



## Installation, Operating, and Maintenance Manuals

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**NOTE:**



# RESOLUTION SHEET

| Comment Number | Document Name: Installation, Operating, and Maintenance Manuals             |                                                                                                                                                                                                     | Revision from which comment first appeared | Comment Status: Open\Closed - (Date Closed:) |
|----------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------|
|                | CLIENT COMMENT                                                              | HMD RESPONSE                                                                                                                                                                                        | Current Rev:                               |                                              |
| 1              | Maintenance Manual is not appearing for Mangnetrol please check and include | Document contains Installation and Operating Manual - which contains a 'Maintianance' section. Please refer to page 5 of Magnetrol Echotel 961 Manual (this manual starts on page of this document) | 1                                          | Closed (21/07/2022)                          |

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**HMD Kontro**



# INSTALLATION & OPERATING MANUAL



## Standard Products

Quality Assured to ISO 9001 since 1986,  
for the design, manufacture and repair  
of SEALLESS pumps, drives and  
packaged pump assemblies.

## AMENDMENTS

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### AMENDMENTS INCORPORATED INTO ISSUE 1.13

| Reference      | Change  | Content                                                                  |
|----------------|---------|--------------------------------------------------------------------------|
| Front cover    | update  | Picture and lay-out updated                                              |
| Safety Warning | update  | BS EN ISO 9001:2015 updated from BS EN ISO 9001:2006.                    |
| EU DofC        | update  | Products listing rationalised. CSA/CSI frame 1 product added. Re-signed. |
| 2.2.1          | update  | Figure 2-1 updated to label C58011830                                    |
| 6              | amended | Table 6-1; ANSIMAG product lines removed and CSA/CSI product added.      |
| 13.2           | amended | Figure 13-1; ANSIMAG product lines removed and CSA/CSI product added.    |

### AMENDMENTS INCORPORATED INTO ISSUE 1.14

| Reference | Change  | Content            |
|-----------|---------|--------------------|
| 8.3       | amended | Table 8-1; revised |

## **SAFETY WARNING**

HMD/Kontro SEALLESS Pumps manufacture magnetic drive pumps to the International Quality Management System standard (ISO 9001). HMD/Kontro parts and accessories have been specifically designed and tested for use with these products to ensure continued product quality and performance. The use of counterfeit parts and accessories is considered to be misuse and should be avoided, and will invalidate any warranty claim, in the event of damage or failure of product.

Additionally, modification of HMD / Kontro product(s) or removal of original components and replacement with counterfeit parts may impair the safety of the products and their effective operation.

## **EUROPEAN UNION MACHINERY DIRECTIVE (CE mark system)**

This document incorporates information relevant to the Machinery Directive 2006/42/EC. It should be read prior to the use of any HMD/Kontro Sealless Pumps.

## **EUROPEAN UNION ATEX DIRECTIVE**



This document incorporates information relevant to the ATEX Directive 2014/34/EU (Directive on equipment and protective systems intended for use in potentially explosive atmospheres). It should be read prior to the use of any our equipment.

Compliance to the Directive is based on Atmospheres having pressures ranging from 0.8 to 1.1 bar and temperatures ranging from -20 °C to + 60 °C.

As indicated in the ATEX Directive 2014/34/EU, It is the responsibility of the user of the pump to indicate to HMD/Kontro the Zone and Corresponding group (Dust or Gas) that the pump is to be installed within.

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## **GSPVS Declaration of Conformity**

The GSPVS pump does not feature in the generic Declaration of Conformity on the following pages. Although compliant to the same legislation and standards, the nature of the GSPVS pump means that it is subject to 'unit verification' for its hazardous area (ATEX) certification, with each unit having a separate ATEX certification number (which differ from the ATEX certificate numbers shown on the generic Declaration of Conformity). GSPVS pumps shall be issued with Declaration of Conformity documents to cover individual pump units.

## STATUTORY INFORMATION



HMD Sealless Pumps Ltd., Hampden Park Industrial Estate, Eastbourne, East Sussex, BN22 9AN, UK  
 Tel. +44 (0) 1323 452000 Web: <http://www.hmdpumps.com> e-mail: [pumps@hmdpumps.com](mailto:pumps@hmdpumps.com)

### EU Declaration of Conformity

**Manufacturer:** HMD Sealless Pumps Ltd.  
**Details of Equipment:** Metallic Magnet Drive Sealless Pumps

| Model                                                                                                                                                   | Description                               | Harmonised Standards applied in order to verify compliance to the Directive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GTI<br>GTA<br>GSI<br>GSA<br>GS<br>GSP<br>GSP/A ZL<br>GSPV<br>GSPLF<br>GSPX<br>LMV-801S<br>SPGSI<br>SPGSA<br>HPGSI<br>HPGSA<br>HPGSP<br>CS<br>CSA<br>CSI | Magnetic Drive Sealless Centrifugal Pumps | <p><b>MACHINERY DIRECTIVE 2006/42/EC:</b></p> <p>BS EN ISO 12100:2010 Safety of Machinery - General principles for design – Risk assessment and risk reduction. BS EN 809:1998+A1:2009 Pumps and pump units for liquids - Common Safety Requirements.</p> <p><b>ATEX DIRECTIVE 2014/34/EU:</b></p> <p>EN 80079-34:2020 Application of quality management systems for Ex Product manufacture</p> <p>EN 80079-36:2016 Non-electrical equipment for explosive atmospheres - Basic method and requirements.</p> <p>EN 80079-37:2016 Non-electrical equipment for explosive atmospheres – Non-electrical type of protection constructional safety “c”, control of ignition sources “b”, liquid immersion “k”.</p> |

**Directives to which the above equipment complies to:**

**Machinery Directive**

Directive relating to Machinery (2006/42/EC)

**ATEX Directive**

Directive on equipment and protective systems intended for use in potentially explosive atmospheres (2014/34/EU)  
 Group II Categories 2 and 3 (gas)

**Marking:**



II 2 G, Ex h IIC Tx Gb

-20°C ≤ Ta ≤ +40°C

**Notified body:**

**Intertek Testing and Certification Ltd**  
 Intertek House  
 Cleeve Road, Leatherhead  
 Surrey, KT22 7SB. UK

**Certification Number:**

ITS03ATEX11179X Issue 02

**ATEX Technical Construction File Number:**

ATEX-HMD-001

**Year in which CE Mark was affixed:**

1996

We certify that magnetically driven bare shaft, close coupled and separately mounted pumps manufactured by HMD Sealless Pumps Ltd meet the requirements of the above Directives, when installed, operated and maintained in accordance with our published Installation and Operating Manual. HMD magnetic drive pumps must not be put into service until all the conditions relating to safety noted in this manual have been met.

**Authorised signatories on behalf of HMD Pumps Ltd:**

**Name:** Sander Helder

**Position:** General Manager

**Name:** David Clark

**Position:** Senior Engineering Manager

**Date of Issue:** 19<sup>th</sup> December 2020

**Place of Issue:** United Kingdom

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## **SECTION 1 : INTRODUCTION**

This manual contains information necessary for the Installation and Operation of an HMD/Kontro Sealless Pump.

It is important that the manual is read thoroughly before installing or operating your HMD/Kontro Sealless Pump. Compliance with the methods and procedures outlined will help in providing economical and safe operation throughout the life of the pump.

If service, spare parts, repairs, or advice are required, do not hesitate to contact us: -  
HMD/Kontro Sealless Pumps, Hampden Park Industrial Estate, Eastbourne,  
East Sussex, England. BN22 9AN

Tel: +44 (0) 1323 452000  
Fax: +44 (0) 1323 503369  
Email: [customersupport@sundyne.com](mailto:customersupport@sundyne.com)

Or your local authorised distributor.

(AGENT LABEL)

When ordering spare parts, always quote the pump serial number for which the parts are required. This will save time in processing your order and will ensure you receive the correct part.

Whilst every care is taken to ensure that the information is correct, no liability can be accepted by HMD/Kontro Sealless Pumps for loss, damage or injury caused by errors in or omission from the information given.

HMD/Kontro Sealless Pumps Ltd RESERVE THE RIGHT TO CHANGE THEIR RECOMMENDATIONS WITHOUT PRIOR NOTICE OR CONSULTATION.

## SECTION 2 : GENERAL

In common with other items of rotating machinery, a pump that is installed incorrectly, operated wrongly, or poorly maintained can present a hazard. If the following considerations are overlooked, the safety of personnel or satisfactory operation of the pump may be endangered.

### 2.1 Warning Symbols

2.1.1 In accordance with BS EN 809 the following warning symbols and signs are used in this manual:



..for instructions where non-compliance will affect safety.



..for instructions involving electrical safety.

#### ATTENTION

..for instructions that are provided for safe operation and protection of the pump.

### 2.2 Application or Use

2.2.1 Each pump is designed for operation at the conditions stated on the pump label (Fig 2-1). Should the need arise to operate the pump outside of the conditions indicated on the pump label, HMD/Kontro should be contacted to check and confirm that the pump can be operated safely at the revised operating conditions.

Fig 2-1

|                                                                                     |                           |                                                                                                             |  |                                                                                       |
|-------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------|
|  |                           | <b>MANUFACTURED BY HMD KONTRO</b>                                                                           |  |  |
| <b>SEALLESS PUMPS LTD. UNITED KINGDOM</b>                                           |                           | <b>Sealless Pumps</b>                                                                                       |  |                                                                                       |
| MODEL                                                                               |                           | HMD SERIAL No                                                                                               |  |                                                                                       |
| ITEM No                                                                             |                           | LIQUID                                                                                                      |  |                                                                                       |
| PUMPING TEMP. (°C)                                                                  | MATERIAL                  | FLANGES                                                                                                     |  |                                                                                       |
| DUTY FLOW (m³/hr)                                                                   | HEAD (m)                  | SPEED (rpm)                                                                                                 |  |                                                                                       |
| IMP. DIA. (mm)                                                                      | MAX. POWER (kW)           | CASING HYDRO TEST PRESSURE (Bar G)                                                                          |  |                                                                                       |
| MAX. ALLOWABLE WORKING PRESSURE (Bar G)                                             | TEMP. BASIS FOR MAWP (°C) | TORQUE OF MAG COUPLING (Nm)                                                                                 |  |                                                                                       |
| BEARING ID NUMBER (FRONT/REAR)                                                      |                           | <b>DO NOT RUN DRY</b>  |  |                                                                                       |
| TELEPHONE: +44 1323 452000 FAX: +44 1323 503369 EMAIL: pumps@hmdpumps.com           |                           |                                                                                                             |  |                                                                                       |

### 2.3 IECEx Hazardous Area Certification

2.3.1 The equipment is certified in accordance with BS EN ISO 80079-36:2016

Ex h IIC Gb

as per IECEx certificate number IECEx ITS 17.0008.

2.3.2 As with ATEX, the temperature class for IECEx is determined as shown in 2.4

## GENERAL

### 2.4 Temperature Classification - (ATEX / IECEx)

2.4.1 The maximum surface temperature of a **metallic** magnetic drive pump is the **highest** temperature ascertained from any one of the following conditions:

1. The temperature of the pumped liquid, plus 20°C.  
or
2. The ambient temperature plus 20°C.  
or
3. The ambient temperature plus 39°C (only in the case of separately mounted pumps with oil lubricated bearing assemblies)  
or
4. The temperature of the heating medium being used in the heating jacket (if fitted)

The actual classification is calculated by obtaining the maximum surface temperature and then using the following table to obtain the relevant Temperature Class:

Table 2-1

| Temperature Class | Maximum Surface Temperature (°C) |
|-------------------|----------------------------------|
| T1                | 450                              |
| T2                | 300                              |
| T3                | 200                              |
| T4                | 135                              |
| T5                | 100                              |
| T6                | 85                               |

**Example:**

The pump is pumping a liquid with a temperature of 120°C. The pump is close coupled and therefore does not have an external oil lubricated bearings. The maximum ambient temperature in which the pump may operate is 30°C

Condition 1 equates to  $120^{\circ}\text{C} + 20^{\circ}\text{C} = 140^{\circ}\text{C}$

Condition 2 equates to  $30^{\circ}\text{C} + 20^{\circ}\text{C} = 50^{\circ}\text{C}$

Condition 3 does not apply.

Condition 4 does not apply.

Thus the maximum surface temperature of the pump is 140°C which equates to a temperature classification of T3.

2.4.2 The maximum surface temperature of a plastic lined non-metallic magnetic drive pump or a ZeroLoss shell pump is the **highest** temperature ascertained from any one of the following conditions:

1. The temperature of the pumped liquid, plus 20°C.  
or
2. The ambient temperature plus 20°C.  
or
3. The ambient temperature plus 39°C (only in the case of separately mounted pumps with oil lubricated bearing assemblies)

## SECTION 3 : TRANSPORT, HANDLING AND STORAGE

### 3.1 Transport and Handling

- 3.1.1 Inspect the shipping container for any damage sustained during shipment. If damage is found, note the nature and extent before unpacking. A photograph is helpful in any claims to be made against the shipper; also, inform HMD/Kontro Sealless Pumps or the local authorised distributor. Check the nameplate data against the shipping papers and against your purchase order to ensure that the correct pump is supplied.
- 3.1.2 After unpacking check to see that the suction and discharge flanges are sealed. If the seals have come loose, examine the pump to ensure no packing material or dirt is in the casing. It may be necessary to remove the pump casing to check. Refer to the Dismantling Instructions if required.
- 3.1.3 Inspect the suction and discharge flanges to be certain that they are free from scratches or nicks and that they are clean. The gasket seating surfaces in particular should be cleaned carefully.
- 3.1.4 Ensure that a copy of this manual is in the hands of the installation personnel and that they have read it thoroughly before proceeding further.



- 3.1.5 Attention must be given to the safe handling of all items. This applies to both installation and maintenance. For HMD/Kontro Sealless Pumps that weigh in excess of 20kg (44lb), it is recommended that suitable lifting equipment should be used in the correct manner to ensure that personal injury or damage to pump components does not occur.
- 3.1.6 Note that lifting eyes fitted to individual pieces such as pump and motor are designed to lift only these parts and not the complete assembly. If a lifting frame or lifting equipment is supplied with the pump this shall be used to install the pump and retained for future use.
- 3.1.7 If the pump is not to be used for a period of time, the recommended storage procedures are: -

### 3.2 Storage

#### 3.2.1 Short term (up to 6 months)

- a) The pump should be left undisturbed in its transportation packaging and stored in a dry area and not subjected to vibration.
- b) If removal from the packaging is necessary, the pump should be stored covered in a clean, dry area protected from physical damage and vibration. All flanged and threaded connections should remain capped.

#### 3.2.2 Long term (in excess of 6 months)

HMD/Kontro should be informed at the time of order that long term storage is anticipated so that special packaging arrangements can be made. These will consist of: -

- a) The pump will be packed in a wooden crate.
- b) The pump will be packed with bags of silica gel and covered with tar paper.
- c) All machined surfaces will be greased (if appropriate).
- d) All flanges and threaded connections will be capped.

It is recommended that the pump should be left in its transportation packaging and stored in a dry area and not subjected to any vibration, which may cause brinelling of electrical motor and pump bearings. At suitable intervals, during a period of storage, the pump rotor should be turned by hand. After long term storage, when the pump is installed, the grease and oil lubricated assemblies should have the lubricants cleaned out and replaced. Refer to the section 8.2.1 for further details. This precaution is necessary because lubricants can deteriorate after a period of time. Prior to installation it is recommended that the pump is inspected by an HMD/Kontro engineer and that the commissioning is similarly supervised.

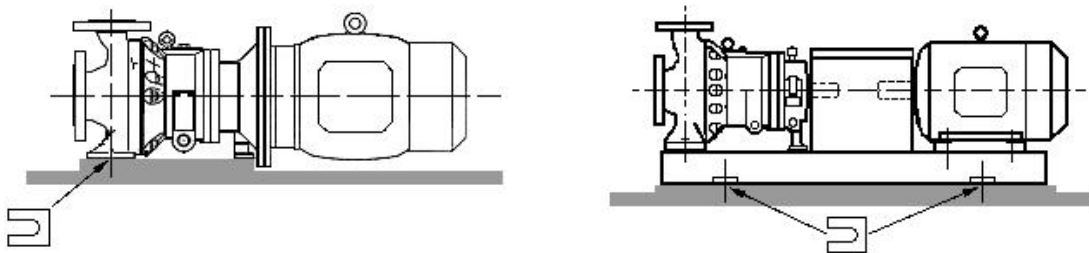
**SECTION 4 : INSTALLATION GUIDELINES****4.1 Location**

- 4.1.1 Centrifugal pumps should be installed as close as is practical to the source of liquid supply and preferably below the liquid level in the supply vessel.
- 4.1.2 Pumps installed on systems requiring suction lifts need special consideration and HMD/Kontro Sealless Pumps should be consulted.
- 4.1.3 Pump units must be installed to ensure that adequate space is available for access and maintenance.
- 4.1.4 HMD/Kontro Sealless Pumps supply certified drawings showing foundation details and the space necessary to carry out routine inspection and maintenance with every pump; extra drawings are available at a moderate cost on request.

**4.2 Foundations**

- 4.2.1 Foundations may consist of any structure heavy enough to afford permanent rigid support to the full area of the pump base and to absorb any normal strains or shock. Concrete foundations built up from solid ground are the most satisfactory.
- 4.2.2 The pump base in the case of close coupled, or the base plate in the case of separately mounted pumps should be bolted securely in position with suitable foundation bolts.
- 4.2.3 When a pump unit is mounted on steelwork or other such structures, care must be taken to ensure that the baseplate is not subject to distortion or vibration.
- 4.2.4 Where possible the pump units should be mounted over or as near as possible to main supporting members.

Fig. 4-1



- 4.2.5 It may be necessary to mount pump units resiliently if there is the possibility of excess vibration. If in doubt, contact HMD/Kontro or their authorised distributor.
- 4.2.6 Misalignment should be corrected by shims. Grouting may be necessary to prevent movement of the pump and stop the accumulation of chemical or hydrocarbon under the pump base – Fig.4-1.
- 4.2.7 On separately mounted units both pump and motor are aligned at HMD/Kontro before despatch to site. After bolting base plate down, motor/pump alignment should be rechecked at the flexible coupling.

## INSTALLATION GUIDELINES

### 4.3 Electrical Installation & Earthing



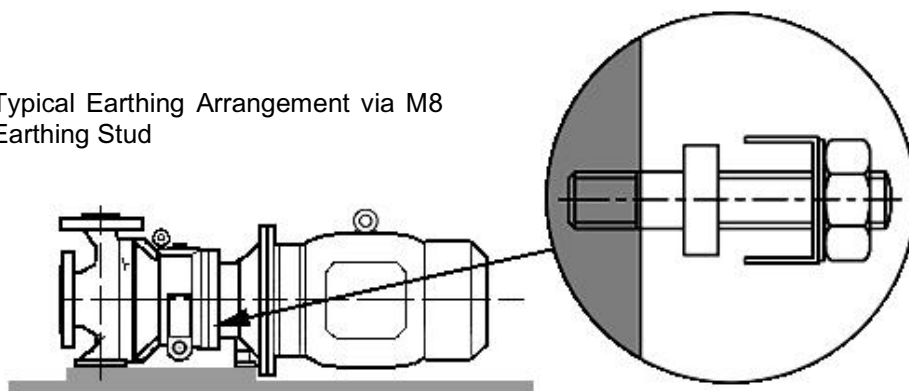
#### ATTENTION

- 4.3.1 Electrical connection of the pump motor, to a suitably rated power supply shall be carried out by electrically skilled persons or staff. Care should be taken to ensure that the motor electrical connection will not overload the power supply. Provision shall be made to enable electrical isolation of the equipment.
- 4.3.2 Pumps that have been supplied in accordance to the ATEX Directive (94/9/EC) will be identified by a label with the following symbol on it:



Such units are supplied with an M8 earthing stud, saddle washer, shakeproof washer and locking nut. Once the unit has been installed and levelled, this shall be wired to earth with a suitable earthing cable. Fig 4-2, by electrically skilled persons or staff.

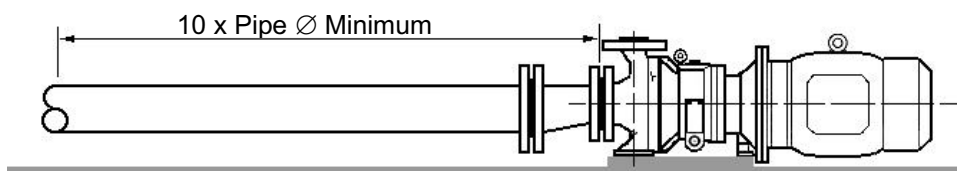
Fig. 4-2 Typical Earthing Arrangement via M8 Earthing Stud



### 4.4 Suction Pipework

- 4.4.1 Good practice dictates that there should be a minimum straight length of pipe on the suction flange of the pump equal to ten times the suction pipe diameter. This is to allow the liquid to flow into the pump casing without turbulence. (Fig. 4-3)

Fig. 4-3



- 4.4.2 In addition, it is also good practice to use suction pipeline at least one to two sizes larger than the pump nozzle and reduce the pipe diameter at the pump flange.
- 4.4.3 Ensure that the inside diameter of the suction pipe matches the nozzle openings as accurately as possible in order not to strain the pump casing. On no account lever the suction pipe flange to align it

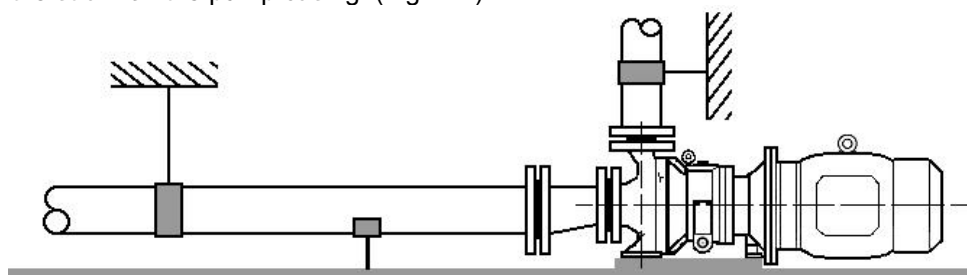
## INSTALLATION GUIDELINES

to the pump suction nozzle flange. The flange bolts should slip in to the aligned flange holes without straining the pipework.



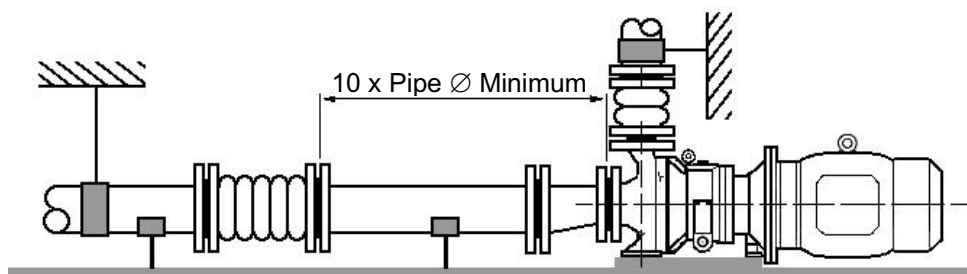
- 4.4.4 Apply proper support to suction and discharge piping with proprietary pipe hangers or supports to keep the strain off the pump casing. (Fig. 4-4)

Fig. 4-4



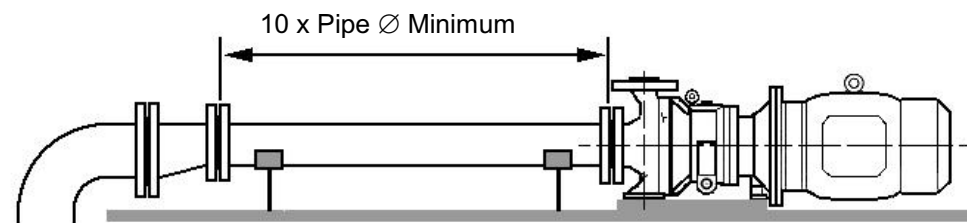
- 4.4.5 Provide for pipe expansion if handling high temperature liquids. (Fig 4-5)

Fig. 4-5



- 4.4.6 Ensure that all joints in the suction pipework are airtight.
- 4.4.7 Install suction piping, elbows, eccentric reducers (flat side up as in Fig 4-6) and all other fittings so that no air pockets can be created within the suction system.
- 4.4.8 Position of eccentric reducer when liquid is below pump centreline. (Fig. 4-6)

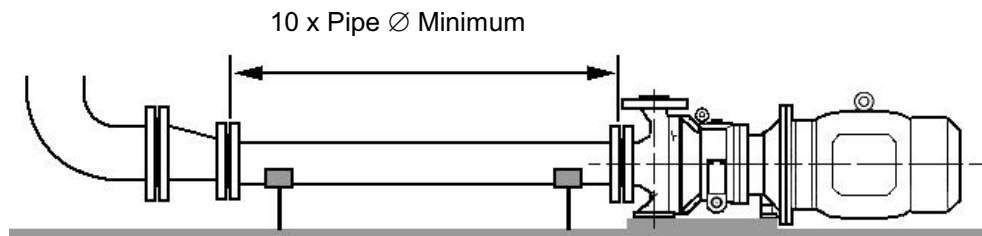
Fig. 4-6



- 4.4.9 Position of eccentric reducer when liquid is above pump centreline. (Fig. 4-7)

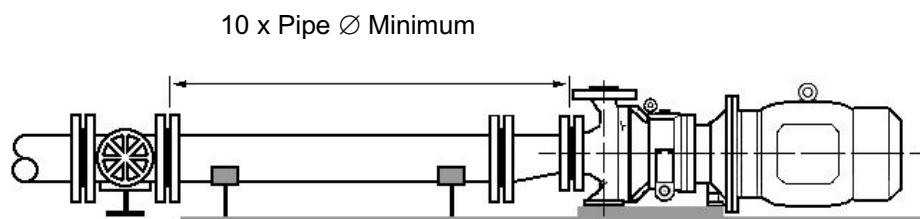
## INSTALLATION GUIDELINES

Fig. 4-7



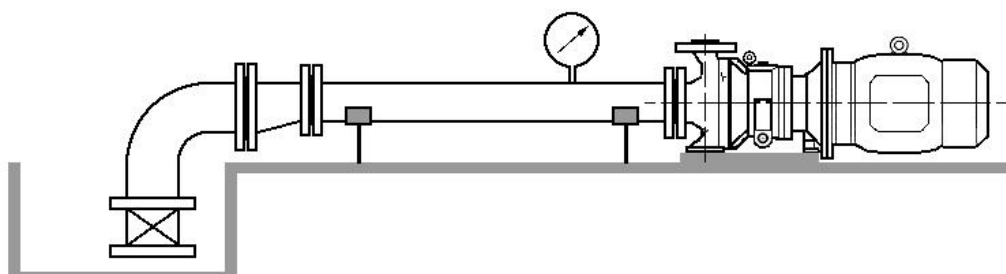
- 4.4.10 Mount valves from the suction pipework with the stems horizontal or vertically down to avoid air pockets. (Fig. 4-8)

Fig. 4-8



- 4.4.11 If pump prime can be lost when the pump is stopped, install a foot valve in the suction line to avoid the need to re-prime on each restart. The flapper type of foot valve sized to avoid undue pressure drop is preferred. (Fig. 4-9)

Fig. 4-9



- 4.4.12 Always fit a suction/vacuum gauge to all installations to monitor suction conditions.

### 4.5 Features to Avoid on Suction Pipework

- 4.5.1 Avoid the use of valves that have high friction loss.
- 4.5.2 Avoid the use of in-line filters (with the exception of the commissioning period)
- 4.5.3 Avoid pipework layouts that promote vortices at the liquid level in the supply vessel.
- 4.5.4 Avoid the use of multiple spring type check valves.
- 4.5.5 Avoid flow meters.
- 4.5.6 Avoid at all costs a pipework system that may allow the pump to run dry.
- 4.5.7 Avoid using more than one pump feeding at the same time from a common suction pipeline.
- 4.5.8 Avoid any operating conditions that reduce the NET POSITIVE SUCTION HEAD (See section covering NPSH).
- 4.5.9 The advice given in this section covers the whole range of **HMD/Kontro Sealless** pumps. There are, however, additional precautions to be taken for self-priming pumps.

#### 4.6 Net Positive Suction Head (NPSH)



- 4.6.1 Liquids cannot be towed or dragged down a pipe; liquids can only be pushed along a pipe. The push the liquid needs to flow in to the pump can only be supplied by some external energy source such as the absolute pressure in the surface of the liquid in the vessel and the head of the liquid over the centre line of the pump.

A system that has insufficient NPSH available will cause the pump to cavitate. The general effects of cavitation are noise, erosion of metal surfaces and vibration of the system. The latter situation will result in the magnetic coupling overheating and the product-lubricated bearings will wear rapidly. Cavitation starts when the pressure at the pump suction falls near to the value of the vapour pressure of the pump liquid and this varies with temperature.

At the time the pump is selected, the NPSH available will have been calculated as per the following method: -

Fig. 4-10

$$\text{NPSH available} = P_s - V_p + H_s + V_s - H_f$$

Where:

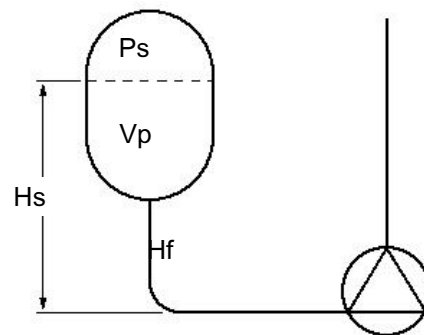
$P_s$  = Absolute pressure in suction vessel

$V_p$  = Vapour pressure of liquid

$H_s$  = Total static head

$H_f$  = Friction losses in suction line

$$V_s = \text{Velocity Head} = \frac{V^2}{2G}$$



In the above equation, all parameters must be converted to metres head of liquid before the liquid calculation is carried out. The pump should be selected so that the NPSH available is a minimum of 0.5m greater than the NPSH required by the pump.

No subsequent alteration should be made to the pipework system without considering the effect that it will have on the NPSH available.

## INSTALLATION GUIDELINES

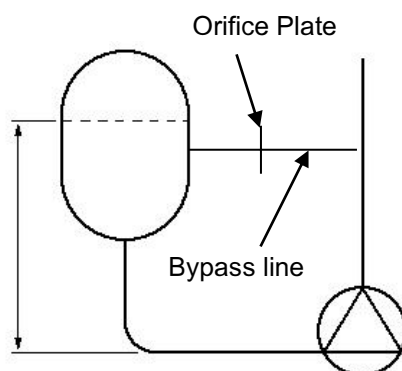
### 4.7 Discharge Pipework

- 4.7.1 The discharge pipework and its related equipment does not normally have as great an influence on pump performance as the suction pipework. There are, however, some points to watch with discharge pipework to ensure efficient pump operation.
- 4.7.2 In a manner similar to the suction pipework, provision must be made to support the discharge pipework and any other equipment.
- 4.7.3 The discharge pipework is normally more extensive than the suction system, so there are increased amounts of pipe strain being transferred to the pump and this must be avoided.
- 4.7.4 Where possible, there should be a straight length of pipe immediately on the discharge nozzle followed by a suitable valve and between the valve and the discharge flange there should be a pressure gauge to help monitor the pump's performance.
- 4.7.5 Should a non-return valve be fitted in the pump discharge line, provision should be made to vent the space between the pump and the non-return valve or the pump will not prime.

#### ATTENTION

- 4.7.6 It cannot be stressed enough, how important it is to have pressure gauges on both the suction and the discharge sides of the pump.
- 4.7.7 Should a bypass be incorporated in the system, the bypass line should incorporate an orifice plate to ensure that the pump – in bypass mode - operates at the specified minimum safe flow (Fig. 4-11).
- 4.7.8 The bypass system should not be led back to the pump suction directly; it should be led back to the supply vessel to dissipate any heat built up during the bypass cycle.
- 4.7.9 Motorised valves should be controlled such that they do not deadhead the pump whilst it is running.
- 4.7.10 It is also important that the system and its operation cannot permit the pump to lose differential head as any substantial loss of head could cause damage to the pump.
- 4.7.11 To ensure correct hydraulic performance, the orifice plate, when supplied must be installed, clamped on centre between the pump discharge nozzle and the discharge pipe flange.

Fig. 4-11



**SECTION 5 : GSPVS INSTALLATION GUIDELINES****5.1 GSPVS Installation**

To remove the GSPVS pump from its packing case, with the pump in a horizontal orientation, connect suitably rated lifting equipment (A and B) as shown in Figure 5-1.

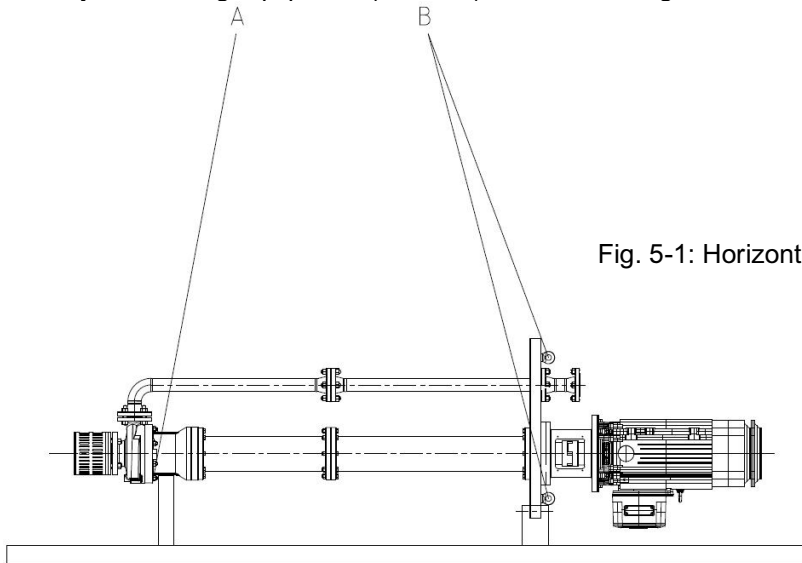


Fig. 5-1: Horizontal lifting of GSPVS

1 -CONDITION OF THE PUMP AS TRANSPORTED

To transition from horizontal to vertical orientation, lift the GSPVS pump from its packing crate and then, whilst suspended, lower A and raise B (see Figure 5-2) to a point where the GSPVS is in a vertical orientation.

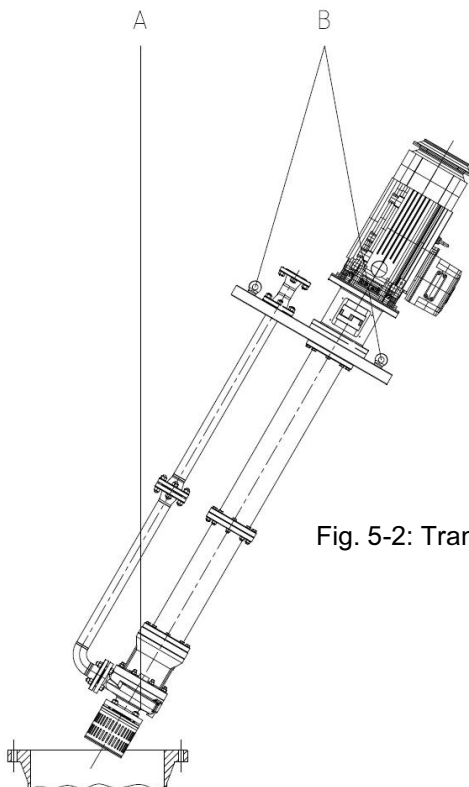


Fig. 5-2: Transition lift of GSPVS from horizontal to vertical

2 - TRANSITION FROM HORIZONTAL TO VERTICAL

## PROTECTION SYSTEMS

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Detach lifting equipment A.

Using lifting equipment B, manoeuvre GSPVS pump over the tank and lower into position (see Figure 5-3)

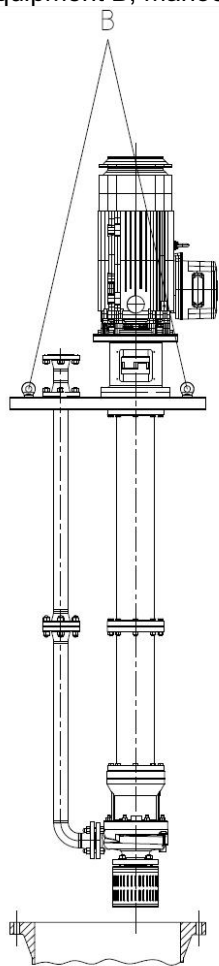


Fig. 5-3: Vertical lowering of GSPVS onto tank

3 - ASSEMBLY OF THE PUMP ON THE TANK

**SECTION 6 : PROTECTION SYSTEMS****ATTENTION**

To minimise the effect of process or system malfunction the HMD/Kontro Sealless Pump can be provided with various fail safe devices to increase plant security.

The type of instrumentation or safety devices offered depends on the properties of the process liquid, the application and plant operating procedures.

It is rare, that all of the protection methods illustrated are needed and the number or type of protective device fitted is often a matter of client experience and preference.

**6.1 Power Control Monitor (PCM)**

Protects Against

- |                |                |
|----------------|----------------|
| **Dry Running  | **Pump Seizure |
| **Cavitation   | **Motor Faults |
| **Closed Valve |                |

Motor power monitoring can provide good pump protection against low flow or dry running. Being remote from the pump head the power sensor is not affected by the liquid handled and is, therefore, more reliable than differential pressure or flow switches.

**6.2 Temperature Sensor**

Protects Against

- |                                  |                                |
|----------------------------------|--------------------------------|
| **Dry Running                    | **Closed head and minimum flow |
| **Internal/External bearing wear | **Pump Seizure                 |
| **Severe Cavitation              | **Process overheating          |

The containment shell provides pressure retention of the liquid cooling the pump bearings. The temperature sensor monitors the temperature of the outside diameter of the containment shell detecting temperature movements in response to operational change. The temperature sensing device, therefore, provides an optimum, inexpensive form of continuous pump protection. Normally an over temperature cut out and/or alarm is required, but low and high trips can be provided for liquids which can freeze at ambient air temperatures.

**6.3 Differential Pressure Switches**

Protection Against

- |                     |                                        |
|---------------------|----------------------------------------|
| **Dry running       | **Minimum/maximum flow and closed head |
| **Severe Cavitation | **Pump Seizure                         |

It is essential that Sealless Pumps are not run dry otherwise rapid bearing wear and heat build up will occur. Differential pressure switches are reliable and economic forms of dry running protection. These failsafe devices are particularly suited to applications where the risk of suction starvation is high. The switch contacts are wired into the motor control circuit to provide a pump cut-out in the event of a drop in pump differential pressure.

**6.4 Liquid Sensing Probe**

Protects Against

- |                           |                         |
|---------------------------|-------------------------|
| **Internal Liquid Leakage | **Starting the pump dry |
|---------------------------|-------------------------|

This instrumentation is usually installed in conjunction with a pressure tight coupling housing. An early warning of internal leakage is given before dangerous quantities of spillage can fill the housing. Another use for the liquid sensing probe is to ensure that the pump is primed with liquid before it can be started. When used for this the liquid sensing probe is mounted at the pump discharge flange.

## PROTECTION SYSTEMS

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### 6.5 Secondary Containment or Control

Protects Against

\*\*Leakage to Atmosphere

\*\*Hazardous Emissions

Where a requirement for secondary containment or control exists, a sealed coupling housing is used to provide secondary pressure retention, to contain or control fluid leakage. The sealed coupling housing is pressure tested to the same hydraulic pressure rating as the pump liquid end. The drive shaft is fitted with a sealing system to suit.

The sealed coupling housing can be configured with optional flanged, top vent and drain vent ports to enable connection to different sensors and to enable the safe disposal and flushing of a system, in the unlikely event of a primary containment breach.

Although not always required, the pressure tight housing is desirable for very toxic or flammable chemicals.

The sealed coupling housing can be specified with a variety of sensors, varying in sensitivity from; the liquid sensing probe (6.4), a pressure switch or a gas or vapour detector. These sensors along with the shaft sealing system are configured to either prevent or limit any liquid or vapour escaping the primary pressure boundary from entering the power frame and its bearings.

If you require further information on secondary containment or control options, or pump protection devices please contact HMD/Kontro or your local agent.

### 6.6 VapourView®

Protects Against

\*\*Dry Running

\*\*Gas or vapour related process upsets

\*\*Gas in system or vapourisation

\*\*Pump Seizure

VapourView® is a patent protected instrument that sits outside the primary pressure boundary and uses ultrasonic technology to monitor the presence of gas or vapour in the containment shell. In addition to protecting the operation of the magnetic drive pump the VapourView® instrument provides vital information to an end-user on the condition of the process liquid.

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| ATTENTION |
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**HMD/Kontro strongly recommends, that as a minimum, power sensing protection with a Power Control Monitor is used to ensure long and safe operation of your HMD/Kontro Sealless Pump. This is particularly relevant to pumps being used in potentially explosive atmospheres.**

For guidance on the availability of protection systems for a specific pump range, please refer to Fig.6-1 and Table 6-1.

If you have a specific requirement, contact HMD/Kontro to discuss the available options in more detail.

## PROTECTION SYSTEMS

Fig. 6-1: Protection Systems (Typical)

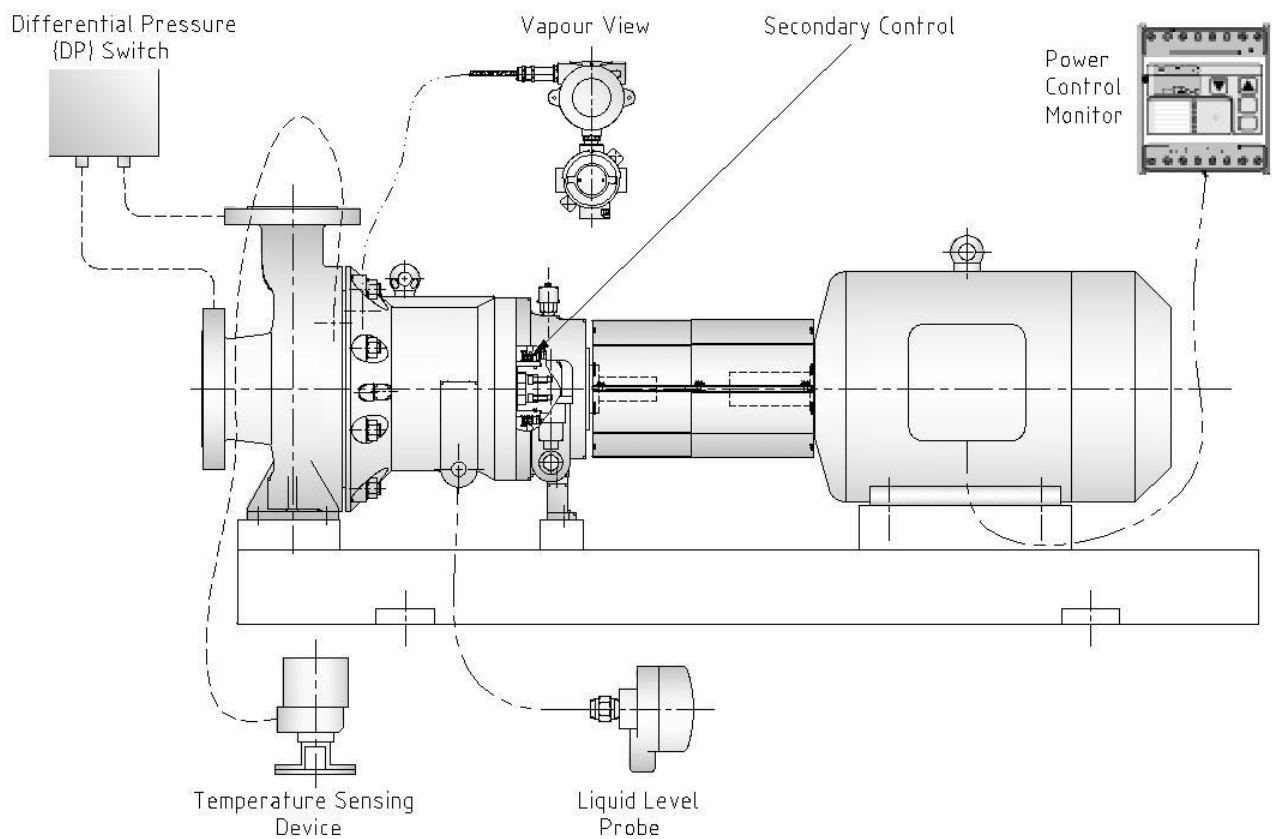


Table 6-1: Availability of Instrumentation

| Model Prefix | Alternative Model Prefix | Power Control Monitor | Temperature Sensing Device | Differential Pressure Switches <sup>1</sup> | Pressure Tight Coupling Housing | Liquid Sensing Probe | Secondary Control | Vapour View |
|--------------|--------------------------|-----------------------|----------------------------|---------------------------------------------|---------------------------------|----------------------|-------------------|-------------|
| CSA & CSI    | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | ✓           |
| GTI & GTA    | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | -                 | -           |
| GSI & GSA    | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | ✓           |
| GS           | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | ✓           |
| GSP & GSPLF  | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | ✓           |
| GSP ZL       | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | ✓           |
| SPGS         | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | -                 | -           |
| HPGS         | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | -                 | ✓           |
| CS           | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | ✓                    | ✓                 | -           |
| GSS          | -                        | ✓                     | ✓                          | ✓                                           | -                               | -                    | -                 | -           |
| GSPV         | -                        | ✓                     | ✓                          | ✓                                           | ✓                               | -                    | ✓                 | ✓           |

Note: Any instrumentation installed in a Potentially Explosive Atmosphere should be ATEX certified.

1. In some cases the connection of DP switch is made into suction and discharge piping and not the pump casing.

## **PROTECTION SYSTEMS**

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## SECTION 7 : COUPLING ALIGNMENT (Separately Mounted Only)

### 7.1 Factory Alignment

Pumps supplied with driver, base and coupling from the factory are aligned prior to shipment. However, stresses caused by lifting and transportation can cause minor distortion, which will disturb the factory alignment. Check coupling alignment after the base plate has been levelled prior to grouting.

### 7.2 Site Alignment

If the coupling alignment has been disturbed by improper levelling of the base plate, correct prior to continuing.

After the base has been grouted and the piping connected make a final pre start alignment check. Additionally, a hot alignment check must be made once the pump has been run up to its operating temperature.

Recheck after the pump has been running for about a week. This check must be made immediately after unit is shut down, before it has a chance to cool.

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| ATTENTION |
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### 7.3 The Need to Correctly Align the Coupling

The flexible coupling when supplied with the pump is not designed to operate with excessive misalignment. Reducing misalignment will increase coupling life and the life of the associated bearings. Coupling alignment procedures are included in this section for the specific type of coupling supplied.



Disconnect the motor from its electrical supply before carrying out any alignment work.

### 7.4 Coupling Alignment Adjustments

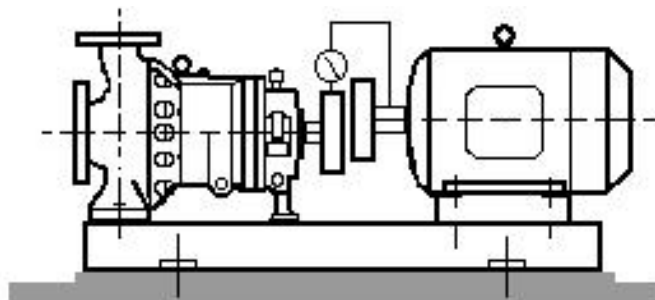
#### a) Non-Spacer Type Couplings

Coupling alignment must be checked in all three planes.

- 7.4.1 Set the dial test indicator to zero in the 12 o'clock position (see Fig. 7-1).
- 7.4.2 Turn both coupling halves together and take the readings in the 6 o'clock position.
- 7.4.3 If the reading is negative, place shim stock equivalent to  $\frac{1}{2}$  the indicator reading under each of the four driver feet. If the dial test indicator has a positive reading, shims equivalent to  $\frac{1}{2}$  the reading must be removed from each of the driver feet.
- 7.4.4 Return to the 12 o'clock position and reset the dial test indicator to zero. Turn the coupling halves and check the reading. If the reading is not zero, repeat the steps 7.4.1 to 7.4.3 until a zero reading is obtained.

## COUPLING ALIGNMENT

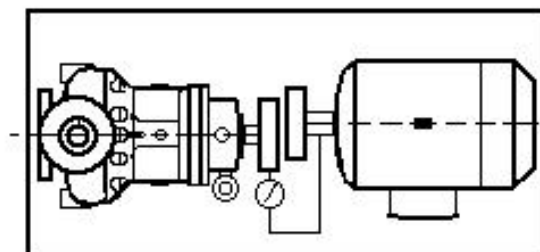
Fig. 7-1: Rim Top to Bottom



To set side alignment: -

- 7.4.5 Mount a dial test indicator rigidly on the driver half of the coupling and set the indicator button on the rim of the pump half (see Fig 7-2).
- 7.4.6 Facing the driver from the coupling end, set the dial test indicator to zero at the 3 o'clock position. Turning both coupling halves together, move the dial test indicator to the 9 o'clock position and record the reading. The two halves together must be returned to prevent the possible misalignment of shaft centrelines due to coupling runout.
- 7.4.7 The dial test indicator reading will show double the amount of correction required to true the coupling side to side. If the dial test indicator moved in a counter clockwise direction, the reading is considered negative. If the movement was clockwise, it is considered a positive reading.
- 7.4.8 If the reading was positive, push the motor – or alter the motor alignment bolt position - in the 3 to 9 o'clock direction,  $\frac{1}{2}$  the dial test indicator reading. If the reading was negative, push the motor – or alter the motor alignment bolt position - in the 9 to 3 o'clock, direction,  $\frac{1}{2}$  the indicator reading.
- 7.4.9 Return to the 3 o'clock position and reset the dial test indicator reading to zero.
- 7.4.10 Turn the coupling halves together and recheck the alignment. If not quite zero at 9 o'clock repeat the steps of 7.4.5 to 7.4.9 until a zero reading is obtained in the 3 to 9 o'clock positions. If a zero reading cannot be obtained, the problem is most likely due to the coupling being vertically misaligned. To check this, set the indicator to zero at the 12 o'clock position. Rotate the coupling through a complete revolution. If the side alignment is correct, similar readings will be obtained in the 3 and 9 o'clock positions. For example a reading of +0.075mm would indicate that the coupling is indeed aligned side to side.

Fig. 7-2: Rim Side to Side



Once side to side alignment is set, face alignment can next be checked (Fig. 6-3 and Fig. 6-4). The coupling gap can be accurately checked with either a dial test indicator, set of feeler gauges or a wedge. Checking with feeler gauges is the easiest option. Rotation of the coupling is not necessary to determine face alignment when using feeler gauges.

- 7.4.11 If the coupling gap is open at the bottom and closed at the top the front feet of the driver must be shimmed to equalise the gap. Should the top be open in relation to the bottom, the back feet must be shimmed (Fig. 7-3).
- 7.4.12 Side to side variance in the coupling gap is compensated for by moving the back of the driver in the appropriate direction to equalise the gap (Fig. 7-4)

Fig. 7-3: Face Top to Bottom

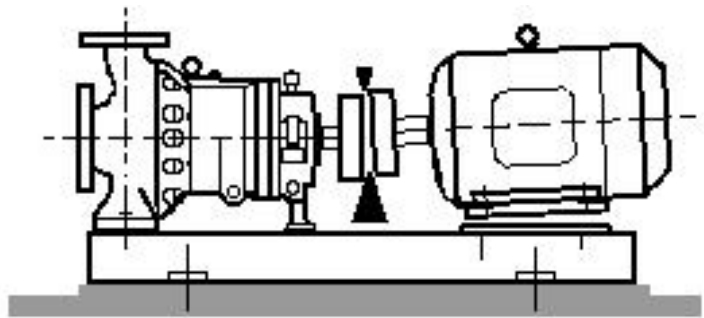
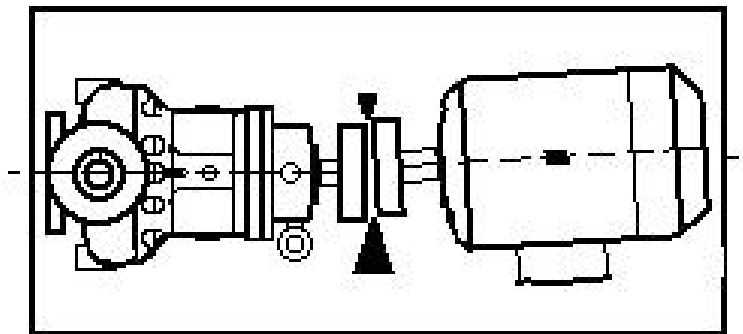


Fig. 7-4: Face Side to Side



Various factors affect the shimming of the driver feet to correct coupling gap. For example, the distance of the driver foot from the coupling will affect the amount of compensation seen when using a shim of specific thickness. In other words, the amount of correction seen using a 0.5mm shim on the front feet of the driver will be different from the amount seen when that same 0.5mm shim is used on the back feet. Each situation is sufficiently unique that the best results are achieved through experimentation.

Upon completion of the alignment procedure for the third axis, the alignment in the other two correction axes must be checked. Setting the vertical alignment may throw the side/side and/or face/face alignment out of tolerance. Due to the effect each axis has on the others, it is often necessary to operate at least one alignment axis approaching the allowable misalignment tolerance of 0.5mm (max).



**The importance of checking the alignment once the unit has been piped and run cannot be understated.** To ensure that dangerous stresses are not imposed on pump or driver during operation, which would reduce operating life and may create hazards to operating personnel, the coupling alignment must be checked with the unit at operating temperature within a week after initial start-up.

#### b) Spacer Type Couplings

For spacer type couplings the techniques used in a) are applicable but in addition it will be necessary to use straight edge and inside callipers to measure run out between the coupling halves with the spacer removed.

## **COUPLING ALIGNMENT**

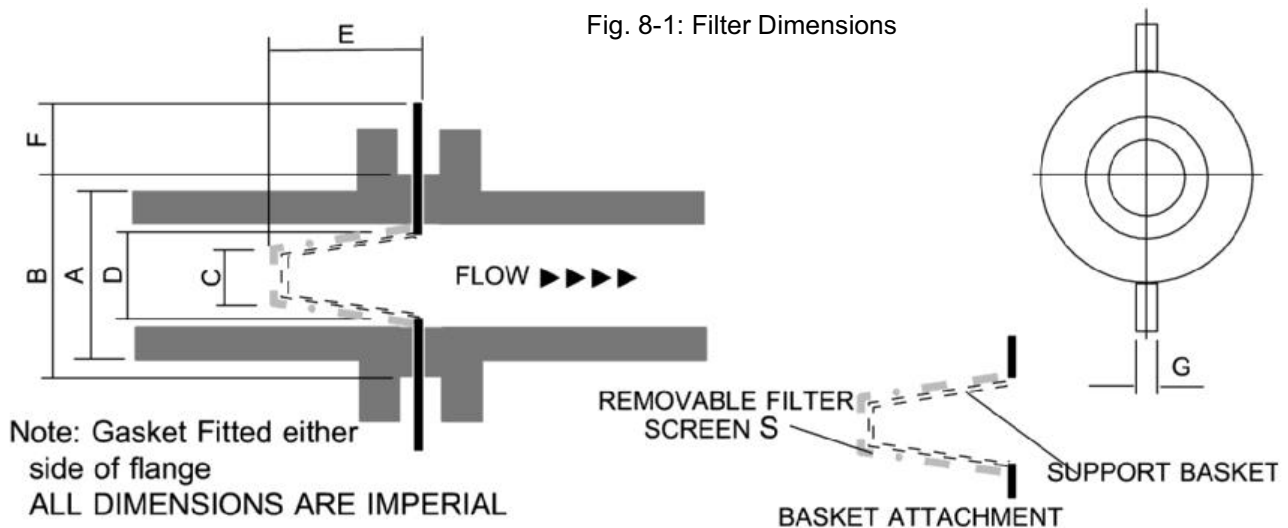
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## SECTION 8 : GENERAL COMMISSIONING INSTRUCTIONS

### ATTENTION

### 8.1 Pre-Commissioning Precautions

- 8.1.1 A significant proportion of all pump problems occur during the commissioning period. There are a number of reasons for these problems and usually they are not as a result of poor materials, bad workmanship or design of the pump.
- 8.1.2 Normally, the problems encountered during commissioning are due to: -
- Debris left in the system during the construction period
  - Unexpected system characteristics
  - Incorrect pump selection
- 8.1.3 Every effort should be made to ensure that debris is removed from the pipework and related equipment prior to installing the pump.
- 8.1.4 The pump should not be installed until all pipework has been flushed to remove washers, nuts, welding slag, welding rod, studs, pieces of gasket material, pieces of rag, shot etc.
- 8.1.5 When the system has been cleared, the pump can be installed but provision should be made to install a temporary filter in the suction pipework close to the pump.
- 8.1.6 The recommended filter size and the method and position of it installation are shown in Fig. 8-1 and Fig. 8-2.



| A   | B    | C    | D    | E    | F   | G   | S            | PIPE FLOW AREA |        | STRAINER FLOW AREA |
|-----|------|------|------|------|-----|-----|--------------|----------------|--------|--------------------|
|     |      |      |      |      |     |     |              | SCH 40         | SCH 80 |                    |
| 1   | 2    | 0.5  | 0.88 | 3    | 2.5 | 1   | 40 x 40 Mesh | 0.864          | 0.719  | 1.94               |
| 1.5 | 2.88 | 0.75 | 1.38 | 4    | 3   | 1   |              | 2.04           | 1.77   | 4.03               |
| 2   | 3.83 | 1    | 1.69 | 6    | 3.5 | 1.5 |              | 3.36           | 2.95   | 8.15               |
| 2.5 | 4.13 | 1.38 | 2.06 | 6.25 | 3.5 | 1.5 |              | 4.79           | 4.24   | 21.3               |
| 3   | 5    | 1.75 | 2.69 | 6.5  | 3.5 | 1.5 |              | 7.39           | 6.60   | 28.4               |
| 4   | 6.19 | 2.5  | 3.56 | 6.75 | 3.5 | 1.5 |              | 12.73          | 11.5   | 40.8               |
| 6   | 8.5  | 3.5  | 5.5  | 9.25 | 3.5 | 1.5 |              | 28.9           | 26.1   | 83.9               |

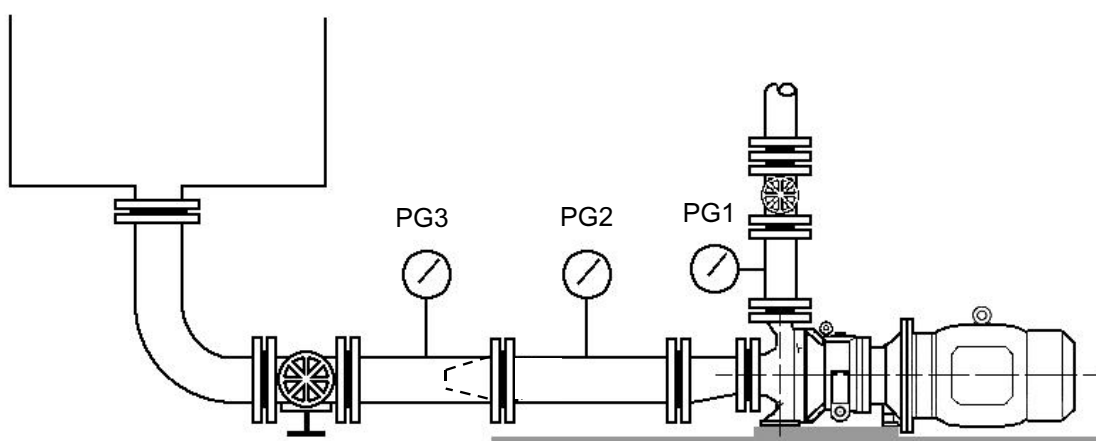
No Basket is required for pipes sized 1 inch and under  
The Basket is made from 16 SWG compatible with the pumped liquid.  
For pipe sizes above 6 inch, 12 SWG is used

## GENERAL COMMISSIONING

- 8.1.7 The filter consists of a 16 SWG metal basket (metal to be compatible with commissioning liquid) and a 40x40 mesh wire screen cloth.
- 8.1.8 The table in Fig 8-1 shows the relationship between pipe diameter, its flow area and the strainer flow area.
- 8.1.9 Do not use a flat spade type screen in the system, the flow area will be less than the pipe flow area and this may create problems due to rapid blockage.
- 8.1.10 Fig. 8-2 shows how the temporary filter is installed in the system. It is important that all the gauges (PG1, PG2 and PG3) are installed; PG2 and PG3 will indicate if the filter is blocking and PG2 and PG1 will monitor the differential head across the pump to check that the pump is achieving duty.

After commissioning, gauges PG1 and PG2 should be installed permanently as they afford excellent continuing checks on the pump's performance.

Fig. 8-2 Temporary Filter Installation



- 8.1.11 The gauges should be calibrated in the same units and measure absolute pressure.
- 8.1.12 All pipework and related equipment should be checked to ensure it is installed correctly and is leak free.

### ATTENTION

## 8.2 Bearing Assembly Lubrication for Separately Mounted Pumps

- 8.2.1 Separately mounted pumps have Drive End Bearing Assemblies (also known as Power Frames) that are either grease or oil lubricated.

**Grease lubricated** Bearing Assemblies (**metallic pumps**) require no immediate attention since they are lubricated at the factory prior to despatch [Shell Alvania RA grease or equivalent is recommended].

**Oil lubricated** Bearing Assemblies (**metallic pumps**) are supplied from the factory **WITHOUT** lubricant in the bearing housing. The constant level oiler operation is based on the simple air compensation principle and will automatically maintain the oil level in the Bearing Assembly provided the bottle itself is kept topped-up with sufficient oil.



### WARNING!

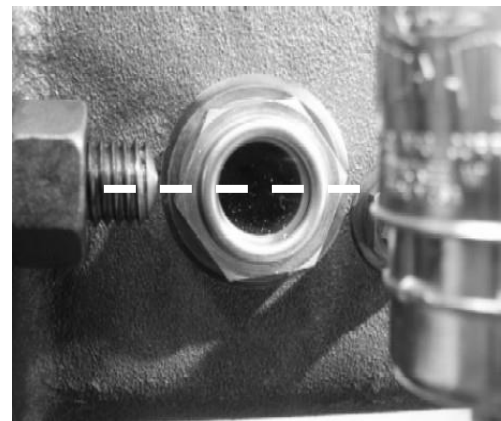
**Before starting the pump the Bearing Assembly of the Oil lubricated type must be filled with oil.**

### 8.3 Filling Procedure and Quantities

- 8.3.1 The CSA/CSI product range has an oil filler port located on the side of the bearing housing that will limit the oil volume in the CSA/CSI bearing housing to 210 mL, with the pump mounted straight and level.

#### Filling oil lubricated type Bearing Assemblies that incorporate oil level Window glass: -

- 8.3.2 Unscrew top nut of Air Breather / Filter using either 8mm AF spanner or small adjustable spanner, then remove rubber washer, and bell shaped cover. This will leave actual filter exposed. Remove filter. Unscrew main breather body from Bearing Housing using small adjustable spanner. Note that main breather body across-flat (AF) size of 15.2mm is non-standard. Insert small funnel into Air Breather / Filter hole.
- 8.3.3 Fill Bearing Housing via funnel with recommended grade of oil (See Table 8-2). The bearing housing should be filled with the appropriate volume of oil as described in Table 8-1; the Air Breather / Filter should then be replaced.
- 8.3.4 To ensure the correct oil level is reached, the remaining volume should be filled using the oiler bottle topping up procedure detailed in section 8.4.
- 8.3.5 The bearing assembly should be filled using the oiler **to centre-line of Window Nut only !** (as shown by superimposed dotted line). This can be achieved by filling the oiler reservoir as described in the section 8.4.



**CAUTION – do not overfill**

Table 8-1 Maximum volume of oil to be added through the air breather/filter.

| Magnet Coupling Range | Pump Model                                     |        |      |       |       |       |       |      |
|-----------------------|------------------------------------------------|--------|------|-------|-------|-------|-------|------|
|                       | [ Approximate quantities in millilitres (mL) ] |        |      |       |       |       |       |      |
|                       | GSI                                            | GSA/GS | GSP  | SPGSI | SPGSA | HPGSI | HPGSA | CS   |
| CA                    | 380                                            | 100    | --   | 380   | 100   | 380   | 100   | --   |
| DA                    | 125                                            | 100    | 375  | 125   | 100   | 125   | 100   | --   |
| EA + FA               | 125                                            | 200    | 740  | --    | --    | 125   | 200   | --   |
| GA                    | --                                             | --     | 1175 | --    | --    | --    | --    | --   |
| C + D                 | --                                             | --     | --   | --    | --    | --    | --    | 270  |
| E + F                 | --                                             | --     | --   | --    | --    | --    | --    | 1175 |

#### Filling oil lubricated type Bearing Assemblies that do not incorporate oil level Window glass: -

- 8.3.6 Remove Air Breather / Filter as per previous page. To determine how much oil is required for a particular pump, refer to the model identifier on either the order acknowledgement or the nameplate fitted to the pump.
- 8.3.7 With that information refer to the Table 8-1 above for the correct *amount* of oil needed. The correct *grade* of oil can be found in Table 8-2 on the following page. Pour the required amount into Bearing Housing via funnel inserted into Air Breather / Filter hole. Refit Air Breather / Filter.

## GENERAL COMMISSIONING

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- 8.3.8 To ensure the correct oil level is reached, the remaining volume should be filled using the oiler bottle topping up procedure in section 8.4.
- 8.3.9 If your Magnet Coupling Size and Model is not listed in the above table, contact HMD/Kontro for further clarification.
- 8.3.10 If there are any doubts or questions please do not hesitate to contact HMD/Kontro or your local supplier.

### 8.4 Topping up Procedure via the constant level oiler

- 8.4.1 Fill Constant Level Oiler bottle with approved grade of oil and refit to the Bearing Housing. Place a thumb over the mouth of the bottle, invert, and insert into the oiler's base.
- 8.4.2 Allow the bottle to empty, which may take 15 minutes or so, then refill and repeat the procedure. Before starting the pump wait for the oil bottle to stop emptying and remain at the same level for at least 30 minutes, which indicates that the oil in the Bearing Housing has reached the correct level.
- 8.4.3 Do not try to take short cuts by topping up via the breather or constant level oiler without the bottle fitted as this may result in overfilling, resulting in oil entering the coupling housing or hot running bearings.
- 8.4.4 When the pump is running the Bearing Housing Assembly may take a further small amount of oil which may cause air bubbles to rise inside Oiler bottle. This is perfectly normal.



**CAUTION – The oiler is adjusted to fill the housing to the correct level. If changes are made to the oiler's assembly it may not fill to the right level.**

- 8.4.5 **The Coupling Housing must not be opened to atmosphere** by removing any plugs or probes fitted to Coupling Housing whilst pump is running - e.g. Temperature or VapourView® Probe (43.TC) or alternate Blanking Plug (43.50C), or Blanking Plugs 43.50 and 43.VP - as this will result in pressure differential between Coupling Housing and Bearing Housing Assembly, which in turn will cause oil to siphon from Bearing Housing Assembly into Coupling Housing, the result of which could cause pump to fail.
- 8.4.6 If Drain Valves are fitted to Coupling Housing they are required to be locked open for safety reasons. This applies to all HMD/Kontro pumps fitted with oil filled Bearing Housings unless otherwise stated by manufacturer.

### 8.5 Temperature Checks

- 8.5.1 It is generally assumed that most applications will only require mineral oil lubrication for the Bearing Housing rated to a maximum working temperature of 80°C (176°F). Even on particularly hot applications, or where Coupling Housing Assembly is fitted with a 'hot jacket', or where Pump is lagged, provided suitable spacers and thermal barriers are fitted between Bearing Housing and Coupling Housing, the temperature of the Bearing Housing should not exceed 80°C (176°F).
- 8.5.2 If in doubt, once Pump is up to full operating temperature, check the Bearing Housing surface temperature with a temperature touch probe, or use thermocouple readings if fitted to Ball Races / oil sump. If temperature exceeds 80°C (176°F) use suitable synthetic oil as listed in Table 8-2 on the next page.

**Note:** The Bearing Housing temperature must never exceed 120°C (248°F) at any time as this is the maximum continuous operating temperature of standard Ball and Roller Races, and this is the overall limiting factor for temperature. The synthetic oil listed in Table 8-2 can also be used for subzero temperatures down to -50°C (-58°F).

Table 8-2: Recommended lubricating oils

| <b>Bearing Housing<br/>operational<br/>temperature</b> | <b>Recommended lubricating oils</b>         | <b>ISO 3448<br/>Viscosity Grade</b> |
|--------------------------------------------------------|---------------------------------------------|-------------------------------------|
| 0°C to 80°C<br>(32°F to 176°F)                         | BP Energol HLP 68                           | 68                                  |
|                                                        | Castrol Hyspin AWS 68                       | 68                                  |
|                                                        | Esso Nuto H 68                              | 68                                  |
|                                                        | Esso Teresso 68                             | 68                                  |
|                                                        | Kyoseki Hydlux 68                           | 68                                  |
|                                                        | Mobil DTE 26                                | 68                                  |
|                                                        | Nisseki Super Hydrando 68                   | 68                                  |
|                                                        | Shell Tellus 68                             | 68                                  |
|                                                        | Texaco Rando HD 68                          | 68                                  |
| -50°C to 120°C<br>(-58°F to 248°F)                     | Mobil SHC 626 (or equivalent) synthetic oil | 68                                  |

## 8.6 Pump Operation

- 8.6.1 Close all drains; open the suction and discharge valves fully and allow the pump to fill with liquid. If the pump has a vent then this can be used to prime the pump casing.
- 8.6.2 On GSPV and LMV-801S pump ranges open the vent line and allow gas to vent appropriately, prior to starting the pump. Allow GSPV and LMV-801S pumps to vent until all gas has escaped and only liquid flows.



### ATTENTION

**Do not energise the motor until the pump has been completely filled with liquid.**

- 8.6.3 Check that the motor rotates in the same direction as the indicating arrow.



### ATTENTION

**!! WARNING !! Under NO circumstances should the pump be run in the reverse direction!!**

- 8.6.4 Close down the discharge valve so that it is about one quarter open. This is done to prevent excessive loading of the pump or driver when starting.



### ATTENTION

**The LMV-801S pump must never be run against a closed discharge valve.**

## GENERAL COMMISSIONING

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8.6.5 Fix your attention on the discharge pressure gauge (PG1 – see Fig. 8-2) and start the motor. The pressure should rise quickly and remain steady. If it hesitates and drops back to a lower level, even momentarily, stop the pump. The erratic pressure behaviour is a sign that air and/or vapours are being purged from the pump.

8.6.6 Wait ten to fifteen seconds and then repeat step 8.6.4 above. You may have to repeat this sequence several times before the discharge pressure goes to the correct reading and remains steady. At that time, the pump is fully primed.



### ATTENTION

8.6.7 With the pump running fully-primed, you should listen for any unusual noises. Metallic scraping sounds would be obvious signals to shut down the pump. If the pump must be dismantled to locate the source of these noises, refer to section 14.1.3.

8.6.8 If the pump emits a rumbling noise from the casing end, the problem is cavitation. Cavitation is the formation of vapour bubbles in the eye of the impeller and their subsequent collapse within the pump. Cavitation is usually due to inadequate NPSH available. Stop the pump and check there are no obstructions in the suction pipework system. Recheck the NPSH available and ensure that this is at least 0.5 metres greater than the pump requires.



### ATTENTION

8.6.9 Do not continue to run the pump under cavitating conditions.

8.6.10 Call the system designer to check the calculations.

8.6.11 When the cause of the cavitation is established and corrected, continue the commissioning.

8.6.12 The differential pressure should now be checked by subtracting the suction pressure gauge reading from the discharge pressure gauge reading and the answer is the differential pressure in absolute terms.

8.6.13 This pressure should then be converted to metres head of liquid taking into account the specific gravity of the liquid.

8.6.14 When the head has been calculated, it should be compared with that stamped on the pump nameplate. Any variation should be investigated.

8.6.15 All of these startup steps and checks can be made in a relatively short time. The only remaining requirement is to monitor for particles or debris content in the pumped liquid over a period of time. Some systems will only require twenty-four hours of monitoring whilst others may need much more. The actual time required depends on the pumped liquid & the process conditions.



### ATTENTION

8.6.16 Check the pressure drop across the start-up filter (PG3-PG2) continually. Under NO circumstances should PG2 be allowed to drop to the point where the NPSH available at the suction flange drops below required level. The danger pressure should be known before commissioning. (Fig. 8-2) is system related.

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**GENERAL COMMISSIONING**

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- 8.6.17 When the pressure drop (PG3-PG2) increases, the temporary screen is becoming clogged with particles and should be cleaned out. This will require closing down the discharge and suction valves to isolate the pump and screen. After the strainer has been cleaned and re-installed, the pump will have to be primed just as on initial start-up. (Fig. 8-2).
- 8.6.18 Examine the debris and/or particles removed from the strainer each time it is cleaned. The strainer contents should be foreign matter to the process and it will take longer and longer for the strainer to clog up. If no new debris shows up for a reasonable period of time then the temporary strainer and pressure gauge PG3 can be removed. (Fig. 8-2).
- 8.6.19 If the temporary strainer keeps clogging up at a relatively even pace and the clogging material is process-orientated particles, such as undissolved crystals, "high boiler" compounds or other entrained particles which are expected to continue forming in the pumped liquid, some permanent modification to the pumping system may be required.
- 8.6.20 If the temporary filter continues to become clogged, it would be a good time to review the problem with HMD/Kontro. To be of greatest assistance to you at the time we would like to know: -
- a) The chemical composition of the solids
  - b) The percentage weight concentration
  - c) The size of the largest particles involved
  - d) The relative hardness of these solids

The more we know about the problem, the better our chances of suggesting a permanent solution to the problem.

**SECTION 9 : COMMISSIONING HOT OIL PUMPS****9.1 Precautions**

The pumping of Hot Oil is one of the most successful applications for HMD/Kontro Magnet Drive Sealless Pumps due to the excellent lubricity of heat transfer medium even at high temperatures. It is important to recognise three factors during the start-up, of any new installation.

- a) Due to the increase to high temperature during start up there is generally a discharge of abrasive particulate into the system in the form of weld slag and pipe scale.
- b) Any heat transfer oil that has been stored or static at low temperature for a period of time will have absorbed moisture. This moisture will be liberated as steam during start up and if attention is not paid to the purging of the system, the result will be that vapour gets locked into the pump and consequential damage to the pump bearings may reduce the pump life.
- c) During cold starting the pumped oil may be extremely viscous. If the pump is started against an open system the power required, may exceed that of the motor and overload the magnetic coupling causing damage.

All of these potential problems can be overcome by simple precautions.

**9.2 Abrasive Particulate**

It is possible for a pump to be damaged within a week or two of being commissioned, mainly due to the rapid deterioration of its internal bearings, weld slag being the most common offender. Customers are always reluctant to admit the presence of abrasive particulate because most have been assured by contractors that the system has been purged. Although this may well be true, weld slag is difficult to remove by flushing the system and breaks away as pipework expands with increasing temperature. In many instances a filter on the suction side of the pump becomes essential and although not necessarily a permanent requirement, it may be needed for several weeks.

**9.3 Moisture**

Although every effort has been made to exclude moisture, this can enter a system through:-

- \*\* Contaminated oil
- \*\* Pockets of moisture retained within the system following flushing or hydraulic testing
- \*\* Condensation

Vapour locking – would normally be indicated by wild fluctuations or sudden drop in delivery gauge readings and usually become evident when system temperature reaches 140-150°C. Careful throttling of the discharge valve can be helpful in dispersing vapour but care must be exercised to ensure that the flow to boiler is not restricted by too much for too long, as this would activate the low flow control and result in the boiler being extinguished.

Whenever traces of vapour become evident it is necessary to vent the system much the same as a domestic radiator is vented to expel air.

Usually, on a hot oil system, a small valve is positioned at a high point for this purpose but extreme care should be exercised because of the high temperatures involved.

**9.4 Viscous Start Up**

Many oils are extremely viscous on start-up and it will be necessary to manually throttle flow during the warm up period to avoid motor overload, but also to avoid magnetic drive overload. The magnetic coupling fitted to the pump is rated to give maximum efficiency at full operating temperature. In the case of Torque Ring Drive magnetic couplings this will result in additional slippage between the inner and outer rotor. In some instances such as low ambient temperature or high liquid viscosity, this slippage could become excessive and cause damage.

## COMMISSIONING HOT OIL PUMPS

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**This can simply be avoided by throttling the discharge valve back during start up (good practice for all centrifugal pumps) and carefully observing the power drawn by the motor, ensuring that this does not cause an overload. As the system heats up the discharge valve can be progressively opened.**

In the absence of pressure gauges a Wattmeter may also be used to detect pump vapour locking which would be characterised by a drop in power consumed.

We strongly advise that pressure gauges be fitted to both suction and delivery of the pump.

Gauge readings showing a steady differential are a positive indication that the pump is performing satisfactorily. They also give a warning of any system upset.

### 9.5 Hot Start Up

If a cold stand-by pump is to be brought on line, it is good engineering practice to allow the pump to be brought up to temperature over a reasonable period of time. This can be done by opening the discharge valve to 50% and the suction valve to approximately 5%. This small opening will allow hot oil to enter the pump gradually and slowly warm the pump up to the operating temperature. The warm up period will take approximately 30 minutes / 50°C of operating temperature.

If the above precautions are taken the pump will give many years of trouble free service.

If the pump is jacketed for high temperature operations, ensure the lubricating oil temperature in the power frame does not increase significantly, as this will cause the lubricating oil to degrade.

## SECTION 10 : COMMISSIONING GSPV & LMV-801S PUMPS

### 10.1 General

The GSPV and LMV-801S pumps are vertical in-line type pumps and are normally close coupled to the drive motor. Prior to initial start-up, special attention must be given to both checking the direction of rotation and to venting any trapped air from the pumps.



#### ATTENTION

The LMV-801S pump must never be run against a closed discharge valve.

### 10.2 Venting

#### Purpose

Internal rotating parts are supported by plain bearings that are lubricated with the liquid being pumped. It is imperative that all internal bearings are immersed in the pumped liquid before the pump is run for the first time after installation or maintenance. Proper venting of the pump will ensure all bearings are flooded and ready for start-up.

#### Method

The following method for venting can be used for all GSPV and LMV-801S pumps.

- Open both suction and discharge lines to flood pump
- Wait 5 minutes
- Open the vent line to purge air, close vent line
- Wait 5 minutes
- Open vent line a second time to purge remaining air, close vent line

Pump is now ready for direction of rotation check.

- On pump start-up check that discharge head is within expected operating range. If discharge head is lower than expected, vent pump once more.

### 10.3 Direction of Rotation

Ensure pump is full of liquid prior to checking direction of rotation – Never run the pump dry, even briefly to check rotation.

- Fill pump with liquid and vent as above
- Connect motor terminals to power supply
- Remove motor cowl to observe motor fan
- Check direction of rotation labelling on pump
- Briefly energise motor to check direction is correct
- If direction is wrong, swap over two phases on the terminal block
- Re-check direction
- Replace motor cowl

Pump is now ready for start-up providing the proper venting procedure has been carried out.

Refer to section 8.6 for Pump Operation.

## COMMISSIONING GSPV & LMV-801S PUMPS

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### SECTION 11 : OPERATING GUIDELINES



ATTENTION

#### 11.1 Precautions

The simple precautions required under operating conditions are as follows: -

##### 11.1.1 DO NOT RUN THE PUMP DRY

Dry running the pump will cause the pump shaft bearings to lose lubrication flow resulting in premature wear and failure, which can occur in minutes. To guard against this a Power Control Monitor (PCM) can be supplied by HMD/Kontro.

##### 11.1.2 DO NOT RUN THE PUMP CONTINUOUSLY WITH THE DISCHARGE VALVE CLOSED

The power required by the impeller does not decrease to zero, as the flow reduces to zero. Consequently the power delivered to the impeller heats the pumped liquid which can overheat and vaporise. If the liquid vaporises, then lubrication of the bearings will be lost causing premature wear and failure.

##### 11.1.3 DO NOT ALLOW THE PUMP TO CAVITATE

Piping changes, process temperature, changes in the level of liquid in the suction supply tank can change the NPSH available resulting in cavitation. Cavitation will damage any pump severely in a short period of time.

##### 11.1.4 PUMPS IN PARALLEL

Should two pumps be supplied to operate in parallel, to meet a specific duty. It is essential that extreme care be taken in controlling the flow rate of any one of the two pumps in the eventuality that the second pump is stopped. Without careful control of the flow rate of the operating pump, then this pump will experience a very low system resistance and as a result will operate at a significantly higher flow rate than that specified, leading to bearing failure and/or cavitation problems.

##### 11.1.5 INSUFFICIENT AND EXCESSIVE FLOW

The pump should not be operated below its specified minimum safe flow rate due to excessive loads and increased heat input into the pumped liquid, leading to bearing failure.

The pump should not be operated at flow rates significantly in excess of those specified. This will lead to high bearing loads, low differential head and cavitation resulting in subsequent pump damage. HMD/Kontro should be consulted for advice on maximum flow limits.

##### 11.1.6 SUCTION TANK

It is essential that good practice be observed in the design of suction pipework and vessels to ensure sufficient submersion of the pipework is maintained and that air entrainment and vortices are not present.

##### 11.1.7 OVER PRESSURE

It is essential that the pumping system is not over pressurised and that the discharge pressure of the pump does not exceed the design rating of the equipment.

##### 11.1.8 HIGH TEMPERATURE

It is essential that the temperature of the system, to which the pump is connected, is monitored accurately and that the pump does not experience temperature excursions that exceed the rating of the equipment.

The continuous operating temperature for pumps with a ZeroLoss shell is 120°C.

**ATTENTION****11.1.9 THERMAL SHOCK**

Pumps should not be subject to thermal shock unless specifically designed for this, because this may lead to premature failure of the internal bearings. In general pumps should not be heated or cooled at a rate greater than 10°C per minute.

**11.1.10 JACKETS**

If the pump has been fitted with heating jackets or trace heating it is essential that this jacket be heated to its operating temperature and that the pump has been given sufficient time to increase the product temperature to the correct value prior to starting the pump.

**11.1.11 LOW AMBIENT TEMPERATURE**

Care should be taken when starting pumps after they have been subject to excessively low ambient temperature, due to the possibility of frost forming on the outer magnet ring and rolling element-bearing races. This could be sufficient to prevent the pump starting and leading to motor overload or magnet coupling disengagement & subsequent damage.

**11.1.12 NON RETURN VALVES**

Care should be exercised in the fitting of non-return valves to discharge pipework as this may prevent correct venting of the pump prior to start up.

**11.1.13 STAND BY PUMPS**

These should be primed fully then left with the line valves closed to prevent process debris accumulating and causing blockages.

**11.1.14 APPLICATIONS**

The equipment should only be used for the application(s) for which it was supplied. Use of this equipment on applications with a significantly different specific gravity, vapour pressure or specific heat could lead to pump failure.

**11.1.15 MOTORS**

The equipment should only be used with the motor specified at time of order. The motor frame size should not be changed without prior approval from HMD/Kontro.

**11.1.16 REMOVAL OF PROTECTION DEVICES**

No protection device such as condition monitoring equipment, or guards supplied by HMD/Kontro should be removed from the equipment without prior approval.

**11.1.17 MODIFICATION TO PARTS**

The user should, under no circumstances, modify parts or use parts other than those manufactured by HMD/Kontro. HMD/Kontro employ rigorous design, Quality and inspection techniques and the use of unapproved components may invalidate warranty conditions and seriously compromise safety.

**11.1.18 SOLIDS**

It is essential that this pump is not operated with the solids greater than that specified at time of order as this could lead to blockage of internal flow passages and the wearing of components.

**11.1.19 DEBRIS**

Suction strainers should be used during commissioning of new plant to ensure that commissioning debris does not enter the suction of the pump.

## COMMISSIONING GSPV & LMV-801S PUMPS

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### ATTENTION

#### 11.1.20 FILTER SYSTEMS

If filter systems and cooling flow pipe valves are fitted it is essential that:

- i. The filter is cleaned regularly to ensure sufficient flow is present.
- ii. All valves are open and no restrictions to flow are placed in the cooling loop.

#### 11.1.21 VENTING

The pump and associated pipework should be fully vented prior to running to ensure no gas is present at the suction of the pump.

#### 11.1.22 COMMISSIONING

Care should be exercised in commissioning a pump with a significantly higher specific gravity liquid (>20%) than that specified for the product. If in doubt consult HMD/Kontro.

#### 11.1.23 ROUTINE STARTING OF THE PUMP

This should be carried out with the pump primed fully, the suction line valve open fully and the discharge line valve approximately one quarter open.

#### 11.1.24 MOUNTING

Pumps and base plates must be located in accordance with HMD/Kontro's recommendations. It is essential that these components be securely mounted to prevent movement.

#### 11.1.25 COUPLINGS

Care should be exercised in aligning the pump drive shaft coupling to ensure that runout is minimised with the pump at operating temperature.

#### 11.1.26 DIRECTION

It is essential that the pump is only run in the direction specified by HMD/Kontro. Failure to do this may result in excessive heating of the product and subsequent damage to the pump.

#### 11.1.27 VIBRATION

Resonance of the pump assembly during operation should be avoided. Pump assembly resonance may result from structural piping vibrations or be due to the rotational frequency of the pump and motor (see also section 13.2).

#### 11.1.28 NOZZLE LOADS

Pumps should not be subject to excessive nozzle loads as this may lead to casing failures and misalignment of couplings. For the maximum allowable nozzle loads for a specific pump model contact HMD/Kontro.

#### 11.1.29 LUBRICATION

Pump lubrication shall use the correct grade of oil at the scheduled intervals. Care shall be taken to prevent contaminants and moisture from entering the oil and causing premature bearing failure.

#### 11.1.30 PUMP DRIVE END BEARINGS

On separate motor units the bearings are either grease or oil lubricated as standard. Re-lubrication should be carried out every 1500/2000 hours with Shell Alvania RA Grease (Aeroshell 7 Grease for sub-zero service). Oil lubricated bearing assemblies, use Castrol Hyspin AWS 68 Oil, or approved equivalent, which should be changed every 4000 hours or more frequent intervals in hot conditions.

#### 11.1.31 MOTOR BEARINGS

The motor bearings shall be greased in accordance with the bearing re-lubrication instructions issued by the motor manufacturer.

## SELF-PRIMING PUMPS FOR TANKER OFF-LOADING

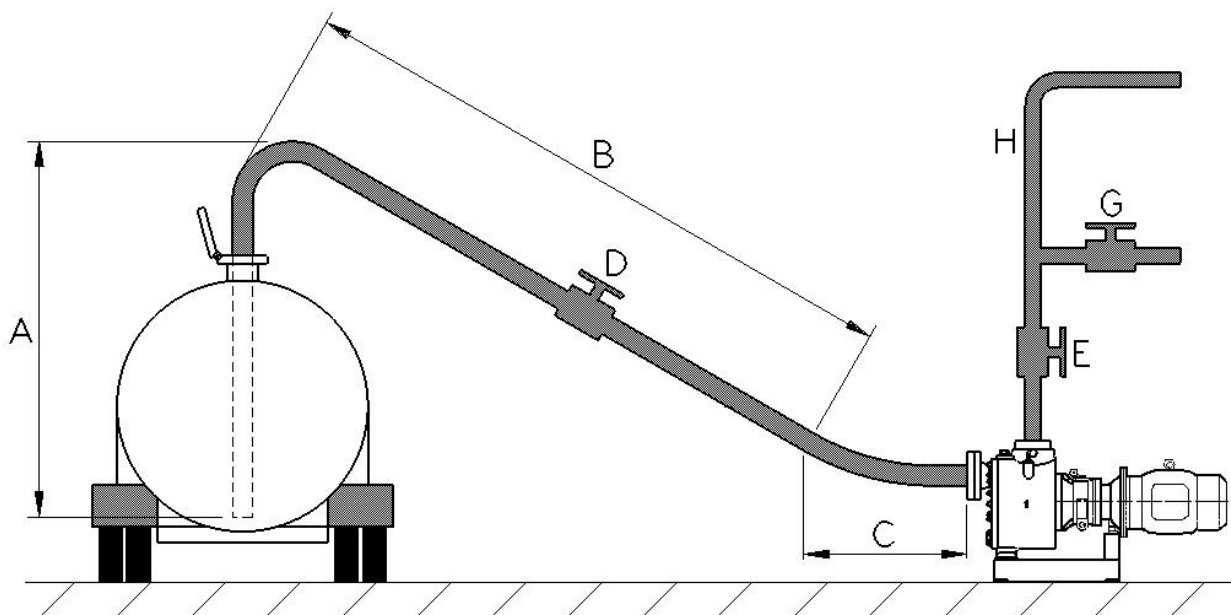
### SECTION 12 : SELF PRIMING PUMPS FOR TANKER OFF LOADING

#### 12.1 Tanker Off-Loading Illustration

Table 12-1

| SUCTION LINE                                                | DISCHARGE LINE                                                                                                                                   |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| A TO BE KEPT SHORT AS POSSIBLE                              | E FULL BORE ISOLATING VALVE                                                                                                                      |
| B TO BE AS SHORT AS POSSIBLE AND TO SLOPE AS SHOWN          | G INITIAL PRIMING POINT                                                                                                                          |
| C TO BE AT LEAST 10 TIMES PIPE DIAMETER FROM SUCTION FLANGE | H DISCHARGE LINE TO BE OPEN ENDED AND CONTAIN NO 'U' BENDS OR DEAD LEGS TO TRAP PRODUCT. WHEN PRIMING AIR MUST BE ABLE TO ESCAPE ALONG THIS LINE |
| D FULL BORE ISOLATING VALVE                                 |                                                                                                                                                  |

Fig. 12-1



#### 12.1.1 This section contains additional notes for the installation and operation of HMD/Kontro SEALLESS SELF PRIMING PUMPS.

No centrifugal pump has an inherent ability to 'suck'. These pumps are primarily for handling liquids and are very poor air movers.

A pump is primed when the casing and suction lines are filled with liquid. On installations where the supply vessel is above the pump, these are filled by gravity. When the supply vessel is below the level of the pump, it is still possible to operate the pump provided a foot valve fitted to the suction line to ensure that the suction line and casing remain full of liquid. In the event of an operational mishap, it is then necessary for special arrangements to be made to refill the line.

#### 12.1.2 To avoid problems of this type, a self-priming pump can provide the answer. It provides an automatic means of priming the pump and, if it becomes air locked, it will re-prime itself.

## SELF-PRIMING PUMPS FOR TANKER OFF-LOADING

NOTE THAT WHEN THE PUMP IS INSTALLED AND COMMISSIONED INITIALLY IT MUST BE FILLED COMPLETELY WITH LIQUID FROM AN OUTSIDE SOURCE. SELF-PRIMING ACTION IS POSSIBLE ON ALL SUBSEQUENT RE-STARTS, PROVIDING THE PUMP IS INSTALLED AND OPERATED IN ACCORDANCE WITH THE INSTRUCTIONS IN THIS SECTION.

- 12.1.3 The self-priming action consists of the liquid in the pump being recirculated continually. During the recirculation, air is drawn from the suction pipe, through the impeller and out through the discharge pipework. As air is expelled from the suction line, atmospheric pressure pushes liquid up the suction line to take its place. When all the air has been removed from the suction line, the liquid will enter the pump casing and full pumping will start.
- 12.1.4 It should be remembered that these pumps are primarily designed to convey a liquid and are, therefore, not an efficient air handling machine. For this reason particular attention should be given to the pump installation to limit the amount of air that the pump will be required to evacuate. The suction lift and the volume of the suction line should be kept to minimum and all joints should be made airtight. Since the pump cannot push air through the discharge line against pressure, this line should not include check valves, closed valves, or any loop that might trap liquid that could act as a check valve.
- 12.1.5 On tanker off-loading duties, it should be remembered that the tanker vapour space should be vented or connected to vapour space of the discharge vessel to prevent a vacuum being created in the tank which would prevent liquid being drawn out.
- 12.1.6 When large volumes of air have to be evacuated from the suction piping, the priming time may become so extended that the liquid recirculating within the pump becomes hot enough to vaporise. When this happens, the priming action ceases and the priming chamber has to be refilled with liquid.



### ATTENTION

- 12.1.7 When the pump is first installed record the priming time. This should be checked at frequent intervals to monitor pump systems performance. Any noticeable increase in priming time indicates that the pump system should be checked for faults.
- 12.1.8 The maximum lift that can be tolerated depends upon the specific gravity and vapour pressure of the liquid being handled. Heavy liquids will not be forced as high in the suction line by atmospheric pressure as will light liquids. Therefore, the maximum lift is lower for those heavy liquids. High vapour pressure liquids will tend to vaporise as they reach the areas of greatest vacuum and maximum lift for these liquids is therefore reduced.
- 12.1.9 With Sealless Pumps, vaporising would result in the pump bearings running dry. For this reason thermal cut-outs can be provided for protection for the pump should the liquid pumped be known to pose such problems.
- 12.1.10 The recommended pipework installation is shown in Fig 12-1.
- 12.1.11 For pump protection devices refer to SECTION 6.

**SECTION 13 : MAINTENANCE AND SERVICING****13.1 Maintenance Schedule**

The timing for maintenance of the HMD/Kontro Sealless pump is established primarily by the liquid end bearing bush system. The time span is longer than for a “canned motor” pump because it has over four times the bearing bush wear allowance. It will outlast mechanical seals because it is more tolerant of solids and because the product of the pressure and surface velocity (PV) values of the bearing bush system are much lower than the PV values of seal faces in the mechanical seal. Despite these conservative design advantages, the bearing bush system can develop some wear over a period of time, depending on the application.

It is possible to avoid the effects of excessive bearing bush wear by the use of planned maintenance based on experience on the particular application involved. This will avoid breakdown situations arising due to unmonitored wear causing pump failure by contact between other rotating and stationary parts of the pump liquid end. It is suggested that after initial commissioning, the pump should be inspected after six months to establish the future maintenance periods by comparison of the running clearances with the “as new” dimensions.

**13.2 Vibration Levels**

An indication as to the condition of pump can be ascertained by recording the vibration level of the pump and comparing them to level that would be expected when the unit is new. The following table indicates typical levels of vibration that can be expected during operation at the conditions indicated on the pump label:-

Table 13-1

| Pump Prefix      | Magnet Coupling Size | 4 Pole Speeds<br>mm/sec - rms | 2 Pole Speeds<br>mm/sec - rms |
|------------------|----------------------|-------------------------------|-------------------------------|
| GTI & GTA        | CA                   | 2.8                           | 4.5                           |
| GSI, GSA & GSS   | CA, DA, EA           | 2.8                           | 4.5                           |
| CSA & CSI        | DB, EB               | 4.8                           | 4.8                           |
| GS, GSP & GSP ZL | DA, EA, FA, GA       | 2.8                           | <3                            |
| GSPV & GSPLF     | DA, EA               | 2.8                           | <3                            |
| CS               | C, D, E, F           | 2.8                           | 4.5                           |
| SPGSI & SPGSA    | CA, DA               | 2.8                           | 4.5                           |
| HPGSI & HPGSA    | CA, DA, EA           | 2.8                           | 4.5                           |

Note: Vibration measurement is not a practical means of detecting internal abnormalities. The internal rotating parts are supported by the containment shell and the shaft support, which has a dampening effect. The shaft is stationary. Vibration measurement showed about 0.5 to 2.3 mm per second. The outer magnet and motor account for the largest part of the vibration measurable at the surface of the pump.

## MAINTENANCE AND SERVICING

---



### ATTENTION

### 13.3 Dismantling

Before starting to dismantle a pump all relevant and appropriate safety precautions must be taken, particularly if the pumps have been handling hazardous or toxic liquids. Consult CoSHH and Material Safety Data Sheets (MSDS). IF YOU HAVE ANY DOUBTS, SEEK ADVICE FROM YOUR SAFETY OFFICER OR THE LIQUID MANUFACTURER.

Obey the following rules: -

- \*\* Always wear adequate Personal Protective Equipment (PPE) when dismantling pumps that have been used to pump toxic or hazardous products. This should comprise clothing, eye and gloved hand protection as a minimum. Breathing apparatus may also be necessary.
- \*\* Always isolate the pump electrically before dismantling. Ensure that the electrical switch gear cannot be operated whilst any work is being carried out on the pump.
- \*\* Always drain the pump casing of product before removing the pump from its associated pipework.
- \*\* Flush out the pump casing and shroud with a compatible flushing liquid and drain away to a safe area.
- \*\* Check with your process engineers to see if any special decontamination procedures have to be followed before working on the pump.
- \*\* All pumps returned to HMD/Kontro for factory servicing must be decontaminated and labelled in accordance with the HMD/Kontro Return Material Authorisation (RMA) procedure.

These safety precautions are to be taken in addition to any formal safety procedures specified by your Company and do not supersede, change or absolve you from your statutory duties under current Government legislation. Our recommendations are based on our current experience. If in doubt or you need to know our latest recommendations – you must contact HMD/Kontro Sealless Pumps.

## SECTION 14 : FAULT FINDING

### 14.1 Flowcharts

- 14.1.1 This section is intended to highlight possible pump problems caused by system design inadequacies or incorrect operation.
- 14.1.2 Because the Sealless pump impeller is not coupled directly to the electric motor, it is inherently quiet so that any increase in noise is a good indication that there is a problem.
- 14.1.3 Should it be necessary to dismantle a pump, please read through the dismantling instructions carefully (see section 13.3).
- 14.1.4 No special tools<sup>1</sup> are required to dismantle an HMD/Kontro pump and no special skills are required as the pump is simple in design and robust in construction.
- 14.1.5 Refurbishing is by replacement and no attempt should be made to repair pump components by welding and re-machining.
- 14.1.6 Clearances between the rotating components in the pump are comparatively large, so care must be taken not to scrap components before checking that the clearances are excessive.



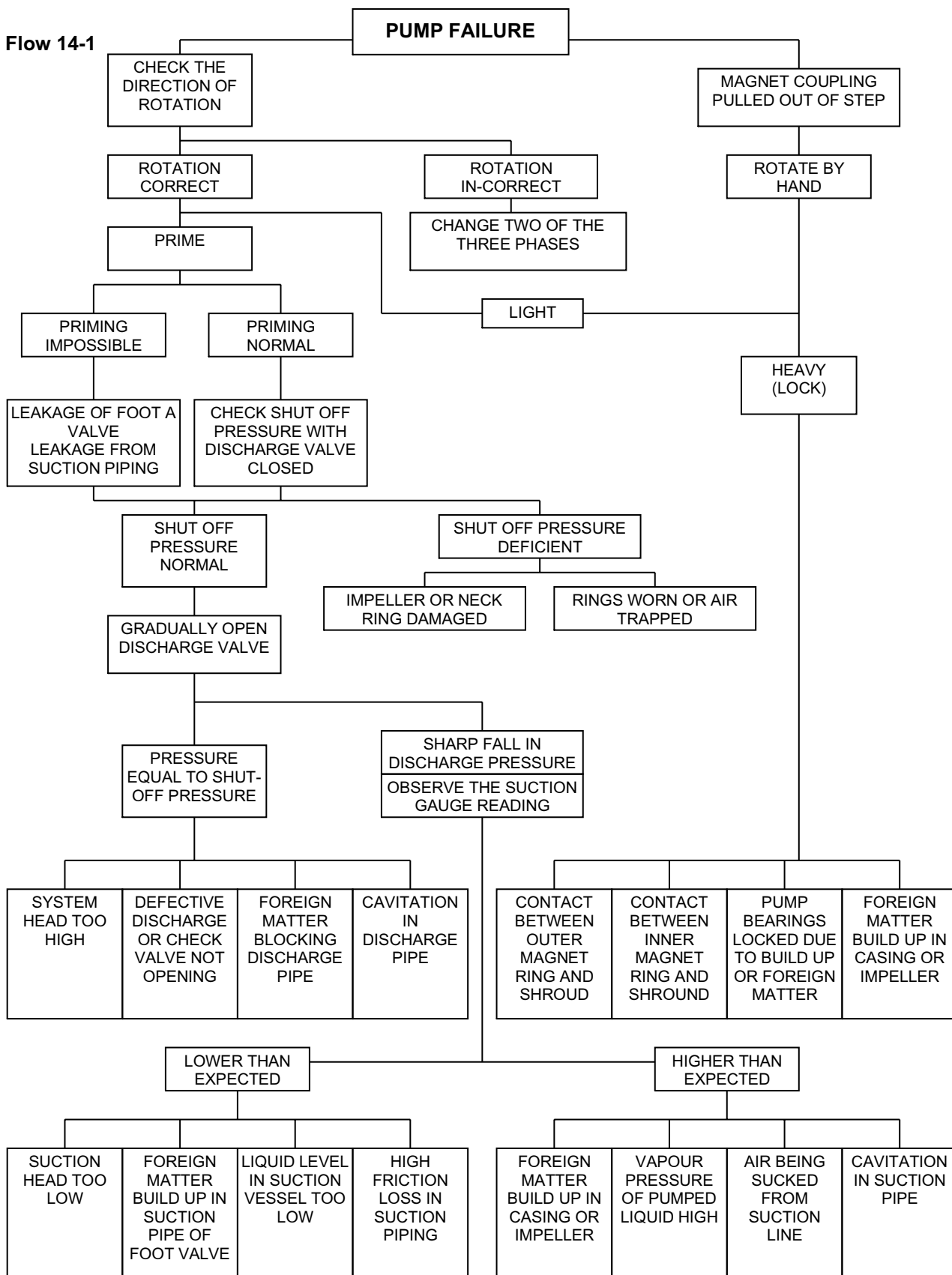
|           |
|-----------|
| ATTENTION |
|-----------|

- 14.1.7 In the event that the magnetic coupling is pulled out of step, then **the motor must be stopped IMMEDIATELY** because continuation of running will damage the magnets.

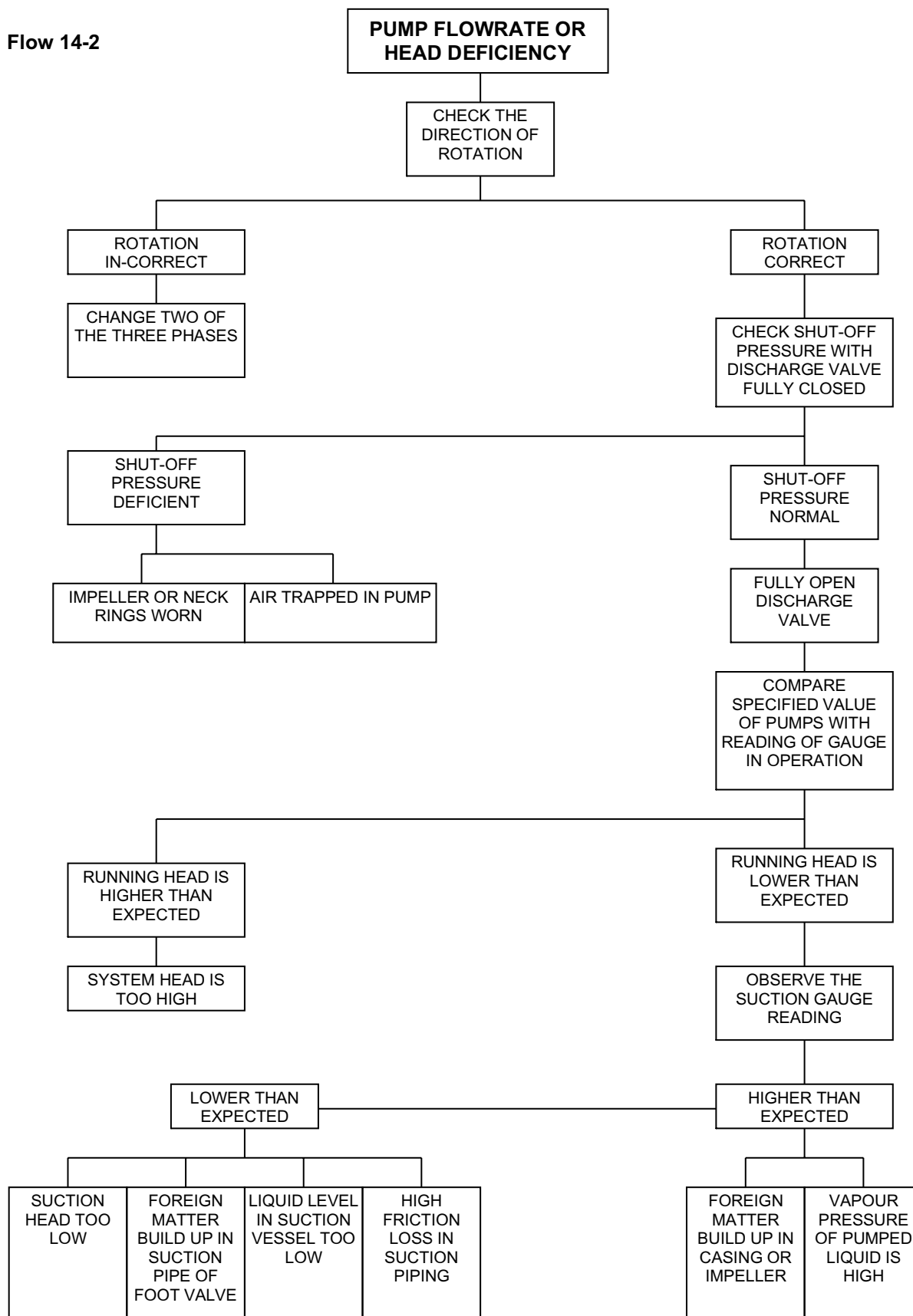
For further information on fault symptoms, causes and remedies consult the Fault Tree flowcharts in the following pages (Flow 14-1 to 14-4).

<sup>1</sup> Some custom engineered products may require the use of a (HMD/Kontro supplied) special tool.

## FAULT FINDING

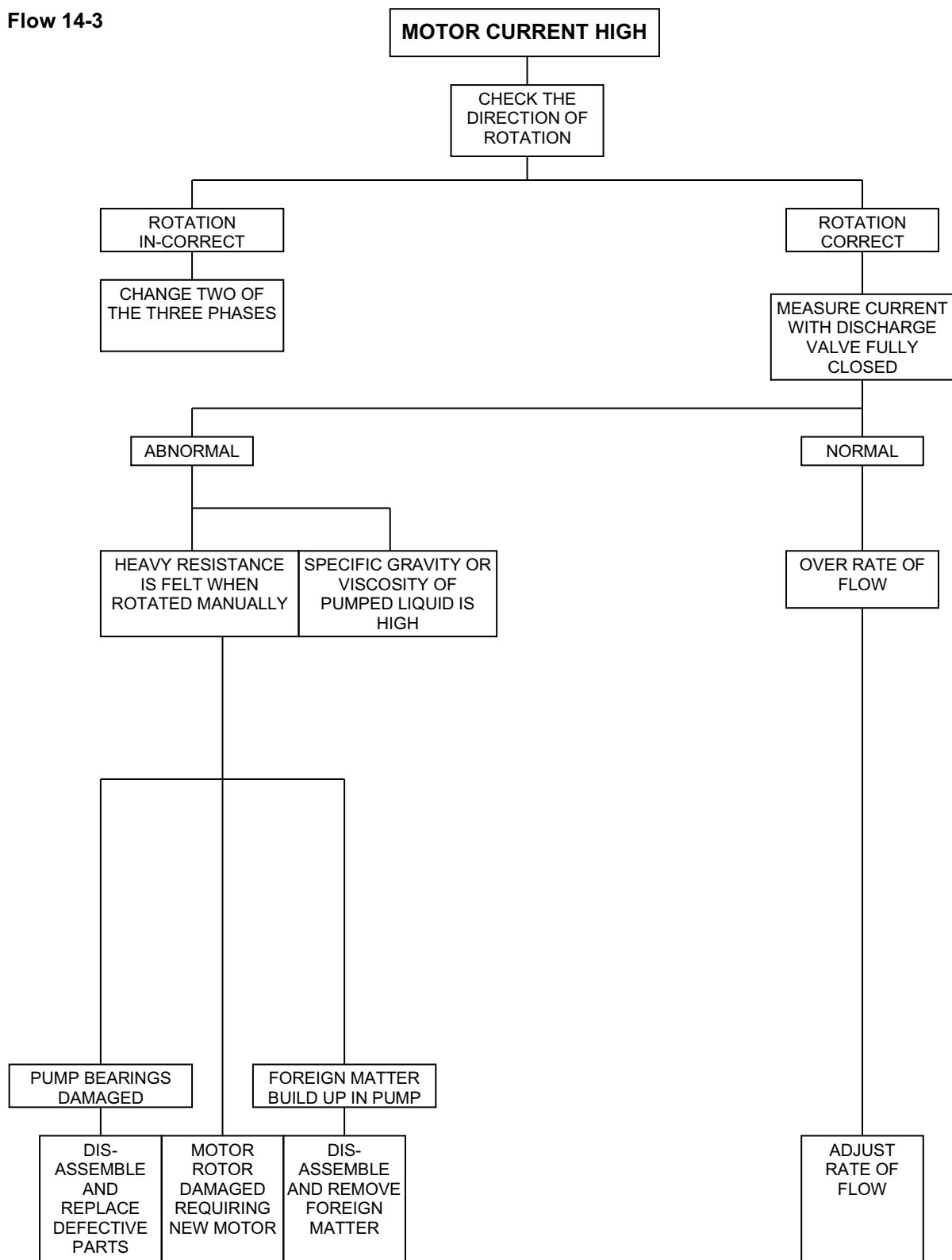


Flow 14-2

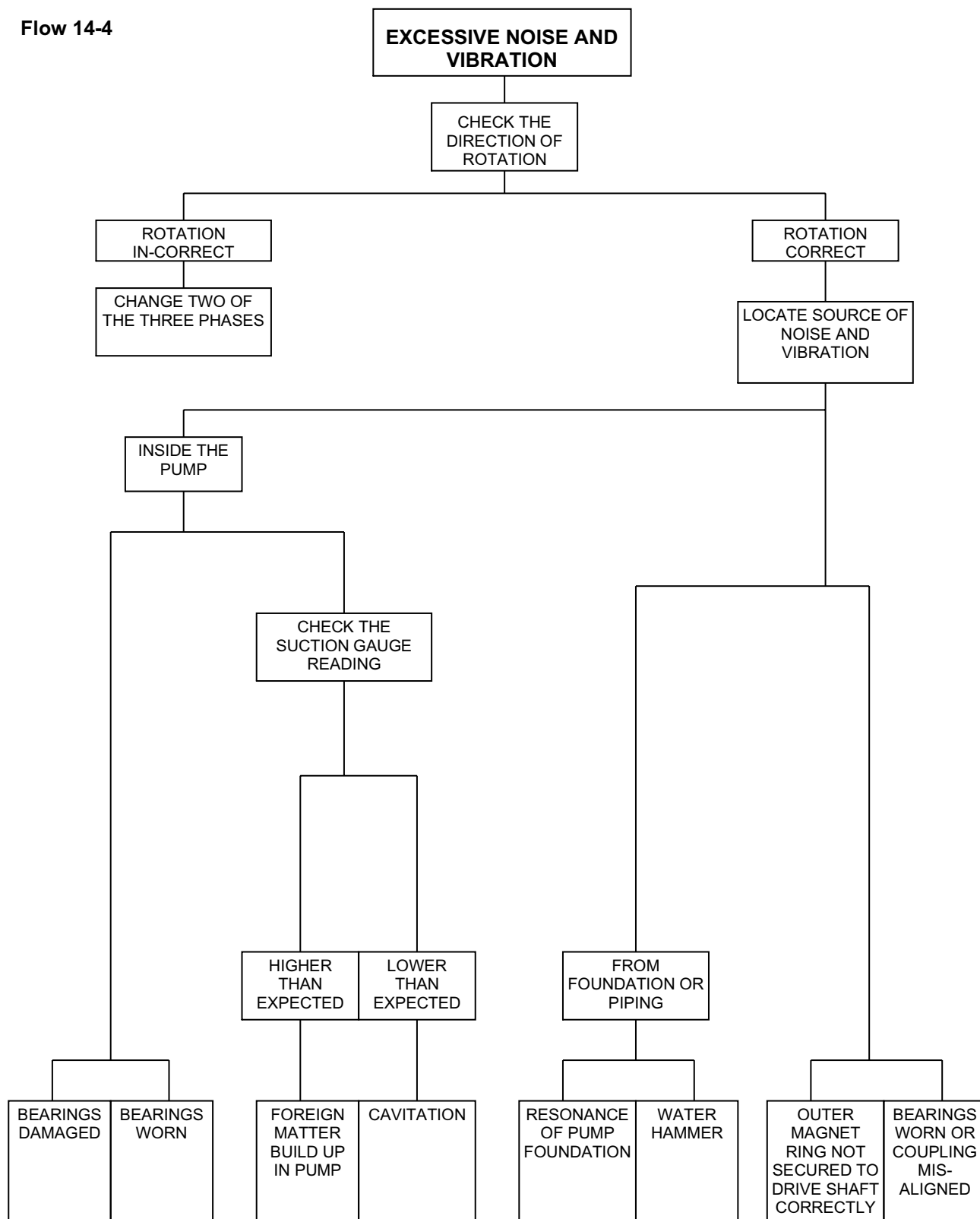


## FAULT FINDING

Flow 14-3



Flow 14-4



**Quality Assured to ISO 9001 since 1986, for the design, manufacture and repair of SEALLESS pumps, drives and packaged pump assemblies.**

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**HMD Kontro**



**GLOBAL STRENGTH,** *powered by people.*



**Sundyne HMD Kontro**  
**Sealless Pumps**

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## **MAINTENANCE INSTRUCTIONS FOR PUMP RANGE GS Frame 1**



**Separately Mounted**



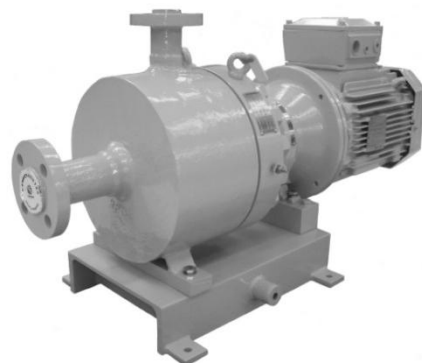
**Close Coupled**



**Centreline Mounted**



**Vertically Oriented**



**High Pressure**

Quality Assured to ISO 9001 and  
BS5750 since 1985 for the  
Design, Manufacture and Repair  
of SEALLESS Pumps and Drives



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Issue. 1.9

Ref. GS1MI0613



## **European Union Machinery Directive (CE Mark System)** (where applicable)

This document incorporates information relevant to the Machinery Directive 2006/42/EC. It should be read prior to the use of any of our equipment. Individual maintenance manuals which also conform to the EU Directive should be read when dealing with specific models.

### **Disclaimer**

HMD / Kontro SEALLESS Pumps manufactures sealless pumps to exacting International Quality Management System Standards (ISO 9001) as certified and audited by Lloyd's Register Quality Assurance Limited. Genuine parts and accessories have been specifically designed and tested for use with these products to ensure continued product quality and performance. As HMD / Kontro SEALLESS Pumps cannot test all parts and accessories sourced from other vendors, incorrect design and/or fabrication of such parts and accessories may adversely affect the performance and safety features of these products. Failure to properly select, install or use authorised HMD / Kontro parts and accessories is considered misuse and damage or failure caused by misuse is not covered by HMD / Kontro's warranty. Additionally, modification of HMD / Kontro products or removal of original components may impair the safety of these products and their effective operation.

Pumps which are supplied for use in potentially explosive atmospheres (Certified EExd or EExde) are subject to third party test and certification. Use of components sourced from other vendors or re-engineered / re-manufactured will invalidate the third party certification and may result in product failure leading to damage to property and loss of life.

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### **Safety**

The following safety precautions are to be taken in addition to safety procedures laid down by your company and do not supersede, change or absolve you from your statutory duties under government legislation. Our recommendations are based on our proven experience.



A pump that is not installed, operated or maintained in accordance with HMD/Kontro's recommendations may present a hazard.



Attention must be given to the safe handling of all items. This applies to both installation and maintenance. Safe lifting practices must be observed to ensure that personal injury or damage to pump components does not occur.

Note that lifting eyes fitted to individual pieces such as pump and motor are designed to lift only this part and not the complete assembly.



HMD / Kontro pumps contain high power magnets which may, in some circumstances, affect the operation of certain types of medical implants such as pacemakers. Extreme caution should be taken by wearers of these implants when in proximity to an HMD / Kontro Sealless Pump. The

assembled pump presents no known problems, however certain internal components need to be treated with caution.



Before disassembling a pump all relevant and appropriate safety precautions must be taken. SEEK ADVICE FROM YOUR SAFETY REPRESENTATIVE OR THE MANUFACTURER IF YOU HAVE ANY DOUBTS.



Should the pumps have been used to pump toxic or hazardous products ensure compliance with COSHH and/or applicable Health and Safety legislation.



Always isolate the pump electrically before dismantling. Ensure that the electrical switch gear cannot be operated during any work being carried out on the pump. Follow applicable lock-out/tag-out procedures.



After the pump has come to a complete stop, isolate the pump by shutting off all valves controlling flow to and from the pump, and any other measures required.



All pumps returned to HMD / Kontro for factory servicing must have a decontamination certificate and the appropriate Health and Safety data sheets.



Care should be taken in assembling magnetic components due to their attraction with ferrous materials. Particular care should be exercised in assembling the inner and outer magnet ring due to the axial pull of the components. Where supplied jacking bolts should be used to prevent fingers from becoming trapped in the assembly.



Always wear adequate protective clothing and eye protection when dismantling pumps, during all process involving the use of power tools such as cleaning, grinding etc. and at all times during the assembly and disassembly of bearing components.

## Introduction

This document details the maintenance procedures to be followed in servicing GS Frame 1 Pumps, as detailed below.

The GS range is a magnetically driven centrifugal pump family with end suction and top discharge nozzles and is available in, but not limited to, the following standards (where applicable):

|      |                                           |
|------|-------------------------------------------|
| GSA  | ANSI pumps to ANSI B73.1, foot mounted    |
| GSI  | ISO pumps to ISO BS/EN22858, foot mounted |
| GSP  | API pumps to API 685, centreline mounted  |
| GSPV | API pumps to API 685, vertically oriented |

For HMD / Kontro guidance and recommendations covering pump foundation and commissioning, refer to the separate Installation & Operating Manual.

If in doubt or you need to know our latest recommendations, or for further assistance, call your nearest HMD/Kontro representative stating the pump serial number, or contact HMD/Kontro direct on:

**Telephone:** 01323 452000 (UK) +44 (1323) 452000 (Int)  
**Facsimile:** 01323 503369 (UK) +44 (1323) 503369 (Int)  
**Customer Service 24 Hour** 07966 525269  
**Email:** [pumps@hmdpumps.com](mailto:pumps@hmdpumps.com)  
**Web:** [www.hmdkontro.com](http://www.hmdkontro.com)



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| Section 7 | Neck Ring and Impeller Wear Ring Replacement | 17-18          |
| Section 8 | Assembly Instructions                        | 19-28          |
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This document must be read in conjunction with the Sectional Arrangement Drawing, Parts List, Installation Drawing and the Installation and Operating manual all contained in the Data Package supplied.



This symbol within the following sections signifies a helpful hint that will assist the user in maintaining the HMD/Kontro pump.

Instructions relevant to GSP/GSPV pumps only are shown in italics.



## Section 1: Tools Required for Maintenance

|                                                                   | <b>GSA / GSP / GSPV</b>                         | <b>GSI</b>                       |
|-------------------------------------------------------------------|-------------------------------------------------|----------------------------------|
| Spanners / Wrenches                                               | 7/16" A/F<br>1/2" A/F<br>3/4" A/F<br>1-5/8" A/F | 10mm A/F<br>13mm A/F<br>19mm A/F |
| Socket Spanner / Wrench                                           | 9/16" A/F<br>1-1/2" A/F<br>1-5/8" A/F           | 38mm A/F                         |
| Hexagonal Key                                                     | 3/16"<br>1/4"<br>7/32"<br>5/16"<br>3/8"         | 5mm<br>6mm<br>8mm                |
| Torque Wrench                                                     | 0-70 ft lbs                                     | 0-100 Nm                         |
| Soft Mallet                                                       | Yes                                             | Yes                              |
| Bearing Press                                                     | Yes                                             | Yes                              |
| Oven Suitable for 350°C (662°F)                                   | Yes                                             | Yes                              |
| Metal Blocks (75mm [3"] diameter x 25mm [1"] thick [Fig 27 & 29]) |                                                 |                                  |
| Puller or Pry Bar                                                 |                                                 |                                  |
| Levers                                                            |                                                 |                                  |
| Extension Arm                                                     |                                                 |                                  |
| Dial Test Indicator                                               |                                                 |                                  |
| <b>Note: A/F means across flats</b>                               |                                                 |                                  |

## Section 2: Equivalent Terms

To assist in global understanding the following equivalent terminology is used:

| <b>Common Terminology</b> | <b>Also Known As</b>      | <b>Common Terminology</b> | <b>Also Known As</b> |
|---------------------------|---------------------------|---------------------------|----------------------|
| Bearing Assembly          | Power Frame               | Separate Mounted          | Long Coupled         |
| Gasket                    | Joint                     | Support Gasket            | Alignment Pad        |
| Containment Shell         | Shroud                    | Shroud Temperature Probe  | Thermometer / RTD    |
| Bush                      | Radial or Journal Bearing | Spanner                   | Wrench               |
| Neck Ring                 | Wear Ring                 |                           |                      |

## Section 3: Units

Both Metric and equivalent US units are shown in this manual where appropriate. Conversion factors between units are :-

|    |    |          |   |                          |
|----|----|----------|---|--------------------------|
| °C | to | °F       | = | multiply by 1.8 & add 32 |
| mm | to | inches   | = | divide by 25.4           |
| Nm | to | lbf-ft   | = | divide by 1.356          |
| ml | to | US fl.oz | = | divide by 29.6           |

## Section 4: Engineering Data

**Table 1 : Clearances & End-floats**  
The table is for guidance only. Contact HMD/Kontro if different.

| Component                                | Diametrical Clearance<br>Max/Min |             | Wear Limits Recommended<br>for Replacement |        |
|------------------------------------------|----------------------------------|-------------|--------------------------------------------|--------|
|                                          | (mm)                             | (inch)      | (mm)                                       | (inch) |
| Front Neck Ring (3", 80mm, 65mm Suction) | 0.70/0.50                        | 0.027/0.020 | 1.16                                       | 0.046  |
| Front Neck Ring (1.5", 50mm Suction)     | 0.70/0.50                        | 0.027/0.020 | 1.16                                       | 0.046  |
| Back Neck Ring                           | 0.70/0.60                        | 0.027/0.023 | 1.16                                       | 0.046  |
| Bump Ring/OMR                            | 0.94/0.69                        | 0.037/0.027 | 1.16                                       | 0.046  |
| OMR/Shroud                               | 2.11/1.43                        | 0.083/0.056 |                                            |        |
| IMR/Shroud                               | 1.89/1.03                        | 0.074/0.040 |                                            |        |
| Sleeve/Bush                              | 0.17/0.13                        | 0.006/0.005 | 0.20                                       | 0.008  |
| End Float                                | 1.75/0.34                        | 0.069/0.013 | 2.5                                        | 0.098  |

**Table 2 : Torque Settings**

| Ref.                | Component                                                  | Torque             |        |
|---------------------|------------------------------------------------------------|--------------------|--------|
|                     |                                                            | Nm                 | lbf-ft |
| 62.63               | Drive Shaft Nut                                            | Fully hand tighten |        |
| 62.S41              | M10 or 3/8" UNC GSA/GSI Outer Magnet Ring Retention Screws | 36                 | 27     |
| 62.S11              | 1/2" UNC GSP Outer Magnet Ring Retention Bolt              | 50                 | 37     |
| 62.S11              | 5/16" UNC GSP Outer Magnet Ring Retention Screws (2 off)   | 25                 | 18     |
| 61.S42              | Front Cap Retention Screws                                 | 12                 | 9      |
| 61.S43              | Back Cap Retention Screws                                  | 12                 | 9      |
| 61.S51              | Labyrinth Retention Screw                                  | Hand tighten only  |        |
| 61.S12              | Foot Retention Screws                                      | 25                 | 18     |
| 45.N13<br>or 43.S42 | 5/16" or 8mm Motor Adaptor Retention Nuts or Screws        | 25                 | 18     |
| 45.S42              | 3/8" UNC Motor Adaptor Retention Screws (NEMA Motors)      | 30                 | 22     |
| 45.S42              | 1/2" UNC Motor Adaptor Retention Screws (NEMA Motors)      | 50                 | 37     |
| 45.N11              | Motor Retention Nuts – M10 or 3/8"                         | 30                 | 22     |
| 45.N11              | Motor Retention Nuts – M12 or 1/2"                         | 50                 | 37     |
| 45.N11              | Motor Retention Nuts – M16                                 | 110                | 81     |
| 43.S49              | 8mm or 5/16" UNC Bearing Housing Retention Screws          | 25                 | 18     |
| 43.N13              | 1/2" UNC Bearing Housing Retention Nuts                    | 50                 | 37     |
| 41.50               | Casing Drain Plug                                          | 30                 | 22     |
| 41.N11              | Casing Retention Nuts                                      | 85                 | 63     |
| 41.N11              | High Pressure 1" UNC Casing Retention Nuts                 | 350                | 258    |
| 20.S42              | Containment Shell Retention Screws                         | Hand tighten only  |        |
| 20.S41              | Bush Holder Retention Screws                               | 14                 | 10     |
| 02.36               | Inner Magnet Ring Retention Nut                            | 110                | 81     |
| 02.03               | GSP Impeller Lock Nut                                      | 50                 | 37     |

## SECTION 5

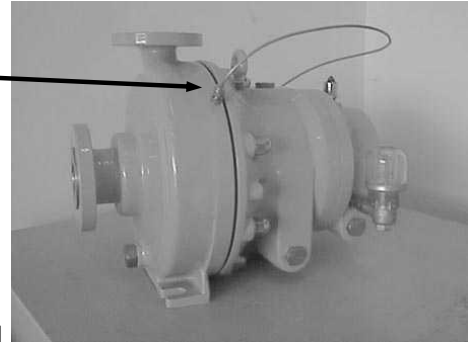
### DISASSEMBLY OF THE GS Frame 1 Pump



Refer to the Sectional/Parts List Drawing supplied with the separate data package. Component references indicated on sectional and parts list are contained in brackets ( ) in this document.

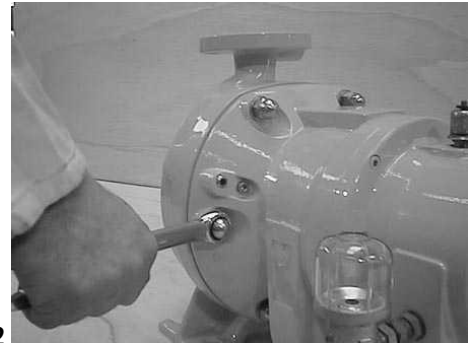
#### 5.01 Removal of Instrumentation

If a Containment Shell temperature probe is installed, ensure that it is removed prior to disassembly to avoid damage when the Casing is withdrawn. - **Fig. 1**



**Fig. 1**

#### 5.02 Remove the Casing Retention Nuts (41.N11) and the Casing Retention Washers (41.W11). - **Fig. 2**



**Fig. 2**

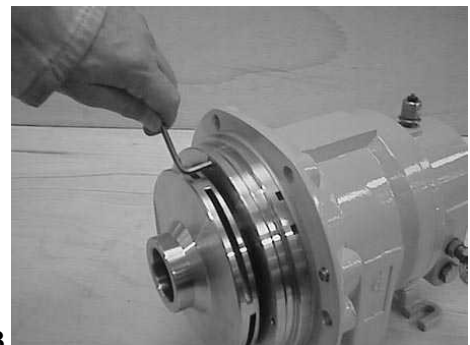
#### 5.03 Remove the Casing Assembly (41.41) (complete with external filter if fitted). If required use the Forcing-off Screws (43.S51) provided.

If Casing is to remain installed in pipework, unbolt mounting bolts and withdraw to clear the Casing.

#### 5.04 *GSP/GSPV only. Remove Impeller Nut (02.03) and Impeller Washer (02.04) and remove Impeller (06.06) complete with Front Thrust Washer (02.07) locking of Impeller may be required. Remove Front Thrust Washer (02.07) from back of Impeller.*

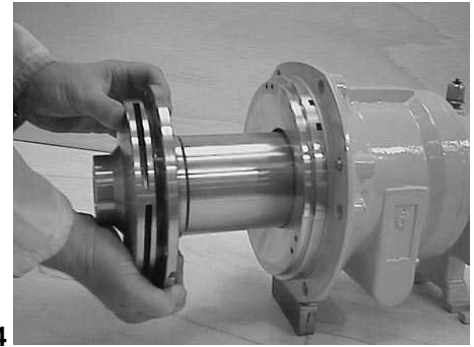
#### 5.05 Remove the three Bush Holder Retention Screws (20.S41) located behind the Impeller (06.06). - **Fig. 3**

NOTE: Some impellers have flats to allow access to Bush Holder Retention Screws.



**Fig. 3**

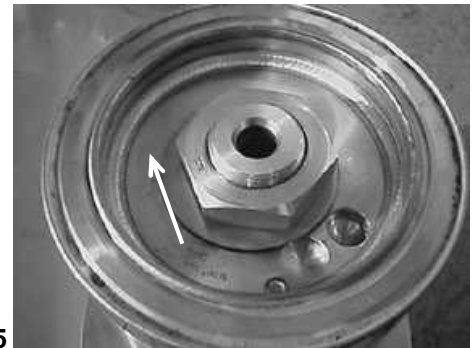
- 5.06** Slide out the internal rotating assembly from the Containment Shell (20.20). Some physical effort is required to overcome the attraction of the Inner and Outer Magnet Rings (37.37 and 51.51). - **Fig. 4**



**Fig. 4**

- 5.07** Straighten the Inner Magnet Ring (IMR) Tab Washer (02.05) and remove IMR Nut (02.36) - **Fig. 5**

Note: It is a left hand thread, and should be undone in the clockwise direction. Remove the Inner Magnet Ring. Care must be taken to ensure that the Back Thrust Washer (08.08) does not drop out.



**Fig. 5**



Do not hold or clamp IMR as this will cause permanent damage.

- 5.08** Remove Back Thrust Washer (08.08) and its Alignment Pad (08.39) from inside the Inner Magnet Ring (37.37). - **Fig. 6**



**Fig. 6**



Removal of Back Thrust Washer can be assisted by using a compressed air line and blowing around the edge of the washer to lift off from seat. Removal by force will cause damage to IMR (37.37) location.

- 5.09** Slide Shaft Assembly from Bush Holder (09.09). - **Fig. 7**



**Fig. 7**

- 5.10** Remove the rear Sleeve (02.86) and two 'O' Rings (02.OR1) from their grooves on the Shaft. - **Fig. 8**



**Fig. 8**



Rear Sleeve is best removed using a twisting action.

- 5.11** Remove the Sleeve Spacer (02.69) and remove the Front Sleeve as 5.10 (02.86), and remove the two 'O' Rings (02.OR1) from their grooves. Remove Front Thrust Washer (02.07) from its location behind the Impeller (06.06).- **Fig. 9**



**Fig 9**



Removal of Front Thrust Washer can be assisted by using a compressed air line and blowing around the edge of the washer to lift off from seat. Removal by force will cause damage to Impeller (06.06) location.

**Fig. 9A** shows the disassembled Impeller Shaft assembly

*Note: Sleeve Spacer not fitted on GSP/GSPV.*



**Fig. 9A**



If thermal ribbon RTD sensors are installed, refer to the RTD instruction manual before removing the Containment Shell. Failure to do so will damage the sensor.

**5.12** Remove the two Containment Shell Retention Screws (20.S42). - **Fig. 10**

**5.13** Remove Containment Shell (20.20) from the Coupling Housing (43.43)



**Fig. 10**

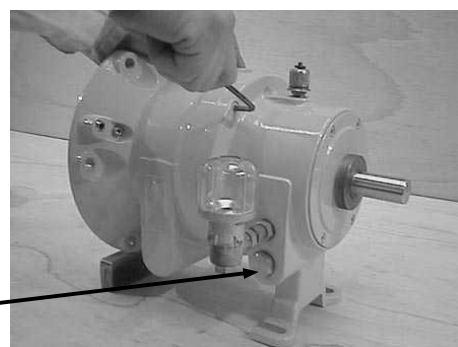
**Separately Mounted Pumps – see following pages 8-9**

**Close Coupled see Pages 9-10, GSPV pumps see Pages 11-12**

Drain oil from Bearing Assembly by removing drain plug (61.50). **Fig. 11**

**5.14** Remove the five Bearing Housing Retention Screws (43.S49). **Fig. 11**

*GSP and High Pressure models. Remove the Bearing Retention Nuts and Washers (43.N13 and 43.W14).*



**Fig. 11**

**Drain Plug**

**5.15** Remove the Bearing Assembly (61.61) complete with the Outer Magnet Ring (OMR) (51.51) from the Coupling Housing (43.43) - **Fig. 12**

Note: Forcing-off Screws (61.S52) are provided if required.

*GSP only. The Bump Ring (51.44) is fitted onto the OMR.*



**Fig. 12**

**5.16** Hold Drive Shaft (62.62) vertically in vice using soft jaws with OMR facing upwards. Remove the Outer Magnet Ring Retention Screw (62.S41) - **Fig. 13**

If required, use levers to gently loosen from location and remove Outer Magnet Ring (51.51). Care must be taken not to damage machined surfaces.

*GSP only. Release Tab Washer and remove Screw (62.S11 and 62.W11).*



**Fig 13**

- 5.17** Remove the four Front Cap Retention Screws (61.S42) and remove the Front Cap (61.67). - **Fig. 14**

Note Forcing-off holes are provided

- 5.18** Remove Front Oil Thrower (61.75).

- 5.19** Remove from vice and remove the Drive Shaft key. (62.K31)

- 5.20** Remove the Back Cap Retention Screws (61.S43) and Back Cap (61.68).

Note Forcing-off Screws (61.S54) are provided (if required). If necessary, press the Outer Labyrinth Seal (61.70B) from the Back Cap

- 5.21** Remove the Labyrinth Seal Retention Screw (61.S51) and remove the Inner Labyrinth Seal (61.70A). - **Fig. 15**

- 5.22** *GSP only. Straighten Drive Shaft Washer (62.63) and remove Nut and Washer.*

- 5.23** Using a soft mallet, gently strike the Key Way end of the Drive Shaft (62.62) until it comes out of the Bearing Assembly (61.61).

- 5.24** Press Ball Race (62.BB1) from Drive Shaft (62.62). - **Fig. 16**  
Remove Ball Race (62.BB1) from Bearing Housing (61.61).

- 5.25** Clean all the dismantled components and examine for wear or damage, any component found to be worn or damaged should be replaced with genuine spares purchased from HMD/Kontro Sealless Pumps or their authorised representatives. Replace all Gaskets and O-Rings.



**Fig. 14**



**Fig. 15**



**Fig. 16**

## Close Coupled Pumps

- 5.26** Remove the Motor Adaptor Retention Screws (43.S42) from the Coupling Housing and remove the Electric Motor complete with the Outer Magnet Ring (51.51) and Motor Adaptor Assembly (45.45). - **Fig. 17**



**Fig. 17**

- 5.27** Remove the Outer Magnet Ring retention screw (62.S41) - **Fig. 18**



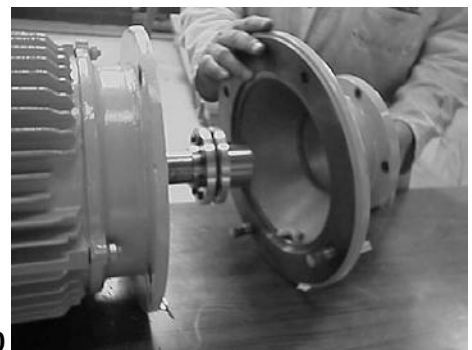
**Fig. 18**

- 5.28** If required use levers to gently loosen from location and remove Outer Magnet Ring (51.51). Care must be taken not to damage machined surfaces. - **Fig. 19**



**Fig. 19**

- 5.29** Remove the Motor retention fasteners (45.S42) and separate the Motor Adaptor (45.45) from the Motor. - **Fig. 20**



**Fig. 20**

- 5.30** Progressively loosen all the bolts on the Shrink Disc Coupling. (52.82) to avoid distortion. - **Fig. 21**



**Fig. 21**

- 5.31** Slide the Shrink Disc Coupling (52.82) off the Drive Adaptor (52.52) towards the motor. - **Fig. 22**



**Fig. 22**

- 5.32** Slide the Drive Adaptor (52.52) from the Motor Shaft and remove the Shrink Disc Coupling (52.82). - **Fig. 23**

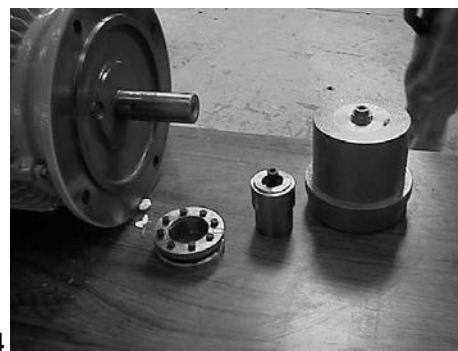
If Drive Adaptor is tight on shaft, gently lever off.



**Fig. 23**

- 5.33** Photograph showing the Close Coupled drive components disassembled. - **Fig. 24**

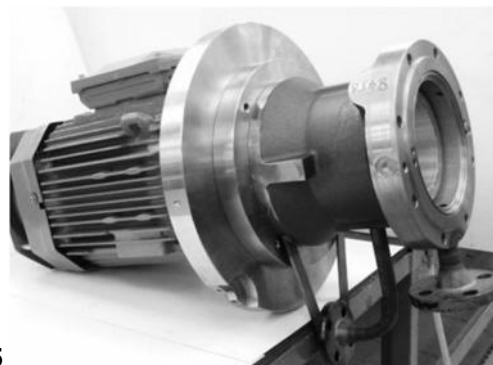
- 5.34** Clean all the dismantled components and examine for wear or damage, any component found to be worn or damaged should be replaced with genuine spares purchased from HMD / Kontro Sealless Pumps or their authorised representatives.



**Fig. 24**

## GSPV Pumps

- 5.35** With the GSPV pump, the Coupling Housing remains attached to the Motor. - **Fig. 25**



**Fig. 25**

- 5.36** Remove the Adaptor Flange Retention Nuts (45.N11) and slide the Coupling Housing (43.43) and Motor Adaptor (45.45) over the Outer Magnet Ring (OMR) - **Fig. 26**



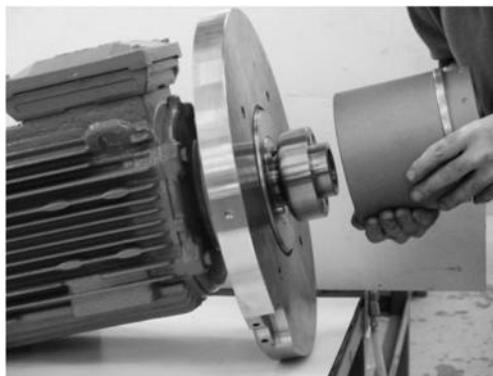
**Fig. 26**

- 5.37** Undo and remove the six off OMR Retention Screws (52.S42). - **Fig. 27**



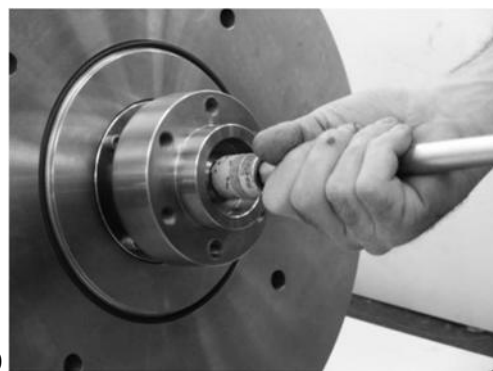
**Fig. 27**

- 5.38** Loosen and remove the Outer Magnet Ring (51.51). - **Fig. 28**



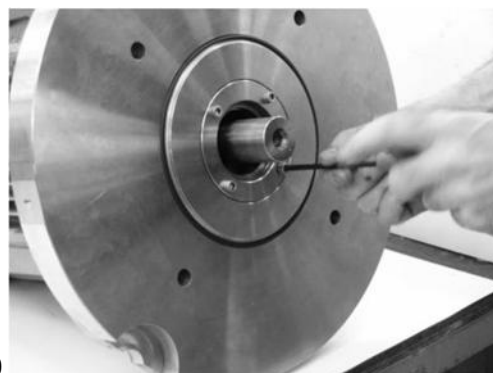
**Fig. 28**

- 5.39** Undo and remove the Drive Adaptor Retention Screw (52.S41) - **Fig. 29** – and slide the Drive Adaptor (52.52) off the Motor shaft and away from the Secondary Control Seal (45.70C).



**Fig.29**

- 5.40** Undo and remove the four off Front Cap, Retention Screws (45.S42) - **Fig. 30** – and remove the Front Cap (45.67) before withdrawing the Secondary Control Seal (45.70C) from the Adaptor Flange (45.16).



**Fig.30**

- 5.41** Loosen and remove the Adaptor Flange (45.16) from the Motor. The GSPV drive components are now dismantled. - **Fig. 31**



**Fig.31**

- 5.42** Clean all the dismantled parts and examine for wear or damage. Any part found to be worn or damaged must be replaced with genuine spare parts purchased from HMD / Kontro Sealless Pumps or their authorised representatives.



## Section 6

# Recommended Procedure for Replacement of Bushes and Thrust Pads



**Please ensure that you conform to safe working practices.**

Guard against the combustion of product residue on the component.

Wear eye protection to guard against the fracturing of Carbon and Silicon Carbide Bushes and Thrust Pads.

Wear suitable protective clothing and heat resistant gloves while handling hot components.

- 6.01** It is strongly recommended that all Bushes and Thrust Pads are replaced before the pump is reassembled, if damaged or beyond wear limits given on page 2.

### Removal

- 6.02** If Bushes are pinned, remove the pins prior to heating the Bush Holder. Remove existing Thrust Pad (09.13) and Bushes (09.10 & 09.10A) by heating the Bush Holder (09.09) in an oven at 350°C (662°F) for approximately 30 minutes. At this point the Bushes and Thrust Pad must be immediately removed.

### Fitting

- 6.03** Clean mating bores and faces thoroughly prior to fitting of replacement parts. Use a non-mechanical cleaning method. Note: Metal blocks will be required, refer to Section 1 (Page 1) Tool Requirements.

For new Bushes (09.10 & 09.10A) and the Back Thrust Pad (09.13) place them into an oven and hold at 100°C (212°F) and maintain for approximately 30 minutes prior to fitting into the Bush Holder. This is not required for Carbon Bushes. Metal blocks should also be preheated to prevent 'cold shock' cracking of the Bush and Thrust Pad.

- 6.04** Stand the clean Bush Holder (09.09) vertical with the Flange uppermost in an oven and heat to 300°C (572°F). - **Fig. 32**



**Fig. 32**

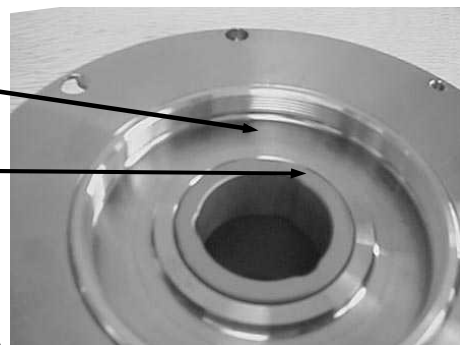
- 6.05** Using heat resistant gloves, take the first Bush (09.10) and insert into Bush Holder (09.09). Ensure that the flow grooves are correctly positioned. - **Fig. 33 & 33A**



**Fig. 33**

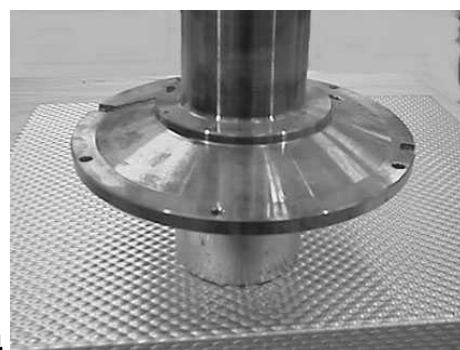
**Vent Hole**

**Flow groove to be approximately 20° clockwise from the Vent Hole**



**Fig. 33A**

- 6.06** Allow the Bush Holder (09.09) to cool to approximately 100°C (212°F). Replace the Bush Holder (09.09) in oven with the flange downwards. To ensure that the front Bush does not fall out, it should be held in place by resting on a pre-heated metal block as shown. - **Fig. 34**



**Fig. 34**

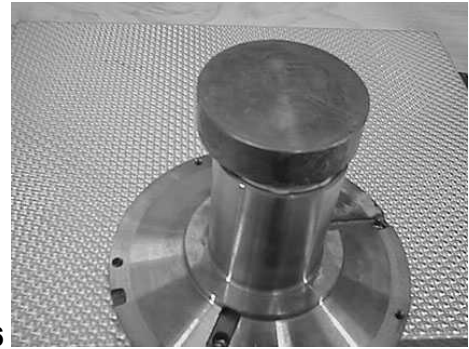
- 6.07** Heat the Bush Holder (09.09) to 300°C (572°F) remove from oven with the block holding in Front Bush, now insert the Back Bush (09.10A) ensuring that it is fully seated and the flow grooves are aligned with the Front Bush flow grooves. Insert the Thrust Pad (09.13) ensuring that it is fully seated and that the flow grooves face outwards. - **Fig. 35**

Note: Bush Holder must still rest on the metal block as shown in **Fig. 34**



**Fig. 35**

- 6.08** Allow the Bush Holder to cool in the vertical position as shown in **Fig. 36**. Do not attempt to accelerate the cooling process. Pre-heated metal block on top must be approx 1kg (2.2lb). When cool, visually inspect for correct Bush and Thrust pad seating and for any signs of damage.
- 6.09** If Bushes are carbon, using existing cross holes in Bush Holder, drill through Bushes with a 5.6mm (7/32") diameter drill, and fit new pins (09.49).



**Fig. 36**



## Section 7

### Neck Ring and Impeller Wear Ring Replacement

#### Removal

- 7.01** Neck Rings (41.01 & 09.01A) are retained by an interference fit and can be removed from their locations by using a suitable puller or pry bar. - **Fig. 37**

Note that if Neck Rings are pinned, the pins should be removed first, prior to removing the Neck Rings.

- 7.02** *GSP only. Impeller Wear Rings (06.84 and 06.84A) are retained by an interference fit and also by three pins (06.49, 06.49A). These rings must be removed by machining.*



**Fig. 37**

#### Fitting

- 7.03** Neck Rings (41.01 & 09.01A) should be fitted using a soft drift until they seat against their shoulder. - **Fig. 38**

Note that the leading edge of the Neck Ring has a 15° chamfer.

Note that the Neck Rings are pinned (where necessary) by milling a 3mm (0.118") diameter hole by 13mm (0.5") deep in three equispaced locations at the interface diameter of the Neck Rings and holder. Fit new Pins (41.49 & 09.49A) and check for distortion of the Neck Ring bores after pinning and re-machine as necessary to dimensions shown in **Table 3**.

- 7.04** Impeller Wear Rings (06.84 & 06.84A) are fitted by heating them to approximately 150°C (272°F) and locating onto the Impeller (06.06) hubs. Once the Rings are cool, drill three holes in each Ring as 7.03. Fit new Pins (06.49 & 06.49A), and machine the Wear Rings to the finished sizes shown in **Table 4**.



**Fig. 38**

**Table 3: Neck Ring Location Bore**

| Pump Size<br><b>GSA/I</b>   | Casing<br>Inch<br>mm               | Bush Holder<br>Inch<br>mm          |
|-----------------------------|------------------------------------|------------------------------------|
| 1.5x1x6 (H) / 50x32x160 (H) | 3.190 / 3.189<br>81.035 / 81.000   | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x1.5x6 (H) / 65x50x160 (H) | 4.017 / 4.016<br>102.035 / 102.000 | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x2x6 (H) / 80x65x160 (H)   | 4.017 / 4.016<br>102.035 / 102.000 | 4.805 / 4.803<br>122.040 / 122.000 |
| 1.5x1x8(H) / 50x32x200 (H)  | 3.190 / 3.189<br>81.035 / 81.000   | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x1.5x8 (H) / 65x40x200 (H) | 4.017 / 4.016<br>102.035 / 102.000 | 4.805 / 4.803<br>122.040 / 122.000 |
| 80x50x200 (H)               | 102.035 / 102.000                  | 122.040 / 122.000                  |

| Pump Size<br><b>GSP</b> | Casing<br>Inch<br>mm               | Bush Holder<br>Inch<br>mm          |
|-------------------------|------------------------------------|------------------------------------|
| 1.5x1x6 (H)             | 3.584 / 3.583<br>91.035 / 91.000   | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x1.5x6 (H)             | 4.411 / 4.409<br>112.035 / 112.000 | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x2x6 (H)               | 4.411 / 4.409<br>112.035 / 112.000 | 4.805 / 4.803<br>122.040 / 122.000 |
| 1.5x1x8 (H)             | 3.584 / 3.583<br>91.035 / 91.000   | 4.805 / 4.803<br>122.040 / 122.000 |
| 3x1.5x8 (H)             | 4.411 / 4.409<br>112.035 / 112.000 | 4.805 / 4.803<br>122.040 / 122.000 |

**Table 4 : Finished Machined Impeller Wear Ring Outer Diameter**

| Pump Size<br><b>GSP</b> | Wear Ring<br>Inch<br>mm            | Wear Ring<br>Inch<br>mm            |
|-------------------------|------------------------------------|------------------------------------|
| 1.5x1x6 (H)             | 3.559 / 3.557<br>90.435 / 90.300   | 4.779 / 4.778<br>121.440 / 121.300 |
| 3x1.5x6 (H)             | 4.385 / 4.384<br>111.435 / 111.300 | 4.779 / 4.778<br>121.440 / 121.300 |
| 3x2x6 (H)               | 4.385 / 4.384<br>111.435 / 111.300 | 4.779 / 4.778<br>121.440 / 121.300 |
| 1.5x1x8 (H)             | 3.559 / 3.557<br>90.435 / 90.300   | 4.779 / 4.778<br>121.440 / 121.300 |
| 3x1.5x8 (H)             | 4.385 / 4.384<br>111.435 / 111.300 | 4.779 / 4.778<br>121.440 / 121.300 |

## SECTION 8

### ASSEMBLY INSTRUCTIONS

Ensure all the Pump Components have been cleaned and are in an "as new" condition before assembly. The assembly should be carried out in a clean, dry area.

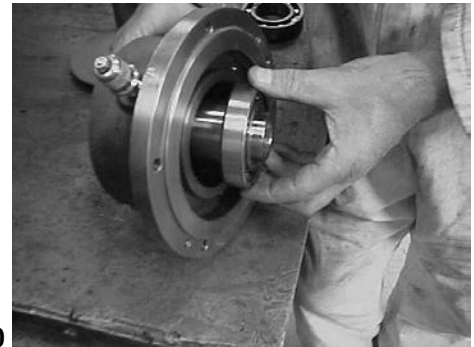
#### Separate Mounted Pumps

- 8.01** Install the Front Ball Race (62.BB1) to the Drive Shaft by pressing on inner race only. Ensure it is seated against the location shoulder on the Shaft (62.62). - **Fig. 39**



**Fig. 39**

- 8.02** Insert the Drive Shaft (62.62) into the Bearing Housing (61.61) and gently tap or press the Outer Ball Race of Bearing until it is seated against the location shoulder in the Bearing Housing (61.61). - **Fig. 40**



**Fig. 40**

- 8.03** Place the Rear Ball Race (62.BB1) on to the Drive Shaft (62.62) and into the Bearing Housing (61.61). - **Fig. 41**



**Fig. 41**

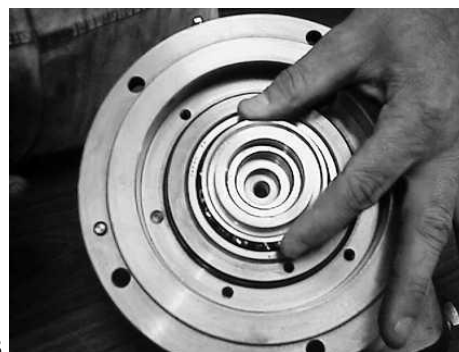
- 8.04** Rear Race can be pressed onto Drive Shaft by pressing on inner race only. - **Fig. 42**

*GSP only. To lock nut, fit Drive Shaft Washer (62.64) and Drive Shaft Nut (62.63) to the Drive Shaft (62.62); clamp Drive Shaft under pneumatic press and fully hand tighten Nut with sharp strikes to end of spanner with mallet. Turn Tab Washer over on to one flat of the Nut.*



**Fig. 42**

- 8.05** Install the Front Oil Thrower (61.75) onto the Drive Shaft. - **Fig. 43**



**Fig. 43**

- 8.06** Install the new 'O' Ring (61.OR1) and Front Cap (61.67) and retain with the Retention Screws (61.S42). Torque Screws to 12Nm (9lbf-ft). - **Fig. 44**



**Fig. 44**

- 8.07** Install the new rear O-Ring (62.OR2) to the bore of the Inner Labyrinth Seal (61.70A) and slide on to the Drive Shaft (62.62) up to the shoulder. Align retention hole with flat on Drive Shaft, apply drop of thread locker to Labyrinth Retention Screw (61.S51) and carefully tighten onto Drive Shaft. - **Fig. 45**



**Fig. 45**

- 8.08** Press Outer Labyrinth Seal (61.70B) into the Back Cap (61.68) ensuring the hole in the seal is in-line with the slot on the inside of the Back Cap. - **Fig. 46**



**Fig. 46**

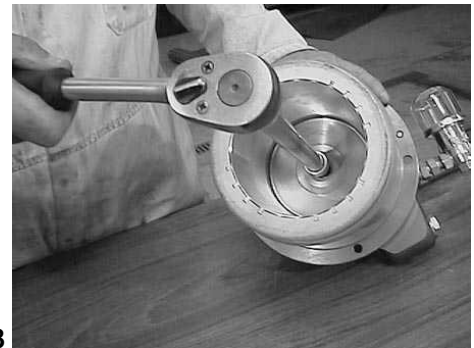
- 8.09** Install the new 'O' Ring (61.OR1) and Back Cap (61.68) and retain with the Retention Screws (61.S43). Torque to 12Nm (9lbf-ft). - **Fig. 47**



**Fig. 47**

- 8.11 GSA/GSI models:** Install the Outer Magnet Ring (OMR) (51.51) by aligning with off-set location in Drive Shaft. Tighten the single M10 or 3/8" UNC Outer Magnet Ring Retention Screw (62.S41) to a torque of 36Nm (26lbf-ft) after applying thread lock to screw. - **Fig. 48**

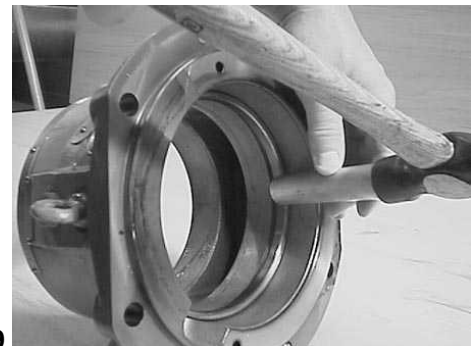
**GSP models:** Single 1/2" UNC Bolt - turn Tab Washer (62.W11) into hole in Outer Magnet Ring (OMR) and tighten OMR Retention Bolt (62.S11) to 50Nm (37lbf-ft) and turn Tab Washer onto one flat of Bolt head. Twin 5/16" UNC Screws (62.S11) – torque to 25Nm (18lbf-ft) after applying thread lock to Screws.



**Fig. 48**

- 8.12** If required insert a new Bump Ring (43.44) to the Coupling Housing (43.43) by gently tapping into place using a soft drift. - **Fig. 49**

- 8.13** Fit the Bearing Housing (61.61) to the Coupling Housing (43.43) using the Retention Screws (43.S49). Torque to 25Nm (18lbf-ft) for 8mm or 5/16" UNC Screws, or 50Nm for GSP 1/2" UNC Nuts (43.N13).



**Fig. 49**

## Close Coupled

- 8.14** Install Shrink Disc Coupling (52.82) and Drive Flange Adaptor (52.52) over Motor Shaft with bolts towards motor; ensure that Adaptor is fully seated against Motor Shaft end. Torque bolts progressively in a sequential order around the circumference. - **Table 5**

The required torque value for the Shrink Disc coupling, are shown in chart below or as indicated on the coupling. - **Fig. 50**



Do not tighten bolts diagonally

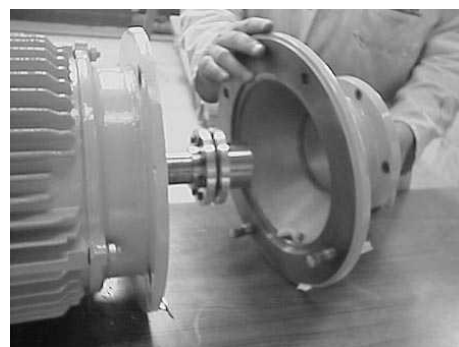
| Motor Frame Size                                                                   | Torque |        |
|------------------------------------------------------------------------------------|--------|--------|
|                                                                                    | Nm     | Ft lbs |
| 143T, 145T, 90S, 90L                                                               | 4      | 3      |
| 182T, 184T, 213T, 215T, 254T, 256T, 100L, 112M, 132S, 132M, 160L, 160M, 180L, 180M | 12     | 9      |

**Table 5**



**Fig. 50**

- 8.15** Fit Motor Adaptor (45.45) to Motor Face/Flange and torque 8mm or 5/16" UNC Nuts (45.N13) or Screws (43.S42) to 25Nm (18lbf-ft). Torque 3/8" UNC Screws (45.S42) to 30Nm (22lbf-ft). Torque 1/2" UNC Screws (45.S42) to 50Nm (37lbf-ft) - **Fig. 51**



**Fig. 51**

- 8.16** Install the Outer Magnet Ring (51.51) to the drive flange adaptor (52.52) aligning the off-set location and tighten the Outer Magnet Ring Retention Bolt or Screw(s) to torque settings shown on previous page, Section 8.11.
- 8.17** Fit Coupling Housing to the Motor Adaptor and retain with the retention fasteners. Torque to 25Nm (18lbf-ft) for 5/16" UNC or 8mm Nuts or Screws (45.N13 or 43.S42). Torque to 30Nm (22lbf-ft) for 3/8" UNC Screws (45.S42). Torque to 50Nm (37lbf-ft) for 1/2" UNC Screws (45.S42). If new Bump Ring (43.44) is required refer to 8.12.

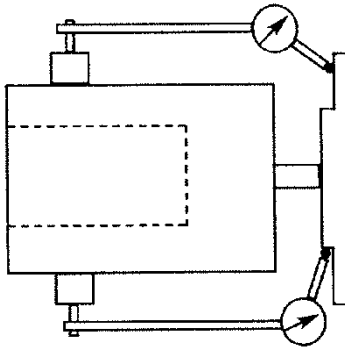
## GSPV Pumps

- 8.18** Assembly of GSPV pumps is the reverse of the disassembly procedure described in 5.35 to 5.41, with the torque values as per Table 2.

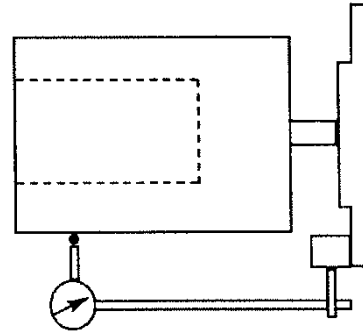
## All Pumps



Check concentricity and squareness of OMR to the face of the Motor or Bearing Housing prior to fitting Coupling Housing. **Fig. 52a & 52b**



**Fig. 52a**



**Fig. 52b**

**8.19** Check that the Outer Magnet Ring (51.51) is rotating concentric within the Coupling Housing (43.43). Maximum face run-out is 0.25mm (0.010") and maximum run-out is 0.50mm (0.020") diametrical, measured in the Shroud location bore. - **Fig. 53**

**8.20** If instrumentation is to be fitted refer to the appropriate manual

**8.21** Install the Containment Shell (20.20) into the Coupling Housing (43.43) using the two Containment Shell Retention Screws (20.S42). Carefully hand-tighten Screws evenly. **Fig. 54**



**Fig. 53**



**Fig. 54**

- 8.22** Install Front Thrust Washer (02.07) to the Impeller (06.06), ensure that the Thrust Washer is located on Thrust Washer Drive Pin (02.49C) and moves freely by hand. - **Fig. 55**



**Fig. 55**

- 8.23** Install two new 'O' Rings (02.OR1) into the grooves in the Impeller end of the Pump Shaft (02.02). - **Fig. 56**



**Fig. 56**

- 8.24** Install in a twisting motion the Front Pump Shaft Sleeve (02.86) onto the Pump Shaft until it seats.

- 8.25** Install the Pump Shaft Sleeve Spacer (02.69) onto the Shaft until it seats. *(Not applicable to GSP).*

- 8.26** Install two new 'O' Rings (02.0R1) into the two remaining grooves on the pump Shaft (02.02). - **Fig. 57**

- 8.27** Install remaining Shaft Sleeve as 8.23



**Fig. 57**

*GSP only. Install key (02.K41) and Impeller (06.06) onto Pump Shaft and install Impeller Washer (02.04) and locking nut (02.03). Torque to 50Nm (37lbf-ft).*

- 8.28** Install the Alignment Pad (08.39), then Back Thrust Washer (08.08) into the Inner Magnet Ring (37.37), ensuring correct pin location. Back Thrust Washer should move freely by hand. - **Fig. 58**



**Fig. 58**

- 8.29** With Inner Magnet Ring (37.37) on a clean surface, place Bush Holder Assembly (09.09) carefully inside Inner Magnet Ring (37.37). - **Fig. 59**



**Fig. 59**

- 8.30** Install Shaft Assembly into Bush Holder (09.09) taking care not to damage Bushes and Sleeves. Align off-set location in IMR with Pump Shaft. - **Fig. 60**

- 8.31** Carefully turn over total Assembly, keeping parts together, and stand on Impeller nose.



**Fig. 60**

- 8.32** Install Tab Washer (02.05) and bend tab into hole in Inner Magnet Ring, install nut (02.36) Torque, to 110Nm (80lbf-ft). Nut is left-handed and should be tightened anti-clockwise. - **Fig. 61**

- 8.33** Check that the Shaft Assembly rotates freely within the Bush Holder then bend new Coupling Tab Washer (02.05) into contact with one of the flats on the Coupling Nut (02.36).



**Fig. 61**

**8.34** Hold on outside of Impeller and Impeller eye and slide the Assembly into the Containment Shell (20.20). Care must be taken as there will be strong magnetic attraction between the Inner and Outer Magnet Rings. Hold on outside of Impeller and Impeller eye.- **Fig. 62**

**8.35** Align off-set Retention Screw holes. Secure the Bush Holder (09.09) to the Containment Shell (20.20) using the three Retention Screws (20.S41). Torque to 14Nm (10 lbf-ft).

**8.36** Check the axial movement (known as 'end-float') of the Impeller Assembly using a "Dial Test Indicator", it should be between 0.34 and 1.75mm (0.013" and 0.069"). - **Fig. 63**

**8.37** Install a new Casing Gasket (20.17). - **Fig. 64**

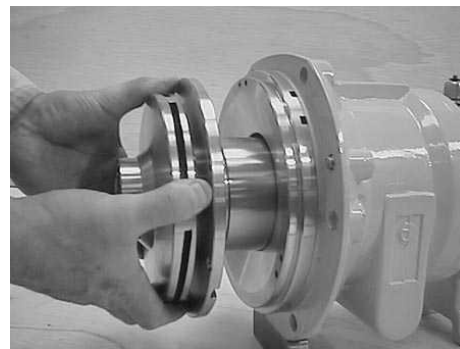


**Note that High Pressure 1" UNC Casing Retention Nuts are torqued to 350Nm (258lbf-ft).**

**8.38** Fit the Casing (41.41) to the Coupling Housing (43.43) and secure using the Casing Retention Nuts (41.N11) and Casing Retention Washers (41.W11). - **Fig. 65**  
Torque to 85Nm (63lbf-ft) following the sequence shown on the next page.



For Centreline Mounted Pumps, ensure mating face of both Casing and Coupling Housing are free of paint, dents, burrs etc, as these faces must touch to compress Gasket by correct amount. Pull Casing evenly and fully up to Coupling Housing using standard spanner (or wrench and socket) prior to applying final torque load. Use torque wrench to apply final load in sequence shown on next page.



**Fig. 62**



**Fig. 63**



**Fig. 64**

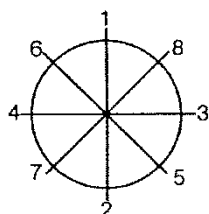


**Fig. 65**

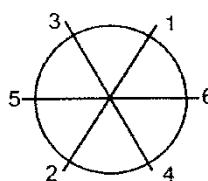
In order to ensure that the Casing Gasket is evenly compressed, and to ensure the Coupling Housing is bolted squarely with the Casing, the following procedure must be followed:-

- 1 After assembly, and before replacing the Nuts, ensure the Casing Studs are lightly lubricated.
- 2 Ensure the Casing Nuts are clean.
- 3 Following the patterns shown tighten the Casing Nuts thus:-
 

|          |                           |
|----------|---------------------------|
| 1st pass | 30% of recommended torque |
| 2nd pass | 60% of recommended torque |
| 3rd pass | Full recommended torque   |



All GS Pumps except GSI



GSI

- 8.39** Fit Casing Drain Plug (41.50). **3/8" BSP Drain Plug:** fit new Gasket (41.17) and torque Nut to 50Nm (37lbf-ft). **NPT Drain Plug:** Wrap PTFE tape around thread & fully tighten Nut.
- 8.40** Ensure either the temperature monitoring (41.TC) device or plug (41.50B) is fitted.
- 8.41** Ensure all unused connections are plugged.
- 8.42** Fit the Adaptor (61.CL2) to the Constant Level Oiler (61.CL1) via the tapered thread. Fit the Union (61.CL3) and Washer to the Adaptor and then the whole assembly to the Bearing Housing (61.61). Ensure the bottle is vertical. Do not fill oil bottle at this stage. Where sealed for life grease bearings are fitted, do not fit the constant level oiler and associated fittings, fit a plug instead.



## Section 9

### Oil Lubricated Bearing Assemblies

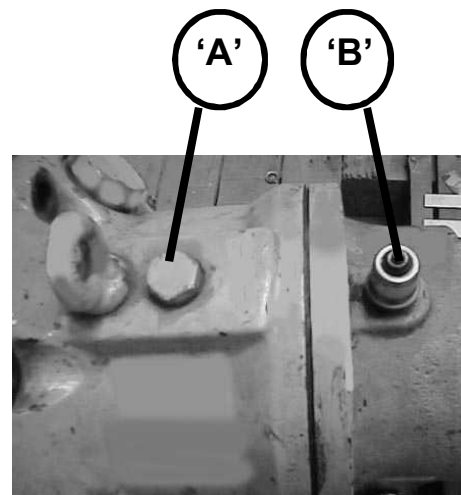
#### Separate Mounted Only

##### 9.01 Filling Procedure

This details the filling procedure for oil lubricated bearing assemblies.



**Do not** fill using the coupling housing Vent Plug 'A' shown in **Fig. 66**, as this will place oil in the coupling housing and may lead to pump failure. The Vent Plug has been removed from later models in this Pump range.



**Fig. 66**

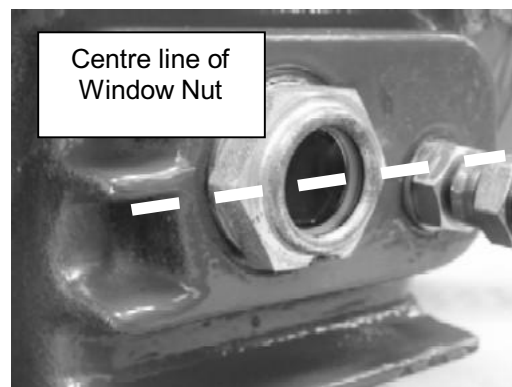
Fill the oil lubricated bearing assembly using a recommended grade of oil, stated in section 9.02, by removing the filter/breather 'B' (61.VP1), and pouring approximately three quarters of the volume of oil, stated in section 9.03, into the housing.

The remaining volume to ensure the correct oil level, should be filled using the oil bottle as follows:-

Fill the oil bottle and place in the constant level oiler (61.CL1) allow the bottle to empty which may take 15 minutes or so, and then refill and repeat the procedure. If the oil bottle does not empty or stops at the same level for 30 minutes or so, the correct oil level in the bearing housing has been reached.

Do not try to take short cuts by topping up via the breather or constant level oiler without the bottle fitted, as this may result in overfilling, resulting in oil entering the coupling housing, or hot running bearings.

*GSP Centreline Mounted Pumps only. Bearing housings are fitted with a Window Nut. The correct oil level is half way up the Window Nut. - **Fig 67.***



**Fig. 67**

## 9.02 Recommended Oil Grade

| Typical Physical Characteristics                                               | Requirement                         | Acceptance Method                        |
|--------------------------------------------------------------------------------|-------------------------------------|------------------------------------------|
| ISO Oil Type                                                                   | HM                                  | -                                        |
| ISO Viscosity grade                                                            | 68                                  | -                                        |
| Kinematic Viscosity cSt at 0°C<br>40°C<br>100°C                                | 1040 (max)<br>64 to 68<br>8.6 (max) | ASTM D445 or IP71                        |
| Viscosity Index                                                                | 98 to 102                           | ASTM D2270 or IP226                      |
| Density at 15°C, kg/m <sup>3</sup>                                             | 878 to 888                          | ASTM D4052 or IP365                      |
| Flash Point °C<br>Pensky-Martens Closed Cup (PMCC)<br>Cleveland Open Cup (COC) | 220 to 255                          | ASTM D92 or IP36<br>ASTM D93<br>ASTM D92 |
| Pour Point °C                                                                  | -30 to -5                           | ASTM D97 or IP15                         |
| Foaming Characteristics, ml after 10 mins<br>Sequence 1 @ 24°C                 |                                     | ASTM D892 or IP146                       |
| Tendency / Stability                                                           | Trace / Nil                         |                                          |
| Sequence 2 @ 93.5°C                                                            |                                     |                                          |
| Tendency / Stability                                                           | 20 / Nil                            |                                          |
| Sequence 3 @ 24°C                                                              |                                     |                                          |
| Tendency / Stability                                                           | Trace / Nil                         | (after sequence 2)                       |

For equipment operating in ambient temperatures below -40°C (-40°F) consult HMD / Kontro for advice. For pumps operating in process temperatures above 260°C (500°F) a synthetic oil is recommended, consult HMD / Kontro for advice.

## 9.03 Oil Capacities (Power Frame Housing)

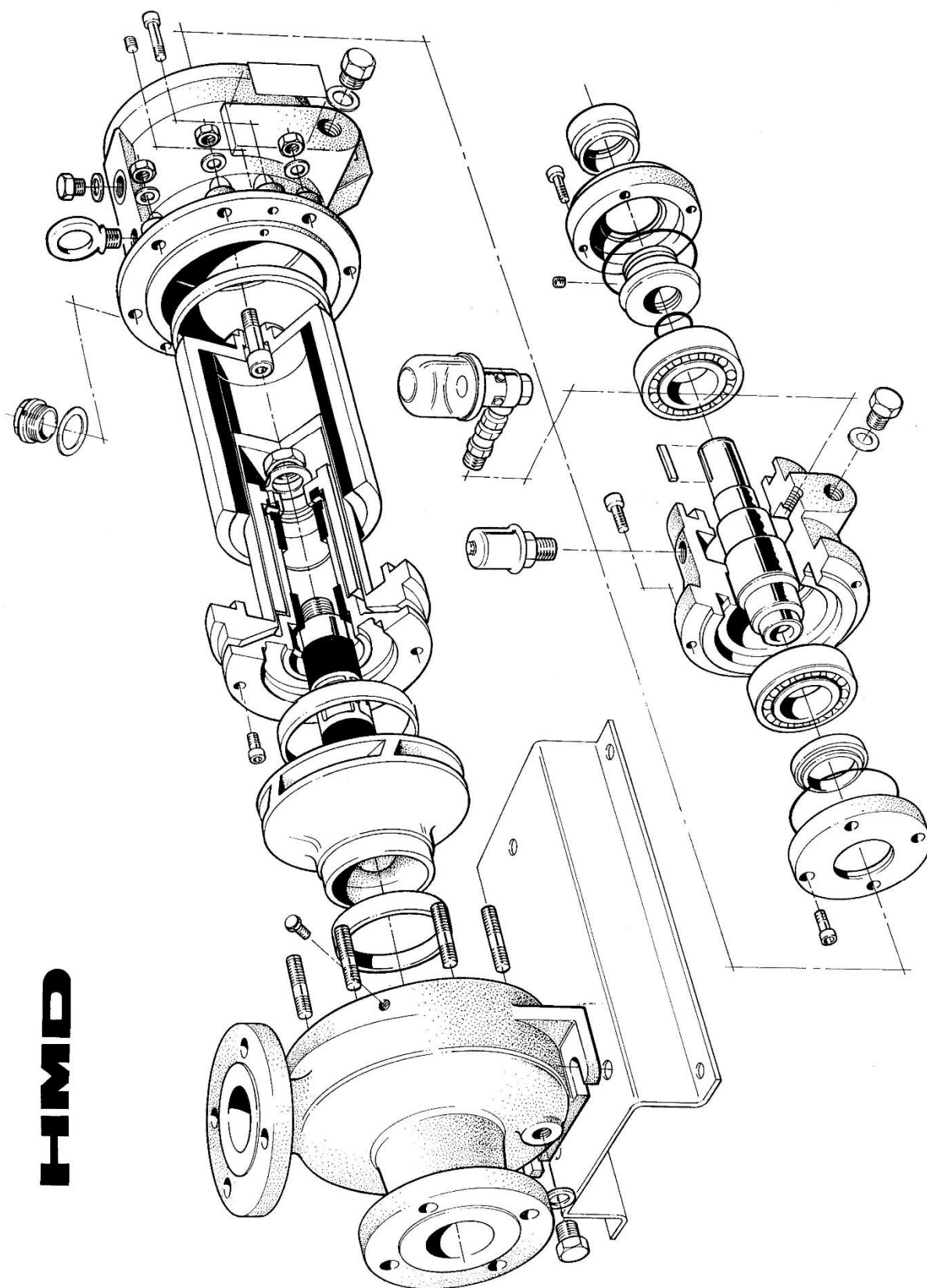
Quantities are in ml and US fl.oz and are approximate.

To determine how much oil is required for your particular pump, refer to the model number on either the order acknowledgement or the nameplate fitted to the pump. With that information refer to the tables below for the correct amount of oil needed.

If you have any doubts or questions please do not hesitate to contact HMD / Kontro or your local representative.

| Size        | GSA |          | GSP |          |
|-------------|-----|----------|-----|----------|
|             | ml  | US fl.oz | ml  | US fl.oz |
| 1.5x1x6 (H) | 100 | 3.3      | 375 | 12.4     |
| 3x1.5x6 (H) | 100 | 3.3      | 375 | 12.4     |
| 3x2x6 (H)   | 100 | 3.3      | 375 | 12.4     |
| 1.5x1x8 (H) | 100 | 3.3      | 375 | 12.4     |
| 3x1.5x8 (H) | 100 | 3.3      | 375 | 12.4     |

| Size          | GSI |          |
|---------------|-----|----------|
|               | ml  | US fl.oz |
| 50-32-160 (H) | 125 | 4.1      |
| 65-50-160 (H) | 125 | 4.1      |
| 80-65-160 (H) | 125 | 4.1      |
| 50-32-200 (H) | 125 | 4.1      |
| 65-40-200 (H) | 125 | 4.1      |
| 80-50-200 (H) | 125 | 4.1      |



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**Customer Service 24 Hour 07966 525269**

## Baldor-Reliance AC & DC Motor Installation & Maintenance

**Note!** The manufacturer of these products, Baldor Electric Company, became ABB Motors and Mechanical Inc. on March 1, 2018. Nameplates, Declaration of Conformity and other collateral material may contain the company name of Baldor Electric Company and the brand names of Baldor-Dodge and Baldor-Reliance until such time as all materials have been updated to reflect our new corporate identity.

Safety Notice: Be sure to read and understand all of the Safety Notice statements in MN408, MN605 or Product Specific manual for your motor. A copy is available at: [http://www.baldor.com/support/product\\_manuals.asp](http://www.baldor.com/support/product_manuals.asp)

### WEEE EU Directive 2012/19/EU

Products that are marked with the crossed-out wheeled bin symbol as shown here; shall be handled by applying following information:



The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For users in the European Union, please contact your dealer or supplier for

more information on how to discard electrical and electronic equipment (EEE).

### ACCEPTANCE

Thoroughly inspect this equipment before accepting shipment from the transportation company. If any damage or shortage is discovered do not accept until noted on the freight bill. Report all damage to the freight carrier.

### SAFETY

Eye bolts, lifting lugs or lifting openings, if provided, are intended only for lifting the motor and motor mounted standard accessories not exceeding, in total 30% of the motor weight. These lifting provisions should never be used when lifting or handling the motor and driven equipment. Eye bolt lifting capacity rating is based on a lifting alignment coincident with eye bolt center line. Eye bolt capacity reduces as deviation from this alignment is increased. Be sure eye bolts are tight and prevented from turning before lifting.

### INSTALLATION OUTSIDE THE USA:

Refer to MN408, MN605 and MN1383 for Compliance with European Directives. Copies are available at: [http://www.baldor.com/support/product\\_manuals.asp](http://www.baldor.com/support/product_manuals.asp)

### MOTOR ENCLOSURE

ODP, Open drip proof motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure.

Standard Totally Enclosed motors provide additional protection from moisture and dust compared to Open motors. Severe Duty and Washdown Duty motors provide additional protection compared to Standard Totally Enclosed motors.

Explosion protected motors, as indicated by a Nationally Recognized Testing Laboratory Certification mark and marking with Class, Division and Temperature Code are intended for installation in hazardous locations as described in Article 500 of the NEC. Refer to MN408 for more details.

### MOUNTING

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

**Flange mounted** machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

**Direct coupled** machines should be carefully aligned and the shaft should rotate freely without binding.

### GENERAL

The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or applicable local codes. Special motors for use by United States Government including special specifications, master plans, etc. refer to the applicable master plans and specifications involved. On motors received from the factory with the shaft blocked, remove blocking before operating the motor. If motor is to be reshipped alone or installed to another piece of equipment, the shaft block must be installed to prevent axial movement and prevent brinelling of the bearings during shipment.

### TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, check the motor insulation resistance with a meg ohm meter. Depending on storage conditions it may be necessary to regrease or change rusted bearings. Contact your local sales office if resistance is less than 5 meg ohms.

**WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.**

**WARNING: Be sure the system is properly grounded before applying power. Electrical shock can cause serious or fatal injury.**

## INSTALLATION

This motor must be installed in accordance with National Electric Code, NEMA MG-2, IEC standards or local codes.

## WIRING

Connect the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. Refer to MN408 or MN605 for additional details on lead marking. The wiring, fusing and grounding must comply with the National Electrical Code or IEC and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

## GROUNDING

Ground the motor according to NEC and local codes. In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

## ADJUSTMENT

The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

## Noise

For specific sound power or pressure level information, contact your local sales office.

## VIBRATION

This motor is balanced to NEMA MG1, Part 7 standard.

## BRUSHES (DC Motors)

Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn 1/2, (length specified in renewal parts data), replace the brushes.

**WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

## INSPECTION

Before connecting the motor to an electrical supply, inspect for any damage resulting from shipment. Turn the shaft by hand to ensure free rotation. Motor leads must be isolated before the shaft will turn freely on permanent magnet motors.

## DRAIN PLUGS

Condensation drains are typically provided in each endplate. For optimal drainage, drains should be located in the lowest portion of the motor. For Washdown motors with multiple drain plugs, drain holes at the lowest

portion of the motor should be open or have a T-drain installed. Drain holes not at the lowest portion of the motor should be plugged.

## MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Grease lubricated ball bearing motors may be mounted with the feet at any angle. After careful alignment, bolt motor securely in place. Use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

## IP (Ingress Protection)

IP designations include two numerals, the first characteristic numeral is for ingress solid bodies and from dust. The second for ingress protection from liquid - water. The IP rating assigned to a motor is based on horizontal mounting unless the motor is specifically designed for vertical positioning. Mounting the horizontal rated motor in a non-horizontal position may require additional protection, contact the local ABB District Office to review the mounting requirements and ingress protection. Open motors (IPX2 and IPX3) must be located, oriented, or additionally protected in the application to prevent falling water from entering the motor.

## GUARDING

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure. Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

## STARTING

Before starting motor remove all unused shaft keys and loose rotating parts to prevent them from flying off. Check direction of rotation before coupling motor to load. The motor should start quickly and run smoothly and with little noise. If the motor should fail to start the load may be too great for the motor, the voltage is low or the motor has been miswired. In any case immediately shut motor off and investigate the cause.

## ROTATION

To reverse the direction of rotation, disconnect and lockout power and interchange any two of the three AC power leads for three phase motors. For two-phase four wire, disconnect and lockout power and interchange the AC line leads on any one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

## Maintenance Procedures

**WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.**

**WARNING: Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming in contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

**Lubrication Information**

Refer to motor nameplate for recommended lubricant. If none is shown, the recommended lubricant for anti-friction bearings (-15°F to 120°) is POLYREX EM. For Min Start Temp -100°F use AEROSHELL #7. For roller bearings is ExxonMobil SHC-220.

**Relubrication Intervals****(For motors with regrease capability)**

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at Table 1 intervals.

**LUBRICATION INSTRUCTIONS**

Cleanliness is important in lubrication. Any grease used to lubricate anti friction bearings should be fresh and free from contamination. Properly clean the grease inlet area of the motor to prevent grease contamination.

1. Select service conditions from Table 2.
2. Select lubrication interval (Table 1).
3. Adjust lubrication interval with multiplier from Table 3.
4. Select volume of grease from Table 4.

**LUBRICATION PROCEDURE**

Bearings should be lubricated while stationary and the motor is warm.

1. Locate the grease inlet, clean the area, and replace the pipe plug with a grease fitting.
2. Locate and remove the grease drain plug, if provided.
3. Add the recommended volume of the recommended grease.
4. Replace the grease inlet plug and run the motor for 15 minutes.
5. Replace the grease drain plug.

**SPECIAL APPLICATIONS**

For special temperature applications, contact your local sales office.

**Relubrication Intervals**

Recommended relubrication intervals are shown in Table 1. It is important to realize that the recommended intervals of Table 2 are based on average use. Refer to additional information contained in Tables 2, 3 and 4.

**Table 1 Relubrication Interval**

| NEMA (IEC) Frame Size        | Rated Speed (RPM) |           |           |           |
|------------------------------|-------------------|-----------|-----------|-----------|
|                              | 3600              | 1800      | 1200      | 900       |
| Up to 210 incl. (132)        | 5500Hrs.          | 12000Hrs. | 18000Hrs. | 22000Hrs. |
| Over 210 to 280 incl. (180)  | 3600Hrs.          | 9500Hrs.  | 15000Hrs. | 18000Hrs. |
| Over 280 to 360 incl. (225)  | 2200Hrs.          | 7400Hrs.  | 12000Hrs. | 15000Hrs. |
| Over 360 to 5800 incl. (400) | 2200Hrs.          | 3500Hrs.  | 7400Hrs.  | 10500Hrs. |

\* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

\*\* For motors operating at speeds greater than 3600 RPM, contact your local sales office for relubrication recommendations.

**Table 2 Service Conditions**

| Severity of Service | Hours per day of Operation | Ambient Temperature Maximum   | Atmospheric Contamination                                       |
|---------------------|----------------------------|-------------------------------|-----------------------------------------------------------------|
| Standard            | 8                          | 40° C                         | Clean, Little Corrosion                                         |
| Severe              | 16 Plus                    | 50° C                         | Moderate dirt, Corrosion                                        |
| Extreme             | 16 Plus                    | >50° C* or Class H Insulation | Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration |
| Low Temperature     |                            | <-29 ° C **                   |                                                                 |

\* Special high temperature grease is recommended (Dow Corning DC44).

\*\* Special low temperature grease is recommended (Aeroshell 7).

Note: Different grease types are generally incompatible and should not be mixed. Mixing different types can cause lubricant and bearing failure. Thoroughly clean bearing and cavity before changing grease type.

**Table 3 Lubrication Interval Multiplier**

| Severity of Service | Multiplier |
|---------------------|------------|
| Standard            | 1.0        |
| Severe              | 0.5        |
| Extreme             | 0.1        |
| Low Temperature     | 1.0        |

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 4 Amount of Grease to Add

| Frame Size<br>NEMA (IEC)  | Bearing Description (These are the “Large” bearings (Shaft End) in each frame size) |                                         |                              |          |
|---------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|------------------------------|----------|
|                           | Bearing                                                                             | Weight of Grease to add * oz<br>(Grams) | Volume of grease to be added |          |
|                           |                                                                                     |                                         | in <sup>3</sup>              | teaspoon |
| 56 to 140 (90)            | 6203                                                                                | 0.08 (2.4)                              | 0.15                         | 0.5      |
| 140 (90)                  | 6205                                                                                | 0.15 (3.9)                              | 0.2                          | 0.8      |
| 180 (100–112)             | 6206                                                                                | 0.19 (5.0)                              | 0.3                          | 1.0      |
| 210 (132)                 | 6307                                                                                | 0.30 (8.4)                              | 0.6                          | 2.0      |
| 250 (160)                 | 6309                                                                                | 0.47 (12.5)                             | 0.7                          | 2.5      |
| 280 (180)                 | 6311                                                                                | 0.61 (17)                               | 1.2                          | 3.9      |
| 320 (200)                 | 6312                                                                                | 0.76 (20.1)                             | 1.2                          | 4.0      |
| 360 (225)                 | 6313                                                                                | 0.81 (23)                               | 1.5                          | 5.2      |
| 400 (250)                 | 6316                                                                                | 1.25 (33)                               | 2.0                          | 6.6      |
| 440 (280)                 | 6318                                                                                | 1.52(40)                                | 2.5                          | 8.2      |
| 440 (280)                 | 6319                                                                                | 2.12 (60)                               | 4.1                          | 13.4     |
| 5000 to 5800 (315–400)    | 6328                                                                                | 4.70 (130)                              | 9.2                          | 30.0     |
| 5000 to 5800 (315–400)    | NU328                                                                               | 4.70 (130)                              | 9.2                          | 30.0     |
| 360 to 449 (225–280)      | NU319                                                                               | 2.12 (60)                               | 4.1                          | 13.4     |
| <b>AC Induction Servo</b> |                                                                                     |                                         |                              |          |
| 76 Frame 180 (112)        | 6207                                                                                | 0.22 (6.1)                              | 0.44                         | 1.4      |
| 77 Frame 210 (132)        | 6210                                                                                | 0.32 (9.0)                              | 0.64                         | 2.1      |
| 80 Frame 250(160)         | 6213                                                                                | 0.49 (14.0)                             | 0.99                         | 3.3      |

Typical IEC vs NEMA Lead Marking

Single Phase Non-Reversible

Refer to the connection diagram provided on the motor.



Single Phase Reversible



Dual Voltage Reversible



DC Motors

Lead markings can be translated between IEC and NEMA designations as follows:

|              | NEMA   | IEC    |
|--------------|--------|--------|
| Armature     | A1, A2 | A1, A2 |
| Series Field | S1, S2 | D1, D2 |
| Shunt Field  | F1, F2 | E1, E2 |

Refer to the connection diagram provided on the motor.

Three Phase

For single winding 3 phase motors, lead markings can be directly translated between IEC and NEMA designations.

For these motors, the lead markings are:

U1=T1 U2=T4 U3=T7 U4=T10  
V1=T2 V2=T5 V3=T8 V4=T11  
W1=T3 W2=T6 W3=T9 W4=T12

Refer to the connection diagram provided on the motor.  
Some examples are as follows:

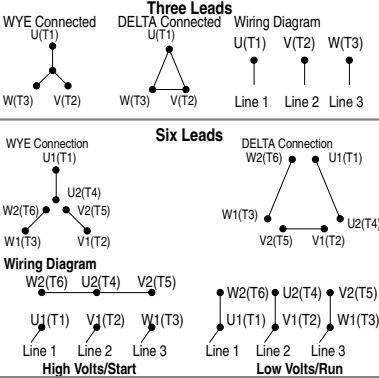
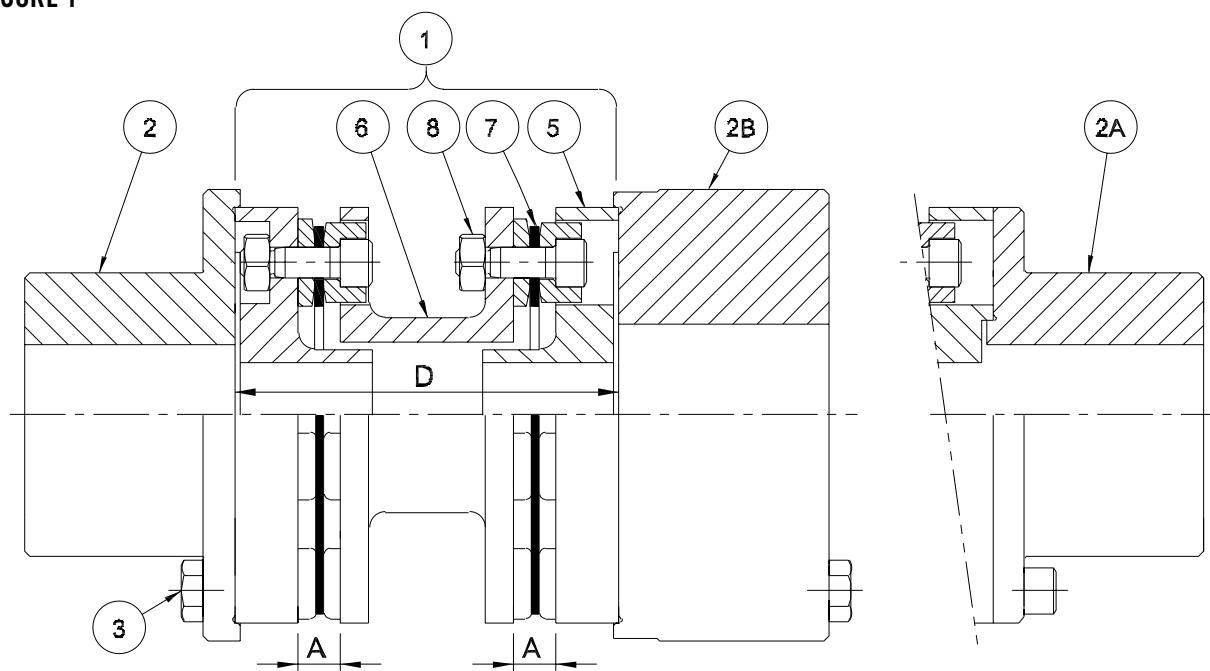


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**FIGURE 1**

- |                                                       |                                                                                    |
|-------------------------------------------------------|------------------------------------------------------------------------------------|
| 1 – Transmission unit                                 | 5 – Guard ring                                                                     |
| 2 – Standard hub -external location [sizes 0014-0360] | 6 – Spacer                                                                         |
| 2A– Standard hub -internal location [sizes 0350-1400] | 7 – Membrane pack                                                                  |
| 2B– Disc hub (large bore) [option on sizes 0014-0360] | 8 – Drive-bolt assembly (drive bolt, locknut, sleeve (washer) and overload collar) |
| 3 – Hub bolt                                          |                                                                                    |

**Foreword**

These instructions are provided to familiarize the user with John Crane's Metastream TSKS coupling and its designated use. These instructions must be followed whenever work is carried out on the coupling and should be kept available for future reference.

**ATTENTION** These instructions are for the fitting, operation and maintenance of the coupling as used in rotating equipment and will help to avoid danger and increase reliability. The information required may change with other types of equipment or installation arrangements. These instructions must be read in conjunction with the instruction manuals for both the driver and driven machinery.

If the coupling is to be used for an application other than that originally intended or outside the recommended performance limits, John Crane must be contacted before its installation and use.

Any warranty may be affected by improper handling, installation or use of this coupling. Contact John Crane for information as to exclusive product warranty and limitations of liability.

If questions or problems arise, contact your local John Crane sales/service engineer or the original equipment manufacturer, as appropriate.

**ATTENTION** John Crane couplings are precision products and must be handled appropriately. Take particular care to avoid damage to spigots, mating faces, hub bores, keyways and membranes. Do not excessively compress the coupling membranes during assembly. Refer to Table 2 for compression limits (Min gap 'X').

These instructions are written for standard catalog products, generally designed in accordance with the drawing shown.



# TSKS

## FLEXIBLE MEMBRANE COUPLING FOR API APPLICATIONS

Fitting &amp; Maintenance Instructions

### Safety Instructions

The following designations are used in the installation instructions to highlight instructions of particular importance.

**IMPORTANT** is used for items of particular concern when using the coupling.

**ATTENTION** where there is an obligation or prohibition concerning the avoidance of risk.



**where there is an obligation or prohibition concerning harm to people or damage to the equipment.**

The usual extent of supply comprises:

- A factory-assembled transmission unit (1) comprising
    - 2-off guard rings (5)
    - 1-off spacer (6)
    - 2-off membrane packs (7)
    - 12-off drive bolt assemblies (8) \*consisting of drive bolt and nut, overload collar and washer\*
  - Driver hub (2, 2a, 2b)
  - Driven hub (2, 2a, 2b)
  - 2 sets of hub bolts (3) to secure the transmission unit between the two hub flanges
  - A set of compression bolts to compress the transmission unit for assembly between the hubs
- NOTE:** Only supplied with 0360 size, or for all sizes when both sides have a disc hubs
- For TDKS-0014 and TSKS-0025 to 0215, with at least one standard hub, compress using standard hub bolts (half on each side)
  - For TSKS-0350 to 1400 sizes, compress using compression slots in the hub. If the length of the spacer allows it, it may be possible to use the standard hub bolts to compress

**IMPORTANT** If a general arrangement drawing is supplied with the coupling, then all data indicated on that drawing takes precedence over information included in these instructions.

### Storage

If the coupling is not to be used immediately, it should be stored indoors or in a waterproof container away from direct heat in its original packing.

All documentation supplied with the coupling should be retained for future reference.

### Spares

When requesting spares, always quote the full designation of the coupling (e.g., TSKS-0120-0177-1500).

The following spares can be purchased from John Crane:

- Set of hub bolts (3) **\*please specify standard and/or disc hubs\***
- Hubs, bored to your requirement or unbored (2, 2a, 2b)
- Complete transmission unit, balanced or unbalanced (1)
- Guard ring assembly (0=kit), including
  - Membrane pack (7)
  - Drive bolt assembly (8) \*consisting of drive bolt and nut, overload collar and washer\*
  - Guard ring (5)

### Installation

Remove the coupling from the packaging and carefully inspect for signs of damage. Pay particular attention to the hub bores and the spigot/recess location features, which should be free from burrs and other damage.

### Installation of hubs



**Prior to installing the coupling, ensure that the machinery is made safe. Hubs must be adequately supported during installation to avoid accidental damage should they slip.**

### Installation gaps

There is a "minimum" and "preferred" installation gap that is required behind the disc hub (see Table 1).

- The "minimum" installation gap (see Figure 2) is mandatory and is required to allow the transmission unit to be fitted and removed without moving driving or driven machinery. However, the small gap provides limitations and, in order to fit the coupling, the instructions below must be followed.
  - When fitting the coupling, insert the hub bolts into the hub prior to fixing the hub axial position.
  - When removing hub bolts, remove the transmission unit then slide the hub towards the end of the shaft to create a gap for bolt removal.
- The 'preferred' installation gap (see Figure 3) is not mandatory but allows the hub bolts to be replaced without disturbing the hub.

TABLE 1

| Coupling Size | Installation Gap (mm) |           |
|---------------|-----------------------|-----------|
|               | Minimum               | Preferred |
| 0014          | 15                    | 57        |
| 0025          | 15                    | 57        |
| 0055          | 21                    | 68        |
| 0120          | 21                    | 78        |
| 0215          | 24                    | 88        |
| 0360          | 27                    | 100       |

### Parallel bore with keyed drive

- Ensure the hub bore and mating shaft are clean.
- The hub is usually installed with the hub face and shaft end flush.
- Measure the shaft diameter and hub bore to confirm the correct fit.
- For clearance fits, install the key(s) into the shaft keyway and with a little lubrication on the shaft, slide the hub onto the shaft. The key should be a tight sliding fit in the keyway with a small clearance at the top of the key. Secure the hub to the shaft in the correct axial position with one or more grub screws.
- John Crane recommends a light interference fit for most applications, and it may be necessary to apply heat to assist fitting of such hubs. A warm oil bath will usually be adequate. DO NOT spot heat or exceed 175°C as this may cause distortion. A thermal heat stick can be used to estimate the temperature before quickly sliding the hub onto the shaft. A suitable stop will ensure the correct axial position is located.

FIGURE 2

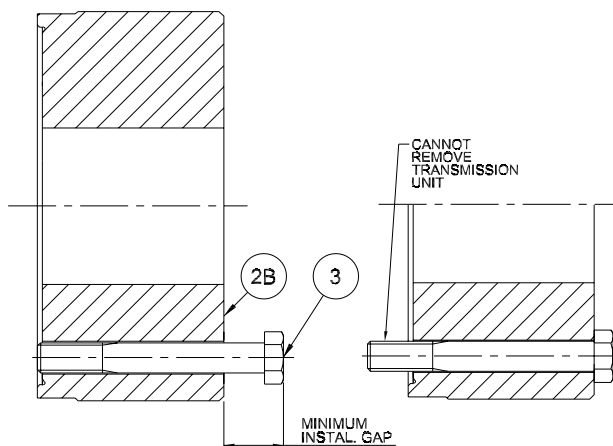
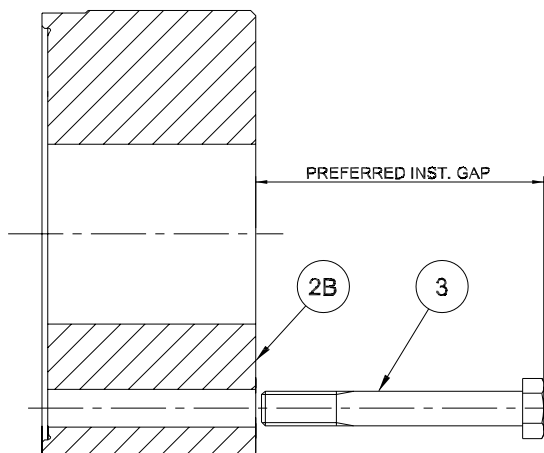


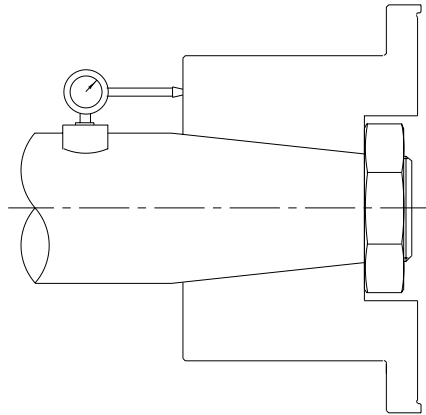
FIGURE 3



**Taper bore with keyed drive (see Figure 4)**

1. Thoroughly clean all contact surfaces and smear the tapered surfaces with oil.
2. Fit the hub onto the shaft without the key(s). Lightly hammer the hub with a soft-faced mallet to ensure metal-to-metal contact takes place.
3. Measure the distance from the end of the shaft to the face of the hub using a depth micrometer (record this measurement).
4. Securely mount a dial gauge onto the inboard hub flange and set to zero.
5. Remove the hub and fit the key(s), which should be a tight sliding fit in the keyway with a small clearance at the top of the key.
6. Refit the hub and draw up the shaft to the correct axial position indicated by the dial gauge. If an interference fit is required the hub may have to be heated (this is rare, however).
7. When the hub has cooled re-measure the distance from the end of the shaft to the face of the hub to confirm the correct axial position.
8. Fit the shaft-end retaining nut if applicable to ensure the hub is locked in position axially.

**NOTE:** The hub face may not be flush with the shaft end when taper bores are used.

**FIGURE 4****Taper hubs mounted by oil injection (see Figure 4)**

1. Ensure that fillets and corner radii of mating surfaces, oil distribution and drainage grooves are well rounded and free from burrs.
2. Thoroughly clean all contact surfaces and smear the tapered surfaces with oil.
3. Fit the hub onto the shaft. Lightly hammer the hub with a soft-faced mallet to ensure metal-to-metal contact takes place.
4. Measure the distance from the end of the shaft to the face of the hub using a depth micrometer (record this measurement).
5. Securely mount a dial gauge onto the inboard hub flange and set to zero.
6. Fit the oil injection equipment, axial stop and mounting tools. Consult the arrangement drawing and the oil injection system suppliers' instructions.



**Fit and secure the axial ram or hydraulic nut BEFORE injecting oil between the components.**

7. Inject oil between the components until the required mounting pressure is reached, or it leaks out at the ends of the mating surfaces.
8. By means of the mounting tools, draw the hub up the shaft to the correct axial position, injecting oil during this operation.  
**NOTE:** The correct pull-up distance should be shown on the hub drawing.
9. Release the oil pressure and leave equipment fitted for one hour to allow for oil to drain from mating surfaces.
10. Remove the mounting tool and oil injection equipment.
11. Remeasure the distance from the end of the shaft to the face of the hub to confirm the correct pull-up.
12. Fit the locking washer and shaft-end retaining nut if applicable.



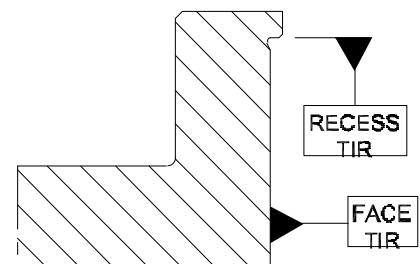
**WAIT for 3-4 hours before applying torque.**

**Unbored hubs**

John Crane recommends a light interference fit for keyed hubs and shafts (e.g., a P7/h6 fit). The finished bore size can be calculated from the measured shaft diameter.

When setting up the hub to machine the bore use the hub location recess and face as datum surfaces, as shown in Figure 5.

The hub face should be set such that the maximum runout does not exceed 0.025 mm TIR. The hub location recess should be set so the maximum runout does not exceed 0.03 mm TIR. Please note that for API 671 applications the required tolerances will be tighter.

**FIGURE 5****Adapters**

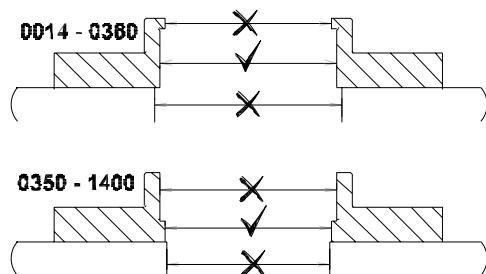
For machines having an integral flanged shaft, the flange may be machined to suit the bolting configuration of the coupling transmission unit. Alternatively, the coupling may be supplied with a customized flange adapter. Refer to the specific general arrangement drawing for location and mounting details.

**Shaft Alignment**

Align the center lines of the driving and driven machine shafts as follows:

1. Move the equipment into position.
2. Check for any soft foot and correct before commencing alignment.
3. With one machine firmly bolted down, set the distance between shaft ends (DBSE) according to the drawing or catalog dimension.

**IMPORTANT** DBSE should be measured between the inner face of the hubs and should not be taken as the length of the transmission unit at its outer periphery. DBSE may not be equal to the precise distance between shaft ends. In particular, the faces of tape-bored hubs may not be flush with the shaft end (refer to Figure 6).

**FIGURE 6**

4. Align the shaft center lines both horizontally and vertically, ideally using the shafts. However, if access prohibits this then align using the hub bosses or flanges. John Crane recommends the reverse periphery method for accurate alignment. This can be done using dial gauges or with a laser shaft alignment kit. Further details on recommended laser alignment vendors are available from John Crane on request.
5. Recheck the DBSE after the shafts have been aligned.
6. Axial shims (together with a shim carrier in some cases) may be supplied on applications where it is difficult to accurately set a predetermined shaft end separation (DBSE). This is often the case where one or both of the hubs are taper bored. Where this feature is supplied, the thickness of shims (plus carrier, if applicable) are added to the free length of the transmission unit so that the combined length is equal to the measured distance between the hub flange faces, making any allowance for known shaft movements.

**NOTE:** It is best to measure the transmission unit when it is in a gagged condition.

**IMPORTANT** The misalignment tolerances quoted in literature and on drawings allow for dynamic conditions and variations. For the best service from the coupling, John Crane recommends that installed misalignment is no more than 10% of the maximum allowable misalignment, with allowance being made for any anticipated movements which will occur during operation (e.g., thermal movements on hot pumps).

### Installation of the Transmission Unit

1. Check spigot and recess locations on the hubs and transmission unit for damage.



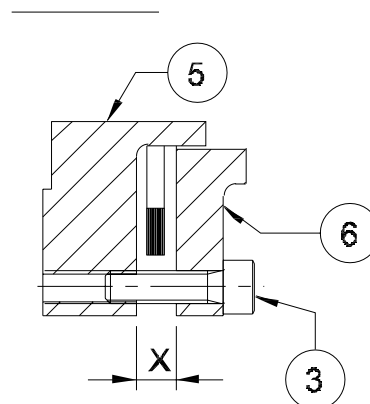
**The transmission unit must be adequately supported during installation to avoid accidental damage should it slip.**

2. Compress the transmission unit then slide it between the hubs.
  - For the TDKS-0014 and TSKS-0025 to 0215, compress using hub bolts (3).
  - For the TSKS-0360 (standard and disc hub) or for all sizes if disc hubs are present on both sides, separate compression bolts will always be supplied.
  - For TSKS-0350 to 1400, compress using compression slots in the hub flanges. If the length of the spacer allows it, it may be possible to use the hub bolts to assist with compression.

To allow for compression using hub bolts (3), the spacer flanges (6) are drilled to allow the bolts to be threaded into the guard ring (5) as shown in Figure 7. For DBFF's less than the preferred minimum, spacer flanges are slotted. Tightening evenly, compressing the transmission unit until clearance between the hub spigots and transmission unit length is achieved, allowing installation. Do not over compress the transmission unit as this can damage the metal membrane elements. The minimum gap 'X' (see Figure 7) should not be less than the values shown in Table 2, unless indicated otherwise on the general arrangement drawing.

**IMPORTANT** Always remove the compression bolts as soon as the transmission unit is in position.

3. Align the hub/transmission unit flanges if they have been match marked.
4. Fit the hub bolts by hand initially, then tighten evenly to locate the transmission unit, ensuring the spigots enter their recesses squarely. Using a torque wrench tighten in a "diametrically opposite" sequence to the torque values shown in Table 2 (tightening torque relates to lubricated bolts).
5. Measure dimension 'A' (see Figure 1) on the transmission unit. Check against the minimum and maximum value in Table 2. If outside these limits, redo the axial alignment.
6. Rotate the machinery two or three times slowly to ensure it moves freely.

**FIGURE 7**

**TABLE 2**

| Coupling Size | Hub Bolt Size | Hub Bolts Tightening Torque (for lubricated bolts) Nm | Min Gap 'X' mm | Coupling Max Axial Deflection +/- mm | Dim'n 'A' (Min) mm | Dim'n 'A' (Max) mm |
|---------------|---------------|-------------------------------------------------------|----------------|--------------------------------------|--------------------|--------------------|
| 0014          | M6            | 12                                                    | 4.5            | 1.5                                  | 5.5                | 5.7                |
| 0025          | M6            | 12                                                    | 7.2            | 1.0                                  | 7.9                | 8.0                |
| 0055          | M8            | 30                                                    | 7.4            | 1.25                                 | 8.3                | 8.4                |
| 0120          | M8            | 30                                                    | 7.7            | 2.0                                  | 9.1                | 9.3                |
| 0215          | M8            | 30                                                    | 8.1            | 2.5                                  | 9.8                | 10.1               |
| 0360          | M10           | 64                                                    | 8.5            | 2.75                                 | 10.4               | 10.7               |
| 0350          | M8            | 25                                                    | 11.6           | 2.75                                 | 13.6               | 13.9               |
| 0500          | M10           | 50                                                    | 11.8           | 3.25                                 | 14.4               | 14.7               |
| 0740          | M10           | 50                                                    | 12.3           | 3.75                                 | 15.2               | 15.5               |
| 0930          | M12           | 86                                                    | 12.5           | 4.25                                 | 15.9               | 16.2               |
| 1400          | M12           | 86                                                    | 13.4           | 5.0                                  | 17.4               | 17.8               |

### Operation, Inspection and Maintenance



**Before starting the machinery, ensure that all necessary safety procedures are being observed and coupling guards are fitted.**

Routine examination should include a periodic check on the tightness of fasteners and visual inspection of transmission unit components for signs of fatigue or wear.

If the coupled machinery is disturbed at any time, shaft alignment should be rechecked. Alignment checking is recommended if a deterioration of installation alignment during service is suspected.



**Maintenance work must only be carried out by suitably qualified personnel when the equipment is stationary and has been made safe.**

John Crane flexible power transmission couplings are designed and selected to give an unlimited service if used within the parameters for which they are specified. Failures are rare and can generally be attributed to excessive misalignment, severe overload or a combination of both. In all cases of coupling failure, it is advisable that the cause of failure is first identified and corrected.

Failure of the coupling will generally be failure of a membrane assembly.

### Transmission Unit Refurbishment

It is recommended that a transmission unit is the minimum spare ordered, in order to ensure that the quality of transmission unit assembly is maintained.

To replace the transmission unit, remove the hub bolts and then withdraw the transmission unit using the compression bolts feature in the spacer, as appropriate.



**The transmission unit must be adequately supported during removal to avoid accidental damage should it slip.**

**ATTENTION** When repairing John Crane flexible membrane couplings, only John Crane approved parts should be used.

**NOTE:** For balanced TSK spacer couplings, the transmission unit is usually supplied as a factory assembled unit that should not be dismantled. However, when used at low or medium speeds, the transmission unit can be reconditioned but will require rebalancing.

Guard ring assembly units (O-kits) should be replaced in pairs, failure of one will usually result in damage to the other.

### Guard Ring Assembly Unit (O-kit) Replacement

1. Remove the drive bolts (8B) and nuts (8N), and remove the guard ring assembly from the spacer piece. Do not attempt to dismantle the guard ring assembly any further.
2. Identify the fasteners on the new guard ring assembly, which attach to the spacer flanges, and remove the loosely assembled nuts (8N).
3. With the bolts (8B) in position, carefully press on the bolt heads to push them into the spacer evenly.  
**NOTE:** Light hammering with a soft mallet may be required, but ensure assembly is even so as not to over-strain the flexible membranes.
4. Place a small amount of thread-locking compound (e.g., Loctite 242 or equivalent) on the protruding bolt threads and then assemble the nuts (8N). Holding the bolts firmly, turn the spacer nuts evenly to the correct tightening torque value given in Table 3.
5. Complete the refurbishment of the transmission unit by replacing the second guard ring assembly unit.

**TABLE 3. Standard Tightening Torques**

| TSKS<br>Coupling Size   | Tightening Torque Nuts (8N) |
|-------------------------|-----------------------------|
|                         | Nm                          |
| TDKS - 0014             | 11                          |
| 0011, 0013, <b>0025</b> | 11                          |
| 0027, 0033, <b>0055</b> | 23                          |
| 0060, 0075, <b>0120</b> | 47                          |
| 0110, 0135, <b>0215</b> | 75                          |
| 0180, 0230, <b>0360</b> | 130                         |
| 0260, <b>0350</b>       | 150                         |
| 0400, <b>0500</b>       | 205                         |
| 0560, <b>0740</b>       | 285                         |
| 0750, <b>0930</b>       | 380                         |
| 1120, <b>1400</b>       | 490                         |

**FIGURE 8**

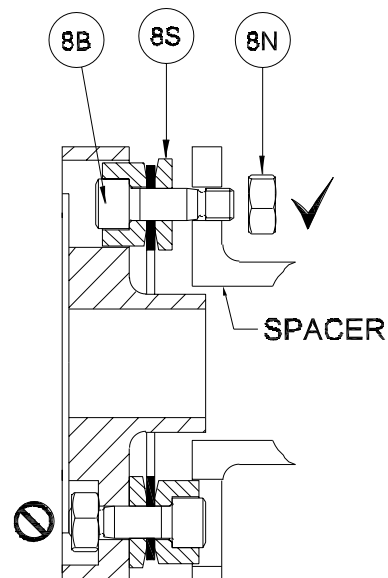


Image indicative of TSKS 0014 to 0360

This section refers to couplings that bear the CE and ATEX required markings:

### CE / ATEX Marking

All couplings that comply with CE and ATEX legislation will be marked as shown. This will be etched on the spacer element of the transmission unit if enough room is available.

#### A) Ambient temperature is standard (40°C max)

CE  I M2<sub>C</sub>  II 2GD<sub>C</sub> T6 (T85°C)  SL1 4LU, UK. XX

Where John Crane's Metastream metal membrane couplings are required for use in higher ambient temperatures, John Crane UK Ltd certifies that the equipment complies with the temperature classification range listed below in Table 4, and in all other respects complies with the type certificates.

TABLE 4

| Ambient Range Marking |            | Group II, Category 2 GD<br>** | Group I, Category 2 M2 | Marking Option |
|-----------------------|------------|-------------------------------|------------------------|----------------|
| Min.                  | Max.       |                               |                        |                |
| Unknown               |            | T3 (T200°C)                   | Not Applicable         | B              |
| -55°C <               | Ta < 150°C | T3 (T200°C)                   | Not Applicable         | B              |
| -55°C <               | Ta < 90°C  | T4 (T135°C)                   | 150°C                  | C              |
| -55°C <               | Ta < 55°C  | T5 (T100°C)                   | 150°C                  | C              |
| -55°C <               | Ta < 40°C  | T6 (T85°C)                    | 150°C                  | A              |

#### B) Ambient temperature is (-55°C < Ta < 150°C) OR ambient temperature is unspecified, the equipment is not suitable for mining applications, Group I, Category 2.

CE  II 2GD<sub>C</sub> T3 (T200°C)  SL1 4LU, UK. XX

#### C) Ambient temperature is (-55°C < Ta < 90°C)

When the ambient temp. is specified, 'T3' is replaced by the following 'T' mark (\*\*) according to Table 4.

CE  I M2<sub>C</sub>  II 2GD<sub>C</sub> \*\*  SL1 4LU, UK. XX

### NOTE:

'XX' is the year of manufacture and will change. For example, for year 2016; XX = 16.

CE and EX marks must meet requirements of Annex II in Reg. (EC) No. 765/2008 and Annex II in Dir. 84/47/EEC respectively.

### Operation in aggressive atmospheres

The following components contain non-metallic materials. Confirm compatibility or provide suitable protection if the coupling is to operate in an aggressive atmosphere.

- The hub electrical insulation (if supplied option) – reinforced thermosetting plastic
- Limited end float bearings (if supplied option) – PTFE based plastic

### Temperature classification of John Crane's Metastream couplings

John Crane's Metastream metal membrane couplings, supplied in conformance with Directive 2014/34/EU, have to meet the classifications specified in Table 4 when used in accordance with instructions and information supplied.

T, L and H series couplings, using the disk type flexible elements, are covered by type examination certificate **Sira 02ATEX9403**.

M series couplings, using the diaphragm type flexible elements, are covered by type examination certificate **Sira 02ATEX9404**.



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 www.johncrane.com

### Declaration of Conformity

EEC Directive 2014/34/EU of 26.02.2014  
 and resultant legislation and standards

We, the manufacturers – John Crane UK Ltd, – confirm that the explosion prevention requirements have been implemented for

#### Metastream® metal-membrane couplings

Equipment complies with the requirements of directive 2014/34/EU. It is in accordance with article 1 3. (a) of the directive and the fundamental Health and Safety requirements of Annex II, are fulfilled.

The current Type Examination Certificates for the couplings are:-

|                         |                 |
|-------------------------|-----------------|
| 'T', 'L' & 'H' Series - | Sira 02ATEX9403 |
| 'M' Series -            | Sira 02ATEX9404 |

The technical documentation is deposited with the designated notified body in accordance with article 13 (b) (ii) of the Directive 2014/34/EU.

SIRA Certification Services  
 Unit 6, Hawarden Industrial Park  
 Hawarden, Chester, CH5 3US  
 United Kingdom

Signed:

Date: 20<sup>th</sup> July 2016

S. Pennington  
 (Engineering Manager - Couplings)



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www.johncrane.com

### **Declaration of Incorporation**

#### **E.C. Machinery Directive (2006/42/EC)**

- Section 1.0 - Machinery Description:  
Flexible Power Transmission Ring and Diaphragm Form Membrane Couplings  
Types:  
  
‘H’, ‘T’, ‘L’ & ‘M’ Series
- Section 2.0 - Applicable Harmonised Standards  
ISO13709 (API 610) for centrifugal pumps  
ISO14691 couplings for - General-purpose applications  
ISO10441 (API 671) (opt) couplings for - Special-purpose applications
- Section 3.0 - Declaration:  
We, John Crane declare that under our sole responsibility for the supply of the machinery defined in Section 1.0 above, the said machinery parts are intended to be incorporated into other machinery or assembled with other machinery to constitute machinery as covered by this Directive.
- The machinery parts, covered by this declaration must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

Signed:

Date: 20th July 2016

S. Pennington  
(Engineering Manager - Couplings)



# TSKS

## FLEXIBLE MEMBRANE COUPLING FOR API APPLICATIONS

Fitting & Maintenance Instructions



# TSKS

## FLEXIBLE MEMBRANE COUPLING FOR API APPLICATIONS

Fitting & Maintenance Instructions



| North America            | Europe              | Latin America        | Middle East & Africa | Asia Pacific      |
|--------------------------|---------------------|----------------------|----------------------|-------------------|
| United States of America | United Kingdom      | Brazil               | United Arab Emirates | Singapore         |
| Tel: 1-847-967-2400      | Tel: 44-1753-224000 | Tel: 55-11-3371-2500 | Tel: 971-481-27800   | Tel: 65-6518-1800 |
| Fax: 1-847-967-3915      | Fax: 44-1753-224224 | Fax: 55-11-3371-2599 | Fax: 971-488-62830   | Fax: 65-6518-1803 |

If the products featured will be used in a potentially dangerous and/or hazardous process, your John Crane representative should be consulted prior to their selection and use. In the interest of continuous development, John Crane Companies reserve the right to alter designs and specifications without prior notice. It is dangerous to smoke while handling products made from PTFE. Old and new PTFE products must not be incinerated. ISO 9001 and ISO14001 Certified, details available on request.

# ECHOTEL® 961/962

## LOOP POWERED

### Installation and Operating Manual

*Ultrasonic*

*Single and*

*Dual Point*

*Level Switches*



**Model 961**



**Model 962**



## UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the foam protection. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crates against the packing slip and report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.



These units are in compliance with:

1. The EMC directive 2014/30/EU. The units have been tested to EN 61326: 1997 + A1 + A2.
2. Directive 2014/34/EU for equipment or protective system intended for use in potentially explosive atmospheres. EC-type examination certificate number ISSeP12ATEX033X - intrinsically safe and ISSeP12ATEX042 - flameproof enclosure.
3. The PED Directive 2014/68/EU (pressure equipment directive). Safety accessories per category IV module H1.

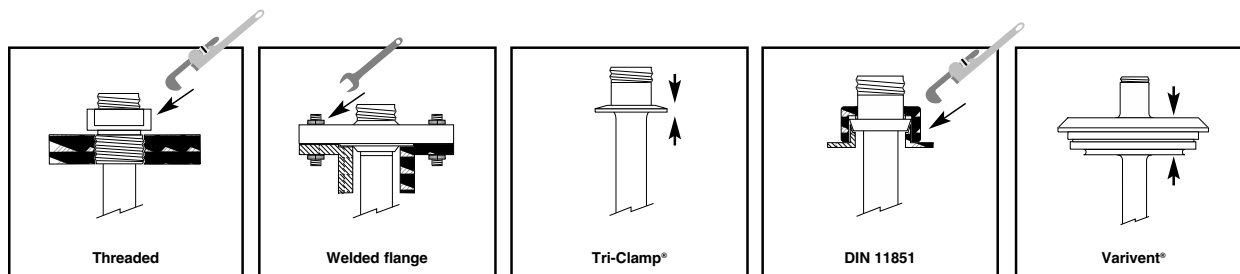
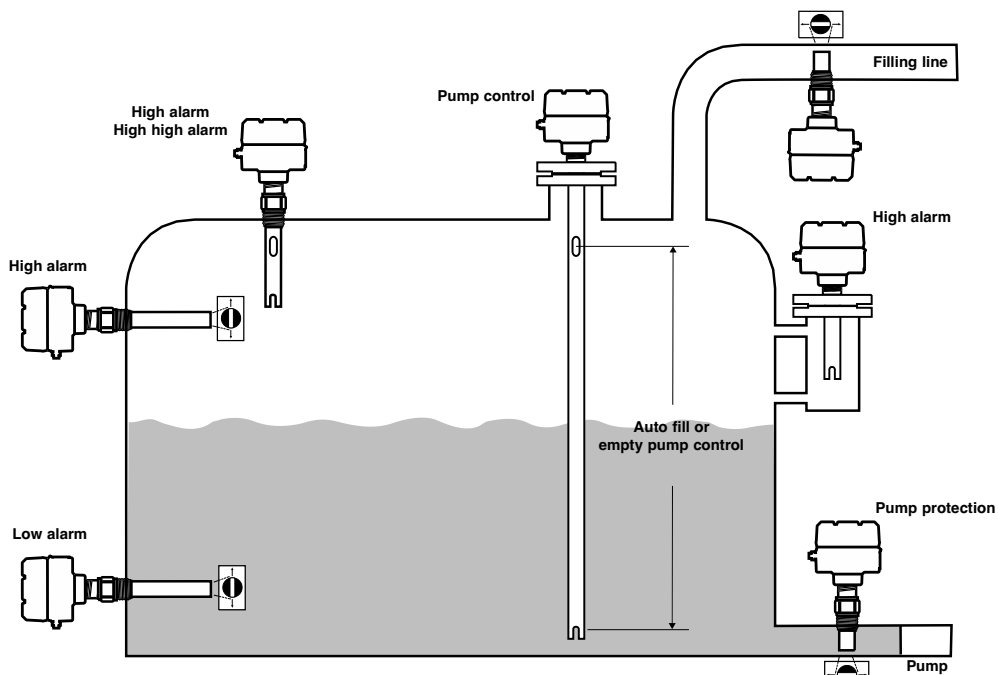
Nameplate:  
- part number  
- serial n°



## SPECIAL CONDITIONS FOR ATEX INTRINSICALLY SAFE USE

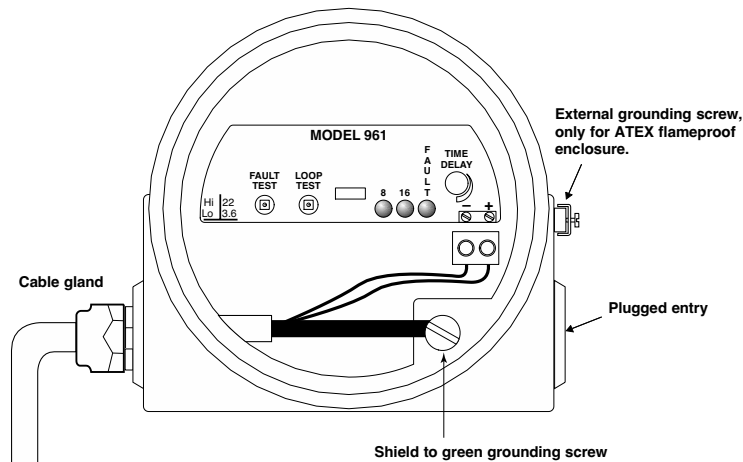
Materials marked as Category 1 equipment and used in hazardous areas requiring this category, shall be installed in such a way that, even in the event of rare incidents, the aluminium enclosure cannot be an ignition source due to impact or friction.

## MOUNTING

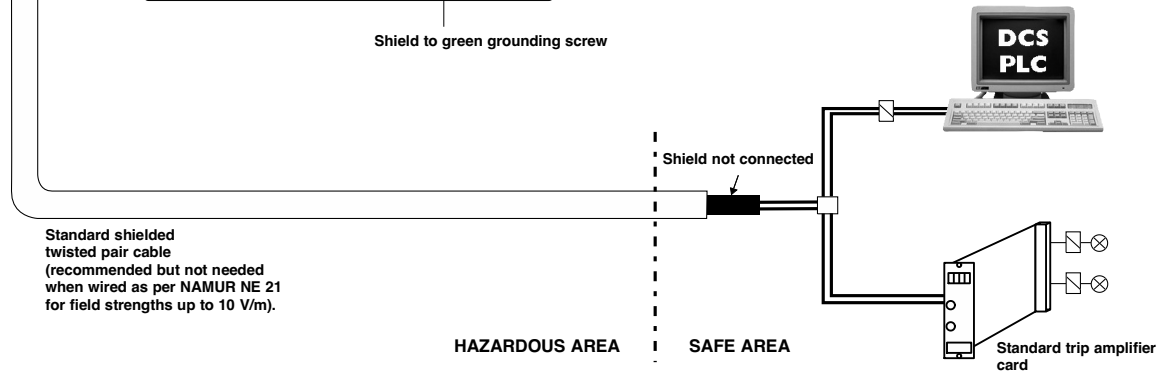
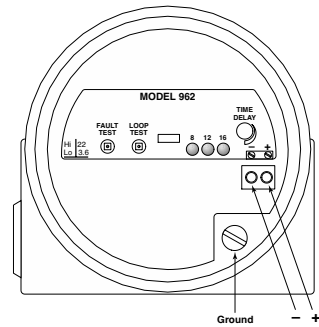


## WIRING

Echotel® 961 electronics



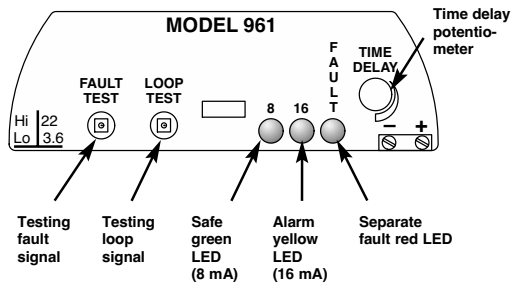
Echotel® 962 electronics



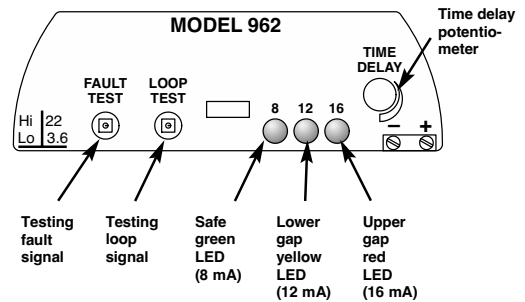
**Important: Connect the unit to the ground for avoiding earth potential drifts.**

## USER INTERFACE

Echotel® 961



Echotel® 962



## SET UP AND FUNCTIONS

### Set up

#### High – Low Level Failsafe selection:<sup>①</sup>

In «Hi» position, the current will shift to 12/16 mA (report alarm) when the transducer is **wet**.  
In «Lo» position, the current will shift to 12/16 mA (report alarm) when the transducer is **dry**.  
In both positions, the current will stay at 8 mA to report a safe condition.

#### Fault selection:

Select for which signal the unit should report a malfunction  $\geq 22$  mA or  $\leq 3,6$  mA

#### Time delay setting:

Turning the potentiometer clockwise will increase the time delay from 0,5 s to 10 s. Time delay is typically used where turbulence, boiling or splashing can cause false level alarms.

### Indication

#### Echotel 961

| Failsafe <sup>①</sup> mode  | Level                                                                             | Output signal       | 8 mA green LED | 16 mA yellow LED | Fault red LED |
|-----------------------------|-----------------------------------------------------------------------------------|---------------------|----------------|------------------|---------------|
| «Hi»<br>High Level Failsafe |  | 8 mA ( $\pm 1$ mA)  | ON             | OFF              | OFF           |
|                             |  | 16 mA ( $\pm 1$ mA) | OFF            | ON               | OFF           |
| «Lo»<br>Low Level Failsafe  |  | 8 mA ( $\pm 1$ mA)  | ON             | OFF              | OFF           |
|                             |  | 16 mA ( $\pm 1$ mA) | OFF            | ON               | OFF           |

Fault LED is ON = Fault indication

#### Echotel 962

| Failsafe mode               | Level                                                                               | Output signal       | 8 mA green LED | 12 mA yellow LED | 16 mA red LED |
|-----------------------------|-------------------------------------------------------------------------------------|---------------------|----------------|------------------|---------------|
| «Hi»<br>High Level Failsafe |  | 8 mA ( $\pm 1$ mA)  | ON             | OFF              | OFF           |
|                             |  | 12 mA ( $\pm 1$ mA) | OFF            | ON               | OFF           |
|                             |  | 16 mA ( $\pm 1$ mA) | OFF            | OFF              | ON            |
| «Lo»<br>Low Level Failsafe  |  | 8 mA ( $\pm 1$ mA)  | ON             | OFF              | OFF           |
|                             |  | 12 mA ( $\pm 1$ mA) | OFF            | ON               | OFF           |
|                             |  | 16 mA ( $\pm 1$ mA) | OFF            | OFF              | ON            |

All LED's OFF = Fault indication

<sup>①</sup> Use the following settings to replace Echotel 915 series with the new Echotel 961 series:  
For High Level Failsafe, use «Lo» setting = low current draw (from 16 mA (safe) to 8 mA (alarm))  
For Low Level Failsafe, use «Hi» setting = high current draw (from 8 mA (safe) to 16 mA (alarm))

## MAINTENANCE

### Manual Testing

#### Loop Test: (8 mA / 12mA / 16mA):

Pressing the "Loop Test" pushbutton, will manually test the loop and connected actuators/indicators. The loop test forces the output and corresponding LED's to shift from 8 mA to 12 mA (only 962) to 16 mA back to 8 mA. The time delay setting is not active during testing.

#### Fault Test (3.6 mA /22 mA):

Pressing the "Fault Test" pushbutton for min 2 s, will manually test the fault output and connected actuators/indicators. The fault test simulates a circuit failure and forces the output to either  $\leq 3.6$  mA or  $\geq 22$  mA. The time delay setting is not active during testing.

### Troubleshooting

| Problem                                       | Action/Indication                                     | Solution                                                                                                                                                                                                                          |
|-----------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No loop signal                                | No LED's are ON                                       | Check wiring / input power<br>Check for malfunction (962). See below                                                                                                                                                              |
| No change in output between wet gap / dry gap | Gap may be plugged by solids / dense foam             | Clean the transducer                                                                                                                                                                                                              |
|                                               | Gap is out of reach of liquid                         | Check mounting section and relocate the unit or check blocking valves.                                                                                                                                                            |
| Chattering output                             | Excessive aeration / Turbulence                       | Introduce a time delay                                                                                                                                                                                                            |
|                                               |                                                       | Check input power                                                                                                                                                                                                                 |
|                                               |                                                       | Relocate the switch                                                                                                                                                                                                               |
|                                               |                                                       | If installed horizontally, make sure the 961 transducer gap is oriented in a vertical position as shown in the mounting section. This allows proper drainage from the gap, and prevents air bubbles from accumulating in the gap. |
| Fault LED is ON (961)<br>All LED's OFF (962)  | A system fault has been detected                      | Check input power                                                                                                                                                                                                                 |
|                                               | Press «Loop Test» pushbutton to identify the problem: |                                                                                                                                                                                                                                   |
|                                               | * --- * : 1 flash (red LED)                           | Check wiring between transducer and electronics or replace transducer.                                                                                                                                                            |
|                                               | ** --- ** : 2 flashes (red LED)                       | Replace electronics                                                                                                                                                                                                               |
|                                               | *** --- *** : 3 flashes (red LED)                     | The unit senses excessive noise interference. Check shield connection or eliminate interference from a walkie-talkie, radio or other nearby source                                                                                |

## REPLACEMENT PARTS

### Replacing electronics/transducer

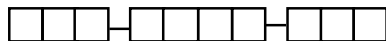
Echotel electronics can be removed in the field under process conditions. Follow below steps to exchange electronics/transducer:

**Note:** Adjust set up of the replacing electronics following the settings of the old electronics (see configuration section)

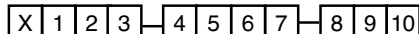
1. Disconnect power before removing the housing cover
2. Remove power/output wires (a)
3. (Skip step 3 if hygienic housing.) Click out the protection cap of the electronics (b)
4. Remove the 2 bracket screws and slide out electronics (c)
5. Remove the transducer wires (see Wiring section) (d)
6. Re-assemble following the same procedure in opposite way. Make sure that the tip on the bracket of the electronic block is seated properly in the corresponding recess in the housing base - (e)

### Replacement parts

Partn°:



Digit in partn°:



→ X = product with a specific customer requirement

Serial n°:



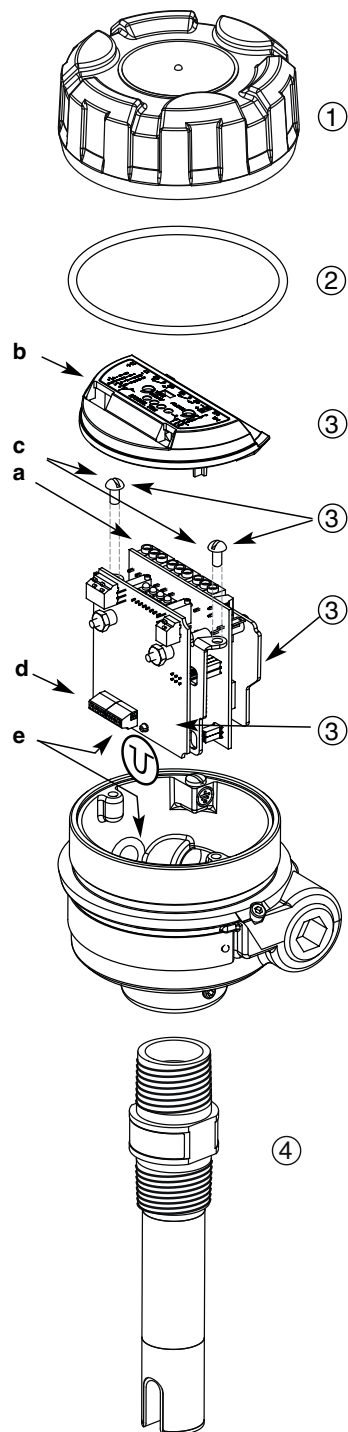
See nameplate, always provide complete partn° and serial n° when ordering spares.



### EXPEDITE SHIP PLAN (ESP)

Several parts are available for quick shipment, within max. 1 week after factory receipt of purchase order, through the Expedite Ship Plan (ESP).  
Parts covered by ESP service are conveniently grey coded in the selection tables.

| No. | Description                                                               | Part Number     |
|-----|---------------------------------------------------------------------------|-----------------|
| 1   | Cast aluminium cover (digit 10 = 0 or 1)<br>Blind                         | 004-9192-009    |
|     | With window                                                               | 036-4410-010    |
|     | Cast stainless steel cover (digit 10 = 2 or 3)<br>Blind                   | 004-9224-014    |
|     | Deep drawn stainless steel cover (digit 10 = 4 or 5)<br>Blind             | 032-3934-001    |
| 2   | "O"-Ring<br>digit 10 = 0, 1, 2 or 3                                       | 012-2201-237    |
|     | digit 10 = 4 or 5                                                         | 012-2201-155    |
| 3   | Electronic module for industrial housing (digit 10 = 0, 1, 2 or 3)<br>961 | 089-7259-005    |
|     | 962                                                                       | 089-7258-003    |
|     | Electronic module for hygienic housing (digit 10 = 4 or 5)<br>961         | 089-7256-003    |
|     | 962                                                                       | 089-7257-003    |
|     | Transducer                                                                | consult factory |
| 4   |                                                                           |                 |



## MODEL IDENTIFICATION

**A complete measuring system consists of:**

1. Echotel® electronics
2. Echotel® transducer

### 1. Code for Echotel® electronics

#### BASIC MODEL NUMBER

|       |                                                              |
|-------|--------------------------------------------------------------|
| 9 6 1 | Echotel® 961 electronics for single setpoint 9M1 transducers |
| 9 6 2 | Echotel® 962 electronics for dual setpoint 9M2 transducers   |

#### INPUT POWER

|       |                                                                        |
|-------|------------------------------------------------------------------------|
| 5 0 A | 12 - 35 V DC 2-wire loop powered electronics with current shift output |
|-------|------------------------------------------------------------------------|

#### ACCESSORIES

|   |                                                                         |
|---|-------------------------------------------------------------------------|
| 0 | Blind housing cover                                                     |
| 1 | Housing cover with glass window (not for cast stainless steel housings) |

#### MOUNTING

|   |                            |
|---|----------------------------|
| 0 | Integral mount electronics |
|---|----------------------------|

#### APPROVALS

|   |                                                             |                                 |
|---|-------------------------------------------------------------|---------------------------------|
| A | ATEX II 1 G Ex ia IIC T5 Ga, intrinsically safe             | - except deep drawn SST housing |
| C | ATEX II 1/2 G / IEC Ex d IIC T6 Ga/Gb, flameproof enclosure | - except deep drawn SST housing |
| 1 | Weatherproof                                                | - except deep drawn SST housing |
| 7 | Weatherproof                                                | - deep drawn SST housing        |

#### HOUSING / CABLE ENTRY

|   |                                                                                     |
|---|-------------------------------------------------------------------------------------|
| 1 | Cast aluminium housing with M20 x 1,5 cable entry (2 entries – one plugged)         |
| 0 | Cast aluminium housing with 3/4" NPT cable entry (2 entries – one plugged)          |
| 3 | Cast stainless steel with M20 x 1,5 cable entry (2 entries – one plugged)           |
| 2 | Cast stainless steel with 3/4" NPT cable entry (2 entries – one plugged)            |
| 5 | Deep drawn 304 stainless steel with M20 x 1,5 cable entry (2 entries – one plugged) |
| 4 | Deep drawn 304 stainless steel with 1/2"NPT cable entry (1 entry)                   |

9 6 5 0 A 0 **complete code for Echotel® electronics**

→ X = product with a specific customer requirement

### 2. Code for Echotel® transducer

#### BASIC MODEL NUMBER

|       |                                              |
|-------|----------------------------------------------|
| 9 M 1 | Echotel® 961 transducer with single setpoint |
| 9 M 2 | Echotel® 962 transducer with dual setpoints  |

#### TRANSDUCER MATERIALS (use only metal transducers for hazardous area)

|   |                                                                                |
|---|--------------------------------------------------------------------------------|
| A | 316/316L (1.4401/1.4404) stainless steel                                       |
| B | Hastelloy® C (2.4819) – only available with 9M1                                |
| C | Monel® (2.4360) – only available with 9M1                                      |
| N | 316/316L (1.4401/1.4404) stainless steel & NACE MR0175/MR0103                  |
| P | CPVC                                                                           |
| R | Kynar® (PVDF) – only available with 9M1                                        |
| S | 316/316L (1.4401/1.4404) stainless steel with 0,5 µm Ra (20 Ra) surface finish |

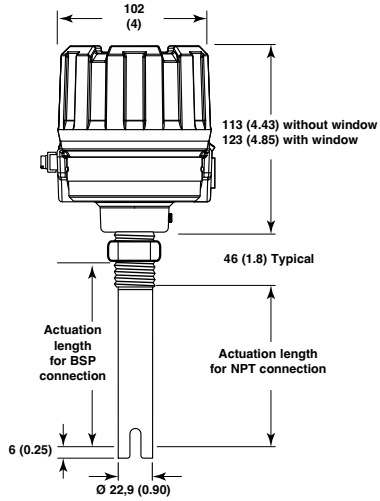
SEE NEXT PAGE

9 M **complete code for Echotel® transducer**

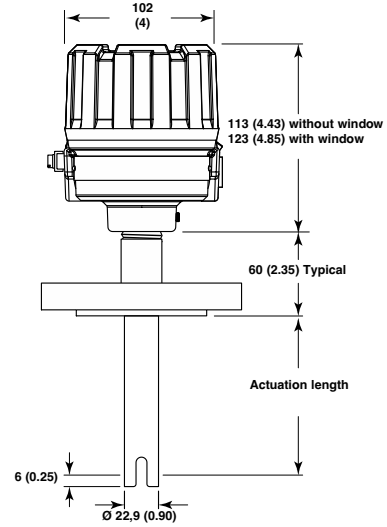
→ X = product with a specific customer requirement



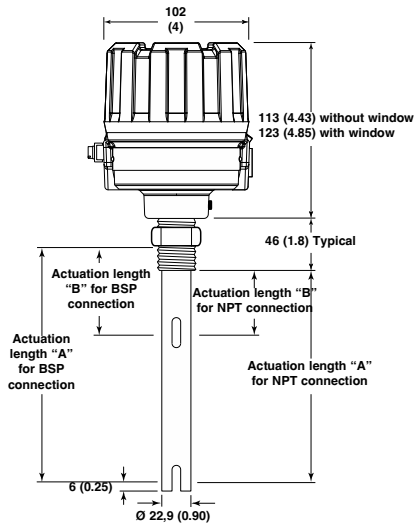
**DIMENSIONS IN mm (inches)**



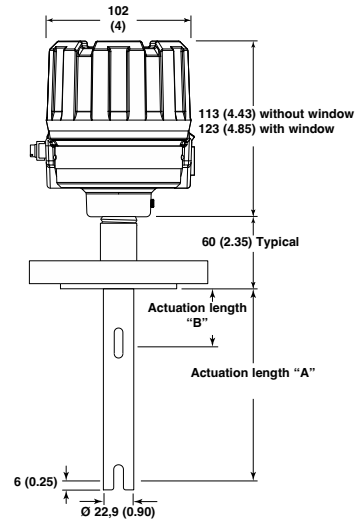
**961 - Threaded connection**



**961 - Flanged connection**



**962 - Threaded connection**

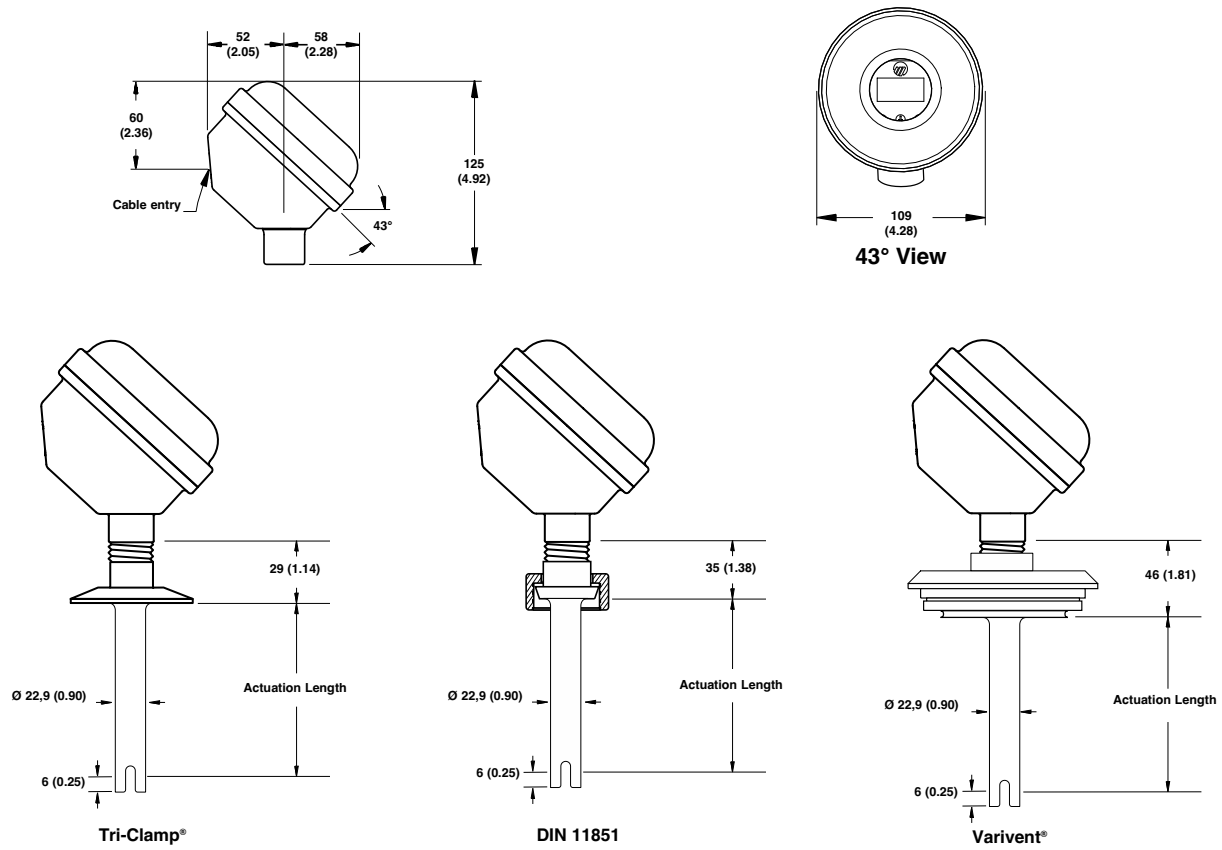


**962 - Flanged connection**

**Note:**

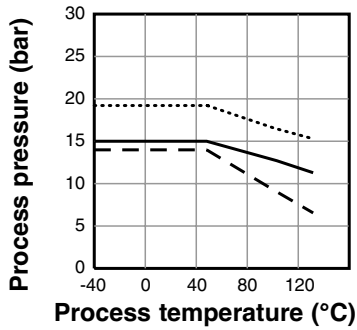
- Difference between actuation lengths "A" and "B" must be min. 8 cm.
- Max. length for dimension "B" is 322 cm.

## DIMENSIONS IN mm (inches)

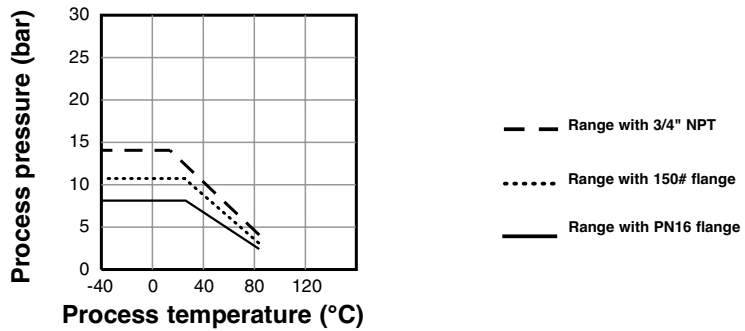


## PRESSURE / TEMPERATURE RATINGS

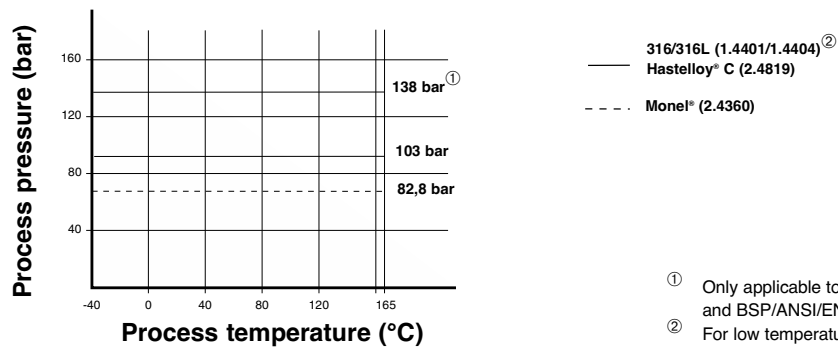
### Kynar® Transducer Ratings



### CPVC Transducer Ratings



### Metal Transducer Ratings



- ① Only applicable to NPT-connections with actuation length = 3 cm and BSP/ANSI/EN (DIN)-connections with actuation length = 5 cm
- ② For low temperature sensor: from -80 °C up to +120 °C

## SPECIFICATIONS

### Electronics specifications

| Description                  |           | Specification                                                                                                                                                                                                                                                                                                               |
|------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Voltage                |           | 2 wire loop powered, 12 - 35 V DC                                                                                                                                                                                                                                                                                           |
| Power Consumption            |           | < 1 Watt                                                                                                                                                                                                                                                                                                                    |
| Output                       |           | <b>961:</b> 8 mA (safe), 16 mA (alarm) $\pm$ 1 mA<br><b>962:</b> 8 mA (safe), 12 mA (lower gap alarm), 16 mA (upper gap alarm) $\pm$ 1 mA<br><b>961/962:</b> $\leq$ 3,6 or $\geq$ 22 mA error signal                                                                                                                        |
| Time delay                   |           | 0,5 to 10 s adjustable (in addition to transducer response time)                                                                                                                                                                                                                                                            |
| Indication                   |           | LED's for process alarm status, malfunction (error of transducer, electronics or electrical noise interference)                                                                                                                                                                                                             |
| Selftest                     | Automatic | Continuously verifies electronics, transducer and noise interference                                                                                                                                                                                                                                                        |
|                              | Manual    | Via pushbutton for checking alarm output(s) and error output/function.                                                                                                                                                                                                                                                      |
| Housing material             |           | IP66, cast aluminium, cast stainless steel or deep drawn 304 stainless steel (IP 67)                                                                                                                                                                                                                                        |
| Approvals <sup>①</sup>       |           | ATEX II 1 G Ex ia IIC T5 Ga, intrinsically safe (units with metal transducers)<br>ATEX II 1/2 G Ex d IIC T6 Ga/Gb, flameproof enclosure (units with metal transducers)<br>IEC Ex d IIC T6 Ga/Gb<br>Overfill prevention TÜV - WHG § 63 / VLAREM II 5.17.7<br>Other approvals are available, consult factory for more details |
| SIL (Safety Integrity Level) |           | Functional safety to SIL 2 in accordance to IEC 61508 – SFF > 90 %<br>Full FMECA report and declaration sheets available at request                                                                                                                                                                                         |
| Electrical data              |           | Ui = 28,4 V, li = 94 mA, Pi = 0,67 W                                                                                                                                                                                                                                                                                        |
| Equivalent data              |           | Ci = 10,4 nF (961) / Ci = 60 nF (962), Li = 400 $\mu$ H                                                                                                                                                                                                                                                                     |
| Shock/Vibration              |           | ANSI/ISA-S71.03 Class SA1 (shock), ANSI/ISA-S71.03 Class VC2 (vibration)                                                                                                                                                                                                                                                    |
| Net weight                   |           | Aluminium / Deep drawn 304 SST: 1 kg (2.2 lbs) – electronics only<br>Cast SST: 2,5 kg (5.5 lbs) – electronics only                                                                                                                                                                                                          |

<sup>①</sup> Only available with cast aluminium or cast stainless steel housings

### Performance

| Description                   | Specification                                                    |
|-------------------------------|------------------------------------------------------------------|
| Response time                 | 0,5 s typical                                                    |
| Repeatability                 | $\pm$ 2 mm (0.078")                                              |
| Ambient Temperature           | -40 °C to +70 °C (-40 °F to +160 °F)                             |
| Humidity                      | 0-99 %, non-condensing                                           |
| Electromagnetic Compatibility | Meets CE requirements (EN 61326: 1997 + A1 + A2) and NAMUR NE 21 |

### Transducer specifications

| Description                                | Plastic transducers                                                                            | Metal transducers                                                                                                                    |
|--------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Material                                   | CPVC<br>Kynar® (PVDF)                                                                          | 316/316L SST (1.4401/1.4404)<br>Hastelloy® C (2.4819)<br>Monel® (2.4360)                                                             |
| Mounting                                   | Threaded (NPT/BSP) – Flanged (ANSI - EN (DIN)) – Hygienic                                      |                                                                                                                                      |
| Actuation length                           | From 5 cm up to 304 cm (2" up to 120") – PVDF<br>From 5 cm up to 330 cm (2" up to 130") – CPVC | From 3 cm up to 330 cm (1.2" up to 130")                                                                                             |
| Process temp. (consult temp/press. graphs) | -40 °C to +120 °C (-40 °F to +250 °F) – PVDF<br>-40 °C to +80 °C (-40 °F to +180 °F) – CPVC    | -40 °C to +165 °C (-40 °F to +325 °F) – standard<br>-80 °C to +120 °C (-110 °F to +250 °F) – low temperature version in 316/316L SST |
| Max pressure (consult temp/press. graphs)  | 13,8 bar @ +40 °C (200 psi @ +100 °F)<br>for NPT threaded units                                | 82,8 bar (1200 psi) for Monel transducers<br>Consult temp/press. graphs for other materials                                          |
|                                            | Flanged models are downrated to the design pressure of the selected flange                     |                                                                                                                                      |

# IMPORTANT

## SERVICE POLICY

Owners of Magnetrol products may request the return of a control; or, any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) **other than transportation cost** if:

- a. Returned within the warranty period; and,
- b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour and the parts required to rebuild or replace the equipment.

In some cases, it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned, will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labour, direct or consequential damage will be allowed.

## RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorisation" (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol's local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number and Ref Number
4. Desired Action
5. Reason for Return
6. Process details

Any unit that was used in a process must be properly cleaned in accordance with the proper health and safety standards applicable by the owner, before it is returned to the factory.

A material Safety Data Sheet (MSDS) must be attached at the outside of the transport crate or box.

All shipments returned to the factory must be by prepaid transportation. Magnetrol **will not accept** collect shipments.

All replacements will be shipped Ex Works.

UNDER RESERVE OF MODIFICATIONS

BULLETIN N°: BE 51-646.11  
EFFECTIVE: AUGUST 2017  
SUPERSEDES: December 2015



**Magnetrol®**

www.magnetrol.com

|                   |                                                                                                                                                                    |
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