

KESTNER ENG. CO. LTD

CONTRACT No:- 23547/CFH

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WARNING

**DO NOT OPERATE THIS UNIT
WITH THE PUMP CASING DRY
OR RUN THE MECHANICAL SEAL
WITH PURE WATER OR
DAMAGE TO THE PTFE SEAL
FACE WILL OCCUR**

WARNING

**THIS BEARING FRAME HAS
BEEN FILLED WITH
CASTROL HYPSPIN AWS 32
HYDRAULIC OIL - PLEASE
ENSURE SIMILAR OIL IS USED
SEE INSTRUCTION MANUAL
FOR EQUIVALENT LUBRICANTS**



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INSTALLATION AND INITIAL START-UP INSTRUCTIONS
FOR CENTRIFUGAL PUMPS.

PLEASE READ CAREFULLY BEFORE START-UP - CHECK AS FOLLOWS:-

ELECTRICAL SUPPLY;

*The supply voltage against the information on the electric motor nameplate.
The phasing of the supply is in accordance with the information plate on the motor.
Check the direction of rotation of the motor **before** starting the pump. This must agree
with the direction arrow indicated on the motor fan cowl.*

START-UP;

*The pump must be thoroughly primed with liquor before starting. The PTFE mechanical
seals should **not** be test run with water as this does not “wet” the PTFE material
sufficiently for good lubrication and a small ammount of proprietry wetting agent should
be used in the pumped liquid if water tests are envisaged.
These seals are designed to operate with Acidic solutions.*

*The ‘ KSI Series” Horizontal End Suction Long Coupled Pump unit is **not** inherently self-
priming – although the unit should be started with the discharge valve closed it should not
be operated against a 'shut valve' or with no flow through the pump for a period
exceeding a few minutes.*

LONG TERM STORAGE;

The pump unit should be stored in a dry vibration free location and the shaft rotated approx 1/4 to 1/2 revolution by hand at least weekly. Special Instructions are available for long term electric motor storage.

FAILURE TO PUMP.

In the unlikely event of the pump failing to pump correctly the following points should be checked:-

- (1) Air leaks into the suction pipework.*
- (2) Air lock in the pump casing due to incorrect priming.*
- (3) Suction pipework may be blocked with solid material.*
- (4) Pump speed possibly incorrect due to faulty electrical connection.*

ROUTINE CHECKS DURING NORMAL RUNNING.

- (1) Excessive noise or vibration.*
- (2) Electric Motor Current*
- (3) Electric Motor Bearing temperature.*

GENERAL POINTS TO NOTE ON INITIAL INSTALLATION.

- (1) Pipework should not allow air pockets to form in the suction pipework.*
- (2) To ensure a smooth liquor flow into the pump the number of bends, valves, and other obstructions, etc. should be kept to a minimum. Suction pipework should be equal to **or preferably one pipe size larger** than that of the pump suction diameter. Valves should be of the ' Free-Flow ' type ie Ball or Butterfly to reduce pipe friction losses.*
- (3) There must be no excessive 'springing' of the connecting pipework as this causes excess mechanical loading on the pump casing. Pipework must be amply and correctly supported.*
- (4) It is good practice to install a control valve close to the pump on the discharge side to allow for delivery control adjustments. Control of the pump flow should **not** be effected by a valve in the suction pipework.*

- (5) *The metal pumps should have CNAF jointing gasket material 1-2mm thick between the pump branches and connecting pipework. The joint material must be compatible with the pumped fluid.*
- (6) *The pump branch flanges, clamp bolts etc should be tightened **not exceeding the maximum** recommended torque figures given in the maintenance instructions.*



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INSTALLATION AND INITIAL START-UP INSTRUCTIONS
FOR KSI MODEL HORIZONTAL PUMPS.

PLEASE READ CAREFULLY BEFORE START-UP.

GENERAL.

- 1.1 We undertake to guarantee the suitability of the material of construction used only on condition that the pump is operated in accordance with the duty conditions specified and confirmed by us.*
- 1.2 Pump testing may be conducted if specified at the time of purchase, or at a later date if requested, at extra cost. By observing the following instructions, the pump will give trouble free operation, and meet the specified design parameters.*
- 1.3 Each pump unit is provided with a stainless steel nameplate fixed to the bearing frame. When ordering spare parts, please quote the pump serial number, pump type, the description of the parts, and the part number as given in the parts list.*

- 1.4 Nameplate details give the following serial number which is unique to the unit supplied. I.e. :- 23547/CFH/00000-00
- 1.5 The following spare parts are recommended for two years continuous operation

Part No.	Description	Material
210	Drive shaft	Steel
230	Impeller	High Silicon Iron
322	DE Bearing	-
323	NDE Bearing	-
400.1	Gasket	CNAF
400.2	Gasket	CNAF
400.3	Gasket	CNAF
411	Gasket	CNAF
412.1	'O' Ring	Viton/Neoprene
412.2	'O' Ring	Viton/Neoprene
	Mechanical Seal	PTFE
420.1	Oil seal	Nitrile
420.2	Oil seal	Nitrile
507	Flinger	Stainless Steel

NOTE:- ALWAYS USE ORIGINAL MANUFACTURERS PARTS WHEN RE-FURBISHING THE PUMP.

IMPORTANT WARNINGS:-

DO NOT OPERATE THE PUMP UNIT WITH THE PUMP CASING DRY OR RUN THE MECHANICAL SEAL WITH PURE WATER OR DAMAGE TO THE PTFE SEAL FACE WILL OCCUR – IF WATER TESTING IS REQUIRED CHECK WITH JOHN CRANE AND ENSURE THAT A SUITABLE WETTING AGENT IS USED.

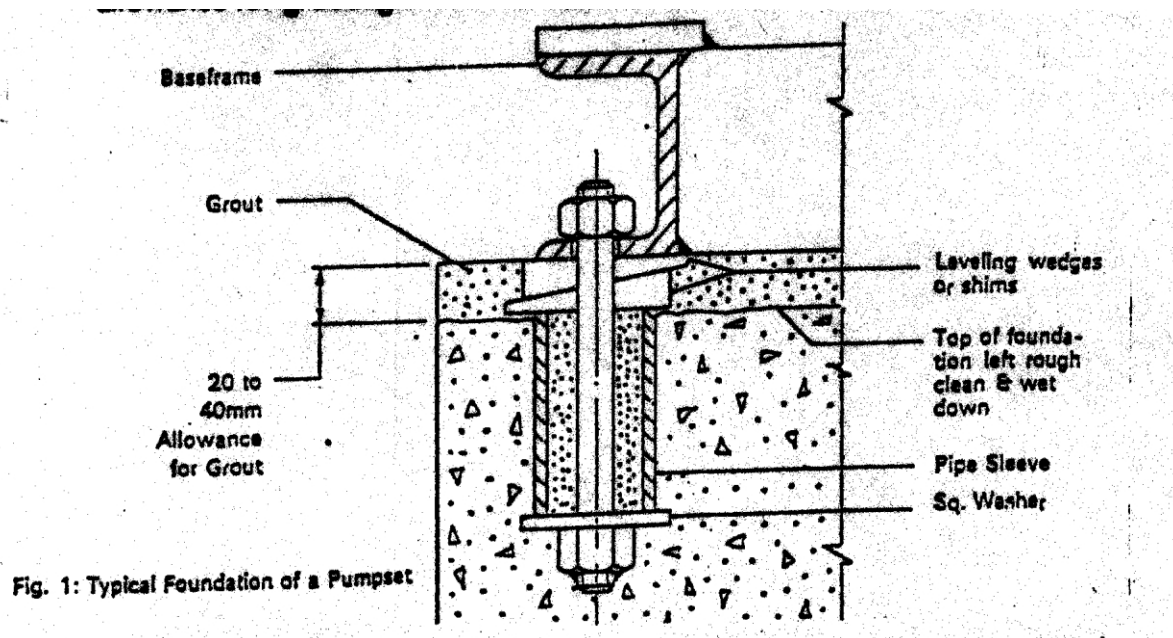
DO NOT OPERATE THE PUMP WITH THE PVC SEAL SPLASH GUARD REMOVED.

HANDLING.

2.0 WHILE LIFTING THE PUMP UNIT OUT OF THE BOX USE NYLON OR JUTE ROPE, AVOID THE USE OF STEEL ROPES – SEE APPENDIX ‘A’.

INSTALLATION,

- 3.0 *Preparation of foundations; Prepare the foundation keeping in mind the type of soil at the site. The top face of the foundation should be flat and horizontal. Place pipe sleeves for the foundation bolts while the foundations are being cast. Suitable allowance for grouting should be made.*



- 3.1 *Suspend the foundation bolts from the baseplate and place the pumpset on the foundation. Level it with the aid of a spirit level placed on the pump shaft/ discharge nozzle. Insert suitable shims or levelling wedges under the baseplate to level the pumpset (see Fig.1 above.) After this, grout the foundation bolts. When the foundation bolts are set firmly, tighten the baseplate, making sure that the levelling of the pumpset is not disturbed. Now grout the baseplate to the foundation with non shrinking mortar. Ensure that no cavities are left unfilled. It is **very important** that the alignment of the coupling and drive is then re-checked.*
- 3.2 *Coupling Alignment; Correct alignment of the shaft is an important consideration in the correct operation of the unit. Even if the pump and motor are supplied from the factory in an aligned condition, there is every possibility of the alignment being disturbed during transit or while tightening the baseplate to the foundation. Therefore, it should be checked before putting the pump into service.*

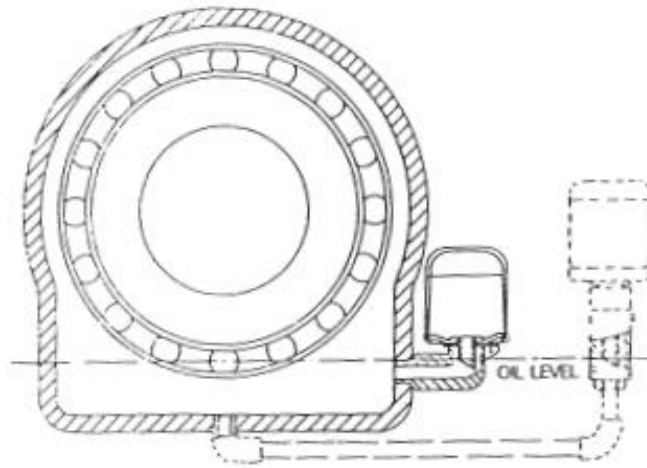
- 3.3 *Piping; Connect the pipework to the delivery and suction flanges of the pump respectively. The weight of the pipework should **not** be allowed to act upon the pump and should be adequately supported. **It is important that the suction and delivery pipes do not exert any strain on the pump flanges.** The nominal sizes of the pipelines should be at least equal to or larger than the nominal sizes of the pump nozzles.*

We also recommend that check valves or non-return valves and isolating valves are installed in the system, depending upon the type of installation. Also consideration should be given to compensate for any possible thermal expansion in the pipelines so that they do not impose any additional loadings on the pump branches. These loads can cause distortion of the unit causing seal failure, and bearing failure etc.

- 3.4 *Auxiliary piping connections; Please ensure that auxiliary pipework connections, such as seal flushing, quenching, sealing, cooling etc. are correctly connected and supply the specified flowrate and pressure for correct operation.*
- 3.5 *Coupling guard; To ensure safe operation and prevent accidents the pump should **only** be operated when the unit is correctly fitted with the coupling guard.*

COMMISSIONING.

- 4.0 *Check the lubricating oil level in the bearing pedestal. Fill the oil up to the level shown on the indicator fitted on the bearing frame. Do not put excess oil in the unit as this may cause overheating of the bearings. See the enclosed data sheet for correct grade of oil. Do not mix oil types or grades. Always maintain the oil level by regularly replenishing the quantity of oil lost in normal operation.*
- Where a constant level oiler is provided, the procedure for oil filling is as follows; Unscrew the breather plug. Pour in the correct grade of oil through the breather plug using a suitable funnel after having hinged down the reservoir of the constant level oiler until oil appears in the elbow of the constant level oiler. Then fill the reservoir of the oiler and snap it back into its normal operating position. Fit the breather plug. Allow a few minutes to elapse, re-check the oil level in the reservoir. The reservoir should always remain filled.*



Constant level oilers, depending on type are mounted into either oil level plug or drain plug holes. The cut-off tube **MUST** be vertical. Final oil level adjustments can be made by filing the cut-off tube or in the case of the VABL by the adjustment screw. To ensure the correct oil level, the gearbox **MUST** be filled using the oil feeder tube of the constant level.

The enclosed Lubrication chart gives details of the correct grade and type of mineral oil to ensure long bearing life under normal operating conditions.

NOTE:- IT IS VERY IMPORTANT THAT THE ALIGNMENT OF THE COUPLING AND DRIVE IS RE-CHECKED AFTER GROUTING INTO FINAL POSITION AND PIPEWORK INSTALLATION.

BEARING LUBRICATION.

- 5.0 *The recommended oils to ensure long bearing life, are given in the table below. Care should be taken to ensure that oil types are not mixed and oil changes made at the specified intervals.*

BEARING HOUSING TEMPERATURE °C	PUMP SPEED	ISO VISCOSITY
ABOVE 80° CENT	1450 / 1750 RPM 2900 / 3500 RPM	46 VG - TELLUS 46
30°C TO 80°C CENT	1450 / 1750 RPM 2900 / 3500 RPM	32 VG - TELLUS 32
-8°C TO 30°C CENT	1450 / 1750 RPM 2900 / 3500 RPM	15 VG - TELLUS 15

NOTE:- Although Shell Oils have been specified, all the major oil companies will supply equivalents. Oil life is reduced by sustained use above 85° Cent. Frequent oil changes and the use of the oil cooler should be considered.

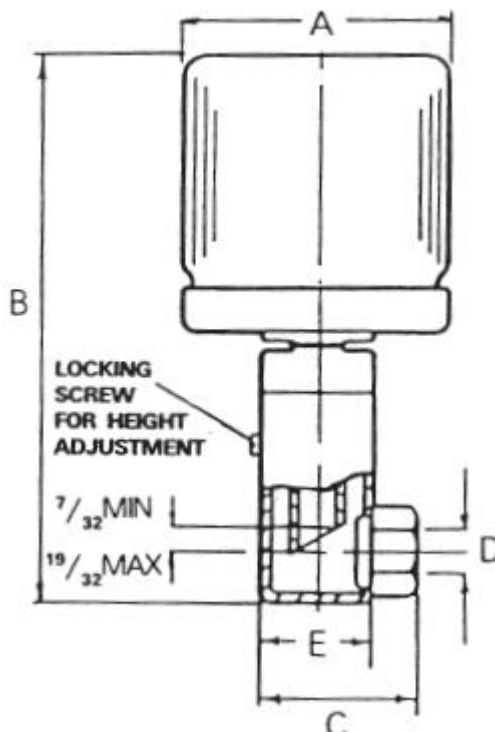
- 5.1 *Lubrication; **The first oil change should be carried out after 300 hours of operation.** The magnetic drain plug (903) should be removed using a hexagon key and the magnet wiped with a clean lint free cloth to remove any metallic particles from the magnet. After this, change the oil after **every 3,000 hours of operation.** The procedure for changing the oil is given in section. 4.0.*

IMPORTANT NOTE.

- 5.2 *Some models of the KSI range are now fitted with a variable level Constant Level Oiler. The setting screw should be adjusted to give the maximum oil level*

i.e. Dimension 'B' = 5. 1/2" (140mm)

Dimension 'F' = 19/32" (15 mm)



FILLING:- Unscrew the breather plug. Pour in the oil through the breather plug hole after removing the glass bottle portion, until oil appears in the bottom of the inlet pipe of the constant level oiler. Remove the glass reservoir bottle from the dip pipe tube and fill with oil. Replace the dip tube pipe onto the glass bottle. Place a finger on the angle of the outlet tube and invert. Then push the dip tube into the fixed oiler until the circlip grips the tube. Fit the breather plug and wait for a few minutes. Check the oil level in the reservoir.

The Constant Level Oiler reservoir should always remain filled during operation of the unit - check frequently.

ROUTINE CHECKS.

- 5.3 Check the pump for free rotation. The supply voltage should be checked with the motor nameplate. The phasing of the supply should be in accordance with the information plate on the motor. Check the direction of rotation of the motor before coupling the pump to the motor. This must agree with the direction arrow indicated on the bearing housing.

Check the auxiliary pipelines are in order. See attached section regarding the use of mechanical shaft seals if fitted.

Check the pump is fully primed if it is working against a suction lift. Remove any air in the suction pipeline by venting it by means of a vacuum pump or any other suitable equipment.

Check that the isolating valve in the discharge line is fully closed.

SWITCHING ON; *Close the discharge line valve fully. Start the pump unit. Open the isolating valve gradually only after the motor has attained its full operating speed. Adjust the operating point until the correct flowrate has been achieved. Check that the electric motor is not overloaded by checking the current drawn by the motor, the full load current is stated on the motor nameplate.*

Check the bearing temperature after the correct operating temperature has been attained. Check all pipelines for leakages. Check the leakage through the gland packing at the stuffing box. Even though excessive leakage is not recommended, the gland should drip a little and with some regularity.

SWITCHING OFF; *Close the discharge line valve. If a non-return valve is used, the isolating valve can remain open. Stop the motor. Close the auxiliary pipe connections, if any, only after stopping the motor. Stop the cooling water supply to the oil cooler, if fitted.*

GENERAL OPERATION.

5.4 *The following points should be checked at regular intervals.*

The pump should run smoothly, free from vibration.

The electric motor should not be overloaded. The pressure gauge reading and the power consumption should not exceed the specified ratings.

Avoid prolonged running of the pump against a closed valve in the discharge line as this will generate excessive heat due to 'churning' which is not desirable.

The bearing temperature should not exceed 50 deg. Cent. above the ambient.

The maximum temperature allowed is 85 deg. Cent.

Auxiliary pipework connections should not be closed whilst the pump is running.

Wherever necessary, provide a pressure gauge with a cock on the discharge line near to the pump discharge nozzle. A suction line gauge is also strongly recommended.

Provision of an Ammeter to maintain a constant check on the current drawn by the motor so as to avoid overloading of the motor is also advisable.

DISMANTLING.

6.0 *Isolate or disconnect the electrical supply to the motor.*

Drain the oil from the bearing housing by removing the drain plug (903) and remove the coupling guard.

Disconnect the spacer coupling by removing the flexible tyre. If no spacer type coupling is fitted, remove the electric motor,

Disconnect any auxiliary piping connections, such as flushing, seal quenching, or oil cooler supply and drain.

Drain the pump casing and remove the unit from the baseplate..

Remove the body clamp bolts (910) and split the casing assembly.

Remove the rotor (230) by unscrewing from the main drive shaft (210), remove the gland assembly and pump backplate (161) complete with the rotor (230).

Now remove the gland follower (454) gland packing set (461) lantern ring (458)

Flinger (507) from the casing backplate (161). Carefully remove the 'O' rings (412)

Inspect each 'O' ring carefully and replace if necessary.

In the case where a mechanical shaft seal is fitted as standard, unscrew the two seal housing clamp bolts, remove the impeller, backplate and seals as complete unit.

Remove the seal clamp plate and seal housing and remove the rear seal and using a suitable drift carefully push the impeller through the pump backplate and then remove the front seal. The mechanical seal seats can then be removed from both the seal housing and the pump backplate by using a suitable drift and carefully applying a light firm pressure. The seal seat 'O' rings or square section seals may then be fully inspected and replaced if necessary.

Remove the bearing housing (330), both the drive end (322) and non drive end (323) bearings may then be removed for inspection.

Drive out the shaft (210) by light tapping on the shaft with a soft faced mallet or wooden block from the impeller side. The drive end bearing (322) will come out with the shaft.

Remove the circlip (932) from the shaft and remove the drive end bearing housing (363), remove the circlip (931) and the bearing may then be removed with a puller.

The non drive end bearing (323) may then be removed with a puller.

Inspect the oil seals (420.1 and 420.2) and replace if necessary.

Clean all of the components and carefully check them for wear and tear, especially the drive shaft, stuffing box components, bearings. Replace all damaged or worn parts with new items.

RE-ASSEMBLY OF THE UNIT.

- 7.0 *Usually the assembly proceeds in the reverse sequence to the dismantling operation. Mechanical seal assembly should be done as per the following instructions. Take care while mounting the bearings, bearing covers along with the oil seals on the drive shaft to ensure that the oil seal lips are not damaged.*
- 7.1 ***Always** ensure that both the Steel Coupling guard and PVC Seal Splash Guard are re-fitted before placing the unit into services.*
- 7.2 *After re-assembly of the unit, the rotor should turn freely without touching the volute casing etc. There may be a little resistance from the gland packing set if they are fitted or from the mechanical seal face friction. This resistance is always different from the feeling of internal components touching.*

ASSEMBLY OF SINGLE MECHANICAL SEALS.

- 7.3a *See the enclosed Fitting and Installation instructions for John Crane Type 10T & 10R PTFE Single mechanical shaft seals.*

ASSEMBLY OF DOUBLE MECHANICAL SEALS.

- 7.3b *The procedure given below is for the initial fitment of double type 59U Eurodin John Crane mechanical shaft seals, assuming that all items are new, in clean and unused condition. (USING GROUP 1 BEARING FRAME)*

Ensure that the rotor setting dimension of 2mm is correctly set between the rotor (230) and the backplate (161).

If this is not correct proceed as follows:-

The method of achieving the correct setting clearance is to first machine a steel setting washer approx. 80mm O/dia by 50mm I/dia by 2.0 mm thick. Slide the setting washer onto the rotor stalk and then place the rotor stalk through the backplate bore with the setting washer sandwiched between the back of the rotor and the face of the backplate. Screw the assembly onto the pump drive shaft (940) until fully engaged on the thread. Loosen the cap screws (914.1) and tighten/or loosen the grubscrews (916) until the

back of the rotor is tightly pulled against the setting washer and backplate. Tighten the cap screws (914.1) to lock into position.

Remove the rotor, setting washer and backplate from the drive shaft. Remove the special setting washer and retain in a safe place for future use.

With the rotor on a bench with the shaft upwards, fit the mechanical seal seat to the backplate (161). Slide the pump backplate over the rotor shaft. Slide the mechanical seal with the face towards the seat onto the rotor shaft and then remove the setting clips. Using a tubular spacer exactly 68.0mm long push the seal onto the rotor shaft with the tube until the tube end is exactly in line with the end of the rotor shaft and then tighten the three seal clamping grub screws.*

Fit the outboard seal seat to the stainless steel seal housing. Slide the second outboard mechanical seal onto the rotor shaft and slide down until the backs of both seals touch. Tighten the outboard seal grub screws.

Fit the seal housing gasket, after fitting the 1/8" BSP drain plugs (if fitted) to the seal housing, and coat the mating faces with red 'Hermatite' sealant. Fit the seal clamp plate (471) onto the securing studs (902.2) but do not tighten yet. (leave the nuts loose.)

(* = Note:- This dimension is applicable to Group 1 bearing frames only - see the relevant assembly drawing for Group 11 Bearing frame setting dimensions.)

Place the seal housing (471) onto the backplate (161) assembly with the rotor and mechanical seals, and then screw the assembly onto the pump drive shaft.

Fit the clamp bracket (110) with the volute casing secured in situ with the special bolts (903.3 and 935) to the pump bearing frame (330) after inserting the gasket (400.3). Tighten the body clamp bolts (920.2) to the correct torque setting. Then fully tighten the seal housing retaining studs evenly, until the clamp plate is tight. (Some distortion of the seal housing clamp plate may occur.) Fit the sealant flush inlet/outlet hoses and hydrostatically pressure test the seal chamber to 100 LBS/sq inch. for approx. 15 minutes, rotate the drive shaft in the correct direction occasionally to check for any leakage, prior to re-commissioning the unit.

NOTE:- It is strongly advised that spare gaskets, joints and mechanical seals are held on site for emergency repairs.

BEARING FRAME	SIZE	SETTING WASHER DIMENSIONS
GROUP 1 FRAMES	40/160	80mm O/D x 50mm I/D x 2.0mm TH'K
	40/200	80mm O/D x 50mm I/D x 2.0mm TH'K
	50/160	80mm O/D x 50mm I/D x 2.0mm TH'K
	50/200	80mm O/D x 50mm I/D x 2.0mm TH'K
GROUP 11 FRAMES	50/250	100mm O/D x 65mm I/D x 2.0mm THK
	50/315	100mm O/D x 65mm I/D x 2.0mm THK
	80/200	100mm O/D x 65mm I/D x 2.0mm THK
	80/250	100mm O/D x 65mm I/D x 2.0mm THK
	100/200	100mm O/D x 65mm I/D x 2.0mm THK

NOTE:- **FOR DETAILS OF GROUP 11 SEAL SETTING POSITION REFER TO THE SECTIONAL ASSEMBLY DRAWING**

NOTE:- **GROUP 11 SETTING INSTRUCTIONS ETC ARE NOT APPLICABLE FOR CONTRACT NO:- 23547/CFH**

KESTNER ENGINEERING. CO. LTD.
RECOMMENDED 'MAXIMUM' TORQUE SETTINGS.

<i>KSI MODEL PUMP SIZE</i>	<i>BODY CLAMP BOLTS</i>		<i>SUCTION FLANGE BOLTS</i>		<i>DISCHARGE FLANGE BOLTS</i>	
	<i>Size</i>	<i>Kgf-cm</i>	<i>Size</i>	<i>Kgf-cm</i>	<i>Size</i>	<i>Kgf-cm</i>
40 / - - -	M12	300	65 M16	200	40 M16	225
50 / - - -	M12	350	80 M16	200	50 M16	225
80 / - - -	M16	500	125 M16	250	80 M16	300
100 / - - -	M16	550	125 M16	250	100 M16	300

lb - ft = kgf - cm x 9.807
100 x 1.3558

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DO NOT EXCEED THE 'MAXIMUM' TORQUE SETTINGS.

LONG TERM STORAGE.

- 8.0 *The pump unit should be stored in a dry vibration free location preferably in the horizontal position. The pump unit should be rotated at least weekly and the motor checked for free rotation prior to installation. (See separate notes regarding long term mechanical seal storage.)*

NOTE:-

ALWAYS USE ORIGINAL MANUFACTURERS PARTS WHEN RE-FURBISHING THE PUMPUNIT.

KESTNER ENGINEERING. CO. LTD.
TROUBLE SHOOTING GUIDE.

<i>PROBLEM</i>	<i>CAUSE</i>	<i>REMEDY</i>
<i>Rate of flow low.</i>	<i>Pump rotates in wrong direction.</i>	<i>Reverse the connections to the to motor terminal.</i>
	<i>Impeller or strainer clogged.</i>	<i>Clean respective part.</i>
	<i>Sealing clearance increased.</i>	<i>Replace worn components.</i>
	<i>Delivery head requirement higher than specified.</i>	<i>Consult manufacturer for fitting larger dia. impeller.</i>
	<i>Pump speed too low.</i>	<i>Voltage drop or low frequency, use motor of correct speed.</i>
	<i>Frictional losses higher than specified.</i>	<i>Increase pipe size.</i>
	<i>Viscosity of liquid higher than specified.</i>	<i>Consult manufacturer for possibility of changing the impeller.</i>
	<i>Impeller worn.</i>	<i>Replace with new component.</i>
<i>Pump discharge too high.</i>	<i>Delivery head lower than specified.</i>	<i>(a) Throttle discharge valve.</i> <i>(b) By-pass part of the capacity.</i> <i>(c) Reduce impeller diameter.</i> <i>(d) Fit orifice plate in discharge line.</i>
<i>Pump vibrates.</i>	<i>Pump starves.</i>	<i>Check suction conditions.</i>
	<i>Impeller out of balance due to clogging.</i>	<i>Clean impeller.</i>
	<i>Misalignment.</i>	<i>Check and Re-align unit.</i>
	<i>Bearing worn out.</i>	<i>Change bearings.</i>
	<i>Undue stress on pump flanges.</i>	<i>Anchor pipelines correctly.</i>
	<i>Foundation not rigid.</i>	<i>Check foundation and correct.</i>
	<i>Rotating part rubbing.</i>	<i>Check rotating assembly.</i>
<i>Motor overloaded.</i>	<i>Specific gravity of liquid higher than specified.</i>	<i>Use motor of higher rating.</i>

Viscosity higher than specified.

Impeller rubbing against backplate/suction cover

Heavy friction in stuffing box bush and sleeve.

Excessive flowrate.

Regulate viscosity or consult the manufacturer.

Check the internal operating clearances.

Check clearances, shaft straightness and alignment.

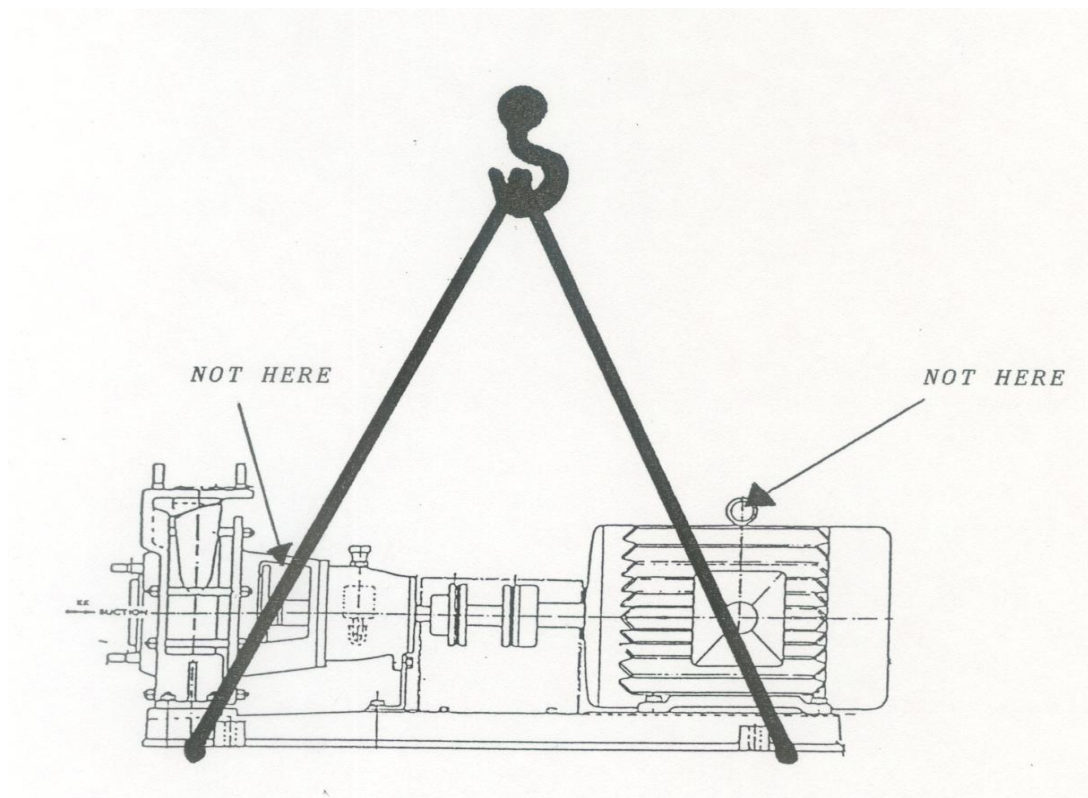
Throttle the valve on discharge side.

**KESTNER ENGINEERING. CO. LTD.
HORIZONTAL LONG COUPLED PUMP UNITS.**

APPENDIX 'A'

WARNING.

IT IS VERY IMPORTANT THAT WHEN LIFTING HORIZONTALLY MOUNTED PUMPS, THE LIFTING SLINGS ARE USED TO LIFT THE COMPLETE BEDPLATE AND NOT THE PUMP OR MOTOR



NOTE:-

AFTER FIXING THE UNIT IN ITS FINAL POSITION AND GROUTING TO FOUNDATION IT IS IMPORTANT THAT THE ALIGNMENT IS CORRECTLY CHECKED AND INSTALLATION AND OPERATION IS IN ACCORDANCE WITH THE INSTRUCTION MANUAL.

SPECIAL INSTRUCTIONS REGARDING SILICON IRON PUMPS.

High Silicon iron process equipment has been serving the chemical and associated industries for nearly eighty years. The corrosion resistance of this alloy has been claimed by many to be unexcelled by any other commercially available metal, or alloy, together with its excellent corrosion resistance High Silicon Iron by virtue of its hardness finds many applications where corrosion and / or erosion is present. The greatest hindrance to the wide-spread use of this alloy has been its susceptibility to thermal and mechanical shock. It is therefore important that the following points are considered to achieve a long and trouble free service life.

- (1) Thermal shock should be minimised, and if possible gradually heat equipment to elevated working temperatures.*
- (2) Do not allow staff to 'hose down' equipment working at high temperatures. Rapid changes in ambient temperature may induce thermal shock, however, gradual temperature changes generally cause no service difficulties.*
- (3) Fitment of pipework expansion bellows, compatible with the pumped fluid, will reduce any mechanical loads or vibrations and is “**Highly**” recommended.*
- (4) Check the correct alignment of suction and discharge pipework this should be adequately and independently supported. The pump casing should **not** be used as a pipework support.*
- (5) Reduce any imposed pipework loading by not overtightening pipe flange connections. (see torque chart for maximum recommended values).*
- (6) High Silicon Iron alloys are very hard and machining of holes is very difficult, welding of castings is also impractical and should not be attempted.*
- (7) Metal pumps should have Compressed Non-Asbestos Fibre or similar jointing gasket material 1-2mm thick between the pump branches and connecting pipework. The joint material must be compatible with the pumped fluid.*

LUBRICATION CHART.

EQUIVALENT OIL GRADES.

<i>SHELL</i>	<i>B.P</i>	<i>CASTROL</i>	<i>MOBIL</i>	<i>ESSO</i>	<i>ELF</i>	<i>TOTAL</i>
<i>TELLUS 15</i>	<i>ENERGOL 15</i>	<i>HYSPIN AWS 15</i>	<i>DTE 11 M</i>	<i>NUTO H 15</i>	<i>ELFOLNA 15</i>	<i>AZOLLA 10</i>
<i>TELLUS 32</i>	<i>ENERGOL 32</i>	<i>HYSPIN AWS 32</i>	<i>DTE 32 M</i>	<i>NUTO H 32</i>	<i>ELFOLNA 32</i>	<i>AZOLLA 32</i>
<i>TELLUS 46</i>	<i>ENERGOL 46</i>	<i>HYSPIN AWS 46</i>	<i>DTE 46 M</i>	<i>NUTO H 46</i>	<i>ELFOLNA 46</i>	<i>AZOLLA 46</i>

EQUIVALENT GREASE GRADES.

<i>SHELL</i>	<i>B.P</i>	<i>SKF</i>	<i>MOBIL</i>	<i>ESSO</i>	<i>ELF</i>	<i>TOTAL</i>
<i>ALVANIA R3</i>	<i>ENERGREASE LS3</i>	<i>ALFALUB LG MT3</i>	<i>MOBILUX EP3</i>	<i>BEACON 3</i>	<i>MULTI 3</i>	<i>MULTI SPECIAL 3</i>



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**INSTALLATION INSTRUCTIONS FOR FENNER TYPE
FENAFLEX TYRE SPACER COUPLINGS.**

ASSEMBLY

- 1.0 Thoroughly Clean all components paying particular attention to the removal of the protective coating in the flange bores and bushes*
- 1.1 Place each cleaned "Taper Lock Bush" in its respective flange and slide the flange onto its shaft. If keys are required, side fitting keys with top clearance should be used.*
- 1.2 Using a straight edge line up the faces indicated with the shaft ends. Using a Dial clock gauge check the run-out of the spacer flange.*
- 1.3 Position the "Fenaflex" flange on the spacer shaft to dimension "Y" shown in the Table 3 below*

- 1.4 *Locate Spacer sub assembly on to the spacer flange and engage spigot, align holes and insert screws and tighten to the torques indicated in Table 4*
- 1.5 *Open out the Tyre to fit over the coupling flanges ensuring that the tyre bead seats properly on the flanges. To ensure proper seating it may be necessary to strike the tyre with a small soft head mallet. When seated there should be a gap in the tyre as shown in Table 2*
- 1.6 *Tighten clamping ring screws alternatively and evenly (approx half a turn at a time) working around each flange until required screw torque is achieved, see Table 1*

DISMANTLING

- 1.1 *Support the spacer sub-assembly*
- 1.2 *Remove the clamping ring screws progressively and evenly (half a turn at a time) to prevent distortion of the clamping rings*
- 1.3 *Remove the tyre*
- 1.4 *Remove the Spacer flange screws and lift out the spacer sub-assembly*

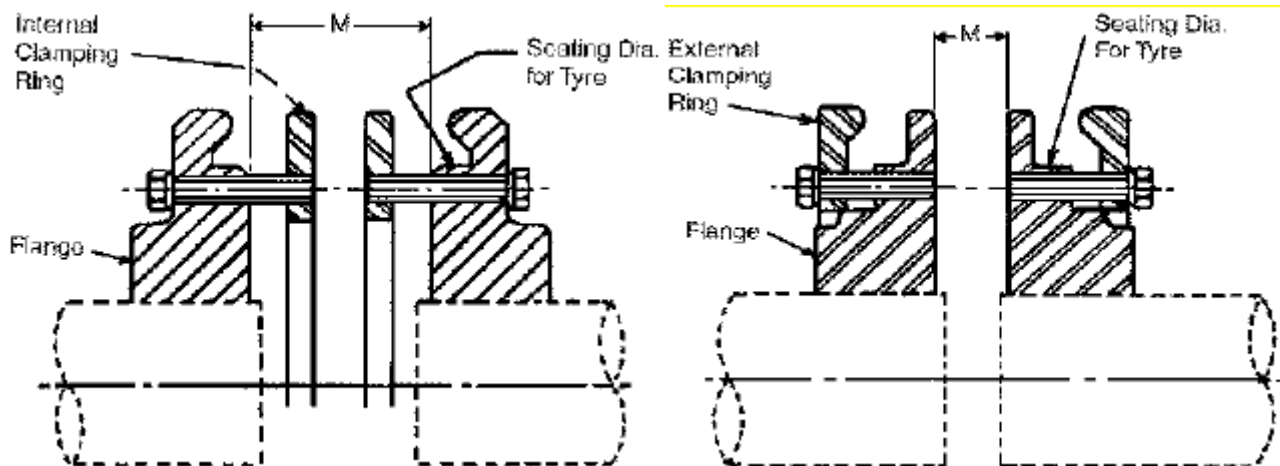
Table 1

<i>Coupling size</i>	<i>F40</i>	<i>F50</i>	<i>F60</i>	<i>F70</i>	<i>F80</i>	<i>F90</i>	<i>F100</i>	<i>F110</i>	<i>F120</i>	<i>F140</i>	<i>F160</i>
<i>M mm</i>	22	25	33	24	26	29	29	29	29	33	30
<i>Size mm</i>	<i>M6</i>	<i>M6</i>	<i>M6</i>	<i>M8</i>	<i>M8</i>	<i>M10</i>	<i>M10</i>	<i>M10</i>	<i>M12</i>	<i>M12</i>	<i>M16</i>
<i>Torque Nm</i>	15	15	15	24	24	40	40	40	50	55	80

ASSEMBLY OF TYRE COUPLINGS

- 1.0 *Thoroughly clean all components, paying particular attention to the removal of the protective coating in the bore of the flanges*

- 1.1 *Fit the flanges to the shafts after placing the external clamp rings on the shafts. (where Taper Lock Bushes are used see separate fitting instructions supplied) Locate the flanges so that the dimension 'M' is obtained (see Section 1.2). Flanges with internal clamping rings should then have the clamping rings fitted, engaging only two of the threads of the screws at this time*
- 1.2 *Bring the shafts into line until dimension 'M' is obtained (Table 1). If shaft end float is to occur, locate the shafts at the mid position of the end float when checking dimension 'M'. Note that the shaft ends may project beyond the faces of the flanges if required. In this event, allow sufficient space between shaft ends for end float and mis-alignment. Flanges should be fitted flush with the end of the shaft when used with Mill-Motor flanges.*
- 1.3 *Check parallel alignment by laying a straight edge across the flanges at several positions around the circumference. Check angular alignment by measuring the gap between the flanges at several positions around the circumference. It is desirable to align the coupling as accurately as possible, particularly on high speed applications.*
- 1.4 *Open out the tyre and fit over the coupling flanges ensuring that the tyre beads seat properly on the flange and/or clamping rings. To ensure proper seating, it may be necessary to strike the outside diameter of the tyre with a small soft head mallet. When seated there should be a gap between the ends of the tyre as shown in Table 2*
- 1.5 *Tighten the clamping ring screws alternately and evenly (half a turn at a time) working around each flange until the required screw torque is achieved (Table 2)*



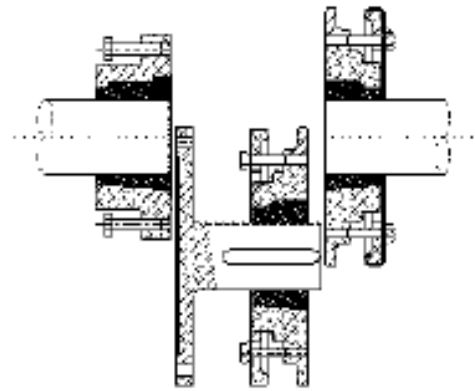
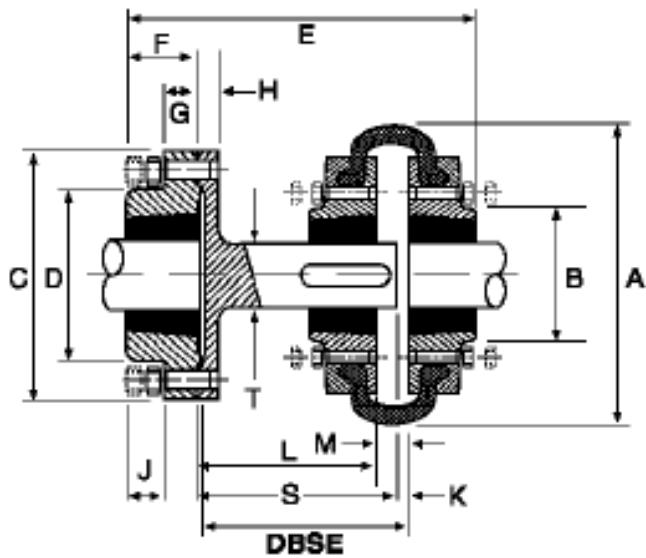


Table 2

<i>Coupling size</i>	<i>F40 to F60</i>	<i>F70 to F120</i>	<i>F140 to F160</i>	<i>F180 to F250</i>
<i>Tyre Gap (mm)</i>	2.0	3.0	5.0	6.0

Table 3

<i>Dimension 'S' For Nominal DBSE</i>			
	<i>100mm</i>	<i>140mm</i>	<i>180mm</i>
<i>F40</i>	94	134	
<i>F50</i>	94	134	
<i>F60</i>	94	134	174
<i>F70</i>	94	134	174
<i>F80</i>	94	134	174
<i>F90</i>		134	174
<i>F100</i>		134	174
<i>F110</i>		134	174
<i>F120</i>		134	174
<i>F140</i>		134	174

Table 4

<i>Flange Size</i>	<i>Screws</i>	<i>Torque (Nm)</i>
<i>SM16</i>	<i>M10</i>	<i>20</i>
<i>SM25</i>	<i>M12</i>	<i>25</i>
<i>SM30</i>	<i>M16</i>	<i>40</i>
<i>SM35</i>	<i>M16</i>	<i>90</i>

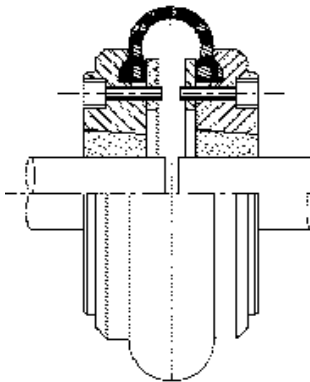
Note:- *If necessary the DBSE may be extended. The maximum DBSE possible is achieved when the spacer shaft end and driven shaft end are flush with the face of their respective Taper Lock Bushes.*

FOR CONTRACT No:- 23547/CFH

The Fenaflex FRAS Coupling tyre is supplied loose in the Sheet Steel Coupling Guard. Adjust the Flange positions to give the correct clearance (M) and then fit the tyre in accordance with the instructions.

Pump Shaft
F50F Flange 1210 x 24

Spacer Shaft
F50H Flange 1210 x 32

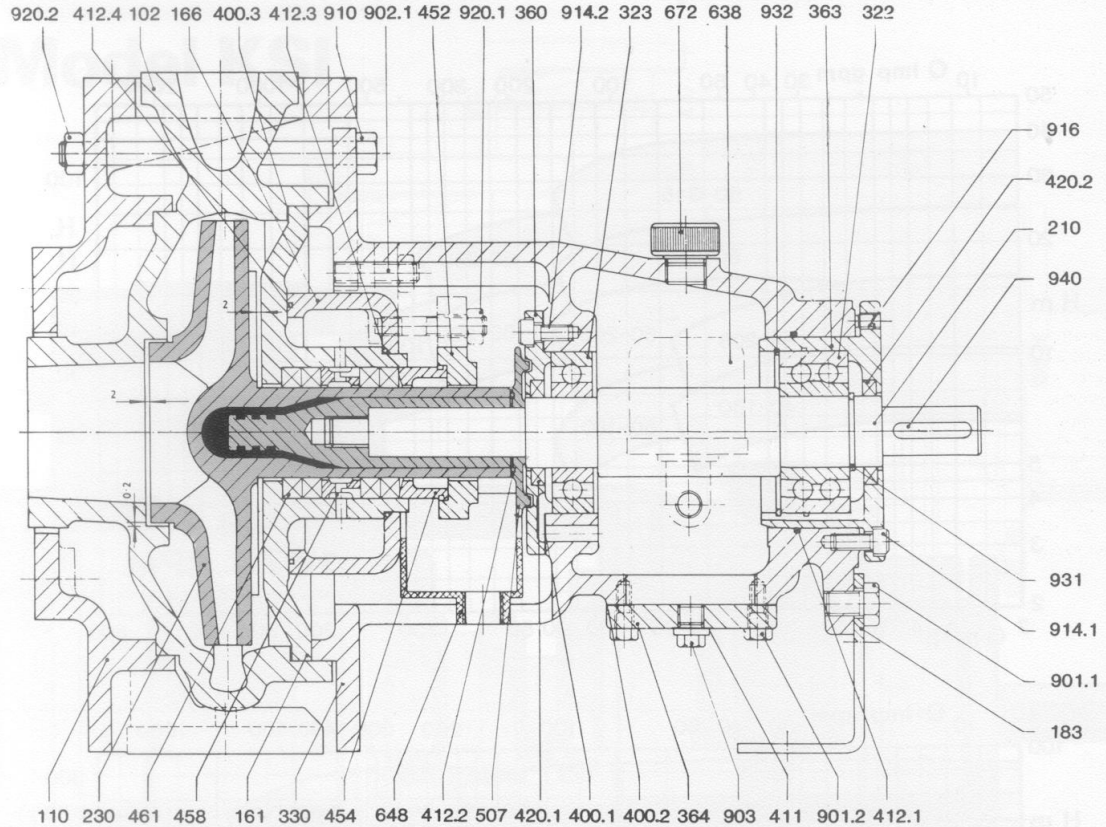


100mm NOMINAL DBSE (DISTANCE BETWEEN SHAFT ENDS)

	<i>SM16 SPACER</i>	
	<i>Min (mm)</i>	<i>Max (mm)</i>
<i>F50 COUPLING</i>	<i>100mm</i>	<i>116mm</i>

Sectional Drawing and Parts List

The sectional drawing and parts lists shown refer to model KSI equipped with a soft packing and without bearing frame cooling. Additional parts are needed for the mechanical and hydrodynamic shaft sealing options and for bearing frame cooling.



Part No.	Designation	Construction Material	Part No.	Designation	Construction Material
102	Casing	Alloy*	420.2	Oil seal	Ntr. Rubber
110	Casing clamping plate	GG20	452	Gland	1.4500
161	Casing back plate	Alloy*	454	Gland follower	1.4500
166	Cooling chamber	GG20	458	Lantern ring	1.4500
183	Support foot	St 37-2	461	Gland packing	
210	Shaft	C-45	507	Flinger	1.4500
230	Impeller	Alloy*	638	Constant level oiler	Plastic
322	Bearing D.E.		648	Drip tray	1.4500
323	Bearing N.D.E.		672	Breather plug	Brass
330	Bearing Housing	GG20	901.1	Hex screw	DIN 601 4.6
360	Bearing cover	GG20	901.2	Hex screw	DIN 601 4.6
363	Bearing cartridge	GG20	902.1	Stud	DIN 939 4.6
364	Window cover	GG20	903	Collared plug	DIN 910 5.8
400.1	Gasket	IT 400	910	Hex head bolt	DIN 931 4.6
400.2	Gasket	IT 400	914.1	Cap screw	DIN 7984 8.8
400.3	Gasket	IT 400	914.2	Cap screw	DIN 7984 8.8
411	Joint ring	IT 400	916	Grub screw (Dog point)	DIN 915 8.8
412.1	O-ring	Neoprene	920.1	Hex nut	DIN 934 4.6
412.2	O-ring	Viton Rubber	920.2	Hex nut	DIN 934 4.6
412.3	O-ring	Viton Rubber	931	Circlip internal	Spring Steel
412.4	O-ring	Viton Rubber	932	Circlip external	Spring Steel
420.1	Oil seal	Ntr. Rubber	940	Coupling key	St 60

*Liquid end parts are cast in different alloys depending on application, such as high silicon iron (14 to 15 % Si) or Ni-Hard 2B.



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INSTALLATION INSTRUCTIONS FOR FENNER TYPE
FENAFLEX TYRE SPACER COUPLINGS.

ASSEMBLY

- 1.0 *Thoroughly Clean all components paying particular attention to the removal of the protective coating in the flange bores and bushes*
- 1.1 *Place each cleaned "Taper Lock Bush" in its respective flange and slide the flange onto its shaft. If keys are required, side fitting keys with top clearance should be used.*
- 1.2 *Using a straight edge line up the faces indicated with the shaft ends. Using a Dial clock gauge check the run-out of the spacer flange.*
- 1.3 *Position the "Fenaflex" flange on the spacer shaft to dimension "Y" shown in the Table 3 below*
- 1.4 *Locate Spacer sub assembly on to the spacer flange and engage spigot, align holes and insert screws and tighten to the torques indicated in Table 4*

- 1.5 *Open out the Tyre to fit over the coupling flanges ensuring that the tyre bead seats properly on the flanges. To ensure proper seating it may be necessary to strike the tyre with a small soft head mallet. When seated there should be a gap in the tyre as shown in Table 2*
- 1.6 *Tighten clamping ring screws alternatively and evenly (approx half a turn at a time) working around each flange until required screw torque is achieved, see Table 1*

DISMANTLING

- 1.1 *Support the spacer sub-assembly*
- 1.2 *Remove the clamping ring screws progressively and evenly (half a turn at a time) to prevent distortion of the clamping rings*
- 1.3 *Remove the tyre*
- 1.4 *Remove the Spacer flange screws and lift out the spacer sub-assembly*

Table 1

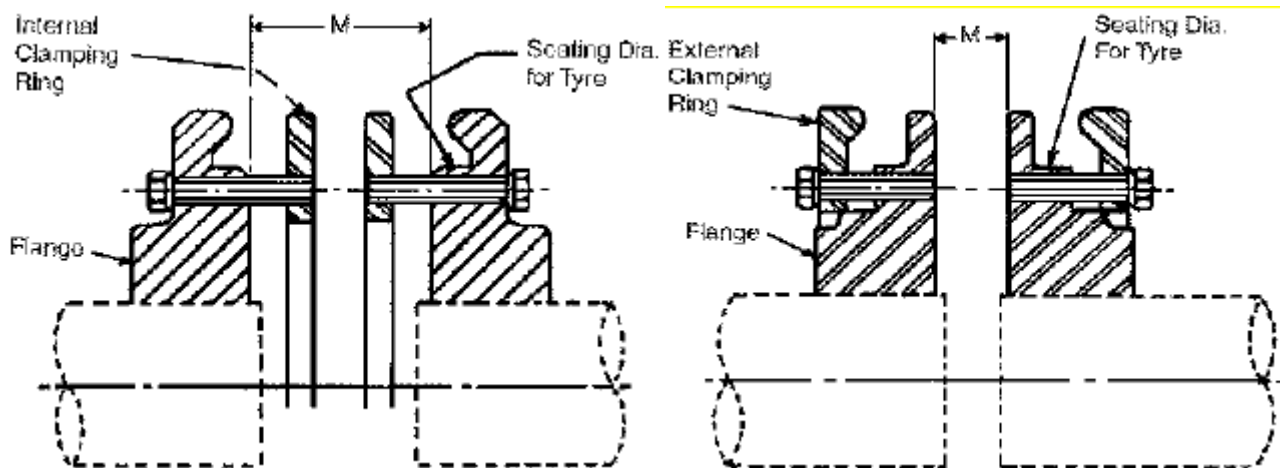
<i>Coupling size</i>	<i>F40</i>	<i>F50</i>	<i>F60</i>	<i>F70</i>	<i>F80</i>	<i>F90</i>	<i>F100</i>	<i>F110</i>	<i>F120</i>	<i>F140</i>	<i>F160</i>
<i>M mm</i>	22	25	33	24	26	29	29	29	29	33	30
<i>Size mm</i>	M6	M6	M6	M8	M8	M10	M10	M10	M12	M12	M16
<i>Torque Nm</i>	15	15	15	24	24	40	40	40	50	55	80

ASSEMBLY OF TYRE COUPLINGS

- 1.0 *Thoroughly clean all components, paying particular attention to the removal of the protective coating in the bore of the flanges*
- 1.1 *Fit the flanges to the shafts after placing the external clamp rings on the shafts. (where Taper Lock Bushes are used see separate fitting instructions supplied) Locate the flanges so that the dimension 'M' is obtained (see Section 1.2). Flanges with internal*

clamping rings should then have the clamping rings fitted, engaging only two of the threads of the screws at this time

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- 1.5 Tighten the clamping ring screws alternately and evenly (half a turn at a time) working around each flange until the required screw torque is achieved (Table 2)



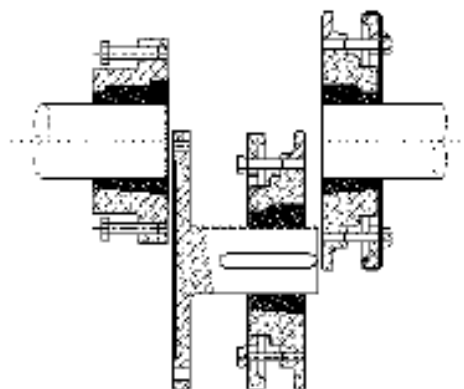
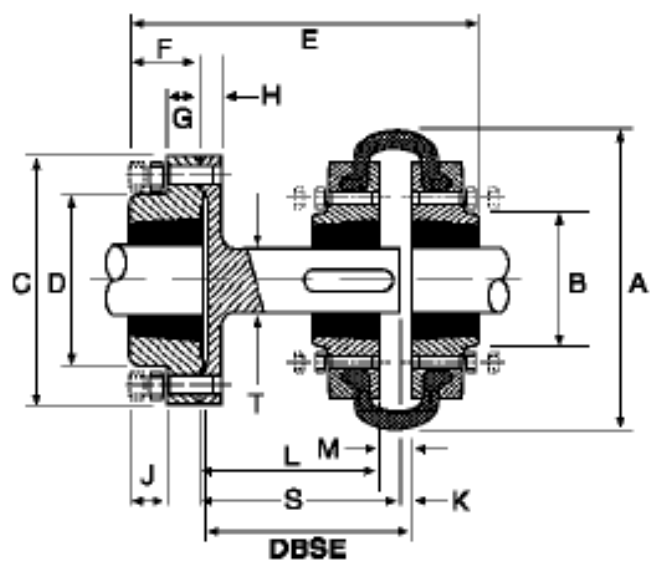


Table 2

<i>Coupling size</i>	<i>F40 to F60</i>	<i>F70 to F120</i>	<i>F140 to F160</i>	<i>F180 to F250</i>
<i>Tyre Gap (mm)</i>	2.0	3.0	5.0	6.0

Table 3

	<i>Dimension 'Y' For Nominal DBSE</i>		
	<i>100mm</i>	<i>140mm</i>	<i>180mm</i>
<i>F40</i>	83	123	
<i>F50</i>	82	122	
<i>F60</i>	75	115	155
<i>F70</i>	76	116	156
<i>F80</i>	74	114	154
<i>F90</i>		111	151
<i>F100</i>		111	151
<i>F110</i>		115	155
<i>F120</i>		111	151
<i>F140</i>		104	144

Table 4

<i>Flange Size</i>	<i>Screws</i>	<i>Torque (Nm)</i>
<i>SM16</i>	<i>M10</i>	<i>20</i>
<i>SM25</i>	<i>M12</i>	<i>25</i>
<i>SM30</i>	<i>M16</i>	<i>40</i>
<i>SM35</i>	<i>M16</i>	<i>90</i>

Note:- If necessary the DBSE may be extended. The maximum DBSE possible is achieved when the spacer shaft end and driven shaft end are flush with the face of their respective Taper Lock Bushes.

KESTNER ENGINEERING CO LTD
QUOTE No 11246 REV 2
APPENDIX A

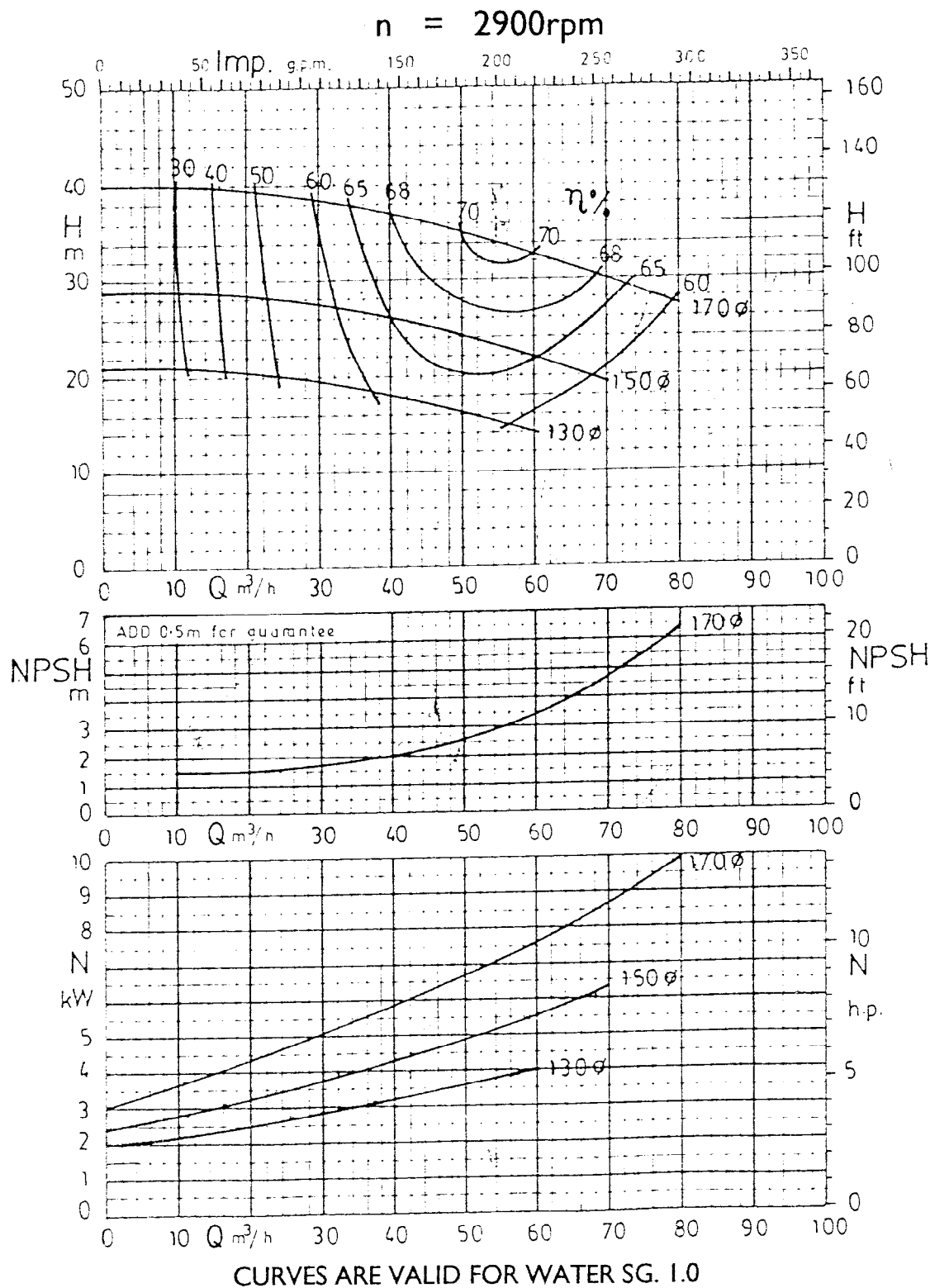
DESCRIPTION	SULPHURIC ACID PUMPS
ITEM NO	P-579/589 – 1&2
MODEL	KSI 50/160
CURVE No	K41747
TYPE	HORIZONTAL END SUCTION
NO OF STAGES	ONE
SUCTION SIZE	80 mm
DISCHARGE SIZE	50 mm
FLANGES	ANSI 150 DRILLING
DUTY FLOWRATE	27.3m3/Hr
DUTY HEAD	22.3 metres
LIQUID	98% W/W H2SO4
DENSITY	1.83
TEMPERATURE	50 Deg. Cent
NPSH reqd	2.25 metres
POWER (ABS)	7.0 kW (APPROX)
POWER (INST)	11 kW
IMPELLER TYPE	CLOSED TYPE
IMPELLER MATERIAL	14.5% HIGH SILICON IRON MATERIAL
VOLUTE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
BACKPLATE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
CORROSION ALLOWANCE	3 mm MINIMUM
SHAFT SEAL	SINGLE MECHANICAL
MANUFACTURER	JOHN CRANE
SEAL TYPE	PTFE EXTERNALTYPE
SPECIFICATION:-	QX1CX/V OR EQUIVALENT
MATERIAL CODE	PTFE vs CERAMIC
SEAL SIZE	45mm
MOTOR MANUFACTURER	ABB
MODEL	PROCESS PERFORMANCE
TYPE	CAST IRON
RATING	MCR
POWER	11 kW
FRAME SIZE	M3BP160MA
FULL LOAD SPEED	2915 rpm
ENCLOSURE	IP 55
INSULATION	CLASS F
TEMP RISE	CLASS B
VOLTAGE	380
PHASE	3
HERTZ	50
SPACER COUPLING	FENAFLEX OR EQUIVALENT
COUPLING GUARD	STEEL
BASEPLATE	CAST IRON

KESTNER ENGINEERING CO LTD
QUOTE No 11246 REV 2
APPENDIX A

DESCRIPTION	PHOSPHORIC ACID PUMPS
ITEM NO	P-579/589 – 5&6
MODEL	KSI 50/160
CURVE No	K41747
TYPE	HORIZONTAL END SUCTION
NO OF STAGES	ONE
SUCTION SIZE	80 mm
DISCHARGE SIZE	50 mm
FLANGES	ANSI150 DRILLING
DUTY FLOWRATE	34 m ³ /Hr
DUTY HEAD	30.6 metres
LIQUID	52% W/W H ₃ PO ₄ + TRACES GYPSUM
DENSITY	1.5
TEMPERATURE	50 Deg. Cent
NPSH reqd	2.5 metres
POWER (ABS)	7.0 kW (APPROX)
POWER (INST)	11 kW
IMPELLER TYPE	CLOSED TYPE
IMPELLER MATERIAL	14.5% HIGH SILICON IRON MATERIAL
VOLUTE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
BACKPLATE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
CORROSION ALLOWANCE	3 mm MINIMUM
SHAFT SEAL	SINGLE MECHANICAL
MANUFACTURER	JOHN CRANE
SEAL TYPE	PTFE EXTERNALTYPE
SPECIFICATION:-	QXS1CX/V OR EQUIVALENT
MATERIAL CODE	SILICON CARBIDE vs CERAMIC
SEAL SIZE	45mm
MOTOR MANUFACTURER	ABB
MODEL	PROCESS PERFORMANCE
TYPE	CAST IRON
RATING	MCR
POWER	11 kW
FRAME SIZE	M3BP160MA
FULL LOAD SPEED	2915 rpm
ENCLOSURE	IP 55
INSULATION	CLASS F
TEMP RISE	CLASS B
VOLTAGE	380
PHASE	3
HERTZ	50
SPACER COUPLING	FENAFLEX OR EQUIVALENT
COUPLING GUARD	STEEL
BASEPLATE	CAST IRON

KESTNER ENGINEERING CO LTD
QUOTE No 11246 REV 2
APPENDIX A

DESCRIPTION	SULPHURIC ACID PUMPS
ITEM NO	P-579/589-3&4
MODEL	KSI 50/160
CURVE No	K41747
TYPE	HORIZONTAL END SUCTION
NO OF STAGES	ONE
SUCTION SIZE	80 mm
DISCHARGE SIZE	50 mm
FLANGES	ANSI150 DRILLING
DUTY FLOWRATE	34m3/Hr
DUTY HEAD	19.12 metres
LIQUID	70% W/W H2SO4
DENSITY	1.6
TEMPERATURE	50 Deg. Cent
NPSH reqd	2.5 metres
POWER (ABS)	6 kW (APPROX)
POWER (INST)	11 kW
IMPELLER TYPE	CLOSED TYPE
IMPELLER MATERIAL	14.5% HIGH SILICON IRON MATERIAL
VOLUTE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
BACKPLATE MATERIAL	14.5% HIGH SILICON IRON MATERIAL
CORROSION ALLOWANCE	3 mm MINIMUM
SHAFT SEAL	SINGLE MECHANICAL
MANUFACTURER	JOHN CRANE
SEAL TYPE	PTFE EXTERNALTYPE
SPECIFICATION:-	QX1CX/V OR EQUIVALENT
MATERIAL CODE	PTFE vs CERAMIC
SEAL SIZE	45mm
MOTOR MANUFACTURER	ABB
MODEL	PROCESS PERFORMANCE
TYPE	CAST IRON
RATING	MCR
POWER	11 kW
FRAME SIZE	M3BP160MA
FULL LOAD SPEED	2915 rpm
ENCLOSURE	IP 55
INSULATION	CLASS F
TEMP RISE	CLASS B
VOLTAGE	380
PHASE	3
HERTZ	50
SPACER COUPLING	FENAFLEX OR EQUIVALENT
COUPLING GUARD	STEEL
BASEPLATE	CAST IRON



KSI
50-160

HIGH SILICON IRON PUMP
TO ISO 2858 STANDARD.

DRG K41747



CERTIFICATE OF TEST

CUSTOMER: BRADLEY PULVERIZER LTD
ORDER NO: 23547/CFH
DATE: 18/06/2008 – 20/06/2008
ITEM: 12-OFF KSI 50/160 VOLUTE CASINGS
HYDRAULIC TEST PRESSURE: 6.895 BAR (100 LBS PER SQ-INCH)
DURATION OF TEST: TWENTY MINUTES

THIS IS TO CERTIFY THAT THE ABOVE ITEM HAS BEEN TESTED AT OUR WORKS AND FOUND TO BE
SOUND AND SATISFACTORY IN ACCORDANCE WITH THE ABOVE TEST PRESSURES.

SIGNED



(Chief Inspector)

KESTNER ENGINEERING CO. LTD
BREDGAR ROAD, GILLINGHAM, KENT, ME8 6PN



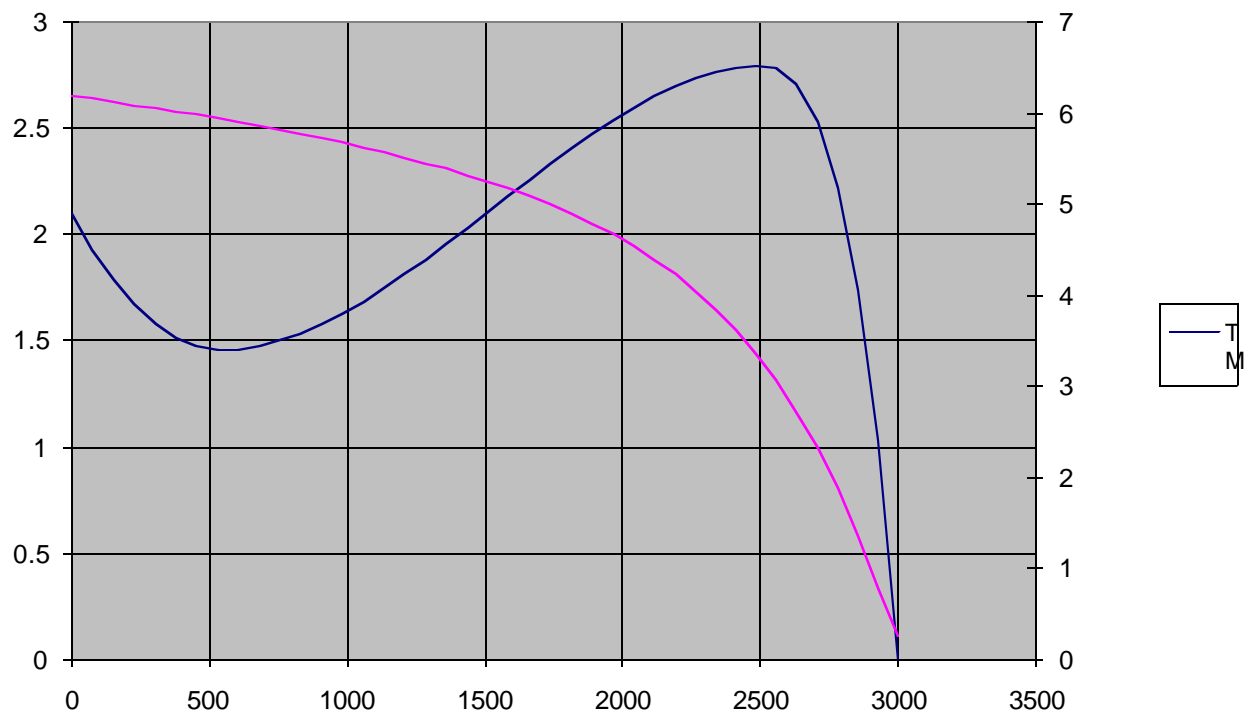
KESTNER ENGINEERING CO LTD - PUMP SPARE PARTS LIST

PUMP TYPE KSI 50/160 (SINGLE TYPE 10T/R SEAL)					DATE: 1/1/08
SECTIONAL ARRANGEMENT DRG NO L16746					SHEET 1 OF 2
ITEM NO	DESCRIPTION	NO PER PUMP	MTL	CODE NO	PRICE EACH
102	VOLUTE CASING	1	SI	SI 120019	
110	CASING CLAMP PLATE - ANSI 150	1	CI	BF120401	
161	BACKPLATE (10T SEAL)	1	SI	SI 120003	
183	SUPPORT FOOT	1	STEEL	BF120355	
210	DRIVE SHAFT	1	EN8M	BF120320	
230	IMPELLER C/W CENTRE	1	SI	SI 120018	
	DRIVE END BEARING	1	STEEL	J/STOCK	
	NON DRIVE END BEARING	1	STEEL	J/STOCK	
330	BEARING HOUSING	1	CI	BF120402	
360	BEARING COVER	1	CI	BF120360	
363	BEARING CARRIER	1	CI	BF120370	
364	WINDOW COVER (PLAIN)	1	MS	BF120380	
400-1	GASKET	1	CNAF	BJ120301	
400-2	GASKET	1	CAF	BJ120302	
400-3	GASKET	1	CAF	BJ120303	
411	GASKET	1	CNAF	BJ120316	
412-1	O' RING	1	NTR	BF120305	
412-2	O' RING	1	VITON	BF120306	
420-1	OIL SEAL	1	NTR	BF120310	
420-2	OIL SEAL	1	NTR	BF120310	
	TYPE 10T/10R MECHANICAL SEAL	1	PTFE	J/STOCK	
	TYPE 10T/10R SEAL CLAMP PLATE	1	ST/ST	SS120000	
	SEAL CLAMP PLATE STUDS	6	ST/ST	N/C/S	
	SEAL CLAMP PLATE HEX NUTS	6	ST/ST	N/C/S	
	SEAL CLAMP PLATE WASHERS	6	ST/ST	N/C/S	
	SEAL HOUSING GUARD	1	PVC	PV121000	
507	FLINGER	1	ST/ST	BF120312	
638	CONSTANT LEVEL OILER	1		N/C/S	
	SPECIAL BARREL NIPPLE	1	STEEL	N/C/S	
672	FILLER / BREATHER PLUG	1	PLAS	BF120325	
901-1	HEX HEAD SCREW	2	STEEL	N/C/S	

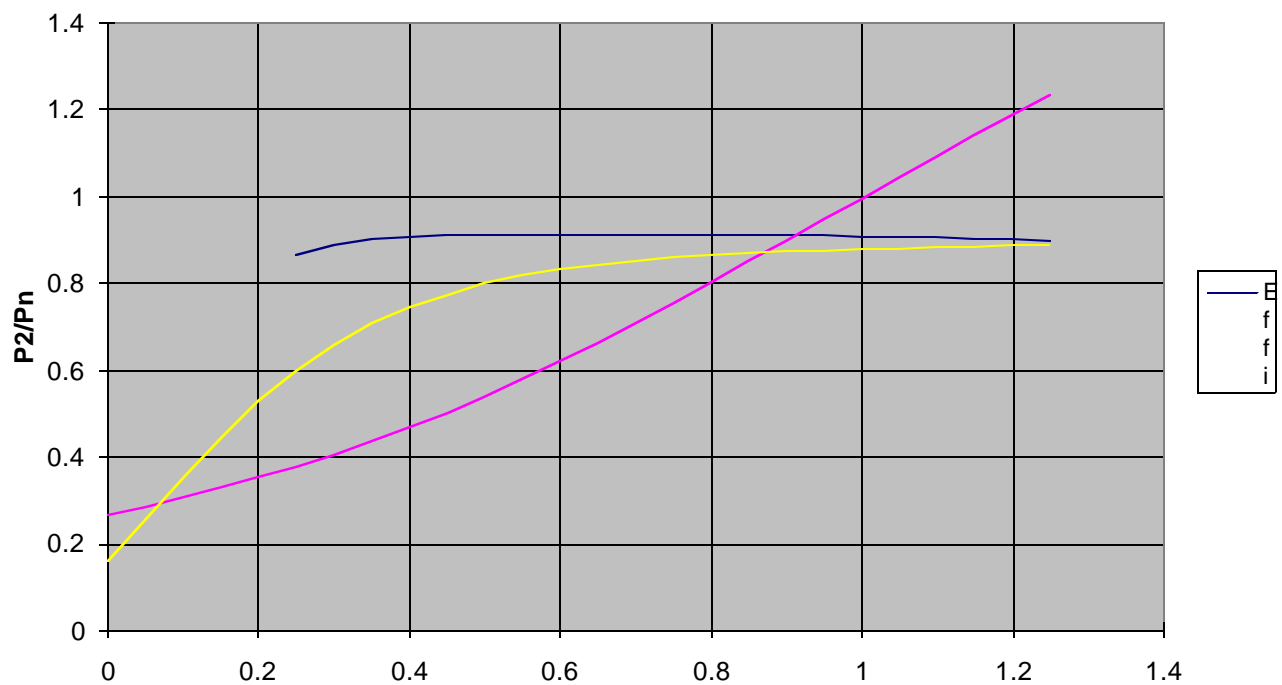
KESTNER ENGINEERING CO LTD - PUMP SPARE PARTS LIST

PUMP TYPE KSI 50/160					DATE: 1/1/08
SECTIONAL ARRANGEMENT DRG NO L16746					SHEET 2 OF 2
ITEM NO	DESCRIPTION	NO PER PUMP	MTL	CODE NO	PRICE EACH
902-1	STUD	2	STEEL	N/C/S	
902-2	STUD	2	STEEL	N/C/S	
903	COLLARED DRAIN PLUG	1	STEEL	N/C/S	
910	CLAMP STUDS	8	ST/STL	BF120323	
920-2	HEX NUTS	16	ST/STL	N/C/S	
	PLAIN WASHERS	16	ST/STL	N/C/S	
914-1	SOCKET HEAD CAP SCREW	4	STEEL	N/C/S	
914-2	SOCKET HEAD CAP SCREW	4	STEEL	N/C/S	
916	GRUB SCREW	4	STEEL	N/C/S	
920-1	HEX NUT	2	STEEL	N/C/S	
920-3	HEX NUT	2	STEEL	N/C/S	
931	CIRCLIP INTERNAL	1	STEEL	BF120314	
932	CIRCLIP EXTERNAL	1	STEEL	BF120315	
935A	SPECIAL WASHER	2	STEEL	BF120301	
935B	SPECIAL WASHER	2	NTR	BF120322	
940	COUPLING KEY	1	STEEL	N/C/S	
	SUCTION STUDS	4	BZP	N/C/S	
	DELIVERY STUDS	8	BZP	BZP	
	HEX NUTS	12	BZP	BZP	
	PLAIN WASHERS	12	BZP	BZP	
	FENAFLEX SPACER COUPLING C/W TAPER LOCK BUSHES ETC	1		J/STOCK	
	COUPLING GUARD D160	1	MS	J/STOCK	
	BASEPLATE D160M DRILLING	1	CI	CI113132	
	ELECTRIC MOTOR	1	CI	J/STOCK	
	STUDS	4	STEEL	N/C/S	
	HEX NUTS	4	STEEL	N/C/S	
	PLAIN WASHERS	4	STEEL	N/C/S	
	CASTROL HYSPIIN AWS 32	A/R		N/C/S	

Starting performance



Running performance



<div style="display: flex; justify-content: space-between;"> Test Report <div> Cert. No. A3.2837 Date of Issue: </div> </div>																																																				
Customer:				Type: M3BP 160MA -2																																																
Customer ref.:				Serial no.:																																																
Rating data:				Order no.:																																																
<div style="display: flex; justify-content: space-between;"> <div> Prod.code 3GBP 161101-ADA class F IP 55 S1 </div> <table border="1" style="font-size: 0.8em; border-collapse: collapse;"> <thead> <tr> <th>V</th> <th>Hz</th> <th>R/min</th> <th>kW</th> <th>Hp</th> <th>A</th> <th>cos φ</th> </tr> </thead> <tbody> <tr><td>690</td><td>Y</td><td>50</td><td>2930</td><td>11,00</td><td>11,5</td><td>0,88</td></tr> <tr><td>400</td><td>D</td><td>50</td><td>2930</td><td>11,00</td><td>20,0</td><td>0,88</td></tr> <tr><td>660</td><td>Y</td><td>50</td><td>2915</td><td>11,00</td><td>11,8</td><td>0,89</td></tr> <tr><td>380</td><td>D</td><td>50</td><td>2915</td><td>11,00</td><td>20,5</td><td>0,89</td></tr> <tr><td>415</td><td>D</td><td>50</td><td>2935</td><td>11,00</td><td>19,4</td><td>0,86</td></tr> <tr><td>440</td><td>D</td><td>60</td><td>3485</td><td>14,50</td><td>24,0</td><td>0,90</td></tr> </tbody> </table> </div>				V	Hz	R/min	kW	Hp	A	cos φ	690	Y	50	2930	11,00	11,5	0,88	400	D	50	2930	11,00	20,0	0,88	660	Y	50	2915	11,00	11,8	0,89	380	D	50	2915	11,00	20,5	0,89	415	D	50	2935	11,00	19,4	0,86	440	D	60	3485	14,50	24,0	0,90
V	Hz	R/min	kW	Hp	A	cos φ																																														
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Test	Pole	U (V)	f (Hz)	I (A)	P1 (kW)	P2 (kW)	n (r/min)	cos φ	η (%)																																											
Temp.-rise test 4	2	400	50	20,46	12,65	11,21	2913	0,89	88,80%																																											
No-Load test	2	401	50	5,68	0,6	-	3000	0,15	-																																											
Locked-Rotor test	2	80	50	20,75	1,15	-	0	0,40	-																																											
Temp.-rise test h																																																				
No-Load test						-			-																																											
Locked-Rotor test						-	0		-																																											
Resistance	Pole	Ambient	23,2 °C		Insulation resistance		High Voltage test		Overload test																																											
Line	2	0,5950	Ω/TE		R> 2000 M.ohm		2400 V 60 s		Volts	130 % 60 s																																										
Line			Ω/TE						Amp	120 % 120 s																																										
									r/min	120 % 120 s																																										
Temperature rise	Pole	K	Method		Temperature	Pole	°C	Method	Measurement method																																											
Winding	2	78,06	1		Ambient	2	22,2	2	1 Resistance																																											
Winding					Frame	2	58,4	2	2 Thermometer																																											
					Bearing D-end	2	78,4	2	3 Thermocouples																																											
					Ambient																																															
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Type test on motor No. 3GBP 161101 which is identical in all respects with the above.																																																				
Manufactured and tested in accordance with the rules of IEC 34-1																																																				
On behalf of customer																																																				
On behalf of manufacturer																																																				
Tested by ATQ Date of test 2002-03-13																																																				

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 ABB Automation Technology Products AB
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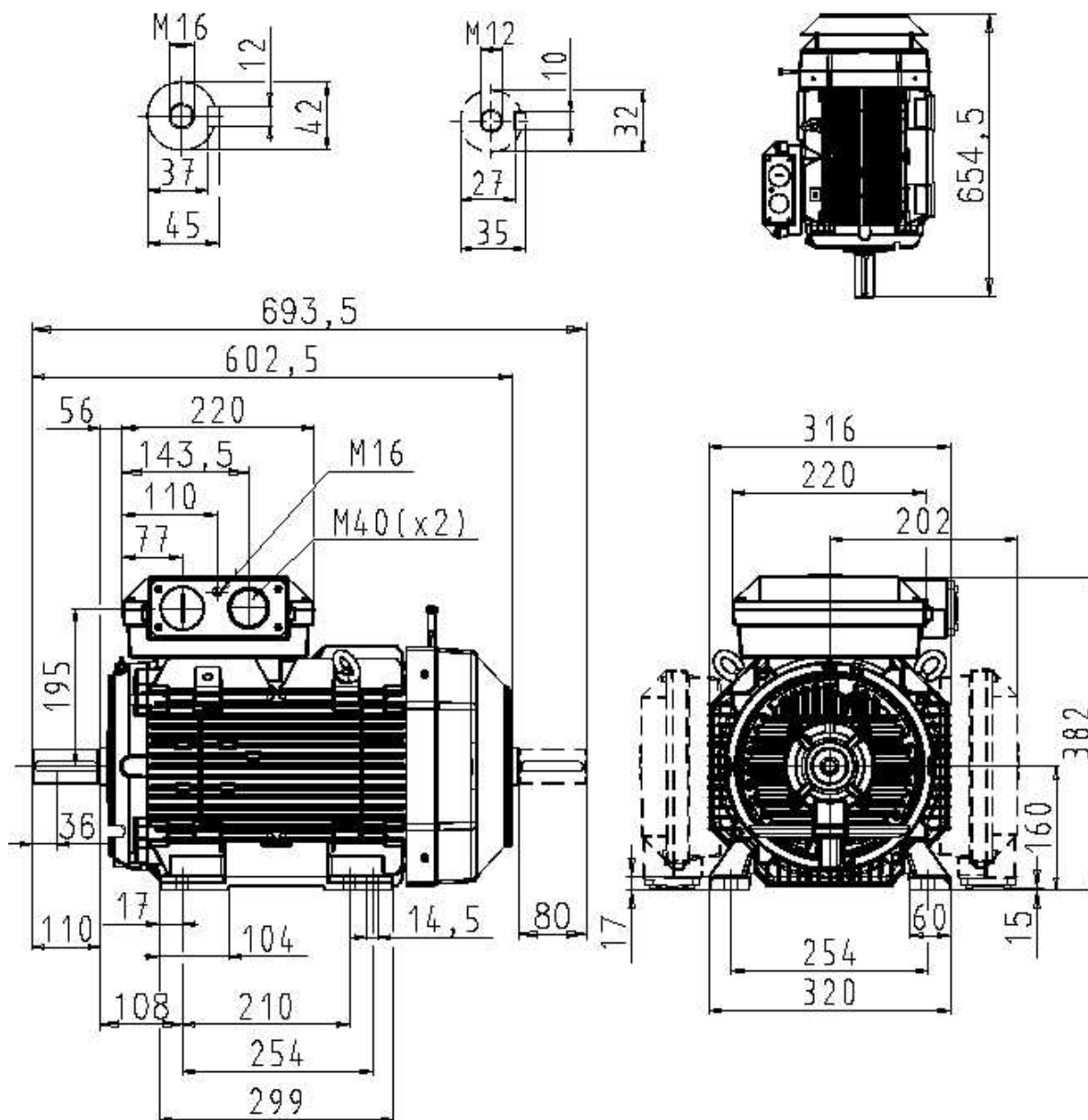
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Bank
 Handelsbanken, Västerås
 Account number
 6531-293977321

SWIFT-code
 HANDSESS

Drive end. Non drive end. With +005 protective
(Optional) roof IM V5. (Optional)



NOT in scale

Motor Dimension Print		Motor Type: M3BP 160 short IM 1001, B3, B6, B7, B8, V5, V6	Document No: 3GZV100042-1 A1.3859
Description: Three phase motor, foot mounted			
Unit: ABB Automation Technology Products AB	Issued by: H.Thorstenson	Replaces:	
Date: 2003-02-17	Approved by: S.Robertsson	Replaced by:	
ABB AB	Customer Reference:		ABB



EC Declaration of Conformity

The Manufacturer: *ABB Automation Technology Products AB, LV Motors
721 70 Västerås, Sweden*

hereby declares that

The Products: *3-phase induction machines,
series M2A*, with product code pos. 14 = A,
centre heights 112, 132, 160, 180, 200, 225, 250 and 280 mm.
series M2B*, with product code pos. 14 = D,
centre heights 160, 180, 200, 225 and 250 mm.
series M3A*, with product code pos. 14 = C,
centre heights 112, 132, 160, 180, 200, 225, 250 and 280 mm.
series M3B*, with product code pos. 14 = A,
centre heights 160, 180, 200, 225 and 250 mm.*

are in conformity with provisions of the following Council Directives:

Low Voltage Directive 73/23/EEC (amended by 93/68/EEC),

and, as components, with the essential requirements of the following:

EMC Directive 89/336/EEC (amended by 92/31/EEC and 93/68/EEC), regarding the intrinsic characteristics to emission and immunity levels,

and are in conformity with:

EN 60 034-1

Additional Information:

By design, the machines, considered as components, comply with the essential requirements of

Machinery Directive 98/37/EEC provided that the installation be correctly realised by the manufacturer of the machinery (for example: in compliance with our Installation Instructions and EN 60 204 "Electrical Equipment of Industrial Machines").

Certificate of Incorporation (Directive 98/37/EEC, Art 4.2 and Annex II, Sub B):

The machines above must not be put into service until the machinery into which they have been incorporated have been declared in conformity with the Machinery Directive.

Year of CE marking: CE00.

Signed by

Lars Sjöberg

Title Design manager

Date 2000-11-03

Drive^{IT} Low Voltage Motors

Manual for Low Voltage Motors

*Installation, operation and
maintenance manual* **GB 3**

*Installations-, Betriebs- und
Wartungshandbuch* **DE 12**

*Manuel d'installation,
d'exploitation et de
maintenance* **FR 22**



*Manual de instalación,
operación
y mantenimiento* **ES 32**

*Manuale di installazione, uso
e manutenzione* **IT 42**

*Manual för installation,
drift och underhåll* **SE 52**

*Asennus-, käyttö- ja
kunnossapito-ohje* **FI 61**



EC Declaration of Conformity

The Manufacturer :- (Name and address of the manufacturer)

hereby declares that

The Products :- (Product identification)

are in conformity with provisions of the following Council Directives :

Low Voltage Directive 73/23/EEC (amended by 93/68/EEC),

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Signed by

Title

Date

Installation, operation and maintenance manual

List of Contents

1. General

2. Installation

3. Operating

4. Maintenance

5. Environmental Requirements

6. Motor trouble shooting chart

1. General

NOTE!

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of anyone who installs, operates or maintains this equipment. Ignoring the instruction may invalidate the warranty.

Declaration of Conformity

Declarations of Conformity with respect to the Low voltage Directive 73/23/EEC amended by Directive 93/68 EEC are issued separately with individual machines.

The Declaration of Conformity also satisfies the requirements of a Declaration of Incorporation with respect to the Machinery Directive 98/37/EEC, Art 4.2 Annex II, sub B

Validity

The instructions are valid for the following ABB electrical machine types, in both motor and generator operation.

series MT*, MBT*, MXMA,
series M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

in frame sizes 56 - 400.

There is a separate manual for e.g. Ex motors 'Low voltage motors for hazardous areas: Installation, operation and maintenance Manual' (Low Voltage Motors/ Manual for Ex-motors).

Additional information is required for some machine types due to special application and/or design considerations. Additional information is available for the following motors:

- roller table motors
- water-cooled motors
- open drip proof motors
- smoke venting motors
- brake motors
- permanent magnet motors

2. Installation

Putting into service (starting)

Reception check

Immediately upon receipt check the machine for external damage and if found, inform the forwarding agent without delay.

Check all rating plate data, especially voltage and winding connection (star or delta). The type of bearing is specified on the rating plate of all motors except the smallest frame sizes.

Remove transport locking if employed. Turn shaft by hand to check free rotation.

Do not exceed permissible loading values of bearings stated in the product catalogue.

Motors equipped with roller bearings: Running the motor with no radial force applied to the shaft may damage the roller bearing.

Motors equipped with angular contact bearing:

Running the motor with no axial force applied in the right direction to the shaft may damage the angular contact bearing.

Motors equipped with regreasing nipples:

When starting the motor for the first time, or after long storage of the motor, apply the specified quantity of grease until grease is forced out of the grease outlet. For details see section "Manual lubrication" on page 8.

Insulation resistance check

Measure insulation resistance before commissioning and when winding dampness is suspected.

Resistance, measured at 25°C, shall exceed the reference value, i.e. 10 M ohm (measured with 500 V dc Megger)

WARNING

Windings should be discharged immediately after measurement to avoid risk of electric shock.

Insulation resistance reference value is halved for each 20°C rise in ambient temperature.

If the reference resistance value is not attained, the winding is too damp and must be oven dried. Oven temperature should be 90°C for 12-16 hours followed by 105°C for 6-8 hours.

Drain hole plugs, if fitted, must be removed and closing valve, if fitted, must be opened during heating.

Windings drenched in seawater normally need to be rewound.

Direct-on-line or star/delta starting

The terminal box on standard single speed machines normally contains 6 winding terminals and at least one earth terminal.

Earthing must be carried out according to local regulations before the machine is connected to the supply voltage.

The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL):

Y or D winding connections may be used.

e.g. 660 VY, 380 VD indicates Y-connection for 660 V and D-connection for 380 V.

Star/Delta starting (Y/D) :

The supply voltage must be equal to the rated voltage of the machine in D-connection.

Remove all connection links from the terminal block.

For two-speed, single phase and special machines, supply connection must follow the instructions inside the terminal box.

If direct-on-line starting lasts for more than 10 seconds or Y/D starting more than 30 seconds, consult ABB Sales Office or see the publication 'The Motor Guide' (also available on the internet on www.abb.com/motors&drives).

Terminals and direction of rotation

Direction of rotation is clockwise when viewing the shaft face at the machine drive end, when the line phase sequence L1, L2, L3 is connected to the terminals as shown in the figure 1.

To alter the direction of rotation, interchange the connection of any two line cables.

If the machine has a uni-directional fan, ensure that the direction of rotation is according to the arrow marked on the machine.

Handling

Storage

The machine should always be stored indoors, in dry, vibration free and dust free conditions.

Unprotected machined surfaces (shaft-ends and flanges) should be protected with anti-corrosive treatment.

It is recommended that shafts be rotated periodically by hand to prevent grease migration.

Anti condensation heaters, if fitted, should preferably be energised.

The characteristics of electrolytic capacitors, if fitted to

single-phase motors, will require “reforming” following periods of storage exceeding 1-2 years.

Contact ABB Sales Office for details.

Transportation

Machines fitted with cylindrical-roller and/or angular contact bearings must be fitted with locking devices during transport.

Lifting

Lift the motor using the lifting lugs only, if not otherwise stated in the separate lifting instruction.

The center of gravity of motors with the same frame may vary due to different outputs, mounting arrangements and auxiliary equipment.

Check that eyebolts or the lifting lugs integrated with the motor frame are undamaged before lifting. Damaged lifting lugs must not be used.

Lifting eyebolts must be tightened before lifting. If needed the position of the eyebolt must be adjusted with suitable washers.

Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.

Care must be taken not to damage auxiliary equipment and cables attached to the motor.

Machine weights

Total machine weight can vary within the same frame size (center height) depending on different output, mounting arrangements and added features.

The following table shows estimated maximum weights for machines in their basic versions as a function of frame material.

The actual weight of all our motors is stated on the rating plate except the smallest frame sizes.

Frame size	Aluminium		Cast iron Weight kg	Steel Weight kg
	Weight kg	Add. for brake		
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Installation

Cooling

Normal ambient temperatures should not exceed 40°C (marine standard +45 or +50°C) if standard performance is to be achieved. Check that the motor has sufficient airflow. Ensure that no nearby equipment, surfaces or direct sunshine, radiate additional heat to the motor. For more information about higher ambient temperatures and cooling, see “the Motor Guide” or contact ABB Sales Office.

Foundation

The purchaser bears full responsibility for preparation of the foundation.

Metal foundations should be painted to avoid corrosion.

Foundations must be even, and sufficiently rigid to withstand possible short circuit forces. They shall be dimensioned as to avoid the occurrence of vibration due to resonance.

Foundation studs

Bolt the foundation studs to the feet of the motor and place a 1-to-2 mm shim between the stud and the feet.

Align the motor directly using appropriate means. Grout the studs with concrete, check alignment and drill holes for locating pins.

Drain holes

Always check that open drain holes face downward.

In extremely dusty environments, all drain holes should be closed.

Alignment

Correct alignment is essential to avoid bearing failures, vibrations and possible fractured shaft extensions.

Slide rails and belt drives

- Fasten the machine to the slide rails as shown in figure 2.
- Place the slide rails horizontally on the same level.
- Check that the machine shaft is parallel with driven, or driving, shaft.
- Any belt must be tensioned according to the supplier's instructions.

WARNING

Excessive belt tension will damage bearings and can cause shaft breakage.

Do not exceed the maximum belt forces (i.e. radial bearing loading) stated in the relevant product catalogues.

Connection

Normal machine design has the terminal box on top with cable entry possible from both sides.

Some machines are available with top mounted terminal boxes rotatable 4 x 90°, and some with side mounted terminal boxes.
Availability of these solutions is described in the product catalogues.

Unused cable entries must be closed.

As well as main winding and earthing terminals, the terminal box can also contain connections for thermistors, standstill heating elements, bimetallic, switches, or PT 100 resistance elements.

WARNING

Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

Connection diagrams for auxiliary elements are found inside the terminal box cover.

WARNING

The capacitor in single-phase motors can retain a charge that appears across the motor terminals, even when the motor has reached standstill.

Connection for variable speed drive

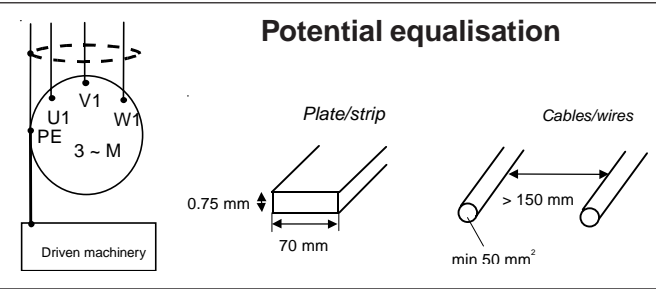
Variable speed drives cause higher voltage stresses than the sinusoidal supply on the winding of the motor and may cause high frequency shaft voltages and bearing currents. Therefore the winding and the bearing insulation of the motor as well as the filter at the converter output must be dimensioned according to "Selection rules for VSD applications/Insulation" (3GZF500930-2), available on request from ABB.

In variable speed drives the motor (Pn > 30 kW) must be cabled by using shielded symmetrical cables and cable glands providing 360° bonding (also called EMC glands). More information can be found in ABB's manual "Grounding and cabling of the drive system" (3AFY61201998).

In frequency converter applications motor frame external earthing must be used for equalising the potential between the motor frame and the driven machine, unless the two machines are mounted on the same metallic base.

For motor frame sizes above IEC 280, use 0.75 x 70 mm flat conductor or at least two 50 mm² round conductors. The distance of the round conductors must be at least 150 mm from each other.

This arrangement has no electrical safety function; the purpose is to equalise the potentials. When the motor and the gearbox are mounted on a common steel fundament, no potential equalisation is required.



To comply with EMC-requirements, use only cables and connectors approved for this purpose. (See instruction for frequency converters.)

The highest permissible rotational speed of a cast iron motor used in variable speed drive (M2BA/M3BP) must not exceed maximum permissible speeds as stated in the figure below or the speed stamped on the rating plate. For information on the highest permissible rotational speed for other motor sizes and types, please contact ABB. Bearing lubrication should follow the directions mentioned later.

Frame size	Speed r/min	
	2 pole	4 pole
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

If there is uncertainty concerning the suitability of the motor for the variable speed drive, please contact ABB.

WARNING

The maximum operating temperature of the grease and bearings must not be exceeded.

Balancing

The rotor of the machine is dynamically balanced.
As standard, balancing has been carried out using **half key**, and the shaft is marked **with a RED tape**, with the text "Balanced with half key".

To avoid vibration the coupling-half or pulley must be balanced with half key after the keyway has been machined.

In the event of balancing **with full key** the shaft is marked **with a YELLOW tape**, with the text "Balanced with full key".

In case balancing **without key**, the shaft is marked **with a BLUE tape**, with the text "Balanced without key".

3. Operating

Use

Operating conditions

The machines are intended for use in industrial drive applications.
Normal ambient temperature limits are -20° to +40°C.
Maximum altitude 1000 m above sea level.

Safety considerations

The machine is intended for installation and use by qualified personnel, familiar with relevant safety requirements.

Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with the local regulations.

WARNING

Small motors with supply current directly switched by thermally sensitive switches can start automatically.

Points to observe

1. Do not use the machine to step on.
2. The temperature of the outer casing of the machine may be hot to the touch during normal operation.
3. Some special machine applications require special instructions (e.g. using frequency converter supplies).
4. Lifting lugs must only be used for lifting the motor. They must not be used to lift the motor when it is attached to other equipment.

Assembly and dismantling

General

Dismantling and assembly of machines must be carried out by qualified personnel using only suitable tools and working methods. All repairs must be carried out according to the standard IEC-60079-19.

Bearings

Special care should be taken with the bearings. These must be removed using pullers and fitted by heating or using special tools for the purpose. How to replace bearings is described in detail in a separate instruction leaflet available from ABB Sales Office.

Fitting coupling halves and pulleys

Coupling halves and pulleys must be fitted using suitable equipment and tools that do not damage the bearings.

Never fit a coupling half or pulley by hammering into place or remove it using a lever pressed against the body of the machine.

Mounting accuracy of coupling half :
check that the clearance **b** is less than 0.05 mm and that the difference **a1** to **a2** is also less than 0.05 mm. See figure 3.

4. Maintenance

Maintenance and lubrication

General inspection

- Inspect the machine at regular intervals.
- Keep the machine clean and ensure free ventilation airflow.
- Check the condition of shaft seals (e.g. V-ring) and replace if necessary.
- Check the condition of connections and mounting and assembly bolts.
- Check the bearing condition by listening for unusual noise, vibration measurement, bearing temperature, inspection of spent grease or SPM bearing monitoring.
* When changes of condition occur, dismantle the machine, check the parts and replace if necessary.

Lubrication

WARNING

Beware of all rotating parts!

WARNING

Grease can cause skin irritation and eye inflammation. Follow all safety precautions specified by the manufacturer.

Machines with permanently greased bearings

Bearings are usually permanently greased bearings of either Z or 2Z types.
Bearing types are specified in the respective product catalogues and on the rating plate of all our motors except smaller frame sizes.

As a guide, adequate lubrication for sizes up to 180 can be achieved for the following duration, according to L1 (i.e. that 99 % of the motors are sure to make the interval time) at ambient temperature of 25°C. For duties with ambient temperatures higher than 25°C, see the respective product catalogue.

Frame size	Poles	Duty hours
56-80	2-8	for life
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Depending on application and load conditions, see applicable product catalogue.

Hours of operation for vertical motors are half of the above values.

Motors with regreasing nipples

Lubrication information plate and general lubrication advice

If the machine is fitted with a lubrication information plate, follow the given values.

On the lubrication information plate, regreasing intervals with regard to mounting, ambient temperature and speed of rotation can be defined.

ABB policy is to have reliability as a vital issue in bearing lubrication intervals. That is why we follow the L1-principle.

Manual lubrication

Regreasing while motor is running

- Remove grease outlet plug or open closing valve if fitted.
 - Be sure that the lubrication channel is open
 - Press the specified amount of grease into the bearing.
 - Let the motor run 1-2 hours to ensure that all excess grease is forced out of the bearing.
- Close the grease outlet plug or closing valve if fitted.

Regreasing while motor is at a standstill

Regrease motors while running. If this is not possible, lubrication can be carried out while the machine is at a standstill.

- In this case, use only half the quantity of grease, then run the motor for a few minutes at full speed.
- When the motor has stopped, press the rest of the specified amount of grease into the bearing.
- After 1-2 running hours close the grease outlet plug or closing valve if fitted.

Automatic lubrication

The grease outlet plug must be removed permanently with automatic lubrication or open closing valve if fitted.

Some motors may be equipped with a collector for old grease. Follow the special instructions given for the equipment.

We recommend only the use of electromechanical systems. Contact your local ABB Sales Office.

The amount of grease per each lubrication interval stated in the table should be doubled if an automatic regreasing system is used.

If 2-pole motors are being automatically regreased, the note (NOTE!) concerning lubricant recommendations given for 2-pole motors in the chapter Lubricants shall be followed.

Lubrication intervals and amounts

Frame size	Amount of grease g/bearing	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
Ball bearings							
Lubrication intervals in duty hours							
112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	1 ¹⁾	1 ¹⁾	6500	8500	12500	16000
355	120	1 ¹⁾	1 ¹⁾	4200	6000	10000	13000
400	120	1 ¹⁾	1 ¹⁾	4200	6000	10000	13000
400 M3BP	130	1 ¹⁾	1 ¹⁾	2800	4600	8400	12000
Roller bearings							
Lubrication intervals in duty hours							
160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	1 ¹⁾	1 ¹⁾	3300	4300	6000	8000
355	120	1 ¹⁾	1 ¹⁾	2000	3000	5000	6500
400	120	1 ¹⁾	1 ¹⁾	2000	3000	5000	6500
400 M3BP	130	1 ¹⁾	1 ¹⁾	1400	2300	4200	6000

¹⁾ Values for IEC sizes 280 to 400 in certain motor types (3600 and 3000 r/min), please see the next page.

Factors influencing the lubrication intervals

Lubrication intervals for vertical machines are half of the above values.

The lubrication intervals are based on bearing operating temperature 80°C (ambient temperature of about + 25°). Note! An increase in the ambient temperature raises the temperature of the bearings correspondingly. The values should be halved for 15°C increase in bearing temperature and may be doubled for 15°C decrease in bearing temperature.

WARNING

The maximum operating temperature of the grease and bearings must not be exceeded.

Lubricants

WARNING

Do not mix different types of grease.
Incompatible lubricants may cause bearing damage.

When regreasing, use only special ball bearing grease with the following properties:

- good quality grease with lithium complex soap and with mineral- or PAO-oil
- base oil viscosity 100-160 cST at 40°C
- consistency NLGI grade 1.5 - 3 *)
- temperature range -30°C - +120°C, continuously.

*) For vertical mounted motors or in hot conditions a stiffer end of scale is recommended.

Grease with the correct properties is available from all major lubricant manufacturers.

Admixtures are recommended, but a written guarantee must be obtained from the lubricant manufacturer especially concerning EP admixtures, that admixtures do not damage bearings or the properties of lubricants at the operating temperature range.

WARNING

Lubricants containing EP admixtures are not recommended in high bearing temperatures in frame sizes 280 to 400.

If the ambient temperature is below -25°C or above +55°C, or bearing temperature is above 110°C, consult ABB Sales Office regarding suitable grease.

The following high performance grease can be used

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP90 (calcium polyurea base)
- FAG Arcanol TEMP110 (lithium complex base)

Lubrication intervals for other grease fulfilling the required properties, contact your local ABB Sales Office.

Lubrication intervals and amounts, 2-pole, IEC frame sizes 280 and 400

Frame size		Amount of grease g/bearing	3600 r/min	3000 r/min
Ball bearings				
Lubrication intervals in duty hours				
280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	600	800
400	M3B*	40	1000	1600
Roller bearings				
Lubrication intervals in duty hours				
280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	-	-
400	M3B*	40	500	800

NOTE!

Always use high speed grease for high speed machines and some other models, e.g. M2BA 355 and 400 2-pole machines, where the speed factor is higher than 400 000 (calculated as $D_m \times n$ where D_m = average bearing diameter, mm; n = rotational speed, r/min).

The following grease can be used:

- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- SKF LGHP2 (polyurea base)

If other lubricants are used, check with the manufacturer that the qualities correspond to those of the above mentioned lubricants, or if the compatibility of the lubricant is uncertain, contact your local ABB Sales Office.

Frequency converter drives

Higher speed operation, e.g. in frequency converter applications, or lower speed with heavy load will require shorter lubrication intervals. Consult your local ABB Sales Office in such cases.

Typically a doubling of speed will require a reduction of lubrication intervals to approx. 40 % of values tabulated above.

WARNING

The constructional maximum speed of the motor must not be exceeded.

Suitability of bearings for high speed operation must be checked.

Spare parts

When ordering spare parts, the full type designation and product code, as stated on the rating plate, must be specified.

If the machine is stamped with a serial manufacturing number, this should also be given.

Rewinding

Rewinding should always be carried out by qualified repair shops.

Smoke venting and other special motors should not be rewound without first contacting ABB.

5. Environmental requirements

Noise levels

Most of our motors have a sound pressure level not exceeding 82 dB(A) refer to 50 Hz sinusoidal supply conditions, tolerance ± 3 dB(A).

Values for specific machines can be found in the relevant product catalogues.

For sound pressure levels for 60 Hz sinusoidal supply and with non-sinusoidal supplies, contact ABB Sales Office.

Sound pressure levels for all machines having separate cooling systems and for series M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, and M2BJ/M2LJ are indicated in separate Manuals.

These instructions do not cover all details or variations in equipment nor provide for every possible condition to be met in connection with installation, operation or maintenance. Should additional information required, please contact the nearest ABB Sales Office.

Motor trouble shooting chart

Your motor service and any trouble shooting must be handled by qualified persons with proper tools and equipment.

TROUBLE	CAUSE	WHAT TO DO
Motor fails to start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter.
	Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
	Improper line connections	Check connections with diagram supplied with motor.
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also, ensure that all control contacts are closed.
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
	Short circuited stator	Indicated by blown fuses. Motor must be rewound.
	Poor stator coil connection	Remove end bells, locate with test lamp.
	Rotor defective	Look for broken bars or end rings.
	Motor may be overloaded	Reduce load.
Motor stalls	One phase may be open	Check lines for open phase.
	Wrong application	Change type or size. Consult manufacturer.
	Overload	Reduce load.
	Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	Open circuit	Fuses blown, check overload relay, stator and push buttons.
Motor runs and then dies down	Power failure	Check for loose connections to line, fuses and control.
Motor does not come up to speed	Not applied properly	Consult supplier for proper type.
	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
	Starting load too high	Check load motor is supposed to carry at start.
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.
Motor takes too long to accelerate and/or draws high amp	Excessive load	Reduce load.
	Low voltage during start	Check for high resistance. Adequate wire size.
	Defective squirrel cage rotor	Replace with new rotor.
	Applied voltage too low	Get power company to increase power tap.
Wrong rotation	Wrong sequence of phases	Reverse connections at motor or at switchboard.
Motor overheats while running underloaded	Overload	Reduce load.
	Frame or bracket vents may be clogged with dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor.
	Motor may have one phase open	Check to make sure that all leads are well connected.
	Grounded coil	Locate and repair.
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers.

TROUBLE	CAUSE	WHAT TO DO
Motor vibrates	Motor misaligned	Realign.
	Weak support	Strengthen base.
	Coupling out of balance	Balance coupling.
	Driven equipment unbalanced	Rebalance driven equipment.
	Defective bearings	Replace bearings.
	Bearings not in line	Line up properly.
	Balancing weights shifted	Rebalance motor.
	Contradiction between balancing of rotor and coupling (half key – full key)	Rebalance coupling or motor
	Polyphase motor running single phase	Check for open circuit.
	Excessive end play	Adjust bearing or add shim.
Scraping noise	Fan rubbing fan cover	Remove interference.
	Fan striking insulation	Clear fan.
	Motor loose on bedplate	Tighten holding bolts.
Noisy operation	Airgap not uniform	Check and correct bracket fits or bearing.
	Rotor unbalance	Rebalance.
Hot bearings general	Bent or sprung shaft	Straighten or replace shaft.
	Excessive belt pull	Decrease belt tension.
	Pulleys too far away	Move pulley closer to motor bearing.
	Pulley diameter too small	Use larger pulleys.
	Misalignment	Correct by realignment of drive.
Hot bearings ball	Insufficient grease	Maintain proper quality of grease in bearing.
	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease.
	Excess lubricant	Reduce quantity of grease, bearing should not be more than 1/2 filled.
	Overloaded bearing	Check alignment, side and end thrust.
	Broken ball or rough races	Replace bearing, first clean housing thoroughly.

Installations-, Betriebs- und Wartungshandbuch

Inhaltsverzeichnis

1. Allgemein

2. Installation

3. Betrieb

4. Wartung

5. Umgebungsanforderungen

6. Motor - Übersicht zur Fehlersuche

1. Allgemein

WICHTIG!

Die nachstehenden Anweisungen sind genau zu befolgen, um die Sicherheit bei der Installation, beim Betrieb und bei der Wartung des Motors zu gewährleisten. Alle Personen, die mit diesen Aufgaben befaßt sind, sind auf vorliegende Anleitung hinzuweisen. Die Nichtbefolgung der hierin enthaltenen Anweisungen kann den Verlust der Gewährleistung zur Folge haben.

Konformitätserklärung

Konformitätserklärungen gemäß der Niederspannungsrichtlinie 73/23/EWG, geändert durch die Richtlinie 93/68/EWG, werden gesondert herausgegeben.

Die Konformitätserklärung erfüllt überdies die Anforderungen einer Herstellererklärung gemäß der Maschinenrichtlinie 98/37/EWG, Art 4.2 Annex II, sub B.

Gültigkeit

Die Betriebsanleitung bezieht sich auf die nachfolgend genannten Baureihen aus dem Produktionsprogramm von ABB. Sie gilt sowohl für die Verwendung als Motor wie auch für den Betrieb als Generator.

Baureihe MT*, MBT*, MXMA,

Baureihe M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

in den Achshöhen 56 - 400.

Es gibt separate Handbücher für z.B. Ex-Motoren 'Low voltage motors for hazardous areas: Installation, operation and maintenance manual' (Low Voltage Motors/Manual for Ex-Motors).

Für Sonderausführungen oder spezielle Anwendungen werden gegebenenfalls zusätzliche Hinweise benötigt. Zusätzliche Informationen sind verfügbar für die folgenden Motoren:

- Rollgangs-Motoren
- Wassergekühlte Motoren
- IP 23 Motoren
- Brandgas-Entlüftungsmotoren
- Bremsmotoren

2. Installation

Eingangsprüfung

Unmittelbar nach dem Empfang ist der Motor auf äußerliche Beschädigungen zu untersuchen, im Schadensfall ist der Spediteur unverzüglich zu verständigen.

Die auf dem Leistungsschild angegebenen Daten - insbesondere Spannung und Schaltung (Y = Stern oder D = Dreieck) - sind zu überprüfen. Die Lagertypbezeichnung ist bei allen Motoren auf dem Leistungsschild angegeben, mit Ausnahme der kleinsten Baugrößen.

Die Motorwelle muss von Hand frei drehbar sein, gegebenenfalls angebrachte Transportsicherungen sind zu entfernen.

Halten Sie die zulässigen Lagerbelastungswerte, die im Produktkatalog angegeben sind strikt ein.

Motoren mit Rollenlagern: Der Betrieb der Motoren ohne ausreichende Radialkraft auf die Welle kann zur Beschädigung des Rollenlagers führen.

Motoren mit Schrägkugellagern: Der Betrieb des Motors ohne ausreichende Axialkraft auf die Welle in der vorgesehenen Richtung kann zur Beschädigung des Schrägkugellagers führen.

Motoren mit Nachschmiernippeln:

Bei Inbetriebnahme der Motoren oder nach einer längeren Lagerzeit ist mindestens die angegebene Fettmenge einzufüllen, bis an der Fettauslassöffnung neues Fett austritt.

Genauere Angaben hierzu enthält der Abschnitt "Motoren mit Nachschmiersystem" auf der Seite 17.

Prüfung des Isolationswiderstandes

Vor der Inbetriebnahme - sowie immer dann, wenn Hinweise auf erhöhte Feuchtigkeit vorliegen - ist der Isolationswiderstand zu prüfen.

Der Widerstand - gemessen bei 25°C mit einem Isolationsprüfer (500 V DC) - soll den nachfolgenden Bezugswert nicht unterschreiten:
10 MOhm (gemessen mit Megger 500 V DC)

WARNUNG

Um die Gefahr eines elektrischen Schlages auszuschließen, sind die Wicklungen unmittelbar nach der Messung zu entladen.

Für erhöhte Umgebungstemperaturen ist der angegebene Bezugswert des Isolationswiderstandes für jeweils 20°C zu halbieren.

Wenn der Bezugswert nicht erreicht wird, ist die Feuchte innerhalb der Wicklung zu groß und eine Trocknung wird erforderlich. Für 12h ... 16h sollte dabei

eine Ofentemperatur von 90°C eingehalten werden, gefolgt von einer Schlusstrocknung mit 105°C für 6h ... 8h.

Etwaig vorhandene Verschlussstopfen von Entwässerungsöffnungen sind während der Wärmebehandlung zu entfernen und ggf. vorhandene Schließventile sind zu öffnen.

Wicklungen, die mit Salzwasser in Berührung gekommen sind, müssen in der Regel erneuert werden.

Direkteinschaltung oder Stern-Dreieck-Anlauf

Der Klemmenkasten von eintourigen Standardmotoren enthält in der Regel sechs Anschlussklemmen und zumindest eine Erdungsklemme.

Die Erdung sollte vor dem Anschließen der Versorgungsspannung im Einklang mit den jeweils gültigen Vorschriften erfolgen.

Spannung und Anschlussart sind auf dem Leistungsschild angegeben.

Direkteinschaltung (DOL):

Wahlweise kann Stern- (Y) oder Dreieckschaltung (D) verwendet werden.

Die Angabe 660 VY, 380 VD bezeichnet beispielsweise die Anschlussart „Stern“ für 660 V und „Dreieck“ für 380 V.

Stern-Dreieck-Anlauf (Y/D):

Die Versorgungsspannung muß gleich der für die Dreieckschaltung angegebenen Spannung sein. Alle Verbindungsblaschen am Klemmenblock sind zu entfernen.

Bei polumschaltbaren Typen und Wechselstrommotoren sowie bei Sonderausführungen sind die entsprechenden Angaben im Klemmenkasten zu beachten.

Falls die Direkteinschaltung länger als 10 Sekunden oder Stern-Dreieck-Anlauf länger als 30 Sekunden dauern, wenden Sie sich an ABB oder lesen Sie im Motoren-Handbuch nach. (Sie finden es auch im Internet auf Seite www.abb.com/motors&drives).

Anschlussklemmen und Drehrichtung

Bei Blick auf das antriebsseitige Wellenende (AS) dreht die Welle im Uhrzeigersinn, wenn die Phasen L1, L2, L3 der Versorgungsspannung entsprechend dem Bild 1 angeschlossen sind.

Die Drehrichtung ändert sich, wenn beliebige zwei Anschlussleitungen vertauscht werden.

Wenn der Motor mit einem drehrichtungsabhängigen Lüfter ausgerüstet ist, muss die Übereinstimmung der Drehrichtung mit dem auf dem Motor angebrachten Pfeilsymbol zu überprüft werden.

Handhabung

Lagerung

Die Motoren sind im Innern geschlossener Räume trocken sowie schwingungs- und staubfrei zu lagern.

Ungeschützte, bearbeitete Oberflächen (Wellenenden und Flansche) sind mit Korrosionsschutzmitteln zu behandeln.

Es wird im Interesse einer gleichmäßigen Schmierung empfohlen, die Welle regelmäßig von Hand zu drehen.

Etwaig vorhandene Heizelemente sollten bestromt werden.

Die für den Betrieb von Einphasenmotoren ggf. verwendeten Elektrolytkondensatoren müssen nach 1- bis 2 jähriger Lagerung „formiert“ werden. Nähere Informationen erhalten Sie von ABB.

Transport

Motoren, die mit Rollenlagern oder Schrägkugellagern ausgerüstet sind, sollten während des Transports mit Feststellvorrichtungen (Transportsicherungen) versehen sein.

Anheben

Der Motor darf nur an den hierfür vorgesehenen Hebeösen angehoben werden, sofern in den Anweisungen nichts anderes angegeben ist.

Die Lage des Schwerpunktes kann auch bei Motoren gleicher Baugröße aufgrund unterschiedlicher Leistungen, Montagevarianten oder Hilfseinrichtungen variieren.

Vor dem Anheben die Ösenschrauben bzw. die im Motorgehäuse integrierten Hebeösen auf ordnungsgemäßen Zustand überprüfen. Beschädigte Hebeösen dürfen nicht verwendet werden.

Ösenschrauben vor dem Anheben festziehen. Falls erforderlich die Position der Ösenschraube mit Hilfe von Unterlegscheiben anpassen.

Es dürfen nur geeignete Hebeeinrichtungen und Haken in für die jeweiligen Hebeösen geeigneter Größe verwendet werden.

Es ist darauf achten, dass Hilfseinrichtungen am Motor sowie am Motor angeschlossene Kabel nicht beschädigt werden.

Gewichte

Das Gesamtgewicht der Motoren kann innerhalb einer Baugröße (Achshöhe) entsprechend der Bemessungsleistung, den unterschiedlichen Bauformen und in Abhängigkeit von etwaig vorhandenen Zusatzbaugruppen variieren.

Die nachfolgende Tabelle - bezogen auf die Grundaussführung - näherungsweise die Maximalgewichte für Motoren in Abhängigkeit von der Baugröße und dem verwendeten Gehäusewerkstoff.

Genauere Gewichtsangaben zu den einzelnen Motoren sind bei Motoren mit einem Gewicht über 25 kg auf dem Leistungsschild enthalten.

Bau- größe	Aluminium		Grauguss	Stahl
	Gewicht kg	Add. für Bremse	Gewicht kg	Gewicht kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Installation

Kühlung

Gemäß den einschlägigen Motornormen gelten Temperaturen bis maximal 40°C (bei Marineanwendungen +45 oder 50°C) als normale Umgebungstemperaturen. Daher ist zu überprüfen, ob am Motor eine ausreichende Luftströmung vorhanden ist. Außerdem muss sichergestellt werden, dass in der Nähe befindliche Anlagen, Oberflächen oder direkte Sonneneinstrahlung keine zusätzliche Wärmebelastung für den Motor darstellen. Weitere Informationen zu höheren Umgebungstemperaturen und zur Kühlung sind dem „Motoren-Handbuch“ zu entnehmen oder von ABB erhältlich.

Fundamentierung

Der Käufer trägt die volle Verantwortung für Vorbereitung des Maschinenfundaments.

In Metall ausgeführte Fundamente sollten einen korrosionsschützenden Anstrich aufweisen.

Die Fundamente sind eben und hinreichend steif auszuführen, um den erhöhten Kräften im Kurzschlussfall standzuhalten. Darüber hinaus sind die Fundamente so zu dimensionieren, dass Schwingungen aufgrund von Resonanzen ausgeschlossen sind.

Fundamentanker

Die Ankerschrauben sind mit den Füßen des Motors zu verschrauben, wobei Ausgleichsscheiben (1 mm ... 2 mm dick) zwischen die Füße des Motors und die Ankerschrauben einzufügen sind.

Anschließend ist der Motor mit geeigneten Hilfsmitteln sorgfältig auszurichten.

Die Ankerschrauben können nun mit Zement vergossen werden. Nach Prüfung der Ausrichtung können gegebenenfalls Bohrungen für Positionierstifte hergestellt werden.

Entwässerungsöffnungen

Immer darauf achten, dass offene Kondenswasserlöcher nach unten gerichtet sind.

In extrem staubreichen Umgebungen sollten alle Entwässerungsöffnungen verschlossen sein.

Ausrichtung

Die sorgfältige Ausrichtung ist von entscheidender Bedeutung für das Vermeiden von Lagerschäden, Schwingungen und möglichen Brüchen der Wellenenden.

Spannschienen und Riementriebe

- Die Befestigung des Motors auf den Spannschienen erfolgt wie auf dem Bild 2.
- Die Spannschienen sind horizontal und auf gleicher Höhe zu montieren.
- Stellen Sie sicher, dass die Motorwelle parallel zur angetriebenen bzw. antreibenden Welle ausgerichtet ist.
- Spannen Sie den Riemen entsprechend den Herstellerangaben.

WARNUNG

Das übermäßige Spannen des Antriebsriemens führt zur Zerstörung der Lager und kann den Bruch der Welle zur Folge haben!

Beachten Sie die maximal zulässigen Riemenkräfte (bzw. Radialkraftbelastungen der Lager), die Sie den entsprechenden Produktkatalogen entnehmen können.

Anschluss

Der Klemmenkasten befindet sich für die Standardausführung auf der Oberseite des Motors und erlaubt den Kabelzugang von beiden Seiten.

Einige Motoren können als Sonderausführung mit Klemmenkästen geliefert werden, die um 4 x 90° gedreht werden können. Daneben sind Motoren mit seitlich angeordnetem Klemmenkasten erhältlich. Die Lieferbarkeit dieser Ausführungen ist aus den Produktkatalogen ersichtlich.

Nicht benötigte Öffnungen im Klemmenkasten sind zu verschließen.

Neben den Anschlüssen für die Hauptwicklung und den Erdungsklemmen kann der Klemmenkasten weitere Anschlussmöglichkeiten z.B. für Thermistoren, Stillstandsbeheizung, Bimetallschalter oder PT100 Widerstandsfühler enthalten.

WARNUNG

Auch bei Stillstand des Motors können gefährliche Spannungen für die Versorgung von Heizelementen oder für eine direkte Wicklungsbeheizung anliegen!

Anschlussbilder für etwaige Zusatzkomponenten finden Sie im Innern des Klemmenkastens.

WARNUNG

Bei Einphasenmotoren kann die Restladung des Kondensators auch beim Stillstand des Motors eine elektrische Spannung über den Motorklemmen zur Folge haben!

Anschlüsse bei Betrieb an Frequenzumrichtern

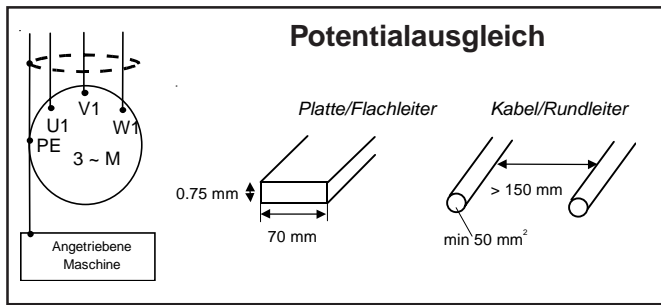
Frequenzumrichter-Antriebe verursachen höhere Spannungsbelastungen der Wicklungen und des Motors als eine sinusförmige Einspeisung. Sie können hochfrequente Wellenspannungen und Lagerströme verursachen. Deshalb müssen die Isolation der Wicklungen und der Lager des Motors und die Filter am Motorausgang des Frequenzumrichters entsprechend den "Selection rules for VSD applications/Insulation" (3GZF500930-2) ausgelegt werden (auf Anfrage von ABB erhältlich).

In drehzahlveränderbaren Antrieben muss der Motor ($P_n > 30 \text{ kW}$) mit geschirmten symmetrischen Kabeln und Kabelverschraubungen mit 360° Erdung (auch EMV-Verschraubungen genannt) angeschlossen werden. Weitere Informationen können Sie dem Handbuch von ABB "Grounding and cabling of the drive system" (3AFY61201998) entnehmen.

Beim Betrieb an einem Frequenzumrichter muss über die außen am Motorgehäuse vorgesehenen Erdungsvorrichtungen eine Potentialausgleichs-Verbindung zwischen dem Motorgehäuse und der getriebenen Maschine hergestellt werden, sofern die beiden Maschinen nicht auf einem gemeinsamen metallischen Unterbau montiert sind.

Hierzu bei Motorbaugrößen $> \text{IEC 280}$ einen Flachleiter mit $0.75 \times 70 \text{ mm}$ oder mindestens 2 Rundleiter mit 50 mm^2 verwenden. Der Abstand zwischen den Rundleitern muss dabei mindestens 150 mm betragen.

Diese Verbindung dient nur dem Potentialausgleich. Sie hat keine elektrische Sicherheitsfunktion. Wenn Motor und Getriebe auf einem gemeinsamen Stahlfundament montiert sind, wird kein Potentialausgleich benötigt.



Die EMV-Vorschriften werden bei Verwendung von für diesen Zweck zugelassenen Kabeln und Anschluss-teilen erfüllt. (Siehe Anleitung für Frequenzumrichter.)

Die höchste zulässige Drehzahl eines Graugussmotors bei einem drehzahlveränderbaren Antrieb (M2BA/M3BP) darf nicht die maximal zulässige Drehzahl gemäß der folgenden Tabelle oder die auf das Leistungsschild gestempelte Drehzahl überschreiten. Informationen über die höchste zulässige Drehzahl anderer Motorgrößen und Typen erhalten Sie von ABB. Die Lagerschmierung muss entsprechend den Anweisungen erfolgen.

Bau- größe	Drehzahl U/min	
	2 polig	4 polig
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

Wenn nicht sicher ist, ob ein Motor für Frequenzumrichterbetrieb geeignet ist, wenden Sie sich bitte an ABB.

WARNUNG

Die maximale Betriebstemperatur des Schmierfetts und der Lager darf nicht überschritten werden.

Auswuchten

Der Rotor des Motors ist dynamisch ausgewuchtet.

Standardmäßig wurde die Auswuchtung mit halber Passfeder vorgenommen; das Wellenende trägt ein **ROTES** Klebeband mit der Aufschrift **„Mit halber Passfeder ausgewuchtet - balanced with half key“**.

Um Schwingungen zu vermeiden, muß die Kupplungshälfte oder Riemenscheibe nach dem Einfräsen der Paßfedernut mit halber Paßfeder ausgewuchtet werden.

Falls der Rotor mit voller Paßfeder ausgewuchtet worden ist, trägt das Wellenende ein **GELBES** Klebeband mit der Aufschrift **„Mit voller Paßfeder ausgewuchtet - balanced with full key“**.

Bei Auswuchtung ohne Paßfeder ist das Wellenende mit **BLAUEM** Klebeband gekennzeichnet (Aufschrift **„Balanced without key / ohne Passfeder ausgewuchtet“**).

3. Betrieb

Verwendung

Betriebsbedingungen

Die Motoren sind für die Verwendung innerhalb industrieller Antriebssysteme bestimmt.

Die standardmäßigen Grenzwerte der

Umgebungstemperatur betragen -20°C ... +40°C.

Die maximale Aufstellhöhe beträgt standardmäßig 1000 m über dem Meeresspiegel (N.N. bzw. MSL).

Sicherheitshinweise

Installation und Betrieb des Motors muss durch qualifiziertes Fachpersonal erfolgen, das die einschlägigen sicherheitsrelevanten Anforderungen kennt.

Die notwendigen Sicherheitseinrichtungen für die Verhütung von Unfällen bei Aufstellung und Betrieb müssen in Übereinstimmung mit den jeweils geltenden Unfallverhütungsbestimmungen vorhanden sein.

WARNUNG

Kleine Motoren, deren Versorgungsspannung durch temperaturabhängige Schalter direkt geschaltet wird, können gegebenenfalls selbsttätig anlaufen!

WICHTIG!

1. Nicht auf den Motor treten oder steigen!
2. Vorsicht: auch im normalen Betrieb können an der Oberfläche des Motors hohe Temperaturen auftreten!
3. Einige Anwendungen (z.B. bei Speisung des Motors mit Frequenzumrichtern) können spezielle Hinweise erfordern!
4. Mit den Aufhängeösen darf ausschließlich der Motor angehoben werden.

Montage und Demontage

Allgemein

Die Montage und Demontage der Motoren darf ausschließlich von qualifiziertem Personal unter Verwendung geeigneter Hilfsmittel und Methoden ausgeführt werden. Alle Reparaturen müssen unter Einhaltung der Norm IEC-60079-19 ausgeführt werden.

Lager

Die Lager sind mit besonderer Sorgfalt zu behandeln. Die Lager dürfen nur mit Hilfe von Ausziehwerkzeugen demontiert und in erwärmtem Zustand oder unter Verwendung von Spezialwerkzeug eingebaut werden. Der Lageraustausch wird in einer von ABB getrennt erhältlichen Hinweisschrift ausführlich beschrieben.

Anbau von Kupplungshälften und Riemenscheiben

Kupplungshälften und Riemenscheiben dürfen nur mit geeigneter Ausrüstung und mit Hilfe von solchem Werkzeug montiert werden, das eine Beschädigung der Lager ausschließt.

Montieren Sie niemals eine Kupplungshälfte oder Riemenscheibe durch Schläge mit dem Hammer. Bei der Demontage darf nie ein Hebel gegen das Motorgehäuse angesetzt werden!

Montagegenauigkeit von Kupplungshälften:
Stellen Sie sicher, dass sowohl der Freiraum **b** als auch die Differenz zwischen **a1** und **a2** jeweils kleiner als 0.05 mm sind. Beachten Sie hierzu auch die Angaben auf dem Bild 3.

4. Wartung

Allgemeine Kontrolle

- Untersuchen Sie den Motor in regelmäßigen Abständen
 - Halten Sie den Motor sauber und sorgen Sie für einen freien Kühlluftstrom
 - Überprüfen Sie den Zustand der Wellendichtungen (z.B. V-Ring) und erneuern Sie diese gegebenenfalls
 - Überprüfen Sie den Zustand aller Verbindungen und Verbindungselemente (z.B. Schrauben)
 - Überprüfen Sie den Zustand der Lager mit dem Gehör (ungewöhnliche Geräusche), durch Schwingungsmessung, durch Lagertemperaturmessung, durch Untersuchung des verbrauchten Fettes oder durch SPM-Lagerüberwachung
- *Im Falle von Zustandsveränderungen ist der Motor zu zerlegen, die Bauteile sind zu untersuchen und ggf. zu erneuern.

Schmierung

WARNUNG

Auf ausreichenden Sicherheitsabstand zu allen drehenden Teilen achten!

WARNUNG

Schmierfett kann zu Hautreizungen und Entzündungen der Augen führen. Befolgen Sie strikt alle Sicherheitsanweisungen des Herstellers.

Motoren mit dauergeschmierten Lagern

In der Regel sind Motoren mit dauergeschmierten Lagern der Typen Z oder ZZ ausgestattet. Die Bezeichnung der Lager kann den jeweiligen Produktkatalogen entnommen werden und sie sind, mit Ausnahme der kleineren Baugrößen, auf das Leistungsschild gestempelt.

Allgemein gilt, dass für Motorgrößen bis 180 eine ausreichende Schmierung mit einem Schmierintervall entsprechend L1 (d.h., bei 99 % der Motoren arbeiten mit diesen Intervallzeiten störungsfrei) bei einer Umgebungstemperatur von 25°C erreicht wird. Angaben zum Betrieb bei Umgebungstemperaturen höher als 25°C enthalten die jeweiligen Produktkataloge.

Baugröße	Polig	Betriebsstunden
56-80	2-8	lebenslänglich
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Je nach Einsatz- und Lastbedingungen; siehe hierzu den betreffenden Produktkatalog.

Bei vertikal aufgestellten Motoren sind die o.g. Werte jeweils zu halbieren.

Motoren mit Nachschmiersystem

Nachschmierschild und allgemeine Schmieranweisung

Wenn der Motor mit einem Nachschmierschild versehen ist, folgen Sie bitte dessen Angaben. Im übrigen gelten die in der Tabelle angegebenen Werte.

Auf dem Nachschmierschild können Schmierintervalle unter Berücksichtigung der Montagerichtung, Umgebungstemperatur und Drehzahl angegeben sein/ werden.

Die Lagerschmierfristen werden von ABB in erster Linie nach dem Gesichtspunkt der Betriebssicherheit festgelegt. Sie werden daher nach dem L1-Prinzip bestimmt (d. h., bei 99 % der Motoren sind diese Fristen ausreichend).

Manuelle Schmierung Manuelle Schmierung Schmierung bei laufendem Motor

- Stopfen der Fettauslassöffnung entfernen, sofern vorhanden.
- Sicherstellen, dass der Schmierkanal frei ist
- Die spezifizierte Fettmenge in das Lager einpressen.
- Den Motor 1-2 Stunden laufen lassen, um überschüssiges Fett aus dem Lager zu entfernen. Fettauslassstopfen, sofern vorgesehen, wieder einsetzen.

Schmierung bei Stillstand des Motors

Die Nachschmierung sollte grundsätzlich bei laufendem Motor durchgeführt werden. Falls dies nicht möglich ist, kann sie jedoch auch bei Stillstand erfolgen.

- In diesem Fall zunächst nur die halbe Fettmenge einpressen und den Motor danach einige Minuten mit Volldrehzahl laufen lassen.
- Nachdem der Motor zum Stillstand gekommen ist, das restliche Fett gemäß Spezifikation in das Lager einpressen.
- Nach 1-2 Betriebsstunden den Fettauslassstopfen/ Auslassventil, sofern vorgesehen, wieder einsetzen.

Automatische Schmierung

Bei automatischer Schmierung muss die Fettauslass-Öffnung oder das Auslassventil, sofern vorhanden, ständig offen sein.

Einige ältere Motoren können mit einem Sammler für altes Schmierfett ausgestattet sein. Befolgen Sie die dafür gegebenen speziellen Anweisungen.

ABB empfiehlt nur den Einsatz elektromechanischer Systeme, wenden Sie sich zur Klärung an ABB.

Bei Einsatz eines automatischen Schmiersystems sollte die in der Tabelle angegebene Schmierfettmenge pro Nachschmierintervall verdoppelt werden.

Bei automatischer Schmierung von 2-poligen Motoren muss der Hinweis (HINWEIS!) betreffend Schmierempfehlungen für 2-polige Motoren in Kapitel Schmierstoffe beachtet werden.

Schmierintervalle und Fettmengen

Bau- größe	Fett- menge r/min g/Lager	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
Kugellager Nachschmierintervalle in Betriebsstunden							
112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	¹⁾	¹⁾	6500	8500	12500	16000
355	120	¹⁾	¹⁾	4200	6000	10000	13000
400	120	¹⁾	¹⁾	4200	6000	10000	13000
400 M3BP	130	¹⁾	¹⁾	2800	4600	8400	12000

Rollenlager Nachschmierintervalle in Betriebsstunden							
160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	¹⁾	¹⁾	3300	4300	6000	8000
355	120	¹⁾	¹⁾	2000	3000	5000	6500
400	120	¹⁾	¹⁾	2000	3000	5000	6500
400 M3BP	130	¹⁾	¹⁾	1400	2300	4200	6000

¹⁾ Werte für IEC-Größen 280 bis 400 bei bestimmten Motortypen (3600 und 3000 r/min), siehe nächste Seite.

Einflussfaktoren für die Schmierintervalle

Für vertikal montierte Motoren sind die angegebenen Nachschmierintervalle zu halbieren.

Die Schmierintervalle basieren auf einer Betriebstemperatur der Lager von 80°C (Umgebungstemperatur von etwa +25°C).

Hinweis! Bei einer höheren Umgebungstemperatur steigt entsprechend auch die Lagertemperatur. Die angegebenen Betriebszeiten sollten für je 15°C höhere Lagertemperatur halbiert und können für je 15°C niedrigere Lagertemperatur verdoppelt werden.

WARNUNG

Die maximal zulässigen Höchsttemperaturen für Schmierfett und Lager dürfen nicht überschritten werden.

Schmierstoffe

WARNUNG

Verwenden Sie beim gleichen Motor keine unterschiedlichen Schmierfette.

Nichtkompatible Schmierstoffe können Lagerschäden verursachen.

Für die Nachschmierung darf nur ein speziell auf die Schmierung von Kugellagern abgestimmtes Fett mit den folgenden Eigenschaften verwendet werden:

- Hochwertiges Fett mit Lithiumkomplexseife und Mineral- oder PAO-Öl
- Viskosität des Basisöls 100-160 cST bei 40°C Konsistenz NLGI Grad 1.5 bis Grad 3 *)
- Dauergebrauchstemperatur -30°C - +120°C

*) Für vertikal montierte Motoren oder in heißen Umgebungen wird ein steiferer NLGI Grad empfohlen.

Geeignete Fette mit den geforderten Eigenschaften sind von allen größeren Schmiermittelherstellern erhältlich.

Zusatzstoffe können empfehlenswert sein, eine schriftliche Garantie, speziell für EP-Zusätze, dass die Lager nicht beschädigt werden oder die Temperaturfestigkeit des Schmierfetts gewährleistet wird, kann nur der Schmierstoffhersteller geben.

WARNUNG

Von Schmierstoffen mit EP-Zusätzen wird bei hohen Lagertemperaturen in den Achshöhen 280-400 abgeraten.

Bei Umgebungstemperaturen unter -25°C oder über +55°C oder Lagertemperaturen über 110°C sind die Möglichkeiten bezüglich der Verwendung geeigneter Fette mit ABB abzusprechen.

Die folgenden Hochleistungsfette können verwendet werden

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP90 (calcium polyurea base)
- FAG Arcanol TEMP110 (lithium complex base)

Schmierintervalle für andere Schmierfette, die die Anforderungen an die Eigenschaften erfüllen, wenden Sie sich zur Klärung an ABB.

Schmierintervalle und Mengen, 2-polige Motoren, IEC Baugrößen 280 and 400

Bau- größe		Fett- menge g/Lager	3600 r/min	3000 r/min
Kugellager				
Nachschmierintervalle in Betriebsstunden				
280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	600	800
400	M3B*	40	1000	1600
Rollenlager				
Nachschmierintervalle in Betriebsstunden				
280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	-	-
400	M3B*	40	500	800

HINWEIS!

Bei schnelllaufenden Motoren, wie z. B. 2-poligen Maschinen vom Typ M2BA 355 und 400, bei denen der Drehzahlfaktor ($D_m \times n$, wobei D_m = durchschnittlicher Lagerdurchmesser, mm; n = Drehzahl, min^{-1}) höher ist als 400 000, sind Hochdrehzahlfette einzusetzen. In diesen Fällen können die folgenden Fette oder andere Fette mit vergleichbaren Eigenschaften verwendet werden:

- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- SKF LGHP2 (polyurea base)

Wenn bei einem Wechsel der Fettsorte Unsicherheit bezüglich der Verträglichkeit besteht, prüfen Sie mit dem Hersteller, ob die Qualität den oben angegebenen Schmierfetten entspricht, oder wenden Sie sich zur Klärung an ABB.

Betrieb an Frequenzumrichtern

Hochtouriger Betrieb, z.B. bei Applikationen mit Frequenzumrichtern, oder niedrige Drehzahlen mit schweren Lasten erfordern verkürzte Schmierintervalle. Wenden Sie sich in diesen Fällen an ABB.

Bei doppelter Drehzahl ist ein verkürztes Schmierintervall auf ca. 40 % der Tabellenwerte typisch.

WARNUNG

Die zulässige Höchstdrehzahl des Motors darf nicht überschritten werden.

Die Eignung der Lager für den Betrieb mit hohen Drehzahlen muss geprüft werden.

Ersatzteile

Bei der Bestellung von Ersatzteilen sollte die vollständige Typenbezeichnung des Motors (siehe Leistungsschild) angegeben werden. Wenn der Motor mit einer Seriennummer gekennzeichnet ist, so ist diese ebenfalls anzugeben.

Neuwicklung

Eine Erneuerung der Ständerwicklung sollte nur von qualifizierten Reparaturbetrieben ausgeführt werden.

Bei Brandgas- oder anderen Sondermotoren ist zuvor Kontakt mit ABB aufzunehmen.

5. Umgebungsanforderungen

Geräuschpegel

Die meisten ABB-Motoren haben einen Schalldruckpegel unterhalb von 82 dB(A) bezogen auf 50 Hz sinusförmige Einspeisung, Toleranz ± 3 dB(A).

Die Werte der einzelnen Maschinen finden Sie im entsprechenden Produktkatalog.

Die Schalldruckpegel für 60 Hz mit sinusförmiger Einspeisung und mit nicht-sinusförmiger Einspeisung erhalten Sie auf Anfrage von ABB.

Die Schalldruckpegel für alle Maschinen mit Fremdkühlsystem und für die Serien M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, und M2BJ/M2LJ sind in separaten Handbücher angegeben.

In den folgenden Anleitungen kann nicht auf sämtliche technische Einzelheiten oder Unterschiede zwischen den verschiedenen Motoren oder alle bei der Installation, beim Betrieb oder bei der Wartung möglicherweise auftretenden Situationen eingegangen werden. Anfragen bezüglich weitergehender Informationen richten Sie bitte an die nächste ABB-Vertriebsstelle.

Motor-Fehlersuchtablelle

Wartungs- und etwaige Fehlersuchmaßnahmen am Motor dürfen nur von hierfür qualifiziertem Personal und mit geeigneten Werkzeugen und Hilfsmitteln durchgeführt werden.

FEHLER	URSACHE	MASSNAHMEN
Motor startet nicht	Sicherungen durchgebrannt	Neue Sicherungen des richtigen Typs und mit entsprechenden Bemessungsdaten einsetzen.
	Überlastauslösung	Überlast in Anlasser prüfen und zurücksetzen.
	Fehlerhafte Stromversorgung	Überprüfen, ob die Stromversorgung den Angaben auf dem Motorleistungsschild entspricht und für den jeweiligen Lastfaktor geeignet ist.
	Fehlerhafte Netzanschlüsse	Anschlüsse anhand des mit dem Motor gelieferten Schaltplans überprüfen.
	Stromkreisunterbrechung in Wicklung oder Steuerschalter	Erkennbar an einem Summen beim Einschalten des Schalters. Verdrahtung auf lockere Anschlüsse überprüfen. Kontrollieren, ob alle Kontakte schließen.
	Mechanischer Fehler	Überprüfen, ob Motor und Antrieb frei drehen. Lager und Schmierung kontrollieren.
	Ständerkurzschluß	Erkennbar an durchgebrannten Sicherungen. Der Motor muß neu gewickelt werden.
	Schlechter Anschluß an Ständerwicklung	Lagerschilde abnehmen; mit Prüflampe lokalisieren.
	Defekter Rotor	Auf gebrochene Stäbe oder Endringe kontrollieren.
	Motor überlastet	Last reduzieren.
Motor läuft nicht	Phasenausfall	Leitungen auf offene Phase kontrollieren.
	Falsche Anwendung	Nach Rücksprache mit dem Hersteller geeigneten Typ bzw. geeignete Baugröße verwenden.
	Überlast	Last reduzieren.
	Unterspannung	Kontrollieren, ob die auf dem Leistungsschild angegebene Spannung eingehalten wird. Anschluß überprüfen.
	Offener Stromkreis	Durchgebrannte Sicherungen; Überlastrelais, Ständer und Drucktasten kontrollieren.
Motor läuft zunächst und bleibt dann stehen	Netzausfall	Auf lose Anschlüsse zum Netz, zu den Sicherungen und zur Steuerung überprüfen.
Motor läuft nicht hoch	Falsche Anwendung	Durch Rücksprache mit dem Lieferanten geeigneten Typ bestimmen.
	Unterspannung an Motorklemmen durch Netzspannungsabfall	Höhere Spannung oder höhere Transformatorstufe verwenden. Anschlüsse überprüfen. Leiter auf angemessenen Querschnitt überprüfen.
	Anlaufast zu hoch	Auslegung des Motors bezüglich Anlaufast überprüfen.
	Gebrochene Läuferstäbe oder lockerer Läufer	Kontrollieren, ob in der Nähe der Ringe Risse vorhanden sind. Möglicherweise wird ein neuer Läufer benötigt, da eine dauerhafte Reparatur in diesem Fall meist nicht möglich ist.
	Offener Primärkreis	Fehler mit Prüfgerät lokalisieren und beheben.
Motor läuft zu langsam hoch und/oder zieht einen zu hohen Strom	Last zu hoch	Last reduzieren.
	Spannung beim Anlauf zu niedrig	Auf zu hohen Widerstand überprüfen. Angemessenen Leiterquerschnitt verwenden.
	Defekter Käfigläufer	Neuen Läufer einbauen.
	Netzspannung zu niedrig	Spannungsversorgung klären

FEHLER	URSACHE	MASSNAHMEN
Falsche Drehrichtung	Falsche Phasenfolge	Anschlüsse am Motor bzw. an der Schalttafel vertauschen.
Motor überhitzt bei Betrieb unter Last	Überlast	Last reduzieren.
	Belüftungsöffnungen sind möglicherweise durch Schmutz verstopft und verhindern eine ordnungsgemäße Kühlung des Motors	Belüftungsöffnungen säubern und kontrollieren, ob ein kontinuierlicher Luftstrom der Motor kühlt.
	Eine Motorphase ist möglicherweise ausgefallen	Kontrollieren, ob alle Anschlußleitungen richtig angeschlossen sind.
	Erdschluß	Fehler lokalisieren und beheben.
	Unsymmetrische Klemmenspannung	Anschlußleitungen, Anschlüsse und Transformatoren auf Fehler überprüfen.
Motorschwingungen	Motor schlecht ausgerichtet	Motor nachrichten.
	Mangelnde Stabilität des Unterbaus	Unterbau verstärken.
	Unwucht in Kupplung	Kupplung auswuchten.
	Unwucht in getriebener Anlage	Getriebene Anlage neu auswuchten.
	Defekte Lager	Lager austauschen.
	Lager schlecht ausgerichtet	Lager ausrichten.
	Auswuchtgewichte verschoben	Motor neu auswuchten.
	Wuchtung von Läufer und Kupplung nicht aufeinander abgestimmt (Halbkeil-bzw. Vollkeilwuchtung)	Kupplung oder Motor neu auswuchten.
	Mehrphasenmotor läuft einphasig	Auf offenen Stromkreis überprüfen.
	Axialspiel zu groß	Lager nachstellen oder Feder-Ausgleichsscheibe einlegen.
Geräusche	Lüfter reibt an Lüfterkappe	Ausreichenden Abstand herstellen.
	Lüfter reibt an Isolierung	Lüfterweg frei machen.
	Lockerer Sitz auf Grundplatte	Fußschrauben anziehen.
Betriebsgeräusch zu laut	Luftspalt nicht gleichmäßig	Lagerschildbefestigung bzw. Lager überprüfen und entsprechend korrigieren.
	Unwucht im Läufer	Neu auswuchten.
Lagertemperatur zu hoch	Welle verbogen oder beschädigt	Welle richten oder austauschen.
	Riemenzug zu stark	Riemenspannung reduzieren.
	Riemenscheiben zu weit entfernt	Riemenscheibe näher am Motorlager anordnen.
	Durchmesser der Riemenscheiben zu klein	Größere Riemenscheiben verwenden.
	Schlechte Ausrichtung	Durch Nachrichten des Antriebs korrigieren.
	Unzureichendes Schmierfett	Angemessene Qualität des im Lager vorhandenen Schmierfetts sicherstellen.
	Qualität des Schmierfetts beeinträchtigt oder Schmiermittel verschmutzt	Altes Schmierfett entfernen, Lager gründlich in Kerosin waschen und mit neuem Fett schmieren.
	Überschüssiges Schmiermittel	Schmiermittelmenge verringern; das Lager sollte maximal zur Hälfte gefüllt sein.
	Lager überlastet	Ausrichtung, Radial- und Axialschub überprüfen.
	Defekte Kugel oder rauhe Laufbahnen	Lager austauschen; vor dem Einbau des neuen Lagers das Lagergehäuse gründlich reinigen.

Manuel d'installation, d'exploitation et de maintenance

Sommaire

1. Généralités

2. Installation

3. Exploitation

4. Maintenance

5. Contraintes d'environnement

6. Localisation des défauts

1. Généralités

NOTA !

Le respect des consignes de cette notice garantit une installation, une exploitation et une maintenance sûres et appropriées du moteur. Le personnel chargé de l'installation, l'exploitation ou la maintenance du moteur devra en être instruit. Le non respect de ces consignes peut entraîner l'annulation de la garantie.

Déclaration de conformité

Les déclarations de conformité au titre de la directive Basse Tension 73/23/CEE modifiée par la directive 93/68 CEE sont fournies séparément avec chaque machine.

La déclaration de conformité satisfait également les exigences du certification d'incorporation au titre de la directive Machine 98/37/CEE, Art 4.2 Annex II, sub B.

Domaine d'application

Cette notice technique s'applique aux machines électriques ABB de types suivants, utilisés en modes moteur et générateur.

Séries MT*, MBT*, MXMA,

Séries M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

En hauteurs d'axe 56 - 400.

Une notice technique séparée existe pour les autres types de moteurs, comme par exemple les moteurs de sécurité Ex: « Moteurs basse tension pour atmosphères explosives: Manuel d'installation, d'exploitation et de maintenance » (réf. Low Voltage Motors/Manual for Ex-motors).

Des consignes supplémentaires sont nécessaires pour certains types de machine en raison de spécificités d'application et/ou de considérations de conception. Des consignes supplémentaires sont disponibles pour les moteurs suivants:

- moteurs pour table à rouleaux
- moteurs refroidis à l'eau
- moteurs de protection IP 23
- moteurs de désenfumage
- moteurs freins

2. Installation

Mise en service (premier démarrage)

Contrôles de réception

A la réception, vérifiez l'état de la machine; tout dommage doit être signalé immédiatement au transporteur par réserves d'usage.

Vérifiez toutes les données de la plaque signalétique, plus particulièrement la tension et le mode de couplage des enroulements (étoile ou triangle). Le type de roulement est spécifié sur la plaque signalétique des moteurs, à l'exception de ceux de faible hauteur d'axe.

Démontez l'éventuel dispositif d'immobilisation du rotor (protection pendant le transport) et tournez l'arbre à la main pour vérifier que sa rotation s'effectue sans entrave.

Ne pas dépasser les valeurs de charge admissibles des roulements spécifiées dans le catalogue produit.

Moteurs dotés de roulements à rouleaux: la rotation du moteur sans charge radiale appliquée à l'arbre est susceptible d'endommager le roulement à rouleaux.

Moteurs dotés de roulements à contact oblique: la rotation du moteur sans charge axiale de direction adéquate appliquée à l'arbre est susceptible d'endommager le roulement à contact oblique.

Moteurs dotés de graisseurs:

Lors du premier démarrage du moteur, ou après un stockage prolongé du moteur, vous devez injecter une quantité suffisante de la graisse spécifiée jusqu'à ce que de la graisse neuve s'écoule par le trou d'évacuation.

Pour des détails, cf. section « Lubrification manuelle » page 27.

Mesure de la résistance d'isolement

La résistance d'isolement du moteur doit être mesurée avant sa mise en service et en particulier si les enroulements sont susceptibles d'être humides.

La résistance, mesurée à 25°C, doit être supérieure à la valeur de référence, à savoir 10 Mohm (mesurée avec un ohmmètre de 500 Vcc.)

ATTENTION

Déchargez les enroulements dès la mesure terminée pour prévenir tout risque de choc électrique.

La valeur de référence de la résistance d'isolement est réduite de moitié chaque fois que la température ambiante augmente de 20°C.

Si vous n'obtenez pas la valeur de résistance de référence, les enroulements sont trop humides. Ils doivent alors être séchés en étuve, à une température

de 90°C pendant 12 à 16 heures et ensuite à 105°C pendant 6 à 8 heures.

Pendant le séchage, vous devez ouvrir la boîte à bornes et retirez les éventuels obturateurs des trous de purge et autres orifices.

Les enroulements imprégnés d'eau de mer doivent normalement être rebobinés.

Démarrage direct ou démarrage étoile/triangle

La boîte à bornes des machines monovitesse standard renferme normalement 6 bornes pour les câbles venant du bobinage et au moins une borne de terre.

La mise à la terre doit être réalisée conformément à la réglementation en vigueur avant le branchement de la machine sur l'alimentation réseau.

La tension et le mode de couplage sont gravés sur la plaque signalétique du moteur.

Démarrage direct sur le réseau:

Possibilité de couplage Y ou D.

Ex., 660 VY, 380 VD désigne un couplage Y pour 660 V et un couplage D pour 380 V.

Démarrage étoile/triangle (Y/D):

En couplage D, la tension d'alimentation doit être égale à la tension nominale de la machine.

Retirez tous les contacts de pontage du bornier.

Pour les machines deux vitesses, monophasées et spéciales, les raccordements électriques doivent respecter les instructions figurant à l'intérieur de la boîte à bornes.

Si le démarrage direct sur le réseau dure plus de 10 secondes ou le démarrage Y/D plus de 30 secondes, contactez ABB ou consultez le document « Le guide moteur » (également disponible sur le site Internet www.abb.com/motors&drives).

Ordre des phases et sens de rotation

Le sens de rotation de l'arbre est le sens horaire vu côté accouplement du moteur, pour un ordre de phases L1, L2, L3 aux bornes tel qu'illustré à la figure 1.

Pour inverser le sens de rotation, permutuez le raccordement de deux conducteurs, au choix.

Si la machine est dotée d'un ventilateur unidirectionnel, vérifiez que celui-ci tourne effectivement dans le sens indiqué par la flèche figurant sur le moteur.

Manutention

Stockage

La machine doit toujours être stockée dans un local fermé, à l'abri de l'humidité et de la poussière, et exempt de vibrations.

Les surfaces usinées non protégées (bouts d'arbre et brides) doivent être recouvertes d'une protection anticorrosion.

Nous préconisons de tourner l'arbre à la main à intervalles réguliers pour prévenir tout écoulement de graisse.

Si le moteur est doté de résistances de réchauffage, il est préférable de les mettre sous tension.

Les condensateurs électrolytiques, éventuellement intégrés aux moteurs monophasés, doivent être « réactivés » après une période de stockage prolongée (1 à 2 ans).

Pour en savoir plus, contactez ABB.

Transport

Pendant le transport ou tout déplacement, le rotor des moteurs dotés de roulements à rouleaux cylindriques et/ou à contact oblique doit être immobilisé par un dispositif spécial.

Levage

Le moteur doit être soulevé uniquement par ses anneaux de levage, sauf spécification particulière autre complémentaire dans notice à part.

Le centre de gravité des moteurs de taille identique peut varier en fonction de leur puissance, de leur disposition de montage et des auxiliaires montés.

Vérifiez l'état des boulons ou des anneaux de levage intégrés à la carcasse du moteur. Les anneaux de levage endommagés ne doivent pas être utilisés.

Les boulons des anneaux doivent être serrés avant de procéder au levage. Au besoin, la position de chaque boulon sera ajustée au moyen de rondelles appropriées.

Vérifiez la compatibilité de l'engin de levage et de la taille des crochets pour les anneaux de levage.

Veillez à ne pas endommager les auxiliaires et les câbles fixés au moteur.

Masse des machines

La masse totale des machines de même hauteur d'axe peut varier selon leur puissance, leur disposition de montage et les auxiliaires montés.

Le tableau suivant donne la masse maxi approximative des machines en exécution de base et en fonction du matériau de la carcasse.

La masse de chaque moteur figure sur sa plaque signalétique, à l'exception des faibles hauteurs d'axe.

Hauteur d'axe	Aluminium		Fonte	Acier
	Masse kg	Ajouter pour frein	Masse kg	Masse kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Installation

Refroidissement

La température ambiante normale ne doit pas dépasser 40°C (moteurs pour application marine +45 ou +50°C) pour respecter les valeurs normalisées. Vérifiez que la circulation d'air est suffisante. Assurez vous qu'aucun équipement à proximité, qu'aucune surface ou qu'aucun rayonnement direct du soleil ne chauffent le moteur. Pour en savoir plus sur les températures ambiantes supérieures ou le refroidissement, cf. « Le guide moteur » ou contactez ABB.

Fondations

La préparation du support de fixation (fondations) du moteur incombe entièrement à l'acheteur.

Les supports métalliques doivent être traités anticorrosion.

Les fondations doivent être de niveau et suffisamment rigides pour encaisser les effets des courts-circuits. Elles doivent être conçues pour prévenir les vibrations résultant des phénomènes de résonance.

Visserie (éléments de fixation)

Boulonnez les éléments de fixation aux pattes du moteur et insérez une cale de 1 à 2 mm d'épaisseur entre chaque élément et les pattes.

Procédez à l'alignement du moteur selon les méthodes appropriées. Scellez les supports de fixation avec du béton, vérifiez l'alignement et percez les trous pour les goupilles de positionnement.

Trous de purge

Vous devez toujours vous assurer que les trous de purge ouverts sont dirigés vers le bas.

Dans les ambiances extrêmement poussiéreuses, tous les trous de purge doivent être fermés.

Alignement

L'alignement doit être parfait pour éviter toute détérioration des roulements, les vibrations et les ruptures éventuelles des bouts d'arbre.

Glissières et entraînements à courroie

- Fixez le moteur sur les glissières comme illustré à la figure 2.
- Disposez les glissières horizontalement à la même hauteur.
- Assurez-vous que l'arbre moteur est parallèle à l'arbre entraîné ou entraînant.
- La tension des courroies doit correspondre aux valeurs prescrites par le fabricant.

ATTENTION

Une courroie trop tendue peut endommager les roulements et provoquer la rupture de l'arbre.

Ne pas dépasser les valeurs de tension maxi des courroies et vérifiez que ces valeurs sont compatibles avec les efforts radiaux admissibles par les paliers figurant dans les catalogues produits correspondants.

Raccordements

Les machines de conception standard sont fournies avec la boîte à bornes montée sur le dessus et les entrées de câbles sur les deux côtés.

Certaines machines sont disponibles avec la boîte à bornes montée sur le dessus et réorientable 4 x 90°, et d'autres machines avec la boîte à bornes montée sur le côté.

La disponibilité de ces solutions est décrite dans les catalogues produits.

Les entrées de câbles non utilisées doivent être obturées.

En plus des bornes principales pour les câbles venant du bobinage et la borne de terre, la boîte à bornes peut contenir des raccordements pour des thermistances, des résistances de réchauffage, des contacts bimétalliques ou des sondes à résistance PT 100.

ATTENTION

Même avec le moteur à l'arrêt, la boîte à bornes peut être sous tension pour les résistances de réchauffage ou le réchauffage direct des enroulements.

Les schémas de raccordement des auxiliaires se trouvent dans le couvercle de la boîte à bornes.

ATTENTION

La charge du condensateur des moteurs monophasés peut entretenir une tension sur les bornes d'alimentation, même si le moteur a atteint l'arrêt.

Raccordement d'un variateur de vitesse

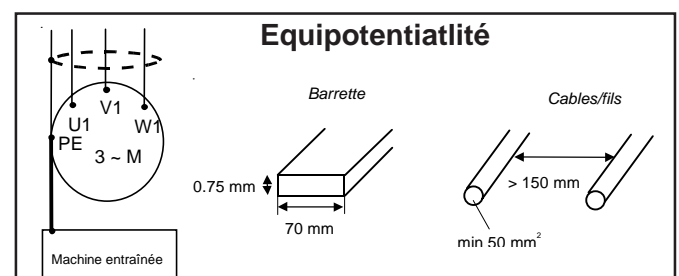
Les variateurs de vitesse peuvent imposer aux enroulements du moteur des niveaux de tension supérieurs à ceux délivrés par un réseau d'alimentation sinusoïdal et induire des tensions dans l'arbre et des courants de palier haute fréquence. Par conséquent, le bobinage et l'isolation des roulements du moteur ainsi que le filtre disposé à la sortie du convertisseur doivent être dimensionnés conformément aux spécifications du document "Selection rules for VSD applications/Insulation" (3GZF500930-2), disponible sur demande auprès d'ABB.

Dans les entraînements à vitesse variable, le moteur ($P_n > 30 \text{ kW}$) doit être raccordé en utilisant un câble symétrique blindé et des presse-étoupes assurant une continuité de masse sur 360° (également appelés presse-étoupes CEM). Pour en savoir plus, cf. document ABB "Grounding and cabling of the drive system" (3AFY61201998).

Dans les applications à vitesse variable avec convertisseur de fréquence, la mise à la terre externe de la carcasse du moteur est nécessaire pour assurer l'équipotentialité entre la carcasse du moteur et la machine entraînée, sauf si les deux machines sont montées sur le même support métallique.

Pour les moteurs de hauteur d'axe $> \text{CEI } 280$, utilisez un conducteur plat de $0.75 \times 70 \text{ mm}$ ou au moins deux conducteurs ronds de 50 mm^2 . Les conducteurs ronds doivent être placés au moins à 150 mm l'un de l'autre.

Cette mise à la terre n'assure aucune fonction de sécurité électrique; elle sert à réaliser l'équipotentialité des masses. Lorsque le moteur et le réducteur sont tous les deux montés sur un même support en acier, cette équipotentialité n'est pas nécessaire.



La conformité CEM sera réalisée en utilisant des câbles et une connectique de type homologué (cf. manuels des convertisseurs de fréquence.)

La vitesse de rotation maxi admissible d'un moteur fonte commandé en vitesse variable (M2BA/M3BP) ne doit pas dépasser les vitesses maxi admissibles du tableau suivant ou la vitesse gravée sur la plaque signalétique. Pour en savoir plus sur la vitesse de rotation maxi admissible pour d'autres tailles et types de moteurs, contactez ABB. La lubrification des roulements doit se faire selon la procédure décrite plus loin.

Hauteur d'axe	Vitesse tr/min	
	2 pôles	4 pôles
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

En cas de doute sur la compatibilité du moteur et du variateur de vitesse, contactez ABB.

ATTENTION

Ne pas dépasser la température maxi de fonctionnement de la graisse et des roulements.

Equilibrage

Le rotor de la machine est équilibré dynamiquement.

En standard, l'équilibrage a été réalisé avec une **demi-clavette** et l'arbre porte une **étiquette de couleur ROUGE** avec la mention "Balanced with half key".

Pour prévenir les vibrations, la poulie ou le demi-accouplement doit être équilibré avec une demi-clavette après usinage de la rainure de clavette.

En cas d'équilibrage avec une **clavette entière**, l'arbre porte une **étiquette de couleur JAUNE**, avec la mention "Balanced with full key".

En cas d'équilibrage **sans clavette**, l'arbre porte une **étiquette de couleur BLEUE** avec la mention "Balanced without key".

3. Exploitation

Utilisation

Conditions d'exploitation

Les machines sont destinées à des applications industrielles.

Plage normale de températures ambiantes: -20° à +40°C.

Altitude maxi: 1000 m au-dessus du niveau de la mer.

Sécurité

La machine doit être installée et exploitée par un personnel qualifié instruit des règles de sécurité applicables.

Les dispositifs de sécurité obligatoires pour la prévention des accidents sur les sites d'installation et d'exploitation doivent être mis à disposition, conformément à la réglementation en vigueur.

ATTENTION

Les petits moteurs dont le courant d'alimentation est directement établi par des interrupteurs thermosensibles peuvent démarrer automatiquement.

Règles à respecter

1. Ne pas prendre appui ni monter sur la machine.
2. Au toucher, la température de l'enveloppe extérieure de la machine peut sembler très élevée, alors que celui-ci fonctionne correctement.
3. Certains modes de fonctionnement spéciaux des machines exigent la mise en œuvre de consignes particulières (ex., alimentation par convertisseur de fréquence).
4. Les anneaux de levage ne doivent servir qu'à soulever le moteur seul. Ils ne doivent en aucun cas servir à soulever le moteur lorsqu'il est fixé à un autre équipement.

Montage et démontage

Généralités

Le montage et le démontage des machines doivent être réalisés par un personnel qualifié en utilisant les outils et les méthodes de travail appropriés. Toutes les réparations doivent être effectuées conformément à la norme CEI-60079-19.

Roulements

Les roulements doivent faire l'objet d'une attention particulière. Ils doivent être démontés avec un extracteur et remontés à chaud ou avec des outils spéciaux prévus à cet effet. La procédure de remplacement des roulements fait l'objet d'une notice à part disponible auprès d'ABB.

Mise en place des demi-accouplements et poulies

Les demi-accouplements et les poulies seront montés à l'aide de dispositifs et outils adaptés pour ne pas endommager les roulements.

Ne jamais utiliser un marteau pour mettre un demi-accouplement ou une poulie en place et ne jamais les retirer en utilisant un levier prenant appui sur la carcasse du moteur.

Précision de montage du demi-accouplement:

Vérifiez que le jeu **b** est inférieur à 0.05 mm et que l'écart entre **a1** et **a2** est également inférieur à 0.05 mm. Cf. figure 3.

4. Maintenance

Maintenance et lubrification

Entretien

- Vérifiez l'état de la machine à intervalles réguliers.
- La machine doit toujours être propre et correctement ventilée.
- Vérifiez l'état des joints de l'arbre (ex., joints V-ring), au besoin, remplacez-les.
- Vérifiez l'état des raccordements et du montage, ainsi que les vis de fixation.
- Vérifiez l'état des roulements: bruit anormal, vibrations, température, aspect de la graisse souillée (utilisation éventuelle d'un dispositif de type SPM de surveillance en continu de l'état des roulements et du comportement vibratoire des machines).
 - * En cas d'évolution anormale, démontez la machine, vérifiez l'état des pièces et remplacez les pièces défectueuses.

Lubrification

ATTENTION

Attention à toutes les pièces en rotation!

ATTENTION

La graisse est susceptible de provoquer une irritation de la peau et une inflammation des yeux. Respectez les précautions d'utilisation du fabricant.

Machines avec roulements graissés à vie

Les roulements sont généralement des roulements graissés à vie de types Z ou 2Z.

Les types de roulements sont spécifiés dans les catalogues produits correspondants et sur la plaque signalétique des moteurs, à l'exception de ceux de faibles hauteurs d'axe.

A titre indicatif, intervalles moyens de lubrification (selon le principe L1: 99 % des moteurs satisfont cette périodicité) à température ambiante de 25°C pour moteurs de tailles inférieures ou égales à 180. Pour des applications avec température ambiante supérieure à 25°C, se reporter aux catalogues produits respectifs.

Hauteur d'axe	Pôles	Heures de fonctionnement
56-80	2-8	pour la vie
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

En fonction de l'application et des caractéristiques de charge, cf. catalogue produit correspondant.

Ces intervalles de lubrification sont réduits de moitié pour les machines à arbre vertical.

Moteurs équipés de graisseurs

Plaque de lubrification et procédure générale de lubrification

Si la machine comprend une plaque de lubrification, respectez les valeurs indiquées.

Sur la plaque de lubrification, les intervalles de lubrification en fonction du montage, de la température ambiante et de la vitesse de rotation peuvent être définis.

Pour ABB, le respect des intervalles de lubrification des roulements est un gage de fiabilité. C'est pour cette raison que nous appliquons le principe L1.

Lubrification manuelle

Lubrification avec le moteur en marche

- Ouvrez les orifices d'évacuation de la graisse si le moteur en est doté.
- Assurez-vous que le conduit de lubrification est ouvert
- Injectez la quantité spécifiée de graisse dans le roulement.
- Faites tourner le moteur pendant 1 à 2 heures pour évacuer le trop-plein de graisse. Refermez les orifices d'évacuation de la graisse si le moteur en est doté.

Lubrification avec le moteur à l'arrêt

La lubrification se fait normalement moteur en marche. Si cela n'est pas possible, le moteur peut être arrêté.

- Dans ce cas, commencez par injecter la moitié de quantité de graisse et faites tourner le moteur à vitesse maxi pendant quelques minutes.
- Après avoir arrêté le moteur, injectez le reste de graisse dans le roulement.
- Après avoir fait tourner le moteur pendant 1 à 2 heures, refermez les orifices d'évacuation de la graisse si le moteur en est doté.

Lubrification automatique

En cas de lubrification automatique, les orifices d'évacuation de la graisse s'ils sont prévus doivent être définitivement ouverts.

Certains moteurs peuvent être équipés d'un collecteur de graisse usagée. Consultez les consignes spéciales fournies avec l'équipement.

Nous conseillons exclusivement l'utilisation de systèmes électromécaniques, contactez ABB.

Les quantités de graisse du tableau par intervalle de lubrification doivent être multipliées par deux si un système de lubrification automatique est utilisé.

Pour les moteurs 2 pôles avec lubrification automatique, les conseils (NOTA !) de lubrification pour les moteurs 2 pôles au paragraphe « Lubrifiants » doivent être suivis.

Intervalles de lubrification et quantités de lubrifiant

Hauteur d'axe	Qté de graisse g/roulem.	3600 tr/min	3000 tr/min	1800 tr/min	1500 tr/min	1000 tr/min	500-900 tr/min
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Roulements à billes

Intervalles de lubrification en heures de fonctionnement

112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	¹⁾	¹⁾	6500	8500	12500	16000
355	120	¹⁾	¹⁾	4200	6000	10000	13000
400	120	¹⁾	¹⁾	4200	6000	10000	13000
400 M3BP	130	¹⁾	¹⁾	2800	4600	8400	12000

Roulements à rouleaux

Intervalles de lubrification en heures de fonctionnement

160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	¹⁾	¹⁾	3300	4300	6000	8000
355	120	¹⁾	¹⁾	2000	3000	5000	6500
400	120	¹⁾	¹⁾	2000	3000	5000	6500
400 M3BP	130	¹⁾	¹⁾	1400	2300	4200	6000

¹⁾ Valeurs pour tailles normalisées de 280 à 400 et certains types de moteurs (3600 et 3000 tr/min), voir tableau suivant.

Facteurs influençant les intervalles de lubrification

Les intervalles de lubrification du tableau seront réduits de moitié pour des machines à arbre vertical.

Les intervalles de lubrification s'entendent pour une température de fonctionnement des roulements de 80°C (température ambiante d'environ +25°).

Nota ! : Toute augmentation de la température ambiante augmente d'autant la température des roulements. Les intervalles seront réduits de moitié pour chaque augmentation de 15°C de la température des roulements et peuvent être doublés pour chaque réduction de 15°C de la température des roulements.

ATTENTION

Ne jamais dépasser la température maxi de fonctionnement de la graisse et des roulements.

Lubrifiants

ATTENTION

Ne pas mélanger différents types de graisse. Des lubrifiants non miscibles peuvent endommager les roulements.

Pour une relubrification, seules les graisses spéciales pour roulements à billes présentant les propriétés suivantes doivent être utilisées:

- graisse de qualité supérieure à base de savon lithium complexe et d'huile minérale ou huile synthétique PAO
- viscosité de l'huile de base entre 100 et 160 cST à 40°C
- consistance (échelle NLGI 1.5 - 3 *)
- Températures d'utilisation: -30°C - +120°C, en continu.

*) Pour les moteurs à arbre vertical ou exploité en ambiance chaude, une consistance NLGI supérieure est préconisée.

Des graisses aux propriétés énoncées sont proposées par les principaux fabricants de lubrifiants.

Des additifs sont recommandés, mais une garantie écrite doit être obtenue auprès du fabricant de lubrifiants, tout particulièrement pour ce qui concerne les additifs EP, stipulant que les additifs n'endommagent pas les roulements ou les propriétés des lubrifiants à la température de fonctionnement.

ATTENTION

Les lubrifiants contenant des additifs EP sont déconseillés pour les températures de roulements élevées, en hauteurs d'axe 280-400.

Si la température ambiante est inférieure à -25°C ou supérieure à +55°C, ou si la température des roulements est supérieure à 110°C, consultez ABB pour le choix du type de graisse approprié.

Les graisses hautes performances suivantes peuvent être utilisées

- Esso Unirex N2, N3 or S2 (savon lithium complexe)
- Mobil Mobilith SHC 100 (savon lithium complexe)
- Shell Albida EMS 2 (savon lithium complexe)
- SKF LGHQ 3 (savon lithium complexe)
- Klüber Klüberplex BEM 41-132 (savon lithium spécial)
- FAG Arcanol TEMP90 (savon calcium polycarbamide)
- FAG Arcanol TEMP110 (savon lithium complexe)

Les intervalles de lubrification pour d'autres graisses aux propriétés requises, contactez ABB.

Intervalles de lubrification et quantités de lubrifiant, moteurs 2 pôles, hauteurs d'axe (CEI) 280 et 400

Hauteur d'axe		Qté de graisse g/roulem.	3600 tr/min	3000 tr/min
Roulements à billes				
Intervalles de lubrification en heures de fonctionnement				
280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	600	800
400	M3B*	40	1000	1600
Roulements à rouleaux				
Intervalles de lubrification en heures de fonctionnement				
280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	-	-
400	M3B*	40	500	800

NOTA !

Pour les moteurs tournant à grande vitesse et certains modèles, ex., machines 2 pôles M2BA 355 et 400 pour lesquelles le facteur de vitesse est supérieur à 400 000 mm (calcul du facteur de vitesse: $D_m \times n$, où D_m est le diamètre moyen du roulement en mm et n la vitesse de rotation en tr/min), vous devez toujours utiliser des graisses grande vitesse. Les types de graisse suivants conviennent:

- FAG L69 (savon polycarbamide)
- Klüber Klüber quiet BH 72-102 (savon polycarbamide)
- SKF LGHP2 (savon polycarbamide)

Si d'autres lubrifiants sont utilisés, vérifiez auprès du fabricant que leurs propriétés correspondent à celles des lubrifiants précités, ou en cas de doute sur la miscibilité du lubrifiant, contactez ABB.

Moteurs alimentés par convertisseurs de fréquence

Le fonctionnement à grande vitesse (ex., commande par convertisseur de fréquence) ou à petite vitesse sous charge élevée impose des intervalles de lubrification plus rapprochés. Dans ce cas, consultez ABB.

En règle générale, un doublement de la vitesse impose une réduction d'environ 40 % des intervalles de lubrification spécifiés dans les tableaux.

ATTENTION

La vitesse maxi assignée du moteur ne doit pas être dépassée.

L'adéquation des roulements au fonctionnement à grande vitesse doit être vérifiée.

Pièces de rechange

Lors de toute commande de pièces de rechange, vous devez fournir la référence complète et toutes les spécifications de la machine figurant sur sa plaque signalétique.

Si un numéro de série est indiqué, il doit également être fourni.

Rebobinage

Le rebobinage doit toujours être réalisé dans un atelier spécialisé.

Les moteurs de désenfumage et autres moteurs spéciaux ne doivent pas être rebobinés sans avoir au préalable contacté ABB.

5. Contraintes d'environnement

Niveaux sonores

La plupart de nos moteurs ont un niveau de pression acoustique qui ne dépasse pas 82 dB(A) pour une alimentation sinusoïdale à 50 Hz. Tolérance: ± 3 dB(A).

Les valeurs figurent dans les catalogues produits correspondants.

Pour les niveaux de pression acoustique avec alimentation sinusoïdale 60 Hz et alimentations non sinusoïdales, contactez ABB.

Le niveau de pression acoustique des machines équipées de systèmes de refroidissement séparés et des machines de séries M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M2LJ, figurent dans des notices techniques particulières.

Ces instructions ne couvrent pas toutes les variantes ou exécutions des machines et ne permettent pas de résoudre tous les problèmes d'installation, d'exploitation ou de maintenance. Pour toute information complémentaire, nous vous invitons à contacter votre correspondant ABB.

Tableau de maintenance du moteur

L'entretien et la maintenance du moteur doivent être réalisés par un personnel qualifié disposant des outils et des instruments adéquats.

PROBLEME	ORIGINE	INTERVENTION
Le moteur ne démarre pas	Fusibles fondus	Remplacez par des fusibles de type et de calibre adéquats.
	Moteur déclenché sur défaut de surcharge	Vérifiez et réarmez la protection contre les surcharges dans le démarreur.
	Alimentation inadéquate	Comparer les caractéristiques de l'alimentation réseau aux valeurs de la plaque signalétique du moteur et le facteur de charge.
	Erreur raccordement réseau	Vérifiez le schéma de raccordement joint au moteur.
	Circuit ouvert dans bobinage ou contacteur de commande	Signalé par un bruit de ronflement lorsque l'interrupteur est fermé. Vérifiez le raccordement des fils. Vérifiez également la fermeture de tous les contacts de commande.
	Problème mécanique	Vérifiez que le moteur et la machine entraînée tournent librement. Vérifiez les paliers et la lubrification.
	Stator court-circuité	Signalé par des fusibles fondus. Le moteur doit être rebobiné.
	Bobine stator mal raccordée	Retirez la protection du bobinage et, repérez avec une lampe témoin.
	Rotor défectueux	Barres ou anneaux d'extrémité cassés.
	Moteur éventuellement surchargé	Réduisez la charge.
Le moteur se bloque	Une phase manquante	Vérifiez le raccordement de chacune des phases.
	Moteur inadapté à l'application	Changez de type ou de taille de moteur. Consultez le constructeur.
	Surcharge	Reduisez la charge.
	Tension trop faible	Cf. valeur de tension sur la plaque signalétique du moteur. Vérifiez le raccordement.
	Circuit ouvert	Fusibles fondus, Vérifiez le relais de surcharge, le stator et les boutons de commande.
Le moteur démarre pour ensuite s'arrêter	Défaut d'alimentation	Vérifiez le raccordement au réseau, les fusibles et le câble de commande.
Le moteur n'atteint pas la vitesse désirée	Moteur inadapté à l'application	Consultez le fournisseur pour le choix du moteur.
	Tension trop faible aux bornes du moteur du fait de perturbations réseau	Utilisez une tension plus élevée ou un transformateur, ou réduisez la charge. Vérifiez les raccordements. Vérifiez la section des conducteurs.
	Charge de démarrage trop élevée	Vérifiez la charge que le moteur peut accepter au démarrage.
	Barres rotor cassées ou rotor déréglé	Présence de fissures à proximité des anneaux. Un rotor neuf peut s'avérer nécessaire car les réparations ne durent en général qu'un temps.
	Circuit primaire ouvert	Localisez le défaut avec un instrument de contrôle et réparez.
Le moteur est trop long à accélérer et/ou absorbe trop de courant	Charge excessive	Reduisez la charge.
	Tension faible au démarrage	Vérifiez la résistance. Section des conducteurs.
	Rotor à cage d'écureuil défectueux	Remplacez par un rotor neuf.
	Tension appliquée trop faible	Demandez à votre fournisseur d'électricité d'augmenter le niveau de puissance autorisé.
Le moteur tourne dans le mauvais sens	Erreur d'ordre des phases	Permutez le raccordement des fils au niveau du moteur ou du tableau de distribution.

PROBLEME	ORIGINE	INTERVENTION
Le moteur s'échauffe lorsqu'il est en sous-charge	Surcharge	Reduisez la charge.
	Ouvertures de ventilation dans la carcasse ou le support encrassées, empêchant le refroidissement du moteur	Ouvrez les ouvertures de ventilation et vérifiez que l'air de refroidissement circule librement.
	Une phase manquante du moteur	Vérifiez le raccordement de tous les conducteurs.
	Bobine mise à la terre	Localisez et réparez.
	Tension aux bornes déséquilibrée	Vérifiez les conducteurs, les raccordements et les transformateurs
Le moteur vibre	Défaut d'alignement du moteur	Ré-alignez.
	Support de montage insuffisamment rigide	Renforcez.
	Accouplement déséquilibré	Équilibrez.
	Machine entraînée déséquilibrée	Ré-équilibrez.
	Roulements défectueux	Remplacez.
	Paliers désaxés	Ré-alignez.
	Poids d'équilibre déplacés	Ré-équilibrez le moteur.
	Incompatibilité entre équilibrage du rotor et de l'accouplement (demi-clavette - clavette entière)	Ré-équilibrez l'accouplement ou le moteur
	Moteur polyphasé fonctionne en monophasé	Vérifiez si circuit ouvert sur une phase
	Jeu axial excessif	Ajustez le palier ou insérez des cales.
Bruit de frottement	Le ventilateur frotte contre le déflecteur d'air	Supprimez le problème.
	Le ventilateur tape contre la protection	Dégagez le ventilateur.
	Jeu du support de montage	Resserrez les boulons de fixation.
Moteur bruyant	Entrefer non homogène	Vérifiez et corrigez le montage des flasques ou le palier.
	Rotor déséquilibré	Ré-équilibrez.
Roulements chauds	Arbre tordu ou faussé	Redressez ou remplacez l'arbre.
	Courroie trop tendue	Réduisez la tension.
	Poulies trop éloignées	Rapprochez la poulie du palier du moteur.
	Diamètre des poulies trop petit	Utilisez des poulies plus grandes.
	Défaut d'alignement	Corrigez l'alignement de l'entraînement.
	Insuffisance de graisse	Respectez la quantité de graisse spécifiée pour le roulement.
	Dégradation de la graisse ou contamination du lubrifiant	Enlevez la graisse souillée, nettoyez à fond le roulement dans du kérosène et lubrifiez à la graisse neuve.
	Excès de lubrifiant	Reduisez la quantité de graisse, le roulement ne doit être rempli qu'à moitié.
	Surcharge palier	Vérifiez l'alignement, la pression latérale et axiale.
	Bille cassée ou chemins de roulement déformés	Remplacez le roulement, nettoyez d'abord à fond le corps de palier.

Manual de instalación, operación y mantenimiento

Índice de Contenidos

1. General

2. Instalación

3. Operación

4. Mantenimiento

5. Requisitos Medioambientales

6. Tabla de Resolución de Problemas

1. General

¡NOTA!

Hay que seguir estas instrucciones para ofrecer una instalación, un funcionamiento y un mantenimiento correctos y seguros del motor. Cualquiera que instale, opere o realice el mantenimiento de este equipo debe tenerlas en cuenta. Ignorar estas instrucciones puede invalidar la garantía.

Declaración de Conformidad

Las declaraciones de conformidad relativas a la Directiva de Baja Tensión 73/23CEE, modificada por la directiva 93/68/CEE se editan separadamente junto con cada motor.

La declaración de conformidad cumple también los requisitos de una declaración de incorporación en relación a la Directiva sobre máquinas 98/37/CEE, Art 4.2 Annex II, Sub B.

Validez

Estas instrucciones son válidas para los siguientes tipos de motores eléctricos de ABB, para funcionamiento como motor o como generador.

series MT*, MBT*, MXMA,
series M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

en tamaños de carcasa 56 - 400.

Existen unas instrucciones de motor independientes para los motores Ex 'Low voltage motors for hazardous areas: Installation, operation and maintenance manual' (Low Voltage Motors/Manual for Ex-motors).

Para algunos tipos de motores se requiere información adicional debido a lo especial de su aplicación y/o consideraciones de diseño. Se dispone de información adicional para los siguientes tipos de motores:

- motores para caminos de rodillos
- motores refrigerados por agua
- motores abiertos
- motores smoke venting
- motores con freno

2. Instalación

Puesta en servicio (arranque)

Comprobación de recepción

A su recepción, verifiquen inmediatamente si el motor presenta daños externos y, en tal caso, informen sin demora al transportista correspondiente.

Comprueben los datos de la placa de características, especialmente la tensión eléctrica, la conexión del devanado (estrella o triángulo). El tipo de rodamientos en los motores desde tamaño 90 y superiores están indicados en la placa de características.

Giren el eje con la mano para comprobar que gira sin dificultad; quiten el bloqueo para transporte, si existe.

No deben sobrepasarse los valores máximos de carga de los rodamientos indicados en el catálogo de producto.

Motores con rodamientos de rodillos: Si se hace funcionar el motor sin fuerza radial aplicada al eje se pueden dañar los rodamientos de rodillos.

Motores con rodamientos de contacto angular: Si se hace funcionar el motor sin fuerza axial aplicada en la dirección correcta al eje se pueden dañar los rodamientos de contacto angular.

Motores con elementos de engrase:

Al arrancar el motor por primera vez, o tras un largo periodo de almacenamiento, hay que aplicar como mínimo la cantidad de grasa indicada hasta que salga la nueva grasa por la válvula de salida. Para más detalles, ver la sección "Motores con sistema de relubricación" en la página 37.

Comprobación de la resistencia de aislamiento

Mida la resistencia de aislamiento antes de poner el motor en servicio o cuando se crea que existe humedad en el devanado.

La resistencia, medida a 25°C, será superior al valor de referencia, por ejemplo: 10 M ohm (medidos con 500 V dc Megger)

ATENCIÓN

Los devanados deben descargarse inmediatamente después de la medición para evitar riesgos de descarga eléctrica.

El valor de referencia de la resistencia de aislamiento es de la mitad por cada aumento de 20°C de la temperatura ambiente.

Si no se alcanza el valor de resistencia indicado, el devanado está demasiado húmedo y debe secarse al horno.

La temperatura del horno debe ser de 90°C durante 12-16 horas, seguida de 105°C durante 6-8 horas.

En caso de existir, deben quitarse los tapones de drenaje y abrirse las válvulas de cierre antes del secado al horno.

Normalmente, si la humedad es causada por agua marina, deberá bobinarse de nuevo el devanado.

Arranque directo o estrella/triángulo

Normalmente, la caja de bornes en los motores estándar de una sola velocidad tiene seis terminales y, como mínimo, un terminal de conexión a tierra.

La toma a tierra debe llevarse a cabo según las normas nacionales antes de conectar el motor a la tensión de la red.

La tensión eléctrica y la conexión se indican en la placa de características.

Arranque directo (D.O.L):

Pueden utilizarse las conexiones Y o D. Pueden utilizarse las conexiones Y o D. Ej.: 660 VY, 380 VD indica conexión Y para 660--- V y conexión D para 380 V.

Arranque estrella/triángulo (Y/D):

La tensión de la red debe ser igual a la tensión nominal del motor en conexión D. Quite todos los puentes de la placa de bornes.

En motores monofásicos de dos velocidades y motores especiales, la conexión a la red debe seguir las instrucciones indicadas en el interior de la caja de bornes.

Si el arranque directo dura más de 10 segundos o el arranque Y/D más de 30 segundos, consulte a la oficina de ventas de ABB o la publicación 'La Guía del Motor' (disponible en Internet en www.abb.com/motors&drives).

Terminales y sentido de rotación

El sentido de rotación es según las agujas del reloj, visto desde el lado acople, y la secuencia de fase de línea L1, L2, L3 está conectada a las terminales, según se muestra en la figura 1.

Para modificar el sentido de rotación, intercambiar la conexión de dos líneas de cable cualquiera.

Si el ventilador del motor es de una sola dirección, asegúrese de que el sentido de rotación es el mismo que el de la flecha dibujada en el motor.

Manipulación

Almacenamiento

El motor debe almacenarse siempre en el interior, en ambientes secos, sin vibraciones y sin polvo.

Las superficies mecanizadas sin protección (salidas de eje y bridas) deben ser protegidas con un tratamiento anticorrosivo.

Se recomienda hacer girar los ejes periódicamente con la mano para evitar migraciones de grasa.

Es preferible que las resistencias calefactoras, si existen, estén conectadas.

Las características de los condensadores electrolíticos, caso de existir en los motores monofásicos, necesitarán una “revisión” después de estar almacenados durante más de 1-2 años. Contacte con ABB para más detalles.

Transporte

Los motores equipados con rodamientos de rodillos y/o de bolas de contacto angular deben llevar un bloqueo durante el transporte.

Elevación

Levanten el motor sólo con cáncamos de elevación, si no se indica lo contrario en una instrucción separada de elevación.

El centro de gravedad de motores con la misma carcasa puede variar según la potencia, la disposición de montaje y los elementos auxiliares.

Comprobar que los cáncamos acoplados a la carcasa del motor no estén dañados antes de elevarlo. No deben utilizarse cáncamos de elevación defectuosos.

Hay que apretar los cáncamos antes de usarlos. Si es necesario, ajustar la posición del cáncamo con arandelas adecuadas.

Asegúrese de que utiliza el equipo de elevación adecuado y que el tamaño de los ganchos es el apropiado para los cáncamos de elevación.

Hay que prestar mucho cuidado en no dañar el equipo auxiliar y los cables unidos al motor.

Pesos de los motores

El peso total de los motores con el mismo tamaño de carcasa (altura del centro) puede variar según la potencia, la disposición de montaje y los elementos especiales añadidos.

La tabla siguiente muestra los pesos estimados para los motores en su versión básica, en función del material de la carcasa.

El peso total se indica en la placa de características de todos nuestros motores excepto los más pequeños.

Tamaño carcasa	Aluminio		Fundición	Acero
	Peso kg	Añadir para freno	Peso kg	Peso kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Instalación

Refrigeración

La temperatura ambiente normal no debe exceder los 40°C (el estándar marino es de +45°C ó +50°C), si se desea conseguir un desempeño estándar. Comprueben que el motor tiene suficiente flujo de aire. Asegúrese de que no existen otros equipos o superficies cerca del motor o luz solar directa, que puedan radiar calor adicional. Para mayor información sobre temperaturas ambiente elevadas y refrigeración, consulten la “Guía del Motor” o contacten con ABB.

Anclajes

El comprador es responsable de preparar el anclaje para los motores.

Los anclajes de metal deben pintarse para evitar la corrosión.

El anclaje debe ser liso y lo suficientemente firme para soportar las fuerzas que puedan aparecer en caso de un cortocircuito trifásico. También debe poder evitar las vibraciones producidas por la resonancia.

Pernos de anclaje

Sujete los pernos a las patas del motor y coloque una galga de 1-2 mm entre el perno y la pata.

Alinee el motor directamente utilizando los medios adecuados. Sujete los pernos con cemento, compruebe el alineamiento y haga agujeros para colocar los tornillos.

Agujeros de drenaje

Compruebe siempre que los agujeros de drenaje están hacia abajo.

En ambientes muy polvorientos deben cerrarse todos los agujeros de drenaje.

Alineación

Una alineación correcta es esencial para evitar daños en los rodamientos, vibraciones y posibles fracturas de las salidas de eje.

Raíles tensores y accionamiento por correas

- Ajuste los motores a los raíles tensores según muestra la figura 2.
- Coloque los raíles tensores horizontalmente en el mismo nivel.
- Compruebe que el eje del motor está en posición paralela con el eje del accionamiento.
- Tense todas las correas según las instrucciones del proveedor.

ATENCIÓN

Una tensión excesiva de las correas puede dañar los rodamientos y causar roturas del eje.

No sobrepase las fuerzas de correa máximas (es decir, las cargas de rodamientos radiales) indicadas en los catálogos del producto.

Conexión

El diseño normal del motor es con la caja de bornes en la parte superior, con la posibilidad de entrada de cables por ambos lados.

Algunos motores están disponibles con una caja de bornes en la parte superior orientable 4 x 90°, y algunos con la caja de bornes montada al lado.

La disponibilidad de estas opciones se describe en el catálogo de producto.

Las entradas de cable que no se utilicen deben cerrarse.

Así como el devanado principal y las terminales de toma a tierra, la caja de bornes también puede tener conexiones para termistores, resistencias calefactoras, conectores bimetálicos o resistencias PT 100.

ATENCIÓN

Las terminales pueden estar activas aunque el motor esté parado, dado que las resistencias calefactoras o el calentamiento directo del devanado pueden tener tensión eléctrica.

Los diagramas de conexión para elementos auxiliares y partes de conexión se encuentran en el interior de la tapa de la caja de bornes.

ATENCIÓN

En los motores monofásicos, el condensador puede retener una carga que aparece en los terminales del motor, incluso cuando el motor se ha parado.

Conexión con accionamiento de velocidad variable

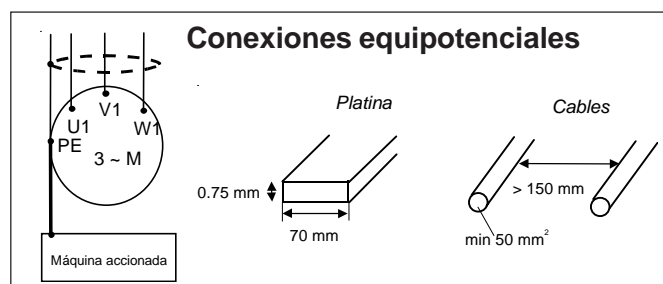
Los accionamientos de velocidad variable producen mayores tensiones que la alimentación sinusoidal en el bobinado del motor y pueden dar lugar a voltajes de alta frecuencia en el eje y corrientes en los rodamientos. Por lo tanto el aislamiento de bobinado y rodamientos así como el filtro a la salida del convertidor se deben dimensionar de acuerdo con el documento "Selection rules for VSD applications / Insulation" (3GZF500930-2), disponible bajo petición a ABB.

En accionamientos de velocidad variable, el motor ($P_n > 30 \text{ kW}$) se debe cablear con cables simétricos blindados y prensaestopas con giro de 360° (también llamados prensaestopas EMC). Se puede encontrar más información en el manual de ABB "Grounding and cabling of the drive system" (3AFY61201998).

En aplicaciones con convertidor de frecuencia, es necesario utilizar una toma a tierra exterior para igualar el potencial entre la carcasa y la máquina accionada, a menos que ambas máquinas estén montadas sobre la misma base metálica.

En motores con carcasas superiores a IEC 280, utilice un conductor plano de 0.75 x 70 mm o, como mínimo, dos conductores cilíndricos de 50 mm². La distancia entre los conductores cilíndricos debe ser como mínimo de 150 mm.

Esta disposición no tiene una función de seguridad eléctrica; el objetivo es igualar los potenciales. Cuando se montan el motor y el reductor en una misma bancada de acero común, no es necesario realizar conexiones equipotenciales.



Para satisfacer los requisitos de compatibilidad electromagnética (EMC) utilicen sólo cables y conectores aprobados para tal propósito (véase instrucciones para convertidores de frecuencia).

La velocidad de rotación máxima para un motor de fundición de hierro con accionamiento de velocidad variable (M2BA/M3BP) no debe exceder las velocidades máximas admisibles que se especifican en la tabla inferior o la indicada en la placa de características. Contacte con ABB para obtener información acerca de la velocidad máxima admisible para otros tamaños y tipos de motores. La lubricación de los rodamientos debe seguir las indicaciones que se dan más adelante.

Tamaño carcasa	Velocidad r/min	
	2 polos	4 polos
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

Si existen dudas acerca de la adecuación del motor para uso con convertidor de frecuencia, por favor contacte con ABB.

ATENCIÓN

La temperatura máxima de operación de grasa y rodamientos no debe ser sobrepasada.

Equilibrado

El rotor del motor está dinámicamente equilibrado.

Como estándar, el equilibrado se lleva a cabo con media chaveta y el eje lleva una **cinta ROJA** con la indicación “**Equilibrado con media chaveta**”.

Para evitar vibraciones, hay que equilibrar la mitad del acoplamiento o la polea con media chaveta, una vez mecanizado el chavetero.

Cuando se equilibra con chaveta entera, el eje lleva una **cinta AMARILLA** con la indicación “**Equilibrado con chaveta entera**”.

En caso de equilibrado sin chaveta, el eje lleva una **cinta AZUL** con la indicación “**Equilibrado sin chaveta**”.

3. Operación

Uso

Condiciones de operación

Los motores están diseñados para funcionar en aplicaciones de accionamiento industrial. Los límites normales de temperatura ambiente son de -20°C a +40°C. Altitud máxima es de 1000 m por encima del nivel del mar.

Consideraciones de seguridad

El motor debe ser instalado y utilizado por personal cualificado y familiarizado con las normas de seguridad correspondientes.

Hay que proporcionar los equipos de seguridad necesarios para la prevención de accidentes en el lugar de la instalación y del funcionamiento, según las normativas locales.

ATENCIÓN

Los motores pequeños conectados directamente a interruptores térmicos pueden arrancar automáticamente.

Puntos a tener en cuenta

1. No suba sobre el motor.
2. La temperatura de la cubierta externa del motor puede llegar a ser demasiado caliente al tacto durante su funcionamiento normal.
3. Algunas aplicaciones especiales del motor requieren instrucciones específicas (ej.: al utilizar convertidores de frecuencia).
4. Los cáncamos de elevación deben utilizarse sólo para levantar el motor, no para levantar el motor cuando éste está unido a otro equipo.

Montaje y desmontaje

General

El montaje y desmontaje de los motores debe ser llevado a cabo por personas cualificadas y con los utensilios y métodos de trabajo adecuados. Todas las reparaciones se deben llevar a cabo de acuerdo con la norma IEC-60079-19.

Rodamientos

Siempre hay que prestar especial atención a los rodamientos. Hay que quitarlos con extractores y montarlos por calentamiento, utilizando herramientas especiales para tal propósito. La forma de cambiar los rodamientos se describe con detalle en un librito de instrucciones separado disponible en ABB.

Montaje de cubos de acoplamiento y poleas

Los cubos de acoplamiento y las poleas deben montarse utilizando equipos y herramientas adecuados que no dañen los rodamientos.

Nunca se debe montar un cubo de acoplamiento o una polea golpeándola con un martillo. Tampoco debe quitarse con una palanca haciendo presión sobre el cuerpo del motor.

Exactitud del montaje de una mitad de acoplamiento: compruebe que la distancia **b** sea inferior a 0.05 mm y que la diferencia de **a1** a **a2** también sea inferior a 0.05 mm. Véase figura 3.

4. Mantenimiento

Mantenimiento y lubricación

Inspección general

- Inspeccione el motor a intervalos regulares.
- Mantenga el motor limpio y asegúrese de que tiene una buena ventilación.
- Compruebe el estado de los retenes (por ejemplo, obturador V) y cámbielos si es necesario.
- Compruebe el estado de las conexiones y de los pernos de montaje y del motor.
- Compruebe el estado de los rodamientos, escuchando si hay ruidos extraños, midiendo la vibración, la temperatura del rodamiento, inspeccionando la grasa utilizada o con monitorización SPM del rodamiento.

* En caso de ocurrir cambios en las condiciones del motor, desmóntelo, verifique las partes y cámbielas si es necesario.

Lubricación

ATENCIÓN

¡Cuidado con todas las partes giratorias!

ATENCIÓN

La grasa puede causar irritación de la piel e inflamación de los ojos. Siga todas las indicaciones de seguridad especificadas por el fabricante.

Motores con rodamientos lubricados de por vida

Los rodamientos son normalmente lubricados de por vida de los tipos Z ó 2Z.

El tipo de rodamientos se especifica en los catálogos de producto respectivos y en la placa de características de todos nuestros motores, excepto los tamaños más pequeños.

Como guía, se puede conseguir una lubricación adecuada en tamaños hasta 180 para el siguiente funcionamiento, según L1 (es decir, que el 99% de los motores superan este intervalo) a una temperatura ambiente de 25°C. Par funcionamiento a temperatura ambiente mayor de 25°C consulte el correspondiente catálogo de producto.

Tamaño carcasa	Polos	Horas de servicio
56-80	2-8	vitalicio
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Según la aplicación y las condiciones de carga, véase el catálogo del producto correspondiente.

Las horas de funcionamiento para motores en disposición vertical son la mitad de los valores dados anteriormente.

Motores con sistema de relubricación

Placa de información sobre lubricación y consejos generales sobre lubricación

Si el motor tiene una placa de información sobre lubricación, siga los valores indicados.

En la placa de información sobre lubricación, los intervalos de relubricación pueden estar definidos atendiendo a la disposición de montaje, temperatura ambiente y velocidad de giro.

La política de ABB es la de considerar la fiabilidad como un elemento vital en los intervalos de lubricación de los rodamientos. Por ello, seguimos el principio L1 (es decir, que con seguridad el 99% de los motores cumplen el intervalo de tiempo).

Lubricación manual

Engrase mientras el motor está funcionando

- Quitar el tapón de engrase o abrir la válvula de salida de engrase, si existe.
- Comprobar que el conducto de lubricación está abierto.
- Introducir la cantidad de grasa especificada en el rodamiento.
- Dejar funcionar el motor 1 ó 2 horas para asegurar que todo el exceso de grasa ha salido del rodamiento. Cerrar el tapón de engrase o la válvula de salida, si existe.

Engrase cuando el motor está parado

Hay que reengrasar los motores mientras están en funcionamiento. Si esto no es posible, se puede llevar a cabo el engrase mientras el motor está parado.

- En tal caso, utilice sólo la mitad de la cantidad de grasa, a continuación haga funcionar el motor unos minutos a toda velocidad.
- Cuando el motor se pare, introducir la cantidad restante de grasa especificada en el rodamiento.
- Después de 1 ó 2 horas de funcionamiento, cierre el tapón de engrase o válvula de salida, si existe.

Lubricación automática

Con lubricación automática, el tapón de engrase debe quitarse de forma permanente o la válvula de salida estar abierta, si existe.

Algunos motores pueden estar equipados con un colector para la grasa usada. Sigán las instrucciones específicas para este equipo.

ABB recomienda exclusivamente sistemas electromecánicos, contacten con ABB.

La cantidad de grasa para cada intervalo de lubricación especificada en la tabla debe ser el doble si se utiliza un sistema de lubricación automático.

Si los motores de 2 polos se lubrican automáticamente, se debe seguir la nota (¡NOTA!) referente a recomendaciones de lubricantes para motores de 2 polos que aparece en el capítulo Lubricantes.

Intervalos de lubricación y cantidades

Tamaño carcasa	Cantidad g/roda- miento	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
Rodamiento de bolas							
Intervalos de lubricación en horas de servicio							
112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	¹⁾	¹⁾	6500	8500	12500	16000
355	120	¹⁾	¹⁾	4200	6000	10000	13000
400	120	¹⁾	¹⁾	4200	6000	10000	13000
400 M3BP	130	¹⁾	¹⁾	2800	4600	8400	12000

Rodamientos de rodillos							
Intervalos de lubricación en horas de servicio							
160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	¹⁾	¹⁾	3300	4300	6000	8000
355	120	¹⁾	¹⁾	2000	3000	5000	6500
400	120	¹⁾	¹⁾	2000	3000	5000	6500
400 M3BP	130	¹⁾	¹⁾	1400	2300	4200	6000

¹⁾ Valores para tamaños IEC 280 a 400 en algunos tipos de motores (3600 y 3000 r/min), por favor consulte la próxima tabla.

Factores que inciden en los intervalos de lubricación

Los intervalos de lubricación para motores en posición vertical son la mitad de los valores anteriores.

Los valores de la tabla se basan en una temperatura de de operación de rodamientos de 80°C (temperatura ambiente de unos +25°C). ¡Nota! Un aumento de la temperatura ambiente incrementa la temperatura de los rodamientos proporcionalmente. Estos valores deben dividirse por la mitad para cada 15°C de aumento de temperatura de los rodamientos y ser el doble para cada 15°C de descenso de la temperatura ambiente.

ATENCIÓN

No debe sobrepasarse la temperatura máxima de funcionamiento de la grasa y de los rodamientos.

Lubricantes

ATENCIÓN

No mezcle distintos tipos de grasa.

Lubricantes incompatibles pueden causar daños en los rodamientos.

Al engrasar, utilicen sólo grasa especial para rodamientos de bolas, que presente las siguientes propiedades:

- grasa de buena calidad con jabón complejo de litio y aceite mineral o poli-alfa olecinas (PAO).
- viscosidad del aceite base 100-160 cST a 40°C
- consistencia NLGI grado 1.5 - 3 *)

- gama de temperatura -30°C - +120°C, de forma continua.

*) Para motores montados en vertical o en condiciones altas de temperatura se recomienda un mayor grado NLGI

Los principales fabricantes de lubricantes ponen a su disposición grasa con las propiedades adecuadas.

Los aditivos están recomendados, pero se debe obtener garantía escrita del fabricante del lubricante, especialmente en lo que se refiere a aditivos EP, de que los aditivos no dañan los rodamientos o altera las propiedades de los lubricantes a la temperatura de trabajo.

ATENCIÓN

No se recomiendan lubricantes que contienen aditivos EP para temperaturas altas del rodamiento en tamaños de carcasa 280-400.

Si la temperatura ambiente es inferior a -25°C o superior a +55°C, o la temperatura del rodamiento supera los 110°C, consulte con ABB acerca de la grasa apropiada.

Pueden utilizarse los siguientes tipos (o similares) de grasa de alto rendimiento:

- Esso Unirex N2, N3 or S2 (base compleja de litio)
- Mobil Mobilith SHC 100 (base compleja de litio)
- Shell Albida EMS 2 (base compleja de litio)
- SKF LGHQ 3 (base compleja de litio)
- Klüber Klüberplex BEM 41-132 (base de litio especial)
- FAG Arcanol TEMP90 (base polyurea de calcio)
- FAG Arcanol TEMP110 (base compleja de litio)

Si se usa otra grasa con las propiedades requeridas los intervalos de lubricación, contacten con ABB.

Intervalos de lubricación y cantidades, 2-polos, Tamaños de carcasa IEC 280 a 400

Tamaño carcasa	Cantidad de grasa g/rodamiento	3600 r/min	3000 r/min
Rodamientos de bolas			
Intervalos de lubricación en horas de operación			
280	M2B*, M2C*, M3B*	35	2000 3500
315	M2B*, M2C*, M3B*	35	2000 3500
355	M2B*, M2C*	45	1200 2000
355	M3B*	35	1200 2000
400	M2B*, M2C*	45	600 800
400	M3B*	40	1000 1600
Rodamientos de rodillos			
Intervalos de lubricación en horas de operación			
280	M2B*, M2C*, M3B*	35	1000 1800
315	M2B*, M2C*, M3B*	35	1000 1800
355	M2B*, M2C*	45	600 1000
355	M3B*	35	600 1000
400	M2B*, M2C*	45	- -
400	M3B*	40	500 800

¡NOTA!

Utilice siempre grasa de alta velocidad para motores de alta velocidad y para algún otro tipo, por ejemplo, motores de 2 polos M2BA 355 y 400, en los que el factor de velocidad es superior a 400 000 (calculado como $D_m \times n$, donde D_m = diámetro medio del rodamiento, mm; n = velocidad de rotación, r/min). Se puede utilizar la siguientes grasas:

- FAG L69 (base de polyurea)
- Klüber Klüber quiet BH 72-102 (base de polyurea)
- SKF LGHP2 (base de polyurea)

Si se utilizan otros lubricantes, pregunte al fabricante si las calidades corresponden con las de los lubricantes antes mencionados, o contacte con ABB si no está seguro de la compatibilidad del lubricante.

Accionamientos por convertidor de frecuencia

El funcionamiento a velocidades mayores, por ejemplo en aplicaciones con convertidor de frecuencia, o a menor velocidad con altas cargas requerirá intervalos de lubricación menores. En estos casos consulte a ABB.

Normalmente al duplicar la velocidad se requerirá una reducción de los intervalos de lubricación de un 40% de los valores indicados en la tabla anterior.

ATENCIÓN

No se debe sobrepasar la velocidad máxima para la que se ha diseñado el motor.

Se debe comprobar la adecuación de los rodamientos para funcionamiento a alta velocidad.

Recambios

Al solicitar recambios, debe especificarse toda la designación del tipo y el código del producto, según se indica en la placa de características.

Si el motor presenta un número de fabricación de serie, éste debe indicarse también.

Rebobinado

El rebobinado debe llevarse siempre a cabo en talleres cualificados.

Los motores para ventiladores contra incendios y otros motores especiales no deben rebobinarse sin contactar primero con ABB.

5. Requisitos medioambientales

Niveles de ruido

La mayoría de nuestros motores tienen un nivel de presión sonora que no sobrepasa los 82 dB(A) referidos a una alimentación sinusoidal de 50 Hz, con tolerancia de ± 3 dB(A).

Los catálogos de producto correspondientes muestran los valores para los motores específicos.

Para niveles de presión sonora con alimentación sinusoidal a 60 Hz o no sinusoidal, contacten con ABB.

Los niveles de presión sonora para motores con sistemas de refrigeración independientes y para las series M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, y M2BJ/M2LJ, están indicados en los correspondientes Manuals de Motor.

Estas instrucciones no cubren todos los detalles o las variaciones de los equipos, ni tienen en cuenta todos los casos posibles que puedan suceder en relación con la instalación, el funcionamiento o el mantenimiento. En caso de necesitar información adicional, rogamos se pongan en contacto con la oficina de ventas de ABB más próxima.

Tabla para resolver problemas de los motores

El servicio del motor y cualquier problema que surja debe estar en manos de personas cualificadas, que tengan las herramientas y los equipos necesarios.

PROBLEMA	CAUSA	QUE HACER
El motor no puede arrancar	Fusibles fundidos	Cambiar los fusibles por otros del tipo y características adecuados.
	Disparos de sobrecarga	Verificar y ajustar la sobrecarga en el arranque.
	Suministro de potencia inadecuado	Comprobar que la potencia suministrada se corresponde con la de la placa de características del motor y con el factor de carga.
	Conexiones a red inadecuadas	Verificar las conexiones con el diagrama suministrado junto con el motor.
	Circuito abierto en el devanado o en el circuito de maniobra	Indicado mediante un zumbido cuando el contactor está cerrado. Comprobar si existen conexiones de cable sueltas. Asimismo, verificar que todos los contactos estén cerrados.
	Fallo mecánico	Comprobar que el motor y el accionamiento giran sin dificultad. Verificar los rodamientos y la lubricación.
	Estátor en corto circuito	Indicado mediante fusibles fundidos. Hay que rebobinar el motor.
	Defecto en la conexión de las bobinas	Desconectar terminales y verificar con lámpara de prueba.
	Rotor defectuoso	Localizar varas o anillos de cortocircuito rotos.
	Posible sobrecarga del motor	Reducir la carga.
El motor pierde velocidad	Es posible que una fase esté abierta	Comprobar las líneas y busque la fase abierta.
	Aplicación incorrecta	Cambiar el tipo o el tamaño. Consultar con el fabricante.
	Sobrecarga	Reducir la carga.
	Baja tensión	Comprobar que se mantiene la tensión de la placa de características. Verificar la conexión.
	Circuito abierto	Fusibles fundidos, comprobar relé de sobrecarga, estátor y pulsadores.
El motor funciona y luego se para	Fallo de potencia	Comprobar si existen conexiones sueltas a la red, a los fusibles y al armario de control.
El motor no alcanza la velocidad adecuada	No se aplica adecuadamente	Consultar con el fabricante para el tipo correcto.
	La tensión es demasiado baja en los terminales del motor debido a una caída de tensión en la red	Utilizar mayor tensión o reducir la carga. Verificar conexiones. Comprobar que los cables estén correctamente dimensionados.
	La carga de arranque es demasiado elevada	Comprobar la carga que el motor debe soportar el arranque.
	Varillas del rotor rotas o rotor suelto	Comprobar si hay fisuras cerca de los anillos de cortocircuito. Quizás será necesario un nuevo rotor, dado que las reparaciones son por lo general temporales.
	Circuito primario abierto	Localizar el defecto con un instrumento de prueba y reparar.
El motor tarda demasiado tiempo en acelerar y/o Absorbe intensidad	Carga excesiva	Reducir la carga.
	Baja tensión durante el arranque	Comprobar si hay alta resistencia. Adecuar el tamaño de cables.
	Rotor de jaula de ardilla defectuoso	Cambiar por un rotor nuevo.
	La tensión aplicada es demasiado baja	Pedir a la empresa eléctrica que aumente la potencia.

PROBLEMA	CAUSA	QUE HACER
Rotación errónea	Secuencia de fases errónea	Cambiar las conexiones al motor o al panel de interruptores.
El motor se sobrecalienta mientras funciona con baja carga	Sobrecarga	Reducir la carga.
	La carcasa o las rejillas de ventilación están llenos de suciedad y obstaculizan una adecuada ventilación del motor	Limpiar los agujeros de la rejilla y verificar que hay una corriente de aire continua en el motor.
	Posiblemente el motor tiene una fase abierta	Verificar que todos los cables estén bien conectados.
	Bobinado a masa	Localizar y reparar.
	Tensión eléctrica en terminal es desequilibrada	Comprobar si hay cables, conexiones y transformadores defectuosos.
El motor vibra	Motor mal alineado	Realignar.
	Soporte inestable	Reforzar la base.
	Acoplamiento desequilibrado	Equilibrar acoplamiento.
	Equipo accionado desequilibrado	Reequilibrar el equipo accionado.
	Rodamientos defectuosos	Sustituir los rodamientos.
	Rodamientos desalineados	Alinear adecuadamente.
	Cambio de posición de los pesos de equilibrio	Reequilibrar el motor.
	Contradicción entre el equilibrio del rotor y el del acoplamiento (media chaveta – chaveta entera)	Reequilibrar el acoplamiento o el motor.
	Motor trifásico funcionando como monofásico	Comprobar si existe circuito abierto.
Chirridos	Juego axial excesivo	Ajustar el rodamiento o añadir galga.
	El ventilador roza el escudo	Eliminar interferencia.
	El ventilador golpea el protector	Verificar ventilador.
Funcionamiento ruidoso	Placa base suelta	Ajustar tornillos de sujeción.
	Entrehierro no uniforme	Verificar y corregir montaje escudos o rodamientos.
Calentamiento excesivo Rodamientos	Desequilibrio del rotor	Reequilibrado.
	Eje doblado o torcido	Ajustar o sustituir eje.
	Tensión excesiva de la correa	Disminuir la tensión de la correa.
	Las poleas están demasiado lejos del resalte del eje	Acercar la polea al rodamiento del motor.
	Diámetro de polea demasiado pequeño	Utilizar poleas más grandes.
Calentamiento excesivo rodamientos de bolas	Mala alineación	Corregir realineando el motor con la máquina accionada.
	Grasa insuficiente	Mantener la calidad adecuada de la grasa en el rodamiento.
	Deterioración de la grasa o lubricante contaminado	Quitar la grasa vieja, limpiar cuidadosamente los rodamientos con queroseno y sustituirla por grasa nueva.
	Exceso de lubricante	Reducir la cantidad de grasa. No llenar el rodamiento más de la mitad de su capacidad.
	Rodamiento sobrecargado	Comprobar alineación, magnitud y dirección empuje.
	Bola rota o caminos de rodadura dañados	Sustituir rodamiento, primero limpiar el alojamiento cuidadosamente.

Manuale di installazione, uso e manutenzione

Indice

1. Informazioni generali

2. Installazione

3. Uso

4. Manutenzione

5. Requisiti ambientali

6. Risoluzione dei guasti

1. Informazioni generali

NOTE!

Seguire attentamente le seguenti istruzioni, atte ad assicurare un'appropriata e sicura installazione, funzionamento e manutenzione del motore. Tutto il personale addetto al funzionamento ed alla manutenzione del motore deve essere a conoscenza di tali istruzioni. La loro inosservanza potrebbe rendere la garanzia nulla.

Dichiarazione di conformità

Dichiarazioni di Conformità nel rispetto della Direttiva Bassa Tensione 73/23/EEC emendata dalla Direttiva 93/68/EEC devono essere emesse separatamente per ogni macchina.

La Dichiarazione di Conformità soddisfa anche i requisiti del Certificato di Incorporazione nel rispetto della Direttiva Macchine 98/37/EEC, Art 4.2 Annex II, sub B.

Validità

Queste istruzioni sono valide per i seguenti tipi di macchine elettriche ABB, in entrambi le funzioni di motore e generatore:

- serie MT*, MBT*, MXMA
- serie M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

nelle grandezze 56 - 400.

E' disponibile una guida separata per e.g. Ex motors "Low voltage motors for hazardous area: Installation, operation and maintenance manual" (Low Voltage Motors/Manual for Ex-motors).

Informazioni aggiuntive possono essere necessarie per alcuni tipi di motori nel caso di speciali applicazioni e/o progettazioni, informazioni aggiuntive sono disponibili per i seguenti motori:

- roller table motors
- water cooled motors
- open drip proof motors
- smoke venting motors
- brake motors

2. Installazione

Messa in servizio (avviamento)

Controllo al ricevimento

Ispezionare immediatamente il motore al ricevimento per verificare che non abbia subito danni durante il trasporto. Se si dovessero riscontrare danneggiamenti contestarli subito allo spedizioniere.

Controllare tutte le caratteristiche elencate sulla targhetta del motore e specialmente la tensione ed il tipo di collegamento (stella o triangolo). I tipi di cuscinetto sono indicati sulla targhetta motore, ad eccezione delle piccole taglie.

Far girare a mano l'albero per verificare che giri liberamente e rimuovere eventuali bloccaggi usati per il trasporto.

Non superare il limite di carico ammesso sui cuscinetti indicato nel catalogo del prodotto.

Motori equipaggiati con cuscinetti a rullo: Il funzionamento del motore in assenza di spinte radiali applicate all'albero, potrebbe danneggiare il cuscinetto a rulli.

Motori dotati di cuscinetto a contatto angolare: Il funzionamento del motore in assenza di spinte assiali applicate all'albero nella giusta direzione, potrebbe danneggiare il cuscinetto a contatto angolare. I tipi di cuscinetto sono indicati sulla targhetta del motore.

Motori dotati di ingrassatori:

Alla prima messa in marcia del motore o dopo lunghi periodi di inattività applicare almeno la quantità di grasso minima indicata o sulla targhetta o su questo manuale sino a quando fuoriesce dai fori di scarico del grasso.

Per i dettagli vedere la sezione "Lubrificazione manuale" alla pag. 47.

Controllo della resistenza d'isolamento

Controllare la resistenza d'isolamento prima della messa in servizio e quando si sospetti una formazione di umidità negli avvolgimenti.

La resistenza, misurata in ambiente con temperatura di +25°C, deve eccedere il valore di riferimento, e cioè 10 Mohm (misurati con Megger da 500 V c.c.)

AVVERTENZA:

Gli avvolgimenti devono essere scaricati immediatamente dopo la misura per evitare rischi di shock elettrici.

Il valore di riferimento della resistenza d'isolamento viene dimezzato ogni 20°C di aumento di temperatura ambiente.

Se tale valore non può essere ottenuto, l'avvolgimento è troppo umido e deve essere essiccato in forno. La temperatura del forno deve essere di 90°C per 12-16 ore e successivamente di 105°C per 6-8 ore.

I tappi dei fori di scarico condensa devono essere rimossi e le valvole chiuse se montate devono essere aperte durante l'essiccamento.

Avvolgimenti che siano rimasti immersi in acqua di mare normalmente devono essere rifatti.

Avviamento diretto oppure stella/triangolo

La scatola morsetti su motori standard a velocità singola contiene normalmente 6 terminali e almeno un morsetto di terra.

La messa a terra deve essere effettuata in accordo alle legislazioni locali prima del collegamento del motore alla rete.

La tensione ed il collegamento sono stampigliati sulla targhetta del motore.

Avviamento diretto da rete (DOL)

Nell'avviamento diretto il motore può essere utilizzato sia con collegamento a stella che a triangolo (naturalmente con tensioni diverse).

Per esempio 660 VY, 380 VD indica che il motore può essere collegato a stella per 660 V ed a triangolo per 380 V.

Avviamento stella/triangolo (Y/D)

La tensione di linea deve essere uguale alla tensione nominale del motore in collegamento a triangolo.

Togliere tutte le piastrine di collegamento dai terminali.

Per collegamento di motori a doppia velocità, monofase e motori speciali, seguire le istruzioni riportate all'interno della scatola morsetti.

Se l'avviamento diretto da rete impiega più di 10 secondi oppure l'avviamento Y/D impiega più di 30 secondi consultare l'ufficio vendite o la pubblicazione "The Motor Guide" (disponibile al sito internet www.abb.com/motors&drives).

Terminali e senso di rotazione

Il senso di rotazione è orario visto dal lato comando quando la sequenza di fase L1, L2, L3 è collegata ai terminali come indicato nella figura 1.

Per invertire la direzione di rotazione, scambiare tra loro i collegamenti di due terminali qualsiasi.

Se il motore ha una ventola unidirezionale, controllare che la direzione di rotazione sia in accordo alla freccia posta sul motore.

Gestione

Immagazzinaggio

Tutti i motori devono essere immagazzinati in luogo coperto, asciutto, privo di vibrazioni e di polvere.

Le superfici non protette del motore (estremità d'albero e flange) devono essere protette con trattamento anticorrosivo.

Si raccomanda di ruotare a mano periodicamente l'albero per prevenire migrazioni di lubrificante.

Le scaldiglie anticondensa, se esistenti, devono essere preferibilmente tenute sotto tensione.

Le caratteristiche di condensatori elettrolitici, se montati su motori monofase, devono essere ripristinate dopo periodi di immagazzinaggio superiori a 1-2 anni. Per maggiori dettagli contattare ABB Motors.

Trasporto

Motori equipaggiati con cuscinetti a rulli cilindrici e/o con contatto angolare devono essere bloccati durante il trasporto.

Sollevamento

Per sollevare il motore utilizzare esclusivamente i golfari di sollevamento, se non specificato diversamente nelle istruzioni separate di sollevamento.

Il centro di gravità dei motori con la stessa altezza d'asse può variare in funzione della diversa potenza, della forma costruttiva e delle apparecchiature ausiliarie.

Prima di sollevare il motore assicurarsi che i golfari di sollevamento non siano danneggiati. I golfari danneggiati non devono essere utilizzati.

I golfari di sollevamento devono essere stretti prima dell'utilizzo. Se necessario la posizione degli anelli può essere adattata con rondelle specifiche.

Assicurarsi che vengano utilizzate apparecchiature di sollevamento appropriate e che le dimensioni dei ganci di sollevamento siano adatte ai golfari.

Fare attenzione a non danneggiare le apparecchiature ausiliarie e i cavi collegati al motore.

Pesi dei motori

I pesi totali dei motori variano anche per motori della stessa grandezza (altezza d'asse) in base alle diverse potenze, diverse forme costruttive ed eventuale aggiunta di accessori.

La tabella seguente indica pesi massimi presunti per motori nella loro versione standard in base al materiale della carcassa.

Il peso esatto di un motore è indicato sulla sua targhetta.

Grandezza	Lega Leggara		Ghisa	Acciaio
	Peso kg	Peso agg. per ev. freno	Peso kg	Peso kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Installazione

Raffreddamento

Le prestazioni standard dei motori sono riferite ad una temperatura massima di 40°C (+45°C o +50°C per marina). Controllare che il motore sia investito dal flusso d'aria prodotto dalla ventola. Assicurarsi che non ci siano apparecchiature nelle vicinanze o superfici esposte ad irraggiamento solare diretto che forniscano calore aggiuntivo al motore. Per ulteriori dettagli su elevate temperature ambiente e sul raffreddamento contattare ABB Motors.

Fondazione

L'acquirente ha la piena responsabilità per la preparazione delle fondazioni.

Le fondazioni metalliche devono essere verniciate per evitare la corrosione.

Le fondazioni devono essere in piano e sufficientemente rigide per sopportare eventuali sollecitazioni da corto circuito. Devono essere dimensionate in modo da evitare l'insorgenza di vibrazioni dovute a risonanza.

Bulloni di fondazione

Inserire i bulloni di fondazione nei piedi del motore e collocare uno spessore di 1-2 mm. tra il bullone ed il piede.

Allineare il motore con l'uso di strumenti adatti. Fare una gettata di calcestruzzo, controllare l'allineamento e praticare i fori necessari per le spine di centraggio.

Fori di scarico condensa

Controllare che i fori di scarico condensa siano aperti e rivolti verso il basso se l'installazione è diversa da quella standard.

In ambienti molto polverosi tutti i fori di scarico condensa devono essere tenuti chiusi.

Allineamento

Un corretto allineamento è indispensabile per prevenire guasti ai cuscinetti, vibrazioni e possibili rotture delle estremità d'albero.

Slitte tendicinghia e pulegge

- Assicurare il motore alle slitte tendicinghia come indicato in figura 2.
- Collocare le slitte tendicinghia orizzontalmente sullo stesso piano.
- Controllare che l'albero motore sia parallelo all'albero condotto.
- Mettere in tensione le cinghie secondo istruzioni del fornitore.

AVVERTENZA:

Un'eccessiva tensione delle cinghie danneggerà i cuscinetti e può anche causare una rottura dell'albero.

Non superare le tensioni di cinghia massime (ovverossia i carichi radiali sui cuscinetti) indicati nei relativi cataloghi di prodotto.

Collegamento

I motori in versione standard hanno la scatola morsetti situata sulla sommità del motore, con ingresso cavi su entrambi i lati.

Alcuni motori possono essere forniti, in alternativa, con la scatola morsetti montata sulla sommità del motore orientabile di 90 in 90 gradi oppure con la scatola morsetti montata lateralmente.

La disponibilità di queste versioni alternative è illustrata sul catalogo di prodotto.

Gli ingressi cavi non utilizzati devono essere chiusi.

Oltre ai terminali dell'avvolgimento e di terra, la scatola morsetti può contenere le connessioni per termistori, scaldiglie, bimetalli o termoresistenze PT100.

AVVERTENZA:

Durante le fermate, all'interno della scatola morsetti può essere presente tensione utilizzata per alimentare le scaldiglie o direttamente l'avvolgimento per tenerlo in temperatura.

Gli schemi di collegamento per circuiti ausiliari si trovano all'interno del coperchio della scatola morsetti o su etichette esterne

AVVERTENZA:

Il condensatore in motori monofase può rimanere caricato tenendo in tensione i morsetti, anche quando il motore è ormai fermo.

Applicazioni con convertitori di frequenza

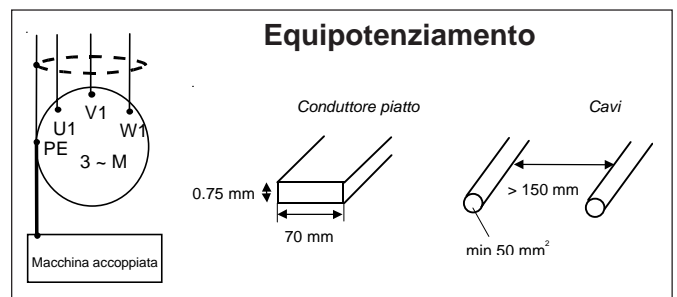
I convertitori di frequenza causano un affaticamento per la presenza di picchi di alta tensione rispetto alla normale onda sinusoidale applicata ai capi dell'avvolgimento del motore, e possono inoltre essere causa della presenza di tensione indotta sull'albero dall'alta frequenza di lavoro e correnti nei cuscinetti. Per tale ragione l'avvolgimento e l'isolamento dei cuscinetti del motore come il filtro di uscita del convertitore devono essere dimensionati in accordo con "Selection rules for VSD application/insulation" (3GZF500930-2), disponibili a richiesta presso ABB.

Nelle applicazioni con convertitore di frequenza il motore ($P_n > 30 \text{ kW}$) deve essere cablo utilizzando cavi simmetrici schermati e passacavo forniti di ghiera metallica a 360° (chiamati anche passacavi EMC). Ulteriori informazioni possono essere reperite sul manuale ABB "grounding and cabling of the drive system" (3AFY61201998).

La vite di messa a terra esterna della carcassa motore deve essere utilizzata per equilibrare la differenza di potenziale tra la carcassa del motore e della macchina accoppiata, salvo che le due macchine non siano montate sulla stessa base metallica.

Per le grandezze maggiori alla IEC 280, utilizzare un cavo piatto da $0.75 \times 70 \text{ mm}$ o almeno due cavi circolari di 50 mm^2 . La distanza tra i cavi circolari dovrà essere di almeno 150 mm l'uno dall'altro.

Questa disposizione non ha funzione di sicurezza elettrica; l'unico scopo è quello di equilibrare i potenziali. Se il motore e il riduttore sono montati sulla stessa base di acciaio non è necessario equilibrare i potenziali.



Per essere conformi ai requisiti delle EMC, è necessario usare cavi e collegamenti conformi allo scopo (vedere le istruzioni per i convertitori di frequenza).

La massima velocità di rotazione per motori cast iron (M2BA/M3BP) usati con convertitore di frequenza non deve superare la massima velocità consentita come indicato nella figura sotto o la velocità indicata sulla targhetta motore. Per informazioni sulla massima velocità di rotazione per altri tipi di motori o altre grandezze prego contattare ABB. La lubrificazione dei cuscinetti deve seguire le istruzioni già menzionate.

Grandezza motore	Velocità r/min	
	2 poli	4 poli
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

Se esiste un'incertezza a riguardo della corretta applicazione del motore per applicazione con convertitore di frequenza prego contattare ABB.

AVVERTENZA :

La massima temperatura di lavoro del grasso e dei cuscinetti non deve essere superata.

Bilanciatura

Il rotore del motore è bilanciato dinamicamente.

Nei motori standard la bilanciatura è effettuata con **mezza** chiave e sull'albero viene applicato un **nastro ROSSO** con la dicitura "bilanciato con mezza chiave" (Balanced with half key).

Per evitare vibrazioni, il giunto o la puleggia devono essere bilanciati con mezza chiave dopo aver ricavato la sede per la stessa.

In caso di bilanciatura con **chiavetta intera**, sull'albero verrà applicato un **nastro GIALLO** con la dicitura "bilanciato con chiave intera" (Balanced with full key).

In caso di bilanciatura **senza chiave**, sull'albero verrà applicato un **nastro BLU** con la dicitura "Bilanciato senza chiave" (Balanced without key).

3. Uso

Condizioni di funzionamento

I motori sono previsti per utilizzo in applicazioni industriali.

I limiti di temperatura ambiente sono -20°C +40°C. L'altitudine massima è 1000 metri slm.

Considerazioni riguardanti la sicurezza

Il motore deve essere installato ed utilizzato da personale qualificato che sia a conoscenza dei requisiti di sicurezza.

Le attrezzature antinfortunistiche necessarie alla prevenzione di incidenti durante il montaggio e funzionamento del motore sull'impianto devono essere in accordo alle regole antinfortunistiche vigenti nel paese.

AVVERTENZA

Piccoli motori collegati direttamente alla rete tramite interruttori termici possono avviarsi automaticamente.

Osservazioni:

1. Il motore non deve essere utilizzato per funzionamento ad impulsi.
2. La temperatura della carcassa del motore può risultare estremamente calda al contatto della mano durante il normale funzionamento.
3. Alcune applicazioni speciali richiedono istruzioni speciali (ad esempio alimentazione a mezzo inverter).
4. I golfari di sollevamento dovranno essere utilizzati per sollevare il solo motore. I golfari non possono essere utilizzati per il sollevamento se il motore è collegato con un altro equipaggiamento.

Assemblaggio e smontaggio

Generalità

L'assemblaggio e lo smontaggio dei motori deve essere effettuato da personale qualificato utilizzando strumenti e metodi di lavoro adatti. Tutte le operazioni devono essere eseguite in accordo allo standard IEC-60079-19.

Cuscinetti

I cuscinetti abbisognano di cure speciali. Devono essere smontati con l'uso di estrattori e montati a caldo o con l'uso di strumenti adatti. La sostituzione dei cuscinetti è descritta in dettaglio su istruzioni separate da richiedere ad ABB Motors.

Montaggio di semigiunti e pulegge

Semigiunti e pulegge devono essere montati solo con l'utilizzo di strumenti adatti, che non danneggino i cuscinetti.

Non usare mai un martello per montare un semigiunto o un cuscinetto e non usare mai una leva infulcrata contro il corpo del motore per rimuoverli.

Per montare accuratamente il semigiunto: controllare che il gioco **b** sia inferiore a 0.05 mm e che la differenza tra **a1** e **a2** sia anch'essa inferiore a 0.05 mm.

Vedere figura 3.

4. Manutenzione

Manutenzione e lubrificazione

Ispezione generale

- Ispezionare il motore a intervalli regolari
- Mantenere il motore pulito e assicurare una buona ventilazione.
- Controllare le condizioni di anelli di tenuta sull'albero (es. V-ring) e sostituirli se necessario.
- Controllare le condizioni delle connessioni e dei bulloni di fissaggio e fondazione.
- Controllare le condizioni dei cuscinetti prestando attenzione ad eventuali rumori anomali, alle vibrazioni, alla temperatura, analizzando il grasso consumato ed effettuando monitoraggi con rilevatori SPM dove esistenti.

*Quando si rilevino condizioni anomale, smontare il motore, controllarne le parti ed effettuare le sostituzioni necessarie.

Lubrificazione

AVVERTENZA

Prestare attenzione alle parti in movimento

AVVERTENZA

Il grasso può causare irritazioni della pelle e infiammazioni agli occhi. Seguire tutte le necessarie precauzioni indicate dal fabbricante.

Motori con cuscinetti ad ingrassaggio permanente

I cuscinetti sono normalmente forniti come cuscinetti ad ingrassaggio permanente dei tipi "Z" o "ZZ".

I tipi di cuscinetti montati sono specificati nei rispettivi cataloghi di prodotto esulla targhetta motore eccetto per le piccole taglie.

Si elencano gli intervalli indicativi per una adeguata lubrificazione per taglie maggiori di 180 in accordo a L1 (ciò significa che il 99 % dei cuscinetti avrà una lubrificazione più che adeguata) riferiti ad una temperatura ambiente di 25°C.

Vedere il rispettivo catalogo di prodotto.

Grandezza	Poli	Ore
56-80	2-8	a vita
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Dipende dall'applicazione e dalle condizioni di carico.

Le ore di servizio per i motori verticali sono la metà di quelle indicate.

Motori forniti con ingrassatori

Targhetta informazioni sulla lubrificazione e indicazioni generali

Se il motore è provvisto di targhetta riportante le istruzioni per la lubrificazione, seguire i valori indicati, altrimenti attenersi ai valori dati.

Sdulla targhetta gli intervalli di ingrassaggio rispetto al tipo di montaggio, temperatura ambiente e velocità di rotazione possono essere riportati in alcuni casi.

Uno degli obiettivi di ABB è di garantire l'affidabilità dei cuscinetti attraverso corretti intervalli di lubrificazione. Questo è il motivo per cui ABB segue le regole del principio L1.

Lubrificazione manuale

Ingrassaggio mentre il motore è in servizio

- Togliere il tappo di scarico grasso, se presente o aprire le valvole di ingrassaggio se presenti.
- Assicurarsi che il canale di ingrassaggio sia aperto.
- Premere la giusta quantità di grasso nel cuscinetto.
- Fare funzionare il motore per 1-2 ore per assicurarsi che tutto il grasso in eccesso venga spinto fuori dai cuscinetti. Rimettere il tappo di scarico grasso e chiudere le valvole di ingrassaggio, se esistenti.

Ingrassaggio quando il motore non è in servizio

Procedere alla rilubrificazione dei motori durante il funzionamento. Se non è possibile, la lubrificazione può essere eseguita a motore fermo.

- In questo caso usare solo la metà della quantità di grasso richiesto, poi mettere in funzione il motore per qualche minuto alla velocità nominale.
- Dopo aver fermato il motore, immettere la quantità rimanente di grasso nel cuscinetto.
- Dopo 1-2 ore di funzionamento rimettere il tappo di scarico grasso o chiudere le valvole di ingrassaggio (se presenti).

Lubrificazione automatica

In caso di lubrificazione automatica rimuovere permanentemente il tappo di scarico grasso o aprire le valvole di ingrassaggio se montate.

Alcuni motori possono essere equipaggiati con un raccoglitore per il grasso usato. Seguire le speciali istruzioni per questo dispositivo.

Noi raccomandiamo di utilizzare soltanto sistemi elettromeccanici. Contattare ABB.

La quantità di grasso per ogni intervallo di lubrificazione indicata nelle tavole deve essere raddoppiata nel caso di lubrificazione automatica.

Nel caso di motore a 2 poli con ingrassaggio automatico le note (NOTE!) a proposito delle indicazioni sulla lubrificazione date per i motori a 2 polio nel paragrafo Lubrificazione devono essere rispettate.

Intervalli di Lubrificazione e quantità'

Gran- dezza	Quantità di grasso g/cuscinetto	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
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Cuscinetti a sfere

Intervalli di lubrificazione in ore di funzionamento

112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	1)	1)	6500	8500	12500	16000
355	120	1)	1)	4200	6000	10000	13000
400	120	1)	1)	4200	6000	10000	13000
400 M3BP	130	1)	1)	2800	4600	8400	12000

Cuscinetti a rulli

Intervalli di lubrificazione in ore di funzionamento

160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	1)	1)	3300	4300	6000	8000
355	120	1)	1)	2000	3000	5000	6500
400	120	1)	1)	2000	3000	5000	6500
400 M3BP	130	1)	1)	1400	2300	4200	6000

¹⁾ Valori per grandezze motori specifici IEC 280 fino a 400 (3600 e 3000 r/min), vedere la tabella seguente.

Fattori che influenzano i valori dell'intervallo di lubrificazione

Gli intervalli di lubrificazione per motori montati verticalmente sono la metà dei valori in tabella.

I valori degli intervalli di lubrificazione si riferiscono ad una temperatura dei cuscinetti di 80°C (temperatura ambiente circa +25°C). Nota! Un incremento della temperatura ambiente causa un corrispondente aumento della temperatura dei cuscinetti. Tali valori devono essere dimezzati ogni 15°C di aumento nella temperatura dei cuscinetti.

AVVERTENZA:

La temperatura massima di esercizio del grasso e dei cuscinetti non deve essere superata.

Lubrificanti

AVVERTENZA:

Non mescolare differenti tipi di grasso.
L'incompatibilità tra diversi lubrificanti può causare danni al cuscinetto.

Per il reingrassaggio, utilizzare solo lubrificanti specifici per cuscinetti a sfere, con le seguenti proprietà:

- grasso di buona qualità con composto al sapone di litio e con minerale o olio di PAO
- viscosità dell'olio di base 100 - 160 cSt a 40°C
- consistenza NLGI grado 1.5 o 3 *)
- gamma di temperature -30°C +120°C continuativa.

*) Per motori a montaggio verticale o in condizioni di funzionamento ad alta temperatura e' raccomandato NLGI grade.

Lubrificanti con le corrette proprietà sono disponibili presso i maggiori produttori.

Le Miscele sono permesse, ma una garanzia scritta deve essere rilasciata dal produttore del lubrificante specialmente per miscele EP, dove si evidenzia che la miscela non danneggia il cuscinetto e le proprietà del lubrificante alla temperatura di lavoro.

AVVERTENZA:

Lubrificanti contenenti miscele EP non sono consigliati per cuscinetti ad alte temperature nelle taglie 280 fino a 400.

Se la temperatura ambiente è inferiore a -25°C o superiore a 110°C consultare ABB Motors per verificare la possibilità di utilizzare grasso per basse temperature.

Possono essere utilizzati i seguenti tipi di lubrificante ad alto rendimento:

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP90 (calcium polyurea base)
- FAG Arcanol TEMP110 (lithium complex base)

Intervalli di lubrificazione per altri tipi di grasso che rispettano le specifiche e proprietà richieste, contattare ABB.

Intervalli di Lubrificazione e quantità', 2-poli, Grandezze IEC 280 fino a 400

Gran- dezza	Quantità di grasso g/cuscinetto	3600 r/min	3000 r/min
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Cuscinetti a sfere

Intervalli di lubrificazione in ore di funzionamento

280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	600	800
400	M3B*	40	1000	1600

Cuscinetti a rulli

Intervalli di lubrificazione in ore di funzionamento

280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	-	-
400	M3B*	40	500	800

NOTA!

Utilizzare sempre lubrificante per alte velocità se si usano motori ad alta velocità ed alcuni modelli tipo M2BA 355 e 400 2-poli, quando il fattore di velocità è superiore a 400 000 (calcolato come $D_m \times n$ dove D_m = diametro medio del cuscinetto, mm; n = velocità di rotazione, r/min).

Utilizzare il seguente, o simile, tipo di lubrificante:

- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- SKF LGHP2 (polyurea base)

Se si cambia la marca del lubrificante controllare la compatibilità in accordo con il produttore del lubrificante. Se la compatibilità non è certa, contattare ABB.

Applicazioni con convertitori di frequenza

Funzionamento a velocità superiori (per esempio nel caso di alimentazione tramite inverter) od a velocità inferiori (per carichi pesanti) necessitano di intervalli di lubrificazione ravvicinati. In tali casi consultare ABB Motors.

Indicativamente, un raddoppio della velocità richiede una riduzione degli intervalli di lubrificazione di circa il 40 % dei valori riportati in tabella.

AVVERTENZA:

La massima velocità di progetto relativa alla struttura del motore non deve essere superata.

Si deve inoltre sempre verificare che i cuscinetti siano adatti alla rotazione ad alte velocità.

Parti di ricambio

Nell'ordinare parti di ricambio per un motore indicare il tipo di motore con codice di prodotto come stampigliato sulla targhetta del motore stesso.

Se sulla targhetta compare un numero di matricola del motore è necessario comunicare anche quest'ultimo.

Riavvolgimento

Il riavvolgimento dovrà sempre essere eseguito da officine qualificate.

Motori speciali e motori per estrazione fumi potranno essere riavvolti solo previo contatto con ABB Motors.

5. Requisiti ambientali

Livello di rumorosità

La maggior parte dei nostri motori hanno un livello di rumorosità (pressione sonora) inferiore ai 82 dB(A) riferita alla condizione di alimentazione sinusoidale, tolleranza ± 3 dB(A).

I valori esatti per ogni tipo di motore possono essere rilevati dai relativi cataloghi di prodotto.

Con alimentazione sinusoidale e frequenza 60 Hz e per livelli di rumorosità con alimentazione non sinusoidale, consultare ABB Motors.

I livelli di rumorosità relativi ai motori in tutte le grandezze con ventilazione separata e relativi ai motori serie M2F*/M3F*, M2L*/M3R*, M2R*/M3R* e M2BJ/M2LJ sono indicati in manuali di istruzioni separati.

Le seguenti informazioni non comprendono tutte le possibili varianti nè tutte le condizioni di installazione, funzionamento o manutenzione. Nel caso siano necessari informazioni aggiuntive, contattare l'ufficio vendite ABB più vicino.

Tabella per la risoluzione dei problemi

Tutte le riparazioni dovranno essere eseguite da personale qualificato che abbia gli strumenti e le apparecchiature necessarie ad effettuare gli interventi sui motori

PROBLEMA	CAUSA	COSA FARE
Il motore non si avvia	Fusibili danneggiati	Sostituire i fusibili con altri simili e correttamente dimensionati.
	Sovraccarico	Controllare e resettare gli interruttori.
	Potenza disponibile insufficiente.	Controllare se la potenza disponibile è in accordo a quella riportata sulla targa del motore.
	Connessioni non corrette	Controllare che le connessioni siano in accordo allo schema di collegamento del motore.
	Collegamenti interrotti	E' segnalato da un rumore anomalo. Controllare che ci sia continuità tra i collegamenti.
	Guasto meccanico	Controllare che il motore e la macchina accoppiata girino liberamente. Controllare i cuscinetti e il lubrificante.
	Corto circuito nello statore Rotore difettoso Motore sovraccaricato	Segnalato da un guasto dei fusibili. Il motore deve essere riavvolto. Verificare se ci sono le sbarre o gli anelli rotti Ridurre il carico
Il motore stalla	Una fase potrebbe essere aperta	Controllare i cavi di collegamento.
	Applicazione sbagliata	Verificare il dimensionamento con il costruttore.
	Sovraccarico	Ridurre il carico.
	Tensione troppo bassa	Assicurarsi che il motore venga alimentato con la corretta tensione di targa. Controllare i collegamenti.
	Circuito aperto	Fusibili danneggiati, controllare i vari interruttori e relè.
Il motore funziona e poi si ferma o decelera.	Mananza di potenza	Controllare i collegamenti alla linea, ai fusibili e ai vari interruttori.
Il Motore non raggiunge la velocità nominale.	Caduta di tensione in linea.	Controllare i collegamenti. Controllare che i cavi siano correttamente dimensionati. Cambiare le prese sul trasformatore per avere la tensione corretta ai morsetti.
	Inerzia troppo elevata	Verificare il dimensionamento del motore.
	Sbarre di rotore interrotte.	Cercare crepe vicino agli anelli di corto circuito. Potrebbe essere necessario un nuovo rotore poiché le riparazioni sono temporanee.
Tempi di accelerazione troppo lunghi e/o assorbimenti troppo elevati.	Carico eccessivo	Ridurre il carico.
	Bassa tensione durante l'avviamento	Verificare che i cavi siano correttamente dimensionati.
	Rotore difettoso	Sostituire con un nuovo rotore.
	Tensione troppo bassa	Rendere disponibile maggior potenza alla linea.
Rotazione sbagliata	Sequenza fasi sbagliata	Invertire due fasi.
Il Motore si surriscalda durante il funzionamento a carico	Sovraccarico	Ridurre il carico.
	Alette di raffreddamento otturate da sporcizia.	Liberare i fori di ventilazione e garantire un flusso d'aria continuo al motore.
	Il Motore potrebbe avere una fase aperta.	Controllare che tutti i cavi siano collegati saldamente ed in modo corretto.
	Una fase dell'avvolgimento a terra Tensioni di fase asimmetriche.	Trovarla e ripararla. Controllare i vari collegamenti dal trasformatore al motore.

PROBLEMA	CAUSA	COSA FARE
Il Motore vibra	Motore non allineato	Allinearlo
	Basamento debole	Rinforzare il basamento.
	Giunto non bilanciato	Bilanciare il giunto
	Macchina accoppiata sbilanciata	Bilanciare la macchina accoppiata.
	Cuscinetti difettosi	Sostituire i cuscinetti.
	Pesi di bilanciatura allentati	Bilanciare il rotore.
	Motore bilanciato diversamente dal giunto (mezza chiavetta – chiavetta intera)	Bilanciare il giunto o il motore
	Motore trifase che funzione a fase singola	Controllare le fasi.
	Gioco eccessivo	Aggiustare il cuscinetto o mettere uno spessore.
Rumore anomalo	La ventola raschia il copriventola Basetta allentata	Eliminare il contatto. Stringere le viti relative.
Rumorosità durante il funzionamento	Traferro non uniforme	Controllare e correggere l'allineamento dei cuscinetti.
	Rotore non bilanciato	Bilanciarlo.
Cuscinetti troppo caldi	Albero piegato o incrinato	Raddrizzare o sostituire l'albero.
	Trazione eccessiva delle cinghie	Diminuire la tensione delle cinghie.
	Pulegge troppo lontane dalla battuta dell'albero	Avvicinare la puleggia alla battuta del motore.
	Diametro puleggia troppo piccolo	Usare pulegge più grandi.
	Allineamento non corretto	Correggere l'allineamento del motore e della macchina accoppiata.
	Grasso insufficiente	Mantere la giusta quantità di lubrificante nei cuscinetti.
	Lubrificante deteriorato o contaminato	Rimuovere il grasso vecchio, lavare i cuscinetti accuratamente con kerosene e reingrassare con del nuovo lubrificante.
	Eccesso di lubrificante	Ridurre la quantità di lubrificante, il cuscinetto non dovrà essere riempito a più di metà .
	Sovraccarico del cuscinetto	Controllare l'allineamento, e le eventuali spinte radiali e/o assiali.
	Sfere o pista del cuscinetto rovinata.	Pulire accuratamente l'alloggiamento e sostituire il cuscinetto.

Manual för installation, drift och underhåll

Innehållsförteckning

1. Allmänt

2. Installation

3. Drift

4. Underhåll

5. Miljökrav

6. Felsökningsschema för motorer

1. Allmänt

OBS!

Dessa regler måste följas för att garantera säker och korrekt installation, funktion och underhåll. Alla personer involverade i dessa arbetsskeden ska uppmärksammas på instruktionerna. Om instruktionerna inte följs kan garantin upphöra att gälla.

EU-deklaration

EU-deklaration om överensstämmelse enligt lågspänningsdirektivet 73/23/EEC kompletterat med direktiv 93/68/EEC utfärdas separat med enskilda motorer.

EU-deklarationen täcker också kraven för en inbyggnadsdeklaration med avseende på maskindirektivet 98/37/EEC, Art 4.2 Annex II, sub B.

Giltighet

Dessa instruktioner gäller för följande ABB elektriska motorer såväl i motor som generator drift.

serierna MT*, MBT*, MXMA,
serierna M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

i storleksområdet 56 - 400.

Det finns särskilda motorinstruktioner för t.ex. explosionsskyddade motorer: 'Lågspänningsmotorer för explosionsfarliga områden: Manual för installation, drift och underhåll' (Low Voltage Motors/Manual for Ex-motors).

Ytterligare information kan behövas för vissa motortyper på grund av speciell användning och/eller utformning.

Ytterligare information finns för följande motorer:

- rullbordsmotorer
- vattenkylda motorer
- öppna droppsäkra motorer
- motorer för rökgasventilation
- bromsmotorer

2. Installation

Igångkörning

Ankomstkontroll

Kontrollera omedelbart vid ankomsten att motorn inte skadats under transporten. Om den skadats skall transportören underrättas om detta så snart som möjligt.

Kontrollera alla märkdata, speciellt spänning och koppling (Y eller D). Lagertypen finns angiven på märkskylten på alla motorer utom på de minsta storlekarna.

Vrid axeln för hand för att kontrollera att rotorn går runt. Avlägsna eventuell transportlåsning.

Överskrid inte de tillåtna lagerbelastningarna, som finns angivna i produktkatalogen.

Motorer utrustade med rullager: Om motorn körs utan radiell belastning på axeln kan rullagret skadas.

Motorer utrustade med vinkelkontaktlager: Om motorn körs utan axiell kraft applicerad på axeln i rätt riktning kan vinkelkontaktlagret skadas.

Motorer utrustade med smörjnipplar:

När motorn startas första gången, eller efter lång tids förvaring av motorn, pressa in minst angiven mängd fett, till dess att färskt fett börjar tränga ut genom fettutloppsöppningarna.

För detaljer se avsnittet "Manuell smörjning" på sid 57.

Kontroll av isolationsresistansen

Mät isolationsresistansen före idrifttagning och då man kan misstänka att lindningarna blivit fuktiga.

Resistansen, mätt vid 25°C, skall överstiga referensvärdet:

10 M ohm (mätt med en 500 V dc Megger)

VARNING

Efter mätningen skall lindningarna omedelbart urladdas för att undvika risken för elektrisk chock.

Isolationsresistansens referensvärde halveras för var 20°C höjning av omgivningstemperaturen.

Om referensresistansen inte kan uppnås är lindningen för fuktig och måste torkas i ugn. Ugnstemperaturen skall vara 90°C i 12-16 timmar följda av 105°C i 6-8 timmar.

Om det finns pluggar i dräneringshålen måste de tas ur och stängningsventiler, om sådana finns, måste vara öppna under värmningen.

Lindningar dränkta i havsvatten måste normalt omlindas.

Direktstart eller Y/D start

Uttagslådan till en standard enhastighetsmotor innehåller normalt 6 lindningsuttag och minst ett jorduttag.

Motorn skall anslutas till jord enligt gällande bestämmelser innan den ansluts till nätet.

Spänning och koppling framgår av märkskylten.

Direktstart

Y eller D koppling kan nyttjas. T.ex 660 VY, 380 VD anger Y-koppling för 660 V och D-koppling för 380 V.

Y/D-start

Nätspänningen måste vara lika med motorns märkspänning i D-koppling. Alla kopplingsbleck skall tas bort från plinten.

För tvåhastighetsmotorer, enfas- och andra specialmotorer måste anslutningen till nätet följa anvisningarna i uttagslådan.

Om en direktstart (DOL) varar längre än 10 sek eller en Y/D-start längre än 30 sek, konsultera ABB:s försäljningskontor eller "Motorhandledningen" (finns även tillgänglig på internet på www.abb.com/motors&drives).

Uttag och rotationsriktning

Rotationsriktningen är medurs sett mot axeländan på drivsidan om nätfaserna L1, L2 och L3 ligger anslutna till uttagen som visas i figur 1.

För att ändra rotationsriktning växla plats på två av nätanslutningskablar.

Om motorn har en rikttningsberoende fläkt skall rotationsriktningen överensstämja med pilen på motorn.

Hantering

Förvaring

All lagring av motorer skall göras inomhus under torra, vibrations- och dammfria förhållanden.

Oskyddade bearbetade ytor (axeltappar och flänsar) skall behandlas med rostskyddsmedel.

Axeln bör roteras med jämna mellanrum för att förhindra att fettfilmen i lagren trängs igenom.

Anslut gärna stilleståndsuppvärmningen om sådan finns installerad i motorn.

Karaktäristiken för elektrolytkondensatorer i enfasmotorer, om sådana används, erfordrar formering efter lagring i 1-2 år. Kontakta ABB:s försäljningskontor för detaljanvisningar.

Transport

Motorer utrustade med rullager och/eller vinkelkontakt-lager skall vara försedda med transportlåsning av rotorn under transport.

Lyftning

Använd endast lyftöglorna för lyftning av motorn, om inte annat anges i den speciella lyftinstruktionen.

Motorns tyngdpunkt kan, trots samma storlek, variera beroende på uteffekt, monteringsätt och sidoutrustning.

Kontrollera att öglebultarna eller lyftöglorna på motorstativet är oskadade före lyftning. Skadade lyftöglor får inte användas.

Lyftöglorna måste vara väl åtdragna före lyftning. Vid behov kan lyftöglornas lägen justeras med hjälp av brickor.

Kontrollera att korrekt lyftutrustning används och att krokarnas storlek är anpassad till lyftöglorna.

Var noga med att inte skada hjälputrustning och kablar som är anslutna till motorn.

Vikter

Motorernas totala vikt varierar inom samma storlek (axelhöjd) beroende på motoreffekt, monteringsätt och olika tilläggsdetaljer.

Följande tabell visar uppskattade maximala vikter för motorer i standardutförande som en funktion av materialet i statorhuset.

För motorer som väger mer än 25 kg är de faktiska vikten instämplad på märkskylt.

Storlek	Aluminium		Gjutjärn Vikt kg	Stål Vikt kg
	Vikt kg	Lägg till. för broms		
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Uppställning

Kylning

Normal omgivningstemperatur bör inte överskrida 40°C (marin standard +40 eller +50°C) för att standardprestanda ska kunna uppnås. Kontrollera att motorn får tillräckligt kylluftflöde. Se till att inga ytor eller angränsande utrustning strålar ytterligare värme mot motorn. För ytterligare information om högre omgivningstemperaturer och kylning, se "Motorhandledningen" eller kontakta ABB:s försäljningskontor.

Fundament

Beställaren ansvarar för utförandet av fundamentet.

Fundament av metall skall vara målade för att förhindra korrosion.

Fundamenten skall vara plana och tillräckligt stabila för att motstå kortslutningskrafterna. De skall vara så dimensionerade så att vibrationer inte uppstår på grund av egenfrekvens.

Fästklotsar

Skruva fast fästklotsarna vid motorns fötter och placera en 1-2 mm mellanlaggsplåt mellan klotsen och foten.

Rikta upp motorn med hjälp av en lämplig metod. Gjut fast klotsarna med betong, kontrollera uppriktningen och borra hål för och fäst styrpinnar.

Dräneringshål

Kontrollera att öppna dräneringshål mynnar neråt då monteringsättet avviker från standard.

I extremt dammiga miljöer skall alla dräneringshål vara stängda.

Uppriktning

Korrekt uppriktning är nödvändigt för att undvika lagerproblem, vibrationer och eventuellt axeltappsbrott.

Spännlinjaler och remdrift

- Fäst motorn vid spännlinjalerna såsom visas i figur 2.
- Placera spännlinjalerna horisontalt på samma nivå.
- Kontrollera att motorns axel är parallell med den drivna axeln.
- Spänn remmarna i enlighet med leverantörens anvisningar.

VARNING

För hög remspänning skadar lagren och kan förorsaka axelbrott.

Överskrid inte maximum remkraft (tillåten radiell kraft på lagret) angiven i tillämplig produktkatalog.

Anslutning

Normalt är motorn konstruerad med uttagsslådan ovanpå motorn och med kabelanslutningsmöjligheter från båda sidorna.

Vissa motorer kan levereras, som special, med roterbar, 4 x 90°, uttagsslåda ovanpå motorn, och andra med sidomonterad uttagsslåda.

Produktkatalogen anger om dessa optioner är möjliga.

Oanvända hål för kabelanslutning skall vara täckta.

Förutom anslutningar för huvudlindning och jord kan uttagsslådan också innehålla anslutningar för termistorer, element för stilleståndsuppvärmning, temperaturvakter av bimetalldyp eller PT100 motståndselement.

VARNING

Anslutningar kan vara spänningsförande även när motorn står stilla, eftersom värmeelement eller direkt lindningsvärmning kan vara aktiverade.

Uttagsdiagram för temperaturvakter och värmeelement finns inuti uttagsslådan.

VARNING

Kondensatorn i enfasmotorer kan vara uppladdade, och ge en spänning på motorns uttag, trots att motorn står still.

Anslutning för frekvensomriktardrift

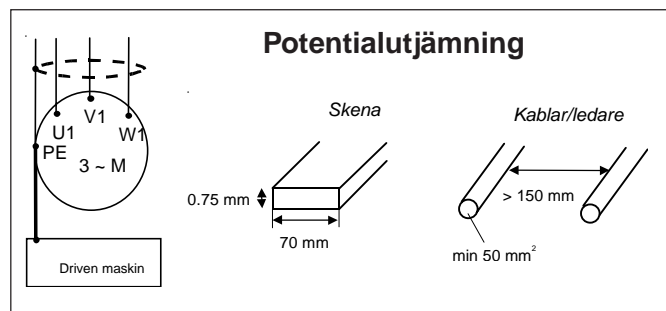
Frekvensomriktardrift orsakar högre spänningspåckänning på motorlindningen än vad sinusmatningen gör. Motorns lindning och lagerns isolering, liksom även frekvensomriktarens utgångsfilter, bör därför vara dimensionerade enligt "Selection rules for VSD applications/Insulation" (3GZF500930-2), som kan beställas från ABB.

Vid frekvensomriktardrift med motorer $P_n > 30$ kW skall kablingen ske med skärmade, symmetriska kablar och med kabelförskruvningar, som ger 360° vidhäftning (även kallade EMC-förskruvningar). Mer information finns i ABB:s handbok "Grounding and cabling of the drive system" (3AFY61201998).

När motorn används tillsammans med frekvensomriktare, så måste motorstativets yttre jordanslutning användas för att utjämna potentialen mellan motorstativet och det drivna systemet, om inte båda är monterade på ett gemensamt metallfundament.

För motorer med storlek över IEC 280, använd 0.75 x 70 mm flatledare eller minst 2 x 50 mm² rundledare. Det inbördes avståndet mellan rundledarna måste vara minst 150 mm.

Detta arrangemang fyller ingen specifik elsäkerhetsfunktion. Syftet är endast potentialutjämning. Om motorn och den drivna utrustningen är monterade på ett gemensamt metallfundament behövs ingen potentialutjämning.



För att uppfylla gällande EMC-krav, använd kablar och anslutningsdon som är godkända för ändamålet. (Se instruktionerna för frekvensomriktare.)

Den högsta tillåtna rotationshastigheten för en gjutjärnsmotor i frekvensomriktardrift (M2BA/M3BP) får inte överstiga de maximalt tillåtna varvtalen i tabellen nedan eller det varvtal, som stämplat på märkskylten. Kontakta ABB för information om högsta tillåtna hastighet för andra motorstorlekar och motortyper. Smörjning av lager skall ske enligt instruktioner längre fram i texten.

Axelhöjd	Varvtal r/m	
	2-polig	4-polig
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

Om det råder osäkerhet om motorns lämplighet för frekvensomriktardrift, kontakta ABB.

VARNING

Maximal arbetstemperatur för fett och lager får ej överskridas.

Balansering

Motorns rotor är dynamiskt balanserad.

Balanseringen har som standard blivit utförd **med halv kil**, och axeln är märkt med en **RÖD** tejp med texten "**Balanced with half key**".

För att undvika vibrationer skall således kopplingshalvor och drivskivor balanseras med halv kil efter det att kilspåret har dragits.

Om balanseringen är utförd **med hel kil** är axeln märkt med **GUL** tejp med texten "**Balanced with full key**".

Om balanseringen är utförd **utan kil** är axeln märkt med **BLÅ** tejp med texten "**Balanced without key**".

3. Drift

Användning

Driftmiljö

Motorn är avsedd att användas för drifter i industrimiljö. Gränserna för normal omgivningstemperatur är -20°C till +40°C. Maximal höjd över havet 1000 m.

Säkerhetsaspekter

Motorn är avsedd att installeras och användas av erfaren personal som har kunskaper och erforderliga säkerhetskrav.

Den säkerhetsutrustning, som är nödvändig för att förhindra olyckor vid montering och användning, ska användas i enlighet med lokalt gällande föreskrifter.

VARNING

Små motorer med nätanslutning direkt kopplad med termiskt känsliga brytare kan starta automatiskt.

Var vänlig observera

1. Motorn skall inte användas att klättra på
2. Temperaturen på motorns hölje kan kännas mycket hög vid beröring även under normal drift
3. Vissa speciella drifter för motorer kräver speciella instruktioner (t.ex frekvensomriktardrifter)
4. Lyftöglan skall endast användas för lyftning av själva motor.

Montering och demontering

Allmänt

Demontering och montering av motorer måste utföras av kunnig personal som använder ändamålsenliga verktyg och arbetsmetoder. Alla reparationer skall ske enligt standard IEC-60079-19.

Lager

Lager kräver speciell omsorg. Lager skall dras av med avdragare och sätts på med hjälp av uppvärmning eller med användning av specialverktyg. Lagerbyte beskrivs i detalj i en särskild instruktionsbroschyr som kan rekvideras från ABB:s försäljningskontor.

Montering av kopplingshalvor och drivskivor

Kopplingshalvor och drivskivor skall monteras med hjälp av ändamålsenlig utrustning och verktyg som inte skadar lagren.

Montera aldrig en kopplingshalva eller en drivskiva genom att banka den på plats eller demontera dem genom att bända mot statorn.

Krav på kopplingshalvans monteringsnoggrannhet: Kontrollera att frigången **b** är mindre än 0.05 mm och att skillnaden mellan **a1** och **a2** också är mindre än 0.05 mm. Se figur 3.

4. Underhåll

Allmänt underhåll

- Inspektera motorn regelbundet.
- Håll motorn ren och säkerställ fri tillgång till ventilationsluft.
- Kontrollera axeltätningarnas tillstånd (t.ex V-ringar) och ersätt dem om det är nödvändigt.
- Kontrollera nätanslutningarnas tillstånd och alla skruvar för uppställning och montage.
- Kontrollera lagrenas tillstånd genom att lyssna efter främmande ljud, vibrationsmätning, mäta lagrenas temperatur, inspektera det använda fettet eller utnyttja SPM lagerövervakning.

*Om det uppträder ändringar i tillståndet så demontera motorn, kontrollera ingående delar och ersätt de delar som behöver ersättas.

Smörjning

VARNING

Se upp för roterande delar.

VARNING

Fett kan förorsaka hudirritation och ögoninflammation. Följ alla säkerhetsföreskrifter som angivits av fettleverantören.

Motorer med permanentmorda lager

Lagren är permanentmorda och vanligtvis av typ Z eller 2Z. Lagertyper framgår av respektive produktkatalog och på märkskylten på alla motorer utom på de minsta storlekarna.

Som riktvärde gäller att tillräcklig smörjning kan uppnås under följande tid, enligt L1 (d.v.s. att 99 % av motorerna ska fungera störningsfritt under hela smörjintervallet) vid omgivningstemperaturen 25°C. För drifter i högre omgivningstemperaturer än 25°C, se respektive produkt-katalog.

Storlek	Poliga	Drifttimmar
56-80	2-8	på livstid
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Beroende på tillämpning och belastningsförhållanden. Se tillämplig produktkatalog.

Antalet drifttimmar för vertikalt installerade motorer är hälften av ovan angivna värden.

Motorer med smörjnipplar

Smörjskyltsinformation och allmänna smörjningsråd

Om motorn är försedd med smörjskylt så skall denna följas.

På smörjskylten kan anges smörjintervall med hänsyn taget till monteringsätt, omgivningstemperatur och varvtal.

ABB har som policy att sätta tillförlitligheten i första rummet vid val av lagersmörjningsintervall. Därför tillämpas L1-principen.

Manuell smörjning

Motoren ska smörjas medan de arbetar

- Ta bort fettutloppspluggen eller öppna stängningsventilen, om sådan finns.
- Se till att smörjkanalen är öppen
- Pressa in angiven mängd färskt fett i lagret.
- Låt motorn arbeta i 1-2 timmar så att allt överskottsfett garanterat har trängt ut ur lagret. Sätt tillbaka eventuell fettutloppsplugg.

Smörjning under stillestånd

Motorer ska smörjas medan de arbetar. Om detta inte är möjligt kan de i stället smörjas under stillestånd.

- Använd i så fall endast halva fettmängden och låt därefter motorn arbeta några minuter vid max varvtal.
- När motorn har stannat, pressa in resten av angiven mängd fett i lagret.
- Efter 1-2 timmars drift, sätt tillbaka fettutloppspluggen eller stäng ventilen, om sådan finns.

Automatisk smörjning

Vid automatisk smörjning ska fettutloppspluggen avlägsnas permanent och ev. stängningsventil vara öppen.

En del motorer kan vara försedda med uppsamlare för gammalt fett. Följ i så fall de särskilda instruktionerna för denna utrustning.

Vi rekommenderar endast användning av elektro-mekaniska system, kontakta ABB:s försäljningskontor.

I tabellen angivna fettmängder per smörjintervall ska fördubblas om automatiska smörjssystem används.

Om 2-poliga motorer smörjs via automatiska system skall anmärkningen (OBS!) beträffande fettrekommendationer och 2-poliga motorer i kapitlet Lagerfett följas.

Smörjintervall i drifttimmar och fettmängder

Storlek	Mängd fett g/lager	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
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Kullager

Smörjintervall i drifttimmar

112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	¹⁾	¹⁾	6500	8500	12500	16000
355	120	¹⁾	¹⁾	4200	6000	10000	13000
400	120	¹⁾	¹⁾	4200	6000	10000	13000
400 M3BP	130	¹⁾	¹⁾	2800	4600	8400	12000

Rullager

Smörjintervall i drifttimmar

160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	¹⁾	¹⁾	3300	4300	6000	8000
355	120	¹⁾	¹⁾	2000	3000	5000	6500
400	120	¹⁾	¹⁾	2000	3000	5000	6500
400 M3BP	130	¹⁾	¹⁾	1400	2300	4200	6000

¹⁾ Värden för IEC storlekar 280 to 400 vid vissa motortyper (3600 och 3000 r/min) - se nästa sida.

Faktorer som påverkar smörjintervallen

Smörjintervallen för vertikalt monterade motorer är hälften av ovanstående värden.

Smörjintervallerna är baserade på en arbetstemperatur i lagret av 80°C (omgivningstemperatur cirka +25°C). OBS! Enhöjning av omgivningstemperaturen medför en motsvarande höjning av temperaturen i lagret. Intervallvärdena i tabellen bör halveras för 15°C ökning av lagertemperaturen och bör fördubblas för 15°C minskning av lagertemperaturen.

VARNING

Maximal arbetstemperatur för fett och lager får inte överskridas.

Lagerfett

VARNING

Blanda inte olika typer av fett. Bristande inkompatibilitet kan orsaka lagerskador.

Då motorerna eftersmörjs ska endast fett med nedanstående egenskaper användas:

- högkvalitetsfett baserat på litiumkomplextvål och med mineral- eller PAO-olja
- Basoljeviskositet 100-160 cSt vid 40°C.
- Konsistens enligt NLGI 1.5 - 3 *)
- Temperaturområde -30°C...+120°C kontinuerligt.

*) För vertikalt monterade motorer eller vid varm omgivning rekommenderas det högre NLGI värdet.(3)

Alla större smörjmedelstillverkare erbjuder fetter med ovan angivna egenskaper.

Tillsatser rekommenderas, men fettstillverkaren bör avge en skriftlig garanti, särskilt vad gäller EP-tillsatser, att tillsatserna inte skadar lagren eller förändrar smörjmedlens egenskaper avseende arbetstemperatur.

VARNING

Smörjmedel som innehåller EP-tillsatser rekommenderas ej vid höga lagertemperaturer i storleksområdet 280 - 400.

Om omgivningstemperaturen är under - 25°C eller över +55°C, eller lagertemperaturen är över 110°C, kontakta ABB för att få råd om lämpligt fett.

Följande typer av högkvalitetsfett kan användas

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP90 (calcium polyurea base)
- FAG Arcanol TEMP110 (lithium complex base)

Smörjintervallen för andra fetter, som innehåller de önskade egenskaperna, kontakta ABB:s försäljningskontor.

Smörjintervall och fettmängder, 2-poliga, IEC storlek 280-400

Storlek	Mängd fett g/lager	3600 r/min	3000 r/min
Kullager Smörjintervall i drifttimmar			
280	M2B*, M2C*, M3B*	35	2000
315	M2B*, M2C*, M3B*	35	2000
355	M2B*, M2C*	45	1200
355	M3B*	35	1200
400	M2B*, M2C*	45	600
400	M3B*	40	1000
Rullager Smörjintervall i drifttimmar			
280	M2B*, M2C*, M3B*	35	1000
315	M2B*, M2C*, M3B*	35	1000
355	M2B*, M2C*	45	600
355	M3B*	35	600
400	M2B*, M2C*	45	-
400	M3B*	40	500

OBS! Använd alltid höghastighetsfett för högvarvs-tillämpningar och för vissa motortyper som t.ex. 2-poliga motorer M2BA 355 och 400 där varvtalsfaktorn överstiger 400 000 (beräknat som $D_m \times n$ där D_m = lagrets medeldiameter (mm); n = varvtal, r/min). Följande typer av fett kan användas:

- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- SKF LGHP2 (polyurea base)

Vid användning av andra fettfabrikat, kontrollera med tillverkaren att egenskaperna överensstämmer med de ovan nämnda fetterna. Vid osäkerhet om kompatibiliteten, kontakta ABB:s försäljningskontor.

Frekvensomriktardrift

Högvarvsdrifter (t.ex frekvensomriktardrifter) eller lägre varvtal vid stor last kräver kortade smörjintervall. Kontakta ABB:s försäljningskontor i sådana fall.

En fördubbling av varvtalet t.ex kräver en minskning av smörjintervallen till omkring 40 % av ovanstående tabells värden.

VARNING

Det maximala varvtal, för vilket motorn är konstruerad, får ej överskridas.

Lagrens lämplighet för högvarvsdrift måste kontrolleras.

Reservdelar

Vid beställning av reservdelar skall motorns fullständiga typbeteckning och beställningsnummer anges enligt märkskyltens uppgifter.

Om motorn är försedd med ett tillverkningsnummer skall detta också uppges.

Omlindning

Omlindningen skall alltid utföras av kvalificerade reparationsverkstäder.

Omlindningen av smoke venting och specialmotorer skall inte utföras utan att först kontakta ABB:s försäljningskontor.

5. Miljökrav

Ljudnivå

De flesta av våra motorer har en ljudtrycksnivå som understiger 82 dB(A) vid 50 Hz och sinusmatning, med tolerans ± 3 dB(A).

Värden för specifika motorer kan hittas i motsvarande produktkataloger.

För ljudtrycksnivåer vid 60 Hz sinusmatning och vid annat än sinusmatning, kontakta ABB:s försäljningskontor.

Ljudtrycksnivåer för alla motorer med separata kylsystem och för serierna M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, och M2BJ/M2LJ, finns angivna i särskilda motorinstruktionerna.

Föreliggande instruktioner täcker inte alla detaljer och varianter av utrustningen och beskriver inte heller alla situationer som kan tänkas uppstå i samband med installation, drift och underhåll. För ytterligare information, kontakta närmaste ABB-försäljningskontor.

Felsökningsschema för motorer

Motorservice och felsökning ska skötas av kvalificerad personal med ändamålsenlig utrustning.

PROBLEM	ORSAK	ÅTGÄRD
Motorn startar inte	Säkringarna har löst ut	Byt till säkringar av korrekt typ och utlösningssvärde.
	Överbelastningsutlösning	Kontrollera och återställ överbelastningsskyddet i startapparaten.
	Felaktig matning	Kontrollera att matningen överensstämmer med uppgifterna på motorns märkskylt och med driftförhållandet.
	Felaktig matningsanslutning	Kontrollera anslutningarna mot det schema som medföljer motorn.
	Lindningsbrott eller öppen brytare	Indikeras av surrande ljud då brytaren sluts. Kontrollera att alla anslutningar är väl åtdragna. Kontrollera att alla hjälpkontakter sluts korrekt.
	Mekaniskt fel	Kontrollera att motorn och den drivna utrustningen roterar fritt. Kontrollera lager och smörjning.
	Kortslutning i stator	Visas av att säkringarna har löst ut. Motorn måste lindas om.
	Bristande anslutning av statorspole	Ta bort ändlocken, hitta felet med en provning slampa.
	Rotorfel	Leta efter avbrutna stavar och gavelringar.
	Motorn kan vara överbelastad	Minska belastningen.
Motor fastlåst	En fas öppen	Kontrollera spänningen i alla faser.
	Fel tillämpning	Ändra typ eller storlek. Kontakta tillverkaren.
	Överbelastning	Minska belastningen.
	För låg spänning	Se till att matningsspänningen uppfyller kraven enligt märkskylten. Kontrollera anslutningen.
	Öppen krets	Säkringar utlösta, kontrollera överbelastningsrelä, stator och tryckknappar.
Motorn startar, men retarderar och stannar	Matningsfel	Kontrollera om matningsanslutningarna behöver dras åt. Kontrollera säkringar och manöverorgan.
Motorn varvar inte upp till rätt varvtal	Felaktig användning	Kontakta tillverkaren för anvisning om rätt typ.
	För låg spänning vid motoranslutningarna på grund av spänningsfall i matningsnät	Använd högre spänning eller transformatoranslutningar för att minska belastningen. Kontrollera anslutningarna. Kontrollera att ledarna har rätt dimension.
	För hög startbelastning	Kontrollera tillåten startbelastning för motorn.
	Avbrutna rotorstavar eller lös rotor	Kontrollera om det finns sprickor nära ringarna. Vanligen är endast en temporär reparation möjlig. Rotorn måste oftast bytas.
	Öppen primärkrets	Hitta felet med mätinstrument och reparera.
Motorn behöver för lång tid för att accelerera och/eller drar för mycket ström.	Överbelastning	Minska belastningen.
	Låg spänning vid start	Kontrollera om resistansen är för hög. Korrekt ledardimension
	Fel på kortsluten rotor	Byt till ny rotor.
	För låg matningsspänning	Kontakta elleverantören för att öka uttagbar effekt.
Fel rotationsriktning	Fel fasföljd	Låt två fasledare byta plats vid gruppcentralen eller motorn.
Motorn blir överhettad trots att den är lågt belastad	Överbelastning	Minska belastningen.
	Ventilationsöppningarna i statorn eller lagerbockarna kan vara igensatta så att motorn inte får tillräcklig kylning	Öppna ventilationsöppningarna och se till att kylluften kan strömma fritt.
	En fas kan vara öppen	Kontrollera att samtliga ledare är korrekt anslutna.
	Jordsluten spole	Hitta och åtgärda felet.
	Obalanserad uttagsspänning	Kontrollera om det finns felaktiga ledare, anslutningar och transformatorer.

PROBLEM	ORSAK	ÅTGÄRD
Motorn vibrerar	Motorn felaktigt uppriktad	Rikta upp motorn.
	Svagt fundament	Förstärk fundamentet.
	Obalanserad koppling	Balansera kopplingen.
	Driven utrustning obalanserad	Balansera den drivna utrustningen.
	Lagerfel	Byt lager.
	Lager ej uppriktade	Rikta upp lagren.
	Balanseringsvikterna har förskjutits	Balansera om motorn.
	Bristande kompatibilitet mellan rotor- och kopplingsbalansering (halv kil – hel kil)	Balansera om kopplingen eller motorn
	Flerfasmotor drivs med enfasmätning	Kontrollera om någon krets är öppen.
	För stort axeländspel	Justera lager eller sätt in shims
Skrapljud	Fläkten i kontakt med kåpan	Åtgärda felet.
	Fläkten i kontakt med isolationsmaterialet	Åtgärda fläkten.
	Motorn lös på fundamentplattan	Dra åt fästskruvarna.
Onormalt driftbuller	Ojämt luftgap	Kontrollera och korrigera lagerbockarna eller lagren.
	Rotor obalanserad	Balansera om.
Lagren för varma	Böjd eller sned axel	Rikta upp eller byt axeln.
	För hög remspänning	Minska remspänningen.
	Remskivorna får långt bort	För remskivan närmare motorlagret.
	För liten remskivediameter	Använd större remskivor.
	Bristande uppriktning	Korrigera genom att rikta upp drivsystemet.
	Bristande smörjning	Se till att lagerfett av rätt kvalitet används.
	Fettet eller smörjmedlet förbrukat eller förorenat	Avlägsna gammalt fett, tvätta lagret grundligt med fotogen och pressa in nytt fett.
	För mycket smörjmedel	Minska fettmängden. Lagret ska inte vara fyllt mer än till hälften.
	Överhettat lager	Kontrollera uppriktningen samt den radiella och axiella belastningen.
	Skadade kulor eller löpbanor	Byt lager och rengör samtidigt lagerhuset noggrant.

Asennus-, käyttö- ja kunnossapito-ohje

Sisältö

1. Yleistä

2. Asennus

3. Käyttö

4. Kunnossapito

5. Ympäristövaatimukset

6. Moottorin vianetsintä taulukko

1. Yleistä

HUOM!

Näitä ohjeita on noudatettava varmistaaksemme moottorin turvallisen ja oikean asennuksen, käytön ja huollon. Henkilöiden, jotka asentavat, käyttävät tai huoltavat koneitamme on tunnettava asennus-, käyttö- ja kunnossapito-ohje. Ohjeiden laiminlyönti saattaa aiheuttaa takuun raukeamisen.

Vaatimustenmukaisuusvakuutus

Jokaiselle koneelle annetaan erikseen vaatimustenmukaisuusvakuutus pienjännitedirektiivin 73/23/EEC ja direktiivin muutoksen 93/68/EEC mukaan.

Vaatimustenmukaisuusvakuutus täyttää myös yhdenmukaisuusvakuutukselle asetetut vaatimukset, konedirektiivin 98/37/EEC mukaan, Art. 4.2 Annex II, Sub B.

Voimassaolo

Ohje on voimassa seuraaville ABB:n sähkökoneille; sekä moottori- että generaattorikäytöissä:

Tyyppi MT*, MBT*, MXMA

Tyyppi M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

runkokokoluokissa 56 - 400.

Ex-moottoreille on olemassa oma ohjeensa. 'Oikosulkumoottori räjähdysvaarallisiin tiloihin, asennus-, käyttö ja kunnossapito-ohje' (Low Voltage Motors/Manual for Ex-motors).

Lisäohjeita voidaan tarvita joissain konetyypeissä, jotka on tarkoitettu erikoiskäyttöihin ja/tai ovat erikoisrakenteisia. Lisäohjeita on mm. seuraavista moottoreista;

- rullaratamoottorit
- vesijäähdytteiset moottorit
- tippuvesisuojatut (IP 23) moottorit
- jarrumoottorit
- savukaasun poistoon tarkoitettut moottorit
- kestopagneettimoottorit

2. Asennus

Käyttöönotto (käynnistys)

Vastaanottotarkastus

Tarkista heti vastaanoton jälkeen, ettei moottori ole vahingoittunut ulkoisesti ja tarvittaessa ota välittömästi yhteyttä kuljetusliikkeeseen.

Tarkista kaikki arvokilven tiedot, etenkin jännite ja kytkentä (tähti tai kolmio). Kaikissa moottoreissa lukuunottamatta muutamaa pienintä runkokokoa on myös laakerityyppi mainittu arvokilvessä.

Pyöritä akselia käsin varmistaaksesi, että se pyörii vapaasti, poista mahdollinen kuljetuslukitus.

Älä ylitä laakereiden sallittuja kuormitusarvoja, jotka on ilmoitettu tuote-esitteissä.

Moottorit, joissa on rullalaakerit:

Moottorin käyttö ilman säteittäistä kuormitusta akselille saattaa vahingoittaa rullalaakereita.

Moottorit, joissa on viistokuulalaakerit :

Moottorin käyttö ilman oikean suuntaista aksiaalivoimaa saattaa vahingoittaa viistokuula-laakeria.

Moottorit, joissa on jalkivoitelu:

Moottoria käynnistettäessä ensimmäistä kertaa sekä moottorin pitkän varastoinnin jälkeen lisätään vähintään taulukossa annettu voiteluainemäärä tai kunnes voiteluainetta tulee poistoaukosta.

Tarkemmat ohjeet katso kohdasta "Voitelunipoilla varustetut moottorit" sivulla 66.

Eristysvastuksen tarkistaminen

Mittaa eristysvastus ennen käyttöönottoa ja epäillessäsi käämityksen olevan kostea.

Eristysvastuksen täytyy ylittää seuraava ohjearvo, mitattuna +25°C lämpötilassa:
10 M ohm (mitattu 500 V dc Megger)

VAROITUS

Käämityksen sähkövaraus on purettava välittömästi mittauksen jälkeen sähköiskun välttämiseksi.

Eristysvastuksen ohjearvo tulee puolittaa jokaista 20°C ympäristön lämpötilan nousua kohti.

Ellei eristysvastusmittauksessa saavuteta ohjearvoa, käämitys on liian kostea ja se on kuivattava uunissa. Uunin lämpötilan on oltava 90°C 12-16 tunnin ajan, ja sen jälkeen 105°C 6-8 tunnin ajan.

Lämmityksen ajaksi on mahdolliset vesireikien tulpat poistettava ja mahdollinen sulkuventtiili avattava.

Meriveden kastelemat käämitykset on useimmiten käämittävä uudestaan.

Suora tai tähtikolmiokäynnistys:

Vakioyksinopeusmoottorin liitäntäkotelossa on yleensä kuusi staattoriliitintä ja ainakin yksi maadoitusliitin.

Maadoitus on hoidettava paikallisten määräysten mukaan ennen moottorin kytkemistä verkkojännitteelle.

Jännite ja kytkentä on leimattu arvokilpeen.

Suora käynnistys:

Y- tai Δ -kytkentää voidaan käyttää. Esimerkiksi 660 VY, 380 V Δ tarkoittaa Y-kytkentää 660 V ja Δ -kytkentää 380 V.

Tähtikolmiokäynnistys:

Verkkojännitteen on oltava sama kuin koneen jännite D-kytkennässä.

Poista kaikki kytkentäliuskat liitäntäalustasta.

Kaksinopeus-, yksivaihe- ja erikoismoottoreilla kytkentä on suoritettava liitäntäkotelon sisällä olevien ohjeiden mukaisesti.

Jos suorakäynnistys kestää yli 10 sekuntia tai Y/D-käynnistys yli 30 sekuntia, ota yhteys ABB:n tuotemyyntiin.

Lisätietoja käynnistyksestä on painatteessa 'The Motor Guide', julkaisu on myös internet osoitteessa www.abb.com/motor&drives.

Liitännät ja pyörimissuunta

Pyörimissuunta on myötöpäivään akselin päästä katsoen, kun vaihejärjestys L1, L2, L3 on kytketty liittimiin kuvan 1 mukaan.

Pyörimissuunta muutetaan vaihtamalla kahden vaihejohtimen päät keskenään.

Mikäli moottorissa on vain yhteen suuntaan pyörivä tuuletin, tarkista, että pyörimissuunta on moottoriin merkityn nuolen mukainen.

Käsittely

Varastointi

Kaikki moottorit tulee varastoida sisätiloissa, kuivissa, tärinättömissä ja pölyttömissä olosuhteissa.

Moottorin suojaamattomat kohdat (akselin päät ja laipat) tulee suojata korroosionestoaineella.

Akselia suositellaan pyöritettävän säännöllisin väliajoin käsin rasvan muuttumisen estämiseksi.

Mahdollisten seisontalämmitysvastusten pitäisi olla kytkettyinä.

Mikäli yksivaihemootoreihin on asennettu elektrolyttiset kondensaattorit, on ne 'herätettävä' uudelleen varastointiajan ylittäessä 1-2 vuotta. Ota yhteyttä ABB:n tuotemyyntiin saadaksesi lisäohjeita.

Kuljetus

Moottorit, joissa on rullalaakerit tai viistokuulalaakerit, tulee varustaa lukituksella kuljetuksen ajaksi.

Nostaminen

Käytä aina nostosilmukkaa konetta nostettaessa, ellei erillisessä ohjeessa sanota toisin.

Saman runkokoon moottorien painopiste saattaa vaihdella johtuen eri tehoista, asennusasunnoista ja lisävarusteista.

Tarkista ennen nostamista, että moottorin nostosilmukat ovat kunnossa. Vahingoittuneita nostosilmukoita ei saa käyttää.

Kierteellä kiinnitetyt nostosilmukat täytyy kiristää ennen nostamista. Tarvittaessa nostosilmukka on säädettävä oikeaan asentoon sopivia aluslaattoja käyttäen.

Varmista että nostovälineet ovat oikean kokoisia ja nostokoukut sopivat nostosilmukoihin.

Nostettaessa on varottava vahingoittamasta moottoriin kiinnitettyjä lisälaitteita ja kaapeleita.

Moottorin paino

Moottorin kokonaispaino vaihtelee samassa runko-koossa, johtuen eri nimellistehosta, erilaisesta asennusasennosta ja erilaisista lisävarusteista.

Seuraavassa taulukossa on ilmoitettu arvioidut maksimipainot vakiomallin moottoreille eri runkomateriaaleilla.

Tarkka paino on ilmoitettu arvokilvessä lähes kaikille moottoreille lukuunottamatta pienimpiä runkokokoja.

Runko- koko	Alumiini		Valurauta	Teräs
	Paino kg	Lisäys jarrusta	Paino kg	Paino kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	55	175	-
180	160	65	250	-
200	220	-	310	-
225	295	-	400	-
250	370	-	550	-
280	405	-	800	600
315	-	-	1300	1000
355	-	-	2300	2200
400	-	-	3500	3000

Asennus

Jäähdytys

Moottoristandardien mukaan ympäristön lämpötila ei saa ylittää +40°C (laivamoottori standardissa +45 tai 50°C). Tarkista, että moottorin ympärillä on tarpeeksi jäähdytyksen vaatimaa etäisyyttä. Varmista, että lähellä olevat laitteet, pinnat tai suora auringonpaiste eivät kuumenna moottoria liikaa.

Lisätietoja korkeammista ympäristön lämpötiloista ja jäähdytyksestä saat ottamalla yhteyden ABB tuotemyyntiin.

Alusta

Ostajalla on täysi vastuu alustan valmistamisesta.

Metalliset alustat on maalattava ruostumisen estämiseksi.

Alustan on oltava tasainen ja riittävän tukeva, jotta se kestää mahdolliset oikosulkuvoimat. Alustan pitää olla niin mitoitettu, että vältetään resonanssien aiheuttamat värähtelyt.

Jalkalaatat

Kiinnitä jalkalaatat moottorin jalkoihin ja asenna väliin 1-2 mm levy.

Kohdista moottori käyttäen sopivia työvälineitä. Vala laatta betoniin, tarkista kohdistus ja poraa reiät ohjaustapeille.

Vesireiät

Varmista aina, että avoimet vesireiät ovat alaspäin, kun asennusasento poikkeaa normaalista.

Erittäin pölyisissä oloissa kaikki vesireiät tulee sulkea.

Linjaus

Oikea linjaus on erittäin tärkeää laakerivaurioiden, tärinän ja akselitapin murtumisen estämiseksi.

Kiristyskiskot ja hihnakäytöt

- Kiinnitä moottori kiristyskiskoihin kuvan 2 mukaan.
- Asenna kiristyskiskot vaakasuoraan samaan tasoon.
- Tarkista, että moottorin akseli on samassa suunnassa käyttöakselin kanssa.
- Hihnnot tulee kiristää toimittajan ohjeiden mukaan.

VAROITUS

Liiallinen hihnojen kiristys vaurioittaa laakereita ja voi aiheuttaa akselin katkeamisen.

Älä ylitä maksimihhnavoimia (laakerin radiaalikuormituksia), jotka on ilmoitettu tuote-esitteissä.

Kytcentä

Vakiomallin moottoreissa liitntäkotelo on moottorin päällä, kaapelaukot molempiin suuntiin.

Erikoisratkaisuna tietyt moottorit voidaan varustaa 4 x 90° käännettävällä moottorin päällä olevalla liitntäkotelolla tai sivulle asennettavalla liitntäkotelolla. Nämä vaihtoehdot on kuvattu tuote-esitteissä.

Käyttämättömät kaapelaukot täytyy sulkea.

Moottorin päälittimien ja maadoitusliittimien lisäksi liitntäkotelossa voi olla kytkennät termistoreille, seisontalämmitysvastuksille, bimetallikytkimille, tai PT100 vastuselementeille.

VAROITUS

Jännite voi olla kytkettynä moottorin seisoessa liitntäkotelon sisällä lämmitysvastuksille tai suoraan käämityksen lämmitykselle.

Lisävarusteiden kytkentäkaaviot ovat joko liitntäkotelon sisällä tai kylteissä.

VAROITUS

Yksivaihemoottorin kondensaattorissa voi olla sähkövaraus moottorin liittimissä, vaikka moottori on pysähdyksissä.

Taajuusmuuttajakäytöt

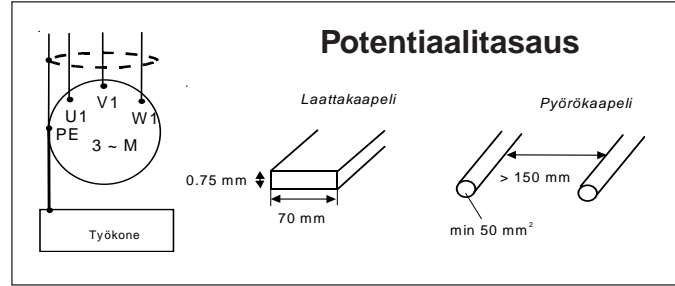
Taajuusmuuttajakäyttö aiheuttaa suurtaajuisia akseli-jännitteitä ja laakerivirtoja sekä verkkokäyttöä suurempia jänniterasituksia moottorin käämitykselle. Tämän johdosta tulee moottorin käämien ja laakereiden eristyksen sekä taajuusmuuttajan lähtösuotimien olla valittu Selection rules for VSD applications/Insulation (3GZF500930-2) -ohjeen mukaan, pyydä ohjeita ABB:n tuotemyynnistä.

Taajuusmuuttajakäytöissä tulee moottori ($P_n > 30$ kW) kaapeloida käyttäen suojattuja symmetrisiä kaapeleita ja 360 asteen maadoitusliittimiä. Tarkemmat ohjeet löytyvät ABB:n Grounding and cabling of the drive system (3AFY 61201998) -manuaalista.

Taajuusmuuttajakäytöissä tulee käyttää moottorin ulkoista maadoitusta moottorin ja työkoneen väliseen potentiaalintasaukseen, mikäli moottori ja työkone eivät ole asennettu samalle teräspedille.

Potentiaalitasausta käytetään runkokooltaan IEC 280 ja suuremmissa moottoreissa. Tasaukseen käytettävän johtimen tulee olla vähintään 0.75 x 70 mm laatta-kaapelia tai vähintään 2 x 50 mm² pyöreää kaapelia. Pyöreiden kaapeleiden välinen etäisyys pitää olla vähintään 150 mm.

Potentiaalitasauksella ei ole merkitystä sähköturvallisuuden kannalta. Sen tarkoituksena on pitää moottorin ja työkoneen runko samassa suurtaajuuspotentiaalissa. Mikäli moottori ja työkone ovat galvaanisesti yhteenkytkettyjä, potentiaalitasausta ei tarvita.



EMC-vaatimukset täyttyvät käyttämällä tarkoitukseen määritellyjä kaapeleita ja liitntäosia. (Katso taajuusmuuttajaohjeistot).

Taajuusmuuttajakäyttöisen valurautarunkoisen (M2BA/M3BP) moottorin suurin pyörimisnopeus ei saa ylittää allaolevassa taulukossa mainittuja arvoja tai arvokilpeen leimattua suurinta pyörimisnopeutta. Muiden kuin taulukossa mainittujen moottorikokojen ja -tyyppien suurimmat sallitut pyörimisajat kysyttäessä. Laakereiden voitelussa tulee noudattaa jäljempänä annettuja ohjeita.

Runkokoko	Pyörimisnopeus r/min	
	2-napaiset	4-napaiset
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800

Mikäli moottorin sopivuus taajuusmuuttajakäyttöön on epäselvä, ota yhteys ABB:n tuotemyyntiin.

VAROITUS

Voiteluaineen ja laakerin maksimikäyttölämpötilaa ei saa ylittää.

Tasapainotus

Moottorin roottori on dynaamisesti tasapainotettu.

Akselit tasapainotetaan normaalisti puolella kiilalla, akselissa **punainen** teippi tekstillä **"tasapainotettu puolella kiilalla (Balanced with half key)"**.

Tärinän välttämiseksi kytkinpuolikas tai hihnapyörä tasapainotetaan puolella kiilalla kiilauran jyrkimisen jälkeen.

Täydellä kiilalla tasapainotettaessa akseli on merkitty **keltaisella** teipillä, jossa on teksti **"tasapainotettu täydellä kiilalla" (Balanced with full key)**.

Ilman kiilaa tasapainotettaessa akseli on merkitty **sinisellä** teipillä, jossa on teksti **"tasapainotettu ilman kiilaa" (Balanced without key)**.

3. Käyttö

Käyttöolosuhteet

Moottorit on tarkoitettu teollisuuskäyttöihin, normaali ympäristön lämpötilan ollessa -20°C... +40°C, asennuskorkeus enintään 1000 m meren pinnasta.

Turvallisuusnäkökohtia

Pätevän, voimassaolevat turvallisuusvaatimukset tuntevan henkilökunnan tulee asentaa ja käyttää moottoreita.

Turvavälineitä, jotka ovat tarpeen onnettomuuksien estämiseksi asennuksen ja käytön yhteydessä, on käytettävä asianomaisen maan määräysten mukaan.

VAROITUS

Pienet moottorit, jotka on suojattu päävirtapiirissä olevilla lämpökyskimillä, voivat käynnistyä automaattisesti.

Huomioitavia seikkoja

1. Moottorin päälle ei saa astua.
2. Moottorin pinta voi olla kuuma normaalikäytössä.
3. Jotkut erikoiskäytöt vaativat erikoisohjeita (esim. taajuusmuuttajakäytöt).
4. Nostosilmukka on tarkoitettu vain moottorin nostamiseen. Moottorin nostosilmukkaa ei saa käyttää nostettaessa moottoria ja siihen kytkettyä muuta laitteistoa.

Kokoonpano ja purku

Yleistä

Pätevän henkilökunnan on suoritettava moottorin purku ja kokoonpano käyttäen tarkoituksenmukaisia työvälineitä ja työtapoja. Kaikki korjaukset on suoritettava standardin IEC-60079-19 mukaisesti.

Laakerit

Laakereista on pidettävä erityistä huolta. Laakerit on poistettava käyttäen ulosvetäjää, asennettava lämmitettyinä tai käyttäen erikoisia, tarkoitukseen sopivia, työkaluja. Laakereiden vaihto on kuvattu erillisessä ABB:ltä saatavassa ohjeessa.

Kytkinpuolikkaiden ja hihnapyörien asentaminen

Kytkinpuolikkaat ja hihnapyörät on asennettava sopivia työkaluja käyttäen niin, etteivät laakerit vahingoitu.

Älä koskaan asenna kytkinpuolikasta tai hihnapyörää lyömällä se paikoilleen tai poista sitä vipuamalla runkoa vasten.

Kytkimen asennustarkkuus:

Tarkista, että poikkeama **b** on alle 0.05 mm, ja että ero **a1 - a2** on myös alle 0.05 mm, katso kuva 3.

4. Kunnossapito

Huolto ja voitelu

Yleinen tarkistus

- Pidä moottori puhtaana ja huolehdi jäähdytysilman vapaasta kulusta.
- Seuraa tiivisteiden (esim. V-rengas) kuntoa ja uusi ne tarvittaessa.
- Seuraa kytkentöjen ja kiinnitysruuvien kuntoa.
- Tarkkaile laakerien kuntoa laakeriääntä kuuntelemalla, laakerien tärinää tai lämpötilaa mittaamalla, poistuvaa voiteluainetta tarkkailemalla tai SPM-valvontalaitteilla.
 - * Kun muuttumista alkaa tapahtua, avaa moottori ja tarkista osat ja uusi ne tarvittaessa.

Voitelu

VAROITUS

Varo pyöriviä osia!

VAROITUS

Monet voiteluaineet saattavat ärsyttää ihoa tai aiheuttaa silmätulehduksia. Seuraa valmistajan antamia turvaohjeita.

Kestovoidelluilla laakereilla varustetut moottorit

Moottorit ovat yleensä vakiona varustettu kestovoidelluilla laakereilla, tyypit Z tai 2Z. Laakerityypit on lueteltu tuote-esitteissä ja lukuunottamatta muutamaa pienintä runkokokoa laakerityyppi on mainittu myös arvokilvessä.

Runkokokoon 180 asti ohjeellinen käyttötuntien määrä, jolloin moottorit ovat edelleen hyvin voideltuja, L₁-periaatteen mukaisesti ympäristön lämpötilan ollessa +25°C (tarkoittaa, että 99 % moottoreista toimii häiriöttömästi voiteluvälän ajan). Ohjeet käyttöihin, joissa ympäristön lämpötila on yli +25°C, ovat tuote-esitteissä.

Runkokokoo	Napaluku	Käyttötunnit
56-80	2-8	elinikäinen
90-112	2-8	40 000
132	2	31 000
132	4-8	40 000
160	2	23 000
160	4-8	40 000
180	2	19 000
180	4-8	40 000

Riippuen sovelluksesta ja kuormitusolosuhteista, katso kyseisen moottorin tuote-esitteestä.

Pystyasentoon asennettujen moottoreiden voiteluvälit ovat puolet yllämainituista arvoista.

Voitelunipoilla varustetut moottorit

Voiteluohjekilpi ja yleistä voitelusta

Jos moottorissa on voiteluohjekilpi, noudata siinä olevia arvoja.

Voiteluohjekilvestä voidaan määrittää jälkivoiteluväli asennusasennon, lämpötilan ja kierrosluvun suhteen.

ABB:n lähtökohtana voiteluvälejä määriteltäessä on käyttövarmuus. Siksi noudatamme L₁-periaatetta.

Käsivoitelu

Voitelu moottorin pyöriessä

- Jos voiteluaineen poistoaukot on varustettu tiivistystulpilla tai sulkuventtiilillä, poista ne voitelun ajaksi.
- Varmista, että voitelukanava on auki.
- Purista suositeltu määrä voiteluainetta laakereihin,
- Anna moottorin pyöriä 1-2 tuntia varmistaaksesi, että ylimääräinen voiteluaine on poistunut. Sulje tiivistystulpilla varustetut poistoaukot tai sulkuventtiili.

Voitelu moottorin ollessa pysähtyneenä

Moottorin voitelu suoritetaan yleensä moottorin pyöriessä, mutta voitelu voidaan suorittaa myös moottorin ollessa pysähtyneenä.

- Tällöin lisätään ensin vain puolet suositellusta voiteluainemäärästä ja annetaan koneen käydä täydellä nopeudella noin viisi minuttia.
- Kun moottori on pysähtynyt lisätään loput voiteluaineesta.
- Anna moottorin pyöriä 1-2 tuntia ja sulje sen jälkeen tiivistystulpilla varustetut poistoaukot tai sulkuventtiili.

Automaattivoitelu

Mikäli voitelu tapahtuu automaattisesti, poista tiivistystulpat poistoaukoista pysyvästi tai avaa sulkuläppä.

Joissain moottoreissa voi olla lisävarusteena poistuvan voiteluaineen kerääjä. Noudata laitteen mukana toimitettavaa erillisohjetta.

Suosittelimme vain sähkömekaanisten järjestelmien käyttöä, lisätietoja ABB:n tuotemyynnistä.

Taulukossa mainitut voiteluainemäärät täytyy kaksinkertaistaa, mikäli käytetään automaattivoitelua.

Jos automaattivoitelun piirissä on 2-napaisia moottoreita noudattakaa kappaleessa 'Voiteluainevälit ja -määrät, 2-napaiset, IEC-runkokoot 280 ja 400' annettua huomautusta (**HUOM!**) voiteluainesuosituksista 2-napaisille moottoreille.

Voiteluvälit ja -ainemäärät

Runko- koko	Voitelu- ainemäärä g/laakeri	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
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Kuulalaakerit

Voiteluväli käyttötunteina

112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000 ¹⁾	3500 ¹⁾	8000	10500	14000	17000
315	90	¹⁾	¹⁾	6500	8500	12500	16000
355	120	¹⁾	¹⁾	4200	6000	10000	13000
400	120	¹⁾	¹⁾	4200	6000	10000	13000
400 M3BP 130	¹⁾	¹⁾		2800	4600	8400	12000

Rullalaakerit

Voiteluväli käyttötunteina

160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000 ¹⁾	2000 ¹⁾	4000	5300	7000	8500
315	90	¹⁾	¹⁾	3300	4300	6000	8000
355	120	¹⁾	¹⁾	2000	3000	5000	6500
400	120	¹⁾	¹⁾	2000	3000	5000	6500
400 M3BP 130	¹⁾	¹⁾		1400	2300	4200	6000

¹⁾ Arvot tietyille moottorityypeille, IEC runkokoot 280-400 (3600 ja 3000 r/min), on lueteltu seuraavalla sivulla.

Voiteluväleihin vaikuttavat tekijät

Taulukko koskee vaakasuoraan asennettuja moottoreita. Pystysuoraan asennettujen moottorien voiteluvälit ovat puolet taulukon arvoista.

Voiteluväli perustuu laakerin käyntilämpötilaan 80°C (ympäristön lämpötila noin +25°C). On huomattava, että ympäristön lämpötilan nousu nostaa vastaavasti laakerin lämpötilaa. Laakerilämpötilan nousu 15°C johtaa voiteluvälin puolittamiseen. Laakerilämpötilan aleneminen 15°C pidentää voiteluvälin kaksinkertaiseksi.

VAROITUS

Voiteluaineen ja laakerin maksimikäyttölämpötilaa ei saa ylittää.

Voiteluaineet

VAROITUS

Älä sekoita eri voiteluaineita keskenään.

Yhteensopimattomat voiteluaineet voivat aiheuttaa laakerivaurion.

Voideltaessa on käytettävä vain erityisesti kuula-laakereille tarkoitettuja, seuraavat ominaisuudet täyttäviä, voiteluaineita:

- korkealaatuinen litium-kompleksisaippua ja mineraali- tai PAO-öljy
- perusöljyn viskositeetti 100-160 cSt 40°C:ssa
- kovuusluokka NLGI aste 1.5 - 3 *)
- lämpötila-alue -30°C...+120°C

*) Pystysuoraan tai kuumiin olosuhteisiin asennetuille koneille suositellaan asteikon jäykempää päätä.

Oikealaatuisia voiteluaineita on saatavissa kaikilta tärkeimmiltä voiteluainevalmistajilta.

Lisäaineistus on suotava, mutta voiteluaineen valmistajalta on saatava kirjallinen takuu erityisesti EP-lisäaineista, että ne eivät toimintalämpötila-alueella vahingoita laakerin tai rasvan ominaisuuksia.

VAROITUS

EP-lisäaineisia voiteluaineita ei suositella korkeissa laakerilämpötiloissa runkokokoluokissa 280-400.

Jos ympäristön lämpötila on alle -25°C tai yli +55°C, tai laakerilämpötila on yli 110°C, ota yhteyttä ABB:n tuotemyyntiin sopivan voiteluaineen valitsemiseksi.

Seuraavia korkealaatuisia voiteluaineita voidaan käyttää:

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP90 (calcium polyurea base)
- FAG Arcanol TEMP110 (lithium complex base)

Lisäohjeita voiteluväleistä muille, vaaditut ominaisuudet täyttävälle voiteluaineille, saat ABB:n tuotemyynnistä.

Voiteluvälit ja -ainemäärät, 2-napaiset, IEC-runkokoot 280 ja 400

Runko-koko		Voiteluainemäärä g/laakeri	3600 r/min	3000 r/min
Kuulalaakerit				
Voiteluväli käyttötunteina				
280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	600	800
400	M3B*	40	1000	1600
Rullalaakerit				
Voiteluväli käyttötunteina				
280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	-	-
400	M3B*	40	500	800

HUOM!

Suurnopeusmoottoreissa ja esim. M2BA 355 ja 400 2-napaisissa moottoreissa, kun kierroslukutekijä ($D_m \times n$, missä D_m = keskimääräinen laakerien halkaisija mm:nä, ja n = pyörimisnopeus, rpm) on korkeampi kuin 400 000, käytä suurnopeusvoiteluaineita. Seuraavia voiteluaineita voidaan käyttää:

- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- SKF LGHP2 (polyurea base)

Mikäli käytetään muita voiteluaineita on varmistettava valmistajalta, että ominaisuudet vastaavat yllämainittuja voiteluaineita tai voiteluaineen yhteensopivuuden ollessa epävarmaa, ottakaa yhteyttä ABB:n tuotemyyntiin.

Taajuusmuuttajakäytöt

Suuret nopeudet, esim. taajuusmuuttajakäytössä, tai hitaat käytöt raskaasti kuormitettaessa, lyhentävät voiteluvälejä. Pyydä ohjeita ABB:n tuotemyynnistä näissä tapauksissa.

Nopeuden kaksinkertaistaminen lyhentää voiteluvälejä n. 40 %:iin taulukon arvoista.

VAROITUS

Älä ylitä moottorin rakenteellista maksiminopeutta!

Laakereiden soveltuvuus suuriin nopeuksiin on myös tarkistettava.

Varaosat

Tilatessasi varaosia ilmoita moottorin arvokilpeen leimattu täydellinen lajimerkki ja tuotekoodi. Ilmoita myös moottorin valmistusnumero, mikäli se on leimattu arvokilpeen.

Uudelleenikämintä

Uudelleenikämintään tulee käyttää vain luotettavia moottorikorjaamoita.

Ota aina yhteys ABB:n tuotemyyntiin ennen savukaasun poistoon tarkoitettujen moottoreiden ja muiden erikoismoottoreiden uudelleenikämintää.

5. Ympäristövaatimukset

Äänitaso

Suurin osa moottoriemme äänitasoista ei ylitä 82 dB(A), arvot perustuvat 50 Hz sinimuotoiseen käyttöön, hyväksyttävä toleranssi ± 3 dB(A).

Yksittäisten moottorien arvot on annettu vastaavissa tuote-esitteissä.

Sinimuotoisessa käytössä 60 Hz sekä ei-sinimuotoisessa käytössä, ota yhteyttä ABB:n tuotemyyntiin.

Äänenpainetasot kaikille moottoreille, joilla on erillinen tuuletin tai jotka kuuluvat sarjaan M2F*/M3F*, M2L*/M3L*, M2R*/M3R* ja M2BJ/M2LJ, on ilmoitettu erillisessä hoito-ohjeessa.

6. Moottorin vianetsintä taulukko

Nämä ohjeet eivät kata kaikkia yksityiskohtia ja vaihtoehtoja eivätkä myöskään tilanteita asennuksen, käytön tai huollon aikana. Lisäohjeiden saamiseksi pyydämme ostajaa ottamaan yhteyttä lähimpään ABB:n myyntikonttoriin.

Moottorin huoltoa ja korjaustoimenpiteitä suorittavan henkilön on oltava pätevä ja turvallisuusmääräykset tunteva ammattilainen, jolla on asianmukaiset työkalut ja –välineet.

Ongelma	Aiheuttaja	Suosittelava toimenpide
Moottori ei käynnisty	Sulake palanut	Vaihda oikean tyyppinen ja nimellisarvoinen sulake.
	Ylikuormalaukaisu	Tarkista ja nollaa ylikuormalaukaisu käynnistimeltä
	Väärä syöttöjännite	Tarkista että syöttöjännite on arvokilven mukainen
	KytKentä väärä	Tarkista kytkennät moottorin mukana toimitet- tavasta kytkentäkaavioista ja arvokilvestä
	Katkos käämissä tai ohjauspiirissä	Kytkimen ollessa suljettuna tunnistetaan se surise- vasta äänestä. Tarkista löysät johtokytkimet. Tarkista myös, että ohjauskytkimet sulkeutuvat.
	Mekaaninen vika	Tarkista, että moottori ja käyttö pyörii vapaasti. Tarkista laakerointi ja voitelu.
	Käämin oikosulku	Tunnistetaan palaneesta sulakkeesta ja mittaamal- la. Moottori täytyy käämiä uudelleen.
	Käämin heikot kytkennät	Avaa moottori, paikallista vika mittaamalla.
	Viallinen roottori	Tarkista roottoritankojen ja oikosulkurenkaiden kunto.
	Moottori saattaa olla ylikuormitettu	Vähennä kuormitusta
Moottori pysähtynyt	Jännitekatkos	Sulakkeet palaneet, tarkista ylikuormitusrele, staattori ja painonapit
	Vääränlainen moottori sovellukseen	Vaihda moottorityyppi ja -koko. Ota yhteys valmistajaan.
	Ylikuormitus	Vähennä kuormitusta.
	Alhainen jännite	Katso, että arvokilven jännitettä on noudatettu. Tarkista kytkennät.
Moottori käynnistyy, sitten pysähtyy	Syöttöjännitevika	Tarkista löysät kytkennät, sulakkeet ja ohjauspiiri.
Moottori ei saavuta nimellinopeuttaan	Vääränlainen moottori	Ota yhteyttä toimittajaan oikean moottorin valinnasta.
	Jännite moottorinliittimillä liian alhainen johtuen jännitehäviöistä	Käytä korkeampaa jännitettä tai käynnistys- muuntajaa. Pienennä kuormaa. Tarkista kytkennät. Tarkista kaapelien oikea koko.
	Käynnistettäessä kuorma liian suuri.	Tarkista moottorin maksimikuormitus käynnistettäessä.
	Roottori rikkoutunut	Katso mahdolliset murtumat oikosulkurenkaassa. Yleensä tarvitaan uusi roottori.
Moottorin kiihdytysaika liian pitkä ja/tai moottori ottaa liikaa virtaa	Ylikuormitus	Vähennä kuormitusta
	Hitausmomentti liian suuri	Tarkista käytön mitoitus
	Käynnistysajan aikana liian alhainen käynnistysjännite	Tarkista johtimien koko jännitehäviöiden perusteella.
	Viallinen roottori	Vaihda uusi roottori.
	Syöttöjännite liian alhainen	Tarkista syöttöjännite.
Väärä pyörimissuunta	Väärä vaihejärjestys	Vaihda kytkentä moottorin liittimillä tai kytkintaulussa.
Moottori ylikuumenee	Ylikuormitus	Vähennä kuormitusta
	Runko tai jäähdytysaukot saattavat olla likaiset tai tukossa ja haittaavat moottorin asianmukaista tuuletusta	Puhdista moottori ja varmista esteetön ilmankierto.
	Moottorissa voi olla yksi vaihe poikki	Tarkista kytkentä.
	Maasulku	Paikallista ja korjaa
	Epäsymmetrinen syöttöjännite moottoriliittimille	Tarkista johtimet, kytkennät ja muuntajat.

Ongelma	Aiheuttaja	Suositeltava toimenpide
Moottori tärisee	Linjaus väärä.	Linjaa moottori oikein
	Moottorin alusta heikko.	Vahvista alusta.
	Kytkin epätasapainossa.	Tasapainota kytkin.
	Käytettävä laite epätasapainossa	Tasapainota laite uudelleen.
	Vialliset laakerit	Vaihda laakerit
	Roottorin tasapainotus muuttunut	Tasapainota roottori uudelleen.
	Roottorin ja kytkimen tasapainotus eroaa (puoli kiila – täysi kiila)	Tasapainota kytkin uudelleen.
	Kolmivaiheinen moottori käy yksi-vaiheisena	Tarkista kytkennät.
	Liian suuri aksiaalivälitys	Tarkista laakerointi.
Hankaava ääni	Tuuletin hankaa suojukseen	Korjaa tuuletin/suojus.
	Tuuletin koskettaa eristykseen	Estä kosketus.
	Moottori irronnut alustastaan	Kiristä kiinnityspultit ja tarkista linjaus
Meluinen käyntiään	Ilmaväli ei ole keskeinen	Tarkista ohjaussorvaus ja laakerit.
	Roottori epätasapainossa	Tasapainota uudelleen.
Laakereiden kuumeneminen	Puutteellinen voitelu	Voitele laakerit
	Väärä voiteluaine	Valitse oikea voiteluaine.
	Voiteluainetta liikaa	Vähennä voiteluaineen määrää.
	Laakerit likaantuneet tai voiteluaine vanhentunut	Poista vanha voiteluaine, puhdista laakerit ja vaihda uusi voiteluaine.
	Ylikuormitetut laakerit	Tarkista linjaus, säteis- ja aksiaalivoimat.
	Laakeri vioittunut	Vaihda laakerit ja puhdista laakeripesä huolellisesti
	Taipunut tai rikkoutunut akseli	Vaihda roottori.
	Liiallinen hihnan kireys	Tarkista kireys.
	Hihnapyörät liian leveä.	Tarkista leveys.
	Hihnapyörän halkaisija liian pieni	Käytä halkaisijaltaan suurempaa hihnapyörää.
	Moottori ei ole linjassa.	Linjaa moottori uudelleen.

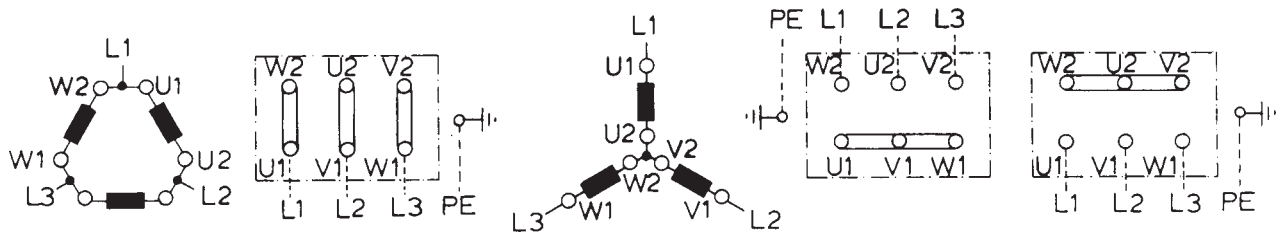


Figure 1. Connection diagram
 Bild 1. Anschlußdiagramm
 Figure 1. Connection
 Figura 1. Conexión
 Figura 1. Collegamento
 Figur 1. Anslutningdiagramm
 Kuva 1. KytKentäkaavio

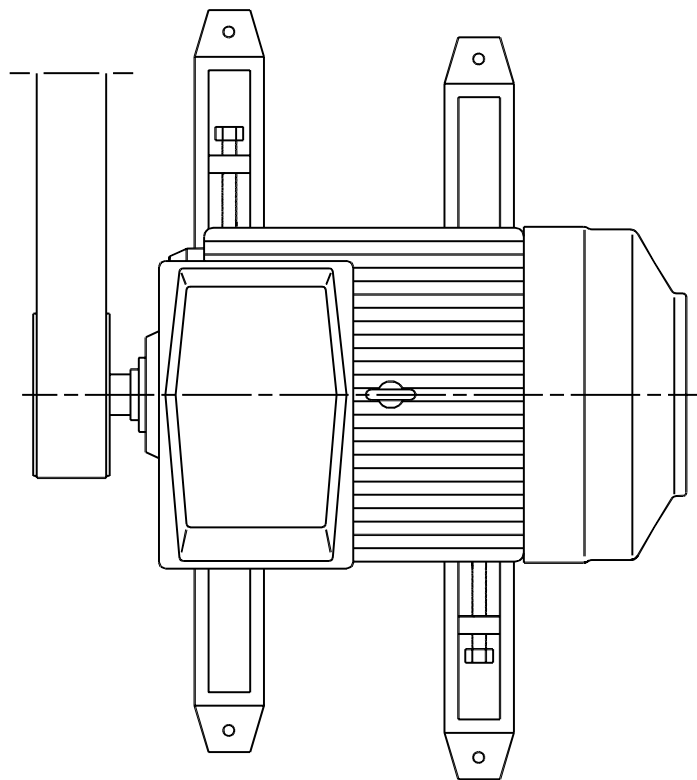


Figure 2. Belt drive
 Bild 2. Riementrieb
 Figure 2. Glissières et entraînements à courroie
 Figure 2. Carriles tensores y correas
 Figura 2. Slitte tendicinghia e pulegge
 Figur 2. Remdrift
 Kuva 2. Hihnakäyttö

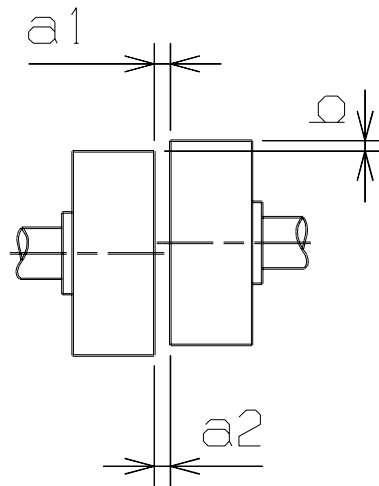


Figure 3. Mounting of half-coupling or pulley
 Bild 3. Anbau von Kupplungshälften und Riemenscheiben
 Figure 3. Montage des demi-accouplements et des poulies
 Figura 3. Montaje de mitades de acoplamiento y poleas
 Figura 3. Montaggio di semigiunti e pulegge
 Figur 3. Montering av kopplinshalvor och drivskivor
 Kuva 3. Kytkinpuolikkaan ja hihnapyörän asennus

Drive^{IT} Low Voltage Motors

Manufacturing sites (*) and some of the biggest sales companies.

Australia

ABB Industry Pty Ltd
2 Douglas Street
Port Melbourne,
Victoria, 3207
Tel: +61 (0) 3 9644 4100
Fax: +61 (0) 3 9646 9362

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ABB AG
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Fax: +43 (0) 1 601 09 8305

Belgium

Asea Brown Boveri S.A.-N.V.
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Fax: +32 (0) 2 718 6657

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West, Saint-Laurent, Quebec
Canada H4S 1N6
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Fax: +1 514 332-0609

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Automation Technology Electrical
Machines
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LV Motors
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Fax: +41 (0) 58 586 0603

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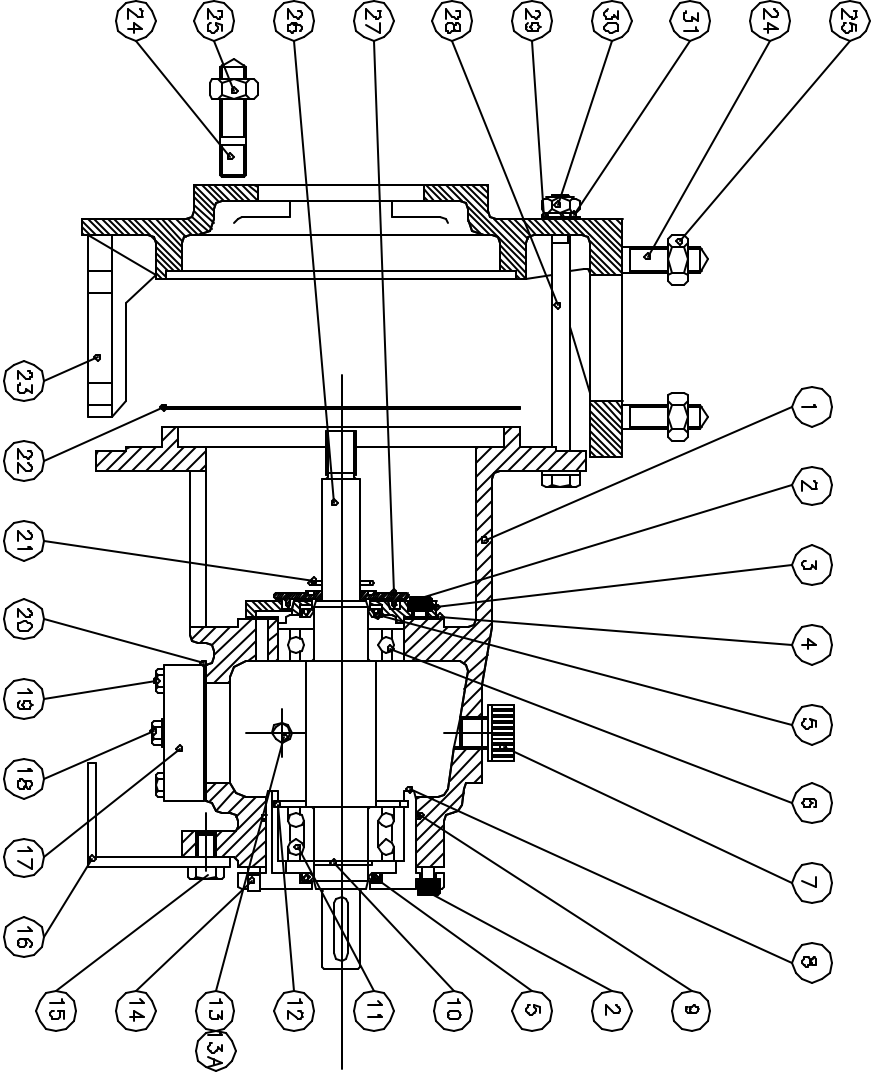
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Fax: +1 262 785 8628

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Carmelitas,
Caracas 1010A
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Fax: +58 (0) 2 239 6383



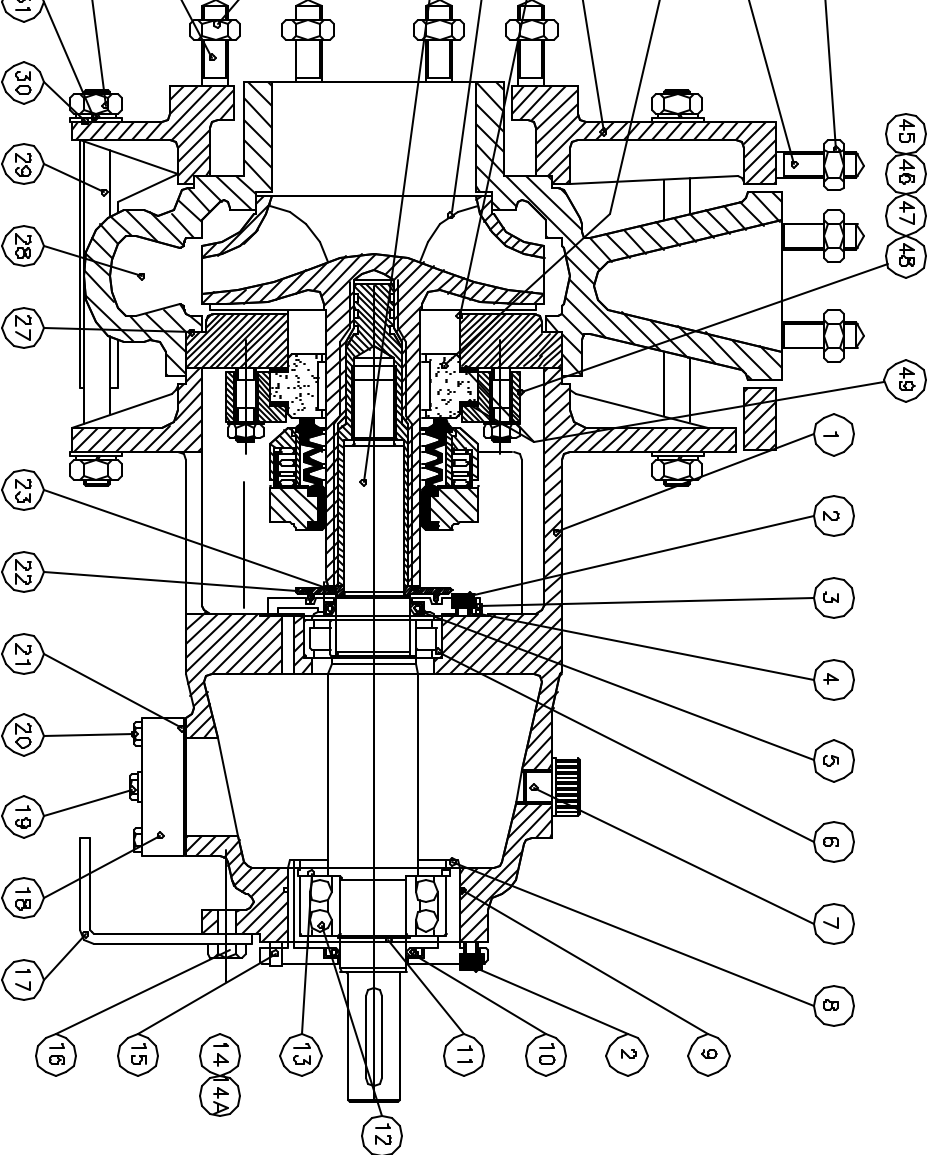


ITEM	DESCRIPTION	PART No.	MATERIAL	QTY.
				0
01	BEARING HOUSING	M16780	CAST IRON	1
02	SOCKET CAP SCREW		STEEL GR. 8.8	8
03	BEARING COVER	M16772	CAST IRON	1
04	BEARING COVER GASKET	M16773	OIL PAPER	1
05	OIL SEAL B.S. 1399		NITRILE	2
06	BALL BEARING		STEEL	1
07	BREATHER 1\2" BSP		STEEL\ALUMIN.	1
08	BEARING CARRIER	M16770	CAST IRON	1
09	O RING		NITRILE	1
10	CIRCLIP (EXT.)		STEEL	1
11	DBL. ANG. CONT. BRG.		STEEL	1
12	INT. CIRCLIP		STEEL	1
13	OILER		GLASS\STEEL	1
13A	BARREL NIPPLE (NOT SHOWN)		STEEL	1
14	DOG HD. SKT. SCREW		STEEL GR. 8.8	4
15	HEX. HD. SETSCREW		STEEL GR. 4.6	1
16	FOOT	M16781	STEEL FAB.	1
17	WINDOW COVER (PLAIN)	M16784	STEEL	1
18	DRAIN PLUG		STEEL	1
19	HEX. HD. BOLT		STEEL GR. 4.6	4
20	WINDOW COVER GASKET	M16783	PERMANITE	1
21	O RING		NITRILE	1
22	GASKET - VOLUTE	M16789	PERMANITE	1
23	CASING CLAMP PLATE	M16779	CAST IRON	1
24	STUD		STEEL GR. 4.6	12
25	HEX NUT		STEEL GR. 4.6	12
26	SHAFT	M16771	STL BS 970EN8	1
27	FLINGER	M16774	ST / STEEL	1
28	HEX HD. BOLT		STEEL GR. 4.6	8
29	WASHER		STEEL	16
30	HEX. NUT		STEEL GR. 4.6	8
31	SPRING WASHER		SPRING STEEL	8
32	WASHER		STEEL	8

NOTE:
ALL FASTENERS TO BE ELECTRO ZINC PLATED



SURFACE TEXTURE ALL DIMENSIONS IN mm	MATERIAL	ISS	CHANGE	SIG	DATE
MACHINE AT N9	UNSPECIFIED LIMITS	TITLE SECTIONAL	ARRGT.	SCALE 1 : 2	
LIMIT UNLESS	MACHINED +/- 0.5	KSI 50/160 BRG. HSG	SHEET 1 OF		
STATED OTHERWISE	UNMACHINED +/- 1.0	HEAT TREAT / FINISH	NUMBER		
			M 16792		ISS01

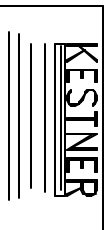


TYPICAL ASSEMBLY OF KSI GROUP II MODEL PUMPS
FITTED WITH JOHN CRANE 10T/10R TYPE
MECHANICAL SHAFT SEALS.

VOLUTE BOLT (NOT SHOWN)
SPECIAL WASHER (NOT SHOWN)
SPECIAL WASHER (NOT SHOWN)
GUARD (NOT SHOWN)

ITEM	DESCRIPTION	PART No.	MATERIAL	QTY.
01	BEARING HOUSING		CAST IRON	1
02	SOCKET CAP SCREW		STEEL GR. 8.8	8
03	BEARING COVER		CAST IRON	1
04	BEARING COVER GASKET		OIL PAPER	1
05	OIL SEAL B.S. 1399		NITRILE	1
06	BEARING		STEEL	1
07	BREATHER		STEEL\ALUMIN.	1
08	BEARING CARRIER		CAST IRON	1
09	O RING		NITRILE	1
10	OIL SEAL		NITRILE	1
11	CIRCLIP (EXT.)		STEEL	1
12	BEARING		STEEL	1
13	INT. CIRCLIP		STEEL	1
14	OILER		GLASS\STEEL	1
14A	BARREL NIPPLE (NOT SHOWN)		STEEL	1
15	DOG HD. SKT. SCREW		STEEL GR. 8.8	4
16	HEX. HD. SETSCREW		STEEL GR. 4.6	1
17	FOOT		STEEL FAB.	1
18	WINDOW COVER (PLAIN)		STEEL	1
19	DRAIN PLUG		STEEL	1
20	HEX. HD. BOLT		STEEL GR. 4.6	4
21	WINDOW COVER GASKET		PERMANITE	1
22	FLINGER		MILD STEEL	1
23	O RING		VITON	1
27	VOLUTE GASKET		PERMANITE	1
28	VOLUTE		SILICON IRON	1
29	SPECIAL STUD		STEEL GR. 4.6	8
30	WASHER		STEEL GR. 4.6	34
31	SPRING WASHER		SPRING STEEL	16
32	HEX. NUT		STEEL GR. 4.6	34
33	STUD		BZP	12
34	SHAFT		STEEL EN8	1
35	CASING CLAMP PLATE		CAST IRON	12
38	IMPELLER ASSY.		SILICON IRON	1
38	CASING BACKPLATE		SILICON IRON	1
39	CRANE 10 T SEAL		PITE	1
42	HEX. HD. BOLT		STEEL GR. 4.6	2
43	SPECIAL WASHER		STEEL	2
44	SPECIAL WASHER		NITRILE	2
45	SEAL CLAMP PLATE		ST. STEEL	1
46	STUDS		ST. STEEL	6
47	WASHER		ST. STEEL	6
48	HEX NUTS		ST. STEEL	6
49	SEAL GASKETS		PITE	2
50	SEAL GUARD		CLEAR PVC	1

PARTS LIST FOR KSI BQ/200 -- TYPICAL

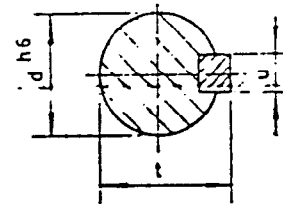
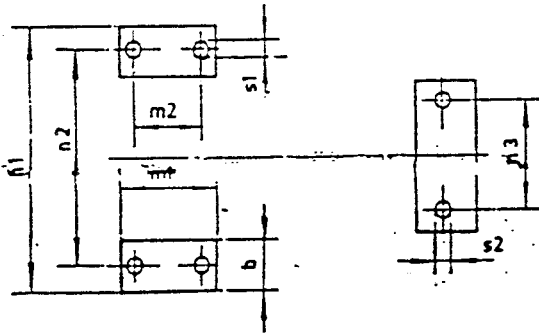
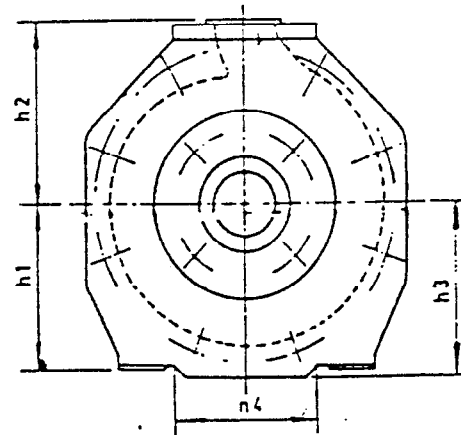
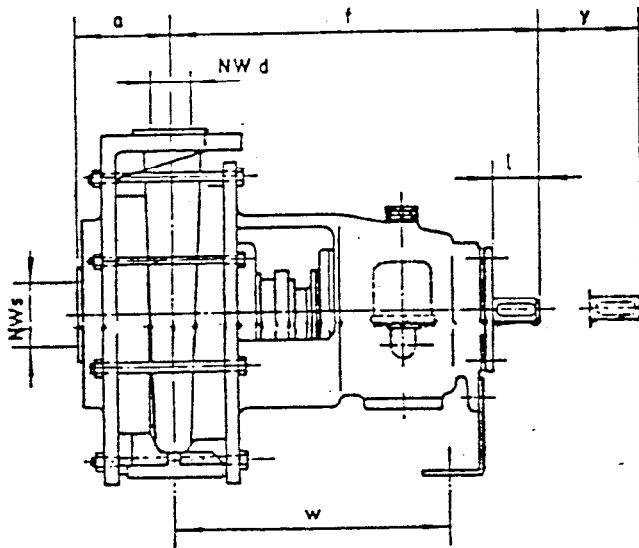


SURFACE TEXTURE ALL DIMENSIONS IN mm
MACHINE ATIN9 UNINSPECIFIED LIMITS
LIMIT UNLESS MACHINED +/- 0.5
STATED OTHERWISEBDMACHINED +/- 1.0

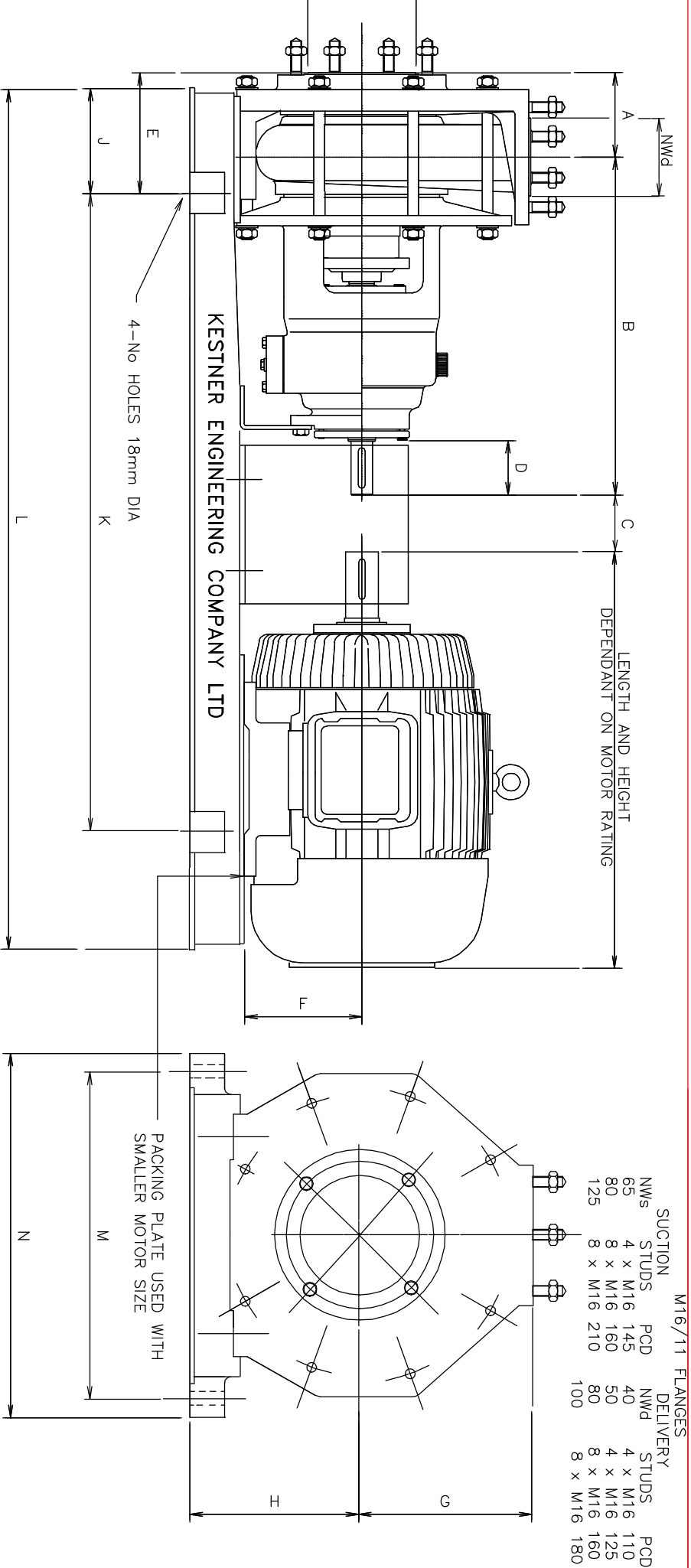
MATERIAL
HEAT TREAT / FINISHNUMBER

ISS	CHANGE	SIG	DATE
1	TITLE TYPICAL ASSY. DRAWING		
2	KSI PUMPS (TYPE 10T SEAL)		
3	M16905		
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FLANGES - TAPPED HOLES AS PER DIN 2533



100-200	100	125	125	500	200	280	205	80	160	120	360	280	110	200	18	14	370	140	32	80	35	10
80-250	80				225		230				400	315		240								
80-200					180	250	185				345	280		215								
50-315	50	80			225	280	230	65	125	95												
50-250				180	225	185				320	250	190										
50-200						200							14									
50-160			100	385	160		163				265	212		140			285	24	50	27	8	
40-200	40	65			180		50	100	70													
40-160			80		132	160	138				240	190	135									
SIZE	NWd	NWs	a	f	h1	h2	h3	b	m1	m2	n1	n2	n3	n4	s1	s2	w	y	d ^{h6}	l	t	u
	FLANGE		PUMP DIMN.					FOOT DIMENSIONS										SHAFT DIMN.				
KSI RANGE			HIGH SILICON IRON PUMP TO ISO 2858 STANDARD.															DRG K41759				



PUMP TYPE		FLANGES			PUMP										MOUNTING			
	NWS	NWD	RATING	A	B	C	D	E	F	G	H	J	K	L	M	N		
KSI 40-160	65	40	M16/11	80	385	100	50	155	132	160	197	146	642	934	332	380		
KSI 40-200	65	40	M16/11	100	385	100	50	175	160	180	225	146	776	1068	384	432		
KSI 50-160	80	50	M16/11	100	385	100	50	175	160	180	225	146	776	1068	384	432		
KSI 50-200	80	50	M16/11	100	385	100	50	175	160	200	225	146	776	1068	384	432		
KSI 50-250	80	50	M16/11	125	500	100	80	240	180	225	260	206	964	1376	522	570		
KSI 50-315	80	50	M16/11	125	500	100	80	240	225	280	305	206	964	1376	522	570		
KSI 80-200	125	80	M16/11	125	500	100	80	240	180	250	260	206	964	1376	522	570		
KSI 80-250	125	80	M16/11	125	500	100	80	240	225	280	305	215	1036	1466	580	628		
KSI 100-200	125	100	M16/11	125	500	140	80	240	200	280	280	215	1036	1466	580	628		

GENERAL ARRANGEMENT OF KSI MODEL HORIZONTAL CENTRIFUGAL PUMP TO ISO 2858 STANDARD

OTHER FLANGE DRILLINGS IE BST 'D' OR ANSI 150 OPTIONAL (NON-ISO STANDARD)

M16/11 FLANGES				SUCTION				DELIVERY			
NWS	STUDS	PCD	NWD	NWS	STUDS	PCD	NWD	NWS	STUDS	PCD	NWD
65	4 x M16	145	40	40	4 x M16	110	40	40	4 x M16	110	40
80	8 x M16	160	50	50	4 x M16	125	50	50	4 x M16	125	50
125	8 x M16	210	80	80	8 x M16	160	80	80	8 x M16	160	80
			100				100				100

KESTNER PUMPING & LIMITED										ISS	CHANGE	SIG	DATE		
Bredgford Road, Gillingham Kent, ME9 8PH Tel: +44 (0)1843 366823 Fax: +44 (0)1843 366824 Internet: www.kestner-eng.co.uk										TITLEGENERAL ARRANGEMENT OF KSI PUMP RANGE				SCALE NTS	
SURFACE TEXTURE ALL DIMENSIONS IN mm										SHEET 1					
MACHINE AT N9 UNspecified LIMITS															
LIMIT UNLESS MACHINED +/- 0.5										HEAT TREAT/FINISH				ISS	
STATED OTHERWISEMACHINED +/- 1.0										NONE				M 16738 01	

KESTNER

Engineering Co. Limited

Bredgar Road, Gillingham,
Kent, ME 8 6 PN.
England



Telephone 01634 ~ 386683
Fax 01634 ~ 386684
Intl Tel + 44 ~1634 ~ 386683
Intl Fax + 44 ~1634 ~ 386684

Internet www.kestner-eng.co.uk
E-mail Sales@kestner-eng.co.uk

DECLARATION OF INCORPORATION

THE MANUFACTURER:- KESTNER ENGINEERING CO. LTD.

HEREBY DECLARES THAT:-

THE PRODUCTS:- CENTRIFUGAL PUMP UNITS
MODELS MJ, MH, MHC, KSI, KHS, KRL.

ARE IN CONFORMITY WITH THE EUROPEAN HARMONISED STANDARDS
COVERING THE SUPPLY OF MACHINERY (SAFETY) REGULATIONS 1992.

ADDITIONAL INFORMATION:-

THE EQUIPMENT SHALL **NOT** BE PROVIDED WITH A CE MARK.

BY DESIGN, THE MACHINES, CONSIDERED AS COMPONENTS OF A SYSTEM,
COMPLY WITH THE REQUIREMENTS OF THE MACHINERY DIRECTIVE
REGULATIONS (1992) - (SI 1992/3073) PROVIDED THAT THE INSTALLATION BE
CORRECTLY REALISED BY THE PURCHASER OF THE MACHINERY.
FOR EXAMPLE IN COMPLIANCE WITH OUR INSTALLATION INSTRUCTIONS
AND THOSE OF THE ELECTRIC MOTOR INSTRUCTIONS (IF SUPPLIED) OR
OTHER ANCILLARY EQUIPMENT SUPPLIED.

(Continued on Page 2)

NOTE:-

THIS MACHINERY MUST NOT BE PUT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF THE MACHINERY DIRECTIVE.

SIGNED:-

A handwritten signature in black ink, appearing to read 'B. Copley', with a long horizontal stroke extending to the right.

NAME:-

BARRY COPLEY

POSITION:-

DIRECTOR

FOR AND ON BEHALF OF:-

KESTNER ENGINEERING CO. LTD.

BREDGAR ROAD, GILLINGHAM.

KENT. ME 8 6 PN.

ENGLAND.

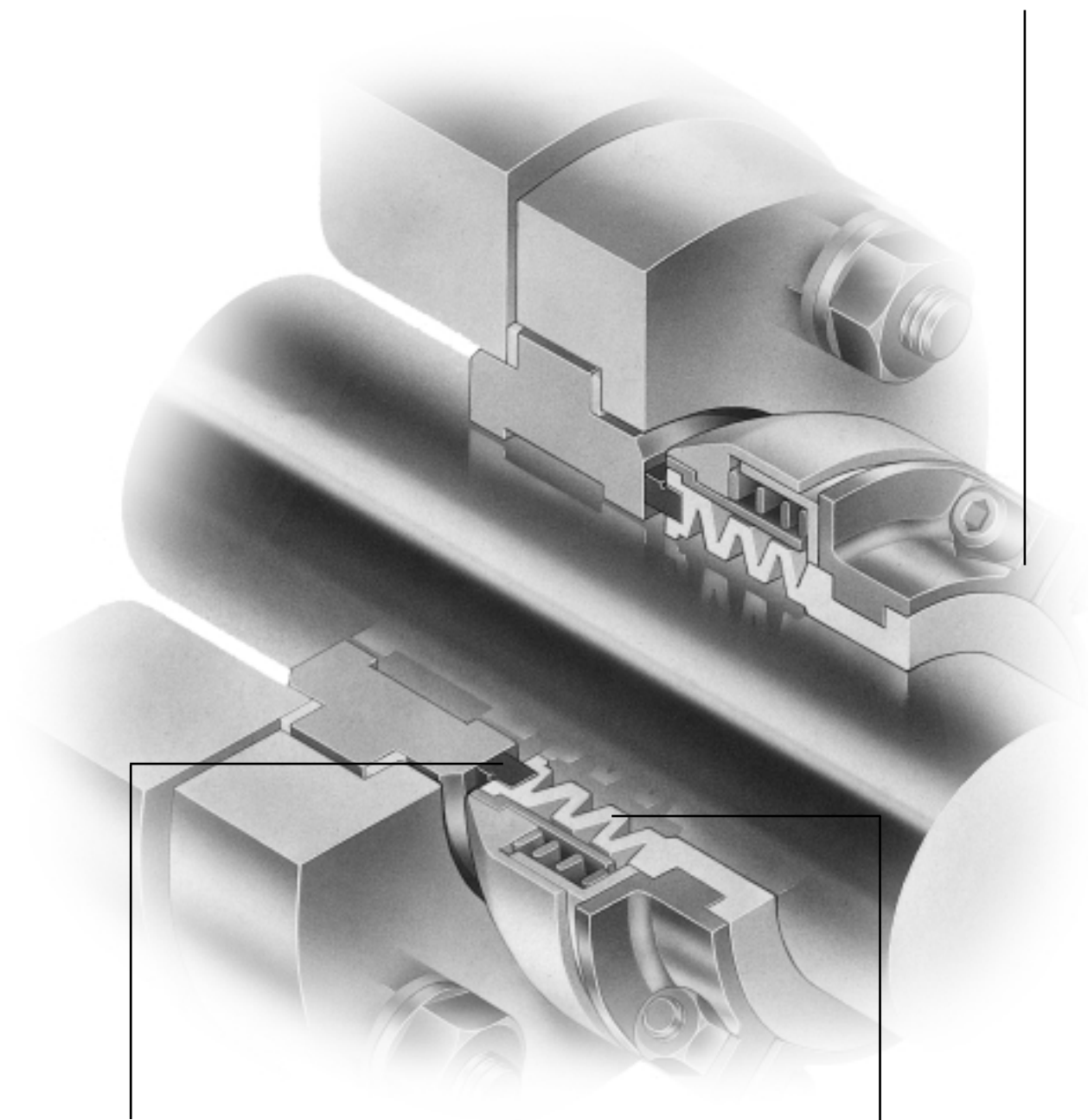


10T/10R PTFE BELLOWS SEALS

Design Features

Mechanical Drive Design

Prevents slippage on shaft or sleeve to eliminate galling and premature wear.



Replaceable Seal Face

The Type 10R seal has a replaceable face insert so that different face materials can be used to handle a wide range of corrosive and abrasive liquids.

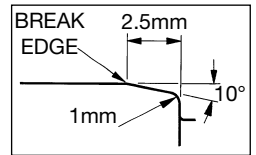
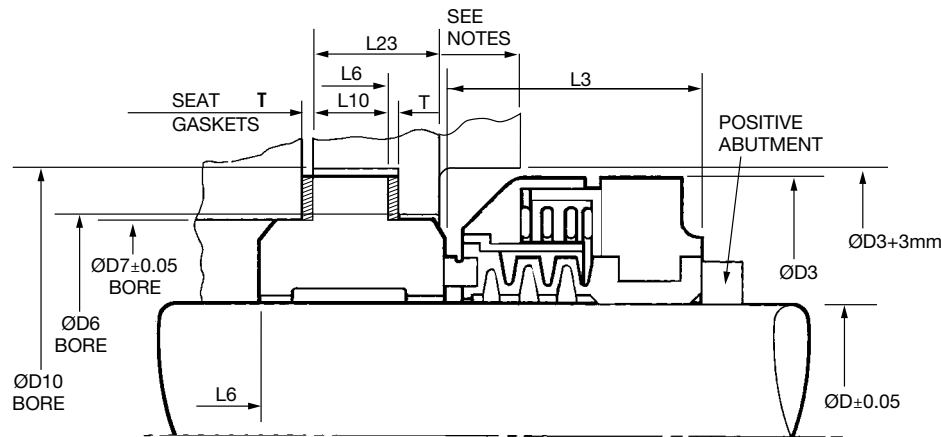
Flexible PTFE Bellows Design

Maximum corrosion resistance. Eliminates the possibility of seal face misalignment. Compensates for shaft run-out to promote low-maintenance, long-life operation.



10T/10R PTFE BELLOWS SEALS

Type 10T and 10R Typical Arrangement/Dimensional Data - Small Sizes (mm)



For ease of installation, the lead-in edge of the shaft or sleeve should be chamfered as shown.

D19=DIA. OF SWING OF CLAMP SCREWS

Chart 1. Type 10T and 10R Dimensional Data - Small Sizes (mm)

D (mm)	Seal Size Code (Metric)	D (In.)	Seal Size Code (In.)	Seal Size Code (Metric & In.)	D3	D6	D7	D10	D19	L3	L6	L10	L23	T
16	0160	0.750	0190	0190	54	37.5	36.51	48	60	31	4.8	8.0*	14*	0.8
18	0180	-	-	0190	54	37.5	36.51	48	60	31	4.8	8.0*	14*	0.8
20	0200	0.875	0222	0222	57	40.5	39.69	51	64	31	4.8	8.0*	16*	0.8
22	0220	-	-	0222	57	40.5	39.69	51	64	31	4.8	8.0*	16*	0.8
24	0240	1.000	0254	0254	61	43.5	42.86	54	65	33	4.8	8.0*	16*	0.8
25	0250	-	-	0254	61	43.5	42.86	54	65	33	4.8	8.0*	16*	0.8
28	0280	1.125	0285	0317	67	51.5	50.80	61	73	36	5.5	9.5	15	1.6
30	0300	1.250	0317	0349	70	55.0	53.98	68	75	37	6.4	9.5	16	1.6
32	0320	-	-	0349	70	55.0	53.98	68	75	37	6.4	9.5	16	1.6
33	0330	1.375	0349	0381	73	58.0	57.15	71	78	38	6.4	9.5	16	1.6
35	0350	-	-	0381	73	58.0	57.15	71	78	38	6.4	9.5	16	1.6
38	0380	1.500	0381	0412	76	64.5	63.50	77	79	38	6.4	9.5	18	1.6
40	0400	1.625	0412	0444	80	67.5	66.68	80	83	40	6.4	9.5	18	1.6
43	0430	1.750	0444	0476	83	71.0	69.85	83	86	40	6.4	9.5	19	1.6
45	0450	-	-	0476	83	71.0	69.85	83	86	40	6.4	9.5	19	1.6
-	-	1.875	0476	0508	86	74.0	73.03	90	91	43	6.4	12.7	19	1.6
48	0480	2.000	0508	0539	89	80.0	79.38	96	92	43	6.4	12.7	19	1.6
50	0500	-	-	0539	89	80.0	79.38	96	92	43	6.4	12.7	19	1.6
53	0530	2.125	0539	0571	103	83.5	82.55	99	105	53	6.4	12.7	19	1.6
55	0550	2.250	0571	0603	107	86.5	85.73	102	110	53	6.4	12.7	19	1.6
58	0580	2.375	0603	0635	110	89.5	88.90	106	113	53	6.4	12.7	20	1.6
60	0600	-	-	0635	110	89.5	88.90	106	113	53	6.4	12.7	20	1.6
63	0630	2.500	0635	0666	113	93.0	92.08	109	116	53	6.4	12.7	22	1.6
65	0650	2.625	0666	0698	116	96.0	95.25	112	119	53	6.4	12.7	22	1.6
68	0680	2.750	0698	0730	118	99.0	98.43	115	122	53	6.4	12.7	24	1.6
70	0700	-	-	0730	118	99.0	98.43	115	122	53	6.4	12.7	24	1.6
-	-	2.875	0730	0762	122	102.5	101.60	118	126	53	6.4	12.7	24	1.6
75	0750	3.000	0762	0793	126	104.0	103.17	120	126	53	6.4	12.7	25	1.6

† Consult your John Crane Sales/Service Engineer.

If the recommended L23 clamp plate dimension is exceeded, or if L23 is greater than L6 + L10, the clamp plate must be recessed as shown under Specifications to L23 thickness and diameter D3 + 3mm so that it is not proud of the seat face to ensure adequate clearance of the seal even after wear has occurred.

To ensure a minimum clearance around the seal head, no part of the clamp plate nuts/bolts should come within ØD3 + 6.

To prevent bowing of the clamp plate, the P.C.D. of the fixing bolts should not exceed the seat outside diameter by more than two fixing bolt diameters. Bolts must be provided with clearance holes.

*VM Seats



10T/10R PTFE BELLOWS SEALS

Type 10T and 10R Typical Arrangement/Dimensional Data - Large Sizes (mm)

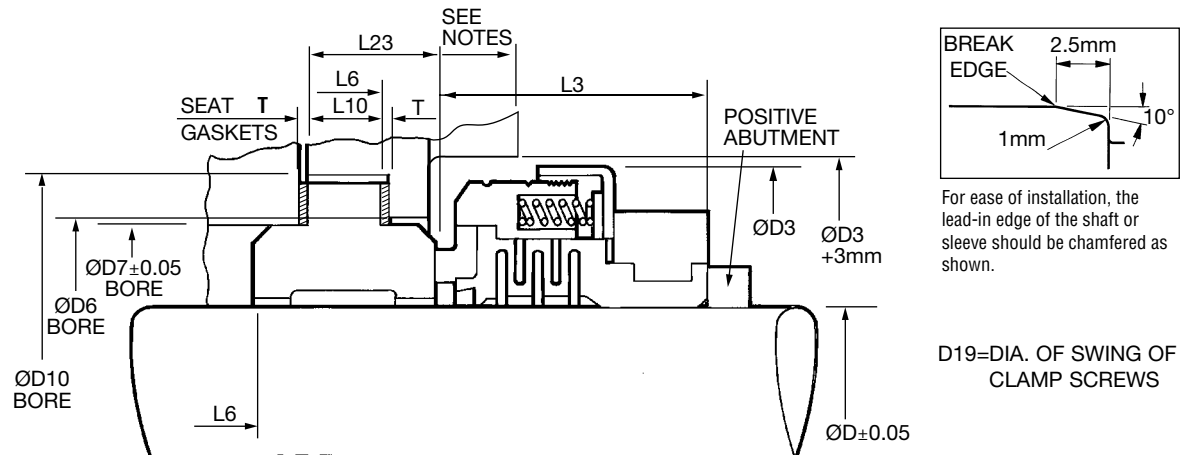


Chart 2. Type 10T and 10R Dimensional Data - Large Sizes (mm)

D (mm)	Seal Size Code (Metric)	D (In.)	Seal Size Code (In.)	Seal Size Code (Metric & In.)	D3	D6	D7	D10	D19	L3	L6	L10	L23	T
80	0800	3.250	0825	0889	150	115.0	114.30	131	164	73	6.4	12.7	27	1.6
85	0850	3.500	0889	0952	156	121.5	120.65	137	170	73	6.4	12.7	28	1.6
90	0900	3.750	0952	1016	163	128.0	127.00	144	177	73	6.4	12.7	30	1.6
95	0950	-	-	1016	163	128.0	127.00	144	177	73	6.4	12.7	30	1.6
100	1000	4.000	1016	1079	169	137.5	136.53	153	183	73	6.4	12.7	39	1.6

Notes: Type 10T and 10R seals can be supplied up to 165mm/6.500in. diameter. For diameters over 100mm/4.000in. consult your John Crane Sales/Service Engineer.

† Consult your John Crane Sales/Service Engineer.

If the recommended L23 clamp plate dimension is exceeded, or if L23 is greater than L6 + L10, the clamp plate must be recessed as shown under Specifications to L23 thickness and diameter D3 + 3mm so that it is not

proud of the seat face to ensure adequate clearance of the seal even after wear has occurred.

To ensure a minimum clearance around the seal head, no part of the clamp plate nuts/bolts should come within ØD3 + 6

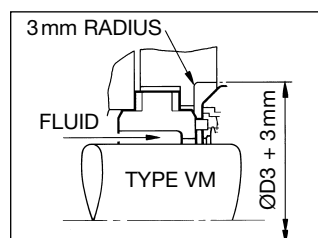
To prevent bowing of the clamp plate, the P.C.D. of the fixing bolts should not exceed the seat outside diameter by more than two fixing bolt diameters. Bolts must be provided with clearance holes.

Positive Abutment

It is recommended that a positive abutment is always provided at the back of the bellows. The outside diameter of the abutment ring (or shaft shoulder) should be related to the seal size, as follows:

Seal Sizes	Outside Diameter = Shaft Diameter +
16 to 25mm	7.00mm/0.28in.
28 to 76mm	10.00mm/0.40in.
82 to 100mm	13.00mm/0.51in.

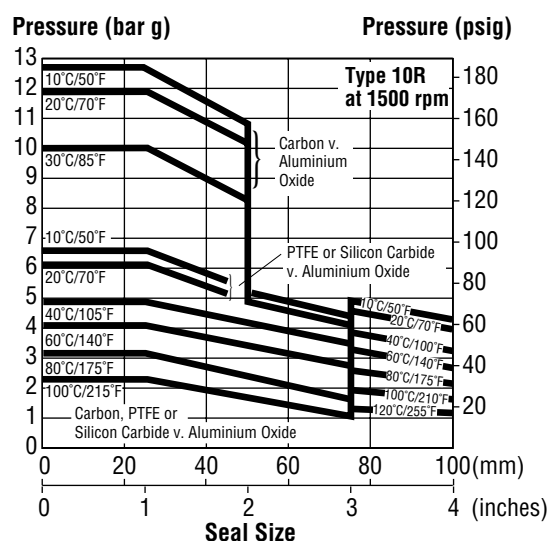
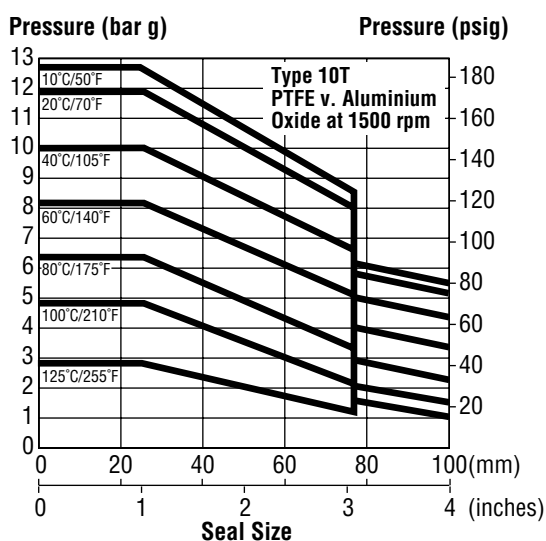
'VM' Seat



Seat type 'VM' for seal sizes 16 to 25mm/0.750 to 1.000in. is used to promote increased fluid flow to the seal faces.

**10T/10R****PTFE BELLOWS SEALS****Chart 3. Operating Limits**

Pressure		Temperature	Speed
Operating	Static Test		
Refer to Chart 4	20°C/70°F: 11 bar g/150 psig 60°C/140°F: 8 bar g/110 psig 100°C/210°F: 5 bar g/65 psig 120°C/250°F: 3 bar g/40 psig	-45°C to +120°C/ -50°F to +250°F	16 m/s/ 3150 fpm and 4000 rpm Maximum

Chart 4. Pressure/Velocity (PV) Limits**Example for determining PV Limits:**

To determine the maximum operating pressure for the required size of Type 10T or 10R seal, refer directly to the appropriate graph in Chart 4. These values are correct at 1500 rpm.

For shaft speeds other than 1500 rpm (where these are permissible), multiply the pressure obtained from the graph by a correction factor as follows.

1000 rpm (All seal sizes)	x 1.3
3000 rpm (Sizes up to 75mm/3in. only)	x 0.9
4000 rpm (Sizes up to 75mm/3in. only)	x 0.8

The maximum operating speed for seals up to 75mm/3in. shaft diameter is 4000 rpm: above 75mm/3in. the limit is 1500 rpm. Type 10R silicon carbide face inserts must not be used at a velocity greater than 7.5m/s/1500 fpm.

The operating parameters shown are the recommended limits for continuous operation, and can be exceeded by a reasonable amount for limited periods. If the required performance is outside the specified limits, contact your John Crane Sales/Service Engineer.

Note: If the seal is required to handle water, e.g., on test or for cleaning, 0.1% of a suitable wetting agent should be added.



10T/10R PTFE BELLOWS SEALS

Chart 5. Material Availability

SEAL COMPONENTS	MATERIALS	
	Standard	Optional
Bellows	Composite PTFE	-
Gasket	Glass Filled PTFE	-
Face Insert	Sintered Silicon Carbide Resin Impregnated Carbon Graphite	Carbon Filled PTFE
Thrust Ring (Small) Spring Shroud	Glass Filled PTFE	-
Thrust Ring (with Pins) (Large) Thrust Washer (Large) Half Clamp Cap Head Screw Self-Locking Nut	316 Stainless Steel	-
Support Sleeve (Small)	PTFE Coated 316 Stainless Steel	-
'VG' Seat 'VM' Seat	99.5% Aluminium Oxide Ceramic	Sintered Silicon Carbide
Spring (Small Sizes) Springs (Large Sizes)	PVDF Coated 316 Stainless Steel 316 Stainless Steel	- -

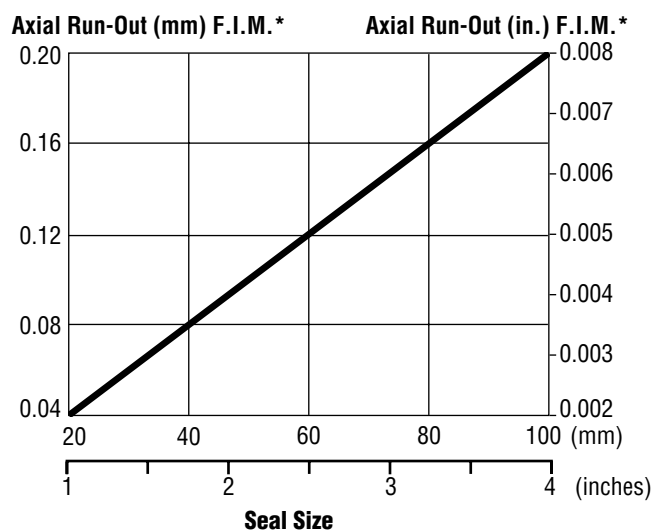
Chart 6. Criteria for installation

Shaft/Sleeve	Limits
Surface Finish	0.8 to 1.2 μm Ra Fine Machined
Ovality/Out of Roundness	0.013 mm/ 0.0005 in.
Dynamic End Play/ Axial Float Allowance	± 0.13 mm/ 0.005 in.
Shaft Squareness to Housing	Refer to Chart 7

Seal Guard

It is essential to provide a guard, preferably of transparent material, around the seal to contain any spray leakage. A suitable means of collection should be included for harmful fluids to facilitate drainage and disposal.

Chart 7. Housing Squareness to Shaft



John Crane Mechanical Seals
Engineered Sealing Systems

North America
Morton Grove, Illinois USA

Tel: 1-847-967-2400
Fax: 1-847-967-3915
1-800-SEALING

Latin America
Mexico City, Mexico

Tel: 52-5-567-4511
Fax: 52-5-587-2342

Europe, Middle East, Africa
Slough, UK

Tel: 44-1753-224000
Fax: 44-1753-224224

Asia Pacific
Singapore

Tel: 65-222-9161
Fax: 65-223-5035

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



10T/10R PTFE BELLOWS SEALS

S-10T/10R-E

Applications

The Type 10T and 10R seals are designed to use PTFE bellows and are for external mounting on extremely corrosive duties.

- Non-pusher bellows feature eliminates sliding contact with the equipment shaft or sleeve during operation.
- The outer end of the seal bellows is clamped to the shaft or sleeve surface, and the bellows convolutions extend to compensate for seal face wear.
- All surfaces contacting the liquid being sealed are made of chemically inert materials. Metallic components - springs and clamping ring - are located outside the pump stuffing box, isolated from the process liquid.
- The Type 10T face is not replaceable, but the seal has a higher duty pressure and transient pressure rating than the Type 10R.
- The Type 10R seal face is replaceable and can be supplied in hard materials making the seal suitable for abrasive applications.
- The seals incorporate visual wear indicators which show the initial seal setting and the amount of face wear while in service.

Operating Limits

- **Temperatures:** -45°C to +120°C/
-50°F to +250°F
- **Pressures:** Up to 13 bar g/
185 psig
- **Speeds:** Up to 16 m/s/
3150 fpm

Fluids

Acids
Organic Compounds
Salts

10T/10R

METRIC AND
INCH RANGE





I-10T/10R(SM)-E

John Crane Type 10T and 10R Mechanical Seal Instruction Manual

Sizes up to 75 mm
and 3.000 inches

Foreword

This instruction manual is provided to familiarise the user with the seal and its designated use. The instructions must be read and applied whenever work is done on the seal, and must be kept available for future reference.

ATTENTION

These instructions are for the installation and operation of a single Type 10T or 10R seal up to 75 mm or 3 inches, running against a seat/mating ring of appropriate material and design as used in rotating equipment. The information required may change with different types of equipment or installation arrangement, and this manual must be read in conjunction with the instruction manual supplied with the seat/mating ring and the instruction manuals for both the pump and any ancillary equipment.

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

Any warranty may be affected by improper handling, installation, or use of this seal; contact the Company for information as to exclusive product warranty and limitations of liability.

If questions or problems arise, contact your local John Crane Sales/Service Engineer or the original equipment manufacturer, as appropriate.

ATTENTION

John Crane mechanical seals and seats/mating rings are precision products and must be handled appropriately. Take particular care to avoid damage to lapped sealing faces and the PTFE bellows. Do not excessively compress the seal before or during installation.

Safety Instructions

1. The following designations are used in this instruction manual to highlight instructions of particular importance:

NOTE:

Refers to special information on how to install or operate the seal most efficiently.

ATTENTION

Refers to special information or instructions directed towards the prevention of damage to the seal or its surroundings.



Refers to mandatory instructions designed to prevent personal injury or extensive damage to the seal or its surroundings.

2. Installation and removal of the seal must be carried out only by qualified personnel who have read and understood this instruction manual.
3. The seal is designed exclusively for sealing rotating shafts. The manufacturer cannot be held liable for use of the seal for purposes other than this.
4. The seal must only be used in technically perfect condition and in conjunction with a suitable seat/mating ring, and must be operated within the recommended performance limits in accordance with its designated use and the instructions set out in this manual.
5. If the pumped fluid is hazardous or toxic, appropriate precautions must be taken to ensure that any seal leakage is adequately contained. Spray leakage is a particular risk, and it is essential that a splash guard is securely fitted around the seal, the guard must be provided with a transparent window with an easily removable

protective cover. Never inspect an unguarded seal while the pump is running. Further information on sealing hazardous or toxic fluids should be obtained from John Crane prior to installation.

6. PTFE components should never be burned or incinerated as the fumes are highly toxic.

7. Type 10 seals are designed for internal pressure and can operate only against a seal also designed for continuous internal pressure.

Storage and Transport

Instructions for the handling, packaging, storage and transport of seal units and seats/mating rings are given in the John Crane Instruction Sheet ref. I-Storage-E, available on request.

Operating Conditions

The above sizes of the Type 10T and 10R are single spring, PTFE bellows seals designed for aggressive chemical services, and are mounted outside the seal chamber. Type 10T seals have an integral PTFE face and, with some sizes, higher duty and transient pressure ratings than the replaceable face Type 10R.

These instructions apply to the seals as installed in a pump and lubricated by the pumped fluid in accordance with the application information contained in the John Crane Seal Specification Sheet ref. S-10T/10R(SM)-E, and any other John Crane seal selection literature or process. Typical operating limits are shown below.

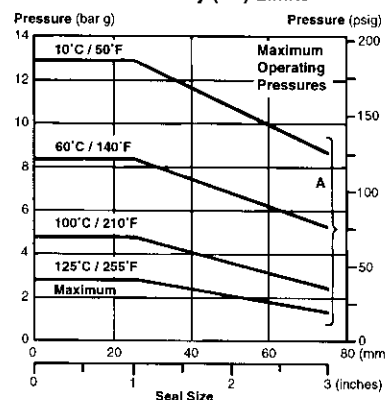
Selection of the seal face/primary ring material should be made with regard to its temperature and chemical resistance/compatibility with the liquid being pumped.

Temperature Limits: -45°C to +125°C / -50°F to +255°F
(refer to PV graphs)

Pressure Limits: Up to 13 bar g / 185 psig (refer to PV graphs)

Speed Limits: Up to 16 m/s / 3150 fpm and 4000 rpm maximum

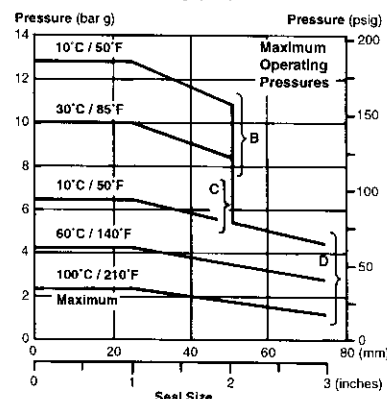
Type 10T Pressure/Velocity (PV) Limits



The maximum operating pressures shown are valid for the specified face/primary ring and seat/mating ring material combinations at 1500 rpm, with a lubricating sealed fluid at the temperatures given.

A - PTFE v. Aluminium Oxide Ceramic

Type 10R Pressure/Velocity (PV) Limits

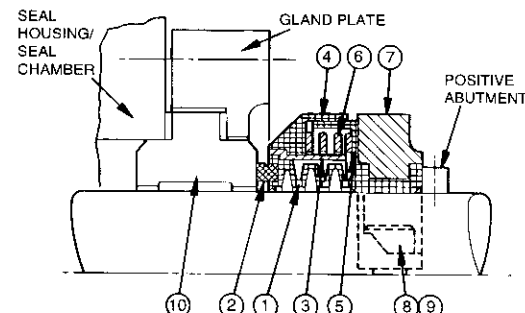


B - Carbon Graphite v. Aluminium Oxide Ceramic

C - PTFE or Silicon Carbide v. Aluminium Oxide Ceramic

D - Carbon Graphite, PTFE, or Silicon Carbide v. Aluminium Oxide Ceramic

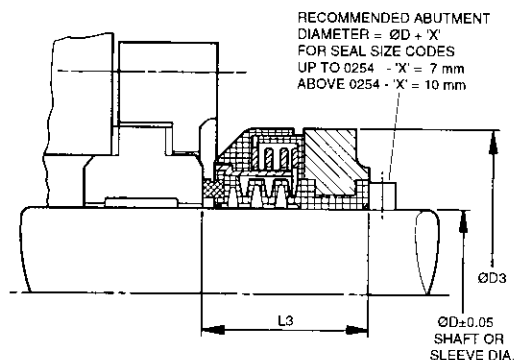
Typical Type 10T/10R Seal Arrangement



Part Name	Part Name	Part Name
1 Bellows	4 Thrust Ring	9 Self-Locking Nut
2 Face/Primary Ring (Integral Face - 10T)	5 Spring Shroud	10 Seat/Mating Ring and Gaskets*
3 Support Sleeve	6 Spring (Face Insert - 10R)	
	7 Half-Clamp	
	8 Cap Head Screw	

*Refer to seat/mating ring instruction manual

Type 10T/10R Seal Installation Dimensions



Type 10T/10R Metric Range Dimensional Data (mm)

Seal Size (mm)	Seal Size Code	D	D3	L3
16	0160	16	54	31
18	0180	18	54	31
20	0200	20	57	31
22	0220	22	57	31
24	0240	24	61	33
25	0250	25	61	33
28	0280	28	67	36
30	0300	30	70	37
32	0320	32	70	37
33	0330	33	73	38
35	0350	35	73	38
38	0380	38	76	38
40	0400	40	80	40
43	0430	43	83	40
45	0450	45	83	40
48	0480	48	89	43

Type 10T/10R Metric Range Dimensional Data (mm) (Cont.)

Seal Size (mm)	Seal Size Code	D	D3	L3
50	0500	50	89	43
53	0530	53	103	53
55	0550	55	107	53
58	0580	58	110	53
60	0600	60	110	53
63	0630	63	113	53
65	0650	65	116	53
68	0680	68	118	53
70	0700	70	118	53
75	0750	75	126	53

Type 10T/10R Inch Range Dimensional Data (mm)

Seal Size (Inches)	Seal Size Code	D	D3	L3
0.750	0190	19.05	54	31
0.875	0222	22.22	57	31
1.000	0254	25.40	61	33
1.125	0285	28.57	67	36
1.250	0317	31.75	70	37
1.375	0349	34.92	73	38
1.500	0381	38.10	76	38
1.625	0412	41.27	80	40
1.750	0444	44.45	83	40
1.875	0476	47.62	86	43
2.000	0508	50.80	89	43
2.125	0539	53.97	103	53
2.250	0571	57.15	107	53
2.375	0603	60.32	110	53
2.500	0635	63.50	113	53
2.625	0666	66.67	116	53
2.750	0698	69.85	118	53
2.875	0730	73.02	122	53
3.000	0762	76.20	126	53

Checking the Equipment

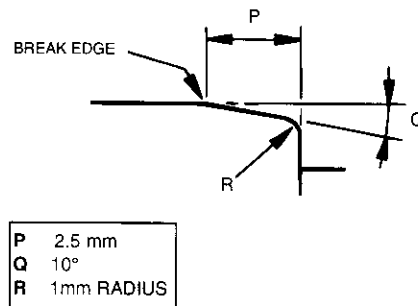
Successful operation and life of this seal is dependent on acceptable equipment dimensions, alignments, and finishes. Before installation of the seal, the following checks should be made with respect to the seal housing and the shaft, especially (where marked †) at the seal position. The usual equipment to measure these features would include a micrometer and dial indicator.

Shaft/Sleeve Outside Diameter †	Refer to Dimension Tables	
Shaft/Sleeve Finish †	0.8 to 1.2 µm Ra (Machined)	
Shaft/Sleeve Ovality/Out-of-Roundness †	< 0.025 mm / 0.001 in.	
Shaft End Play/Axial Float	< 0.08 mm / 0.003 in. F.I.M.	
Shaft/Sleeve Run-Out †	< 0.08 mm / 0.003 in. F.I.M. ≤ 1800 rpm < 0.05 mm / 0.002 in. F.I.M. > 1800 rpm	
Shaft/Sleeve Lead-On	Refer to Lead-On Chamfer	
Seal Housing End Face Squareness to Shaft/Sleeve	Refer to Housing Squareness Graph	
Concentricity of the Seal Chamber to the Shaft/Sleeve	< 0.15 mm / 0.006 in. F.I.M.	

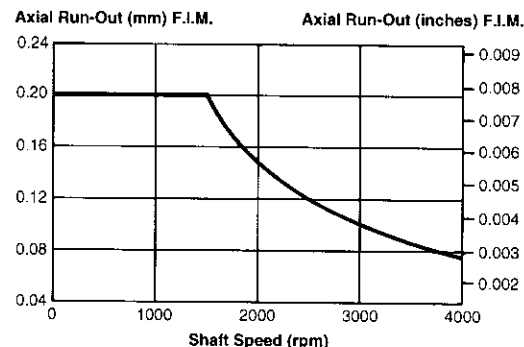
NOTE: If the measured dimensions exceed the values given, correct the equipment to meet the specifications before installing the seal. If the seal is installed on a sleeve, the sleeve must be liquid- and pressure-tight through its bore. The thickness of the gland plate must be sufficient to retain the service pressure without distortion.

Lead-On Chamfer

For ease of installation, the lead-on edge of the shaft or sleeve should be chamfered as shown. Remove any burrs and sharp edges that could damage the seal during fitting.



Housing Squareness to Shaft

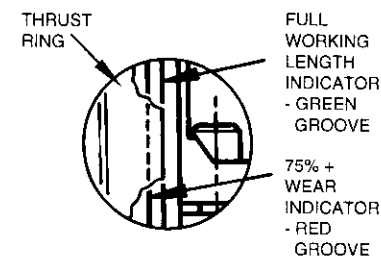


Setting the Seal

The seal must be installed to its correct working length L3. Visual setting and wear indicators are incorporated in the seal design, and the simple setting procedure is described as part of the installation sequence - refer to the diagram below. Note that, should the direct method of seal compression and setting be found difficult, an alternative method is included in the installation procedure.

ATTENTION

If L3 is overlength, the seal will be undercompressed and will leak; if L3 is underlength, the seal will be overcompressed and this will cause dry running and high wear of the seal faces.



Installing the Seal

Before starting the installation, read the following instructions carefully, both to be aware of special information, and because the fitting sequence may be different depending on the construction of the pump. These instructions assume the use of an abutment ring, and fitting onto a plain shaft from the impeller end of a dismantled pump.

ATTENTION

It is recommended that a positive abutment is always provided at the back of the bellows.

1. Remove the protective packaging from the seal; check for any damage, and wipe clean. Save package labels for future reference.
2. Fit the seat/mating ring and the gland plate to the seal housing as described in the appropriate seal instruction manual.
3. Clean and lightly lubricate the shaft.
4. Slide the positive abutment ring onto the shaft with the set screws clear of the ring bore.

ATTENTION

Check that the half-clamp screws are fitted with their heads positioned diagonally opposite each other, i.e., facing in the same rotary direction, to maintain the dynamic balance of the seal.

5. Loosen the screws connecting the seal half-clamps, sparingly lubricate the inside diameter of the bellows, and then carefully slide the seal unit clamp-end first onto the shaft and beyond its final position.
6. Carefully fit the seal housing/seat assembly over the shaft and secure in position. Turn the shaft by hand to check for free rotation.

ATTENTION

The shaft should not be allowed to impact the seat/mating ring bore during assembly, and must be clear of the seat bore when in operation.

7. Wipe the lapped surfaces of the seat and seal face perfectly clean and dry, and then slide the seal unit along the shaft until the face touches the seat.
8. Lightly tighten the half-clamp screws, ensuring that the ends of the clamps are equally spaced.
9. Using hand pressure on opposite sides of the two half-clamps, compress the unit against the seat until the rear edge of the thrust ring is aligned with the green indicator line in the spring shroud - refer to the Setting the Seal diagram. This sets the seal to its correct working length, although the visual setting can be checked against the appropriate L3 dimension if required.
10. Holding the seal in its working position, tighten the clamp screws evenly and progressively to the torque recommended in the torque table. Ensure that the ends of the half-clamps remain equally spaced while tightening.

ATTENTION

Accurate torque settings will avoid cap screw damage and prevent seal movement in operation.

NOTE: If the above direct method of seal compression and setting is found to be difficult, use the following procedure.

With the seal and seal housing assembly installed in its working position, mark the shaft in line with the seat face.

From the dimension tables find the L3 dimension for the size of seal being fitted. Measure this distance along the shaft from the first mark, and mark the shaft again. This new mark is the location for the back of the seal.

Slacken the seal housing mounting bolts (not the gland plate bolts) and move the housing back sufficiently to allow the seal to be moved freely and accurately onto its location mark. Secure the seal as in step 10, and then evenly re-tighten the housing bolts to compress the seal against the seat.

11. Position the positive abutment ring firmly against the tail of the bellows and secure.
12. Fit the splash guard and drain - refer to Before Commissioning the Equipment.

Maintenance



Do not closely examine the seal for leakage when operating, without using suitable protection.

During operation, periodic inspection of the seal should be carried out. A measure of seal operating condition is the level of leakage, and as no maintenance of the seal is possible while installed, the seal should be replaced either when leakage becomes unacceptable or when the external indicator shows more than 75% face/primary ring wear - refer to Setting the Seal. It is recommended that a spare seal unit and seat/mating ring are held in stock to allow immediate replacement of a removed seal.

Before Commissioning the Equipment

ATTENTION

Allow at least 15 minutes to elapse between seal installation and pump commissioning to enable the seal to adjust to its working position.

1. Ensure that the gland plate nuts are evenly tightened according to the pump instruction manual.
2. Complete the assembly of the pump, and turn the shaft (by hand, if possible) to ensure free rotation. Confirm that the splash guard is fitted.
3. Consult all available equipment instruction manuals to check for correctness of all piping and connections, particularly regarding the splash guard drain, seat cooling/flush (if required), and any other services external to the seal.

ATTENTION

This mechanical seal is designed to operate with a liquid at the faces, and therefore the following check should be carried out, not only after seal installation, but also after any period of equipment shut-down.

4. Check that the seal chamber fluid lines are open and free of any obstruction, and ensure that the seal chamber is filled with liquid and fully vented.

ATTENTION

Dry running - often indicated by a squealing noise from the seal - will cause overheating and scoring or other damage to the sealing surfaces, resulting in excessive leakage or a much shortened seal life.

ATTENTION

The pump must not be run with the suction and delivery valves closed. All valves - particularly quick acting ball valves - should be operated as slowly as possible to minimise pressure surges, which can be the cause of rapid seal failure.

Decommissioning the Equipment

1. Ensure that the pump is electrically isolated.



If the equipment has been used on toxic or hazardous fluids, ensure that the equipment is correctly decontaminated and made safe prior to commencing work. Remember that fluid is often trapped during draining and may be present inside the seal chamber. The pump instruction manual should be consulted to check for any special precautions.

2. Ensure that the pump is isolated by the appropriate valves. Check that the fluid is drained and pressure fully released.

Removing the Seal

NOTE: Dismantle with care: components may be suitable for reuse after duty if otherwise undamaged.

1. Referring to the pump instruction manual, dismantle the equipment sufficiently to expose the seal housing and seal.
2. Remove the seal housing complete with the gland plate and seat/mating ring, and carefully dismantle the seal.
3. Clean and oil the shaft; slacken the clamp ring screws, and remove the seal from the shaft. If necessary, an extraction tool may be applied to the clamp ring. Remove the abutment ring, if fitted.

A seal unit should always be serviced after removal from duty. It is recommended that used seals are returned to a John Crane Service Centre, since rebuilding to as-new specification must be carried out by qualified personnel.



It is the responsibility of the equipment user to ensure that any parts being sent to a third party have appropriate safe-handling instructions externally attached to the package.

ATTENTION

If part-worn seals are reinstalled after local reconditioning, the wear indicator cannot be safely used, and the seal should be set to the appropriate working length dimension L3.



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If the products featured will be used in a potentially dangerous and/or hazardous process, your John Crane representative should be consulted prior to their selection and use. In the interest of continuous development, John Crane Companies reserve the right to alter designs and specifications without prior notice.



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GENERAL POINTS REGARDING MECHANICAL SEALS.

The main consideration in starting up equipment with mechanical shaft seals is to ensure that the seal faces are immersed in liquid from the very beginning so that they will not be scored or damaged by dry operation. The recommendations below will be applicable to most types of seal installations, if followed successful start-up and normal seal life can be expected;-

- (1) Caution the electrician not to run the equipment dry while checking the electric motor for the correct direction of rotation. Kestner horizontal pumps are generally despatched from the works with the spacer coupling disconnected to ensure that this does not occur. The direction should be checked and then the coupling can be connected for operation. A slight turnover by hand will not damage the seals, **however**, full motor speed for a short period under dry conditions will destroy or severely damage the rubbing faces.*
- (2) Sealant connections at the stuffing box should be connected and the specified coolant flowrate and pressure should be checked and confirmed prior to starting the equipment. Flow switches in the sealant supply lines may be beneficial to prevent energising the electric motor drive under 'no-flow' conditions.*
- (3) On hot operational equipment that is shut down at the end of the day, it is*

generally advisable to leave the sealant liquid flowing at least long enough for the seal chamber to cool below the temperature limits of the materials in the seal.

- (4) Most double mechanical seals are dependent upon the controlled pressure and flow of the sealing fluid to function correctly (generally a minimum of 1 bar above the stuffing box/discharge pressure.) Even before the shaft is rotated the sealing liquid pressure must exceed the product pressure opposing the seal.*
- (5) A squealing noise indicates insufficient liquid at the seal faces (that is the faces are running dry) and to avoid reduced seal life the installation should be checked immediately. Dry operation from the sudden loss of suction liquor is sometimes encountered and should be rectified immediately to prevent possible damage to the seal faces.*
- (6) New plant start-up should consider the presence of dirt and debris in the system during construction. This cannot be eliminated entirely however, proper cleaning and flushing pipelines prior to running the equipment can greatly eliminate many seal failures. The use of strainers, cyclone separators and filters on critical installations during commissioning is often advisable for new plant initial start-up as a large percentage of seal failures occur during the commissioning process.*
- (7) If a seal leaks slightly on start-up allow a reasonable period of time for it to adjust itself. Liquids with good lubricating properties will naturally take longer to bed-in. When a seal starts out with a slight leak and get progressively less with running, it is indicative of a leakage across the seal faces and continued running will cure it.*

Where leakage occurs initially and is not affected by running it generally indicates seal damage or misalignment.

- (8) Unless absolutely necessary **DO NOT OPEN SEAL FACES FOR INSPECTION.** After a seal has been running for some time a wear pattern is established between the two faces which microscopically mates these two faces, since it is very unlikely that the two faces can be put back together in their exact wear pattern position, disturbing the seal in any manner will probably necessitate establishing a new wear pattern, perhaps after re-lapping the mating faces.*
- (9) **CAVITATION:-** excessive cavitation can cause seal failure, in addition to any damage which may occur in the pump. Cavitation causes severe vibration of the pump shaft, shaft deflection and bearing failure. Pump cavitation is generally*

indicated by excessive noise in the pump casing.

- (10) *Stand-by equipment having mechanical seals should not be allowed to stand idle for long periods of time. Rotate the equipment at least once a week, if only for a few moments. Better still allow a designated period for placing the unit on line. This procedure will generally only take a minimum period of time and effort as almost all stand-by and duty equipment have common suction and delivery pipework.*
- (11) *It should be borne in mind that the driver alignment is checked at our works prior to despatch, however, this should be re-checked after final installation at site. Also the effect of pipework strain is well documented as to the damage it can cause to pump bearings and seals. Pipework should be of the correct size, properly aligned and adequately supported with expansion bellows fitted if necessary. The pump suction and delivery branches should not be used as pipework supports.*
- (12) *Long term storage;- It is recommended that mechanical seals left in storage for over 2 years are returned to the manufacturer for inspection. For seals already installed in the equipment;- Pumps subject to long term storage (over 1 year.) are best stored without the mechanical seals being fitted or with the seal installed on the shaft but left unclamped (i.e. untensioned) in its final set position. Seal installation and setting (tensioning) should only then be carried out shortly before the actual start-up of the equipment.*
- (A) *Removing the complete seal :-*
- Remove the seal unit from the equipment. Any adapter ring/abutment collar can be left on the shaft, located in its correct position. The seat and its sealing component(s) can also be removed. The seat is to be cleaned and de-greased before being coated in a film of oil and sealed in polythene wrapping. All PTFE and elastomer parts can be disassembled, dried and stored in black plastic bags before being kept in a cool, dark area. The seal unit is to be totally dried and stored in polythene wrapping or a bag containing a moisture absorbing agent, (e.g. a bag of silica gel). The rotating shaft and seat recess/abutment on the equipment should be thoroughly cleaned, de-greased and dried before being protected from corrosion for the duration of its time in storage.*
- (B) *Leaving the seals in the equipment:-*

*Pumps equipped with double seals;- The seal chamber is to be filled with ethylene glycol with an inhibitor to prevent corrosion. Suction and discharge flanges are to be covered to exclude the ingress of dirt. Covers should be marked:- **DO NOT REMOVE UNTIL EQUIPMENT IS INSTALLED**. The open area between the glandplate and shaft or shaft sleeve, is to be protected from airborne dirt, (e.g. with masking tape or suitable glued in rubber gasket ring, that has a close clearance with the shaft/ sleeve O.D). If at all possible, the shaft should be rotated slowly by hand in the direction of the normal equipment approx. once every week.*

*Pumps equipped with single seals; -The seal chamber should be completely dry. The seal faces should ideally be assembled dry also. If hydrostatic or acceptance testing is to be done by the equipment manufacturer, then the seal area must be flushed clean and totally dried afterwards. Pumps on cryogenic duties should be drained from the lowest point, and then blown through with dry, hot air or nitrogen, for at least 30 minutes. Suction and discharge flanges are to be covered to exclude the ingress of dirt. Covers should be marked;- **DO NOT REMOVE UNTIL EQUIPMENT IS INSTALLED**. The open area between the glandplate and shaft sleeve, is to be masked to exclude dirt. All open ports in the gland, adapter plate and stuffing box are to be plugged and sealed. Clamp bolts can be loosened off approximately 3 turns of the thread to relax the spring loading. The corresponding gap left between the stuffing box face and the glandplate should be masked to exclude dirt. If the shaft has to be rotated by hand occasionally to comply with the bearing manufacturers recommendations, then the sealing faces should be coated with a light film of clean lubricating oil.*

IF THE PUMP IS TO BE STORED IN-SITU, THEN IT IS RECOMMENDED TO DISCONNECT ALL ELECTRICAL CONNECTIONS TO THE PUMP MOTOR OR AT LEAST EARTH THE PUMP CASING.



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SPECIAL INSTRUCTIONS REGARDING SILICON IRON PUMPS.

High Silicon iron process equipment has been serving the chemical and associated industries for nearly ninety years. The corrosion resistance of this alloy has been claimed by many to be unexcelled by any other commercially available metal, or alloy, together with its excellent corrosion resistance High Silicon Iron by virtue of its hardness finds many applications where corrosion and / or erosion is present.

The greatest hindrance to the wide-spread use of this alloy has been its susceptibility to both thermal and mechanical shock. It is therefore important that the following points are considered to achieve a long and trouble free service life :-

- (1) Thermal shock should be minimised - if possible gradually heat the equipment to elevated working temperatures.*
- (2) Do not allow staff to 'hose down' equipment working at high temperatures. Rapid changes in ambient temperature may induce thermal shock, however, gradual temperature changes generally cause no service difficulties.*
- (3) Fitment of pipework expansion bellows, compatible with the pumped fluid, will reduce any mechanical loads or vibrations and is **highly** recommended.*
- (4) Check the correct alignment of suction and discharge pipework etc this should be adequately and independently supported. The pump casing should **not** be used as a pipework support.*
- (5) Reduce any imposed pipework loading by not overtightening the pipe flange connections. (see torque chart for the **maximum** recommended values).*

- (6) *High Silicon Iron alloys are very hard and machining of holes is very difficult, welding of castings is also impractical and should not be attempted.*
- (7) *Metal pumps should have Compressed Non-Asbestos Fibre or similar jointing gasket material approx 1.0 - 2.0 mm thick between the pump branches and connecting pipework. The joint material must be compatible with the pumped fluid.*



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**GENERAL POINTS REGARDING LONG TERM
PUMP AND MOTOR STORAGE AND INSTALLATION.**

*The handling and lifting of pump and motor units must only be undertaken by skilled personnel using the correct equipment. These notes apply to Brook Hansen manufactured motors but general notes may be applicable to **all** electric motor manufacturers.*

(1) RECEIPT.

Before any unit is accepted on site it should be inspected carefully for damage or loss incurred in transit. Packing materials may be damaged including sheeting and crate timbers. Handling operations may have damaged motor fan cowls, terminal boxes or auxiliaries. Where an instance of droppage or loss is evident or suspected, it may be necessary to unpack the goods to establish the full extent of the problem. Wherever possible the damage should be recorded, photographed and witnessed. Report any damage to the carriers. The insurance company's agent as shown on the insurance certificate should also be advised.

(2) LIFTING.

The lifting of equipment must be carried out by skilled personnel working in accordance with safe working practices. Before lifting units the correct equipment must be available. Cranes, jacks, slings and lifting beams must be capable of carrying the weight of the unit to be lifted.

(2.1) **VERTICAL MOUNTING.**

Motors for vertical mounting positions are provided with sufficient lifting points, either fitted or loose, to aid controlled rotation from a horizontal to a vertical shaft position. On large motors it may be necessary to use several lifting points to provide stability, particularly for shaft down mountings.

(2.2) **INSPECTION.**

Eyebolts and lifting lugs should be inspected regularly. Attention should be paid to the following areas:-

Legibility of markings.

Threads free from wear and corrosion.

No debris on the underside of the collar.

No distortion of the eyebolt.

No nicks, cracks or corrosion.

(3) **STORAGE.**

If motors have to be stored before installation, precautions should be taken to prevent deterioration.

(3.1) **ENVIRONMENT.**

Depending on the site conditions it may be necessary to create a suitable stores area to hold the motor prior to installation. Packing cases are not waterproof. Motors should be stored in a dry vibration free and clean area at normal ambients (-20°C to 40°C) Where low temperature ambient storage is anticipated, special precautions should be taken with the type of grease, no plastic components etc. to ensure trouble free start-up. Motors must be stored away from corrosive or chemically damaging fumes. Before placing motors into storage any exposed machined components should be carefully inspected. Bearings and shafts are normally covered with a corrosion resistant barrier. If this coating is damaged it should be made good. The component should be cleaned and the protective coating re-applied. Under no circumstances should rust be merely covered over.

(3.2) **DRAIN HOLES.**

Motors provided with drain holes have the drain plugs provided loose in the terminal box up to frame size 180, and fitted on frame size 200 and above. Position the drain holes at the lowest point.

(3.3) **BEARINGS.**

*To avoid static indentation the storage area should be free from vibration. If this is not possible it is strongly recommended that the motors be stood on thick rubber blocks or other soft material. **Shafts should be rotated by hand one quarter of a revolution weekly.***

(3.4) **GREASE.**

*Factory fitted bearings use a lithium based grease with a recommended shelf life of two years. If stored for a longer period, grease may need to be replaced *. Shielded bearings have a storage life of approx. five years and a further two years operational life following installation.*

** Wash all bearing parts in solvent. Lightly pack the bearings with grease applying a 33% fill by volume into the bearing and housings.*

(3.5) **HEATERS.**

Where space heaters are fitted, and storage environment has wide humidity and temperature variations, it is strongly recommended they be energised.

Warnings should be placed on the motor to make operatives aware that the heaters are live !

Supplies are normally 220-240 volt single phase, from a 380-420 volt three phase supply. See terminal box lid / Rating plate for details.

(3.6) **INSULATION RESISTANCE.**

During extended storage a three monthly insulation test is recommended to avoid possible lengthy drying out periods when installing. Use a 500 volt d.c. Megger. The insulation resistance between the phases and between the windings and the frame should be checked. The insulation resistance should be maintained above 10 megohm. If a lower reading is measured, use one of the drying out methods recommended until an acceptable reading is obtained. If heaters are fitted but not energised, they should be used in future.

(4) **INSTALLATION.**

Work on Hazardous area motors should only be carried out by trained and authorised personnel or those trained to work on certified motors.

All warnings instructions and labels must be observed and retained with the motor.

It is essential equipment is installed, earthed and guarded in accordance with current legislation.

(4.1) **CHECKLIST.**

General	<i>Location.</i> <i>Nameplate details.</i>
Mechanical	<i>Drain holes.</i> <i>Alignment.</i> <i>Free rotation.</i> <i>Bearings and grease.</i> <i>Cable termination.</i> <i>Motor bolts.</i> <i>Slide rails. (where used)</i> <i>Pulley fitment. (where used)</i>
Electrical	<i>Insulation resistance.</i> <i>Drying out procedures.</i> <i>Supply.</i> <i>Earthing.</i> <i>Protection.</i> <i>Heater continuity.</i> <i>Thermistor continuity.</i> <i>Auxiliaries.</i> <i>Connection diagram.</i> <i>Rotation.</i> <i>Starting.</i>

(4.2) **GENERAL.**

(4.2.1)**LOCATION.**

The motor must be provided with adequate access for operation and maintenance. The fan inlet must be at least 20mm from any obstruction on frame sizes up to 180, and 50mm on frame size 200 and above. A minimum working distance of 0.75m around the motor is also recommended. Where several motors are located together care must be taken to ensure that there is no re-circulation of exhausted warm air. Foundations must be rigid and level.

(4.2.2)**NAMEPLATE DETAILS.**

The information on the nameplate should be checked to ensure that it is correct in all details i.e. kW, amps, volts, speed etc. It is a wise precaution to take nothing for granted.

(4.3) MECHANICAL.

(4.3.1) DRAIN HOLES.

Prior to installation remove drain plugs if fitted. If any water has accumulated, the integrity of all gaskets, sealants, etc. should be checked. Drain plugs should be put back into place after draining.

(4.3.2) FREE ROTATION.

The rotor must be free to rotate in its housing. Where uneven or bumpy rotation occurs the bearings should be inspected to establish that they have not been damaged during transportation or storage.

(4.3.3) LUBRICATION.

Bearings are pre-packed with lithium or lithium complex based grease. Standard regreasing facilities where provided are situated on the periphery of the drive end and non-drive end endshields. Motors without grease nipples have sealed for life bearings and bearing replacement should be considered at normal re-lubrication intervals. An overgreased bearing will cause overheating of the bearing with the possible escape of grease, loss of lubrication qualities, leading to ultimate bearing failure.

(4.3.4) CABLE TERMINATION / TERMINAL BOX SEALING.

*All cable terminations must be screwed down tightly. Customer's leads should be in face to face contact with the motor leads. Lockwashers and nuts should be screwed down over the connection. There should be no nuts or lockwashers between the mains and motor lead as these are not current carrying components. The installer must ensure maximum clearance is maintained between the cables in the terminal box by placing connections onto the studs carefully. Conduit and gland entries to the terminal box must be correctly fitted. The integrity of the terminal box gasket must be checked to ensure the terminal box lid can maintain the correct sealing level. **EEX d terminal boxes are despatched with a non-setting sealant on the terminal box/ lid faces to provide protection during transit and storage. All joint faces must be cleaned and a sealant applied after the fitting of the supply cables.***

(4.3.5) MOTOR BOLTS.

All accessible motor bolts should be checked for tightness.

(4.3.6) DRYING OUT PROCEDURES.

Consult manufacturers for recommendations regarding the drying out of motors.

(4.3.7) SUPPLY.

It is important that a motor is operated within the limits of its specified design voltage and frequency. The supply cables must be capable of carrying the full load current of the motor (see motor nameplate) without overheating or excessive voltage drop under starting conditions.

(4.3.8) EARTHING.

All motors are fitted with an earthing terminal, in or adjacent to the terminal box, to enable connection to an effective earthing bond. The terminal is designed for connecting the correct size of copper earth connector. If a different material is to be used consult manufacturer.

The motor must be earthed by connecting the shortest possible length of cable to the earth screws. The cable must have a capacity of at least that of the main connections up to 16 mm² phase conductors. Between 16 and 35mm² phase conductors, the earth should be a minimum of 16 mm². Above 35mm² phase conductors, the earth conductor should be a minimum of half the phase conductor.

(4.3.9) NOTES.

*For specific information regarding lubrication intervals or any other detailed information please consult the electric motor manufacturer or their authorised agents. Whilst the information given is of a general nature no liability is accepted whatsoever. **IF IN DOUBT - ASK !!!***

IMPORTANT NOTES:-

For general notes regarding the long term storage of pump units fitted with either single or double mechanical shaft seals - see specific notes regarding installation operation and long term storage.

WARNING

**IT IS MOST IMPORTANT THAT THE
MOTOR AND PUMP ARE CHECKED
FOR ACCURATE ALIGNMENT AFTER THE
BASEPLATE HAS BEEN GROUTED
INTO FINAL POSITION**

WARNING

**THE FENAFLEX COUPLING TYRE IS
SUPPLIED LOOSE IN THE COUPLING GUARD**

**CHECK THE MOTOR ROTATION
BEFORE FITTING THE COUPLING TYRE**

WARNING

THE 10T/10R MECHANICAL SHAFT SEAL

HAS NOT BEEN SET - PLEASE CHECK

BEFORE PLACING THE PUMP INTO OPERATION

SEE THE INSTRUCTION MANUAL

FOR INITIAL SETTING INSTRUCTIONS

Kestner Engineering Co Ltd

23547/CFH - TAG DETAILS

Contract / Serial No	Client	Pump Type	Rotor mm	Motor kW	Speed rpm	Details Frame Size	Build Date	Tag No	Seal Type
23547/CFH/11708	BRADLEY PULVERIZER LTD	KSI 50/160	140	11	2900	M3BP160MA	22/08/08	P-579 / 1	10T SEAL
23547/CFH/11709	BRADLEY PULVERIZER LTD	KSI 50/160	140	11	2900	M3BP160MA	22/08/08	P-579 / 2	10T SEAL
23547/CFH/11710	BRADLEY PULVERIZER LTD	KSI 50/160	140	11	2900	M3BP160MA	22/08/08	P-589 / 1	10T SEAL
23547/CFH/11711	BRADLEY PULVERIZER LTD	KSI 50/160	140	11	2900	M3BP160MA	22/08/08	P-589 / 2	10T SEAL
23547/CFH/11712	BRADLEY PULVERIZER LTD	KSI 50/160	135	11	2900	M3BP160MA	22/08/08	P-579 / 3	10T SEAL
23547/CFH/11713	BRADLEY PULVERIZER LTD	KSI 50/160	135	11	2900	M3BP160MA	22/08/08	P-579 / 4	10T SEAL
23547/CFH/11714	BRADLEY PULVERIZER LTD	KSI 50/160	135	11	2900	M3BP160MA	22/08/08	P-589 / 3	10T SEAL
23547/CFH/11715	BRADLEY PULVERIZER LTD	KSI 50/160	135	11	2900	M3BP160MA	22/08/08	P-589 / 4	10T SEAL
23547/CFH/11716	BRADLEY PULVERIZER LTD	KSI 50/160	160	11	2900	M3BP160MA	22/08/08	P-579 / 5	10R SEAL
23547/CFH/11717	BRADLEY PULVERIZER LTD	KSI 50/160	160	11	2900	M3BP160MA	22/08/08	P-579 / 6	10R SEAL
23547/CFH/11718	BRADLEY PULVERIZER LTD	KSI 50/160	160	11	2900	M3BP160MA	22/08/08	P-589 / 5	10R SEAL
23547/CFH/11719	BRADLEY PULVERIZER LTD	KSI 50/160	160	11	2900	M3BP160MA	22/08/08	P-589 / 6	10R SEAL