WP 49

## IPSWICH WATER

## KEIDGES ROAD

## PUMPING STATION UPGRADE

## ELECTRICAL SWITCHBOARD OPERATION AND MAINTENANCE MANUAL

## Developed by:



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Date: $\quad 8 / 5 / 052: 10 \mathrm{pm}$
Subject: Keidges Road Pump Station
Trevor,
As discussed, please find attached correspondance from CMG confirming operation of the 33 kW motor. Please advise if additional information is required.

## Best regards

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### 1.0 INTRODUCTION

These operating instructions cover the Keidges Road pumping station electrical equipment supplied by J \& P Richardson Industries Pty Ltd in September 2004.

### 1.1 Operating Instructions

Normal operation of the pumping station is in the automatic mode with control by means of a Radio Telemetry Unit (RTU).

Manual operation control of the station is available by means of selector switches on the motor control switchboard.

### 2.0 DESCRIPTION OF OPERATION

### 2.1 Operating Philosophy

The power for the switchboard is supplied from service fuses out on the street.
The pumps can be controlled either manually, or automatically by the Scada system. These operations are detailed in Clauses 2.2,3,4.

Also contained within the switchboard are controls for minor drives such as fans, general light \& power, \& instrumentation.

The starting \& protection methods for the Main Pumps are detailed in Section 4, Clauses $4.1,2,3$. The indication methods are detailed for these \& other controls are detailed in Section 4, Clause 4.4

### 2.2 Mode Selection

The station can be operated either automatically or manually with mode selection being made by means of the mode selector switches mounted on each pump section of the switchboard. These selector switches are designated with the following mode selections AUTO-OFF-MAN.

### 2.3 Manual Control

Each pumping unit can be run in manual control from the motor control centre by: -
a). Selecting the "MAN" setting on the "MODE SELECTOR SWITCHES" as described in Clause 2.2.
b). Starting by "START" pushbutton.
c). Stopping by "STOP" pushbutton.

## N.B. DO NOT LEAVE IN MANUAL WHILE STATION UNATTENDED

### 2.4 Automatic Control

For automatic control of the station: -
a). The "MODE SELECTOR SWITCHES" on the switchboard should be in the "AUTO" position.
b). The automatic Duty Selection is done via the RTU software.
c). The automatic starting, and stopping of the pumps is controlled by signals from the RTU.

For NORMAL OPERATION, each of the pump selector switches should have "AUTO" mode selected.


### 3.0 PUMPS

| SUPPLIER: | KSB AJAX PUMPS Pty. Ltd. 27 INDWE STREET TOTTENHAM, VIC 3012 |
| :---: | :---: |
| Ph: | (03) 93140611 |
| Fax: | (03) 93147435 |
| MODEL: | KSB OMEGA 125-365B GB WITH CMG 33Kw 4P MOTOR |
| SERIAL NUMBER: | 0406 |
| FULL LOAD CURRENT: | 57Amps |
| VOLTAGE: | 415 V 50 Hz |
| R.P.M.: | 1450 |
| DRIVE END BEARING: | 6312 |
| NON DRIVE END BEARING: | 6312 |
| WEIGHT: | 260 kg |
| ENCLOSURE: | IP55 |

# Operating And Maintenance Instructions 

## Client:

 J \& P RICHARDSON INDUSTRIES PTY LTDProject: $\qquad$ Order No: P0640

Pump Type/Model: OMEGA 125-365B
KSB Works No: 45816


Quality
Endorsed
Company
AS/NZS ISO9001:1994
LIC 768
27 Indwe St., Tottenham


## INDEX

- Omega Pumps Operating Instructions
- Electric Motors Maintenance Instructions
- Coupling Installation \& Alignment Instructions
- Certified G.A. Drawing No. A4-UX02503
- Pump Performance Curve \& Details No. 278-04A


## KSB AJAX O \& M MANUAL DATA SHEET

| CUSTOMER:- | J \& P RICHARDSON INDUSTRIES P/L |
| :--- | :--- |
| PROJECT:- | KEIDGES RD, PUMP STATION |
| ORDER NO:- | P0640 |


| OPERATING DATA |  |
| :--- | :---: |
| CLIENT EQUIP REF:- | ELECTRIC UNIT |
| KSB AJAX REF:- | $45816-01$ |
| PUMP MAKE:- | OMEGA |
| PUMP SIZE:- | $125-365 \mathrm{~B}$ |
| PUMP SERIES:- | UX02503KAP |
| IMPELLER DIA (MM):- | 330 |
| COUPLING TYPE:- | RATHI |
| COUPLING SIZE:- | RRS226140 |
| DRIVER:- | CMG |
| DRIVER MODEL/FRAME NO:- | D200L |
| POWER (KW):- | 30 |
| SPEED (RPM):- | 1475 |
| FLOW (L/S):- | 47 |
| HEAD (M):- | 35.5 |
| TEST NO:- | $278-04 \mathrm{~A}$ |
| DRAWING NO:- | A4-UX02503 |

## Omega



Volute casing pump
with radial impeller

Pump set

Horizontal installation-3E

These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, electrical connection and commissioning.
It is imperative to comply with all other operating instructions referring to components of individual units.


Any work on the unit must only be carried out with the electrical connections (incl. control cable) disconnected (or unplugged). Make sure that the pump set cannot be switched on accidentally.


Omega

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## 1 General

This KSB pump has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control.
These operating instructions are intended to facilitate familiarization with the pump and its designated use.
The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the pump and to avoid any risks.
These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.

This pump / unit must not be operated beyond the limit values specified in the technical documentation for the medium handled, capacity, speed, density, pressure, temperature and motor rating. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation.

The name plate indicates the type series / size, main operating data and works / series number; please quote this information in all queries, repeat orders and particularly when ordering spare parts.
If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact KSB's nearest customer service centre.

## 2

## Safety

These operating instructions contain fundamental information which must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the location of operation of the machine $/$ unit for easy access.

Not only must the general safety instructions laid down in this chapter on "Safety" be complied with, but also the safety instructions outlined under specific headings.

### 2.1 Marking of Instructions in the Manual

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the general hazard sign, namely

safety sign in accordance with DIN 4844 - W9.

The electrical danger warning sign is

safety sign in accordance with DIN 4844 - W8.

The word

## Caution

is used to introduce safety instructions whose nonobservance may lead to damage to the machine and its functions.

Instructions attached directly to the machine, e.g.

- arrow indicating the direction of rotation
- markings for fluid connections
must always be complied with and be kept in perfectly legible condition at all times.


### 2.2 Personnel Qualification and Training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved.
Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the requisite know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer / supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

### 2.3 Non-Compliance with Safety Instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.
In particular, non-compliance can, for example, result in:

- failure of important machine / unit functions
- failure of prescribed maintenance and servicing practices
- hazard to persons by electrical, mechanical and chemical effects
- hazard to the environment due to leakage of hazardous substances


### 2.4 Safety Awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national health and safety regulations and the operator's own internal work, operation and safety regulations.
2.5 Safety Instructions for the Operator / User

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards which are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed whilst the machine is operating.
- Leakages (e.g. at the shaft seal) of hazardous media handled (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons and the environment. Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (In this respect refer to the relevant safety regulations applicable to different countries and/or the local energy supply companies.)
2.6


## Safety Instructions for Maintenance, Inspection and Installation Work

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.
Pumps or pump units handling media injurious to health must be decontaminated.
Immediately following completion of the work, all safetyrelevant and protective devices must be re-installed and/or re-activated.
Please observe all instructions set out in the chapter on
"Commissioning" before returning the machine to service.

### 2.7 Unauthorized Modification and Manufacture of Spare Parts

Modifications or alterations of the machine are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.

### 2.8 Unauthorized Modes of Operation

The warranty relating to the operating reliability and safety of the pump / unit supplied is only valid if the machine is used in accordance with its designated use as described in section 1 of these operating instructions. The limits stated in the data sheet must not be exceeded under any circumstances.

## 3

## Transport and Interim Storage

### 3.1 Transport

Transport of the unit requires proper preparation and handling. Always make sure that the pump or the unit remains in horizontal position during transport and cannot slip out of the transport suspension arrangement. Do not use lifting slings on the free shaft end of the pump or on the motor eyebolt.

Also make sure that the coupling guard is not damaged by the sling arrangement.


If the pump / unit slips out of the suspension arrangement, it may cause personal injury and damage to property.

Transport in horizontal position is recommended in all cases, since this ensures stable positioning of the unit without any risk of accident, whatever the method of transport, e.g. road, rail or ship, etc.

For transport purposes the unit shall be secured on suitable pallets or sleds. All loose and movable parts must be secured.


Fig. 1: Transport of pump (Fig.0)


Fig. 2: Transport of motor


The motor eyebolts must only be used for lifting the motor alone, never for lifting the complete unit.


Fig. 3: $\quad$ Never transport the unit as shown above!


Fig. 4a: Transport of complete unit (horizontal installation type 3E)

- up to motor size 280 (IEC standard)
- or up to a total weight of 1500 kg

Observe angles of pull when lifting.
Angle of pull > $90^{\circ}$ not permitted. Use two separate sets of lifting slings!


Fig. 4b: Transport of complete unit

- up to motor size 280 (IEC standard)
- or up to a total weight of 1500 kg


Fig. 4c: Transport of unit (without motor)

- motor sizes 315 and above - or total weight (unit) of 1500 kg and above


Safe transport in horizontal position must be ensured by suitable transport facilities. Make sure the pump cannot slip out of the transport arrangement.

### 3.2 Interim Storage / Preservation

When the unit is temporarily put into storage, only the wetted low alloy components, e.g. JL1040 (GG-25) must be preserved. Commercially available preservatives can be used for this purpose. Please observe the manufacturer's instructions for application / removal.

## 4 Description of the Product and Accesories

### 4.1 Technical Specification

Design
The KSB pump of the Omega series is a horizontally installed, single-stage, axially split volute casing pump with double-entry radial impeller. Connection flanges are manufactured according to DIN, ISO, BS or ANSI, as preferred.

## Fields of application

In waterworks, irrigation and drainage pumping stations, power stations, for industrial water supply, dock installations, fire extinguishing systems, refineries, pipelines and tank farms, also for handling crude oil and refinery intermediates

### 4.2 Designation



### 4.3 Design Details

4.3.1 Pump Casing

Axially split volute casing with replaceable casing wear rings.
Suction and discharge nozzles in lower half of casing are at the same level (inline version).

### 4.3.2 Impeller

The double-entry radial impeller is manufactured for the operating data provided in each case. Also with impeller wear rings, if requested.
In double-entry radial impellers the axial thrust is largely balanced.

### 4.3.3 Pump Shaft

The shaft is fully sealed against the liquid being pumped. Shaft-protecting sleeves are fitted in the seal area.

### 4.3.4 Shaft Seal

The shaft seals at the drive end and non-drive end are gland packings or mechanical seals, as requested.

### 4.3.5 Bearings and Lubrication

The pump is fitted with covered deep-groove ball bearings which are grease-lubricated for life.

The fixed bearing at the non-drive end is located on a bush to permit rapid changing without removing the rotor or upper half.

### 4.4 Types of Installation

The pump set is installed in configuration 3E - horizontal installation, direct-coupled (see appendix).

### 4.5 Accessories (optional)

The following accessories are available:

| Configuration | Omega |  |
| :--- | :---: | :---: |
| Accessories | Fig. 0 | $3 E$ |
| Motor | - | $x^{1)}$ |
| Baseplate/baseframe | - | $x^{17}$ |
| Coupling and coupling guard | - | $x^{1)}$ |
| Sealing and flushing water <br> piping | x | x |
| Set of pressure gauges | x | x |
| Cyclone separator with <br> pipework | x | x |
| Vent valve (manual or <br> automatic) | x | x |
| Temperature sensor for <br> rolling element bearings <br> (PT 100) | x | x |
| Signal transmitter for <br> PT 100 | x | x |
| Drain line | x |  |

### 4.6 Dimensions and Weights

For dimensions and weights please refer to the tables in the appendix.

## 5 Installation at Site

## 5.1 <br> Safety Regulations

 Electrical equipment operated in "zone
1" hazardous locations must comply
with the explosion protection
regulations. This is indicated on the
motor rating plate.

If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access (e.g. foreman's office).

### 5.2 Checks to Be Carried out Prior to Installation

All structural work required must have been prepared in accordance with the dimensions and loads stated in the dimension table / installation plan.
The concrete foundations shall have sufficient strength (min. BN 25) to ensure safe and functional installation in accordance with DIN 1045 or equivalent standards.

Make sure that the concrete foundation has set firmly before placing the unit on it. Its surface shall be truly horizontal and even. horizol and

### 5.3 Installing the Pump / Unit

## Caution

Before setting up the pump, check the operating data. Ensure that the data on the name plate matches the data in the order and the system data, e.g. operating voltage, frequency, pumped liquid temperature etc.

After placing the pump on the foundation, align it with the help of a spirit level. Shims shall be fitted between the baseplate and the foundation itself; they shall always be inserted to the left and right of the foundation bolts and in close proximity to these bolts. For a bolt-to-bolt clearance of more than 1000 mm , additional shims shall be inserted halfway between the adjoining holes. All shims must lie perfectly flush.


Fig. 3: Fitting required shims
Insert the foundation bolts and set them into the foundation using concrete. When the concrete has set, align the baseplate as described in section 5.3.2 and tighten the foundation bolts evenly and firmly. Then grout the baseplate using low shrinkage concrete, making sure no cavities remain.

### 5.3.1 Removing Rotor Lock

This is not necessary for a horizontally installed pump, since no locking device is fitted.

### 5.3.2 Aligning the Pump / Drive



Improper alignment of the unit can cause damage to both the coupling and the unit itself!

A pump set in horizontal installation type $3 E$ is correctly aligned, if a straight-edge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a feeler gauge, a wedge gauge or a dial micrometer to verify (see fig. 5).


Fig. 5 Loupirng anymment, using yauge antu straight edge Special instructions see appendix

### 5.4 Connecting the Piping

## Caution

Never use the pump itself as an anchorage point for the piping.

Suction lift lines shall be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump. The pipelines shall be anchored in close proximity to the pump and connected without transmitting any stresses or strains. Their weight must not exert any load on the pump. With short pipelines, the nominal diameters shall be at least equal to the nominal diameters of the pump nozzles. For long pipelines the most economical nominal diameter has to be determined from case to case.

Any additional loads on the discharge and suction nozzles, e.g. caused by:

Weight of the water-filled pipes, changes in the length of pipes owing to temperature fluctuations, reaction forces due to unbraced expansion joints must not exceed the values stated in the installation plan.


An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.
Danger of life when hot media are handled!
The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

### 5.4.1 Auxiliary Connections

The locations of the auxiliary connections (sealing liquid, flushing liquid, etc.) are indicated on the installation plan or piping layout (see appendix).

Please refer to the appendix for detailed assembly instructions.

## Caution

These connections are required for proper functioning of the pump and are therefore of vital importance!

### 5.4.2 Coupling Guard



In compliance with the accident prevention regulations the pump must not be operated without a coupling guard. If the customer specifically requests not to include a coupling guard in our delivery, then the operator must supply one.

### 5.5 Final Check

Re-check the alignment as described in section 5.3.2. It must be easy to rotate the shaft by hand at the coupling.

## Caution

Check the integrity and proper functioning of all connections.

## 6 Commissioning, Start-up / Shutdown

## Caution Compliance with the following

 requirements is of paramount importance. Damage resulting from noncompliance shall not be covered by the scope of warranty.
### 6.1 Commissioning

Before starting up the pump make sure that the following requirements have been checked and fulfilled:

- Has the pump been firmly bolted to the foundation?
- Have the coupling and pump unit been aligned as specified?
- Can the unit be easily rotated by hand at the coupling? (Carry out at least one full rotation)
- Are the pipes properly fitted?
- Has the coupling guard been fitted?
- Have staff been informed about sources of danger and measures been taken to comply with the accident prevention regulations?
- Correct start-up procedure for suction lift operation.
- Is the unit protected against overload (appropriate safety valve)?
- Have the seals been fitted as described in the appendix?
- Have any additional devices been prepared and fitted as specified in the appendix?
- Has the pump been vented as specified in section 6.3.?


### 6.2 Shaft Seal

For commissioning the shaft seal please refer to section 8.1/8.2. If the pump has been out of service for a prolonged period, the measures specified in section 6.6 must be carried out.

### 6.3 Venting

Before start-up, the pump and the pipes must be vented and filled with the liquid to be pumped. This is done at the vent plug on the casing (903). For suction lift operation, the pump must also be evacuated, i.e. a vacuum must be produced.

### 6.4 Commissioning

### 6.4.1 Checking the Direction of Rotation

For trouble-free operation of the pump, the correct direction of rotation of the impeller is of paramount importance.
If running in the wrong direction of rotation, the pump cannot reach its duty point; vibrations and overheating will be the consequence. The unit or the shaft seal might be damaged.

## Correct direction of rotation:

The direction of rotation must correspond to the direction indicated by the arrow on the pump. This can be verified by switching the pump on and then off again immediately.


Before checking the direction of rotation make sure that there is no foreign matter in the pump casing.

Never put your hands or any other objects into the pumpl

### 6.4.2 Start-up

## Caution

Dry-running will result in increased wear and must be avoided.

If a non-return valve is not fitted at the discharge-side, close the discharge-side gate valve.

If a shut-off valve is fitted in the suction line, open it fully.
All additional connections for flushing or sealing liquid etc., if fitted, must be opened fully and the flow must be checked.

Switch on the motor.
As soon as the pump starts to deliver - this can be recognised by the rising gauge pressure - slowly open the discharge-side gate valve fully.

## Caution

The pump may operate against the closed gate valve only during start-up and shutdown, as otherwise inadmissible temperature rise occurs resulting in damage.

### 6.4.3 Pump Operating Range

The flow rate "Q" adjusts itself automatically to the delivery head according to the H-Q characteristic. The pump's permitted operating range is subject to limits, which have separate causes.

## 1. Part load operating limit for low flow rate

This limit is indicated in the $H-Q$ characteristic by $Q_{\min }$ or by the discontinuation of the characteristic curve.

## Caution

It is not permissible to operate the pump in the range from $Q=0$ to $Q_{\text {min }}$. Prolonged operation in this range causes greatly increased mechanical loads which the components cannot withstand.
Brief passage through the critical range is permissible, e.g. during start-up
2. NPSH-related limits in the part load and overioad ranges

These two limits are determined by the ratio of NPSH required to $\mathrm{NPSH}_{\text {available. }}$. They are determined as follows:

The intersections of $\mathrm{NSPH}_{\text {required }}$ and $\mathrm{NSPH}_{\text {available }}$ are projected onto the $\mathrm{H}-\mathrm{Q}$ characteristic, where they indicate the operating limits (refer to the diagram below). Checking of the NPSH-related operating limit is not necessary for operating the pump under design conditions. If systemrelated changes occur, an NPSH check must be carried out. If necessary, consult the nearest after-sales service centre.


### 6.4.4 Shutdown

Close the shut-off element in the discharge line. If the discharge line is equipped with a check valve, the shut-off element may remain open, provided there is back pressure in the line.


The shut-off element in the suction line must not be closed when switching off the pump. Switch off the motor, making sure that the unit runs smoothly down to a standstill.
Depending on the system the pump shall have an adequate after-run period - with the heat source switched off - to allow the medium handled to cool down sufficiently to avoid any heat build-up within the pump.
In the case of prolonged shutdown, the shut-off element in the suction line has to be closed.
Close the auxiliary connections.
In the event of frost and / or prolonged shutdowns, the pump must be drained or otherwise protected against freezing.

### 6.5 Shutdown / Storage / Preservation

Each KSB pump leaves the factory carefully assembled. If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump storage.

### 6.5.1 Storage of New Pumps

- New pumps are supplied by our factory duly prepared for storage.
Maximum protection for up to 12 months, if the pump is properly stored indoors.
- Store the pump in a dry location.


### 6.5.2 Measures to be Taken for Prolonged Shutdown

1. The pump remains installed; periodic check of operation
In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3 month for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.

## 2. The pump is removed from the pipe and stored

Before putting the pump into storage carry out all checks specified in sections 7.1 to 7.4. Then apply appropriate preservatives:

- Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative. Spray the preservative through the suction and discharge nozzles. It is advisable to close the nozzles (for ex. with plastic caps or similar).


### 6.6 Returning to Service after Storage

Before returning the pump to service carry out all checks and maintenance work specified in sections 5.1 and 5.2.


In addition, the instructions laid down in section 6.1 "Commissioning" and section 6.4.3 "Operating limits" must be observed.

Upon completion of the work, all safetyrelated and protective equipment must be properly refitted and / or reactivated before starting the pump set.

## 7

### 7.1 General Instructions

The operator is responsible for ensuring that all maintenance, inspection and installation work is carried out by authorized, duly qualified staff who are thouroughly familiar with these operating instructions.
A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure and work.


Work on the pump and the motor must only be carried out with the electrical connections disconnected. Make sure that the pump set cannot be switched on accidentally (danger of life!).


Pumps handling liquids posing health hazards must be decontaminated. When draining the medium see to it that there is no risk to persons or the environment. All relevant laws must be adhered to (danger of lifel).

### 7.2 Maintenance / Inspection

7.2.1 Supervision of Operation


The pump shall run quietly and free from vibrations at all times. The pump must never be allowed to run dry.


Prolonged operation against a closed shut-off element is not permitted in order to prevent the medium handled from heating up.
At room temperatures of up to $30^{\circ} \mathrm{C}\left(86{ }^{\circ} \mathrm{F}\right)$ the bearing temperature shall be below $90^{\circ} \mathrm{C}\left(194^{\circ} \mathrm{F}\right)$. At higher room temperatures, the bearing temperature shall be below $100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right)$.


During pump operation the shut-off element in the inlet line must not be closed.

Any stand-by pumps installed shall be switched on and then immediately off again once a week to keep them operational.
Attention shall be paid to the correct functioning of the auxiliary connections.

## Caution

If the flexible coupling elements begin to show signs of wear, they must be replaced in due time. See section "Coupling".
If an external supply of sealing, flushing or lubricating liquid is used, make sure supply pressure is 1.0 to 2.0 bar higher than pressure at the suction nozzle.


On pumps fitted with a gland packing the packing must drip slightly during operation. The gland cover should therefore only be gently tightened. (See section 8 "Special instructions for subassemblies, shaft seal variants").

### 7.2.2 Shaft Seal Maintenance

For required maintenance work on gland packings please refer to section 8.1. "Shaft seal". Mechanical seals are maintenance-free.

### 7.2.3 Bearing Maintenance

The bearings are maintenance-free and greased for life. No re-lubrication is required.

### 7.3 Dismantling



Before dismantling, secure the pump so as to make sure it cannot be switched on accidentally. The shut-off elements in the suction and discharge lines must be closed. The pump must have cooled down to ambient temperature, pump pressure must be released and the pump must be drained.
Dismantling and reassembly must always be carried out in accordance with the relevant sectional drawing.

### 7.3.1 Fundamental Instructions and Recommendations

Repair and maintenance work to the pump must only be carried out by specially trained personnel, using original spare parts.
Observe the safety regulations laid down. Any work on the motor shall be governed by the specifications and regulations of the respective motor supplier.
Dismantling and reassembly must always be carried out in accordance with the relevant general drawing. The general drawing and other relevant documents are found in the annex. The dismantling sequence can be derived from the general drawing.
In case of damage you can always contact our nearest customer service centre.

### 7.3.2 Preparations for Dismantling

The pump is designed so that the complete rotor can be removed in the sequence described below without removing the suction or discharge pipe or disturbing the alignment of the pump unit:

- Close the suction and discharge-side gate valves and drain the pump by opening the drain plug ( 903.01 bottom) and vent plug ( 903.01 top).
- Remove any pipes between additional equipment and the pump.
- Remove the coupling guard.

Decouple pump-side coupling half as described in the appendix.

- Loosen and push back the seal cover (471), if a mechanical seal is fitted.
- Undo the flange screws (901.01 / 901.02) and separate the upper casing half (105.02) from the lower casing half (105.01) with the aid of the forcing screws. Remove with lifting gear. The interior of the pump (impeller with casing wear rings, shaft seal) is now accessible for inspection.
- Remove the screwed connection (901.04) between bearing housing ( 350.01 ) and bearing brackets. Also undo the nuts (920.05) and bolts (901.07) which secure the bearing cover (360).
- Press the bearing housing out of the recesses and lift the rotor out of the lower casing half. For further - disassembly, place securely in horizontal position.
- Pull off the bearing housing of the fixed bearing (opposite the drive end).
- Undo and remove the keywayed nuts (920.03).
- Remove the deep-groove ball bearing (312) with bush (520) from the shaft.
- Remove the bearing cover (360).
- Remove the V-ring (412.02) from the shaft-protecting sleeve (524.01).
- Pull off the shaft-protecting sleeve (524.01).
- Remove the shaft seal housing (441).
- The impeller (234) is located with a sliding fit on the shaft and can normally be removed easily. In case of difficulty, it can be loosened by gently tapping the hub with a wooden hammer.
- Remove the second shaft protection sleeve (524.01) complete with the shaft seal housing (441), if fitted.
- Remove the coupling half.
- Pull off the bearing housing (350.01).
- Remove the circlip (932) and pull off the deep-groove ball bearing (321).


### 7.4 Reassembly

Reassembly is effected in reverse order to dismantling. For all work on the pump unit refer to the general drawing, in conjunction with the list of components, for orientation.
The rules of sound engineering practice and also the instructions for removal and installation of shaft seal, bearings, impeller wear rings and casing wear rings (sections 7.5.1 and 7.5.2) must be observed.

The tightening torques indicated for nuts and bolts shall be observed. The table below indicates the tightening torques for threads depending on the materials used.

| Property class | (Material) | 8.8 | 10.9 | A. 50 | A. 70 | 1.4462 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} 0,2 \% \text { yield stress } \\ R_{\mathrm{p} 02} \text { in } \mathrm{N} / \mathrm{mm}^{2} \end{gathered}$ |  | 640 | 900 | 210 | 250 | $0$ |
| $\begin{aligned} & \text { Metric } \\ & \text { coarse-pitch } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { threads } \\ & \text { fine-pitch } \end{aligned}$ | Tightening torque $M_{\mathrm{A}}$ in Nm |  |  |  |  |
| $\begin{aligned} & \text { M4 } \\ & \text { M5 } \\ & \text { M6 } \\ & \text { M8 } \\ & \hline \end{aligned}$ |  | $\begin{gathered} 3.1 \\ 6.1 \\ 10.4 \\ 25.2 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 4.4 \\ & 8.7 \\ & 14.9 \\ & 36.1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.00 \\ & 2.00 \\ & 3.40 \\ & 8.30 \\ & \hline \end{aligned}$ |  |  |
| M10 M12 | $\begin{gathered} \text { M8x1 } \\ \text { M10x1,25 } \end{gathered}$ | $\begin{aligned} & 27.2 \\ & 49,5 \\ & 52.5 \\ & 85,2 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 39.0 \\ 71.0 \\ 75.4 \\ 122.2 \\ \hline \end{gathered}$ | $\begin{aligned} & 8.90 \\ & 16.2 \\ & 17.3 \\ & 28.0 \\ & \hline \end{aligned}$ |  |  |
| M16 | M12×1,5 M12×1,25 <br> M16x1.5 | $\begin{aligned} & 89.5 \\ & 93.9 \\ & 211 \\ & 226 \\ & \hline \end{aligned}$ | $\begin{aligned} & 128.5 \\ & 134.7 \\ & 302.7 \\ & 324.7 \end{aligned}$ | $\begin{aligned} & 29.4 \\ & 30.8 \\ & 69.2 \\ & 74.3 \end{aligned}$ |  |  |
| M20 M24 | $\begin{aligned} & M 20 \times 1,5 \\ & M 24 \times 2 \\ & \hline \end{aligned}$ | $\begin{aligned} & 412 \\ & 461 \\ & 710 \\ & 780 \\ & \hline 1050 \end{aligned}$ | 591.9 661.0 1019.6 1118,6 | $\begin{aligned} & 135 \\ & 151 \\ & 233 \\ & 256 \\ & \hline 212 \end{aligned}$ | $\begin{array}{r} 276 \\ 305 \\ \hline \end{array}$ | $\begin{aligned} & 500 \\ & 548 \\ & \hline \end{aligned}$ |
| M27 M30 | $\begin{aligned} & M 27 \times 2 \\ & M 30 \times 2 \end{aligned}$ | $\begin{aligned} & 1050 \\ & 1130 \\ & 1420 \\ & 1580 \\ & \hline \end{aligned}$ | $\begin{aligned} & 1501.3 \\ & 1627.1 \\ & 2036.4 \\ & 2269.9 \end{aligned}$ | $\begin{aligned} & \hline 343 \\ & 372 \\ & 466 \\ & 519 \\ & \hline \end{aligned}$ | $\begin{aligned} & 409 \\ & 443 \\ & 554 \\ & 618 \\ & \hline \end{aligned}$ | $\begin{aligned} & 736 \\ & 797 \\ & 1000 \\ & 1110 \\ & \hline \end{aligned}$ |
| M33 M36 | M33x2 <br> M36x3 | $\begin{aligned} & 1940 \\ & 2130 \\ & 2480 \\ & 2630 \\ & \hline \end{aligned}$ | $\begin{aligned} & 2779.4 \\ & 3062.6 \\ & 3552.4 \\ & 3775.4 \\ & \hline \end{aligned}$ | $\begin{aligned} & 636 \\ & 700 \\ & 812 \\ & 883 \\ & \hline \end{aligned}$ | - - - | $\begin{aligned} & 1360 \\ & 1500 \\ & 1740 \\ & 1850 \\ & \hline \end{aligned}$ |

1) Nominal values to DIN ISO 898 Part 1, DIN 267 Part 11 and DIN 267 Part 18

It is imperative to lock and seal the screwed connections specially marked in the general drawings.

Symbols for screwed connections to be locked and sealed:

| (aP | ALTEMP Q NB 50 grease |
| :--- | :--- |
| aNB 50 |  |
| 574 | Sealed with Loctite 574 |

O-rings and $V$-rings must be replaced and their seats on the shaft must be cleaned. In addition, all the sealing elements must be fitted into the respective components before installation.

For assembling the rotor, position the pump shaft (211) securely. All fits, threads and sliding fits of the shaft must be cleaned and coated with assembly paste.

Insert the keys required for assembly into the pump shaft (211).

Mount the impeller (234), which has a sliding fit. When fitting the impeller, observe the direction of rotation (see diagram below).


For assembing the casing wear rings (502), observe section 7.5 .2 "Replacing the casing wear rings".
Put the casing wear rings onto the running surfaces of the impeller. Ensure that the bezels of the rings are on the outside (towards the bearing). Insert the pins required for fixing the casing wear rings.
The remaining components are fitted first on the movable bearing side (i.e. the drive side) of the pump shaft.
Push the shaft protecting sleeve (524.01) onto the pump shaft (211). Ensure that the groove provided engages in the key of the impeller.
Push the shaft seal housing (441) onto the shaft and install the shaft seal as described in section 8.1, "Gland packing". Slip on V-ring (411.01).
Insert the radial shaft seal ring (421.02) into the bearing cover (360) and push the bearing cover over the shaft.
Heat the deep-grooved ball bearing (321) and fit it onto the pump shaft (211). It is essential to avoid one-sided pressure or hammer blows on the outer races. The bearing is secured by the disc (550.01) and the circlip (932).

To fit the shaft protecting sleeve (524.01), shaft seal housing (441), V-ring (411.01) and bearing cover (360) at the non-drive end, proceed as described above for the drive side.

Heat the deep-groove ball bearing (321) and fit it onto the sleeve (520).

Push the sleeve (520) with deep-groove ball bearing (321) onto the pump shaft (211) with key (940.01) inserted. Tension the rotor parts elastically with keywayed nut (920) and cup spring (950). For this purpose tension the cup spring (950) to blocking point and then undo the keywayed nut ( 920 ) again by half a turn $\left(180^{\circ}\right)$.

## Caution

This measure is essential to compensate for differences in thermal expansion between the pump shaft (211) and the components fitted on it.

Rotor assembly is now complete.
Insert the rotor into the pump casing.
Apply Loctite 574 to the casing wear ring surfaces and the sealing surfaces of the casing.
Install the rotor, making sure that the direction of rotation is correct.
Align the rotor and ensure that the fixing pins are correctly seated in the casing.
The pins (561.01) must be positioned as shown in the diagram below.
The bearing housings (350.01) must be fastened to the bearing brackets by means of the screwed connections (901.04), with the sealing cap (580) inserted at the nondrive end. The seating positions are determined by the recesses.
Fit the bearing covers.
To assemble the casing cover, apply Loctite 574 to the casing joint surface of the lower casing half.
Tighten the flange bolts diagonally from the inside towards the outside.
Insert the key for fitting the coupling into the pump shaft (211).

When fitting the coupling and accessories, refer to the relevant section of the operating instructions.

7.5 Instructions for Replacing Subassemblies

### 7.5.1 Replacing the Shaft Seal

Proceed as described in section 8.1 and 8.2.

### 7.5.2 Replacing Casing Wear Rings and / or Impeller Wear Rings

The impeller clearance ${ }^{17}$ clearance between impeller 234 and casing wear ring 502 is given in the table below.

For impeller removal proceed as described in section 7.3,
"Dismantling".

After dismantling as described in section 7.3.2, the casing wear rings (502) can be removed. When fitting the rings, ensure that their bezels are on the outside (towards the bearing). The pins ( 561.01 ) must be positioned as shown in the diagram below.

If the impeller has not been fitted with a wear ring at the factory, and changing the casing wear ring alone does not achieve anything close to the required impeller clearance (the impeller neck is badly worn by clearance flows), the impeller neck must be turned off on a lathe (contact KSB before doing so) and an impeller wear ring fitted in addition (available as spare part).
Alternatively, a new impeller can be supplied at short notice.

Impeller clearances and trim dimensions for impeller wear rings

|  |  |  |  | Clearance (as-new) |  | Dimensions of impeller wear ring |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. | Pump size | Shaft unit D W | Nominal clearance$\begin{gathered} \text { (max. perm.) } \\ \mathrm{D}_{2}-\mathrm{D}_{1} \\ 2 \\ \hline \text { [mm] } \\ \hline \end{gathered}$ | Min. clearance $S$ min | Max. clearance $S$ max | D 5 | b |
|  |  |  |  | [mm] | [mm] | [mm] | [mm] |
| 2 | 80-210 | 40 | 0.3 | 0.15 | 0.2 | 134 г6 | 18 |
|  | 80-270 |  | 0.3 | 0.15 | 0.2 | 134 г6 | 18 |
|  | 80-370 |  | 0.3 | 0.15 | 0.2 | 134 r6 | 18 |
| 456 | 100-250 |  | 0.35 | 0.17 | 0.2 | 163 r6 | 22 |
|  | 100-310 |  | 0.35 | 0.17 | 0.2 | 163 г6 | 22 |
|  | 100-375 |  | 0.35 | 0.17 | 0.2 | 163 r6 | 22 |
| 10 | 125-230 | 50 | 0.35 | 0.18 | 0.23 | 178 r6 | 22 |
|  | 125-290 |  | 0.35 | 0.18 | 0.23 | 178 r6 | 22 |
|  | 125-365 |  | 0.35 | 0.18 | 0.23 | 178 г6 | 22 |
|  | 125-500 |  | 0.35 | 0.18 | 0.23 | 178 r6 | 22 |
| $\begin{aligned} & \hline 11 \\ & 12 \\ & 13 \\ & 14 \\ & \hline \end{aligned}$ | 150-290 |  | 0.45 | 0.22 | 0.26 | 210 г6 | 30 |
|  | 150-360 |  | 0.45 | 0.22 | 0.26 | 210 r6 | 30 |
|  | 150-460 | 60 | 0.45 | 0.22 | 0.26 | 210 r6 | 30 |
|  | 150-605 |  | 0.45 | 0.22 | 0.26 | 210 г 6 | 30 |
| $\begin{aligned} & 15 \\ & 16 \\ & 17 \\ & 18 \\ & \hline \end{aligned}$ | 200-320 |  | 0.5 | 0.24 | 0.28 | 243 r6 | 30 |
|  | 200-420 |  | 0.5 | 0.24 | 0.28 | 243 r6 | 30 |
|  | 200-520 | 70 | 0.5 | 0.24 | 0.28 | 243 r6 | 30 |
|  | 200-670 |  | 0.5 | 0.24 | 0.28 | 243 r6 | 30 |
| 19 | 250-370 |  | 0.5 | 0.24 | 0.28 | 276 г6 | 30 |
| $\begin{array}{r} 20 \\ 21 \\ \hline \end{array}$ | 250-480 | 80 | 0.5 | 0.24 | 0.28 | 276 г 6 | 30 |
|  | 250-600 |  | 0.5 | 0.24 | 0.28 | 276 r6 | 30 |
| 22 | 300-300 | 70 | 0.5 | 0.24 | 0.28 | 259 r6 | 30 |
|  | 300-435 | 80 | 0.6 | 0.29 | 0.35 | 313 r6 | 35 |
| $\begin{array}{r} 24 \\ 25 \end{array}$ | 300-560 | 90 | 0.60.6 | 0.29 | 0.35 | 313 r6 | 35 |
|  | 300-700 |  |  | 0.29 | 0.35 | 313 r6 | 35 |
| 26 | 350-360 | 80 | 0.5 | 0.24 | 0.28 | 294 r6 | 35 |
| $\begin{aligned} & 27 \\ & 28 \end{aligned}$ | 350-430 | 90 | 0.6 | 0.32 | 0.37 | 333 r6 | 35 |
|  | 350-510 |  | 0.6 | 0.32 | 0.7 | 353 r6 | 35 |



Omega
8 . Special Instructions for Subassemblies (Shaft Seal Variants)

The shaft seal variant supplied is shown in the purchase order and order-processing documents.

### 8.1 Gland packing

The gland packings used by KSB are asbestos-free and suitable for drinking water applications.

## Installation and commissioning

Before installation, ensure that the gland space is clean (no packing remnants or corrosion). The shaft protecting sleeve must be bright and have no scoring. Otherwise a new shaft protecting sleeve must be used.

## Cutting the packing rings to size

If moulded packing rings are not available, the rings can best be cut to size using a special cutting gauge. If no cutting gauge is available, take a tube with the same diameter as the shaft, wind the packing around the tube in a spiral and cut the rings from the spiral. We recommend a straight cut.

## Installing the packing rings

Push the packing rings with the stuffing box insert into the gland space one by one. The joints of the packing rings must be offset by $90^{\circ}$. The number of rings and the arrangement of the lantern ring are shown in the general drawing (see appendix). After fitting all the packing rings, put on the stuffing box insert and gland cover and tighten them so that the packing rings adapt to the gland space. Then loosen the gland cover again to relieve the load on the packing. This procedure is not necessary if moulded packing rings are used.

## Commissioning

When the pump is started up, the gland must only be gently tightened (by hand). A high leakage rate (approx. 50 to 200 drops per minute), depending on the liquid being pumped, must be accepted until the packing material has settled and has adapted to the temperature conditions (approx. 10 to 15 minutes).

Then the gland cover must be carefully and evenly tightened to reduce the leakage to a minimum. If there is no leakage, there is a risk that the packing will run hot.

## Also note the following:

Leakage and temperature rise: If necessary, shut down the pump. After a short cooling period (approx. 10 to 15 minutes) the pump can be restarted. The necessary minimum leakage depends on the liquid being pumped, the pressure, sliding velocity and temperature. It is approx. 10 to 120 drops per minute ( 20 drops of water correspond to approx. 1 ml ).

## Disassembly

A packing puller must be used for pulling out the packing rings.

## Maintenance

Gland packings must be repacked in accordance with the section "Installation and commissioning" after prolonged standstill, repair work or heavy leakage. Therefore, the leakage rate must be observed during operation, also to avoid possible overheating.

### 8.2 Mechanical Seal Variants (Mech. Seal Size / Pump Size Combinations)



### 8.2.1 Mechanical Seal <br> "Type Burgmann H 7 N 4" <br> (Shaft unit dw 40 to 80 mm )

The Burgmann mechanical seal type H7N4 used is a single-acting, bi-rotational, non-balanced seal which does not require circulation pipework in cold water applications, due to the pump design.

## Caution Dry-running of the seal must be

## Installation

For the installation of the total seal assembly (mechanical seal, seal housing) see operating instructions for the pump.

The shaft protection sleeves and also the surfaces of the casing are subjected to accurate finishing processes with regard to the O-ring seats, in order to achieve a complete and reliable seal. Care must be taken during installation to keep these parts absolutely clean, to avoid the surfaces from being damaged and prevent entry of foreign particles.

The seat ring (8) together with the relevant $O$-ring (9), is fitted into the seal cover (see general drawing). The Oring can be lubricated for easy sliding movement. Special attention must be given to ensure that pressure is applied evenly. The contact surfaces are generally fitted dry.

In Burgmann mechanical seals of the M 7 N 4 design, the rotating assembly is supplied as one unit, consisting of a housing and pin ( $1+5$ ), fitted spring loaded ring (6), 0 ring (2), spring (3), thrust plate (4) and grub screws (7). The grub screws (7) must be loosened so far as to prevent them from protruding from the housing (1) at the inner diameter. The O-ring (2) can be slightly lubricated to facilitate assembly.

The complete rotating assembly is pushed onto the shaft protection sleeve in compliance with the installation dimensions which are given in the mech. seal drawing, or until it reaches the stop on the shaft protection sleeve. Finally the grub screws are tightened and secured with LOCTITE.


| Item | Description | Material | No. of <br> items |
| :---: | :--- | :--- | :---: |
| 1 | Housing | Cr-Ni-Mo steel | 1 |
| 2 | O-ring | Viton | 1 |
| 3 | Spring | Cr-Ni-Mo steel | 1 |
| 4 | Thrust plate | Cr-Ni-Mo steel | 1 |
| 5 | Pin | Cr-Ni-Mo steel | 2 |
| 6 | Spring-loaded ring | Si-SiC | 1 |
| 7 | Grub screw | Cr-Ni-Mo steel | 2 |
| 8 | Seat ring | Si-SiC | 1 |
| 9 | O-ring | Viton | 1 |

Special instructions for mechanical seal assembly

- The contact faces must only be cleaned with propyl alcohol and paper tissue.
- Never use cleaning rags or cloth.
- Clean carefully to remove any smears.
- Do not touch the contact faces with bare fingers.
- Never use force during mechanical seal assembly.
- Never put the spring-loaded ring and the seat ring face down on the contact faces without the protective wrapping.
- Cover the contact face with a cardboard washer and press the seat ring into its position slowly and evenly, lubricating it with a generous amount of water or alcohol. Use a spacer sleeve, if necessary. Verify that the seat ring position is normal to the shaft axis.
- In the mechanical seal area, the shaft shall be slightly lubricated with water, alcohol or silicone grease. Sealing elements made of EP rubber must never come into contact with mineral oil base lubricants (swelling, possibly decomposition).


## Commissioning

Flood the pump and the seal chamber with the medium to be handled and vent carefully. The seal is operational now.

On single-acting mechanical seals, the pressure in the seal chamber of the pump (stuffing box) must always exceed ambient pressure, to prevent any air intake at the seal faces, which would result in dry running and thus failure of the mechanical seal.

In all operating conditions, the product to be sealed off must be available in liquid state at the mechanical seal, particularly during pump start-up and shutdown. This must be ensured by appropriate facilities on the pump (e.g. heating).

Should the mechanical seal fail, the liquid to be sealed off may spurt out. Take suitable precautions to prevent hazards to persons and the environment, e.g. install splash guards, wear safety goggles, etc. Proper disposal of leakage shall be arranged for and supervised by the operator.

## Maintenance

Mechanical seals operated in compliance with the manual are maintenance-free in their entire service life.

The mechanical seal should be inspected in accordance with the plant inspection schedule.

During planned plant outage periods the spring-loaded rings and the seat rings should be checked for visible damage in installed condition.

If the mechanical seal is inspected during plant outage, the contact faces should be re-worked.

## Faults

Determine and document the nature of the fault.
In the event of a fault as evidenced by excessive leakage, observe the tendency of the leakage amount. Changes in operating conditions must be documented. If an excessive temperature rise is detected, the mechanical seal must be shut down for safety reasons.

During the warranty period the Burgmann mechanical seal shall only be removed and dismantled with the manufacturer's approval or in the presence of a Burgmann representative.

If the fault cannot be remedied by the operator or if the cause is unclear, please contact the competent Burgmann field personnel, Burgmann service centre or the Burgmann factory.

## Dismantling

For dismantling of the mechanical seal assembly please refer to section 7.3 "Dismantling". Grub screws (7) and joint rings $(2+9)$ shall be replaced whenever the mechanical seal has been dismantled!

## Repair

If the seal needs to be repaired, always return the complete seal to the manufacturer. The manufacturer will know best which parts can be re-worked and which parts have to be replaced to ensure an optimum sealing effect.

If repair on the spot is necessary, it should be carried out in a clean workshop preferrably by Burgmann fitters or skilled operator staff. Spring-loaded rings, seat rings, all elastomer materials and springs should be replaced in any case.

Make sure to comply with the instructions for handling hazardous substances and the applicable accident prevention regulations when repairing, dismantling and cleaning used mechanical seals. If you have any queries in this context please inform yourself before commencing any repair work.

## Spare parts

Only genuine Burgmann spare parts shall be used. Non-compliance with this requirement entails the risk of seal malfunctions which may jeopardize the safety of personnel and the environment. It will also lead to forfeiture of all warranty claims. Burgmann recommends to keep a complete spare seal on stock.

### 8.2.2 Mechanical Seal - <br> "Type Burgmann M 74 N " <br> (Shaft unit dw $=90 \mathrm{~mm}$ )

This mechanical seal type (make Burgmann) is a single-acting, bi-rotational, non-balanced mechanical seal with multiple spring arrangement.

## Caution

It is imperative to avoid dry running of the mechanical seal!

Special instructions for mechanical seal installation

- Application limits

| Pressure to be sealed off, p max. | 25 bar |
| :--- | ---: |
| Product temperature, t | $-40 . .220^{\circ} \mathrm{C}$ |
| Sliding velocity, vg | $20 \mathrm{~m} / \mathrm{s}$ |

## - Safety

Any work on the mechanical seal shall only be performed after the pump has stopped and pump pressure has been released.

In addition to the safety instructions contained in this manual, the general health and accident prevention regulations shall be observed.

## Preparations for installation

Check pump components for:

- chamfered edges (sliding cones $2 \mathrm{~mm} / 30^{\circ}$ or to DIN 24960).
- radiused transitions
- locating surfaces, surfaces for O-rings: fine finished Rz 10 (DIN 4768)
- Shaft surface in the area of the dynamically loaded joint ring: roughness depth $\mathbf{R}_{\max } 5 \boldsymbol{\mu m}$.

The shaft must be provided with the requisite recesses for the housing screws of the mechanical seal.

## Check pump for:

- damage at the mating surfaces with the mechanical seal
- connecting dimensions, rectangularity and concentricity to the shaft axis


## Installation

For the installation of the total seal assembly (mechanical seal, seal housing) see operating instructions for the pump.
The shaft protection sleeves and also the surfaces of the casing are subjected to accurate finishing processes with regard to the O-ring seats, in order to achieve a complete and reliable seal. Care must be taken during installation to keep these parts absolutely clean, to avoid the surfaces from being damaged and prevent entry of foreign particles.

The seat ring (8) together with the relevant $O$-ring (9), is fitted into the seal cover (see general drawing). The Oring can be lubricated for easy sliding movement. Special attention must be given to ensure that pressure is applied evenly. The contact surfaces are generally fitted dry.

In Burgmann mechanical seals of the M $\mathbf{7 4} \mathbf{N}$ design, the rotating assembly is supplied as one unit, consisting of a housing and pin ( $1+5$ ), fitted spring loaded ring (6), 0 ring (2), spring (3), thrust plate (4) and grub screws (7). The grub screws (7) must be loosened so far as to prevent them from protruding from the housing (1) at the inner diameter. The O-ring (2) can be slightly lubricated to facilitate assembly.

The complete rotating assembly is pushed onto the shaft protection sleeve in compliance with the installation dimensions which are given in the mech. seal drawing, or until it reaches the stop on the shaft protection sleeve. Finally the grub screws are tightened and secured with LOCTITE.


| Item | Description | Material | No. of <br> items. |
| :---: | :--- | :--- | :---: |
| 1 | Housing | Cr-Ni-Mo steel | 1 |
| 2 | O-ring | Compat. elastomers | 1 |
| 3 | Spring | Cr-Ni-Mo steel | 1 |
| 4 | Trust plate | Cr-Ni- Mo steel | 1 |
| 5 | Pin | Cr -Ni- Mo steel | 2 |
| 6 | Rotating ring | Buka, Buke, Bume | 1 |
| 7 | Grub screw | Cr -Ni- Mo steel | 2 |
| 8 | Seat ring | Buke, Buko, Buka | 1 |
| 9 | O-ring | Compat. elastomers | 1 |

- Apply a thin coat of grease to the shaft in the mechanical seal area.

Sealing elements made of EP rubber must never come into contact with mineral oil base lubricants (swelling, possibly decomposition).

- Unwrap the mechanical seal and inspect for damage to the spring-loaded ring and the seat ring, the O-rings and the mating surfaces.

Never put the spring-loaded ring and the seat ring face down on the contact faces without the protective wrapping.

- Thoroughly clean all components with alcohol and cellulose tissue.


## Installation

Never use force during mechanical seal installation.

- Slip the degreased O-ring onto the seat ring.
- Cover the contact face with a cardboard washer.
- Push the seat ring slowly and evenly into its seat. Use a spacer sleeve, if necessary. Lubricate with a generous amount of water or alcohol.
- Verify that the seat ring position is normal to the shaft axis.
- Push the rotating assembly with the degreased joint rings onto the shaft. Thread in the degreased grub screws with 1 drop of thread sealant each (e.g. Loctite No. 243) and position the mechanical seal by tightening the grub screws. The installation dimensions given in the drawing must be adhered to.
- The contact faces must only be cleaned with propyl alcohol and paper tissue (no cleaning rags or cloth). Clean carefully to remove any smears. Do not touch the contact faces with bare fingers afterwards.

The contact faces must not be lubricated; they must be clean and dry.

- Assemble the seal cover with the installed seat ring.


## Commissioning

Flood the pump and the seal chamber with the medium to be handled and vent carefully. The seal is operational now.

## Reliable seal operation

On single-acting mechanical seals, the pressure in the seal chamber of the pump (stuffing box) must always exceed ambient pressure, to prevent any air intake at the seal faces, which would result in dry running and thus failure of the mechanical seal.
In all operating conditions, the product to be sealed off must be available in liquid state at the mechanical seal, particularly during pump start-up and shutdown. This must be ensured by appropriate facilities on the pump (e.g. heating).
If the operating conditions indicated are observed and the instructions given in this operating manual are complied with, the mechanical seal can be expected to give troublefree operation.

Should the mechanical seal fail, the liquid to be sealed off may spurt out. Take suitable precautions to prevent hazards to persons and the environment, e.g. install
splash guards, wear safety goggles, etc. to persons and the environment, e.g. install
splash guards, wear safety goggles, etc. Proper disposal of leakage shall be arranged for and supervised by the operator.


## Faults

Determine and document the nature of the fault.
In the event of a fault as evidenced by excessive leakage, observe the tendency of the leakage amount. Changes in operating conditions must be documented. If an excessive temperature rise is detected, the mechanical seal must be shut down for safety reasons.

A continuous flow of leakage indicates a fault.
During the warranty period the Burgmann mechanical seal shall only be removed and dismantled with the manufacturer's approval or in the presence of a Burgmann representative.

If the fault cannot be remedied by the operator or if the cause is unclear, please contact the competent Burgmann field personnel, Burgmann service centre or the Burgmann factory.

## Maintenance

Mechanical seals operated in compliance with the manual are maintenance-free; however, wear parts will have to be replaced as required.

The mechanical seal should be inspected in accordance with the plant inspection schedule. We recommend to have the mechanical seal inspected by authorized BURGMANN field personnel.

If the mechanical seal is inspected during plant outage, the contact faces should be re-worked and all elastomer seals and springs should be replaced.

## Repair

If the seal needs to be repaired, always return the complete seal to the manufacturer. The manufacturer will know best which parts can be re-worked and which parts have to be replaced to ensure an optimum sealing effect.

If repair on the spot is absolutely necessary (e.g. no spare seal available, long transport distances, problems with customs procedures), skilled operator staff may carry out the repair work in a clean workshop to the directions of Burgmann fitters.

Mechanical seal removal


- Shut down the pump in accordance with the operating manual, allow to cool down and release pump pressure.
- There must be no pumped product at the mechanical seal The pump must be drained.
- Secure the pump to prevent inadvertent start-up.
- Follow the safety instructions (safety data sheets)!

Make sure to comply with the applicable accident prevention regulations when removing a mechanical seal. Also observe the instructions for handling hazardous substances if the mechanical seal has already been in operation. If you have any queries about the applicable regulations please inform yourself before commencing any repair work.

Any work on the mechanical seal is only permitted with the pump shut down and pump pressure released.

Removal of the mechanical seal shall be performed analogously with mechanical seal installation, but in reverse order.

## Removing the subassembly

See section 7.3.

- Replace the grub screw (7) and the joint rings ( $2+9$ ) whenever the mechanical seal has been dismantled.


## Spare parts

Only genuine Burgmann spare parts shall be used. Non-compliance with this requirement entails the risk of seal malfunctions which may jeopardize the safety of personnel and the environment. It will also lead to forfeiture of all warranty claims. Burgmann recommends to keep a complete spare seal on stock.

### 8.2.3 Mechanical Seal <br> "Type Burgmann HJ 92 N " <br> (Shaft unit dw $=40$ to 80 mm )

Note:
Refer to sections 8.2.1 and 8.2.2 for general recommendations and instructions for handling this seal type.

For detailed information please refer to the original BURGMANN operating manual for seal type HJ92 N/dw.

## OPERATING MANUAL

## BURGMANN MECHANICAL SEAL (M.S.)

## HJ92N/dw <br> HJ977GN/dw

$(\mathrm{dw}=$ specified shaft diameter $)$

PLEASE READ this manual carefully and OBSERVE the information contained as to:
■ Safety ■ Storage $\quad$ Installation $\square$ Start up Maintenance ■ Repair

If there are any unclear points please contact BURGMANN by all means.

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## ■ SAFETY NOTES

Any person at the user's shop being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Operating Manual and in particular the safety notes. We recommend the user to have this confirmed.

BURGMANN Mechanical Seals are manufactured on a high quality level (ISO9001) and they keep a high working reliability. Yet, if they are not operated within their intended purpose or handled inexpertly by untrained personnel they may cause risks.

The user is asked to check as part of his security program what effects a failure of the mechanical seal might have on the environment and what additional safety measures have to be taken to prevent personal injury.


The pump must be positioned in such a way that no persons are endangered if product splashes out in case of seal failure. Leakage of product has to be disposed properly.

Any operation mode that affects the operational safety of the mechanical seal is not permitted.

BURGMANN mechanical seals must be operated, maintained or repaired by authorised, trained and instructed personnel only.

Any work to be done on the mechanical seal is only permitted when the seal is neither operating nor pressurised.

The responsibilities for the respective jobs to be done have to be determined clearly and observed in order to prevent unclear competencies from the point of security.

Apart from the notes given in this manual the general regulations for worker's protection and those for the prevention of accidents have to be observed.

Unauthorised modifications or alterations which affect the operational safety of the mechanical seal are not permitted.

MANUFACTURER
FEODOR BURGMANN
Dichtungswerke GmbH \& Co.
D - 82502 Wolfratshausen
Federal Republic of Germany

## DECLARATION

within the meaning of the EC-directive » MACHINERY «
A mechanical seal does not function independently. It is intended to be incorporated into or assembled with machinery.

## OPERATING LIMITS

Shaft diameter $\mathrm{dw}: \quad 18-100 \mathrm{~mm}$
Press. to be sealed p max. $: \quad 25 \mathrm{bar}^{*}$ )
*) depending on the materials of the sliding part

Type HJ92N
Product temperature $\mathrm{t}:-\mathbf{- 4 0 - 2 2 0}{ }^{\circ} \mathrm{C}$
Sliding speed vg : $20 \mathrm{~m} / \mathrm{s}$

## Type HJ977G

Product temperature $\mathrm{t}:-20-180^{\circ} \mathrm{C}$
Sliding speed vg: $10 \mathrm{~m} / \mathrm{s}$
Operation under several limit values simultaneously should be avoided as higher loads (pressure, temperature, speed) can increase wear or lead to damage of sliding faces or elastomers. This could result in a shorter service life and in the risk of a sudden seal failure endangering men and environment.

## ■ DESIGNATED USE

Operation under conditions lying outside those limits stated in paragraph »operating limits $\%$ is considered contrary to its designated use.

Should the seal be operated under different conditions or at a different application BURGMANN has to be asked for recognition as safe in advance.

## MATERIALS

Type HJ92N
$\begin{array}{lll}\text { Seal face }(1.1) & = & \text { carbon (A) ; (B) } \\ \text { Seat }(2) & = & \text { ceramic }(V) ; \operatorname{SiC}(Q 1)\end{array}$

Type HJ977GN
$\begin{array}{lll}\text { Seal face (1.1) } & = & \operatorname{SiC}(Q 12) \\ \text { Seat (2) } & = & \operatorname{SiC}(Q 12)\end{array}$

## DRAWINGS

## Assembly drawing HJ92N/dw-00 <br> HJ977GN/dw-00

The assembly drawing in the original scale and in its latest edition (latest revision) only is decisive for the design and the use in connection with this manual.

## ■ DESCRIPTION <br> - Single seal <br> - Balanced <br> - Bi-directional <br> - Connecting dimensions acc. to DIN 24960 KB <br> - Fitting length $\mathrm{I}_{1 \mathrm{~K}}$ <br> - Product-protected ondular spring

Due to the product-protected springs mechanical seals of this type are particularly suitable for media containing solids and/or highly viscous media, as for example in pulp and paper or sewage water applications. The seal design is rugged and operationally reliable. The springs do neither clog nor conglutinate. The permitted axial displacement between shaft and housing is 0.5 mm in each direction.

When the seal is operated at negative pressures (up to -0.2 bar) a stop for seat is not required.

In general, the torque is transmitted to the shaft by means of set screws. Other torque transmissions, e.g. by special drivers, are possible.

## - DIMENSIONS

The required mounting space for the mechanical seal is decisive for the design of the housing parts by the machine manufacturer. The connecting dimensions have to be checked by the machine manufacturer by means of the BURGMANN drawing before mounting the mechanical seal.

## ■ SUPPLY

For a safe operation of the mechanical seal we recommend to apply the most suitable type of circulation described in API 610. This protects the seal cavity from deposition of solids.

For a prolonged operation under vacuum a fluid quench has to be provided on the atmosphere side (behind the seal) to ensure the operational safety (avoidance of dry run).

## EMISSIONS

A mechanical seal is a dynamic seal that cannot be free of leakage due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems (e.g. packings) there is few leakage.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

## STORAGE

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

## Notes for income inspection:

- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

These instructions apply to all BURGMANN mechanical seals which have been supplied and stored in their undamaged original packing, as well as to seals which have been installed in a component of a plant (e.g. pump, compressor, agitator etc.) but have not yet been put into operation.

A preservation of the BURGMANN mechanical seals is not necessary.

- Do not use any anticorrosives!
$>$ Risk of deposits and possibly chemical attack of the elastomer secondary sealing elements.

Check in case of a preservation of complete plants with mechanical seals installed:

- the compatibility of the chosen preservation agent with the seal materials and with the elastomers
- no impairment of the seal's axial movability by conglutination or by gumming

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the seals. Yet, this may be avoided by observing the storage instructions.

Damages caused by improper storage may not be claimed on the BURGMANN company with reference to their warranty.

## Storage in the original packing lying on a flat surface.

The mechanical seals have to be stored in dry, dustfree, moderately ventilated and tempered rooms. We recommend: relative air humidity below $65 \%$, temperature between $15{ }^{\circ} \mathrm{C}$ and $25^{\circ} \mathrm{C}$.

- Protect the seal from
- direct exposure of heat (sun, heating)
- ozone and ultraviolet light (halogen or fluorescent lamps)
$>$ risk of embrittlement of elastomeric materials
Check the mechanical seal:
- after a storage period of approximately 2-3 years
- after a damage of the packing
- after a shock on the mechanical seal (e.g. by dropping the packed seal)
$>$ at the manufacturer's or at the nearest service centre


## - PRELIMINARIES

Check the parts of the machine for:

- chamfered edges (sliding cones i.e. $30^{\circ} / 2 \mathrm{~mm}$ or in accordance with DIN 24960)
- radiused transitions
- mating fits and O-ring surfaces: fine finished $\mathrm{Rz} 10 \mu \mathrm{~m}(=\mathrm{N} 7=$ CLA 63 ).
- shaft surface in the area of the dynamically loaded o-ring: Rmax. $5 \mu \mathrm{~m}$ (= N6 = CLA 32).


## Check at the machine:

- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

- run-out accuracy of the shaft acc. to DIN ISO 5199: 50-100 $\mu \mathrm{m}$ (depending on the shaft diameter)
- Lubricate the shaft slightly in the area of the seal.
$>$ Elastomers made of EP-rubber must never come into contact with lubricants on the base of mineral oil (swelling, decomposition).
$>$ Lubricant for elastomers (o-rings etc.) recommended by BURGMANN: "TURMOPOLGREASE SH2"; make Lubricant Consult (LUBCON)


## AUXILIARIES

- propyl alcohol + cellulose-tissue (no rag, no cloth!)
- lubricant for elastomer-sealing rings: "TURMOPOLGREASE SH2" make Lubricant Consult (LUBCON)
- liquid screw retention, e.g. "LOCTITE (B) No. 243", make LOCTITE Corporation
- o-ring lifter
- set of hexagon keys ( 2 mm to 6 mm )
- hand screw press (compulsory for seal size $>80 \mathrm{~mm}$ ).


## INSTALLATION

For installation the assembly drawing HJ92N/dw has to be on hand.
The mechanical seal has to be installed very carefully and under the cleanest conditions.

Do never force during installation.
After having unpacked the seal:

- remove the protective covers from the sliding faces
- clean the sliding faces with propyl alcohol and paper tissues
- check if there are any damages.
- All parts have to be thoroughly cleaned.

The order of assembly to install the mechanical seal cartridge into the machine depends on the design of the machine and has to be determined by the machine manufacturer.

- When using double-PTFE-
 wrapped o-rings care has to be taken that the joint on the outer Teflon(B) wrapping faces against the assembly direction. Otherwise there is a risk of the wrapping opening and being pulled off, possibly resulting in seal leakage.


## Possible installation order:

- Feed the degreased o-ring onto the seat.
- Cover the sliding face of the seat with a cardboard washer.
$>$ Use plenty of water or alcohol as lubricant.
$>$ Use a distance sleeve, if necessary.
- Press the seat slowly and without interruption into its position.
- Check the rectangular position of the seat to the shaft axis.
- Feed the rotating unit with the lubricated o-rings onto the shaft.
- Insert the degreased set screws with 1 drop each of liquid screw retention (e.g. Loctite $\left(\begin{array}{l}\text { No. 243) }\end{array}\right.$
- Fix the rotating unit by tightening the screws.
$>$ Stick to the dimensions in the assembly drawing!
- Thoroughly clean the sliding faces with alcohol and paper tissues (no cloths!). Do not touch them any more with bare fingers.
$>$ Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!
- Mount the seal cover with the seat installed before.


## ■ START UP

For a safe operation of the mechanical seal we recommend to apply the most suitable type of circulation described in API 610. This protects the seal cavity from deposition of solids.

- Flood pump and seal area with medium.
- Thoroughly vent seal and circulation system.
- After a short start up period repeat the venting procedure several times with the pump being at standstill.

Operating manual HJ92N/dw / HJ977GN/dw

For a prolonged operation under vacuum a fluid quench has to be provided on the atmosphere side (behind the seal) to ensure the operational safety (avoidance of dry run).

## SAFE OPERATION

For a single mechanical seal the pressure in the seal chamber (stuffing box pressure) should always be higher than the ambient pressure at the pump. Otherwise the pump will suck in air via the sliding faces, which will result in dry-running and consequent failure of the mechanical seal.

The mechanical seal has to be constantly wetted by the product in its liquid form, in particular when the pump is started or stopped. The pump design has to be such as to take this necessity into consideration (e. g. heating of the product).

If the operation limit values and the instructions given in this manual are observed a trouble-free operation of the mechanical seal can be expected.

## WORKERS PROTECTION

Mechanical seals are often used for sealing hazardous substances (chemicals, medical substances etc.). The valid regulations for handling hazardous substances have to be observed by all means.

Medium may splash out if the seal fails. Personal injury may be prevented by the user providing for splash protection and wearing safety goggles. Care has to be taken by the user for proper disposal of the leakage.

## TROUBLES

Try to define the kind of failure and record it.
In case of failure due to high leakage the amount of leakage should be observed. Changes of the operating conditions have to be recorded. In case of an unacceptable temperature rise the mechanical seal must be shut down for reasons of safety.

A damage of the mechanical seal is indicated by a continuous, flowing leakage.

If there is a malfunction which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest BURGMANN agency, a BURGMANN service centre or the BURGMANN headquarters.

During the warranty period the mechanical seal must only be disassembled or removed with BURGMANN's approval or when a BURGMANN representative is present.

## MAINTENANCE

A correctly operated mechanical seal is maintenance-free. Wear parts, however, have to be replaced, if necessary.

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by authorised BURGMANN personnel.

If the mechanical seal is disassembled during a revision of the plant the sliding faces should be refinished at the manufacturer and both orings and springs should be replaced.

## REPAIR

If repair is necessary, the complete seal cartridge should be sent to the manufacturer, as this is the best way to find out which components can be reconditioned or which parts must be replaced.

If, for compelling reasons, a repair has to be carried out on site (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by trained personnel of the operating company under the instruction of BURGMANN maintenance personnel.

## SPARE PARTS

- Only BURGMANN original parts must be used. Otherwise
- risks of a seal failure with danger for persons and environment.
$>$ The BURGMANN guarantee lapses.
- Store a complete spare seal for a quick replacement.


## REMOVAL

## $\triangle$

- Shut down the pump in duly procedure, let it cool down and - depressurise it
- No product should contact the mechanical seal $\Rightarrow$ drain the pump, if necessary!
- Secure the pump against inadvertent start!
- Observe the safety notes (safety data sheets)!

Follow the valid regulations for preventing accidents when disassembling mechanical seals as well as those for handling hazardous substances if the seals have been already in operation. In case of doubt the necessary information has to be obtained before starting repair.

Any work to be done on the mechanical seal is only permitted when the seal is neither operating nor pressurised.

The order of disassembly to remove the mechanical seal out of the pump depends on the design of the pump and has to be determined by the pump manufacturer.

The disassembly (removal) of the seal is carried out in the reverse sequence as described for assembly (set up).

## AFTER-SALES

The range of services offered by BURGMANN not only includes advise during the planning stages but also technical support after commissioning. This is supported by a world-wide comprehensive network of subsidiaries, field engineers and service centres.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

Address of headquarters:

## FEODOR BURGMANN

Dichtungswerke GmbH \& Co.
Äußere Sauerlacher Str. 6-10
D - 82502 Wolfratshausen
Germany
出 +49 8171-23 0
Fax +49 8171-23 1214

## HOW TO ORDER

For enquiries and orders the following details are required:

- BURGMANN commission no.
- Drawing no. of mechanical seal : HJ92N/dw-00 and/or HJ977GN/dw-00
- Part item no., designation, material, number of pieces with reference to the drawing.


## ■ DISPOSAL

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.
$\square$ Metal parts (steels, stainless steels, non-ferrous heavy metals)
divided into the different groups $\Rightarrow$ scrap metal waste.
$\square$ Synthetic materials/plastics (elastomers, PTFE) $\Rightarrow$ special waste. Some of them, divided into the different groups $\Rightarrow$ can be recycled.

- ATTENTION! Material containing fluorine must not be burnt
$\square$ Ceramic materials (synthetic carbons, ceramics, carbides) can be separated from their housing materials, as they are
physiologically recognised as safe $\Rightarrow$ waste products.


## E COPYRIGHT

The FEODOR BURGMANN Dichtungswerke GmbH \& Co. (Germany) has the copyright in this document. Buyer, planner and user of the product are authorised for use in connection with their own documentation.

We reserve the right to carry out technical modifications which might become necessary to improve our products but are not mentioned in this manual yet.

October 14, 1998 tkocz

Department Technical Documentation

### 8.2.4 Mechanical Seal -

"Type Burgmann H 75 N"
(Shaft unit dw = 90 mm )
General instructions concerning assembly/installation, commissioning, maintenance, faults and repair have already been given in sections 8.2.1 and 8.2.2

For details please refer to Burgmann's documentation for the balanced mechanical seal type, which has been included in this operating manual in its original version.

For detailed information please refer to the original BURGMANN operating manual for seal type H $75 \mathbf{N} / \mathbf{d w}$.

## OPERATING MANUAL

# BURGMANN MECHANICAL SEAL (M.S.) 

H75N/dw<br>( $d w=$ specified shaft diameter)<br>applies to all mechanical seals of the same series

PLEASE READ this manual carefully and OBSERVE the information contained as to:
Safety ■ Storage Installation ■ Start up M Maintenance ■ Repair

If there are any unclear points please contact BURGMANN by all means.

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## - SAFETY NOTES

Any person at the user's shop being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Operating Manual and in particular the safety notes. We recommend the user to have this confirmed.

BURGMANN Mechanical Seals are manufactured on a high quality level (ISO9001) and they keep a high working reliability. Yet, if they are not operated within their intended purpose or handled inexpertly by untrained personnel they may cause risks.

The user is asked to check as part of his security program what effects a failure of the mechanical seal might have on the environment and what additional safety measures have to be taken to prevent personal injury.

Any operation mode that affects the operational safety of the mechanical seal is not permitted.

The pump must be positioned in such a way that no persons are endangered if product splashes out in case of seal failure. Leakage of product has to be disposed properly.

BURGMANN mechanical seals must be operated, maintained or repaired by authorised, trained and instructed personnel only.

Any work to be done on the mechanical seal is only permitted when the seal is neither operating nor pressurised.

The responsibilities for the respective jobs to be done have to be determined clearly and observed in order to prevent unclear competencies from the point of security.

Apart from the notes given in this manual the general regulations for worker's protection and those for the prevention of accidents have to be observed.

Unauthorised modifications or alterations which affect the operational safety of the mechanical seal are not permitted.

## - PRODUCT INFORMATION

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning of mechanical seals in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

MANUFACTURER
BURGMANN Dichtungswerke GmbH \& Co.KG
Äußere Sauerlacher Str. 6-10
82515 Wolfratshausen
Germany

## DECLARATION

within the meaning of the EC-directive "MACHINERY"
A mechanical seal does not function independently. It is intended to be incorporated into or assembled with machinery.

## ■ OPERATING LIMITS

Shaft diameter
Pressure to be sealed
Medium temperature
Sliding speed

| $\mathrm{dw}:$ | $28-100 \mathrm{~mm}$ |
| :--- | :---: |
| p | $\left.: \quad \max .40 \mathrm{bar}{ }^{*}\right)$ |
| t | $:-40$ to $+220^{\circ} \mathrm{C}$ |
| vg | $:$ |
|  | $20 \mathrm{~m} / \mathrm{s}$ |

*) depending on the materials of the sliding parts
Operation under several limit values simultaneously should be avoided as higher loads (pressure, temperature, speed) can increase wear or lead to damage of sliding faces or elastomers. This could result in a shorter service life and in the risk of a sudden seal failure endangering men and environment.

## DESIGNATED USE

Operation under conditions lying outside those limits stated in paragraph » operating limits « is considered contrary to its designated use.

Should the seal be operated under different conditions or at a different application BURGMANN has to be asked for recognition as safe in advance.

## ■ MATERIALS

The materials of the mechanical seal depend on the application and are fixed in the order. They may vary from those stated in the drawing.

Seal face $\quad: \quad Q_{1} ; Q_{2} ; V ; S$
Seat $\quad G 9: A ; B ; Q_{1} ; Q_{2}$

## - VERSIONS

The seal types mentioned before are also usable as multiple mechanical seals in tandem arrangement together with a quench supply system or as double mechanical seals together with a pressurized supply (barrier) fluid system (also in combination with seal types of other series). Consultation with the BURGMANN company is recommended.

## DRAWINGS

Assembly drawing H75N/dw-00
The assembly drawing in the original scale and in its latest edition (latest revision) only is decisive for the design and the use in connection with this manual.


## DESCRIPTION

- single seal
- balanced
- bi-directional
- rotating seal face
- stationary seat
- multiple springs in guide sleeves
- axial movability $\pm 2 \mathrm{~mm}$ up to shaft DIA 5 mm and $\pm 3 \mathrm{~mm}$ for shaft DIA above
- torque transmission to the shaft normally by means of set screws, others, e.g. key, are possible on request by using special drivers (seal version H75S2).
- connecting dimensions to DIN 24960 KB
- installation length lik

Mechanical seals (M.S.) of this series are designed for universal application and ideal for stock rationalization. Due to the loosely inserted, easily exchangeable seal face all material combinations are possible at minimum stock keeping.

## DIMENSIONS

The available mounting space given by the machine was decisive for the design of the housing parts of mechanical seal. The connecting dimensions are checked before shipment with regard to the BURGMANN drawing.

## SUPPLY OF M.S.

The inboard seal faces of the mechanical seal should be constantly wetted by the medium to be sealed.

For a safe operation of the mechanical seal we recommend to apply the most suitable type of circulation described in API 610. This protects the seal cavity from deposition of solids.
To operate dual seals special supply systems are required. Please contact BURGMANN.

## ■ EMISSIONS

A mechanical seal is a dynamic seal that cannot be free of leakage due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems (e.g. packings) there is few leakage.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.
Leakage of mechanical seal at outboard side has to be drained and disposed properly.


Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

## - TRANSPORT

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

## Notes for income inspection:

- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.


## STORAGE

BURGMANN mechanical seals are super finished and tested machine elements whose handling before and during the storage period (in particular of spare parts) entails certain conditions. For elastomeric parts please refer to ISO 2230-1973(E).

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the seals. Yet, this may be avoided by observing the storage instructions.

Storage in the original packing lying on a flat surface.
Conveniences for storing of mechanical seals

- dustfree
- moderately ventilated
- constantly tempered
- relative air humidity below $65 \%$,
- temperature between $15^{\circ} \mathrm{C}$ and $25^{\circ} \mathrm{C}$.


## - Protect the seal from

- direct exposure to heat (sun, heating)
- ultraviolet light (arc welding, halogen or fluorescent lamps, sunlight)
- presence or development of ozone (arc welding, mercury vapor lamps, high-voltage devices, electric motors)
$>$ risk of embrittlement of elastomeric materials


## Check the mechanical seal:

- after a storage period of approximately 2-3 years
- after a damage of the packing
- after a shock on the mechanical seal (e.g. by dropping the packed seal)
> at the manufacturer's or at the nearest service centre
Damages caused by improper storage may not be claimed on the BURGMANN company with reference to their warranty.
These instructions apply to all BURGMANN mechanical seals which have been supplied and stored in their undamaged original packing, as well as to seals which have been installed in a component of a plant (e.g. pump, compressor, agitator etc.) but have not yet been put into operation.

A preservation of the BURGMANN mechanical seals is not necessary.

- Do not use any anticorrosives!
$>$ Risk of deposits and possibly chemical attack of the elastomer secondary sealing elements.

Check in case of a preservation of complete plants with mechanical seals installed:

- the compatibility of the chosen preservation agent with the seal materials and with the elastomers
- no impairment of the seal's axial movability by conglutination or by gumming


## - PRELIMINARIES



Check the parts of the machine for:

- chamfered edges (sliding cones i.e. $30^{\circ} / 2 \mathrm{~mm}$ or in accordance with DIN 24960)
- radiused transitions
- mating fits and O-Ring surfaces: fine finished $\mathrm{Rz} 10 \mu \mathrm{~m}(=\mathrm{N} 7=$ CLA 63).
- shaft surface in the area of the dynamically loaded o-ring: Rmax. $5 \mu \mathrm{~m}$ ( $=$ N6 = CLA 32).

Check at the machine:

- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.
- run-out accuracy of the shaft acc. to DIN ISO 5199: 50-100 $\boldsymbol{\mu m}$ (depending on the shaft diameter)
- Lubricate the shaft slightly in the area of the seal with suitable grease.
$>$ Elastomers made of EP-rubber must never come into contact with lubricants on the base of mineral oil (swelling, decomposition).
$>$ Lubricant for elastomers (o-rings etc.) recommended by BURGMANN: "TURMOPOLGREASE SH2"; make Lubricant Consult (LUBCON)

- When using double-PTFEwrapped 0 -rings care has to be taken that the joint on the outer Teflon(8) wrapping faces against the assembly direction. Otherwise there is a risk of the wrapping opening and being pulled off, possibly resulting in seal leakage.


## ■ AUXILIARIES

- propyl alcohol + cellulose-tissue (no rag, no cloth!)
- lubricant for elastomer-sealing rings: "TURMOPOLGREASE SH2" make Lubricant Consult (LUBCON)
- liquid screw retention, e.g. "LOCTITE No. 243", make LOCTITE Corporation
- o-ring lifter
- set of hexagon keys ( 2 mm to 6 mm )
- cardboard discs to protect the sliding faces during installation
- hand screw press (compulsory for seal size $>80 \mathrm{~mm}$ ).


## ■ INSTALLATION

BURGMANN mechanical seals are super-finished and repeatedly tested machine elements whose handling before and during assembly (in particular of elastomers) requires special care during several procedures.

For installation the assembly drawing of mechanical seal has to be on hand.

In the surroundings for the seal installation a high degree of cleanness has to be observed.

Do never force during installation.
O-rings in sliding contact with other parts when mounting the mechanical seal may be lubricated very thinly, if not described otherwise.
$>$ Elastomers made of EP-rubber must never come into contact. with lubricants on the base of mineral oil (swelling, decomposition).

After having unpacked the seal:

- remove the protective covers from the sliding faces
- clean the sliding faces with propyl alcohol and paper tissues
- check if there are any damages.
> Never place the seal faces or seats on their sliding faces without having covered them adequately.
- Check before starting assembly:
- complete availability of all components by means of the drawing
- all components have to be clean and in perfect condition.


## Possible installation order:

- Feed the degreased o-ring onto the seat.
- Cover the sliding face of the seat with a cardboard washer.
$>$ Use plenty of water or alcohol as lubricant.
> Use a distance sleeve, if necessary.
- Press the seat slowly and without interruption into its position.
- Check the rectangular position of the seat to the shaft axis.
- Feed the rotating unit with the lubricated O-rings onto the shaft.

D Stick to the dimensions in the assembly drawing!

- Insert the degreased set screws with 1 drop each of liquid screw retention (e.g. Loctite ${ }^{(8)}$ No. 243)
- Fix the driver by tightening the screws.
- Thoroughly clean the sliding faces with alcohol and paper tissues (no cloths!). Do not touch them any more with bare fingers.
$>$ Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!
- Mount the seal cover with the seat installed before.


## ■ START UP

For a safe operation of the mechanical seal we recommend to apply the most suitable type of circulation described in API 610. This protects the seal cavity from deposition of solids.

- Flood pump and seal area with medium.
- Thoroughly vent seal and circulation system.
- After a short start up period repeat the venting procedure several times with the pump being at standstill.
Now the seal is ready for operation.


## - SAFE OPERATION

For a single mechanical seal the pressure in the seal chamber (stuffing box pressure) should always be higher than the ambient pressure at the pump. Otherwise the pump will suck in air via the sliding faces, which will result in dry-running and consequent failure of the mechanical seal.

The mechanical seal has to be constantly wetted by the product in its liquid form, in particular when the pump is started or stopped. The pump design has to be such as to take this necessity into consideration (e. g. heating of the product).

If the operation limit values and the instructions given in this manual are observed a trouble-free operation of the mechanical seal can be expected.

## WORKERS PROTECTION

Mechanical seals are often used for sealing hazardous substances (chemicals, medical substances etc.). The valid regulations for handling hazardous substances have to be observed by all means.

Medium may splash out if the seal fails. Personal injury may be prevented by the user providing for splash protection and wearing safety goggles. Care has to be taken by the user for proper disposal of the leakage.

## TROUBLES

Try to define the kind of failure and record it.
In case of failure due to high leakage the amount of leakage should be observed. Changes of the operating conditions have to be recorded. In case of an unacceptable temperature rise the mechanical seal must be shut down for reasons of safety.

A damage of the mechanical seal is indicated by a continuous, flowing leakage.

During the warranty period the mechanical seal must only be disassembled or removed with BURGMANN's approval or when a BURGMANN representative is present.

If there is a malfunction which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest BURGMANN agency, a BURGMANN service centre or the BURGMANN headquarters.

## MAINTENANCE

In general a correctly operated mechanical seal is maintenance-free. Wear parts, however, have to be replaced, if necessary.

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by authorised BURGMANN personnel.

If the mechanical seal is disassembled during a revision of the plant the sliding faces should be refinished at the manufacturer and both orings and springs should be replaced.

## REPAIR

If repair is necessary, the complete seal cartridge should be sent to the manufacturer, as this is the best way to find out which components can be reconditioned or which parts must be replaced.

If, for compelling reasons, a repair has to be carried out on site (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by trained personnel of the operating company under the instruction of BURGMANN maintenance personnel.

## AFTER-SALES

The range of services offered by BURGMANN not only includes advise during the planning stages but also technical support after commissioning. This is supported by a world-wide comprehensive network of subsidiaries, field engineers and service centres.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

## REMOVAL

\section*{\}

- Shut down the pump in duly procedure, let it cool down and depressurise it
- No product should contact the mechanical seal $\Rightarrow$ drain the pump, if necessary!
- Secure the pump against inadvertent start!
- Observe the safety notes (safety data sheets)!

Follow the valid regulations for preventing accidents when disassembling mechanical seals as well as those for handling hazardous substances if the seals have been already in operation. In case of doubt the necessary information has to be obtained before starting repair.

Any work to be done on the mechanical seal is only permitted when the seal is neither operating nor pressurised.

The order of disassembly to remove the mechanical seal out of the pump depends on the design of the pump and has to be determined by the pump manufacturer.

The disassembly (removal) of the seal is carried out in the reverse sequence as described for assembly (set up).

## - SPARE PARTS

- Only BURGMANN original parts must be used. Otherwise
- risks of a seal failure with danger for persons and environment.
> The BURGMANN guarantee lapses.
- Store a complete spare seal for a quick replacement.


## ■ HOW TO ORDER

Bei Anfragen und Bestellungen machen Sie bitte folgende Angaben:

- BURGMANN-Kommissions-Nr.
- GLRD-Zeichnungs-Nr.

H75N/dw-00

- Einzelteil-Pos.-Nr., Benennung, Werkstoff, Stückzahl.


## Address of headquarters:

## BURGMANN Dichtungswerke GmbH \& Co.KG

Postfach 1240
82502 Wolfratshausen
Germany
윺 $\quad+49(0) 8171-230$
Telefax +49 (0) $8171-231214$

## ■ DISPOSAL

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.
$>$ ATTENTION: Material containing fluorine must not be burnt.
$\Rightarrow$ Some of the synthetic materials, divided into the different groups can be recycled.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.


## COPYRIGHT

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We reserve the right to carry out technical modifications which might become necessary to improve our products but are not mentioned in this manual yet.
March 27, 2000
J. Hartung

Department Technical Documentation

## 9 Spare Parts

## Recommended Spare Parts

Recommended spare parts stock for 2 years' operation to VDMA 24296 (also for continuous operation)

| Part no. | Description |  | Number of pumps (incl. stand-by pumps) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 2 | 3 | 4 | 5 | 6 | 8 | and more |
|  |  |  | Number of spare parts * |  |  |  |  |  |  |
| 234 | Impeller |  | 1 | 1 | 1 | 2 | 2 | 3 | 30\% |
| 502 | Casing wear ring |  | 4 | 4 | 4 | 6 | 6 | 8 | $50 \%$ |
| 503 | Impeller wear ring |  | 4 | 4 | 4 | 6 | 6 | 8 | $50 \%$ |
| $\begin{aligned} & 211,940 \\ & 920,932 \end{aligned}$ | Shaft with keys and shaft nuts |  | 1 | 1 | 2 | 2 | 2 | 3 | $30 \%$ |
| 321 | Rolling element bearing |  | 2 | 2 | 4 | 4 | 6 | 8 | $100 \%$ |
| 524 | Shaft protecting sleeve |  | 4 | 4 | 4 | 6 | 6 | 8 | 50\% |
| 461 | Packing ring |  | 32 | 32 | 48 | 48 | 48 | 64 | 40\% |
| $\begin{gathered} 411,412, \\ 4 \geqslant 1 \end{gathered}$ | Set of sealing elements |  | 4 | 6 | 8 | 8 | 9 | 12 | $150 \%$ |
| 433 | Mechanical seal: | Spring-loaded ring | 4 | 6 | 8 | 8 | 8 | 12 | 90 \% |
|  |  | Seat ring | 4 | 6 | 8 | 8 | 8 | 12 | $90 \%$ |
|  |  | O-rings | 4 | 6 | 12 | 16 | 16 | 20 | 150\% |
|  |  | Seals on seat ring | 4 | 6 | 12 | 16 | 16 | 20 | 150 \% |
|  |  | Set of springs | 1 | 2 | 2 | 2 | 2 | 4 | 20\% |

*These figures already allow for components required twice for replacement

Interchangeability of rotor components

| Pump sizes | Pump shaft diameter |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 40 | 50 | 60 | 70 | 80 | 90 |
| 80-210 | * |  |  | $\cdots$ |  |  |
| 80-270 | * |  |  |  |  |  |
| 80-370 | * |  |  |  |  |  |
| 100-250 | * |  |  |  |  |  |
| 100-310 |  |  |  |  |  |  |
| 100-375 | * |  |  |  |  |  |
| 125-230 |  |  |  |  |  |  |
| 125-290 |  | * |  |  |  |  |
| 125-365 |  | * |  |  |  |  |
| 125-500 |  | * |  |  |  |  |
| 150-290 |  | * |  |  |  |  |
| 150-360 |  | * |  |  |  |  |
| 150-460 |  |  |  |  |  |  |
| 150-605 |  |  | * |  |  |  |
| 200-320 |  |  | * |  |  |  |
| 200-420 |  |  | * |  |  |  |
| 200-520 |  |  |  | * |  |  |
| 200-670 |  |  |  | * |  |  |
| 250-370 |  |  |  | * |  |  |
| 250-480 |  |  |  |  | * |  |
| 250-600 |  |  |  |  | * |  |
| 300-300 |  |  |  | * |  |  |
| 300-435 |  |  |  |  | * |  |
| 300-560 |  |  |  |  |  | * |
| 300-700 |  |  |  |  |  | * |
| 350-360 |  |  |  |  | * |  |
| 350-430 |  |  |  |  |  | * |
| 350-450 |  |  |  |  |  | * |

10 Forces and Moments


The given forces and moments are mean values for simultaneous loading in the three planes. If the forces and moments in one particular direction are larger than given in the table, consult KSB.


The values given in the table do not apply to the reaction forces of braceless expansion joints.


[^0]| $\begin{aligned} & \text { Pump } \\ & \text { sizes } \end{aligned}$ |  | $\begin{aligned} & \text { pass } \\ & 10 \% \end{aligned}$ |  | eller | dian | ter | Clearances |  |  | Permis <br> forces in $N$ | le nozzle <br> moments in Nm | Mass m in <br> (withou in | ents of J <br> upling) $n^{2}$ | Permissible operating pressure |  | Permissible test pressure |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | A | B | c | A | B | C | A | B | C | $\begin{gathered} F_{X}, F_{y}, F_{z} \\ 1) ; 3) \\ \hline \end{gathered}$ | $\begin{gathered} M_{x}, M_{y}, M_{z} \\ 1) ; 3) \end{gathered}$ | without water | with water | 1) | 2) | 1) | 2) |
| 250-370 | 39 | 27 | 20 | 390 | 390 | 390 | 0.5 | 0.5 | 0,5 | 4000 | 2750 | 0.721 | 1.225 | 10 | 25 | 15 | 37.5 |
| 250-480 | 30 | 20 | - | 478 | 478 | - | 0.5 | 0.5 | - | 4000 | 2750 | 0.956 | 1.625 | 16 | 25 | 24 | 37.5 |
| 250-600 | 23 | 16 | - | 622 | 622 | - | 0.5 | 0.5 | $\cdot$ | 4000 | 2750 | 2.206 | 3.750 | 24 | 25 | 28 | 37.5 |
| 300-300 | 39 | 27 | - | 323 | 323 | - | 0.5 | 0.5 | - | 4000 | 3000 | 0.571 | 0.800 | 10 | 25 | 15 | 37.5 |
| 300-435 | 45 | 32 | 30 | 450 | 450 | 450 | 0.6 | 0.6 | 0,6 | 4000 | 3000 | 1.785 | 2.500 | 10 | 25 | 15 | 37.5 |
| 300-560 | 35 | 23 | - | 553 | 553 | - | 0.6 | 0.6 | - | 5000 | 3000 | 2.411 | 3.375 | 16 | 25 | 24 | 37.5 |
| 300-700 | 26 | 18 | - | 719 | 719 | - | 0.6 | 0.6 | - | 5000 | 3000 | 6.346 | 8.250 | 24 | 25 | 28 | 37.5 |
| 350-360 | 39 | 27 | - | 373 | 373 | - | 0.5 | 0.5 | - | 5000 | 3000 | 1.116 | 1.563 | 10 | 25 | 15 | 37.5 |
| 350-430 | 57 | 40 | - | 430 | 430 | - | 0.6 | 0.6 | - | 5000 | 3000 | 2.232 | 3.125 | 10 | 25 | 15 | 37.5 |
| 350-510 | 52 | 36 | 35 | 518 | 518 | 518 | 0.6 | 0,6 | 0,6 | 5000 | 3000 | 3.393 | 4.750 | 10 | 25 | 15 | 37.5 |

1) Casing material JL 1040 and GGG-NiCrNb 202
2) Casing material JS 1030 and 1.4517
3) Casing material JS 1030; 1.4 -times the given value

Casing material 1.4517; 1.9-times the given value

## Trouble-Shooting

### 11.1 General

The diagram opposite is to facilitate understanding of the causes of faults and their remedies as indicated in the trouble-shooting table.
The cause of many operating faults on pumps is often hydraulic. The hydraulic behavior of a pump is illustrated by its characteristic curves H, P, Eta and NPSH in combination with the plant characteristic curves $\mathrm{H}_{\mathrm{A}}$ and $\mathrm{NPSH}_{\mathbf{A}}$. The operating point $\mathbf{B}$ is where the system curve $\mathrm{H}_{\mathrm{A}}$ and the characteristic curve H intersect. Consult the manufacturer if the cause of a fault is unclear.

11.2 Trouble-shooting Table

| 3 <br> $\mathbf{0}$ <br> 9 |  |  | 2 <br> 20 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 |  |  | 믈 블 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 |  |  |  | Exessive leakage at shaft seal |  | 0 <br> 0 <br>  <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 | Cause | Remedy ${ }^{1)}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | - | - | - | - | - |  | - | - |  |  | - |  | Operating point $B$ does not lie at the calculated intersections of Q and H | Re-adjust operating point |
|  |  |  |  |  | $\bullet$ |  |  |  |  |  |  |  | Pump or piping incompletely vented or not primed | Vent. |
| $\bullet$ |  |  | $\bullet$ |  | - | $\bullet$ | - | - |  |  |  |  | Suction pipe or impeller blocked | Clean impeller <br> Check plant for impurities <br> Remove deposits in pump and / or piping Check strainer / suction opening |
|  |  |  |  |  | - | $\bullet$ | - |  |  |  |  |  | Formation of air pockets in the piping | Correct suction conditions Alter piping |
| $\bullet$ |  |  | $\bullet$ |  | - | $\bullet$ | - |  |  |  |  |  | Suction head too high (NPSHavailable too low) / water level too low | Check mode of operation Correct suction conditions Increase positive suction head Increase back pressure by throttling Install pump at a lower level Alter intake pipe if resistances are too high |
| - |  |  | - |  | - | $\bullet$ |  |  |  | - | , |  | Air is drawn in at shaft seal | Clean sealing liquid line, possibly introduce sealing liquid from an external source or increase pressure Check level of liquid in feed tank Replace shaft seal Replace shaft protecting sleeve |
| - |  |  | - | - |  |  | - | . |  |  | - |  | Wrong direction of rotation | Interchange two phases of the power cable <br> Check electrical connections Check impeller position, correct if necessary |
| $\bullet$ |  |  | - |  | . |  | - |  |  |  |  |  | Speed too low | Increase speed ${ }^{1)}$ Check switchgear Fit larger impeller 1) |
| - |  |  | - |  | - | $\bullet$ |  |  |  |  |  |  | Internals worn | Check duty point / pump selection Increase back pressure by throttling Check medium handled for contamination by chemicals and solids content <br> Replace worn components |
|  |  |  |  | - |  |  |  |  |  |  | - |  | Pump pressure is lower than specified in the order | Re-adjust operating point Increase back pressure by throttling. |

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Trouble-shooting Table


[^1]
## Trouble-shooting Table


Trouble-shooting Table

|  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

1) Consult KSB

12 Routine Maintenance and Inspection Intervals

| Interval | Number of personnel required | Time <br> [h] | Maintenance job |
| :---: | :---: | :---: | :---: |
| Daily | 1 | 1/10 | Check leakage on mechanical seal or leakage of packed gland (see section 8.1 "Gland packing"). |
| Weekly | 1 | $1 / 4$ | Check pump operation (positive suction pressure, total head, bearing temperature, noises and vibrations) |
| Monthly | 1 <br> 1 | $\begin{gathered} 1 / 4 \\ 1 / 4 \\ \hline \end{gathered}$ | Check torsional play of coupling (see section "Coupling"), If available, switch to stand-by pump or carry out a test run (for 5 min .) |
| every 20.000 operating hours | 2 | 3 | Replace deep-groove ball bearings (see section 7.3 "Dismantling" and 7.4 "Reassembly"). |
| every 4 years or if total head of pump drops | 2 | 6 | General inspection and overhaul of pump in accordance with the operating instructions. <br> Check and renew, if required: <br> - wear parts such as: bearings, casing wear ring (impeller wear ring, if any), shaft protecting sleeve <br> - impeller and shaft <br> - Replace sealing elements |

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## 13 Appendix

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Types of installation


Direction of rotation / flow direction

## Horizontal

Direction of rotation anticlockwise, viewed from the drive end


Direction of rotation clockwise, viewed from the drive end

Vertical

Direction of rotation anticlockwise, viewed from the drive end


[^2] available

Type of Installation 3E - Motor Height Adjustment
Baseplate with adjusting screw or shims under the motor feet


Type of Installation 3E - Motor Height Adjustment - Baseplate with adjusting screw and pedestal


Type of Installation 3E - Motor Height Adjustment - Baseframe with Base / Shims under the Motor Feet


| Part no | Description |
| :---: | :--- |
| $89-4$ | Shim |
| 180 | Pedestal |
| 550 | Washer |
| 592 | Base |
| 890 | Baseplate |
| 891 | Baseframe |
| 900 | Screw |
| 901 | Hex. head bolt |
| 902 | Stud |
| 909 | Adjusting screw |
| 920 | Nut |

## Sealing / flushing water piping

The pump is equipped with sealing / flushing water piping. These pipes are sheathed PTFE hoses which are flexible, temperature and highly pressure resistant.
Arrangement of sealing water and flush pipes

Another favourable property of . PTFE (polytetrafluorethylene) is the extremely low friction coefficient which prevents pipe clogging.
Normally we supply this assembly ready mounted to the pump. If this is not the case, mount the hoses and fittings as per the attached drawings (see appendix).

## 01 section water pipe wr plard pacian




De Fhem pepe for muthanial scas

04 Fugh ppe formechatieal enal Fiblingenfor Mesidut besion



OS ven walve

or Gastng witor ppe targlind pactirg




## Sealing water pipe for gland packing



| Part no. | Description |
| :---: | :--- |
| 719.01 | Flexible tube |
| 731.02 | Nipple joint |
| 731.03 | Cross |
| 731.04 | Nipple joint |
| 731.05 | Pipe bend |
| 731.12 | Socket |
| 903.01 | Screwed plug |

## Sealing water pipe for mechanical seal



| Part no. | Description |
| :---: | :--- |
| 719.01 | Flexible tube |
| 731.02 | Nipple joint |
| 731.03 | Cross |
| 731.04 | Nipple joint |
| 903.01 | Screwed plug |

## Coupling (N-EUPEX) <br> (Flexible couplings N-EUPEX and N-EUPEX-DS, types A and ADS)

- N-EUPEX couplings provide radial, angular, axial and torsional flexibility. They are positive-locking.
- Torque is transmitted by flexible coupling elements (flexibles).
- The non-linear spring characteristic and the favourable damping properties of the N-EUPEX coupling effectively counteract any dangerous increase in vibrations.


## General instructions and safety notes

When fitting and removing N-EUPEX couplings please note the following requirements:

- The coupling shall only be operated, serviced or repaired by authorized, skilled and duly qualified staff.
- The coupling shall only be used and operated within the conditions stipulated in the technical specification and supply contract.
- Unauthorized modification and removal of protective equipment is not permitted.
- Any work on the coupling shall only be performed with the machine shut down. The driver must be secured against inadvertent start-up (e.g. by locking the key-operated switch or removing the power supply fuses). At the switch-on point a notice shall be affixed to the effect that work is being performed on the coupling.
- Immediately switch off the driver when changes in coupling behaviour occur, such as changed running noises.
- The coupling must be suitably protected against accidental contact.


## Installation

## - Design of types A / ADS

The N-EUPEX coupling types A / ADS consist of a coupling part 1 which houses the flexible coupling blocks (12), the finger part 3 and the coupling part 2 , which bolts onto part 3.

The bolted connection between part 2 and part 3 makes it possible to separate the coupled machines without axial displacement (if clearance $P$ is observed).


- Mounting the coupling components

Before fitting the coupling components, carefully clean the shaft ends and the coupling parts. Make sure to remove the flexible coupling blocks before cleaning the coupling parts with a solvent.


Heed the manufacturer's instructions for the use of solvents.

## Caution

Use appropriate tools when pulling on the coupling parts, to prevent damage to the shaft bearings due to the axial joining force.
Make sure to use suitable lifting tackle.
The shaft ends must not protrude from the hub faces. The coupling is locked in axial direction by means of the set screw or end plate, as applicable / set screw and end plate, respectively.

## Caution

The set screws shall only be tightened by means of a hexagon socket head wrench to DIN 911, without extension.

Non-compliance with these instructions may cause the coupling to burst. Danger of life by flying fragments!

Heating up the coupling parts (to max. $+150^{\circ} \mathrm{C}$ ) may facilitate pulling on the coupling parts. If temperatures exceed $+80^{\circ} \mathrm{C}$, the flexible coupling blocks must be removed from the coupling parts before the heating process.


Protect against burns from contact with hot components!

If the coupling blocks have been removed, they shall be re-installed after the coupling parts have been pulled on. Make sure the heated coupling parts have cooled down to under $80^{\circ} \mathrm{C}$ before doing so. All coupling blocks used must be of identical size and marking.

Push the machines to be coupled together.


Take appropriate precautions to prevent injury by crushing.

Make sure to observe dimension $\mathrm{S}_{1}$. On types A and ADS, the connection between parts 2 and 3 shall be reestablished before aligning the coupling, and the tightening torque of the screwed connection between parts 2 and 3 shall be checked (for tightening torques and clearance $S_{1}$ please refer to point 6.6).

## Aligning the coupling

(Also refer to section 5.3.2).
The couplings will only tolerate misalignment of the shaft ends to be coupled to a certain extent.

When aligning the coupling, the radial and angular. misalignment of the shaft ends should therefore be minimized. With identical operating conditions, the useful life of the flexible coupling blocks will be increased as a result.

Coupling alignment shall be effected in two planes which are normal to each other. Use a straight-edge (radial misalignment) and feeler gauge (angular misalignment) as shown below to verify.

Using a dial micrometer will make for increased measuring accuracy.
To allow one shaft end to rotate freely, the driving section can be separated on types A and ADS by loosening the screwed connection between parts 2 and 3 and pulling part 3 out of the recesses in part 1.

## Caution

After the connection has been reestablished, check the tightening torque of the bolts.


Correlation between tightening torques, dimension $\mathbf{P}$ and clearance $\mathbf{S}_{\mathbf{1}}$

| N-EUPEX coupling | N-EUPEX-DS coupling | Tightening torque $T_{A}$ and width across flats $S_{w}$ for bolts to DIN 912 Part $2 / 3$ |  |  | $\begin{gathered} \mathrm{S}_{1} \\ {[\mathrm{~mm}]} \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Size | Size | $\begin{gathered} \mathrm{T}_{\mathrm{A}} \\ \mathrm{Nm} \\ \hline \end{gathered}$ | $\begin{gathered} \mathrm{S}_{\mathrm{w}} \\ {[\mathrm{~mm}]} \end{gathered}$ | $\begin{gathered} \mathrm{P} \\ {[\mathrm{~mm}]} \end{gathered}$ |  |
| 110 | 118 | 14 | 6 | 33 | 2-4 |
| 125 | 135 | 17,5 | 6 | 38 | 2-4 |
| 140 | 152 | 29 | 8 | 43 | 2-4 |
| 160 | 172 | 35 | 8 | 47 | 2-5 |
| 180 | 194 | 44 | 8 | 50 | 2-6 |
| 200 | 218 | 67,5 | 10 | 53 | 2-6 |
| 225 | 245 | 89 | 10 | 61 | 2-6 |
| 250 | 272 | 145 | 14 | 69 | 3-8 |
| 280 | 305 | 185 | 14 | 73 | 3-8 |
| 315 | 340 | 200 | 14 | 78 | 3-8 |
| 350 | 350 | 260 | 17 | 83 | 3-8 |
| 400 | 430 | 340 | 17 | 88 | 3-8 |
| 440 | 472 | 420 | 17 | 99 | 5-10 |
| 480 | 514 | 550 | 19 | 104 | 5-10 |
| 520 | 556 | 670 | 19 | 115 | 5-10 |
| 560 | -- | 710 | 19 | 125 | 6-12 |
| 610 | -- | 1450 | 22 | 135 | 6-12 |
| 660 | -- | 1450 | 22 | 145 | 6-12 |
| 710 | - | 1450 | 22 | 155 | 6-12 |

## Commissioning the coupling

## Measures to be taken prior to commissioning

Before commissioning the coupling check the proper installation of the flexible coupling elements, i.e. make sure the flexibles are flush with the hub face, and check whether the set screws are properly tightened. Also verify coupling alignment and clearance $S_{1}$ and correct, if necessary. Check whether all screwed connections have been tightening with the tightening torques specified Finally, fit the coupling guard against accidental contact.

## Operation

## General operating data

During coupling operation, watch out for

- changed running noises,
- sudden vibrations.


## Caution

If any irregularities occur during operation, switch off the driver immediately and refer to the troubleshooting table to determine the cause.
The trouble-shooting table lists possible faults, causes and suggested remedies.

Trouble-shooting

## General

The faults listed below shall serve as orientation only when determining failure causes.

In a complex plant system, all other components will have to be included in the search for possible failure causes.

The coupling shall give low-noise and vibration-free operation in all phases of operation. Any other operating behaviour shall be considered a fault which must be remedied immediately.


Before commencing any maintenance, repair or other work on the coupling, the operator must shut down the entire driving mechanism. The drivers, in particular, must be secured against inadvertent start-up.
Also, the accident prevention regulations in force at the installation site shall be complied with.

Trouble-shooting list

| Fault | Possible causes | Remedy |
| :---: | :---: | :---: |
| Sudden change in noise level and/or sudden vibrations | Misalignment | Shut down the unit. |
|  |  | Eliminate cause for misalignment, if any. (E.g. re-tighten the foundation bolts). |
|  |  | Inspect for wear, proceed as described in section "Coupling - Maintenance and Repair" |
|  | Flexibles are worn | Shut down the unit. |
|  | Torque transmission by metal-to-metal contact | Dismantle the coupling and remove what is left of the flexible coupling blocks. |
|  | durch Metallkontakt | Inspect the coupling parts and replace any damaged components. |
|  |  | Coupling blocks shall always be replaced by complete sets of new coupling blocks; only use. coupling blocks with identical markings. |
|  |  | Verify alignment and correct, if necessary. |
|  |  | Check the tightening torques of the screwed connection between parts 2 and 3 . |

## Maintenance and repair

## General

The torsional play between the two coupling parts shall be checked in acc. with the maintenance schedule of the plant, but at least once a year.

If torsional play must not be limited for extremely smooth coupling operation, the plastic flexibles can be allowed to wear down to approx. $1 / 4$ of their original thickness before they have to be replaced. To assess the wear condition of the coupling blocks, the table below indicates the permissible torsional play as indicated by the chord dimension $\Delta S_{v}$ on the outside coupling diameter.

To determine the chord dimension $\Delta S_{\mathrm{v}}$, rotate one coupling part by hand up to the stop and mark the coupling parts (see illustration). Hand-rotate one coupling part into the opposite direction up to the stop. The two marks will diverge. The distance between the marks is the chord dimension $\Delta S_{v}$. If $\Delta S_{v}$ exceeds the value given in the table, the flexible coupling blocks have to be replaced.

## Caution

Coupling blocks shall always be replaced by complete sets of new coupling blocks; only use coupling blocks with identical identification numbers.


Table: Wear mark on N-EUPEX coupling

| Size | 58 | 68 | 80 | 95 | 110 | 125 | 140 | 160 | 180 | 200 | 225 | 250 | 280 | 315 | 350 | 400 | 440 | 480 | 520 | 560 | 610 | 660 | 710 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Wear <br> mark <br> $\Delta S_{V}$ | 5.5 | 5.5 | 5.0 | 6.0 | 7.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.5 | 9.0 | 10.0 | 11.5 | 10.5 | 11.5 | 13.0 | 14.0 | 15.5 | 17.5 | 17.5 | 19.5 | 21.0 | 22.5 |

Table: Wear mark on N-EUPEX-DS coupling

| Size | 66 | 76 | 88 | 103 | 118 | 135 | 152 | 172 | 194 | 218 | 245 | 272 | 305 | 340 | 380 | 430 | 472 | 514 | 556 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Wear <br> mark <br> $\Delta S_{y}$ | 6.0 | 7.0 | 5.0 | 7.0 | 9.0 | 10.5 | 11.5 | 9.0 | 8.0 | 7.0 | 6.5 | 7.0 | 8.0 | 6.5 | 7.0 | 10.0 | 12.0 | 14.0 | 16.0 |

## Replacing wear parts

Use only genuine N-EUPEX flexible blocks as spare parts, to ensure correct torque transmission and troublefree operation.

## Please note:

On types A and ADS, the flexibles can be replaced without axial displacement of the coupled machines.

After the screwed connection between parts 2 and 3 has been undone, part 3 can be shifted in axial direction. By rotating part 3, the flexible coupling blocks are freely accessible. To facilitate axial displacement, sizes 225-430 are provided with forcing threads in part 1. From size 440, the forcing threads are located in part 3 (see illustrations).


For reassembly carefully follow the instructions in the sections on "Installation" and "Commissioning".


| Shaft <br> diameter <br> $d_{w}$ | Axial overhang of shaft <br> protecting sleeve <br> $\mathbf{A \pm 0 . 5}$ |
| :---: | :---: |
| 40 | 2 |
| 50 | 2 |
| 60 | 2 |
| 70 | 5 |
| 80 | 4 |
| 90 | 4 |

Omega

| Part no. | Description |
| :--- | :--- |
| 102 | Volute casing |
| 105.01 | Lower casing half |
| 105.02 | Upper casing half |
| 211 | Pump shaft |
| 234 | Impeller |
| 321 | Deep-groove ball bearing |
| 350 | Bearing housing |
| 360 | Bearing cover |
| 411 | V-ring |
| 412 | O-ring |
| 421 | Radial shaft seal ring |
| 441 | Housing for shaft seal |


| Part no. | Description |
| :--- | :--- |
| 452 | Gland cover |
| 461 | Gland packing |
| 455 | Stuffing box insert |
| 457 | Neck ring |
| 458 | Lantern ring |
| 502 | Casing wear ring |
| 503 | Impeller wear ring |
| 520 | Sleeve |
| 524 | Shaft protecting sleeve |
| 550 | Washer |


| Part no. | Description |
| :--- | :--- |
| 561 | Grooved pin |
| 580 | Cap |
| 901 | Hexagon head bolt |
| 902 | Stud |
| 903 | Screwed plug |
| 904 | Grub screw |
| 920 | Nut |
| 932 | Circlip |
| 940 | Key |
| 950 | Cup spring |

General drawing of pump with parts list
Shaft seal: Mechanical seal


| Shaft <br> diameter <br> $\mathbf{d w}_{\mathbf{w}}$ | Axial overhang of shaft <br> protecting sleeve <br> $\mathbf{A} \pm 0.5$ |
| :---: | :---: |
| 40 | 2 |
| 50 | 2 |
| 60 | 2 |
| 70 | 5 |
| 80 | 4 |
| 90 | 4 |


| Part no. | Description |
| :--- | :--- |
| 102 | Volute casing |
| 105.01 | Lower casing half |
| 105.02 | Upper casing half |
| 211 | Pump shaft |
| 234 | Impeller |
| 321 | Deep groove ball bearing |
| 350 | Bearing housing |
| 360 | Bearing cover |
| 411 | V-ring |
| 412 | O-ring |
| 421 | Radial shaft seal ring |
| 433 | Mechanical seal |
| 441 | Housing for shaft seal |


| Part no. | Description | Part no. | Description |
| :---: | :---: | :---: | :---: |
| 457.02 | Neck ring | 920 | Nut |
| 502 | Casing wear ring | 932 | Circlip |
| 503 | Impeller wear ring | 940 | Key |
| 520 | Sleeve | 950 | Cup spring |
| 524.01 | Shaft protecting sleeve |  |  |
| 525.02 | Spacer sleeve |  |  |
| 550 | Washer |  |  |
| 561 | Grooved pin |  |  |
| 580 | Cap |  |  |
| 901 | Hexagon head bolt |  |  |
| 903 | Screwed plug |  |  |

## Mechanical seals, standard design

Standardized mechanic al seal to DIN 24960 - short design, non-balanced Sizes for shaft diameter dw = 40 to $\mathbf{8 0 ~ m m ~ ( w i t h ~ s i n g l e ~ s p r i n g ) ~}$


Standardized mechanic al seal to DIN 24960 - short design, non-balanced Sizes for shaft diameter $\mathbf{d w}=\mathbf{9 0} \mathbf{~ m m}$ (with multiple spring arrangement)


| Part no. | Description |
| :--- | :--- |
| 211 | Pump shaft |
| 433 | Mechanical seal |
| 441 | Housing for shaft seal |
| 457.02 | Neck ring |


| Part no. | Description |
| :--- | :--- |
| 471 | Seal cover |
| 524.01 | Shafl protecting sleeve |
| 525.02 | Spacer sleeve |
| 901.16 | Hexagon head boll |

Mechanical seals, standard design
Balanced mechanical seal (for operating pressures > 16 bar) to DIN 24960
Sizes for shaft diameter $\mathrm{dw}=40$ to 80 mm (with covered spring)


Balanced mechanical seal (for operating pressures $p \geq 16$ bar) to DIN 24960 Sizes for shaft diameter $\mathrm{dw}=90 \mathrm{~mm}$ (with multiple spring arrangement)


| Part no. | Description |
| :--- | :--- |
| 211 | Pump shaft |
| 433 | Mechanical seal |
| 441 | Housing for shaft seal |
| 457.02 | Neck ring |


| Part no. | Description |
| :--- | :--- |
| 471 | Seal cover |
| 524.01 | Shaft protecting sleeve |
| 525.02 | Spacer sleeve |
| 901.16 | Hexagon head bolt |

Omega

## Shaft seal - mechanical seals - <br> Type Crane 58U and 58B

## Description

The mechanical seals, 58 U and 58B, are precision-made and must be treated accordingly. The contact faces are lapped to a high degree of accuracy and prior to despatch they are covered in a protective sleeve to prevent damage. If the protective sleeve is removed for installation purposes, then great care must be taken to avoid any damage to the finely finished, lapped surfaces.

Whenever replacing worn out or damaged mechanical seals, the section of the shaft or sleeve which will accept the new seal must be cleaned and oiled.

## Preparation for installation

1. The installation dimensions and tolerances must comply with those outlined in the relevant literature.
2. The cover which will accept the seat ring must be checked with regard to depth and installation dimensions.


|  |  |  |  |
| :--- | :--- | :--- | :--- |
| 780 | Retainer | 578 | Balanced face |
| 305 | Grub screw | 096 | Snap ring |
| 582 (092) | Spring | 500 | Seat type BP |
| 583 | Thrust ring | 501 | Seat ring |
| 123 | O-ring | 902 | Seat type BO |
| 574 | Rotating face | $123(R)$ | O-ring |
| 564 | Support ring |  |  |

## Installation and operation

1. Clean and lightly lubricate the shaft / sleeve with a suitable lubricant.

## Attention:

Sealing elements manufactured in EP-Elastomer materials must not come in contact with mineral oil and grease.
2. Push on the rotating unit applying light manual pressure.
3. Push the seat ring together with the joint ring into the cover applying even manual pressure. The joint ring shall also be lubricated using a suitable lubricant.
4. The contact faces must be cleaned prior to installation into the machine. Tighten the cover bolts evenly. Overtightening can affect the true running of the rubbing faces and therefore have an adverse effect on the functioning of the mechanical seal.
5. Manually turn the shaft. Fill the machine whilst simultaneously monitoring the venting equipment within the seal area. Check the circulation pipe.

## Dismantling and assembly of the rotating unit

The first step is to remove the snap ring (096) from the retainer (780). The springs are compressed to achieve this. This can be done by using a simple tool, as illustrated.

Attention: Lapped surfaces of the rotating face must be protected.


1. The rotating face $(574 / 578)$ is pushed down and the snap ring (096) is removed from the groove using a pointed tool.

2. Now remove in the following sequence: the rotating face (574 / 578), the O-ring (123), the thrust ring (583) and the springs ( $582 / 092$ ).


Assembly is carried out in reverse sequence.
The following must be noted during assembly:
The drive cams in the retainer (780) must engage into the grooves of the thrust ring (583) or the rotating face (574 / 578).

Fit the snap ring (096) into the groove of the retainer (780), leaving one end of the snap ring protruding by approx 6-12 mm to the side of the drilled hole.


At the outer circumference of the retainer (780) there are 2 marker grooves. The lower one runs precisely through the centre of the drilled hole for the internal socket head screws, which indicates that the thread of the screws is metric.

The upper groove assists during installation. If the initial tension of the mechanical seal is set correctly to the installation length, then the thrust ring shall be in alignment (be flush) with this groove.

Dimension table Omega 80-210 up to 150-605
Fig. 0
Direction of rotation: CLOCKWISE


Fingers:

- Allmanes deagnod plote hanges
- Ravge miviouss lo ANSI


Connmetions:
N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).



- © ) Gm: G $1 / 2$
- 69 Dranmege Gl,
- B5 Leowoneudrdin 6 da

Dimensions and weights All dimensions in mm

| $\begin{aligned} & \text { Pump } \\ & \text { size } \end{aligned}$ | DN1 | DN 2 | Flange dimensions |  | . Pump dimensions |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{S}_{1}$ | S2 | $a_{1}{ }^{2)}$ | $\mathrm{a}_{2}{ }^{2)}$ | $\mathrm{d}_{3}$ | $f$ | $h_{1}{ }^{2}$ | $\mathrm{h}_{2}{ }^{\text {) }}$ | $\mathrm{h}_{3}$ | $\mathrm{l}_{2}$ | 13 | $z^{1)}$ |
| 80-210 | 125 | 80 | 36 | 29 | 300 | 300 | 19 | 415 | 315 | 140 | 168 | 300 | 715 | 340 |
| 80-270 |  |  |  |  |  |  |  |  |  |  | 190 |  |  | 380 |
| 80-370 |  |  |  |  | 330 | 330 |  |  |  |  | 225 |  |  | 450 |
| 100-250 | 150 | 100 | 37 | 32 | 330 | 330 | 19 | 415 | 355 | 170 | 195 | 300 | 715 | 390 |
| 100-310 |  |  |  |  |  |  |  |  |  |  | 225 |  |  | 450 |
| 100-375 |  |  |  |  | 370 | 370 |  |  |  |  | 260 |  |  | 520 |
| 125-230 | 200 | 125 | 41 | 35 | 370 |  | 19 | 515 | 400 | 200 | 210 | 366 | 881 | 420 |
| 125-290 |  |  |  |  |  |  |  |  |  |  | 230 |  |  | 460 |
| 125-365 |  |  |  |  |  |  |  |  |  |  | 260 |  |  | 520 |
| 125-500 |  |  |  |  | 450 | 450 |  |  |  |  | 305 |  |  | 610 |
| 150-290 | 200 | 150 | 41 | 37 | 400 | 400 | 19 | 515 | 400 | 200 | 245 | 366 | 881 | 490 |
| 150-360 |  |  |  |  | 400 | 400 |  | 515 |  |  | 265 |  |  | 530 |
| 150-460 |  |  |  |  | 450 | 450 |  | 590 |  |  | 305 | 399 | 989 | 610 |
| 150-605 |  |  |  |  | 600 | 500 |  |  | 500 | 300 | 370 |  |  | 740 |


| Pump | Foot dimensions |  |  |  |  |  |  |  |  | Shaft |  | Weights [kg] |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | $b_{1}$ | $\mathrm{d}_{2}$ | $\mathrm{m}_{1}$ | $\mathrm{m}_{2}$ | $\mathrm{n}_{1}$ | $\mathrm{n}_{2}$ | $n_{3}$ | $n_{4}$ | s | $\mathrm{d}_{1}$ | $l_{1}$ | Pump | Water fill |
| 80-210 | 70 | 17.5 | 320 | 270 | 205 | 205 | 170 | 170 | 20 | 35 | 80 | 185 | 10 |
| 80-270 |  |  |  |  |  |  |  |  |  |  |  | 195 | 15 |
| 80-370 |  |  |  |  |  |  |  |  |  |  |  | 205 | 20 |
| 100-250 | 70 | 17.5 | 320 | 270 | 235 | 235 | 200 | 200 | 20 | 35 | 80 | 210 | 20 |
| 100-310 |  |  |  |  |  |  |  |  |  |  |  | 225 | 25 |
| 100-375 |  |  |  |  |  |  |  |  |  |  |  | 245 | 30 |
| 125-230 | 70 | 17.5 | 390 | 340 | 260 | 260 | 225 | 225 | 20 | 45 | 100 | 250 | 35 |
| 125-290 |  |  |  |  |  |  |  |  |  |  |  | 275 | 40 |
| 125-365 |  |  |  |  |  |  |  |  |  |  |  | 300 | 45 |
| 125-500 |  |  |  |  | 315 | 315 | 280 | 280 |  |  |  | 335 | 55 |
| 150-290 | 70 | 17.5 | 390 | 340 | 260 | 260 | 225 | 225 | 20 | 45 | 100 | 350 | 50 |
| 150-360 |  |  |  |  |  |  |  |  |  |  |  | 360 | 60 |
| 150-460 |  |  | 480 | 430 | 315 | 315 | 280 | 280 |  | 55 | 125 | 440 | 75 |
| 150-605 |  |  |  |  | 385 | 385 | 350 | 350 |  |  |  | 650 | 90 |

${ }^{1}, z=$ clearance above casing cover for dismantling of the rotor
${ }^{2)}$ material combinations SB and SC: dimensions are $1 \%$ larger

Standard flange connections ${ }^{11}$ :

| Pump size | JL 1040 / GGG-NiCrNb 202 Nominal pressure acc. to: |  |  | JS 1030 / 1.4517 <br> Nominal pressure acc. to: |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \\ \hline \end{gathered}$ | BS 4504 | ANSI B 16.1 |
| 80-210 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 80-270 |  |  |  |  |  |  |
| 80-370 |  |  |  |  |  |  |
| 100-250 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 100-310 |  |  |  |  |  |  |
| 100-375 |  |  |  |  |  |  |
| 125-230 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 125-290 |  |  |  |  |  |  |
| 125-365 |  |  |  |  |  |  |
| 125-500 |  |  |  |  |  |  |
| 150-290 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 150-360 |  |  |  |  |  |  |
| 150-460 |  |  |  |  |  |  |
| 150-605 | PN 25 | Table 25/11 |  |  |  |  |


${ }^{1)}$ Other flange connections on request

Flange dimensions - Hole pattern

| Flange dimensions - Hole pattern |  |  |  |  |  |  |  |  |  |  |  |  |  | All dimensions in mm |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Standard |  | DN 80 |  |  | DN 100 |  |  | DN 125 |  |  | DN 150 |  |  | DN 200 |  |  |
|  |  | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n |
| $\begin{aligned} & \text { ISO 7005/2 } \\ & \text { DIN } 2501 \\ & \hline \end{aligned}$ | PN 16 | 19 | 160 | 8 | 19 | 180 | 8 | 19 | 210 | 8 | 23 | 240 | 8 | 23 | 295 | 12 |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \hline \end{array}$ | PN 25 | 19 | 160 | 8 | 23 | 190 | 8 | 28 | 220 | 8 | 28 | 250 | 8 | 28 | 310 | 12 |
| BS 4504 | Table 16/11 | 19. | 160 | 8 | 19 | 180 | 8 | 19 | 210 | 8 | 23 | 240 | 8 | 23 | 295 | 12 |
| BS 4504 | Table 25/11 | 19 | 160 | 8 | 23 | 190 | 8 | 28 | 220 | 8 | 28 | 250 | 8 | 28 | 310 | 12 |
| ANSI B 16.1 | Class 250 | 23 | 168 | 8 | 23 | 200 | 8 | 23 | 235 | 8 | 23 | 270 | 12 | 28 | 330 | 12 |

Dimension tables Omega 200-320 up to 350-510
Fig. 0
Direction of rotation: CLOCKWISE
N.B.: : If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).


Flingers
Blllanges theogroon a glate tanger
Fwanemotores to Ansl.

- Comect puet whoul tringheleg siresces o strine.


Comardiras:

- 3M Presuegenge G12
-41 lom
012
BQ Drinege: G12
- Be LeombetharedmanG34

Dimensions and weights
All dimensions in mm

| Pump | Flange dimensions |  |  |  | Pump dimensions |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | DN1 | DN2 | $\mathrm{s}_{1}$ | $\mathrm{S}_{2}$ | $\mathrm{a}_{1}{ }^{3)}$ | $\mathrm{a}_{2}{ }^{3)}$ | $\mathrm{d}_{3}$ | $f$ | $h_{1}{ }^{3)}$ | $\mathrm{h}_{2}{ }^{2)}$ | $\mathrm{h}_{3}$ | $\mathrm{I}_{2}$ | $I_{3}$ | $z^{2)}$ |
| 200-320 | 250 | 200 | 48 | 41 | 450 | 450 | 24,5 | 590 | 500 | 240 | 285 | 399 | 989 | 570 |
| 200-420 |  |  |  |  | 500 | 500 |  |  |  |  | 310 |  |  | 620 |
| 200-520 |  |  |  |  | 600 |  |  | 655 | 560 | 300 | 370 | 464 | 1119 | 740 |
| 200-670 |  |  |  |  | 650 | 550 |  |  | 600 | 350 | 430 |  |  | 860 |
| 250-370 | 300 | 250 | 33 (51) ${ }^{\prime \prime}$ | 32 (48) ${ }^{11}$ | 500 | 500 | 12,5 | 655 | 600 | 300 | 320 | 464 | 1119 | 640 |
| 250-480 |  |  |  |  | 550 | 550 |  | 730 |  |  | 355 | 515 | 1245 | 710 |
| 250-600 |  |  | 51 | 48 | 650 | 550 |  | 730 | 630 | 350 | 415 |  |  | 830 |
| 300-300 | 350 | 300 | 36 (54) ${ }^{\prime \prime}$ | $\begin{array}{r} 33 \\ (51)^{1)} \\ \hline \end{array}$ | 550 | 500 | 24,5 | 655 | 630 | 300 | 360 | 464 | 1119 | 720 |
| 300-435 | 400 |  | $38(57){ }^{1 /}$ |  | 650 | 550 |  | 730 | 670 | 350 | 365 | 515 | 1245 | 730 |
| 300-560 |  |  |  |  | 700 | 650 |  | 810 | 710 | 350 | 430 | 585 | 1395 | 860 |
| 300-700 |  |  | 57 | 51 | 750 |  |  |  | 750 | 400 | 480 |  |  | 960 |
| 350-360 | 400 | 350 | $38(57)^{\prime \prime}$ | $36(54)^{17}$ | 650 | 550 | 24,5 | 730 | 670 | 350 | 410 | 515 | 1245 | 820 |
| 350-430 | 450 |  | 41 (60) ${ }^{11}$ |  | 750 | 650 |  | 810 | 750 | 400 | 465 | 585 | 1395 | 930 |
| 350-510 | 400 |  | 38 (57) ${ }^{11}$ |  | 700 |  |  |  |  |  | 420 |  |  | 840 |


| Pump | Foot dimensions |  |  |  |  |  |  |  |  | Shaft |  | Weights [kg] |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | $\mathrm{b}_{1}$ | $\mathrm{d}_{2}$ | mi | $\mathrm{m}_{2}$ | $\mathrm{n}_{1}$ | $\mathrm{n}_{2}$ | n3 | $\mathrm{n}_{4}$ | S | $\mathrm{d}_{1}$ | $I_{1}$ | Pump | Water fill |
| 200-320 | 70 |  | 480 | 430 | 315 | 315 | 280 | 280 | 20 | 55 | 125 | 450 | 80 |
| 200-420 |  | 17.5 |  |  |  |  |  |  |  |  |  | 520 | 95 |
| 200-520 |  | 22 |  | 400 | 385 | 385 |  |  |  |  |  | 840 | 115 |
| 200-670 | 100 |  |  | 400 | 400 | 400 | 350 | 350 | 26 | 65 | 140 | 990 | 140 |
| 250-370 | 100 | 22 | 480 | 400 | 400 | 400 | 350 | 350 | 26 | 65 | 140 | 665 | 125 |
| 250-480 |  |  | 600 | 520 |  |  |  |  |  | 75 | 160 | 830 | 145 |
| 250-600 |  |  |  |  |  |  |  |  |  |  |  | 1215 | 180 |
| 300-300 | 100 | 22 | 480 | 400 | 400 | 400 | 350 | 350 | 26 | 65 | 140 | 630 | 100 |
| 300-435 |  |  | 600 | 520 |  |  |  |  |  | 75 | 160 | 905 | 190 |
| 300-560 |  |  |  |  | 52 |  | 475 | 475 |  | 85 | 180 | 1425 | 225 |
| 300-700 |  |  |  |  | 52 | 52 | 475 | 475 |  | 85 | 180 | 1690 | 275 |
| 350-360 | 100 | 22 | 600 | 520 | 400 | 400 | 350 | 350 | 26 | 75 | 160 | 865 | 160 |
| 350-430 |  |  |  |  | 525 | 525 | 475 | 475 |  | 85 | 180 | 1285 | 240 |
| 350-510 |  |  |  |  |  |  |  |  |  |  |  | 1395 | 290 |

[^3]Standard flange connections ${ }^{1}$ ):

| Pump size | JL 1040 / GGG-NiCrNb 202 Nominal pressure acc. to: |  |  | JS 1030 / 1.4517 <br> Nominal pressure acc. to: |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{array}{r} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \\ \hline \end{array}$ | BS 4504 | ANSI B 16.1 | $\begin{array}{r} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{array}$ | BS 4504 | ANSI B 16.1 |
| 200-320 | PN 16. | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 200-420 |  |  |  |  |  |  |
| 200-520 |  |  |  |  |  |  |
| 200-670 | PN 25 | Table 25/11 |  |  |  |  |
| 250-370 | PN 10 | Table 10/11 | Class 125 | PN 25 | Table 25/11 | Class 250 |
| 250-480 | PN 16 | Table 16/11 | Class 250 |  |  |  |
| 250-600 | PN 25 | Table 25/11 |  |  |  |  |
| 300-300 | PN 10 | Table 10/11 | Class 125 | PN 25 | Table 25/11 | Class 250 |
| 300-435 |  |  |  |  |  |  |
| 300-560 | PN 16 | Table 16/11 |  |  |  |  |
| 300-700 | PN 25 | Table 25/11 | Class 250 |  |  |  |
| 350-360 | PN 10 | Table 10/11 | Class 125 | PN 25 | Table 2511 | Class 250 |
| 350-430 |  |  |  |  |  |  |
| 350-510 |  |  |  |  |  |  |


${ }^{1)}$ Other flange connections on request

Flange dimensions - Hole pattern
All dimensions in mm

| Standard |  | DN 200 |  |  | DN 250 |  |  | DN 300 |  |  | DN 350 |  |  | DN 400 |  |  | DN 450 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | n | $\mathrm{d}_{2}$ | k | $n$ |
| $\begin{aligned} & \text { ISO 7005/2 } \\ & \text { DIN } 2501 \\ & \hline \end{aligned}$ | PN 10 | 23 | 295 | 8 | 23 | 350 | 12 | 23 | 400 | 12 | 23 | 460 | 16 | 28 | 515 | 16 | 28 | 565 | 20 |
| $\begin{aligned} & \text { ISO 7005/2 } \\ & \text { DIN } 2501 \\ & \hline \end{aligned}$ | PN 16 | 23 | 295 | 12 | 28 | 355 | 12 | 28 | 410 | 12 | 28 | 470 | 16 | 31 | 525 | 16 | 31 | 585 | 20 |
| ISO 7005/2 $\text { DIN } 2501$ | PN 25 | 28 | 310 | 12 | 31 | 370 | 12 | 31 | 430 | 16 | 34 | 490 | 16 | 37 | 550 | 16 | 37 | 600 | 20 |
| BS 4504 | Table 10/11 | 23 | 295 | 8 | 23 | 350 | 12 | 23 | 400 | 12 | 23 | 460 | 16 | 28 | 515 | 16 | 28 | 565 | 20 |
| BS 4504 | Table16/11 | 23 | 295 | 12 | 28 | 355 | 12 | 28 | 410 | 12 | 28 | 470 | 16 | 31 | 525 | 16 | 31 | 585 | 20 |
| BS 4504 | Table 25/11 | 28 | 310 | 12 | 31 | 370 | 12 | 31 | 430 | 16 | 34 | 490 | 16 | 37 | 550 | 16 | 37 | 600 | 20 |
| ANSI B 16.1 | Class 125 | 23 | 299 | 8 | 28 | 362 | 12 | 28 | 432 | 12 | 28 | 476 | 12 | 28 | 540 | 16 | 31 | 578 | 16 |
| ANSI B 16.1 | Class 250 | 28 | 330 | 12 | 28 | 387 | 16 | 31 | 451 | 16 | 31 | 514 | 20 | 34 | 572 | 20 | 34 | 629 | 24 |

General arrangement drawing Omega 80-210 up to 100-375

## Installation type 3E

Direction of rotation: CLOCKWISE "
N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).
$1-$



Dimensions and weights

| $\left\{\begin{array}{c}\text { dingension- } \\ \text { size }\end{array}\right.$ |  | Flange dimensions |  |  |  | $a_{1}{ }^{2)}$ | Pump dimensions |  |  |  |  |  | $\mathrm{l}_{2}$ | $z^{1)}$ | Weight [kg] |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Motordependent | DN1 |  | $\mathrm{S}_{1}$ | S2 |  | $a_{2}{ }^{\text {2 }}$ | $f$ | $\mathrm{h}_{4}{ }^{\text {) }}$ | $h_{5}$ max. | $h_{B}{ }^{2)}$ | i |  |  | Pump | Water fill |
| 80-210 | - | 125 | 80 | 36 | 29 | 300 | 300 | 415 |  | 660 |  |  | 300 | 340 | 185 | 10 |
| 80-270 | up to 280 M |  |  |  |  |  |  |  | 295 |  | 460 | 85 |  | 380 | 195 | 15 |
| 80-370 | - |  |  |  |  | 330 | 330 |  | 295 |  | 435 | 70 |  | 450 | 205 | 20 |
| 100-250 | up to 280 M | 150 | 100 | 37 | 32 | 330 | 330 | 415 | 305 | 760 | 475 | 70 | 300 | 390 | 210 | 20 |
|  | up 315 S |  |  |  |  |  |  |  | 330 |  | 500 | 85 |  |  |  |  |
|  | up to 280 M |  |  |  |  |  |  |  | 305 |  | 475 | 70 |  |  |  | 25 |
| 100-310 | up 315 S |  |  |  |  |  |  |  | 330 |  | 500 | 85 |  | 450 | 225 | 25 |
| 100-375 | - |  |  |  |  | 370 | 370 |  | 305 |  | 475 | 70 |  | 520 | 245 | 30 |

${ }^{1)} z=$ clearance above casing cover for rotor removal
${ }^{2)}$ material combinations SB and SC: dimensions are1 \% larger
Baseplate / base frame and foundation dimensions All dimensions in mm

| Baseplate | Baseplate and foundation dimensions |  |  |  |  |  |  |  | Foundation bolts |  |  | Ancor bolts |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. Drawing no. | $\mathrm{b}_{2}$ | $\mathrm{G}_{1}$ | $\mathrm{G}_{2}$ | 13 | 14 | 15 | $\mathrm{h}_{8}$ | Weight [kg] | Size | ${ }^{\mathrm{D}} \mathrm{N}$ | L | Size | ${ }^{\circ} \mathrm{N}$ | L |
| $\begin{gathered} 1 \\ \text { OW } 384167-00 \\ \hline \end{gathered}$ | 530 | 475 | 590 | 1190 | 495 | 495 | 120 | 74 | M 16x250 | 100 | 250 | M 12 / 25 | 18 | 110 |
| $\begin{gathered} 2 \\ \text { OW } 384169-00 \\ \hline \end{gathered}$ | 640 | 580 | 700 | 1400 | 600 | 600 | 120 | 97 |  |  |  |  |  |  |
| $\begin{gathered} 3^{3} \\ \text { OW } 384170-00 \\ \hline \end{gathered}$ | 670 | 610 | 720 | 1630 | 715 | 715 | 145 | 105 |  |  |  |  |  |  |

Standard flange connections ${ }^{11}$ ：

| Pump | JL 1040 ／GGG－NiCrNb 202 Nominal pressure acc．to： |  |  | $\text { JS } 1030 / 1.4517$ <br> Nominal pressure acc．to： |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 ． |
| 80－210 |  |  |  |  |  |  |
| 80－270 |  |  |  |  |  |  |
| 80－370 |  |  |  |  |  |  |
| 100－250 | PN 16 | Table 16／11 | Class 250 | PN 25 | Table 25／11 | Class 250 |
| 100－310 |  |  |  |  |  |  |
| 100－375 | ， |  |  |  |  |  |

${ }^{1)}$ Other flange connections on request

Flange dimensions－Hole pattern All dimensions in mm

| Standard |  | Suction flange |  |  |  | Discharge flange |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | DN | $\mathrm{d}_{2}$ | k | n | DN | $\mathrm{d}_{2}$ | k | n |
| Pump size 80－210 up to 80－370 |  | 125 |  |  |  | 80 |  |  |  |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 16 <br> Table 16／11 |  | 19 （M16） | 210 | 8 |  | 19 （M16） | 160 | 8 |
| $\begin{array}{\|l} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 25 <br> Table 25／11 |  | 28 （M24） | 220 |  |  |  |  |  |
| ANSI B 16.1 | Class 250 |  | 23 （M20） | 235 |  |  | 23 （M20） | 168 |  |
| Pump size 100－250 up to－375 |  | 150 |  |  |  | 100 |  |  |  |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 16 <br> Table 16／11 |  | 23 （M20） | 240 | 8 |  | 19 （M16） | 180 | 8 |
| ISO 7005／2 <br> DIN 2501 <br> BS 4504 | PN 25 <br> Table 25／11 |  | 28 （M24） | 250 |  |  | 23 （M20） | 190 |  |
| ANSI B 16.1 | Class 250 |  | 23 （M20） | 270 | 12 |  | 23 （M20） | 200 |  |

Mating flange All flanges designed as plate flanges


Baseplate／motor combinations

| Pump size | $100 \mathrm{~L}$ | Motor size |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 112M | 132 S | 132M | 160M |  | 160L |  | 180M |  | 180L | 200L |  | 225S | 225M |  | 250M |  | $280 S$ | 280M | 315S | 315M | 315L | 315 |
| No of poles | 4 | 4 | 4 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 4 | 2 | 4 | 4 | 2 | 4 | 2 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| 80－210 | 1 | 1 | 1 | 1 | 1 |  | 1 |  | 1 |  |  | 1 |  | $2$ | 2 |  | 2 |  | 5es新雨 | 商新縞䍗 |  | $\sqrt{3+5 x}$ |  |  |
| 80－270 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | \％ | 1 |  |  | 2 |  | 2 |  | 2 | 2 | 3 |  |  |  |
| 80－370 |  |  | 1 | 1 |  | 1 |  | 1 |  | 1 | 1 |  | 1 |  | \％ | $y^{2}$ | 5xe | $4$ | $2$ | $\sqrt{4 x+4}$ |  | 4 4 | $\sqrt{2+3}+3$ | 人x+2x |
| 100－250 | 1 | 1 | 1 | 1 |  | 1 | 1 | 1 | 1 | $4$ | $4$ | 1 |  |  | 2 |  | 2 |  | 2 | 2 | 3 | 3 | $\sqrt{4}$ |  |
| 100－310 |  |  | 1 | 1 |  | 1 |  | 1 |  | 1 | 1 | 1 | 1 | ぞ | 2 |  | 2 |  | 2 | 2 | 3 | 3 | 3 | 3 |
| 100－375 | $\sqrt{\pi}$ |  |  |  |  | 1 |  | 1 |  | 1 | 1 |  | 1 | 2 |  | 2 |  | 2 | rix | 654x |  | - | $4$ | 4xwan |

N．B．：－The numbers listed in the table indicate the relevant baseplate numbers．
－The baseplate numbers shown in the boxes also serve to select the correct motor size for the listed pump size．
－Units comprising a motor size 315 and larger are completely assembled for verification and adjustment of the individual components．Before shipment，the units are dismantled again and the components packed／shipped separately

General arrangement drawing Omega 125-230 up to 150-360
Installation type 3E
Direction of rotation: CLOCKWISE "
N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).


| Dimensio | d weig |  |  |  |  |  |  |  |  |  |  |  |  |  | All dim | ns in mm |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pump size |  |  | ge di | ensi |  |  |  |  | Pum | dime | ons |  |  |  |  |  |
|  | Motordependent | DN1 | D ${ }_{2}$ | $\mathrm{s}_{1}$ | $\mathrm{s}_{2}$ | $a_{1}{ }^{2)}$ | $\mathrm{a}_{2}{ }^{\text {) }}$ | $f$ | $h_{4}{ }^{2 \prime}$ | $h_{5}$ max. | $\mathrm{h}_{6}{ }^{\text {2 }}$ | i | $\mathrm{I}_{2}$ | $z^{1)}$ | Pump | Water fill |
|  | up to 280 M |  |  |  |  |  |  |  | 320 |  | 520 |  |  | 420 | 250 | 35 |
| 125-230 | up 315 S |  |  |  |  |  |  |  | 345 |  | 545 |  |  | 420 | 250 | 35 |
| 125-290 | up to 280 M |  |  |  |  | 370 | 370 |  | 320 |  | 520 |  |  | 460 | 275 | 40 |
| 125-290 | up 315 S | 200 | 125 | 41 | 35 |  |  |  | 345 | 825 | 545 |  |  | 460 | 275 | 40 |
| 125-365 | - |  |  |  |  |  |  | 515 | 320 |  | 520 | 120 | 366 | 520 | 300 | 45 |
|  | up to 280 M |  |  |  |  |  |  |  | 320 |  | 520 |  |  |  |  |  |
| 125-500 | up 315 S |  |  |  |  | 450 | 450 |  | 345 |  | 545 |  |  | 610 | 335 | 55 |
| 150-290 | - | 200 |  |  |  |  |  |  |  |  |  |  |  | 490 | 347 | 50 |
| 150-360 | - | 200 | 150 | 41 | 37 | 400 | 400 |  | 320 | 1050 | 520 |  |  | 530 | 359 | 60 |

2) $\mathbf{z}$ clearance above casing cover for rotor removal
${ }^{2)}$ material combinations SB and SC: dimensions are $\%$ larger
Baseplate- / base frame and foundation dimensions All dimensions in mm

| Baseplate | Baseplate and foundation dimensions |  |  |  |  |  |  |  | Foundation bolts |  |  | Anchor bolts |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. Drawing no. | $\mathrm{b}_{2}$ | $\mathrm{G}_{1}$ | $\mathrm{G}_{2}$ | $I_{3}$ | $\mathrm{I}_{4}$ | 15 | $\mathrm{h}_{8}$ | Weight [kg] | Size | ${ }^{\text {a }} \mathrm{N}$ | L | Size | ${ }^{1}$ | $L$ |
| $\begin{gathered} 4 \\ \text { OW } 384171-00 \end{gathered}$ | 695 | 635 | 750 | 1330 | 565 | 565 | 120 | 92 | M 16x250 | 100 | 250 | M $12 / 25$ | 18 | 110 |
| OW 384 172-00 | 695 | 635 | 750 | 1540 | 670 | 670 | 120 | 106 |  |  |  |  |  |  |
| $\begin{gathered} 6^{37} \\ \text { OW } 384173-00 \end{gathered}$ | 560 | 500 | 610 | 1820 | 810 | 810 | 145 | . 110 |  |  |  |  |  |  |

KSB ${ }^{-}$

Standard flange connections ${ }^{11}$ ：

| Pump size | JL 1040 ／GGG－NiCrNb 202 Nominal pressure acc．to： |  |  | JS 1030 ／ 1.4517 <br> Nominal pressure acc．to： |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \\ \hline \end{gathered}$ | BS 4504 | ANSI B 16.1 |
| 125－230 | PN 16 | Table 16／11 | Class 250 | PN 25 | Table 25／11 | Class 250 |
| 125－290 |  |  |  |  |  |  |
| 125－365 |  |  |  |  |  |  |
| 125－500 |  |  |  |  |  |  |
| 150－290 |  |  |  |  |  |  |
| 150－360 |  |  |  |  |  |  |

${ }^{1)}$ Other flange connections on request

Flange dimensions－Hole pattern All dimensions in mm

| Standard |  | Suction flange |  |  |  | Discharge flange |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | DN | $\mathrm{d}_{2}$ | k | n | DN | $\mathrm{d}_{2}$ | k | $n$ |  |
| Pump sizes 125－230 up to$125-500$ |  | 200 |  |  |  | 125 |  |  |  |  |
| ISO 7005／2 DIN 2501 BS 4504 | PN 16 <br> Table 16／11 |  | 23 （M20） | 295 | 12 |  | 19 （M16） | 210 | 8 | All flanges designed as plate flanges |
| ISO 7005／2 <br> DIN 2501 <br> BS 4504 <br> ANSI B 16.1 | PN 25 <br> Table 25／11 |  | 28 （M24） | 310 |  |  | 28 （M24） | 220 |  |  |
| ANSI B 16.1 | Class 250 |  | 28 （M24） | 330 |  |  | 23 （M20） | 235 |  | $\mathrm{Cl}^{d_{2}}$ |
| Pump size 150－290 up to 150－360 |  | 200 |  |  |  | 150 |  |  |  | －number |
| $\begin{array}{\|l} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 16 <br> Table 16／11 |  | 23 （M20） | 295 | 12 |  | 23 | 240 | 8 |  |
| $\begin{aligned} & \text { ISO 7005/2 } \\ & \text { DIN } 2501 \\ & \text { BS } 4504 . \\ & \hline \end{aligned}$ | PN 25 <br> Table 25／11 |  | 28 （M24） | 310 |  |  | 28 | 250 |  |  |
| ANSI B 16.1 | Class 250 |  | 28 （M24） | 330 |  |  | 23 | 270 | 12 |  |

Baseplate／motor combinations

| Pump | Motor size |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | 132 S | 132M | 160M | 160L | 180M | 180L | 20 | OL | 225S | 22 |  | 25 | OM | 28 | OS | 28 |  | 31 | 5 S | 31 | 5M |  | 5 L | 315 |
| Number of poles | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 |
| 125－230 | 4 | 4 | 4 | 4 | 4 | ＋4\％ | 4 | ： |  | 5 |  | 5 |  | 5 |  | 5 |  | 6 |  | 6 | \％ | \％ | 4 | Wemiter |
| 125－290 |  | 4 | 4 | 4 | 4 | 4 |  | 4 | 5 | 5 |  | 5 |  | 5 |  | 5 |  | 6 |  | 6 |  | 6 |  | 6 |
| 125－365 | $4$ | 15 |  | 4 | 4 | 4 |  | 4 | 5 |  | 5 |  | 5 |  | 5 |  | 5 | 䜌齐 | 53教 | 紋 |  | Fer |  | Watw |
| 125－500 | Yरene | $\text { 3 } 3$ |  | - |  | 4-x |  | 4 | 5 |  | 5 |  | 5 |  | 5 |  | 5 |  | 6 |  | 6 |  |  | 3䜌䜌畐 |
| 150－290 | (5) | $5$ | - | 4 | 4 | 4 |  | 4 | 5 |  | 5 | $5$ | $6$ |  | $4$ |  | $5$ |  | 衰 | $5$ | 彦 | 5x | 54 | 4, 4x |
| 150－360 |  |  | $\sqrt{4 \approx \sum}$ | 4 | 4 | 4 |  | 4 | 5 |  | 5 |  | 5 |  | 5 |  | 5 | \％ | ［4］ | \％ | \％ | $\sqrt{38}$ | $5$ | Y乡kive |

N．B．：－The numbers listed in the table indicate the relevant baseplate numbers．
－The baseplate numbers shown in the boxes also serve to select the correct motor size for the listed pump size．
－Units comprising a motor size 315 and larger are completely assembled for verification and adjustment of the individual components．Before shipment，the units are dismantled again and the components packed／shipped separately．

General arrangement drawing Omega 150-460 up to 250-370 and Omega 300-300 Installation type 3E

Direction of rotation: CLOCKWISE

N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).

Dimenslons and weights All dimensions in mm

| Pump size | Motordependent | Flange dimensions |  |  |  | Pump dimensions |  |  |  |  |  |  |  |  | Weight [kg] |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | DN 1 | $\mathrm{DN}_{2}$ | $\mathrm{S}_{1}$ | $\mathrm{S}_{2}$ | $a_{1}{ }^{3}$ | $a_{2}{ }^{3)}$ | $f$ | $h_{4}{ }^{3}$ | $\underset{\max }{\mathbf{h}_{5}}$ | $h_{6}{ }^{\text {3) }}$ | 1 | $\mathrm{l}_{2}$ | $z^{2)}$ | Pump | Water fill |
| 150-460 | up to 250 M | 200 | 150 | 41 | 37 | 450 | 450 | 590 | 320 | 1050 | 520 | 399 |  | 610 | 436 | 75 |
|  | 280 S up to 315 L |  |  |  |  |  |  |  |  |  | 580 |  |  |  |  |  |
| 150-605 | - |  |  |  |  | 600 | 500 |  | 380 |  | 680 |  |  | 740 | 646 | 90 |
| 200-320 | up to 250 M | 250 | 200 | 48 | 41 | 450 | 450 |  |  | 1240 | 620 | 215 | 399 | 57.0 | 450 | 80 |
|  | 280 S, M |  |  |  |  |  |  |  | 440 |  | 680 |  |  |  |  |  |
| 200-420 | up to 250 M |  |  |  |  | 500 | 500 |  | 380 |  | 620 |  |  | 620 | 517 | 95 |
|  | 280 S up to 315 L |  |  |  |  |  |  |  | 440 |  | 680 |  |  |  |  |  |
| 200-520 | 250 M |  |  |  |  | 600 | 500 | 655 | 380 |  |  | 150 | 464 | 740 | 840 | 115 |
|  | up 280 S |  |  |  |  |  |  |  | 440 |  | 740 |  |  |  |  |  |
| 200-670 | - |  |  |  |  | 650 | 550 |  | 430 |  | 780 |  |  | 860 | 990 | 140 |
| 250-370 | 250 M | 300 | 250 | 33 (51) ${ }^{1 \prime}$ | $32(48)^{17}$ | 500 | 500 |  | 420 | 1275 | 720 |  |  | 640 | 665 | 125 |
|  | up 280 S |  |  |  |  |  |  |  | 480 |  | 780 |  |  |  |  |  |
| 300-300 | up to 250 M | 350 | 300 | $36(54)^{11}$ | 33 (51) ${ }^{1}$ | 550 | 500 |  | 450 | 1430 | 750 |  |  | 720 | 630 | 100 |
|  | up 280 S |  |  |  |  |  |  |  | 510 |  | 810 |  |  |  |  |  |

[^4]Omega

Baseplate／base frame and foundation dimensions

| Baseplate | Baseplate | Baseplate and foundation dimensions |  |  |  |  |  |  |  | Foundation bolis |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No． | Drawing no． | $\mathrm{b}_{2}$ | $\mathrm{G}_{1}$ | $\mathrm{G}_{2}$ | ${ }_{3}$ | $I_{4}$ | ${ }_{5}$ | $h_{8}$ | Weight ［kg］ | Size | ${ }^{7}$ | L |
| 7 | OW 384 174－00 | 880 | 820 | 960 | 1660 | 730 | 730 | 120 | 157 | M 20x320 | 100 | 320 |
| 81 | OW 384 175－00 | 700 | 620 | 750 | 1870 | 835 | 835 | 180 | 185 |  |  |  |
| $9^{11}$ | OW 384 176－00 |  |  |  |  |  |  |  | 204 |  |  |  |
| $10^{17}$ | OW 384 478－00 |  |  |  | 1970 | 885 | 885 |  | 208 |  |  |  |
| $14^{17}$ | OW 384 479－00 |  |  |  | 2170 | 985 | 985 |  | 210 |  |  |  |
| $15{ }^{17}$ | OW 384 480－00 |  |  |  | 2320 | 1060 | 1060 |  | 215 |  |  |  |

＂Base frame
Standard flange connections ${ }^{2}$ ）．

| Pump size | JL 1040 ／GGG－NiCrNb 202 Nominal pressure acc．to： |  |  | JS 1030／1．4517 <br> Nominal pressure acc．to： |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 | $\begin{aligned} & \text { DIN } 2501 \\ & \text { ISO } 7005 / 2 \end{aligned}$ | BS 4504 | ANSI B 16.1 |
| 150－460 | PN 16 | Table 16／11 | Class 250 | PN 25 | Table 25／11 | Class 250 |
| 150－605 | PN 25 | Table 25／11 |  |  |  |  |
| 200－320 | PN 16 | Table 16／11 |  |  |  |  |
| 200－420 |  |  |  |  |  |  |
| 200－520 |  |  |  |  |  |  |
| 200－670 | PN 25 | Table 25／11 |  |  |  |  |
| 250－370 | PN 10 | Table 10／11 | Class 125 |  |  |  |
| 300－300 |  |  |  |  |  |  |


| ${ }^{2 /}$ Other flange connections on request Flange dimensions－Hole pattern Standard |  | All dimensions in mm |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Suction flange |  |  |  | Discharge flange |  |  |  |
| Standard |  | DN | $\mathrm{d}_{2}$ | k | n | DN | $\mathrm{d}_{2}$ | k | n |
| Pump sizes 150－460 and | 150－605 | 200 |  |  |  | 150 |  |  |  |
| $\begin{aligned} & \text { ISO 7005/2, DIN } 2501 \\ & \text { BS 4504 } \\ & \hline \end{aligned}$ | PN 16 <br> Table 16／11 |  | 23 （M20） | 295 | 12 |  | 23 （M20） | 240 | 8 |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2, DIN } 2501 \\ \text { BS 4504 } \\ \hline \end{array}$ | PN 25 Table 25／11 |  | 28 （M24） | 310 |  |  | 28 （M24） | 250 |  |
| ANSI B 16.1 | Class 250 |  | 28 （M24） | 330 |  |  | 23 （M20） | 270 | 12 |
| Pump sizes 200－320 up | to 200－670 | 250 |  |  |  | 200 |  |  |  |
| ISO 7005／2，DIN 2501 BS 4504 | PN 16 <br> Table 16／11 |  | 28 （M24） | 355 | 12 |  | 23 （M20） | 295 | 12 |
| $\begin{aligned} & \text { ISO 7005/2, DIN } 2501 \\ & \text { BS } 4504 \end{aligned}$ | PN 25 Table 25／11 |  | 31 （M27） | 370 |  |  | 28 （M24） | 310 |  |
| ANSI B 16.1 | Class 250 |  | 28 （M24） | 387 |  |  | 28 （M24） | 330 |  |
| Pump size 250－370 |  | 300 |  |  |  | 250 |  |  |  |
| $\begin{array}{\|l} \hline \text { ISO 7005/2, DIN } 2501 \\ \text { BS 4504 } \end{array}$ | PN 10 Table 10／11 |  | 23 （M20） | 400 | 12 |  | 23 （M20） | 350 | 12 |
| $\begin{aligned} & \text { ISO 7005/2, DIN } 2501 \\ & \text { BS 4504 } \end{aligned}$ | PN 16 Table 16／11 |  | 28 （M24） | 410 |  |  | 28 （M24） | 355 |  |
| $\begin{array}{\|l} \text { ISO 7005/2, DIN } 2501 \\ \text { BS 4504 } \\ \hline \end{array}$ | PN 25 <br> Table 25／11 |  | 31 （M27） | 430 | 16 |  | 31 （M27） | 370 |  |
| ANSI B 16.1 | Class 125 |  | 28 （M24） | 432 | 12 |  | 28 （M24） | 362 |  |
| ANSI B 16.1 | Class 250 |  | 31 （M27） | 451 | 16 |  | 28 （M24） | 387 | 16 |
| Pump sizes 300－300 |  | 350 |  |  |  | 300 |  |  |  |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2, DIN } 2501 \\ \text { BS 4504 } \\ \hline \end{array}$ | PN 10 Table 10／41 |  | 23 （M20） | 460 | 16 |  | 23 （M20） | 400 | 12 |
| $\begin{aligned} & \text { ISO 7005/2, DIN } 2501 \\ & \text { BS 4504 } \\ & \hline \end{aligned}$ | PN 16 <br> Table 16／19 |  | 28 （M24） | 470 |  |  | 28 （M24） | 410 |  |
| $\begin{aligned} & \text { ISO 7005/2, DIN } 2501 \\ & \text { BS 4504 } \\ & \hline \end{aligned}$ | PN 25 <br> Table 25／11 |  | 34 （M30） | 490 |  |  | 31 （M27） | 430 | 16 |
| ANSI B 16.1 | Class 125 |  | 28 （M24） | 476 | 12 |  | 28 （M24） | 432 | 12 |
| ANSI B 16.1 | Class 250 |  | 31 （M27） | 514 | 20 |  | 31 （M27） | 451 | 16 |

## Mating flange

All flanges designed as plate flanges


Baseplate／motor combination

| Pump | Motor size |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | 180 L | 200 L | 225 S | 225M | 250M | 280 S | 280M | 315S | 315M | 315L | 315 | 355 | 400 |
| Number of poles | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 150－460 | 5\％ | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | \＆${ }^{\text {a }}$ | \％ | W边 |
| 150－605 | 3䜌䊽 |  | Wers | E\％ | W5x6 | 8 | 8 | 8 | 8 | 9 | 9 | 14 | 56348 |
| 200－320 | 7 | 7 | 7 | 7 | 7 | 8 | 8 |  |  | \％\％＝ |  | \％ | ¢ए¢ |
| 200－420 | Fefexay | 7 | 7 | 7 | 7 | 8 | 8 | 8 | －8 | 9 |  | \％ | \％为为 |
| 200－520 | 2\％ | \＆ | \％4 |  | 7 | 8 | 8 | 8 | 8 | 10 | 10 | 15 | 5－3x |
| 200－670 |  |  | Stame | \％es | ＜ | 4semax |  | 8 | 8 | 10 | 10 | 15 | 15 |
| 250－370 |  | 5， |  | 䜌絞 | 7 | 8 | 8 | 8 | 8 | 10 |  |  |  |
| 300－300 |  | 7 | 7 | 7 | 7 | 8 | 8 | 8 |  |  |  |  |  |

The numbers listed in the table indicate the relevant base plate numbers．
The baseplate numbers shown in the boxes also serve to select the correct motor size for the listed pump size．
Units comprising a motor size 315 and larger are completely assembled for verification and adjustment of the individual components
Before shipment，the units are dismantled again and the components packed／shipped separately．

General arrangement drawing Omega 250-480 up to 250-600; 300-435 and 350-360 Installation type 3E
N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is reversed (mirror image).


The motor-dependent dimensions refer to KSB standard motors

| Dimensions and weights |  |  |  |  |  |  |  |  |  |  |  |  |  | All dimensions in mm |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pump | Flange dimensions |  |  |  | Pump dimensions |  |  |  |  |  |  |  |  | Weight [kg] |  |
| size | DN 1 | $\mathrm{DN}_{2}$ | S1 | $\mathbf{S}_{2}$ | $a_{1}{ }^{3)}$ | $\mathrm{a}_{2}{ }^{3)}$ | $f$ | $\mathrm{h}_{4}{ }^{3}$ | $h_{5}$ max. | $h_{6}{ }^{3)}$ | i | $\mathrm{I}_{2}$ | $z^{2)}$ | Pump | Water fill |
| 250-480 | 300 | 250 | 51 | 48 | 550 | 550 | 730 | 500 | 1275 | 800 | 210 | 515 | 710 | 830 | 145 |
| 250-600 |  |  |  |  | 650 |  |  | 480 |  | 830 |  |  | 830 | 1215 | 180 |
| 300-435 | 400 | 300 | $38(57)^{1)}$ | $33(51)^{17}$ |  |  |  |  | 1430 |  |  |  | 730 | 905 | 190 |
| 350-360 |  | 350 |  | $36(54)^{1}$ |  |  |  | 520 | 1415 | 870 |  |  | 820 | 865 | 160 |

${ }^{\text {1) }}$ for casing material GGG-NiCrNb 202, JS 1030, 1.4517
2) $z=$ clearance above casing cover for dismantling of the rotor
${ }^{3)}$ material combinations SB and SC: dimensions are 1\% larger
Baseplate / base and foundation dimensions
All dimensions in mm

| Baseplate | Baseplate and foundation dimensions |  |  |  |  |  |  |  |  | Foundation bolts |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No Drawing no. | $\mathrm{b}_{2}$ | $\mathrm{G}_{1}$ | $\mathrm{G}_{2}$ | 13 | $I_{4}$ | 15 | $I_{6}$ | $\mathrm{h}_{8}$ | Weight [kg] | Size | ${ }^{\text {C }} \mathrm{N}$ | L |
| $\begin{gathered} 11^{4} \\ \text { OW } 384177-00 \\ \hline \end{gathered}$ | 700 | 620 | 760 | 1950 | 875 |  | - | 200 | 215 | M 20x320 | 100 | 320 |
| $\begin{array}{r} 12^{4} \\ \text { OW } 384 \text { 178-00 } \end{array}$ |  |  |  | 2100 | 950 |  | - |  | 228 |  |  |  |
| $\begin{gathered} 16^{4} \\ \text { OW } 384481-00 \end{gathered}$ |  |  |  | 2450 | 750 |  | 750 |  | 240 |  |  |  |

Standard flange connections ${ }^{1)}$ :

| Pump size | JL 1040 / GGG-NiCrNb 202 <br> Nominal pressure acc. to: |  |  | JS 1030/1.4517 <br> Nominal pressure acc. to: |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { DIN } 2501 \\ & \text { ISO } 7005 / 2 \end{aligned}$ | BS 4504 | ANSI B 16.1 | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 |
| 250-480 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 250-600 | PN 25 | Table 25/11 |  |  |  |  |
| 300-435 | PN 10 | Table 10/11 | Class 125 |  |  |  |
| 350-360 |  |  |  |  |  |  |

${ }^{1)}$ Other flange connections on request


Baseplate / motor combinations

| Pump size | 250M | 2805 | 280M | 315S | $\begin{aligned} & \hline \text { Motor size } \\ & \|315 \mathrm{M}\| \end{aligned}$ | 315L | 315 | 355 | 400 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of poles | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 250-480 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 16 |  |
| 250-600 |  |  |  |  | 11 | 12 | 12 | 16 | 16 |
| 300-435 | Wextide |  | 11 | 11 | 11 | 12 | 12 |  |  |
| 350-360 | 11 | 11 | 11 | 11 | 11 | 12 | 12 |  |  |

N.B.: - The numbers listed in the table indicate the relevant baseplate numbers.

- The baseplate numbers shown in the boxes also serve to select the correct motor size for the listed pump size.
- Units comprising a motor size 315 and larger are completely assembled for verification and adjustment of the individual components. Before shipment, the units are dismantled again and the components packed/shipped separately.

General arrangement drawing Omega 300-560 up to 300-700; 350-430 and 350-510 Installation type 3E
Direction of rotation: CLOCKWISE
N.B.: If the pump's direction of rotation is ANTI-CLOCKWISE, the position of the suction and discharge nozzle is



The motor-dependent dimensions refer to KSB standard motors

Dimensions and weights
All dimensions in mm

| Pump | Flange dimensions |  |  |  | Pump dimensions |  |  |  |  |  |  |  |  | Weight [kg] |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| size | DN1 | $\mathrm{DN}_{2}$ | $\mathrm{S}_{1}$ | $\mathbf{S}_{2}$ | $a_{1}{ }^{3)}$ | $a_{2}{ }^{3}$ | f | $h_{4}{ }^{3}$ | $h_{5}$ max. | $h_{B}{ }^{3)}$ | i | $\mathrm{I}_{2}$ | $z^{2)}$ | Pump | Water fill |
| 300-560 | 400 | 300 | 57 | 51. | 700 | 650 | 810 | 560 | 1430 | 910 | 210 | 585 | 860 | 1425 | 225 |
| 300-700 |  |  |  |  | 750 |  |  | 550 |  | 950 |  |  | 960 | 1690 | 275 |
| 350-430 | 450 | 350 | $41(60)^{1)}$ | $36(54)^{1)}$ |  |  |  |  | 1415 |  |  |  | 930 | 1285 | 240 |
| 350-510 | 400 |  | $38(57)^{1)}$ |  | 700 |  |  |  |  |  |  |  | 840 | 1395 | 290 |

") for casing material GGG-NiCrNb 202, JS 1030, 1.4517
${ }^{2)} z=$ clearance above casing cover for dismantling of the rotor
${ }^{3)}$ material combinations SB and SC: dimensions are 1\% larger
Baseplate / base frame and foundation dimensions
All dimensions in mm

| Baseplate size | Baseplate and foundation dimensions |  |  |  |  |  |  |  |  | Foundation bolts |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. Drawing no. | $\mathrm{b}_{2}$ | $\mathrm{G}_{1}$ | $\mathrm{G}_{2}$ | $I_{3}$ | $I_{4}$ | 15 | $I_{6}$ | $\mathrm{h}_{8}$ | Weight [kg] | Size | ${ }^{\square} \mathrm{N}$ | L |
| $\begin{gathered} 13^{4)} \\ \text { OW } 384179-00 \end{gathered}$ | 950 | 870 | 1010 | 2195 | 665 |  |  | 200 | 290 | M 20x320 | 100 | 320 |
| $\begin{gathered} 17^{4} \\ \text { OW } 384482-00 \\ \hline \end{gathered}$ |  |  |  | 2540 | 780 |  |  |  | 322 |  |  |  |
| $\begin{gathered} 18^{4)} \\ \text { OW } 384483-00 \end{gathered}$ |  |  |  | 2390 | 730 |  |  |  | 309 |  |  |  |

4) Base frame

## Standard flange connections ${ }^{11}$ :

| Pump size | JL 1040 / GGG-NiCrNb 202 Nominal pressure acc. to: |  |  | $\text { JS } 1030 / 1.4517$ <br> Nominal pressure acc. to: |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 | $\begin{gathered} \text { DIN } 2501 \\ \text { ISO } 7005 / 2 \end{gathered}$ | BS 4504 | ANSI B 16.1 |
| 300-560 | PN 16 | Table 16/11 | Class 250 | PN 25 | Table 25/11 | Class 250 |
| 300-700 | PN 25 | Table 25/11 |  |  |  |  |
| 350-430 | PN 10 | Table 10/11 | Class 125 |  |  |  |

${ }^{1)}$ Other flange connections on request

Flange dimensions - Hole pattern All dimensions in mm

| Standard |  | Suction flange |  |  |  | Discharge flange |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | DN | $\mathrm{d}_{2}$ | k | n | DN | $\mathrm{d}_{2}$ | k | n |  |
| Pump size 300-560 and 300-700 |  | 400 |  |  |  | 300 |  |  |  |  |
| $\begin{array}{\|l\|} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 10 <br> Table 10/11 |  | 28 (M24) | 515 | 16 |  | 23 (M20) | 400 | 12 | Mating flange |
| $\begin{aligned} & \hline \text { ISO 7005/2 } \\ & \text { DIN } 2501 \\ & \text { BS } 4504 \\ & \hline \end{aligned}$ | PN 16 <br> Table 16/11 |  | 31 (M27) | 525 |  |  | 28 (M24) | 410 |  | All flanges designed as plate |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 | PN 25 <br> Table 25/11 |  | 37 (M33) | 550 |  |  | 31 (M27) | 430 | 16 |  |
| ANSI B 16.1 | Class 125 |  | 28 (M24) | 540 |  |  | 28 (M24) | 432 | 12 | $\mathrm{d}_{2}$ |
| ANSI B 16.1 | Class 250 |  | 34 | 572 | 20 |  | 31 (M27 | 451 | 16 |  |
| Pump size 350-430 |  | 450 |  |  |  | 350 |  |  |  | number. |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 | PN 10 Table 10/11 |  | 28 (M24) | 565 | 20 |  | 23 (M20) | 460 | 16 |  |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 <br> IS $7005 / 2$ | PN 16 Table 16/11 |  | 31 (M27) | 585 |  |  | 28 (M24) | 470 |  |  |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 <br> ANSIB 16.1 | PN 25 <br> Table 25/11 |  | 37 (M33) | 600 |  |  | 34 (M30) | 490 |  |  |
| ANSI B 16.1 | Class 125 |  | 31 (M27) | 578 | 16 |  | 28 (M24) | 476 | 12 |  |
| ANSI B 16.1 | Class 250 |  | 34 | 629 | 24 |  | 31 (M27) | 514 | 20 |  |
| Pump size 350-510 |  | 400 |  |  |  | 350 |  |  |  |  |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 <br> ISO 70052 | PN 10 <br> Table 10/11 |  | 28 (M24) | 515 | 16 |  | 23 (M20) | 460 | 16 |  |
| $\begin{array}{\|l} \hline \text { ISO 7005/2 } \\ \text { DIN } 2501 \\ \text { BS } 4504 \\ \hline \end{array}$ | PN 16 <br> Table 16/11 |  | 31 (M27) | 525 |  |  | 28 (M24) | 470 |  |  |
| ISO 7005/2 <br> DIN 2501 <br> BS 4504 <br> ANSIB | PN 25 <br> Table 25/11 |  | 37 (M33) | 550 |  |  | 34 (M30) | 490 |  |  |
| ANSI B 16.1 | Class 125 |  | 28 (M24) | 540 |  |  | 28 (M24) | 476 | 12 |  |
| ANSI B 16.1 | Class 250 |  | 34 | 572 | 20 |  | 31 (M27) | 514 | 20 |  |

Baseplate / motor combinations

| Pump <br> size | 315 M | 315 L | 315 | 355 | 400 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Number <br> of poles | 4 | 4 | 4 | 4 | 4 |
| $300-560$ | 13 | 13 | 13 | 17 | 17 |
| $300-700$ | 4 |  | 13 | 18 | 17 |
| $350-430$ | 13 | 13 | 13 | 18 |  |
| $350-510$ | simether size | 13 | 13 | 18 | 17 |

N.B.: - The numbers listed in the table indicate the relevant baseplate numbers.

- The baseplate numbers shown in the boxes also serve to select the correct motor size for the listed pump size
- Units comprising a motor size 315 and larger are completely assembled for verification and adjustment of the individual components. Before shipment, the units are dismantled again and the components packed/shipped separately.


## ELECTRIC MOTORS

## MAINTENANCE

## DISASSEMBLING INSPECTION:

It is recommended to inspect by disassembling a motor subject to continuous (day and night) operation once every two or three years. In the case of intermittent operation, disassembling inspection should be performed once every three years. In the case, however of the motor for special use or manufactured under special specification, it is necessary to perform disassembling inspection at the designated intervals.

Record:
(A) Items to be recorded at definite time every date:

1. Date, time, weather.
2. Voltage, load current, frequency.
3. Ambient temperature (room temperature).
4. Bearing temperature, bearing sound.
5. Stator winding temperature, frame surface temperature (totally enclosed type.)
6. Abnormal vibration, abnormal noise.
(B) Item to be measured of checked periodically:
7. Date, time, weather.
8. Vibration amplitude.
9. The color or content or grease discharge from the bearings.
10. Dirtiness inside and outside the motor.
11. Connecting accuracy of the coupling belt tension, (see 2).
12. Loose anchor bolt, foot clamp bolt and other clamp bolt.

## MAINTENANCE OF BEARINGS (OPEN TYPE WITH OVERGREASE PROTECTION):

Except for special operating conditions or special requirements, sealed for life bearings are mostly used. In the case of grease lubricated bearings other than sealed ball bearings, overgrease protective construction is adopted to make grease filling and exhausting easy. The maintenance procedure will be explained below.

## Maintenance Points:

(A) When starting operation of newly installed motor or starting operation of motor after shutdown of more than two months, be sure to refill grease immediately after starting.
(B) After starting operation, refill grease at the amount and intervals described on the caution plate.
(C) Discharge excess grease after refilling.

## Refilling Grease:

The most important for maintenance of bearing is to refill grease (and discharge used grease).
The main objectives for refilling grease are:
(1) To ensure lubrication of sliding lubricated surface (prevent metal to metal contact).
(2) To form an oil film on the rolling contact surface to withstand the load and abrasion. The above two items prevent abnormal sound and prolong life.
(3) It is important to ensure that the correct type and grade of grease is used, and that all fittings are clean to prevent introduction of dirt, grit or other contaminates.

## ELECTRIC MOTORS

## FAULTS AND THEIR DIAGNOSIS

| Trouble | Cause | What to do |
| :---: | :---: | :---: |
| Motor connected but will not start. | Supply failure either complete or in one phase. | Disconnect motor immediately. If a single phase fault has developed the windings will overheat. Check wiring and fuses so that correct supply reaches motor terminal. |
|  | Required starting torque too great. | Reduce load or use a larger motor. |
| Motor takes a lone time to accelerate or will not reach full speed. | Low voltage due to line drop. | Arrange for correct voltage. |
|  | Low nominal supply voltage. | Ensure that motor nameplate voltage and supply voltage match. |
|  | Load inertia or torque characteristic too severe. | Check that specification of motor covers required duty. |
|  | Faulty Star/Delta starter with motor permanently connected in star. | Rectify to ensure correct changeover to Mesh for full load running. |
| Motor runs normally and then loses speed or stalls. | Power failure either complete or in one phase. | Check for loose connections and continuity etc. |
|  | Low supply voltage. | Check that correct nameplate voltage is available at motor terminals. |
|  | Excessive load. | Reduce load to nominal motor rating. |
|  | Wrong application e.g. excessive peak torque on duty cycle. | Check that motor specification covers applied duty or refer to Sales Office. |
| Motor vibrates. | Misalignment. | Re-align. |
|  | Foundations weak or uneven. | Strengthen or straighten. |
|  | Couplings out-of-balance. | Balance couplings. |
|  | Driven equipment out-of-balance. | Balance driven equipment. |
|  | Defective ball or roller bearing. | Replace bearing. |
|  | Third bearing no in line. | Ensure correct alignment. |
|  | Single-phasing. | Check and correct open circuit. |
| Unbalance line current during normal operation. | Unequal terminal voltage. | Check all leads and connections. |
|  | Single-phasing. | Restore correct supply to all terminals |
|  | Poor contracts in control resistance of wound rotor. | Check control gear. |
| Motor overheating while running on load. | Single-phasing. | Check that supply is not open-circuited. |
|  | Earthed coil. Open-circuit in windings. Partial short-circuit. | Local and repair. |
| , . | Unbalanced terminal voltage. | Check for faulty leads, connections and transformer tappings. |
|  | Low supply voltage. | Arrange for correct voltage. |
| .. | Overload. | Reduce load or use a larger motor. |

## FAULTS AND THEIR DIAGNOSIS (cont.)

|  | Excessive ambient temperature. | Motors usually wound for maximum ambient of <br> $40^{\circ} \mathrm{C}$. Above this special windings will be <br> necessary. |
| :--- | :--- | :--- |
|  | Foreign matter in air-gap or ventilating <br> openings. | Dismantle motor and thoroughly clean. |
| Bearings noisy. | Damaged bearing. | Renew. |
|  | Dirty bearing. | Wash out in clean spirit, repack with grease and <br> refit. |
| Bearings overheating (Ball and <br> roller). | Overgreasing. | Remove excess grease. |
|  | Incorrect assembly. | Ensure bearing is fitted squarely on shaft. |
|  | Misalignment, exhaust belt pull, <br> excessive and thrust, pulley fitted too far <br> from bearing. | Take steps to reduce the excessive load on the <br> bearing. |
|  | Bent shaft. | New shaft required. |
|  | Pulley diameter too small. | Arrange drive so that a larger motor pulley is <br> needed. |
|  | Out of balance. | Arrange for shaft fitment to be balanced. |

All conditions which produce OVERHEATING will, in time, cause a motor to burn out, and it is therefore important to remove the origin of the overheating at the earliest possible moment.

Properly adjusted overload trips on starters should deal with any excess current from overloading, but they will not trip when conditions arise which do not increase the rated current. High ambient temperatures or choked ventilation ducts are typical cases where a current operated starter will not trip out.

There are, however, increasing tendencies to use temperature-sensing devices embedded in the windings of motors, which open-circuit the operating coil of a contactor starter either by direct means or through an amplified circuit. Because they are responsive to temperature rather than current, such devices will protect against high ambient temperatures, chocked ventilation ducts, or similar conditions.

Another hazard to be avoided is VIBRATION, whether caused by the drive or by adjacent machinery. It increases bearing wear and in the case of slip-ring machines, can cause considerable trouble to the slip-rings and brushgear.

On ball and roller machines, which are subject to vibration when stationary, special attention should be given to the motor foundations, as vibration will damage the motor bearings. This becomes apparent when the bearings become noisy during the motor run-up and is followed by very rapid bearing wear.. Unless the vibration is cured, the trouble will reoccur after new bearings has been fitted.

## COUPLING INSTALLATION AND ALIGNMENT INSTRUCTION

## INSTALLATION

## TYPE SWIRRS

To install simply mount the coupling halves (hubs) on the shafts. The shaft may protrude inside the hub to obtain necessary gap distance, when necessary.

Insert the SW ring on one of the hubs.
Tighten socket head screw to lock coupling halves onto shaft.

## FOR SW (NON SPACER TYPE)

Bring the driving and driven shafts together maintaining the distance $\mathbf{G}$ as per the table.
Align the shafts as indicated in the Alignment Section below.
Fit snap wrap rubber, slide SW ring over the snap wrap and tighten the cheese head screws/hex head screws for clamping the SW ring.

## FOR RRS (SPACER TYPE)

Bring the driving and driven shafts together, maintaining a distance equal to the spacer length required. Spacer lengths are to be 140,180 or 200 mm . The actual lengths of the spacers are slightly less to allow for a gap between coupling parts.

Align the shafts as indicated in the Alignment Section below.
Insert spacer with SW ring on it. Fit both wrap rubbers and slide SW rings over the snap wraps and tighten the cheese head/hex screws to clamp the SW rings.

Rotate shafts 2-3 times to ensure freedom of movement.

## ALIGNMENT

## Checking Parallel Alignment

Place a straight edge, eg. A 150 or 300 mm rule, across the coupling outside diameter at the top, bottom and at both sides. Align the coupling so that the straight edge rests evenly on the coupling outside diameter at all positions.

Rotate the shaft $90^{\circ}$ and check alignment once again.

## Checking Angular Alignment

Insert taper or feeler gauge at all points between the jaws and coupling faces. When the gap (dimension G ) is the same at all points checked, the unit is angularly aligned.

Note: The alignment of RRS couplings cannot be carried out with the spacer fitted unless special tooling is used.

Misalignment at installation should not exceed one third of the maximum allowable listed below to ensure maximum coupling life.

## Misalignment Capability:

Parallel 0.4 mm


Angular $1^{\circ} \quad 0.017 \mathrm{~mm} / \mathrm{mm}$ Coupling Diam.


## KSB AJAX STANDARD COUPLING RANGE



STD. SPACER LENGTHS - 100, 140, $180, \mathrm{~mm}$ TYPE - RRS


PUMP SIDE

TYPE - SWS

## Dimensional Data

| Coupling Type | Size | Rated Torque Nm | kW Capacity |  |  | Bore |  | A | Length thru Bore D | B | Gap G | C | Total Weight kg $S=140$ | Moment of Inertia $\mathrm{kgm}^{2}$ $S=140$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & 100 \\ & \mathrm{rpm} \end{aligned}$ | $\begin{aligned} & 1500 \\ & \mathrm{rpm} \end{aligned}$ | $\begin{gathered} 3000 \\ \mathrm{rpm} \end{gathered}$ | Min. | Max. |  |  |  |  |  |  |  |
| RRS | 095 | 21.1 | 0.22 | 3.30 | 6.60 | 10. | 28 | 65 | 25 | 49 | 2 | 13 | 1.2 | 0.0007 |
|  | 100 | 46.4 | 0.49 | 7.35 | 14.70 | 10 | 35 | 78 | 35 | 57 | 2 | 22 | 2.2 | 0.0013 |
|  | 110 | 89.0 | 0.93 | 13.95 | 27.9 | 15 | 42 | 96 | 43 | 76 | 3 | 30 | 4.5 | 0.0043 |
|  | 150 | 141 | 1.49 | 22.35 | 44.70 | 15 | 48 | 111 | 45 | 80 | 3 | 30 | 5.4 | 0.0063 |
|  | 190 | 190 | 2.01 | 30.15 | 60.30 | 20 | 55 | 129 | 54 | 102 | 3 | 35 | 9.9 | 0.017 |
|  | 225 | 265 | 2.76 | 41.40 | 82.80 | 20 | 60 | 142 | 64 | 108 | 3 | 45 | 12.7 | 0.025 |
|  | 226 | 317 | 3.43 | 51.45 | 102.90 | 25 | 65 | 153 | 70 | 115 | 3 | 54 | 15.4 | 0.038 |


| Coupling Type | Size | RatedTorqueNm | kW Capacity |  |  | Bore |  |  |  | A | Length thru Bore D D1/D | B | E | C | Total Weight kg $S=180$ | Moment of Inertia $\mathrm{kgm}^{2}$ $\mathrm{S}=180$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & 100 \\ & \text { rpm } \end{aligned}$ | $\begin{aligned} & 1500 \\ & \mathrm{rpm} \end{aligned}$ | $\begin{gathered} 3000 \\ \mathrm{pmm} \end{gathered}$ | Motor Side |  | Pump Side |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Min. | Max. | Min. | Max. |  |  |  |  |  |  |  |
| SWS | 276 | 527 | 5.60 | 84 | 168 | 25 | 75 | 25 | 48* | 173 | 60/60 | 137 | 130 | 61 | 18.8 | 0.066 |
|  | 280 | 782 | 8.20 | 123 | 246 | 30 | 75 | 30 | 55 | 208 | 65/60 | 154 | 130 | 61 | 28 | 0.128 |
|  | 295 | 1279 | 13.4 | 201 | - | 30 | 90 | 30 | 65 | 253 | 80/65 | 189 | 160 | 70 | 53 | 0.46 |
|  | 2955 | 2132 | 22.4 | 336 | - | 30 | 90 | 30 | 65 | 253 | 80/80 | 234 | 160 | 83 | 53 | 0.46 |

Note: SWS 276 available with 200 mm spacer

* 48 with steel coupling half only kW Capacity is based on a service factor of 1 , and is suitable for a continually running electrically driven centrifugal pump.
Service Factor:
For centrifugal pumps only.

| Engine Drive: | 1 or 2 cyl. | $3-5$ cyl. | 6 and above |
| :--- | :---: | :---: | :---: |
| Service Factor: | 2 | $\ddots$ | 1.5 |

Misalignment Capability:
Parallel 0.4 mm Angular $1^{\circ}$. $0.017 \mathrm{~mm} / \mathrm{mm}$ Coupling Diami.

kse 6
DATA SHEET

## KSB AJAX STANDARD COUPLING RANGE

## TYPE RRS



## Materials:

| Component | Material | Australian Standards <br> Equivalent |
| :--- | :--- | :--- |
| Coupling Half | Cast Iron | AS 1830-1986 T220 |
| Spacer | Aluminium | AS 1874-1988 |
| Snap Wrap | Neoprene | ASTM-D2000-720 |
| SW Ring | Steel | AS 3678/250 |

## Spare Parts:

Individual items are not available Spares will only be sold in the following kits.

| Coupling Half | Spacer Kit | Snap Wrap Kit * |
| :---: | :---: | :---: |
| Items 1 or 9 | Items $5,6,7$ <br> and 8 | Items 2,3 and 4 <br> or 2,7 and 8 |

* 2 off required for spares.


## TYPE SWS



## Materials:

| Component | Material | Australian Standards <br> Equivalent |
| :--- | :--- | :--- |
| Coupling Half-Driver | Cast Iron | AS 1830-1986 T220 |
| Coupling Half-Pump | Cast Iron | AS 1830-1986 T220 |
| Jaws | Cast Iron | AS 1830-1986 T220 |
| Spacer | Steel | AS 3678/250 |
| Snap Wrap | Neoprene | ASTM-D2000-720 |
| Setscrews | Steel | AS 1110-1984/M8.8 |

## Spare Parts:

Individual items are not available
Spares will only be sold in the following kits.

| Coupling Half <br> Driver | Coupling Half <br> Pump | . SWS Jaw Kit |
| :---: | :---: | :---: |
| Items 2,7. | Items 1. | Items 4,7,8. |
| Spacer <br> Kit | Snap <br> Wrap |  |
| Items 3,8 | Item 6 |  |



### 4.0 VALVES

SUPPLIER:TYCO WATER63 CURRUMBIN CREEK ROADCURRUMBIN, QLD 4223
Ph: (07) 55894400Fax: (07) 55347079
MODEL:$\varnothing 200$ R.S. SLUICE VALVE$\varnothing 150$ C.W. SWING CHECK VALVE

## OPERATION AND MAINTENANCE MANUAL

## CONTENTS

1.00.00 Description of DN200 Table $C$ Resilient Seated Sluice Valve
1.01.00 Operating Instructions
1.02.00 Maintenance Instructions
2.00.00 Spare Parts List
3.00.00 Address for Queries

## OPERATION AND MAINTENANCE MANUAL

1.00 .00
1.01 .00
1.02 .00

MAINTENANCE INSTRUCTIONS

2.00.00 SPARE PARTS LIST
$\begin{array}{cl}2.00 .01 & \text { Spare parts are NOT normally required for } \\ \text { 2.00.02 } & \text { this type of valve. } \\ & \text { In the unlikely event of a sealing ring } \\ & \text { failure the appropriate ring may be } \\ & \text { selected from items } 14 \text { \& } 15 \text { in the } \\ & \text { attached general assembly } \\ & \text { drawing }\end{array}$ No. 08-16-02-1081.
3.00.00 ADDRESS FOR QUERIES
3.00.01 Should there by any queries or additional information required, please contact:

Tubemakers Foundry Products Coastline Foundry (Qld) Pty Ltd 63 Currumbin Creek Road CURRUMBIN QLD 4223
$\mathrm{Ph}:(075) 342522$
Fax: (075) 347079

## BLLL OF MATERIAL

## DN200 RESILIENT SEATED SLUICE VALVE - CLASS 16 <br> tABLE 'C'

PARENT ITEM NO. : VRDCC20500A

| CHILD ITEM NO. | DESCRIPTION | MATERIAL | QTY |
| :--- | :--- | :--- | ---: |
|  |  |  |  |
| VZ081602601C | BODY, FL/FL 'C' | DUCTILE IRON | 1 |
| VZ081602611 | BONNET | DUCTILE IRON | 1 |
| VZ081602612 | STEM HOUSING | GUNMETAL | 1 |
| VZ081602624 | WEDGE (SBR COATED) | DUCTILE IRON | 1 |
| VZ081602644 | STEM | STAINLESS STEEL | 1 |
| VZ081602618 | CAP | DUCTILE IRON | 1 |
| VZ081602620 | THRUST WASHER | ERTACETAL | 1 |
| VZ081602629 | BODY GASKET | SYNTHETIC RUBBER | 1 |
| VZ081602623 | STEM HOUSING GASKET | SYNTHETIC RUBBER | 1 |
| VZ081602628 | WEDGE NUT | GUNMETAL | 1 |
| ZDBMT14040 | SOC. HEAD CAPSCREW | ALLOY STEEL | 6 |
| ZDBMT12035 | SOC. HEAD CAPSCREW | ALLOY STEEL | 4 |
| ZDSTH12020 | HEX. HEAD SETSCREW | STAINLESS STEEL | 1 |
| ZSRR0218 | 'O' RING | SYNTHETIC RUBBER | 2 |
| ZSRRW24 | WIPER RING | SYNTHETIC RUBBER | 1 |



# OPERATION AND MAINTENANCE MANUAL 

## CONTENTS

1.00.00 Description of DN100 \& DN150 Flanged Class 14 Swing Check Valves
1.01.00 Operating Instructions
1.02.00 Maintenance Instructions
2.00.00 Spare Parts List
3.00.00 Troubleshooting Guide
4.00.00 Address for Queries

Ref: 3-96.MKT

## OPERATION AND MAINTENANCE MANUAL

### 1.00.00 DESCRIPTION

1.00.01 Operation and maintenance instructions for DN100 \& DN150 flanged class 14 swing check valves. Free acting and lever and weight versions.
1.00.02 Reference drawing number 04-16-03-002 typical.
1.01.00 OPERATING INSTRUCTIONS
1.01.01 The operation of the swing check valve is automatic. The valve opens in response to flow velocity and closes in response to cessation or reversal of flow in the forward direction.
1.01.02 Valves are supplied either free acting or with extended hinge pin for fitting of lever and weight.
1.01.03 Lever and weighs are often applied to swing check valves to assist the closing action and to make the valve more responsive to flow reversal and thus reducing disc slam with resulting water hammer effects.
1.01.04 When lever and weight is applied it should be positioned on the hinge pin to maximise its effect on closure ie. with valve positioned horizontally, the lever should move through an arc $45^{\circ}$ below the centre line.
1.01.05 Through trials the weight should be positioned along the lever at a point where the smallest valve action is obtained under cessation of flow.
1.01.06 Where a valve is fitted with extended hinge pin it should also be fitted with lever and weight. When a valve is fitted with extended hinge pin it necessarily has to have seals fitted. The seals increase friction which in turn retards the action of the disc, increasing the tendency toward valve slam and thus more severe water hammer effect.
1.01.07 To minimise wear and increase the valve performance life, ensure the valve is correctly sized and the disc is fully open under normal flowing conditions.

### 1.02.00 MAINTENANCE INSTRUCTIONS

1.02.01 No external maintenance either preventative or otherwise can be applied external to the valve under operating conditions other than adjustments to lever and weight assemblies etc.
1.02.02 Major maintenance involving complete de-watering of the valve may be necessary once or twice throughout the product's life, depending on severity of service conditions. The usual reasons for such a service are:

- Worn hinge components needing replacement.
- Degradation of seat seal requiring refacing.
- Severely retarded valve action requiring cleaning and freeing of all hinge bearing areas.
1.02.03 To obtain access to internal components, first remove both hinge seal plugs, RH screwed. In free-acting valve hinge pin, can be drifted from bearings from either side releasing disc sub-assembly for removal through the cover opening.
For the extended hinge pin version, drift hinge pin from the non-extended side, the bronze hinge pin bush interference fitted, will be removed with the hinge pin thus releasing the disc assembly.


### 2.00.00 SPARE PARTS LIST

2.00.01 It is not usual to carry spare parts for this product as they are major components used very infrequently.

Refurbishment is usually carried out in conjunction with major planned outages. The reason for the work has usually been identified well prior to the shutdown allowing for specific components to be obtained from the manufacturer if necessary.
3.00.00 TROUBLE SHOOTING GUIDE
3.00.01 There are a number of malfunctions which can occur within the generic type.

- $\quad$ Seat leakage - replace body and disc seats
- Increasing tendency for valve slam (increasing water hammer) - hinge components binding, clean and free.
- Disc hanging up (not closing) - worn hinge components replace.
4.00.00 ADDRESS FOR QUERIES
4.00.01 Should there by any queries or additional information required, please contact:

Tubemakers Water
63 Currumbin Creek Road
CURRUMBIN QLD 4223
Ph: .(07) 55342522
Fax: (07) 55347079


### 5.0 TEST SHEETS

Instrumentation Ident:ifying Label
Pag. 001/1


Instrumentation Ideni:ifying Label Page. 001/1

## Instrument Identifying Label <br> FAS Order 1000122449

Yr. Order
5159550

Our Order Acknoledge 1804016336

Position 000400

Messrs. AUINY03
ABB INDUSTRY $\mathrm{P} / \mathrm{L}$
/AUINY
26 AUBURN ROAD D
REGENTS PARK NSW 21.13
AUSTRALIA

Split 000006

Quantity Part Number
1 ST $264 H S$ PSBB1/B2 Gauge pressure transmitter

Serial Number
6404015256

Calibration: from
scale:
from
to
UM

QA checked by:
 AL/E/Cict

## Instrumentation Iden:ifying Label Pag. 001/1



QA checked by:


251504

# ABB <br> ABB SACESpa 

Via Statale, 113-22016 Lenno (CO) Italy
Tel. $+39(0) 34458111$ - Fax. $+39(0) 34456278$
CERTIFICATO DI TARATURA
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Pos Vs. Ordine e Rif. - Yr Item - Pos.Or. - Best Pos.

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Item Cliente - Customer Item

Spett. - Messrs. - Messieures - Kunde
AUINY03
ABB INDUSTRY PIL IAUINY 26 AUBURN ROAD

REGENTS PARK NSW 2143


## TEST > PASS

| \% Range | Pres. applicata Input press. | Pres. rilevata Output press. | Unita' Unit | Uscita mA Output mA | Errore \% Deviation \% | Limite di errore Dev. Limit | Esito Test Test Result |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0\% | 24 | 24.3 | kPa | 4.0008 | 0.005 | 0.075 | PASS |
| 50\% | 1212 | 1212.4 | kPa | 12.0012 | 0.007 | 0.075 | PASS |
| 100\% | 2400 | 2400.1 | kPa | 20 | 0 | 0.075 | PASS |
| 50\% | 1212 | 1212.7 | kPa | 12.0032 | 0.02 | 0.075 | PASS |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - - | - |
|  | - | - | - | - | - | - | - |

Si attesta che lo strumento e' stato collaudato secondo gli standard ABB , e' costruttivamente rispondente alle caratteristiche succitate e in conformita' al vostro ordine We certify that instrument has been tested according to the ABB standard, it is manufactured in compliance with the above mentioned characteristics and is with the order. Nous certifions que linstrument a été contrôlé et répond aux normes ABB, qu'il posséde toutes les caractéristiques ci-dessus citées et conformite' a la commande. Wir bestätigen dass die Geräte nach dem ABB standart getested wurden und der oben augeführten Charakteristik entsprechen und esentspricht beider bestellung.


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CERTIFICAT DE ETALONNAGE
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Vs. Ordine - Your Order - VICommande - Ihr Aufrag 5159550
Pos Vs. Ordine e Rif. - Yr Item - Pos.Or. - Best Pos.

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Item Cliente - Customer Item

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REGENTS PARK NSW 2143

| Pos - Item | S/Pos | U.M. | Quantità - Q.ty - Quant - Menge | Uscita - OutPut / Sortie - Ausiang <br> 000400 | 000003 |
| :--- | :--- | :--- | :--- | :--- | :--- |


| Numero di serie - Serial number No. de série - Fabr. -Nr. | 6404015253 |  |
| :---: | :---: | :---: |
| Data - Date Kalibrier Datum | 25/06/2004 |  |
| Massimo Errore - Max. deviation Max. Kennlinienabweichung - Déviation max. | 0.075 |  |
| Campo di misura - Calibration Range Eingest. auf. - Ajustée à | $0 / 2400 \mathrm{kPa}$ |  |
| Tag-Name | Descriptor | Message |

## TEST > PASS

| \% Range | Pres. applicata Input press. | Pres. rilevata Output press | Unita' <br> Unit | Uscita mA Output mA | Errore \% Deviation \% | Limite di errore Der. Limit | Esito Test Test Result |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0\% | 0 | 0.1 | kPa | 4 | 0 | C. 075 | PASS |
| 50\% | 1200 | 1200.2 | kPa | 12 | 0 | C. 075 | PASS |
| 100\% | 2400 | 2400 | kPa | 20 | 0 | C. 075 | PASS |
| 50\% | 1200 | 1200.5 | kPa | 12.002 | 0.042 | C. 075 | - PASS |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |

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Wir bestätigen dass die Geräte nach dem ABB standart getested wurden und der oben augeführten Charakteristik entsprechisn und esentspricht beider besteilung.
Prova di tensione - Test Voltage - Essai de tension - Spannungsprüfung [ $k V=] \quad$ Prova Sovrapressione - Over Range pressure lest - Essai de surpression - Max Uberdruck

Prova Sovrapressione - Over Range pressure lest - Essai de surpression - Max Uberdruck
1
PASS (MWP = 21 Mpa )
Nota - Note :
Le misurazioni sopra registrate sono state ottenute in condizioni di test standard di produzione e hanno riferimento negli standard naziona i attraverso i labciatori del S.I.T. (Servizio Italiano Taratura) The measurement recorded above were obtained under standard productions test conditions and are traceable to national standards trough the laboratories of S.I.T.(Servizio Italiano Taratura)


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5159550
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Ns Conferma - Our Job N. - n/accusė de réception N. - Unser Auftrag
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ABB INDUSTRY P/L. IAJINY 26 AUBURN ROAD

REGENTS PARK NSW 2143


| Numero di serie - Serial number No. de série - Fabr. -Nr. | 6404015253 |  |
| :---: | :---: | :---: |
| Data - Date Kalibrier Datum | 25/06/2004 |  |
| Massimo Errore - Max. deviation Max. Kennlinienabweichung - Déviation max. | 0.075 |  |
| Campo di misura - Calibration Range Eingest auf - Ajustee à | $0 / 2400 \mathrm{kPa}$ |  |
| Tag - Name | Descriptor | Message |

TEST > PASS

| \% Range | Pres. applicata Input press. | Pres. rilevata Output press. | Unita' Unit | Uscita mA Output mA | Errore \% Deviation \% | Limitt: di errore <br> De:. Limit | Esito Test Test Result |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0\% | 0 | 0.1 | kPa | 4 | 0 | C. 075 | PASS |
| 50\% | 1200 | 1200.2 | kPa | 12 | 0 | C. 075 | PASS |
| 100\% | 2400 | 2400 | kPa | 20 | 0 | c. 075 | PASS |
| 50\% | 1200 | 1200.5 | kPa | 12.002 | 0.012 | C. 075 | PASS |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | $\bullet$ | - | - |

Si attesta che lo strumento e' stato collaudato secondo gli standard ABB , e' costruttivamente rispondente alle caratteristiche succitate e in cc:Aformita' al vostro ordine
We certify that instrument has been tested according to the ABB standard, it is manufactured in compliance with the above mentioned chara:teristics and is with the order.
Nous certifions que linstrument a été contrôlé et répond aux normes ABB, qu'il posséde toutes les caractéristiques ci-dessus citées et confo mite' a la commande.
Wir bestätigen dass die Geräte nach dem ABB standart getested wurden und der oben augeführten Charakteristik entsprechen und esentsprucht beider bestellung.

Prova di tensione - Test Voltage - Essai de tension - Spannungsprüfung [ $\mathrm{kV}=$ ]
1
Prova Sovrapressione - Over Range pressure tust - Essai de surpression - Max Uberdruck
PASS (MWP = 21 Mpa )

Nota - Note
Le misurazioni sopra registrate sono state ottenute in condizioni di test standard di produzione e hanno riferimento negli standard naziona i attraverso ilabc ratori del S.IT. (Servizio llaliano Taratura)
The measurement recorded above were obtained under standard productions test conditions and are traceable to national standards trough the laboratories of S.I. T. (Servizio taliano Taratura)


ABB SACE Spa
Una società del gruppo ABB An ABB Group company Sede Amministrativa/Commerciale
Via Statale, 113-22016 Lenno (CO) Italy
Tel. $+39(0) 34458111$ - Fax. $+39(0) 34456278$
CERTIFICATO DI TARATIJRA
CALIBRATION CERTIFICATE CERTIFICAT DE ETALONNAGE
KALIBRIERUNG - PR(ITOKOLL

Vs. Ordine - Your Order - V/Commande - Ihr Aufrag 5159550
Pos Vs.Ordine e Rif. - Yr Item - Pos. Or. - Best Pos.

Ns Conferma - Our Job N. - n/accusé de réception N. - Unser Auftrag
1804016336
Item Cliente - Customer Item

Spett. - Messrs. - Messieures - Kunde
AUINYO3
ABB INDUSTRY PIL. IAUINY 26 AUBURN ROAD

REGENTS PARK NSW 2143

| Pos-1tem | S/Pos | U.M. | Quantità - Q.ty - Quant - Menge | Uscita - OutF uut Sortie - Aus ang |
| :--- | :--- | :--- | :--- | :--- |
| 000400 | 000006 | ST | 1 | HART(4-20mA) |

Dati Strumento - Instrument data
Codice - Product code $\quad$ 264HSPSBB1 B2

| Numero di serie - Serial number No. de série - Fabr. -Nr. | 6404015256 |  |
| :---: | :---: | :---: |
| Data - Date Kalibrier Datum | 25/06/2004 |  |
| Massimo Errore - Max deviation Max. Kennlinienabweichung - Déviation max | 0.075 |  |
| Campo di misura - Calibration Range Eingest. auf. - Ajustée à | 012400 kPa |  |
| Tag - Name | Descriptor | Message |

## TEST > PASS

| \% Range | Pres. applicata Input press. | Pres. rilevata Output press. | Unita' Unit | Uscita mA Output mA | Errore \% Deviation \% | Limitts di errore Dev. Limit | Esito Test Test Result |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0\% | 0 | 0.1 | kPa | 4 | 0 | ¢ 0.075 | PASS |
| 50\% | 1200 | 1200.2 | kPa | 12.0012 | 0.007 | (. 075 | PASS |
| 100\% | 2400 | 2400 | kPa | 20 | 0 | $(1.075$ | PASS |
| 50\% | 1200 | 1200.5 | kPa | 12.002 | 0.012 | $(1.075$ | PASS |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |
|  | - | - | - | - | - | - | - |

Si attesta che lo strumento e' stato collaudato secondo gli standard ABB, e' costruttivamente rispondente alle caratteristiche succitate e in ec nformita' al vostro ordine. We certify that instrument has been tested according to the ABB standard. it is manufactured in compliance with the above mentioned charecteristics and is with the order. Nous certifions que linstrument a été contrölé et répond aux normes ABB , quili posséde toutes les caractéristiques ci-dessus; citées et confcimite' a la commande. Wir bestätigen dass die Geräte nach dem ABB standart getested wurden und der oben augeführten Charakteristik entsprechən und esentspıcht beider bestellung.

Prova di tensione - Test Voltage - Essai de tension - Spannungsprüfung [ kV =]
Prova Sovrapressione - Over Fange pressure est - Essai de surpression - Max Uberdruck 1 PASS (MWP = 21 Mpa )

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Le misurazioni sopra registrate sono state ottenute in condizioni di test standard di produzione e hanno riferimento negli standard nazionali atraverso i labs ratori del S.IT. (Servizio Italiano Taralura) The measurement recorced above were obtained under standard productions test conditions and are traceable to national standards trough the laboratorie!. of S.IT. (Servizio ltaliano Taratura)


| то: | $J \& P$ R | chardson | From: | KSB Ajax Pumps P/L A.C.N. 006414 842, A. B.N. 29008414642 |
| :---: | :---: | :---: | :---: | :---: |
| Fax: | 3271 | 3623 | Fax: <br> Emall: | (07) 38160225 bret.kendall©ksbalax.com.au |
| Name: | Trevor |  | Name: | Bret Kendall |
| Dopt.: |  | : | Oapt: | Sales |
| T |  |  | P | (07) 32821766 |
| Pages: | 1 |  | Dato: | 3/2/2005 |
| TRImrs To |  |  | 320 | $\phi$ br $<1$ S |

Trevor,
Please find below some results of tests conducted at Keidges Rd, Omega 125-365B

Shut Valve:

| Discharge | 47.5 m |
| :--- | :--- |
| Discharge (panel) | 46 |
| Suction | 7 |

$65 \mathrm{~L} / \mathrm{s}$
Discharge
Discharge (panel)
36.6m

Suction
Suction (panel)
Flow
Current

36m
6.5 m

6 m
$65 \mathrm{~L} / \mathrm{s}$
49A

| Open: $80 \mathrm{~L} / \mathrm{s}$ |  |
| :--- | :--- |
| Discharge | 31 m |
| Discharge (panel) | 30.3 m |
| Suction | 6 m |
| Suction (panel) | 5.7 m |
| Flow | $80 \mathrm{~L} / \mathrm{s}$ |
| Current | 54 A |
|  |  |
| $35 \mathrm{~L} / \mathrm{s}$ |  |
| Discharge | 43 m |
| Discharge (panel) | 42 m |
| Suction | 7 m |
| Suction (panel) | 6.5 m |
| Flow | $35 \mathrm{~L} / \mathrm{s}$ |
| Current | 38.5 A |

Ian Slape has spoken to the motor manufacturer, who advise that the max current is within the range. They will be issuing a new nameplate.
Any concerns, please just give me or lan Slape a call.

Yours faithfully,


Site



### 6.0 PRESSURE TRANSMITTERS

## SUPPLIER:

ABB INSTRUMENTATION 8/38 TENNYSON MEMORIAL AV. YEERONGPILLY, QLD 4105

Ph: (07) 38486123
Fax: (07) 38486091

MODEL:
ABB-264HSPSBB

Operating instructions

## 2600T Series

HART Pressure Transmitters Models 262H/N/G/A Models $264 \mathrm{H} / \mathrm{N} / \mathrm{G} / \mathrm{A}$


ABB

## ABB AUTOMATION

## The Company

ABB Automation is an established wond force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

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

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

## BS EN ISO 9001

St Neots, U.K, - Cert. No, O5907
Stonehouse, U.K. - Cert. No. FM 21106

UNI EN ISO 9001

auntir
Lenno, Italy - Cert. No. 9/90A


Stonehouse, U.K. - Cert. No. 0255

## Use of Instructions

## Warning

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

## Caution.

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

## Note.

Clarification of an instuction or additional information.
information.
Further reference for more detailed information or technical details.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all Warning and Caution notices.
Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Automation.

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## INTRODUCTION

The 2600T series is a modular range of field mounted, microprocessor based electronic transmitters, using a unique inductive sensing element. The models here described are a pressure transmitter with "single port" process connection; this provides accurate and reliable measurement of gauge and absolute pressure, in the even most difficult and hazardous industrial environments.

The 2600T Smart series transmitter now includes Analog Version plus HART digital communication, a Profibus DP-PA Version and a Fieldbus FOUNDATION Version.

Digital communication protocols allow remote re-ranging, calibration and diagnostics.

With respect to HART, the bidirectional digital communication does not have any interference with the standard $4-20 \mathrm{~mA}$ analog output signal.

Profibus has a complete digital only communication, as well as Fieldbus FOUNDATION.

This manual describes the features, the installation and calibration procedures related to the 2600T Series Transmitter with HART Communication Protocol.

The 2600 t series also gives the opportunity to utilize ceramic and silicon sensing elements, depending on measuring range and measured variable.

## SUPPLEMENTARY DOCUMENTATION

Reference information on remote seals and configuration of the transmitter can be found in the following documents:

SS / S264 Remote Seal Specification
2600 T Data Sheets
SL/2600T Spare Pant List
IM / 691HT Rev. 1 Hand-Held Communicator

## TRANSPORT.

After final catibration, the instrument is packed in a carton (Type 2 to ANSI/ASME N45.2.2-1978), intended to provide protection from physical damage.

## STORAGE

The instrument does not require any special treatment if stored as despatched and within the specified ambient conditions level (Type 2 to ANSI/ASME N45.2.2-1978).
There is no limit to the storage period, although the terms of guarantee remain as agreed with the Company and as given in the order acknowledgement.

## HANDLING

The instrument does not require any special precautions during handing athough normal good practice should be observed.

## PRODUCT IDENTIFICATION

The instrument is identified by the data plates shown in Figure 1.
The Nameplate (ref.A) provides information conceming the code number, maximum process working pressure, range and span limits, power supply and output signal. See code/ specification sheet for detailed information. This plate also shows the transmitter serial number.
Please refer to this number when making enquiries.
A dedicated label (rel. B) is welded as standard to the primary unit, carrying specific details of the transducer (diaphragms material, fill fluid, range limit and identification number).
A Safety Marking plate ( ref. C) is fitted when the transmitter is required to comply with hazardous area regulations, e.g. flameproof or intrinsic safety protection. Additionally a wiredon typetag plate (ref. D) provides the customer tag number and calibrated range, maximum process working pressure ( P and temperature (TS).
The instrument may be used as a satety accessory (category IV) as defined by the Pressure Equipment Directive $97 / 23 / E C$. In this case, near the CE mark, there is the number of the notified body (1130) that veritied the compliance.


Fig. 1 - Product identification

Important - The instrument serial number must always be quoted when making enquiries.

## PRINCIPLE OF OPERATION

## Models 262_264H/N

Models 262_264HN
Sensors H, M, P, Q, S


Fig. 2a - Primary Unit

## The instrument consists of two functional units:

## - Primary Unit

- Secondary Unit

The Primary Unit includes the process interface and the sensor, the Secondary Unit includes the electronics, theteminal block and the housing. The two units are mechanically coupled by a threaded joint. Electronics of Secondary Units is based on custom integrated components (Application Specific Integrated Circuit - ASIC).
The principle of operation of the Primary Unit, excluding model 420 bar (see later), is as follows. The process fluid (liquid, gas or vapour ) exerts pressure on to the measuring diaphragm via flexible, corrosion-resistant isolating diaphragm and the fill fluid (see Fig. 2a). The other side of the measuring diaphragm is either at "atmosphere", for gauge measurement, or at "vacuum", for absolute measurement. As the measuring diaphragm deflects in response to input pressure changes, it simultaneously produces variations in the gap between the magnetic disc and the magnetic core of the coil, which is mounted rigidly on to the primary body. As a result, the inductance of the coil changes.
The inductance values of the coil is compared to that of a reference inductor carried by the primary electronics. The unit also includes a temperature sensor. The two inductance values and the sensor temperature, are combined in the primary electronics to provide a proprietary standard signal.
For the 420 bar model the principle is quite different because the sensor is a capacitive silicon sensor. Referring to fig. 2a Gange T-420 barmodel) the pressure applied to the separating ,laphragm is transferred to the filling fluid (typical silicon oil) ácting directly on the silicon chip. The variation of capacitance is compared with a reference capacitance and it is converted in an electrical signal of the same type as for the inductance sensor. Consequently the further elaboration, together with
temperature signal is equivalent allowing to use the same secondary electronics.
In the manufacturing process the sensor output characteristics are compared with reference pressures and temperatures: the "mapped" parameters are then stored in EEPROM \# 1.
Depending on measuring range and measured variable in other words, on the model, also a ceramic pressure sensor (Fig. 2b) and a silicon pressure sensor (Fig. 2c) can be adopted.
In case of the ceramic pressure sensor, the applied process pressure ( $p e / p a b s$ ) is transferred directly to the measuring diaphragm, whereas, in case of the silicon pressure sensor, the pressure is transterred via the separating diaphragm and the fill fluid to the measuring diaphragm. When using the ceramic pressure sensor, a minimal deflection of the measuring diaphragm changes the output voltage of the pick-up system. in the silicon pressure sensor, the resistance values of four piezo-resistors doped in the measuring diaphragm will change which causes a change of the output voltage. This pressureproportional output voltage is converted by means of the electronic matching unit and the amplifier into an electrical signal.
The measuredvalues and the sensorparameters are transferred to the Secondary Unit, where a microprocessor computes precise primary output linearisation, compensating for the combined effects of sensor non linearity and temperature changes. In the secondary electronics EEPROM \#2 stores specific transmitter information:

- non modifiable data such as the serial number, the UID (Unique Identifier), the manufacturer's name and device type, the hardware and software version of the electronics.
- the modifiable data such as the final trimming and calibration ie., all data that can be changed by the user through the configurator devices.


## PRINCIPLE OF OPERATION



Fig. 2b - Capacitive - Ceramic pressure sensor for absolute pressure


Fig. 2c-Piezoresistive - Silicon pressure sensor for gauge pressure and level


Fig. 2d - Secondary Unit
The microprocessor receives data from the intemal modem, in order to provide bidirectional digital communication with the configuration device, i.e. the Hand Held terminal "Communicator" or P.C. based "Configurator".


Fig. 3 - Functional Block Diagram

With secondary electronics analog+HART, it is to be consider that different communication protocols exist for configuration and maintenance operations. Here follows a brief description on the matter; please refer to appropriatetechnical specification for additional deeper explanations on the communication aspects.
The HART protocol is based on the standard Bell 202 FSK (Frequency Shitt Keying ) with a $\pm 0.5 \mathrm{~mA}$ signal modulation superimposed on the 4 to 20 mA analog signal. As the energy balance added to the current loop is virtually zero and the frequency is very high compared to that of the process dynamic,
the analog process signal remains undisturbed.
Using a configuration device it is then possible to remotely modify the configuration of the transmitter, e.g. the measuring range. It is also possible to read other transmitter data and diagnostic information. Limited rezeroing and respanning, comparable to that conventional analog transmitters is possible using the optional calibration device. Refer to Fig. 3 for a complete view of the Functional Block Diagram.
The sensor and all electronic parts are galvanically isolated from the transmitter body.

## INSTALLATION

WARNING - In order to ensure operator safety and plant safety it is essential that installation is carried out by suitably trained personnel according to the technical data provided in the specification for the relevant model.

The transmitter may be mounted on a 2 -inch pipe (figg. 4, 5a, $5 b, 5 c, 6 a$ and $6 b$ b by means of the proper mounting bracket. The transmitter may also be direcily, supported by the piping connection.


Fig. 4 - Mounting on pipe

WARNING - For installation in Hazardous Areas, i.e. areas with dangerous concentrations of e.g. gases or dusts that may explode if ignited, the installation must be carried out in accordance with relative standards either EN 60079-14 or IEC 79-14 and/or with local authority regulations, for the relevant type of protection adopted. Together with safety information here and after enclosed see also the Addendum for "Ex Satety" aspects which is part of this instruction mannua!.


WARNING: The transmitter when installed in accordance with this instruction manual will not be subjected to mechanical stresses.

WARNING: the transmitter should not be installed where it may be subjected to mechanical and thermal stresses or where it may be attached by existing or foreseable aggressive substances.
ABB cannot guarantee that a construction material is suited to a particular process thuid under all possible process conditions. See also the paragraph on "Operative limits".

CAUTION - Proper location of the transmitter with respect to the process pipe will depend upon the service for which the instrument is used. Care should be exercised to identify correct process connections.

The secondary unit of the transmitter may be rotated through $360^{\circ}$ approx. with respect to the primary unit without degrading performance or damaging the intemal wiring. Do not force the primary unit to rotate; use the 2 mm Allen keysupplied to unlock and lock the tang grub screw (see Fig. 7). This feature, obtained by unscrewing (one turn is sufficient) the Allen screw, is particularty useful for reaching optimum access to the electrical connections and visibility of the output indicator.


1/2in-14 NPT female connection

Note: dimensions are expressed in mm . (Between parenthesis the same dimensions expressed in inches).

WP49 Kėidges Rd Bellbird Park WPS - Electrical Switchboard - OM Manual


DIN-EN837-1 G 1/2in B connection


1/2in-14 NPT male connection


Adapter connection (7/16in 20-UNF drilling)
Note: dimensions are expressed in mm. (Between parenthesis the same dimensions expressed in inches).


Fig. 6b
Adapter angle ( $90^{\circ}$ ) entry connection (7/16in-20 UNF drilling)

## ELECTRICAL CONNECTIONS

WARNING - For installation in Hazardous Areas, i.e. areas with danger of fire and/or explosion, prior to making electrical connections, ensure compliance with safety information on the Safety Marking plate. Failure to comply with this warming can result in fire or explosion.

Signal terminals are located in a separate compartment of the secondary unit housing. The housing incorporates two connection ports for cable glands or conduit fittings. They are protected with a temporary plastic plug for transit purpose which should be replaced with a suitable permanent plug in the unused port. Connections can be made by removing the cover (indicated in Fig. 7); first screw down the locking screw located below the cover, using a 3 mm Allen Key.

WARNING - For Hazardous Areas installations, the connection of cables and conduits to the transmitter shall be made in accordance with the requirements of the relevant type of protection. Cables and cable-glands must be in accordance with the type of protection.
Unused openings for connection shall be closed with blanking elements suitable for the relevant type of protection. With the exception of intrinsically safe transmitters, the means provided for this shall be such that the blanking element can be removed only with the aid of tools. The blanking elements must be certified for the type of protection. See standards either EN 60079-14 or IEC 79-14. The transmitter connections must also guarantee the degree of protection of the transmitter enclosure, egg. IPxx according to EN 60529 standard (or IEC529). See also the Addendum for "IP" protection (and Ex Safety) which is part of this instruction manual.

The signal cable should be connected to the terminals marked respectively ( + ) and ( - ). If an internal output meter - either with analog or digital indication - is installed, it should be removed in order to make the connection, simply by pulling it out from its socket. After the connections have been made, reinstall the output meter. Refer to the Meters Option addendum for details.


Fig. 7 - Location of the locking screws and terminals

The power to the transmitter is supplied over the signal wiring and no additional wiring is required. The signal wiring does not need to be shielded but the use of a twisted pair is highly recommended. The cable shield should be grounded in one side only, to avoid dangerous earth paths.

WARNING - For Hazardous Areas installations, when the ambient temperature is higher than $70^{\circ} \mathrm{C}$, the cable used for the connections must be suitable for $5^{\circ} \mathrm{C}$ above the ambient temperature.

Normal practice is to ground in the control room side, in which case the field side of the screen should be adequately protected to avoid contact with metallic objects. Signal wiring may be ungrounded (floating) or grounded at any place in the signal loop, but for intrinsically safe installations the wiring and grounding must follow the specific rules for this technique. The transmitter case may be grounded or ungrounded: a ground connection is provided intemally (in the terminal compartment) and externally.

Do not run the signal wiring in close proximity to power cable or high power equipment; use dedicated conduits or trays for signal wiring.


After the connections have been completed check the integrity of the cover $O$-ring, screw down the cover and secure it by unscrewing the safety screw.

CAUTION - Unless absolutely necessary, avoid the removal on site of the protective cover which gives access to the electronic circuitry. Although the electromics are fully tropicalized they should not be subjected to humidity for long periods.

WARNING - For Hazardous Areas installations, at least eight (8) threads on each cover must be engaged in order for the transmitter to meet (flameproof - explosion-proof) requirements.


Fig. Ba - Terminals arrangements

## . . . ELECTRICAL CONNECTIONS



NOTE : If the use of the Hand Held Communicator is foreseen, a resistance of 250 ohms minimum must be included in the current loop, between the power supply and the connection point of the Hand Held Terminal, for communication purpose.

Here below is given an explanation regarding the possible connection of the terminal block to the power supply and a representation of the connection in case of remote indicator presence.


Fig. 8b - Electrical connections


Fig. 8c - Electrical connections with remote indicator

## ELECTRICAL REQUIREMENTS

The transmitter operates on a minimum voltage of 10.5 Vdc to a maximum of 42 Vdc and is protected against polarity inversion.

Note - The transmitter operates from 10.5 to 42 Vdc with no load (additional load allows operation over 42 Vdc ). For EEx ia and intrinsically safe (FM, CSA and SAA) approval power supply must not exceed $30 \mathrm{Vdc} . \mathrm{In}$ some countries the maximum power supply voltage is limited to a lower value.
installing optional devices the minimum voltage increases to:
-10.5 Vdc with no option or with integral digital display

- 10.7 Vdc with output analog indicator
- 12.5 Vde with LCD ProMeter
- 12.3 Vdc with surge protection
- 13.3 Vdc with LCD CoMeter
- 15.3 Vdc with no link on output indicator plug

The total loop resistance is indicated in the expression below.

$$
R(k \Omega)=\frac{\text { Supply voltage }- \text { min. operating voltage }(V d c)}{22.5}
$$

The total loop resistance is the sum of the resistance of all elements of the loop, including wiring, conditioning resistor, satety barriers and additional indicators (excluding the equivalent resistance of the transmitter).

Where a configuration device (HART), such as the Hand Held Communicator or a Modem is likely to be used, a resistance of 250 ohm minimum should be present between the power supply and the point of insertion of these devices, to allow communication.

Several types of safety barriers, eitherpassive oractive, can be satisfactorily used in conjunction with the Smart 2600T transmitter. Nevertheless, in case of use of active barriers, check with the supplier if the model is suitable for use with smart transmitters allowing the connection of the configuration devices in the "safe" or non-hazardous area.

Note - For models $262 \mathrm{G} / \mathrm{A}$ and $264 \mathrm{G} / \mathrm{A}$ the frequency immunity between 150 kHz and 2 MHz with direct coupling and unshielded line is 3 V ; with direct coupling and shielded line is 10 V .

WARNING - The transmitter may be used as a safety accessory (as defined by the Pressure Equipment Directive $97 / 23 / E C$ ) i.e. as part of a shutdown system. In this case it is recommended to select the correct fail safe mode tor the 4-20 mA signal (as per Namur NE43 recommendation).
See also the instructions relevant to fail safe selection (Up/ Down scale mode) in the addendum to the instruction manual on "Use of hardware links on the secondary electronics' .

## RANGEANDSPANCONSIDERATION

The Smart 2600T Transmitter Specification Sheets provide all information concerning the Range and Span limits in relation to the model and the sensor code.

The terminology currently used to define the various parameters is as follows:

URL: Upper Range Limit of a specific sensor. The highest value of the measured value that the transmitter can be adjusted to measure.

LRL: Lower Range Limit of a specific sensor. The lowest value of the measured value that the transmitter can be adjusted to measure.

URV: Upper Range Value. The highest value of the measured value to which the transmitter is calibrated.

LRV : Lower Range Value. The lowest value of the measured value to which the transmitter is calibrated.

SPAN : The algebric difference between the Upper and Lower Range Values. The minimum span is the minimum value that can be used without degradation of the specified performance.

TURN DOWN RATIO: is the ratio between the maximum span and the calibrated span.

The transmitter can be calibrated with any range between the LRL and the URL with the following limitations:

LRL $\leq$ LRV $\leq$ (URL - CAL SPAN)
CAL SPAN $\geq$ MIN SPAN
$U R V \leq U R L$

## CALIBRATION

Unlike conventional electronic transmitters, the use of a microprocessor and the presence of serial communications between the transmitter and the configuration device, allows the use of several ditferent approaches in calibration and servicing. Different methods can be used to calibrate the Smart transmitter:
i) using the local keys in the transmitter secondary unit.
ii) using zero/span raise/lower on transmitter electronics links.
iii) using the Hand Held Communicator.
iv) using the Personal Computer Configuration Software Package.

This chapter describes the first method; the others are described next or in the relevant Instruction Manuals of configuration tools.
h the addendum (use of hardware links on the secondary electronics) there is an explanation of the raise/lower operation for ZERO and SPAN. In the Analog + HART version it is also possible to apply a scaling to the reading of the transmitter. The operation is called PV-scaling and is used to align the "zero" of the process with the "zero" reading of the transmitter. See the description in the Addendum for PV scaling operation.


Note: Unless otherwise specified the instrument is factory calibrated at maximum span with the LRV set to true zero. Instruments adjusted and tagged for a specific range will not require recalibration. Rezeroing of the transmitter may be required in order to compensate for zero shift arising from the installation.

## Preliminary operation

Before commencing calibration ensure that:
i) the required span, the upper and lower range value (URV \& LRV) are within the span and range limits (URL \& LRL) indicated on the nameplate (please refer to "Range and Span" consideration on the previous page).
ii) the transmitter is properly powered and the electrical connections correctly made.
iii) the write protect link, located on the electronics module is in position OFF (write allowed). Access to the link is gained by unscrewing the secondary unit housing cover at the opposite end to the terminal cover (See Fig. 9).
iv) the Upscale/Downscale link is positioned to the required function: ON for Downscale OFF for Upscale (see Fig. 9).
v) make the electrical connections, as indicated in Fig. 10. Connect a precision milliammeter as shown and remove the short circuit link.


Fig. 9 Location of the links on the electronics and the integral digital display


Fig. 10-Calibration electrical connections
Set up an appropriate test rig in accordance with the required calibration. Figure 11 shows a complete test nig that can be selectively used to suit the calibration.


Fig. 11 - Calibration pressure connections
Note that calibration accuracy is strictly related to the accuracy of the test equipment: the use of a dead weight tester is highly recommended.
The local adjustment keys are located behind the Nameplate. To gain access slacken the nameplate screw and rotate $90^{\circ}$; proceed in the reverse mode when the calibration procedure has been completed. Fig. 12 shows the calibration screws: they provide two large plastic heads that can rotate $90^{\circ}$ in the direction indicated by the arrows, with spring-retum to normal. The calibration screws can be removed after the calibration, to avoid improper use by inserting a screwdriver blade below the plastic flange and pulling out.


Fig. 12-Top view of the local adjustment keys

## Zero and span - true zero procedure Gauge pressure

## - Set the $A-B$ switch into " $A$ " position

- Switch on the power supply.
- With no pressure applied to the transmitters, the value read on the digital milliammeter should be 4 mA ; if it is not press the zero screw for at least 1 second. After this operation the reading should move to 4 mA ; if no change occurs repeat the operation.
- Apply a pressure equal to the upper range value (URV) and allow time for the pressure to stabilize.
- Press the span screw for at least 1 second: after this operation the reading on digital milliammeter should be 20 mA and the calibration procedure is complete. If no change occurs either the calibration procedure was not correctly performed or the span exceeds the limit; correct and repeat the operation.


## Absolute pressure

## - Set the $A-B$ switch into " $B$ ' position

- Switch on the power supply.
- Operate the vacuum pump connected to the transmitter and draw the maximum possible vacuum obtainable. The value read on the digital milliammeter should be 4 mA ; if it is not press the zero screw for at least 1 second. After this operation the reading should move to 4 mA ; if no change occurs repeat the operation.
- If the value of the calibration span (URV) is less than atmospheric pressure gently open the vent valve so increasing the pressure to the Upper Range Value. If the calibration span (URV) is greater than the atmospheric pressure then set the AB switch to "A" position and generate a pressure corresponding to the URV. Allow time for the pressure to stabilize.
- Press the span screw for at least 1 second: after this operation the reading on digital milliammeter should be 20 mA and the calibration procedure is complete. If no change occurs the calibration procedure was not correctly performed or the span exceeds the limit; correct and repeat the operation.


## Zero suppression procedure Gauge pressure

Two different methods (a) or (b) can be used:
a) After completion of the zero and span procedure above, apply a pressure equal to the pressure to be suppressed. Aliow time for pressure stabilization and then press the zero screw for at least 1 second. After this operation the digital milliammeter reading should be 4 mA and the Upper Range Value automatically moved to a value equal to the sum of the pressure to be suppressed and the previous calibrated span.
b) Use the zero and span procedure above but apply pressures equal to the Lower Range Value (LRV) and then to Upper Range Value (URV), and pressing, for at least 1 second, the zero and span screws respectively.

## Absolute pressure

Use the zero and span procedure above but apply to the.... process connection absofute pressures equal to the Lower Range Value (LRV) and then to the Upper Range Value (URV), pressing, for at least 1 second, the zero and span screws respectively.

## Zero elevation procedure

This procedure applies to the gauge pressure transmitter, only. The zero can be elevated up to a full vacuum.
Apply pressures equal to the LRV (this value is therefore between the zero gauge pressure and the full vacuum) and then equal to the upper range value (URV) and correspondingly press the zero and span screws respectively.

NOTE - To prevent unauthorized calibration operation refit the write protection link in position $P$ (Write Protect).

Note - If during the calibration procedure the readings on the digital milliammeter are outside its inherent accuracy, output trimming of the transmitter may be requested. This operation can only be performed using the Hand Held Terminal Communicator or the Personal Computer Configurator. If this equipment is not available the transmitter should be returned to a Sevice Center for recalibration.

In some cases, expecially for tank level measurement, the calibration can also be obtained automatically by the indication of the actual output percentage, without any calculation for LRV and URV. The operation is called Output \% Reranging and can be performed using a HART configuration tool (see the "Addendum for flange-mounted transmitter").

## DISMANTLING AND REASSEMBLY

WARNING - Process fluids and/or pressure retained in the transmitter primary unit can cause severe injury and death or damage to the equipment. It is the user responsibility to make sure that the instrument is not under pressure before removing the instrument from service or when draining or venting.
Dangerous fluids
In case of toxic or otherwise dangerous process fluid, take any precautions as recommended in the relevant Material Safety Data Sheet.

CAUTION - Dismantling and reassembly should not be carnied out on site because of the risk of damage to components and printed circuits as a result of adverse environmental conditions such as humidity,dust,etc. The dismantiing and reassembly procedures givenbelow should be carried out in the listed order to avoid instrument damage.

## Required tools

2 mm Allen key
3 mm Allen key
Small Phillips screwdriver
Small flat-bladed screwdriver
13 mm spanner
13 mm torque wrench - (Range $>17 \mathrm{Nm}-12.6$ foot lbs)

## Dismantling

a) Screw down completely the coverlockingscrew, electronics side, using the 3 mm Allen key
b) Unscrew and remove the covers
c) Unscrew the two fixing screws and remove the secondary electronic assembly
d) Unplug the sensor cable
e) Remove the tang grub screw using the 2 mm Allen key
f) Unscrew the housing taking care not to damage the sensor cable or the connector.

## Reassembly <br> WARNING - Assembling the components with improper "O rings" can cause fracture or overstressing and release of pressurized process material. Use only otticial spare parts (") and do not exceed the specified torque limits. DO NOT REMOVE the "O ring" fitted in the sensor neck: it provides the housing a degree of protection.

a) Insert the sensor cable in its recess at the bottom of the housing.
b) Screw the housing down completely until the nesting of housing/sensor assy is reached, then unscrew by one complete tum maximum. Rotate the topwork in the desired position and lock it with the tang grub screw previously removed.
c) Plug the sensor cable to the secondary electronics. Fix the electronic circuit by its screws.
d) Refit the covers and tighten securely.

WARNING - For Hazardous Areas installations, at least eight (8) threads on the cover must be engaged in order to meet the (flameproof - explosion-proof) requirements.
e) Unscrew the cover locking screw to secure the covers. This is mandatory to meet "Flameproof requirements" for Hazardous Areas installation.

## PRESSURE TEST WARNING

Once reassembled the process flanges and the transducer, a pressure test is required. At this purpose, apply a hydrostatic pressure of the maximum overrange pressure rating to both process connections simultaneously. Wait for one minute, then verify that no leakages occurred. Repeat the assembly procedure and the pressure test.
(*) The spare parts list is available at: www.abb.com

- searching for: SL262_4H.pdf
or from local ABB representatives.

WP49 Keidges Rd Bellbird Park WPS - Electrical Switchboard - OM Manual


Fig. 13a - Transmitter Sectional View for models 264 HS-NS


## SIMPLE FAULT FINDING (HART)

This part is applicable only for a quick fault finding in the case that the Hand Held Terminal or the P.C. Configurator Package are not available.
If the transmitter does not appear to be working satisfactory, carry out the following fault finding checks before contacting your nearest Service Centre.
If the instrument is to be retumed for repair, ensure that it is adequately packed using the original polystyrene box or high density chip foam: the trouble sheet/returning form should be sent with the instrument, filled in all its parts. If the transmitter needs to be dismantled follow the procedures of the previous section.

WARNING : If the transmitter forms part of a control loop, the plant must be placed under local manual control while the instrument is examined or taken out of service. Take all precautions to avoid damages caused by pressure or dangerous fluids release.

## Equipment needed

Voltmeter, milliammeter ( 0 to 100 mA d.c.), solvent contact cleaner.

High, Low or Irregular Output
Start (power off)


## No output



WARNING - If the transmitter needs to be repaired, the faulty unitassembly must be replaced by an equivalent unit/assembly.
(*) If the source of the problem is suspected to be the power supply, check it by disconnecting the wires from the transmitter and testing the volts available at the wires.

TROUBLE SHEET

WARRANTY REPAIR $\square \square$ REPAIR ORDER
Rejection or discrepancy reports

- identification

| Customer |
| :--- |
| Purchase order No. |
| Plant |
| Name of person to contact |
| Instrument tag No. |
| Model |
| Serial No. |

- operating conditions

Specity location, environmental conditions, type of service and approximate number of operating hours or date of installation if known.
$\square$

- REASON FOR RETURN
$\square$
- DANGEROUS FLUIDS

In case of toxic or otherwise dangerous process fluid, please attach the relevant Material Safety Data Sheet.
Trouble found during :
Installation $\square$ CommissioningMaintenance


At start up $\quad \square$ On service $\quad \square$
Shipping information for the return of the equipment

Material returned for factory repair, should be sent to the nearest ABB Service Center, transportation charges prepaid by the Purchaser.

Please enclose this sheet duly completed to cover letter and packing list
Date Signature Originator

## ADDENDUM FOR "METERS" OPTION OF THE TRANSMITTERS

## GENERAL DESCRIPTION

This option provides four different indications (meters) inside the transmitter housing. Three meters, "output meters", can be mounted on the terminal block (field terminals) side; the first is of "analog" type, the second is of "digital" type (LCD, ProMeter) and the third is the CoMeter. All are operated by the output signal of the transmitter. The fourth meter, "integral digital display", is mounted on the electronics side: it is of "digital" type (LCD, 4-digit), microprocessor driven. The integral digital display has 4 different mounting positions. The analog meters can be rotated to exactly match the mounting position of the transmitter.

## ANALOG OUTPUT METER

The analog output meter provides a $90^{\circ}$ scale indication. thas either a 0 to 100 linear scale or a 0 to 10 square root scale.

## ANALOG OUTPUT METER CALIBRATION

The calibration of the analog type meter only involves zeroing. Fig. 1 shows the analog output meter and the location of the zero adjustment.
The calibration is quite simple using one of the following methods:

- with the loop unpowered adjust the zero screw to read exactly the true zero mark on the scale (Fig. 1).
- with the transmitter transmitting 4 mA adjust the zero screw to read exactly the live zero of the scale.


Fig. 1 - Analog meter

## INTEGRAL DIGITAL DISPLAY MICROPROCESSOR DRIVEN

On the Secondary electronics can be fitted an integral digital display.
It can be used, together with local keys, for transmitter configuration, as well as for display various type of information, from Process Variable to output percentage.


Fig. 2 - Display
In addition, also diagnostic information are provided, in the way that only the highest priority message will appear and when it disappear, other message, next in priority order, will be given. Here follows a list of error and waming message, in priority order:
"ELECTRONIC FAIL"
"SENSOR INVALID"
"SENSOR FAIL"
"PV SENS OUTLIM"
"STATIC PRESS"
"SENS TEMP"
"OUT SATUR"
"OUT FIXED"
'DAC OUTRANG"
These indication are self explanatory as far as the possible repair action is concemed.
The integral digital display is an option for the 2600T series transmitter. When it is fitted on the transmitter, the latter automatically detects the presence and allows the use of local keys for operations with the display.
The first message that is given, when the display is fitted or at power on is: ABB - HART. Then the indication selected and the bargraph appear, as in the next example.

## ADDENDUM FOR "METERS" OPTION OF THE TRANSMITTERS

## General notes:

To enter the main menu the two local keys must be pressed together, and for at least two/three seconds.
The two keys can be then used in the same way (pressed for more than two seconds) to obtain an ENTER key.
For the ESCAPE key they must be pressed together for only one second.
The use of a single key corresponds to the NEXT and PREV keys and more precisely, the ZERO key for NEXT and SPAN key for PREV. The correct execution causes a VALID message to be displayed, otherwise the message is INVALID.
The following table summarize the main action and message.

| Zero key and Span key <br> for three secs. | Enter MAIN MENU and <br> ENTER KEY |
| :--- | :--- |
| Zero key and Span key <br> for only one sec. | ESC key |
| VALID | Message for OK action |
| INVALID | Message for action <br> rejected |
| Zero key | NEXT key |
| Span key | LAST key |

The avaitable option are:
REVIEW: allows the examination of data and parameters
DspConf: allows the selection of parameter to be displayed and the scale definition
DevCont: allows the transmitter configuration
SEE_VAR: allows the display of primary and secondary variables
SIMUL: allows the simulation of the analog output and the output trimming
For the change of the numeric values, the position is initially given by the flashing of the digit that can be increased or decreased by the NEXT and PREV key.
Next is the decimal point that can be selected or removed with the NEXT and PREV key.
The ENTER key is used to shitt to the next digit, and the ESC key is used to shift to the prev digit.
For the change of the units or another parameter single use the NEXT and PREV key.
Refer to the following diagrams for operations.


MAIN MENU

## . . . ADDENDUM FOR "METERS" OPTION OF THE TRANSMITTERS



## ADDENDUM FOR "METERS" OPTION OF THE TRANSMITTERS




DEVICE CONFIG



## ADDENDUM FOR "METERS" OPTION OF THE TRANSMITTERS

## METER INSTALLATION OR REPLACEMENT

WARNING - If the transmitter is not certified as intrinsic Safety type, DO NOT REMOVE ANY COVER in areas classified as "HAZARDOUS LOCATIONS: CAN RESULTS IN HAZARD OF FIRE AND EXPLOSION". Contact your Safety Dpt. in ordertoestablish correct installation procedure.


Fig. 3 - Cover Internal label

## ANALOG OR DIGITAL OUTPUT METER

To install (or to replace) the meter, use the following procedure:

1) It the transmitter is part of a control loop, put the loop in manual.
2) Remove the cover on the terminal block side: inside of which is affixed the label shown in Fig. 3.
3) Remove the link shown on the tabel by pushing down at its left extremity and then its right. Altematively it can be removed on the left side only in preparation for a further refit.
4) Plug the meter into the socket. The digital indication meter can rotate, for easy viewing, in $15^{\circ}$ steps, $90^{\circ}$ degree clockwise and $255^{\circ}$ counterclockwise.
Further rotation causes damage to the meterstops or to the "banana" connections and should be avoided. Note that considerable effort must be applied for $15^{\circ}$ rotation. The analog output meter can also rotate for easy viewing.
5) Check that the cover $O$-ring gasket is properly in place, screw on the extended windowed cover and tighten property.

To remove the meter simply pull it out from the socket and fit a replacement following the above procedure.

CAUTION - If the meter is removed, ensure that it is replaced immediately by another one or with the proper link provided. This operation is important for I.S. loop operation.

## INTEGRAL DIGITALDISPLAY MICROPROCESSORDRIVEN

The Microprocessor Driven Integral Display can be installed simply by plugging it into the connector provided in the secondary electronics and replacing the blind cover with a windowed one. To provide an easy view, the indicator can be installed in 4 different positions, in steps of $90^{\circ}$. The indicator is provided with 4 female connectors, equally spaced at $90^{\circ}$, while the secondary electronics is provided with one female connector, marked "METER". An 8 pin insert, supplied with the meter, should be positioned in order to connect the two female connectors with the indicator in the required position.

Proceed as follows:

1) Switch Off the transmitter power supply
2) Remove the blind cover in the electronics side.

Verity the correct position of the hardware links (Refer to the proper ADDENDUM).
3) Fit the insert in to the electronics connector, place the indicator in the required position, check that the connectors match, and push, with both thumbs, until the two parts hook together.
4) Screw on the windowed cover.
5) Switch on the transmitter power supply

To replace a Microprocessor Driven Integral Display proceed as follows:

1) Switch Off the transmitter power supply
2) Remove the windowed cover in the electronics side.

Lift gently the 4 plastic hooks and disengage the display from the secondary electronics.

Proceed now as indicated at point 3) to 5) above and don'4 forget to adjust the hardware links on the display.

## ADDENDUM FOR COMETER - ANALOG LCD INDICATOR WITH HART PROGRAMMING CAPABILITY AND PROMETER - PROGRAMMABLE INDICATOR

The name CoMeter is an acronym for COMMUNICATING METER. The name ProMeter stands for PROGRAMMABLE METER.
It can be connected, plug \& play, into the standard terminal block of the 2600T Series Pressure Transmitter.
It is capable to provide both reading and configuration operations, when used in connection with the analog-only version, the ProMeter is only indicator.
The LCD display has three lines; the first one is used for 5 numeric characters, up to 99999, plus a minus (-) sign on the left and a star (*) sign, up on the right, to indicate HART communication is in progress; the second line is a 10 segments bargraph used to show the output, from $0 \%$ to $100 \%$ in $10 \%$ steps;
the third line is used for seven alphanumeric characters to display units or messages.
In addition to the display the plastic membrane has 4 push buttons used for programming and for menus navigation. And more precisely, they are:
top left position: ESCAPE key
top right position: ENTER key
bottom left position: NEXT key
bottom right position: PREVIOUS key


Fig. 4 - CoMeter and ProMeter

The normal operating condition for the CoMeter is to display the analog output signal of the transmitter, expressed in miliAAmpere (this is the default setting), or in percentage or in engineering unit, with all the units available as for the HART Communication Protocol.
In addition to the indicator functionality, the CoMeter can be used as a configuration tool, where both the CoMeter itself and the transmitter can be configured.
In the CoMeter, in fact, two are the main menu: "ConF METER" and "ConF XMTR".

## ACCESS TO CONFIGURATION

To enter these menù, in both configurators, the keys PREV and NEXT must be pressed simultaneoushy for 3 seconds, then the user can switch between the XMTR and the METER configuration using the NEXT and the PREV key. In the ProMeter entry is directly in Manual Configuration, as shown in the next page.

[^6]
## CONF METER - METER CONFIGURATION

## PASSWORD

The access to the configuration menus can be protected by a 5 digits numeric password.
It is under the CONF METER menu that the password can be defined and enabled.
See figure 5 tor the access to the "ConF PASSWORD" menu. Once you have entered the "ConF PASSWORD" menu the cursor is blinking on the most significant digit.
Press ENTER, if you want to change the digits, initially set to zero (0).
Use the NEXT and PREV key to increase or decrease the value of the single digit, use the ENTER key to move the cursor to the next digit, use the ESC key to move back to the previous digit. When the string "UPDATE?' appears on the display you can use the ENTER key to accept the new password or the ESC key to abort the password definition.
When all digits are set to zero, the password is disabled.

ADDENDUM FOR COMETER - ANALOG LCD INDICATOR WITH HART PROGRAMMING CAPABILITY AND PROMETER - PROGRAMMABLE INDICATOR


The other options under ConF METER menu are:

## Conf AUTO

By selecting this option, the CoMeter is automatically updated with the LRV, URV and Unit of the HART transmitter connected. Before accepting the transmitter configuration by pressing ENTER at the request "ConF UPDATE?", it is possible to view the LRV (ZERO), the URV (FULL SC) and the UNIT.
If the output transfer function of the transmitter is not linear,
Prometer and CoMeter show the message: CanF NO_LIN and the user cannot update the configuration.
It is necessary to change the output transfer function of the transmitter to linear.
See Fig. 5- "ConF METER" menu, for ConF AUTO procedure.

## Conf manual

The selection of MANUAL configuration allows the user to define manually CoMeter and ProMeter configuration, i.e. define the LRV (ZERO), the URV (FULL SC), and the UNIT, as well as to decide for a LINEAR on SQR output function. LRV and URV can have a value between -99999 and +99999 . Referto Fig. 5-ConF METER menufor detail on the procedure. For having the CoMeter to display the analog output current or the output percentage, select respectively:

Conf CURRENT and ConF PERCENT

## ADDENDUM FOR COMETER - ANALOG LCD INDICATOR WITH HART PROGRAMMING CAPABILITY AND PROMETER - PROGRAMMABLE INDICATOR

Under ConF PERCENT option, the user can decide for linear or SQR output. When SQR output is selected, the output is linear from 0 to 20\% (to 4\% of input).
Refer to Fig. 5 -ConF METER for details on the procedures.

## ConF XMTR - TRANSMITTER CONFIGURATION (CoMeter only)

Four are the operations under the ConF XMTR menu: CONF, TRIM, REVIEW and PV.
By pressing ENTER on the ConF XMTR menu, the string LOADING appears on the display, with the blinking star (*) indicating communication activity, i.e. the CoMeter is reading the transmitter information.

Then the CONF option appears.
Using PREV or NEXT key, the user can select CONF, TRIM, REVIEW or PV option, and with the ENTER key he moves into the menu.
When entering CONF and TRIM menu a message "LOOP IN_MAN" appears to remind that a modification can change the transmitter output, so for security the loop should be put in Manual.

See below a list of the avaitable operation under the selected option:

| CONF menu | TRIM menu | REVIEW menu | PV menu |
| :---: | :---: | :---: | :---: |
| Change LRV <br> Change URV Change DAMPING Change UNITS Change OUTPUT | Reranging (RERANG.) <br> Loop test (LOOPTST) <br> Output trim (OUTTRIM) <br> Zero adjustment (SNSZERO) | TAG 8 <br> Finat Assembly Nr. (XMTR N.) Sensor Serial Nr. (SENS N.) Up/Down scale (UP/DOWN) UNITS <br> LRV <br> URV <br> LRL (See Sensor Units) <br> URL (See Sensor Units) <br> DAMPING <br> OUTPUT | Primary variable (PRIMARY) <br> Secondary variable (2ND) <br> Tertiary variable (3RD) <br> Fourth variable (4TH) |

Use PREV or NEXT key to scroll through the options and ENTER key to change or view the values.
The procedure to change the numeric value remains the one already explained for PASSWORD operation, i.e., the cursor starts blinking on the most significant digit, then use the NEXT and PREV key to increase or decrease the value of the single digit (the minus sign(-)automatically appears or disappears when the value increases above 9 or decreases below 0 , as well as for the decimal point(.). Use the ENTER key to move the cursor to the next digit, use the ESC key to move back to the previous digit. An ENTER on the last digit will cause the value to be sent to the transmitter.
Refer to figures 6, 7, 8 and 9 for details.


Fig. 6 - CONF menu

ADDENDUM FOR COMETER - ANALOG LCD INDICATOR WITH HART PROGRAMMING CAPABILITY AND PROMETER - PROGRAMMABLE INDICATOR



Fig. 8 - REVIEW menu


Fig. 9 - PV menu

## ADDENDUM FOR PV-SCALING OPERATION

PV-scaling operation can be used to align the "zero" of the process with the "zero" reading of the transmitter. Aconfiguration tool must be use to perform this operation through digital communication.

There are two ditterent ways to perform a PV-scaling.
Method 1: apply to the transmitter a pressure that corresponds to the scaling value (offset) you have to apply to the reading and perform the operation using the contiguration tools. The operation is called SET PV ZERO (see example 1).
Method 2: calculate the scaling value (offset) and apply it to the fransmitter following the operation available on the configuration tool. With this method it is possible to perform a scaling operation evenfor a value different then zero. The operation is called SET PV VALUE (see example 2).

Effect of the PV-scaling operation:
An example can better explain the effect of the scaling action.
Example $n^{\circ} 1$
the transmitter is calibrated at:
LRV $=0 \mathrm{mbar}$
URV $=200 \mathrm{mbar}$
the transmitter model has the following limits of operation:
$\mathrm{LRL}=-400 \mathrm{mbar}$
$\mathrm{URL}=+400 \mathrm{mbar}$

For the effect of a transmitter's capillary, connected to a tank, there is a pressure of 80 mbar when the tank is empty, i.e. the transmitter's reading is 80 mbar .
In order to eliminate the pressure caused by the fluid inside the capillary, you can periorm a PV scaling for compensating/ scaling the reading for these 80 mbar. The result of this operation is:
the transmitters reading is now 0 mbar.
offset is -80 mbar and must be considered that while the
limits of the transmitter remains:
$L R L=-400 \mathrm{mbar}$
URL $=+400 \mathrm{mbar}$
and the calibration does not change
LRV $=0$ mbar
URV $=200 \mathrm{mbar}$
The configuration tools aliows you to evaluate the new. operative limits:
operative LRL $=-480 \mathrm{mbar}$
operative URL $=+320 \mathrm{mbar}$

## Example $\mathrm{n}^{\circ} 2$

the transmitter is calibrated at:

$$
\begin{aligned}
& \mathrm{LRV}=0 \mathrm{mbar} \\
& \mathrm{URV}=200 \mathrm{mbar}
\end{aligned}
$$

the transmitter model has the following limits of operation:

$$
\mathrm{LRL}=-400 \mathrm{mbar}
$$

$$
\text { URL }=+400 \mathrm{mbar}
$$

the transmitter is reading:

$$
P V=100 \mathrm{mbar}
$$

and you know the process value is $\mathbf{5 0}$ mbar.
You can apply this 50 mb ar for your PV scaling operation, with similar effect as per the previous example:

$$
\text { PV reading = } 50 \mathrm{mbar}
$$

offset $=50 \mathrm{mbar}$ so that while the limits of the transmitter remains:

$$
\begin{aligned}
& \mathrm{LRL}=-400 \mathrm{mbar} \\
& \mathrm{URL}=+400 \mathrm{mbar}
\end{aligned}
$$

with no change for the calibration, the configuration tools allows you to display the new operative limits: operative LRL $=-450 \mathrm{mbar}$

$$
\text { operative URL }=+350 \text { mbar }
$$

When requested it is possible to reset the value actually applied as offset.
When an offset is defined, the trimming operations are disabled and can be rehabilitated only by eliminating the scaling, i.e. setting the offset to 0 .

## ADDENDUM FOR "SURGE PROTECTION" OPTION OF THE TRANSMITTERS

## WARNING - Note for Hazardous Area Installation

For the Pressure Transmitter with surge protector must be additional considered:
1 The transmitter has to be supplied from a voltage source which is sately separated from mains (galvanic separation).
2 The potential equalization for the entire cable link must be guaranteed since the intrinsic satety circuit of the transmitter is grounded.

## GENERAL DESCRIPTION

This option provides a built-in surge protection circuit.
The surge protector is designed to dissipate large quantities of electrical energy which have been induced in a transmission line.
The option is suitable to protect up to 2500 V ( 5 kA discharge current) of $8 \mu \mathrm{~s}$ rise time $/ 20 \mu \mathrm{~s}$ decay to half value.
These large quantities of energy can be induced in the signal transmission line by lightning discharge in the area or by nearby electrical equipment.
The dissipation of this energy prevents damage to transmitter circuitry connected to the transmission line.
The surge protector will not protect the instrument in case of a direct lightning strike.
The surge protector board is located inside the terminal block of the transmitter (see drawing).
The circuit is designed to operate and recover automatically. It does not require periodic testing or adjustment.

## FITTING PROCEDURE

## CAUTION : This procedure should not be carried out on the field site.

a) Remove the transmitter cover of the field connections side.
b) Unplug the built-in indicator, if present.
c) Unscrew the two Phillips screws ( $\mathrm{M} 4 \times 18 \mathrm{~mm}$ ) which secure the terminal block and pull it off the housing.
d) Unweld the + and - wires which connect the two RF (radio frequency) fitters, on the back of the terminal block.
e) Fit properly the surge protector p.c. board and secure it by a self-tapping screw ( $\mathrm{M} 2.9 \times 6 \mathrm{~mm}$ )
f) Secure the two +1 - eyelet terminals to +1 - holes on the back of the terminal block, by a welding operation.
g) Secure the two $+/$ - wire eyelet terminals of the RF fitters to the $+/$-bushes of the p.c. board by ta welding operation.
h) Connect the wire eyelet terminal of the Surge Protector to the dedicated ground connection below terminal block, using a provided self tapping screw $M 4 \times 8 \mathrm{~mm}$ and relevant washers.
i) Reinstall the terminal block and stick on the notice label in the proper position.
I) Plug the built-in indicator, if used.
m) Refit the cover.

Refer to Fig. 1 and also follows the indication in the figures 2 a and 2 b .
In the first one (2a) you can see the terminal block connection when there is no surge protector applied.
In the latter (2b) you can see the terminal block connection when surge protector is in!

NOTE - The Surge Protector is suitably provided with the necessary instaltation screws and the notice label. Adding the unit to an existing transmitter will affect the power supply requirement for a minimum added operating voltage of 1.6 V d.c.

## ... ADDENDUM FOR "SURGE PROTECTION" OPTION OF THE TRANSMITTERS



Fig. 1 - SURGE PROTECTOR

## . . . ADDENDUM FOR "SURGE PROTECTION" OPTION OF THE TRANSMITTERS



Fig. 2a
Connection for terminal block and housing.
Note: Betore to fix the terminal block to the housing put the two wires in the position as shown above, in order to avoid any damages.

Fig. 2b
Connection for terminal block and housing, with surge protection.

Note: Before to fix the terminal block to the housing put the two wires in the position as shown above, in order to avoid any damages.


## ADDENDUM USE OF HARDWARE LINKS ON THE SECONDARY ELECTRONICS

A picture of the secondary electronics is given.
There are 6 dip switches located on the secondary electronics as indicated below; they are used for settings when integral digital display is not available.


Switch 1 and $\mathbf{2}$ are used for Snap Calibration, Zero and Span Raise/Lower and also for Damping step.

Switches 3 and 4 are used tor Electronics or Transducer replace

Switch 5 is for Write Protect mode selection
Switch 6 is for Up/Down Scale selection
Now follows a description of the operations.

## ZERO / SPAN SNAP CALIBRATION



With switches 1 and 2 down in position, ZERO and SPAN Iocal adjustment, located below the nameplate of the transmitter housing can be used for ZERO ( $4-\mathrm{mA}$ point), and SPAN ( 20 mA point), adjustment, i.e. range calibration,

## ZERO / SPAN - RAISE / LOWER



When switch 1 is moved on in " 1 " position, ZERO/SPAN Raise/Lower is active. The usage of - and + buttons on the secondary electronics causes respectively an increment and a decrement of the SPAN value (URV); ZERO and SPAN local adjustment under the nameplate allows ZERO value (LRV) increment or decrement.


## DAMPING RAISE / LOWER

With switch 2 up in "1" position, DAMPING Raise/Lower is active.
Use-button and + buttion on the secondary electronics to respectively decrement and increment the damping value.
Acceptable values for damping are: 0-0,25-0,5-1-2-4-8 and 16 .


## ZERO/DAMPING - RAISE / LOWER

When switches 1 and 2 are up in " 1 " position, both ZERO and DAMPING Raise/Lower can be performed.
Use - button and + button on the secondary electronics to respectively decrement and increment the damping value.
Use ZERO and SPAN local adjusiment under the nameplate for ZERO value (LRV) increment or decrement.

## .. ADDENDUM USE OF HARDWARE LINKS ON THE SECONDARY ELECTRONICS



REPLACE
Usually switches 3 and 4 are down in " 0 " position.
They are moved when a replace operation is required.

Switch 3 up in "1" position is required before power up the transmitter, when a replace is being performed. Switch 4 down in "0" position allows the replace of the transducer.

Switch 4 up in "1" position allows the replace of the secondary electronics. It must be moved in this position, when electronics replace is being performed, before power up the transmitter.

## WRITE PROTECT mode

With the switch 5 up in ON position the write protect mode is active. It is a way to protect the device from any change: configuration data and parameters cannot be modified.

## UP/DOWN SCALE mode

The switch 6 defines the fail safe output condition in case of transmitter failure:

- In the ON position the output is Down (below 4 mA and more precisely $3,7 \mathrm{~mA}$ );
- In the OFF position the output is UP (above 20 mA and more precisely 22 mA )

NOTE: The message WRITE DISABLE appears on the integral digital display when Write Protect Link is in Protect position. The message ZERO DSBL or SPAN DSBL appears on the integral digital display when ZERO and SPAN local adjustment are disable. Zero and Span can be disabled using a HART configuration software.

NOTE: Typically the Up/Down scale mode is activated when there is a tailure in the physical elements of the sensor and on the electronics of the device, and more precisely:

1) Values in the sensor database are corrupted;
2) EEprom of Primary Electronic (sensor) is failed;
3) Values of Primary variables are out of limits;
4) Digital to analog converter (DAC) circuit is out of range.
5) ASIC - (Integrated circuit) of sensor is failed.
6) ASIC - (Integrated circuit) of electronics is failed.

These failure will cause diagnostic messages to appear on the integral digital display:

1) ELECTRONIC FAIL
2) SENSOR FAIL
3) SENSOR INVALID
4) DAC OUTRANG

## ADDENDUM FOR SELECTABLE OUTPUT FUNCTIONS

## GENERAL DESCRIPTION

The 2600 T Series Pressure Transmitter can be selected with a linear, a "polynomial" output function, for input linearization using a 5th order polynomial function, or for input linearization using 2 polynomial functions of 2nd order.
Also a Constant Current function can be choosen for loop or associated equipment test.

### 1.0 LINEAR

Using this function, the relationship between the input (measured value), expressed in \% of the calibrated span and the output is linear, e.g. at $0 \%$ input, corresponds $0 \%$ output ( 4 mA ), at $50 \%$ input corresponds $50 \%$ output ( 12 mA ) and at $100 \%$ input corresponds $100 \%$ output ( 20 mA ). Available for analog and anaiog + HART version.

### 2.0 POLYNOMIAL 1 (5th order)

The polynomial function, applied to the transmitter input ( $x$ ) expressed in \% of the calibrated span, has the following form:

$$
\text { Out }= \pm A_{0} \pm A_{1}(x) \pm A_{2}\left(x^{2}\right) \pm A_{3}\left(x^{3}\right) \pm A_{4}\left(x^{4}\right) \pm A_{5}\left(x^{5}\right)
$$

where ( x ) and Out should be normalized in the range 0 to 1 for calculation purpose, with following Out meaning:
Out $=0$ means Analog out 4 mA
Out $=1$ means Analog out 20 mA
This function can be used for linearization purpose: the user can plot the characteristic curve of the input and find, using a mathematical method, the parameters of the polynomium that better approximate the plotted curve. Check, after the calculation, if the maximum error is compatible with the application.
The following are some application examples.

### 2.1 CYLINDRICAL VESSEL

Using the polynomial function applied to a level transmitter installed in a horizontal cylindrical vessel it is possible to transmit the measure of level in term of partial volume. Some different cases should be considerect:
a) Cilindrical vessel with flat ends (not often used. Fig. 1a). Transmitter measuring the whole vessel heigth.
The following polynomium gives the area of the circular section in relation to the heigth $h$ (heigth of the liquid in the vessel).

$$
\text { Out }=-0.02+0.297 h+2.83 h^{2}-4.255 h^{3}+3.5525 h^{4}-1.421 h^{5}
$$

Being both the input $h$ and the output Out nomalized, i.e. in the range 0 to 1 ( 0 0 $0 \%$ to $100 \%$ ), the vessel diameter corresponding to a circular area equal to 1 ( $100 \%$ ) will be "normalized" by a " $K$ " factor of the following value:
$K=2 \cdot \sqrt{1 / \pi}=1.12838$
The volume of the liquid contained in the vessel, at heigth $=\mathrm{h}$ will be $V=$ Out $\cdot(\mathrm{d} / 1.12838)^{2} \cdot L$
where $d=$ vessel diameter and $L=$ vessel length.
The non conformity error is within $0.1 \%$ between $0.5 \%$ and $99.5 \%$ of $h$, $0.2 \%$ at $0 \%$ and $100 \%$.
b) Cilindrical vessel with hemispherical ends (see Fig. 1b). Transmitter measuring the whole vessel heigth.
The same polynomium can be used also for the cylindrical vessel with hemispherical ends. To obtain the volume contained in the vessel can be used the following empyrical formula:
$V=$ Out $\cdot(d / 1.12838)^{2} \cdot(L+2 / 3 d)$

## . . ADDENDUM FOR SELECTABLE OUTPUT FUNCTIONS

The non conformity error depends on the ratio between diameter and length of the vessel: for ratio $\geq 5$ to 1 the error is $\leq 0.25 \%$. The polynomium found with mathematical method gives an error of $\pm 0.15 \%$.
c) Cilindrical vessel with elliptical or pseudoelliptical ends (see Fig. 1c). Transmitter measuring the whole vessel heigth.
The same polynomium can be used also for the cylindrical vessel with elliptical or pseudoellipticall ends. To obtain the volume contained in the vessel can be used the following empyrical formula:

$$
V=O u t \cdot(d / 1.12838)^{2} \cdot(\mathrm{~L}+2 / 3 \mathrm{~m})
$$

where $m$ is the length of the minor ellipse axis (see Fig.1c)
The non conformity error depends on the ratio between the diameter and the length of the vessel: for ratio $\geq 5$ to 1 the error is $\leq 0.25 \%$. The polynomium found with mathematical method gives an error of $\pm 0.15 \%$.

### 2.2 SPHERICAL TANK

Spherical tank (see Fig.1d). Transmitter measuring the whole vessel height.

The following polynomium gives the volume of the spherical section in relation to the heigth $h$ of the liquid in the tank.

$$
\text { Out }=3 h^{2}-2 h^{3}
$$

This formula is geometrical and then his conformity is perfect.
Being both the input $h$ and the output Out normalized, i.e. in the range 0 to 1 (or $0 \%$ to $100 \%$ ), the sphere diameter D corresponding to a volume equal to $1(100 \%)$ will be "normalized" by a "K" factor of the following value:

$$
K=2 \cdot 3 \sqrt{3 /(4 \pi)}=1.2407
$$

The volume of the liquid contained in the tank, at heigth $=\mathrm{h}$ will be $V=$ Out • (D/1.2407) ${ }^{3}$
where $D=$ sphere diameter .

### 2.3 CYLINDRICAL VESSEL AND SPHERICAL TANK WITH PARTIAL LEVEL MEASUREMENT

Cases a) to d) but with partial level measurement (Fig. 2a) in these cases two methods can be used:

1) Plot the changes in volume in relation to the level changes and, using a mathematical method, find the relevant polynomium.
2) Use the polynomium coefficients forcases a) to d) and calibrate the transmitter range to cover the full diameter of the vessel or tank: the changes in volume for the $h$ changes between $h_{0}$ and $h_{\text {max }}$ will be correct. Of course the transmitter will transmit, when the level is


Fig. $1 c$


Fig. 2a $\leq h_{0}$, the volume corresponding to $h_{0}$ : the same apply for ievel $\geq h_{\text {maxi }}$. All transmitted volumes are $\%$ of the total volume of the vessel.

If it is required the partial volume starting from $h_{0}$ (i.e. the volume at $h_{0}=0$ ) then the $A_{0}$ coefficient should be equal to the polynomium solved for $h_{0}$ with negative sign: for example for $h_{0}=20 \%$

$$
A_{0}=-0.02+0.297 \cdot 0.2+2.83 \cdot 0.2^{2}-4.255 \cdot 0.2^{3}+3.5525 \cdot 0.2^{4}-1.421 \cdot 0.2^{5}=-0.14179
$$

The polynornium coefficients for the example will be:

$$
\begin{array}{cccc}
A_{0} & A_{1} & A_{2} & A_{3} \\
\text { Out }=-0.14179 & A_{4} & A_{4} & A_{5} \\
\hline
\end{array}
$$

Note : The accuracy of all above numerical values can not be guaranteed.

## ADDENDUM FOR SELECTABLE OUTPUT FUNCTIONS

3.0 POLYNOMIAL 2 (Two polinomial functions of 2 nd order)

Analog Output transfer function can also be defined as a two polinomial function. Both polinomials are of 2 nd order. So two different polinomial functions are used:

$$
\text { Out }=\left[ \pm A_{0}+A_{1}\left(x^{1}\right) \pm A_{2}\left(x^{2}\right)\right]+\left[ \pm B_{0}+B_{1}\left(x^{1}\right) \pm B_{2}\left(x^{2}\right)\right]
$$

Here the polinomial with A coefficients is used for $X$ from 0 to a $K$ value, and the second one with $B$ coefficients for $X$ greater than the $K$ value.


Ax and Bx terms of the polinomials have to be calculated according to the shape of the vessel.
A PC based sottware tool is available for polinomial coefficients definition.

### 4.0 CONSTANT CURRENT



Fig. 2b

This output function, activated by a Configuration Tool, can be used to test the transmitter output, the integrity of the transmission loop and the calibration of associated equipment like receivers, recorders, etc. When this function is activated the transmitter acts like a costant current generator: using the configuration tool the user can specify a fixed output current of $4 \mathrm{~mA}, 20 \mathrm{~mA}$ or any value between 4 and 20 mA .

## ADDENDUM FOR FLANGE-MOUNTED TRANSMITTERS

Flange-mounted transmitters are suitable for open or closed tank service.
The process fluid may, or may not, be corrosive, viscous, dirty and with suspended solids; each case requires a proper transmitter: 2600 T Series provides a model for tank service and suitable for liquid level measurement.

Liquid level transmitter is mounted to a tank as shown in Figure 1.
The ambient temperature of the transmitter mounting location must be between $-40^{\circ} \mathrm{C}$ and $+85^{\circ} \mathrm{C}\left(-40\right.$ and $\left.+185^{\circ} \mathrm{F}\right)$.
The process temperature can instead be between $-40^{\circ} \mathrm{C}$ and $+320^{\circ} \mathrm{C}\left(-40\right.$ and $\left.+608^{\circ} \mathrm{F}\right)$. The process interface and fill fluid of the transmitter must be selected amongst the various options provided according to the specific range of temperature.

> DANGER - For installation in Hazardous Areas, i.e. areas with danger of fire and/or explosion, irrespective of the protection mode used, the installation must carried out in accordance with local regulations. Ensure also that the temperature of the transmitter does not exceed the value indicated in the Safety Marking plate. In this connection, consider that process temperature above $85^{\circ} \mathrm{C}\left(185^{\circ} \mathrm{F}\right)$ requires derating the ambient limits by $1.5: 1^{\text {ratio. }}$


The liquid level transmitter has been designed to connect to a flanged tank nozzle, or similar ANSI (DIN) fitting. Standard connections for 2/3/4-inch Class 150/300/600/900 flanges, and equivalent DIN, are available.


[^7]Operation is not affected by mounting in other positions, however, some rezeroing may be required.
The liquid level transmitter can be used to measure liquid level in either open or closed (pressurized) tanks.

Here below, more detailed information regarding Size/Rating and dimensions, are given.


| SIZE/RATING | DIMENSIONS mm (in) |  |  |  |  |  |  |  | $\mathrm{N}^{\circ}$ of holes |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | A (dia) |  | B (dia) | C (dia) | D (dia) | E (dia) | F | G |  |
|  | flush | extended |  |  |  |  |  |  |  |
| 2 in ANSI CL 150 | 60 (2.36) | 48 (1.9) | 92.1 (3.62) | 120.5 (4.74) | 152.5 (6) | 20 (0.79) | 19.5 (0.77) | 9.5 (0.37) | 4 |
| 2 in ANSI CL 300 | 60 (2.36) | 48 (1.9) | 92.1 (3.62) | 127 (5) | 165 (6.5) | 20 (0.79) | 22.5 (0.88) | 9.5 (0.37) | 8 |
| 2 in ANSI CL 600 | 60 (2.36) | NA | 92.1 (3.62) | 127 (5) | 165 (6.5) | 20 (0.79) | 25.5 (1) | 9.5 (0.37) | 8 |
| 2in ANSI CL 900 | 60 (2.36) | NA | 92.1 (3.62) | 165 (6.5) | 216 (8.5) | 26 (1.02) | 38.5 (1.51) | 9.5 (0.37) | 8 |
| 3 in ANSI CL 150 | 89 (3.5) | 72 (2.83) | 127 (5) | 152.5 (6) | 190.5 (7.5) | 20 (0.79) | 24 (0.94) | 9.5 (0.37) | 4 |
| 3 in ANSI CL 300 | 89 (3.5) | 72 (2.83) | 127 (5) | 168.5 (6.63) | 210 (8.26) | 22 (0.86) | 28.5 (1.12) | 9.5 (0.37) | 8 |
| 3 in ANSI CL 600 | 89 (3.5) | NA | 127 (5) | 168.5 (6.63) | 210 (8.26) | 22 (0.86) | 32 (1.26) | 9.5 (0.37) | 8 |
| 3 in ANSI CL 900 | 89 (3.5) | NA | 127 (5) | 190.5 (7.5) | 241 (9.48) | 26 (1.02) | 38.5 (1.51). | 9.5 (0.37) | 8 |
| 4in ANSI CL 150 | 89 (3.5) | 94 (3.7) | 157.2 (6.2) | 190.5 (7.5) | 228.6 (9) | 20 (0.79) | 24 (0.94) | 9.5 (0.37) | 8 |
| 4 S ANSI CL 300 | 89 (3.5) | 94 (3.7) | 157.2 (6.2) | 200.2 (7.88) | 254 (10) | 22 (0.86) | 32 (1.26) | 9.5 (0.37) | 8 |
| DN50 DIN PN16 | 60 (2.36) | 48 (1.9) | 102 (4.02) | 125 (4.92) | 165 (6.5) | 18 (0.71) | 20 (0.79) | 9.5 (0.37) | 4 |
| DN50 DIN PN40 | 60 (2.36) | 48 (1.9) | 102 (4.02) | 125 (4.92) | 165 (6.5) | 18 (0.71) | 20 (0.79) | 9.5 (0.37) | 4 |
| DN50 DIN PN64 | 60 (2.36) | NA | 102 (4.02) | 135 (5.31 | 180 (7.08) | 22 (0.86) | 26 (1.02) | 9.5 (0.37) | 4 |
| DN50 DIN PN100 | 60 (2.36) | NA | $102(4.02)$ | 145 (5.71) | 195 (7.67) | 26 (1.02) | 28 (1.1) | 9.5 (0.37) | 4 |
| DN50 DIN PN160 | 60 (2.36) | NA | $102(4.02)$ | 145 (5.71) | 195 (7.67) | 26 (1.02) | 30 (1.18) | 9.5 (0.37) | 4 |
| DN80 DIN PN16 | 89 (3.5) | 72 (2.83) | 138 (5.43) | 160 (6.3) | 200 (7.87) | 18 (0.71) | 20 (0.79) | 9.5 (0.37) | 8 |
| DN80 DIN PN4O | 89 (3.5) | 72 (2.83) | 138 (5.43) | 160 (6.3) | 200 (7.87) | 18 (0.71) | 24 (0.94) | 9.5 (0.37) | 8 |
| DN80 DIN PN64 | 89 (3.5) | NA | 138 (5.43) | 170 (6.7) | 215 (8.46) | 22 (0.86) | 28 (1.1) | 9.5 (0.37) | 8 |
| DNBO DIN PN100 | 89 (3.5) | NA | 138 (5.43) | 180 (7.08) | 230 (9.05) | 26 (1.02) | 32 (1.26) | 9.5 (0.37) | 8 |
| DN80 DIN PN160 | 89 (3.5) | NA | 138 (5.43) | 180 (7.08) | 230 (9.05) | 26 (1.02) | 36 (1.42) | 9.5 (0.37) | 8 |
| DN100 DIN PN16 | 89 (3.5) | 94 (3.7) | 158 (6.22) | 180 (7.08) | 220 (8.66) | 18 (0.71) | 20 (0.79) | 9.5 (0.37) | 8 |
| DN100 OIN PN40 | 89 (3.5) | 94 (3.7) | 162 (6.38) | 190 (7.48) | 235 (9.25) | $22(0.86)$ | 24 (0.94) | 9.5 (0.37) | 8 |

[^8]
## ADDENDUM FOR FLANGE-MOUNTED TRANSMITTERS

These models, suitable for liquid level application, can be used with remote seal diaphragm.
This solution is necessary when the process characteristics are high temperature and/or corrosive fluids.
See below the pictures for these transmitters and related sensors.


Mod. 264 HR_NR - Sensors H,M,P,Q,S


Mod. 264 HR_NR - Sensor T

## Sensor trimming

If a sensor trimming operation is requested for level transmitters, follow the relevant procedure of the Hand Held Communicator and PC Sottware instructions.
If the result is not satisfactory atter having carried out either the ZERO TRIMMING or the FULL TRIMMING, the operation must be repeated with a special variation for these transmitters.
This special procedure dedicated to the level transmitters is as follows:
a) LOW TAIM (low value) for FULL TRIM operation, or ZERO TRIM, only,

A standard operation must be performed according to the procedure. If the result is not satisfactory the operation must be repeated with a similar procedure but with a new value which has to be entered. This value must be catculated, as follows, taking in consideration the error with reversed sign:

$$
\text { new } \mathbf{V} \text { entered }=\mathbf{V} \text { applied : ( } \mathbf{V} \text { displayed } \cdot \mathbf{V} \text { applied)* } \quad \text { (*) error }
$$

- 1st Example: Trimming at 10 mbar (applied value)

If the displayed value (via HART) after the first operation, is 10.2 mbar, then the error is $+0.2(10.2-10)$. The new value to be therefore entered is $9.8 \mathrm{mbar}(10-0.2$ ).

- 2nd Example: Trimming at true zero (0 mbar)

If the displayed value (via HART) atter the first operation, is -0.5 mbar, the operation must be repeated entering +0.5 mbar.

?
b) HIGH TRIM (high value) for FULL TRIM operation. A standard operation must be pertorned according to the procedure. If the result is not satisfactory the operation must be repeated with a procedure similar to that shown at point a above.
(new calculated value with error taken with reversed sign).

## Output \% Reranging

Sometimes, in case of tank level measurement, it becomes difficult to calculate the LRV or the URV of the transmitter, or to empty the tank for zero adjustment. So, not only with flange-mounted, but also with pressure absolute or relative transmitters using remote seals, the Output \% Reranging operation helps the user during transmitter calibration.
When it is knows the level of the tank, expressed in percentage, the liquid level, it is possible to input this percentage that automatically the transmitter recalculates its LRV and URV according to the new percentage value.
This can be done using a HART configuration tool on a 2600 T Transmitter.
Two options are available as Output \% Reranging operation:

1) OP Range Low where both LRV and URV are adjusted
2) OP Range High where only URV is change in accordance with the new input percentage

As example:


Actual level measured by the transmitter:
Transmitter output $=27 \%$
Calibration:

$$
\text { LRV }=-125 \text { mbar }
$$

$$
\begin{aligned}
\text { LHV } & =-125 \mathrm{moar} \\
\text { URV } & =+340 \mathrm{mbar}
\end{aligned}
$$

a) New input level measurement (Option 1) $=30 \%$

New calibration: LRV $=-139.5$ mbar
URV $=+325.5 \mathrm{mbar}$
The transmitter output is now $=30 \%$
Starting again from the initial settings:
Transmitter output $=27 \%$
Calibration: $\quad$ LRV $=-125$ mbar URV $=+340$ mbar
b) New input level measurement (Option 2) $=30 \%$

New calibration : LRV $=-125$ mbar
URV $=+291.5 \mathrm{mbar}$
The transmitter output is now $=30 \%$

## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and relative European Standards which can assure compliance with Essential Safety Requirements, i.e., EN 50014 (General requirements) EN 50018 (Flameproof enclosures "d") EN 50020 (Intrinsic safety ${ }^{\text {ji" }}$ ) EN 50284 (Equipments, group II, category 1G) EN 50281 (Apparatus for use with combustible dusts), the pressure transmitters of the 2600T SERIES have been cerified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.
a) Certificate ATEX II 1G DT50 $0^{\circ} \mathrm{C}$, EEx ia IIC T6 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$ respectively, $\mathrm{DT} 95^{\circ} \mathrm{C}, \mathrm{EEx}$ ia IIC $\mathrm{T} 4\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$

## ZELM certificate number ZELM 02 ATEX 0081

The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
1: Category
G: Gas (dangerous media)
D: Dust (dangerous media)
$\mathrm{T} 50^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
$\mathrm{T} 95^{\circ} \mathrm{C}$ : As before for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production)

The other marking refers to the protection type used according to relevant EN standards:
EExia: Intrinsic safety, protection level "a"
IIC: Gas group
T6: $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max)
with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$
About the applications, this transmitter can be used in "Zone 0 " (Gas) and "Zone 20" (Dust) classified areas (continuous hazard) as it is shown on the following sketch:


## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)

b) Certificate ATEX \|I $1 / 2 \mathrm{G}$ DT50 ${ }^{\circ} \mathrm{C}$, EEx ia IIC T6 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$
respectively, DT95 ${ }^{\circ} \mathrm{C}$, EEx ia IIC $T 4\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$

## ZELM certificate number ZELM 02 ATEX 0081

Note: this ATEX Category depends on the application (see below) and also on the intrinsic safety level of the transmitter supply (associated apparatus) which can sometimes suitably be [ib] instead of [ia]. As it is well known, the level of an intrinsic safety system is determined by the lowest level of the various apparatus used, i.e., in the case of [ib] supply, the system takes over this level of protection.

The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
$1 / 2$ : Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch)
G: Gas (dangerous media)
D: Dust (dangerous media)
$750^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
$795^{\circ} \mathrm{C}$ : As before for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production)

The other marking refers to the protection type used according to relevant EN standards:
EExia: Intrinsic satety, protection level "a"
IIC: Gas group
T6: $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$

About the applications, this transmitter can be used in Zone " 0 " (Gas) classified areas (continuous hazard) with its "process part" only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (normally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the EN50284 and EN50018. About Dust application, the transmitter is suitable for "Zone 21 " according to the EN 50281 as it is shown on the relevant part of the sketch:


## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)

## c) Certiticate ATEX II $1 / 2$ GD, EEx d IIC T6 <br> IP67 $\quad \mathrm{T} 85^{\circ} \mathrm{C} \quad\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+75^{\circ} \mathrm{C}\right)$

CESI Certificate number CESI O2ATEX 027
The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
1/2: Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch)
G: Gas (dangerous media)
D: Dust (dangerous media)
$\mathrm{T} 85^{\circ} \mathrm{C}$ : Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+75^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
(Note: the number close to the CE marking of the transmitter satety label identifies the Notified Body which has responsibility for the Surveillance of the production)

The other marking refers to the protection type used according to relevant EN Standards:
EEx d: Flameproof
IIC: Gas group
T6 : Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+75^{\circ} \mathrm{C}$.
About the applications, this transmitter can be used in Zone " 0 " (Gas) classified areas (continuous hazard) with its "process part" only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (normally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the EN50284 and EN50018. About Dust application, the transmitter is suitable for "Zone $21^{\prime \prime}$ according to the EN 50281 as it is shown on the relevant part of the sketch:


[^9]
## ADDENDUM FOR "EX SAFETY" ASPECTS (EUROPE)

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and retative Standards which can assure compliance with Essential Safety Requirements, i.e., EN 50014 (General requirements) EN 50021 (Specification for electrical apparatus with type of protection " $n$ ") EN 50281 (Apparatus for use with combustible dusts), the pressure transmitters of the 2600T SERIES have been centified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.
d) Certificate ATEX II 3 G DT50 ${ }^{\circ} \mathrm{C}$, EEX OL IIC T6 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$ respectively, DT $95^{\circ} \mathrm{C}$, EEx NL IIC T $4\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$

ZELM "Conformity Statement" number ZELM 02 ATEX 3088
(Note: It is the technical support for the ABB Declaration of Conformity)
The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
3: Category
G: Gas (dangerous media)
D: Dust (dangerous media)
$750^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
$795^{\circ} \mathrm{C}$ : As betore for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
The other marking refers to the protection type used according to the standards:
$E E \times n L$ : Type of protection " $n$ " with "energy limitation" technique
IIC: Gas group
T6 : $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$

Note: when instailed this transmitter must be supplied by a voltage limiting device which will prevent the rated voltage of 42 V d.c. being exceeded.

About the applications, this transmitter can be used in "Zone 2" (Gas) and "Zone 22" (Dust) classified areas (unlikelyfinfrequent hazard) as it is shown on the following sketch:


## EC DECLARATION OF CONFORMITY

We: ABB SACE S.p.A.<br>Via Statale, 113 22016 Lenno (Como) Italy

declares under our sole responsibility that the products:

# 2600 EN Series (Transmitters models 262/264/266/268, Hand Held Terminal, Field Indicator) in all the communication configurations ( $4 \div 20 \mathrm{~mA}+\mathrm{HART}^{\top}$, Profibus, Foundation Fieldbus, Safety) 

## are in conformity with the following standards:

| EN 61000-6-3 (2001) | Electromagn Emission stand industrial env | compatib rd for re ments |
| :---: | :---: | :---: |
| according to: | EN55022 | (2001) |
| EN 61000-6-2 (2001) | Electromagne Immunity for | compatib ustrial en |
| according to: | EN 61000-4-2 | (2001) |
|  | EN 61000-4-3 | (2002) |
|  | EN 61000-4-4 | (2001) |
|  | EN 61000-4-5 | (2001) |
|  | EN 61000-4-6 | (2001) |

following the provisions of the EMC Directives 89/336/EEC and 93/68/EEC.


ABB SACE S.p.A.
BU Instrumentation Technical Manager
A. Moroni

## ABB SACE S.p.A.

## Business Unit Instrumentation

Sede kegale/Registered Otice:
$1 \cdot 20124$ Milano - Via Vituor Pisani, 16 fel: - 39022444.1 Capitale Sociale: $\in 60.000 .000 \mathrm{i} . \mathrm{v}$. Partita IVAVAT $\mathrm{n}^{\mathrm{E}}$ : 1 T 00257710731
Registro delle imprese di Milano e Codice
Fiscale: 01099490151
A.E.A. Milanc: $1066547+$

## A Comprehensive Instrumentation Range

## Analytical Instrumentation

- Transmitters

On-line pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.

- Sensors
pH , redox, selective ion, conductivity and dissolved oxygen.
- Laboratory Instrumentation
pH and dissolved oxygen meters and associated sensors.
- Water Analyzers

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

- Gas Analyzers

Zirconia, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.

## Controllers \& Recorders

- Controllers

Digital display, electronic, pneumatic. Discrete singleloop and multi-loop controliers which can be linked to a common display station, process computer or personal computer.

- Recorders

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

## Electronic Transmitters

- Smart \& Analog Transmitters

For draft, differential, gauge and absolute pressure measurement. Also, liquid level and temperature.

- I to P Converters and Field Indicators


## Flow Metering

- Magnetic Flowmeters Electromagnetic, insertion type probes and watermeters.
- Turbine Flowmeters
- Wedge Flow Elements
- Mass Flow Meters Transmitters, sensors, controllers and batch/display units.


## Level Control

- Submersible, Capacitance \& Conductivity.


## Pneumatic Instrumentation

- Transmitters
- Indicating Controllers
- Recording Controllers


## Customer Support

ABB provides a comprehensive after sales service via a Woridwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

Italy
ABB SACE spa - Business Unit Instrumentation
Tel: +39 (0) 34458111
Fax: +39(0)34458278

United Kingdom
ABB Lid
Tel. +4401480475321
Fax + 4401480217948
United States of America
ABB Inc.
Instrumentation Division
Tel. +101480475321
Fax +101480217948 .

## Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.
In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged faulty unit.

The Company's policy is one of continuous product improvement and the right is reserved to modify the soecifications contained herein without notice.

ABB Inc.
125 E. County Line Road Warminster, PA 18974 USA
Tel: +1 2156746000
Fax: +1 2156747183

ABB SACE spa
Business Unit Instrumentation Via Statale 113 22016 Lenno (CO) Italy
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ABB Automation Products GmbH Schillerstrasse 72
D-32425 Minden

Fax: +49 (0) 5718301368


BS EN ISO 9001

St Neots, U.K. - Cert. No. O5907
Slonehouse, U.K. - Cert. No. FM 21106

UNI EN ISO 9001

guactir selumit
Lenno, Italy - Cert. No. 9/90A

Stonehouse, U.K. - Cert. No. 0255

## Use of Instructions

## Warning.

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

## Caution.

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

Note.
Clarification of an instruction or additional information.


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

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

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

[^10]
## PRODUCT IDENTIFICATION

The instrument is identified by the data plates shown in Figure 1.
The Nameplate (ref.A) provides information concerning the code number, maximum process working pressure, range and span limits, power supply and output signal. See code/ specification sheet for detailed information. This plate also shows the transmitter serial number.
Please refer to this number when making enquiries.
A dedicated label (ref. B) is welded as standard to the primary unit, carrying specific details of the transducer (diaphragms material, fill fluid, range limit and identification number).

A Safety Marking plate ( ref. C) is fitted when the transmitter is required to comply with hazardous area regulations, e.g. flameproof or intrinsic safety protection.
Additionally a wired-on type tag plate (ret. D) provides the customer tag number and calibrated range, maximum process working pressure (PS) and temperature (TS).
The instrument may be used as a safety accessory (category IV) as defined by the Pressure Equipment Directive 97/23/EC. In this case, near the CE.mark, there is the number of the notified body (1130) that verified the compliance.


Fig. 1 - Product identification

## INSTALLATION - PRECAUTIONS

$\triangle$ WARNING - In order to ensure operator safety and plant safety it is essential that installation is carried out by suitably trained personnel according to the technical data provided in the "Operative limits" section in the following of the document.

The transmitter may be mounted on a 2 -inch pipe by means of the proper mounting bracket. The transmitter may also be directly, supported by the piping connection.

$\triangle$ WARNING - For installation in Hazardous Areas, i.e. areas with dangerous concentrations of e.g. gases or dusts that may explode if ignited, the installation must be carried out in accordance with relative standards either EN 60079-14 or IEC 79-14 and/or with local authority regulations, for the relevant type of protection adopted.

WARNING: The transmitter when installed in accordance with this instruction manual will not be subjected to mechanical stresses.

WARNING: the transmitter should not be installed where it may be subjected to mechanical and thermal stresses or where it may be attached by existing or foreseable aggressive substances.
ABB cannot guarantee that a construction material is suited to a particular process fluid under all possible process conditions. Therefore, it is complete responsibility of the user the selection of wetted parts and fill fluids. See also the paragraph on "Operative limits".

CAUTION - Proper location of the transmitter with respect to the process pipe will depend upon the service for which the instrument is used. Care should be exercised to identify correct process connections.

The secondary unit of the transmitter may be rotated through $360^{\circ}$ approx. with respect to the primary unit without degrading performance or damaging the internal wiring. Do not force the primary unit to rotate; use the 2 mm Allen key supplied to unlock and lock the tang grub screw. This feature, obtained by unscrewing (one tum is sufficient) the Allen screw, is particularly useful for reaching optimum access to the electrical connections and visibility of the output indicator.

## OPERATIVE LIMITS

The transmitter operates on a minimum voltage of 10.5 Vdc to a maximum of 42 Vdc and is protected against polarity inversion.

## Note - The transmitter operates from 10.5 to 42 Vdc

 with no load (additional load allows operation over 42 Vdc). For EEx ia and intrinsically safe (FM, CSA and SAA) approval power supply must not exceed 30 Vdc . In some countries the maximum power supply voltage is limited to a lower value.Installing optional devices the minimum voltage increases to:

- 10.5 Vdc with no option or with integral digital display
- 10.7 Vdc with output analog indicator
- 12.5 Vdc with LCD ProMeter
- 12.3 Vdc with surge protection
- 13.3 Vdc with LCD CoMeter
- 15.3 Vde with no link on output indicator plug

The total loop resistance is indicated in the expression below.
$R(k \Omega)=\frac{\text { Supply voltage }- \text { min. operating voltage }(\mathrm{Vdc})}{22.5}$

The total loop resistance is the sum of the resistance of all elements of the loop, including wiring, conditioning resistor, safety barriers and additional indicators (excluding the equivalent resistance of the transmitter).

Where a configuration device (HART), such as the Hand Held Communicator or a Modem is likely to be used, a resistance of 250 ohm minimum should be present between the power supply and the point of insertion of these devices, to allow communication.

Several types of satety barriers, either passive or active, canbe satisfactorily used in conjunction with the Smart 2600 T transmitter. Nevertheless, in case of use of active barriers, check with the supplier if the model is suitable for use with smart transmitters allowing the connection of the configuration devices in the "safe" or non-hazardous area.

Note - For models 262G/A and 264G/A the frequency immunity between 150 kHz and 2 MHz with direct coupling and unshielded line is 3 V ; with direct coupling and shielded line is 10 V .

WARNING - The transmitter may be used as a safety accessory (as defined by the Pressure Equipment Directive 97/23/EC) i.e. as part of a shutdown system. Inthis case it is recommended to select the correct fail safe mode for the $4-20 \mathrm{~mA}$ signal (as per Namur NE43 recommendation).
See also the instructions relevant to tail safe selection (Up/ Down scale mode) in the addendum to the instruction manual on "Use of hardware links on the secondary electronics".

## Temperature limits ${ }^{\circ} \mathrm{C}\left({ }^{\circ} \mathrm{F}\right)$ :

Ambient (is the operating temperature)

| Filling | Model 262/264H | Model $\mathbf{2 6 2 / 2 6 4 N}$ |
| :--- | :--- | :--- |
| Silicone oil | -40 and +85 | -40 and +85 |
|  | $(-40$ and +185$)$ | $(-40$ and +185$)$ |
| Inert | -20 and +85 | -10 and +65 |
|  | $(-4$ and +185$)$ | $(+14$ and +150$)$ |
| ABB till. | -40 and +85 | -10 and +85 |
|  | $(-40$ and +185$)$ | $(+14$ and +185$)$ |

Models 262/264GA:
Silicone oil filling: $-40^{\circ} \mathrm{C}$ and $+85^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ and $\left.+185^{\circ} \mathrm{F}\right)$ Inert filling: $-20^{\circ} \mathrm{C}$ and $+85^{\circ} \mathrm{C}\left(-4^{\circ} \mathrm{F}\right.$ and $\left.+185^{\circ} \mathrm{F}\right)$ Lower ambient limit for LCD indicators: $-20^{\circ} \mathrm{C}\left(-4^{\circ} \mathrm{F}\right)$
Upper ambient limit for LCD indicators: $+70^{\circ} \mathrm{C}\left(+158^{\circ} \mathrm{F}\right)$
Note : For Hazardous Atmosphere applications see the temperature range specified on the certificate/ approval relevant to the aimed type of protection

## Process

Lower limit

- refer to lower ambient limits for models $262 / 264 \mathrm{HN}$ :
$-50^{\circ} \mathrm{C}\left(-58^{\circ} \mathrm{F}\right)$ for models $262 / 264 \mathrm{GA}$
$-20^{\circ} \mathrm{C}\left(-4^{\circ} \mathrm{F}\right)$ for Viton gasket
$-15^{\circ} \mathrm{C}\left(+5^{\circ} \mathrm{F}\right)$ for Perfluoroelastomer gasket
Upper limit
- Silicone oil and ABB fill: $121^{\circ} \mathrm{C}\left(250^{\circ} \mathrm{F}\right)(1)$
- Inert fluid: $100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right)$ (2)
$-+80^{\circ} \mathrm{C}$ for Perfluoroelastomer gasket
(1) $100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right)$ for application below atmospheric pressure
(2) $65^{\circ} \mathrm{C}\left(150^{\circ} \mathrm{F}\right)$ for application below atmospheric pressure


## Storage

Lower limit: $-50^{\circ} \mathrm{C}\left(-58^{\circ} \mathrm{F}\right) ;-40^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right)$ for LCD indicators Upper limit: $+85^{\circ} \mathrm{C}\left(+185^{\circ} \mathrm{F}\right)$

## Pressure limits

Overpressure limits (without damage to the transmitter) 0.067 kPa abs, 0.67 mbar abs, 0.01 psia (double with inert filling) to:
Models $262 / 264 \mathrm{HN}$ :

- 21MPa, 210bar, 3045psi for sensor codes H to S
- $65 \mathrm{MPa}, 650 \mathrm{bar}, 9400$ psi for sensor code $T$

Models 262/264GA:

- 1MPa, 10bar, 145 psi for sensor codes C,F
- 0.5MPa, 5bar, 72.5 psi for sensor code L
- 6MPa, 60bar, 870psi for sensor code U
- 20MPa, 200bar, 2900psi for sensor code R
-90MPa, 900bar, 13050psi for sensor code V


## Proof pressure

The transmitter can be exposed without leaking to line pressure of up to:
Models 262/264HN:
-40MPa, $400 \mathrm{bar}, 5800$ psi for sensor code $H$ to $S$

- $112 \mathrm{MPa}, 1120 \mathrm{bar}, 16240 \mathrm{psi}$ for sensor code T

Models 262/264GA:

- 8MPa, 80bar, 1160 psi for sensor code U
- 112MPa, 1120bar, 16240psi for sensor code V

Meet ANSI/ISA-S 82.03 hydrostatic test requirements and
SAMA PMC 27.1.

## . . . OPERATIVE LIMITS

## Environmental limits

Electromagnetic compatibility (EMC)
Comply with EN 50081-1 for emission and EN 50082-2 for immunity requirements and test;
Radiated electromagnetic immunity level: $30 \mathrm{~V} / \mathrm{m}$
(according to IEC $1000-4-3$, EN61000-4-3)
Conducted electromagnetic immunity level : 30 V
(according to IEC 1000-4-6, EN 61000-4-6)
Surge immunity level (with surge protector): 4 kV
(according to IEC 1000-4-5 EN 61000-4-5)
Fast transient (Burst) immunity level: 4 kV
(according to IEC 1000-4-4 EN 61000-4-4)
Humidity
Relative humidity: up to $100 \%$ annual average
Condensing, icing: admissible

## Vibration resistance

Accelerations up to 2 g at frequency up to 1000 Hz (according to IEC 60068-2-26)

## Shock resistance

Acceleration: 50 g
Duration: 11 ms
(according to IEC 60068-2-27)

## Wet and dust-laden atmospheres

The transmitter is dust and sand tight and protected against immersion effects as defined by IEC 60529 (1989) to IP 67 (IP 68 on request) or by NEMA to 4 X or by JIS to C0920.

## Fill fluid warning

Be sure that the fill fluid can mix safely with the process fluid in case of rupture of the sensor membrane.

## CORROSION

A fluid/material compatibility table is available at: www.abb.com - searching for: CORROSION.pdf or from local $A B B$ representatives

## NOTE

Data of the table are based on information from manufacturers.
All data is based on a temperature of $20^{\circ} \mathrm{C}, 70^{\circ} \mathrm{F}$ unless noted otherwise.
Since corrosion involves many more variables than this table considers, such as trace contaminants, aeration or temperature-concentration profile, stress corrosion cracking and pitting, the table should be used only as a reference in narrowing the choice of materials that merit further investigation. Suitability of a particular material is best determined by field test. At this purpose, please contact out local ABB representatives.

## WARNING

For safety purpose the design corrosion allowance of differential pressure instrument flanges is of about 1.5 mm 0.04 in . Therefore from the viewpoint of safe containment of liquids compatible with a specific material according to the following table, the expected instrument lifetime is more than 10 years, but the previous note apply.

## DISMANTLING AND REASSEMBLY

WARNING - Process fluids and/or pressure retained in the transmitter primary unit can cause severe injury and death or damage to the equipment. It is the user responsibility to make sure that the instrument is not under pressure before removing the instrument from service or when draining or venting.

## Dangerous fluids

In case of toxic or otherwise dangerous process fluid, take any precautions as recomimended in the relevant Material Satety Data Sheet.

CAUTION - Dismantling and reassembly should not be carried out on site because of the risk of damage to components and printed circuits as a result of adverse environmental conditions such as humidity,dust,etc. The dismantling and reassembly procedures given below should be carried out in the listed order to avoid instrument damage.

## Required tools

2 mm Allen key
3 mm Allen key
Small Phillips screwdriver
Small flat-bladed screwdriver
13 mm spanner
13 mm torque wrench - (Range $>17 \mathrm{Nm} \cdot 12.6$ toot lbs)

## Dismantling

a) Screw down completely the coverlocking screw, electronics side, using the 3 mm Allen key
b) Unscrew and remove the covers
c) Unscrew the two fixing screws and remove the secondary electronic assembly
d) Unplug the sensor cable
e) Remove the tang grub screw using the 2 mm Allen key
f) Unscrew the housing taking care not to damage the sensor cable or the connector.

## Reassembly

WARNING - Assembling the components with improper "O rings" can cause fracture or overstressing and release of pressurized process material. Use only official spare parts (*) and do not exceed the specified torque limits. DO NOT REMOVE the "O ring" fitted in the sensor neck: it provides the housing a degree of protection.
a) Insert the sensor cable in its recess at the bottom of the housing.
b) Screw the housing down completely until the nesting of housing/sensor assy is reached, then unscrew by one complete turn maximum. Rotate the topwork in the desired position and lock it with the tang grub screw previously removed.
c) Piug the sensor cable to the secondary electronics. Fix the electronic circuit by its screws.
d) Refit the covers and tighten securely.

WARNING - For Hazardous Areas installations, at least eight (8) threads on the cover must be engaged in order to meet the (flameproof - explosion-proof) requirements.
e) Unscrew the coverlocking screw to secure the covers. This is mandatory to meet "Flameproof requirements" for Hazardous Areas installation.

## PRESSURE TEST WARNING

Once reassembled the process flanges and the transducer, a pressure test is required. At this purpose, apply a hydrostatic pressure of the maximum overrange pressure rating to both process connections simultaneously. Wait for one minute, then verity that no leakages occurred. Repeat the assembly procedure and the pressure test.

[^11]WP49 Keidges Rd Bellbird Park WPS - Electrical Switchboard - OM Manual


Fig. a - Transmitter Sectional View for models 262/264HN


Fig. b - Transmitter Sectional View for models 262/264GA

## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and relative European Standards which can assure compliance with Essential Safety Requirements, i.e., EN 50014 (General requirements) EN 50018 (Flameproof enclosures "d") EN 50020 (Intrinsic safety "i") EN 50284 (Equipments, group II, category 1G) EN 50281 (Apparatus for use with combustible dusts), the pressure transmitters of the 2600T SERIES have been certified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.
a) Certificate ATEX \|I 1 G DT $50^{\circ} \mathrm{C}$, EEx ia IIC $\mathrm{T} 6\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$
respectively, DT $95^{\circ} \mathrm{C}$, EEx ia IIC $\mathrm{T} 4\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$
ZEL.M certificate number ZELM 02 ATEX 0081
The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
1: Category
G: Gas (dangerous media)
D: Dust (dangerous media)
$T 50^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
T95 ${ }^{\circ} \mathrm{C}$ : As before for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production)

The other marking refers to the protection type used according to relevant EN standards:
EEx ia: Intrinsic safety, protection level "a"
IIC: Gas group
T6: $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$
About the applications, this transmitter can be used in "Zone 0" (Gas) and "Zone 20" (Dust) classified areas (continuous hazard) as it is shown on the following sketch:


## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)

b) Certificate ATEX II $1 / 2 \mathrm{G}$ DT50 $0^{\circ} \mathrm{C}$, EEx ia IIC T6 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$
respectively, OT $95^{\circ} \mathrm{C}$, EEx ia IIC T4 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$
ZELM certificate number ZELM 02 ATEX 0081
Note: this ATEX Category depends on the application (see below) and also on the intrinsic safety level of the transmitter supply (associated apparatus) which can sometimes suitably be [ib] instead of [ia]. As it is well known, the level of an intrinsic safety system is determined by the lowest level of the various apparatus used, i.e., in the case of [ib] supply, the system takes over this level of protection.

The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
1/2: Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch)
G: Gas (dangerous media)
D: Dust (dangerous media)
$T 50^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
$\mathrm{T} 95^{\circ} \mathrm{C}$ : As before for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production)

The other marking refers to the protection type used according to relevant EN standards:
EEx ia: Intrinsic satety, protection level " $a$ "
IIC: Gas group
T6: $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$

About the applications, this transmitter can be used in Zone " 0 " (Gas) classified areas (continuous hazard) with its "process part" only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (nomally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the EN50284 and EN50018. About Dust application, the transmitter is suitable for "Zone 21" according to the EN 50281 as it is shown on the relevant part of the sketch:


## ADDENDUM FOR "EX SAFETY" ASPECTS AND "IP" PROTECTION (EUROPE)


CESI Certificate number CESI O2ATEX 027
The meaning of ATEX code is as follows:
11: Group for surface areas (not mines)
1/2: Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch)
G: Gas (dangerous media)
D: Dust (dangerous media)
$785^{\circ} \mathrm{C}$ : Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+75^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the Surveillance of the production)

The other marking refers to the protection type used according to relevant EN Standards:
EEx d: Flameproof
IIC: Gas group
T6: Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+75^{\circ} \mathrm{C}$.
About the applications, this transmitter can be used in Zone " 0 " (Gas) classified areas (continuous hazard) with its "process part" only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (nomally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the EN50284 and EN50018. About Dust application, the transmitter is suitable for "Zone 21" according to the EN 50281 as it is shown on the relevant part of the sketch:


## IP code

About the degree of protection provided by the enclosure of the pressure transmitter, the 2600 T SERIES has been certified IP67 according to EN 60529 standard.
The first characteristic numeral indicates the protection of the inside electronics against ingress of solid forein objects including dusts. The assigned " 6 " means an enclosure dust-tight (no ingress of dust).
The second characteristic numeral indicates the protection of the inside electronics against ingress of water. The assigned " 7 " means an enclosure water-protected against a temporary immersion in water under standardized conditions of pressure and time.

## ADDENDUM FOR "EX SAFETY" ASPECTS (EUROPE)

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and relative Standards which can assure compliance with Essential Safety Requirements, i.e., EN 50014 (General requirements) EN 50021 (Specification for electrical apparatus with type of protection " $n$ ") EN 50281 (Apparatus for use with combustible dusts), the pressure transmitters of the 2600T SERIES have been certified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.
d) Cerificate ATEX II 3G DT50 ${ }^{\circ} \mathrm{C}$, EEx NL IIC $T 6\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+40^{\circ} \mathrm{C}\right)$
respectively, DT $95^{\circ} \mathrm{C}$, EEx NL IIC T4 $\left(-40^{\circ} \mathrm{C} \leq \mathrm{Ta} \leq+85^{\circ} \mathrm{C}\right)$
ZELM "Conformity Statement" number ZELM 02 ATEX 3088
(Note: It is the technical support for the ABB Declaration of Conformity)
The meaning of ATEX code is as follows:
II: Group for surface areas (not mines)
3: Category
G : Gas (dangerous media)
D: Dust (dangerous media)
$\mathrm{T} 50^{\circ} \mathrm{C}$ :Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$ for Dust (not Gas) with a dust layer up to 50 mm depth.
T $95^{\circ} \mathrm{C}$ : As before for Dust for a $\mathrm{Ta}+85^{\circ} \mathrm{C}$
The other marking refers to the protection type used according to the standards:
EExnL: Type of protection " $n$ " with "energy limitation" technique
IIC: Gas group
T6 : $\quad$ Temperature class of the transmitter (which corresponds to $85^{\circ} \mathrm{C}$ max) with a Ta (ambient temperature) $+40^{\circ} \mathrm{C}$
T4: $\quad$ Temperature class of the transmitter (which corresponds to $135^{\circ} \mathrm{C}$ max)
with a Ta (ambient temperature) $+85^{\circ} \mathrm{C}$
Note: when installed this transmitter must be supplied by a voltage limiting device which will prevent the rated voltage of 42 V d.c. being exceeded.

About the applications, this transmitter can be used in "Zone 2" (Gas) and "Zone 22" (Dust) classified areas (unlikelyfintrequent hazard) as it is shown on the following sketch:
Application with Gas

## EC DECLARATION OF CONFORMITY

We: ABB SACE S.p.A.<br>Via Statale, 113 22016 Lenno (Como) Italy

declares under our sole responsibility that the pressure transmitters of 600T and 26007 series, as below specified:
are in compliance with the requirements of 97/23/CE PED Directive
in details, when applicable, have been used for the compliance demonstration, as defined in the annex III of the Directive considering the transmitter as category IV, the D and B modules.

For the D Module has been released by Consorzio RINA OMECO the certificate $n^{\circ}$ D/1 2002 MI PP 11

For the B Module have been released by Consorzio RINA OMECO the certificates:
$\pi^{\circ}$ B/1 2002 MI PP 11 for the models:
$611 \mathrm{ED}, 621 \mathrm{ED}, 611 \mathrm{EE}, 621 \mathrm{EE}, 611 \mathrm{EG}, 621 \mathrm{EG}, 611 \mathrm{EA}, 621 \mathrm{EA}, 611 \mathrm{EH}, 621 \mathrm{EH}$, 262DS, 264DS, 262PS, 264PS, 262VS, 264VS, 266DS, 268DS, 266PS, 268PS, 266VS, 268VS, 262DF, 264DF, 262PF, 264PF, 262VF, 264VF
$n^{\circ}$ B/2 2002 MI PP 11 for the models:
$614 \mathrm{EG}, 624 \mathrm{EG}, 614 \mathrm{EA}, 624 \mathrm{EA}, 262 \mathrm{NS}, 264 \mathrm{NS}, 262 \mathrm{HS}, 264 \mathrm{HS}, 266 \mathrm{NS}, 268 \mathrm{NS}$, $266 \mathrm{HS}, 268 \mathrm{HS}, 262 \mathrm{NF}, 264 \mathrm{NF}, 262 \mathrm{HF}, 264 \mathrm{HF}$
$n^{\circ}$ B/3 2002 MI PP 11 for the models:
614EGS, 624EGS, 614EAS, 624EAS, 262HSxT, 264HSxT, 262NSxT, 264NSxT

Lenno, $2^{\text {nd }}$ January 2003

-ABB SACE S.p.A.
BU Instrumentation Technical Manager
A. Moroni

ABB SACE S.p.A.
Business Unit Instrumentation

## EC DECLARATION OF CONFORMITY

```
We: ABB SACE S.p.A.
        Via Statale, 113
        22016 Lenno (Como)
        Italy
```

declares under our sole responsibility that the products:

50T Series: $\quad 51 \mathrm{G} / \mathrm{A}, 53 \mathrm{G} / \mathrm{A}, 54 \mathrm{G} / \mathrm{A}, 55 \mathrm{G} / \mathrm{A}$
600T Series: 611ED, 621ED, 611EE, 621EE, 611EG, 621EG, 611EA, 621EA, $611 \mathrm{EH}, 621 \mathrm{EH}, 621 \mathrm{SA}, 614 \mathrm{EG}, 624 \mathrm{EG}, 614 \mathrm{EA}, 624 \mathrm{EA}, 614 \mathrm{EGS}$, 624EGS, 614EAS, 624EDS, 611ES, 621ES, 614ES, 624ES, 621EM, S6 Seals.

2600T Series: 262DC, 264DC, 262DG, 264DG, 262DL, 264DL, 262DH, 264DH, 262DR, 264DR, 262HC, $264 \mathrm{HC}, 262 \mathrm{HG}, 264 \mathrm{HG}, 262 \mathrm{HP}, 264 \mathrm{HP}$, 262HR, 264HR, 262NC, 264NC, 262NG, 264NG, 262NP, 264NP, 262NR, 264NR, 268 DC , 268DG, 268DL, 26 BDH , 268 DR , 268 HC , 268HG, 268HP, 268HR, 268NC, 26BNG, 268NP, 268NR, 262 G , 264G, 262A, 264A, 262B, 264B, S264 Seals

Deltapi Series: NAA, NAB, NAD, NAE, NBC, NBD, NDA, NDB, NDC, NDD, N6 Seals

Campo Series:JAA, JAF, JAG, JBA,JBG, JCA,JCF,JCG, BBA, DBT
Others: . $=18311$, WPP, WEP

## are in compliance with the requirements of 97/23/CE PED Directive

in accordance with article 3, comma 3, of the Directive itself because designed following the sound engineering practice (SEP).


BU Instrumentation Technical Manager
A. Moroni

ABB SACE S.p.A.
Business Unit Instrumentation


Direzione e Uffici Amministrativi/Administration: Via L. Lama, 33-20099 Sesto S. Giovanni (MI) Italy Tel. +39 022414 i - Fax +390224143892 e-mail: sace.ssoatt.abo.com

Ossuccio (CO) Sesto S. Giovanni (MI)

## EC DECLARATION OF CONFORMITY

| We: | ABB SACE S.p.A. |
| :--- | :--- |
|  | Via Statale, 113 |
|  | 22016 Lenno (Como) |
|  | ltaly |

declares under our sole responsibility that the products:

2600 EN Series (Transmitters models 262/264/266/268, Hand Held Terminal, Field indicator) in all the communication configurations ( $4 \div 20 \mathrm{~mA}+\mathrm{HART}^{\circ}$, Profibus, Foundation Fieldbus, Safety)

## are in conformity with the following standards:

| EN 61000-6-3 (2001) | Electromagnetic compatibility (EMC) - Generic standards Emission standard for residential, commercial and lightindustrial environments |  |
| :---: | :---: | :---: |
| according to: | EN55022 | (2001) |
| EN 61000-6-2 (2001) | Electromagnetic compatibility (EMC) - Generic standards Immunity for industrial environments |  |
| according to: | EN 61000-4-2 <br> EN 61000-4-3 <br> EN 61000-4-4 <br> EN 61000-4-5 <br> EN 61000-4-6 | (2001) (2002) (2001) (2001) (2001) |



AbB SACE S.p.A. BU Instrumentation Technical Manager A. Moroni

ABB SACE S.p.A.

## Business Unit Instrumentation

### 7.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

## XS250 and XH250 series

$\square$ Adjustment range 63-100\% of nominal current rating.

- Standards AS 2184/AS 3947-2.
- Adjustable thermal, fixed magnetic trip.
- Max. voltage (INSUL) 690V.

XS250NJ (35kA) 3 pole
Ampere

| rating | Min | Max | Cat. No. |
| :---: | :---: | :---: | :---: |
| 160 | 100 | 160 |  |
| 250 | 160 | 250 | K6S250NY25033630 |
| 250 | Non-Auto | ( 1 sec$)^{4}$ ) | $\mathrm{XS} 250 \mathrm{NN} 3)$ |

XS250NJ (35kA) 4 pole

| 160 | 100 | 160 | - $\times 2500160045$ |
| :---: | :---: | :---: | :---: |
| 250 | 160 | 250 | XS250102504 |
| 250 | Non-Aut | ( sec$)^{4}$ ) | 9S250NN4 ${ }^{4}$ ) |



Bolt on earth leakage module ELB 250

## XH250NJ (50kA) 3 pole

| 160 | 100 | 160 | 584250N516033 |
| :---: | :---: | :---: | :---: |
| 250 | 160 | 250 | 0 |

## XH250NJ (50kA) 4 pole

| 160 | 100 | 160 |  |
| :---: | :---: | :---: | :---: |
| 250 | 160 | 250 | T250 |


| Short circuit capacity |  |  |
| :--- | :--- | :--- |
| Model | UC | Voltage |
| $X S 250 \mathrm{NJ}$ | $35 \mathrm{kA}(\mathrm{AS} \mathrm{2184)}$ | 415 V 50 Hz |
| $X H 250 \mathrm{NJ}$ | 50 kA | 415 V 50 Hz |
| DC use | UC $\left.{ }^{3}\right)$ | Voltage |
| XS250NJ | 40 kA | 250 VDC |
| $X H 250 \mathrm{NJ}$ | 40 kA | 250 VDC |

Refer this section for ratings to AS 3947-2 and AS 2184, and Ics/lcu.

## Dimensions (mm)

| Description |  | Height | Width | Depth | kg |
| :--- | :--- | :--- | :--- | :--- | :--- |
| XS250NJ | 3 pole | 165 | 105 | 86 | 1.85 |
| XH250NJ | 3 pole | 165 | 105 | 103 | 2.1 |
| XS250NJ | 4 pole | 165 | 140 | 86 | 2.4 |
| XH250NJ | 4 pole | 165 | 140 | 103 | 2.6 |



Notes: ') Isolating switch only - no protection.
${ }^{2}$ ) MCCB's only.
${ }^{3}$ ) Poles in series.
${ }^{4}$ ) Short time rating. Refer rating chart for complete technical data. Special low instantaneous magnetic generator protection MCCB's available on request.

## Connections and mountings

MCCB accessories
Front-connection type (FC)

Compression terminals


Attached flat bar


Types of terminal screws (Compression terminal and bar) Breakers and screw size

XE series
(Economical)
Pan headed screw

XS125CJ M8 XH125NJ M8 XM30PB M5

XS125NJ M8 XH125PJ M8

Hex socket head bolt


XE225NC M8
8

| XS250NJ | M8 | XH250NJ | M8 |
| :--- | :--- | :--- | :--- |
|  |  | XH160PJ | M8 |
| XS400 | M10 | TL250NJ | M10 |
| XH400 | M10 | TL400NJ | M10 |
| XV400 | M10 | XH250PJ | M10 |

Connections and mountings
MCCB accessóries
Rear-connection type (RC)

Bolt stud
Horizontal (standard)

Vertical


Applicable breakers
Horizontal ') XS1250, XV1250NE
Vertical XS1600, XS2000NE XS2500NE.

Notes: The arrangement of the flat bar can be made by the user.
If not specified the horizontal arrangement will be supplied.
${ }^{1}$ ) Vertical arrangement also available on request, contact NHP for details.

## Types of connections and mountings

Plug-in Type
Switchboard use


Types of plug-in mounting blocks for
switchboard use


## Plug-in type

Degree of protection
The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529
Standard Safety Trip (Trip first plug-in mechanism) indent.

- The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in' the breaker when it is in the "ON" position.


## Application table (up to 100A frame)

| Breaker | IP cover code | Pole | Qty Req. |
| :--- | :--- | :--- | :--- |
| $X S 125$ | IP 20 | $2,3 P$ | $1=2$ |

XH125

IP 20 degree of protection and safety trip ${ }^{1}$ ) are available for plug-in type breakers, for switchboard and distribution board use.

## Types of connections and mountings

## Draw-out type (DO indent)

Two-position type i
Applicable breakers

- XS series

XS400, XS630, XS800, XS1250.

- XH series

XH160, XH250, XH400, XH630, XH800.

- The plug-in type breaker is housed in the draw-out cradle.
- The draw out cradle has two positions "connected" and "isolated".
$\square$ The auxiliary circuits are automatically connected or isolated by the auxiliary circuit terminals on the plug-in breaker.Manual connector type is available.
- Safety trip (first draw out mechanism). The breaker will trip automatically if it is drawn out while still in the 'on' position.
$\square$ Position keylock in isolated position (optional). Available on request.IP 20 degree of protection (optional). Available on request.


MCCB Technical data
$\sqrt{N}-1$ P

Crimp lưgs (compression type)



| 400 | XS400CJ <br> XS400NJ |
| :--- | :--- |
|  | XS4OS |



XS400NE XH400NE XV400NE XS400SE XH400SE XH250PJ TL250NJ TL400NJ XH400PJ XH400PE


| XH40ONE |
| :--- |
| XV40ONE |
| XS400SE |
| XH400SE |
| XH250PJ |
| TL250NJ |
| TL400NJ |
| XH40OPJ |
| XH400PE |

$630 \quad \mathrm{XS630CJ} / \mathrm{NJ}$

800 XH63ONESE
 XS630NE/SE XS800NJ/PJ XS800NEISE XHBOONE/SE XH800PE

## 1250 <br> XS1250NE <br> XV1250NE



Commercially available compression terminals available from CABAC - Cable Accessories and JST Australia.
Key: CAL = CABAC lugs
MT = JST lugs

## Connection

(one electric cable)
If low clearance occurs use a recommended tape or insulation.


Connection
(two electric cables)
If low clearance occurs use a recommended tape or insulation.

## XS250NJ, XH250NJ

Time/current characteristic curves


Ambient compensating curves



Breakers with terminal bars available on request.


Plug-in (optional)

Mounting block


Drilling plan


Preparation of conductor
(optional)
With terminal bars


Drilling plan


Note: Breakers with terminal bars available on request.

Rear-connected (optional)


Note: In the standard shipment made, both terminals on the line side and the load side are in a horizontal direction.

Panel mount


Panel cut out dimensions shown give an allowance of 1.0 mm around the handle escutcheon.

Plug-in (optional)


Outline dimensions (mm)


- Breakers with terminals bars available on request.

Rear connected (optional)


Note: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction.
Plug-in (optional)
Mounting block



Note: For dimensions and selection of motors for TL225F refer to NHP.
ASL: Arrangement Standard Line
나: Handle frame centre line

Outline dimensions (mm)
Front connected (standard)


Rear connected (optional)


Note: In the standard selection mode, both terminals on
 the line side and the load side are in the horizontal direction

## Plug-in (optional)




ASL: Arrangement Standard Line
it: Handle frame centre line

## Mîníature circuit breakers and fuse fault current limiters co-ordination chart

For fault current levels up to 50 kA at 415 V


Tembreak MCCB's
XS125NTCJUN

Notes: ') Minimum fuse size is based on grading under overload of one MCB with one set of fuses. Where a single set of fuses protects more than one MCB, the minimum fuse size shall be increased to allow for load biasing effects.
${ }^{2}$ ) Maximum fuse size based on testing to AS 3439.1 clause 8.2.3.

Tables based on the following maximum pre-arching $1^{2} t$ for both BS 88 and DIN fuses:
$160 \mathrm{~A}-0.62 \times 10^{5}, \quad 200 \mathrm{~A}-1.2 \times 10^{5}, \quad 250 \mathrm{~A}-2.1 \times 10^{5}$.
Suitable fuses include NHP, GEC, Siemens and Bovara-Crady.
Fuses with higher current ratings may be used providing $1^{2} t$ values are equal to, or less than the levels above.
Semi-conductor fuses have very low $l^{2} t$ values and may suit some applications.
Attention is also drawn to AS 3000 clause 7.10 .4 .4 regarding the use of fault current limiters in installations containing fire and smoke control equipment, evacuation equipment and lifts.

A higher reliance on electrical supply and safety in commerce and industry has increased awareness in circuit breaker technology and applications. Additionally, while maximising system safety and reliability, efficient economy of overall costs is also of great importance.
The combination of these factors has given rise to more precise methods of circuit breaker application.
Two common terminologies relating to general power backup and system protection are: Selectivity (Discrimination) and Cascading (Back-up). In general terms, Selectivity is used to improve system reliability and to ensure a continuous supply of power to as high a degree as possible. Cascading on the other hand is where an upstream breaker is used to "back-up" a lower specification breaker installed downstream to clear a fault current, and is generally used where economics plays a significant part in system design.

## Selectivity (Discrimination)

Previously known as "Discrimination", the most basic form of Selectivity is where two circuit breakers are connected in series. A higher amperage breaker is installed upstream, and a lower amperage breaker downstream. Should an overload or short circuit occur downstream, the downstream breaker will trip, but the upstream breaker will not, hence feeding parts of the system which are fault-free. This is the concept of Selectivity.
Selectivity is generally used, for example in critical applications, feeding essential loads. It is important to ensure total installation power is not lost due to a small or minor fault in a sub part of the overall electrical system, for example in a local distribution board. Total power loss could affect vital systems such as in Hospitals or Computer Centres etc.
The principle of Selectivity (Discrimination) is based upon an analysis of several types of circuit breaker characteristics. These include tripping characteristics (timecurrent curves), Peak Let Through Current (limak $)$ and Energy Let Through ( ${ }^{1} \mathrm{~T}$ ).
Selectivity can be "enhanced" beyond the breaking capacity of the downstream device provided it is backed up by an appropriately selected upstream device, which should not trip (unlatch) under stated conditions.

## Cascading (Back-up)

Cascading is achieved by using an upstream device to assist (back-up) a downstream device in clearing a fault current that happens to be greater than the breaking capacity of the downstream device.
In Cascading applications, the upstream device may have to trip (unlatch) in order to give sufficient protection to the downstream device, thus interrupting supply of power to all devices downstream. Therefore, Cascading is generally used in applications involving the supply of non-essential loads, such as basic lighting. The main benefit of Cascading is that in certain circumstances circuit breakers with breaking capacities lower than the prospective fault level, and hence lower in cost, can be safely used downstream provided it is backed-up by the relevant upstream breaker.

## Cascade / Selectivity Tables

The Selectivity and Cascade tables shown in the following pages are structured as follows.


Selectivity: The Selectivity or Enhanced Selectivity limit of the two nominated devices in series. Up to this level of fault current the downstream device will trip (unlatch) before the upstream device. Above this level, the upstream may also trip.
Cascade: The enhanced or maximum downstream fault current that can be safely interrupted when both breakers are installed in series. Both breakers may trip (unlatch).
The Selectivity and Cascade levels stated by NHP are fully compliant with the requirements of the applicable standards. Selection of breakers should be in accordance with the selection tables.
The figures stated in NHP tables are for nominated Terasaki devices only, and should not be used as guidance for using alternative brands of circuit breakers.

## TemBreak NCCB's and Safe-T/Din-T MCB's - Selectivity and Cascade tables at 415V

Guide


Upstream MCCB

| Downstream |  | XS125CJ | XS125NJ | XH125NJ | XS250NJ | XH250NJ | XS400CJ | XS400NJ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| MCB | kA (rms) | 18 | 30 | 50 | 35 | 50 | 35 | 50 |



Note: ') Dependant on the number of poles. Refer to NHP.

## TemBreak Plứs MCCB's - Selectivity and Cascade tables at 415V

Guide


## Selectivity Cascade

## Upstream MCCB

|  |  | $50$ | $65$ | $50$ | $65$ | $50$ | $65$ | $65$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| KS125Cd |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |
| KH400E, |  |  |  |  |  |  |  |  |  |
| 65 w |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
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| $x^{x}$ |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |
| Xr800SE -365 , 6 |  |  |  |  |  |  |  |  |  |
| X4800PE |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Application data

Standard TemBreak MCCB's - Selectivity and Cascade tables at 415 V
Guide


## Upstream MCCB

| МССВ |  | 50 | $35$ | $50$ | $35$ | $50$ | $50$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |
| XSI25NO <br> 4303 <br> - -150 <br> $3 / 30$ <br>  <br> 6150 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| $\times \mathrm{K} 250 \mathrm{NO}$ |  |  |  |  |  |  |  |  |
| XS4009 $0^{2}$ |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XS400NE 2 |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |
| XH630NE |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XS8800NE <br>  |  |  |  |  |  |  |  |  |
| 仿S1250NE. |  |  |  |  |  |  |  |  |

## Upstream MCCB

|  |  | $45$ | $65$ | $50$ | $65$ | $65$ |  | $65$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |
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| Cun 25 |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |
| (1h250NJ / w |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |
| XHAOONE $65$ <br>  |  |  |  |  |  |  |  |  |
| <s6630cy <br>  <br> 45 <br>  |  |  |  |  |  |  |  |  |
| XS63ONY 65 <br>  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XH630NE |  |  |  |  |  |  |  |  |
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## Standard TemBreak MCCB's - Sêlectivity and Cascade tables at 415 V

Guide


| CB | kA | $85$ | $65$ | $100$ | $100$ | $100$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| X1125N1 5 K225NC |  |  |  |  |  |  |
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| (S250N0 4 , 35 |  |  |  |  |  |  |
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| XS400NT, \% \% w w |  |  |  |  |  |  |
| KS400NE |  |  |  |  |  |  |
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| XS630ct |  |  |  |  |  |  |
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| S S 630 NE <br> WHW Wher 50 485 $\square$ $15 \% 65$ 20 |  |  |  |  |  |  |
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## Motor Stalting - Introduction

Generally, an item of switchgear is selected on the basis of one or more performance criteria, be it current/power carrying or interrupting capabilities.

Additional consideration is often necessary when several different pieces of switchgear are connected in series, none more so than in motor starting applications. As motors play a significant part in most modern day electrical systems it is important to ensure that the components of switchgear controlling and protecting the motor will interact with each other, or in other words, they are "co-ordinated".

In order to protect and operate a motor several components may be used, each with a different function. A typical set-up is as follows:







## M

What problems can occur?
At the instant the motor is supplied with power it draws an "in-rush current" to its terminals, before gradually decaying to a normal operating current.
Should the in-rush current be high, it could be detected by the SCPD and classed as a fault current. If a high in-rush current should occur or even after repeated stop-start (inching) operations of the motor the SCPD may trip, albeit without a fault in the system. This is commonly known as "nuisance tripping" of the SCPD.

Special care must be taken when selecting a SCPD for motor-starting applications to prevent nuisance tripping, and at the same time ensuring adequate protection to the motor and associated cabling.

Another function of the SCPD is to protect the control device (e.g. contactor) from high-current, high-energy faults. Therefore, attention must also be paid when selecting an SCPD-Starter (contactor + thermal overload relay) combination.

When clearing a fault every SCPD has a finite opening time, which will result in an amount of fault current and energy being "let-through" to the downstream system and other devices. At the same time, a control device, such as a contactor can only withstand a finite level of fault current and energy, otherwise internal damage could occur.

Even at relatively low fault levels the electromagnetic forces created by the fault current can cause the contacts of a contactor to lift. This can cause heating or even mild arcing which in turn can damage or weld the contacts of the contactor.
Furthermore, the let-through current of the SCPD can distort the bi-metal strip in the overload relay. This can prevent the restoration of the bi-metal strip to its original configuration on cooling, altering the relay's protection characteristics and resulting in under or over protection of the motor.

What solutions are available to me?
Good component design in association with correct component co-ordination is the only way to ensure reliable protection and operation under abnormal condition.

Terasaki circuit breakers and Sprecher + Schuh starter combinations are tested to provide full and safe co-ordination for most motor starting applications.


Motor Starting

## What is co-ordination

The motor starter consists of a combination of contactor, overload relay and Short Circuit Protection Device (SCPD) being either fuses or circuit breakers.
During motor starting and at normal loading, the overload relay protects both the motor and cables by tripping the contactor in a time inversely proportional to the current. However, under short circuit conditions, the response time would be too long and the fuses or circuit breakers must takeover to interrupt the fault current therefore limiting energy passed through the starter components. When this is successfully achieved, the combination is said to be co-ordinated.
It is a requirement of the Australian Standard AS 3947.4.1 that combination motor starters are capable of withstanding the effects of load side short circuits. Some damage to the combination is permitted, but this must be confined and not present a risk to the operator, or damage equipment adjacent to the starter.

Contactors and thermal overload relays only have limited ability to withstand the high current associated with a fault such as an internal motor short. Their design is optimised for performance at much lower currents and to design in the ability to control or withstand high fault levels would add to costs and possibly reduce its performance at normal levels.

## The standards

The requirements of several standards can be applied to these combination units. The Wiring Rules, AS 3000, are concerned mainly with setting standards for the fixed wiring. In this regard the concern is the wiring between the protection device and the motor.
As motors can experience short term overloading the current rating of a fuse can be up 4 times and a circuit breaker 2.5 times the full load rating of the motor. The Wiring Rules allow the overload protection and the short circuit protection to be provided by different devices. This allows magnetic only circuit breakers, or back-up type fuses, to be used in conjunction with a contactor/thermal overload relay configuration.
Isolating switches must also be provided in the motor or control circuit. These are to be in clear view of any person working on the motor, or provided with a locking device.

AS 3947.4.1 specifies testing requirements for the combination of components required to perform the motor control and protection functions. If the equipment has been mounted in a switchboard it is possible to meet the testing requirements of AS 3947.2 short circuit withstand of the outgoing circuit at the same time as the tests to AS 3947.4.1 are performed.

Both standards look at the performance of the equipment when a fault occurs on the outgoing circuit. It is accepted in these standards that some damage may be sustained by the components of the starter when subjected to short circuit conditions.
AS 3947.2 requires that during the tests the equipment installed in the switchboard performs in accordance to its own standard. A selection by the customer of the performance required needs to be made, as AS 3947.4.1 allows for Type ' 1 ' and Type ' 2 ' performance.

Type '1'
Under short circuit conditions the starter shall not cause danger to persons or the installation. The starter itself may need repair.
Type '2'
After a short circuit the starter is suitable for further service. A contact weld is permitted, but it must be easily separated - for example, by a screwdriver, without significant deformation.

Type ' 2 ' co-ordination does not mean the starter is suitable for normal operation without inspection/repair of the contacts. So, in both cases it is important that the condition of the starter is checked, to ensure that the SCPD has operated and that no damage has taken place.

Notes: IEC Standards are the basis of many Australian Standards. AS 3947.4.1 is equivalent to IEC 947.4.1 and AS 3947.2 is equivalent to IEC 947.2.
Both Australian standards list some amendments to the IEC versions.

Typical arrangement for co-ordination test


## Motor Stärtíng Protective devices selection

In most cases very little difference will be noticed in the service performance of a system using fuses as against circuit breakers.
The circuit breaker is easier when it comes to restoring power, but as tripping should only be the result of a system fault it is unwise to reclose the circuit breaker without finding the cause. In this regard it is normal for only a "skilled person" to attend to fuse replacement and they are more likely to check for other problems.

As the circuit breaker or fuse is operating in conjunction with separate motor overload protection, it is the contactor which responds to overload problems. This is different to a protective device on a distribution circuit. For this application the advantages of the circuit breakers easy return to service has caused a general trend towards using circuit breakers.

Consideration should be given to preventing unskilled people from reclosing a tripped circuit breaker in a motor control application. This can be done by making the switchboard only accessible to the correct people, or by requiring the switchboard to be opened to reset the circuit breaker.

It must be assumed with both Type '1' and Type '2' co-ordination that if the short circuit protective device has operated there is a fault in the motor, or wiring to it and that the starter itself needs attention.

It is the let-through energy of the protective device which determines the damage to the starter. As this varies greatly between different models, it is essential that only proven combinations are used.
NHP, Sprecher + Schuh and Terasaki have now conducted many tests on different combinations and these are detailed in the co-ordination tables.

## Terasaki circuit breakers for short circuit protection

Terasaki circuit breakers have been tested in combination with Sprecher + Schuh contactors and overloads and can be used for Type ' 1 ' and Type '2' co-ordination requirements. (Refer to following tables for actual combinations).

## TemBreak

A new generation of MCCB's offering a choice of 3 series (economical, standard and high fault) and two types, ie, adjustable thermal magnetic or microprocessor based solid state OCR are available from Terasaki. Both types have common construction features and interchangeable plug-in accessories. TemBreak thermal-magnetic MCCB's offer a wide adjustment range, with $63 \%$ to $100 \%$ of rated current. Each MCCB is individually calibrated to ensure precision tripping on overcurrent.
TemBreak electronic type
The rated current of the electronic type TemBreak is adjustable in 15 steps from $50 \%$ to $100 \%$ of the nominal rated current, using the base current (lo) select switch and the pickup current (I1) setting dial.
This is one of the essential features for precise protection co-ordination and for low voltage distribution systems.

## TemBreak motor protection circuit breaker

The XM30PB circuit breaker will protect contactor starters with direct connected overcurrent relays with ratings 1 amp to 12 amp in systems with up to 50 kA rms prospective short circuit. The protection is due to the special current limiting effect of the XM30PB.

## Motor starter protection

The XM30PB circuit breaker has been developed for motor starter protection and is suitable as the Short Circuit Protection Device (SCPD) for motor starters equipped with either direct connected or CT connected overcurrent relays.

## XM30PB compared to HRC fuse

The circuit breaker tripping characteristic is more suitable for protection of starters than the HRC fuse. Unlike the HRC fuse, the breaker can be selected to trip instantaneously at a predetermined current level just lower than the maximum breaking current of the starter contactor, thus always protecting the contactor against opening fault currents higher than its capability. This can be seen from the typical breaker and fuse tripping characteristics compared to the contactor breaking capacity in figure 1.

No protection is provided by the fuse when the overcurrent is of value B to C amps should the contactor open by earth fault relay. If the breaker is used as a SCPD then protection is provided for all currents in excess of the instantaneous trip current of the breaker. Also, the circuit breaker can be tripped by earth fault relay and so prevent the risk of contactor damage due to the long delay of the HRC fuse interruption if the fault current is of a value between $B$ and $C$.

Fig 1.


A - Normal CA 3 rating of contactor B - Maximum breaking current of contactor C - Cut-off current of fuse I - Instantaneous tripping current of breaker

## Type '1' short circuit co-ordination Motor starter co-ordination table for DOL starting 50kA at 415V to AS 3947-41



|  | amps |  | Sprecher + Sc contactor type | hermal overl lay type ${ }^{2}$ ) | range amps |
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Notes: ') Use 'magnetic only' breaker. Refer NHP for details.
${ }^{2}$ ) Thermal or electronic overload relays may be used. Some combinations also achieve Type '2' performance. CA 7 contactor can be replaced with equivalent CA 3 size.

## Type '2' short circuit co-ordination Terasaki Din-T at 50kA

The 10kA Din-T miniature circuit breaker gives an amazing 50kA performance when used in the combinations shown in the co-ordination tables. For the low current ratings, the resistance of the thermal overloads assists in reducing the current to a level that the Din-T can handle with ease. For the higher ratings a Sprecher + Schuh limiter block lifts the combined performance to the 50 kA level.
All the listed Din-T combinations include a rotary isolator which allows external control. To reset the starter after a short circuit, access to the breaker is required. This can be used to prevent unskilled operators from reclosing the motor starter after a fault.
It should also be remembered that whenever the circuit breaker trips under high fault currents, the contactor must be checked for welded contacts.


KTA 3 Motor starter combination

## Type '2' co-ordination table for Din-T circuit breakers with rotary isolator DOL starting 50kA @ 415V to AS 3947.4.1

|  | $415 \mathrm{~V}$ | olato | eak | Sprech Schuh limiter | Sprecher + Schuh contactor | ermal verload | verlo |
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## (9) MEMSAM

# Type ' 2 ' short circuit co-ordination <br> Motor starter co-ordination table for DOL starting 50kA at 415V to AS 3947-4-1 



|  |  | Terasak circuit breaker | contactor ty |  | amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
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Notes: ${ }^{1}$ ) Use 'magnetic only' breaker or next higher circuit breaker/contactor combination. Refer NHP.
${ }^{2}$ ) Use with separate mounting bracket.
${ }^{9}$ ) Thermal or electronic overload relays may be used.
Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

## Type '2' short circuit co-ordination Motor starter co-ordination table for DOL starting 65kA, 415V to AS 3947-4-1

Terasaki
circuit
breaker

|  |  | circuit breaker |  | overioad relay ${ }^{1}$ ) | range amps |
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Notes: ') Thermal or electronic overload relays may be used. ${ }^{2}$ ) Use with separate mounting bracket.
Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

# Type '2' short circuit co-ordination Motor starter co-ordination table for DOL starting 85kA, 415V to AS 3947-4-1 

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Notes: ') Thermal or electronic overload relays may be used.

Motor circuit application table for DOL starting
General applications

## High fault range



Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ of full load current (FLC) continuously and $600 \%$ of FLC for at least 10 seconds. Lower circuit breaker ratings are possible in some applications. Refer NHP.
${ }^{1}$ ) 80,100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) Use magnetic-only TemBreak MCCB. Refer NHP.
Adjustable magnetic trips set to high. Thermal magnetic TemBreak adjustable $63 \%-100 \%$ of NRC (nominal rated current). Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are available from stock. Refer NHP.

## Mơtor circuit application table for reduced voltage starting General applications

Breaker type and current rating, star delta, auto transformer resistor or reactance starting

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|  |  |  |  | XS125N |  |  | 400 | XS630SE | 00N |  |
|  |  | C \& D |  | XH125NJ |  | XS250NJ | XS400 | XS63 | X H 8 |  |
|  | (amps) | Curv | Safe | TL100NJ | XE225 | XH | XS400 | XS630N | XS800 |  |
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| $160$ |  |  |  |  |  |  |  |  |  |  |
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Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ FLC continuously and $350 \%$ FLC for at least 20 seconds.
') 80, 100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) TL100NJ up to 100A only.
If co-ordination to IEC 947-4-1 is required refer to Type 1 and 2 co-ordination tables, contact NHP.
Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are available from stock. Refer NHP.

Motor circuit application table for DOL FIRE PUMP starting duty
Breaker type and current rating (A)


Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ FLC continuously and $600 \%$ FLC for at least 20 seconds.
${ }^{1}$ ) 80,100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) TL100NJ up to 100A only.
Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of ' $D$ ' Curve are available from stock refer NHP.

Application data

Motor starting table for DOL starting at 1000 VAC 50 Hz



TemBreak XV400NE mining breaker


[^12]
## MCCB's for protection of Power Factor Correction (PFC) units

In circuits containing capacitor banks for Power Factor Correction (PFC) two conditions that the circuit breaker must overcome are as follows:

1. Voltage surges during MCCB opening.
2. Nuisance tripping due to in-rush current.
3. Voltage surges during MCCB opening

At the instant where the MCCB has to open, the voltage developed across its contacts can be up to twice the supply voltage, which can have damaging consequences should the breaker be slow to operate. If this worse case scenario actually occurs a potential re-arcing can take place across the contacts of the MCCB, until the breaker has fully opened and the distance between the contacts is at a maximum.
Re-arcing at each instant can be:
1st re-arcing - $3 \times$ supply voltage
2nd re-arcing - $5 x$ supply voltage
3rd re-arcing - $7 \times$ supply voltage
Internal capacitor damage will occur if the voltage level is greater than the capacitor's Dielectric Strength. With modern-day protection devices, (for example the Terasaki TemBreak MCCB's) this problem will not occur.
The numerous cases of re-arcing are mainly a result of older style "dependant manual closing" devices, which rely on the operator speed for opening or closing.
All Terasaki MCCB's are of the "manually independent closing" type, with high speed opening to prevent re-arcing between the contacts.

## 2. Nuisance tripping due to in-rush current

 When feeding a circuit containing a PFC unit the circuit breaker and the PFC unit can be exposed to a large in-rush current, equal to the instantaneous value of the power source. The end result of this is a large in-rush current, which could cause the circuit breaker to operate instantaneously due to its short-circuit protection. (The value of in-rush current will depend on the source voltage, the inductance and reactance in the circuit).Special care should be taken to ensure that the MCCB selected will not nuisance trip due to high in-rush currents.

The table below shows typical MCCB selections for varying capacitor ratings, and the breaker selection is by a rule-ofthumb.

$$
\begin{equation*}
\text { Capacitor Rated Current }=\frac{\text { KVAR } \times 1000}{\sqrt{3 \times V}} \tag{A}
\end{equation*}
$$

## kVAR: Capacitor Rating

## V: Source Voltage

MCCB Rating = Capacitor Rated Current $\times 1.5$ (A)
Once the MCCB rating has been determined, the MCCB type should be selected according to the short circuit fault level of the system.

## MCCB's selection for power factor capacitor application



Note: ') Select applicable short circuit rating required by system specifications.
${ }^{2}$ ) TemBreak Plus MCCBs can also be used.

## MCCB use in higigh frequency ( 400 Hz ) applications

General<br>Terasaki TemBreak MCCB's are designed to operate primarily in 50 or 60 Hz systems. However, it is possible to use the same MCCB's in high frequency $(400 \mathrm{~Hz})$ applications provided consideration is taken to the effects high frequencies will have on the breaker.<br>A consequence of high frequencies is an increase in Eddy currents in conductors, including those internal to the breakers. This generally causes an increase of temperature in and around the breaker. As such, some derating allowances must be made when selecting a breaker in these 400 Hz systems.<br>Thermal Magnetic MCCB's<br>In low overload (thermal) regions the current required to trip the MCCB is reduced as a result of the heat generated due

to the higher Eddy currents. As a result the thermal protection must be derated to take the heating effect into account.

In short-circuit (magnetic) regions, the demagnetising effects of the Eddy currents mean that a larger fault will be required to trip the breaker. The rule of thumb generally used is that the Magnetic/Instantaneous Trip setting will be approximately twice that at normal $50 / 60 \mathrm{~Hz}$ operation.

## Electronic MCCB's

Electronic MCCB's offer better performance at higher frequencies, although some consideration must be taken with regards to the heating effects caused by the Eddy currents. The figures in the table give the maximum Over Current Relay (OCR) rated current setting ( $\mathrm{I}_{0} \times \mathrm{I}_{1}$ ) that should be used when in high frequency applications.
MCCB
Model

Note: When used at 400 Hz , the rated current setting of the OCR must not exceed the values shown in Column 4.

## Circuit breaker selection for DC applications

The characteristics of an MCB or MCCB for DC applications are different from AC. The main differences are as follows:

1. Maximum permissible voltage is reduced in value (refer table).
2. Number of electrical operations is reduced (refer table).
3. Magnetic trip current increases by $40 \%$.

Selecting the circuit breaker
When selecting the MCB most suitable for the protection of
DC circuits the following criteria must be considered:

- Rated current.
- Rated voltage which determines the number of poles required to be involved in the interruption of the circuit.
- The type of DC system used.
- Maximum short circuit current to determine the breaking capacity.
As a general rule the Isc (short circuit current at the battery terminals) can be calculated as follows:

$$
\mathrm{Isc}=\frac{\mathrm{Vb}}{\mathrm{Ri}}
$$

Where Vb - maximum discharge battery voltage
Where Ri - internal resistance (sum of all calls resistance) generally expressed in Ampere/hour capacity of the battery.

Terasaki MCB use in DC systems


Example: For a Din-T10 to break 10kA at 110V DC it must have 2 poles connected in series.

## Breaking capacities of TemBreak MCCB in DC systems

мCCB


## Notes:

') Time constant $(L / R)<=15 \mathrm{~ms}$; excludes 50/63A where the time constant (L/R) <= 4ms.
${ }^{2}$ ) Special version of the standard AC circuit breaker. Standard circuit breakers cannot be used at these ratings. Please specify for use on 500 or 600 V DC on application. Indent only.
${ }^{3}$ ) Magnetic trip only, without overload protection. Indent only.
For voltage levels up to and including 250V DC standard 2-pole breakers maybe be used, with both poles connected in series. For voltage levels greater than 250V DC 3-pole breakers must be used, with all three poles connected in series as shown.
The time constant ( $L / R$ ) of the circuit should be:
less than 2 ms at rated current.
less than 2.5 ms for overload ( $2.5 \times \mathrm{in}$ ). less than 7 ms for short circuit $\leq 10 \mathrm{kA}$. less than 15ms for short circuit > 10kA.

The following connection diagram should be applied to TemBreak circuit breakers when the voltage is greater than 250 V DC.


## Circuit breaker selection for DC application (cont.)

Arrangement of breaking poles according to type of system.

Both poles insulated from earth
Protection only


The poles required to interrupt the fault can be divided between the $(+)$ and $(-)$ polarities. The total number of poles connected in series should be capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$.

Sharing the circuit breaker interrupting poles between both polarities also ensures isolation as well as protection of the system.

One polarity of the DC supply is earthed
Protection only


Full protection is assured if the total number of poles in series on the side not connected to earth are capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$.
If full isolation is required then at least one interrupting pole is also required on the earthed polarity side.

Protection and Isolation


Protection and Isolation


## Protection and Isolation

The centre point of the DC supply is earthed


To ensure full protection the number of poles connected in series on each polarity must be capable of breaking the maximum short circuit current, but at a reduced voltage level of $U_{b} / 2$.
Having circuit breaker interrupting poles breaking both polarities ensures isolation as well as protection of the system.

Application data

## Selection of MCCB's for use in welder circuits

1. Definitions
$\mathbf{P}=\quad$ Rated capacity of welder in KVA.
$\mathbf{V}=\quad$ Welder rated voltage.
I1 = Maximum primary current (PN).
$\mathrm{T}_{1}=$ Current 'ON' period.
$T_{2}=$ Current 'OFF' period.
$\mathbf{T}_{1}+\mathbf{T}_{\mathbf{2}}=$ One welding cycle time.
B = Duty ratio, current 'ON' period divided by one welding cycle.
$\mathrm{Ie}=\quad$ Thermally equivalent continuous current.

## 2. MCCB selection

a) Current rating

It can be seen from the diagrams below that the welder only draws current intermittently. MCCB selection should be based on the thermally equivalent continuous current, i.e. the current which would produce the MCCB average temperature shown in the diagram below.
It can further be seen that the MCCB temperature will not be constant but will vary as the load varies.


## The thermally equivalent continuous current, le, may be calculated from:

$$
I e=\frac{P \times 1000}{V} \times \sqrt{B} \quad\left(B=\frac{T_{1}}{T_{1}+T_{2}}\right)
$$

Note: The rated capacity of a spot welder is normally expressed in terms of its $50 \%$ duty ratio, ie. $B=0.5$.

Once an MCCB has been selected, it is necessary, to compare the maximum primary current $I_{1}$ and the current 'ON' period, $\mathrm{T}_{1}$ with the MCCB characteristic curve to ensure that it will not trip.


Note: A tolerance of 10 to $15 \%$ should be included to allow for variations in the supply voltage and equipment.

## General guide lines for MCCB selection

| Selection factor | MCCB rating |
| :--- | :--- |
| Resistance welders | 3.00 max |
| Transformer arc welders | 2.00 max |

SAA wiring rules states that a circuit breaker protecting a circuit from which one or more welders are supplied may be greater than the rating of the protected conductor calculated as follows:

The maximum demand of the circuit excluding that of the largest welding machine plus
i) Three times the primary current of the largest resistance welding.
ii) Two times the primary ratings of the largest transformer arc welders.

## Selection of MCCB's for use in welder circuits

b) Instantaneous setting

The MCCB's instantaneous trip setting should be high enough to avoid nuisance tripping due to the welding transformers excitation inrush current. When voltage is supplied to the transformers primary side, the iron core is saturated. This results in the flow of a large inrush current caused by a combination of the DC component of the voltage at the instant of closing and the residual magnetic flux of the transformer. The transformer input current value when the welder secondary is completely short-circuited is about $30 \%$ higher than the value calculated from the nominal maximum power input of the welder. So the maximum welder input current, Im, at the start of welding is given by:

$$
I_{m}=\frac{P_{m} \times 1000}{V} \times 1.3 \times K
$$

The value of $K$ varies depending on the type of welder control employed. (Some form of synchronous closing is nearly always employed in order to stabilise the welding work and to prevent nuisance tripping of the MCCB).
$K=1$ to 1.5 for synchronous type with peak control.
$K=1.4$ to 3 for synchronous type without peak control.
$K=2$ to 6 for non-synchronous soft start type.
If the protection of the thyristor stack is also required, the instantaneous trip setting must be greater than Im , but less than the surge on-state current rating of the thyristor stack:

Im $_{\text {m }} \quad<\|_{\text {inst }}<$
1.
1.1
where:
Is = surge on-state current rating of thyristor stack, in A
Im = maximum welder input current at start of welding, in $A$
$I_{\text {wst }}=$ MCCB Instantaneous trip setting, in $A$
$1.1=$ Factor to allow for $\pm 10 \%$ tolerance on the instantaneous setting
c) MCCB breaking capacity

The MCCB breaking capacity should be higher than the estimated short-circuit fault level of the system.

## Pŕimary LV/LV transformer protection

When selecting an MCCB to protect the primary of an LV/LV transformer, the inrush current during initial energisation must be taken into account.
The magnitude of inrush current for any transformer is governed by several variables:

1. The primary winding resistance.
2. The supply impedance.
3. The excitation current.

The excitation current is, in theory at a maximum when the voltage is at a minimum, and vice versa.
Usually the level does not exceed 30 times the normal operating current.
If the inrush current is not known then a rule of thumb is that it is approximately 15 x the Primary Current.


The above breaker selections are based upon inrush currents calculated using the table below

|  | Single-phase transformer | Three-phase transforme |  |
| :---: | :---: | :---: | :---: |
| (kVA) | First peak Decay tim <br> multiplier <br> constant  | multip | Decay tim constant |
|  |  | 146242 |  |
| 15220 |  |  |  |
|  | 烈学 |  |  |
|  |  | $524$ |  |
|  |  |  |  |
|  |  | $68$$6810$ |  |
|  |  | 5v46 |  |
|  |  | 614. |  |
|  | 14k |  |  |

Notes: First peak multiplier is the first peak current as a multiple of the transformer rated current.
The above table/multipliers are in general larger than the practical current levels, as the current limiting by the circuit impedance is not taken into account.

## MCB selection fór high pressure sodium lamps

## Assumption

1. The maximum inrush current which the circuit will pass is a feature of the current limiting ballast and not the lamp.
Assuming these ballasts comply with the relevant IEC specification the circuit will pass currents not exceeding twice the appropriate lamp nominal current.
2. Run up time 10 minutes with the current decaying exponentially.
3. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.

This table provides details for Din-T type ' $C$ ' MCB's


## Example

Given 42 lamps each 250 W installed on a 415 V 3 phase
system.
Which MCB must be selected?
Number of tubes per phase $=\frac{42}{3}=14$
Therefore from the table above a 32A MCB should be selected.

A short circuit rating as appropriate must be selected.

## NCB selection for fluorescent lighting loads

Assumptions

1. The power rating of the ballast is $25 \%$ of power of the tubes.
2. Power factor -0.6 for non compensated fittings 0.86 for compensated fittings.
3. MCB's are installed in an enclosure with extemal ambient of $25^{\circ} \mathrm{C}$.
4. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.
5. MCB is used for circuit protection only, not switching.

For switching duties of Din-T MCBs refer NHP.

This table provides details for Din-T type 'C' MCB's
Type of
fitting
Power
(W) Number of fittings per phase

## MCB selection for incandescent lighting loads

## Assumptions

1) Tungsten lamps have theoretical inrush current of 14 times normal current, when switched from cold.
2) The circuit impedance typically limits the inrush to 10 times normal running current, the inrush current peaking at 0.0007 seconds falling exponentially to normal running current within 0.1 seconds.
3) Consider the worst case, if all lamps are switched on simultaneously, then nuisance tripping of MCB may result.
4) Above is based on $415 / 240 \mathrm{~V} 3$ phase and neutral or 240 V single phase system and 240 V lamps.
5) MCB is used for circuit protection only, not switching. For switching duties of Din-T MCB's refer NHP.

## Method

In order to cope with this inrush the following formula should be used to calculate breaker size:
Breaker rating $=\frac{W \times 10}{P \times 240 \times 1 \text { inst }}$
Where $\mathrm{W}=$ total wattage
Where $P=$ Number of phases l inst
$=$ Minimum instantaneous tripping co-efficient.
C curve $=5$
D curve $=10$

## TemBreak NCCB clearance requifrements at $380 / 415 \mathrm{~V}$

Clearance requirements for MCCB's (phase to phase and earth).
When MCCB's are called upon to interrupt large short circuits ionised gas and arcing material is expelled from the vents, usually at the top of the MCCB.
This ionised gas is highly conductive and is also at an elevated temperature when it exits the MCCB via the arc vents. Care must be taken therefore to avoid an arcing fault occurring due to the presence of the ionised gas.

Insulating distance from Line-End for 380/415V
When earth metal is installed within the proximity of the breakers the correct insulating distance must be maintained.

WARNING:
EXPOSED CONDUCTORS INCLUDING TERMINALS AT ATTACHED BUSBARS MUST BE INSULATED TO AVOID POSSIBLE SHORT CIRCUITING OR EARTHING DUE TO FOREIGN MATTER COMING INTO CONTACT WITH THE CONDUCTORS.

Notes: When using the terminal bar (optional), the specified insulating distance must be maintained. All dimensions in mm.
When earthed metal is installed within the proximity of the breakers the correct insulating distance must be maintained (refer to Table 1). This distance is necessary to allow the exhausted arc gases to disperse.

Therefore, incoming conductors must be insulated right up to the terminal opening of the MCCB. This also applies to the attached busbars supplied as a proprietory part with the MCCB.
Proprietary type interpole barriers may be used to achieve creepage and clearance requirements.
Conductors must not impede the flow of ionised gas.

This distance is necessary to allow the exhausted arc gases to disperse.


Table 1 below illustrates the min clearance that must be maintained

A Distance from lower breaker to open charging part of terminal on upper breaker (front connection) or the distance from lower breaker to upper breaker end (rear connection and plug-in type)
B1 Distance from breaker end to ceiling (earthed metal)

B2 Distance from breaker end to insulator
C Clearance between breakers
D Distance from breaker side to side plate (earthed metal)

Table 1
This table is valid for $\mathbf{3 8 0 / 4 1 5 V}$


TEBASAKI

## Clearance for mining MCCB's ( 1100 V ) and incoming connections

The arc chamber in Terasaki TemBreak circuit breakers is located adjacent to the LINE side terminals. The chamber is vented through holes located just above each line terminal. The holes are covered by a flap which deflects when arc gases are being expelled. Even at low fault levels the arc gases that are released are very hot and reduce the dielectric strength of the air in the vicinity of the terminals. If care is not taken when installing the TemBreak this gas can cause arcing faults on the incoming bars or cables.

Significant voltage transients may also be produced as inductive circuits are switched and contribute to an arcing fault.

These problems affect all circuit breaker installations to varying degrees.

To ensure that problems are not created by the installation please observe the following recommendations.


## Notes:

1: Always observe LINE/LOAD marking.
2: Ensure insulation on incoming conductors is adequate. Do not use low grade heat shrink (some grades split at operating temperatures).
3: Minimum clearance to earth metal,
Above and below breaker - 120mm (XV1250NE-150mm)
To sides of breaker -40 mm .

4: Switchboard construction to be a minimum form 2 to AS 3439.1 with IP3x protection between busbar and circuit break zones.
5: Actual construction can vary to the above but in all cases it is the responsibility of the switchboard manufacturer to ensure compliance to the relevant standard ie. AS 3439.1.
${ }^{6}$ ) TL100EM MCCB's must use a TL100EMTLC lineside terminal cover. XV400 can use either a terminal cover or Interpole Barriers.

## MCCB mountiting angles

The overcurrent tripping characteristics of TemBreak are not influenced by the mounting angles for electronic and thermal magnetic types.

The XM30PB motor circuit protectors however, use an oil filled dashpot style trip mechanism, which can be affected. Refer to the diagram below.

Diagram at right is only applicable to XM30PB motor circuit protectors.


Note:
1: The above diagram applies to an XM30 MCCB mounted either way

## Calculation of circuit fault level

## NHP Nomogram

## Fault calculation

The NHP Nomogram is a simple and easy to use aid. Developed by NHP to enable convenient and accurate calculation of circuit fault current.
When selecting circuit breakers for the use in modern distribution systems, it is important to calculate the fault level and then choose an MCCB with breaking capacity that is either higher or at least equal to the circuit fault current.

## How to use the Nomogram

In the nomogram all you need to know is the size and length of the cable or cables and the size of the Transformer in kVA. The fault level at the terminals of the transformer is very dependant upon the Transformer internal impedance eg. the Australian Standard for a 2000 kVA transformer is $6.5 \%-7 \%$ impedance. This results in a fault level of $40-43 \mathrm{kA}$.

However, many Supply Authorities are now installing low impedance transformer eg. 5\% or less. Thus if the impedance is $5 \%$ then the fault level will be 56 kA . If the impedance is unknown on the side of caution choose $Z=$ $5 \%$ in your calculations.
eg. From the table, the maximum fault level of a 2000 kVA transformer, with $Z=5 \%$ is 56 kA . Proceed then to calculate the resultant fault level by applying the cable size and length in metres to the Transformer secondary fault level and calculate the resultant. By following the example shown it can be seen that the fault level is reduced from 50 kA to 6.7 kA . Shoit circuit calculation nomogram
Please refer to previous page for instructions on use.


## Application notes

A series of application notes are available on Terasaki breakers from your nearest NHP branch. The notes cover the following subjects.

Ref No.
5006
5025
5093
5088
5067
5065
5074
5078
5087
5083
5086
5195

Description
Specification for corrosive proofing of MCCB's
De-rated current of ACB's when enclosed
De-rated current of MCCB's when enclosed
De-rating of TemBreak electronic MCCB's when enclosed
DC applications of ACB's
Reverse connection
Thyristor protection with MCCB's
ELCB's at high frequency
ACB's and MCCB's at high altitude
Circuit breaker life mechanical and electrical
TemBreak UVT: transient response time
Inspection and maintenance of earth leakage and moulded case circuit breakers.

## IP rating protection against ingress of dust and liquids



IP 1st digit
Degree of protection against contact and ingress of foreign bodies

| foreign bodies |  |
| :--- | :--- |
| $0 \quad$ No protection |  |

1 Protection against ingress of solid foreign bodies with diameters greater than 50 mm

2 Protection against contact with the fingers, protection against ingress of solid foreign bodies with diameter greater than 12 mm

3 Protection against contact with wires etc., with diameters greater than 2.5 mm , or ingress of solid foreign bodies with diameters greater than 2.5 mm

4 Protection against contact with wires etc., with diameter greater than 1 mm , or ingress of solid foreign bodies with diameters greater than 1 mm
5 Complete protection against contact with live parts, protection against harmful deposits of dust
6 Complete protection against contact with live parts, protection against ingress of dust

IP 2nd digit
Degree of protection against ingress of liquids

0 No protection
1 Protection against vertically falling water drops

2 Protection against obliquely falling water, up to an angle of $15^{\circ}$

3 Protection against obliquely sprayed water, up to an angle of $60^{\circ}$ from the vertical

4 Protection against sprayed low pressure water from any direction

5 Protection against water-jets from any direction - limited ingress permitted
6 Protection against strong jets of water eg. ship decks

7 Protection against temporary immersion in water
8 Protection against indefinite immersion in water - under pressure
-. PID controller with 'one shot' autotune

- single loop, heat/cool and ramp/soak as standard

Quick code, front face or PC configuration

- easy commissioning and operation using our Windows ${ }^{\mathrm{TM}}$-based software

Universal process input with transmitter power supply

- direct connection for any process signal

Hoseproof front panel and full noise immunity

- reliability in the harshest environments

RS485/MODBUS serial communications

- SCADA, PLC and open systems integration


COMMANDER 100 -the-easy-to use $1 / 8$ DIN controller with extensive application capabilities

## COMMANDER 100

The COMMANDER 100 Universal Process controller is a highly versatile, single loop controller designed to be exceptionally easy to operate and set up.

Universal input and integral transmitter power supply ensure that the COMMANDER 100 has the capabilities to measure a wide range of process signals such as temperature, pressure, flow and level.

Analog, logic and relay control outputs are all fitted as standard, with the option to add further i/o capabilities such as additional relays, remote set point and digital input, to suit your application.

The configuration of the COMMANDER 100 is simply achieved by moving the security switch and entering a simple code from the front panel keys. No passwords, no input links, no complications.

With hoseproof front panel protection and superior RF immunity as standard the COMMANDER 100 has been designed to control reliably in the harshest of today's industrial environments.


KEY: Standard Option


Ramp/Soak Set Point Profiles
The ramp/soak facility available on every COMMANDER 100 provides for a single program, four-segment profile. This facility also includes guaranteed ramp/soak, repeat program, skip and reset.

## Master/Slave and Cascade

Two or more COMMANDER 100s can be used in master/slave, or cascade, configuration with the addition of the remote set point option to the basic unit.


## RS485/MODBUS

Fitted with an optional RS485 serial communication board, the COMMANDER 100 can communicate with PLCs and SCADA systems using the MODBUS protocol.

## Specification

| Summary |
| :--- |
| P, PI, PID single loop controller |
| Autotune facility |
| Fully user configurable |
| Hoseproof front face |

## Operation

## Display

High-intensity 7 -segment, $2 \times 4$-digit LED display
Display range
-999 to +9999
Display resolution
$\pm 1$ digit
Display height
10 mm (0.39inches)

## Configuration

User defined via front panel or PC Configurator

## Standard Functions

## Control types

Programmable for manual, on/off, time proportioning, current proportioning and heat/cool control.
Set points
Local
Remote
4 selectable fixed value
Ramping set point
Profile controller

| Number | 4 ramp/soak segments |
| :--- | :--- |
| Features | Guaranteed ramp/soak, self seeking <br> set point, program repeat |
| Controls | Run, hold and stop from front panel <br> switches |
|  | Run/hold or run/stop from digital input |

Alarms

| Number | Two user-defined |
| :--- | :--- |
| Type | High/low process |
|  | High/low deviation |
|  | Loop break alarm |

## Outputs

## Control output/retransmission

Analog, configurable in the range of 4 to 20 mA
Max. load 15 V ( $750 \Omega$ at 20mA)
Accuracy $\leq 0.25 \%$ of span
Dielectric 500 V d.c. from $\mathrm{i} / \mathrm{p}$ (not isolated from logic $\mathrm{o} / \mathrm{p}$ )

## Logic output

18 V d.c. at 20 mA
Min. load $400 \Omega$
Dielectric 500 V d.c. from i/p (not isolated from control o/p)

## Relay output

One relay as standard (SPDT) - 5A @ 115/230V a.c.

## Analog Inputs

## Number

One as standard
One optional - 4 to 20 mA remote set point input
Input sampling rate
250 ms per channel
Type
Universally configurable to provide (Channel 1 only):
Thermocouple (THC)
Resistance Thermometer (RTD)
Millivolt
Current D.C. voltage

Input impedance

| mA | $100 \Omega$ |
| :--- | :--- |
| $\mathrm{mV}, \mathrm{V}$ | $>10 \mathrm{M} \Omega$ |

## Linearizer functions

Programmable for standard inputs: SqRoot, THC types B, E, J, K, N, R, S, T or Pt100

## Broken sensor protection

Upscale drive on THC and RTD
Downscale drive on milliamps and voltage

## Cold junction compensation

Automatic CJC incorporated as standard
Stability $-<0.05^{\circ} \mathrm{C} /{ }^{\circ} \mathrm{C}$ change in ambient temperature

## Input protection

Common mode isolation $>120 \mathrm{~dB}$ at $50 / 60 \mathrm{~Hz}$ with $300 \Omega$ imbalance
Series mode rejection $\quad>60 \mathrm{~dB} 50 / 60 \mathrm{~Hz}$

## Transmitter power supply

24V, 30mA max. powers one 2-wire transmitter

## Options

One option board can be installed from:
Type 1 - One relay
Type 2 - Two relays + one digital input + remote set point
Type 3 - One relay + one digital input + remote set point

+ MODBUS serial communications
Relay output
SPDT $\quad-5 \mathrm{~A} @ 115 / 230 \mathrm{~V}$ a.c.
Digital input
Type - Volt-free
Minimum pulse -250 ms
(not isolated form remote set point)
MODBUS serial communications

| Connections | - RS422/485, 2 or 4 -wire |
| :--- | :--- |
| Speed | -2.4 k or 9.6 k baud rate |
| Protocol | - MODBUS RTU slave |

## Remote Set Point Input

4 to 20 mA d.c., $100 \Omega$ nominal input impedance
Preset to process variable engineering units
(not isolated from digital inputs)

## Standard Analog Input Ranges

| Thermocouple | Maximum Range ${ }^{\circ} \mathrm{C}$ | Maximum Range ${ }^{\circ} \mathrm{F}$ | Accuracy (\% of reading) |
| :---: | :---: | :---: | :---: |
| B | -18 to 1800 | 0 to 3270 | $0.25 \%$ or $\pm 2^{\circ} \mathrm{C}$ (above $200^{\circ} \mathrm{C}$ ) |
| E | -100 to 900 | -140 to 1650 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |
| J | -100 to 900 | -140 to 1650 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |
| K | -100 to 1300 | -140 to 2350 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |
| N | -200 to 1300 | -325 to 2350 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |
| R | -18 to 1700 | 0 to 3000 | $0.25 \%$ or $\pm 1.0^{\circ} \mathrm{C}\left(\right.$ above $\left.300^{\circ} \mathrm{C}\right)$ |
| S | -18 to 1700 | 0 to 3000 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}\left(\mathrm{above} 200^{\circ} \mathrm{C}\right)$ |
| T | -250 to 300 | -400 to 550 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |


| RTD | Maximum Range ${ }^{\circ} \mathrm{C}$ | Maximum Range ${ }^{\circ} \mathrm{F}$ | Accuracy $(\%$ of reading) |
| :---: | :---: | :---: | :---: |
| PT100 | -200 to 600 | -325 to 1100 | $0.25 \%$ or $\pm 0.5^{\circ} \mathrm{C}$ |


| Linear Inputs | Range |  | Accuracy (\% of reading) |
| :---: | :---: | :---: | :---: |
| Milliamps | 0 to 20 |  | $0.25 \%$ or $\pm 2 \mu \mathrm{~A}$ |
| Milliamps | 4 to 20 |  | $0.25 \%$ or $\pm 2 \mu \mathrm{~A}$ |
| Volts | 0 to 5 | $0.25 \%$ or $\pm 200 \mu \mathrm{~V}$ |  |
| Volts | 1 to 5 |  | $0.25 \%$ or $\pm 200 \mu \mathrm{~V}$ |
| Millivolts | 0 to 50 |  | $0.25 \%$ or $\pm 20 \mu \mathrm{~V}$ |


| Square Root Input | Range |  | Accuracy (\% of reading) |
| :---: | :---: | :---: | :---: |
| Milliamps | 4 to 20 |  | $0.25 \%$ or $\pm 2 \mu \mathrm{~A}$ |

Notes.
Performance accuracy is not guaranteed at extreme low end of thermocouple and sq. root ranges.
ranges.
RTD, 3 -wire platinum, $100 \Omega$ per DIN 43760 standard (IEC751), with range of 0 to $400 \Omega$. Min. span below zero Type T $70^{\circ} \mathrm{C} / 126^{\circ} \mathrm{F}$
$\begin{array}{ll} & \text { Type N } 105^{\circ} \mathrm{C} / 189^{\circ} \mathrm{F} \\ \text { THC standards } & \text { DIN } 43710 \text { ECC } 584\end{array}$
DIN 43760 IEC 75

## Environmental

Operating limits
0 to $55^{\circ} \mathrm{C}$ ( 32 to $131^{\circ} \mathrm{F}$ )
5 to $95 \%$ RH non-condensing
Temperature stability
$<0.02 \%$ of reading or $2 \mu \mathrm{~V} /{ }^{\circ} \mathrm{C}\left(1 \mu \mathrm{~V} /{ }^{\circ} \mathrm{F}\right)$

## Physical

Size
48 wide $\times 96$ high $\times 125 \mathrm{~mm}$ ( $1.89^{\prime \prime}$ wide $\times 3.78^{\prime \prime}$ high $\times 4.92^{\prime \prime}$ )
Weight
$250 \mathrm{~g}(0.5 \mathrm{lb})$ approximate

## Electrical

## Voltage

85 to 265 V a.c. $(50 / 60 \mathrm{~Hz})$
24 V d.c.
Power consumption
< 6VA

## Dimensions



## Wiring Connections



Ordering Guide


## Instrument Coding Example

COMMANDER 100 Universal Process Controller

One additional relay $\square$

85 V to 265 V a.c. power supply

Standard build $\qquad$

Configured to factory standard $\qquad$

The Company's policy is one of continuous produc improvement and the right is reserved to modify the information contained herein without notice.

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ABB Instrumentation 22016 Lenno Como Italy Tel: +39 (0)344-58111 Fax: +39 (0) $344-58278$

- Industry Specific design for the water and waste water industries in diameters from $15 \mathrm{~mm}\left(1 /{ }_{2} \mathrm{in}\right)$ to 2200 mm (88in).
- Unrivalled, fully traceable flow performance. Bi-directional system. Operable flow range: 1500:1


## Ensures:

- more precise revenue measurement; superior control of process; accurate night-flow measurement.
- Submersible and buriable
- inherently suitable for use in flooded environments;
Eliminates chambers and promotes very low installation costs.
- Designed, manufactured and calibrated to internationally accepted standards - ISO 9001/NAMAS/NIST/NATA ; CENELEC FM; CSA.
Ensures reliable, maintenance-free operation with a 2 year warranty as standard.

In-Built earthing (grounding) electrode

- eliminates requirement for earthing (grounding) flanges.

Three internal totalizers: forward, reverse, net; Forward and reverse flowrates and comprehensive range of outputs : current, pulse, data, HART - single package satisfying all user display requirements; Ensures compatibility with user's control system requirements.


MagMaster - bringing unsurpassed flowmetering performance to the Water and Waste Water industries

## ABB Instrumentation



## Setting the Standard

MagMaster Water and Waste sets new standards for accuracy, reliability and low cost of ownership. This enhanced range, available in sizes 15 mm ( $1 / 2 \mathrm{in}$ ) to 2200 mm ( 88 in ), is designed specifically for use on the many diverse applications encountered in the water and waste water industry.

The specification, features and user benefits offered by this range are based on ABB's worldwide experience in this industry, and they are all specifically targeted to the industry's requirements.

## Unrivalled Fiow Performance

MagMaster sets the standard for flow measurement performance. The combination of sensors with ultra-linear magnetics, new technology transmitters and a next generation sensor drive and signal processing system, results in unrivalled flow performance. An unrivalled accuracy and an operable flow range of 1500:1 enables reliable and accurate measurement over the widely varying flow rates which occur in a typical distribution system. Particularly important is that previously unregistered minimal night flow rates can now be accurately metered. In addition, the absence of moving, wearing components and MagMaster's unique design, ensures that the calibration remains stable in the long term.

## Subimersible and Buriable

All MagMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the water and waste industry. The sensors are, as standard, inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits which are liable to become flooded.

A unique feature of MagMaster sensors is that sizes up to 1600 mm ( 66 ins ) are buriable. Installation merely involves excavating to the underground pipe, fitting the sensor, cabling back to the transmitter, and then backfilling the hole. No metering chambers or pits are required, and the overall low cost installation is simple and fast.

## Comprehensive Features

A wide range of features and user benefits are built into MagMaster as standard:

- bi-directional flow;
- integral earthing/grounding electrodes;
- liquid sensing;
- comprehensive test mode;
- universal switch mode power supply (options are available for a.c. and d.c. supplies);
- self-diagnostics;
- programmable multiple alarm capability.

All of these features ensure that MagMaster fully satisfies the users' requirements.


## Assured Quality <br> Fully Featured Transmitters

MagMaster is designed and manufactured in accordance with international quality procedures (ISO 9001) and all flowmeters are calibrated on nationally traceable calibrations rigs to provide the end user with complete assurance of both quality and performance of the meter. An indication of the in-built quality is the two year warranty which is offered as standard on the MagMaster Water Waste range.


MagMaster is available with integral or remote transmitters, each being available with a choice of display, conliguration and communication options to suit the application. Standard features include forward, reverse and net flow totalizers, flow rate, alarm monitoring, and automatic self diagnostics to ensure integrity. All data and values are in customer-defined units of measurement. System compatibility is assured with a choice of current, pulse, serial data and Smart (HART) communications.

MagMaster operating parameters may be set via local keypads, remote configurators or computers as appropriate. The software features multi-level password protection capability to prevent inadvertent programs or settings changes. Data is stored in non-volatile memory for 10 year retention.

Additionally the keypad/display format is available in $1 / 4 \mathrm{DIN}$ format for panel mounting in control rooms up to 1 km ( 0.6 miles) from the basic transmitter.

In the non-keypad variant, display data can only be changed using a magnetic wand. No operational parameters can be changed without the use of configurators and appropriate passwords.

## International Approvals

Alternative versions of MagMaster are available for general locations with FM Approval/CSA Certification and for Hazardous Area locations to CENELEC, FM, CSA and SAA Standards. Abrief summary of these Hazardous Area versions is given below, covering location of the sensor and transmitter, and the safety designation inside the pipe. No external safety barriers are required.

| SENSOR | INSIDE PIPE | TRANSMITTER LOCATION |
| :--- | :--- | :--- |
| FM \& CSA HAZARDOUS AREA APPROVAL - CLASS 1, DIV. 2, GROUPS A B C D |  |  |
| FM APPROVED | INTRINSICALLY | REMOTE ONLY IN HAZARDOUS AREA |
|  | CSA CERTIFIED | SAFE ELECTRODES |
|  | REMOTE ONLY IN HAZARDOUS AREA |  |
| CSA CERTIFIED | NON INCENDIVE | INTEGRAL AND REMOTE IN HAZARDOUS AREA |
|  |  |  |

CENELEC - EEX e m ia IIC T4
SAA - Exem ia IIC T4 HAZARDOUS AREA APPROVED

| ZONE 1 | ZONE 0 | REMOTE TRANSMITTER IN SAFE AREA |
| :--- | :--- | :--- |

Sizes:

| Size |  | Flow Range |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| mm | in | Minimum |  | *Maximum |  |
|  |  | $m^{3 / h}$ | US g/min | $m^{3 / h}$ | US g/min |
| - 15 | 0.5 | 0.005 | 0.021 | 6 | 28 |
| 20 | 0.75 | 0.009 | 0.038 | 11 | 50 |
| 25 | 1 | 0.014 | 0.059 | 17 | 77 |
| 40 | 1.5 | 0.035 | 0.15 | 45 | 197 |
| 50 | 2 | 0.053 | 0.23 | 71 | 311 |
| 65 | 2.5 | 0.089 | 0.40 | 119 | 525 |
| 80 | 3 | 0.136 | 0.59 | 181 | 796 |
| 100 | 4 | 0.212 | 0.94 | 283 | 1243 |
| 150 | 6 | 0.477 | 2.10 | 640 | 2797 |
| 200 | 8 | 0.848 | 3.73 | 1130 | 4974 |
| 250 | 10 | 1.32 | 5.83 | 1770 | 7771 |
| 300 | 12 | 1.91 | 8.39 | 2540 | 11190 |
| 350 | 14 | 2.60 | 11.4 | 3460 | 15230 |
| 400 | 16 | 3.39 | 14.9 | 4520 | 19890 |
| 450 | 18 | 4.29 | 18.8 | 5730 | 25180 |
| 500 | 20 | 5.30 | 23.3 | 7070 | 31090 |
| 600 | 24 | 7.63 | 33.5 | 10180 | 44760 |
| 700 | 27 | 10.4 | 45.6 | 13850 | 60920 |
| 760 | 30 | 11.9 | 52.4 | 15900 | 69930 |
| 800 | - | 13.6 | 59.6 | 18100 | 79560 |
| 900 | 36 | 16.6 | 75.5 | 22900 | 100700 |
| 1000 | 39 | 21.2 | 93 | 28300 | 124300 |
| 1050 | 42 | 25.7 | 112 | 34200 | 150400 |
| 1200 | 48 | 30.5 | 134 | 40700 | 179000 |
| 1400 | 54 | 41.6 | 182 | 55400 | 243700 |
| 1500 | 58 | 47.7 | 208 | 63600 | 279700 |
| 1600 | 66 | 54.3 | 238 | 72400 | 318300 |
| 1800 | 71 | 68.7 | 302 | 91600 | 402800 |
| 2000 | 79 | 85 | 372 | 113100 | 497400 |
| 2200 | 88 | 102 | 451 | 137000 | 602000 |

*Based on $10 \mathrm{~ms}^{-1}\left(33 \mathrm{fts}^{-1}\right)$, but instrument capability in excess of $15 \mathrm{~ms}^{-1}\left(50 \mathrm{fts}{ }^{-1}\right)$
Transmitter/Sensor
Separation: $<100 \mathrm{~m}$ (328ft)
Pipe conditions:


Accuracy (under forward flow reference conditions)


Note. Uncertainty of flow calibration facility may limit calibration accuracy:

Sizes $300 / 600 \mathrm{~mm}(12 / 24 \mathrm{ins}) \pm 0.2 \%$ Sizes $\geq 700 \mathrm{~mm}$ ( $\geq 27$ ins) $\pm 0.25 \%$

Analog output: $\quad$ Additional $< \pm 0.008 \mathrm{~mA}$.

## Temperature effect:

| Transmitter: | $< \pm 0.08 \%$ of reading $/ 10^{\circ} \mathrm{C}$. |
| :--- | :--- |
|  | Analog output - Additional |
|  | $< \pm 0.08 \%$ of reading $/ 10^{\circ} \mathrm{C}$. |
| Sensor: | $< \pm 0.03 \%$ of rate $/ 10^{\circ} \mathrm{C}$. |
| Power supply | Negligible. |
| variation: | $<0.15 \%$ over the operating range <br> of the equipment. |

Power consumption: < 20VA.

Conductivity: $\quad \geq 5 \mu \mathrm{~S} / \mathrm{cm}$.

## Mounting:



## End Mating Connections:

6 bar metric
10 bar metric 16 bar metric

ANSI Class 150
ANSI/AWWA C207 Class B ANSI/AWWA C207 Class D AS2129 Table 'C' BS10/AS2129 Table ' $D$ ' BS10/AS2129 Table 'E'


## 200 to 600 mm (8 to 24in)

| Meter Size <br> $\boldsymbol{m m}(\mathrm{in})$ | Dimensions mm (in) |  |  | Approx. Weight |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | A | B | C | kg | lb |
| $200(8)$ | $396(15.6)$ | $402(15.8)$ | $350(13.8)$ | 37 | 81 |
| $250(10)$ | $430(16.9)$ | $440(17.3)$ | $450(17.7)$ | 60 | 132 |
| $300(12)$ | $461(18.1)$ | $480(18.9)$ | $500(19.7)$ | 70 | 154 |
| $350(14)$ | $513(20.2)$ | $520(20.5)$ | $550(21.7)$ | 100 | 220 |
| $400(16)$ | $570(22.4)$ | $576(22.7)$ | $600(23.6)$ | 115 | 253 |
| $450(18)$ | $632(24.9)$ | $627(24.7)$ | $698(27.5)$ | 160 | 352 |
| $500(20)$ | $686(27.0)$ | $679(26.7)$ | $768(30.2)$ | 217 | 455 |
| $600(24)$ | $772(30.4)$ | $770(30.3)$ | $918(36.1)$ | 315 | 693 |



## 700 to 2000 mm (27 to 78in)

| Meter Size |  | Length 'A' * |  | Approx. Weight <br> $(16$ bar flanges) |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{m m}$ | in | $\mathbf{m m}$ | in | $k g$ | 16 |
| 700 | 27 | 700 | 27.6 | 430 | 945 |
| 760 | 30 | 762 | 30 | 430 | 945 |
| 800 | - | 800 | 31.5 | 430 | 945 |
| 900 | 36 | 900 | 35.4 | 540 | 1190 |
| 1000 | 39 | 1000 | 39.4 | 720 | 1585 |
| 1050 | 42 | 1067 | 42 | 880 | 1930 |
| 1200 | 48 | 1200 | 47.2 | 1000 | 2160 |
| 1400 | 54 | 1400 | 55.1 | 1450 | 3190 |
| 1500 | 60 | 1524 | 59 | 1370 | 3000 |
| 1600 | 66 | 1600 | 63 | 2000 | 4400 |
| 1800 | 71 | 2132 | 83.9 | 2400 | 5280 |
| 2000 | 79 | 2282 | 89.8 | 3200 | 7040 |



* Note. Typical Tolerance $\pm 12 \mathrm{~mm}$ ( $\pm 0.5 \mathrm{in}$ )

Note. See page 6 for Terminal Box dimensions and page 9 for Transmitter dimensions.

Materials:

| Item | Material |
| :--- | :--- |
| Lining | Teflon (PFA, PTFE, and FEP), Elastomer or <br> Neoprene |
| Electrodes | Stainless steel 316 or Hastelloy 'C' |
| Flanges | Carbon steel |

## Pressure Limitations:



## Environmental Protection (when installed):

Rating: IP68/NEMA 6P (to 10m (33ft) depth) sizes up to 1600 mm .

## TERMINAL BOX DIMENSIONS

(Mounted on Sensor)


Note. See page 5 for Sensor dimensions and page 9 for Transmitter dimensions.
Temperature Ranges:
Process

## Display (optional):

## 2-Wire Display Version

Keypad Version


- Local hand-held configurator
- Integral keypad
- HART
- Up to $1000 \mathrm{~m}(3280 \mathrm{ft})$ remote via serial communications and remote $1 / 4$ DIN panel-mounted keypad/display unit

| Fully configurable | A choice of engineering parameters in engineering units e.g. flowrate, flow units, all outputs etc. |
| :--- | :--- |
| Liquid sensing | Ensures units read zero on empty pipe |
| Interchangeability | Transmitter/sensor can be changed without affecting performance |
| Self diagnostics | Ensures transmitter and sensor integrity |
| Test mode | Powerful commissioning aid. Exercises all outputs and displays, even without a connected sensor |
| Multi-lingual | English, French, German, Spanish, Italian, plus others on application |

Temperature Ranges:


Power Supply *:

| Voltage <br> Type | Voltage Range <br> (V) Absolute <br> rating | Frequency <br> (Hz) | VA |
| :---: | :---: | :---: | :---: |
| a.c. | 85 to 265 | 47 to 440 | $<20$ |
| d.c. | 11 to 40 | - | $<20$ |

*Power supply fully isolated

## Environmental

protection:

EMC Specification:
Conforms to -
EMC Directive 89/336/EEC to $10 \mathrm{~V} / \mathrm{m}$
$\begin{array}{ll}\text { Enclosure: } & \text { Glass loaded polypropylene, } \\ \text { polycarbonate window. UL VO rated. }\end{array}$

Electrical connections: 20 mm glands, or accepts 0.5 in NPT connections.

Sensor Cable:

ABB supplied standard and armoured versions.

## Outputs/Inputs:



Optional (For Blind \& 2-line display units)


Optional (For Keypad units)


Galvanic separation to 50 Vd .c. between analog, pulse/alarm and earth/ground.



Note. See page 5 for Sensor dimensions and page 6 for Terminal Box dimensions

SENSOR ORDERING INFORMATION


TRANSMITTER ORDERING INFORMATION


## CONNECTION INFORMATION



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$\left.A C 3 \quad A C 3 \quad A C 1^{9}\right) A C 1^{\circ}$ ) Auxiliary contacts

## Ratings to IEC 947 and AS $3497400 / 415$ V

Contactor CA 7-9


Contactor CA 7-72


Contactor CA 6-105-EI


Contactor CA 6-170-EI


Contactor CA 6-250-EI


Contactor CA 6-420-EI


O For CA 7 contactors with coil terminals on line side, add ...V AC to Catalogue No. Eg - CA 7-9-10-240 V AC ${ }^{3}$ )
O For CA 7 contactors with coil terminals on load side, add ...V AC-U to Catalogue No. Eg - CA 7-9-10-240 V AC-U

400/415 V 400/415V Amps Amps standard

| kW ') | Amps ${ }^{\text {1 }}$ ) | $40^{\circ} \mathrm{C}$ | $60^{\circ} \mathrm{C}$ | N/O | N/C | Max. | Cat. No. ${ }^{2}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | 9 | 32 | 32 |  |  |  |  |
|  |  |  |  | 0 | 1 | 9 |  |
| 5.5 | 12 | 32 | 32 | 1 | 0 | 9 | $\text { CAT712 } 100 . \mathrm{VAC}$ |
|  |  |  |  | 0 | 1 | 9 |  |
| 7.5 | 16 | 32 | 32 | 1 | 0 | 9 | CA VCIGTOUVAC |
|  |  |  |  | 0 | 1 | 9 | CAT |
| 11 | 23 | 32 | 32 | 1 | 0 | 9 | $C A T 232000 \mathrm{VAG}$ |
|  |  |  |  | 0 | 1 | 9 |  |
| 15 | 30 | 50 | 45 | 0 | 0 | 8 | CAM30-00uvacu |
| 18.5 | 37 | 50 | 45 | 0 | 0 | 8 | CAT-3700 |
| 22 | 43 | 85 | 63 | 0 | 0 | 8 |  |
| 30 | 60 | 100 | 100 | 0 | 0 | 8 | CA76000 以 AC |
| 37 | 72 | 100 | 100 | 0 | 0 | 8 | CAL/2-00xyck |
| 45 | 85 | 100 | 100 | 0 | 0 | 8 |  |
| 55 (45) | 95 (33) | 160 | 135 | 1 | 1 | 8 |  |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 |  |
| 90(75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | CA6E40314 VACN0 |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 |  |
| 90(75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | CA66140EE1U VAC |
| 100 (90) | 170 (65) | 250 | 210 | 1 | 1 | 8 | CA6060-111 V/ACt |
| 132 (111) | 225 (80) | 350 | 300 | 1 | 1 | 8 |  |
| 150 (133) | 258 (95) | 350 | 300 | 1 | 1 | 8 | CA6250 |
| 185 (163) | 320 (115) | 450 | 380 | 1 | 1 | 8 | CA6300EH10 VAC |
| 250 (225) | 425 (160) | 500 | 425 | 1 | 1 | 8 |  |
| 220 (220) | 370 (155) | 500 | 420 | 2 | 2 | 8 |  |
| 265 (280) | 450 (200) | 600 | 510 | 2 | 2 | 8 |  |
| 325 (355) | 550 (250) | 780 | 645 | 2 | 2 | 8 |  |
| 430 (500) | 700 (340) | 1000 | 850 | 2 | 2 | 8 |  |
| 520 (550) | 860 (380) | 1100 | 930 | 2 | 2 | 8 |  |
| 600 | 1000 | 1200 | 1020 | 1 | 1 | 8 |  |
| 700 | 1150 | 1350 | 1150 | 1 | 1 | 8 |  |

Notes: ${ }^{1}$ ) 1000 volt ratings ( ).
${ }^{2}$ ) Add control voltage to Cat. No. when ordering: $24,32,110,240,415,440 \mathrm{~V} 50 \mathrm{~Hz}$. Standard voltages for CA 6-105-El...250-El are 24, 48, 110, 240 and 415 V AC. Standard voltages for CA 6-300-EI...420-EI 48, 110, 240 and 415 V AC. Standard voltages for CA 5-370...1200, 110, 240 and 415 V AC.
${ }^{3}$ ) All CA 7 coils can be reversed for line or load side coil terminals as required. Both versions are held in NHP stock for convenience.
${ }^{4}$ ) Electronically controlled mechanism (ECM) with interface suffix (EI).
$\left.{ }^{5}\right) \quad 55^{\circ} \mathrm{C}$ enclosed.
${ }^{6}$ ) Contact NHP for recommended cable size.
$240 / 415 \mathrm{~V}$ rated coils are suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS 60038 : 2000.

4-45kW

## Rêfer catalogue'SACS

## The highest switching capacity in the smallest space



## Compact without compromise

Compact without compromise is the best way to describe the CA 7 range of contactors and motor protection relays from Sprecher + Schuh. In spite of the new compact dimensions, the CA 7 range features high breaking capacity and extraordinary flexibility. Up to 18.5 kW the contactors are only 45 mm wide and even the largest 45 kW frame is only 72 mm wide. The CA 7 contactors are the main component in the new Advanced Control System (ACS).

## With CA 7 you have flexibility with auxiliary contacts

Common auxiliaries from 9 to 85 amps
Three fitting positions
O Front mounting
O Side mounting left
O Side mounting right
Alternatively you can choose to combine left, right and front mounting auxiliary contacts to fulfil your requirements.
Instead of the top mounted auxiliary contacts, on or off delay timing modules or mechanical latches can be fitted.


With CA 7 you have more clip on accessories
Common accessories from 9 to 85 amps
O On and off delay pneumatic timers
O Coil mounted electronic timers on delay, off delay, star delta
O Coil mounted 24 V DC interface
O Coil mounted RC and varistor suppressor modules
O Mechanical latch
O Mechanical interlock
O Mechanical interlock with integrated N/C interlock contacts
O Moulded wire link sets for DOL, reversing and star delta starters
O Large choice of front and side mounting auxiliary contacts

# Innovation and ease of use provide solutions for your control systems 

class $\mathbf{1 0}$ or 20.


High tech electronic protection type CEP 7 in trip

## With Sprecher + Schuh you can choose the best protection for your motors.



## Coil terminals are always in the correct position

The coil terminations on the CA 7 contactors can be supplied optionally at the top or the bottom of the contactor. It is also a simple task to change this on site should the requirements change.
When CA 7 contactors are used in combination with KTA 7 circuit motor circuit breakers the bottom coil terminations are used. For use with standard CT 7 thermal or CEP 7 electronic overloads the top coil termination should be selected.


CA 7 contactors provide improved wiring terminals
The main terminals of all CA 7 contactors are designed to accept at least two cables. At the same time they comply with safety standards regarding touch protection.
The larger contactors CA 7-30 and upwards employ a special cage terminal which allows the connection of two cables in separate chambers.
The ease of wiring with CA 7 contactors saves both time and money.


## Mechanical interlocks save space

Only 9 mm wide, the CM 7 mechanical interlock snaps into place between any of the CA 7 contactors. It is allowed also to interlock different sizes of the CA 7 range with the same interlock.
The basic mechanical interlock is supplemented by a variation with built in N/C auxiliary contacts for electrical interlocking. This version is also only 9 mm wide and further minimises space requirements.



Standard thermal overloads type CT 7

# Automatic Type ' 2 ' co-ordination ') with no-oversizing of contactors <br> DOL starting <br> 50/65 kA @ 400/415 V 

| Motor <br> size <br> kW | Approx. <br> amps @ <br> $400 / 415 \mathrm{~V}$ | Sprecher + <br> Schuh <br> circuit breaker | Setting <br> range <br> amps | Magnetic <br> amps | Sprecher + Schuh <br> contactor | AC-3 <br> amps |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 0.18 | 0.60 | KT 7-25S | $0.40-0.63$ | 8.2 | CA 7-9 | 9 |
| 0.25 | 0.80 | KT 7-25S | $0.63-1.00$ | 13 | CA 7-9 | 9 |
| 0.37 | 1.10 | KT 7-25S | $1.00-1.60$ | 21 | CA 7-9 | 9 |
| 0.55 | 1.50 | KT 7-25S | $1.00-1.60$ | 21 | CA 7-9 | 9 |
| 0.75 | 1.80 | KT 7-25S | $1.60-2.50$ | 33 | CA 7-9 | 9 |
| 1.10 | 2.60 | KT 7-25S | $2.50-4.00$ | 52 | CA 7-9 | 9 |
| 1.15 | 3.40 | KT 7-25S | $2.50-4.00$ | 52 | CA 7-9 | 9 |
| 2.20 | 4.80 | KT 7-25S | $4.00-6.30$ | 80 | CA 7-9 | 9 |
| 3.00 | 6.50 | KT 7-25S | $6.30-10.0$ | 130 | CA 7-9 | 9 |
| 4.00 | 8.20 | KT 7-25S | $6.30-10.0$ | 130 | CA 7-9 | 9 |
| 5.50 | 11.00 | KT 7-25S | $10.0-16.0$ | 208 | CA 7-12 | 12 |
| 7.50 | 14.00 | KT 7-25S | $10.0-16.0$ | 208 | CA 7-16 | 16 |
| 9.00 | 17.00 | KT 7-25H | $14.5-20.0$ | 260 | CA 7-23 | 23 |
| 11.00 | 21.00 | KT 7-25H | $18.0-25.0$ | 325 | CA 7-23 | 23 |
| 15.00 | 28.00 | KT 7-45H | $23.0-32.0$ | 416 | CA 7-30 | 30 |
| 18.50 | 34.00 | KT 7-45H | $32.0-45.0$ | 585 | CA 7-37 | 37 |
| 22.00 | 40.00 | KT 7-45H | $32.0-45.0$ | 585 | CA 7-43 | 43 |
| 30.00 | 55.00 | KT 3-100 | $40.0-63.0$ | 882 | CA 7-60 | 60 |
| 37.00 | 66.00 | KT 3-100 | $63.0-90.0$ | 1260 | CA 7-72 | 72 |
| 45.00 | 80.00 | KT 3-100 | $63.0-90.0$ | 1260 | CA 7-85 | 85 |
|  |  |  |  | 9 |  |  |

Definition Type '2' co-ordination according to IEC 947-4-1:

- The contactor or the starter must not endanger persons or systems in the event of a short circuit
- The contactor or the starter must be suitable for further use
- No damage to the overload relay or other parts may occur with the exception of welding of the contactor or starter contacts provided that these can be easily separated without significant deformation (such as with a screwdriver)
- In the event of a short circuit, fast opening current limiting circuit breakers KT 7 make it possible to build economical, fully short circuit co-ordinated starter combinations in accordance with IEC 947-4-1, Type ' 2 ' co-ordination
- Type '2' co-ordination without oversizing of contactors means: Type '1' = Type '2'

Note: ') What is meant by Automatic Type ' 2 ' co-ordination?
The high speed operation of the new KT 7 motor protection circuit breakers means that contactors need not be oversized to achieve type ' 2 ' co-ordination. Simply select the normal AC 3 rated contactor and the corresponding KT 7 circuit breaker and type ' 2 ' co-ordination is assured.
240/415 V rating suitable for use on 230/400 V in accordance with AS 60038: 2000


Refer Catalogue C-CO
MCCB or fuse DOL starting
50/65 kA @ 400/415 V to AS 3947.4.1

## TemBreak Moulded Case Circuit Breaker or fuse

Terasaki

| Motor size kW | Approx. amps | circuit or breaker | NHP HRC <br> fuse to BS88 | Sprecher + Schuh contactor type | Sprecher + Schuh thermal O/L relay type | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | NTIA-6 | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | NTIA-6 | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | NTIA-10 | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | XM30РВ/8 | NTIA-16 | CA 7-9 | CT 7-24 | 4-6 |
| 3.0 | 6.5 | XM30PB/10 | NTIA-16 | CA 7-9 | CT 7-24 | 6-10 |
| 4.0 | 8.2 | XM30PB/12 | NTIA-25 | CA 7-9 | CT 7-24 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | NTIA-32 | CA 7-12 | CT 7-24 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | NTIS-40 | CA 7-16 | CT 7-24 | 10-16 |
| 11 | 21 | XH125NJ/32 | NTIS-50 | CA 7-23 | CT 7-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | NTIS-63 | CA 7-30 | CT 7-45 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | NTCP-80 | CA 7-37 | CT 7-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | NTCP-80 | CA 7-43 | CT 7-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | NTCP-100 | CA 7-60 | CT 7-75 | 45-60 |
| 37 | 66 | XH125NJ/100 | NTF-160 | CA 7-72 | CT 7-75 | 60-75 |
| 45 | 80 | XH125NJ/125 ${ }^{\text {') }}$ | NTF-160 | CA 6-85 | CT 7-100 | 70-90 |
| 55 | 100 | XH125NJ/125 ${ }^{\prime}$ ) | NTF-200 | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 ') | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ${ }^{1}$ ) | NTKF-315 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XH400NE/400 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XH400NE/400 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XH400NE/400 | NTMF-400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 185 | 310 | XH400NE/400 | NTTF-450 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400NE/400 | NTTM-500 | CA 6-420-EI/CA 5-450 | CEF 1-41/42 | 160-400 |
| 250 | 425 | XH630NE/630 | NTTM-630 | CA 6-420-EI/CA 5-450 | CEF 1-52 | 160-630 |
| 315 | 530 | XH630NE/630 | NTLM-710 | CA 5-550 | CEF 1-52 | 160-630 |

Notes: Fuses 65 kA . XH125NJ circuit breaker combinations limited to 50 kA , others 65 kA . Overloads may be changed to different types eg. thermal style to electronic.
Some combinations also gives Type ' 2 ' performance.
') Use 'magnetic only' breaker - Refer NHP.
240/415 V rating suitable for use on 230/400 V in accordance with AS 60038: $\mathbf{2 0 0 0}$

Refer Catalogue C-CO

## Fuse protection DOL starting ${ }^{1}$ ) <br> 50/65 kA @ 400/415 V to AS 3947.4.1

| Motor size kW | Approx. amps @ 400/415 V | NHP HRC fuse to BS88 | Sprecher + Schuh contactor | Sprecher + Schuh overload relay $\left.{ }^{2}\right)^{3}$ ) | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | NTIA-4 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.75 | 1.8 | NTIA-6 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 1.5 | 3.4 | NTIA-10 | CA 7-9 | CEP 7 | 1.6-5 |
| 2.2 | 4.8 | NTIA-16 | CA 7-9 | CEP 7 | 3.7-12 |
| 4.0 | 8.2 | NTIA-20 | CA 7-9 | CEP 7 | 3.7-12 |
| 5.5 | 11 | NTIA-25 | CA 7-12 | CEP 7 | 3.7-12 |
| 7.5 | 14 | NTIA-32 | CA 7-16 | CEP 7 | 12-32 |
| 11 | 21 | NTIS-50 | CA 7-30 | CEP 7 | 12-32 |
| 15 | 28 | NTIS-63 | CA 7-30 | CEP 7 | 12-37 |
| 18.5 | 34 | NTCP-80 | CA 7-37 | CEP 7 | 12-37 |
| 22 | 40 | NTCP-80 | CA 7-43 | CEP 7 | 14-45 |
| 30 | 55 | NTCP-100 | CA 7-60 | CEP 7 | 26-85 |
| 37 | 66 | NTF-125 | CA 7-72 | CEP 7 | 26-85 |
| 45 | 80 | NTF-160 | CA 7-85 | CEP 7 | 26-85 |
| 55 | 100 | NTF-200 | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | NTKF-315 | CA 6-210-EI | CEF 1-41/42 ${ }^{\text {4 }}$ ) | 160-400 |
| 132 | 225 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 ${ }^{\text {a }}$ ) | 160-400 |
| 150 | 250 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 ${ }^{4}$ ) | 160-400 |
| 185 | 320 | NTTM-450 | CA 6-300-EI | CEF 1-41/42 ${ }^{\text {¢ }}$ ) | 160-400 |
| 250 | 425 | NTTM-560 | CA 6-420-EI | CEF 1-52 ${ }^{4}$ ) | 160-630 |
| 320 | 538 | NTLM-710 | CA 5-550 | CEF 1-52 ${ }^{\text {4 }}$ ) | 160-630 |
| 380 | 650 | NTLM-800 | CA 5-700 | CEF 1-11/12P ${ }^{4}$ ) | 300-1200 |

Notes: ${ }^{1}$ ) Fuses with equal or lower let through energy may also be used.
${ }^{2}$ ) Thermal overloads may be used instead of electronic CEP 7.
${ }^{3}$ ) Above 37 kW overloads may also be electronic or thermal.
${ }^{4}$ ) CET 4 may be used instead of CEF 1.
240/415 V rating sultable for use on 230/400 V in accordance with AS 60038: $\mathbf{2 0 0 0}$

TEBASAK

Refer Catalogue C-CO
TemBreak circuit breakers DOL starting
50 kA @ 400/415 V to AS 3947.4.1
TemBreak MCCBs

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.55 | 1.5 | ХM30РB/2 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| 4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA 7-30 | CT 7-24-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | CA 7-43 | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43 | CT 7-45-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | CA 7-43 | CT 7-45-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{2}$ ) | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{2}$ ) | 60-75 |
| 45 | 80 | XH125NJ/125 | CA 6-105-EI | CT 6-90 | 70-90 |
| 55 | 100 | XH125NJ/125 ${ }^{\text {' }}$ ) | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 | C A6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ${ }^{\text {') }}$ | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XS400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XS400SE/400 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400SE/400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 6-420-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

$\begin{array}{ll}\text { Notes: } & \text { Overloads may be thermal or electronic. } \\ \text { Combinations based on the overload tripping before the circuit breaker at overload currents up to the motor locked rotor current. }\end{array}$
') Use 'magnetic only' breaker or next higher circuit breaker / contactor combination.
${ }^{2}$ ) Use with separate mounting bracket.
Data for 65 kA co-ordination available refer Cat. C-CO.
240/415 V rating suitable for use on 230/400 V in accordance with AS 60038: 2000

| Motor size kW | Approx. FLC @ $400 / 415$ V (A) | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh thermal O/L type | Setting range (A) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2.0 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30РВ/2.6 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 4 | 8.2 | XM30PB/10 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL.100NJ/20 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | TL100NJ/50 | CA 7-43 | CEP 7-M37-37-10 | 12-37 |
| 22 | 40 | TL100NJ/63 | CA 7-43 | CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100 | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 90 | 160 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 110 | 200 | TL250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE/400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6-300-EI | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

Din-T circuit breakers with rotary isolator. DOL starting. 50 kA @ 400/415 V to AS 3947.4.1

| 50 kA @ 400/415 V to AS 3947.4.1 |  |  |  |  |  | Sprecher + |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Motor size kW | Approx. amps @ 400/415 V | Sprecher + <br> Schuh isolator | Terasaki circuit breaker | Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Schuh thermal O/L relay | Thermal overload range |
| 0.37 | 1.1 | LA 7-80 | Din-T 10 / 4 | - | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.55 | 1.5 | LA 7-80 | Din-T $10 / 4$ | - | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | LA 7-80 | Din-T $10 / 6$ | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | LA 7-80 | Din-T 10/10 | KTL 3-65 | CA 7-23 | CT 7-24 | 4-6 |
| 3 | 6.5 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4 | 8.2 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 5.5 | 11 | LA 7-80 | Din-T 10/20 | KTL 3-65 | CA 7-23 | CT 7-24 | 10-16 |
| 7.5 | 14 | LA 7-80 | Din-T 10 / 32 | KTL 3-65 | CA 7-30 | CT 7-45 | 10-16 |
| 11 | 21 | LA 7-80 | Din-T 10/40 | KTL 3-65 | CA 7-30 | CT 7-24 | 16-24 |
| 15 | 28 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 18-30 |
| 18.5 | 34 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |



Din-T circuit breakers with rotary isolator. DOL starting. 50 kA @ 400/415 V to AS 3947.4.1

| Motor <br> size <br> kW | Approx. <br> amps @ <br> 400/415 V | Sprecher + <br> Schuh <br> Isolator | Terasaki <br> circuit breaker | Sprecher + <br> Schuh <br> current limiter | Sprecher + <br> Schuh <br> contactor | Sprecher + <br> Schuh <br> thermal <br> O/L relay | Thermal <br> overload <br> range |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 0.37 | 1.1 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.55 | 1.5 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | $1-1.6$ |
| 0.75 | 1.8 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | $1.6-2.4$ |
| 1.1 | 2.6 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | $2.4-4$ |
| 1.5 | 3.4 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | $2.4-4$ |
| 2.2 | 4.8 | LA 7-80 | Din-T 10/10 | KTL 3-65 | CA 7-23 | CT 7-24 | $4-6$ |
| 3 | 6.5 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | $6-10$ |
| 4 | 8.2 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | $6-10$ |
| 5.5 | 11 | LA 7-80 | Din-T 10/20 | KTL 3-65 | CA 7-23 | CT 7-24 | $10-16$ |
| 7.5 | 14 | LA 7-80 | Din-T 10/32 | KTL 3-65 | CA 7-30 | CT 7-45 | $10-16$ |
| 11 | 21 | LA 7-80 | Din-T 10/40 | KTL 3-65 | CA 7-30 | CT 7-24 | $16-24$ |
| 15 | 28 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | $18-30$ |
| 18.5 | 34 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | $30-45$ |


| General data | CA 7-9...CA 7-85 |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Rated insulation voltage $U_{i}$ |  |  |  |  |  |  |  |  |  |  |
| IEC |  |  |  |  | 690 V |  |  |  |  |  |
| UL, CSA |  |  |  |  | 600 V |  |  |  |  |  |
| Rated impulse voltage withstand Uimp |  |  |  |  | 8k V |  |  |  |  |  |
| Test voltage |  |  |  |  |  |  |  |  |  |  |
| 1 minute (to IEC 947-4) |  |  |  |  | 2500 V |  |  |  |  |  |
| Rated voltage $U_{*}$ |  |  |  |  |  |  |  |  |  |  |
| AC |  |  |  |  | 110, 240, | 400/415, |  | 500, 690 V |  |  |
| DC |  |  |  |  | 24, 48, 110, |  |  | 220, 440 V |  |  |
| Rated frequency of coil |  |  |  |  | $50 / 60 \mathrm{~Hz}$ |  |  |  |  |  |
| Ambient temperature |  |  |  |  |  |  |  |  |  |  |
| Storage |  |  |  |  | $-55 \ldots+80^{\circ} \mathrm{C}\left(-67 \ldots 176{ }^{\circ} \mathrm{F}\right)$ |  |  |  |  |  |
| Operation at nominal current |  |  |  |  | $-25 . . .+60^{\circ} \mathrm{C}\left(-13 . . .140^{\circ} \mathrm{F}\right)$ |  |  |  |  |  |
| Maximum with $15 \%$ AC 1 current reduction $>60^{\circ} \mathrm{C}$ |  |  |  |  | $-25 . . .+70^{\circ} \mathrm{C}\left(-13 . .158{ }^{\circ} \mathrm{F}\right)$ |  |  |  |  |  |
| Climatic withstand |  |  |  |  | Cyclicly changing humid atmosphere to IEC 68-2-30 and DIN 50 016, 56 |  |  |  |  |  |
| Maximum altitude |  |  |  |  | 2000 m NN , to IEC 947-4 |  |  |  |  |  |
| Protection class |  |  |  |  |  |  |  |  |  |  |
| IP 2LX (IEC 529 and DIN 40050) |  |  |  |  | In connected condition |  |  |  |  |  |
| Protection against contact |  |  |  |  | Touch protection to VDE 0106, Part 100 |  |  |  |  |  |
| Standards |  |  |  |  | IEC 947-1/4; VDE 0660, Part 100/104; UL 508; CSA 22.2. Part 14 |  |  |  |  |  |
| Compliance |  |  |  |  | CE; UL; CSA |  |  |  |  |  |
| Short time withstand |  |  |  |  |  |  |  |  |  |  |
| $1 \mathrm{~s}(\mathrm{~A})$ | 210 | 210 | 290 | 380 | 480 | 525 | 650 | 1100 | 1150 | 1250 |
| $4 \mathrm{~s}(\mathrm{~A})$ | 140 | 150 | 220 | 280 | 360 | 390 | 480 | 820 | 860 | 910 |
| $10 \mathrm{~s}(\mathrm{~A})$ | 100 | 120 | 175 | 220 | 290 | 310 | 375 | 640 | 680 | 710 |
| $15 \mathrm{~s}(\mathrm{~A})$ | 90 | 100 | 150 | 200 | 250 | 270 | 325 | 560 | 600 | 620 |
| $60 \mathrm{~s} \mathrm{(A)}$ | 60 | 60 | 90 | 125 | 170 | 175 | 200 | 350 | 370 | 380 |
| 240 s (A) | 40 | 40 | 50 | 60 | 100 | 100 | 120 | 190 | 190 | 200 |
| 900 s ( A ) | 30 | 30 | 38 | 38 | 54 | 60 | 76 | 108 | 108 | 120 |
| Minimum cooling time at zero current [Min] | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |

AB

## Technical data



|  |  | Built-in auxiliary contacts CA 7-9... 85 |  |  |  |  | Front moun |  |  |  | liary contactsSide mount |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Switching DC loads |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $L / R<1 \mathrm{~ms}$, resistive loads at: | (V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [ A$]$ | 12 | 9 | 3.5 | 0.55 | 0.2 | 12 | 9 | 3.5 | 0.55 | 0.2 | 6 | 3.2 | 0.45 | 0.18 | 0.1 |
| L/R<15 ms, inductive loads with |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| economy resistor in series at: | [V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [A] | 9 | 5 | 2 | 0.4 | 0.16 | 9 | 5 | 2 | 0.4 | 0.16 | 2 | 1.6 | 0.3 | 0.12 | 0.05 |
| DC-13, switching electro |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| magnets at: | [V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [A] | 5 | 2 | 0.7 | 0.25 | 0.12 | 5 | 2 | 0.7 | 0.25 | 0.12 | 3 | 1.5 | 0.6 | 0.3 | 0.2 |

## Additional rating data - contactors to IEC 947

## Contactor

CA 7-9 CA 7-12 CA 7-16 CA 7-23 CA 7-30 CA 7-37 CA 7-43 CA 7-60 CA 7-72 CA 7-85
AC 1 resistive load
switching 3~
Ambient temperature $40^{\circ} \mathrm{C}$

| $\left.l^{1}\right)$ | $[\mathrm{A}]$ | 32 | 32 | 32 | 32 | 50 | 50 | 85 | 100 | 100 | 100 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $230 / 240 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 10 | 10 | 13 | 13 | 18 | 20 | 25 | 36 | 36 | 40 |
| $400 / 415 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 18 | 18 | 23 | 23 | 32 | 36 | 45 | 64 | 64 | 71 |
| 690 V | $[\mathrm{~kW}]$ | 30 | 30 | 38 | 38 | 54 | 60 | 75 | 108 | 108 | 120 |
| Ambient temperature $60^{\circ} \mathrm{C}$ |  |  |  |  |  |  |  |  |  |  |  |
| $\left.l_{\theta}{ }^{1}\right)$ | $[\mathrm{A}]$ | 32 | 32 | 32 | 32 | 45 | 45 | 63 | 100 | 100 | 100 |
| $230 / 240 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 8 | 8 | 10 | 10 | 14 | 16 | 20 | 29 | 29 | 34 |
| $400 / 415 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 14 | 14 | 17 | 17 | 26 | 28 | 36 | 51 | 51 | 61 |
| 690 V | $[\mathrm{~kW}]$ | 24 | 24 | 29 | 29 | 44 | 48 | 60 | 86 | 86 | 102 |

AC motor switching
AC 2, AC 3, AC 4

| $230 / 240 \mathrm{~V}$ | $[\mathrm{~A}]$ | 11.5 | 14.5 | 20 | 26.5 | 34 | 37 | 42 | 62 | 70 | 85 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $400 / 415 \mathrm{~V}$ | $[\mathrm{~A}]$ | 9 | 12 | 16 | 23 | 30 | 37 | 43 | 60 | 72 | 85 |
| 690 V | $[\mathrm{~A}]$ | 5 | 7 | 9.3 | 12 | 17 | 20 | 25 | 34 | 42 | 49 |
| $230 / 240 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 3 | 4 | 5.5 | 7.5 | 10 | 11 | 13 | 18.5 | 22 | 25 |
| $400 / 415 \mathrm{~V}$ | $[\mathrm{~kW}]$ | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 |
| 690 V | $[\mathrm{~kW}]$ | 4 | 5.5 | 7.5 | 10 | 15 | 18.5 | 22 | 30 | 37 | 45 |

Rated making capacity

| $I_{\theta} A C$ | $4,50 \mathrm{~Hz}$ | $\max .690 \mathrm{~V}[\mathrm{~A}]$ | 135 | 180 | 240 | 345 | 450 | 555 | 645 | 900 | 1080 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $R$ | 1275 |  |  |  |  |  |  |  |  |  |  |

Rated breaking capacity

| $I_{\theta} \mathrm{AC} 4$ | max. 460 V [ A$]$ | 135 | 180 | 240 | 345 | 450 | 555 | 645 | 900 | 1080 | 1275 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | max. $690 \mathrm{~V}[\mathrm{~A}]$ | 75 | 105 | 140 | 140 | 255 | 300 | 375 | 510 | 630 | 735 |

Short circuit protection
without protection relay
fuse gG to IEC 947-4-1

| co-ordination type '1' | $[A]$ | 50 | 50 | 50 | 63 | 100 | 125 | 160 | 200 | 250 | 250 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| co-ordination type '2' | $[A]$ | 20 | 25 | 25 | 35 | 50 | 80 | 100 | 100 | 125 | 160 |

Main current circuit
resistance
$\begin{array}{lllllllllll}{[\mathrm{m} \Omega]} & 2.7 & 2.7 & 2.7 & 2 & 2 & 2 & 1.5 & 0.9 & 0.9 & 0.9\end{array}$
Power dissipated by all
$\begin{array}{lllllllllllll}\text { circuits at le AC } 3 & {[w]} & 0.7 & 1.2 & 2.1 & 3.2 & 5.4 & 8.2 & 8.3 & 9.7 & 14 & 19.5\end{array}$
Total power dissipation

| at le AC 3 | AC control $[\mathrm{w}]$ | 3.3 | 3.8 | 4.7 | 6.2 | 8.4 | 11.2 | 11.5 | 14.2 | 18.5 | - |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | DC control $[\mathrm{w}]$ | 6.7 | 7.2 | 8.1 | 12.4 | 14.6 | 17.4 | 18.4 | 14.6 | 18.9 | - |

Life span in millions of operations

| Mechanical | AC control | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 10 | 10 | 10 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | DC control | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 10 | 10 | 10 |

Operating times (DC)

$$
\begin{array}{lllllllllllllll}
\text { Make }(\mathrm{mS}) & 40 \ldots 70 & 40 \ldots 70 & 40 \ldots 70 & 40 \ldots 70 & 50 \ldots 8 & 50 \ldots 80 & 50 \ldots 80 & 20 \ldots 4 & 20 \ldots 40 & 20 \ldots 40 \\
\text { Break }(\mathrm{mS}) & 7 \ldots 15 & 7 \ldots 15 & 7 \ldots 15 & 7 \ldots 15 & 7 \ldots 15 & 7 \ldots 15 & - & - & - & - \\
\hline
\end{array}
$$

Note: ${ }^{1}$ ) Contact NHP for recommended cable size.

## Dimensions in (mm)



Mounting position


DC Control


## Contactor (AC control)

| Type | a | b | c | c1 | c2 | od | d1 | d2') |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9...CA 7-23 ${ }^{2}$ ) | 45 | 81 | 80.5 | 75.5 | 6 | 4.5 | 60 | 35 |
| CA 7-30...CA 7-37 | 45 | 81 | 97.5 | 92.6 | 6.5 | 4.5 | 60 | 35 |
| CA 7-43 | 54 | 81 | 100.5 | 95.6 | 6.5 | 4.5 | 60 | 45 |
| CA 7-60...CA 7-85 | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 | 55 |

## (DC control)

| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{c}$ | $\mathbf{c 1}$ | c2 | ød | d1 | d2 $\left.{ }^{\prime}\right)$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9C...CA 7-16C | 45 | 81 | 106.5 | 101.5 | 6 | 4.5 | 60 | 35 |
| CA 7-23C | 45 | 81 | 123.5 | 119 | 6 | 4.5 | 60 | 35 |
| CA 7-30C...CA 7-37C | 45 | 81 | 141.5 | 136.5 | 6.5 | 4.5 | 60 | 35 |
| CA 7-43C | 54 | 81 | 144.5 | 140 | 6.5 | 4.5 | 60 | 45 |
| CA 7-60C...CA 7-85C | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 | 55 |

## Accessories

| Contactor with | (AC control) <br> $(\mathbf{m m})$ | (DC control) <br> (mm) |  |
| :--- | :--- | :--- | :--- |
| Front mounting auxiliary contact | 2 or 4 pole | $\mathrm{c} c 1+39$ | $\mathrm{c} / \mathrm{c} 1+39$ |
| Side mounting auxiliary contact | 1 or 2 pole | $\mathrm{a}+9$ | $\mathrm{a}+9$ |
| Pneumatic timing module |  | $\mathrm{c} / \mathrm{c} 1+58$ | - |
| Electronic timing module | coil mounting | $\mathrm{b}+24$ | $\mathrm{~b}+24$ |
| Mechanical interlock | mounts between contactors | $\mathrm{a}+9$ | $\mathrm{a}+9$ |
| Mechanical latch |  | $\mathrm{c} / \mathrm{c} 1+61$ | - |
| Interface | coil mounting | $\mathrm{b}+9$ | - |
| Suppressor | coil mounting | $\mathrm{b}+3$ | $\mathrm{~b}+3$ |
| With inscriptions ${ }^{9}$ ) | labels | +0 | +0 |
|  | label support system V4N5 | +5.5 | +5.5 |

Notes: ') DIN Rail mounting 35 mm to EN 50022.
${ }^{2}$ ) Dimensions for 4 pole contactors same as 3 pole with auxiliary.
$\left.{ }^{3}\right)$ Dimensions with inscriptions.

## Dimensions with and without contactors

## Dimensions in (mm)

CEP 7, CEP 7s and CEP 7-B mounted on CA 7 contactors


| Cat. No. | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{b 1}$ | $\mathbf{c}$ | e1 | e2 | d1 | d2 | h | j | ød |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9/12/16/23 with CEP 7 or CEP 7S | 45 | 131 | 86 | 88.5 | 16.5 | 69 | 60 | 35 | 86.5 | 2 | 4.2 |
| CA 7-9/12/16/23 with CEP 7-B | 54 | 137 | 97 | 90.7 | 5.1 | 59 | 60 | 35 | 85.1 | 2 | 4.2 |
| CA 7-30/37 with CEP 7 or CEP 7S | 45 | 136.5 | 91.5 | 92 | 16.5 | 69 | 60 | 35 | 104 | 2 | 4.2 |
| CA 7-30/37 with CEP 7-B | 54 | 137 | 97 | 92.1 | 5.2 | 59 | 60 | 35 | 104.7 | 2 | 4.2 |
| CA 7-43 with CEP 7, CEP 7S or CEP 7-B | 54 | 136.5 | 91.5 | 93 | 22 | 69 | 60 | 45 | 107 | 2 | 4.2 |
| CA 7-60/72/85 with CEP 7, CEP 7S or CEP 7-B | 72 | 188.5 | 120 | 120 | 18 | 84.5 | 100 | 55 | 125.5 | 2 | 5.5 |

CEP 7 with separate mounting bracket


| CEP 7-37-P-A | 45 | 90 | 75 | 30 | 75 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| CEP 7-45-P-A | 55 | 90 | 96.5 | 40 | 75 |
| CEP 7-85-P-A | 70 | 115 | 110 | 55 | 105 |



Contactor, timer and overload selection chart for auto transformer starters

| ATS kW | Line <br> contactor | Trans <br> contactor | Star <br> contactor | Timer | Overload |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 11 | CA 7-23-10 | CA 7-16-10 | CA 7-9-10 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 15 | CA 7-30-00 | CA 723-10 | CA 7-12-10 | RZ7 FSY2D | CEP 7-M37-37-10 |
| 18.5 | CA 7-37-00 | CA 7-30-00 | CA 7-16-10 | RZ7 FSY2D | CEP 7-M37-37-10 |
| 22 | CA 7-43-00 | CA 7-30-00 | CA 7-23-10 | RZ7 FSY2D | CEP 7-M45-45-10 |
| 30 | CA 7-60-00 | CA 7-37-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 37 | CA 7-72-00 | CA 7-43-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 45 | CA 7-85-00 | CA 7-60-00 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 55 | CA 6-85-11 | CA 7-60-00 | CA 7-43-00 | RZ7 FSY2D | CT 6-110 |
| 75 | CA 6-105-11 | CA 7-85-00 | CA 7-60-00 | RZ7 FSY2D | CT 6-150 |
| 90 | CA 6-140EI-11 | CA 6-85-11 | CA 7-72-00 | RZ7 FSY2D | CT 6-200 |
| 110 | CA 6-170EI-11 | CA 6-105-11 | CA 7-85-00 | RZ7 FSY2D | CEF 1-41 |
| 132 | CA 6-210EI-11 | CA 6-140EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 150 | CA 6-250EI-11 | CA 6-140EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 185 | CA 6-300EI-11 | CA 6-210EI-11 | CA 6-140EI-11 | RZ7 FSY2D | CEF 1-41 |
| 220 | CA 6-420EI-11 | CA 6-210EI-11 | CA 6-140-EI-11 | RZ7 FSY2D | CEF 1-41 |

Contactor, timer and overload selection chart for star delta starters

| SDS kW | Line <br> contactor | Delta <br> contactor | Star <br> Contactor | Timer | Overload |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 7.5 | CA 7-9-10 | CA 7-9-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-12-10 |
| 11 | CA 7-12-10 | CA 7-12-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 15 | CA 7-16-10 | CA 7-16-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 18.5 | CA 7-23-10 | CA 7-23-01 | CA 7-12-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 22 | CA 7-23-10 | CA 7-23-01 | CA 7-16-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| $30-37$ | CA 7-37-00 | CA 7-37-00 | CA 7-23-01 | RZ7 FSY2D | CEP 7-M45-45-10 |
| 45 | CA 7-60-11 | CA 7-60-11 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 55 | CA 7-60-11 | CA 7-60-11 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 75 | CA 7-85-00 | CA 7-85-00 | CA 7-43-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 90 | CA 6-85-11 | CA 6-85-11 | CA 7-60-00 | RZ7 FSY2D | CT 6-90 |
| 110 | CA 6-105-11 | CA 6-105-11 | CA 7-72-00 | RZ7 FSY2D | CT 6-110 |
| 132 | CA 6-140EI-11 | CA 6-140EI-11 | CA 7-85-00 | RZ7 FSY2D | CT 6-150 |
| 150 | CA 6-170EI-11 | CA 6-170EI-11 | CA 6-85-00 | RZ7 FSY2D | CTA 6-200 |
| 185 | CA 6-210EI-11 | CA 6-210EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 220 | CA 6-210-EI-11 | CA 6-210-EI-11 | CA 6-140-El-11 | RZ7 FSY2D | CEF 1-41 |
| TMS1368 |  | ACtive 29/07/2015 |  | Page 269 of 296 |  |

## ACS thermal overloads CT 7

## Dimensions with and without contactors

## Mounted on CA 7 contactors

$\rightarrow$

CT 7-24, CT 7-45, CT 7-75

| Type | For contactor | a | b | b1 | c | c1 | c2 | c3 | c4 | c5 | ød | d1 | d2 | e1 | e2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CT 7-24 | CA 7-9... 23 | 45 | 127 | 83 | 96 | 91 | 15 | 51 | 39 | 5 | 4.5 | 60 | $35^{1}$ ) | 16.5 | 51 |
|  | CA 7-30... 37 | 45 | 127 | 83 | 105 | 99 | 6.5 | 51 | 39 | 9.5 | 4.5 | 60 | $35^{1}$ ) | 16.5 | 51 |
| CT 7-45 | CA 7-30... 37 | 60 | 140 | 97 | 105 | 99 | 6.5 | 51 | 39 | 6.5 | 4.5 | 60 | $35^{1}$ ) | 16.5 | 57 |
|  | CA 7-43 | 60 | 140 | 97 | 107 | 103 | 6.5 | 51 | 39 | 8.5 | 4.5 | 60 | $45^{1}$ ) | 16.5 | 57 |
| CT 7-75 | CA 7-60... 85 | 72 | 185 | 120 | 125 | 120 | 8.5 | 51 | 39 | 28.5 | 5.4 | 100 | $55^{1}$ ) | 16.5 | 82 |

Separate mounting with bracket


Separate mounting


| Type | a | b | b1 | c | c1 | c2 | c3 | ød | d1 | d2 | e1 | e2 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CT 7-24 | 45 | 85 | 44 | 95 | 70.5 | 5 | 51 | 4.5 | $60 \ldots . .74$ | $\left.35^{\prime}\right)$ | 16 | 3 |
| CT 7-75 | 60 | 90 | 44 | 117 | 112 | 15 | 51 | 5.4 | 74 | $\left.50^{\prime}\right)$ | 16 | 0 |
| CT 7-90 | 100 | 120 | - | 135 | - | 5 | 51 | 6.2 | 74 | $\left.80^{\prime}\right)$ | 16 | 7 |

Notes: ${ }^{7}$ ) Standard DIN rail to EN 50 022-35.
${ }^{2}$ ) With reset rod, maintain 9 mm maximum operating radius from centre of reset button.
c3 Reset magnet.
c4 Auxiliary contact block.

1/

### 8.0 SWITCHBOARD WORKS TEST RESULTS

## J. \& P. RICHARDSON INDUSTRIES PTY LTD

114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 32712911 -Far: (07) 32713623
E-mail: jpr@jpr.comiau

## SWITCHBOARD \& SHEETMETAL INSPECTION REPORT



## SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST


 Quotation No

| 10. | Installation of Switchboards and Panels | Complies with relevant Drawings, Schedules and Contract Documents |  | x | w |  | QPR-303, Contract Documents ITP as required | F1014, F1015 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11. | Installation of cables and field equipment | Complies with Contract Documents, Drawings and Schedules |  | x | w |  | Uик-jús, Conıract Documents ITP as required, AS3000 \& AS 3008. | $\overline{\text { riuij }}$ |
| 12. | Testing | Compliance with AS 3000 Drawings and Schedules, Contract and Documents |  | $\mathrm{x}$ | H | w+a | QPR-303, QPR-310, ITP's Contract Documents, AS 3000 | F1015 |
| 13. | Commissioning | Contract Documents |  | x | H | w+a | Contract Documents | Acceptance |
| J \& P Richardson Ind Pty Ltd |  | *Legend  <br> $\mathbf{x}=$ Perform H = Hold (mandatory) <br> w = Witness h = Hold (optional) <br> a = Accept c = Certify <br> r = Random R = Review |  |  |  | Issue <br> Appro <br> Date: | $\begin{array}{ll} \text { No: } & \text { 'A' } \\ \text { ved: } & \\ & 28^{\text {th }} \text { July } 2004 \end{array}$ |  |

J. \& P. RICHARDSON IND. PTY. LTD.
ABN 23001952325
114 CAMPBELL AVE. WACOL Q 4076
J. \& P. RICHARDSON INDUSTRIES PTY. LTD. QUALITY PLAN

## TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)
LOCATION: WACOL WORKSHOP
DATE: …9.9....4

| AUTHORISATIONS | PERSONAL PROTECTIVE EQUIPMENT |  |
| :---: | :---: | :---: |
| - Authorisation from person in charge | - Long cotton clothing <br> - Insulating work gloves in test <br> - Insulating mats / covers in test <br> - Switchboard rescue kit in test | (1.) YES <br> $\square$ YES <br> d. YES <br> Y YES |
| TASK <br> LIVE LOW VOLTAGE WORK <br> TESTING SWITCHBOARDS <br> AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES <br> OPTION <br> OPTION | - Isolation points identified and accessible <br> - Work area clear of obstructions <br> - Unauthorised access prevented to work area <br> - P.P.E. is fit for purpose <br> - Test equipment is fit for purpose <br> - Written authority to proceed has been obtained from a person in charge <br> - JPR authorisation to conduct live work is current <br> - Approved dedicated power supply only used for testing. <br> - Approved dedicated power supply in current test <br> (A) RCD protected outputs used at power supply <br> $>\mathrm{RCD}$ protection checked daily prior to use <br> $>$ Safety Observerj//is not required <br> (B) Non RCD protected outputs used at power supply <br> $>$ Supervisor consulted prior to use <br> > Safety Observer is in attendance | $\checkmark$ YES <br> $\boxed{\square}$ YES <br> Ø YES <br> $\square$ YES <br> $\square$ YES <br> $\square$ YES <br> 4. YES <br> © YES <br> Y YES <br> Y YES <br> $\square \mathrm{YES}$ <br> $\square$ YES <br> - YES <br> - YES |

I understand and am fully aware of the requirements of this job safety analysis.


## J. \& P. RICHARDSON INDUSTRIES PTY LTD

114 Campbell Avenue, WACOL QLD 4076
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SWITCHBOARD ELECTRICAL INSPECTION \& TEST REPORT


## J. \& P. RICHARDSON INDUSTRIES PTYLTD

114 Campbell Avenue, VYACOL QLD 4076 Ph: (07) 32712911 - Fax: (07) 32713623 E-mail: jpr@jpr:com.au

## SWITCHBOARD CONTINUITY \& INSULATION TEŚS REPORT



## J. \& P. RICHARDSON INDUSTRIES PTY LTD

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E-mail: jpr@jpr.com.au

## SWITĊCHBOARD ELECTRICAL INSPECTION \& TEST REPORT VFD \& SOFT STARTER SETUP



$$
\begin{aligned}
& \text { O32 - BYFASS - ON } \\
& \text { O } 71 \text { - MOTBK PTC INPG - YES } \\
& \text { ALL DTHER SETTNGS LEFT AS DEFAHET. }
\end{aligned}
$$

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## J. \& P. RICHARDSON INDUSTRIES PTY LTD

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## SWITĊCHBOARD ELECTRICAL INSPECTION \& TEST REPORT VFD \& SOFT STARTER SETUP

Customer Name: IFSWIGH WATER

Project: KEIDCES RD PUMP STATION

| JPR Job No: $\mathcal{B} 70892$ | Item: $M \subset C$ | Drive: $P \cup-1 \hat{1} 2$ |
| :--- | :--- | :--- |
| Constructed by: RoLf | Tested by: $A \cdot \sqrt{ }$ Ky | Date: $2-9-04$ |

Drive Type: EMOTRON MSFOGO SOFT STARTER, Drive Rating: 6OA

## Drive Setup Details:

O32 -BYPASS - ON
O71 -MOTOR PT MUT - YES
Ail. OTHER SETTINGS LEFT AS DEFAUST

## J. \& P. RICHARDSON INDUSTRIES PTY LTD

## 114 Campbell Avenue, WACOL QLD 4076

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E-mail: jpr@jpr.com.au

## SWITCHBOARD ELECTRICAL INSPECTION \& TEST REPORT VFD \& SOFT STARTER SETUP



## 9.0 "AS CONSTRUCTED" DRAWINGS




| REVVIIIONS |  |  |  | Construction Certification : <br> As Supervising Engineer for this project, I certify that the works detailed on this drawing hove been carried out in accordonce with this of the PSSWCH CTY COUNCIL. |
| :---: | :---: | :---: | :---: | :---: |
| Smuen |  | कान |  |  |
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| - $\frac{1}{\text { cosasicus }}$ | $\stackrel{L}{2}$ |  |  |  |
| 8 Bramememe |  |  |  |  |



| REVISIONS |  |  |  | Construction Certification As Supervising Engineer for this project, certify that the morks detailed on this drowing hove been carried out in occordance with this of the IPSWCH CITY COUNCTL |
| :---: | :---: | :---: | :---: | :---: |
| NMESOUVEN | Tus | OMIE |  |  |
|  |  |  |  |  |
| ssmuem | $\stackrel{\square}{4}$ | (1-12-4) |  |  |
|  | ${ }_{\text {L }}^{\text {PR }}$ |  |  |  |


sules before resoction:

cation: KEIDGES ROAD
Tite : PUMP STATION UPGRADE
EQUIPMENT SCHEDULE SHEET 7 OF 10

SECTION F - F


SECTION G-G


SECTION H - H


SECTION 1 -


SECTION J - J


SECTION K - K




TR.




## $\frac{\text { NOIE }}{1.2}$ 2. EXISTING PIPEWORK SHOWN DOTTED










[^0]:    1); 2); 3) see next page

[^1]:    1) Consult KSB
[^2]:    ${ }^{1)}$ General arrangement drawing "Pump set 3 E - Baseplate/baseframe with motor height adjustment" shows the main variants

[^3]:    T for casing material GGG-NiCrNb 202, JS 1030, 1.4517
    ${ }^{2)} \mathbf{z}=$ clearance above casing cover for dismantling of the rotor
    ${ }^{3)}$ material combinations SB and SC: dimensions are 1\% larger

[^4]:    for casing material GGG-NiCrNb 202, JS 1030, 1.4517
    $z=$ clearance above casing cover for dismantling of the rotor
    material combinations SB and SC: dimensions are $1 \%$ larger

[^5]:    Health and Safety
    To ensure that our products are safe and without risk to health, the following points must be noted:

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

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

[^6]:    NOTE: when the Configuration action is finished, remember to press the ESC key to retum to display the previous selected value.

[^7]:    Flush and extended diaphragm options are also available, Figure 2.
    The flush diaphragm is suitable for applications where the process is free of suspended solids.
    The extended diaphragm eliminates the pocket at the transmitter connection and is typically used for slumies and viscous liquids.

[^8]:    Note: dimensions are expressed in mm. (Between parenthesis the same dimensions expressed in inches).

[^9]:    IP code
    About the degree of protection provided by the enclosure of the pressure transmitter, the 2600T SERIES has been certified IP67 according to EN 60529 standard.
    The first characteristic numeral indicates the protection of the inside electronics against ingress of solid forein objects including dusts. The assigned " 6 " means an enclosure dust-tight (no ingress of dust).
    The second characteristic numeral indicates the protection of the inside electronics against ingress of water. The assigned " 7 " means an enclosure water-protected against a temporary immersion in water under standardized conditions of pressure and time.

[^10]:    Health and Safety
    To ensure that our products are safe and without risk to health, the following points must be noted:

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

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

[^11]:    (") The spare parts list is available at: www.abb.com - searching for: SL262_4H.pdf of from local $A B B$ representatives.

[^12]:    Sprecher + Schuh 1000V CA 6 contactor
    (Refer Part A for more Information)

