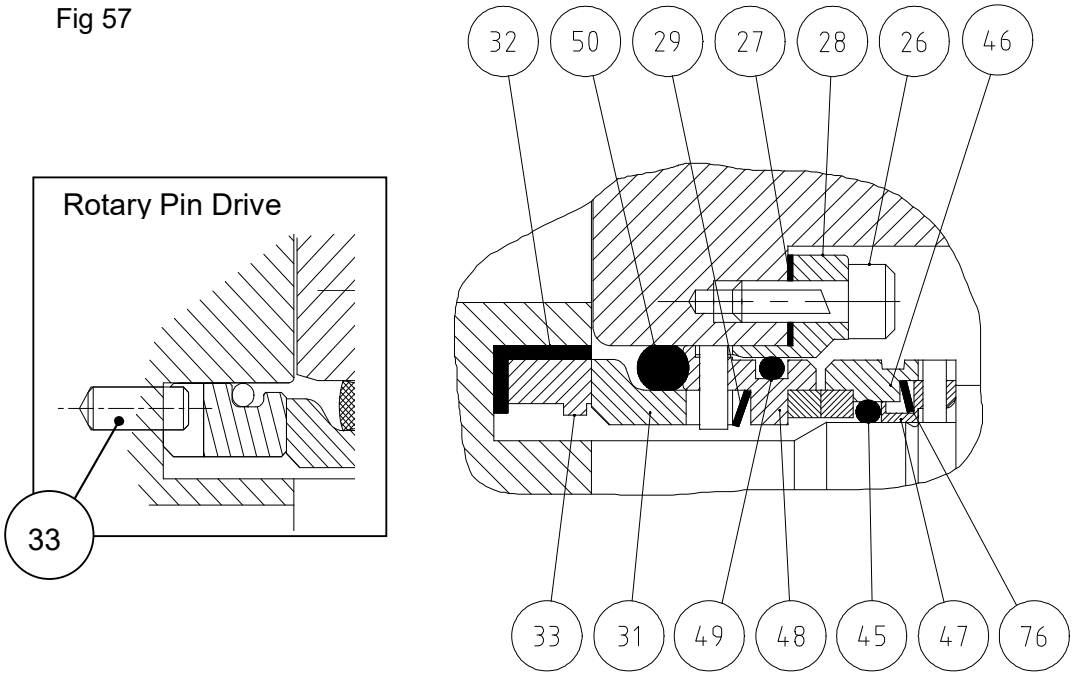
- Remove retainers (42) and lipseals (43) from flushed housings (44).

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

4.5.4 Double Mechanical Seal (high-pressure flush).

Fig 57



Read the General Procedures to prepare for seal installation, refer to section 4.5.1.

If only the seal faces are being replaced, the seal housings (28) and gaskets (27) will already be in place.

- Install seal housings (28) with gasket (27) on SQ2 models or o ring (27) on SQ3 & SQ4 models to rotorcase (40) ensuring arrows on seal housings (28) align, see Fig 46, securing with screws (26) tightened to correct torque, refer to section 5.2.

- Install rotary seal faces (33) into L-cups (32), where pin drive option is available, ensure the anti-rotation pin is aligned with hole provided in rotor. Once installed the seal face should be level with the rotor.

- Install L-cups (32) with rotary seal faces (33) into rotors (41) using tools (58A & 58B) see Fig 50**.**

The correct method is as follows:

Position rotary seal face (33) and L-Cup (32) assembly into place over counterbore in rotor (41). Install tool (58B) so that flat face of tool (58B) abuts against working face of rotary seal face (33). Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until its driving face abuts with tool (58B), then continue screwing until rotary seal face (33) and L-Cup (32) assembly has been pushed fully into place. This is achieved when face of tool (58B) contacts rear face of rotor (41), see Fig 51.

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

- Remove tools (58A & 58B).

- Make sure the L-Cups (32) are located correctly with the seal faces (33) sitting squarely in them.

- Install housing / wave spring (47/76) assemblies to rotorcase (40) ensuring correct engagement of drive pins into slots in shafts (9 and 10).

- Install o-rings (45) into outboard rotary seal faces (46) and then install to shafts (9 and 10) ensuring engagement of slots with pins in housings (47).

- You should now be able to feel the resistance being generated by the wave springs (76).

- Install o-rings (49) to seal cartridges (29/48).

- Clean faces of outboard seal (46 and 48) use a soft tissue and a suitable solvent based, non-abrasive, cleaner for best results.

- Install seal cartridge assemblies (comprising parts 29, 48 and 49) onto shafts (9 and 10) and push in until outboard seal faces (46) and (48) mate - ensuring engagement of pins with slots in housings (28). Take care not to damage the o rings (49).

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

- Install Squad rings (30) (ensuring correct orientation, see Fig 52) or o rings (50) to stationary seats (31). Refer to section 4.5.7 for details of pressure limitations of parts (30) and (50).

- Gently push the stationary seat (31) and Squad ring (30) or o-ring (50) assemblies into the housings (44), ensuring correct location of drive pins into slots.

- You should now be able to feel the resistance being generated by the wave springs (29) in addition to that being generated by wave springs (76).

- Before final assembly, check that the seal faces are absolutely clean, use a soft tissue and a suitable solvent based, non-abrasive, cleaner for best results.

Dismantling of Double Mechanical Seals for Flush

Ensure pump is fully shutdown refer to section 3.5.

WARNING

Note: If seals are being reinstalled, ensure that seal faces remain matched.

- Remove rotary seal faces (33) from rotors (41) using extraction tools (58A & 58B).

- To dismantle, reverse the above procedure using the extraction tools supplied to aid in the removal of the seal faces.

The correct method is as follows, see fig 53:

Slide tool (58A) over rotor (41) draw bolt such that spanner-flats are outermost and internal thread in tool (58A) engages with external thread inside rotor (41). Screw tool (58A) in until it is fully home. DO NOT TIGHTEN. Install tool (58B) so that lugs of tool (58B) engage into recesses in rotary seal face (33). Rotate tool (58B) through 90 degrees such that its driving dogs are located beneath the dogs in inside of rotary seal face (33). Unscrew tool (58a), whilst holding tool (58b), so as to cause tool (58B) to pull rotary seal face (33) out of L-Cup (32).

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

- Remove L-cups (32) from rotors (41).

- The static seal faces (31) can be removed by use of tool (58C) see Fig 54.

- Remove stationary seal cartridge assemblies (29, 48 and 49) from the shafts (9 and 10) by pulling off.

- Remove o-rings (49) from seal cartridges (29/48).

- Remove rotary seal faces (46) and housing / wave-spring (47/76) assemblies from shafts (9 & 10). This can be achieved by inserting the extraction tool (58c) through the drain/leakage detection holes in the sides of the rotorcase (40) and applying a twisting action, see Fig 56.

WARNING

Note: Extreme care should be taken when carrying out these procedures to ensure that the seal faces are not damaged. No excessive force is necessary if the extraction tools are used correctly.

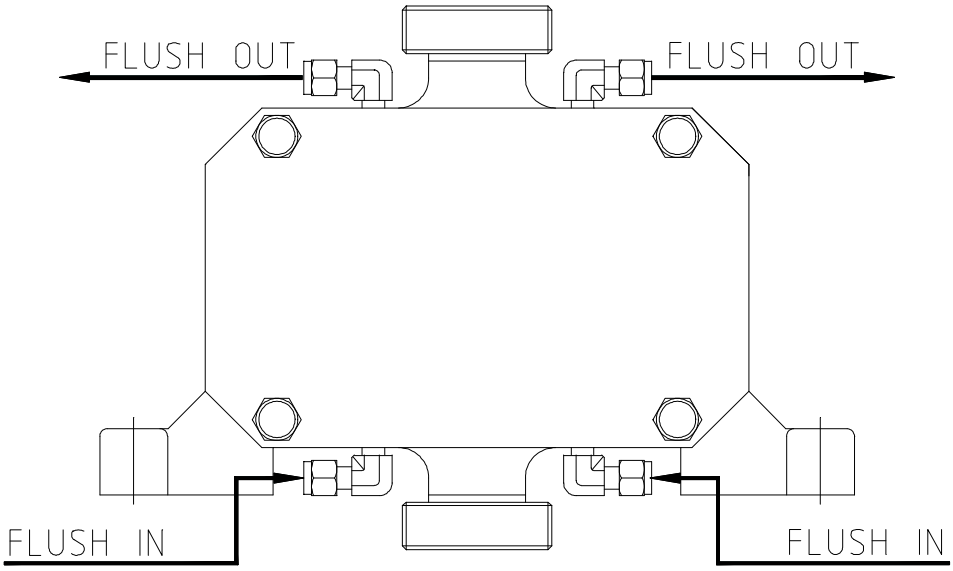
- Remove o-rings (45) from rotary seal faces (46).

4.5.5 Mechanical Seals for Quench or Flush - Auxiliary Services

Every Concept SQ pump is provided with four seal flushing connections, two on each side of the rotorcase, which are tapped 1/8" BSP.

Pumps supplied with mechanical seals requiring an auxiliary flush have an elbow adapter terminating in compression joint to accept 1/4" diameter pipework installed to each flushing connection. There are two flushing connections for each seal, one for flush 'in', the other for flush 'out', see Fig 58 and the pipework for the flush should be arranged to provide an independent flush to each seal.

Fig 58



Pumps supplied with a mechanical seal not requiring an auxiliary flush have blanking plugs in each flushing connection. Should the pump be converted to a flushed mechanical seal after original supply these plugs can be removed and the flush connections used to provide the appropriate flush.

Terminology.

"Quench"
- To provide a liquid barrier, which is not, induced to flow through the seal area by any external means.

"Flush"
- To provide a liquid barrier, which is, induced to flow through the seal area by an external means.

Quench or Flush Media

WARNING

The media used for quenching or flushing a seal must be fully compatible with the pumped media, and the materials of construction of pump and seal.

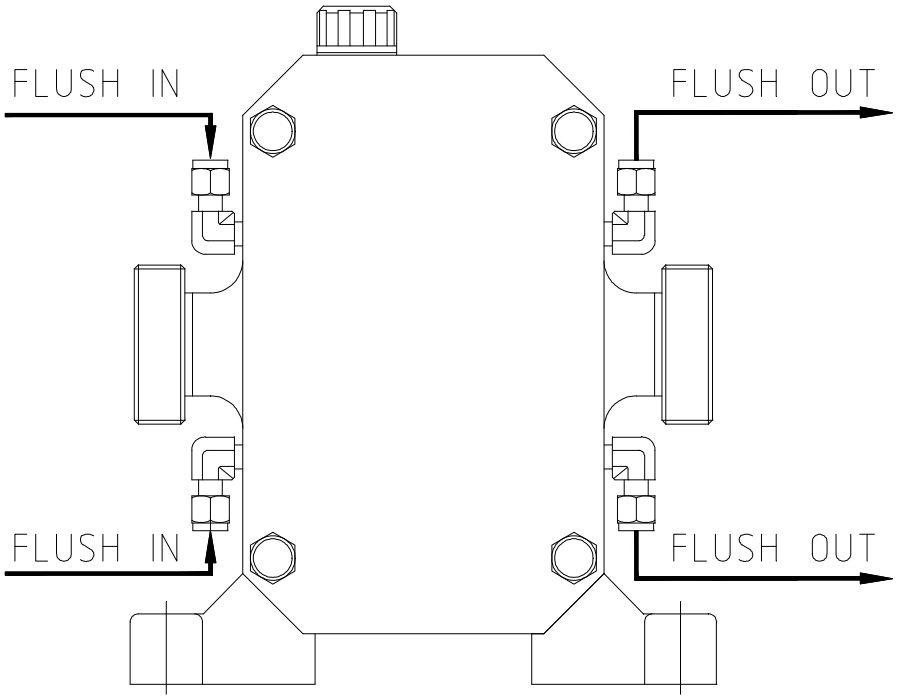
Special consideration must be given to the temperature limitations of the media to ensure that no hazards are created, e.g. risk of fire or explosion.

Venting of Seal Housings

WARNING

When starting up an SQ pump which is equipped with a quenched or flushed mechanical seal, and which is mounted with the rotorcase port connections in the horizontal plane, see Fig 59. The pump should be run for a few minutes with the quench / flush media being caused to flow at a rate of approximately 5 litres per minute. This will allow for venting of the seal housings.

Fig 59



After this initial period of running, the flush flow rate and pressure should be regulated.

Single Mechanical Seal for Quench / Flush (For low-pressure Quench or Flush)

Refer to section 4.3.3.

This seal arrangement requires a supply of media to the outboard side of the mechanical seal to quench or flush the seal area. The nature of the pumped media and the specific duty conditions will determine whether a quench or a flush is required.

A quench provides a static head. The quench media vessel should be mounted a minimum of 0.5 metres above the pump, preferably directly above the seal area. The interconnecting pipework should be as straight as possible, avoiding horizontal runs, and with the minimum number of bends and restrictions.

For a suitable flush, the media must be supplied at a flow rate of 3 litres per minute per shaft seal.

WARNING **Note: The limiting flush or quench pressure in any application is 0.5 bar**

Double Mechanical Seal for Flush (For High Pressure Flush).

Refer to section 4.3.4.

This seal arrangement requires a supply of media to be circulated between the inboard and outboard mechanical seals.

$$Q = \frac{(0.6 \times p + 0.25) \times n \times d^3 \times T}{c_p \times \rho \times 2.5 \times 10^9}$$

Q = Flow rate	[l/hr]
p = Applied buffer / barrier pressure	[bar]
n = Shaft speed	[rpm]
d = Shaft diameter	[mm]
T = Temperature of processed media	[°C]
ρ = Specific gravity of buffer / barrier fluid	[kg/dm^3]
c_p = Specific heat capacity for buffer / barrier fluid	[kJ/(kg x K)]

Typical values for some common barrier fluids:

Media	Density [kg/dm^3]	Specific Heat [kJ/(kg x K)
Water	1.0	4.2
Olive Oil	0.9	1.6
Mineral Oil	0.9	1.7
Acetone	0.8	2.2

The flush media must be supplied at a minimum flow rate of 0.5 Litres/ Minute per seal, this can be worked out by the following equation where “Q” is the flow rate.

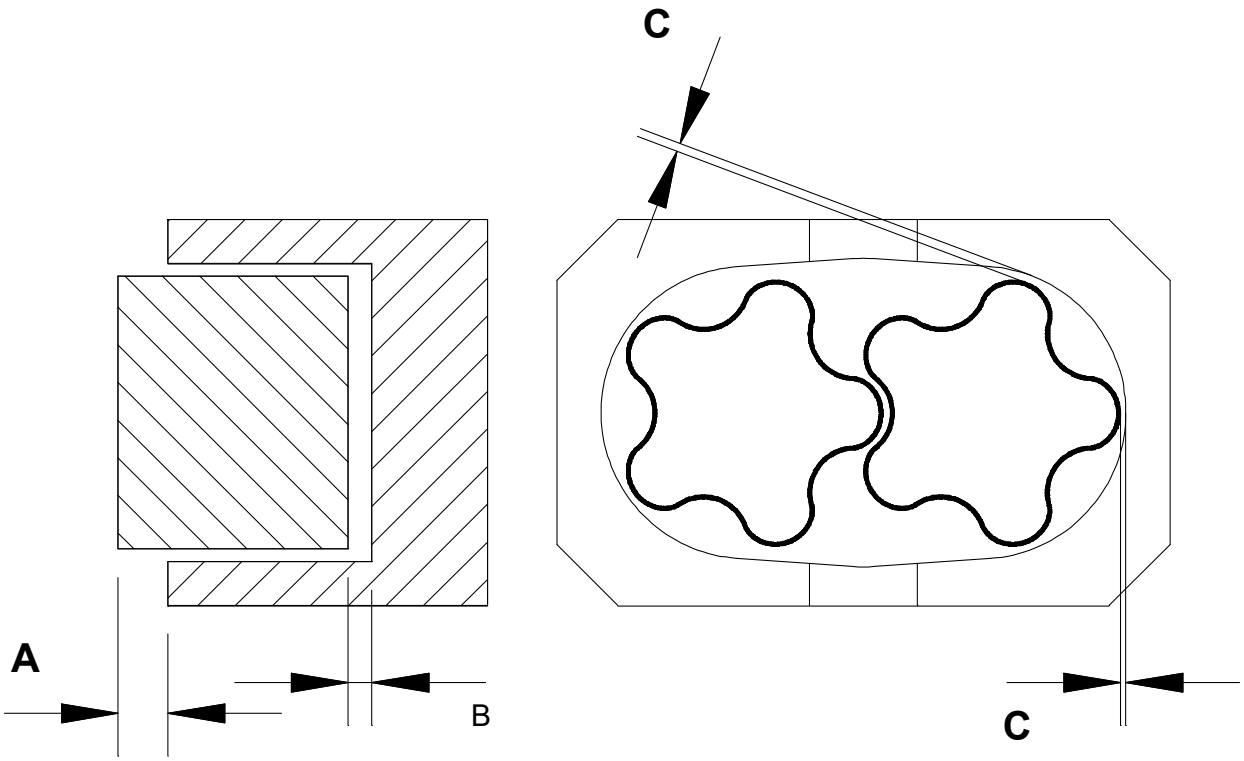
The flush pressure must be a minimum of 1 Bar (15 psi) greater than the maximum discharge pressure created by, or the maximum suction pressure applied to, the pump, whichever is the greater.

WARNING **Note: Where the Double Mechanical Seal is installed with o-ring (50), the limiting flush pressure in any application is 16 bar g.**

Where the Double Mechanical Seal is installed with Squad ring (30), the maximum differential pressure that can be allowed to occur between the pumped media and the flush media is 5 Bar.

5.0 Specifications

5.1 Clearance Chart



CONCEPT SQ MODEL	MAXIMUM				MILLIMETRES	x 0.01		INCHES	x 0.001	
	Bar	PSI	°C	°F	FRONT	REAR	RADIAL	FRONT	REAR	RADIAL
					A	B	C	A	B	C
SQ1/0004/12	12	175	150	300	5.91 - 5.94	6 - 15	7 - 16	0.233 - 0.234	2.4 - 5.9	2.7 - 5.9
SQ1/0007/06	6	85	150	300	5.88 - 5.91	8 - 18	10 - 19	0.231 - 0.233	3.1 - 7.1	3.9 - 7.5
SQ2/0017/15	15	215	150	300	7.85 - 7.87	10 - 20	11 - 22	0.309 - 0.310	3.9 - 7.8	4.3 - 8.7
SQ2/0030/07	7	100	150	300	7.84 - 7.86	11 - 21	13 - 25	0.308 - 0.309	4.3 - 8.3	5`1 - 9.8
SQ3/0054/15	15	215	150	300	4.83 - 4.85	15 - 26	14 - 30	0.190 - 0.191	5.9 - 10.2	5.5 - 11.8
SQ3/0103/07	7	100	150	300	4.81 - 4.83	17 - 29	17 - 33	0.189 - 0.190	6.7 - 11.4	6.7 - 12.9
SQ4/0160/15	15	215	150	300	6.69 - 6.71	23 - 36	26 - 47	0.263 - 0.264	9.0 - 14.1	10.2 - 18.5
SQ4/0303/07	7	100	150	300	6.64 - 6.66	25 - 40	30 - 51	0.261 - 0.262	9.8 - 11.6	11.8 - 20.0
SQ4/0303/07	7	100	180	356	6.50 – 6.55	32 - 44	35 - 48	0.260 - 0.262	12.60 -17.32	13.77 -18.89

5.2 Fixings & Torque Settings

ITEM	DESCRIPTION	POSITION		CONCEPT SQ MODEL							
				SQ1/0004/12		SQ2/0017/15		SQ3/0054/15		SQ4/0160/15	
				SQ1/0007/06		SQ2/0030/07		SQ3/0103/07		SQ4/0303/07	
2	SOCKET HEAD CAP SCREW	FOOT / ROTORCASE	QUANTITY/PUMP	4		4		4		4	
			SIZE - mm	M8 X 12		M10 X 16		M10 X 20		M16 X 25	
			TORQUE - N.M (ft-lb).	17	12.54	30	22.13	30	22.13	140	103.26
7	SOCKET HEAD CAP SCREW	GEARBOX / ROTORCASE	QUANTITY/PUMP	4		4		4		4	
			SIZE – mm	M6 X 50		M8 X 50		M10 X 50		M10 X 55	
			TORQUE - N.M (ft-lb).	7	5.16	17	12.54	30	22.13	30	22.13
12	LOCK NUT (SEE 1.0)	BEARING / SHAFT	QUANTITY/PUMP	2		2		2		2	
			SIZE - mm	M20 X 1.0		M35 X 1.5		M45 X 1.5		M65 X 2.0	
			ROLLING TORQUE - N.M (ft-lb).	1.0 - 1.5		2.0 - 2.5		3.0 - 3.5		5.5 - 6.0	
				(0.75 – 1.11)		(1.46 – 1.85)		(2.21 – 2.58)		(4.06 – 4.43)	
23	SOCKET HEAD CAP SCREW	BEARING SLV / MOUNTING PLT	QUANTITY/PUMP	6		-		-		-	
			SIZE - mm	M6 x 20		-		-		-	
			TORQUE - N.M (ft-lb).	16	11.80	-		-		-	
23	SOCKET HEAD CAP SCREW	BEARING SLV / ROTORCASE	QUANTITY/PUMP	-		6		6		6	
			SIZE - mm	-		M8 X 30		M12 X 50		M16 X 55	
			TORQUE - N.M (ft-lb).	-		25	18.44	80	59.00	140	103.26
26	SOCKET HEAD CAP SCREW	HOUSING / ROTORCASE	QUANTITY/PUMP	8		8		8		12	
			SIZE - mm	M4 X 8		M5 X 12		M6 X 16		M8 X 20	
			TORQUE - N.M (ft-lb).	5	3.69	6	4.43	8	5.90	17	12.54
36	DOME NUT	FRONT COVER / ROTORCASE	QUANTITY/PUMP	4		4		4		8	
			SIZE - mm	M8		M10		M12		M12	
			TORQUE - N.M (ft-lb).	17	12.54	30	22.13	55	40.57	55	40.57
37	STUD	FRONT COVER / ROTORCASE	QUANTITY/PUMP	4		4		4		8	
			SIZE - mm	M8 X 36		M10 X 43		M10 X 57		M12 X 65	
			TORQUE - N.M (ft-lb).	17	12.54	30	22.13	30	22.13	55	40.57
56	HAMMER DRIVE	NAMEPLATE / GEARBOX	QUANTITY/PUMP	4		4		4		4	
			SIZE - mm	-		-		-		-	
			TORQUE - N.M (ft-lb).	-		-		-		-	
74	SOCKET HEAD CAP SCREW	MOUNTING PLT/ GEARBOX	QUANTITY/PUMP	4		-		-		-	
			SIZE - mm	M6 X 20		-		-		-	
			TORQUE - N.M (ft-lb).	16	11.80	-		-		-	
81	CASTLE NUT	DRAWBOLT / SHAFT	QUANTITY/PUMP	2		2		2		2	
			SIZE - mm	M6		M12		M16		M20	
			TORQUE - N.M (ft-lb).	10	7.38	50	36.88	90	66.38	130	95.88
82	SPLIT PIN	CASTLE NUT / SHAFT	QUANTITY/PUMP	2		2		2		2	
			SIZE - mm	1/16" X 1/2"		1/8" X 3/4"		1/8" X 1"		5/32" X 1 1/4"	
			TORQUE - N.M (ft-lb).	-		-		-		-	
88	TORQUE LOCK ASSEMBLY	TIMING GEAR / SHAFT	QUANTITY/PUMP	6		-		-		-	
			SIZE - mm	-		-		-		-	
			TORQUE - N.M (ft-lb).	2	1.48	-		-		-	

Notes:
1.0) Rolling torque quoted for nut, item 12 (reference section 4.2.1).
2.0) For positions of items see section 5.6, Typical Basic Pump Build.

5.3 Lubricants

Gearbox oil recommended for use with Concept SQ pumps is an “EP (Extreme Pressure) grade gear lube” for the following ambient temperature ranges.

EP150	0 – 32°F
EP220	32 – 85°F
EP320	85°F and higher

Approximate pump gearbox capacities for SQ pumps:

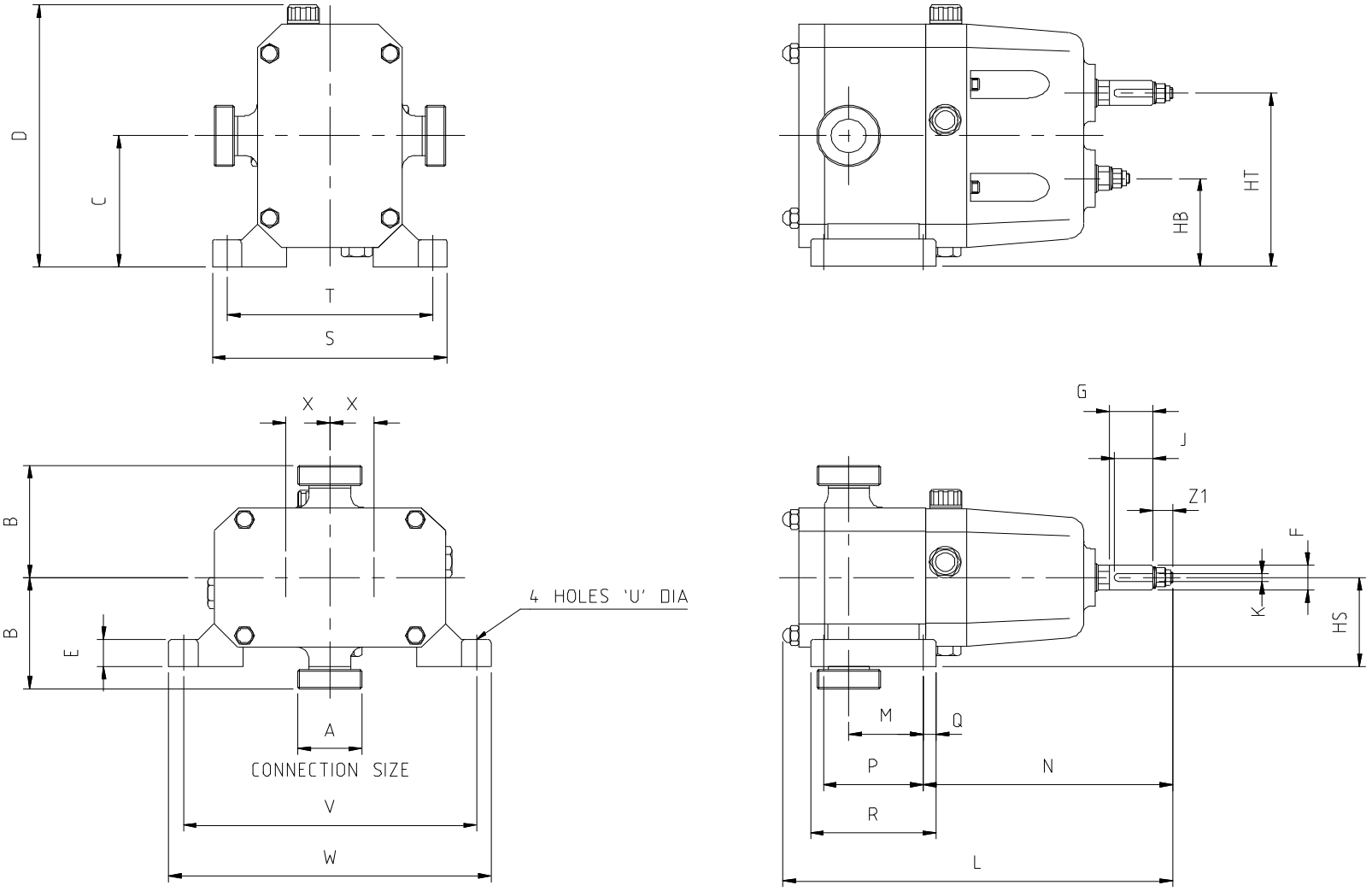
	Mounting Attitude Suction and Discharge ports in:			
Pump Model	**Horizontal Plane**		**Vertical Plane**	
	litres	**US pints**	**litres**	**US pints**
SQ1/0004/12	0.3	0.6	0.3	0.6
SQ1/0007/06	0.3	0.6	0.3	0.6
SQ2/0017/15	1.1	2.4	1.1	2.4
SQ2/0030/07	1.1	2.4	1.1	2.4
SQ3/0054/15	3.0	6.3	2.55	5.4
SQ3/0103/07	3.0	6.3	2.55	5.4
SQ4/0160/15	7.55	16.0	5.7	12.0
SQ4/0303/07	7.55	16.0	5.7	12.0

Always add oil to the level of the sight glass. The sight glass must be located in the uppermost position on the side of the gearbox cover. DO NOT OVERFILL.

5.4 Material Specification.

Rotors	316L Stainless Steel
Rotorcase	316L Stainless Steel
Shafts	316L Stainless Steel
Front Cover	316L Stainless Steel
Rotor Retainer	316L Stainless Steel
Gearbox Cover	Grade 220 Grey Cast Iron or 316 Stainless Steel
Bearing Sleeve	070 M20 Steel - S1, S2 & S3 For Grade 220 Grey Cast Iron – S4

5.5 Concept SQ Range Foundation Dimensions and Weights



Dimensions in Millimetres

MODEL	A	B1	B2	B3	B4	B5	C	D	E	F	G	HB	HS	HT	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Z1	Weight (kgs)
SQ1/0004/12	25	86	104	100	107	148	84.5	176	17	16 j6	28	57	57	112	24	5	253	41	168	62	8	78	146	128	9	183	201	27.5	11	12.9
SQ10007/06	25	86	104	100	107	148	84.5	176	17	16 j6	28	57	57	112	24	5	270	56	168	62	8	78	146	128	9	183	201	27.5	11	13.4
SQ2/0017/15	40	107	129	121	128	169	118	246	21	28 j6	42	75	75	160	38	8	363	65	230	90	14	117	197	170	11	255	282	42.5	22	35.3
SQ2/0030/07	50	107	129	121	128	169	118	246	21	28 j6	42	75	75	160	38	8	391	87	230	90	14	117	197	170	11	255	282	42.5	22	40.3
SQ3/0054/15	50	131	153	145	152	193	157	324	29	38 k6	80	100	100	215	70	10	482	83	315	124	14	152	243	214	13	329	358	57.5	27	83.0
SQ3/0103/07	80	131	165	145	162	213	157	324	29	38 k6	80	100	100	215	70	10	527	115	315	124	14	152	243	214	13	329	358	57.5	27	91.0
SQ4/0160/15	80	178	208	192	209	260	216	442	30	60 m6	140	136	147	296	129	18	652	109	416	170	16	202	378	342	18	480	516	80.0	34	219.0
SQ4/0303/07	100	182	198	192	199	250	216	442	30	60 m6	140	136	147	296	129	18	714	151	416	170	16	202	378	342	18	480	516	80.0	34	266.0

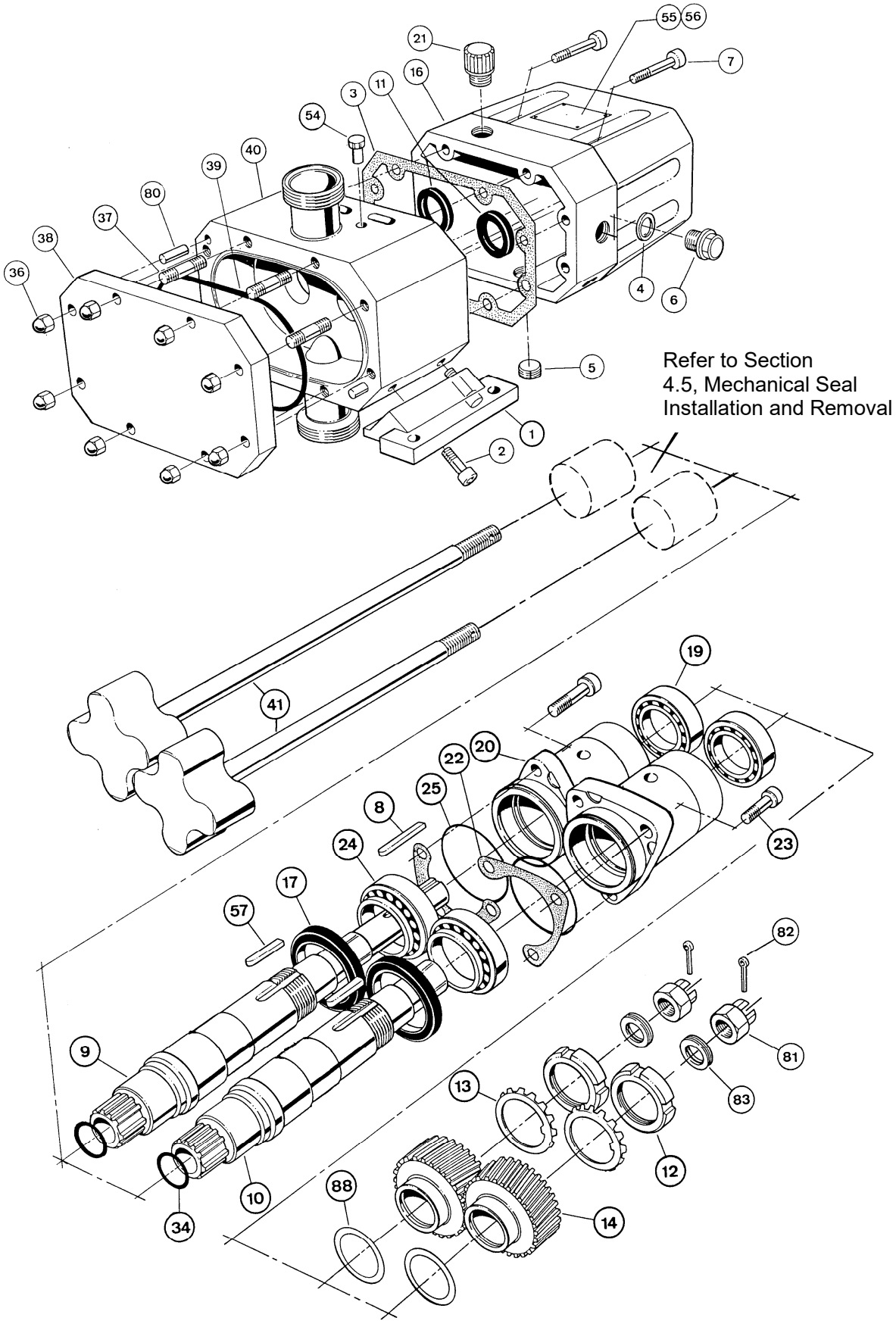
Dimensions in Inches (except F and K)

MODEL	A	B1	B2	B3	B4	B5	C	D	E	F (mm)	G	HB	HS	HT	J	K (mm)	L	M	N	P	Q	R	S	T	U	V	W	X	Z1	Weight (lbs)
SQ1/0004/12	1.00	3.39	4.09	3.94	4.21	5.83	3.33	6.93	0.67	16 j6	1.10	2.24	2.24	4.41	0.94	5	9.96	1.61	6.61	2.44	0.31	3.07	5.75	5.04	0.35	7.20	7.91	1.08	0.43	28
SQ10007/06	1.00	3.39	4.09	3.94	4.21	5.83	3.33	6.93	0.67	16 j6	1.10	2.24	2.24	4.41	0.94	5	10.6	2.2	6.61	2.44	0.31	3.07	5.75	5.04	0.35	7.20	7.91	1.08	0.43	29
SQ2/0017/15	1.50	4.21	5.08	4.76	5.04	6.65	4.65	9.69	0.83	28 j6	1.65	2.95	2.95	6.30	1.50	8	14.3	2.56	9.06	3.54	0.55	4.61	7.76	6.69	0.43	10.04	11.10	1.67	0.87	78
SQ2/0030/07	2.00	4.21	5.08	4.76	5.04	6.65	4.65	9.69	0.83	28 j6	1.65	2.95	2.95	6.30	1.50	8	15.4	3.43	9.06	3.54	0.55	4.61	7.76	6.69	0.43	10.04	11.10	1.67	0.87	89
SQ3/0054/15	2.00	5.16	6.02	5.71	5.98	7.6	6.18	12.76	1.14	38 k6	3.15	3.94	3.94	8.46	2.76	10	19	3.27	12.4	4.88	0.55	5.98	9.57	8.43	0.51	12.95	14.09	2.26	1.06	183
SQ3/0103/07	3.00	5.16	6.5	5.71	6.38	8.39	6.18	12.76	1.14	38 k6	3.15	3.94	3.94	8.46	2.76	10	20.7	4.53	12.4	4.88	0.55	5.98	9.57	8.43	0.51	12.95	14.09	2.26	1.06	200
SQ4/0160/15	3.00	7.01	8.19	7.56	8.23	10.2	8.50	17.40	1.18	60 m6	5.51	5.35	5.79	11.65	5.08	18	25.7	4.29	16.4	6.69	0.63	7.95	14.88	13.46	0.71	18.90	20.31	3.15	1.34	482
SQ4/0303/07	4.00	7.01	7.8	7.56	7.83	9.84	8.50	17.40	1.18	60 m6	5.51	5.35	5.79	11.65	5.08	18	28.1	5.94	16.4	6.69	0.63	7.95	14.88	13.46	0.71	18.90	20.31	3.15	1.34	585

Notes: Dimensions given are for guidance only and should not be used for installation purposes.
Certified dimensions will be supplied on request

B1 applies for Triclamp & thread connections.
B2 applies for DIN Aseptic Connections.
B3 applies for DIN 2633 Flanges.
B4 applies for DIN Aseptic Flanges.
B5 applies for Barrier DIN Aseptic Connections (Male &

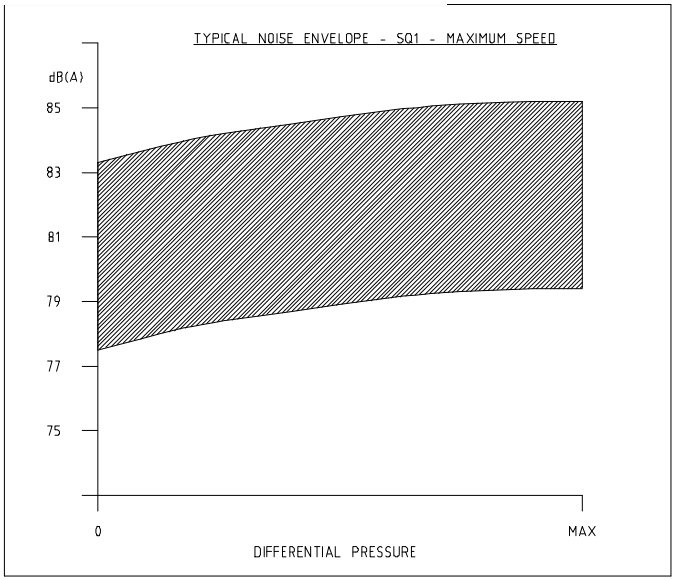
5.6 Typical Basic Pump Build

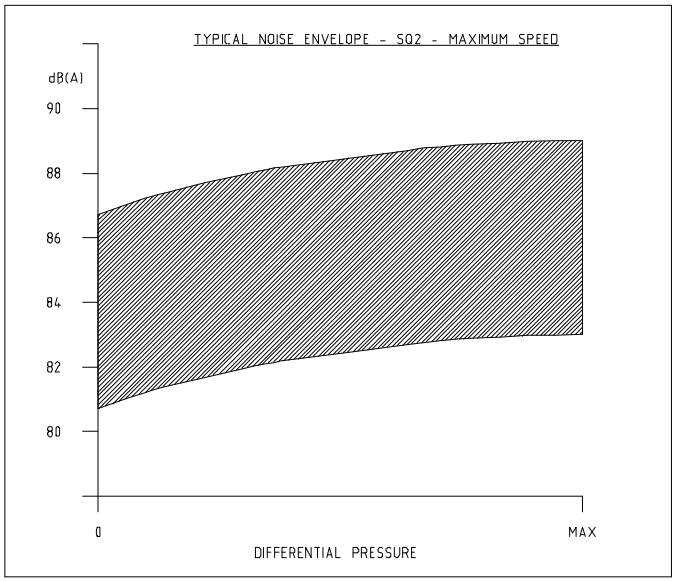


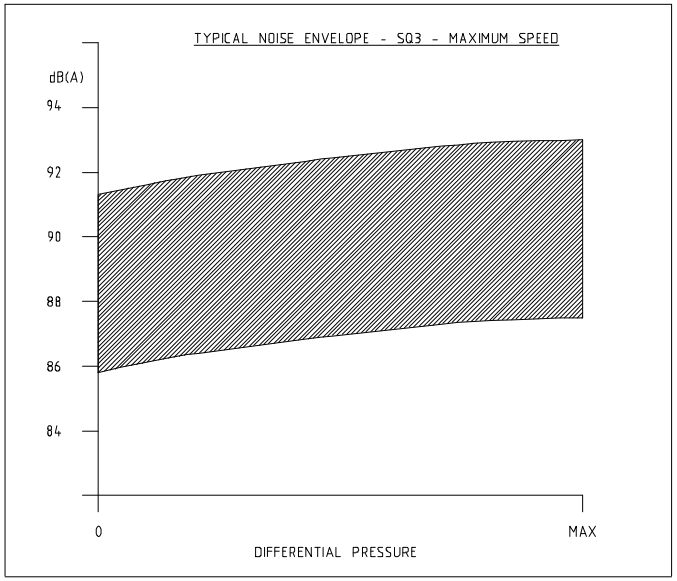
5.7 Fault Finding

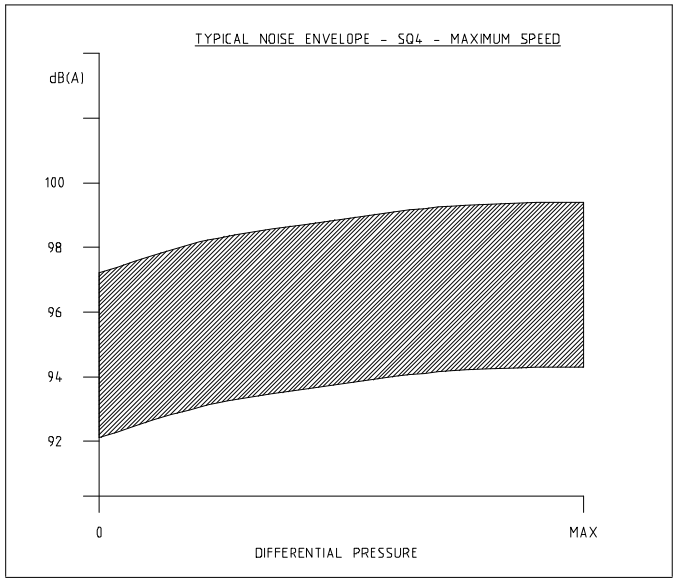
No Flow	Irregular Flow	Under Capacity	Pump Overheats	Motor Overheats	Excessive Rotor Wear	Excessive Seal Wear	Noise / Vibration	Seizure	Pump Stalls On Start UP	Causes	Action
■										Incorrect Direction Of Rotation.	Reverse Motor.
■										Pump Not Primed.	Expel Gas From Suction Line / Pump Chamber & Prime.
■	■	■					■			Insufficient NPSH Available.	Increase Suction Line & Static Suction Head Diameter. Simplify Suction Line & Reduce Length. Reduce Pump Speed & Product Temperature.
	■	■					■			Product Vaporising In Suction Line.	
	■	■					■			Air Entering Suction Line.	Remake Pipework Joints.
■	■	■					■			Gas In Suction Line.	Expel Gas From Suction Line / Pump Chamber.
	■	■					■			Insufficient Static Suction Head.	Raise Product Level To Increase Static Suction Head.
			■	■			■		■	Product Viscosity Too High.	Decrease Pump Speed / Increase Product Temperature.
		■								Product Viscosity Too Low.	Increase Pump Speed / Increase Product Temperature.
		■	■		■		■		■	Product Temperature Too High.	Cool Product / Pumping Chamber.
				■					■	Product Temperature Too Low.	Heat Product / Pumping Chamber.
					■	■	■	■		Unexpected Solids In Product	Clean System / Install Strainer On Suction Side Of Pump.
		■	■	■	■		■	■	■	Discharge Pressure Too High	Check For Blockages / Simplify Discharge Line.
			■	■	■		■	■		Rotorcase Strained By Pipework.	Check Pipe Alignment / Support Pipework.
				■			■			Pump Speed Too High	Decrease Pump Speed.
		■								Pump Speed Too Low	Increase Pump Speed
			■	■	■	■	■	■		Seal Flush Inadequate	Increase Seal Flush To Required Pressure / Flow.
			■	■	■	■	■	■	■	Bearing / Timing Gear Wear	Replace Worn Components.

5.8 Typical Noise Emission Data









5.9 Service History.

Pump Serial No:

Date	Comments

5.10 Tool List

Listed below are tools required for the maintenance of the Concept SQ pump range.

TYPE	SIZE OR RANGE	SQ1	SQ2	SQ3	SQ4
COMBINATION WRENCH	10mm	■			
COMBINATION WRENCH	13mm	■			
COMBINATION WRENCH	17mm	■	■		
COMBINATION WRENCH	18mm	■			
COMBINATION WRENCH	19mm		■		
COMBINATION WRENCH	24mm		■	■	■
COMBINATION WRENCH	32mm			■	
COMBINATION WRENCH	55mm				■
HEXAGON (ALLEN) KEY	1/4"	■			
HEXAGON (ALLEN) KEY	3/8"		■	■	■
HEXAGON (ALLEN) KEY	3mm	■			
HEXAGON (ALLEN) KEY	4mm		■		
HEXAGON (ALLEN) KEY	5mm	■	■	■	
HEXAGON (ALLEN) KEY	6mm	■	■		■
HEXAGON (ALLEN) KEY	8mm		■	■	■
HEXAGON (ALLEN) KEY	10mm			■	
HEXAGON (ALLEN) KEY	14mm				■
HEXAGON (ALLEN) KEY SOCKET DRIVEN	3mm	■			
HEXAGON (ALLEN) KEY SOCKET DRIVEN	4mm		■		
HEXAGON (ALLEN) KEY SOCKET DRIVEN	5mm	■	■	■	
HEXAGON (ALLEN) KEY SOCKET DRIVEN	6mm	■	■		■
HEXAGON (ALLEN) KEY SOCKET DRIVEN	8mm		■	■	■
HEXAGON (ALLEN) KEY SOCKET DRIVEN	10mm			■	
HEXAGON (ALLEN) KEY SOCKET DRIVEN	14mm				■
TORQUE WRENCH	ADJUSTABLE UP TO MINIMUM 39 NM (28.765 FT-LB)	■			
TORQUE WRENCH	ADJUSTABLE UP TO MINIMUM 77 NM (56.792 FT-LB)		■		
TORQUE WRENCH	ADJUSTABLE UP TO MINIMUM 135 NM (99.571 FT-LB)			■	
TORQUE WRENCH	ADJUSTABLE UP TO MINIMUM 180 NM (132.761 FT-LB)				■
DEPTH MICROMETER	0 - 25 mm (0 – 1”)	■	■	■	■
FEELER GAUGE SET		■	■	■	■
ROLLING TORQUE METER	0 - 5 NM (0 - 3.688 FT-LB)	■	■		
ROLLING TORQUE METER	0 - 10 NM (0 - 7.376 FT-LB)			■	■
SEAL FACE TOOL	SUPPLIED WITH PUMP	■	■	■	■
HOOK WRENCH	TO SUIT LOCKNUT OUTSIDE DIAMETER 32mm	■			
HOOK WRENCH	TO SUIT LOCKNUT OUTSIDE DIAMETER 52mm		■		
HOOK WRENCH	TO SUIT LOCKNUT OUTSIDE DIAMETER 65mm			■	
HOOK WRENCH	TO SUIT LOCKNUT OUTSIDE DIAMETER 85mm				■
SOFT-FACED MALLET		■	■	■	■
PIN PUNCH	SMALL	■	■	■	■
STEEL HAMMER	SMALL	■	■	■	■
COMBINATION PLIERS		■	■	■	■
PRY BAR	SMALL	■	■	■	■

5.11 Notes

The information contained in this document is correct at time of print but may be subject to change without prior notice. The latest updated copies are available from our website

wright flow TECHNOLOGIES®

Wright Flow Technologies Ltd.
Edison Road, Eastbourne,
East Sussex, BN23 6PT
United Kingdom

Phone: +44 1323 509211
Fax: +44 1323 507306
E-mail: wright.eu@idexcorp.com

Wright Flow Technologies, Inc.
406 State Street
Cedar Falls, Iowa 50613 U.S.A.

Phone: (319) 268-8013
Fax: (803) 216-7686
E-mail: wright.usa@idexcorp.com

www.wrightflowtechnologies.com

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