

Voith Turbo

VOITH

**Technical Documentation
Instruction Manual**

**Code
Chengda S1 UongBi #2**

**Geared variable speed coupling
R 17 K.2E**

Techn. Documentation No. 91800083110_BA1_en

Revision 0

**Appendix_A_
Appendix_B_**

If you have questions regarding the Geared variable speed coupling, please contact the Service Center (aira) of the Product Group 'Variable Speed Drives' (stating the serial number) at Voith Turbo GmbH & Co. KG Crailsheim

Voith Turbo GmbH & Co. KG
P.O. Box 15 55
D-74555 Crailsheim
Switchboard: +49 7951 32-0
Main fax: +49 7951 32-650
E-mail: regelbare.antriebe@voith.com

Service Center - Variable Speed Drives
www.voith-coupling-service.com
E-mail:
service.regelbare.antriebe@voith.com

Tel. +49 7951 32 1666
Fax +49 7951 32 903

This Instruction Manual describes the technological level of the Geared variable speed coupling at the time of delivery.

Subsequent changes in the design of the Geared variable speed coupling are not incorporated in this Instruction Manual.

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Version 1.00

		- Amendments, exchange of chapters/ sheets of the instruction manual
		- Addendums within an instruction manual
		- Complete exchange of the whole instruction manual

Overhaul	Version	Revision	Date
0	1.00	First edition of Instruction Manual	2010-01-26

Date	Author	Head of product group
2010-01-26	airpd / cra_SPa	airev / Hilpert airek / Hofmann

General information on the Instruction Manual

This Instruction Manual contains important information on how to operate the Geared variable speed coupling safely, properly and economically. Your observations help to avoid hazards, repair costs and down-times and to increase the life-span of the Geared variable speed coupling.

Economical operation

Read this Instruction Manual carefully, to become familiar with the proper handling and operation.

Reading the Instruction Manual

The Instruction Manual must always be available at the installation site of the Geared variable speed coupling.

Installation site

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The contents of this Instruction Manual are intended for various target groups. The level of knowledge that the target group must have is defined here.

Definition of the target groups

All target groups must have read this Instruction Manual and have a good understanding of the content.

Operating personnel must,

- be 18 years old.
- be trained in handling of the Geared variable speed coupling.
- know the country-specific accident prevention regulations.

Maintenance personnel must,

- be 18 years old.
- know the maintenance points on the Geared variable speed coupling.
- know the country-specific environmental protection regulations for disposing of lubricants and cleaning materials.

Service personnel must,

- be 18 years old.
- have a sound school education and vocational education.
- be trained by Voith Turbo GmbH & Co. KG in the service activities on the Geared variable speed coupling.
- be trained in the rules of conduct in case of faults.

Our systems are under continual further development and improvements. The data contained in this edition corresponds with the latest technology.

We reserve the right to any changes in technical details differentiating from the information and images in the operating instructions.

Besides those regulations for accident prevention stipulated in the operating instructions, those in the country of use and the installation location, the recognized technical regulations for safety and proper work practices are to be observed.

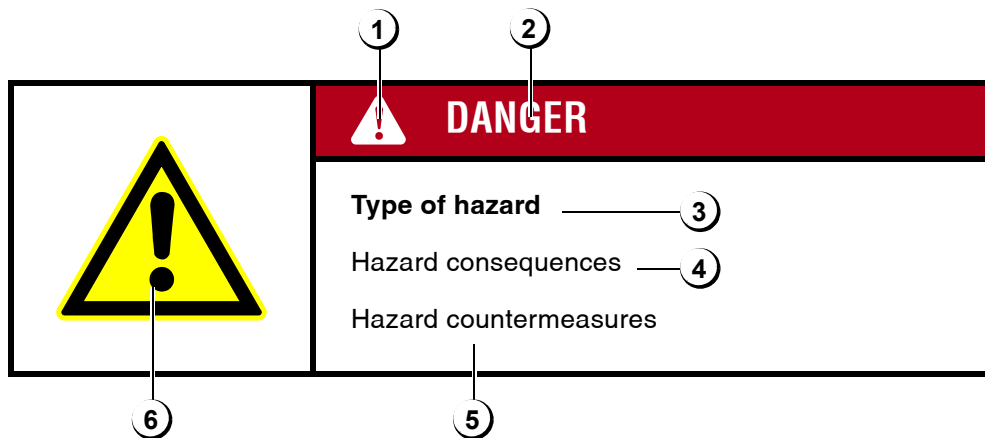
Technical modifications

Accident prevention regulations

Notes on using the Instruction Manual

Operation-related warning information:

Structure of safety information



Summarized safety information and additional notes before the respective chapters:

Type of hazard ③

Hazard consequences ④

Hazard countermeasures ⑤



1. Safety symbol
2. Signal word, danger level
3. Type and source of hazard
4. Possible consequences of hazard
5. Measures for averting the hazard
6. Safety sign

Notes

NOTE

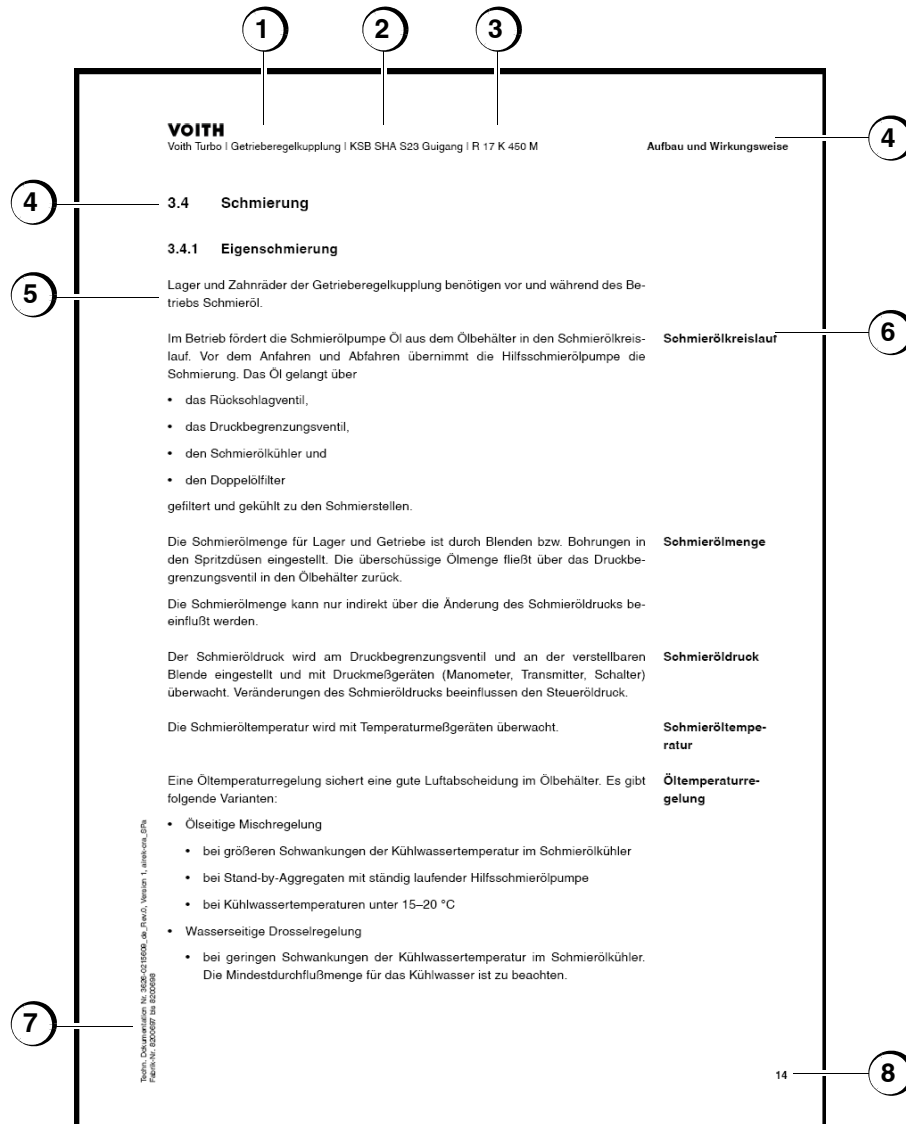
Indicates information that contains important notes on the use and/or procedures to be used. Non-observance/non-compliance can cause malfunctions.

Fonts are designated according to their functionality in the following ways:

Font designations

Font	Designation	Function
Action instruction	1., 2., etc.	instruction to perform an activity
List 1st level	•	indicates individual elements of the numbered list
List 2nd level	—	indicates sub-points of the list
Cross-reference	➔	indicates other chapters or points in the text

Page structure:



1. Plant type
2. Code
3. Coupling size
4. Chapter designation
5. Text column
6. Marginal column
7. Technical documentation No., Language, Version and Author
8. Page number

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1 Technical Data

Geared variable speed coupling	R 17 K.2E
Code	Chengda S1 UongBi #2
Order number	38001974
Serial No.	8206149 to 8206151

1.1 Machine data

Geared variable speed coupling as feed pump drive

Geared variable speed coupling

Direction of rotation viewed in direction of power flow.

• Input shaft	CCW
• Hydr. circuit	CW
• Output shaft	CW

Power requirement of the driven machine	P_a	4436 kW
Motor speed	n_e	1490 rpm
Gear ratio	$U_1 = Z_2/Z_1$	111 / 29
Primary speed	n_1	5703 rpm
Full-load slip	s	< 3%
Max. output speed	n_a	5600 rpm
Regulation range		4:1 downward
Capacity of oil reservoir		850 l
Required oil viscosity		ISO VG 32

Weight:

• Total (without oil)	3600 kg
• Input shaft with gear	800 kg
• Primary-side components of the coupling runner with gear pinion	200 kg
• Secondary-side components of the coupling runner	102 kg

Attaching parts
Main oil pump

Pumps	for working and lubricating oil
Type	FuZP 450
Drive	By the input shaft of the Geared variable speed coupling

Auxiliary lube oil pump

Type	ZP 240
Drive	Electric motor

Motor for auxiliary lube oil pump

Type	ABB M2QA
Design type	B5
Degree of protection	IP 54

Duplex oil filter

Type	VSF 50
Grade of filtration	35 µm
Filter element	Element, can be cleaned
Achievable oil cleanliness grade of	20/16 ¹

1. Oil cleanliness grade in accordance with ISO 4406

Actuator

Type	RHD 250-10
Accessories Type	<ul style="list-style-type: none"> Power electronics CONTRAC EBN 853
Control signal	4 - 20 mA

Connecting couplings

Input side	not supplied by Voith-Crailsheim
Output side	not supplied by Voith-Crailsheim

Oil level indicator/switch

Indicator - Type

Design

Sight glass

Switch - Type

Design

Heat exchanger

Working oil cooler type

not supplied by Voith-Crailsheim

Lube oil cooler type

not supplied by Voith-Crailsheim

Instruments

See [Chapter 14 „Attaching Parts“](#) in this Instruction Manual

➔ For a detailed description of the components mentioned, see [Chapter 14 „Attaching Parts“](#) in this Instruction Manual.

1.2 Operating data

1.2.1 Geared variable speed coupling

Temperatures

Bearing temperatures	Operating range	< 90 °C
	Alarm at	90 °C
	Shutdown at	95 °C
Working oil temperature upstream of the heat exchanger	Operating range	> 60 < 110 °C
	Alarm at	110 °C
	Shutdown at	130 °C
Working oil temperature downstream of the cooler	Operating range	> 35 < 75 °C
	Alarm at	75 °C
	Shutdown at	85 °C
Lube oil temperature upstream of the cooler	Operating range	> 45 < 65 °C
	Alarm at	65 °C
	Shutdown at	70 °C
Lube oil temperature downstream of the heat exchanger	Operating range	> 35 < 55 °C
	Alarm at	55 °C
	Shutdown at	60 °C
Oil temperature in oil reservoir	Start enabled	5 °C
	Operating range ¹	> 45 < 65 °C
	Alarm at ¹	70 °C
	Shutdown at ¹	75 °C

Pressures

Main oil pump pressure Pressure gauge	___ bar
Working oil pressure before the orifice (in working oil circuit) ¹ Test connection II/M2 (see Assembly Plan)	1.5 to 2.2 bar
Working oil pressure after the orifice (in working oil circuit) Test connection III/M3 (see Assembly Plan)	0.2 to 0.5 bar
Lube oil pressure	Operating range ² 2 - 3 bar
	Actuation of the driving machine at > 1.7 bar
	Shutdown of the auxil. lube oil pump with ³ > 2.2 bar
	Alarm - auxil. lube oil pump ON at < 1.5 bar
	Shutdown of driving mach. at < 0.8 bar
Lube oil pressure for external units	1.0 bar
Pressure differential across duplex oil filter	Switch and clean filter at > 0.6 bar

1. Factory setting: approx. 1.5 bar
2. In the case of overly high bearing temperatures but adequate cooling of the lube oil, an increase up to 4 bar is possible. Factory setting: approx. 2.5 bar
3. Further switching by means of a time-delay relay after 3 minutes

Oil quantities

Working oil flow rate	max. 768 l/min
Lube oil flow rate for Geared variable speed coupling	181 l/min
Lube oil flow rate to external units:	
• Total	120 l/min
– Feed pump	98 l/min
– Booster pump	- l/min
– Motor	22 l/min
– Connecting coupling	- l/min

Vibrations - housing

Housing (radial)	Alarm at ¹ > 5.6 mm/s Shutdown at ¹ > 8 mm/s
Housing (axial)	Alarm at ¹ > 8 mm/s Shutdown at ¹ > 11.5 mm/s

These limits can be maintained only so long as there is no foundation resonance within the speed range.

1. Signal, only with appropriate instrumentation or manually on site.

1.2.2 Heat exchanger

Design data

Working oil heat exchanger ¹ „not supplied by Voith-Crailsheim“	Shell chamber (oil)	Tube chamber (water)
Heat to be dissipated	866 kW	
Medium	Oil	Water
Volumes	__ l	__ l
Nominal flow rate V_{nom}	46.1 m ³ /h	__ m ³ /h
Minimum flow rate as the result of corrosion V_{min}		__ m ³ /h
Inlet temperature	95 °C	__ °C
Outlet temperature	56 °C	__ °C
Permissible operating temperature	__ °C	__ °C
Permissible pressure loss ²	0.8 bar	
Permissible operating pressure (gauge)	__ bar	__ bar
Test pressure (gauge)	__ bar	__ bar

1. Have heat exchanger supplier complete design data
2. At operating temperature

Lube oil heat exchanger ¹ „not supplied by Voith-Crailsheim“	Shell chamber (oil)	Tube chamber (water)
Heat to be dissipated	130 kW	
Medium	Oil	Water
Volumes	__ l	__ l
Nominal flow rate V_{nom}	18.1 m ³ /h	__ m ³ /h
Minimum flow rate as the result of corrosion V_{min}		__ m ³ /h
Inlet temperature	60 °C	__ °C
Outlet temperature	44 °C	__ °C
Permissible operating temperature	__ °C	__ °C
Permissible pressure loss ²	0.8 bar	
Permissible operating pressure (gauge)	__ bar	__ bar
Test pressure (gauge)	__ bar	__ bar

1. Have heat exchanger supplier complete design data
2. At operating temperature

2 Safety information

2.1 Basic principles underlying the design of the equipment

The Geared variable speed coupling has been designed and manufactured using the latest technology and in accordance with accepted safety principles. Nevertheless, its use can result in danger to life and limb of the user or damage to the equipment itself and other property.

Basic principle

The Geared variable speed coupling is to be operated only if it is in proper working condition and only for the designated use, in a safety-conscious manner that complies with the Instruction Manual, including knowledge of the associated dangers! Immediately correct any situations that adversely affect safety.

Use of the equipment

2.2 Proper use of the equipment

The Geared variable speed coupling is used to transmit power in a wear-free manner from a prime mover (driving machine) to a power consumer (driven machine). Use the equipment only for the designated purpose.

Use of the equipment

Complying with designated use also means satisfying the manufacturer's requirements regarding operating conditions, maintenance and repair.

Use of the equipment for any other purpose is considered improper use. The manufacturer assumes no liability for damage arising from improper use; the risk associated with improper use is borne by the user.

2.3 Improper use of the equipment

The permissible power that can be transmitted by the coupling in a stationary installation for a given input speed, power input, direction of rotation, oil flow rate in external machines, and oil reservoir content is specified in this Instruction Manual. Any other use beyond that described herein, e.g. for higher power levels, higher speeds, possibly lower speeds, with other operating fluids, under operating conditions that have not been agreed upon or involving physical modifications is considered improper use.

2.4 General safety information

2.4.1 Safety symbol

The safety symbol is used to alert you to possible risk of personal injury. Heed all instructions following this symbol in order to avoid possible injury or death.



2.4.2 Hazard classification

Hazard classification applicable to warnings about procedures (see following examples), summarized safety information and additional instructions at the beginning of each chapter.

Indicates an immediate, potentially dangerous situation which – if the safety regulations are not observed – could result in death or serious bodily injury.

Danger



Indicates a potentially dangerous situation which – if the safety regulations are not observed – could result in death or serious bodily injury.

Warning



Indicates a potentially dangerous situation which – if the safety regulations are not observed – could result in damage to equipment or slight to moderate bodily injury.

Caution



Indicates a potentially dangerous situation which – if the safety regulations are not observed – could result in damage to equipment.

Caution - with safety symbol



2.4.3 Maintaining and replacing safety symbols

The safety of the operator must always take priority.

- Replace all damaged or lost safety symbols.
- Use a mild cleaning agent and water to clean the safety symbol.

Do not use any cleaning agents that contain solvents.

2.4.4 Personal safety

The Instruction Manual and safety symbols described therein must be read and understood by all individuals who work on or with the Geared variable speed coupling.

2.5 General safety information

- Compliance with the manufacturer's Instruction Manual is mandatory for operation, maintenance, repair, assembly and transport.
- The operator must provide additional specific safety instructions that reflect the local operating conditions, if deemed to be necessary.
- This Instruction Manual and the safety information contained therein must be stored in a safe location.
- This Instruction Manual and the safety information contained therein must be kept in their entirety and in always legible condition.
- Prior to starting any work, familiarize yourself with first-aid and rescue procedures (how to contact a doctor, the fire department or rescue services in an emergency).
- Familiarize yourself with the location and operation of fire extinguishers as well as the location of fire alarm boxes and fire fighting equipment.
- Never disable safety devices or remove them.
- Wear protective work clothing while working. Remove rings, shawls and open jackets. For certain work, you must wear safety goggles, safety shoes, a safety helmet, protective gloves, a reflecting vest, ear protection etc.
- Refrain from any behavior that adversely affects safety.
- Operate the Geared variable speed coupling only when it is in safe and functional condition.
- Never operate the equipment with defective monitoring devices.
- Ensure compliance with applicable environmental protection regulations whenever working on or with the Geared variable speed coupling.
- Take precautions especially during installation, repair and maintenance work that substances hazardous to the environment such as grease and oil or solvent-containing cleaning liquids do not get into the soil and sewage system. These substances must be stored, transported, collected and disposed of in suitable containers.
- If the above-mentioned liquids are seeping into the soil, you must stop their escape immediately and treat the area with a liquid-binding absorbent. It may be necessary to remove the soil.
- Dispose of the absorbent and any soil removed properly and in compliance with applicable environmental protection regulations.

Prior to starting any work

While working

Environmental protection regulations

2.6 Organizational measures

This Instruction Manual contains important information regarding proper handling of the Geared variable speed coupling. Before installing the equipment and especially before commissioning the entire system, read the Instruction Manual carefully and ensure that it is understood.

instruction Manual



Store the Instruction Manual such that it is available to the operating personnel at all times.

In addition to the Instruction Manual: ensure that regulations regarding accident prevention and environmental protection are accessible and observed.

**Accident prevention /
environmental
protection**

In the event of physical modifications:

**Physical modifica-
tions**

	 WARNING
	<p>Danger arising from physical modification</p> <p>Physical modifications of the Geared variable speed coupling can result in personal injury and damage to equipment.</p> <p>Modifications, additions or changes to the Geared variable speed coupling are permitted only after receiving approval of Voith Turbo GmbH & Co. KG, Crailsheim.</p>

NOTE
<p>Additional components that are not supplied by Voith Turbo GmbH & Co. KG must be inspected for internal or external damage and contamination (possibly by silicone-containing sealing compounds) prior to being installed or attached. Ensure proper operation.</p>

2.7 Personnel selection and qualification, basic obligations

- Only properly trained and instructed personnel must be allowed to work on the Geared variable speed coupling. These personnel must be trained, instructed and authorized to
 - Operate and maintain the equipment properly and in a manner that ensures compliance with safety standards
 - Dispose of liquids and their associated components, e.g. filters, oil filter cartridges and oil, properly
 - Service and use safety devices in a manner that ensures compliance with safety standards
 - Provide first aid and prevent accidents.
- Untrained, uninstructed and unschooled personnel as well as personnel currently receiving general training and instruction must not be allowed to perform any actions on the equipment unless they are under the continuous supervision of an experienced individual.

Trained personnel**Untrained personnel**

2.8 Obligations of the operator

A Geared variable speed coupling that is not in proper operating condition can cause personal injury and damage to equipment.

The operator is obligated to operate the Geared variable speed coupling only if it is in proper operating condition.

Hazardous areas between the Geared variable speed coupling and customer's equipment must be protected by the operator.

The Geared variable speed coupling generates heat that raises the temperature in the immediate surroundings and may have an adverse affect on personnel. The operator is obligated to always provide adequate ventilation.

When work is being performed on the equipment, the operator must provide adequate illumination.

After delivery of the equipment / machine, the operator must provide sufficient corrosion protection.

2.8.1 Protection systems

Protection systems, interlocks and couplings on the system are to be inspected for safe operation on a regular basis by a qualified specialist.

Areas on the housing of the coupling, working oil lines and the working oil cooler reach surface temperatures > 60°C. Guarding to prevent contact with these areas is not supplied with the coupling, since conditions at the subsequent installation site are not known, and complete guarding to prevent contact can be cumbersome and severely restrict access required for maintenance.

We recommend that, by taking suitable measures at the installation site, e.g. marking aisles, installing warning signs and instructing personnel access be restricted to areas needed during normal operation. These include the instrument gauge panel and the oil filters (for the required exchange of filter elements).

If protective guarding is nevertheless required, this will require an evaluation of conditions on-site. In such a case, Voith Turbo still recommends limiting the guarding to only essential measures, e.g. areas "within arm's length of aisles used during normal operation". Voith Turbo can offer this as an option after clarification of details.

2.8.2 Designating and instructing responsible individuals

Assign only personnel with proper training or instruction, clearly designate the responsibilities for operation, adjustment, maintenance, repairs.

Regularly check that personnel maintain safety-conscious work habits in compliance with the Instruction Manual and are aware of the dangers involved.

Safety-conscious work

2.8.3 Obligations regarding information

The personnel responsible for performing any work on the system must, prior to starting such work, read the Instruction Manual, and the **Safety information** chapter in particular. Reading while performing the work is too late. This applies especially to personnel who work on the system only occasionally, e. g. to perform maintenance on the system.

Reading the Instruction Manual

The Instruction Manual must always be kept in a readily accessible location at the installation site!

2.9 Operation of the system

Heed all safety instructions and hazard notices on the system! Ensure that all safety instructions and hazard notices on the system are present and in legible condition!

Information on the system

Supplement the Instruction Manual with information about monitoring and reporting obligations in order to account for special aspects of operation, e. g. with regard to organization of work, work procedures, assigned personnel.

Special aspects of operation

The personnel are not allowed to have long, loose hair, or wear loose clothing or jewelry, including rings. These pose the risk of injury, e. g. by becoming caught in machinery.

Risk of injury arising from clothing and the like

Use personal protective equipment whenever necessary or required by regulations!

Protective equipment

2.10 Working on the system

Observe the adjustment, maintenance and inspection intervals, including replacement of parts, specified in the Instruction Manual! These activities may only be performed by qualified individuals.

Maintenance

Inform personnel before starting to perform any special or maintenance work! Designate supervisors!

Comply with all procedures for switching equipment on and off specified in the Instruction Manual as well as instructions regarding servicing of equipment when performing any work that involves operation or adjustment of the system and its safety devices or inspection, maintenance or repair!

Switching on and off

Safeguard as large a maintenance area as necessary!

If the system has been switched off completely for maintenance and repair work, it must be secured against being switched on again unexpectedly.

Securing against being switched on

Spare parts must meet the technical specifications of the manufacturer. This is always assured by purchasing genuine Voith replacement parts.

Spare parts

Individual parts and larger assemblies are to be carefully fastened and secured to lifting gear when being exchanged so that no danger is posed. Use only suitable lifting appliances and accessories that are in good condition and have the necessary load-carrying capacity! Do not work or stop under suspended loads!

Lifting appliances

When performing assembly work above body height, use the provided or other safety ascent aids and work platforms. Do not use parts of the system as ascent aids!

Work performed above body height

Before starting maintenance/repair work, clean the system, especially connections and threaded fittings, of oil, lubricants or similar substances! Do not use any aggressive cleaning agents! Use lint-free cleaning rags!

Connections and threaded fittings

Always tighten bolted connections when performing maintenance or servicing the equipment!

Bolted connections

If disassembly of safety devices is required when performing maintenance and repairs, these safety devices are to be reassembled and checked for proper operation immediately after the completion of the maintenance and repair work.

Completion of maintenance and service work

Ensure that all operating fluids and replaced parts are disposed of safely and in an environmentally responsible manner!

In addition to the Instruction Manual, ensure that generally applicable as well as any specific regulations regarding accident prevention and environmental protection are observed and pointed out!

In the event of any system modifications that affect safety or any changes in the operation of the system, shut the system down immediately and notify the responsible party/individuals of the malfunction!

Observe the specified deadlines for recurring maintenance/service work! Always ensure that maintenance instructions and intervals are observed.

Maintenance/service

Keep access paths to areas needed for service work free of obstructions.

Servicing of the equipment requires tools that are appropriate for the work to be performed.

The system must be disassembled only by qualified personnel who perform their work in compliance with local safety regulations.

Relocating the equipment



Suitably pack components that are subject to breakage, drain fluids where necessary.

Protect the environment. Comply with local regulations.

Disposal

Prior to disassembly for salvage purposes or scrapping, completely remove any oil or other substances that pose a danger to water.

2.11 Electrical/electronic equipment

	 DANGER
	<p>Danger to life</p> <p>Dangerous electric currents and voltages on the Geared variable speed coupling can injure or kill individuals.</p> <p>Only a qualified electrician who is knowledgeable about rules that apply to electronic equipment is allowed to perform work involving the electrical equipment on the Geared variable speed coupling.</p>

Use only new fuses rated for the specified current! Shut down the system immediately in the event of problems with the electricity supply!

Electrical energy

Work on electrical equipment or machinery must be performed only by a qualified electrician or by trained individuals under the direction and supervision of a qualified electrician who is knowledgeable about the rules that apply to electronic equipment.

System components on which inspection, maintenance or repair work is being performed must - if so specified - be switched off and secured against being switched on again. Check disconnected components to ensure the absence of electrical voltage, then ground and short circuit them; isolate adjacent components that are still connected to electricity!

The electrical equipment must be inspected/checked on a regular basis. Deficiencies such as loose wires or charred cables must be replaced immediately.

2.12 Special types of hazards

When handling oil and grease, observe the safety regulations that apply to the product!

Oil, grease and aerosols

Exercise caution when handling hot operating fluids and similar substances (risk of burns and scalding)!

Escaping aerosols can be absorbed into the body via the skin, eyes and lungs, causing irritations or injuries. The operator is obligated to always provide adequate ventilation.

2.13 Interface to machinery from others



The danger area that arises at an interface to machinery from others must be protected by the operator.

2.14 Prohibition against arbitrary modifications



Do not make any alterations, modifications or add any attachments to the system that could affect safety before receiving approval from Voith Turbo GmbH & Co.KG Crailsheim!

Modifications

2.15 Cleaning the Geared variable speed coupling

	 WARNING
	<p>Risk of injury</p> <p>Rotating parts on the system can cause injury.</p> <p>Shut down the system when it is necessary to clean these parts.</p>



2.15.1 Cleaning agents

	 WARNING
	<p>Risk of injury</p> <p>Flammable solvents can burst into flame and cause injury.</p> <p>Use only approved cleaning agents.</p>

2.15.2 For normal dirt

- Use commercially available, non-flammable solvents.
- If solvent vapors can be inhaled, breathing protection must be worn.
- Do not allow solvents to drain into the sewage system.
- Heed the identifying information and instructions on the containers and the packaging of the cleaning agent.

2.16 Individual phases of operation

	 WARNING
	<p>Equipment damage</p> <p>The Geared variable speed coupling is delivered without any oil in it. Operation without oil will damage the equipment within a few seconds.</p> <p>Prior to startup, fill the Geared variable speed coupling with the working oil!</p>

NOTE
<p>Proper operation of the Geared variable speed coupling requires that the instruments be functioning correctly.</p>

- The Geared variable speed coupling can be damaged if
 - it is started without working oil,
 - the heat exchanger and the lines to the heat exchanger have not been flushed prior to commissioning,
 - a working oil not approved by Voith is used,
 - the equipment was filled with contaminated working oil,
 - the heat exchanger does not have adequate cooling capacity.
- The Geared variable speed coupling can also be damaged
 - if the driving machine is not rotating in the correct direction or
 - if the components that are supplied with lubricating oil from the Geared variable speed coupling are sealed with silicone-containing gaskets.

Commissioning

- Perform specified maintenance at the times indicated!
- Immediately repair or exchange components that are not in perfect operating condition. Use only genuine Voith replacement parts!

Maintenance

The working oil in the Geared variable speed coupling may be under pressure. Prior to performing any maintenance or repair work, disconnect the equipment from the electricity (observe local regulations!)

The housing, oil lines, connecting couplings and working oil may be very hot - in extreme cases, up to 130°C. Contact can cause burns on the skin.

The Geared variable speed coupling must be allowed to cool prior to maintenance or repair work!


When steam cleaning or using a stream of water under high pressure, dirt may be forced into the equipment.

Cleaning

Protect shaft seals (labyrinth seals) and breather filters on the Geared variable speed coupling, so that the stream of water or steam does not strike them directly.

Note the following when disposing of used oil:

Disposal of used oil

	<h3>CAUTION</h3>
	<p>Environmental damage</p> <p>Used oil that escapes into the soil or sewage system can cause serious damage to the environment.</p> <p>Dispose of used oil in a proper manner that complies with national statutory regulations.</p>

2.17 Warranty

The conditions specified in the general terms of delivery of Voith Turbo GmbH & Co. KG Crailsheim apply with respect to warranty claims. Warranty claims will be rejected if they are attributable to one or several of the following causes:

- Improper transportation, storage, setup, commissioning or operation of the Geared variable speed coupling,
- If service, repairs or modifications that affect operation were not performed by Voith technicians or personnel trained by Voith.
- Failure to comply with the instructions regarding occupational safety and product safety contained in the Instruction Manual,
- Filling the Geared variable speed coupling with contaminated oil, with different oil grades or with a grade that does not appear on the Voith-authorized list or is not approved by Voith Turbo GmbH & Co. KG Crailsheim.

NOTE

During the warranty period, repairs to the Geared variable speed coupling may be performed only with the approval of Voith Turbo GmbH & Co. KG Crailsheim.

3 Design and Principle of Operation

3.1 Design

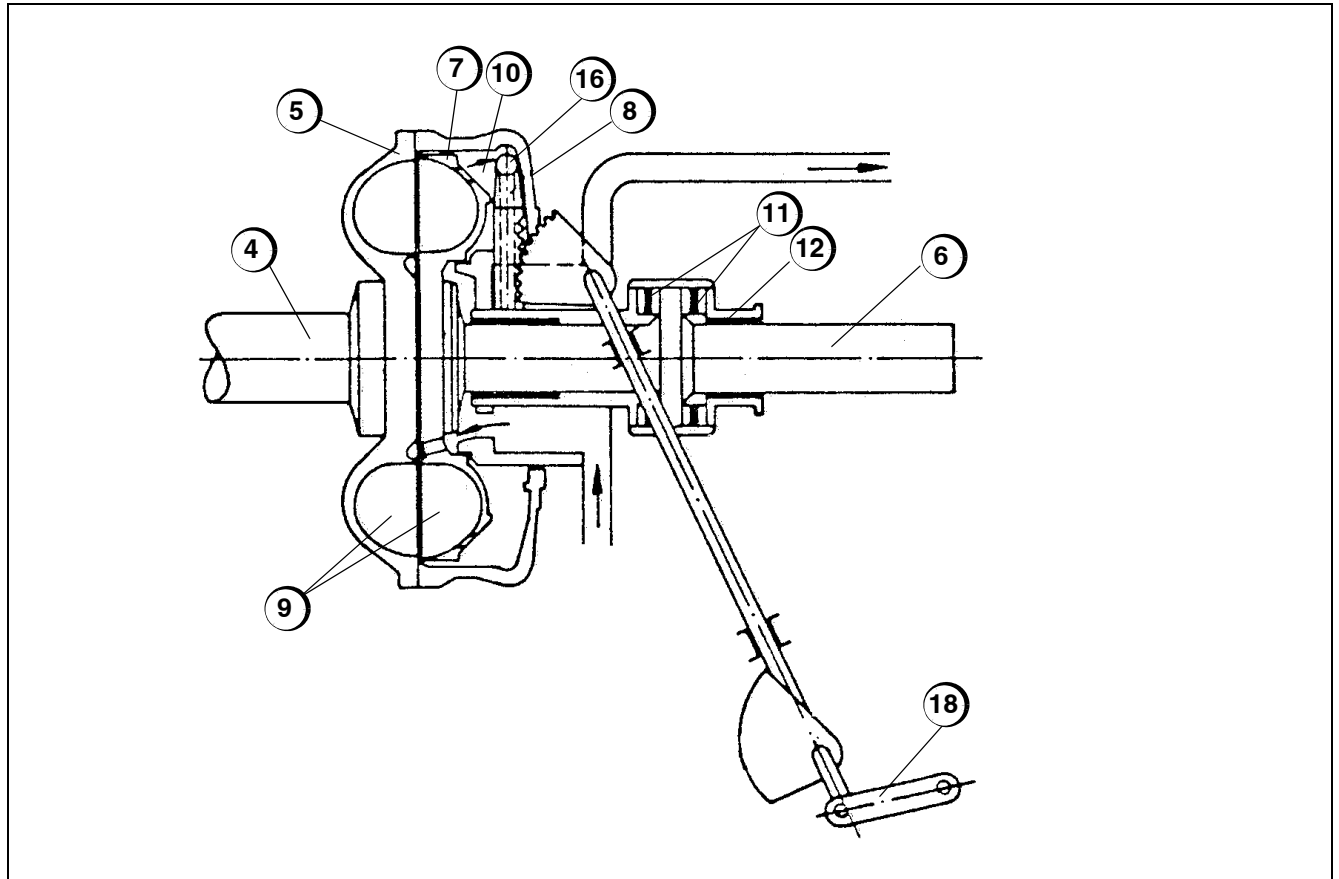


Illustration 3-1: Design of the Geared variable speed coupling (only partially shown)

1 Housing with oil reservoir	11 Thrust bearing	20 Pressure relief valve
2 Input shaft	12 Radial bearing	Working oil
3 Gear wheel	13 Mechanically driven main oil pump	21 Lubricating oil sequence valve
4 Primary shaft	15 Auxiliary lubricating oil pump with electric motor	22 Duplex oil filter
5 Primary wheel	16 Scoop tube	23 Lube oil cooler
6 Secondary shaft	17 Scoop tube - actuator	24 Working oil cooler
7 Secondary wheel	18 Control lever	25 Instruments
8 Shell	19 Orifice in working oil circuit	26 Check valve
9 Working chamber		
10 Scoop chamber		

The mechanical gearing and the coupling are combined in an enclosed housing.
The oil reservoir is flange-mounted at the bottom of the housing.

Housing

The coupling consists of the

Coupling

- primary shaft and primary wheel,
- secondary shaft and secondary wheel,
- shell (flange-mounted to the primary wheel, encloses the secondary wheel) as well as the
- scoop tube housing with scoop tube control.

The primary shaft and primary wheel are permanently attached to one another, the same is true of the secondary wheel and secondary shaft. The primary shaft is connected to the driving machine via the gear unit; the secondary shaft is connected to the driven machine.

The primary wheel, secondary wheel and shell form the working circuit. The working oil circulates within the working chamber.

The scoop tube with the scoop tube housing is integrated in the housing of the Geared variable speed coupling. The secondary shaft is mounted in the scoop tube housing.

The gear unit contains the input shaft with a gear and the pinion gear shaft. The pinion gear shaft is connected with the primary shaft of the coupling.

Gear unit

All rotating parts have plain bearings and are lubricated.

Bearings

The working oil and lube oil circuits are separate, but draw oil from the same oil reservoir. The oil is pumped by the main oil pump and put into circulation.

Oil pumps

The main oil pump, which pumps working oil and lubricating oil, is driven mechanically by the input shaft of the Geared variable speed coupling.

The electrically driven auxiliary lube oil pump supplies the system with lube oil during startup, shutdown and in the event of a malfunction.

3.2 Power transmission

The Geared variable speed coupling transmits power in a wear-free manner from a driving machine to a driven machine. The power is transmitted in the following way:

- by means of a connecting coupling between the driving machine and Geared variable speed coupling,
- by means of a step-up gear unit between the input shaft and primary shaft,
- hydrodynamically by means of the working oil between the primary wheel and the secondary wheel,
- by means of a connecting coupling between the driving machine and Geared variable speed coupling,

The scoop tube control provides infinitely variable adjustment of the driven machine's speed.

The power from the driving machine is transmitted to the primary wheel (function: pump) to the working oil; the working oil is accelerated in the primary wheel, and the mechanical energy is converted into the energy of fluid flow. The secondary wheel (function: turbine) picks up the flow energy and converts it into mechanical energy. This energy is transmitted to the power consumer.

**Mechanical energy –
fluid flow energy**

The torque at the primary wheel is identical to that at the secondary wheel.

Because of slip during power transmission, the speed of the secondary wheel (n_2) is lower than that of the primary wheel (n_1).

Slip

$$[s = (1 - n_2/n_1) \times 100 \%]$$

The power loss resulting from the slip heats the working oil. To dissipate this heat, the oil must be cooled.

Oil flows into the working circuit of the coupling via the orifice in the working oil circuit and forms a rotating ring of oil in the scoop chamber as a result of centrifugal force. The position of the scoop tube determines the height (thickness) of the oil ring in the scoop chamber and thus the level of oil in the working chamber. The scoop picks up the heated working oil in the scoop chamber and directs it to the working oil cooler. There, it is cooled and put back into the coupling via the orifice. This completes the circuit.

**Working oil cooling
circuit**

If the amount of working oil in the coupling needs to be increased, the scoop tube is adjusted and the main oil pump also pumps working oil from the oil reservoir into the circuit via the sequence valve.

The orifice in the working oil circuit, along with the working oil pressure, determines the working oil flow rate. Excess oil in the circuit is returned to the oil reservoir through the pressure relief valve.

Working oil flow rate

The working oil pressure is adjusted at the pressure relief valve.

**Working oil
pressure**

The working oil temperature depends on the power loss (slip) and the working oil recirculation rate. It is monitored by temperature sensors.

**Working oil
temperature**

If cooling water consumption in the working oil cooler is to be reduced, a temperature control circuit for the working oil based on reducing the flow of cooling water can be provided.

**Oil temperature
control**

If as the result of a malfunction the oil temperature rises to $160\text{ }^{\circ}\text{C}^1$, the fusible plugs in the coupling melt, and oil is diverted into the housing of the Geared variable speed coupling. The coupling empties and if the working oil pump does not supply any additional oil, the equipment comes to a stop.

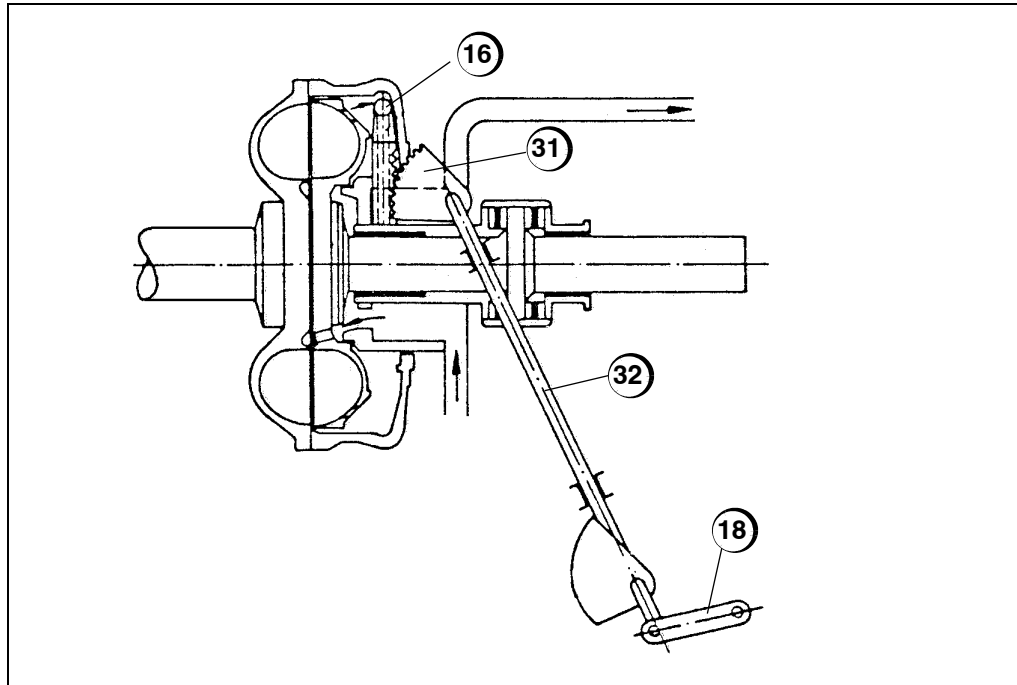
Fusible plugs

Reasons for an increase in oil temperature could be:

- lack of cooling (cooler malfunction)
- overloading of the coupling

1. if the necessary oil temperature acts on the solder in the fusible plug together with a suitable oil pressure.

3.3 Speed control



*Illustration 3-2:
Speed control by means
of the scoop tube*

- 16 Scoop tube
- 18 Control lever
- 31 Gear segment
- 32 Control shaft

The speed of the driven machine is infinitely variable. This is accomplished by varying the amount of oil in the coupling during operation with the aid of the adjustable scoop tube:

- Scoop tube advanced as far as possible into the scoop chamber of the coupling (0 % position): minimum oil ring, minimum output speed.
- Scoop tube retracted as far as possible out of the scoop chamber of the coupling (100 % position): maximum oil ring, maximum output speed.

The position of the scoop tube depends on the position of the control lever. The control lever is connected with the actuator by a linkage. The control lever is adjusted by the actuator.

The control lever is adjusted via the actuator in direction "Max. output speed" (100 %).

Max. output speed

- The control lever is solidly connected with the control shaft.
- The control shaft is turned by turning the control lever.
- The control shaft moves the scoop tube one gear segment in the direction of 100 % (out of the scoop chamber). The main oil pump adds oil to the working oil circuit.

The control lever is adjusted via the actuator in direction "min. output speed" (0 %).

Min. output speed

- The mechanical processes are the same as described previously. The direction of movement is different however.
- The scoop tube moves in the direction of 0 % (into the scoop chamber). The coupling empties. The working oil is returned to the oil reservoir via the pressure relief valve.

3.4 Lubrication

3.4.1 Self-lubrication

Bearings and gears of the Geared variable speed coupling require lubricating oil for starting up, during operation and when shutting down.

During operation, the main oil pump delivers oil from the oil reservoir into the lube oil circuit. At startup and shutdown, the auxiliary lube oil pump supplies the oil for lubrication. The oil flows through

Lube oil circuit

- the check valve,
- the lubricating oil cooler and
- the duplex oil filter

to the lubrication points after being cooled and filtered.

The lube oil flow rate for the bearings and gears is set by means of orifice plugs or orifice openings in the lube oil nozzles. Excess oil flows into the working oil circuit via the sequence valve.

Lube oil flow rate

The lube oil flow rate can be altered only indirectly by means of the lube oil pressure.

The lubricating oil pressure is set at the sequence valve and is monitored with pressure measuring devices (pressure gauge, transmitter, switch).

Lube oil pressure

The lube oil temperature is monitored by temperature measuring devices.

**Lube oil
temperature**

Controlling the oil temperature ensures good separation of air in the oil reservoir. The following possibilities exist:

**Oil temperature
control**

- Mixed control (on the oil side)
 - for larger cooling water temperature fluctuations in the lube oil cooler
 - for stand-by units with a continuously operating auxiliary lube oil pump at cooling water temperatures under 15–20 °C
- Flow control (on the water side)
 - for smaller cooling water temperature fluctuations in the lube oil cooler

3.4.2 Lubrication of external equipment

The oil for lubrication of the driving machine, the driven machine and/or the connecting couplings is drawn from the lube oil circuit of the Geared variable speed coupling and returned to the oil reservoir of the Geared variable speed coupling.

The lube oil pressure and lube oil flow rate are set with the aid of the orifices plugs on the flange connection of the Geared variable speed coupling and possibly with the aid of the orifice plugs upstream of the respective lubrication points.

**Lube oil pressure,
lube oil flow rate**

4 Transport and Storage

4.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Hazard from loss of stability and danger arising from masses

As the result of inadequate packaging and securing, the coupling may have become unstable and could shift unintentionally, causing serious injury.

Maintain a safe distance! Allow only knowledgeable personnel to handle transport!



Hazard from loss of stability and danger arising from masses

Unqualified personnel could misjudge the weight of the coupling. This could (for instance, as the result of selecting unsuitable lifting equipment) allow the load to drop on someone underneath, resulting in serious injury or death and/or cause severe damage to the coupling.

For weight data, see [Section 1 „Technical Data“](#) and [Section „Assembly Plan“](#).

Allow only knowledgeable personnel to handle transport!



Hazard of crushing of upper and lower body limbs

Improper handling of the coupling, especially during transport by a crane, poses the risk of crushing and serious injury.

Maintain a safe distance! Allow only knowledgeable personnel to handle transport!



Impact hazard

The suspended and swinging coupling could strike someone and cause serious injury.

Maintain a safe distance! Allow only knowledgeable personnel to handle transport!



Friction and abrasion hazard

The suspended and swinging coupling could rub against someone and cause friction or abrasion wounds.

Maintain a safe distance! Allow only knowledgeable personnel to handle transport!



Impact hazard during transport

While being transported, the coupling could strike a person or object, resulting in serious injury or damage.

Allow only knowledgeable personnel to handle transport!



4.2 As-delivered condition

4.2.1 State of assembly and test run

The Geared variable speed coupling cannot be used on its own in the as-delivered condition.

- The Geared variable speed coupling is fully assembled and ready for installation.
- All internal piping for the working oil and lube oil is in place.
- All external piping connections are provided in the form of welding neck flanges with gaskets, and are sealed for protection during transport.
- If connecting couplings are being supplied by Voith or have been provided by the customer, their hubs have been attached to the input and secondary shafts of the Geared variable speed coupling.
- All instruments (gauges, switches etc.) are attached or installed in an instrument panel. The panel is attached to the housing by means of vibration-absorbing mounts.
- Electrical indicating instruments and switches are wired to a terminal strip in a junction box.
- The instruments installed are identified.
- The actuator is installed and set.

State of assembly

Prior to shipment, the Geared variable speed coupling underwent a trial run at the Voith test facility.

Test run

The following items measured:

- Losses during idling
- Oil and bearing temperatures
- Vibration¹

The following items were adjusted:

- Oil flow rates
- Oil pressures
- Operating points of the instruments installed

1. Evaluation on the basis of DIN ISO 3945, Items. 0–7, and as prescribed in VDI 2056, Machinery group T

4.2.2 Preservation/corrosion prevention and packing

The Geared variable speed coupling and all attached components have been treated (preserved) and packed in a manner that provides protection for 12 months.

4.3 Storage and preservation

The internal surfaces of the Geared variable speed coupling have a light film of oil in the as-delivered condition (either from the oil used during the trial run or from having had solvent-free corrosion-inhibiting oil sprayed on as corrosion protection¹). This film of oil provides 12 months of protection within Europe, provided that the coupling is stored in a dry location.

Corrosion protection for shipment within Europe

For shipment overseas, the Geared variable speed coupling is additionally sealed in plastic film. Bags of desiccant inside the packaging absorb some of the humidity. Equipment packaged in this way can also be stored for 12 months in a dry location, provided that the plastic film is not punctured or damaged.

Corrosion protection for shipment overseas

→ [Section 4.5 „Preservation specification“ on page 34](#)

For Geared variable speed couplings that are to be stored for periods of longer than 12 months, Voith Turbo GmbH & Co. KG Crailsheim offers special long-term corrosion prevention with storage instructions after delivery.

Long-term preservation/corrosion protection

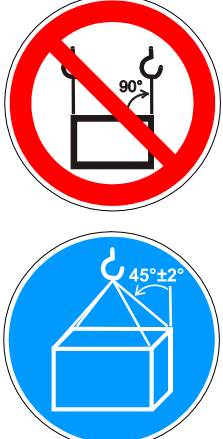
→ [Appendix_A_ „Preservation method and instructions for storage after delivery 3625-006714“](#)


1. used by the factory as well as recommended [Section „Internal corrosion-inhibiting oils“ on page 36](#)

4.4 Unpacking, transportation

The Geared variable speed coupling is delivered in a transport framework, ready for installation. If necessary, it is also protected by a crate. Both the coupling and the crate have specified lifting points.

1. If necessary, remove the crate.

	<div style="background-color: orange; color: black; padding: 5px; text-align: center;">! WARNING</div> <p>Risk of injury</p> <p>Improper lifting of the Geared variable speed coupling can result in equipment damage and personal injury.</p> <p>Geared variable speed coupling is only to be suspended in the indicated lifting points under the consideration of $45 \pm 2^\circ$.</p> <p>Use only appropriate lifting appliances that conform to safety requirements!</p>
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	<div style="background-color: yellow; color: black; padding: 5px; text-align: center;">CAUTION</div> <p>Equipment damage</p> <p>Transporting and setting the Geared variable speed coupling down improperly can result in damage to the coupling.</p> <p>The Geared variable speed coupling is to be transported only when it is properly secured and with the transport rails attached!</p> <p>Set it down only on a firm and appropriate surface!</p> <p>Rest it only on the feet attached to the housing or the feet attached to the oil reservoir!</p>
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<div style="background-color: blue; color: white; padding: 5px; text-align: center;">NOTE</div> <p>The lifting points provided on the Geared variable speed coupling are intended only for the weight of the coupling itself.</p> <p>Do not lift any other equipment at the same time! The Geared variable speed coupling is to be lifted only without oil in it!</p>
--

2. Check anchor eyelets¹ (4) for cracks, deformation and corrosion before using.
3. The Geared variable speed coupling is to be suspended from the indicated lifting points (1, 2). When suspending, the lifting shackle (3) must be inserted into the anchor eyelet (4). Hooking directly into the anchor eyelets is not permitted. Transporting is only permitted in the indicated position, other suspension methods are not permitted. Angle of inclination $45^\circ \pm 2^\circ$ and crane hook height **H** must be observed (see Assembly Plan).

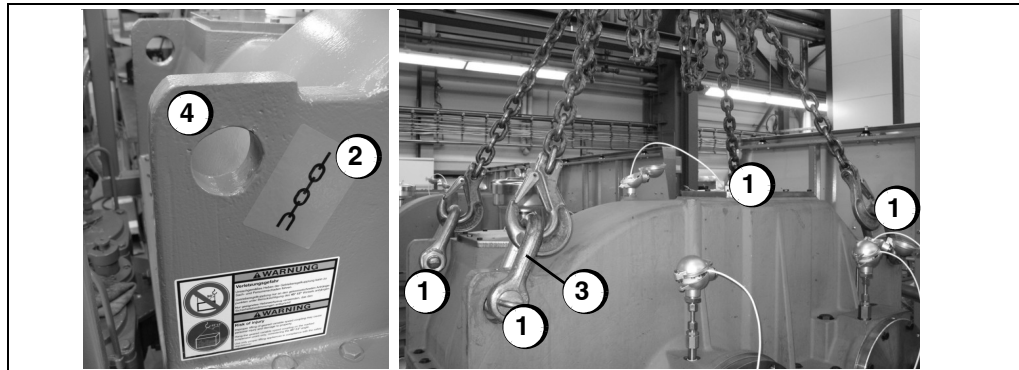


Illustration 4-3:
Lifting points

- 1 Lifting points
- 2 Stickers
- 3 Lifting shackle 4x
- 4 Lifting lugs 4x

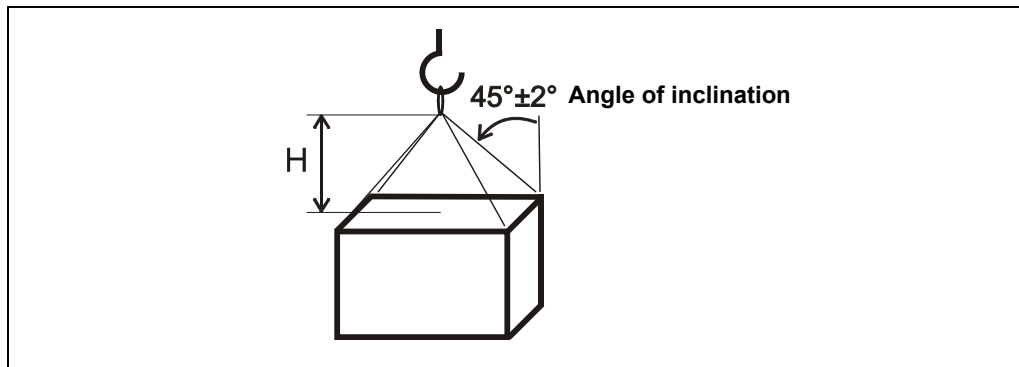


Illustration 4-4:
Suspension sketch

Crane hook height **H**
(see Assembly Plan)

4. Unscrew the machine from the transport framework and pull the frame from under the machine.
5. Set the Geared variable speed coupling down on the feet attached to the oil reservoir.

NOTE

The transport frame can later be used as an assembly block. Returning the transport frame to Voith Turbo GmbH & Co. KG Crailsheim is only possible with previous consultation.

1. Anchor eyelets are to be checked by an expert at least once per year. Surfaces must undergo a crack test every 3 years.

4.5 Preservation specification

Source: Sheet 3625-006212 de, date of issue: November 2008

These specifications apply to the protection of internal and external surfaces (insofar as the surfaces are not treated and/or corrosion-resistant or made of cast aluminum), as well as the packing of the shipments.

Overview

		Preservation		
Transport, storage and storage duration	Packaging No.	External	Internal with test run	Internal without test run
1. Overland/air transport for immediate installation at the destination (or storage in a closed building for up to 6 months)	Packaging No. 1	External preservation No. 1	Internal preservation No. 1	Internal preservation No. 2
2. Sea transport and / or storage for up to 12 months after the date of packaging	Packaging No. 2			
3. Sea transport and / or storage for up to 24 months after the date of packaging	Packaging No. 3			
4. Extended protection (after expiration of the initial protection)	Replace plastic film and reseal	External preservation No. 2	Internal preservation No. 3	

- Paint finish as specified in order documents.
- Bare iron parts sprayed with "Shell Ensic Fluid S"¹.
- See note.

Outer preservation No. 1

- Check the external preservation.
- If necessary, reapply depending on the condition of preservation No. 1.
- Exchange desiccant.

Outer preservation No. 2

NOTE

If use of VCI preservation products for an order is ensured throughout the entire packaging chain, corrosion protection based on this preservation method is permissible if agreed upon. (Carefully flush the unit before filling in operation oil as the VCI active ingredients may have a negative influence on the air release property of oils).

¹. Before installing the coupling or parts, clean sprayed surfaces with solvent (white spirits or petroleum).

- Internal preservation from oil used during test run.
- If the order documents call for “Inspection” after the test run, spray with solvent-free corrosion-inhibiting oil (“Shell Ensic Engine Oil 20” used at the factory) to the extent possible. For alternatives to “Shell Ensic Engine Oil 20”, see 3625-006237).
- Fill the interior of the coupling with dry air, relative humidity max. 10%.

**Internal
preservation
No. 1**

- All surfaces of iron parts (including holes, cavities and internal surfaces of pipes) sprayed, immersed or flushed with solvent-free corrosion-inhibiting oil during assembly (with Shell Ensic Engine Oil 20 at the factory) based on installation progress. All assemblies sprayed during assembly to the extent possible. For alternatives to “Shell Ensic Engine Oil 20” see 3625-006237).
- Fill the interior of the coupling with dry air, relative humidity max. 10%.

**Internal
preservation
No. 2**

- Inspect the preservation.
- Spray all rotating parts and wall surfaces with solvent-free corrosion-inhibiting oil (e.g. “Shell Ensic Engine Oil 20”), turn rotating parts while spraying. For alternatives to “Shell Ensic Engine Oil 20”, see 3625-006237).
- Spray the inside of piping with solvent-free corrosion-inhibiting oil (see above). As an alternative, fill the interior of the coupling with dry air, relative humidity max. 10 %.
- To the extent possible, fill the interior of the coupling with dry air, relative humidity max. 10%.

**Internal
preservation
No. 3**

- Means suitable for transport (e. g. transport frame, holder, support)
- Transport means provides protection from the weather.

Packaging No. 1¹

- Means suitable for transport (e. g. transport frame, holder, support)
- Sharp edges and supporting surfaces covered with elastic materials.
- Sealed in PE film with low density (PE-LP $\leq 0,2$ mm thick) according to DIN 55 530; water vapor permeability $WVP_{ClimateB} = 2 \text{ g/m}^2/24\text{h}$ or $WVP_{ClimateE} = 0.4 \text{ g/m}^2/24\text{h}$ according to DIN 53 122-2².
- Desiccant in acc. with DIN 55 473.
- Required desiccant units according to DIN 55 474 for permissible ultimate humidity $\leq 40\%$.
- Water-resistant carton or wooden crate.
- Inside of crate lid covered with closed ribbed PE sheets (Akylux). With PVC film underneath at butt joints.
- For checking the relative humidity, a humidity control window ($\varnothing 90$ mm) with moisture indicator (30, 40, 50% RH) has to be integrated in the PE foil; a swiveling cover has to be provided before the control window at the box.

Packaging No. 2¹

- Identical to Packaging No. 2. Difference: sealed in aluminized plastic film according to DIN 55 531 instead of PE film.

Packaging No. 3

1. The unit is packaged in accordance with the latest version of the packaging guidelines issued by the German Association for Wooden Packaging -Pallets - Export Packaging (HPE) e. V.
2. Tropical climate B: 38 °C, 90% RH; moderate climate E: 20 °C, 85% RH.

Internal corrosion-inhibiting oils

NOTE
Geared variable speed coupling is <i>not</i> filled with working oil!

Source: Sheet 3625-006237 en, date of issue: June 2008

High-pressure motor oils with excellent anticorrosive properties are recommended as internal corrosion-inhibiting oils. Special ingredients in these solvent-free corrosion-inhibiting oils promote the formation of strongly adhering protective films that protect vertical surfaces effectively.

(Shell Ensis Motor Oil 20 used at the factory)

Supplier	Designation	Recommended grades
AGIP	AGIP RUSTIA C 10W-20	
ARAL	ARAL KONIT SAE 20 W 20	
ExxonMobil	Mobilarma 524 (SAE 30)	
SHELL	Ensis Motoröl 20	
SRS Schmierstoffvertrieb GmbH Salzbergen	WINTERSHALL Antikorrol 20 W-20	

(This list makes no claim regarding completeness.)

4.5.1 To be ensured at the installation site:

Special attention should be paid to the effectiveness of the preservation applied to these units, since it often subjected to additional hazards such as water, accumulation of large amounts of dirt and physical damage.

This includes measures that provide supplemental internal protection when idle times of up to about 12 months are to be expected and when the original corrosion prevention coating has been disturbed.

Fill units with water-free working oil. The following can be performed at intervals of 1-2 months, depending on the state of installation:

- System that is ready to operate:
 - Start and operate only briefly (approx. 5 minutes) to coat the surface of internal parts with oil; do not run until warm.
- System that is not ready to operate:
 - Units with a ready-to-operate electric auxiliary lube oil pump or oil pump and oil reservoir:
 - Switch on pump; allow system to operate, if possible. Move operating components (e. g. joints).
 - Units without a ready-to-operate electric auxiliary lube oil pump or oil pump:
 - Remove oil from the sump, spray inside through openings in the housing and circulate oil through the piping with the aid of a separate oil pump, run for approx 5 minutes: allow system to operate, if possible. Move operating components (e. g. joints).

Installed units or units ready for installation

Complete systems installed on a foundation

NOTE

Before filling with the working fluids, contact the suppliers to confirm compatibility with the internal corrosion preventative.

→ Appendix_A_ „Preservation method and instructions for storage after delivery 3625-006714“

5 Configuration

5.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Hazard from improper installation

Improperly installed or assembled components could loosen, electrical lines could be incorrectly connected or routed, the insulation on poorly routed cables could be abraded and, as a result, cause serious personal injury or equipment damage.

Only a qualified electrician who is knowledgeable about rules that apply to electronic equipment in the country of installation is allowed to perform work involving the electrical equipment on the Geared variable speed coupling.

Use only cables with insulation that can withstand the ambient operating conditions!



Danger in areas that cannot be fully viewed

A person could be severely injured while working on the machine when starting it up.

Attach suitable protective covers that cannot be removed without the respective tool, between the coupling and the shaft!

Only work on the machine when the system is shut down (no power)!

Operation is only permitted after visually ensuring that no persons are in the hazard areas!



Hazard from maximum pressures, pressure shocks, pressure rise or pressure loss

An unsuitable or poorly maintained heat exchanger, improperly sized oil lines, the absence of shutoff valves, incorrectly set pressure relief valves or an improperly installed check valve could result in high pressures could destroy the equipment, causing serious personal injury due to flying objects as well as damage to the environment. A severe pressure drop could damage bearings.



- Allow only trained personnel to perform installation, maintenance and service work on the equipment and to operate it!
- Confirm that check valves are installed correctly!
- Observe maintenance intervals!
- Comply with limits!
- Do not install shutoff valves in the oil circuit, make sure that the oil circuit conforms to the schematic provided!

Equipment damage

Creepage or stray electric currents can reach the Geared variable speed coupling via the drive shaft, leading to spark erosion damage on bearing surfaces and the surfaces of teeth on the drive gears in the pump insert.

Provide appropriate grounding/insulation between the prime mover (driving machine) (e.g. between the connecting coupling and take the necessary measures to interrupt the flow of electric current!

CAUTION**Equipment damage**

Dirt caused by construction, flying sparks, grinding dust and water can get into the Geared variable speed coupling and cause the equipment to malfunction.

Cover the Geared variable speed coupling with a tarpaulin completely during construction work at the installation site!

Protect instruments, electrical cables and cable trays particularly well!

Use only appropriate sealants that are oil resistant up to 130 °C and do not contain silicone. Failure to comply with the above will have an adverse effect on oil quality and can cause damage to the geared variable-speed coupling.

CAUTION**Equipment damage**

Improper installation can result in malfunctions and premature wear in the equipment.

Setup and initial commissioning should be performed by a Voith technician!

CAUTION

5.2 Tools and auxiliary means

- Metric tools
- Torque wrench
- Sealing compound (must not contain silicone)
- Lifting appliances
- Device for mounting the coupling hubs
- Shims
- Adjusting screws on the foundation rails for horizontal alignment
- Adjusting screws for vertical alignment
- Alignment device

5.2.1 How to seal the keyway

How to seal the keyway in the case of an oil-filled or grease-filled connecting coupling.

- Connecting coupling hub provided or still to be provided with a tapped hole above the keyway.
- Mount the hub on the shaft.
- Fill the tapped hole 2/3 with the sealing compound¹.
- Insert and tighten adjusting screw. Remove any sealing compound squeezed out of the face side.

1. LOCTITE 5910; When applying, please follow the instructions on the tube.

5.3 Mounting the connecting couplings

NOTE

Gear couplings or all-metal couplings with low radial restoring forces are suitable. Connecting couplings with a flexible compensating element (flexible element) are to be agreed upon only in individual cases.

If the connecting couplings are being supplied by Voith or have been provided by the customer, the input- and output-side connecting coupling halves will have been mounted at the factory:

- The end cover (2) and coupling hub (3) have been mounted on the shaft ends (1)
- The coupling sleeves are packaged separately.

Factory mounting

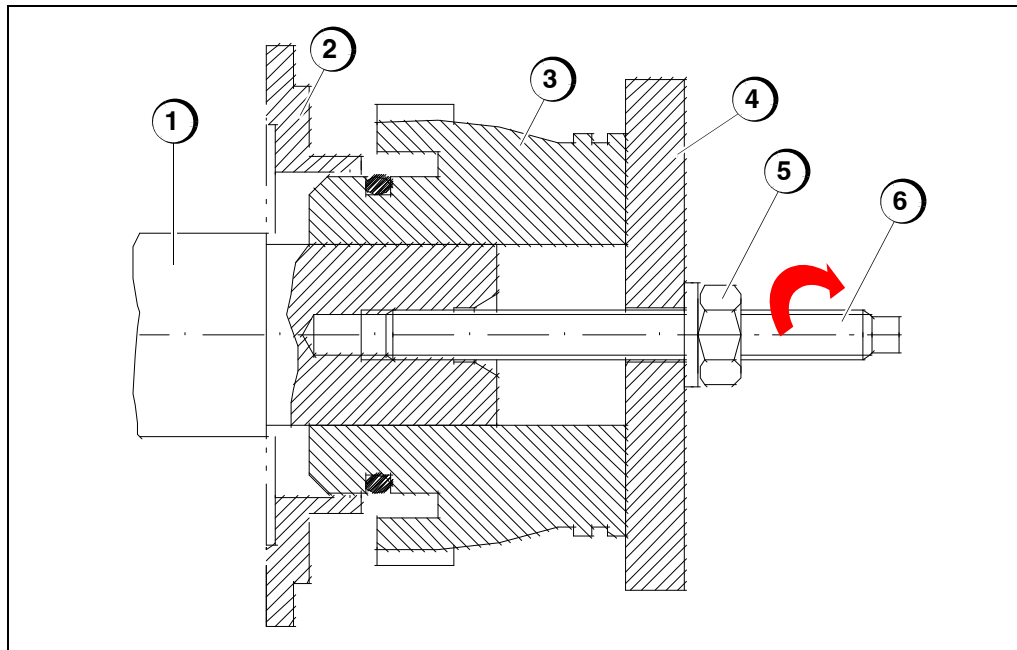


Illustration 5-5:
Coupling hub on shaft

- 1 Shaft end
- 2 End cover
- 3 Coupling hub
- 4 Plate
- 5 Bolt
- 6 Threaded spindle

If the connecting couplings are not yet mounted:

→ (manufacturer's specification for connecting coupling)

On-site mounting

NOTE

Check the connecting coupling for existence of the puller thread at the face end and tapped hole above the keyway.


**Gear couplings
with key**

1. Clean the shaft (1) and hub (3) from preservation agents using gasoline or cellulose thinner (not petroleum) and degrease.
2. Check the bore, shaft, key and keyway for dimensional accuracy.
3. Remove the key from the shaft keyway and fit it into the hub keyway. Then fit the key into the shaft keyway again. Check the height of the key: the back clearance between the keyway and key must be 0.2 – 0.3 mm.
4. Apply a thin coat of Molykote D Paste¹ or an equivalent lubricant to the shaft.
5. Slide the end cover (2) and O-rings over the shaft end.
6. Mount the coupling hub using a hub puller (4, 5, 6).
7. Seal the keyway of the connecting coupling hub ([Section 5.2.1 „How to seal the keyway“](#)).
8. Connecting couplings without an intermediate piece: slide the sleeve over the hub.
9. Connecting couplings with an intermediate piece: mount the sleeve only after alignment.
10. Protect the connecting couplings against corrosion and cover them.

1. Molykote D Paste; When applying, please follow the instructions on the tube/can.
Manufacturer Dow Corning Europe Rue General de Gaulle 62 B-1310 La Hulpe

5.4 Installing the oil drain line

After the Geared variable speed coupling has been installed, the bottom of the oil reservoir with the connection for the oil drain line is, in most cases, not accessible. Therefore, perform the following actions prior to positioning the Geared variable speed coupling:

	CAUTION
	<p>Environmental damage</p> <p>When removing the screw plug or blind flange, a small amount of residual corrosion-preventing oil may drain out; this oil could seep into the ground.</p> <p>Collect the oil in a flat container and dispose of it in a professional manner!</p>

1. Remove the blind flange from the oil drain line connection and collect any oil that drains out.
2. Attach the valve to the oil drain line and install the complete line/valve assembly. Close the valve.
3. Apply a corrosion inhibitor to the line (corrosion protection).

Installing the oil drain line with valve

5.5 Set the machine down on a concrete foundation

NOTE

The calculation and construction for the foundation are not included in the scope of delivery from Voith Turbo GmbH & Co. KG, therefore the customer or a third-party is responsible for this. Cementing is also not the responsibility of Voith Turbo GmbH & Co. KG.

Geared variable speed coupling set up with foundation rails on a concrete foundation.

Anchoring methods

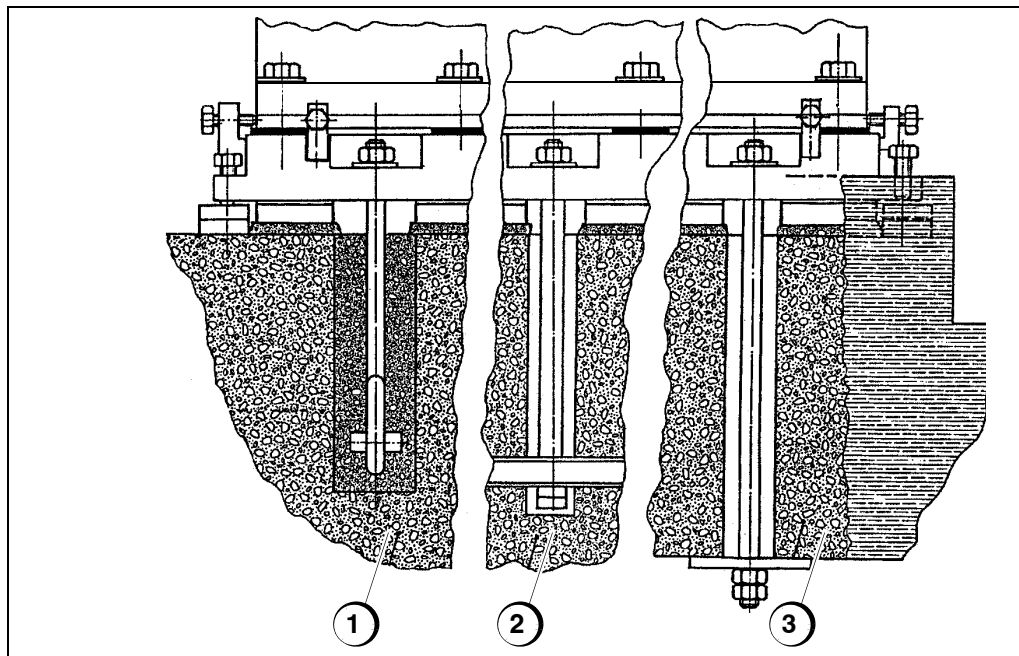


Illustration 5-6:
Concrete foundation
with anchoring methods

- 1 Anchor bolt with cross-irons
- 2 Hammer bolt with U-rails cemented in
- 3 Anchor bolt going completely through (Cover foundation)

Checks:

- Are the foundations for all machines in the system properly sized? (height, center position, flatness)
- Is the height of the concrete foundation measured so that there is free space of **2 mm** for putting shims beneath the Geared variable speed coupling and foundation rails?
- Are the connecting coupling sleeves mounted or has a sufficient distance been provided between the shafts for connecting couplings with an intermediate piece, in order to mount the sleeve later?
- Can the oil lines be installed after positioning the Geared variable speed coupling?
- Is the driven machine fixed axially?
- Is the axial clearance of the driving machine within tolerances? Is the rotor of the driving machine in operating position?
- Are the 35 mm thick support shims present, whereby four of these must have center holes?

Prior to setting down

Preparatory work:

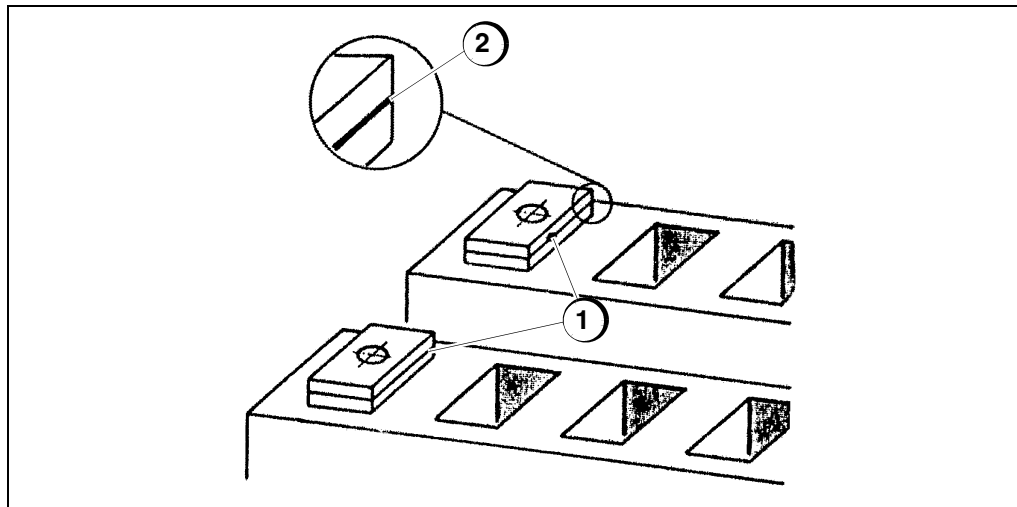


Illustration 5-7:
Arrange the support shims

- 1 Support shims (by pairs)
- 2 Contact surfaces (greased)

1. Prepare the foundation for positioning the support shims.
2. Mark the position of the support shims at the four corner points according to the layout.
3. Set the support shims completely on the foundation and align them with one another using a level. Measure the height of the support shims so that the Geared variable speed coupling is positioned at least 1 mm under the 0 line (shaft centerline).

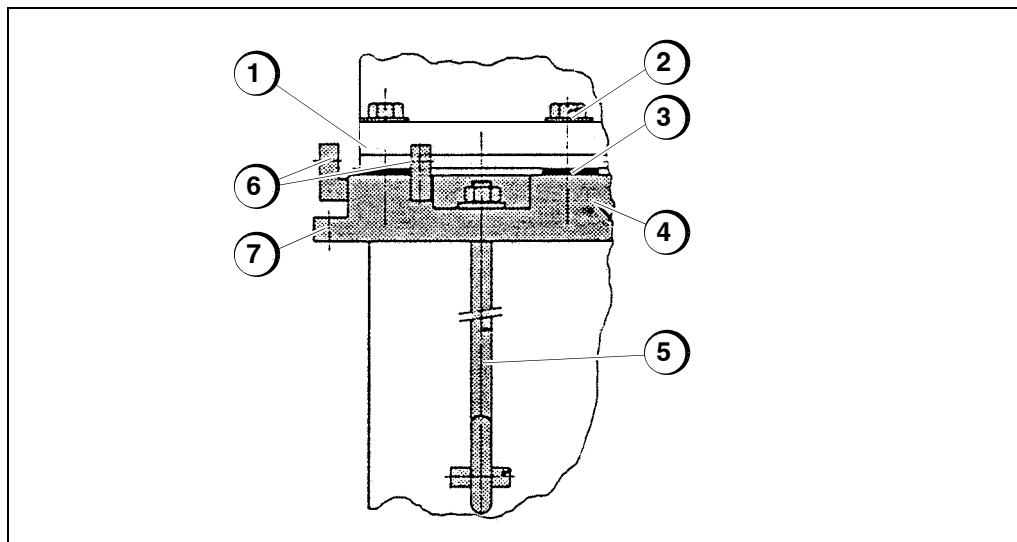


Illustration 5-8:
Foundation rail assembly

- 1 Housing base for the Geared variable speed coupling
- 2 Foundation bolt Shim, 10mm thick
- 3 Foundation rail
- 4 Anchor bolt
- 5 Adjusting screw, horizontal
- 6 Adjusting screw, vertical
- 7

4. Screw the foundation rails (4) with the shims (3) onto the housing base of the Geared variable speed coupling.
 - The foundation rails are to be arranged so that the foundation bolts are centered in the holes in the housing base.

- Screw the adjusting screws (6) in to secure the foundation rails horizontally. This will allow subsequent alignment of the Geared variable speed coupling on the foundation rails.
- 5. Mount the anchor bolts (5) in the foundation rails so that two threads protrude past the nut.
- 6. Install the adjusting screws (7).
- 1. Set the Geared variable speed coupling down on the concrete foundation with the aid of suitable lifting appliances. Every adjusting screw (7) must be positioned in the center hole of the support shim. Maintain the specified axial clearance between the connecting couplings in this case.
- 2. Use the adjusting screws to adjust the height of the Geared variable speed coupling.
- 3. Align laterally by moving the Geared variable speed coupling on the support shims, the surfaces of which have been greased.

Setting down

The system components must be aligned with one another.

Normal alignment sequence:

- 1. Align the Geared variable speed coupling with the driven machine
 - 2. Driving machine to the Geared variable speed coupling.
- Measurements: [Section 5.6 „Machine alignment“](#).

Aligning to grout the anchor bolts

NOTE

All machines involved (driving machine, Geared variable speed coupling, driven machine) should be set in position prior to performing the alignment.

- 1. Place the anchor bolts in the holes in the concrete foundation.
- 2. Fill in the holes or gaps in the concrete foundation with good, wet concrete mixture.

Concrete grout - mixing proportion:

- 1 part cement
- 2 parts sand

Grouting of anchor bolts

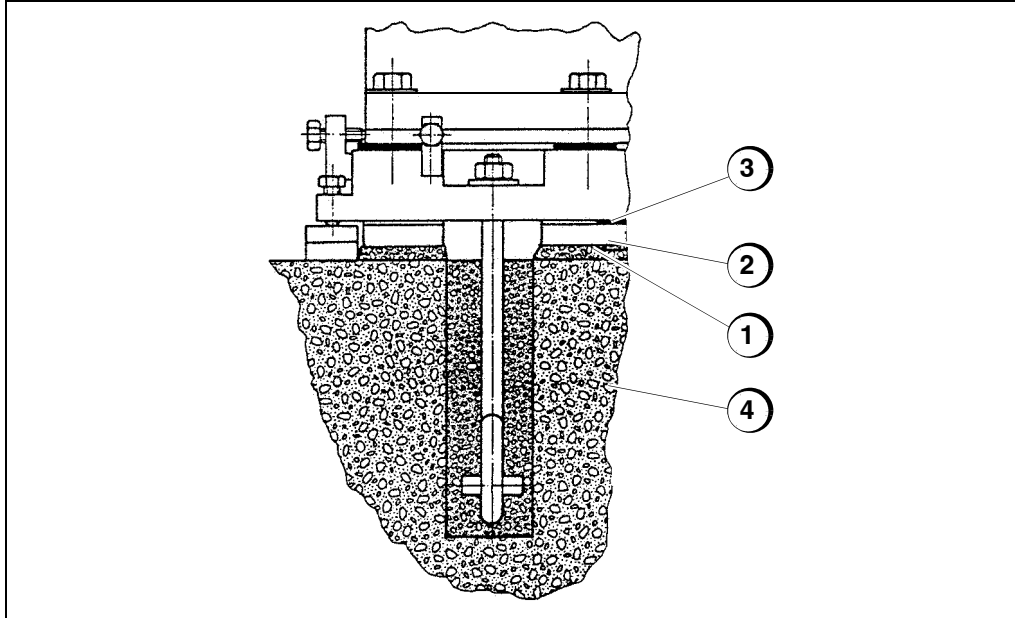
NOTE

Vertically grouted anchor bolts do not impose any shearing forces on the Geared variable speed coupling when tightening.

- 3. The setting time of the concrete grout is about three days.

At the very earliest, support measures can be started after three days.

The rebasing for the foundation rails is to be done on both sides per anchor bolt.

Foundation rail supports

*Illustration 5-9:
Rebasing the foundation
rails*

- 1 Compressed concrete
- 2 Base plate
- 3 Shim (Laminum)
- 4 Anchor bolt

Procedure 1:

1. Use a chisel to roughen the concrete foundation and clean with water.
2. Place the tamped concrete on the concrete foundation and pack.
3. Set the base plate on top.
4. Fill the minimum space with a shim (Laminum).

Tamped concrete - Mix ratio:

1 part cement

2 parts sand

Do not make tamped concrete too wet.

Procedure 2:

1. Use a chisel to roughen the concrete foundation and clean with water.
2. Determine the space between the concrete foundation and the foundation rail.
3. Manufacture the base plate according to the spacing dimensions minus 1 cm.
4. Unscrew the nuts from the anchor bolts.
5. Geared variable speed coupling, on the anchor bolts, are to be lifted approximately 5 cm.
6. Place 2-3 cm of tamped concrete on the concrete foundation.
7. Set the base plate on it.
8. Geared variable speed coupling is lowered onto the adjusting screws, which compresses the tamped concrete. Excess will be pressed out to the side. Install the nuts for the anchor bolts.

After a settling time of three days, the vertically adjusting screws are removed.

Any lateral deviations are corrected during final alignment using the adjusting bolts in the horizontal position.

Final alignment

If there are deviations in height, adjusting screws are threaded into the housing base of the Geared variable speed coupling to vertically correct the radial offset.

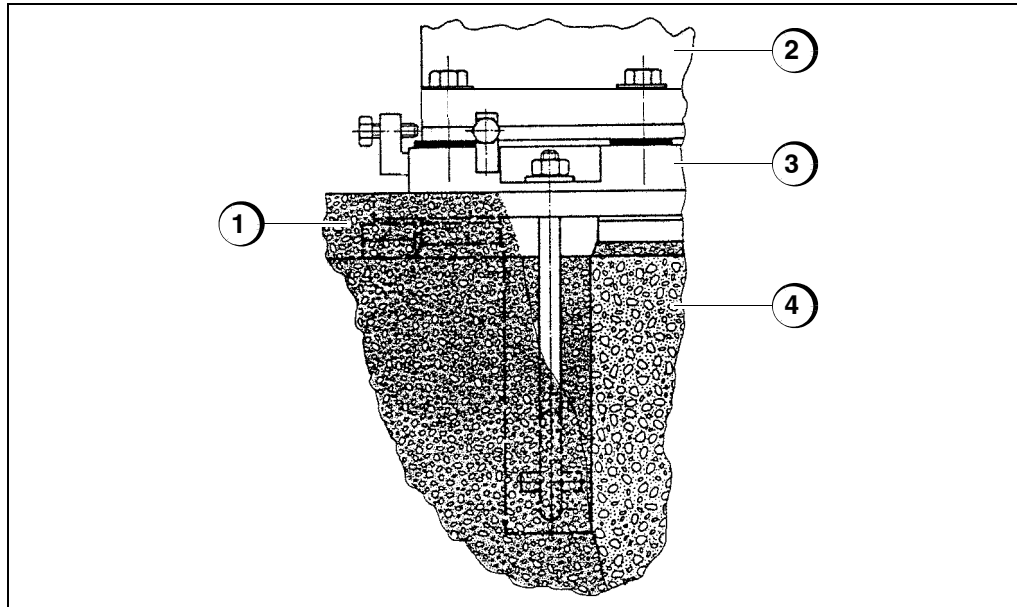
Loosen the foundation bolts, and adjust the height by adjusting the shims between the foundation rail and the housing base.

For measurements, see [Section 5.6 „Machine alignment“](#).

Fasten the Geared variable speed coupling to [Section 5.7 „Secure machine“](#) on the foundation rails.

After the final alignments have been made, the foundation rails must be cast in the concrete.

Last concrete grout



*Illustration 5-10:
Concrete grout for the
foundation rails*

- 1 Concrete grout
- 2 Geared variable speed coupling
- 3 Foundation rail
- 4 Concrete foundation

1. Frame the inside of the oil reservoir pit to the height of the foundation rail.
2. Grout in the foundation rails and the underlying space with a wet well-flowing concrete mixture.
3. After the respective settling and hardening time, remove the framing and paint the oil reservoir pit with an oil-resistant paint.

5.6 Machine alignment

The system components must be aligned with one another. All machines must be at the standstill temperature. At operating temperature, the shafts must be optimally aligned.

Normal alignment sequence:

1. Align the Geared variable speed coupling with the driven machine
2. Align the driving machine with the Geared variable speed coupling

NOTE

The machine alignment procedure described here is based on a measuring method using dial indicators.

It is also possible to use equivalent systems such as "electronic/optical measuring methods", for example, the electronic CTC measuring method, Optalin measuring system or Indikon measuring system as well as others.

Additional information regarding alignment can be found in:

- VDI Directive VDI 2726 "Alignment of Gearboxes"
- Manual for practical use "Alignment of Shafts in Machine Sets", VDI Publishers

5.6.1 Shaft misalignment and alignment tolerance

When aligning the Geared variable speed coupling, dimensional changes arising from the following must be taken into account:

Shaft misalignment

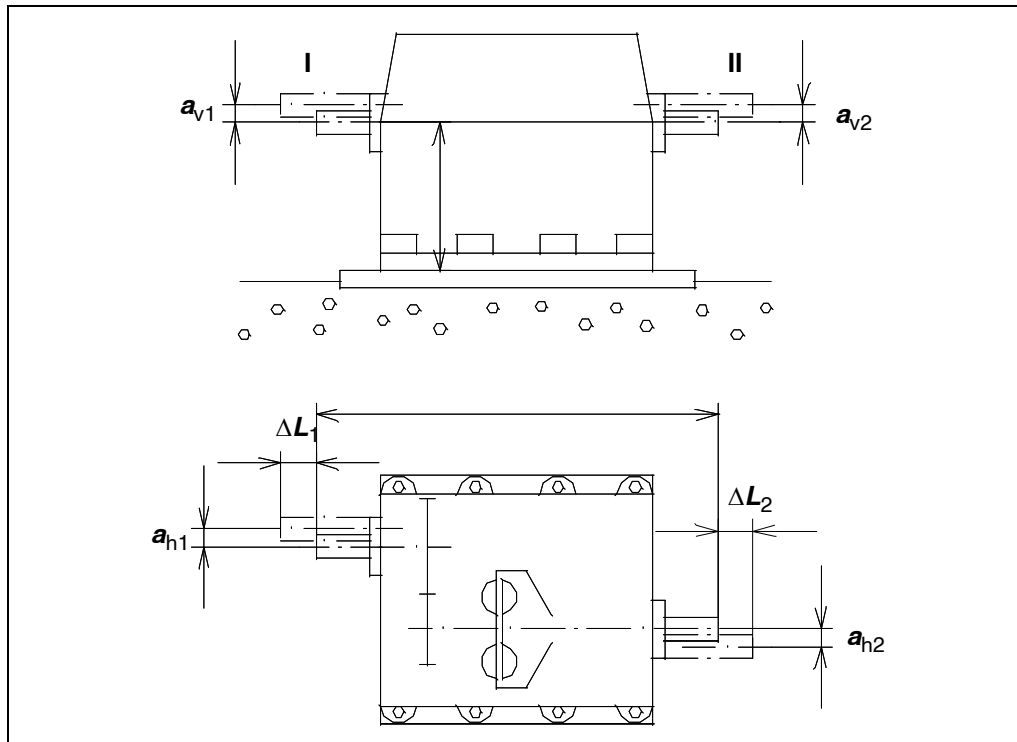
- Warming and expansion of the housing during operation and
- Rotation-dependent shaft misalignment due to tooth forces, bearing clearances and hydrodynamic lubrication.

5.6.2 Shaft misalignment and alignment tolerance

When aligning the Geared variable speed coupling, dimensional changes arising from the following must be taken into account:

Shaft misalignment

- Warming and expansion of the housing during operation and
- Rotation-dependent shaft misalignment due to tooth forces, bearing clearances and hydrodynamic lubrication.



*Illustration 5-11:
Radial and
axial displacement*

I Input end
II Output end

Radial displacement
horizontally a_h and
vertically a_v

Axial displacement
 ΔL

Radial displacement, horizontal¹

• input side (driving side)	a_{h1}	0.20 mm
• output side (driven side)	a_{h2}	0.13 mm

Radial displacement, vertical¹

• input side	a_{v1}	0.30 mm
• output side	a_{v2}	0.30 mm

Axial displacement¹

• input side (driving side)	ΔL_1	0.35 mm
• output side (driven side)	ΔL_2	0.35 mm

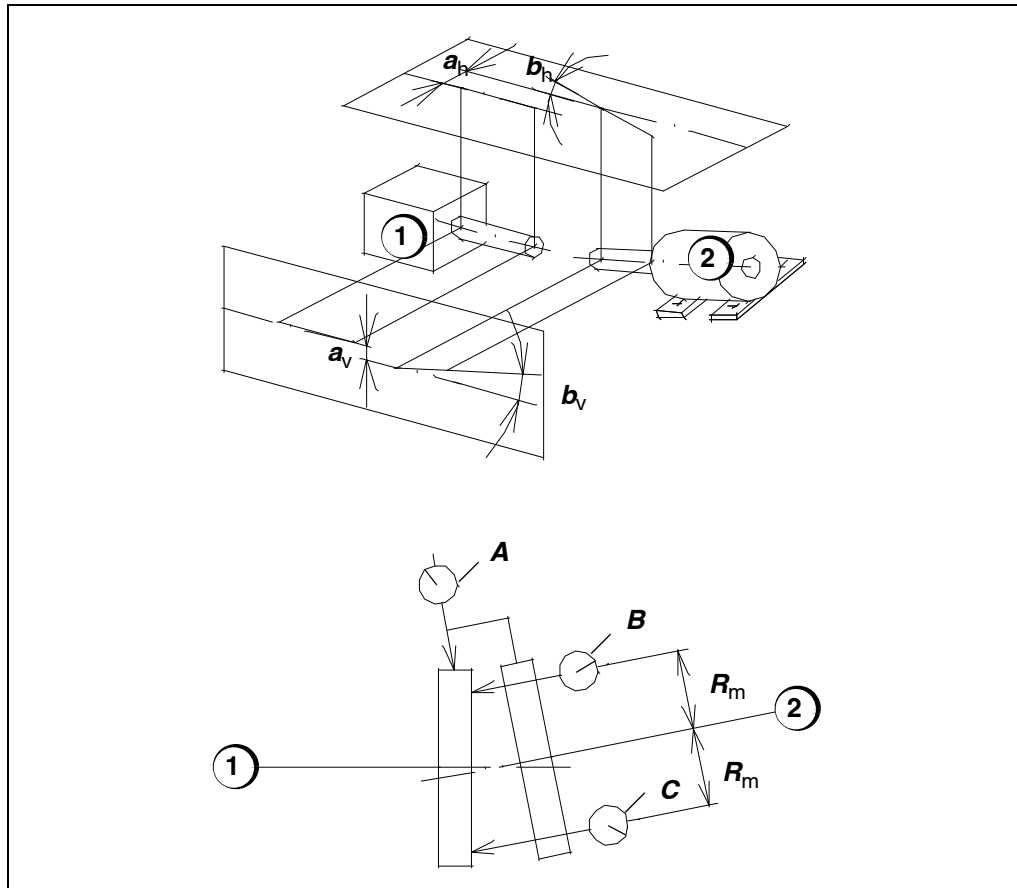
1. assumed housing temperature: 20 °C at installation, 60 °C during operation

This means that the shafts connected by means of connecting couplings should not be aligned at standstill, but rather must have a radial/angular/axial offset. This offset compensates for the displacement arising at startup and during operation.

When rotating both shafts by 360°:

- Radial measurement A: radial offset ± 0.03 mm
- Angular measurements B and C:
Angular misalignment ± 0.03 mm/100 mm Radius R_m

**Alignment tolerance
at operating temperature**



*Illustration 5-12:
Angular displacement
and radial offset*

- 1 Machine aligned
- 2 Machine still to be aligned

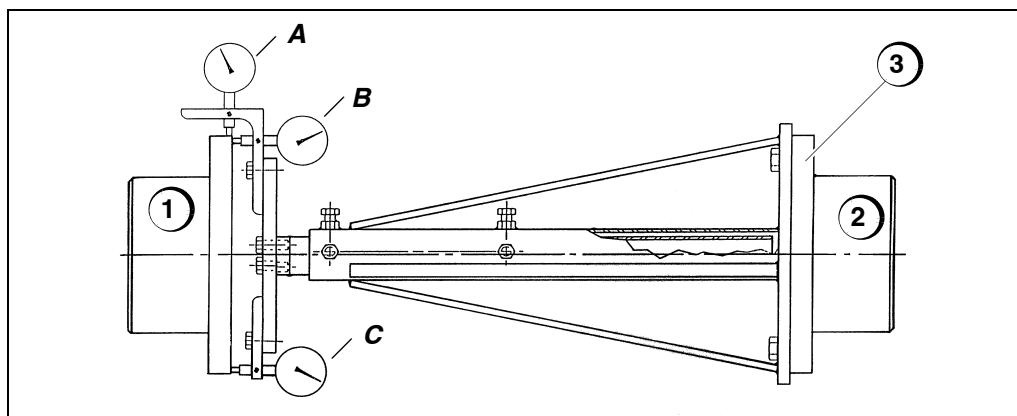
Radial offset
horizontally a_h and
vertically a_v

Angular misalign-
ment
horizontally b_h and
vertically b_v

Radius R_m

5.6.3 Connecting couplings with an intermediate piece

In most cases, a connecting coupling with an intermediate piece is placed between the driven machine and the Geared variable speed coupling, i.e. there is a space between the shaft ends.



*Illustration 5-13:
Alignment using the
alignment device for
connecting couplings
with an intermediate
piece*

- 1 Machine aligned
- 2 Machine still to be aligned
- 3 Alignment device with dial gauges

1. Fabricate a solid alignment device out of flat stock, round bar stock and steel profiles (3) and bolt to the shaft end of the machine to be aligned (2).

NOTE

The initial value or reading on the dial gauge can be 5.00 as assumed in the following examples.

2. Insert the dial gauges so that they are free from play and secure them.
3. Check the radial runout of the already aligned machine (1): rotate the shaft (1) by 360°.

Value to be aimed at: dial gauge deflection ≤ 0.02 mm;
permissible value: see instruction manual of driven machine.
4. Reset the dial gauges to the initial value.
5. Rotate shaft (2) by 180°.
6. Enter the dial indicator deflection in the coordinate system of the installation check form.

Radial runout check

Precision alignment in the vertical plane

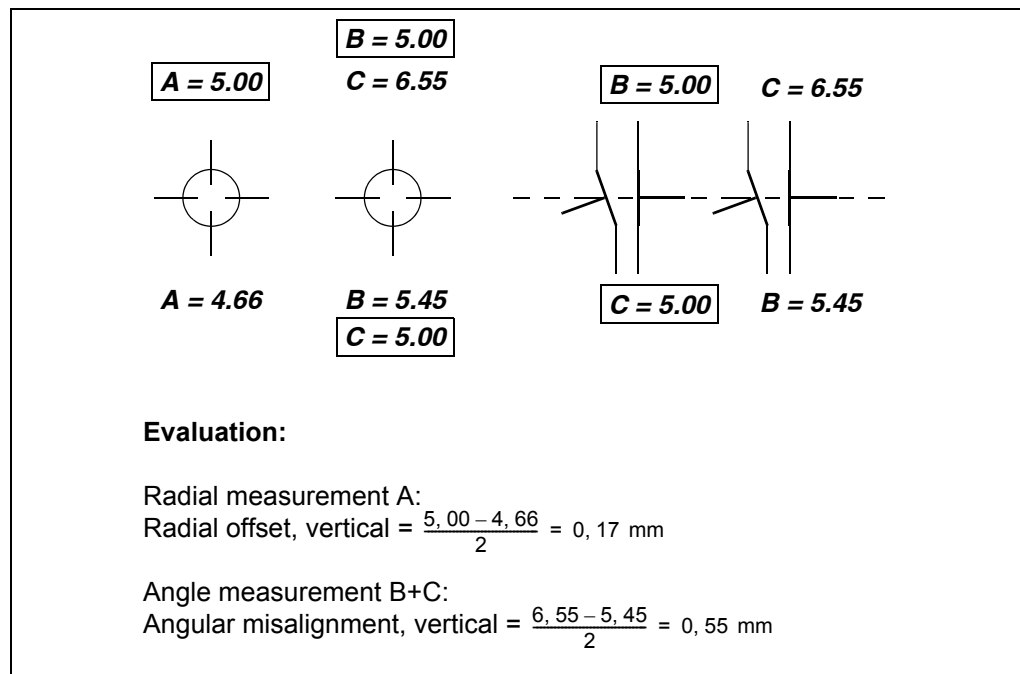


Illustration 5-14:
Example of radial
measurement A and
angular measurements
B and C in the vertical
plane

For the angular measurements: half of the difference between two angular measurements is the amount of the angular misalignment.

7. Correct the vertical radial offset and the vertical angular misalignment by means of the adjusting bolts.

8. Place the alignment device (3) in the horizontal position (rotate 90° with respect to the original position).
9. Repeat the measurement.

Precision alignment in the horizontal plane

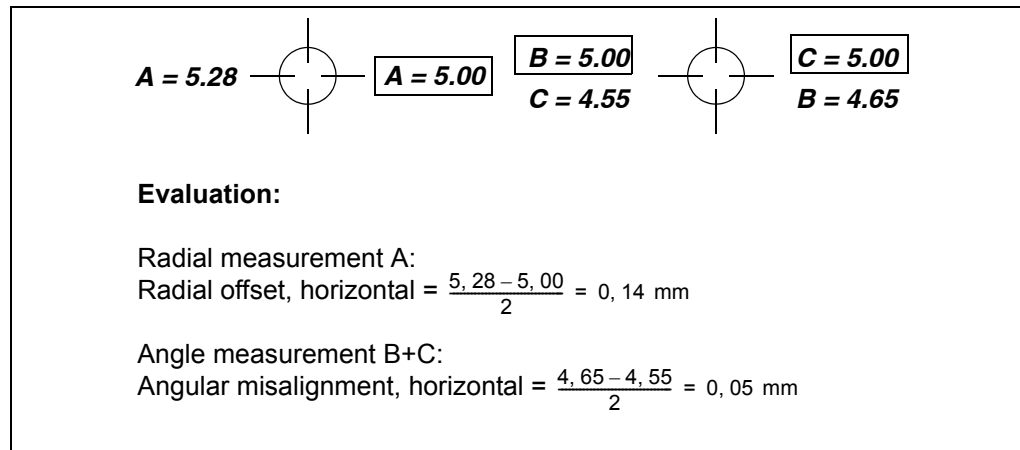


Illustration 5-15:
 Example of radial measurement and angular measurement in the horizontal plane

10. Move the Geared variable speed coupling horizontally using the adjusting bolts and in this way correct the horizontal radial offset and the horizontal angular misalignment.

5.6.4 Connecting couplings without an intermediate piece

In most cases, a connecting coupling without an intermediate piece is placed between the driving machine and the Geared variable speed coupling, i.e. there is no space between the shaft ends.

Prior to performing the precision alignment, it is advisable to first align the machines roughly use a feeler gauge and straightedge.

Rough alignment

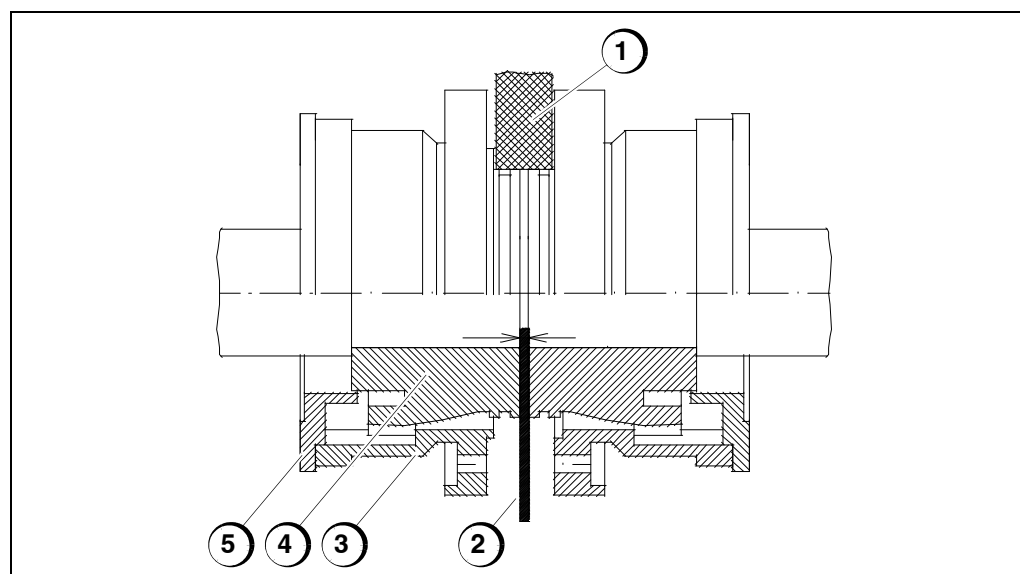


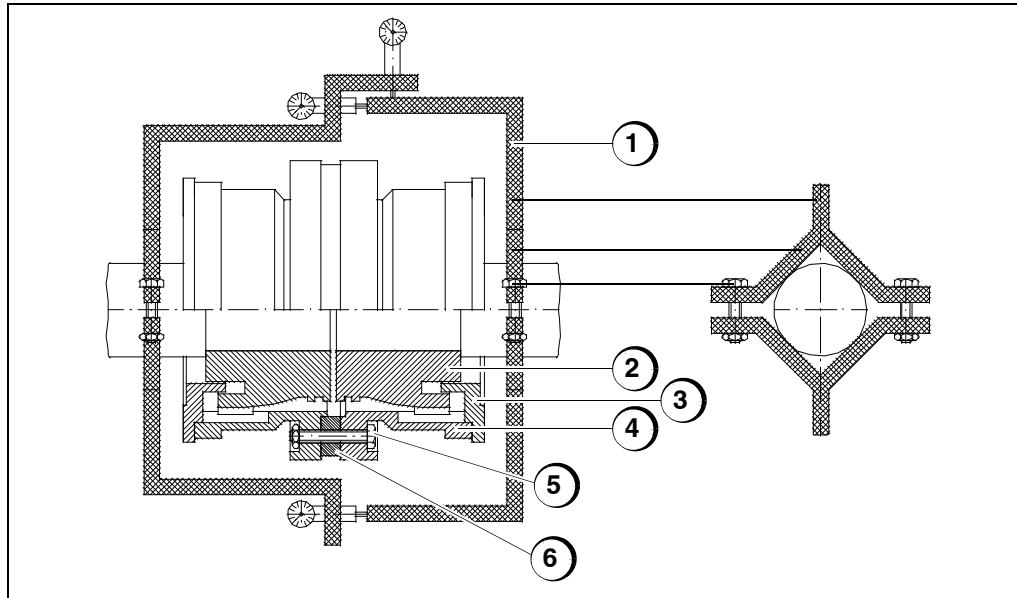
Illustration 5-16:
 Rough alignment of connecting couplings without an intermediate piece

- 1 Straightedge
- 2 Feeler gauge
- 3 Coupling sleeve
- 4 Coupling hub
- 5 End cover

1. Check the shaft spacing using the thickness gauge (2).
2. Check the radial and axial misalignment with a short straightedge (1).

Following this, align the machine precisely using an alignment device with dial gauges.

Precision alignment in the vertical plane



*Illustration 5-17:
Rough alignment of
connecting couplings
without an intermediate
piece*

- 1 Alignment device with dial gauges
- 2 Coupling hub
- 3 End cover
- 4 Coupling sleeve
- 5 Bolt
- 6 Spacer

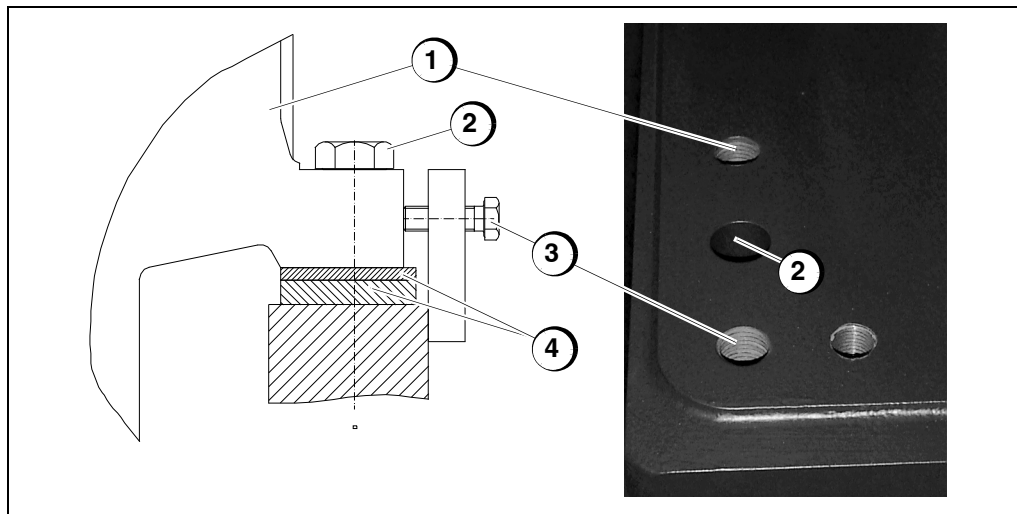
3. Fabricate an alignment device out of flat bar stock (1) and attach it to the shafts.

NOTE

The initial value or reading on the dial indicator can be 5.00 as assumed in the following examples!

4. Insert the dial indicators so that they are free from play and secure them.
5. Connect the sleeves of the connecting couplings (4) with each other using 2 bolts (5) and 2 spacers (6) of about 20 mm.
6. Slide the flat steel between the two sleeves and rotate the two shafts by 180°.
7. Continue measuring in the vertical and horizontal planes as outlined in [Section 5.6.3 „Connecting couplings with an intermediate piece“](#).

5.7 Secure machine



*Illustration 5-18:
Securing to the
foundation*

- 1 Housing base for the Geared variable speed coupling
- 2 Foundation bolts
- 3 Adjusting screws
- 4 Shims

1. Position shims (4) under the housing base of the Geared variable speed coupling on all foundation bolts (2). Ensure that all shims support equally.
2. Unscrew the adjusting screws (3) in the housing base.
The machine is seated completely on the shims.
3. Tighten the foundation bolts (2).
4. Check the alignment.
5. Record the final measurements in the coordinate system of the installation check form.

5.8 Plumbing the machine to the heat exchanger

For installation dimensions for the heat exchanger:

- ➔ See the heat exchanges installation diagram in [Chapter 14 „Attaching Parts“](#) of these operating instructions.

5.8.1 Installing the heat exchanger

NOTE

If the heat exchanger is installed such that the pipes rise when viewed from the Geared variable speed coupling, the oil cooler and piping will empty into the Geared variable speed coupling when the system is shut down, causing the Geared variable speed coupling to overfill and leak on startup. The temperature will exceed the permissible value and the fusible plugs will melt.

If possible, install the heat exchanger below the level of the oil in the Geared variable speed coupling! Take the necessary measures when installing it above the oil level!

5.8.2 Horizontal heat exchangers

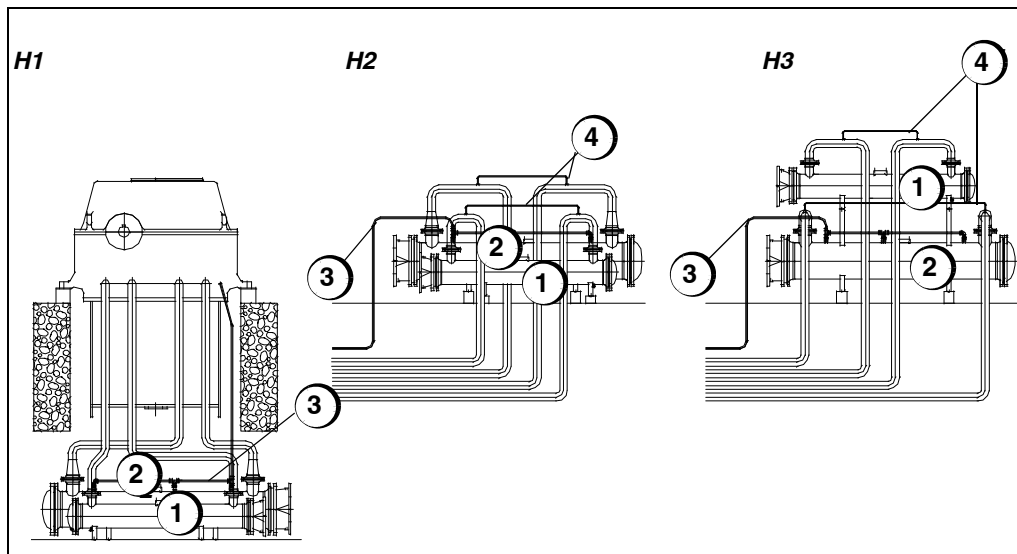


Illustration 5-19:
Horizontal heat
exchangers

H1	H2	H3
Both heat exchangers below the Geared variable speed coupling and positioned horizontally next to one another ¹	Both heat exchangers at the same height as the Geared variable speed coupling and positioned horizontally next to one another ¹	Both heat exchangers at the same height as the Geared variable speed coupling and positioned above one another ¹
Piping and heat exchanger cannot drain.	Pipes and heat exchanger can drain.	
Run the pipes to the heat exchanger horizontally or descending, if possible. Favorable.	Measures: run the oil supply and return lines to the heat exchanger siphon-like in an upward direction and, at the highest point, connect an oil compensating line ² DN 8 (4). Run the lines below the oil level of the Geared variable speed coupling.	

1. Working oil cooler shell vented three times, with collection line and return line to the Geared variable speed coupling housing. (Section 5.8.5 „Installing the vent lines“)
2. Install an orifice plug with a 3 mm orifice opening in the oil compensating line.

5.8.3 Vertical heat exchangers

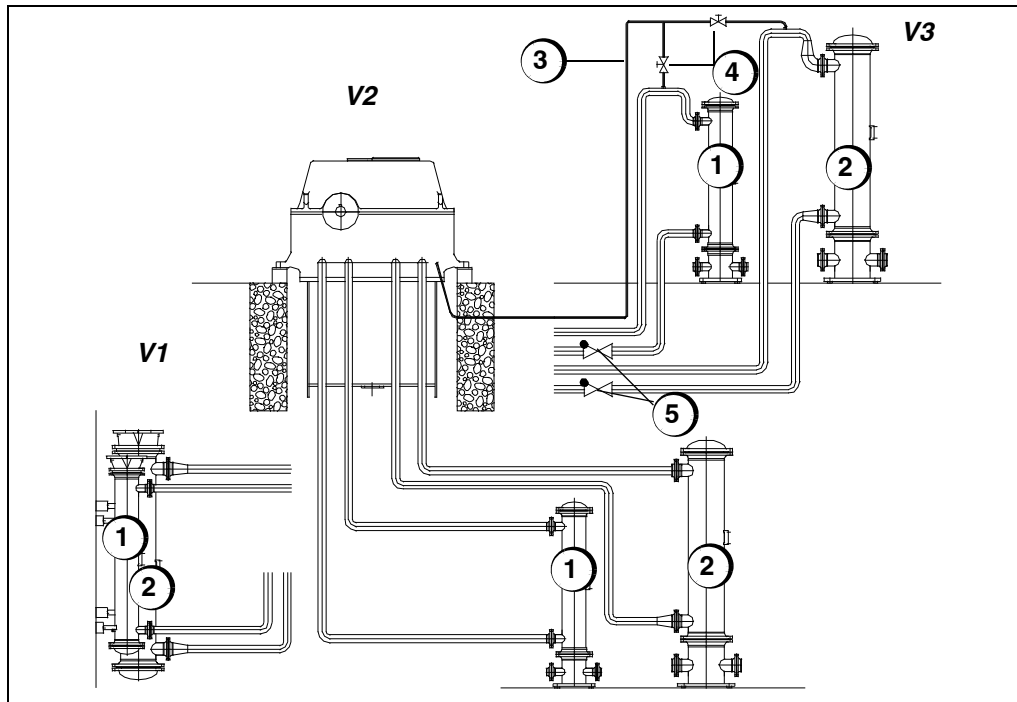


Illustration 5-20:
Vertical heat exchangers

- 1 Lube oil heat exchanger
- 2 Working oil heat exchanger
- 3 Vent line combined with oil compensating line
- 4 Vent valve
- 5 Check valve

V1	V2	V3/V4
Both heat exchangers below the Geared variable speed coupling and in a vertical position against the wall ¹	Both heat exchangers below the Geared variable speed coupling and in a vertical position ¹	Both heat exchangers at the same height as the Geared variable speed coupling and in a vertical position
Piping and heat exchanger cannot drain. Run the pipes to the heat exchanger horizontally or descending, if possible. Favorable.		Pipes and heat exchanger can drain. Measures: <ul style="list-style-type: none"> • Run the lines below the oil level of the Geared variable speed coupling. • V3: Install the check valve (5) in the supply line to the cooler and the vent valve (4) in the return line from the cooler with discharge into the coupling housing. • V4 (not shown): similar to V3, but without the check valve. Run the oil supply and return lines to the heat exchanger siphon-like in an upward direction and, at the highest point, connect an oil compensating line DN 8 (4).

1. similar to H1, but without heat exchanger venting

5.8.4 Installing the oil lines

NOTE

It is preferable to run the oil lines below the oil level in the Geared variable speed coupling.

The oil lines should be as short as possible (< 8 m). In the case of longer lines that run above the oil level in the Geared variable speed coupling, install a check valve in the oil line from the Geared variable speed coupling to the heat exchanger and follow the installation instructions for heat exchangers ([Illustration 5-19 „Horizontal heat exchangers“ on page 58](#) und [Illustration 5-20 „Vertical heat exchangers“ on page 59](#)).

Size the oil lines upstream and downstream of the heat exchanger to allow the lube oil and working oil to flow at a velocity between 1.0 m/s and 4.0 m/s.

Maintain a constant oil line diameter over the entire length. In the case of larger connections on the cooler, increase the line size directly at the cooler.

→ (Heat exchanger assembly plan in [Section 14 „Attaching Parts“](#) of this Instruction Manual)

The machine is aligned exactly.

Requirement

Installing the oil lines

1. Remove the weld-neck flanges from the machine.
2. Connect the Geared variable speed coupling to the heat exchanger as shown in [Illustration 5-19 „Horizontal heat exchangers“ on page 58](#) and [Illustration 5-20 „Vertical heat exchangers“ on page 59](#). Ensure that the installed piping is free from stress.
3. Support the lines.
4. Horizontal heat exchangers H1–H3:
 - Attach a collection line ([Illustration 5-21 „Vent line for working oil heat exchanger“ on page 61](#), item 1) to the vent connection ([Illustration 5-21 „Vent line for working oil heat exchanger“ on page 61](#), item 3) of the heat exchanger to vent the shell.
 - Attach a drain line with shutoff valve to the drain connection ([Illustration 5-21 „Vent line for working oil heat exchanger“ on page 61](#), item 4) of the working oil heat exchanger.
5. Install the external lube oil lines (e.g. for the driving machine, driven machine and/or the connecting couplings).
6. Switch on the auxiliary lube oil pump. Pilot drill orifices at the lube oil outlets from the Geared variable speed coupling to the driving machine and driven machine or install already pilot drilled orifices.

Drilling of orifices for lube oil supplied to external units

The lube oil flow rate and lube oil pressure for external units depend on the diameter of these orifices and possibly on additional orifices upstream of bearing locations on the driving and driven machines.

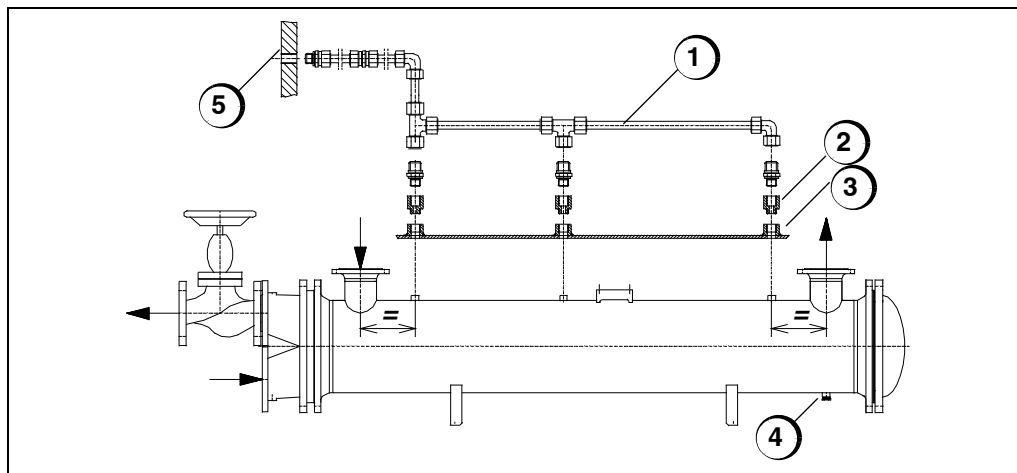
- ➔ For diameters of orifice holes, please refer to [Section 5.11 „Orifice holes for lube oil supply to external units“](#) in the appendix to this chapter.
- ➔ For required lube oil flow rates, please refer to [Section 1.2 „Operating data“](#).

5.8.5 Installing the vent lines

It is necessary to vent the working oil heat exchanger continuously.

Tube bundle - heat exchanger

Working oil heat exchanger vent line (H1, H2, H3, V3)



*Illustration 5-21:
Vent line for working oil
heat exchanger*

- 1 Collection line
- 2 Screw-in orifice
- 3 Vent connection
- 4 Drain connection
- 5 Coupling housing

Install the vent line as shown in [Illustration 5-21 „Vent line for working oil heat exchanger“ on page 61](#) :

1. Insert three screw-in orifices (2) at the three vent connections (3) in the oil cooler shell.

Orifice size for normal cooler oil pressure 3 mm.

2. Connect the orifices to a collection line DN 20 (1).
3. Run the collection line to the Geared variable speed coupling (5) (see installation diagram for tie-in point).



When installing the heat exchanger above the oil level in the Geared variable speed coupling, the oil compensating line (H2, H3, V4) or the vent line (V3) between the two siphon-like line segments prevents the heat exchangers from draining when the equipment is at a standstill.

Attach oil compensating line and vent line as shown in [Illustration 5-19 „Horizontal heat exchangers“ on page 58](#) and [Illustration 5-20 „Vertical heat exchangers“ on page 59](#).

Oil compensating line DN 8 (H2, H3, V4), vent line (V3)

5.8.6 Pickling of oil lines

NOTE
<p>Before preparing this or another pickle, be sure to read and understand the specifications, safety information (data sheets) and application information.</p>

	 WARNING
	<p>Hazard from dangerous substances</p> <p>Hazardous substances (pickling solutions) can cause injuries or burns.</p> <p>Wear personal protective equipment, especially safety goggles, when cleaning and pickling oil lines!</p>

Oil lines assembled and welded on site must be disassembled and pickled in an immersion bath to ensure that they are free from scale and rust. Only then can they be reassembled and flushed.

Pickling oil lines made of steel (neither rust-proof nor acid-proof)

1. Unscrew the oil lines.
2. Degrease heavily oiled or greased work-pieces prior to pickling, e.g. by means of steam cleaning or immersion in a degreasing bath.
3. Mix the pickle¹ with water.
4. To remove dirt, light oil films, graphite or carbon deposits: add pickling degreaser² to the pickle.
5. Heat the solution to 40 °C.
6. Place parts into the pickle.
7. Remove the parts from the pickle. After pickling, they should be bright and free from scale and rust.

1. Recommendation: product BETONA, manufacturer Karowa Co., Memmingerstr. 39A, Neu-Ulm, Germany, or equivalent pickle. Mixture: 1 part pickle to 10 parts water

2. Recommendation: product S13, manufacturer Karowa Co., Memmingerstr. 39A, Neu-Ulm, Germany, or equivalent pickle. Mixture: 1–3 l to 100 l of pickling solution.

	Pickling period
Rust film	approx. 5–10 min.
Rust	approx. 15–30 min.
Rolling skin	approx. 50 min.
Descaling of annealed steel parts	approx. 120 min.

8. Allow the parts to dry protected from dripping water (24–48 hours at 20 °C). Do not wash off! If the drying time cannot be observed, rinse again with clean water.

9. Spray parts internally with the working oil and externally with paint.

Oil lines assembled and welded on site must be disassembled and pickled in an immersion bath to ensure that they are free from scale, temper colors and rust. Only then can they be reassembled and flushed.

**Pickling of oil lines
made of rust-proof
and acid-proof steel
(stainless steel)**

NOTE

Before preparing this or another pickle, be sure to read and understand the specifications, safety information (data sheets) and application information.

1. Unscrew the oil lines.
2. Degrease heavily oiled or greased workpieces prior to pickling, e.g. by means of steam cleaning or immersion in a degreasing bath¹.
3. Prepare the pickle².
4. Place parts into the pickle.
5. Remove the parts from the pickle. After pickling, they should be bright and free from scale and rust.

The pickling period depends on the

- Temperature and
- Life (age of the pickle).


Pickling procedure for materials with the materials nos.1.4541, 1.4550, 1.4571

1. Recommendation: product DERUSTIT 1622, manufacturer Deutsche Derustit GmbH • Emil von Behringstrasse 4 • Dietzenbach/Germany • or equivalent degreaser.
2. Recommendation: product DERUSTIT pickle 1234, manufacturer Deutsche Derustit GmbH • Emil von Behringstrasse 4 • Dietzenbach/Germany • or equivalent pickle.

Age of pickle	Pickling period
New pickle up to 1 week old	20 to 30 min.
1 to 4 weeks	40 to 60 min.
4 weeks and older	up to 120 min.

Pickling procedure for materials with the material nos. 1.4301, 1.4306, 1.4401



Age of pickle	Pickling period
New pickle up to 1 week old	10 to 15 min.
1 to 4 weeks	20 to 30 min.
4 weeks and older	60 to 120 min.



	CAUTION
	<p>Environmental damage</p> <p>Pickle that escapes into the sewers or ground can cause damage to the environment.</p> <p>Dispose of used pickle in a proper manner that complies with national statutory regulations.</p>



6. Flush the part with water¹, making sure to comply with protection regulations.
7. Spray the wet parts with a passivation solution².
8. For final cleaning of the parts, flush them with water³.
9. Let the parts dry in clean rooms. Allow parts with cavities to dry in pure nitrogen.
10. Spray parts internally with the working oil and externally with paint.

1. High pressure 160 bar
2. DERUSTIT passivation solution 2016, contact time 5-10 minutes
3. Fully demineralized water with a conductivity of 10 µm

5.9 Connecting electrical instruments

	 WARNING
	<p>Risk of injury</p> <p>Dangerous electric currents and voltages on the Geared variable speed coupling can injure or kill individuals.</p> <p>Only a qualified electrician who is knowledgeable about rules that apply to electronic equipment in the country of installation is allowed to perform work involving the electrical equipment on the Geared variable speed coupling.</p>

	 WARNING
	<p>Risk of injury</p> <p>Hazard resulting from improper insulation.</p> <p>As the result of improper insulation, an individual could come into contact with electrical components and be seriously injured.</p> <p>Use only cables with insulation that can withstand the ambient operating conditions!</p>

	 CAUTION
	<p>Risk of injury/equipment damage</p> <p>Stray currents in the Geared variable speed coupling can cause personal injury or damage gear teeth and bearings.</p> <p>Take suitable grounding measures on all components of the drain train!</p>



1. Connect all power consuming equipment.
2. Connect all control units.
3. Check motors for their direction of rotation, current draw and protection by fuses.
 - ➔ Terminal diagram for wiring in the junction box.
 - ➔ [Section 14 „Attaching Parts“](#) of these Operating Instructions for detailed information on the instruments installed.



5.10 Attaching guards

- Guarding to prevent accidental contact with rotating and hot components (connecting couplings, oil lines) and other recognizable source of danger
- Protection from noise
- Protection from the weather in the event of outdoor installation (roof or enclosure)

Types of guarding and protection

5.10.1 Attaching guarding to prevent contact

	 WARNING
	<p>Risk of injury</p> <p>Entanglement or trapping hazard in the vicinity of rotating shafts and in the vicinity of the rotating connecting couplings.</p> <p>Clothing, long hair or loose objects (lines, cords and ropes/cables) could become entangled in the danger zone and cause serious injury/damage.</p> <p>Attach suitable guarding over the connecting couplings that can only be removed by using tools!</p>

	 CAUTION
	<p>Burn hazard</p> <p>The housing, oil lines, connecting couplings and working oil may be very hot - in extreme cases, up to 130 °C. Contact can cause burns on the skin.</p> <p>The Geared variable speed coupling must be allowed to cool prior to maintenance or repair work!</p>



Attach guarding to prevent contact with rotating and hot components and other recognizable sources of danger in compliance with the safety regulations of the operator and/or the country where the equipment is being installed.



5.10.2 Attaching sound-absorbing covers

Attach sound-absorbing covers in such a way as to not impede continued performance of the following activities¹.

Unimpeded work

- Reading instruments on the instrument panel and on piping
- Reading the oil level from the oil level indicator
- Cleaning the duplex oil filter
- Actuating shutoff valves
- Installing and removing instruments
- Performing service work (topping up lubricant, e.g. in connecting couplings and the like)

	 CAUTION
	<p>Explosion hazard</p> <p>Heat may accumulate when using sound-absorbing covers without openings.</p> <p>Always provide sound-absorbing covers with vent holes to dissipate the heat and exchange the air!</p>

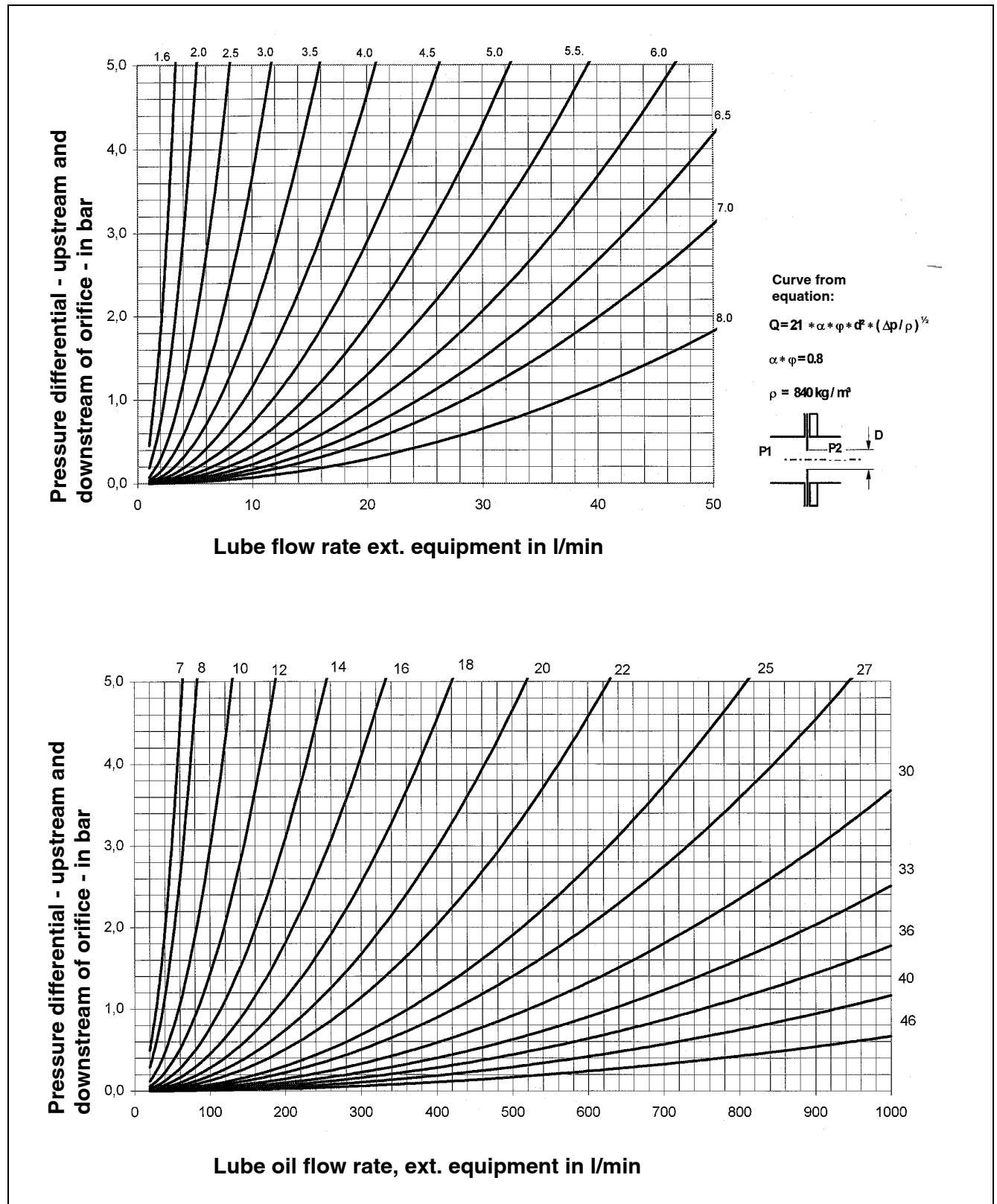
	 WARNING
	<p>Poisoning hazard</p> <p>Use of sound-absorbing covers without openings can result in poisoning.</p> <p>Poisoning and suffocation can result from gas leaks when compressors are operating.</p> <p>Always provide sound-absorbing covers with vent holes to exchange the air!!</p>

1. Instructions based on VDI Directive 2711 "Sound Protection by Encapsulation"

- Avoid exposing instruments, control units, electrical insulation and equipment to excessive operating temperatures.
- Provide separate ventilation for electric motors. The cooling air for an air-cooled electric motor can be used for ventilation, if necessary (consider the characteristic curve of the cooling fan and the required motor cooling).
- Regulate the air flow in the cover to ensure heat dissipation (determine the flow rate for a cooling air temperature increase of 10 °C).
- Route the vented air from the gearbox housing and coverings (closed connecting coupling covers) through the sound-absorbing covers via ducts.
- Provide openings and seals for shaft passages, windows for viewing of instruments, pipe and cable entry points and vents.

Heat dissipation and ventilation

5.11 Orifice holes for lube oil supply to external units



6 Commissioning

6.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Entanglement or trapping hazard in the vicinity of rotating shafts and in the vicinity of the rotating connecting couplings

Clothing, long hair or loose objects (lines, cords and ropes/cables) could become entangled in the danger zone and cause serious injury/damage.

Attach suitable guarding over the connecting couplings that can only be removed by using tools!



Hazard from the hydraulics

Oil can escape from leaking connections or seals, create a slipping hazard and cause injury as well as damage to the environment.

Clean up leaking oil immediately!



Hazard from dangerous substances

Escaping operating fluids could cause burns or injuries as well as damage to the environment.

Wear personal protective equipment, in particular, safety goggles when filling oil, when checking for leaks and when changing filters!

Follow the procedures specified on the material safety data sheet for the particular operating fluid!



Equipment damage

The Geared variable speed coupling is delivered without any oil in it. Operation without oil will damage the equipment within a few seconds.

Prior to startup, fill the Geared variable speed coupling with the working oil!



Note

Before starting the driving machine, check all attaching parts (instruments, actuator, motor etc.) for:

Proper connection of the supply voltage, transmittal/processing of control and monitoring signals.



6.2 Fill the working oil

For Voith's list of recommended oils, see [Section 6.7 „Operating fluids“](#). The oil grades contained in this list have been selected on the basis of the following criteria:

Criteria for suitable working oil

- Lowest possible viscosity
(Initial viscosity $\leq 250 \text{ mm}^2/\text{s}$ (cSt) at a temperature of 5 °C)
- Superior lubricity
- Best possible air separation
- Resistance to aging
- Chemical neutrality with respect to metals and seals
- Compatibility with the human organism

NOTE

If using an oil grade that does not appear in the recommended oil list:

- Check compatibility with Voith's corrosion-preventing oil (Shell Ensis Engine Oil 20).
- Check the suitability of the oil on the basis of the criteria listed in [Section 6.7 „Operating fluids“](#).
- Clean the inside of the Geared variable speed coupling.

For the required amount of oil, see [Section 1.2 „Operating data“](#) and the instructions regarding the oil cooler in [Chapter 14 „Attaching Parts“](#) of this documentation.

NOTE

Fill the working oil as soon the piping for the system has been completed.

1. Add oil at the flanged connection identified as "Oil filling" on the coupling's housing (see location of the Δ item in the assembly plan).
2. Filter the oil when filling (grade of filtration $25 \mu\text{m}^1$ or finer).
After the piping and coolers have been filled and bled, the oil level should be midway between the min. and max. marks on the oil level indicator.

Filling oil

1. Extends the life of the filter elements, especially during commissioning.
Corresponds to an oil cleanliness class of 18/15 as defined in ISO 4406.

6.3 Flushing the coupling

The newly installed oil lines must be flushed for several days prior to the actual commissioning (corrosion protection and filtering of the oil).

1. Check the oil level (should be midway between the oil level in operation and max. marks on the level indicator).
2. Check and add lubricant for attached parts such as actuator and connection couplings, as necessary.
3. Check the direction of rotation of the auxiliary lube oil pump.
4. Check that threaded connections in the oil lines are oiltight.

To be checked prior to flushing

5. Start the electrically operated auxiliary lube oil pump (lock out the driving machine in case it would otherwise start automatically).

Start the flushing operation

The lube oil circuit fills. The working oil circuit, the working oil cooler and the oil lines in the system are filled by an interconnecting line with orifice between the lube oil circuit and the working oil circuit.

6. Check the oil lines for leaks.
7. When the pressure differential increases to the max. permissible value (Section 1.2 „Operating data“), switch the duplex oil filter to the cleaned filter housing and clean the dirty filter housing (Section 8.4 „Cleaning the duplex oil filter“).
8. Check the lube oil flow rate for external equipment and, if necessary, correct by changing the size of the opening in the orifice plugs (Section „Drilling of orifices for lube oil supplied to external units“ on page 60).
9. Check the amount of oil injected into the connecting coupling when working with injection lubrication (manufacturer's specification) and, if necessary, correct by installing orifice plugs.
10. Check and fill the oil (should be midway between the oil level in operation and max. marks on the level indicator) if necessary.
11. Check the lubricating oil pressure and adjust on the pressure limiting valve for lubricating oil if necessary (Section 6.5 „Set the lubricating oil pressure“).
12. Check the operating points of the pressure measuring devices and, if necessary, correct.
13. Flush the oil lines until the duplex oil filter remains clean (one to several days).
14. Switch off the auxiliary lube oil pump.

Additional items to be checked during the flushing operation

Ending the flushing operation

6.4 Trial run

6.4.1 Preparing for the trial run

1. Check the alignment of the coupling and correct as necessary.
1. Check attachment to the foundation.
2. Loosen connecting couplings and check the direction of rotation of the drive motor with the Geared variable speed coupling uncoupled.
3. Check and add lubricant for attached parts such as actuator and connection couplings, as necessary.
4. Check for proper installation of connecting couplings and guarding.
5. Check that manufacturer specifications are met when adjusting the supply of lubricating oil to external equipment.
6. Check the oil level (should be midway between the oil level in operation and max. marks on the level indicator).
7. Check for proper connection of the supply voltage to the electrical system as well as transmittal/processing of signals.
8. When using water/oil coolers, open the valves on the water side, vent the water side of the oil cooler and check the flow rate.
9. Upon delivery, review the operational data and the operating instructions for the oil cooler in [Chapter 14 „Attaching Parts“](#) of this instruction manual.
10. Check the setting of the actuator over the angular adjustment range on the scoop tube positioning device. Both end positions must be restricted mechanically (positive stops) on the actuator.
 - At 100 % scoop tube position, check the max. actuation and feedback signal on the actuator and correct if necessary.
 - The min. actuation or feedback signal corresponds with a scoop tube position of 0 % after going through the angular adjustment range.
11. Move the scoop tube to 0 % position.
12. Check that the entire system is ready to operate.

Items to be checked and adjusted prior to the trial run

6.4.2 Conducting the trial run

1. Start the auxiliary lube oil pump.
2. When the lube oil pressure reaches the required value, switch on the driving machine or monitor automatic startup.
3. Once the driving machine is up to speed and the required lube oil pressure has been reached, monitor automatic shutdown of the auxiliary lube oil pump or switch off the pump manually.
4. Operate the system at minimum speed.
5. Monitor smooth operation, temperatures lube oil pressure and filter condition.
6. Slowly increase the speed of the driven machine.
7. Monitor and log temperatures and pressure until they stabilize.
8. Check the functionality of the temperature controller (if installed) on the lubricating oil cooler (see the operating instructions for the heat exchanger in [Chapter 14 „Attaching Parts“](#) of this Instruction Manual).
9. If the hubs for the connecting couplings have not been provided and balancing of the complete arrangement was performed without original hubs: rebalance the input and output shafts if the equipment does not operate perfectly smoothly.
10. Perform vibration measurements on the coupling housing. Evaluate whether the equipment is operating smoothly and log the scoop tube position, speed and readying at measurements points. ([„Vibrations - housing“ on page 5](#))
11. If the working oil temperature is too high, correct the working oil flow rate ([Section 6.6 „Adjusting the working oil flow rate“](#)).

Minimum speed

Increase the speed slowly

If the characteristic of the system is to be optimized on the basis of the operating conditions:

Operating over the entire speed range

12. Operate the system over its entire speed range.
13. Adjust the working oil flow rate ([Section 6.6 „Adjusting the working oil flow rate“](#)).

Slowdown

14. Bring the system/unit down to minimum speed.
15. After switching off the driving machine, check that the auxiliary lube oil pump switches on automatically.
16. Once the driving machine and the driven machine have come to a stop, switch off the auxiliary lube oil pump.

After the trial run

17. Clean the duplex oil filter and fill with working oil as necessary ([Section 8.4 „Cleaning the duplex oil filter“](#)).
18. Check the oil level and correct (should be midway between the oil level in operation and max. marks on the level indicator).
19. Check the fastening of the stops on the scoop tube positioning device. The stroke must be limited on the positioning mechanism itself and not on the scoop tube controller.
20. Check the piping for leaks.

6.5 Set the lubricating oil pressure

NOTE

Adjust the oil pressures only at operating temperature!

The lubricating oil pressure is set on the sequence valve.

→ For pressure values: see [Section 1.2 „Operating data“ - „Pressures“](#).

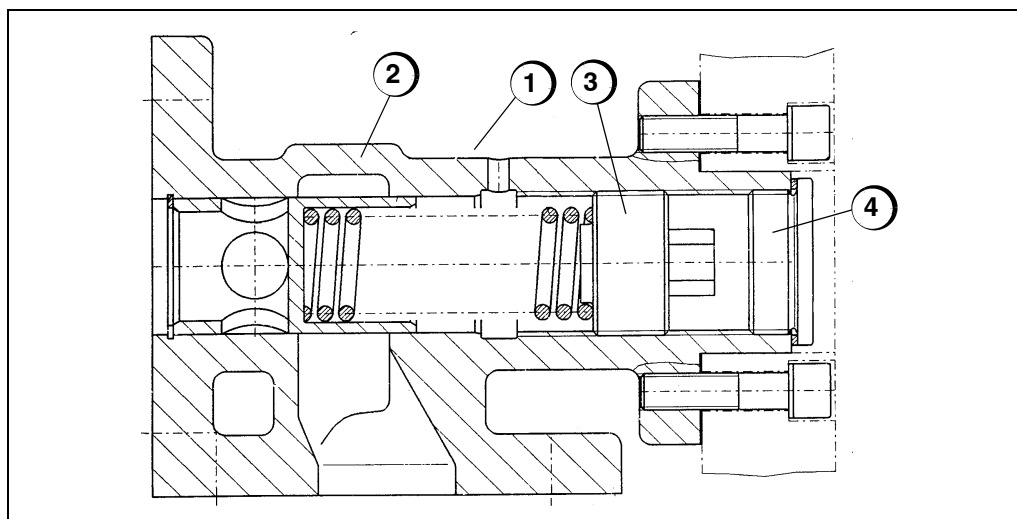


Illustration 6-22:
Sequence valve

- 1 Sequence valve
- 2 Housing
- 3 Adjusting screw
- 4 Screw plug



WARNING

Burn hazard



Hot oil under high pressure can cause serious burns.


Do not unscrew the adjusting screw completely from the housing!

1. Unscrew the screw plug (4).
2. Screw in the adjusting screw (3).
3. Check the pressure increase at the pressure gauge and correct as necessary:
 - Turning the adjusting screw clockwise:
Increasing the lubricating oil pressure
 - Turning the adjusting screw counterclockwise:
Reducing the lubricating oil pressure
4. Install the screw plug (4) and seal ring.

**Setting via the
sequence valve**

6.6 Adjusting the working oil flow rate

	 WARNING
	<p>Risk of injury</p> <p>Risk of moving parts crushing or shearing the upper and lower body limbs.</p> <p>A person's finger could be crushed or sheared by the motion of the positioning mechanism.</p> <p>Allow only trained personnel to perform assembly, maintenance and service work!</p>

	CAUTION
	<p>Equipment damage</p> <p>Unauthorized readjustment can result in mechanical damage to the oil circulation valve.</p> <p>The following description must be observed when adjusting the oil circulation valve!</p>

The orifice in the working oil circuit is used to feed the coupling with the amount of working oil necessary to compensate for power losses. The oil flow rate is set at the factory to the value obtained from the power loss calculations.

Oil circulation control

If oil temperatures that are too high or too low during certain points of operation, the working oil pressure and the orifice diameter are to be changed in the working oil circuit.

If the oil temperature is high or low throughout the entire speed and scoop tube adjustment range, the oil flow can be adjusted, i.e. increased or reduced. The maximum oil flow is required at a scoop tube position between 40 % and 50 %.

High or low oil temperature over the entire speed range

NOTE
<p>Changing the hole of the orifice is only to be done after discussing with VOITH-Crailsheim.</p>

By adapting the working oil pressure and the hole dimension in the orifice, the adjustment is made as follows:

- Raise or lower the working oil pressure by ± 0.5 bar on the pressure limiting valve.
- By changing the orifice hole.

NOTE

Adjust oil pressures only at operating temperature.

The working oil pressure is adjusted at the pressure relief valve.

➔ For pressure values: see [Section 1.2 „Operating data“](#) - „Pressures“.

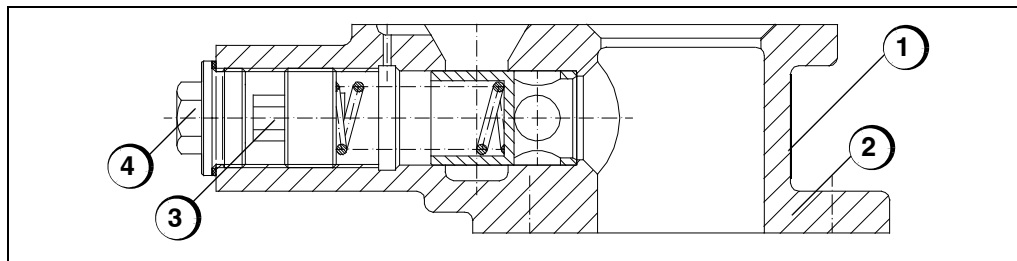


Illustration 6-23:
Pressure relief valve

- 1 Pressure relief valve
- 2 Housing
- 3 Adjusting screw
- 4 Screw plug



WARNING

Burn hazard

Hot oil under high pressure can cause serious burns.

Do not unscrew the adjusting screw completely from the housing!

1. Unscrew the screw plug (4).
2. Screw in the adjusting screw (3).
3. Check the pressure increase at test connection M2 and correct if necessary:
 - Turning the adjusting screw clockwise:
Increasing the lubricating oil pressure
 - Turning the adjusting screw counterclockwise:
Reducing the lubricating oil pressure
4. Install the screw plug (4) and seal ring.

Adjustment via the pressure relief valve

6.7 Operating fluids

The following can be used, provided they satisfy the requirements:

- **Hydraulic oils HLP 32 as specified in DIN 51524, Part 2**
- **Turbine oils as specified in DIN 51515, Part 1 and 2 with sufficient load-carrying capacity (FZG) for gear lubrication**

Do not mix different oil grades. Approval to use oil mixtures must be clarified with the oil supplier.

Requirements (characteristics) of the operating fluids and recommended grades:

→ [Appendix_B_„Operating fluids ISO VG 32 for hydrodynamic circuits with gearing 3625-006073“](#)

Grade selection by operator and oil supplier

7 Operation

7.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Danger in areas that cannot be fully viewed

A person could be severely injured while working on the machine when starting it up.

Attach suitable protective covers that cannot be removed without the respective tool, between the coupling and the shaft!

Only work on the machine when the system is shut down (no power)!

Operation is only permitted after visually ensuring that no persons are in the hazard areas!



Entanglement or trapping hazard in the vicinity of rotating shafts and in the vicinity of the rotating connecting couplings

Clothing, long hair or loose objects (lines, cords and ropes/cables) could become entangled in the danger zone and cause serious injury/damage.

Attach suitable guarding over the connecting couplings that can only be removed by using tools!



Hazard from loss of stability and danger arising from masses

In the event of severe imbalance, a shaft could break as the result of vibrations and cause serious injury or damage to the equipment.

If the imbalance is impermissibly high or the equipment is not running smoothly, conduct an inspection immediately!



Danger of slipping on leaked oil

Leaking oil on or next to the machine could cause someone to slip or fall and be seriously injured.

Check for oil and leaks regularly!

Clean the machine regularly!



Hazard from the hydraulics

Oil can escape from leaking connections or seals, create a slipping hazard and cause injury.

Clean up leaking oil immediately!



Fire hazard

In conjunction with high temperatures and oil, an electrical short circuit due to an abraded cable or water leaking into the junction box could trigger a fire and cause personal injury or damage to the environment.

Allow only a qualified electrician to install the equipment!
Observe the maintenance intervals!

**Fire hazard**

Leaking (hot) oil or oil mist could trigger a fire and cause serious injury.
Check for oil and leaks regularly!

**Danger caused by incorrect assembly**

Not observing the correct direction of rotation could damage the machine and severely injure persons.
The incorrect assembly of the machine or individual parts could damage the machine.
Allow only trained personnel to perform assembly, maintenance and service work!

**Hazard from pressure shocks, pressure rise or pressure loss**

Pressure shocks can cause vibration and pipe failure, and result in personal injury due to leaking oil.

Ensure that the installation complies with the designated use of the equipment and that the operating data and ambient conditions are taken into account!

**Noise hazard**


A sustained sound pressure level above 85 dBA could lead to loss of hearing.
Wear hearing protection!

**Environmental pollution**

Leaking oil could damage the environment.
Check for oil and leaks regularly!



7.2 Starting up and slowing down the equipment

	CAUTION
	<p>Equipment damage</p> <p>The Geared variable speed coupling is delivered without any oil in it. Operation without oil will damage the equipment within a few seconds.</p> <p>Prior to startup, fill the Geared variable speed coupling with the working oil!</p>

1. Perform the same checks as before starting the trial run
([Section „Items to be checked and adjusted prior to the trial run“ on page 73](#)).
2. Check that the entire system is ready to operate.
3. Place the scoop tube in the 0 % position.

Checks prior to start-up

The Geared variable speed coupling can, in principle, be started up with the scoop tube in any position. However, starting up with the scoop tube in the 0 % position is preferred, since the driving machine can come up to speed with practically no load.

The Geared variable speed coupling is ready for operation.

Start-up

Operating conditions	Action	Result
	Place the scoop tube in the 0 % position.	
	Aux. lube oil pump switches ON	The coupling and driven machine are at standstill. Bearings are being lubricated
With lubricating oil pressure „> 1.7 bar“	Switch the driving machine ON	Driving machine starts up. Coupling fills and starts to rotate.
3 minutes after starting the drive machine and at a lubricating oil pressure of „> 2.2 bar“	Switch the aux. oil lube pump OFF	Coupling and driven machine are operating.
	Place the scoop tube in the n % position.	Driven machine is operating at the desired speed.

Shutdown

Operating conditions	Action	Result
	Place the scoop tube in the 0 % position.	Coupling empties. Driven machine is operating at minimum speed.
	Switch driving machine OFF	Driving and driven machines come to a stop. Bearings continue to be lubricated.
Automatically at drive machine OFF or at lubricating oil pressure „< 1.5 bar“.	Aux. lube oil pump switches ON	Bearings continue to be lubricated.
After the equipment comes to a stop (standstill)	Switch the aux. oil lube pump OFF	Bearings are no longer lubricated.

7.3 Operating the equipment

7.3.1 Monitoring the equipment

The following items must be monitored during operation:

- Temperatures
- Lube oil pressure
- Differential pressure (duplex oil filter)
- Oil level

NOTE

If the behavior of the Geared variable speed coupling changes during operation, this indicates the need for service.

[Section 8.2.1 „Maintenance measures and intervals“](#)

Temperatures

			Oil reservoir
Temperature of oil in the reservoir	Operating range ¹	„> 45 < 65 °C“	
	Alarm at ¹	„65 °C“	
	Shutdown at ¹	„70 °C“	

1. Indication or signal only with appropriate instrumentation

			Bearings
Bearing temperatures	Operating range	„< 90 °C“	
	Alarm at	„90 °C“	
	Shutdown at	„95 °C“	

The bearings can have different temperatures. Reasons:

- Different shaft speeds
- Different bearing loads
- Heat load from working oil

Set the trigger point for the message "Bearing temperature too high" to about 15 °C above the temperature of the warmest bearing or to „90 °C“.

Working oil

Working oil temperature <i>upstream</i> of the working oil cooler	Operating range Alarm at ¹ Shutdown at	„> 60 < 110 °C“ „110 °C“ „130 °C“
Working oil temperature <i>downstream</i> of the working oil cooler	Operating range Alarm at ² Shutdown at ²	„> 35 < 75 °C“ „75 °C“ „85 °C“

1. Temperatures above 110 °C do not occur during normal operation, but only when flushing or performing a similar activity.
2. Signal, only with appropriate instrumentation

Lube oil

Lube oil temperature <i>upstream</i> of the lubricating oil cooler	Operating range Alarm at ¹ Shutdown at ¹	„> 45 < 65 °C“ „65 °C“ „70 °C“
Lube oil temperature <i>downstream</i> of the lubricating oil cooler	Operating range Alarm at Shutdown at	„> 35 < 55 °C“ „55 °C“ „60 °C“

1. Signal, only with appropriate instrumentation

The fusible plugs melt when the working oil temperature in the scoop chamber reaches 160 °C¹, thus preventing overheating of the coupling.

Fusible plugs

Reasons for a brief increase in working oil temperature could be:

- lack of cooling (cooler malfunction)
- overloading of the coupling

Fusible plugs that have melted result in the following:

- slight change in the control behavior of the coupling
- almost max. power output
- slight increase of the oil temperature in the reservoir
- longer time for the driven machine to come up to speed

1. if the necessary oil temperature acts on the solder in the fusible plug together with a suitable oil pressure.

Pressures

		Working oil/lubricating oil
Main pump oil pressure Pressure gauge		„___ bar“
Working oil pressure before the working oil orifice ¹ Test connection II/M2 (Assembly plan)		„1.5 to 2.2 bar“
Working oil pressure after the working oil orifice Test connection III/M3 (Assembly plan)		„0.2 to 0.5 bar“
Lube oil pressure	Operating range ²	„2 - 3 bar“
	Switch on driving mach. at	„> 1.7 bar“
	Shutdown of the auxil. lube oil pump with ³	„> 2.2 bar“
	Alarm - aux. lube oil pump ON at	„< 1.5 bar“
	Shutdown of driving mach. at	„< 0.8 bar“

1. Factory setting: approximately 1.5 bar
2. Factory setting: approx. 2.5 bar
3. after a duration of 3 minutes

The working oil pressure before the "Working oil" orifice is maintained within the operating range by the pressure relief valve.

➔ Lubricating oil pressure: see [Section 6.5 „Set the lubricating oil pressure“](#)

Oil level

When the coolers and tubing are full, the oil level should be midway between the oil level in operation and the max. mark of the oil level indicator.

7.3.2 Controlling speed

The actuator adjusts the scoop tube between position 0 % and 100 %. The scoop tube position determines the speed of the driven machine.

The actuator is positioned by a control signal „4 - 20 mA“ from the master controller.

7.3.3 Changing over the duplex oil filter

Pressure differential across duplex oil filter	Switch and clean filter at	„> 0.6 bar“
--	----------------------------	-------------

The duplex oil filter cleans the lubricating oil. It has two filtering jugs, through only one of which oil flows during operation. The filter is equipped with a differential pressure switch that triggers an alarm when the pressure differential across the filter becomes too large. If an alarm occurs, the filter housing no longer allows sufficient oil through during operation and must be cleaned (Section 8.4 „Cleaning the duplex oil filter“).

Before the duplex oil filter is switched to the second filter, it must be flooded.

Flooding the clean filtering jug

NOTE

If the clean filter housing is not flooded, the lube oil pressure drops too drastically upon switching the double filter and the system is shut down by the monitoring instruments.

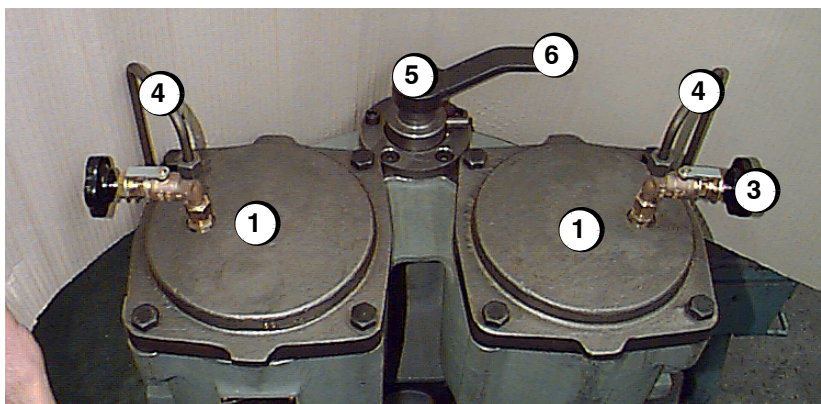
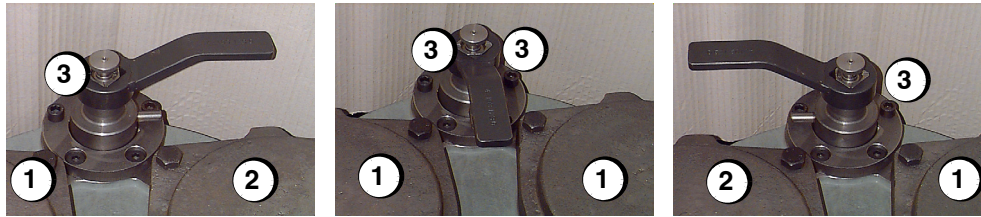


Illustration 7-24:
Duplex oil filter

- 1 Contaminated filter housing
- 2 Clean filter housing
- 3 Vent filter
- 4 Vent line
- 5 Flood spindle
- 6 Change-over lever

1. Remove the plug. Place a container under the vent line (4). Slightly open the vent valve (3).
2. Raise the flood spindle (5) and flood the clean filter housing (2) until the oil escapes the vent line (4).
3. Close the vent valve (3). Install the plug.
The clean filter housing (2) is now ready for operation.

4. Using the change-over lever, slowly switch the filter to the clean filtering jug.



Changing over the filter

*Illustration 7-25:
Changing over the
double oil filter*

- 1 Filtering jug in use
- 2 Filter jug to be cleaned
- 3 Flow indication

7.4 Measures to take in the event of tailspin and rotation in the opposite direction

The term "tailspin" describes the slow rotation of the coupling caused by the driven machine after the system has been shut down, e.g. by a fan drive.

- Switch on the auxiliary lube oil pump to ensure that the bearings are lubricated.

If the working machine can run backwards, a rotational direction monitor must be used. If this rotational direction monitor indicates running backwards:

- Switch on the auxiliary lube oil pump without delay.
- Set the scoop tube to the 100 % position.
- Close the shutoff valve on the driven machine.
- Limit rotation in the opposite direction to max. 1–3 minutes.
- Before starting again, check the bearings and fusible plugs.

Tailspin

Rotation of the secondary shaft in the opposite direction

NOTE

If stopped by switching off or reverse running and before starting the Geared variable speed coupling:

- Inspect bearings and fusible plugs
- Switch the auxiliary lubricating pump on
- Check oil pressures

7.5 Taking a sample of the working oil

NOTE

The value of the information obtained from an analysis of the working oil depends on correct and careful sampling. An oil sample is preferably taken from a region with good flow of oil either during operation or immediately after a system shutdown.

In the case of the Geared variable speed coupling, the oil sample should be taken from the lube oil circuit. A reliable oil sample can be drawn from the filtering jug currently in operation.



CAUTION

Burn hazard

The filter housing, oil lines and working oil can be hot. In an extreme case, up to 60 °C for this section of the lube oil circuit.

Wear protective gloves!



WARNING

Risk of injury

Hot, pressurized oil in the duplex oil filter and vent line can cause serious injury.

Wear protective gloves, safety goggles and protective clothing!

- Collection container for initial amount drawn
- Sample collection container(s)

Accessories

1. Identify the active filtering jug. The selector handle indicates which filter housing is being used ([Illustration 7-25 „Changing over the double oil filter“ on page 87](#)).

Taking the oil sample**NOTE**

Perform the remaining operations only on the filtering jug currently in use.
The oil sample is only to be taken from the clean oil side (filter cover).

2. Remove the plug from the vent valve.

NOTE

If the vent valve is opened too far, a pressure drop could result, causing the monitoring instruments to shut down the system.

3. Place the collection container for the initial amount beneath the valve and open the vent valve slightly.
4. After drawing off some initial oil, fill the oil sample container with working oil.
5. Close the vent valve and reinsert the plug.
6. Perform working oil analysis ([Section 8.6 „Test criteria and notes for evaluating working oils“](#)).

7.6 Measures to take during standby

- Allow the auxiliary lube oil pump to run continuously.

7.7 Measures to be taken during stop periods

When the stop periods are longer than a day:



- Switch on the auxiliary lube oil pump for at least five minutes daily.
- Protect the Geared variable speed coupling against ingress of water and moisture. Apply corrosion inhibitor to bare metal parts.
- Start up the Geared variable speed coupling briefly every 1–2 months. Do not allow to operate until warm (risk of condensation forming).


The internal surfaces of the equipment receive a light film of oil and are thus protected against corrosion.

→ Appendix_A_ „[Preservation method and instructions for storage after delivery 3625-006714](#)“

→ Oil cooler standstill times: see instruction manual for the oil cooler in [Chapter 14](#) „[Attaching Parts](#)“ of this instruction manual.

7.8 Removing the Geared variable speed coupling

	 WARNING
	<p>Risk of injury</p> <p>Dangerous electric currents, voltages and other sources of energy on the Geared variable speed coupling can injure or kill a person.</p> <p>Before removing the Geared variable speed coupling, disconnect every external source of energy. Drain all liquids.</p> <p>The Geared variable speed coupling must be removed only by qualified personnel who perform their work in compliance with local safety requirements.</p>

	CAUTION
	<p>Environmental damage</p> <p>Used oil that escapes into the soil or sewage system can cause serious damage to the environment.</p> <p>Dispose of used oil in a proper manner that complies with national statutory regulations.</p>

Prior to disassembly for salvage purposes or scrapping, completely remove any oil or other substances that pose a danger to water.

The Geared variable speed coupling is made of steel, lightweight alloys and various plastics. These materials can be salvaged and recycled.

Send problem materials that can no longer be used to an authorized disposal facility.

8 Maintenance

8.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Danger of parts slipping out

Without the connecting coupling attached and the protective cover, the key or bolts for the connecting coupling could slip out and injure someone.



Allow only trained personnel to perform assembly, maintenance and service work!
The variable-speed coupling must be started up only after the connecting coupling is attached (as a minimum) or the complete connecting coupling and protective guarding in accordance with the manufacturer's instructions.

Hazard from an incompletely shut down and secured system

A system that has not been shut down completely and secured could restart and injure anyone working on the equipment.



Only work on the machine when the system is shut down (no power)!

Danger in areas that cannot be fully viewed

A person could be severely injured while working on the machine when starting it up.



Attach suitable protective covers that cannot be removed without the respective tool between the coupling and the shaft!

Only work on the machine when the system is shut down (no power)!

Operation is only permitted after visually ensuring that no persons are in the hazard areas!

Burn hazard

A person could burn themselves on the hot machine or on hot operational equipment.



Only touch the machine when it has cooled down!

Risk of being cut

A person could be cut by sheet metal guarding that has not been deburred or by sharp edges on an enclosure.



Allow only trained personnel to perform assembly, maintenance and service work!

Hazard from dangerous substances

Escaping operating fluids could cause burns or injuries as well as damage to the environment.



Wear personal protective equipment, in particular, safety goggles when filling oil, when checking for leaks and when changing filters!

Follow the procedures specified on the material safety data sheet for the particular operating fluid!

Risk of injury

The wrong seals or improperly sealed metal surfaces, flanges, inadequately tightened joints or incorrectly set pressure relief valves could allow oil to escape and cause personal injury.



Allow only trained personnel to perform assembly, maintenance and service work!

Note

Keep access to the maintenance work areas free.
Pay attention to dimensions and design in the Assembly Plan!



8.2 Maintenance and repair

- Maintenance, measures to take to maintain the desired condition
- Repair, measures to take to restore the desired condition.

8.2.1 Maintenance measures and intervals

When the equipment is operating

If the pressure differential across the duplex oil filter increases	<ul style="list-style-type: none"> • Switch duplex oil filter and clean.
If the speed of the driven machine fluctuates	<ul style="list-style-type: none"> • Check the air separation characteristics of the working oil. • Ensure that the working oil cooler is venting continuously.
If the oil level is high	<ul style="list-style-type: none"> • Check the amount of water in the working oil¹.
Daily, if monitoring of the instruments is not incorporated into a supervisory system	<ul style="list-style-type: none"> • Check the oil level.
Every three months	<ul style="list-style-type: none"> • Check vent filter for external soiling and clean as necessary. • Inspect hose lines. • Always check for smooth operation under the same operating conditions², record and compare the measurements. • Inspect the working oil ¹⁺³ for suitability

1. [Section 8.6 „Test criteria and notes for evaluating working oils“](#)

2. Specification of measurement points within the output speed range.

3. This maintenance interval can be extended, depending on experience with the equipment. This should not exceed 6 months.

When the equipment is idle

If the quality of the hoses is questionable,	<ul style="list-style-type: none"> • replace the hoses.
If the oil quality is questionable (suitability for use)	<ul style="list-style-type: none"> • Determine and correct the causes. Separate or exchange the oil¹.
The vibrations have increased	<ul style="list-style-type: none"> • Check and correct alignment of the Geared variable speed coupling. Check attachment to the foundation.
Between 50 and 500 hours of operation	<ul style="list-style-type: none"> • Examine the gear teeth surfaces for signs of scuffing.
After every 8,000 hours of operation or at least annually	<p>Analyze the working oil for signs of aging; take any necessary measures¹. Inspect and service the connecting couplings². Check and service the motor³ for the auxiliary lube oil pump. Check and correct alignment of the Geared variable speed coupling. Check attachment to the foundation. Open the inspection hole cover on the housing cover and check the gears and coupling from the outside. In particular, check the contact pattern on the tooth flanks and the state of the fusible plugs (solder filling).</p>

1. Observe the specifications of the oil supplier

2. Note the manufacturer's specifications and identification marks regarding balancing

3. Observe the manufacturer's specifications

NOTE

Prior to restarting a Geared variable speed coupling that was shutdown for some reason

- Check bearings for signs of overheating
- Inspect the fusible plugs
- Switch on the auxiliary lube oil pump and check the oil pressure

8.2.2 Service/repair measures and intervals

Change in operating behavior

- Determine cause.
- Repair the Geared variable speed coupling. For instructions.

After max. 8 years of operation

- Perform a general overhaul.


8.3 Cross references

Topics	Relevant documentation
Working oil	Section 6.2 „Fill the working oil“ Section 6.7 „Operating fluids“ Section 8.6 „Test criteria and notes for evaluating working oils“ Oil supplier's specifications
Hoses	Section 8.5 „Inspecting hose lines“
Fusible plugs	Section 8.7 „Replacing the fusible plugs“
Duplex oil filter	Section 7.3.3 „Changing over the duplex oil filter“ and Section 8.4 „Cleaning the duplex oil filter“
Working oil cooler:	Section 5.8.5 „Installing the vent lines“ Operating instructions for oil cooler in Chapter 14 „Attaching Parts“ of this Instruction Manual
Alignment	Section 5.6 „Machine alignment“
Temperatures and pressures	Section 7.3.1 „Monitoring the equipment“
Actuator	Operating instructions for the actuator in Chapter 14 „Attaching Parts“ of this instruction manual
Connecting couplings	Manufacturer's specifications
Auxiliary lube oil pump motor	Manufacturer's specifications

8.4 Cleaning the duplex oil filter

- Cleaning container with clean mineral spirits or diesel oil (approx. 5 l)
- Container for collecting drained oil (approx. 10 l)
- Angled fine brush (Do not use a heavy brush!)
- Compressed air
- Roll of corrugated cardboard or newspaper

Accessories

	<h3>CAUTION</h3>
	<p>Environmental damage.</p> <p>Used oil that escapes into the soil or sewage system can cause serious damage to the environment.</p> <p>Dispose of used oil in a proper manner that complies with national statutory regulations.</p>

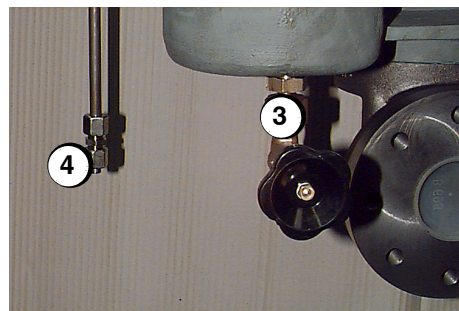
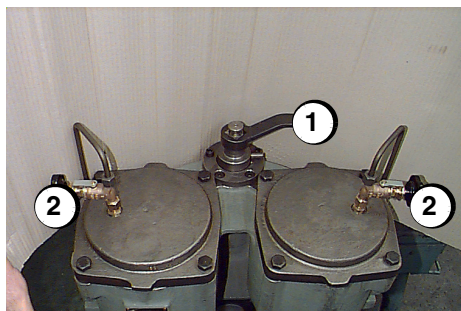


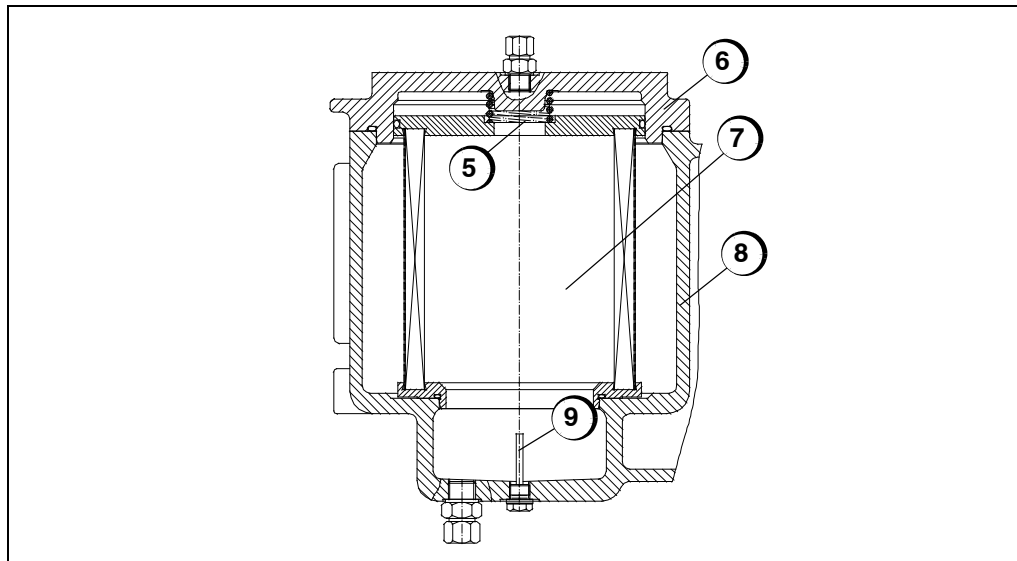
Illustration 8-26:
Duplex oil filter

- 1 Change-over lever
- 2 Vent valve
- 3 Oil drain valve
- 4 Plug

1. Remove change-over lever (1).
2. Remove plug (4).
3. First open the oil drain valve (3) and then the vent valve (2) on the dirty filter housing and collect the draining oil in a suitable container.

Draining oil

<h3>NOTE</h3>
<p>During the cleaning procedure:</p> <ul style="list-style-type: none"> - Do not switch the filter - Do not lift the flood spindle



*Illustration 8-27:
Filter housing with filter
element*

- 5 Compression spring
- 6 Filter cover
- 7 Filter element
- 8 Filter housing
- 9 Magnetic bolt

1. Unscrew filter cover (6).
2. Remove the compression spring (5) and the filter element (7).
 - Outside of the filter element: Clean oil side
 - Inside of the filter element: Dirty side
3. Unscrew and clean the magnetic bolt (9).
4. Clean the inside of the filter housing (8).

Removing the filter element

5. Clean the contaminated inside of the filter element (7) with mineral spirits or diesel oil; wash out the inside of the filter element from top to bottom using the fine brush. Do not immerse the filter element in the cleaning fluid.
6. Insert the roll of paper into the filter element. Blow out the entire surface of the filter element from the outside with compressed air. Remove the dirty roll of paper.
7. If the filter element is heavily soiled, repeat the cleaning procedure.
8. Clean the cover plate of the filter element.
9. If particles from the seals or gaskets are observed in the filter element, immerse the insert briefly (max. 15 min.) in Trichloroethylene or a substitute and wash off.
10. Inspect the filter element and O-rings for damage.
11. Screw in the magnetic bolt (9).

Cleaning the filter element

12. Insert the filter element (7) into the filter housing (8). Make sure to watch that the O-rings are installed correctly while doing this.
13. Insert the compression spring (5) and install the filter cover (6). Close the oil drain valve and the vent valve. Screw in the plugs.
14. Fill the filter housing with oil ([Section „Flooding the clean filtering jug“ on page 86](#)).

Reinstalling the filter element

8.5 Inspecting hose lines

- Storage duration: Max. four years from the time of manufacture
- Environmental conditions: Dry rooms without direct sunlight
- Utilization duration: Max. six years, depending on use and environmental influences

Storage

Utilization

NOTE

The date of manufacture is stamped into the hoses.
Example: 4 Q 08 (Year of manufacture 2008)

- Outer layer damage to the woven inlay (worn areas, cuts or cracks)
- Brittle outer layer (cracks)
- Deformed when under pressure or not (layers separated, bubbles)
- Leaks

Inspection criteria

8.6 Test criteria and notes for evaluating working oils

The suitability of working oils for continued use should be checked and evaluated at regular intervals.

The value of the information obtained from an analysis of the working oil depends on correct and careful sampling [Section 7.5 „Taking a sample of the working oil“](#).

General

NOTE
<p>This list contains aspects to be considered and rough limits for evaluating the suitability of working oils for continued use.</p> <p>The decision regarding the suitability of the working oil for continued use remains the right of the manufacturer and oil supplier.</p>

The following can only be considered recommendations, since they depend on the operating conditions, formulation and type of working oil.

The oil should be changed when

- It is very black in color
- Residues start to accumulate
- It has a sharp, burnt odor

Visual and sensory check

It is necessary to determine the cause.

- Viscosity change $> \pm 10\%$

Viscosity (DIN 51562)

It is necessary to determine the cause.

- Increase in NZ(s) versus that of fresh oil (new working oil)
 - Turbine oil -TD-0.5 -1 mg KOH/g
 - Hydraulic oil -HLP-1 - 1.5 mg KOH/g
 - Lube oil -CLP-1.5 - 2 mg KOH/g

Neutralization number NZ(s) (DIN 51558)

- Water content > 0.05 weight % (500 ppm).

Water content (DIN 51582)

No oil change is necessary, if the water content is eliminated by means of

- Centrifuging
- Filtering through a coalescence separator
- Vacuum treatment
- Settling (allowing to rest for 1-2 days) and then draining or pumping off¹
- Heating

1. In the case of synthetic oils with a density > 1.0 , condensation, for instance, floats on top.

An oil change is necessary when

- Water content is > 0.2 weight %

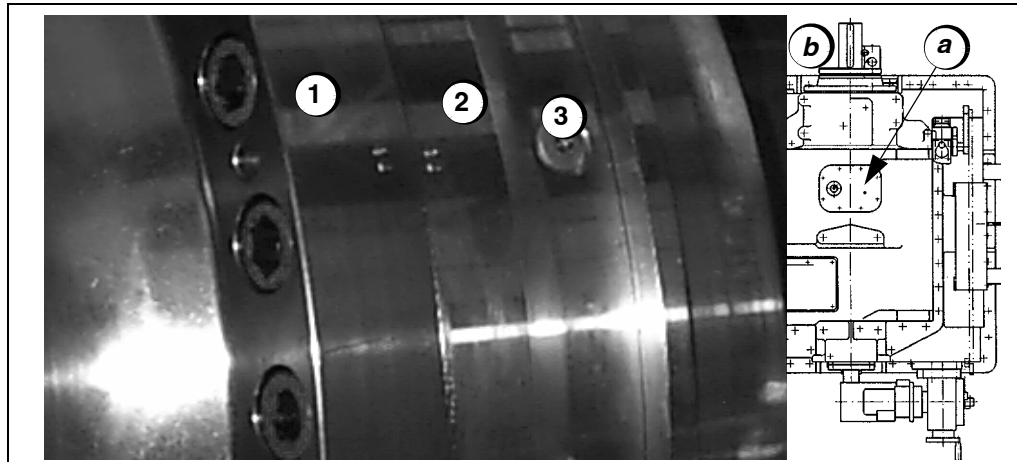
It is necessary to determine the cause.

- Occurrence of pressure and speed fluctuations, if too low an oil level is to be excluded and the LAV value > 5 minutes (0.2 % at 50 °C).
- Reduction in FZG load level, if it drops more than one level.
(remaining additive content of EP components < 30 %)

**Air separation
characteristics LVA
(DIN 51381)**

**Damaging force
level in FZG test
A/8,3/90
(DIN 51354)**

8.7 Replacing the fusible plugs



*Illustration 8-28:
Location of the fusible
plug*

- 1 Primary wheel
- 2 Shell
- 3 Fusible plug

- a Inspection hole cover
- b Output

1. Remove the inspection hole cover on the housing cover.
2. Rotate the input shaft until the fusible plugs (or the holes for the fusible plugs) in the shell are visible.
3. Check the solder filling in the plugs; install new plugs, if necessary.

9 Troubleshooting

9.1 Start-up

Malfunction	Cause(s)	Action(s)
Driven machine does not start up after the driving machine has attained its rated speed	• Scoop tube set at 0 %	• Take the following actions: <ul style="list-style-type: none"> – Move scoop tube towards 100 % – Check the actuator power supply – Check the positioning signal – Troubleshooting (Actuator operating instructions)
	• Working oil pump does not deliver oil <ul style="list-style-type: none"> – Oil temperature in the oil reservoir < +5 °C or oil viscosity > 250 mm²/s – Oil level too low – Foaming oil (oil temp. too low; water in the oil; poor air separation characteristics; wrong oil grade) – Working oil pump pressure < 1.0 bar – Working oil delivery rate too low 	• Take the following actions: <ul style="list-style-type: none"> – Warm oil to > +5 °C, possibly by running the pump. Close the cooling water supply on the lube oil cooler – Check the oil level and fill to a value between the oil level during operation and the Max. mark. Check the fusible plugs. – Check the oil for contaminants. Centrifuge or separate the oil. Change oil, if necessary – Check the working oil pump pressure at pressure test ports – Increase working oil flow
	• Startup torque too high (high motor inrush current), driven machine blocked (see working oil temperature)	• Check that driven machine turns freely. Check fusible plugs

9.2 Output speed

Malfunction	Cause(s)	Action(s)
Automat. control: <ul style="list-style-type: none"> Output speed fluctuates The actuator and scoop tube move occasionally (see deviation indicator) 	<ul style="list-style-type: none"> Master controller overshoot Adjustment speed of actuator too high Play between the actuator and the control lever Play between the control block and the scoop tube 	<ul style="list-style-type: none"> Dampen controller (Section "Manual control") Compare the adjustment speed with the design data; Discuss with Voith Crailsheim Replace the connection between the actuator and the control lever Replace the scoop tube positioning mechanism
Manual control: <ul style="list-style-type: none"> Output speed fluctuates Actuator and scoop tube at a standstill (see deviation indicator) 	<ul style="list-style-type: none"> Foaming oil (oil temperature in reservoir < 40 °C, resulting in poor air separation characteristics) Working oil pump pressure fluctuates <ul style="list-style-type: none"> Oil temperature in the oil reservoir < 40 °C, resulting in poor air separation characteristics Oil level too low Foaming oil (oil temp. too low; water in the oil; poor air separation characteristics; wrong oil grade) Working oil pump pressure < 1.5 bar Working oil delivery rate too low Air trapped in working oil cooler escaping periodically into coupling Pressure or flow rate variations in the water supply system (in the case of a pump-operated supply) 	<ul style="list-style-type: none"> Warm oil in the reservoir to > 40 °C. To do so, lower the cooling water flow rate by partially closing the cooling water inlet valve on the lube oil cooler. Take the following actions: <ul style="list-style-type: none"> Warm oil in the reservoir to > 40 °C. To do so, lower the cooling water flow rate by partially closing the cooling water inlet valve on the lube oil cooler Check the oil level and fill to a value between the oil level during operation and the Max. mark. Check the fusible plugs. Check the oil for impurities. Centrifuge or separate the oil Change oil, if necessary Check the work oil pump pressure at pressure test ports Increase working oil flow Check that cooler is vented completely (the working oil cooler must be vented at three locations on the shell) Check the feed water supply system
Output speed cannot be controlled	<ul style="list-style-type: none"> Fault on the actuator or in the control circuit Fault in the scoop tube adjustment device 	<ul style="list-style-type: none"> Check the actuator and the control circuit (electrical connections) Check the scoop tube control and the ease of movement of the scoop tube mechanism

Malfunction	Cause(s)	Action(s)
Max. output speed not attained	• Scoop tube not at 100 %	• Check the position of the scoop tube; shift the stops on the actuator if necessary
	• Fusible plugs have melted	• Determine and correct cause. Install new fusible plugs.
	• Power consumption of the working oil pump too high	• Check the motor rating with the project design data. Check that driven machine turns freely.
	• Working oil flow rate too low	• Readjust the working oil flow rate

9.3 Pressures

Malfunction	Cause(s)	Action(s)
Lube oil pressure too low to enable startup	• Motor for auxiliary lube oil pump connected incorrectly	• Check line connections
	• Delivery of lube oil to external equipment too high	• Adjust orifices
	• Leak in the oil circuits	• Check the oil level. Check the piping for leaks (take the necessary action to prevent damage to the environment).
	• Pressure relief valve set too low	• Correct the pressure relief valve setting
	• Lube oil filter clogged	• Switch lube oil filters and clean filter housing. Check pressure differential monitoring.
Pressure differential across duplex filter too high	• Lube oil filter clogged	• Switch lube oil filters and clean filter housing.
Lube oil pressure too low during normal operation	• Lube oil filter clogged	• Switch lube oil filters and clean filter housing.
	• Pressure relief valve jammed or set incorrectly	• Check the pressure relief valve; reset lubricating oil pressure if necessary.
	• Delivery of lube oil to external equipment too high	• Adjust orifices
	• Check valve in auxiliary lube oil pump circuit jammed (motor for auxiliary lube oil pump rotating in the wrong direction)	• Check the check valve
Working oil pump pressure too low	• Oil temperature in reservoir < 40 °C, resulting in poor air separation characteristics	• Warm oil in the reservoir to > 40 °C. To do so, lower the cooling water flow rate by partially closing the cooling water inlet valve on the lube oil cooler
	• Oil level too low	• Check the oil level and fill to a value between the oil level during operation and the Max. mark. Check fusible plugs.
	• Foaming oil (oil temp. too low; water in the oil; poor air separation characteristics; wrong oil grade)	• Check the oil for contaminants. Centrifuge or separate the oil. Change oil, if necessary

9.4 Temperatures

Malfunction	Cause(s)	Action(s)
Lube oil temperature downstream of lube oil cooler too high	Lube oil cooler: <ul style="list-style-type: none"> Cooling water flow rate too low Cooling water too warm Cooler clogged 	<ul style="list-style-type: none"> Increase the cooling water flow rate Check the thermostatic control valve Check and clean the cooling system
Lube oil temperature upstream of lube oil cooler too high	<ul style="list-style-type: none"> Fusible plugs have melted 	<ul style="list-style-type: none"> Determine and correct cause. Install new fusible plugs.
Bearing temperatures too high	<ul style="list-style-type: none"> Bearing damage 	<ul style="list-style-type: none"> Check for smooth operation. Check the bearings and replace, if necessary.
	<ul style="list-style-type: none"> Lube oil temperature too high 	<ul style="list-style-type: none"> Check lube oil cooler
	<ul style="list-style-type: none"> Lube oil pressure too low 	<ul style="list-style-type: none"> Check the lube oil system Switch lube oil filters and clean filter housing. Check pressure differential monitoring. Check the oil level. Check the pressure relief valve. Increase the lube oil pressure.
Working oil temperature rises to above 110 °C upstream of the working oil cooler during startup	<ul style="list-style-type: none"> Startup torque too high (high motor inrush current), driven machine blocked (see working oil temperature) 	<ul style="list-style-type: none"> Check that driven machine turns freely. Check fusible plugs
	<ul style="list-style-type: none"> Working oil pump does not deliver oil <ul style="list-style-type: none"> Oil temperature in the oil reservoir < 40 °C, resulting in poor air separation characteristics Oil level too low Foaming oil (oil temp. too low; water in the oil; poor air separation characteristics; wrong oil grade) Working oil pump pressure < 1.5 bar Working oil delivery rate too low Oil system not filled prior to startup 	<ul style="list-style-type: none"> Take the following actions: <ul style="list-style-type: none"> Warm oil in the reservoir to > 40 °C. To do so, lower the cooling water flow rate by partially closing the cooling water inlet valve on the lube oil cooler Check the oil level and fill to a value between the oil level during operation and the Max. mark. Check the fusible plugs. Check the oil for impurities. Centrifuge or separate the oil Change oil, if necessary Check the working oil pump pressure at pressure test connections Increase working oil flow rate Fill the oil system with the aid of the auxiliary lube oil pump. Check the piping system (correct pipe routing, no draining into the oil reservoir) Check the fusible plugs
	Working oil cooler: <ul style="list-style-type: none"> Cooling water flow rate too low Cooler clogged 	<ul style="list-style-type: none"> Increase the cooling water flow rate Check and clean the cooling system

Malfunction	Cause(s)	Action(s)
Working oil temperature rises to above 110 °C upstream of the working oil cooler during operation	<ul style="list-style-type: none"> Working oil pump does not deliver oil <ul style="list-style-type: none"> Oil temperature in the oil reservoir < 40 °C, resulting in poor air separation characteristics Oil level too low Foaming oil (oil temp. too low; water in the oil; poor air separation characteristics; wrong oil grade) Working oil pump pressure < 1.5 bar Working oil delivery rate too low 	<ul style="list-style-type: none"> Take the following actions: <ul style="list-style-type: none"> Warm oil in the reservoir to > 40 °C. To do so, lower the cooling water flow rate by partially closing the cooling water inlet valve on the lube oil cooler Check the oil level and fill to a value between the oil level during operation and the max. mark. Check the fusible plugs. Check the oil for impurities. Centrifuge or separate the oil Change oil, if necessary Check the working oil pump pressure at pressure test connections Increase working oil flow rate
	<ul style="list-style-type: none"> Fusible plugs have melted 	<ul style="list-style-type: none"> Determine and correct cause. Install new fusible plugs.
	Working oil cooler:	
	<ul style="list-style-type: none"> Cooling water flow rate too low Cooling water too warm Cooler clogged 	<ul style="list-style-type: none"> Increase the cooling water flow rate Check the thermostatic control valve Check and clean the cooling system
	<ul style="list-style-type: none"> Operating outside the performance characteristics specified for the project 	<ul style="list-style-type: none"> Comply with design data, especially the pump characteristic curve

9.5 Smooth operation

Malfunction	Cause(s)	Action(s)
Rough operation, vibrations and noise	<ul style="list-style-type: none"> Poor alignment 	<ul style="list-style-type: none"> Check alignment and correct, if necessary
	<ul style="list-style-type: none"> Poor support between equipment and foundation (foundation rails); uneven support; equipment cocked 	<ul style="list-style-type: none"> Check the alignment and support; correct, if necessary
	<ul style="list-style-type: none"> Foundation bolts loose, defective foundation, foundation rails not grouted 	<ul style="list-style-type: none"> Check foundation; retighten the foundation bolts, if necessary
	<ul style="list-style-type: none"> Wear or lack of lubrication in the connecting couplings; sleeve in curved tooth coupling does not move axially (teeth worn) 	<ul style="list-style-type: none"> Check the connecting couplings, lube oil supply and injection nozzles
	<ul style="list-style-type: none"> Rotating components unbalanced Bearing damage 	<ul style="list-style-type: none"> Measure the vibration and perform a frequency analysis on the entire system. Record the readings and operating data.
	<ul style="list-style-type: none"> Bearing damage 	<ul style="list-style-type: none"> Replace bearing

9.6 Cross references

Topics	Relevant documentation
Working oil cooler:	Operating instructions for oil cooler in Chapter 14 „Attaching Parts“ of this instruction manual
Bleeding the working oil cooler	Section 5.8.2 „Horizontal heat exchangers“ Section 5.8.5 „Installing the vent lines“
Working oil flow rate	Section 6.6 „Adjusting the working oil flow rate“
Alignment	Section 5.6 „Machine alignment“
Operating data (pressures, temperatures, oil flow rates)	Section 1.2 „Operating data“ Section 7.3.1 „Monitoring the equipment“
Orifice plugs for lubrication of external equipment	Section „Drilling of orifices for lube oil supplied to external units“ on page 60
Foundations	Section 5.7 „Secure machine“
Auxiliary lube oil pump motor	Operating instructions for the auxiliary lube oil pump motor in Chapter 14 „Attaching Parts“ of this instruction manual
Bearings	
Oil	Section 8.6 „Test criteria and notes for evaluating working oils“
Oil level	Section 6.2 „Fill the working oil“
Fusible plugs	Section 8.7 „Replacing the fusible plugs“
Lube oil pressure	Section 6.5 „Set the lubricating oil pressure“
Lube oil filter	Section 8.4 „Cleaning the duplex oil filter“
Lube oil cooler	Operating instructions for oil cooler in Chapter 14 „Attaching Parts“ of this instruction manual
Actuator	Operating instructions for the actuator in Chapter 14 „Attaching Parts“ of this instruction manual
Connecting couplings	Operating instructions for the connecting couplings in Chapter 14 „Attaching Parts“ of this instruction manual

10 Introduction to General Overhaul

NOTE

Constant operation subjects units to natural wear, which is also influenced by the surroundings. The scheduled reconditioning of your equipment minimizes the risk of expensive production downtime. Our service department will develop a maintenance strategy that precisely suits your needs. Professional and regular reconditioning by our service team extends the service life of your Voith product.

Contact our Service Center for further details: See contact information.

10.1 Safety information

The following safety information applies to the entire chapter. They must be observed in addition to the various specific instructions.

Danger of crushing or shearing upper and lower limbs

During maintenance and assembly work, especially when turning shafts manually, during assembly work and when positioning the machine, a person's fingers could be crushed or cut off.

Allow only trained personnel to perform assembly, maintenance and service work!



Risk of injury

Improper lifting of the Geared variable speed coupling can result in equipment damage and personal injury.

The Geared variable speed coupling is to be suspended only from the indicated lifting points under consideration of the $45 \pm 2^\circ$ angle of inclination.

Use only appropriate lifting appliances that conform to safety requirements!



Damage to equipment and personal injury

Improper disassembly and assembly of the Geared variable speed coupling can lead to damaging the equipment and to personal injury.

Disassembly and assembly work on the Geared variable speed coupling is to be performed only by qualified personnel.

Observe the personnel selection and qualifications indicated in the Instruction Manual!



Environmental damage

Used oil that escapes into the soil or sewage system can cause serious damage to the environment.

Dispose of used oil in accordance with the national legal regulations!
Check for oil and leaks regularly!

CAUTION

Danger of slipping on leaked oil

Leaking oil on or next to the machine could cause someone to slip or fall and be seriously injured.

Check for oil and leaks regularly!
Clean the machine regularly!

 **WARNING**

Danger in areas that cannot be fully viewed

A person could be severely injured while working on the machine when starting it up.
Attach suitable protective covers that cannot be removed without the respective tool between the coupling and the shaft!
Only work on the machine when the system is shut down (no power)!
Operation is only permitted after visually ensuring that no persons are in the hazard areas!

 **WARNING**

Risk of injury

A person could burn themselves on the hot machine or on hot operational equipment.
Only touch the machine when it has cooled down!

 **WARNING**

Danger caused by incorrect assembly

Not observing the correct direction of rotation could damage the machine and severely injure persons.
The incorrect assembly of the machine or individual parts could damage the machine.
Allow only trained personnel to perform assembly, maintenance and service work!

 **WARNING**

Note

The Geared variable speed coupling and removable parts of the Geared variable speed coupling are always to be put down on a suitable surface (e.g. rubber mat).

NOTE

Note

Keep access to the maintenance work areas free.
Pay attention to dimensions and design in the Assembly Plan!

NOTE

10.2 Tools and auxiliary means

- Standard tool kit
- Torque wrench (See diagrams for torques)
- Measuring equipment
- Metric tools
- Lifting appliances

Tools

If necessary, these tools can be purchased or rented from Voith.

Disassembling/assembling the Geared variable speed coupling requires no further special tools.

- Surface of rubber or similar material
- Fastening/securing agents
- Sealant

Accessories

Fastening/securing agents

Use fastening/securing agents that comply with the drawing specifications for "Liquid plastic".

Parts that are connected with one another must be

- clean
- oil- and grease-free.

Cleaning agent: trichloroethane or similar grease dissolving liquids.

Sealant

Sealant must meet the following criteria for use with Geared variable speed coupling:

- oil-resistant to 130 °C
- does not contain silicone

Voith Turbo recommends HYLOMAR - L¹ as sealant. The sealant is only to be applied in a thin layer and ventilated for approximately 10 minutes. Observe other instructions from the manufacturer.

Cleaning agent: trichloroethane or similar grease dissolving liquids.

1. HYLOMAR-L; Observe information on the tube when applying
Manufacturer - MARSTON-DOMSEL D-53909 Zulpich

10.3 Preparations

NOTE

We recommend that general overhauls are only carried out by Voith mechanics or those trained by Voith.

Before disassembling components of the Geared variable speed coupling, do the following preparatory work:

NOTE

Comply with any additional special on-site safety information!

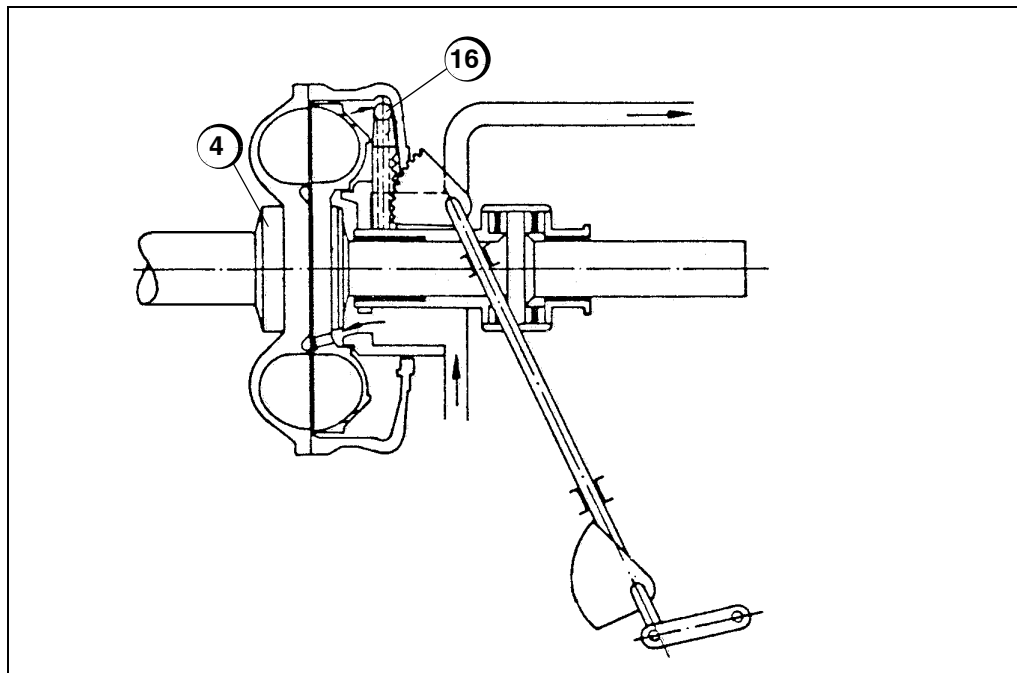
1. Shut down driving machine, Geared variable speed coupling allow to cool.
2. Electrically disconnect system motor.
3. Obtain approval to proceed with disassembly from the responsible party.
4. Disconnect electrical connections, when necessary.
5. Remove attached equipment such as cable ducts, wiring or sound insulation covering based on the circumstances.
6. Make the lifting appliance (crane) ready for the Geared variable speed coupling and components removed.

Required weight information: [Section 1.1 „Machine data“](#).

NOTE

During the warranty period, work on the Vorecon is only to be performed with the approval of Voith Turbo GmbH & Co. KG Crailsheim.

10.4 List of components

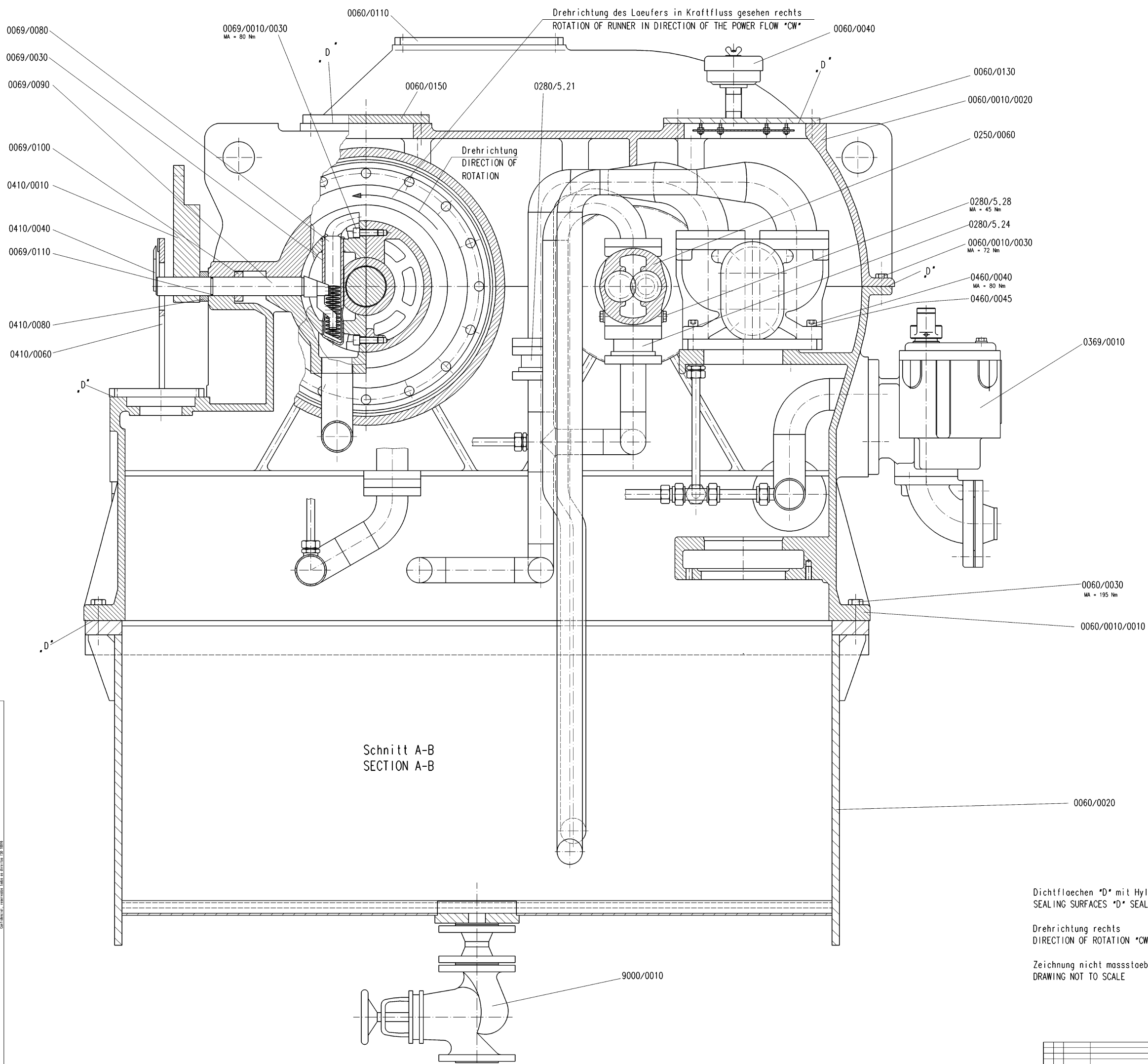


*Illustration 10-29:
Assemblies of the
Geared variable speed
coupling (only partially
displayed)*

- 4 Coupling runner with primary shaft and gear and secondary shaft
- 16 Scoop tube with scoop tube controller

11 Drawings, Schematics, Diagrams

Horizontal section	20500731010
Vertical section	20500731010
Main lubricating oil pump	42579740
Auxiliary lubricating oil pump	42255620
Pressure relief valve - Working oil	42255630
Sequence valve - Lubricating oil	42255040
Duplex filter	42255640
Adjustable orifice	42584870
Oil circuit and measuring point scheme	91600286510
Instrument list	91600286610
Logic Diagram	91600292710
Terminal Diagram	91600288210
Assembly Plan	
- Geared variable speed coupling	91500248410



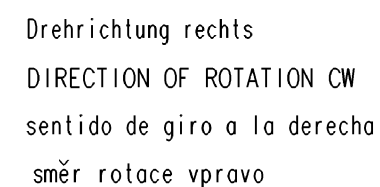
Dichtflaechen "D" mit Hylomar abgedichtet
SEALING SURFACES "D" SEALED WITH "HYLOMAR"

Drehrichtung rechts
DIRECTION OF ROTATION "CW"

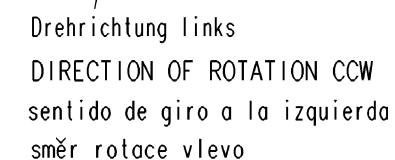
Zeichnung nicht massstoeblieh gezeichnet
DRAWING NOT TO SCALE

* GEARED VARIABLE SPEED COUPLING
VERTICAL SECTION

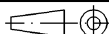
[illegible]



Schnitt A-A
SECTION A-A
sección A-A
řez A-A

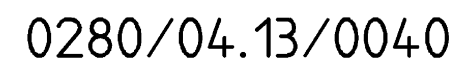


* bomba
✓ čerpadlo

		R17K.2-E				CAD Freigebevermerk Released for micro	
				Sprache deen Language		es-CS F	
		Kanten Chamfers ISO 13715		Allg. Toleranzen Gen. Tolerances ISO 2768-mK-E		Oberfläche Surface Quality Ra in µm ISO 1302	
		Tolerierung Tolerancing DIN 7167		Massstab im Orig. Scale of Orig.		1:2 Masse Mass ca.15 kg	
		Werkstoff Material		Modell- / Gesenk-Nr. Pattern / Die No.		Rohteil-Nr. Blank-No.	
		Datum Date		Name Name		Doku-Art Doc. Type	
		2003-10-20 Trp		Benennung Title		*	
		2003-10-20 Ruh crpk Frei. No. Met		*		PUMPE PUMP	
		Zeichnungs-Nr. / Doku-Nr. Drawing No. / Doc. No.		4 257974 0		Blatt Sheet 1 v. 1 Bl	
		VOITH TURBO ANTRIEBS TECHNIK		4 225561 0		Ers. d.	
		Passmass Abmasse		Urspr.		Ers. d.	



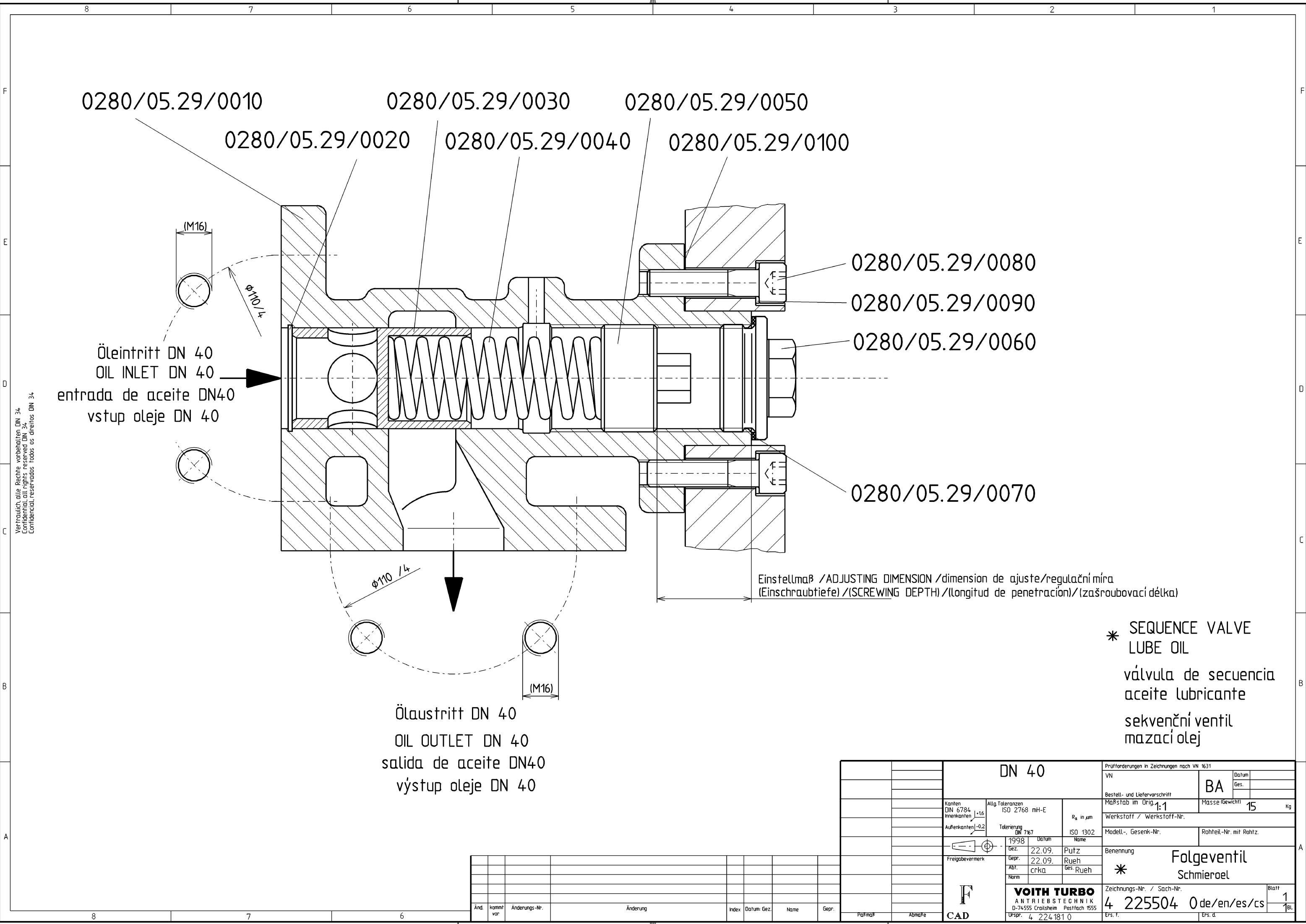
A1



* VALVULA LIMITADORA DE PRESION DN40 Tlakový redukční ventil DN40	E
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Änd.	kommt vor	Änderungs-Nr.	Änderung	Index	Datum: Gez.	Name	Gepr.

		R1.K.1-E R1.K.2-E		Prüfforderungen in Zeichnungen nach VN 1631 VN Datum Ges. Bestell- und Liefervorschrift	
		Kanten DIN 6784 Innenkanten $+1.6$ Außenkanten -0.2		Maßstab im Orig. 1:1 Masse (Gewicht) Kg	
		Allg. Toleranzen ISO 2768 mH-E Tolerierung DIN 7167 ISO 1302		Werkstoff / Werkstoff-Nr. Modell-, Gesenk-Nr. Rohteil-Nr. mit Rohtz.	
				1998 Datum Name	
		Freigabevermerk		Benennung * Druckbegrenzungsventil DN40 PRESSURE RELIEF VALVE DN40	
		F CAD		Zeichnungs-Nr. / Sach-Nr. 4 225563 0 de/en/es/cs	
Paßmaß		Abmaße		Blatt 1 1 Bl.	
		VOITH TURBO ANTRIEBSTECHNIK D-74555 Crailsheim Postfach 1555 Urspr. 3623-013364		Ers. f. 3623-016020 Ers. d.	



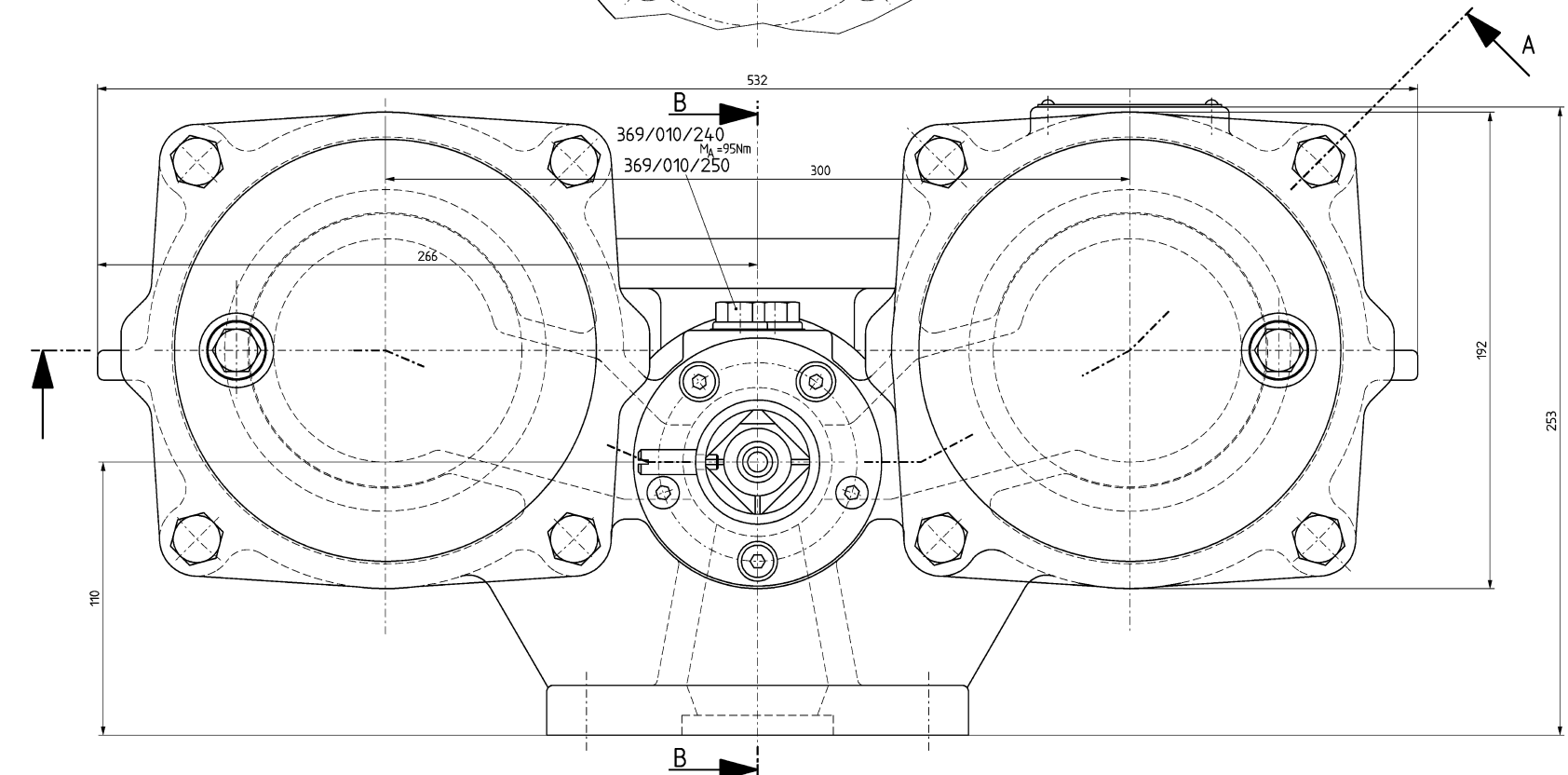
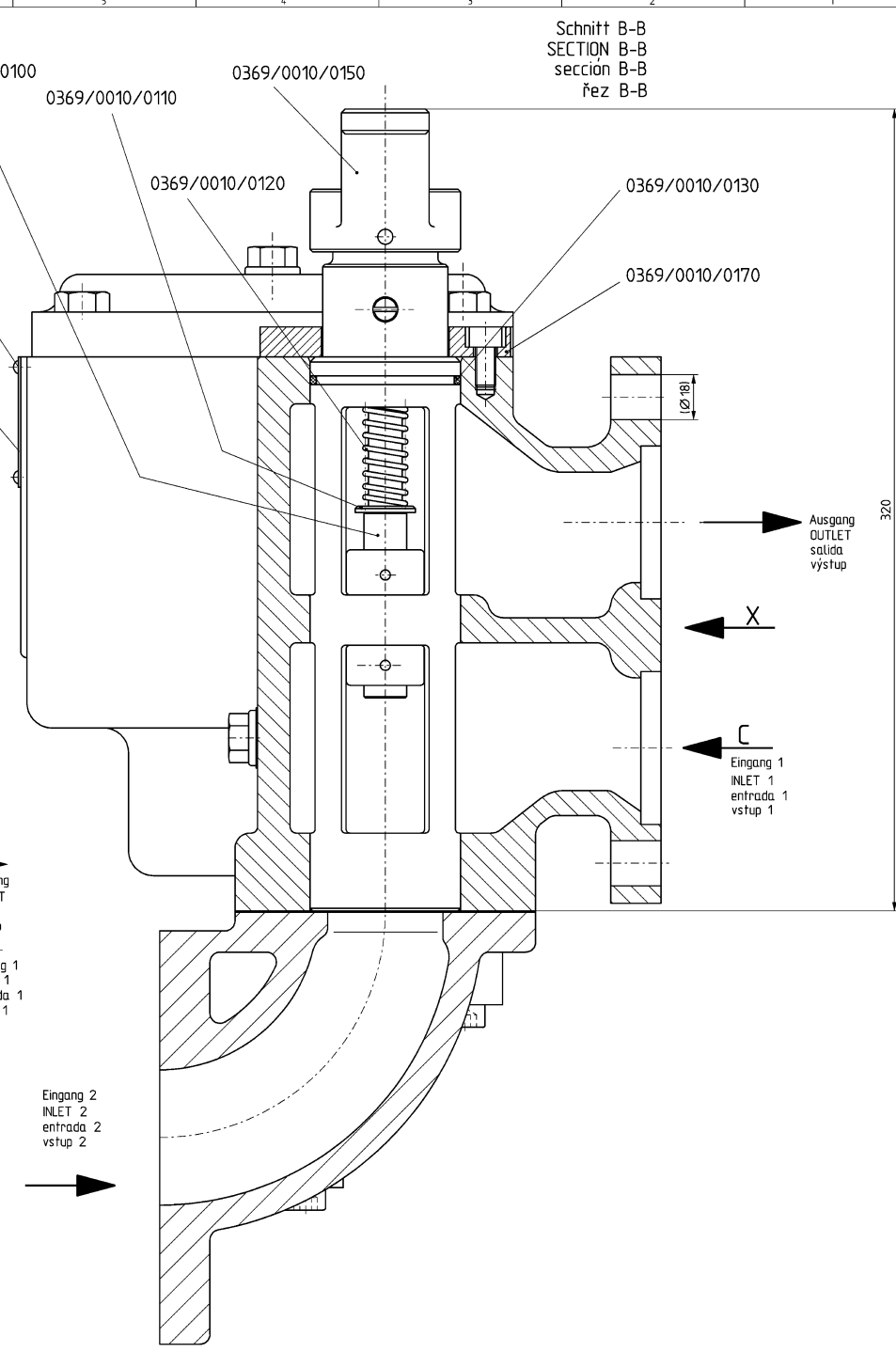
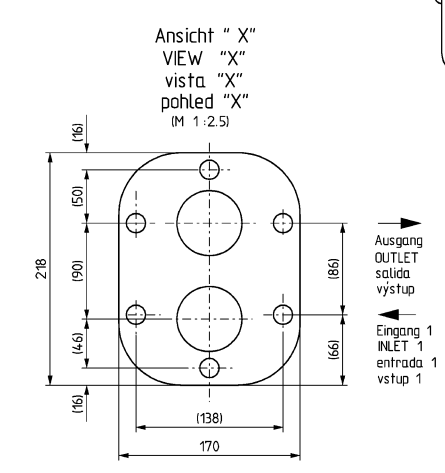
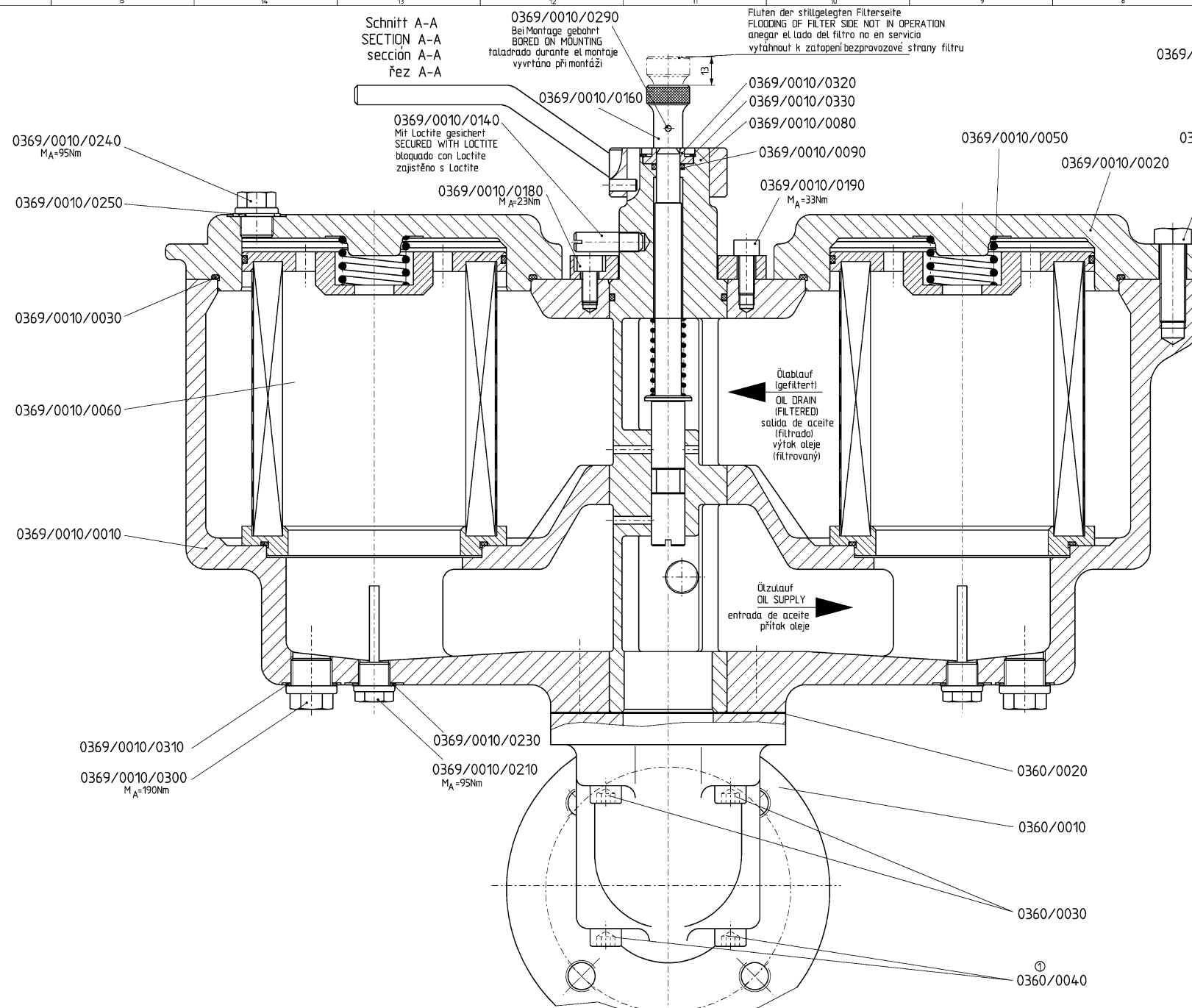
Vertraulich, alle Rechte vorbehalten DIN 34
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Confidencial, reservados todos os direitos DIN 34

* SEQUENCE VALVE
LUBE OIL
válvula de sequencia
aceite lubricante
sekvenční ventil
mazací olej

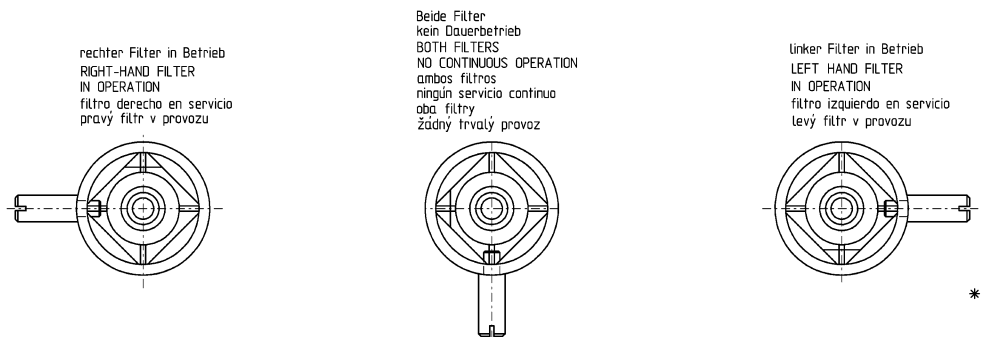
Änd.	kommt vor	Änderungs-Nr.	Änderung	Index	Datum	Gez.	Name	Gepr.

DN 40		Prüfbedingungen in Zeichnungen nach VN 1631	
VN		BA	Datum
Bestell- und Liefervorschrift		Masse/Gewicht	15 kg
Maßstab im Orig. 1:1		Werkstoff / Werkstoff-Nr.	
Modell-, Gesenk-Nr.		Rohteil-Nr. mit Rohtz.	
Benennung		Folgeventil Schmieröl	
Zeichnungs-Nr. / Sach-Nr.		4 225504	0 de/en/es/cs
Ers. f.		Ers. d.	

Kanten DIN 6784 Innenkanten Außenkanten	Allg. Toleranzen ISO 2768 mH-E Tolerierung DN 7/67	R _a in µm ISO 1302 Name
1-1.6 -0.2	1998 Gez. 22.09. Abt. crka Norm	Putz Rueh Ges. Rueh
Freigabevermerk		
F CAD		
VOITH TURBO ANTRIEBSTECHNIK D-74555 Crailsheim Postfach 1555 Urspr. 4 2241810		

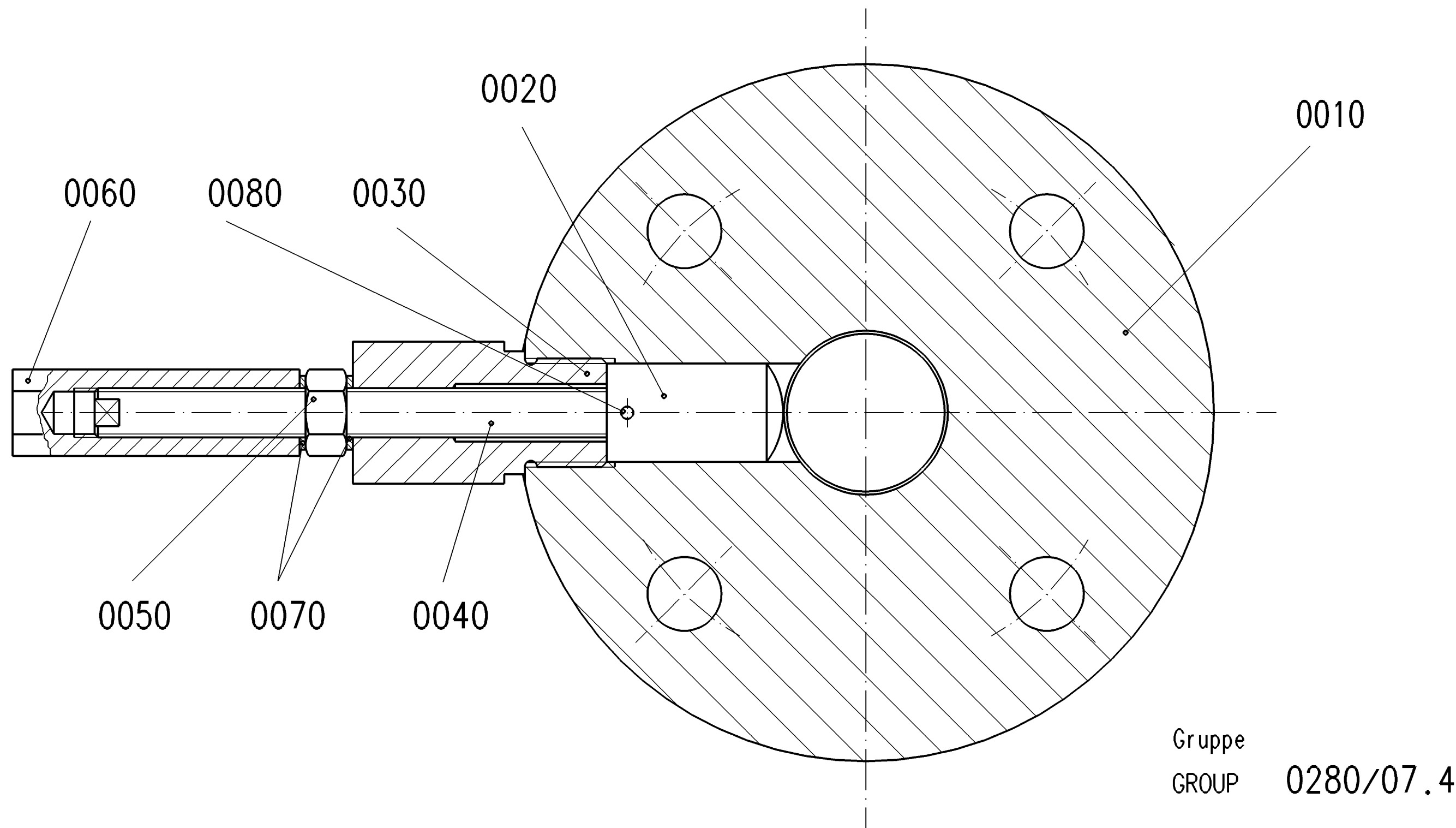


Stellungen des Umschalthebels
POSITIONS OF CHANGE LEVER
posiciones de la palanca de reglaje
polohy řadič páky

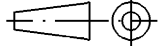




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Confidential, all rights reserved DIN 34

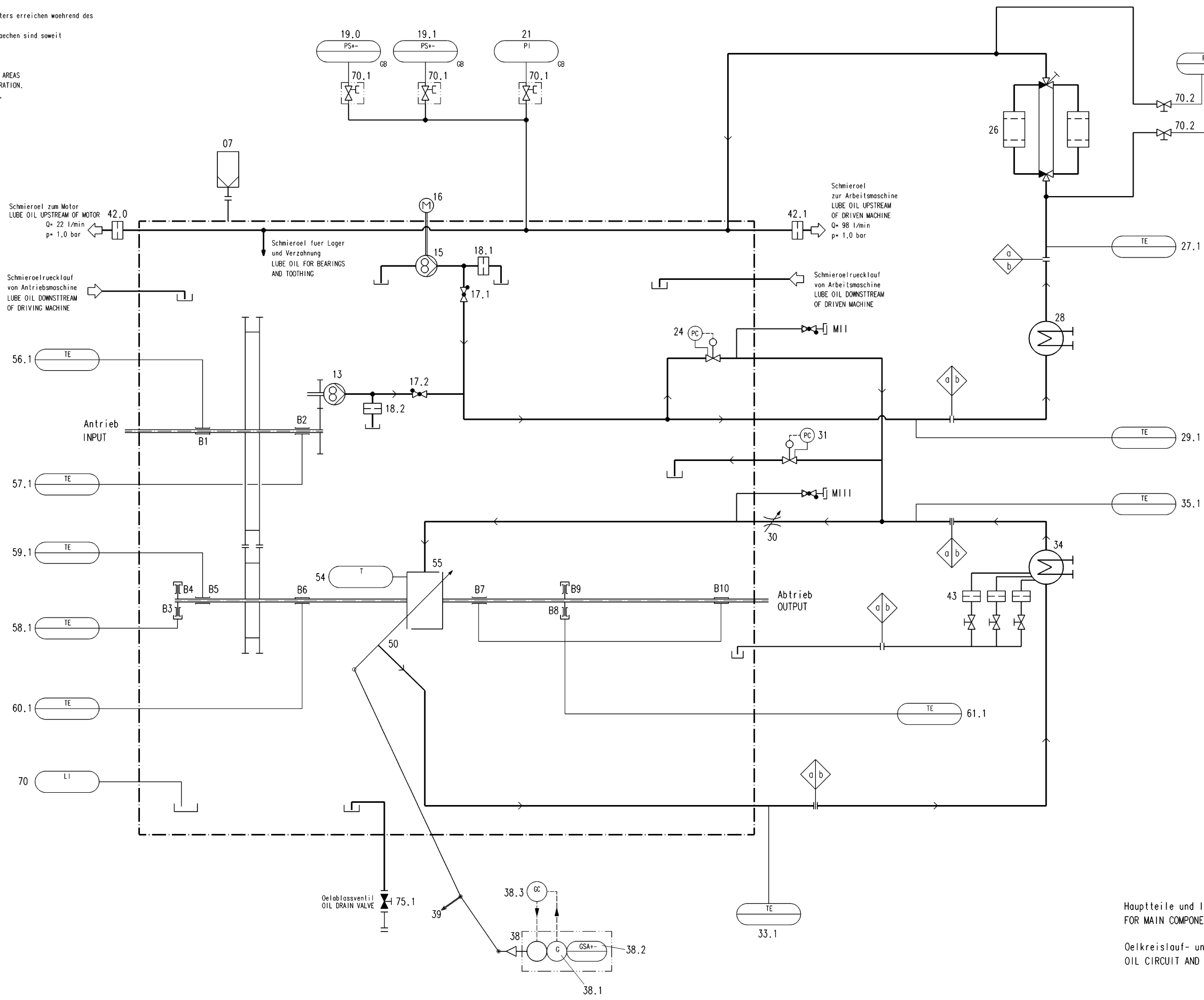


Aend.	Kommt vor	Aenderungs-Nr.	Aenderung	Index	Datum: Gez.	Name	Gepr.
1	-	A2119/04	REVISION		04-02-19	AkB	Rueh

		R17 K.2E				CAD		Freigabevermerk			
				Sprache		de		F			
		Kanten ISO 13715  		Allg. Toleranzen ISO 2768-mK-E Tolerierung DIN 7167		Oberflaechen R _a in µm ISO 1302		Massstab im Orig.		Masse kg	
		Gez. 2004-02-12 AkB		Datum		Name		Doku-Art		Benennung	
		Gepr. 2004-02-12 Rueh								DROSSEL	
		Abt. crpk Frei. Met								Zeichnungs-Nr. / Doku-Nr.	
		Norm								4 258487 0	
										Blatt 1	
										v. 1 Bl.	
										Ers. d.	
										Ers. f.	
										Urspr.	
										Passmass	
										Abmasse	

Heisse Oberfloechen
Rohrleitungen, Bereiche des Gehaueses und des Oelbehalters erreichen waehrend des Betriebes der Maschine Temperaturen ueber 60°C.
Schutzeinrichtungen gegen Beruehrung der heissen Oberfloechen sind soweit erforderlich kundenseitig vorzusehen.

HOT SURFACES
THERE ARE PIPEWORK SECTIONS AND HOUSING / OIL RESERVOIR AREAS WHICH REACH SURFACE TEMPERATURES ABOVE 60° C DURING OPERATION.
PROTECTION AGAINST ACCIDENTAL CONTACT WITH HOT SURFACES, IF REQUIRED, SHALL BE PROVIDED BY OTHERS.



Ausgabe- oder Bedienungsorl:
OUTPUT LOCATION OR SERVICE LOCATION:

- Messort oder Stellort
MEASURING POINT OR ADJUSTING POINT
- Oertliche Instrumententafel
LOCAL GAUGE BOARD
- Zentrale Warte
CONTROL ROOM
- Oertliche Instrumententafel
Signalverarbeitung in zentraler Warte
LOCAL GAUGE BOARD
SIGNAL PROCESSING IN CONTROL ROOM
- Druckmessstelle
PRESSURE MEASURING POINT
- Rueckschlagventil (Durchfluss wie dargestellt)
CHECK VALVE (FLOW DIRECTION AS SHOWN)


Hauptteile und Instrumente siehe Liste-Nr. 91600286610
FOR MAIN COMPONENTS AND INSTRUMENTS SEE LIST NO. 91600286610

Oelkreislauf- und Messstellenschema
OIL CIRCUIT AND MEASURING POINT SCHEME

Voith-Lieferung
VOITH SUPPLY

keine Voith-Lieferung
NOT VOITH SUPPLY

Chengda S 1 UongBi #2

R17K.2E												CAD		Erstellung Datum	
ORDER-NO.: 38001974										de		den			
Kunden-Adresse		Kunden-Telefon		Kunden-Fax		Kunden-Web		Kunden-Postfach		Kunden-Email		Kunden-Postfach		Kunden-Postfach	
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Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	B 1		Radial bearing				Input shaft			
	B 2		Radial bearing				Input shaft			
	B 3		Thrust bearing				Primary shaft			
	B 4		Thrust bearing				Primary shaft			
	B 5		Radial bearing				Primary shaft			
	B 6		Radial bearing				Primary shaft			
	B 7		Radial bearing				Secondary shaft			
	B 8		Thrust bearing				Secondary shaft			
	B 9		Thrust bearing				Secondary shaft			
	B 10		Radial bearing				Secondary shaft			
	07		Vent filter Type: T L F I 3 - 40 G 25 Make: Eppensteiner		G 1 ½		Coupling housing			
	13		Mech. driven oil pump							
	15		Aux. lube oil pump							
	16		Three-phase motor				Aux. lube oil pump			Power supply: 380 V, 3 Ph, AC Power : 5.5 kW

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	91600286510	38001974	Chengda S 1 UongBi #2	2009-03-06 airek-Leh/SSte	R 17 K.2 E	1) 82476, 2009-03-26, Leh/SSte	

Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	17.1		Check valve Make: Gestra				Aux. lube oil pump			
	17.2		Check valve Make: Gestra				Mech.driven oil pump			
	18.1		Orifice				Lube oil / aux. lube oil pump			Discharge pipe venting
	18.2		Orifice (bore in pipe)				Mech. driven oil pump			Discharge pipe venting
	19.0		Pressure switch Type: 44V1-AA45-M4-C1A Make: SOR	0.3 - 5.2 bar	¼" NPT --- ¾" NPT	IP 65	Lube oil pressure / downstream of lube oil filter	Main motor release: ↑ 1.7 bar Trip: ↓ 0.8 bar	2.5 ± 0.5 bar	2x DPDT contact Housing material: aluminum. Gauge board mounted Switch rating: 5 A, 250 V AC / 0.5 A, 125 V DC
	19.1		Pressure switch Type: 44V1-AA45-M4-C1A Make: SOR	0.3 - 5.2 bar	¼" NPT --- ¾" NPT	IP 65	Lube oil pressure / downstream of lube oil filter	Aux. lube oil pump OFF, with timer 3 min. after main motor start-up ↑ 2.2 bar Alarm / aux. lube oil pump ON ↓ 1.5 bar	2.5 ± 0.5 bar	2x DPDT contact Housing material: aluminum. Gauge board mounted Switch rating: 5 A, 250 V AC / 0.5 A, 125 V DC Time relay not Voith supply
	21		Pressure gauge Type: 100- T 5500 Make: Dresser Ashcroft	0 - 6 bar	G ½	IP 65	Lube oil pressure / downstream of lube oil filter		2.5 ± 0.5 bar	Housing material: stainless steel. Gauge board mounted

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	91600286510	38001974	Chengda S 1 UongBi #2	2009-03-06 airek-Leh/SSte	R 17 K.2 E	1) 82476, 2009-03-26, Leh/SSte	

Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	24		Pressure relief valve				Lube oil			
	25		Diff. pressure switch Type: 101RN-KK3-M4-C1A Make: SOR	0.2 - 2.0 bar	¼" NPT --- 3/4" NPT	IP 65	Diff. pressure / lube oil filter	Alarm clean filter: ↑ 0.6 bar	< 0.6 bar	1x DPDT contact Power supply: 15 A, 220 V AC / 0.4 A, 110 V DC
	26		Duplex oil filter, Type: VSF 50 Make: Voith		DN 50 PN 16 EN 1092-1		Lube oil			Filter elements: cleanable 25 µm stainless steel mesh
	27.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G ½ --- M20 x 1.5	IP 65	Lube oil temperature / downstream of cooler	Alarm: ↑ 55 °C Trip: ↑ 60 °C	< 55 °C	Connection head material: aluminum, coated With thermowell
	28		Lube oil cooler							not Voith supply
	29.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G ½ --- Thermowell G ¾		Lube oil temperature / upstream of cooler	Alarm: ↑ 65 °C Trip: ↑ 70 °C	< 65 °C	Connection head material: aluminum, coated With thermowell
	30		Adjustable orifice				Working oil			
	31		Pressure relief valve				Working oil			
	33.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G ½ --- M20 x 1.5	IP 65	Working oil temperature / upstream of cooler	Alarm: ↑ 110 °C Trip: ↑ 130 °C	< 110 °C	Connection head material: aluminum, coated With thermowell

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Voith Turbo GmbH & Co. KG
D - Crailsheim

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Order No.

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Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	34		Working oil cooler							not Voith supply
	35.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G ½ --- Thermowell G ¾		Working oil temperature / downstream of cooler	Alarm: ↑ 75 °C Trip: ↑ 85 °C	<75 °C	Connection head material: aluminum, coated With thermowell
	38 38.1 38.2		Actuator RHD 250-10 Make: ABB			IP 65			5 - 100 % *	Local scoop tube indicator
	38.3		Positioning power electronic unit EBN 853 Make: ABB				Actuator		5 - 100 % 4 - 20 mA	loose part
	39		Scoop tube Stroke indicator							
	42.0		Orifice				External lube oil, upstream of motor			
	42.1		Orifice				External lube oil, upstream of driven machine			
	43		Working oil cooler venting							not Voith supply
	50		Scoop tube							
	54		Fusible plug				Turbo coupling			

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Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	55		Voith Variable Speed Turbo Coupling							
	56.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G 3/8 --- M20 x 1.5	IP 65	Bearing temperature / Radial bearing 1 B1	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated
	57.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G 3/8 --- M20 x 1.5	IP 65	Bearing temperature / Radial bearing 2 B2	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated
	58.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G 3/8 --- M20 x 1.5	IP 65	Bearing temperature / Thrust bearing 3 / 4 B3 / B4	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated With thermowell
	59.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G 3/8 --- M20 x 1.5	IP 65	Bearing temperature / Radial bearing 5 B5	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated
	60.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G ½ --- M20 x 1.5	IP 65	Bearing temperature / Radial bearing 6 B6	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated

VOITH

Voith Turbo GmbH & Co. KG
D - Crailsheim

Scheme No.

91600286510

Order No.

38001974

Code

Chengda S 1 UongBi #2

Date

2009-03-06
airek-Leh/SSte

Type

R 17 K.2 E

Revision

1) 82476, 2009-03-26, Leh/SSte

Document No.

91600286610 en

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Main Components and Instrument List

Revision No.	Item / TAG No.		Component or Instrument Type: Make:	Measuring range --- Adjusted range	Process Connection --- Electrical Connection	Ingress Protection	Measurement / Measuring point, location	Set value	Nominal value during operation	Remarks
	Voith	Customer								
	61.1		Resistance thermometer Type: 2 x PT 100, 3-wire-system DIN IEC 751, Class B Drawing No.: 42035240 Make: Voith / Juchheim	0 to 180 °C	G 3/8 --- M20 x 1.5	IP 65	Bearing header temperature / Radial bearing 7 Thrust bearing 8/9 Bearing 10 B7 / B8 / B9 / B10	Alarm: ↑ 90 °C Trip: ↑ 95 °C	< 90 °C	Connection head material: aluminum, coated With thermowell
	70		Oil level indicator	see assembly Plan			Gear housing		Between min. and max. oil level	
	70.1		Shut off valve Type: DIN 16271		Process: G ½		Shutoff measuring line / Pressure instrument			
	70.2		Shutoff valve Type: LDV10S/dk Make: Ermeto		G 3/8		Shutoff diff. pressure measuring line			
	75.1		Oil drain at the bottom Type: KSB BOAH		DN 32 PN 16 EN 1092-1		Oil reservoir			
	M II		Pressure measuring point				Pressure upstream of adjustable orifice			
	M III		Pressure measuring point				Pressure downstream of adjustable orifice			

VOITH Voith Turbo GmbH & Co. KG D - Crailsheim	Scheme No.	Order No.	Code	Date	Type	Revision	Document No. 91600286610 en Page 6 / 6
	91600286510	38001974	Chengda S 1 UongBi #2	2009-03-06 airek-Leh/SSte	R 17 K.2 E	1) 82476, 2009-03-26, Leh/SSte	

VOITH TURBO

POWER TRANSMISSION

Variable Speed Drives

Voithstrasse 1

D-74564 Crailsheim

Tel.: 07951 / 32 - 0

Fax : 07951 / 32 - 650

Code : Chengda S 1 UongBi #2

VC product : R17K.2-E

Order number : 38001974

Drawing number : 91600292710 en

Designation : Logic Flow Chart

Symbolic files :

File : J:\Turbo\ai-VTCR\air\BA-Doku\916\002500-003000\91600292710en.pfd

Department : airek

Issued on : 09-03-13 by : M.Mayer Number of pages : 23

				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	Cover sheet	Order No.: 38001974	
				Editor	M.Mayer					
				Date		R17K.2-E	Dept.airek		Drawing No.: 91600292710 en	Page 1
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Contents

[illegible]

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				Editor	M.Mayer							
				Date					R17K.2-E	Dept.airek	Drawing No.: 91600292710 en	Page 2
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Revision list

Page	Revision description	Index	Revision No.	Date	Name
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				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	Revision list	Order No.: 38001974	
				Editor	M.Mayer					
				Date		R17K.2-E	Dept.airek		Drawing No.: 91600292710 en	Page 3
Index	Rev. No.	Date	Name	Checked						23 P.

This is the input side.

This is the output side.

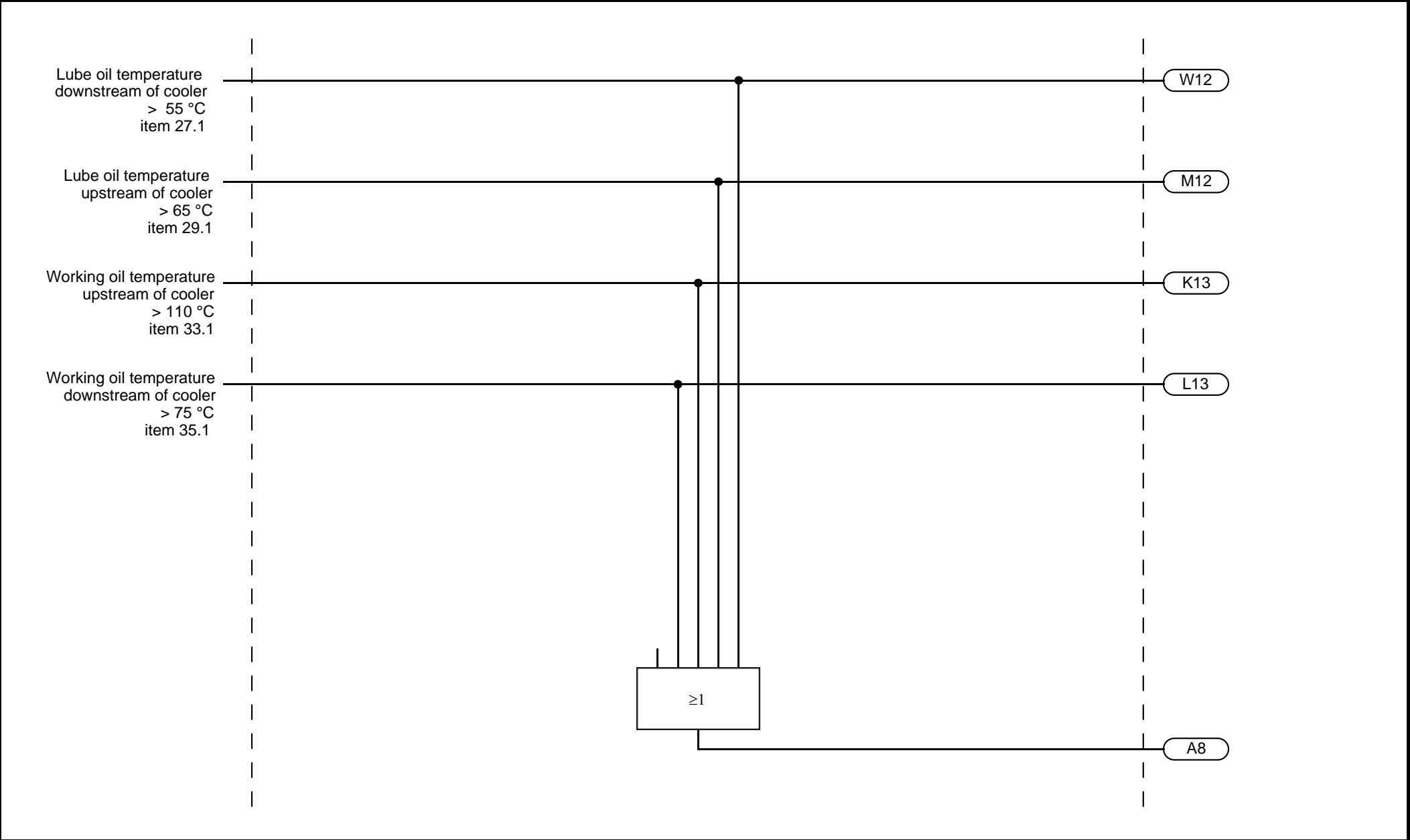
GENERAL COMMENTS

Identification of symbols for logic diagram, refer to the last 4 pages of this document.

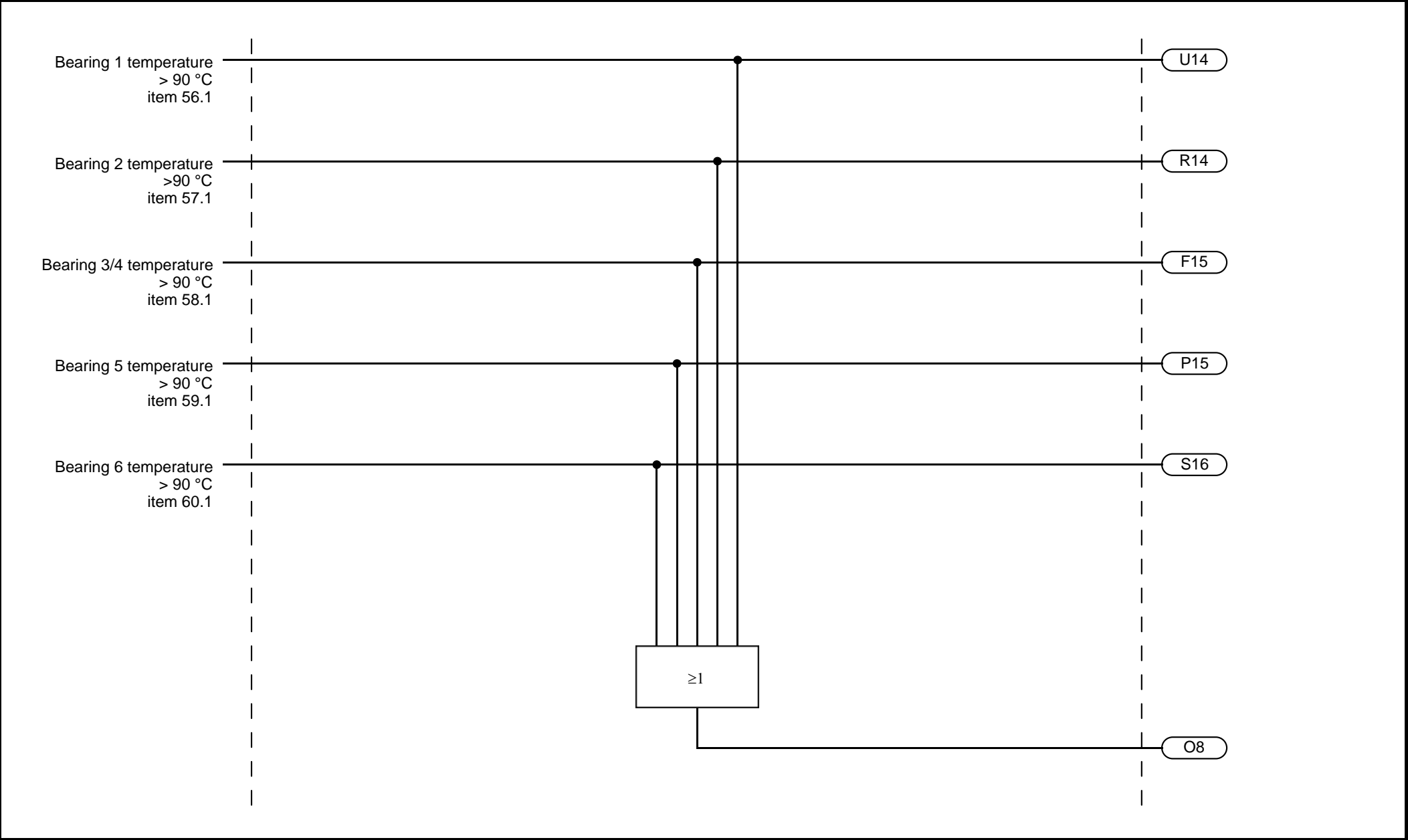
Item numbers, see Oil Circuit and Measuring Point Scheme 91600286510.
Before test run and after each revision all switch points and connections have to be checked or adjusted.

Switch points, see Instrument List 91600286610 .

				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	General comments	Order No.: 38001974	
				Editor	M.Mayer					
				Date		R17K.2-E	Dept.airek		Drawing No.: 91600292710 en	Page 4
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				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	Pre-start conditions part 1	Order No.:	38001974	
				Editor	M.Mayer						
				Date		R17K.2-E	Dept.airek		Drawing No.:	91600292710 en	Page 5
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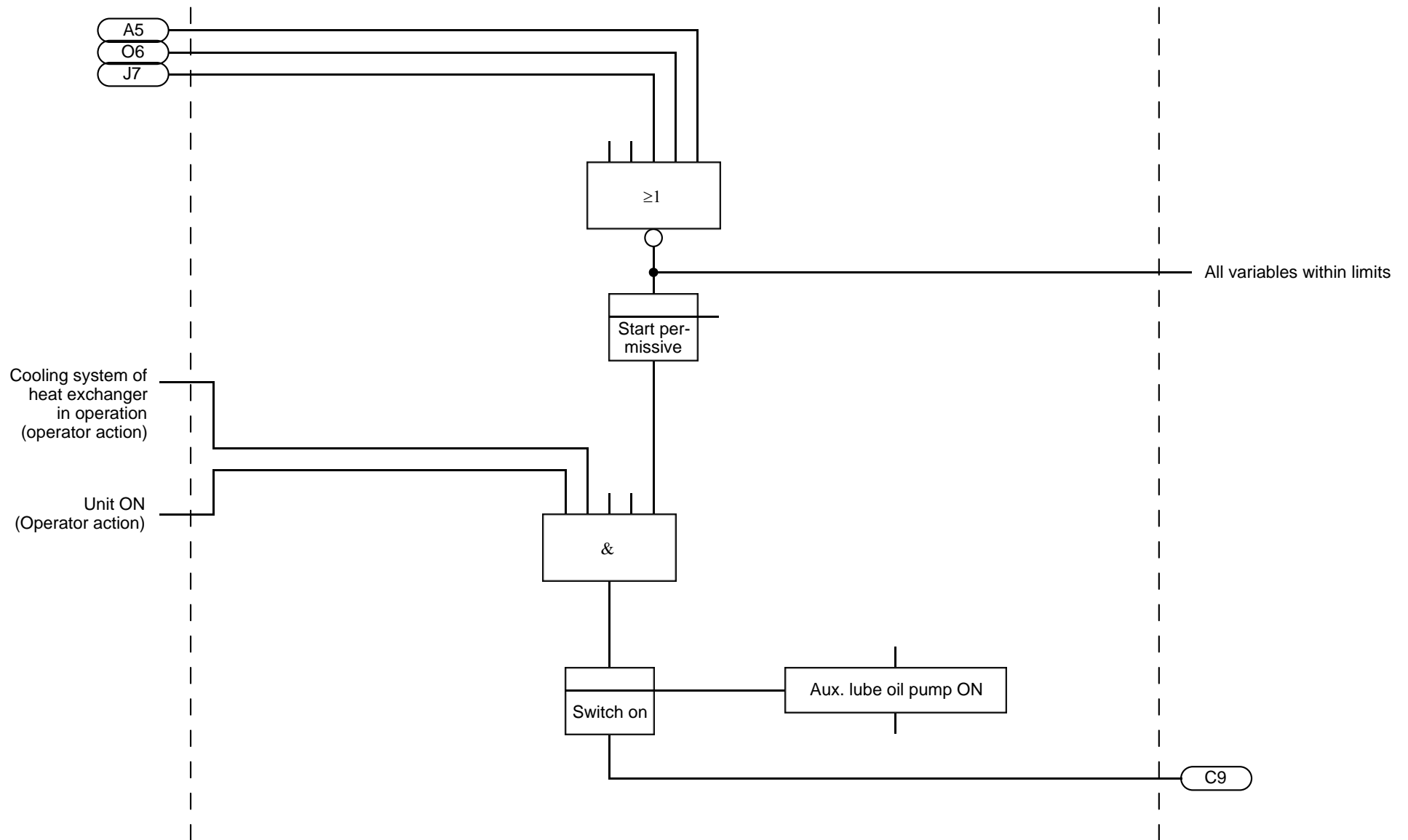
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				Editor	M.Mayer	R17K.2-E	Dept.airek		Drawing No.:	91600292710 en	Page 6
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Bearings 7, 8/9, 10
temperature
> 90° C
item 61.1

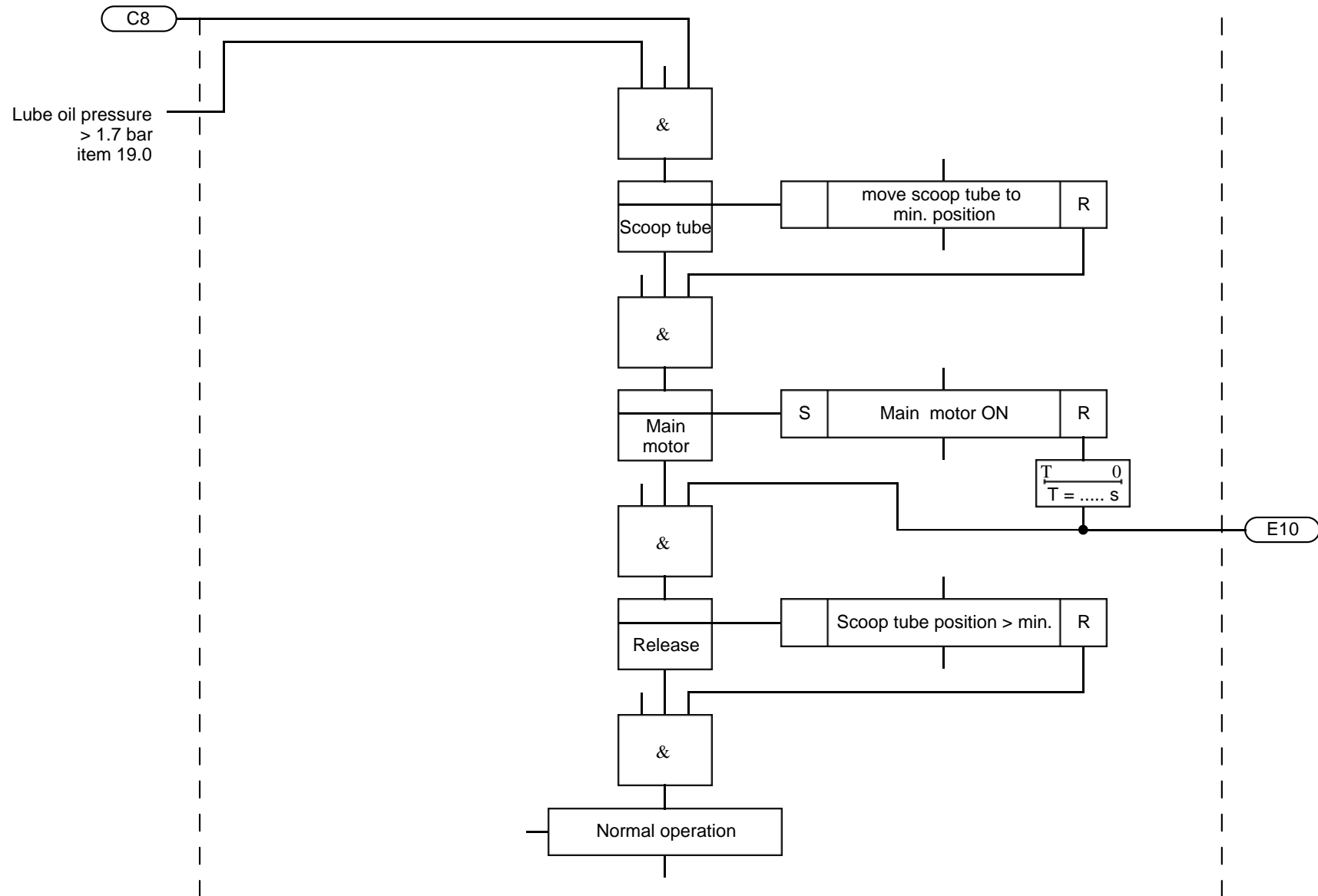
Y16

J8

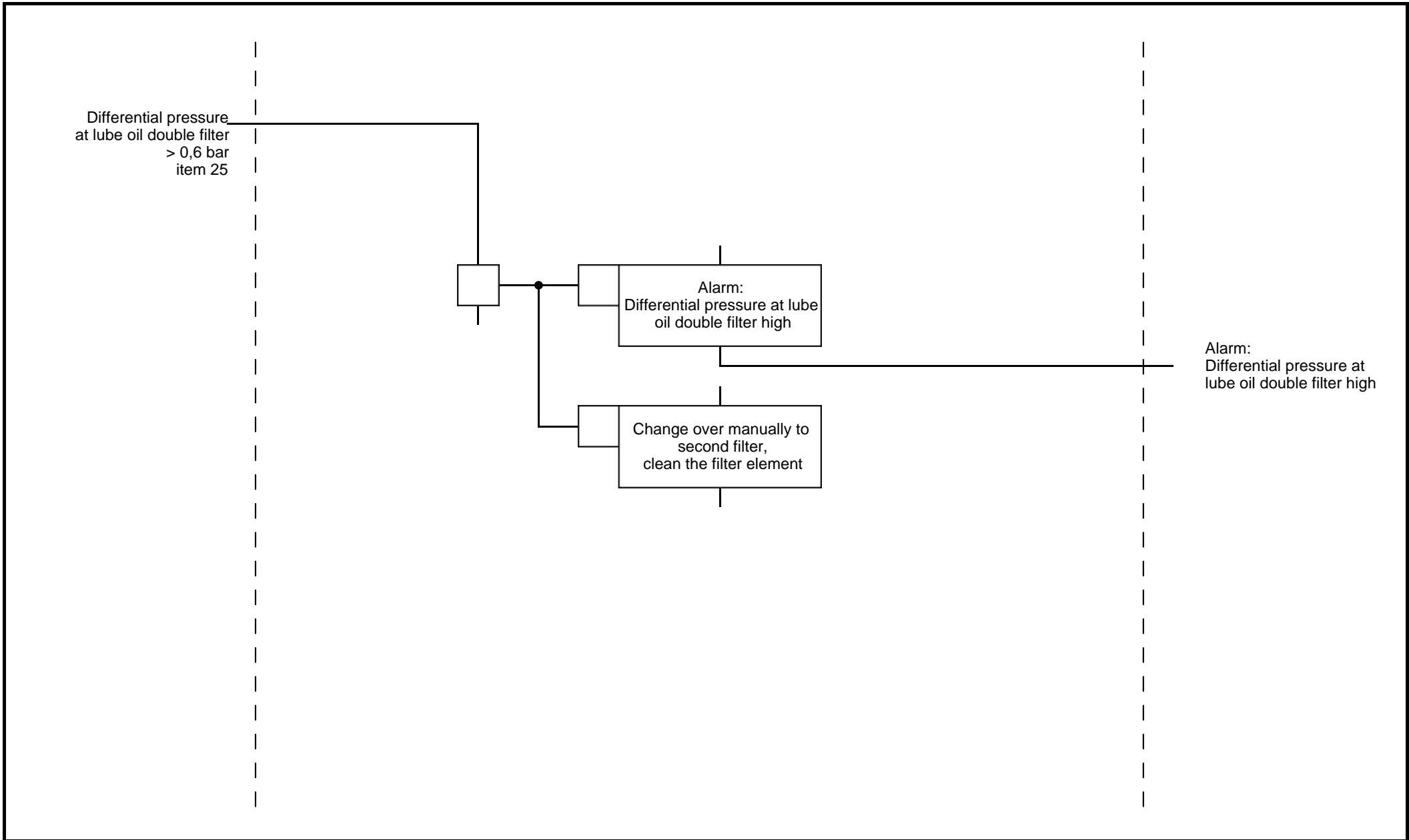
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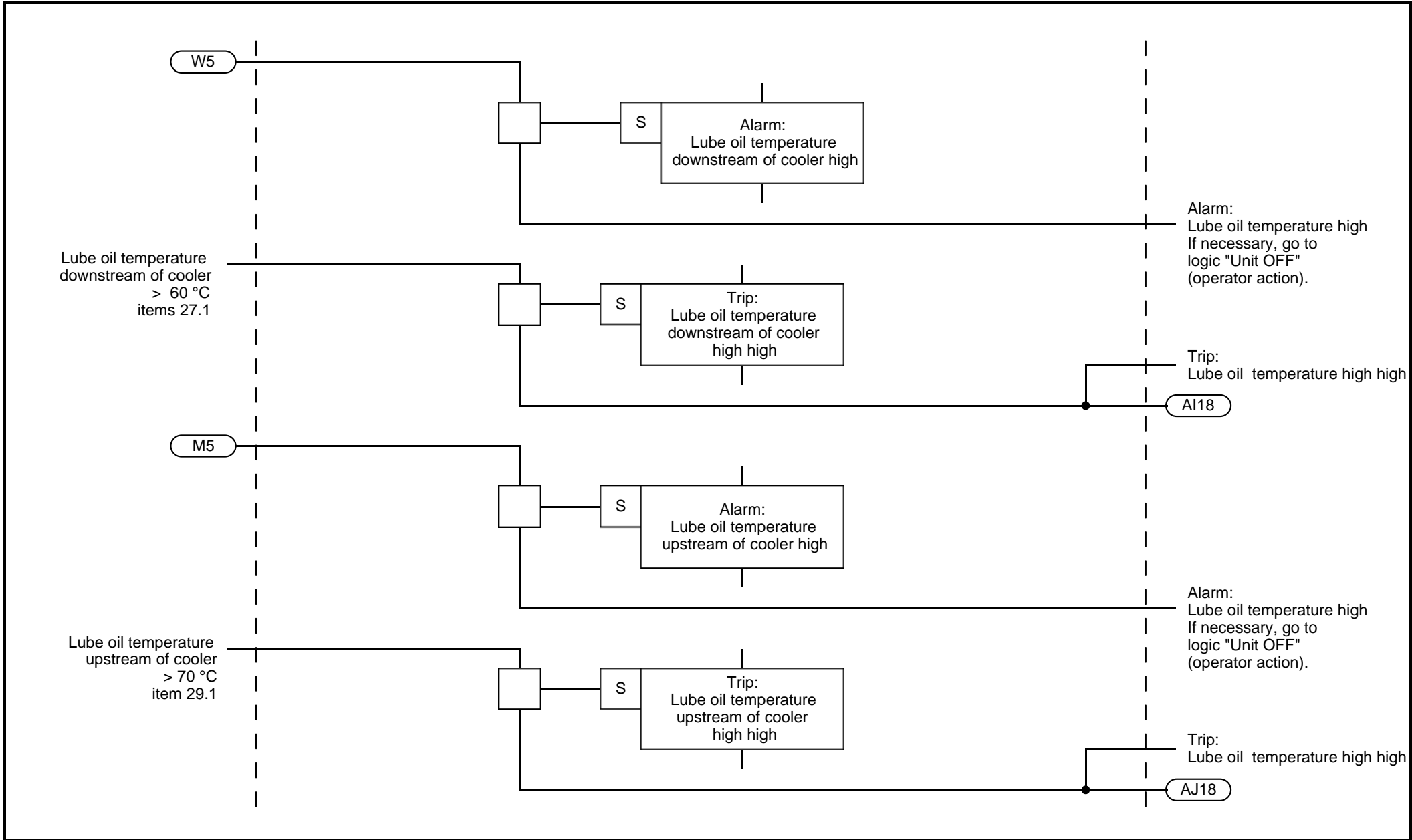
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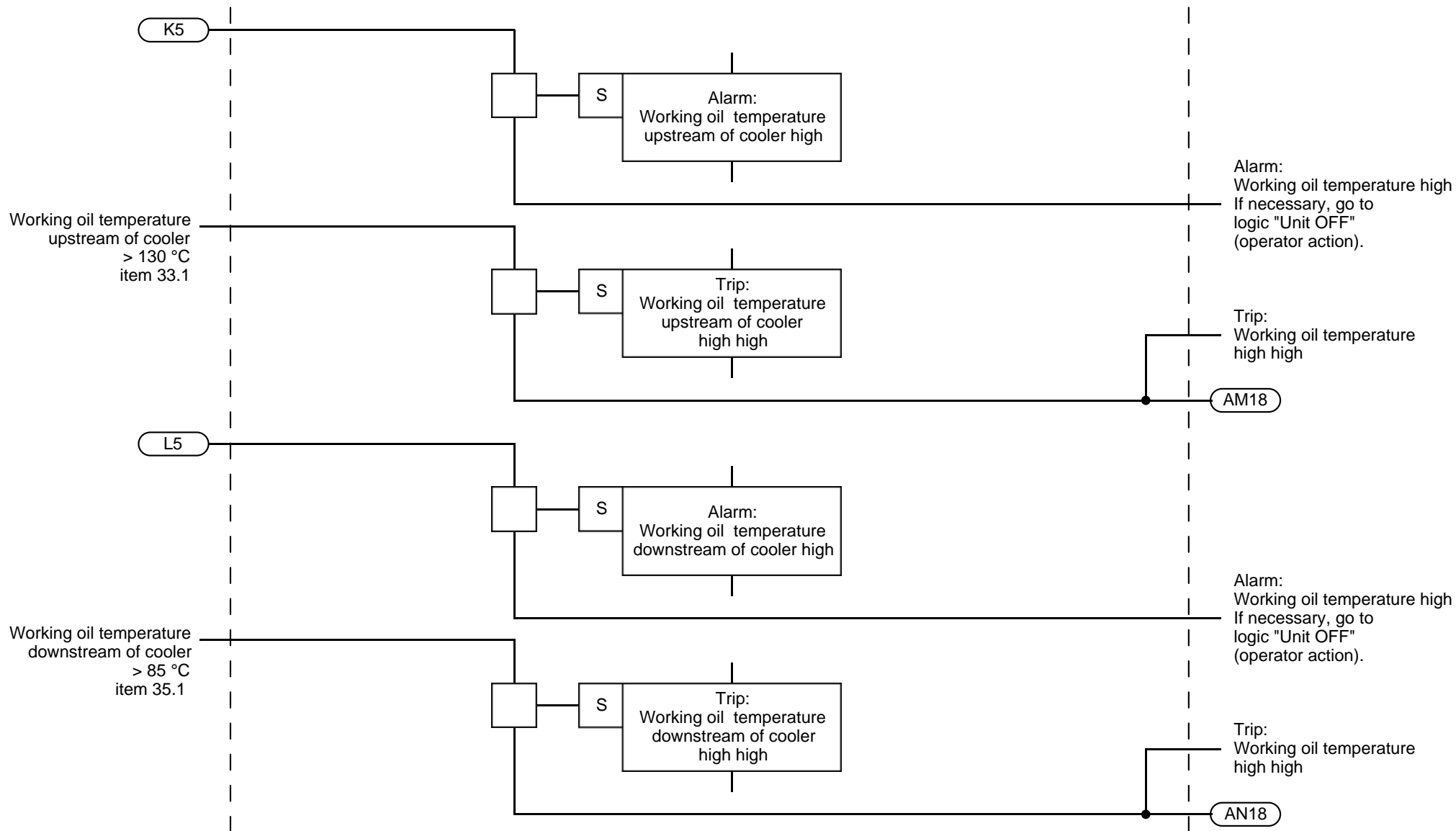
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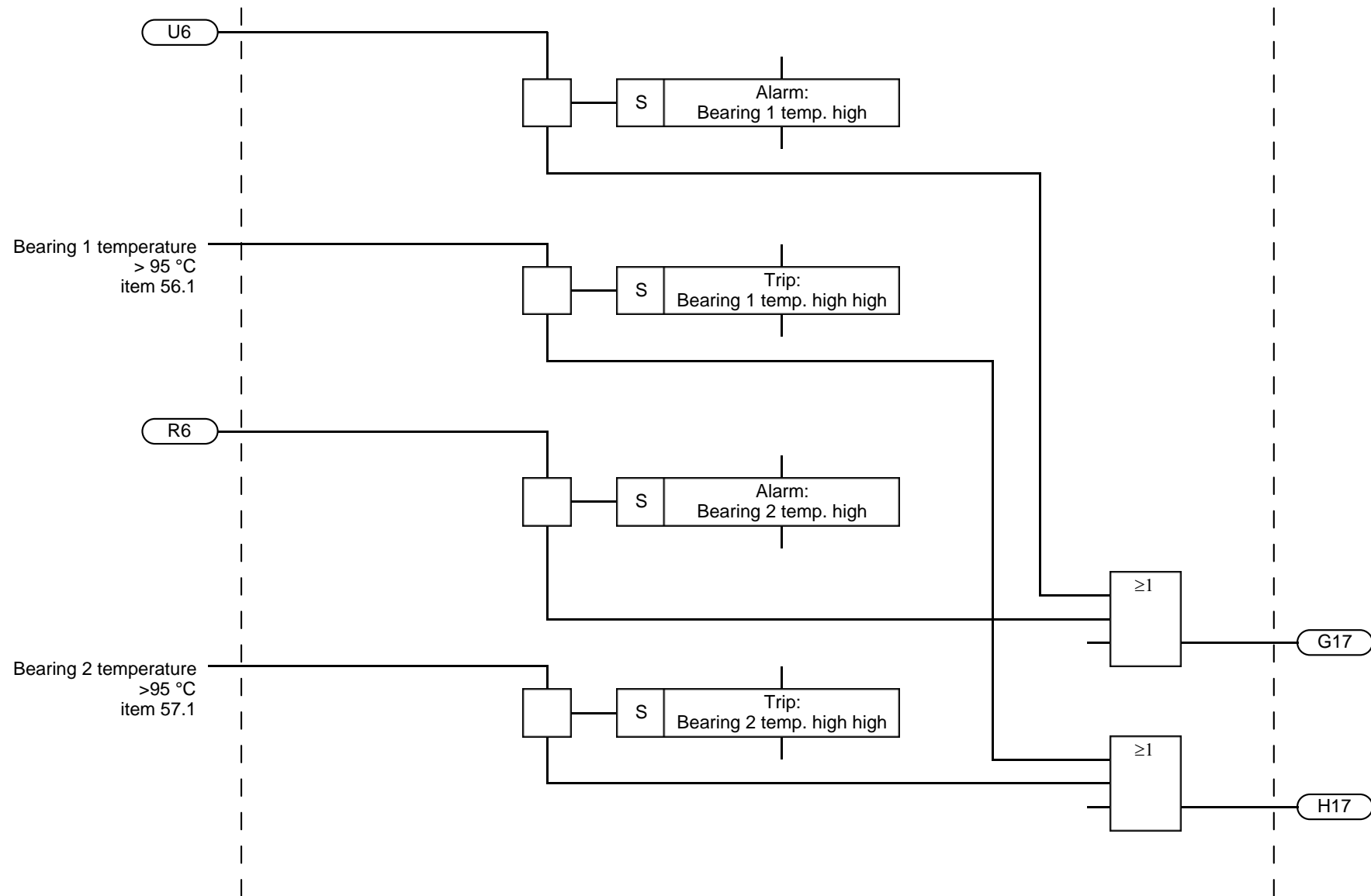
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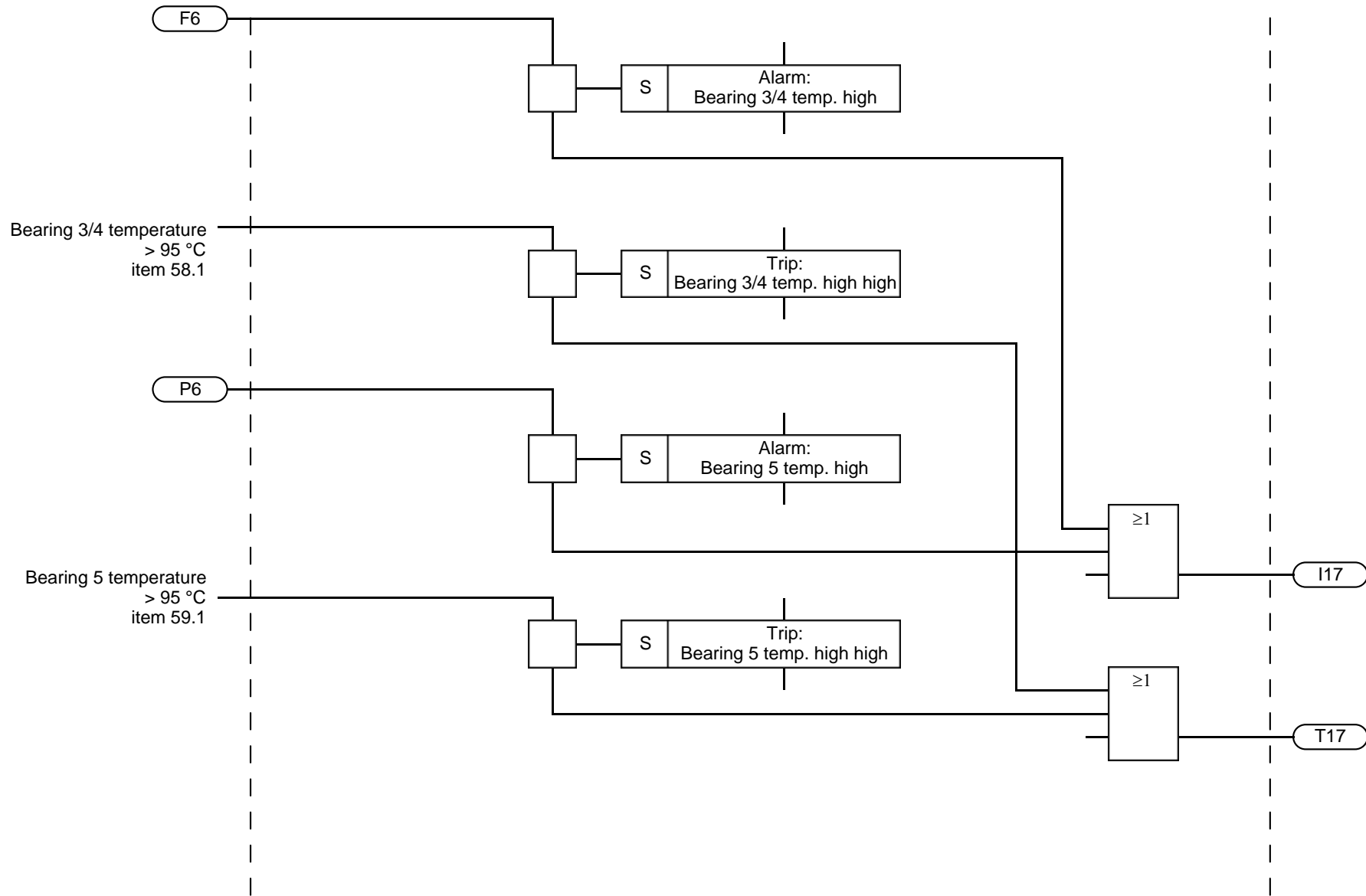
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Index	Rev. No.	Date	Name	Checked							23 P.



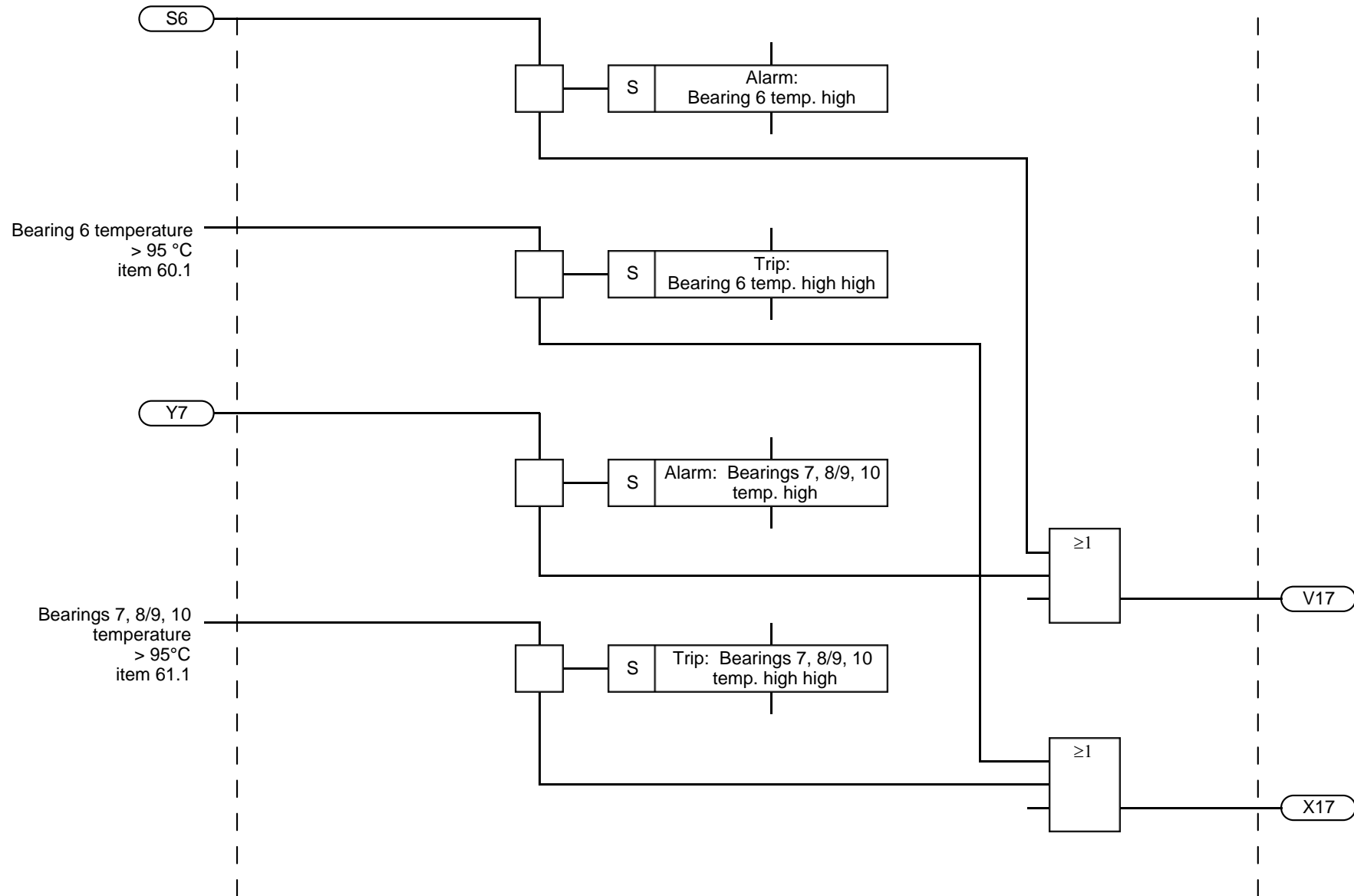
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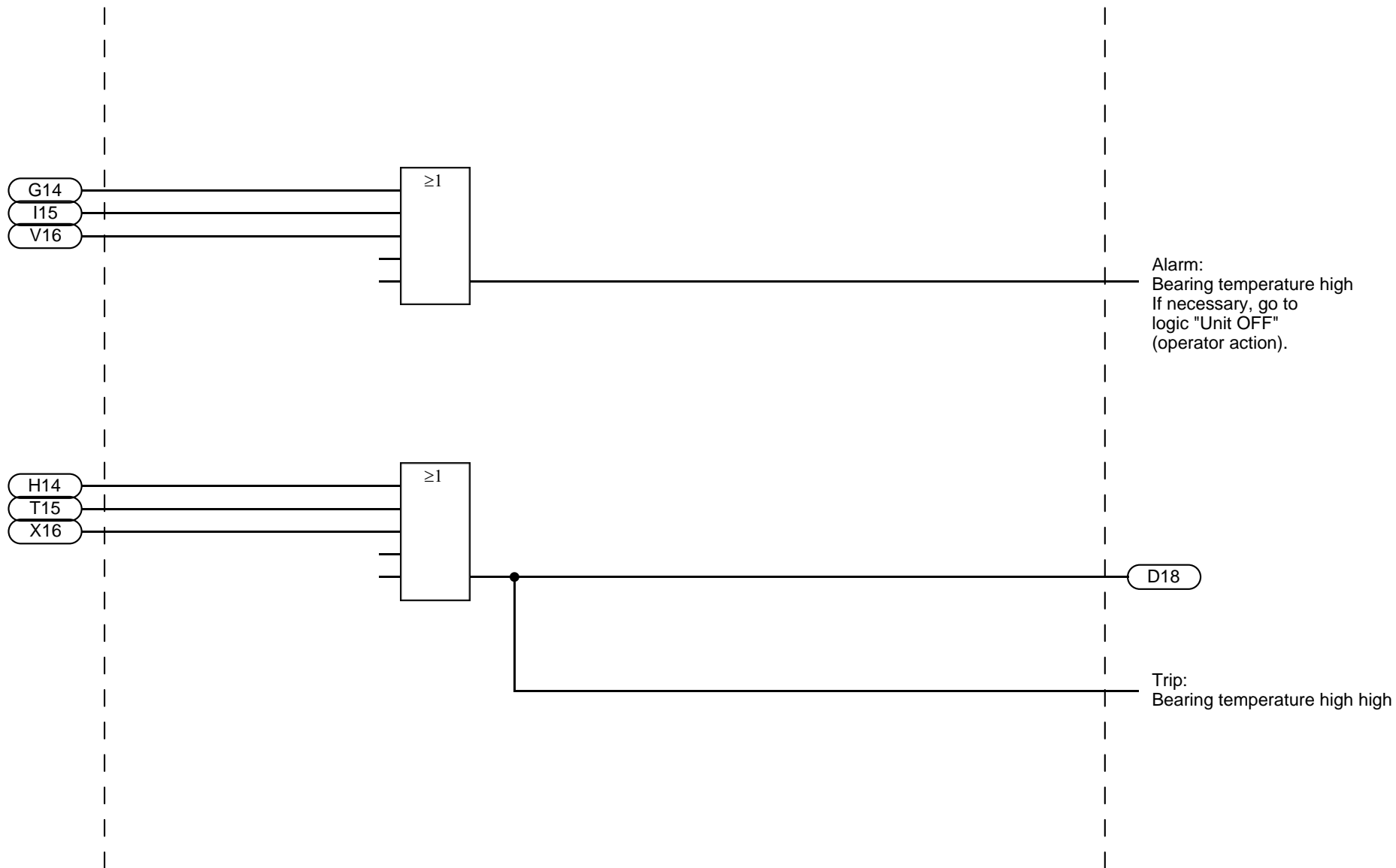
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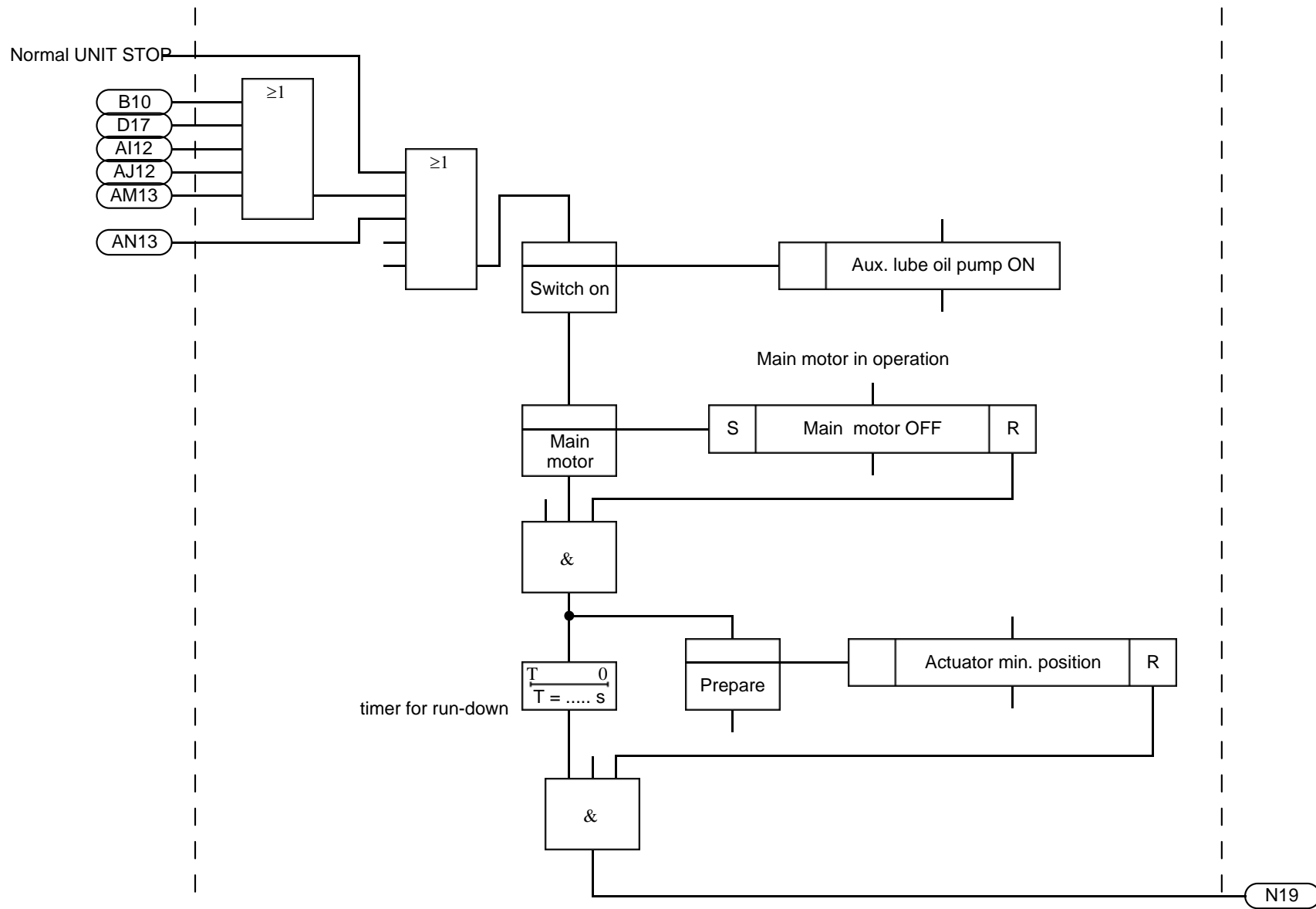
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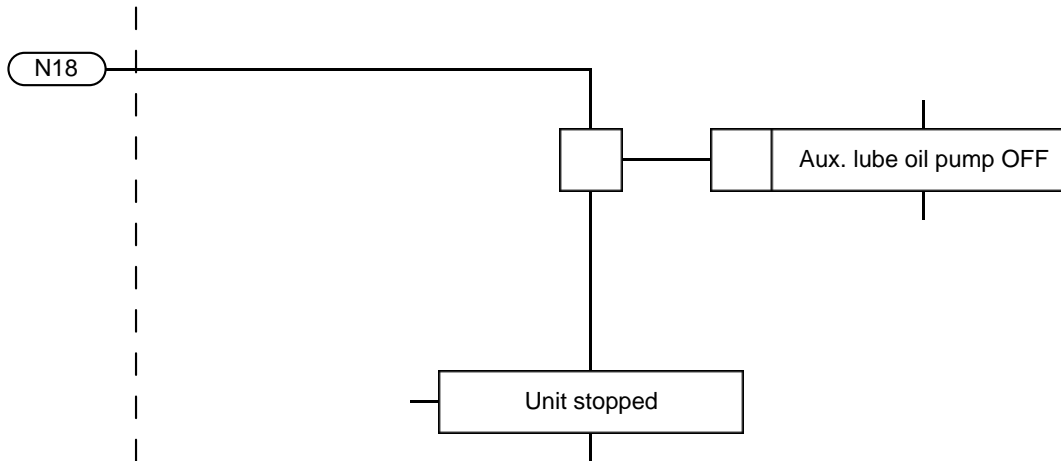
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				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	Bearing temperature checks	Order No.:	38001974	
				Editor	M.Mayer			part 4			
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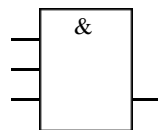


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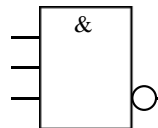


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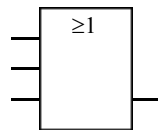
This is the input side.



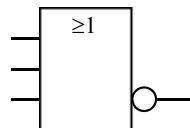
AND
The output will be in the 1-state if all the connected inputs are in their defined 1-state.



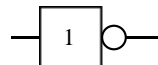
NAND
The output will be in the 0-state if all the connected inputs are in their defined 1-state.



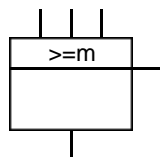
OR
The output will be in the 1-state if any of the connected inputs is in its defined 1-state.



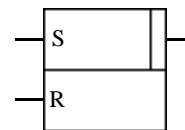
NOR
The output will be in the 0-state if any of the connected inputs is in its defined 1-state.



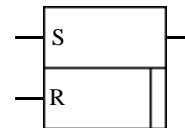
NOT (Negator/Inverter)
The output will be in the 0-state if the input is in the defined 1-state.



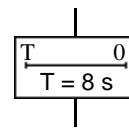
Logic threshold element
The output stands at its 1-state and only if the number of inputs which stand at their 1-states is equal to or greater than the number in the qualifying symbol, represented by m



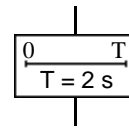
Bistable logic function symbol with prevailing S input



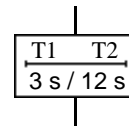
Bistable logic function symbol with prevailing R input



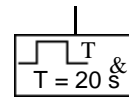
ON - delay (8 sec)



OFF - delay (2 sec)



ON - delay (3 sec) and
OFF - delay (12 sec)



The output pulse time is always 20 sec irrespective of the input signal duration.

This is the output side.

The letter indicates the signal, the number indicates the page where the signal is going to.

Q21

Example of a connection to another page

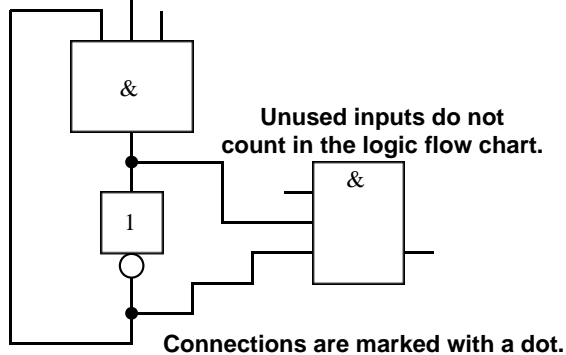
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				Editor	M.Mayer						
				Date		R17K.2-E	Dept.airek		Drawing No.:	91600292710 en	Page 20
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This is the input side.

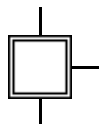
Q20

Example of a connection
from another page

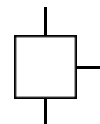
The letter indicates the signal,
the number indicates the page
where the signal is coming from.



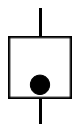
This is the output side.



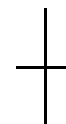
This is the initial step in a process
representing the start conditions.



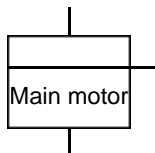
This a step in a process.



This is a step in a process.
The dot indicates that its condition
is logic 1 (fulfilled).



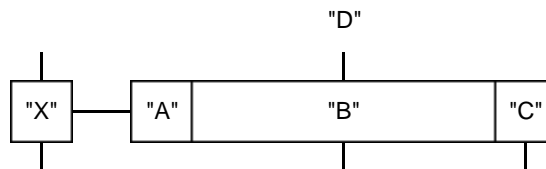
This is a transition. It is located between
steps and describes the necessary
actions between the steps.



This is a step with a
description of the step.

				Date	09-03-13	Chengda S 1 UongBi #2	VOITH TURBO	Description of symbols part 2	Order No.:	38001974	
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This is the input side.



This is the output side.

The symbol on the right-hand to the step symbol is an action symbol.
The action symbol could exist of 3 fields (field "A", "B" and "C").

Field "A" or "C" are to be used only if required.

Field "B" describes the action if step "X" is fulfilled.

Field "A" describes the correlation between the step "X" and the action "B",
the following letters are to be used:

S	stored
D	delayed
L	time limited
P	pulse shape
C	conditional

Letter combinations can be used, therefore the order the letters are written is important.

For example: "A" = DSL The input signal "X" will be delayed, stored
and the action "B" limited to a certain time.

Field "C" describes the feedback of the command "B".

The following symbols can be used:

A	Command output
R	Command effect is achieved (response control)
X	Fault signal, command effect is not achieved
1,2...	No. of feedback

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For example:

"A" = DSL

The input signal "X" will be delayed, stored
and the action "B" limited to a certain time.

If letter c (conditional) is used the action is only enabled if the condition described under "B" is fulfilled.

For example:

"A" = SLC

"B" = lube oil pump ON

"D" = oil level ok

The input signal "X" will be stored and the lube oil pump will be switched ON for a limited
time if the oil level is ok.

Field "C" indicates the feedback of the action to be carried out.

In the above example "C" would indicate logic 1 if the lube oil pump is ON.

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				Editor	M.Mayer					
				Date		R17K.2-E	Dept.airek		Drawing No.: 91600292710 en	Page 23
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VOITH

VOITH TURBO GmbH & Co. KG

Voithstrasse 1 74564 Crailsheim

Tel: 07951 / 32-0

Fax: 07951 / 32-650

Client : China Chengda Engineering Co., Ltd.
Unit designation : R 17 K.2 E
Order number : 38 001 974
Drawing number : 916 002 882 10 en
Code word : Chengda S1 UongBi #2

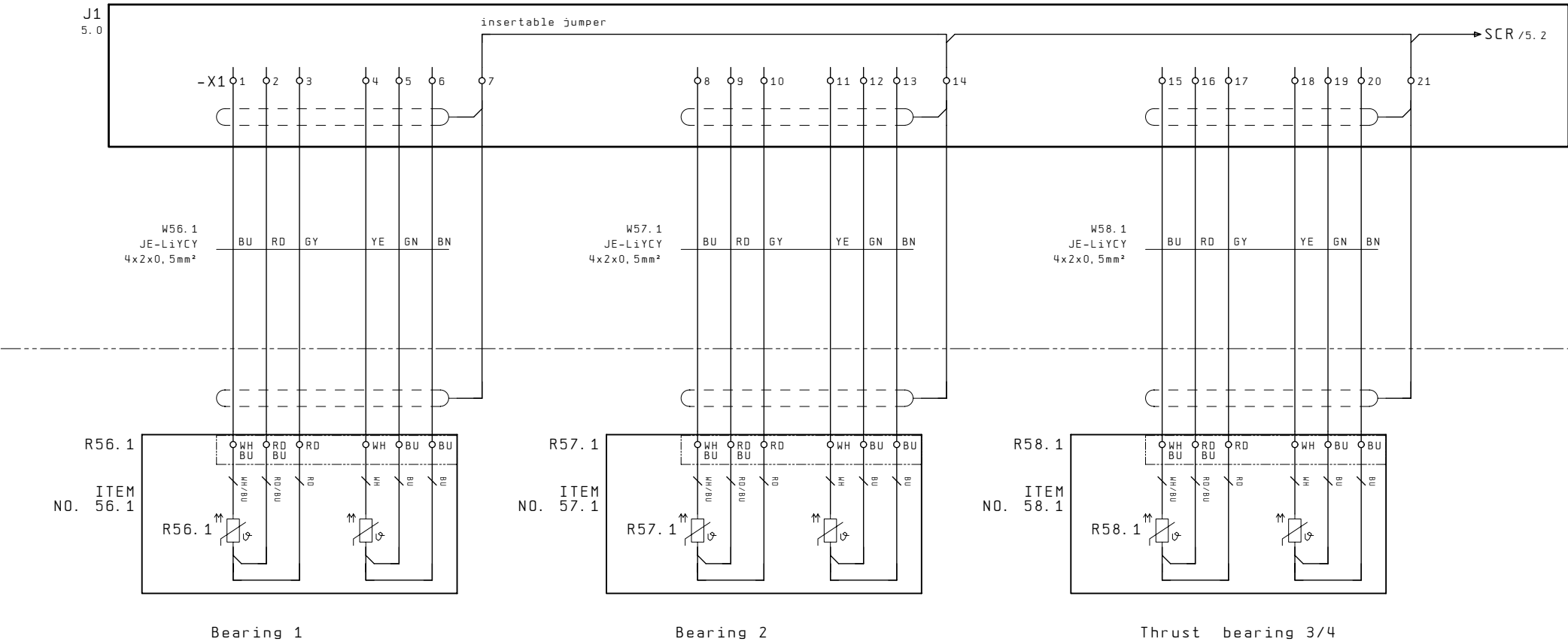
Regulating and Control : ABB
Equipment - Type : CONTRAC RHD 250-10 / EBN 853
File name without \EPLAN\P: \VOI\GA_2009\916 002 882 10 EN
CAD - Symbolic files : DIN_WUP

Designation : WIRING DIAGRAM
Department : airea-Ga

Created at : 09.03.2009
Revised edition : 09.03.2009 by : Gaugler

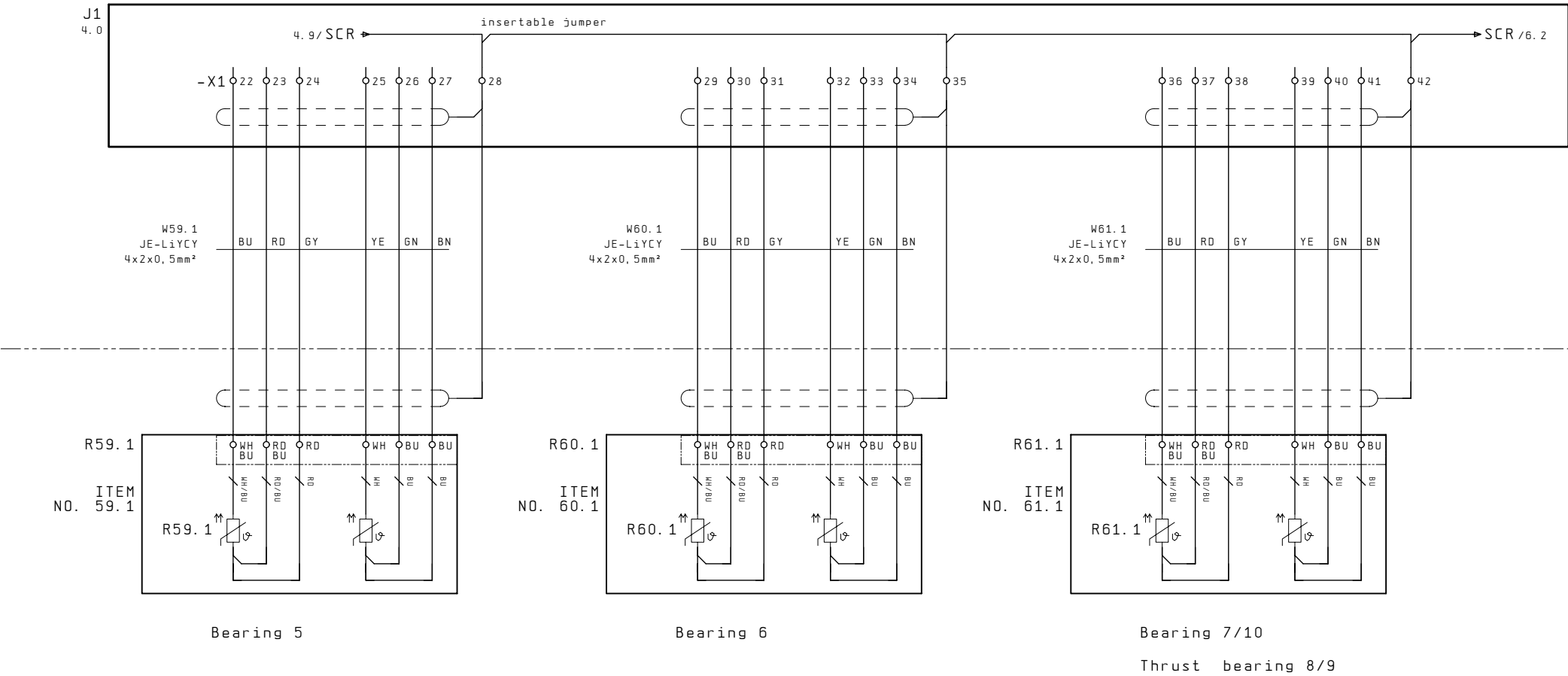
item no. see oil circuit and measuring point scheme 916 002 865 10

CLIENT
VOITH



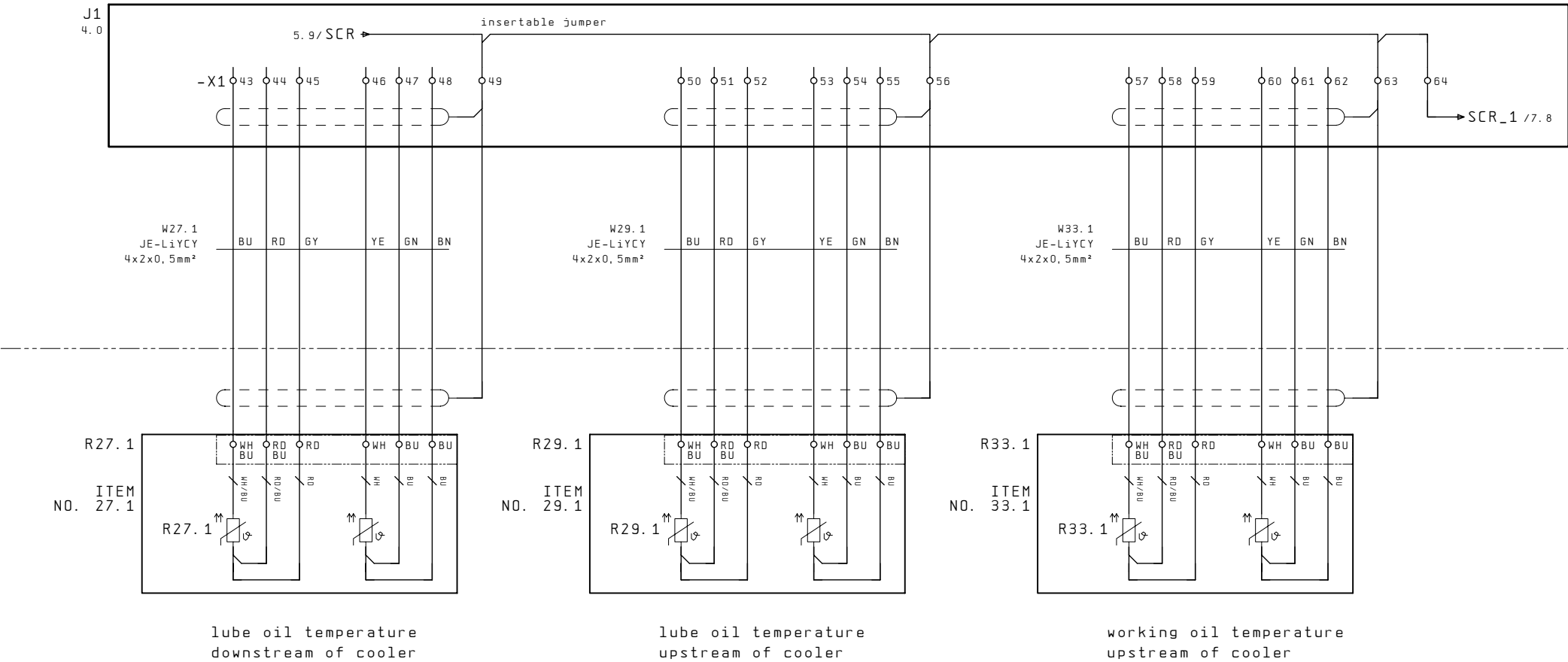
item no. see oil circuit and measuring point scheme 916 002 865 10

CLIENT
VOITH



item no. see oil circuit and measuring point scheme 916 002 865 10

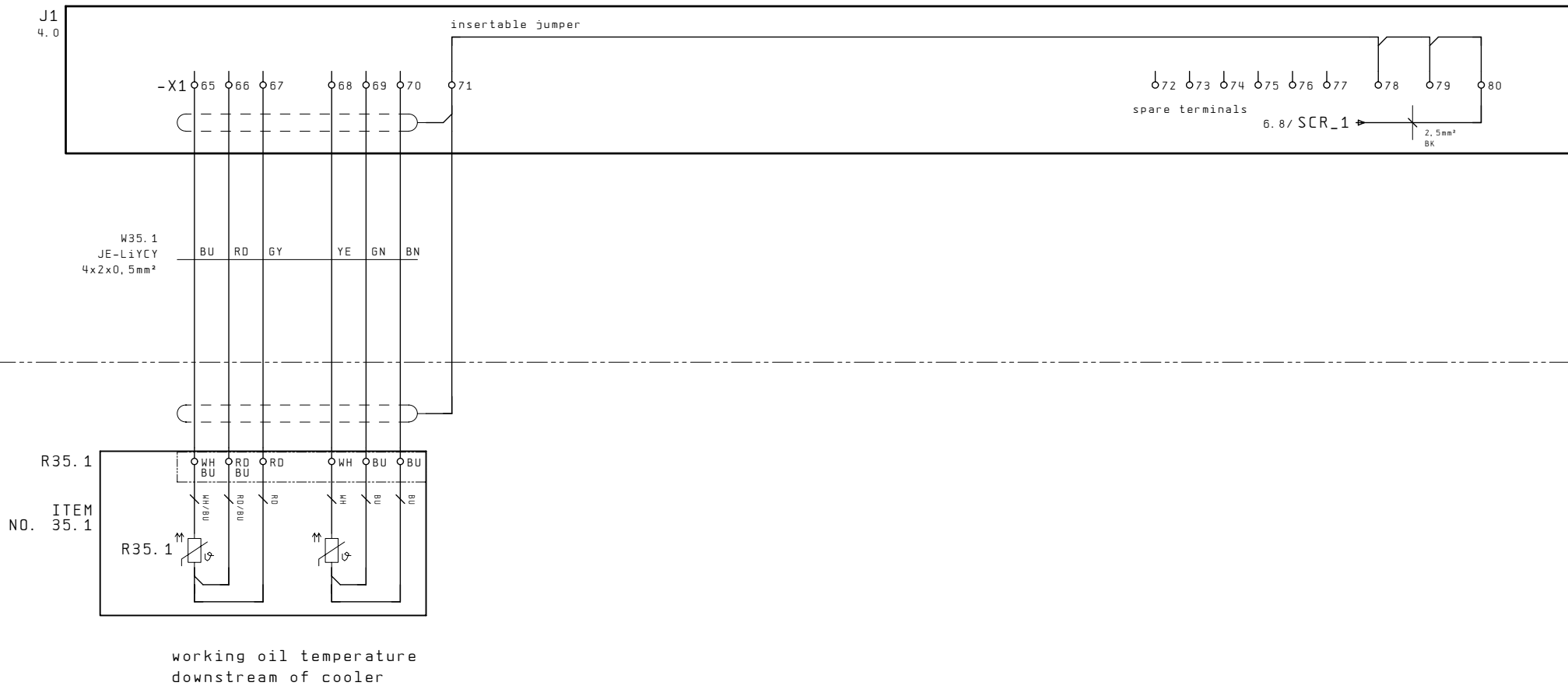
CLIENT
VOITH



item no. see oil circuit and measuring point scheme 916 002 865 10

CLIENT

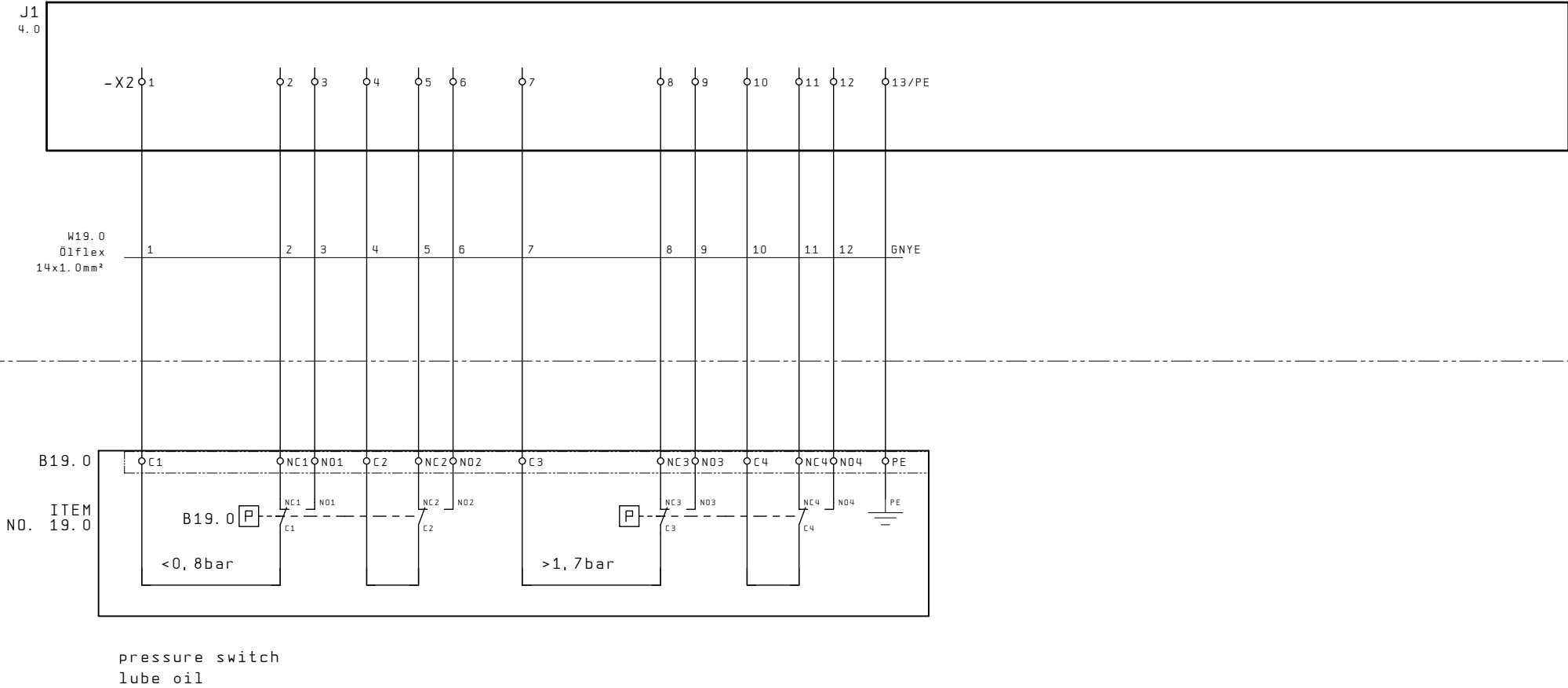
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			Date	09.03.2009	Chengda S1 UongBi #2		VOITH TURBO	resistance thermometer	Order no.: 38 001 974	=	
			Editor	Gaugler						+	
			Date	09.03.2009	R 17 K.2 E		Dep.: airea-Ga	PT100			
Revisions	Date	Name	Checked		Original	Replacing	Replaced by		Drawing number: 916 002 882 10 en	Page	11 p.

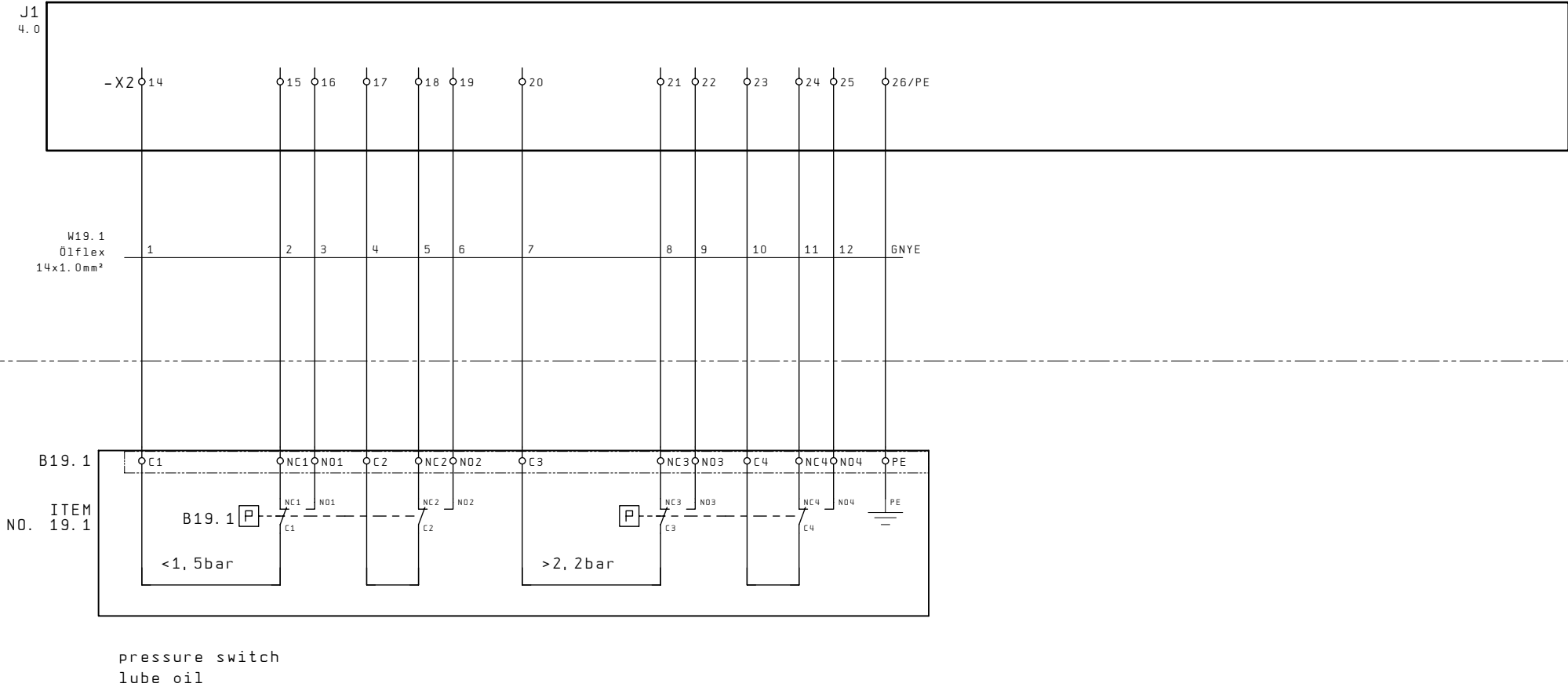
item no. see oil circuit and measuring point scheme 916 002 865 10

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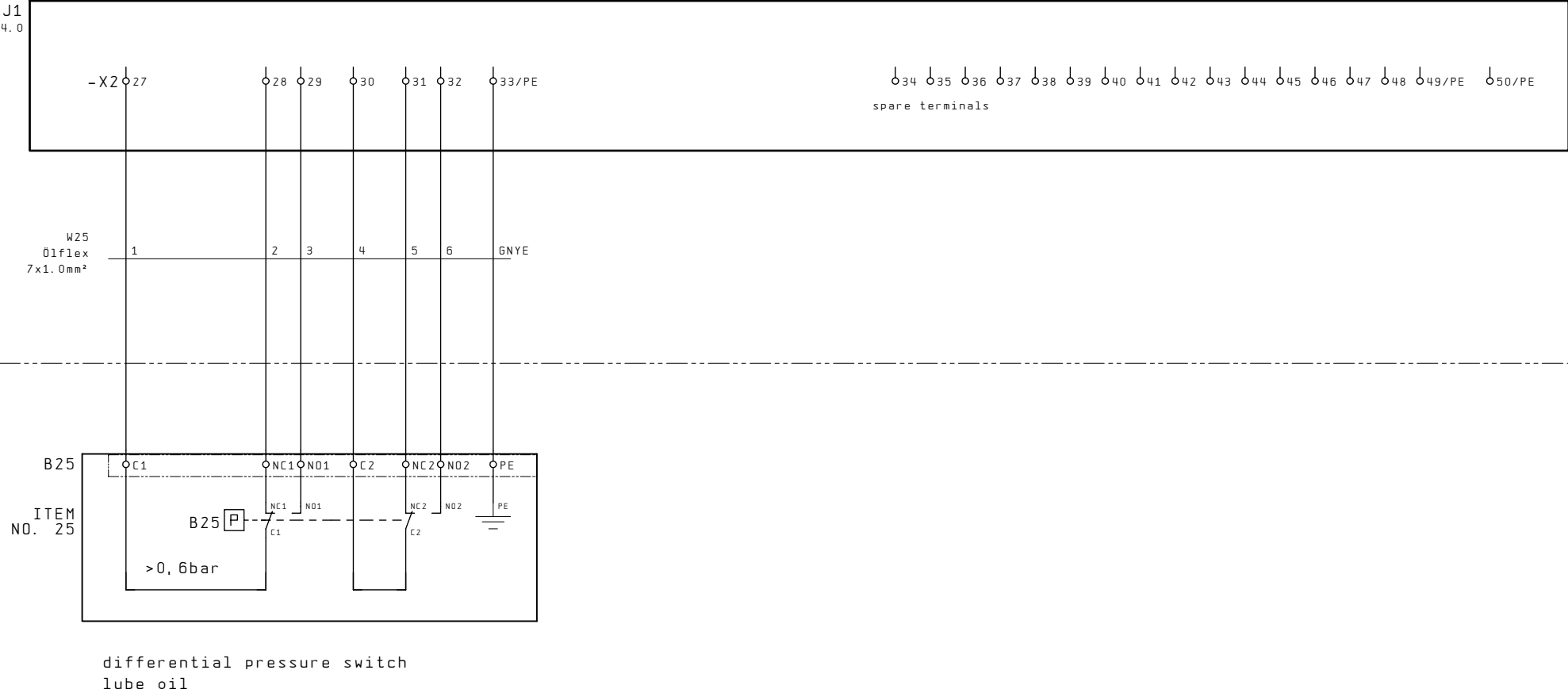
item no. see oil circuit and measuring point scheme 916 002 865 10

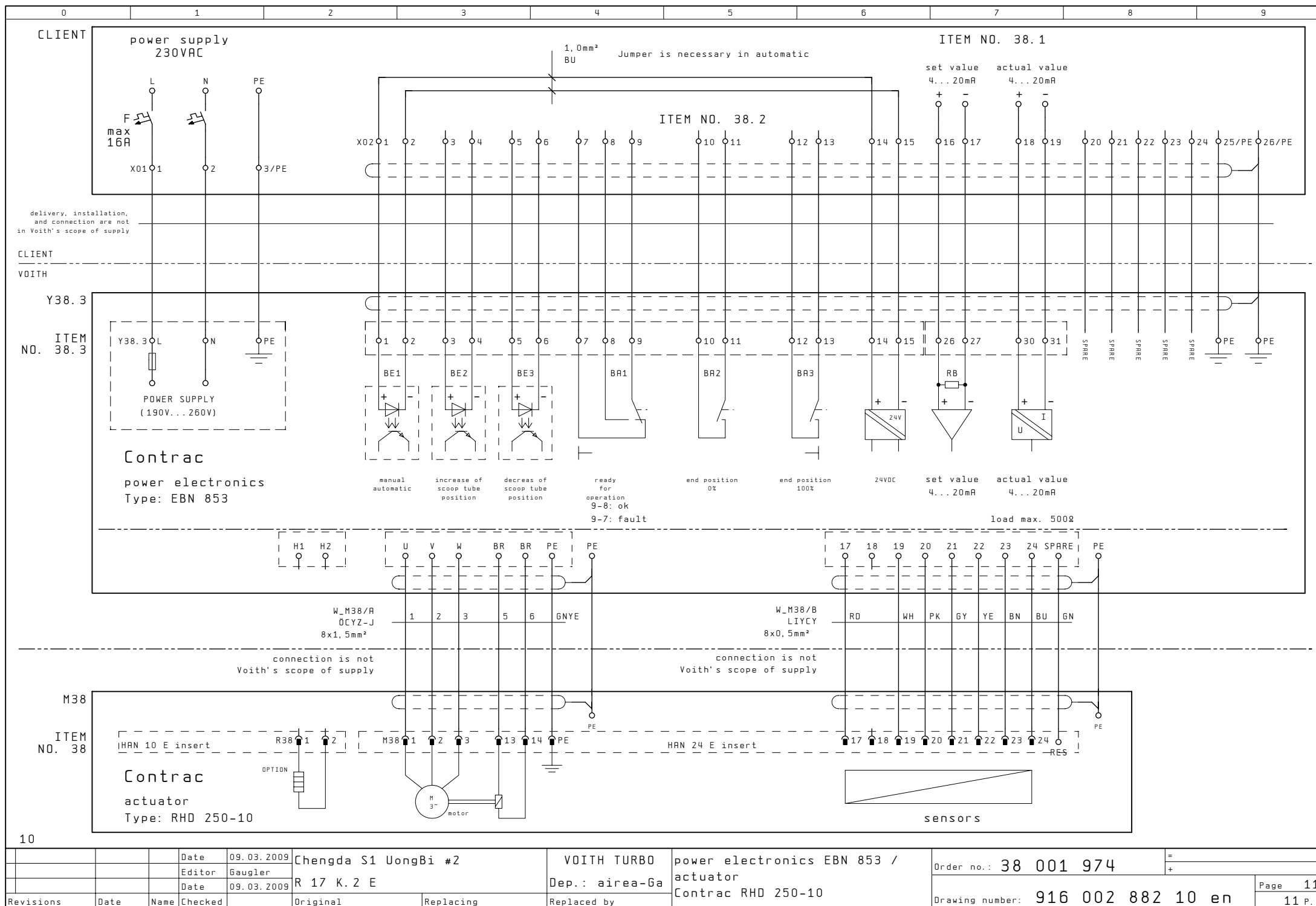
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item no. see oil circuit and measuring point scheme 916 002 865 10

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12 Parts List

Drawing designation/Drawing No..	Group	Date
„Horizontal section 20500731010“	04	2010-01-26
„Vertical section 20500731010“		
„Main lubricating oil pump 42579740“	10	2010-01-26
„Auxiliary lubricating oil pump 42255620“	12	2010-01-26
„Pressure relief valve - Working oil 42255630“	17	2010-01-26
„Sequence valve - Lubricating oil 42255040“	16	2010-01-26
„Duplex filter 42255640“	14	2010-01-26
„Adjustable orifice 42584870“	20	2010-01-26

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Chengda S 1 UongBi #2 Reference:		Mat.-Nummer: 216.000402 Material No.:	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:		Zeichnungs-Nr.: 20500731010 Drawing No.:	Gruppe Group
	Typ: Type: R 17 K.2 E		Blatt: Sheet:	Seite Page 1/ 4

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0010/0010/0010	1	ST	TCR.41323560	Primaerrad	primary gear	04	
0010/0010/0020	6	ST	TCR.40747450	Schraube Gewichtst.	weight-tol.screw	04	C3
0010/0010/0030	6	ST	TCR.40170570	Verbindungsbolzen	connecting pin --	04	
0010/0010/0040	6	ST	TCR.40747310	Schraube Gewichtst.	weight-tol.screw	04	C3
0010/0010/0050	1	ST	205.00635410	Welle mit Ritzel	shaft w. pinion	04	
0010/0010/0060	1	ST	TCR.41339240	Kupplungsschale	coupling shell	04	
0010/0010/0070	56	ST	TCR.40747350	Schraube Gewichtst.	weight-tol.screw	04	C3
0010/0010/0080	2	ST	TCR.41336730	Schmelzsichergs.Schrau	fusible plug	04	C1
0011/0010/0010	1	ST	TCR.41311810	Sekundaerwelle	secondary shaft	04	
0011/0010/0020	1	ST	TCR.42580380	Sekundaerrad	secondary wheel	04	
0011/0010/0030	6	ST	TCR.40170570	Verbindungsbolzen	connecting pin --	04	
0011/0010/0040	6	ST	TCR.40747310	Schraube Gewichtst.	weight-tol.screw	04	C3
0011/0010/0050	6	ST	TCR.40747410	Schraube Gewichtst.	weight-tol.screw	04	C3
0011/0010/0060	1	ST	TCR.03160307	Passfeder	key	04	L6
0012/0010/0010	1	ST	205.00635310	Getrieberad+ Welle	gear + shaft	04	
0012/0020	2	ST	TCR.03160356	Passfeder	key	04	L5
0026/0010	1	ST	TCR.42479820	Lagerdeckel	bearing cover	04	
0026/0020	1	ST	TCR.03645221	Runddichtring	o-ring	04	C3
0026/0030	1	ST	TCR.03645151	Runddichtring	o-ring	04	C3
0026/0040	1	ST	TCR.41311690	Schleuderring	oil thrower	04	
0026/0050	1	ST	TCR.41311700	Labyrinthscheibe	labyrinth disc	04	
0026/0070	8	ST	TCR.03014070	Zylinderschraube	socket head screw	04	
0026/0130	1	ST	TCR.03645260	Runddichtring	o-ring	04	C3
0031/0010	1	ST	TCR.42479830	Lagerdeckel	bearing cover	04	
0031/0020	1	ST	TCR.03645180	Runddichtring	o-ring	04	C3
0031/0030	1	ST	TCR.03645103	Runddichtring	o-ring	04	C3
0031/0040	1	ST	TCR.41311680	Schleuderring	oil thrower	04	
0031/0050	1	ST	TCR.41311710	Labyrinthscheibe	labyrinth disc	04	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Chengda S 1 UongBi #2 Reference:		Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:		Zeichnungs-Nr.: 20500731010 Drawing No.:	Gruppe Group
	Typ: Type: R 17 K.2 E		Blatt: Sheet:	Seite Page 2/ 4

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0031/0070	6	ST	TCR.03014070	Zylinderschraube	socket head screw	04	
0031/0130	1	ST	TCR.03645217	Runddichtring	o-ring	04	C3
0040/0010	1	ST	TCR.40001380	Spurring	thrust ring ---	04	L5
0040/0020	10	ST	TCR.03014125	Zylinderschraube	socket head screw	04	C3
0050/0010	2	ST	TCR.42582390	Lagerschale	bearing shell	04	B1
0050/0020	1	ST	TCR.42582410	Lagerschale	bearing shell	04	B1
0050/0030	1	ST	TCR.42582420	Lagerschale	bearing shell	04	B1
0050/0040	1	ST	TCR.42582430	Lagerschale	bearing shell	04	B1
0050/0050	1	ST	TCR.42582440	Lagerschale	bearing shell	04	B1
0050/0060	4	ST	TCR.03049053	Zylinderstift	straight pin	04	C3
0050/0070	1	ST	TCR.03130072	Spann-Stift	roll pin	04	C3
0050/0080/0010	40	ST	TCR.03130028	Spann-Stift	roll pin	04	
0050/0080/0020	2	ST	TCR.40822560	Kalottenkaefig	calotte cage	04	
0050/0080/0030	20	ST	TCR.40095180	Kalotte	calotte	04	
0050/0080/0040	20	ST	TCR.40225510	Segment	segment	04	
0050/0090	20	ST	TCR.03014043	Zylinderschraube	socket head screw	04	
0050/0100/0010	40	ST	TCR.03130028	Spann-Stift	roll pin	04	
0050/0100/0020	2	ST	TCR.40822610	Kalottenkaefig	calotte cage	04	
0050/0100/0030	20	ST	TCR.40095180	Kalotte	calotte	04	
0050/0100/0040	20	ST	TCR.40225510	Segment	segment	04	
0050/0110	16	ST	TCR.03015021	Zylinderschraube	socket head screw	04	
0050/0120	1	ST	TCR.40729270	Blende	orifice plate	04	
0060/0010/0010	1	ST	TCR.41312131	Getriebegehaeuse	transmission housing	04	
0060/0010/0020	1	ST	TCR.41312141	Gehaeusedeckel	housing cover	04	
0060/0010/0030	30	ST	TCR.03002220	Sechskantschraube	hexagon bolt	04	
0060/0010/0040	2	ST	TCR.03002226	Sechskantschraube	hexagon bolt	04	
0060/0010/0045	1	ST	TCR.03002224	Sechskantschraube	hexagon bolt	04	
0060/0010/0050	4	ST	TCR.03002383	Sechskantschraube	hexagon bolt	04	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type: R 17 K.2 E	Mat.-Nummer: 216.000402 Material No.:	Rev.: 0 Rev.:
			Zeichnungs-Nr.: 20500731010 Drawing No.:	Gruppe Group 04
	Auftrags-Nr.: 38001974 Order No.:		Blatt: Sheet:	Seite Page 3/ 4

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0060/0010/0060	4	ST	TCR.03002379	Sechskantschraube	hexagon bolt	04	
0060/0010/0070	4	ST	TCR.03002434	Sechskantschraube	hexagon bolt	04	
0060/0010/0080	2	ST	TCR.03002390	Sechskantschraube	hexagon bolt	04	
0060/0020	1	ST	TCR.40826780	Oelwanne	oil reservoir	04	
0060/0030	54	ST	TCR.03002294	Sechskantschraube	hexagon bolt	04	
0060/0040	1	ST	TCR.4188931002	Entlueftungs-Filter	vent filter	04	
0060/0080	1	ST	TCR.49912001	Oelstandsglas	oil level glass -	04	L12
0060/0110	1	ST	TCR.40150220	Deckel	cover --	04	
0060/0130	1	ST	TCR.41929140	Gehaeuseentlueftung	housing ventilation -	04	
0060/0150	1	ST	TCR.41045580	Deckel	cover --	04	
0060/0280	1	ST	TCR.40822500	Spurlagerdeckel	thrust brg cover	04	
0060/0285	1	ST	TCR.03645015	Runddichtring	o-ring	04	C3
0060/0290	8	ST	TCR.03002220	Sechskantschraube	hexagon bolt	04	
0069/0010	1	ST	TCR.41363570	Verteilgehaeuse	distrib. housing	04	
0069/0010/0030	2	ST	TCR.03014735	Zylinderschraube	socket head screw	04	
0069/0030	1	ST	TCR.42589500	Fuehrungsbuechse	guide bush	04	B5
0069/0050	8	ST	TCR.03014820	Zylinderschraube	socket head screw	04	
0069/0060	1	ST	TCR.03171018	Sicherungsring	circlip	04	C3
0069/0070	1	ST	TCR.42159660	Fuehrungsbolzen	guide pin	04	B6
0069/0080	1	ST	TCR.41311780	Schoepfrohr	scoop tube	04	L13
0069/0090	1	ST	TCR.42582700	Regelwelle	regulating shaft	04	L13
0069/0100	1	ST	TCR.49918001	Stellring	adjusting ring -	04	
0069/0110	1	ST	TCR.03646028	Runddichtring	o-ring	04	C3
0250/0060	1	ST	TCR.40802660	Zahnradpumpe	gear pump	04	L2
0280/4.13	1	ST	TCR.41903260	Druckbegrenzungsventil	press.limit.valve	04	L15
0280/5.21	1	ST	TCR.41349750	Rueckschlagventil	non-return valve -	04	
0280/5.24	1	ST	TCR.49904014	Rueckschlagventil	non-return valve -	04	
0280/5.28	1	ST	TCR.41031130	Entlueftungsschraube	deaeration screw	04	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 20500731010 Drawing No.:	Gruppe Group 04
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Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0369/0010	1	ST	TCR.41373100	Doppelfilter	duplex filter	04	
0410/0010	1	ST	TCR.41756450	Regelhebel	control lever	04	
0410/0040	1	ST	205.00543810	Zeiger	pointer	04	
0410/0060	1	ST	TCR.41307640	Halterung	mounting	04	
0410/0080	1	ST	TCR.49918001	Stellring	adjusting ring -	04	
0450/0010	1	ST	TCR.4130748001	Pumpe	pump	04	L1
0460/0040	4	ST	TCR.03014732	Zylinderschraube	socket head screw	04	
0460/0045	4	ST	TCR.03110012	Federscheibe	spring washer	04	C3
0470/0010	1	ST	TCR.42479480	Stirnrad	spur gear -	04	
0470/0020	1	ST	TCR.42479490	Stirnrad	spur gear -	04	
0470/0030	8	ST	TCR.03014730	Zylinderschraube	socket head screw	04	
0480/0010	1	ST	TCR.03666012	Motor	motor	04	L2

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 42579740 Drawing No.:	Gruppe Group 10
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Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0450/0010/0010	1	ST	TCR.41307380	Pumpengehaeuse	pump housing	10	
0450/0010/0020	1	ST	TCR.41000030	Pumpendeckel	pump cover	10	
0450/0010/0030	1	ST	TCR.40436540	Deckscheibe	cover plate .	10	
0450/0010/0040	4	ST	TCR.41307390	Gleitlager	plain bearing	10	B2
0450/0010/0050	1	ST	TCR.40585420	Antriebsritzel	input pinion	10	
0450/0010/0060	1	ST	TCR.40585430	Zahnradritzel	gear pinion	10	
0450/0010/0070	1	ST	TCR.42479500	Haltescheibe	holding disc	10	
0450/0010/0080	1	ST	TCR.03160117	Passfeder	key	10	
0450/0010/0090	1	ST	TCR.03002218	Sechskantschraube	hexagon bolt	10	
0450/0010/0095	1	ST	TCR.03110013	Federscheibe	spring washer	10	C3
0450/0010/0100	12	ST	TCR.03015029	Zylinderschraube	socket head screw	10	
0450/0010/0170	2	ST	TCR.03039017	Verschlusschraube	screw plug -	10	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Chengda S 1 UongBi #2 Reference:		Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:		Zeichnungs-Nr.: 42255620 Drawing No.:	Gruppe Group
	Typ: Type: R 17 K.2 E		Blatt: Sheet:	Seite Page 1/ 1

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0250/0010	1	ST	TCR.41311990	Tschan-N-Mexnabe	tschan-n mex. hub	12	L2
0250/0011	1	ST	TCR.41314920	Tschan-N-Mexnabe	tschan-n mex. hub	12	L2
0250/0012	1	ST	TCR.03647063	Normex-Elastomerring	normex-elast.ring	12	C3
0250/0020	1	ST	TCR.40432160	Zwischengehaeuse	adaptor housing -	12	
0250/0030	4	ST	TCR.03014730	Zylinderschraube	socket head screw	12	
0250/0040	4	ST	TCR.03002212	Sechskantschraube	hexagon bolt	12	
0250/0060/0010	1	ST	TCR.40143360	Pumpengehaeuse	pump housing	12	
0250/0060/0020	1	ST	TCR.40143330	Deckel	cover --	12	
0250/0060/0030	1	ST	TCR.40143290	Antriebsritzel	input pinion	12	
0250/0060/0040	1	ST	TCR.40143300	Ritzel	pinion	12	
0250/0060/0050	1	ST	TCR.03160064	Passfeder	key	12	
0250/0060/0060	1	ST	TCR.42011610	Gleitlager	plain bearing	12	B4
0250/0060/0070	1	ST	TCR.42011630	Gleitlager	plain bearing	12	B4
0250/0060/0080	1	ST	TCR.42011640	Gleitlager	plain bearing	12	B4
0250/0060/0090	1	ST	TCR.42011620	Gleitlager	plain bearing	12	B4
0250/0060/0100	1	ST	TCR.40169140	Anschlussflansch	connecting flange	12	
0250/0060/0110	1	ST	TCR.49917301	Wellendichtring	shaft seal ring	12	C3
0250/0060/0120	2	ST	TCR.03045312	Stiftschraube	stud -	12	
0250/0060/0125	4	ST	TCR.03014735	Zylinderschraube	socket head screw	12	
0250/0060/0140	2	ST	TCR.03072012	Sechskantmutter	hexagon nut	12	
0250/0060/0150	6	ST	TCR.03014735	Zylinderschraube	socket head screw	12	
0250/0070	7	ST	TCR.03014735	Zylinderschraube	socket head screw	12	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 42255630 Drawing No.:	Gruppe Group 17
			Blatt: Sheet:	Seite Page 1/ 1

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0280/4.13/0010	1	ST	TCR.41903230	Ventilgehaeuse	valve body	17	
0280/4.13/0020	1	ST	TCR.41387070	Ventilkolben	valve piston -	17	B6
0280/4.13/0030	1	ST	TCR.40161540	Einstellschraube	adjusting screw -	17	
0280/4.13/0040	1	ST	TCR.03210049	Zyl.Druckfeder	cyl.compr.spring	17	C3
0280/4.13/0050	1	ST	TCR.03040255	Verschlusschraube	screw plug -	17	
0280/4.13/0060	1	ST	TCR.03658048	Dichtring	seal ring	17	C3

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	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 42255040 Drawing No.:	Gruppe Group 16
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Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0280/5.29/0010	1	ST	TCR.41903320	Gehaeuse	housing	16	
0280/5.29/0020	1	ST	TCR.03171045	Sicherungsring	circlip	16	C3
0280/5.29/0030	1	ST	TCR.40702890	Ventilkolben	valve piston -	16	B6
0280/5.29/0040	1	ST	TCR.03210104	Zyl.Druckfeder	cyl.compr.spring	16	C3
0280/5.29/0050	1	ST	TCR.40161540	Einstellschraube	adjusting screw -	16	
0280/5.29/0060	1	ST	TCR.03040255	Verschlussschraube	screw plug -	16	
0280/5.29/0070	1	ST	TCR.03658048	Dichtring	seal ring	16	C3
0280/5.29/0080	2	ST	TCR.03014740	Zylinderschraube	socket head screw	16	
0280/5.29/0090	2	ST	TCR.03658012	Dichtring	seal ring	16	C3
0280/5.29/0100	1	ST	TCR.41349280	Dichtung	seal -	16	C3

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type: R 17 K.2 E	Mat.-Nummer: 216.000402 Material No.:	Rev.: 0 Rev.:
			Zeichnungs-Nr.: 42255640 Drawing No.:	Gruppe Group 14
	Auftrags-Nr.: 38001974 Order No.:		Blatt: Sheet:	Seite Page 1/ 2

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0360/0010	1	ST	TCR.41902220	Rohrkruemmer	pipe elbow	14	
0360/0020	1	ST	TCR.40769510	Dichtung	seal -	14	C3
0360/0030	2	ST	TCR.03014147	Zylinderschraube	socket head screw	14	
0360/0040	2	ST	TCR.03014221	Zylinderschraube	socket head screw	14	
0369/0010/0010	1	ST	TCR.42205800	Filtergehaeuse	filter casing	14	
0369/0010/0020	2	ST	TCR.42206900	Filterdeckel	filter cover	14	
0369/0010/0030	2	ST	TCR.03645150	Runddichtring	o-ring	14	C3
0369/0010/0040	8	ST	TCR.03002927	Sechskantschraube	hexagon bolt	14	
0369/0010/0050	2	ST	TCR.40794170	Druckfeder	compression spring	14	C3
0369/0010/0060	2	ST	TCR.4201062001	Siebt.Filtereinsatz	STAR FILTER ELEMENT	14	C2
0369/0010/0080	1	ST	TCR.41031210	Drehschieber	rotary slide valve	14	
0369/0010/0090	1	ST	TCR.03646612	Quadring	Quadring	14	C3
0369/0010/0100	1	ST	TCR.40747750	Flutspindel	flood spindle	14	
0369/0010/0110	1	ST	TCR.03100014	Scheibe	washer ---	14	
0369/0010/0120	1	ST	TCR.03210089	Druckfeder	compression spring	14	C3
0369/0010/0130	1	ST	TCR.03645055	Runddichtring	o-ring	14	C3
0369/0010/0140	1	ST	TCR.03045351	Schaftschraube	headless screw	14	
0369/0010/0150	1	ST	TCR.41031230	Schalthebel	control lever -	14	
0369/0010/0160	1	ST	TCR.03054150	Raendelmutter	knurled nut	14	
0369/0010/0170	1	ST	TCR.40747700	Anschlussdeckel	connecting cover	14	
0369/0010/0180	3	ST	TCR.03016073	Zylinderschraube	socket head screw	14	
0369/0010/0190	2	ST	TCR.03014079	Zylinderschraube	socket head screw	14	
0369/0010/0210	2	ST	TCR.40786190	Schraube	bolt	14	
0369/0010/0230	2	ST	TCR.03658016	Dichtring	seal ring	14	C3
0369/0010/0240	4	ST	TCR.03040259	Verschlussschraube	screw plug -	14	
0369/0010/0250	4	ST	TCR.03658017	Dichtring	seal ring	14	C3
0369/0010/0260	1	ST	TCR.42002270	Typenschild	rating plate	14	
0369/0010/0270	4	ST	TCR.03125036	Halbrundkerbnagel	round head notched pin	14	

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 42255640 Drawing No.:	Gruppe Group 14 Seite Page 2/ 2

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0369/0010/0290	1	ST	TCR.03130023	Spann-Stift	roll pin	14	C3
0369/0010/0300	2	ST	TCR.03040260	Verschlussschraube	screw plug -	14	
0369/0010/0310	2	ST	TCR.03658021	Dichtring	seal ring	14	C3
0369/0010/0320	1	ST	TCR.41031240	Buechse	bush -	14	
0369/0010/0330	1	ST	TCR.03171026	Sicherungsring	circlip	14	C3

VOITH	Teileliste zur Betriebsanleitung Parts list for instruction manual		Betriebsanl.-Nr.: 91800083110 Operating inst.No.:	Datum: 26.01.2010 Date:
	Kennwort: Reference: Chengda S 1 UongBi #2	Typ: Type:	Mat.-Nummer: 216.000402 Material No.:	Rev.: 0 Rev.:
	Auftrags-Nr.: 38001974 Order No.:	R 17 K.2 E	Zeichnungs-Nr.: 42584870 Drawing No.:	Gruppe Group 20
			Blatt: Sheet:	Seite Page 1/ 1

Zeichnungs-Pos.-Nr. Drawing item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Fremdbenennung Foreign designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.
0280/7.4/0010	1	ST	TCR.42479630	Gehaeuse	housing	20	
0280/7.4/0020	1	ST	TCR.42479650	Drossel	throttle	20	
0280/7.4/0030	1	ST	TCR.42479640	Einschraubstueck	screw-in piece	20	
0280/7.4/0040	1	ST	TCR.42479840	Gewindestange	threaded rod	20	
0280/7.4/0050	1	ST	TCR.03072012	Sechskantmutter	hexagon nut	20	
0280/7.4/0060	1	ST	TCR.42479850	Hutmutter	cap nut -	20	
0280/7.4/0070	2	ST	TCR.03656009	Dichtring	seal ring	20	C3
0280/7.4/0080	1	ST	TCR.03130432	Spann-Stift	roll pin	20	C3

13 Recommended Spare Parts List

13.1 Use/installation of genuine Voith spare parts

Genuine Voith spare parts have been designed specifically for use with the Geared variable speed coupling. We would like to point out that original spare parts that are not supplied by "VOITH" are also not checked and approved by us.

Installation and/or use of non-original spare parts may adversely affect the design characteristics of the Geared variable speed coupling, thus compromising safety. "VOITH" does not assume any responsibility for damage arising from the use of non-original spare parts.

13.2 Spare parts identification

Spare parts are classified into groups.

Spare parts identification:

- **C** Commissioning parts
- **B** Basic spare part equipment
- **L** Long-term spare parts

NOTE

Item nos. in a drawing (*e.g.* 0210/0010/0040) that appear in the spare parts list without an associated drawing group (*e.g.* 04) are not itemized in the drawings and parts lists (see [Section 11 „Drawings, Schematics, Diagrams“](#) and [Section 12 „Parts List“](#)).

Original spare parts are supplied on the basis of the latest level of technology.

We thus suggest that the spare parts in the recommended spare parts list be stored on site.

Ordering spare parts

NOTE

Gears may be replaced in sets only. Please send still usable shafts to Voith Crailsheim for joint assembly and balancing with the gears.

NOTE

The primary wheel and secondary wheel are balanced together with the shafts and the shell using a special balancing procedure. Therefore, these components can be replaced only at Voith Crailsheim or, in exceptional cases, under the supervision of a Voith service engineer on site using special auxiliary means.

13.3 Ordering spare parts

When ordering spare parts, please indicate:

1. Serial number of the Geared variable speed coupling (see nameplate)
2. Full designation such as
 - Drawing item no.
 - Material/Article No.
 - Part name (designation)
 - Quantity

VOITH	Ersatzteilliste Übersicht Survey of Spare Parts Lists		Kennwort: Chengda S 1 UongBi #2	Voith Turbo GmbH & Co.KG Voithstraße 1 74564 Crailsheim, Germany Tel. +49 7951 32-1666 Fax +49 7951 32-903 coupling-service@voith.com www.voith-coupling-service.com Datum/Date: 2009-12-21 Rev.No: 0
			Code:	
			Typ: R 17 K.2E	
			Type:	
	SAP Angebots-Nr.: 20122187		Serien Nr.: 8206149, 8206150, 8206151	
	SAP Offer No.:		Serial No.:	
	Lieferumfang: 216.000402		Betriebsanl.-Nr.: 91800070510	
	Scope of supply:		Instruction Manual No.:	

C = Teile für Inbetriebnahme / Commissioning parts

C1	1 Satz / set	Schmelzsicherungsschrauben / of fusible plugs
C2	1 Satz / set	Filterelemente / of filter elements
C3	1 Satz / set	Dichtungs- und Revisionsteile allgemein / service kit with a set of sealings

B = Ersatzteilgrundausrüstung / Basic spare parts

B1	1 Satz / set	Hauptwellenlager oder Nadellager für Wandler / of main shaft bearings or needle bearings
B2	1 Satz / set	Lager zur Hauptfüllpumpe / of bearings for main filling pump
B4	1 Satz / set	Lager zur Anfahrsmierpumpe ASP / of bearings for aux.lube oil pump
B5	1 Satz / set	Schöpfrohrführungsbüchsen / of scoop tube guide bushes
B6	1 Satz / set	Teile für VEHS und Steuerungsteile / of parts for electro-hydraulic positioning control make Voit

L = Ersatzteile für Langzeitbetrieb / Long term spare parts

L1	1 Stück / off	Hauptfüllpumpe / main filling pump
L2	1 Stück / off	Anfahrsmierpumpe (ASP) plus 1 Motor / aux. lube oil pump plus 1 motor
L5	1 Satz / set	Primärläuferteile / of primary runner parts
L6	1 Satz / set	Sekundärläuferteile / of secondary runner parts
L12	1 Satz / set	Anbauteile für Druck-, Schwingungs-, Drehzahl- und Temperatur / components for pressure, vibration, turn, temperature m
L13	1 Stück / off	Schöpfrohr / scoop tube
L14	1 Stück / off	Stellantrieb komplett (voreingestellt) / actuator, complete (adjusted)
L15	1 Satz / set	Regel-Ventile / of control valves

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	SAP Angebots-Nr.: 20122187 SAP Offer No.:	Serien Nr.: 8206149, 8206150, 8206151 Serial No.:		
	Lieferumfang: 216.000402 Scope of supply:	Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:		

Brief instructions for spare parts enquiries or spare parts orders

<u>Item No.</u>	The drawing item number is indicated in the spare parts offer/order position, enabling a clear allocation of parts to the items stated in the spare parts lists and the drawings of the instruction manual.
<u>Quantity</u>	Determines the quantity of parts installed in the unit.
<u>Unit</u>	Physical unit of the material used per article number.
<u>Part No.</u>	Voith Material No.
<u>Designation</u>	Designation of material in SAP.
<u>Drawing Group contained.</u>	Indicates the numbering of the drawing in which the part with the appropriate drawing item number is
<u>Spare part id.</u>	The spare part identification classifies the spare parts in groups for which corresponding recommendations for spare parts storage can be made by the Voith Coupling Service . Upon request, the Voith Coupling Service prepares individual spare parts proposals for every project with one or several units.
<u>Selection</u>	By ticking, one or several articles are being selected on item level for which an offer or an order confirmation for spare parts needs to be prepared. It is omitted if the field "all items" was ticked and selected.
<u>Enquiry</u>	Selection for enquiry initiating the preparation of a spare parts offer.
<u>Order</u>	Selection for order initiating the preparation of an order confirmation.
<u>All items</u>	By ticking, all items with the corresponding identification are selected for which an offer or an order confirmation needs to be prepared. If individual items are selected, that field has to remain blank.

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	Lieferumfang: 216.000402 Scope of supply:	Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:		

C = Commissioning parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0010/0010/0080	2	ST	TCR.41336730	fusible plug	04	C1	<input type="checkbox"/>
0060/0040/0010	1	ST	TCR.4188931007	filter element		C2	<input type="checkbox"/>
0369/0010/0060	2	ST	TCR.4201062001	STAR FILTER ELEMENT	14	C2	<input type="checkbox"/>
0010/0010/0020	6	ST	TCR.40747450	weight-tol.screw	04	C3	<input type="checkbox"/>
0010/0010/0040	6	ST	TCR.40747310	weight-tol.screw	04	C3	<input type="checkbox"/>
0010/0010/0070	56	ST	TCR.40747350	weight-tol.screw	04	C3	<input type="checkbox"/>
0011/0010/0040	6	ST	TCR.40747310	weight-tol.screw	04	C3	<input type="checkbox"/>
0011/0010/0050	6	ST	TCR.40747410	weight-tol.screw	04	C3	<input type="checkbox"/>
0026/0020	1	ST	TCR.03645221	o-ring	04	C3	<input type="checkbox"/>
0026/0030	1	ST	TCR.03645151	o-ring	04	C3	<input type="checkbox"/>
0026/0060	1	ST	TCR.03130022	roll pin		C3	<input type="checkbox"/>
0026/0100	2	ST	TCR.03658017	seal ring		C3	<input type="checkbox"/>
0026/0130	1	ST	TCR.03645260	o-ring	04	C3	<input type="checkbox"/>
0031/0020	1	ST	TCR.03645180	o-ring	04	C3	<input type="checkbox"/>
0031/0030	1	ST	TCR.03645103	o-ring	04	C3	<input type="checkbox"/>
0031/0060	1	ST	TCR.03130022	roll pin		C3	<input type="checkbox"/>
0031/0100	2	ST	TCR.03658017	seal ring		C3	<input type="checkbox"/>
0031/0130	1	ST	TCR.03645217	o-ring	04	C3	<input type="checkbox"/>
0040/0020	10	ST	TCR.03014125	socket head screw	04	C3	<input type="checkbox"/>
0050/0060	4	ST	TCR.03049053	straight pin	04	C3	<input type="checkbox"/>
0050/0070	1	ST	TCR.03130072	roll pin	04	C3	<input type="checkbox"/>
0060/0162	1	ST	TCR.03658048	seal ring		C3	<input type="checkbox"/>
0060/0210	5	ST	TCR.03110008	spring washer		C3	<input type="checkbox"/>
0060/0235	1	ST	TCR.03660026	flat seal ring		C3	<input type="checkbox"/>

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	Lieferumfang: 216.000402 Scope of supply:		Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:	

C = Commissioning parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0060/0285	1	ST	TCR.03645015	o-ring	04	C3	<input type="checkbox"/>
0060/0330	0,300	M	TCR.03661132	sealing tape --		C3	<input type="checkbox"/>
0060/0350	1	ST	TCR.03658036	seal ring		C3	<input type="checkbox"/>
0060/0370	2	ST	TCR.03658027	seal ring		C3	<input type="checkbox"/>
0060/0390	1	ST	TCR.03658014	seal ring		C3	<input type="checkbox"/>
0069/0060	1	ST	TCR.03171018	circlip	04	C3	<input type="checkbox"/>
0069/0110	1	ST	TCR.03646028	o-ring	04	C3	<input type="checkbox"/>
0250/0012	1	ST	TCR.03647063	normex-elast.ring	12	C3	<input type="checkbox"/>
0250/0060/0010/0030	2	ST	TCR.03658017	seal ring		C3	<input type="checkbox"/>
0250/0060/0110	1	ST	TCR.49917301	shaft seal ring	12	C3	<input type="checkbox"/>
0250/0100	1	ST	TCR.41347680	seal -		C3	<input type="checkbox"/>
0250/0120	2	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/	17	ST	TCR.03110008	spring washer		C3	<input type="checkbox"/>
0280/1.10	2	ST	TCR.03660027	flat seal ring		C3	<input type="checkbox"/>
0280/1.6	8	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/1.8	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>
0280/10.5	4	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/10.9	1	ST	TCR.03645045	o-ring		C3	<input type="checkbox"/>
0280/11.5	4	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/11.7	1	ST	TCR.41926300	gasket -		C3	<input type="checkbox"/>
0280/12.3	2	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/2.10	8	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/2.12	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>
0280/2.14	2	ST	TCR.03660027	flat seal ring		C3	<input type="checkbox"/>

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C = Commissioning parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0280/29.5	1	ST	TCR.41349270	seal -		C3	<input type="checkbox"/>
0280/3.3	1	ST	TCR.03645045	o-ring		C3	<input type="checkbox"/>
0280/3.5	4	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/35.1	1	ST	TCR.03661082	flat seal ring		C3	<input type="checkbox"/>
0280/4.10	1	ST	TCR.03660027	flat seal ring		C3	<input type="checkbox"/>
0280/4.13/0040	1	ST	TCR.03210049	cyl.compr.spring	17	C3	<input type="checkbox"/>
0280/4.13/0060	1	ST	TCR.03658048	seal ring	17	C3	<input type="checkbox"/>
0280/4.7	2	ST	TCR.03660028	flat seal ring		C3	<input type="checkbox"/>
0280/5.12	1	ST	TCR.03645045	o-ring		C3	<input type="checkbox"/>
0280/5.14	1	ST	TCR.03660027	flat seal ring		C3	<input type="checkbox"/>
0280/5.17	4	ST	TCR.03110016	spring washer		C3	<input type="checkbox"/>
0280/5.19	4	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/5.23	2	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/5.27	2	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/5.29/0020	1	ST	TCR.03171045	circlip	16	C3	<input type="checkbox"/>
0280/5.29/0040	1	ST	TCR.03210104	cyl.compr.spring	16	C3	<input type="checkbox"/>
0280/5.29/0070	1	ST	TCR.03658048	seal ring	16	C3	<input type="checkbox"/>
0280/5.29/0090	2	ST	TCR.03658012	seal ring	16	C3	<input type="checkbox"/>
0280/5.29/0100	1	ST	TCR.41349280	seal -	16	C3	<input type="checkbox"/>
0280/50.2	1	ST	TCR.03660028	flat seal ring		C3	<input type="checkbox"/>
0280/52.3	2	ST	TCR.03661072	flat seal ring		C3	<input type="checkbox"/>
0280/6.3	4	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/6.5	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>
0280/7.3	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>

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C = Commissioning parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0280/7.4/0070	2	ST	TCR.03656009	seal ring	20	C3	<input type="checkbox"/>
0280/7.4/0080	1	ST	TCR.03130432	roll pin	20	C3	<input type="checkbox"/>
0280/8.3	4	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
0280/9.5	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>
0280/9.7	1	ST	TCR.03660028	flat seal ring		C3	<input type="checkbox"/>
0340/17.3	3	ST	TCR.03110008	spring washer		C3	<input type="checkbox"/>
0360/0020	1	ST	TCR.40769510	seal -	14	C3	<input type="checkbox"/>
0360/0070	1	ST	TCR.03645060	o-ring		C3	<input type="checkbox"/>
0360/0080	1	ST	TCR.41347670	seal -		C3	<input type="checkbox"/>
0369/0010/0030	2	ST	TCR.03645150	o-ring	14	C3	<input type="checkbox"/>
0369/0010/0050	2	ST	TCR.40794170	compression spring	14	C3	<input type="checkbox"/>
0369/0010/0090	1	ST	TCR.03646612	Quadring	14	C3	<input type="checkbox"/>
0369/0010/0120	1	ST	TCR.03210089	compression spring	14	C3	<input type="checkbox"/>
0369/0010/0130	1	ST	TCR.03645055	o-ring	14	C3	<input type="checkbox"/>
0369/0010/0230	2	ST	TCR.03658016	seal ring	14	C3	<input type="checkbox"/>
0369/0010/0250	4	ST	TCR.03658017	seal ring	14	C3	<input type="checkbox"/>
0369/0010/0290	1	ST	TCR.03130023	roll pin	14	C3	<input type="checkbox"/>
0369/0010/0310	2	ST	TCR.03658021	seal ring	14	C3	<input type="checkbox"/>
0369/0010/0330	1	ST	TCR.03171026	circlip	14	C3	<input type="checkbox"/>
0410/0020	1	ST	TCR.03130076	roll pin		C3	<input type="checkbox"/>
0450/0010/0095	1	ST	TCR.03110013	spring washer	10	C3	<input type="checkbox"/>
0450/0010/0150	1	ST	TCR.03130028	roll pin		C3	<input type="checkbox"/>
0460/0030	2	ST	TCR.03130060	roll pin		C3	<input type="checkbox"/>
0460/0045	4	ST	TCR.03110012	spring washer	04	C3	<input type="checkbox"/>

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	Lieferumfang: 216.000402 Scope of supply:	Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:		

C = Commissioning parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0460/0050	1	ST	TCR.03049042	straight pin		C3	<input type="checkbox"/>
0460/0065	4	ST	TCR.03110012	spring washer		C3	<input type="checkbox"/>
7100/0060	2	ST	TCR.49914002	capeelement		C3	<input type="checkbox"/>
7100/0070	3	ST	TCR.49914000	capeelement		C3	<input type="checkbox"/>
7200/0110	5	ST	TCR.03658017	seal ring		C3	<input type="checkbox"/>
7200/0120	12	ST	TCR.03658028	seal ring		C3	<input type="checkbox"/>
7300/0050	6	ST	TCR.03625018	fiber seal		C3	<input type="checkbox"/>
9000/0030	4	ST	TCR.03660026	flat seal ring		C3	<input type="checkbox"/>

VOITH	Ersatzteilliste Übersicht Survey of Spare Parts Lists		Kennwort: Chengda S 1 UongBi #2 Code:		Voith Turbo GmbH & Co.KG Voithstraße 1 74564 Crailsheim, Germany Tel. +49 7951 32-1666 Fax +49 7951 32-903 coupling-service@voith.com www.voith-coupling-service.com Datum/Date: 2009-12-21 Rev.No: 0
			Typ: R 17 K.2E Type:		
	SAP Angebots-Nr.: 20122187 SAP Offer No.:		Serien Nr.: 8206149, 8206150, 8206151 Serial No.:		
	Lieferumfang: 216.000402 Scope of supply:		Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:		

B = Basic spare parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0050/0010	2	ST	TCR.42582390	bearing shell	04	B1	<input type="checkbox"/>
0050/0020	1	ST	TCR.42582410	bearing shell	04	B1	<input type="checkbox"/>
0050/0030	1	ST	TCR.42582420	bearing shell	04	B1	<input type="checkbox"/>
0050/0040	1	ST	TCR.42582430	bearing shell	04	B1	<input type="checkbox"/>
0050/0050	1	ST	TCR.42582440	bearing shell	04	B1	<input type="checkbox"/>
0050/0080	2	ST	TCR.40822550	thrust-bearing		B1	<input type="checkbox"/>
0050/0100	2	ST	TCR.40822600	thrust bearing split		B1	<input type="checkbox"/>
0450/0010/0040	4	ST	TCR.41307390	plain bearing	10	B2	<input type="checkbox"/>
0250/0060/0060	1	ST	TCR.42011610	plain bearing	12	B4	<input type="checkbox"/>
0250/0060/0070	1	ST	TCR.42011630	plain bearing	12	B4	<input type="checkbox"/>
0250/0060/0080	1	ST	TCR.42011640	plain bearing	12	B4	<input type="checkbox"/>
0250/0060/0090	1	ST	TCR.42011620	plain bearing	12	B4	<input type="checkbox"/>
0069/0030	1	ST	TCR.42589500	guide bush	04	B5	<input type="checkbox"/>
0069/0070	1	ST	TCR.42159660	guide pin	04	B6	<input type="checkbox"/>
0280/4.13/0020	1	ST	TCR.41387070	valve piston -	17	B6	<input type="checkbox"/>
0280/5.29/0030	1	ST	TCR.40702890	valve piston -	16	B6	<input type="checkbox"/>
7200/0005/0003	10	ST	TCR.42215150	resist. thermometer		B6	<input type="checkbox"/>
7300/0010	1	ST	204.00636010003	pressure switch		B6	<input type="checkbox"/>
7300/0010	1	ST	204.00636010002	pressure switch		B6	<input type="checkbox"/>
7300/0010	1	ST	205.00790110001	diff.press.switch		B6	<input type="checkbox"/>

VOITH	Ersatzteilliste Übersicht Survey of Spare Parts Lists		Kennwort: Chengda S 1 UongBi #2 Code:	Voith Turbo GmbH & Co.KG Voithstraße 1 74564 Crailsheim, Germany Tel. +49 7951 32-1666 Fax +49 7951 32-903 coupling-service@voith.com www.voith-coupling-service.com Datum/Date: 2009-12-21 Rev.No: 0
			Typ: R 17 K.2E Type:	
	SAP Angebots-Nr.: 20122187 SAP Offer No.:	Serien Nr.: 8206149, 8206150, 8206151 Serial No.:		
	Lieferumfang: 216.000402 Scope of supply:	Betriebsanl.-Nr.: 91800070510 Instruction Manual No.:		

L = Long term spare parts

Anfrage/Enquiry ☐ Bestellung/Order ☐ Alle Positionen/All items ☐

Zeichnungs-Pos.Nr. Item No.	Menge Quantity	ME Unit	Materialnummer Part. No.	Benennung Designation	Zeichnungsgrp. Drawing Group	Ersatzteilkz. Spare part id.	Auswahl Selection
0450/0010	1	ST	TCR.4130748001	pump	04	L1	<input type="checkbox"/>
0250/0010	1	ST	TCR.41311990	tschan-n mex. hub	12	L2	<input type="checkbox"/>
0250/0011	1	ST	TCR.41314920	tschan-n mex. hub	12	L2	<input type="checkbox"/>
0250/0060	1	ST	TCR.40802660	gear pump	04	L2	<input type="checkbox"/>
0480/0010	1	ST	TCR.03666012	motor	04	L2	<input type="checkbox"/>
0010/0010	1	ST	205.00646610	primary rotor		L5	<input type="checkbox"/>
0012/0010	1	ST	205.00646810	gear stage - input		L5	<input type="checkbox"/>
0012/0020	2	ST	TCR.03160356	key	04	L5	<input type="checkbox"/>
0040/0010	1	ST	TCR.40001380	thrust ring ---	04	L5	<input type="checkbox"/>
0011/0010	1	ST	TCR.4259231002	secondary rotor		L6	<input type="checkbox"/>
0011/0010/0060	1	ST	TCR.03160307	key	04	L6	<input type="checkbox"/>
0060/0080	1	ST	TCR.49912001	oil level glass -	04	L12	<input type="checkbox"/>
7300/0015	1	ST	TCR.42014770	pressure gauge ---		L12	<input type="checkbox"/>
0069/0080	1	ST	TCR.41311780	scoop tube	04	L13	<input type="checkbox"/>
0069/0090	1	ST	TCR.42582700	regulating shaft	04	L13	<input type="checkbox"/>
8100/0010	1	ST	TCR.4255860003	actuator ---		L14	<input type="checkbox"/>
8100/0015	1	ST	TCR.4255812001	electro.power unit		L14	<input type="checkbox"/>
0280/4.13	1	ST	TCR.41903260	press.limit.valve	04	L15	<input type="checkbox"/>

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14.1 Resistance thermometer with connection head

14.1.1 Resistance thermometer

Voith Article No.: 4221515004

2 x PT 100, 3-wire system

for bearings 1 - 10,

Lube oil temperature upstream and downstream of the cooler

and working oil temperature upstream and downstream of the cooler

Drawing42576990

14.1.2 Connection head

Voith Article No.: 4203470001

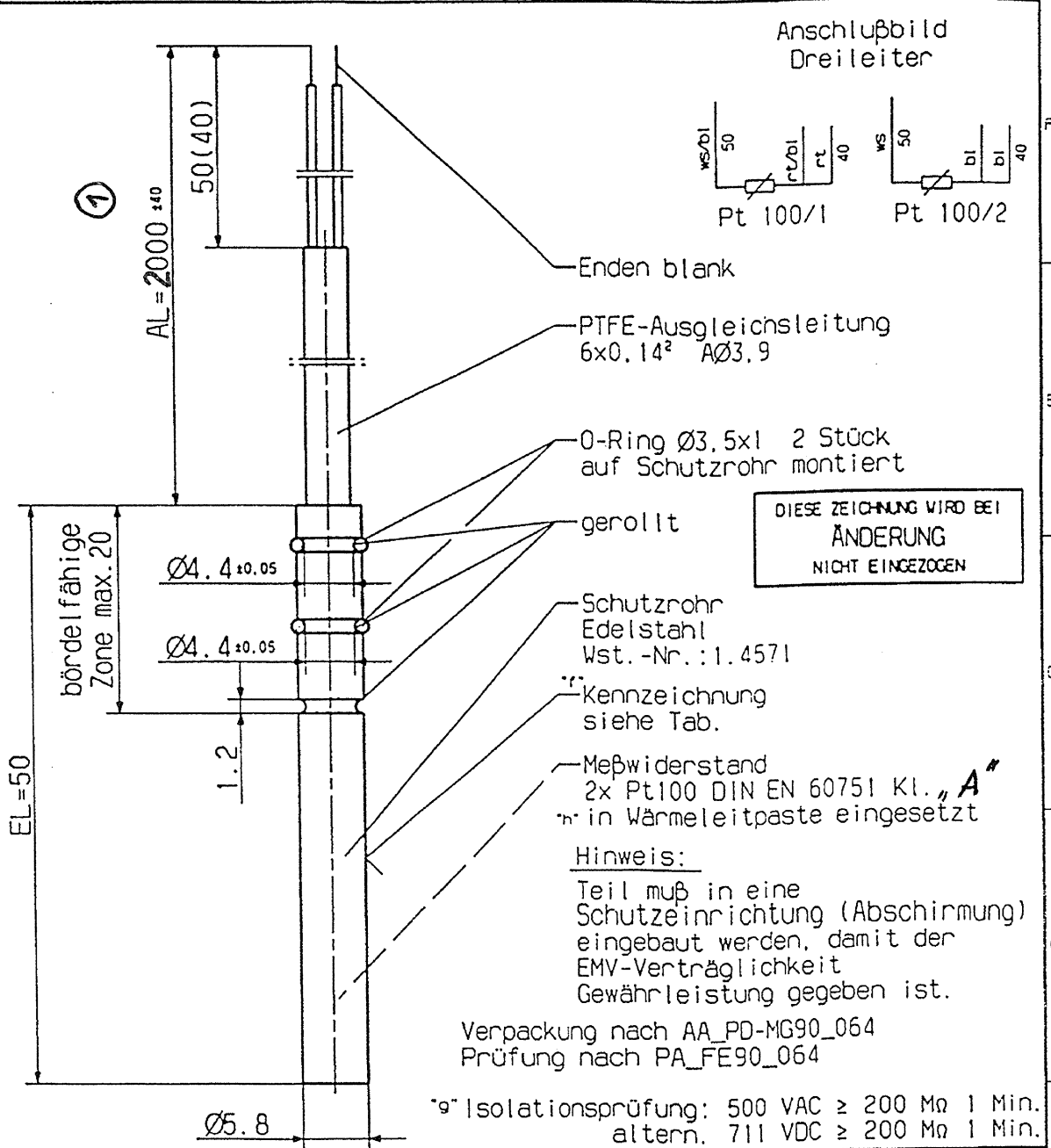
Type: BUZ

Protection: IP 65

Terminal block, 6-pole

Drawing90.238-F62.04.00

Diese Zeichnung ist unser Eigentum. Jede Vervielfältigung, Erweiterung oder Mitteilung an dritte Personen ist strafbar und wird gerichtlich verfolgt.
(Urhebergesetz, Gesetz gegen unlauteren Wettbewerb, B.G.B.)



Verleiter
Abt./Nr. Bereich
Postf. Stück
SBEH-90 (63) 1
SBEH-90-SE (63) 2
LEEM-90 (63) 1
LEPD-90-MG (57) 2
LEPD-90-SE (63) 1
SBDP-90-FS (48) 1
SBDP-90-FP (48) 1
GRPD-90-MR (57) 1
KF2 (63) 1
SBDP-10-FP (41) 1
VK90 (14) 1
SÖVK-90 (14) 1
LEPF (38) 1
Niederl. (14) 1
Metz /F 1
Stafa /CH 1
Eupen /B 1
Vien /A 1
Veessp /NL 1
Hartlow /GB 1
Dorastadt/D 1
Barcelona/E 1
Helsingborg/S 1
Mailand/I 1
Dallier/YR 1
Gesamt 19

"g" Isolationsprüfung: 500 VAC ≥ 200 MΩ 1 Min.
altern. 711 VDC ≥ 200 MΩ 1 Min.

"i" Voith-Zeichn.-Nr.: 42576990 Rev. 1

Betriebstemperaturbereich:

Anschlußleitung: 180°C
Schutzrohr: 180°C

Pos.	Halbzeug	Werkstoff-Nr.	DIN-Kurzbezeichnung	Oberfläche
1		Datum	Name	Widerstandsthermometer
2		Bearb.	06.06.01	Fitzner
3		Gepr.	06.06.01	Bz
4		Norm.		
5		Ges.	Nau	
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				


JUMO

MESS- UND
REGLTECHNIK

M.K. JUCHHEIM GMBH & CO FULDA

Maßstab
2:1

Verteiler	Ant. AG Bereich	Postf. Stück
Niederl.	{14}	
Hertz /F		1
Stafa /CH		1
Eupen /B		1
Wien /A		2
Uesop /NL		1
Herlow /GB		1
Berchona/E		1
Meltingborg/S		1
Melind /I		1
Dallan/NRC		1
Moskau/RUS		1
Gesamt		12

Rev. 1	2006-2-20	Änd.-Nr. 41487	Änderung - Brm / MGB																																																																																
Voith-Zeichng. -Nr. 42034700 Rev. 1																																																																																			
6	Ausf. 4 Form J	Standard Silber	Alu-Druckguß	28000042610	480863																																																																														
5	Ausf. 2 Form BUZH	tropenfest lackiert		4203471002	402377																																																																														
4	Ausf. 1 Form BUZ	tropenfest lackiert		4203470002	402376																																																																														
3	Ausf. 3 Form CNI-3	blank	ASI 316	4203472001	402375																																																																														
2	Ausf. 2 Form BUZH	Standard Silber	Alu-Druckguß	4203471001	402374																																																																														
1	Ausf. 1 Form BUZ	Standard Silber		4203470001	402373																																																																														
Pos.	Ausführung Anschlusskopf	Oberfläche Anschlusskopf	Wst. -ASK	Voith-Sach-Nr.	Teile-Nr.																																																																														
<table border="1"> <tr> <td>Lfd.-Nr.</td> <td>Halbzeug</td> <td>Verkst.-Nr.</td> <td>DIN-Kurzbezeichnung</td> <td colspan="3">Oberfläche</td> </tr> <tr> <td>Bearb.</td> <td>07.12.2006</td> <td>Hergenr.</td> <td colspan="2">Montagesatz</td> <td></td> <td></td> </tr> <tr> <td>Gepr.</td> <td>07.12.2006</td> <td>Klewer</td> <td colspan="2">Benennung</td> <td></td> <td></td> </tr> <tr> <td>Norm.</td> <td></td> <td></td> <td colspan="2">90.238-F62.04.00</td> <td></td> <td></td> </tr> <tr> <td>Ges.</td> <td></td> <td>Belz</td> <td colspan="2">Zeichnungs-Nr.</td> <td>03</td> <td>K/E 90.9421</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">Ersatz für Nr.</td> <td>07.12.2006</td> <td>AKL/HEH</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">gl.Nr.vom 12.11.01</td> <td>Ver.</td> <td>Änderung</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">Maße ohne Toleranzangabe</td> <td colspan="2">Datum</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">Maßstab</td> <td colspan="2">Name</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">DIN 150</td> <td colspan="2">401211</td> </tr> <tr> <td colspan="3"></td> <td colspan="2">1:1</td> <td colspan="2">Blatt 01/01</td> </tr> </table>							Lfd.-Nr.	Halbzeug	Verkst.-Nr.	DIN-Kurzbezeichnung	Oberfläche			Bearb.	07.12.2006	Hergenr.	Montagesatz				Gepr.	07.12.2006	Klewer	Benennung				Norm.			90.238-F62.04.00				Ges.		Belz	Zeichnungs-Nr.		03	K/E 90.9421				Ersatz für Nr.		07.12.2006	AKL/HEH				gl.Nr.vom 12.11.01		Ver.	Änderung				Maße ohne Toleranzangabe		Datum					Maßstab		Name					DIN 150		401211					1:1		Blatt 01/01	
Lfd.-Nr.	Halbzeug	Verkst.-Nr.	DIN-Kurzbezeichnung	Oberfläche																																																																															
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			1:1		Blatt 01/01																																																																														
 GmbH & Co. KG Fulda Germany																																																																																			

14.2 Pressure gauge with shutoff valve

14.2.1 Pressure gauge

Voith Article No.: 42014770

Type: 100 T5500 S WL 15 L

Measuring range: 0-6 bar

Protection: IP 65

Glycerine-filled

Data sheet G1.T5500/D

Instruction Manual GAUGE - BA

14.2.2 Shutoff valve with test connection

Voith Article No.: 42212930

Type: Standard conforming with DIN 16271, Form B

Drawing S004.17.120.0088

Description MV-01

All stainless steel process gauge open or solid front Model T5500 and T6500

According EN 837-1

Nominal size 100 mm or 160 mm

Accuracy: Class 1 (DIN)

Features

- Rugged stainless steel construction
- Socket and case welded
- Protection IP54 and IP65
- Usable to full scale
- Overload protection 130%
- Dry, liquid filled or liquid less (*PLUS!* gauge)
- Measuring system stainless steel or Monel
- Optional contacts

Ranges

-1 ... 0 bar up to 0 ... 2.500 bar

-30 in.Hg ... 0 psi up to 0 ... 36.000 psi

Applications

Chemical and petrochemical industry

Machine and apparatus construction

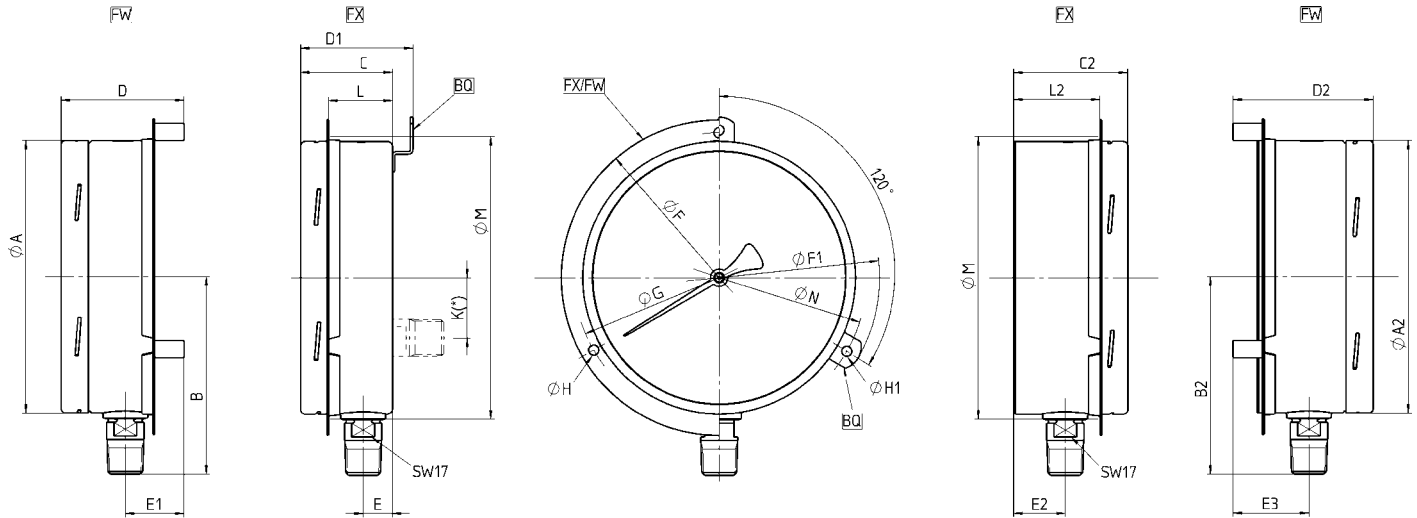
Food and beverage industry

Pulp and paper industry



Technical specification	T5500										T6500							
Dial size [mm]	100					160					100				160			
Construction	Open front cylindrical case with blow out disc at the back										Solid front safety pattern cylindrical case with blow out at the back							
Measuring principle	Bourdon tube																	
Range [bar]	0,6	1	1,6	2,5	4	6	10	16	25	40	60	100	160	250	400	600	1000	
Overpressure limit	1600 2500 -1/0 -1/0,6 -1/1,5 -1/3 -1/5 -1/9																	
Pressure type	130% F.S., short time																	
Process connection	Gauge, vacuum and compound																	
Connection location	G ¼ B male, G ½ B male, G 3/8 B male according EN 837, M20x1,5 male, R ½ male tapered (DIN 2999), ½" male straight (JIS, BSP), 3/8" male straight (JIS, BSP) ¼ NPT male, ½ NPT male according ANSI/ASME B1.20.1 9/16-18 UNF-2B Aminco (high pressure), Others on request (for pressure limitations see order information)																	
Connection location	Lower, back										Lower only							
Material	Stainless steel 316L (1.4404), optional Monel																	
Pressure connection	Stainless steel 316L (1.4404), optional Monel, > 1000 bar Ni Span																	
Tube	Stainless steel 304 (1.4301), optional 316L (1.4404)																	
Case/bayonet ring																		
Window	Instrument glass, optional laminated safety glass or acrylic glass										Laminated safety glass, optional acrylic glass							
Dial	Aluminum, black markings on white background																	
Pointer	Aluminum, black, optional micrometer adjustment, red set hand or maximum pointer																	
Movement	Stainless steel 304/303 (1.4301/1.4305)																	
Accuracy	Class 1 (1% F.S.), optional 0,5% F.S.																	
Permissible																		
Ambient temperature	-25 ... 60°C																	
Medium temperature	max. 100°C																	
Storage temperature	-40 ... 60°C																	
Effect	max. 0,3% / 10 K																	
Protection according EN 60 529/IEC 529	IP54 (dry), IP65 (liquid filled), optional IP65 for dry gauges																	
Filling liquids	Glycerin, silicone, halocarbon, others on request																	
	Optional dampened movement (liquid less gauge), functions as liquid filled gauge (<i>PLUS!</i> gauge)																	
Mounting	Standard stem, optional flush or surface, others on request																	
Weight dry/filled [kg]	0,8/1,0					1,2/2,0					0,8/1,0				1,2/2,0			
Accessories, options	Diaphragm seals, valves, gauges with contacts (see G1.K55/E), gauges with electrical output, NACE																	

General dimensions [mm]



T5500

ϕ	A	B	C	D	D1	E	E1	F	F1	G	H	H1	K	K*	L	M	N
100	101	89	51	69	62	18,5	36,5	132	134	116	4,5	6	35	31	33	103	119
160	162	118	49	70	59	17	38	196	194	178	5	6	35	54	31	164	179

K* = Bereich / range / échelle >1000 bar oder / or / ou Material System / system material / matière élément D, M, P

T6500

ϕ	A2	B2	C2	D2	E2	E3	F	G	H	H1	L2	M	N
100	101	89	61	76	26	41	132	116	4,5	6	42	103	119
160	158	118	66	80	30	44	183	168	6	6	50	161	179

Rev. I

Order information

Size	Type	System material	Execution	Process connection	Connection orientation	Range	Engineering units	Filling/Case material	Options
(100) 100 mm	T5500	(S) 316L (1.4404) ≤ 1000 bar	(D) IP54	(04) ½ NPT male ¹⁾	(L) Lower	-1/ 0 -1/ 1,5 -1/ 3	(BAR)	(=) Standard no filling	(NH) Tagging wired
(160) 160 mm	T6500	(P) Monel 400 ≤ 1000 bar	(L) Liquid filled IP65	(02) ¼ NPT male ¹⁾	(B) Back ¹⁾	-1/ 5 -1/ 9		(GV) Silicone	(DA) Dial Marking
		(M) Monel 400 tube, 316L (1.4404) socket ≤ 1000 bar		(09) 9/16-18 UNF-2B Aminco		0/ 0,6 ¹⁾ 0/ 1 0/ 1,6 0/ 2,5 0/ 4 0/ 6 0/ 10 0/ 16 0/ 25 0/ 40 0/ 60 0/ 100 0/ 160 0/ 250 0/ 400 0/ 600 0 1000 0/1600 0/2500		(GV3) Silicone 3 cst	(TU) Throttle plug stainless steel
		(D) Ni span tube, 316L (1.4404) socket > 1000 bar		(13) G ¼ B male ¹⁾				(GR) Glycerin ¹⁾	(6B) Oxygen cleaned (not for open front acc. EN 837-1)
				(14) G 3/8 B male ¹⁾				(GX) Halocarbon ²⁾	(MP) Micrometer pointer
				(15) G ½ B male ¹⁾				(YW) Case material 316L (1.4404)	(EP) Maximum pointer, adjustable
				(16) M20x1,5 male ¹⁾				() Contact type and function (see G1.K55/E)	(PD) Acrylic glass
				(KQ) R½ male tapered DIN 2999 ¹⁾					(SG) Safety glass
				(KN) ½" male straight (JIS,BSP) ¹⁾					(FX) Front flange
				(KP) 3/8" male straight (JIS,BSP) ¹⁾					(FW) Back flange
				¹⁾ max. 1000 bar	¹⁾ not for type T6500	¹⁾ not allowed with execution L	psi and others on request	¹⁾ not for ranges ≤ 2,5 bar	(BQ) Wall mounting bracket (not for T6500)
								²⁾ Not allowed in combination with Liquid less (LL) option	(UF) U-clamp (not for solid front)
									(SH) Red set hand stationary
									(LJ) Field fillable (only for execution "D", IP65)
									(AJ) Calibration 0,5% F.S. (not for range 0/0,6 bar filled)
									(LL) Liquid less gauges (Halocarbon filling not allowed)
									(PR) Receiver gauge
									(OS) Overload stop
									(VS) Underload stop

How to order

Size	Type	System material	Execution	Process connection	Connection orientation	Range	Engineering unit	Filling/Case material	Option
100	T5500	S	D	15	L	0/16	BAR	YW	NH

DRESSER EUROPE GmbH Measurement & Control

Germany

Max-Planck-Str. 1, D-52499 Baesweiler
P.O. Box 11 20, D-52490 Baesweiler

Tel.: +49 (0) 24 01 80 80, Fax: +49 (0) 24 01 80 81 25

France

206 Rue des Campanules, Le Mandinet
F-77185 Lognes

Tel.: +33 (0) 1 60 37 25 30, Fax: +33 (0) 1 60 37 25 39

Website: www.dresserbae.de

United Kingdom

East Gillibrands
Skelmersdale, Lancashire WN8 9TU

Tel.: +44 (0) 16 95 52 600, Fax: +44 (0) 16 95 52 693

E-Mail: Sales@Dresserbae.de

Betriebsanleitung Druck- und Differenzdruckmanometer

Operating Instruction Pressure- and DP gauge

Instruction de Service Manomètre et Manomètre différentiel

Dresser Europe GmbH

Niederlassung Baesweiler

Germany/Deutschland/Allemagne

Max - Planck - Straße 1

D - 52499 Baesweiler

☎ +49 (0) 24 01 80 80

Fax: +49 (0) 24 01 80 81 25

England/Angleterre

East Gillibrands

Skelmersdale, Lancashire WN8 9TU

☎ +44 (0) 16 95 52 600

Fax: +44 (0) 16 95 52 693

France/Frankreich

206 Rue des Campanules, Le Mandinet

F-77185 Lognes

☎ +33 (0) 1 60 37 25 30

Fax: +33 (0) 1 60 37 25 39

6. Nullpunktkorrektur

- Bei Meßgeräten mit abnehmbaren Frontring oder externer Verstellmöglichkeit kann der Nullpunkt eingestellt werden.
- Bei Meßgeräten mit interner Nullpunktverstellung muß der Bajonett - Ring bzw. der klappbare Ring vorsichtig entfernt werden. Meßgeräte mit geschraubtem Ring werden wie in Bild 1 dargestellt geöffnet.

1. Gerät (3) mit einer Schutzhülse (2) im Schraubstock einspannen.
 2. Schraubring vorsichtig mit einem Hammer und einem großen Schraubendreher (1) gegen den Uhrzeigersinn lösen.
 3. Nach der Nullpunktkorrektur Schraubring von Hand fest andrehen. Bei wetterfester Ausführung eine 1/8 Umdrehung, bei hermetisch dichter und gefüllter Ausführung eine 1/3 Umdrehung nachziehen.
- Differenzdruckmeßgeräte haben eine externe Verstellmöglichkeit an der Gehäuseseite.

- Feinmeßgeräte mit klappbarem Ring haben eine frontseitige Nullpunktkorrektur (siehe Bild 2).

1. Feststellschraube A lösen.
2. Mit der Justierschraube B den Nullpunkt einstellen.
3. Feststellschraube A in Justierschraube B eindrehen.

- Vor der Nullpunktkorrektur ist ein Druckausgleich erforderlich.

6. Zero adjustment

For instruments with a removable ring, bezel or external zero adjust feature the zero can be adjusted. For the instruments with internal zero adjustments the bayonetting or hinged ring bezel must be removed, for gauges with screwed ring see sketch 1 to remove the ring.

1. Hold gauge in vise with threaded nut. It is important to hold the gauge rigidly otherwise ring lugs may be damaged.
2. To remove ring - tap counterwise as shown using hammer and large screw driver with flat tip
3. To install ring tighten snugly by hand. Turn as per sketch 1/8 turn for weatherproof and 1/3 turn for liquid filled and hermetically sealed. The differential pressure gauges have an external adjustment on the side of the case.

- Testgauges with hinged ring are equipped with a front mounted zero adjustment (see sketch 2).

1. Loosen ring locking screw A.
2. Rotated knob B until required adjustment.
3. Tighten screw A down on knob B.

The pointer can be adjusted to zero after releasing the pressure element against atmosphere.

6. Réglage du zéro

- Pour les instrument à lunette amovible ou munis d'une système de remise à zéro externe, le zéro peut être. Pour les instruments munis d'un système de réglage interne du zéro, la lunette à baïonnette ou articulée peut être aisément enlevée, pour les manomètres lunette visée, voir le schéma pour retirer la lunette.

1. Tenir la manomètre solidement fixé. il est important de le tenir étroitement sinon les ergots de la lunette pourraient être endommagés.

2. Pour retirer la lunette, tapoter dans le sens inverse des aiguilles d'une montre comme indiqué en utilisant un marteau et un tournevis à bout plat.
 3. Pour installer la lunette, la serrer à fond à la main. Tourner comme indiqué sur le schéma d'1/8 de tour pour l'étanchéité et d'1/3 de tour pour les boîtiers à bain ou hermétique.
- Les manomètres différentiels ont un ajustement externe sur le côté du boîtier.
 - Les manomètres étalons à lunette amovible sont équipés d'une vis de remise à zéro sur la façade (voir schéma 2).
1. Desserrer la bague de verrouillage „A“
 2. Faire tourner le bouton „B“ pour ajuster le zéro.
 3. Serrer la vis „A“ sur le bouton „B“.
- L'aiguille ne peut être remise à zéro qu'après avoir libéré l'élément sensible de tout pression.

Bild / sketch / schéma

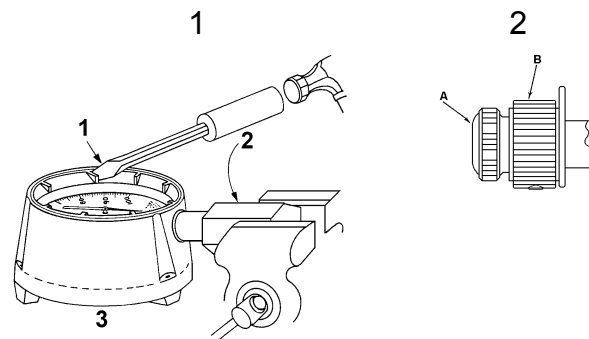


Tabelle / table / tableau 3

max. Umgebungstemperatur / ambient temperature limits / température ambiante maximum

Ausführung execution type de boîtier		°C	°F
hermetisch dicht hermetically sealed hermétique	Luft / air / air	- 25 ... 50	- 10 ... 125
Flüssigkeitsgefüllt liquid filled à bain	Glycerin / glycerin / glycérine	- 18 ... 65	0 ... 150
	Silikon / silicon / silicone	- 45 ... 65	- 50 ... 150

- Füllflüssigkeit und Meßstoff müssen kompatibel sein.
- Be sure filling liquid is compatible with process fluid
- S'assurer que le liquide de remplissage est compatible avec le fluide de service.

1. Montagebedingungen

- Die Manometer müssen nach den in Betracht kommenden Anforderungen ausgewählt und montiert werden.
- Zul. Umgebungstemperatur siehe Tabelle 3. Andere Temperaturgrenzen sind optional mit speziellen Serien möglich.

2. Montage

- Der Einbau des Meßgerätes sollte in der Nähe des Meßpunktes erfolgen. Der Einbauort sollte zugänglich und frei von Erschütterungen sein.
- Die Betriebsstellung muß mit der auf dem Zifferblatt angegebenen Gebrauchsstellung übereinstimmen. Ohne Angabe auf dem Zifferblatt ist die Gebrauchslage $90^\circ \pm 5^\circ$ (Zifferblatt in vertikaler Lage).
- Bei extremen Bedingungen (Druckspitzen, Vibrationen) Schutzelemente (Dämpfungselemente, Füllflüssigkeiten).
- Das Meßgerät ist vor schädlichen Umwelteinflüssen, Beschädigungen, großen Temperaturschwankungen und, bei Differenzdruckmeßgeräten, vor einseitiger Wärmestrahlung zu schützen.
- Differenzdruckmeßgeräte müssen frostsicher eingebaut werden.
- Überschreitet die Temperatur des Meßstoffes die zulässige Betriebstemperatur, so muß eine ausreichend lange Meßleitung, ein Wasser-sackrohr oder ein Druckmittler mit Kapillarrohr vorgeschaltet werden.
- Beim Montieren ist ein entsprechender Maulschlüssel zu verwenden. Es darf keine Kraft (Moment) auf das Gehäuse ausgeübt werden.

3. Inbetriebnahme

- Ist auf dem Zifferblatt keine Begrenzungs- markierung \blacktriangledown aufgedruckt, so ist der Verwendungsbereich gleich dem Anzeigebereich. Bei Differenzdruckmeßgeräten ist der maximale statische Druck zu berücksichtigen.
- Beim Abdrücken von Rohrleitungen und Kesseln darf das Meßgerät nicht höher als die vorgenannten Begrenzungen belastet werden.
- Die Bezugstemperatur beträgt $+20^\circ\text{C}$ (Normaltemperatur bei betrieblicher Eichung). Abweichend von der Bezugstemperatur ergibt sich je $\pm 30^\circ\text{C}$ Betriebstemperaturzunahme bzw. Abnahme ein zusätzlicher Anzeigefehler von $\pm 1\%$ bezogen auf den M. E..
- Die Anschlußleitung sollte, in Abhängigkeit von Druck und Länge, einen Innendurchmesser von 4 ... 9 mm haben.
- Nach Montage eines Differenzdruckmeßgerätes sind die Anschlußleitungen auszublasen, bzw. bei flüssigen Medien zu entlüften. Bis zum Einsatz bleibt das Anschlußventil geschlossen und das Ausgleichsventil geöffnet. Einseitige Druckbelastungen sind zu vermeiden.
- Absperrventile immer langsam öffnen.
- Bei Inbetriebnahme von Differenzdruckmeßgeräten wie folgt vorgehen:
 1. Ausgleichsventil öffnen
 2. Anschlußventil öffnen.
 3. Ausgleichsventil schließen. Der Differenzdruck wird angezeigt.
- Bei Außerbetriebnahme wie folgt vorgehen:
 1. Ausgleichsventil öffnen.
 2. Anschlußventil schließen.

4. Nullpunktprüfung / Funktionstest

- Nach dem Schließen der Absperrventile und erfolgtem Druckausgleich muß der Zeiger im als Nullpunkt gekennzeichneten Bereich stehen.
- Bei Differenzdruckmeßgeräten steht der Zeiger bei gleichzeitigem Schließen der Ventile innerhalb des Anzeigebereiches. Fällt der Zeiger, ist die Plusleitung undicht oder das Ausgleichsventil nicht geschlossen. Steigt der Zeiger, ist die Minusleitung undicht. Zeigt das Differenzdruckmeßgerät nichts an, Minusleitung schließen und Plusleitung öffnen. Bewegt sich der Zeiger nicht, so ist das Gerät defekt.

5. Wartung

- Das Gerät ist wartungsfrei.
- Lassen sich Störungen nicht beheben, wenden Sie sich bitte an unsere Niederlassungen und Vertretungen, die Ihnen mit Beratung und Service zur Verfügung stehen.

1. Installation requirements

- The pressure gauges must be selected and installed this wise, that the possibility of failure, resulting in injury or misapplication, is minimized.
- For the maximum ambient temperature see table 3. Other limits are possible at special series.

2. Mounting

- The mounting of measuring instruments shall be in proximity of measuring point, easily accessible and safe from vibrations and always coincide with the position as indicated on the dial. If no such statement is printed on the dial, the gauges must be mounted in a $90^\circ \pm 5^\circ$ position with the vertical dial. If the instrument can not protected against shock or vibration, use an additional movement damping feature (liquid filled or pulsation dampener). The measuring instrument must be protect against damages, great pollution, high fluctuation of temperature and one-sided heat radiation for the dp gauge. Please note the freezing point of media and choose a frost - protected place for the dp gauges.
- If the process temperature at the gauge is in excess of the max. allowable operation temperature, than depending of the application a syphon, diaphragm seal or sufficient length of pipe / capillary has to be mounted between the pressure tap and the instrument.
- When installing always use a wrench suitable for the flats on the instrument. Do never apply mechanical torque's to the case.

3. Operation

- The operating range corresponds to the scale range or see static pressure limit mark \blacktriangledown printed on the dial. For dp gauges look for the max. allowable static pressure. When carrying out pressure test of process pipes and vessels, the instrument may not exposed to the above limits as mentioned before. The calibration temperature is $+20^\circ$, each $\pm 30^\circ\text{C}$ deviation of this temperature adds \pm one class of full scale value to the accuracy. The instruments piping shall be between 4 and 9 mm ID, depending on the pressure and the lengths.
- After installation of the dp gauges the measuring lines must be blowed through. When using liquid media, the measuring lines must be bled.
- Until definitive operation the connection valve remains closed and the compensation valve remains open. Please avoid one-sided charge.
- On start up for pressure gauges open the shut off valve slowly.
- For dp gauges follow the following sequence for:
 - Operation:
 1. Open balancing valve.
 2. Open connection valves.
 3. Close balancing valve. Differential pressure is indicated on dial
 - Out of operation:
 1. Open balancing valve.
 2. Close connection valves.

4. Zero or functional test

- The shut off valve(s) at the pressure tap(s) for the instrument has to be closed and the pressure has to be released to atmosphere. The pointer tip must stay within the zero mark.
- Check for dp gauges: Close both valves at the pressure taps at the same time. The pointer must rest within the scale range. If pointer drops the plus line leaks or the balancing valve is still open. In case of rising pointer the minus line leaks. If the dp gauge shows no indication, close the minus line and open the plus line. In case the pointer doesn't move the instrument is damaged.

5. Maintenance

- The instrument require no special maintenance.
- In case of any default apply for assistance from ourselves or our agents. We will assist you with advice and service.

1. Conditions de montage

- Les manomètres doivent être choisis et montés de manière à minimiser les possibilités d'erreurs, résultant d'un mauvais montage d'une mauvaise application.
- Pour la température ambiante maximum, se référer au tableau 3. D'autres limites sont possibles dans des modèles particuliers.

2. Montage

- Le montage de mano's doit être fait à proximité du point de mesure, facilement accessible, exempt de vibrations et toujours coïncider avec la position indiquée sur cadran. En standard, les manomètres doivent être montés à $90^\circ \pm 5^\circ$ par rapport au cadran à la verticale. Protéger les mano's contre les chocs ou les vibrations ou utiliser un système d'amortissement supplémentaire (remplissage ou amortisseur). Le mano doit être protégé contre avaries, pollution, hautes fluctuations de température et chaleur d'un côté de l'appareil pour le mano différentiel. Noter la point de gel du fluide et choisir une place protégée du gel pour les mano's différentiels.
- Si la température du process au niveau du mano est supérieure à la température maximum admissible, alors il sera nécessaire de monter un siphon, un séparateur ou un capillaire suffisamment long. Utilisez toujours clefs adaptées au plats du mano. Ne jamais appliquer de forces sur le boîtier.

3. Mise en service

- L'échelle d'opération correspond à la pleine échelle sinon se référer à la marque \blacktriangledown indiquant la limite de pression. Pour les mano's différentiels, vérifier la pression statique maxi. Pendant les essais d'étanchéité des tuyaux, les mano's ne doivent pas être exposés hors limites indiquées. La température d'étalonnage est de $+20^\circ$, chaque déviation de $\pm 30^\circ$ ajoute \pm une classe de la valeur pleine échelle à la précision. Les tuyaux vers les mano's doivent avoir un diamètre interne entre 4 et 9 mm, en fonction de la pression et de la longueur.
- Après l'installation de mano's différentiels, les lignes de mesure doivent être ventilées (purgées pour liquides).
- Jusqu'à la mise en service définitive, la vanne d'isolement doit rester fermée et la vanne d'équilibrage ouverte. Faire attention aux charges unidirectionnels.
- Au démarrage pour les mano's ouvrir la vanne d'isolement lentement.
- Pour les mano's différentiels, suivre les instructions suivantes pour:
 - Mise en service:
 1. Ouvrir la vanne d'équilibrage
 2. Ouvrir les vannes d'isolement
 3. Fermer la vanne d'équilibrage. La pression différentielle est indiquées sur le cadran
 - Mise hors service:
 1. Ouvrir la vanne d'équilibrage.
 2. Fermer les vannes d'isolement.

4. Zéro ou test de fonctionnement

- La vanne d'isolement du mano fermée, la pression doit être amenée à la pression atmosphérique. L'aiguille doit rester à zéro.
- Vérification pour les mano's différentiels. Fermer l'ensemble des vannes à la prise de pression en même temps. L'aiguille doit rester dans l'échelle. Si l'aiguille descend, la partie haute pression a des fuites ou la vanne d'équilibrage est restée ouverte. En cas montée de l'aiguille, la partie basse pression a des fuites. Si le mano ne montre aucune indication, fermer la coté basse pression et ouvrir la haute pression. Si l'aiguille ne bouge pas, l'instrument est défectueux.

5. Maintenance

- L'instrument ne demande pas une maintenance particulière.
- En cas de défaut, demander l'assistance de nos agents ou la nôtre. Nous vous apporterons conseil et service.

Proper use

Pressure gauge valves are used to shut off pressure instruments in chemical plants, power stations or similar facilities.

The max. permissible operating pressure depends on the temperature of the medium and on the used materials of the parts and gaskets. Please pay attention to the pressure-temperature-diagram that you can find in the catalogue or on the drawing.

Any other use or any modification are not allowed and exclude the manufacturer from any liability.

General warning


Pressure gauge valves are used to shut off various media. These can be **poisonous, explosive, irritating, very hot or very cold**. Mounting, disassembling, operation and maintenance may only be done by experienced staff, which is familiar with the secure handling of the used medium.

In addition to these instructions also the common safety regulations and the instructions of the complete installation and of the measuring device have to be considered.

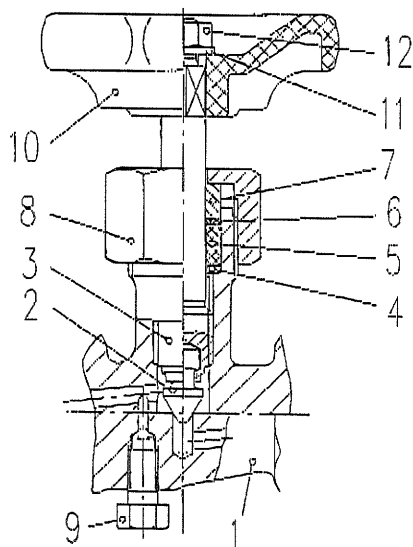
Suitability of material:

Protection against improper use of the pressure gauge valve:

In particular, it has to be ensured that the chosen materials of the wetted parts of the valve are suitable for the used media.

The manufacturer is not responsible for damages at the pressure gauge valve caused by corrosive media.

The disregard of these precautions can mean danger for the user and it can also cause damages in the piping system.



1	valve body
2	valve tip
3	stem
4	washer
5	packing
6	packing support
7	gland
8	union nut
9	vent screw
10	hand wheel
11	washer
12	hex. nut

Installation / Disassembling

Installation and disassembling may only be done at depressurized systems!

Even at depressurized systems the parts can be very hot or very cold for a reasonable period of time!

Small volumes of the medium can penetrate during disassembling.

Wear protective gloves and safety glasses!

Operating

The valves are operated by hand wheel.

Close clockwise.

1. Adjustment of packing

The packing (5; stem sealing against atmosphere) is pre-set at 1,5 times the nominal pressure. In case of long storage, the packing can lose it's tightness. In this case it should be adjusted as follows:

Open the stem (3). Tighten the union nut (8) 1/4 to 1/2 turn until the valve feels not too slack or difficult to operate.

2. Venting

Before using the vent screw (9) or the test connection, the valve has to be closed. The pressure which is retained between the valve and the instrument can then be reduced via the vent screw or the test connection. When the pressure is discharged, please make sure that no one is endangered by the escaping medium.

3. Replacing the packing

- Depressurize the impulse line.
- Open the stem (3) up to the stop and dismount the hand wheel (10).
- Dismount the union nut (8).
- Unscrew the stem (3). Take off the gland (7), the packing support (6), the packing (5) and the washer (4).
- Clean all parts and the sealing areas. Reassemble the new parts on the stem.
- Lubricate the thread of the stem (valves for oxygen service require special approved lubricants!).
- Screw in the stem.
- Tighten the union nut (8) with a torque of 26Nm (PTFE) resp. 30Nm (graphite).
- Reassemble the hand wheel (10).
- Pressurize the impulse line.
- Check the packing for tightness and whether the valve feels not too slack or difficult to operate.

4. Oxygen service

For degreased valves for oxygen service please consider the applicable accident prevention regulations.

When the thread protection caps are taken off, possibly remaining plastics are to be removed by suitable means.

Our products are manufactured to ISO9001 levels of quality assurance.

14.3 Pressure switch with shutoff valve

14.3.1 Pressure switch

Voith Article No.: 20400636010002 / 20400636010003

Type: 44V1-AA45-M4-C1A

Description Form # 248

14.3.2 Shutoff valve with test connection

Voith Article No.: 42212930

Type: Standard conforming with DIN 16271, Form B

Drawing S004.17.120.0088

Description MV-01



Dual Hi-Lo Pressure Switches

General Instructions

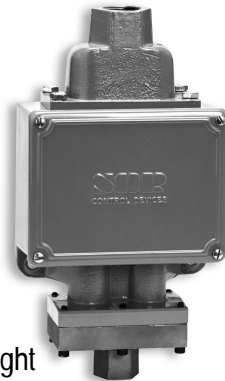
V1

Weathertight
Housing



V2

Weathertight
Explosion Proof
Hermetically Sealed



General

This instruction provides information for installation, process and electrical connections, and field calibration of SOR Dual Hi-Lo Series Pressure Switches.

The pressure sensing elements are a pair of force-balanced, piston-actuated assemblies sealed by flexible diaphragms and o-rings that are static. The only wetted parts in this arrangement are the single pressure port, two sensing assembly diaphragms and o-rings.

Media pressure on the area of the pistons counteracts the force of the range spring (adjustable by the adjusting nuts), which moves the piston shafts only a few thousandths of an inch to directly actuate the electrical snap-action switching elements.

Installation

Dual Hi-Lo Pressure Switches may be secured to bulk-heads, panels or pipe stanchions with suitable bolts. When mounting the pressure switch to an irregular or uneven flat surface, install rubber washers on the mounting bolts between the housing and the mounting surface.

CAUTION: Failure to place washers between the housing and the mounting surface may result in torsional forces on the housing that could cause false trips or render the pressure switch inoperative.

Line-mounting by either the process connection or the electrical conduit connection is **not** recommended.

CAUTION: Failure to mount the housing on a flat mounting surface may result in torsional forces on the housing that could cause false trips or render the pressure switch inoperative.

Process Connection

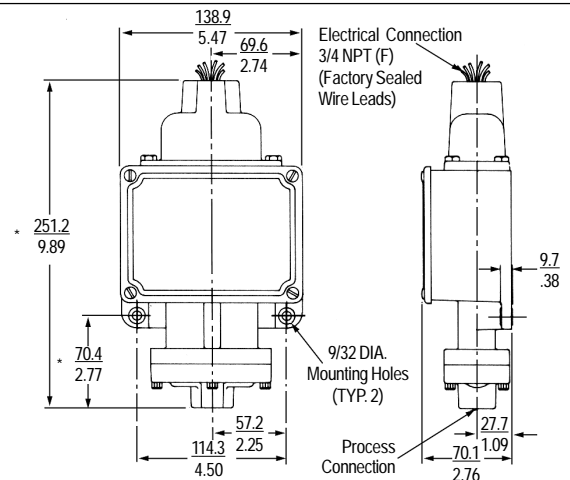
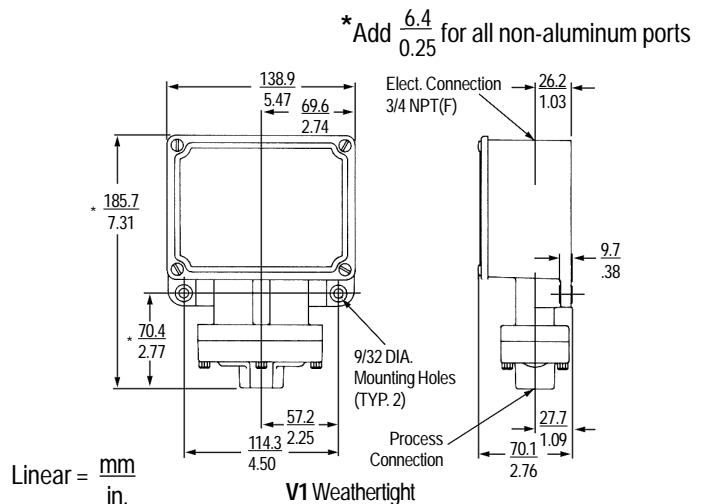
Securely connect the process line to the pressure port using two wrenches; one to hold the hexagonal flats on the pressure port, the other to tighten the process pipe or tube fitting.

IMPORTANT: Ensure that the process connection is tightened and positioned so that bending and torsional forces imposed on the pressure switch are minimal. **Do not** loosen the pressure port from the body, because leakage could result or the pressure switch could be rendered inoperative.

Dimensions

Dimensions are for reference only. Contact the factory for certified drawings for a particular model number.

Design and specifications are subject to change without notice.



Electrical Connection

WARNING: Units in hazardous locations-Prior to removal from service, make sure that the work area is declassified. Failure to do so could result in severe personal injury or substantial property damage.

Ensure that wiring conforms to all applicable local and national electrical codes and install unit(s) according to relevant national and local safety codes.

V1 WEATHERTIGHT

	Common	Normally Open	Normally Closed
--	--------	---------------	-----------------

SPDT: Screw terminal block with marked insulation. Left and right positions.

No. 1 (Left side)	C1	NO1	NC1
No. 2 (Right side)	C2	NO2	NC2

2-SPDT (DPDT): Left and right positions

Nos. 1 & 2 (Left side)	C1	NO1	NC1
	C2	NO2	NC2
Nos. 3 & 4 (Right side)	C3	NO3	NC3
	C4	NO4	NC4

"V2 Explosion Proof 18" 18 AWG color coded and marked wire leads with 3/4" NPT (F) conduit connection."

	Common	Normally Open	Normally Closed
--	--------	---------------	-----------------

SPDT

No. 1 (Left side)	C1 Blue	NO1 Black	NC1 Red
No. 2 (Right side)	C2 Blue	NO2 Black	NC2 Red

2-SPDT (DPDT)

Nos. 1 & 2 (Left side)	C1 Blue	NO1 Black	NC1 Red
	C2 Yellow	NO2 Brown	NC2 Orange
Nos. 3 & 4 (Right side)	C3 Blue	NO3 Black	NC3 Red
	C4 Yellow	NO4 Brown	NC4 Orange

GR - Ground (Earth) Green wire connected to each hermetically sealed switching element capsule.

NOTE: Transpose NO and NC on vacuum switches when set points are in the vacuum range.

CAUTION: Overtravel has been preset at the factory, i.e. the switching element assembly has been precisely positioned in the housing for optimum performance. It normally should not be changed in the field. Should adjustment be necessary, factory approved procedures must be closely followed. Any inadvertent movement or replacement in the field will degrade performance, void the warranty and could render the device inoperative.

Calibration

- Remove the housing cover.
- To increase the set point at which the No. 1 (left side) switching element(s) actuates, turn the hex adjusting nut clockwise with a 3/4-inch open-end wrench.
- Sight across the flat top of the adjusting nut to the calibration scale at the bottom of the housing for an approximate set point. Use a 1/4% external pressure gauge to more precisely calibrate the pressure switch.
- Repeat steps b and c for the No. 2 (right side) set point. There is no interaction, so it is not critical whether the left or right side is set first.
- Replace the housing cover. The pressure switch can be placed in service.



Proper use

Pressure gauge valves are used to shut off pressure instruments in chemical plants, power stations or similar facilities.

The max. permissible operating pressure depends on the temperature of the medium and on the used materials of the parts and gaskets. Please pay attention to the pressure-temperature-diagram that you can find in the catalogue or on the drawing.

Any other use or any modification are not allowed and exclude the manufacturer from any liability.

General warning


Pressure gauge valves are used to shut off various media. These can be **poisonous, explosive, irritating, very hot or very cold**. Mounting, disassembling, operation and maintenance may only be done by experienced staff, which is familiar with the secure handling of the used medium.

In addition to these instructions also the common safety regulations and the instructions of the complete installation and of the measuring device have to be considered.

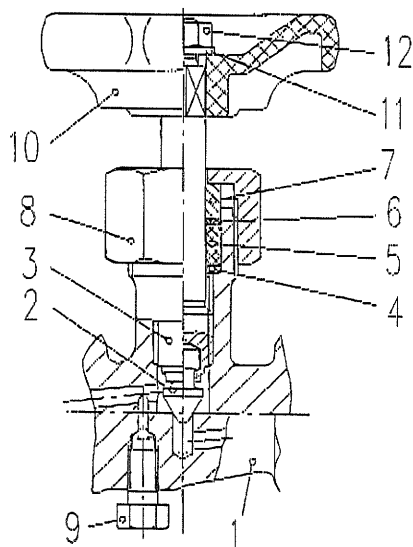
Suitability of material:

Protection against improper use of the pressure gauge valve:

In particular, it has to be ensured that the chosen materials of the wetted parts of the valve are suitable for the used media.

The manufacturer is not responsible for damages at the pressure gauge valve caused by corrosive media.

The disregard of these precautions can mean danger for the user and it can also cause damages in the piping system.



1	valve body
2	valve tip
3	stem
4	washer
5	packing
6	packing support
7	gland
8	union nut
9	vent screw
10	hand wheel
11	washer
12	hex. nut

Installation / Disassembling

Installation and disassembling may only be done at depressurized systems!

Even at depressurized systems the parts can be very hot or very cold for a reasonable period of time!

Small volumes of the medium can penetrate during disassembling.

Wear protective gloves and safety glasses!

Operating

The valves are operated by hand wheel.

Close clockwise.

1. Adjustment of packing

The packing (5; stem sealing against atmosphere) is pre-set at 1,5 times the nominal pressure. In case of long storage, the packing can lose it's tightness. In this case it should be adjusted as follows:

Open the stem (3). Tighten the union nut (8) 1/4 to 1/2 turn until the valve feels not too slack or difficult to operate.

2. Venting

Before using the vent screw (9) or the test connection, the valve has to be closed. The pressure which is retained between the valve and the instrument can then be reduced via the vent screw or the test connection. When the pressure is discharged, please make sure that no one is endangered by the escaping medium.

3. Replacing the packing

- Depressurize the impulse line.
- Open the stem (3) up to the stop and dismount the hand wheel (10).
- Dismount the union nut (8).
- Unscrew the stem (3). Take off the gland (7), the packing support (6), the packing (5) and the washer (4).
- Clean all parts and the sealing areas. Reassemble the new parts on the stem.
- Lubricate the thread of the stem (valves for oxygen service require special approved lubricants!).
- Screw in the stem.
- Tighten the union nut (8) with a torque of 26Nm (PTFE) resp. 30Nm (graphite).
- Reassemble the hand wheel (10).
- Pressurize the impulse line.
- Check the packing for tightness and whether the valve feels not too slack or difficult to operate.

4. Oxygen service

For degreased valves for oxygen service please consider the applicable accident prevention regulations.

When the thread protection caps are taken off, possibly remaining plastics are to be removed by suitable means.

Our products are manufactured to ISO9001 levels of quality assurance.

14.4 Differential pressure switch with shutoff valve

14.4.1 Differential pressure switch

Voith Article No.: 20500790110001

Type: 101RN-KK3-M4-C1A

Description Form # 506

14.4.2 Shutoff valve with test connection

Voith Article No.: 49907110

Type: LDV 10-S/DK

Description F11



Differential Pressure Switches

General Instructions



Mini-Hermet Models

General Purpose
and Weathertight
ModelsB-Series
Models

General

These instructions provide information for installation, electrical connection, process connection and calibration of Series 101/121 Differential Pressure Switches.

B-Series models (B3, B4, B5, B6) may be ATEX Approved with the addition of a CL option at the end of the model string. Specific information and instructions concerning these models will be found throughout the following pages.

NOTE: SOR discourages field modifications and field repair. Products should be returned to SOR for inspection and necessary repair work. Contact the factory for a return authorization number. Any field work should be performed by qualified instrument technicians using factory-authorized procedures.

Principle of Operation

Process pressure is sensed by a diaphragm and piston assembly. The piston responds to differential pressure and moves a shaft that actuates (deactuates) an electrical switching element. Low side pressure and an adjustable range spring oppose high side pressure. Adjustment of the range spring determines the set point. (See Calibration.)

CAUTION: Use care during installation to avoid moving the electrical switching element or its housing. Movement of either could change calibration or render the device inoperative.

Design and specifications are subject to change without notice.

Installation

This product should only be installed by trained and competent personnel.

1. Secure the housing to a bulkhead, panel rack or pipe stanchion with suitable bolts.

IMPORTANT: When bolting housings with integral mounting pads to irregular or uneven surfaces, install rubber washers between the housing and the mounting surface to prevent deformation of the housing.

CAUTION: Failure to mount the housing on a flat mounting surface may result in torsional forces on the housing that could cause false trips or render the pressure switch inoperative.

2. Line mounting by either process connection or electrical conduit connection is **not** recommended for housings with integral mounting pads.
3. Suggested mounting orientation is high side process pressure port at 6 o'clock. However, the device can be mounted in any position. Optional breather drains should be positioned to allow moisture to escape from the housing interior. *Breather drains must be kept clear of paint and foreign matter.*

CAUTION: For B-Series Housings

One vent hole should be fitted with a suitable breather to maintain weathertight rating NEMA 4, 4X, IP65 or vented to a safe area. Piping should be minimum 1/4" diameter and maximum 5 meters long (based on process fluid SG 1.0). The other vent hole may be plugged.

Process Connection

Connect the process lines to the pressure ports using two wrenches: one to hold the hex flats on the pressure port, the other to tighten the process pipe or tube fitting. The high pressure side (stamped HI) and the low pressure side (stamped LO) have 1/4" NPT(F) or 1/4" BSP(F) process connections as standard.

IMPORTANT: Rigid process piping must be arranged to minimize bending or twisting forces which could disturb the positioning of internal parts and change calibration or render the device inoperative after installation. Use care to avoid loosening the pressure port from the body or the body from the electrical housing.

Electrical Connection

Ensure that wiring conforms to all applicable local and national electrical codes and install unit(s) according to relevant national and local safety codes.

NOTE: For B-Series ATEX Certified Models

Electrical conduit connection threads may be of non-ISO thread form. Check the product nametag for relevant thread form information before attempting to connect to the electrical conduit connection. In the event a fitting is used, check the adaptor body for thread size information.

CAUTION: Electrical power must be disconnected from explosion proof models before the cover is removed. Failure to do so could result in severe personal injury or substantial property damage.

When making electrical connections, use care to avoid movement of the electrical switching element.

Electrical connections are either screw terminals, terminal blocks or 18-gauge, 18-inch wire leads.

Screw terminal and terminal block points are identified on the insulation card inside the electrical housing. Refer to the wiring schematic in Figure 1 for wire lead color codes.

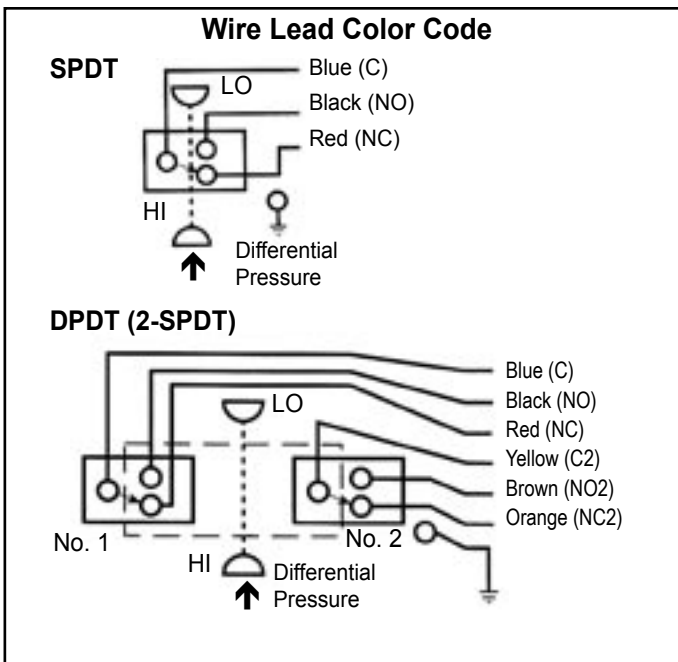


FIGURE 1

NOTE: Storing excess wire or making wire lead splices inside the pressure switch housing should not be done and may interfere with the pressure switch operation.

Calibration

Mini-Hermet models

Remove the weathertight cap. Use a 1/8" hex Allen wrench to turn the adjusting screw to the desired set point. Turn the adjusting screw clockwise (in) to increase the set point and counterclockwise (out) to decrease the set point. Use either the coarse or the precise set point calibration procedure.

CAUTION: Do not unthread the adjusting screw more than two threads below the flush point of housing as calibration could be adversely affected.

All Other Models

Use a 3/4-inch open-end wrench to turn hex adjusting nut clockwise to increase set point, and counterclockwise to decrease set point. An approximate set point can be obtained by sighting across top of adjusting nut to the calibration scale

on the interior wall of the housing. If coarse or precise set point calibration is required, calibrate according to the appropriate procedure.

WARNING: For B-Series Housings

The electrical compartment cover must remain sealed and the Allen locking screw tightened at all times to prevent removal of the cover while the pressure switch is in service. Removal of the cover while the pressure switch is in service in a hazardous location could result in severe personal injury or substantial property damage.

Coarse Calibration Procedure

1. Connect variable pressure source to test gauge and HI side pressure port.
2. Connect test light or ohmmeter across C – Common and NO – Normally Open switching element contacts.
3. Raise pressure and note test gauge reading when circuit closes.
4. Slowly drop pressure and note test gauge reading when circuit opens.
5. Turn set point adjustment clockwise to increase set point, or counterclockwise to decrease set point.
6. Repeat Steps 3, 4 and 5 until contacts change at desired increasing or decreasing differential pressure set point.

Precise Calibration Procedure

The precise calibration procedure references system (static) pressure. Set point accuracy is enhanced by calibrating the differential pressure switch under simulated service pressure conditions. The following test apparatus is recommended.

1. Differential pressure gauge
2. Variable pressure source
3. Block/bleed and equalizer valves
4. Test light or ohmmeter

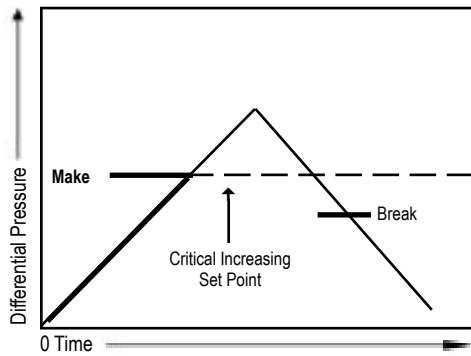
Determine whether the critical set point occurs on increasing or decreasing differential pressure, and calibrate using the appropriate procedure:

For Critical Set Point on Increasing Differential Pressure

1. Connect the continuity test lamp or ohmmeter across the C - Common and NO - Normally Open switching element / contacts.
2. Close the bleed valve(s), open the equalizer valve and raise pressure equally on both HI and LO sides to the static pressure that the differential pressure switch will see under normal operating conditions.
3. With static pressure stable, close the equalizer valve to isolate the HI side from the LO side.
4. Keeping high side pressure steady, slightly open the LO side bleed valve to reduce the LO side pressure (increase differential pressure) until desired differential pressure set point appears on indicator. Close bleed valve to stabilize differential pressure. Check the status of the electrical contacts against the following differential pressure trend graphs. Follow the instructions under the graph that matches the status of the contacts.

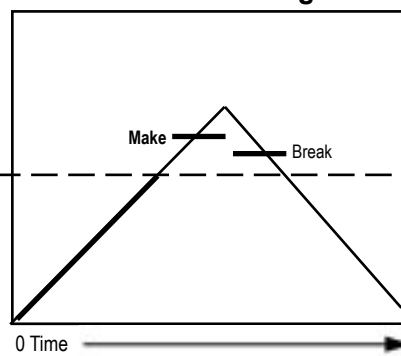
See SOR Form 468 for reference dimension drawings. For certified dimension drawings contact factory.

Set Point OK



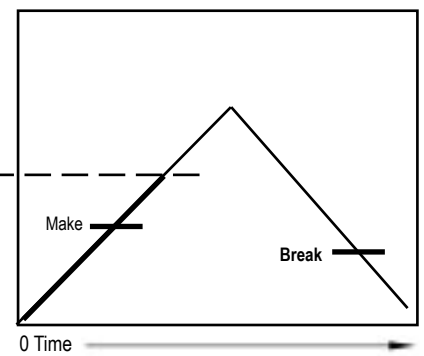
If contacts **make** precisely at critical increasing differential pressure set point, repeat Steps 2 - 4 as desired to verify calibration. Calibration is complete.

Contacts Open Set Point Too High



If contacts are **open** when critical increasing differential pressure is reached, turn set point adjustment counterclockwise (out) until contacts make. Repeat Steps 2-4.

Contacts Closed Set Point Too Low

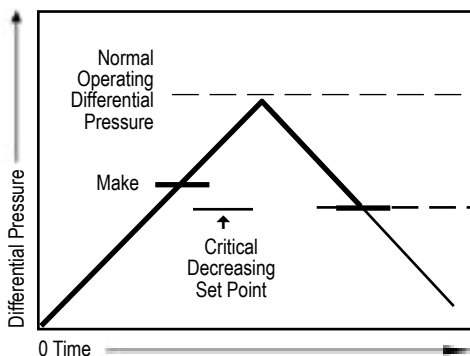


If contacts are **closed** when critical increasing differential pressure is reached, turn set point adjustment clockwise (in) until contacts break. From this point, turn set point adjustment counterclockwise (out) until contacts make. Repeat Steps 2-4.

For Critical Set Point on Decreasing Differential Pressure

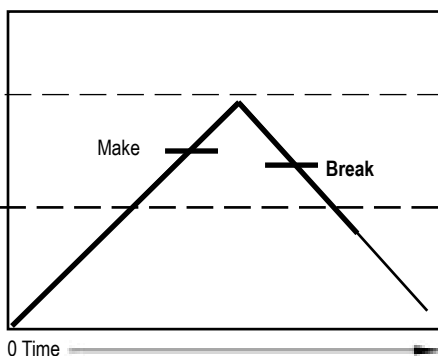
1. Connect the continuity test lamp or ohmmeter across the C - Common and NO - Normally Open contacts.
2. Close the bleed valve(s), open the equalizer valve, and raise pressure equally on both HI and LO sides to the normal operating *high* side pressure.
3. With normal HI side pressure stable, close the equalizer valve to isolate the HI side from the LO side.
4. Slightly open the LO side bleed valve to reduce LO side pressure (increase differential pressure) *until the normal operating differential pressure appears on the digital indicator*. Close the bleed valve to stabilize differential pressure. Contacts should close (make) by the time normal operating differential pressure is reached. If the contacts are still open at normal operating differential pressure, turn the set point adjustment counterclockwise (out) until the contacts make.
5. Keeping the high side pressure steady, slightly open the equalizer valve to increase LO side pressure (decrease differential pressure) until the desired differential pressure set point appears on the digital indicator. Close the equalizer valve to stabilize differential pressure. Check the status of the electrical contacts against the following differential pressure trend graphs. Follow the instructions under the graph that matches the status of the contacts.

Set Point OK



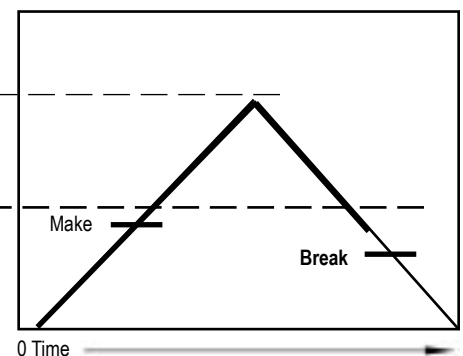
If contacts break precisely at critical decreasing differential pressure set point, repeat steps 2-5 as desired to verify calibration. Calibration is complete.

Contacts Open Set Point Too High



If contacts are **open** when critical decreasing differential pressure is reached, turn set point adjustment counterclockwise (out) until contacts make. From this point, turn set point adjustment clockwise (in) until contacts break. Repeat Steps 2-5.

Contacts Closed Set Point Too Low



If contacts are **closed** when critical increasing differential pressure is reached, turn set point adjustment clockwise (in) until contacts break. Repeat Steps 2-5.

Operation

For B-Series ATEX Certified Models

Maximum Surface Temperature

T6 Rating - 85°C

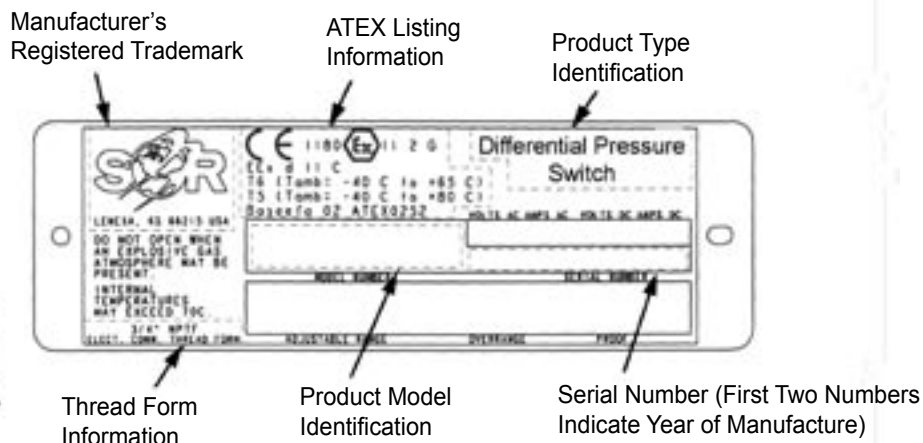
T5 Rating - 100°C

Basic and 4th Designator	Adjustable Range		Maximum System Pressure		Maximum Differential Pressure	
	psid	bar	psi	bar	psi	bar
101 □ □ - □ 3	3 to 30	.2 to 2.1	500	34	500	34
101 □ □ - □ 45	10 to 75	.7 to 5.2	500	34	500	34
121 □ □ - □ 45	75 to 500	5.2 to 34	1000	69	1000	69

Designator		AC Rating		DC Rating Resistive			
SPDT	DPDT	Volts	Amps	Volts	Amps	Volts	Amps
K	KK	250	15	125	0.4	30	5
KA	N/A	125	1	-	-	28	1
J	JJ	125	1	-	-	30	1
G	GG	250	15	125	0.5	-	-
A	AA	250	11	125	0.5	30	5
L	LL	250	15	-	-	30	10
E	EE	250	5	125	0.5	30	5
C	N/A	250	15	125	0.5	-	-
S	N/A	125	10	125	1.5 Minimum 10.0 Maximum	-	-
B	BB	250	5	125	0.3	-	-
Y	YY	250	5	125	0.5	-	-
W	N/A	250	5	125	0.3	-	-
T	N/A	250	15	125	0.4	-	-
H	N/A	250	15	-	-	-	-
AF	AG	250	5	125	0.5	30	5
EF	EG	125	1	-	-	28	1
JF	JG	125	1	-	-	30	1

ATEX Marking Information

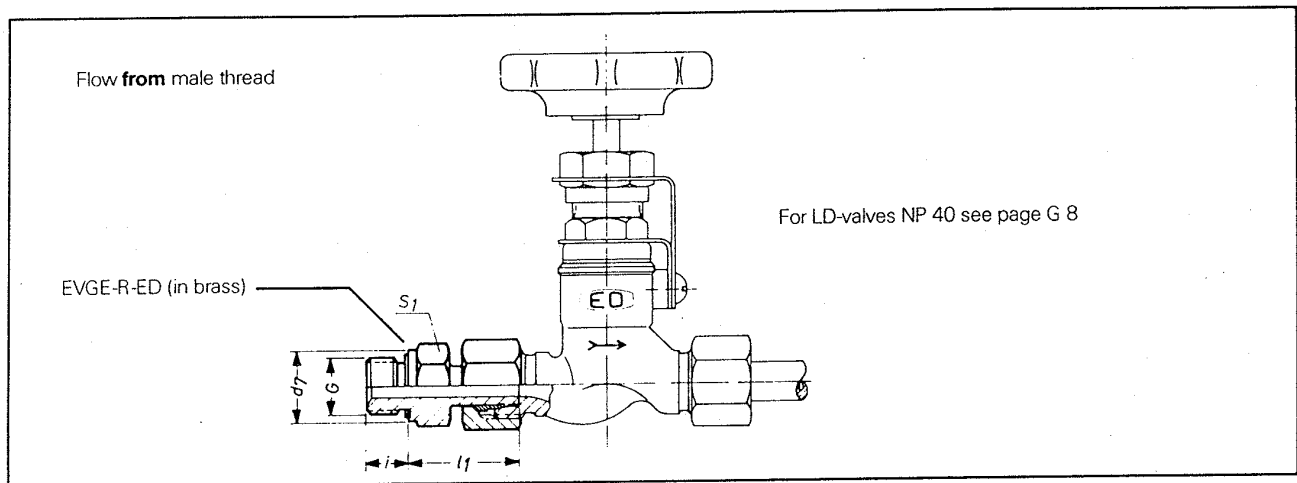
For B-Series ATEX Certified Models



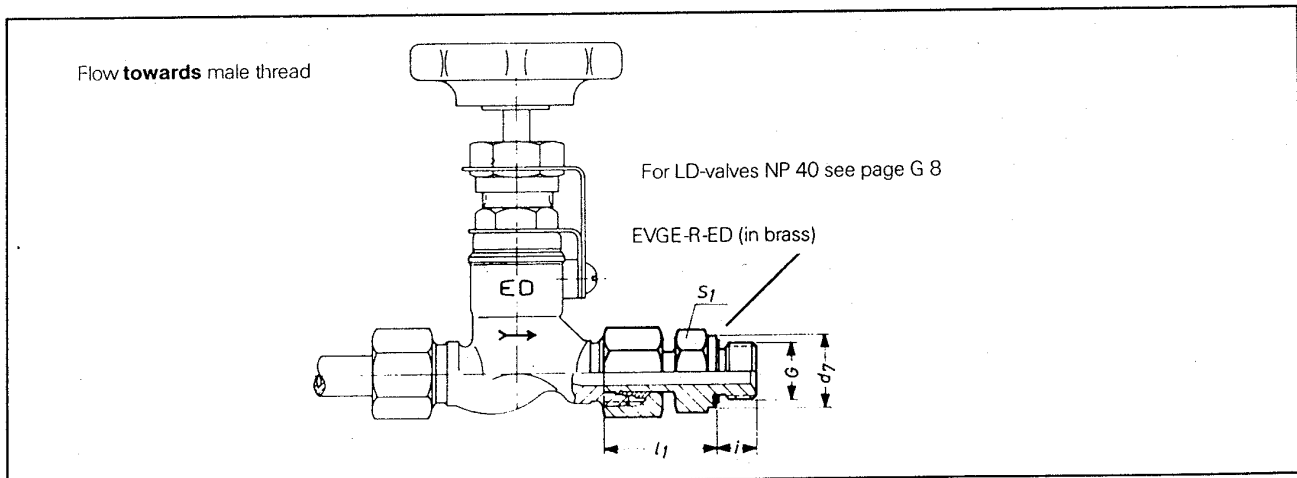
Shut-off valves NP 40

LDV/Z

with male thread and EOLASTIC®-sealing*



Tube o.d.	DN	G	i	d _{7-0,4}	S ₁	~ l ₁	Part no.	kg per piece
10	6	G 3/8	12	22	22	31,5	LDV 10-S/DK	0,51
12	8	G 1/2	14	27	27	34,5	LDV 12-S/R 1/2-DK	0,59
14	10	G 1/2	14	27	27	36,5	LDV 14-S/DK	0,65
16	12	G 3/4	16	32	32	38,5	LDV 16-S/R 3/4-DK	0,95
20	16	G 3/4	16	32	32	43	LDV 20-S/DK	1,07
25	20	G 1	18	40	41	48	LDV 25-S/DK	1,97
30	25	G 1 1/4	20	50	50	51	LDV 30-S/DK	2,25
38	32	G 1 1/2	22	55	55	58	LDV 38-S/DK	3,54



Tube o.d.	DN	G	i	d _{7-0,4}	S ₁	~ l ₁	Part no.	kg per piece
10	6	G 3/8 A	12	22	22	31,5	LDZ 10-S/DK	0,51
12	8	G 1/2 A	14	27	27	34,5	LDZ 12-S/R 1/2-DK	0,59
14	10	G 1/2 A	14	27	27	36,5	LDZ 14-S/DK	0,65
16	12	G 3/4 A	16	32	32	38,5	LDZ 16-S/R 3/4-DK	0,95
20	16	G 3/4 A	16	32	32	43	LDZ 20-S/DK	1,07
25	20	G 1 A	18	40	41	48	LDZ 25-S/DK	1,97
30	25	G 1 1/4 A	20	50	50	51	LDZ 30-S/DK	2,25
38	32	G 1 1/2 A	22	55	55	58	LDZ 38-S/DK	3,54

*EOLASTIC®-sealing of Perbunan (admissible temperature -20°C up to +90°C).
For steel pipes we recommend the use of shut-off valves with ecGE-ed-R of steel. Please indicate in order. · DK = abbreviation for Dieselkraftstoff (diesel fuel).

ERMETO ARMATUREN GMBH

F 11

14.5 Differential pressure gauge with shutoff valve

14.5.1 Differential pressure gauge

Voith Article No.: ____

Type: ____

14.5.2 Shutoff valve with test connection

Voith Article No.: ____

Type: ____

14.6 Scoop tube - Actuator

14.6.1 Actuator

Voith Article No.: 4255860003

Type: RHD 250-10

Instruction Manual42-68-153 DE

14.6.2 Power electronics

Voith Article No.: 4255812001

Type: CONTRAC EBN 853

Instruction Manual 42-68-822 DE Rev. 2

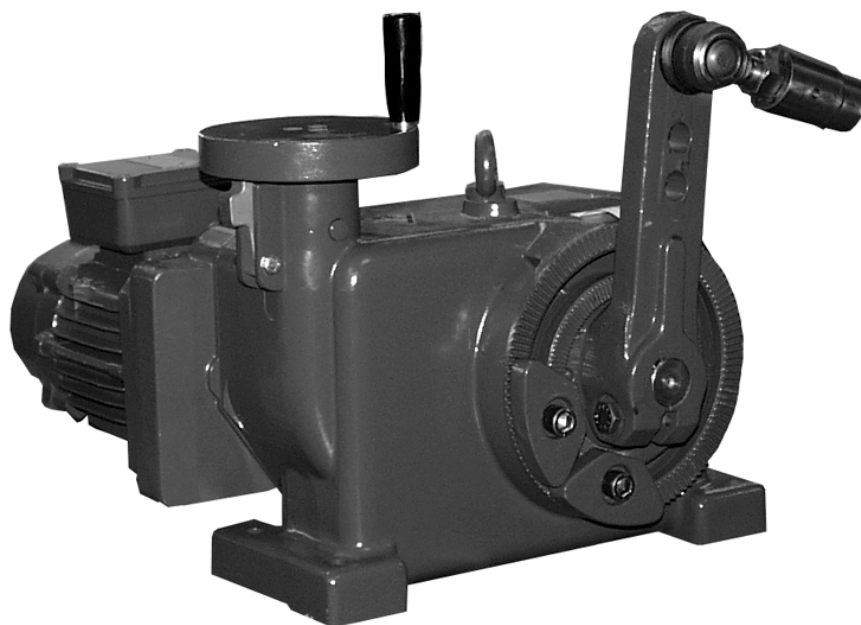
Contrac

**Part Turn Actuator
RHD 250**

Rated Torque 250 Nm

Operating Instructions

42-68-153 EN



(r0125rxa)

ABB

Table of Contents

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Your Notes	14

1. Device Identification

1.1 Actuator ID Label

1	Antrieb / Actuator: CONTRAC		
2	F-Nr./No	NL	
3	M =	Jahr/Year	CE
4	t =	IP 66	
5	min.....max.	max.	
6	Öl / Oil:		
7	Mit / With Elektronik/Electronics EBN 851 / EBS 852		
8			
9			
10			
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> Automation D-32425 Minden </div> <div style="font-size: 2em; font-weight: bold;">ABB</div> </div>			

1. Actuator type
2. Device number / No. of non-standard version
3. Rated torque / Year of manufacture
4. Permissible ambient temperature
5. Min./max. positioning travel / Min./max. speed
6. Filled-in oil type
7. Associated electronics
8. Not used
9. Not used
10. Available for customer-specific information

2. General

2.1 Proper Use

Control actuators are intended to be used exclusively for actuating final control elements (valves, vanes, etc.). Do not use these actuators for any other purpose. Otherwise, a hazard of personal injury or of damage to or impairment of the operational reliability of the device may arise.

2.2 Safety and Precautions

When mounting the actuator in areas which may be accessed by unauthorized persons, take the required protective measures.

- Control actuators perform movements for positioning vanes and valves. Handle properly and with care. Otherwise, a hazard of bruise injuries may arise.
- When changing the oil of the actuator, thoroughly remove any oil that may have run down on the floor during the procedure to avoid accidents.
- Dispose of the waste oil in compliance with the respective local regulations. Make sure that no waste oil reaches the water cycle
- Only qualified specialists who have been trained for these tasks are authorized to mount and adjust the control actuator, and to make the electrical connection.
- When working on the actuator itself or its electronics always observe the locally valid accident prevention regulations and the regulations concerning the construction of technical installations.

! Warning !

3. Storage

Contrac actuators may be stored under moist and aggressive condition for a short time. The equipment is protected against external corrosive influences. However, direct exposure to rain, snow, etc. must be avoided

Interior areas of the actuator with risk of condensation are protected by desiccant placed in the following locations:

Motor: under brake cover

Position sensor: under position sensor cover

Electronics (delivered separately): in terminal enclosure

The desiccant guarantees sufficient protection for approximately 150 days. It can be regenerated at a temperature of 90° C within 4 h.

The desiccant must be removed prior to commissioning the actuator or the electronics.

3.1 Long-time Storage

If you intend to store or transport the device for a longer time, we recommend to wrap it in plastic foil and add desiccant. Regularly check if the desiccant is still active.

4. Delivery State

If not otherwise specified by the customer, **Contrac** actuators are delivered with the following standard configuration:

Behavior in 0/100% position:	Shut-off with rated torque
Setpoint function:	Linear; setpoint = positioning value
Input (setpoint):	4 ... 20 mA
Function:	Positioner, parameter: setpoint
Output (actual value):	4 ... 20 mA
Digital inputs:	DI 1 switch-over manual/automatic and v.v. DI 2 / DI 3 manual control +/-
Digital outputs:	DO 1 ready to operate, DO 2/3 end position signaling
Range:	Not adjusted

The configuration of your actuator may differ from the standard configuration specified above. It can be called up for display using the configuration program.

5. Assemblies

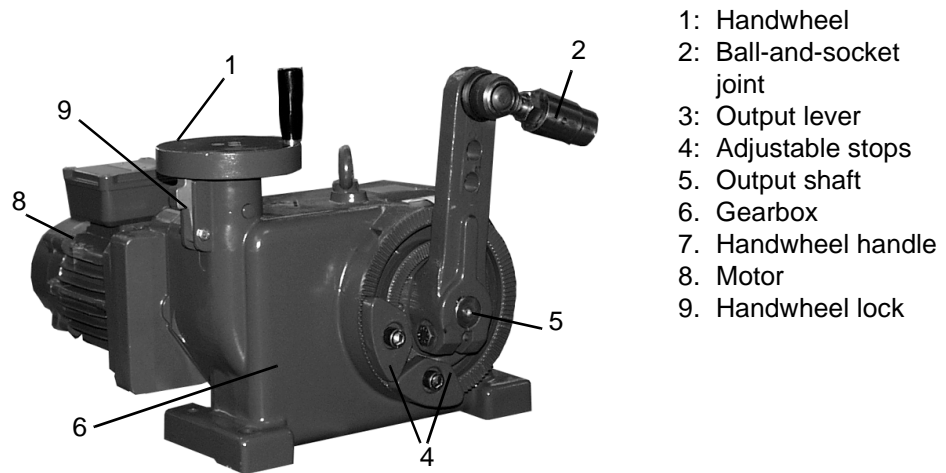


Figure 1: RHD 250

5.1 Operation

5.1.1 Normal mode

The motor (8) triggered by the power electronics drives the output shaft via oil-lubricated spur gears.

The brake built in the motor acts as a retainer when the power is off.

5.1.2 Handwheel mode

- Allows you to move the actuator manually when the electrical power is off.
- Press down the handwheel lock (9).
- Turn the handwheel to move the part turn actuator to the desired position.
- Release the lock.

6. Technical Data

	RHD 250-10
Rated torque [Nm]	250
Starting torque [Nm]	appr. 1.2 x rated torque (break-away torque in end positions 2 x rated torque for short time)
Rated speed [°/s]	9.0 ... 0.1 adjustable on power electronics
Motor	MCS 71 BA
Weight	approx. 45 kg
Associated electronics	For field mounting: EBN 851 For rack mounting: EBS 852
Power supply (on electronics)	115 V AC (94 V ... 130 V) or 230 V AC (190 V ... 260 V); 47.5 ... 63 Hz
Maximum power consumption at 115/230 V AC [A]	1.8 / 0.9
Current consumption in positioning mode	approx. 40 ... 50% of I_{max} , each

Table 1:

7. Lubrication

Prior to delivery the actuator is filled with 4.7 l oil in factory.

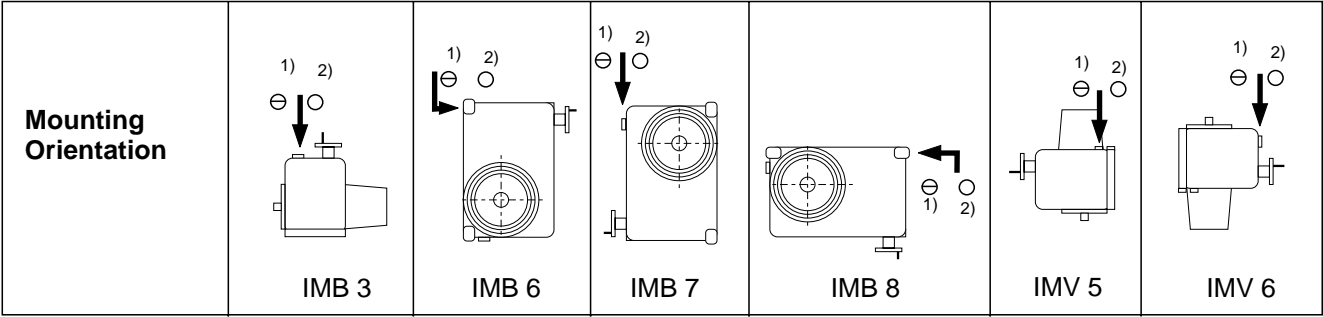


Figure 2:

Minimum oil quantity; approx. [l]	4.7	4.7	4.7	4.7	4.7	4.7
Min. oil level [mm] under inspection screw	40	12	15	Lower edge of upper oil screw	35	Lower edge of upper oil screw

Table 2: The arrow indicates the position of the inspection screw ¹⁾ and the vent screw ²⁾. After having mounted the actuator, replace the highest inspection screw with the separately delivered vent screw.

7.1 Lubricants

	Oil types	
Ambient temperature	Oil type used by manufacturer for first filling ¹⁾	Possible other oil types
- 10°C ... + 65°C	ESSO Spartan EP 220 (L-CKC to ISO TR 3498)	Aral Degol BMB 220 BP Energol GR-XP 220 Shell Omala 220 Mobilgear 630
- 30°C ... + 50°C	Mobil SHC 629	

Table 3:

! Warning !

Do not pollute the synthetic Mobil SHC 629 oil, nor mix it with mineral oils. Prior to changing over to synthetic lubricant oil always thoroughly clean the set of gears!

8. Mounting

8.1 Actuator Check

- Is the actuator filled with the appropriate oil type?
- Is enough oil in the actuator?
- Did you fasten the separately delivered vent screw in the highest bore (depending on the mounting orientation)?

8.2 Mounting Orientation

All mounting orientations seen in Figure 2 are permissible. To facilitate mounting and maintenance, however, it is recommended to use orientation IMB 3.

8.3 Mounting Instructions

- Make sure that the actuator is accessible from all sides to ensure convenient hand-wheel operation, electrical connection, and replacement of assemblies.
- Avoid direct exposure to rain, snow and other environmental influences. Select the mounting site accordingly.
- Exclusively mount the actuator on a rigid, non-vibrating support to avoid relative motion between the actuator and the valve.
- When mounting the actuator close to heat sources use an insulating layer or shielding.

8.4 Mounting the Actuator to the Valve

8.4.1 Preparing the Equipment

- Make sure that the shaft and lever bore surface are clean and free of grease.
- Determine the length of the stay tube (not included in the scope of delivery).
- Move the valve to the "CLOSED" position.
- Move the actuator to the corresponding end position using the handwheel. Observe the permissible angle.
- Refer to Figure 4 for the required length of the link tube.
- Drill a cone bore into the valve lever for mounting the second ball-and-socket joint, as seen in Figure 4.
- Insert the ball-and-socket joint, secure with crown nut and split-pin.
- Remove the welding bushings and weld them to the stay tube (C 15 to DIN 17210)
- Insert the link rod between the two ball-and-socket joints and screw it in.
- If required adjust "L" by turning the link rod.
- When all adjustment steps are finished, fasten the counter nuts.

8.4.2 Adjusting the Stops in Dependence of the Travel

- Move the output lever / valve to the position requiring fine adjustment.
- Put the stop onto the tothing as close to the output lever as possible and fasten with screws.
- Move the output lever towards the stop using the handwheel; turn the coupling rod for fine adjustment.
- Fasten the counter nuts.
- Fasten the stop in the other mounting position close to the end position, depending on the tothing.

8.4.3 Adjusting the Stops in Dependence of the Torque

- First proceed as described above for travel-dependent adjustment.
- Prior to re-fastening the counter-nut lock the handwheel and then turn the coupling rod in such a way that an initial tension occurs in the valve's closing position.
- Fasten the counter-nuts.

9. Electrical Connection

9.1 Wiring Diagram

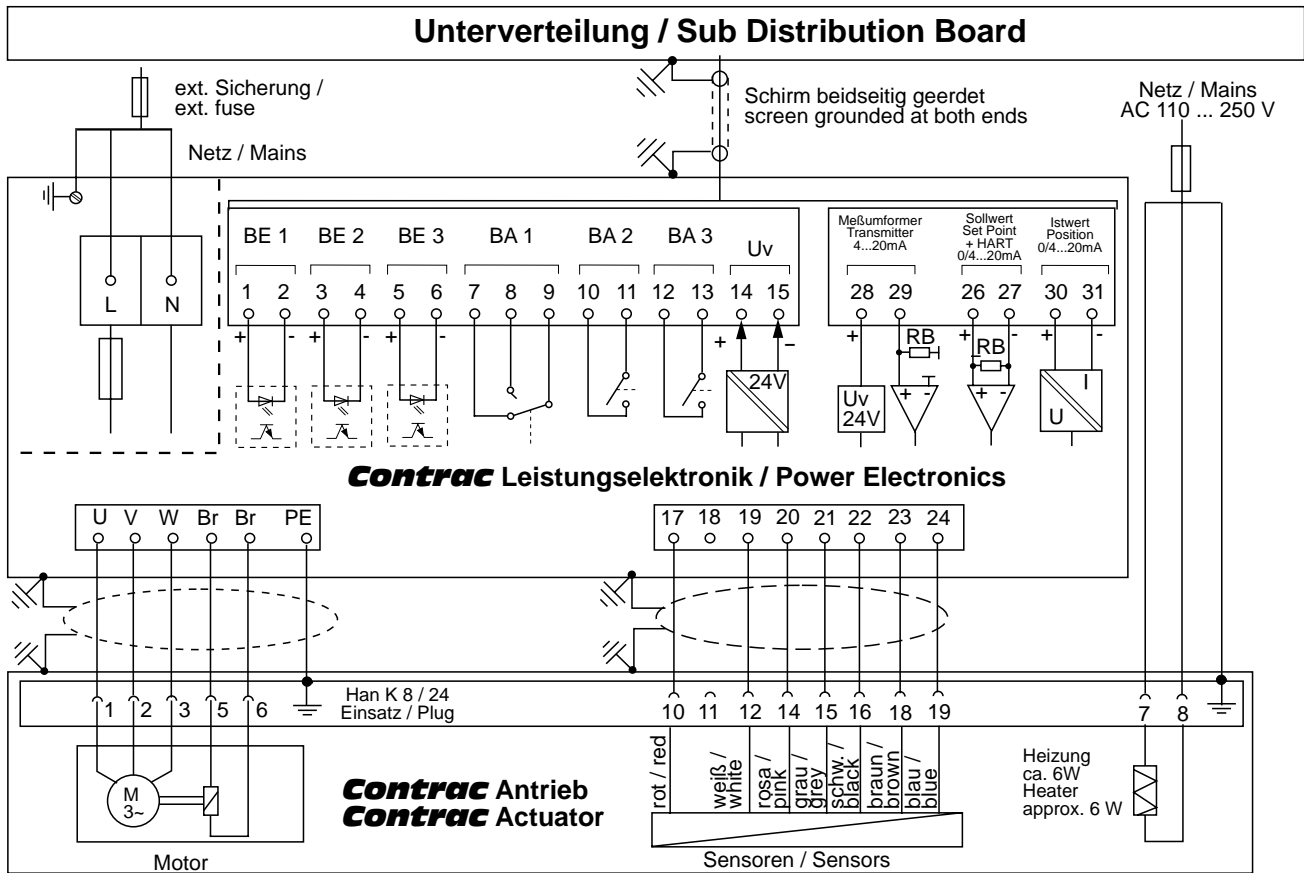


Figure 5: Wiring diagram for conventional triggering of EBN 851 / EBN 861 / EBS 852 / EBS 862 (optional heater)

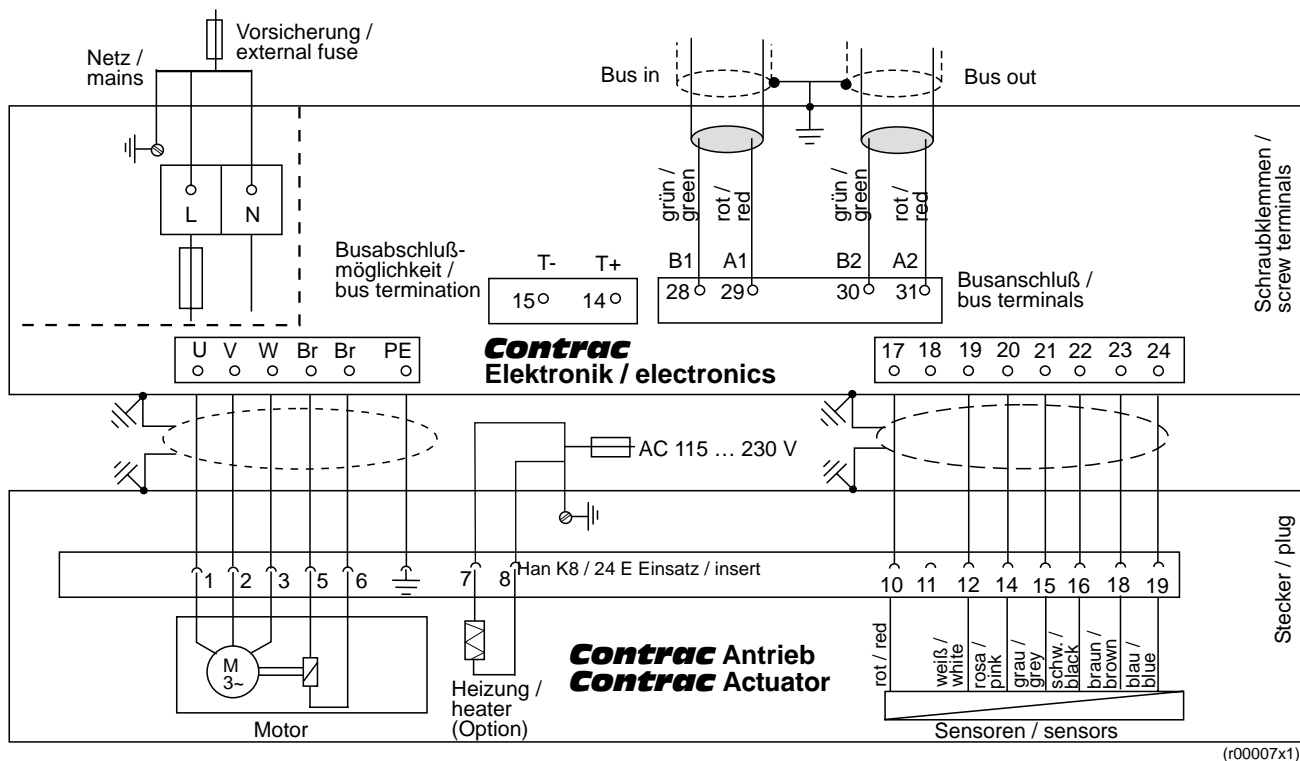


Figure 6: Wiring diagram for EBN 851 / EBN 861(bus connection)

The following steps must be performed to switch the actuator to automatic mode (AUT):

- Activate digital inputs DI 1, DI 2 and DI 3 via the configuration program.
- Make sure that the supply voltage is present on digital input 1 (DI 1).
- Activate AUT mode via the configuration program.

9.1.1 Signal Inputs and Outputs (Conventional Triggering)

(Standard)

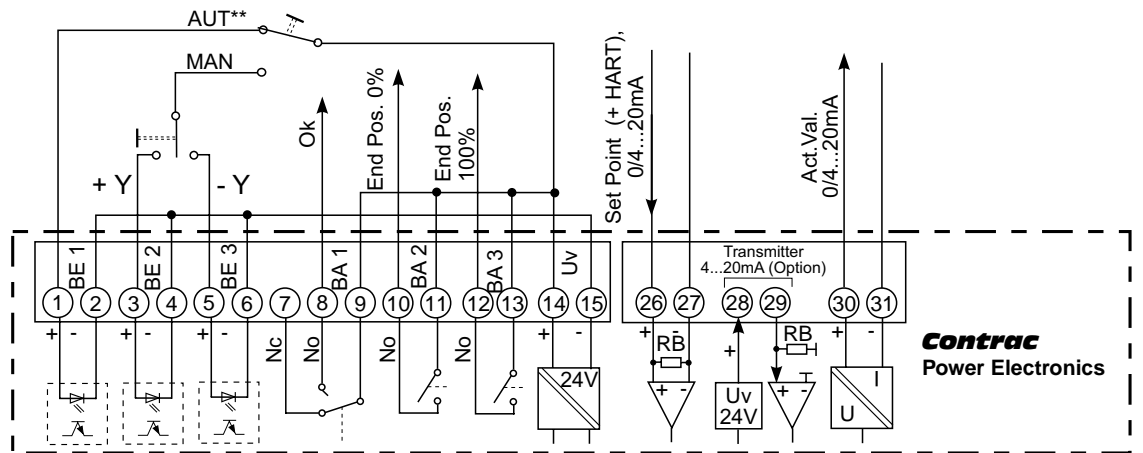


Figure 7:

** Write-protected when applying +24 V DC to DI 1.

9.1.2 Signal Inputs and Outputs (Conventional Triggering)

(after a step controller)

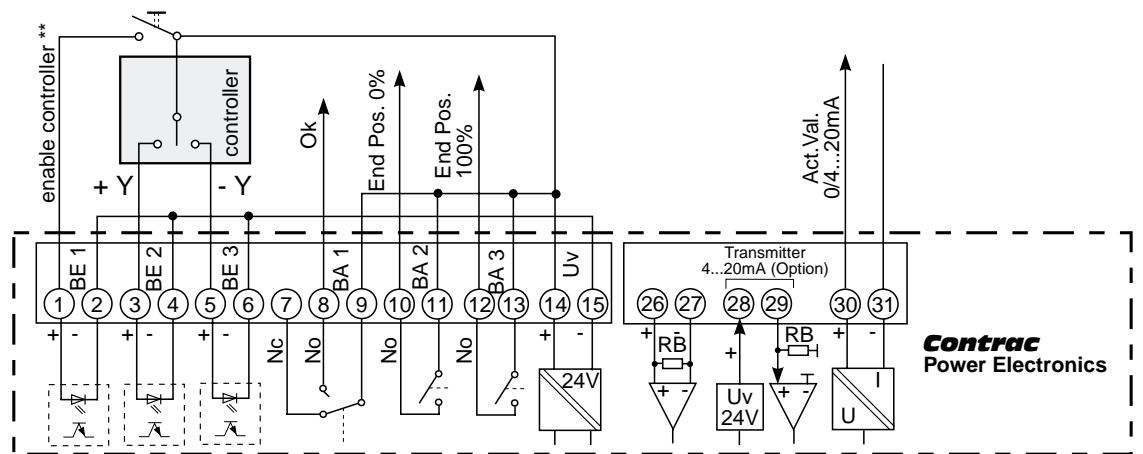


Figure 8:

** Write-protected when applying +24 V DC to DI 1.

Refer to Operating Instructions 42/68-820 (Power Electronics for Field-Mounting) and 42/68-821 (Rack-Mounting Electronics) for installation details.

10. Setup

! Note !

The commissioning and service field is located on the electronics!

The basic settings (definition of end positions) can be made via the commissioning and service field (CSF). It is used for adapting the actuator to the operating range and the effective direction without a PC. The actuator can be set up and configured completely using the appropriate configuration program.

10.1 Setup via CSF

10.1.1 Operating Elements

- | | |
|----------------------------|---|
| 1. Write-protect switch | (Default setting: OFF) |
| 2. LED for 100% position | Indication if adjustment procedure, saved position, or fault by different flash frequencies. |
| 3. Drive button | Press to cause drive motion |
| 4. Reset button | Press to restart processor and clear any 0% and 100% values. |
| 5. Drive button | Press to cause drive motion |
| 6. RS 232 socket | Connector for PC |
| 7. Potential toggle switch | Connection of reference potential to the system or protective earth (by default set to system) |
| 8. HART sockets | Connectors for HART communication |
| 9. LED for 0% position | Indication if adjustment procedure, saved position, or fault by different flash frequencies. |
| 10. Accept button (0%) | Press to define current position as 0%; simultaneously press push button 11 to complete the adjustment procedure. |
| 11. Accept button (100%) | Press to define current position as 100%; simultaneously press push button 10 to complete the adjustment procedure. |

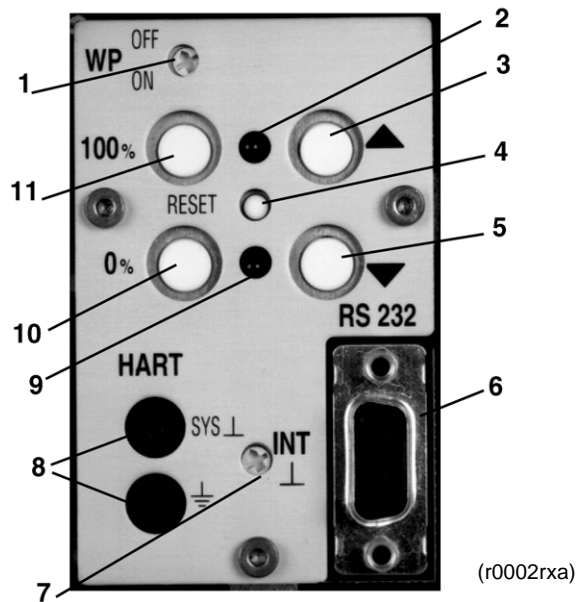


Figure 9: Commissioning and Service Field (CSF)

! Warning !

The actuator range is not preset in factory!

10.1.2 Initial Situation

- Electronics connected to power supply and actuator
- Write-protect switch (1) set to "OFF" position
- Electronics in operating mode "MAN" (no signal on DI 1)
- No fault (if a fault occurs, both LEDs flash alternately at 4 Hz)

10.1.3 Setup Procedure

- Undo the screws of the CSF
- Swing the cover to the side

10.1.3.1 “Adjustment” Mode

- Set electronics to “Adjustment” mode by pressing push buttons (3) and (5) simultaneously for approx. 5 seconds, until both LEDs (2 + 9) are flashing synchronously at approx. 4Hz.

10.1.3.2 Defining First Position (0% or 100%)

(Higher precision in 2nd position)

- Move to desired position by pressing push button (3) or (5).
- To accept the position, press push button (10) or (11); the associated LED flashes at approx. 1Hz when value is correctly accepted, the other continues to flash at approx. 4Hz

10.1.3.3 Defining Second Position (0% or 100%)

- Move to second position by pressing push button (3) or (5).
- To accept the position, press push button (10) or (11); both LEDs (2) and (9) are flashing at approx. 1Hz when value is accepted correctly.

10.1.3.4 Saving the Settings

- The settings are accepted by simultaneously pressing the push buttons (10 + 11); the LEDs (2 + 9) extinguish after a short time, and the adjustment procedure is completed.
- If the selected range is too small for the actuator, both LEDs will flash again at 4Hz, and the adjustment procedure has to be repeated with a larger value (min. positioning travel).
(See positioning travel specification on actuator ID label)

10.1.3.5 Correction after Setup

- If the setting is to be corrected after accepting the first value, first press the Reset button (4) and then repeat the setting.
- If the correction is to be done after saving the settings, the entire adjustment procedure must be repeated.

10.2 Adjustment Using the Configuration Program

Context-sensitive help information is available in the configuration program at all times. For basic handling and installation instructions refer to the associated manual, number 41/68-001.

10.3 Indication at CSF

Function	Indication
Adjustment	
Change-over to adjustment mode: Press and hold both drive switches for approx. 5 seconds	Both LEDs flash synchronously at approx 4Hz after time has expired.
Moving to an end position Use respective drive button on CSF	Both LEDs continue to flash at 4Hz while driving.
Saving the first end position Press button 0% or 100%	The associated LED flashes at approx. 1Hz, the other continues at 4Hz.
Saving the second end position Press button 0% or 100%	The associated LED flashes at approx. 1Hz synchronously to the first one.
Terminate adjustment Press 0% and 100% buttons simultaneously	Both LEDs are briefly lit together and then extinguish.
Operation	
Normal operation: MAN / AUT	LED off
Driving with button on CSF Priority over control system	LED off
Fault (both LEDs flash alternately at 4Hz)	
Reset: Resets fault indications	If no other fault conditions exist, both LEDs extinguish.
Reset if operating range is exceeded; press and hold both drive button for 5 seconds, then press Reset button	After approx. 5 seconds the flash rhythm is briefly interrupted. After “Reset” the electronics switch to adjustment mode.

Table 4:

! Warning !

A conductive ground connection is established between the PC and the CONTRAC electronics with the RS 232 communication cable. If the PC is grounded, this may cause a ground loop in the installation.

11. Maintenance

Contrac actuators have a robust construction. As a result, they are highly reliable and require only little maintenance. The maintenance intervals depend upon the effective load and are therefore not specified here.

The built-in microprocessor evaluates the actual load factors (e.g. torques, temperatures, etc.) and derives the remaining operating time until the next routine maintenance is required. Use the configuration program for viewing this information.

11.1 Motor and Gears

All maintenance work must be carried out by qualified specialists who have been trained for this task. As a rule, perform the following routine maintenance works:

- Check the shafts and gears.
- Check the motor pinion gear and the respective mating gear.
- Replace the motor's rotary shaft seal and ball bearings.
- Check the position sensor.
- Change the oil; then make a visual check and check for proper operation.

11.2 Adjusting the Brake

! Warning !

Note that the actuator setting may be changed accidentally by the repelling power of the valve when the brake is released!

In automatic mode the brake is permanently released. Therefore, it is not exposed to wear and does not require any re-adjustment.

11.3 Replacing the Position Sensor

11.3.1 Dismounting

- Remove the position sensor cover
- Use a crimp ejector tool to disconnect the cable from the connector plug.
- Undo the two fastening screws (1) of the position sensor and pull the sensor out of the gears.

11.3.2 Mounting

The toothed gear pair of the position sensor is held in place by a tension spring (3), to ensure sufficient free motion when the direction of rotation is reversed.

- Set the stop pin to the center position, as seen in Figure 10.
- Position the output shaft such that the groove for the fitting key is oriented upwards.
- Turn the potentiometer until the set screw is in 12:00 o'clock position (see Figure 10).
- Align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o'clock position onto the drive shaft gear (4).
- Slightly move the sensor back and forth to pre-tension the toothed gears with the difference "z" until the second toothed gear snaps in.
- Fasten the screws (1) tightly.
- Fasten the cable in the connector plug (observe the color code).

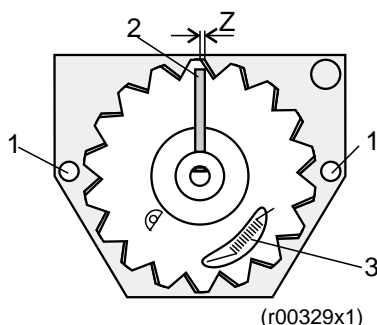


Figure 10: Position sensor SP 1

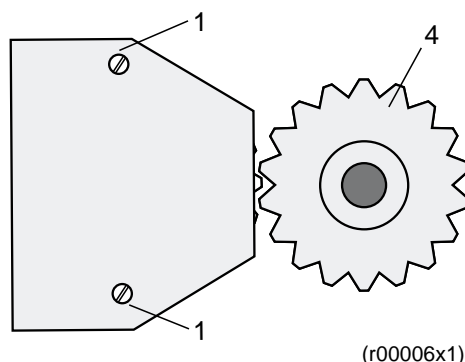


Figure 11: Mounting position of SP 1

After mounting is completed readjust the actuator range as described in section 10 of this manual.

12. Troubleshooting

This section only describes how to handle hardware errors. Refer to the configuration program's online help for errors related to the software.

Error	Possible reason	Measures to be taken
Valve cannot be moved by actuator	Malfunction of actuator or valve (e.g. cable gland fastened too tightly)	Disconnect the actuator from the valve. If the actuator is working properly then, the valve is likely to be defective. Otherwise, the actuator seems to be the error source.
Actuator does not react	No communication	Set up communication using the configuration program
	Motor / brake is defective	Check the winding resistances of the motor and brake. Check the brake fuse.
	Digital inputs of electronics are not connected	Connect
	Brake does not release (no audible "click" noise)	Check the air gap (should be around 0.25 mm) and the electrical connection of the brake. Check the winding resistance of the brake coil.
Actuator does not work in automatic mode, although "AUT" has been selected in the configuration program	Digital input 1 (DI 1) has not been connected.	Connect DI 1.
LEDs on the commissioning and service field are flashing simultaneously	Actuator has not been adjusted properly	Adjust the actuator.
Fault when approaching an end position	Actuator is working in the limit range of the position sensor	<ul style="list-style-type: none"> - Move the actuator either manually or with the CSF buttons to a position beyond the end position ¹⁾ (disconnect from valve if required). - Move actuator back. If required, reconnect to the valve (if applicable) - Adapt actuator to new operating range

Table 5:

¹⁾ If actuator end position = valve end position, mount the sensor as described in section 11.3.2.

12.1 Electrical Test Values

	MCS 071 BA
Winding resistance $\pm 5\%$ at 20° C (motor)	42 ohms
Winding resistance $\pm 5\%$ bei 20° C (brake)	2134 ohms

Table 6:

13. Your Notes

Subject to technical changes.

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ABB Automation Products
Schillerstraße 72
D-32425 Minden
Phone: +49 (571) 830 - 0
Fax.: +49 (571) 830 - 1860
<http://www.abb.de/automation>

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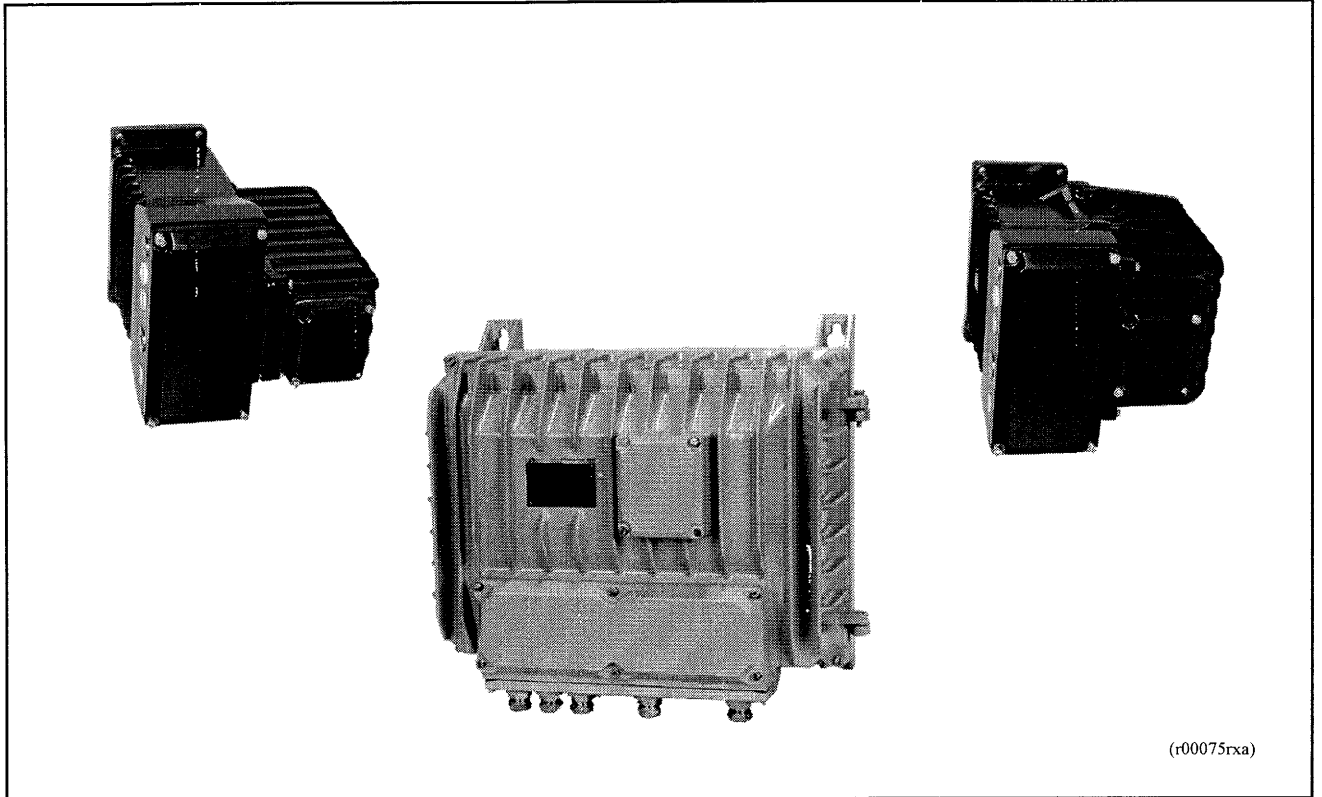
Electronics for Electrical, Continuous Actuators

**EAN 823, EBN 853,
EBN 861**

Power Electronics
For Field Mounting

Operating Instructions

42-68-822EN Rev. 2



ABB

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Legend

ELECTRICAL WARNING



An instruction with reference to electrical components or equipment. It draws attention to the risk of injury or death to persons or damage to the product, process or surroundings

WARNIG



General instruction that draws attention to the risk of injury or death to persons or damage to the product, process or surroundings

INFORMATION



Further reference for more detailed information or technical details.

1. Device Identification

1.1 General

The ID labels of the power electronics are located both on the base (power supply) and on the cover (electronics and software memory) of the unit. As the base and cover are considered as separate assemblies, they may have different serial numbers (BA numbers).

1.2 ID Label on the Base

1	Elektronik / Electronics Type:		Made in Germany
2	B-Nr./No.	NL	
3	U = 230 V ...	Jahr/Year	
4	f = 50/60 Hz ± 5%	Pmax. = W	
5	t =°C	IP 66	
6	Ext. Sicherung / Fuse		
			CE
Automation D-32425 Minden			
ABB			

1. Electronics type
2. Device no./ No. of non-standard version
3. Permissible supply voltage range / Year of manufacture
4. Permissible frequency range / Max. power dissipation
5. Permissible ambient temperature / Protection class
6. Information on external fuse


1.3 ID Labels on the Cover

1.3.1 ID Label for Software Description

1	Für / For Antrieb / Actuator
2	Mit / NL. Nr./No.
3	Eingestellt / adjusted auf/for M=..... %s
4	F-Nr. / No. Software Version
5	

- 1 Associated actuator
- 2 Number of non-standard version (if required)
- 3 Adjusted torque / Adjusted speed
- 4 Device number of cover
Downloaded software version
- 5 Available for customer-specific information

1.3.2 ID Label for Hardware Description

1	Elektronik / Electronics Type:		Made in Germany
2		NL	
3		Jahr/Year	
4			
5	t =°C	IP 66	
6			
			CE
Automation D-32425 Minden			

1. Electronics type
2. Device number / No. of non-standard version
3. / Year of manufacture
4. /
5. Permissible ambient temperature / Protection class
- 6.

2. General

2.1 Proper Use

Power electronics models EAN 823, EBN 853 and EBN 861 are to be used exclusively for triggering electrical actuators of the PME 120, LME 620, RSD... or RHD ... series. Do not use them for any other purpose. Otherwise, a hazard of personal injury or of damage to or impairment of the operational reliability of the device may arise.

2.2 Safety and Precautions

When mounting the electronics in areas which may be accessed by unauthorized persons, take the required protective measures.

- Only qualified specialists who have been trained for these tasks are authorized to mount and adjust the electronics, and to make the electrical connection.
- When working on the electronics always observe the locally valid accident prevention regulations and the regulations concerning the construction of technical installations.



3. Storage

The devices may be stored under moist and aggressive condition for a short time. The equipment is protected against external corrosive influences. However, direct exposure to rain, snow, etc. must be avoided.

Condensation may occur in the terminal box. Therefore, it is protected by a desiccant, which ensures sufficient protection for approximately 150 days. The desiccant can be regenerated at a temperature of 90° C within 4 h.

The desiccant must be removed prior to commissioning the electronics.

3.1 Long-time Storage

If you intend to store or transport the device for a longer time, we recommend to wrap it in plastic foil and add desiccant. Regularly check if the desiccant is still active.

4. Delivery settings

Behavior in 0/100% position:	Shut-off with rated torque
Setpoint function:	Linear; setpoint = positioning value
Input (setpoint):	4 ... 20 mA ¹⁾
Function:	Positioner, parameter: setpoint
Output (actual value):	4 ... 20 mA ¹⁾
Digital inputs: ¹⁾	DI 1 switch-over manual/automatic and v.v. DI 2 / DI 3 manual control +/-
Digital outputs: ¹⁾	DO 1 ready to operate, DO 2/3 end position signaling
Range:	Not adjusted

The configuration of your actuator may differ from the standard configuration specified above. It can be called up for display using the configuration program.

1) not with fieldbus communication.

5. Assemblies

Power electronics EAN 823, EBN 853 and EBN 861 consist of 2 parts each, one containing the connecting units (EAN 823 and EBN 853) and the transformer, the other containing the electronics and the commissioning and service panel (CSP) for local operation and adjustment of the actuator.

5.1 EAN 823 / EBN 853

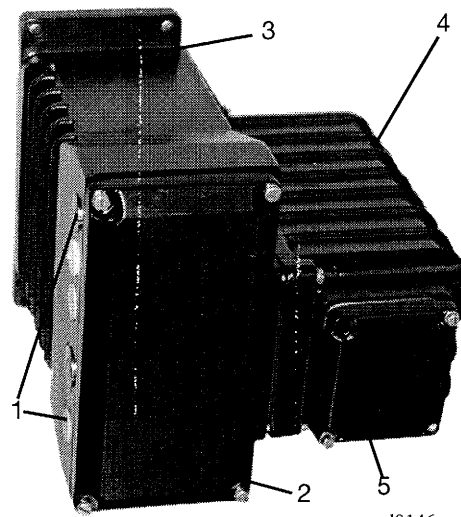


Figure 1: Electronic unit EAN 823

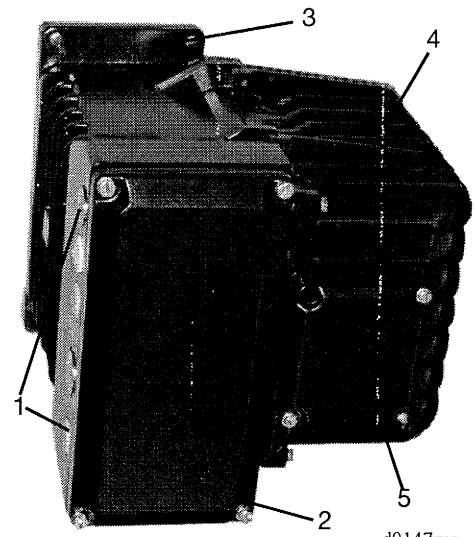


Figure 2: Electronic unit EBN 853

- 1 taphole for cable glands
- 2 cover for connection chamber
- 3 connection housing
- 4 electronic hod
- 5 cover for commissioning and service panel

5.1.1 Connection chamber

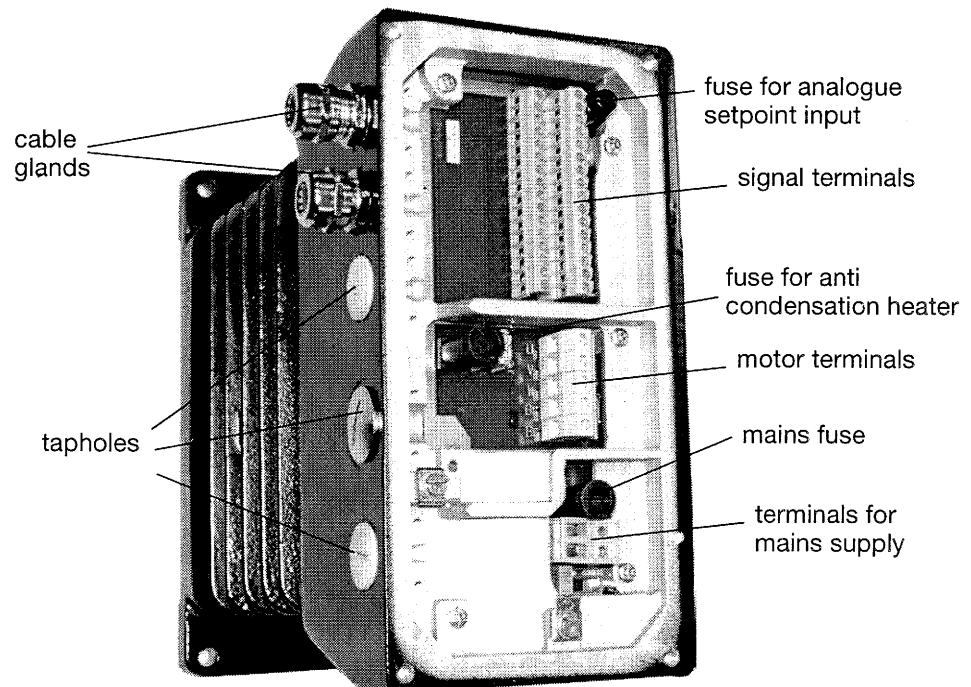


Figure 3: connection chamber EAN 823 / EBN 853.

The standard scope of delivery considers tapholes covered with screw-in plugs. Adapters for PG or NPT cable glands are available on request.

5.2 EBN 861

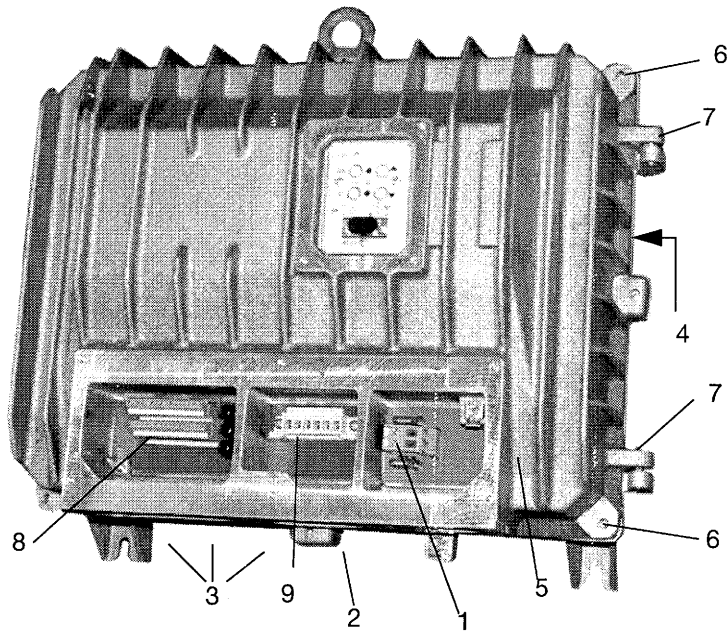


Figure 4: EBN 861

- 1 Mains cable
- 2 Power cable (motor) to the actuator
- 3 Link cable (signals)
- 4 Transformer and power part
- 5 Part for electronics and for commissioning and service field
- 6 Cover screws
- 7 Hinge screws
- 8 Terminal strip (signals)
- 9 terminal strip (motor / brake)

6. Technical Data

6.1 General

	EAN 823	EBN 853	EBN 861
Supply voltage	115 V AC (94 V ... 130 V) or 230 V AC (190 V ... 260 V) ; 47.5 ... 63 Hz; 1Ph		230 V AC (190 V... 60 V); 47.5 ... 63 Hz; 1Ph
External fuses	16 A; slow-blow		35 A fuse 16 A thermal safety cutout
Analog input ¹⁾	0 / 4 ... 20 mA		
Analog output ¹⁾	0 / 4 ... 20 mA, electrically isolated		
Digital inputs, DI ¹⁾	Logical 0:-3V ... + 5 V or open, electrically isolated Logical 1:+12 V ... + 35 V, electrically isolated		
Digital outputs, DO ¹⁾	Potential-free relay contact, max. 60 V, 150 mA		
Digital communication	RS 232 for commissioning and service, optional FSK / HART® or Profibus DP		
Default settings	Behavior in 0/100% position: Setpoint function: Input (setpoint): Function: Output (actual value): Digital inputs: Digital outputs:		Shut-off with rated torque Linear; setpoint = positioning value 4 ... 20 mA ¹⁾ Positioner, parameter: setpoint 4 ... 20 mA ¹⁾ DI 1 switch-over manual/automatic and v.v., DI 2 / DI 3 manual control +/- ¹⁾ DO 1 ready to operate, DO 2/3 end position signaling ¹⁾
Individual settings	See data sheet 68-2.40 or on request		
Protection class	IP 66		
Humidity	≤ 95% annual average (condensation permitted)		
Ambient temperature	-25° C ... +55° C		
Mounting orientation	Mounting on vertical mounting plate, cable glands to the left		Mounting on vertical mounting plate, cable glands at the bottom
Varnish	2-component epoxy resin (RAL 9005, black)		
Link cable between actuator and electronics	optionally 5m, 10m or 20m		
Weight	approx. 10 kg	approx. 11 kg	approx. 42 kg

Table 1:

¹⁾ Not available for communication via Profibus DP

6.2 Current Consumption of EAN 823

	I _{max} 115 V	I _{max} 230 V	I _{pos.}
PME 120 AN	1.0 A	0.55 A	each around 40 ... 50% of I _{max}
LME 620 AN	1.0 A	0.55 A	

Table 2:

6.3 Current Consumption of EBN 853

	I_{max} 115 V	I_{max} 230 V	I_{pos.}
RHD 250-10	1.8 A	0.9 A	each around 40 .. 50% of I _{max}
RHD 500-10	2.2 A	1.1 A	
RHD 800-10	3.4 A	1.7 A	
RHD 1250-12	6.0 A	3.0 A	
RHD 2500-25	4.8 A	2.4 A	
RHD 4000-40	4.0 A	2.0 A	
RHD 8000-80	4.0 A	2.0 A	
RSD 10-5,0	3.4 A	1.7 A	
RSD 10-10,0	3.8 A	1.9 A	
RSD 20-5,0	4.8 A	2.4 A	
RSD 20-7,5	3.8 A	1.9 A	
RSD 50-3,0	4.0 A	2.0 A	
RSD 100-1,5	4.4 A	2.2 A	
RSD 200-0,7	5.0 A	2.5 A	

Table 3:

6.4 Current consumption of EBN 861

	I_{max} 230 V	I_{pos.}
RHD 2500-10	5.3	around 40 ... 50% of I _{max}
RHD 4000-10	10.0	
RHD 8000-15	8.0	
RHD 16000-30	12.5	
RSD 50-10,0	6.4	
RSD 100-10,0	12.5	
RSD 200-5,5	13.0	

Table 4:

6.5 Fuses

Electronics	Fuse type	Mounting site	U = 115 V	U = 230 V ¹⁾
EBN 823	Series fuse	external	16 A, slow	
	Mains fuse	in connection chamber	6.3 A, slow	3.15 A, slow
	Relay fuse for DO 1, DO 2, DO 3	on processor board, contact manufacturer for replacement	3 x 0.5 A; medium time-lag	
EBN 853	Series fuse	external	16 A, slow	
	Mains fuse	in connection chamber	12.5 A, slow	10 A, slow
	Relay fuse for DO 1, DO 2, DO 3	on processor board, contact manufacturer for replacement	3 x 0.5 A; medium time-lag	
	Brake fuse	power board	0.315 A, medium time-lag	
	Intermediate circuit fuse	power board	10 A, super-quick	
EBN 861	Series fuses ¹⁾	external	35 A fuse 16 A thermal safety cutout	
	Relay fuse for DO 1, DO 2, DO 3	on processor board, contact manufacturer for replacement	3 x 0.5 A; medium time-lag	
	Brake fuse	on board (power section)	0.315 A, medium time-lag	
	Intermediate circuit fuse	power board	15 A, medium time-lag	

Table 5:

¹⁾ The 35 A fuse and the thermal safety cutout (16 A) are included in the scope of delivery. They ensure safe operation for the special switching conditions of power electronics EBN 861. Note that the cable cross-sectional area between the fuse and the electronics must be at least 2.5 mm².

7. Mounting

Install the electronics close to the actuator. The connection is made via a 32-pin connector on the actuator side and screw terminals on the electronics side. The electronics are provided with the appropriate PG cable glands (see Figures 1 to 3 for the assignment).

7.1 Preparing the electronics

- Make sure that disconnection on site is possible.
- Shield all signal cables and the motor cable between the actuator and the electronics
- The shield of the connection cable between the electronics and the actuator must be applied to both housings.

7.2 Mounting of EAN 823 / EBN 853

Disconnect the electronics and the actuator prior to all installation and service works.

- Fasten the unit to the vertical mounting plate, using screws of property class 8.8 (tensile strength 800 N/mm²; yield strength 640 N/mm²)
- Make sure that there is enough spacing for mounting, and that the unit can be easily accessed
- Make sure that the cable glands are oriented to the left
- Remove the cover of the connection chamber (2)
- Insert the cables through the cable glands and connect them according to the wiring diagram.
- Check if the cable is connected properly; then close the connection chamber cover. Adjust as described in section 9.

7.2.1 Mounting electronics EBN 861

Electronics unit EBN 861 has a total weight of around 42 kg. For safety reasons it may be necessary to mount each of the two parts separately.

- Undo and remove the cover screws (4).
- Undo the hinge screw (5)
- Fold down the front part, then lift it off from the hinge bolts towards the top.
- Undo the internal connection between the two housing parts.
- First mount the rear part of the housing
- Attach the front housing part to the hinge bolts, insert a screw into the top bolt and fasten.
- Make the internal connections between the two housing parts.
- Close the cover and fasten the cover screws (4)
- Connect the cables

The item numbers refer to Figure 1 to 4.



8. Electrical Connection

The electrical connection is done with a combined plug on the actuator and with screw terminals on the electronics.



8.1 Wiring diagram EAN 823 (Conventional)

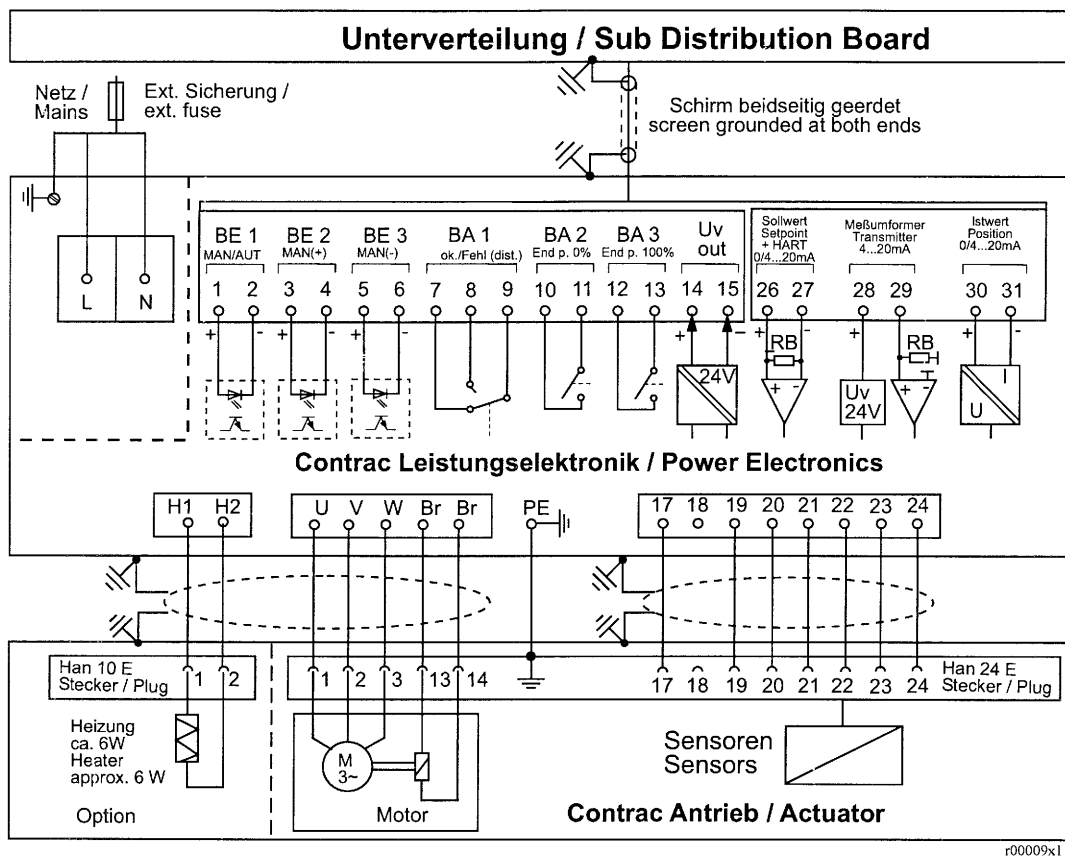


Figure 5:

8.2 Wiring diagram EAN 823 (Profibus DP)

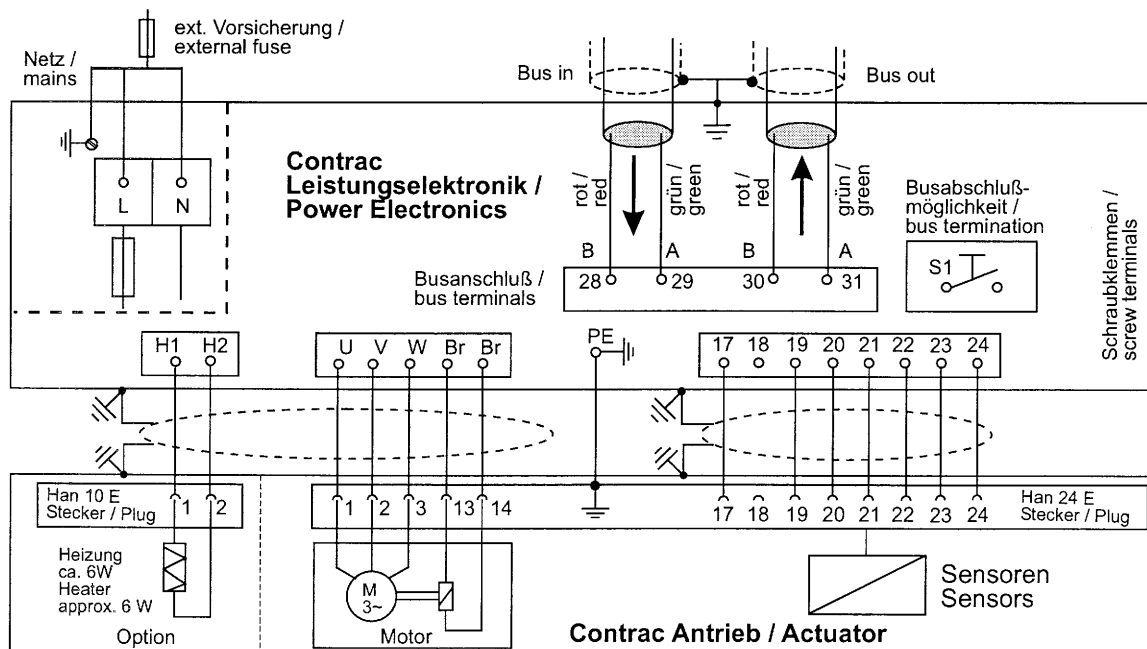


Figure 6:

8.3 Wiring diagram EBN 853 (Conventional)

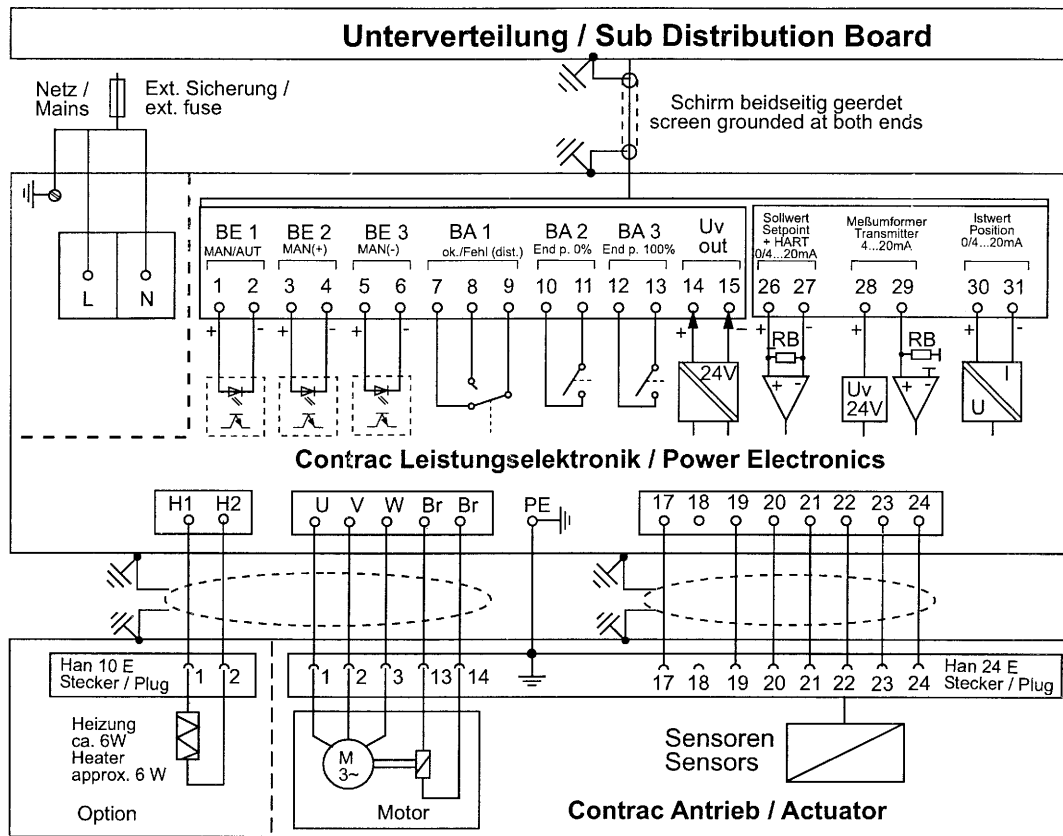


Figure 7:

8.4 Wiring diagram EBN 853 (Profibus DP)

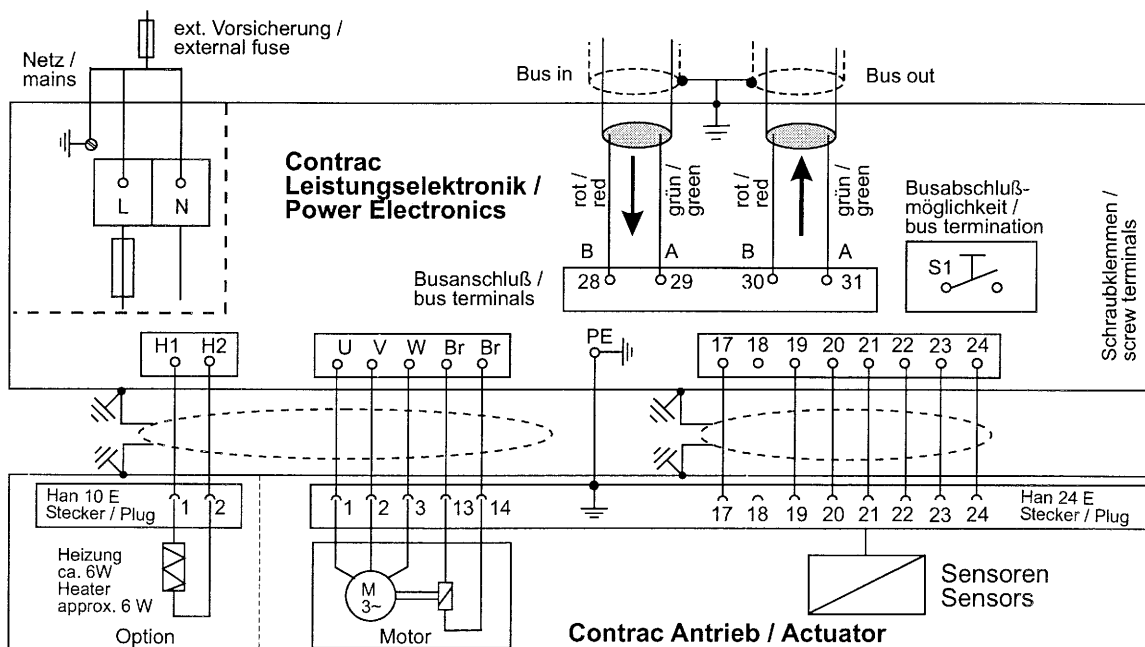


Figure 8:

8.5 Wiring diagram EBN 861 (Conventional)

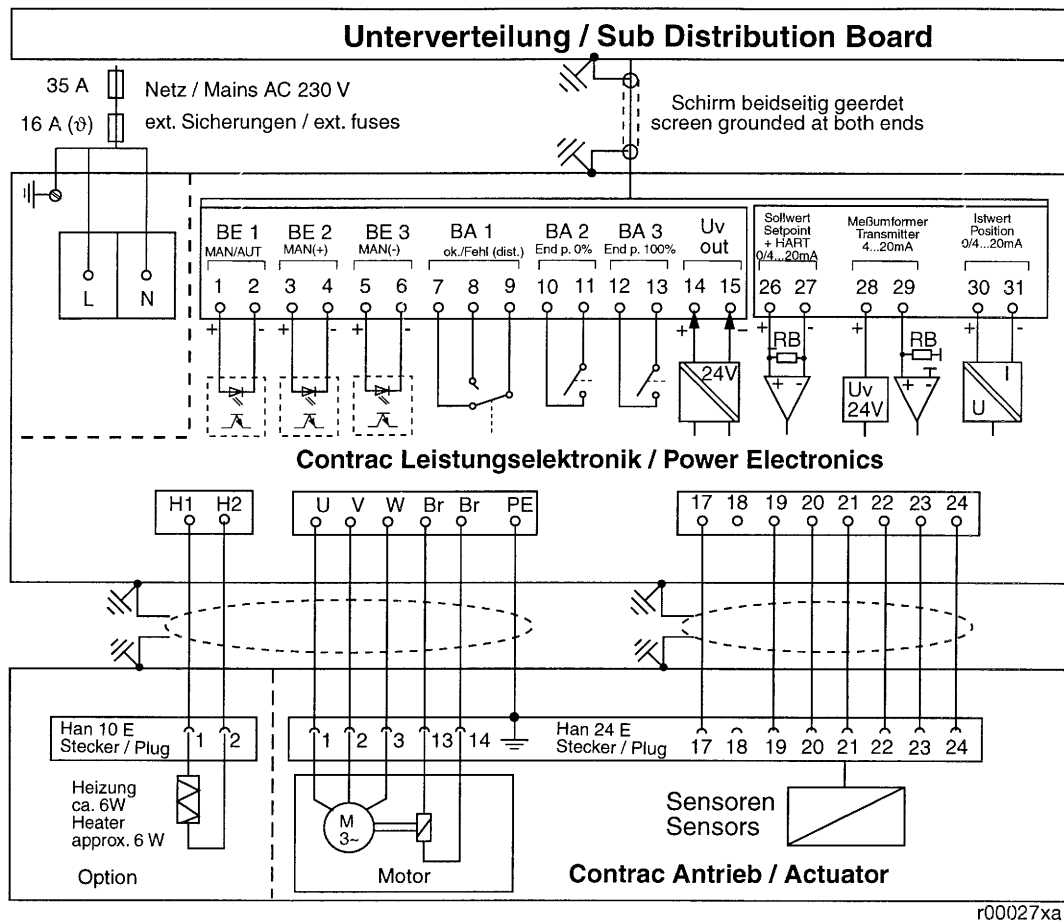


Figure 9:

8.6 Wiring diagram EBN 861 (Profibus DP)

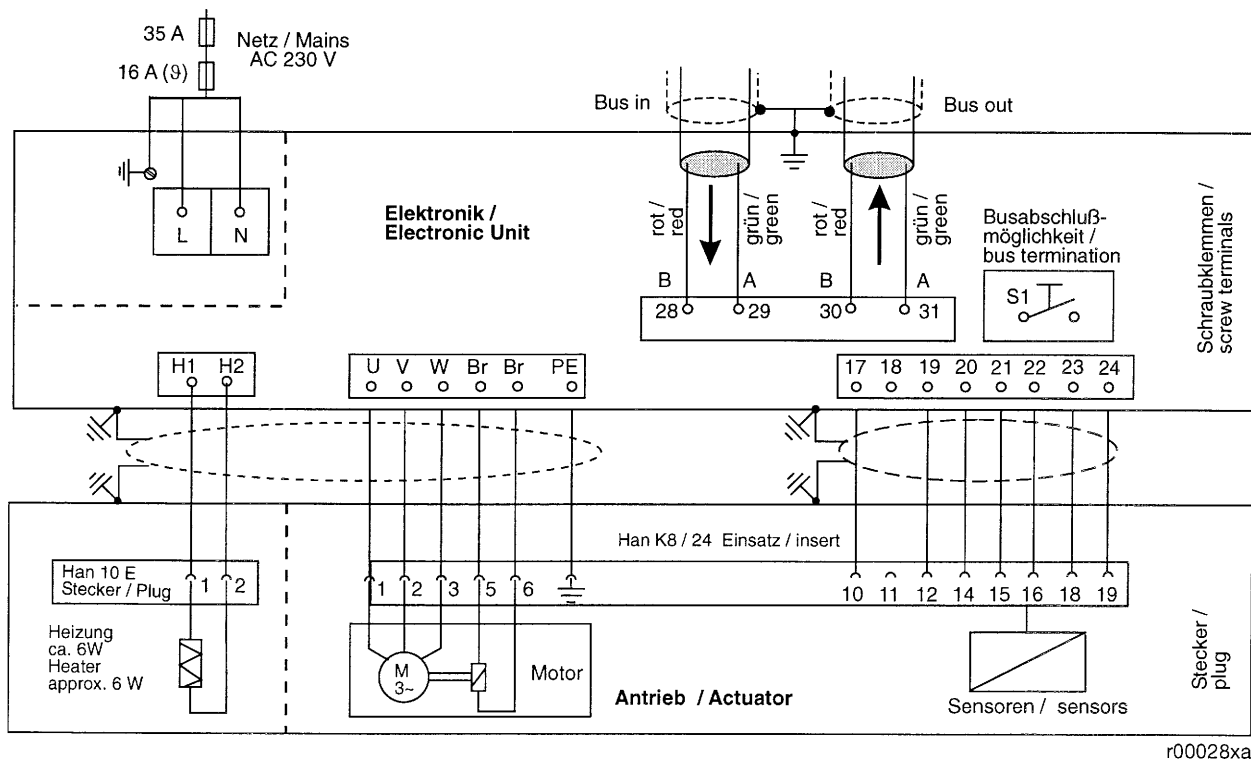


Figure 10:

8.7 Signal Inputs and Outputs

8.7.1 Standard

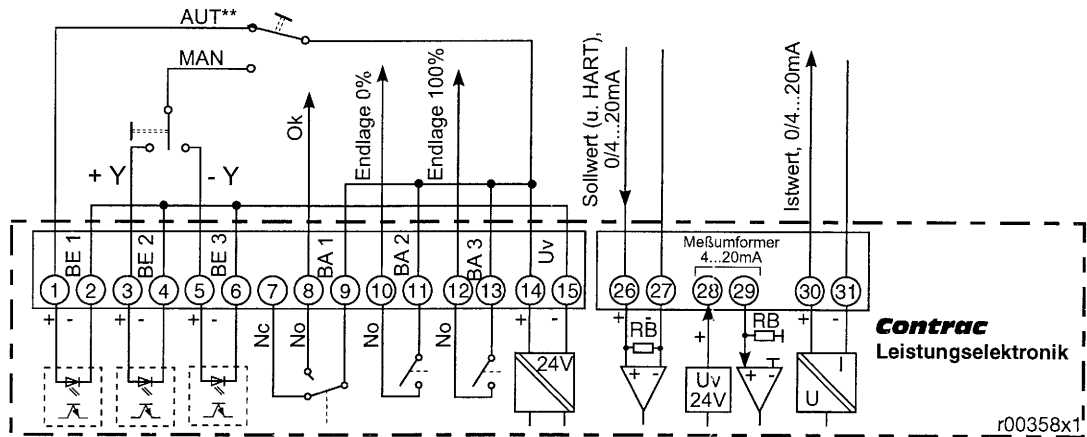


Figure 11:

8.7.2 Operation after a Step Controller

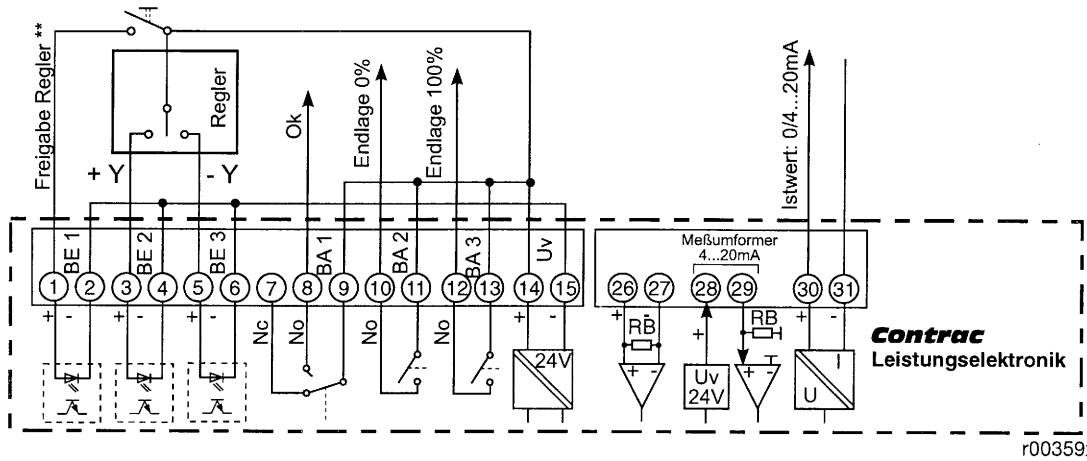


Figure 12:

8.8 Connecting the Cable Shield

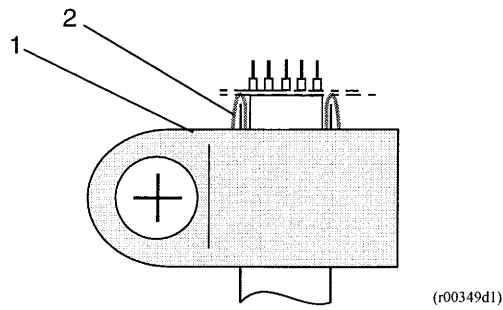


Figure 13: Connecting the cable shield of EAN 823 and EBN 853

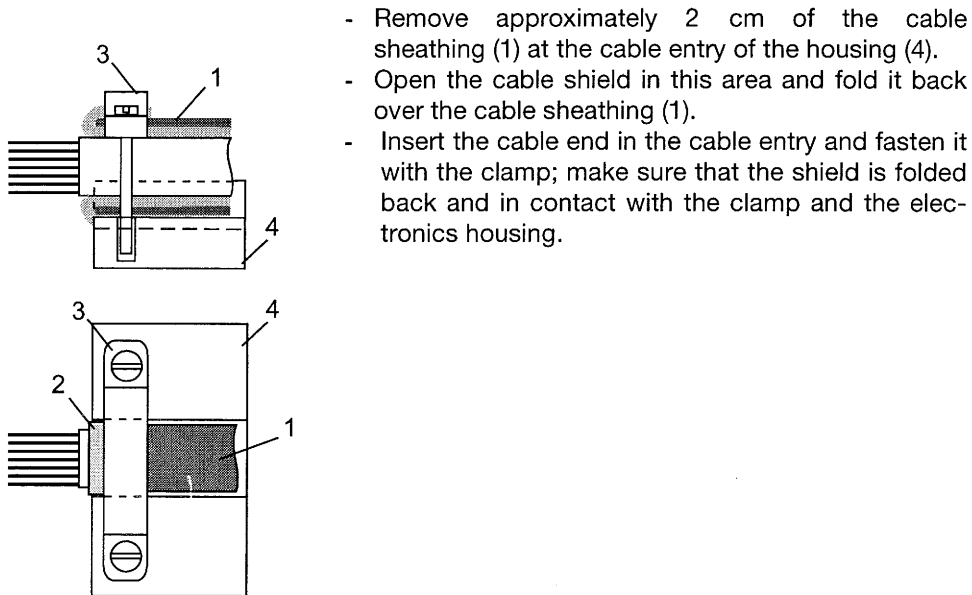


Figure 14: Connecting the cable shield of EBN 861

9. Setup



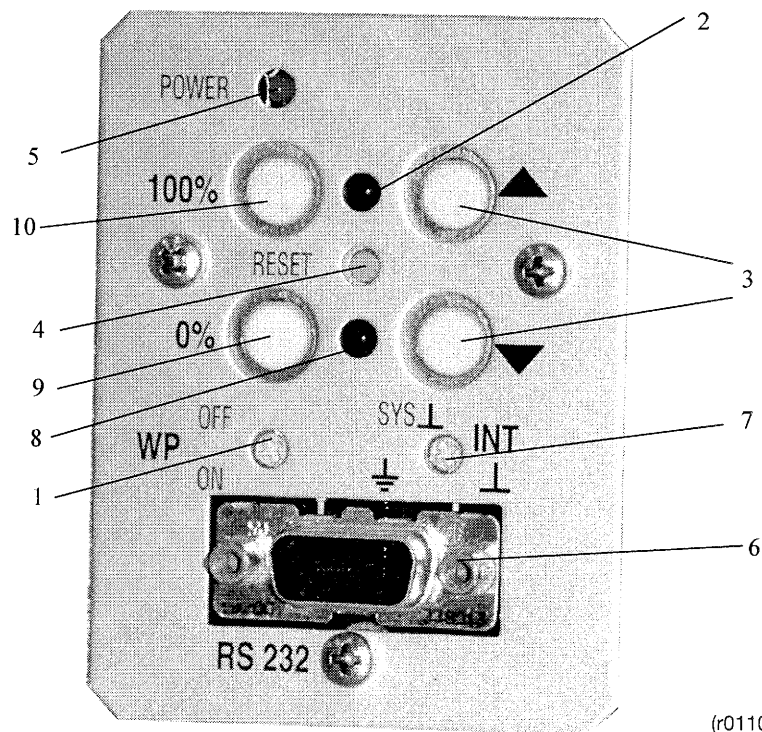
The basic settings (definition of end positions) can be made via the **Local Control Panel (LCP)**. It is used for adapting the actuator to the operating range and the effective direction without a PC. The actuator can be set up and configured completely using the appropriate configuration program.

The commissioning and service field is located on the electronics!

9.1 Setup via LCP

9.1.1 Operating elements

- | | |
|----------------------------|--|
| 1. Write-protect switch | (Default setting: OFF) |
| 2. LED for 100% position | Indication if adjustment procedure, saved position, or fault by different flash frequencies. |
| 3. Drive buttons | Press to cause drive motion |
| 4. Reset button | Press to restart processor and clear any 0% and 100% values. |
| 5. Power LED | Indicates available mains supply |
| 6. RS 232 socket | Connection socket to PC |
| 7. Potential toggle switch | Connection of reference potential to the system or protective earth (by default set to system) |
| 8. LED for 0% position | Indication if adjustment procedure, saved position, or fault by different flash frequencies.. |
| 9. Accept button (0%) | Press to define current position as 0%; simultaneously press push button 11 to complete the adjustment procedure. |
| 10. Accept button (100%) | Press to define current position as 100%; simultaneously press push button 10 to complete the adjustment procedure |



(r0110rxa)

Figure 15: **Local Control Panel (LCP)**

The actuator range is not preset in factory!



9.1.2 Initial situation

- Electronics connected to power supply and actuator
- Write-protect switch (1) set to "OFF" position
- Electronics in operating mode "MAN" (no signal on DI 1)
- No fault (if a fault occurs, both LEDs flash alternately at 4 Hz)

9.1.3 Setup procedure

- Undo the screws of the LCP cover
- Swing the cover to the side

9.1.3.1 "Setting" mode

- Set electronics to "setting" mode by pressing both push buttons (3) simultaneously for approx. 5 seconds, until both LEDs (2 + 8) are flashing synchronously at approx. 4Hz.

9.1.3.2 Defining first position (0% or 100%)

- Move to desired position by pressing one push button (3).
- To accept the position, press push button (10) or (9); the associated LED flashes at approx. 1Hz when value is correctly accepted, the other continues to flash at approx. 4Hz

(Higher precision in 2nd position)

9.1.3.3 Defining second position (0% or 100%)

- Move to second position by pressing one push button (3).
- To accept the position, press push button (10) or (9); both LEDs (2) and (8) are flashing at approx. 1Hz when value is accepted correctly.

9.1.3.4 Saving the settings

- The settings are accepted by simultaneously pressing the push buttons (10 + 9); the LEDs (2 + 8) extinguish after a short time, and the adjustment procedure is completed.
- If the selected range is too small for the actuator, both LEDs will flash again at 4Hz. Repeat the adjustment procedure a larger value (min. positioning travel).
(See positioning travel specification on actuator ID label)

9.1.3.5 Correction after setup

- If the setting is to be corrected after accepting the first value, first press the Reset button (4) and then repeat the setting.
- If the correction is to be done after saving the settings, the entire adjustment procedure must be repeated.

9.2 Adjustment using the configuration program

Context-sensitive help information is available in the configuration program at all times. For basic handling and installation instructions refer to the associated manual, number 41/68-001.

A conductive ground connection is established between the PC and the CONTRAC electronics with the RS 232 communication cable. If the PC is grounded, this may cause a ground loop in the installation.



9.3 Indication at LCP

Function	Indication
Adjustment	
Change-over to adjustment mode: Press and hold both drive switches for approx. 5 seconds	Both LEDs flash synchronously at approx 4Hz after time has expired.
Moving to an end position Use respective drive button on CSF	Both LEDs continue to flash at 4Hz while driving.
Saving the first end position Press button 0% or 100%	The associated LED flashes at approx. 1 Hz, the other continues at 4Hz.
Saving the second end position Press button 0% or 100%	The associated LED flashes at approx. 1 Hz synchronously to the first one.
Terminate adjustment Press 0% and 100% buttons simultaneously	Both LEDs are briefly lit together and then extinguish.
Operation	
Normal operation: MAN / AUT	LED off
Driving with button on CSF Priority over control system	LED off
Fault (both LEDs flash alternately at 4Hz)	
Reset: Resets fault indications	If no other fault conditions exist, both LEDs extinguish.
Reset if operating range is exceeded; press and hold both drive button for 5 seconds, then press Reset button	After approx. 5 seconds the flash rhythm is briefly interrupted. After "Reset" the electronics switch to adjustment mode.

Table 6:

Subject to technical changes.

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ABB Ltd.

Salterbeck Trading Estate
Workington, Cumbria
CA14 5DS
UK
Tel. +44 (0)1946 830 611
Fax. +44 (0)1946 830 611
<http://www.abb.com>

ABB Inc.

125 E. County Line Road
Warminster, PA 18974
USA
Tel. +1 215 674 6000
Fax +1 215 674 7183
<http://www.abb.com>

ABB Automation Products GmbH

Schillerstraße 72
D - 32425 Minden
DEUTSCHLAND
Tel. +49 571 830 - 1494
Fax +49 571 830 - 1860
<http://www.abb.de>

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14.7 Duplex filter with shutoff valve

14.7.1 Duplex filter

Voith Article No.: 41373100

Type: VSF 50

14.7.2 Filter element

Voith Article No.: 4201062001

Type: „VSF 50“/ „35 µm“

Drawing „Duplex filter 42255640“

Description:

[Section 7.3.3 „Changing over the duplex oil filter“](#)

[Section 8.4 „Cleaning the duplex oil filter“](#)

14.8 Three-phase motor for auxiliary lube oil pump

Voith Article No.: 03666012

Type: ABB M2QA

Power: 5.5 KW

Voltage: 220/380 V

Frequency: 50 Hz

Speed: 1500 rpm

Degree of protection: IP54

Design: B5

Instruction Manual Low-voltage motors

Low Voltage Motors

Manual for Low Voltage Motors

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

*Installations-, Betriebs- und
Wartungshandbuch* **DE 15**

*Manuel d'installation,
d'exploitation et de
maintenance* **FR 27**



*Manual de instalación, operación
y mantenimiento* **ES 39**

*Manuale di installazione, uso
e manutenzione* **IT 51**

*Manual för installation,
drift och underhåll* **SE 63**

*Asennus-, käyttö- ja
kunnossapito-ohje* **FI 75**



More languages – see web site

www.abb.com/motors&drives > Motors > Document library





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),

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

Title

Date

Translations into other languages are available from ABB.

Low Voltage Motors

Installation, operation and maintenance manual

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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.

1.1 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

1.2 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 - 450.

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

2.1 Putting into service (starting)

2.1.1 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 9.

2.1.2 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.

2.1.3 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).

2.1.4 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.

2.2 Handling

2.2.1 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.

2.2.2 Transportation

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

2.2.3 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.

2.2.4 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	Aluminum		Cast iron	Steel
	Weight kg	Add. for brake	Weight kg	Weight 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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Table 1

2.3 Installation

2.3.1 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.

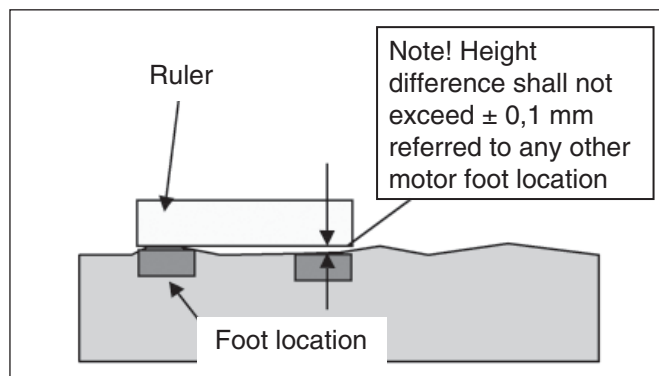
2.3.2 Foundation

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.

Before mounting the motor, the foundation surface for the shims or for the feet must be clean from thick paint, paint drops and dirt. Then it should be checked in order to discover any height differences between the individual foot locations. Also, the smoothness within each footprint area has to be checked. The requirements are noted in the figure below.



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.

2.3.3 Alignment

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

2.3.4 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.

2.4 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 or in additional labels on the frame of the machine.

WARNING

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

2.4.1 Connection for variable speed drive

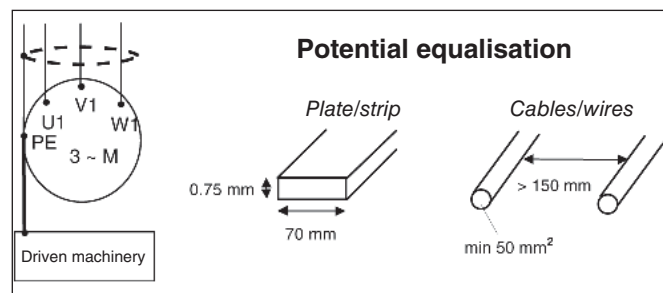
Variable speed drives cause higher voltage stresses than the sinusoidal supply on the winding of the motor and may cause high frequency shaft voltages and bearing currents. Therefore the winding and the bearing insulation of the motor as well as the filter at the converter output must be dimensioned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

In variable speed drives the motor ($P_n > 30$ 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 table 2 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
450	3600	1800

Table 2

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.

2.5 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". In case of motors delivered without any tape defining the type of balancing, these motors are also 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

3.1 Use

3.1.1 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.

3.2 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.

3.2.1 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.

3.3 Assembly and dismantling

3.3.1 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.

3.3.2 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.

3.3.3 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

4.1 Maintenance and lubrication

4.1.1 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.

4.1.2 Lubrication

WARNING

Beware of all rotating parts!

WARNING

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

4.1.3 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 200 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	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Table 3

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

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

Motors with roller bearings have considerably shorter grease life. For continuous operation regreasing nipples should be considered.

4.1.4 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.

During the first start or after a bearing lubrication it may appear a temporary temperature rise, appr. 10-20 hours. ABB policy is to have reliability as a vital issue in bearing lubrication intervals. That is why we follow the L1-principle.

A. 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.

B. 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 tables 4-5 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.

4.1.5 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⁾	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
450	140			2400	4000	8000	8800

Table 4

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⁾	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
450	140			1200	2000	4000	4400

Table 5

¹⁾ Values for IEC sizes 280 to 450 (cast iron and steel motors) in certain motor types (3600 and 3000 r/min), see tables 6-7.

Lubrication intervals and amounts, 2-pole, IEC frame sizes 280 to 450

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	1200 2000
400	M3B*	40	1000 1600
450	M3B*	40	1000 1600

Table 6

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	600 1000
400	M3B*	40	500 800
450	M3B*	40	500 800

Table 7

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.

4.1.6 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 450.

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 TEMP110 (lithium complex base)

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

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)
- Lubcon Turmogrease PU703 (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.

WARNING

Especially in high rotational speed (the speed factor > 400000) over greasing may cause damage.

4.1.7 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 (see table 2).

Suitability of bearings for high speed operation must be checked.

4.1.8 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.

For more information, please visit our web site www.abb.com/partsonline.

4.1.9 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

5.1 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*, M2BJ/M3BJ and M2LJ/M3LJ are indicated in separate Manuals.

6. Troubleshooting

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 troubleshooting chart

Your motor service and any troubleshooting 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 Poor stator coil connection	Indicated by blown fuses. Motor must be rewound. 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, to fuses and to 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.

TROUBLE	CAUSE	WHAT TO DO
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.
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 ball	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.
	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.

Niederspannungsmotoren

Installations-, Betriebs- und Wartungshandbuch

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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.

1.1 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.

1.2 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 - 450.

Es gibt separate Handbücher z. B. für 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
- dauermagneterregte Motoren

2. Installation

2.1 Inbetriebnahme (Anlassen)

2.1.1 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 22.

2.1.2 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.

Etwas 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.

2.1.3 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 Verbindungslaschen 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).

2.1.4 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.

2.2 Handhabung

2.2.1 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.

Etwas 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.

2.2.2 Transport

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

2.2.3 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 Ösensrauben bzw. die im Motorgehäuse integrierten Hebeösen auf ordnungsgemäßen Zustand überprüfen. Beschädigte Hebeösen dürfen nicht verwendet werden.

Ösensrauben 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.

2.2.4 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 Grundauführung - 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.

Baugröße	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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Tabelle 1

2.3 Installation

2.3.1 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.

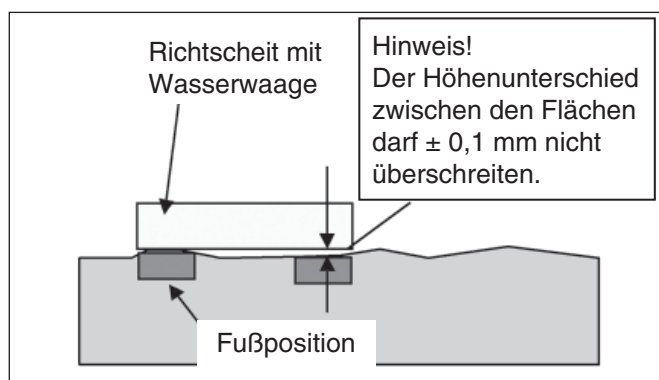
2.3.2 Fundamentierung

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.

Vor Montage des Motors muss die Fundamentfläche für die Ausgleichsscheiben bzw. die Füße frei von dicken Lackrückständen und -tropfen sowie Schmutz sein. Dann muss geprüft werden, ob es zwischen den einzelnen Aufstellflächen für die Füße Höhenunterschiede gibt. Zudem muss geprüft werden, ob die Aufstellflächen für die Füße eben sind. Die Anforderungen sind in der folgenden Abbildung dargestellt.



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.

2.3.3 Ausrichtung

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

2.3.4 Spannschienen und Riementreibe

- 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.

2.4 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 $4 \times 90^\circ$ 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!

Die Anschluss-Schaltbilder für die Hilfselemente befinden sich auf der Innenseite des Klemmenkastendeckels oder sind auf den Maschinenrahmen aufgeklebt.

WARNUNG

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

2.4.1 Anschlüsse bei Betrieb an Frequenzumrichtern

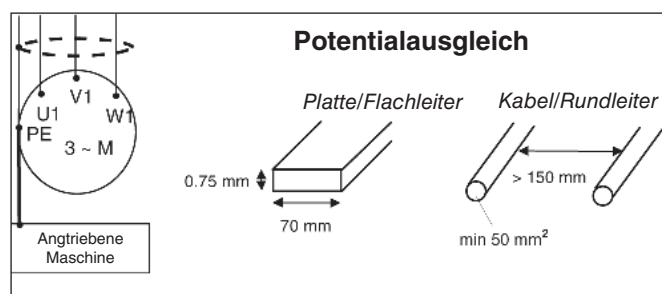
Frequenzumrichter-Antriebe verursachen höhere Spannungsbelastungen der Wicklungen und des Motors als eine sinusförmige Einspeisung. Sie können hochfrequente Wellenspannungen und Lagerströme verursachen. Deshalb müssen die Isolation der Wicklungen und der Lager des Motors und die Filter am Motorausgang 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 zulässige Höchstdrehzahl eines Graugussmotors im Frequenzumrichterbetrieb (M2BA/M3BP) darf die in der nachfolgenden Tabelle 2 angegebene, maximal zulässige Drehzahl bzw. die auf dem Leistungsschild angegebene Drehzahl nicht überschreiten.

Bau- größe	Drehzahl U/min	
	2 polig	4 polig
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800
450	3600	1800

Tabelle 2

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.

2.5 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“. Motoren, die ohne ein die Art des Auswuchtens anzeigendes Etikett geliefert werden, sind ebenfalls mit **halber Passfeder** ausgewuchtet.

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

3.1 Verwendung

3.1.1 Betriebsbedingungen

Die Motoren sind für die Verwendung innerhalb industrieller Antriebssysteme bestimmt.

Die standardmäßigen Grenzwerte der Umgebungstemperatur betragen $-20^{\circ}\text{C} \dots +40^{\circ}\text{C}$.

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

3.2 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!

3.2.1 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. Der Motor darf ausschließlich an den Aufhängeösen angehoben werden.

3.3 Montage und Demontage

3.3.1 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.

3.3.2 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.

3.3.3 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

4.1 Wartung und Schmierung

4.1.1 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.

4.1.2 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.

4.1.3 Motoren mit dauergeschmierten Lagern

In der Regel sind Motoren mit dauergeschmierten Lagern der Typen Z oder 2Z 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 200 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	lebenslanglich
90-112	2-8	40 000
132	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Tabelle 3

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

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

Motoren mit Rollenlagern müssen wesentlich öfter geschmiert werden. Für den Dauerbetrieb sollten Nachschmiernippel in Betracht gezogen werden.

4.1.4 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.

Beim ersten Start oder nach einer Lagerschmierung kann für ca. 10-20 Stunden ein temporärer Temperaturanstieg auftreten.

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).

A. 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.

B. 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 Benutzung eines automatischen Nachschmiersystems sind die in den Tabellen 4 und 5 Schmierfettmengen pro Schmierintervall zu verdoppeln.

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

4.1.5 Schmierintervalle und Fettmengen

Bau- größe	Fett- menge 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
450	140			2400	4000	8000	8800

Tabelle 4

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
450	140			1200	2000	4000	4400

Tabelle 5

¹⁾Werte für die IEC-Größen 280 bis 450 (Grauguss- und Stahlmotoren) bei bestimmten Motortypen (3600 und 3000 U/min) finden Sie in den Tabellen 6-7.

Schmierintervalle und Mengen, 2-polige Motoren, IEC Baugrößen 280 and 450

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	1200	2000
400	M3B*	40	1000	1600
450	M3B*	40	1000	1600

Tabelle 6

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	600	1000
400	M3B*	40	500	800
450	M3B*	40	500	800

Tabelle 7

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. Bei einem Anstieg der Lagertemperatur um 15 ° C müssen die Werte halbiert werden und können bei einem Abfall der Lagertemperatur um 15 ° C verdoppelt werden.

WARNUNG

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

4.1.6 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 Lithiumkomplexeife 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 280-450 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 (Lithiumkomplex-Basis)
- Mobil Mobilith SHC 100 (Lithiumkomplex-Basis)
- Shell Albida EMS 2 (Lithiumkomplex-Basis)
- SKF LGHQ 3 (Lithiumkomplex-Basis)
- Klüber Klüberplex BEM 41-132 (Spezielle Lithiumbasis)
- FAG Arcanol TEMP110 (Lithiumkomplex-Basis)

Anforderungen an die Eigenschaften erfüllen, wenden Sie sich zur Klärung an ABB.

HINWEIS!

Bei schnellaufenden 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 (Polyuretan-Basis)
- Klüber Klüber quiet BH 72-102 (Polyuretan-Basis)
- Lubcon Turmogrease PU703 (Polyuretan-Basis)

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.

VORSICHT

Speziell bei hohen Drehzahlen (Drehzahlfaktor > 400000) kann eine Überschmierung zu Beschädigungen führen.

4.1.7 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 Höchstdrehzahl, für die der Motor ausgelegt ist, darf nicht überschritten werden (siehe Tabelle 2).

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

4.1.8 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.

Weitere Informationen finden Sie auf unserer Website unter www.abb.com/partsonline.

4.1.9 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

5.1 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 eigenen Kühlsystemen und für die Reihen M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ und M2LJ/M3LJ sind in gesonderten Handbüchern angegeben.

6. Motor-Störungssuchtablelle

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 Motorsleistungsschild 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 bei 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	Netzausfall	Auf lose Anschlüsse zum Netz, zu den und bleibt dann stehen 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.

FEHLER	URSACHE	MASSNAHMEN
Motor läuft zu langsam Hoch und/oder zieht	Last zu hoch	Last reduzieren.
	Spannung beim Anlauf zu niedrig	Auf zu hohen Widerstand überprüfen. einen zu hohen Strom Angemessenen Leiterquerschnitt verwenden.
	Defekter Käfigläufer	Neuen Läufer einbauen.
	Netzspannung zu niedrig	Spannungsversorgung klären.
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 den Motor kühlt.
	Eine Motorphase ist möglicherweise ausgefallen	Kontrollieren, ob alle Anschlußleitungen richtig angeschlossen sind.
	Erschluß	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, Kugellager	Welle verbogen oder beschädigt	Welle richten oder austauschen.
	Riemenzug zu stark	Riemenspannung reduzieren.
	Riemenscheiben zu weit von Wellenschulter 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.

Moteurs à faible voltage

Manuel d'installation, d'exploitation et de maintenance

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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.

1.1 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.

1.2 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 - 450.

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
- moteurs magnétiques permanents

2. Installation

2.1 Mise en service (premier démarrage)

2.1.1 Contrôles de réception

À 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 34.

2.1.2 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.

2.1.3 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).

2.1.4 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.

2.2 Manutention

2.2.1 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.

2.2.2 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.

2.2.3 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.

2.2.4 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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1 700	1 000
355	-	-	2 700	2 200
400	-	-	3 500	3 000
450	-	-	5 000	4 500

Tableau 1

2.3 Installation

2.3.1 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.

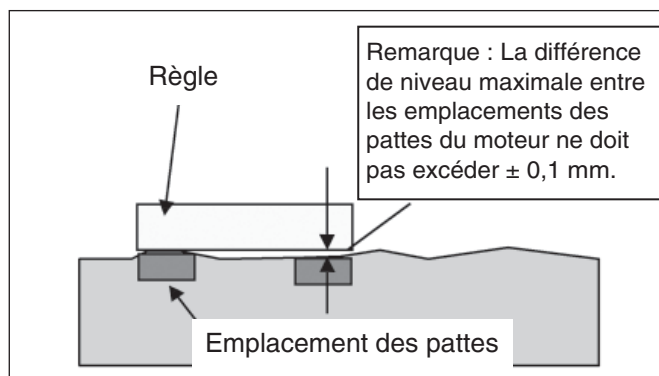
2.3.2 Fondations

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.

Avant de monter le moteur, ôtez du support de fixation des cales ou des pattes toute trace de peinture ou de saleté. Vérifiez ensuite que la différence de niveau entre les emplacements des pattes n'est pas trop disparate. Veillez également à ce que les parties du sol concernées soient bien lisses. La figure ci-après indique les conditions à remplir.



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.

2.3.3 Alignement

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

2.3.4 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.

2.4 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.

Vous trouverez des diagrammes de connexion des éléments auxiliaires à l'intérieur du couvercle de la boîte à bornes ou sur les étiquettes apposées sur le châssis de la machine.

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.

2.4.1 Raccordement d'un variateur de vitesse

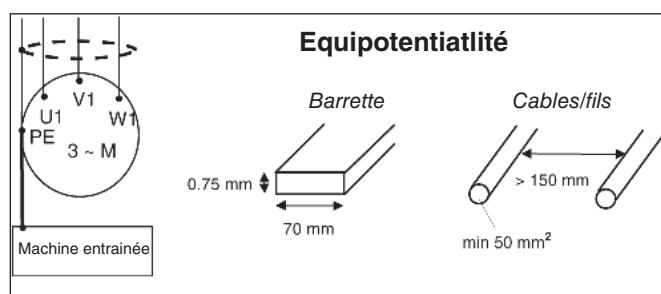
Les variateurs de vitesse peuvent imposer aux enroulements du moteur des niveaux de tension supérieurs à ceux délivrés par un réseau d'alimentation sinusoïdal et induire des tensions dans l'arbre et des courants de palier haute fréquence. Par conséquent, le bobinage et l'isolation des roulements du moteur 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 ($P_n > 30$ 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 > CEI 280, utilisez un conducteur plat de 0.75 x 70 mm ou au moins deux conducteurs ronds de 50 mm². 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 2 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	3 600	2 600
315	3 600	2 300
355	3 600	2 000
400	3 600	1 800
450	3 600	1 800

Tableau 2

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.

2.5 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 ». Si le moteur ne comporte pas d'étiquette définissant le type d'équilibrage, cela signifie qu'il est aussi équilibré avec **une demi-clavette**.

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

3.1 Utilisation

3.1.1 Conditions d'exploitation

Les machines sont destinées à des applications industrielles.

Plage normale de températures ambiantes : -20 ° à +40 °C. Altitude maxi : 1 000 m au-dessus du niveau de la mer.

3.2 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.

3.2.1 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.

3.3 Montage et démontage

3.3.1 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.

3.3.2 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.

3.3.3 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

4.1 Maintenance et lubrification

4.1.1 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.

4.1.2 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.

4.1.3 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 200. 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	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Tableau 3

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.

Les moteurs pourvus de roulements à rouleaux doivent être graissés beaucoup plus régulièrement. En cas de fonctionnement en continu du moteur, vous devrez opter pour des graisseurs.

4.1.4 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.

Au cours du premier démarrage ou après une lubrification des roulements, vous constaterez peut-être une hausse temporaire de la température, pouvant durer de 10 à 20 heures. 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.

A. 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.

B. 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 par intervalle de lubrification, indiquées dans les tableaux 4 et 5, 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.

4.1.5 Intervalles de lubrification et quantités de lubrifiant

Hauteur d'axe	Qté de graisse g/roulem.	3 600 tr/min	3 000 tr/min	1 800 tr/min	1 500 tr/min	1 000 tr/min	500-900 tr/min
Roulements à billes Intervalles de lubrification en heures de fonctionnement							
112	10	10 000	13 000	18 000	21 000	25 000	28 000
132	15	9 000	11 000	17 000	19 000	23 000	26 500
160	25	7 000	9 500	14 000	17 000	21 000	24 000
180	30	6 000	8 000	13 500	16 000	20 000	23 000
200	40	4 000	6 000	11 000	13 000	17 000	21 000
225	50	3 000	5 000	10 000	12 500	16 500	20 000
250	60	2 500	4 000	9 000	11 500	15 000	18 000
280	70	2 000 ¹⁾	3 500 ¹⁾	8 000	10 500	14 000	17 000
315	90	¹⁾	¹⁾	6 500	8 500	12 500	16 000
355	120	¹⁾	¹⁾	4 200	6 000	10 000	13 000
400	120	¹⁾	¹⁾	4 200	6 000	10 000	13 000
400 M3BP	130	¹⁾	¹⁾	2 800	4 600	8 400	12 000
450	140			2 400	4 000	8 000	8 800

Tableau 4

Roulements à rouleaux Intervalles de lubrification en heures de fonctionnement							
160	25	3 500	4 500	7 000	8 500	10 500	12 000
180	30	3 000	4 000	7 000	8 000	10 000	11 500
200	40	2 000	3 000	5 500	6 500	8 500	10 500
225	50	1 500	2 500	5 000	6 000	8 000	10 000
250	60	1 300	2 200	4 500	5 700	7 500	9 000
280	70	1 000 ¹⁾	2 000 ¹⁾	4 000	5 300	7 000	8 500
315	90	¹⁾	¹⁾	3 300	4 300	6 000	8 000
355	120	¹⁾	¹⁾	2 000	3 000	5 000	6 500
400	120	¹⁾	¹⁾	2 000	3 000	5 000	6 500
400 M3BP	130	¹⁾	¹⁾	1 400	2 300	4 200	6 000
450	140			1 200	2 000	4 000	4 400

Tableau 5

¹⁾ Valeurs pour tailles CEI 280 à 450 (moteurs fonte et moteurs acier) et certains types de moteurs (3 600 et 3 000 tr/min), voir tableaux 6 et 7.

Intervalles de lubrification et quantités de lubrifiant, moteurs 2 pôles, hauteurs d'axe (CEI) 280 et 450

Hauteur d'axe	Qté de graisse g/roulem.	3 600 tr/min	3 000 tr/min
Roulements à billes Intervalles de lubrification en heures de fonctionnement			
280	M2B*, M2C*, M3B*	35	2 000 3 500
315	M2B*, M2C*, M3B*	35	2 000 3 500
355	M2B*, M2C*	45	1 200 2 000
355	M3B*	35	1 200 2 000
400	M2B*, M2C*	45	1 200 2 000
400	M3B*	40	1 000 1 600
450	M3B*	40	1 000 1 600

Tableau 6

Hauteur d'axe	Qté de graisse g/roulem.	3 600 tr/min	3 000 tr/min
Roulements à rouleaux			
Intervalles de lubrification en heures de fonctionnement			
280	M2B*, M2C*, M3B*	35	1 000
315	M2B*, M2C*, M3B*	35	1 000
355	M2B*, M2C*	45	600
355	M3B*	35	600
400	M2B*, M2C*	45	600
400	M3B*	40	500
450	M3B*	40	500

Tableau 7

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 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.

4.1.6 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 températures de fonctionnement.

ATTENTION

Les lubrifiants contenant des additifs EP sont déconseillés pour les températures de roulements élevées, en hauteurs d'axe 280-450.

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 TEMP110 (savon lithium complexe)

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

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 : $Dm \times n$, où Dm 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)
- Lubcon Turmogrease PU703 (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.

ATTENTION

Tout graissage excessif peut causer des dommages, particulièrement dans le cas de moteurs tournant à grande vitesse (facteur de vitesse > 400 000).

4.1.7 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 maximale assignée du moteur ne doit pas être dépassée (voir tableau 2).

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

4.1.8 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.

Pour plus d'informations, visitez notre site Web www.abb.com/partsonline.

4.1.9 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

5.1 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/M3BJ et M2LJ/M3LJ figure dans des notices techniques particulières.

6. Localisation des défauts

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 au niveau du 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 interrupteur 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 roulements et la lubrification.
	Stator court-circuité	Signalé par des fusibles fondus. Le moteur doit être rebobiné.
	Bobine stator mal raccordée	Retirez les flasques du moteur, repérez les connexions avec une lampe témoin.
	Rotor défectueux : Rupture de barreaux ou d'anneaux	Changez le rotor.
	Moteur éventuellement en surcharge	Réduisez la charge.
Le moteur se bloque	Une phase manquante	Vérifiez le raccordement des conducteurs de phase.
	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-poussoirs.
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 encaisser au démarrage.
	Barres rotor coupées	Présence de fissures dans la cage rotorique. Changement de rotor conseillé.
	Circuit primaire ouvert	Localisez le défaut avec un instrument de contrôle et réparez.

PROBLEME	ORIGINE	INTERVENTION
Le moteur est trop long à accélérer et/ou prélève	Charge excessive	Reduisez la charge.
	Tension faible au démarrage	Vérifiez la résistance ainsi que la section des câbles d'alimentation trop de courant.
	Rotor à cage d'écureuil défectueux	Remplacez par un rotor neuf.
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.
Le moteur s'échauffe anormalement	Surcharge	Reduisez la charge.
Le moteur s'échauffe lorsqu'il est en sous-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 tout circuit ouvert.
	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 à billes chauds	Arbre tordu ou faussé	Redressez ou remplacez l'arbre.
	Courroie trop tendue	Réduisez la tension.
	Poulies trop éloignées de l'épaule du moteur	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 pétrole 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 pistes de roulement déformées	Remplacez le roulement, nettoyez d'abord à fond le corps de palier.

Motores de baja tensión

Manual de instalación, funcionamiento y mantenimiento

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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.

1.1 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.

1.2 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 - 450.

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
- motores de imanes permanentes

2. Instalación

2.1 Puesta en servicio (arranque)

2.1.1 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 carga radial aplicada sobre el eje se pueden dañar los rodamientos de rodillos.

Motores con rodamientos de contacto angular: Si se hace funcionar el motor sin carga 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 46.

2.1.2 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 megaohmios (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, el motor deberá bobinarse de nuevo.

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

El voltaje del motor y el tipo de 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 de dos velocidades, motores monofásicos 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).

2.1.4 Terminales y sentido de rotación

El sentido de rotación es según las agujas del reloj, visto desde el lado acople, y la secuencia de fases 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 cables de línea cualesquiera.

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.

2.2 Manipulación

2.2.1 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 desplazamientos y/o escapes de grasa.

Es preferible que las resistencias calefactoras, si el motor dispone de ellas, 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.

2.2.2 Transporte

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

2.2.3 Elevación

Levantar el motor usando sólo los 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 tener mucho cuidado en no dañar el equipo auxiliar y los cables unidos al motor.

2.2.4 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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Tabla 1

2.3 Instalación

2.3.1 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 funcionamiento correcto. 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.

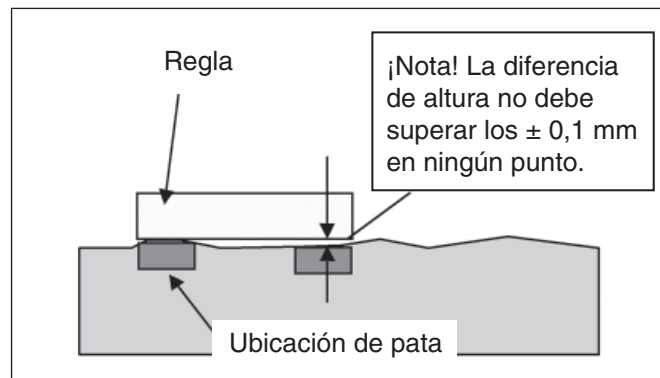
2.3.2 Anclajes

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.

Antes de montar el motor, debe limpiarse la superficie de anclaje, donde se colocarán las galgas o las patas, para eliminar el exceso de pintura, gotas de pintura o suciedad. A continuación, es necesario comprobar la superficie para detectar cualquier diferencia de altura entre las distintas ubicaciones de las patas. Además, es necesario comprobar también la planicidad de las superficies donde se apoyarán las patas. Los requisitos se indican en la figura siguiente.



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 abiertos están hacia abajo.

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

2.3.3 Alineación

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

2.3.4 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.

2.4 Conexión

El diseño normal del motor corresponde al de 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 $4 \times 90^\circ$, 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.

Además de las conexiones del devanado principal y las de puesta a tierra, la caja de bornes puede disponer también de conexiones para termistores, resistencias calefactoras, relés bimetálicos o de resistencias Pt100.

ATENCIÓN

Aún con el motor parado, puede haber tensión en la caja de bornes con el fin de alimentar a las resistencias calefactoras o al bobinado para su propio calentamiento.

Los diagramas de conexión de los elementos auxiliares se encuentran en la parte interior de la tapa de la caja de bornes o en las etiquetas adicionales adheridas a la carcasa de la máquina.

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.

2.4.1 Conexión con accionamiento de velocidad variable

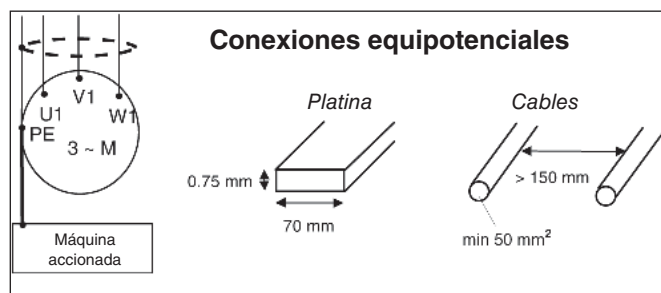
Los accionamientos de velocidad variable producen mayores tensiones que la alimentación sinusoidal en el bobinado del motor y pueden dar lugar a voltajes de alta frecuencia en el eje y corrientes en los rodamientos. Por lo tanto el aislamiento de bobinado y rodamientos así como el filtro a la salida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

En las aplicaciones con convertidores de frecuencia, el motor ($P_n > 30\text{kW}$) se debe cablear con cables simétricos blindados y prensaestopas que aseguren la puesta a masa en los 360° (también denominados 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 $0,75 \times 70\text{ mm}$ o, como mínimo, dos conductores cilíndricos de 50 mm^2 . 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 permitida para un motor de fundición de hierro utilizado en un variador de velocidad (M2BA/M3BP) no debe superar las velocidades máximas permitidas que se indican en la Tabla 2 siguiente ni la velocidad estampada 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
450	3600	1800

Tabla 2

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.

2.5 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". En el caso de los motores suministrados sin ninguna cinta que defina el tipo de equilibrado, estos motores se equilibran también **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. Funcionamiento

3.1 Uso

3.1.1 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.

3.2 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 la fuente de tensión a través de relés térmicos, pueden arrancar automáticamente.

3.2.1 Puntos a tener en cuenta

1. No suba ni se apoye 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.

3.3 Montaje y desmontaje

3.3.1 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.

3.3.2 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 folleto de instrucciones aparte, disponible en ABB.

3.3.3 Montaje de acoplamientos y poleas

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

Nunca se debe montar un 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

4.1 Mantenimiento y lubricación

4.1.1 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.
- 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 el estado de las piezas y cámbielas si es necesario.

4.1.2 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.

4.1.3 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 respectivos de cada producto 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 200 para el siguiente funcionamiento, según L1 (es decir, que el 99% de los motores superan este intervalo) a una temperatura ambiente de 25 °C. Para funcionamiento a temperatura ambiente mayor de 25 °C consulte el correspondiente catálogo de producto.

Tamaño carcasa	Polos	Horas de servicio
56-80	2-8	de por vida
90-112	2-8	40 000
132	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Tabla 3

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.

Los motores dotados de rodamientos de rodillos tienen un ciclo de engrase considerablemente más corto. Para un funcionamiento continuado, debe considerarse la posibilidad de utilizar boquillas de reengrase.

4.1.4 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.

Durante la primera puesta en marcha o después de la lubricación de los rodamientos, puede producirse un aumento temporal de la temperatura durante aproximadamente 10 y 20 horas. 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).

A. Lubricación manual

Engrase mientras el motor está funcionando

- Abrir los orificios o válvulas de salida de grasa, si el motor dispone de ellos.
- 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 los orificios 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 los orificios o válvula de salida, si existe.

B. Lubricación automática

Con lubricación automática, los orificios o válvula de salida de grasa, si existen, deben permanecer abiertos de forma permanente.

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

ABB recomienda exclusivamente sistemas electromecánicos, contacten con ABB.

La cantidad de grasa por intervalo de lubricación indicada en las Tablas 4 y 5 debe doblarse si se utiliza un sistema de reengrase 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.

4.1.5 Intervalos de lubricación y cantidades

Tamaño carcasa	Cantidad g/rodamiento	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
450	140			2400	4000	8000	8800

Tabla 4

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
450	140			1200	2000	4000	4400

Tabla 5

¹⁾ Para tamaños de carcasa IEC de 280 a 450 (motores de fundición de hierro y acero) en determinados tipos de motores (de 3.600 y 3.000 r/min), consulte las Tablas 6 y 7.

Intervalos de lubricación y cantidades, 2-polos, Tamaños de carcasa IEC 280 a 450

Tamaño carcasa		Cantidad de grasa g/rodamiento	3600 r/min	3000 r/min
Rodamientos de bolas				
Intervalos de lubricación en horas de servicio				
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	1200	2000
400	M3B*	40	1000	1600
450	M3B*	40	1000	1600

Tabla 6

Rodamientos de rodillos				
Intervalos de lubricación en horas de servicio				
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	600	1000
400	M3B*	40	500	800
450	M3B*	40	500	800

Tabla 7

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 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. Los valores deben reducirse a la mitad en caso de un aumento de 15 °C en la temperatura de los rodamientos y pueden doblarse en caso de una reducción de 15 °C en la temperatura de los rodamientos.

ATENCIÓN

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

4.1.6 Lubricantes

ATENCIÓN

No mezcle distintos tipos de grasa.

Lubricantes incompatibles pueden causar daños en los rodamientos.

Al engrasar, utilizar 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 aceite sintético (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 280-450.

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 o 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 TEMP110 (base compleja de litio)

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

¡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 poliurea)
- Klüber Klüber quiet BH 72-102 (base poliurea)
- Lubcon Turmogrease PU703 (base poliurea)

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.

ATENCIÓN

Especialmente para velocidades de rotación elevadas (factor de velocidad > 400.000), un engrase excesivo puede causar daños.

4.1.7 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 superar la velocidad constructiva máxima del motor (consulte la Tabla 2).

Se debe comprobar que los rodamientos sean adecuados para funcionamiento a alta velocidad.

4.1.8 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.

Para obtener más información, visite nuestra página web: www.abb.com/partsonline.

4.1.9 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

5.1 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 de todas las máquinas dotadas de sistemas de refrigeración separados y para las series M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ y M2LJ/M3LJ se indican en manuales separados.

6. Tabla de resolución de problemas del 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 y el mantenimiento del motor, así como el tratamiento de las soluciones a los problemas que pudiesen surgir 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 barras 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.
	Caída de 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 en la alimentación	Comprobar si existen conexiones sueltas a la red, a los fusibles y al armario de control.
El motor no alcanza la velocidad adecuada	Motor inadecuado para la aplicación	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 en 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 provisionales.
	Circuito primario abierto	Localizar el defecto con un instrumento de prueba y reparar.
El motor tarda demasiado tiempo en acelerar y/o absorbe una intensidad demasiado alta	Carga excesiva	Reducir la carga.
	Baja tensión durante el arranque	Comprobar la 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
Sentido de giro incorrecto	Secuencia de fases errónea	Permutar dos fases en los terminales del motor o en el panel de interruptores.
El motor se sobre calienta mientras funciona con baja carga	Sobrecarga	Reducir la carga.
	La carcasa o las rejillas de ventilación están llenas 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 terminales 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 equilibrado	Reequilibrar el motor.
	Contradicción entre el equilibrado del rotor y el del acoplamiento (media chaveta – chaveta entera)	Reequilibrar el acoplamiento o el motor.
	Motor trifásico funcionando como monofásico	Buscar y reparar la falta de fase.
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 rodamiento.
Calentamiento excesivo Rodamientos	Desequilibrio del rotor	Reequilibrado.
	Eje doblado o torcido	Enderezar 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.
	Deterioro 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 de la carga.
	Bola rota o caminos de rodadura dañados	Sustituir rodamiento, limpiando primero el alojamiento cuidadosamente.

Motori a bassa tensione

Manuale di installazione, uso e manutenzione

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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.

1.1 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.

1.2 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 - 450.

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:

- motori per vie a rulli
- motori raffreddati ad acqua
- motori con protezione IP 23
- motori per ventilazione
- motori autofrenanti
- motori a magneti permanenti

2. Installazione

2.1 Messa in servizio (avviamento)

2.1.1 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. 57.

2.1.2 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'essicamento.

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

2.1.3 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).

2.1.4 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.

2.2 Gestione

2.2.1 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.

2.2.2 Trasporto

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

2.2.3 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.

2.2.4 Pesì 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.

Gran- dezza	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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Tabella 1

2.3 Installazione

2.3.1 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.

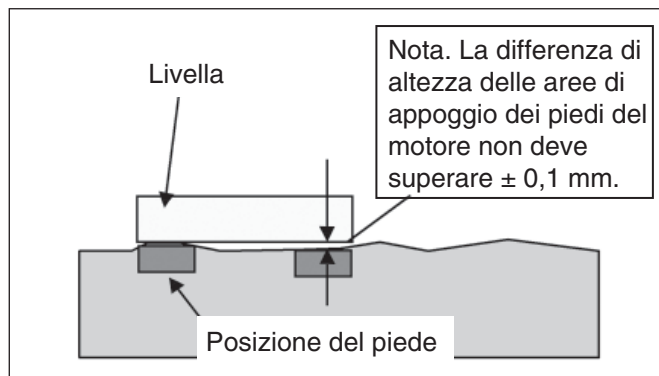
2.3.2 Fondazione

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.

Prima di montare il motore, è necessario pulire la superficie della fondazione su cui poggeranno gli spessori o i piedi, rimuovendo vernice troppo spessa, gocce di vernice e sporco. Quindi è necessario verificare che non vi siano differenze di altezza tra le posizioni dei singoli piedi. Verificare inoltre la levigatezza dell'area su cui poggeranno i singoli piedi. I requisiti sono indicati nella figura seguente.



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.

2.3.3 Allineamento

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

2.3.4 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.

2.4 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 i circuiti ausiliari si trovano all'interno del coperchio della scatola morsetti o su etichette poste sulla carcassa della macchina.

AVVERTENZA:

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

2.4.1 Applicazioni con convertitori di frequenza

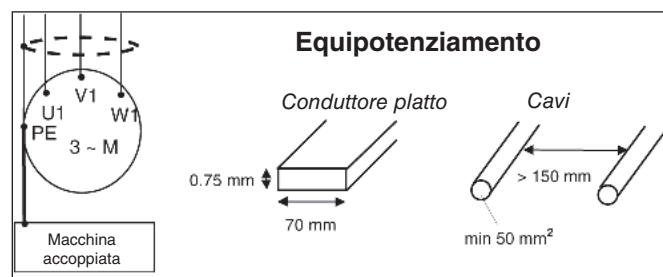
I convertitori di frequenza causano un affaticamento per la presenza di picchi di alta tensione rispetto alla normale onda sinusoidale applicata ai capi dell'avvolgimento del motore, e possono inoltre essere causa della presenza di tensione indotta sull'albero dall'alta frequenza di lavoro e correnti 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 ($P_n > 30$ kW) deve essere cablatto 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 x 70 mm o almeno due cavi circolari di 50 mm². 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 velocità di rotazione massima dei motori in ghisa utilizzati negli azionamenti a velocità variabile (M2BA/M3BP) non deve superare la velocità massima riportata nella tabella 2 di seguito o la velocità nominale riportata sulla targhetta.

Grandezza	Velocità r/min	
	2 poli	4 poli
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800
450	3600	1800

Tabella 2

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.

2.5 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). Nel caso di motori consegnati senza il nastro che definisce il tipo di bilanciatura, tali motori sono stati bilanciati con **mezza** chiave.

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. Informazioni operative

3.1 Uso

3.1.1 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.

3.2 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.

3.2.1 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.

3.3 Assemblaggio e smontaggio

3.3.1 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.

3.3.2 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.

3.3.3 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

4.1 Manutenzione e lubrificazione

4.1.1 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.

4.1.2 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.

4.1.3 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 200 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	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Tabella 3

Dipende dall'applicazione e dalle condizioni di carico.

Le ore di servizio per i motori verticali sono la metà di quelle indicate.

L'intervallo di lubrificazione per i motori con cuscinetti a rulli è notevolmente più breve. Per un funzionamento continuo si consiglia di utilizzare degli ingrassatori.

4.1.4 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.

Sulla targhetta gli intervalli di ingrassaggio rispetto al tipo di montaggio, temperatura ambiente e velocità di rotazione possono essere riportati in alcuni casi.

Dopo il primo avviamento o dopo la lubrificazione di un cuscinetto, è possibile che si manifesti temporaneamente un aumento di temperatura, per circa 10-20 ore. 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.

A. 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).

B. 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 raccogliore per il grasso usato. Seguire le speciali istruzioni per questo dispositivo.

Noi raccomandiamo di utilizzare soltanto sistemi elettromeccanici. Contattare ABB.

La quantità di grasso necessario per ogni intervallo di lubrificazione, riportato nelle tabelle 4-5, deve essere raddoppiata se si utilizza un sistema di ingrassaggio automatico.

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.

4.1.5 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
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
450	140			2400	4000	8000	8800

Tabella 4

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
450	140			1200	2000	4000	4400

Tabella 5

¹⁾ Valori per grandezze IEC 280 - 450 (motori in ghisa e acciaio) in alcuni tipi di motori (3600 e 3000 r/min), vedere tabelle 6-7.

Intervalli di Lubrificazione e quantità', 2-poli, Grandezze IEC 280 fino a 450

Gran- dezza	Quantità di grasso g/cuscinetto	3600 r/min	3000 r/min
Cuscinetti a sfere			
Intervalli di lubrificazione in ore di funzionamento			
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	1200
400	M3B*	40	1000
450	M3B*	40	1000

Tabella 6

Gran- dezza	Quantità di grasso g/cusci- netto	3600 r/min	3000 r/min
Cuscinetti a rulli			
Intervalli di lubrificazione in ore di funzionamento			
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	600
400	M3B*	40	500
450	M3B*	40	500

Tabella 7

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. I valori dovranno essere dimezzati ogni 15°C di aumento della temperatura dei cuscinetti e raddoppiati ogni 15°C di diminuzione della temperatura dei cuscinetti.

AVVERTENZA:

La temperatura massima di esercizio del grasso e dei cuscinetti non deve essere superata.

4.1.6 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 450.

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
(base con composto al litio)
- Mobil Mobilith SHC 100
(base con composto al litio)
- Shell Albida EMS 2 (base con composto al litio)
- SKF LGHQ 3 (base con composto al litio)
- Klüber Klüberplex BEM 41-132
(base di poliurea di calcio)
- FAG Arcanol TEMP110
(base con composto al litio)

Intervalli di lubrificazione per altri tipi di grasso che rispettano le specifiche e proprietà richieste, contattare ABB.

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 $Dm \times n$ dove Dm = diametro medio del cuscinetto, mm; n = velocità di rotazione, r/min).

Utilizzare il seguente, o simile, tipo di lubrificante:

- FAG L69 (base di poliurea)
- Klüber Klüber quiet BH 72-102 (base di poliurea)
- Lubcon Turmogrease PU703 (base di poliurea)

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.

AVVERTENZA:

L'eccesso di grasso può causare danni soprattutto a velocità di rotazione elevate (fattore di velocità > 400000).

4.1.7 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:

Non superare la temperatura massima consentita per il motore (vedere tabella 2).

Si deve inoltre sempre verificare che i cuscinetti siano adatti alla rotazione ad alte velocità.

4.1.8 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.

Per ulteriori informazioni, visitare il sito www.abb.com/partsonline.

4.1.9 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

5.1 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 per tutte le macchine con sistemi di raffreddamento separati e per le serie M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ e M2LJ/M3LJ sono riportati nei relativi manuali.

6. Grafico per la risoluzione dei problemi del motore

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	Segnalato da un guasto dei fusibili. Il motore deve essere riavvolto.
	Rotore difettoso	Verificare se ci sono le sbarre o gli anelli rotti.
	Motore sovraccaricato	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	Mancanza 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 e coprivotola otturati 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	Trovarla e ripararla.
	Tensioni di fase asimmetriche	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 funziona a fase singola	Controllare le fasi.
	Gioco eccessivo	Aggiustare il cuscinetto o mettere uno spessore.
Rumore anormale	La ventola raschia il copriventola	Eliminare il contatto.
	Basetta allentata	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.

Lågspänningsmotorer

Manual för installation, drift och underhåll

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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.

1.1 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.

1.2 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 - 450.

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:

- rullbanemotorer
- vattenkylda motorer
- öppna droppsäkra motorer
- motorer för rökgasventilation
- bromsmotorer
- permanentmagnetmotorer

2. Installation

2.1 Igångkörning

2.1.1 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 angiven mängd fett, till dess att färskt fett börjar tränga ut genom fettutloppsöppningarna. För detaljer se avsnittet "Manuell smörjning" på sid 69.

2.1.2 Kontroll av isolationsresistansen

Mät isolationsresistansen före idrifttagning och vid de tillfällen 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.

2.1.3 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 se publikation "The Motor Guide" (finns även tillgänglig på internet på www.abb.com/motors&drives).

2.1.4 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 nätanslutningskablarna.

Om motorn har en riktningsberoende fläkt skall rotationsriktningen överensstämma med pilen på motorn.

2.2 Hantering

2.2.1 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.

2.2.2 Transport

Motorer utrustade med rullager och/eller vinkelkontakt-lager skall vara försedda med transportlåsning av rotorn under transport.

2.2.3 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.

2.2.4 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	Stål
	Vikt kg	Lägg till för broms	Vikt kg	Vikt 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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Tabell 1

2.3 Uppställning

2.3.1 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 kylflöde. Se till att inga ytor eller angränsande utrustning strålar ytterligare värme mot motorn. För ytterligare information om högre omgivningstemperaturer och kylning, se "The Motor Guide" eller kontakta ABB:s försäljningskontor.

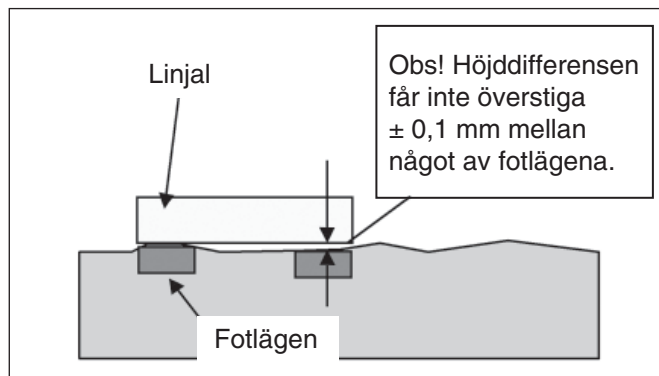
2.3.2 Fundament

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.

Rengör fundamentets yta vid mellanläggsplåtarna eller fötterna samt avlägsna tjock färg, färgdroppar och smuts innan motorn monteras. Kontrollera sedan ytan i syfte att upptäcka eventuella höjddifferenser mellan respektive fotläge. Kontrollera också ytjämnheten vid respektive fotyta. Kraven anges i bilden nedan.



Fästklotsar

Skruva fast fästklotsarna vid motorns fötter och placera en 1 - 2 mm mellanläggsplåt 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 monterings sättet avviker från standard.

I extremt dammiga miljöer skall alla dräneringshål vara stängda.

2.3.3 Uppriktning

Korrekt uppriktning är nödvändigt för att undvika lagerproblem, vibrationer och eventuellt axeltapps brott.

2.3.4 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 maximal remkraft (tillåten radiell kraft på lagret) angiven i tillämplig produktkatalog.

2.4 Anslutning

Normalt är motorn konstruerad med uttagsslådan ovanpå motorn och med kabelanslutningsmöjligheter från båda sidorna.

Vissa motorer kan levereras, med roterbar, 4 x 90 °, uttagsslåda ovanpå motorn, och andra med sidomonterad uttagsslåda.

Produktkatalogerna anger om dessa alternativ är möjliga.

Oanvända hål för kabelanslutning skall vara täckta.

Förutom anslutningar för huvudlindning och jord kan uttagsslådan också innehålla anslutningar för termistorer, värmeelement för stilleståndsuppvärmning, temperaturvakter av bimetalltyp eller PT100 motståndselement.

VARNING

Anslutningar kan vara spänningsförande även när motorn står stilla, eftersom värmeelement eller direkt lindningsvärmning kan vara aktiverade.

Anslutningsscheman för hjälpfunktioner finns i uttagsslådans lock eller på extra etiketter på motorns stomme.

VARNING

Kondensatorn i enfasmotorer kan vara uppladdade, och ge en spänning på motorns uttag, trots att motorn står still.

2.4.1 Anslutning för frekvensomriktardrift

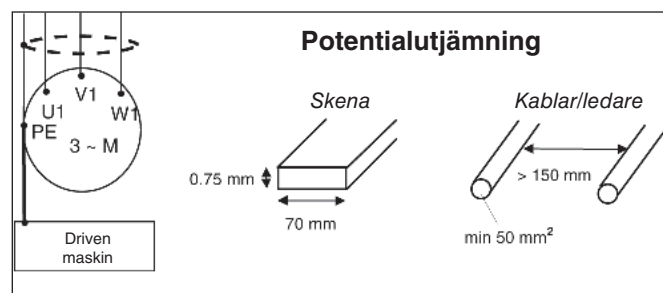
Frekvensomriktardrift orsakar högre spänningspåkänning på motorlindningen än vad sinusmatningen gör. Motorns lindning och lagerns isolering, liksom även frekvensomriktarens utgångsfilter, bör därför vara dimensionerade enligt "Selection rules for VSD applications/Insulation" (3GZF500930-2), som kan beställas 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 endast kablar och anslutningsdon som är godkända för ändamålet. (Se instruktionerna för frekvensomriktare.)

Det högsta tillåtna varvtalet för en gjutjärnsmotor som används i ett varvtalsreglerat drivsystem (M2BA/M3BP) får inte överstiga det maxvarvtal som anges i tabell 2 nedan eller det varvtal som är inpräglad i 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
450	3600	1800

Tabell 2

Om det råder osäkerhet om motorns lämplighet för frekvensomriktardrift, kontakta ABB.

VARNING

Maximal arbetstemperatur för fett och lager får ej överskridas.

2.5 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". Motorer levererade utan tejp som anger typ av balansering är även de balanserade **med halv kil**.

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

3.1 Användning

3.1.1 Driftmiljö

Motorn är avsedd att användas för drift i industrimiljö.

Gränserna för normal omgivningstemperatur är -20 °C till +40 °C. Maximal höjd över havet 1000 m.

3.2 Säkerhetsaspekter

Motorn är avsedd att installeras och användas av erfaren personal som har kunskaper om 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.

3.2.1 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 motordrifter kräver speciella instruktioner (t.ex frekvensomriktardrifter)
4. Lyftöglorna skall endast användas för lyftning av själva motor. De får ej användas för att lyfta motorn tillsammans med annan utrustning.

3.3 Montering och demontering

3.3.1 Allmänt

Demontering och montering av motorer måste utföras av kunnig personal som använder ändamålsenliga verktyg och arbetsmetoder. Alla reparationer skall ske enligt standard IEC 60034-19.

3.3.2 Lager

Lager kräver speciell omsorg. Lager skall dras av med avdragare och sättas 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.

3.3.3 Montering av kopplingshalvor och remskivor

Kopplingshalvor och remskivor skall monteras med hjälp av ändamålsenlig utrustning och verktyg som inte skadar lagren.

Montera aldrig en kopplingshalva eller en remskiva 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

4.1 Underhåll och smörjning

4.1.1 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.

4.1.2 Smörjning

VARNING

Se upp för roterande delar.

VARNING

Fett kan förorsaka hudirritation och ögoninflammation. Följ alla säkerhetsföreskrifter som angivits av fettleverantören.

4.1.3 Motorer med permanentismorda lager

Lagren är vanligtvis permanentismorda lager 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 produktkatalog.

Storlek	Poliga	Drifttimmar
56-80	2-8	på livstid
90-112	2-8	40 000
132	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Tabell 3

Beroende på tillämpning och belastningsförhållanden. Se tillämplig produktkatalog.

Antalet drifttimmar för vertikalt installerade motorer är hälften av ovan angivna värden.

Smörjfettet i motorer med rullager har betydligt kortare livslängd. Överväg smörjnipplar vid kontinuerlig drift.

4.1.4 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.

Vid första starten eller efter en smörjning av lagren kan en tillfällig temperaturhöjning uppträda, under cirka 10 - 20 timmar. ABB har som policy att sätta tillförlitligheten i första rummet vid val av smörjintervall. Därför tillämpas L1-principen.

A. Manuell smörjning

Smörjning under drift

- 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.

B. 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.

Mängden smörjfett per smörjningsintervall som anges i tabellerna 4 - 5 skall fördubblas om ett automatiskt avfettningssystem används.

Om 2-poliga motorer smörjs via automatiska system skall anmärkningen (OBS!) beträffande fettrekommendationer och 2-poliga motorer i kapitlet Lagerfett följas.

4.1.5 Smörjintervall i drifttimmar och fettmängder

Storlek	Mängdt fett g/lager	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
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⁾	6500	8500	12500	16000
355	120		¹⁾	4200	6000	10000	13000
400	120		¹⁾	4200	6000	10000	13000
400 M3BP	130		¹⁾	2800	4600	8400	12000
450	140			2400	4000	8000	8800

Tabell 4

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⁾	3300	4300	6000	8000
355	120		¹⁾	2000	3000	5000	6500
400	120		¹⁾	2000	3000	5000	6500
400 M3BP	130		¹⁾	1400	2300	4200	6000
450	140			1200	2000	4000	4400

Tabell 5

¹⁾ Värden för IEC-storlekar 280 till 450 (gjutjärn och stålmotorer) i vissa motortyper (3600 och 3000 r/min), se tabellerna 6 - 7.

Smörjintervall och fettmängder, 2-poliga, IEC storlek 280-450

Storlek	Mängdt 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	1200
400	M3B*	40	1000
450	M3B*	40	1000

Tabell 6

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	600
400	M3B*	40	500
450	M3B*	40	500

Tabell 7

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! En höjning av omgivningstemperaturen medför en motsvarande höjning av temperaturen i lagret. Värdena bör halveras vid 15 °C ökning av lagertemperatur och kan dubblas vid 15 °C minskning av lagertemperatur

VARNING

Maximal arbetstemperatur för fett och lager får inte överskridas.

4.1.6 Lagerfett

VARNING

Blanda inte olika typer av fett.

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.

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 - 450.

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 (litiumkomplex bas)
- Mobil Mobilith SHC 100 (litiumkomplex bas)
- Shell Albida EMS 2 (litiumkomplex bas)
- SKF LGHQ 3 (litiumkomplex bas)
- Klüber Klüberplex BEM 41-132 (speciell litiumbas)
- FAG Arcanol TEMP110 (litiumkomplex bas)

Smörjintervallen för andra fetter, som innehåller de önskade egenskaperna, kontakta ABB:s försäljningskontor.

OBS!

Använd alltid höghastighetsfett för högvarvstil-lämpningar 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 (polyureabas)
- Klüber Klüber quiet BH 72-102 (polyureabas)
- Lubcon Turmogrease PU703 (polyureabas)

Vid användning av andra fettfabrikat, kontrollera med tillverkaren att egenskaperna överensstämmer med de ovan nämnda fetterna. Vid osäkerhet om kompatibiliteten, kontakta ABB:s försäljningskontor.

WARNING

För mycket smörjfett kan ge skador, speciellt vid höga varvtal (varvtalsfaktor > 400000).

4.1.7 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.

WARNING

Motorns högsta konstruktionsvarvtal får inte överskridas (se tabell 2).

Lagrens lämplighet för högvarvsdrift måste kontrolleras.

4.1.8 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.

Ytterligare information finns på vår webbsida www.abb.com/partsonline.

4.1.9 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

5.1 Ljudnivå

De flesta av våra motorer har en ljudtrycksnivå som ej överstiger 82 dB(A) vid 50 Hz och sinusmatning, med tolerans ± 3 dB(A).

Värden för specifika motorer kan hittas i respektive produktkataloger.

För ljudtrycksnivåer vid 60 Hz sinusmatning och vid annat än sinusmatning, kontakta ABB:s försäljningskontor.

Ljudtrycksnivåerna för alla motorer med separata kylsystem och för serierna M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ och M2LJ/M3LJ finns angivna i separata manualer.

6. Felsökning

Dessa 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 provningslampa.
	Rotorfel	Leta efter avbrutna stavar och kortslutningsringar.
Motor fastlåst	Motorn kan vara överbelastad	Minska belastningen.
	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.
Motorn startar, men retarderar och stannar	Öppen krets	Säkringar utlösta, kontrollera överbelastningsrelä, stator och tryckknappar.
	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 transformator anslutningar 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 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.

PROBLEM	ORSAK	ÅTGÄRD
Motorn blir överhettad trots att den är lågt belastad	Överbelastning	Minska belastningen.
	Ventilationsöppningarna 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 matningsspänning	Kontrollera om det finns felaktiga ledare, anslutningar och transformatorer.
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 enfasmatning	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 driftljud	Ojämt luftgap	Kontrollera och korrigera lagerbockarna eller lagren.
	Rotor obalanserad	Balansera om.
Lagerkolor överhettade	Böjd eller sned axel	Rikta upp eller byt axeln.
	För hög remspänning	Minska remspänningen.
	Remskivan för långt från axelansatsen	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 kolor eller löpbanor	Byt lager och rengör samtidigt lagerhuset noggrant.

Pienjännitemoottorit

Asennus-, käyttö- ja kunnossapito-ohje

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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.

1.1 Vaatimustenmukaisuusvakuutus

Jokaiselle koneelle annetaan erikseen vaatimustenmukaisuusvakuutus pienjännitedirektiivin 73/23/EEC ja direktiivin muutoksen 93/68/EEC mukaan.

Vaatimustenmukaisuusvakuutus täyttää myös yhdenmukaisuusvakuutukselle asetetut vaatimukset kone-direktiivin 98/37/EEC mukaan, Art. 4.2 Annex II, Sub B.

1.2 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 - 450.

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

2.1 Käyttöönotto (käynnistys)

2.1.1 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 viistokuulalaakereita.

Moottorit, joissa on jälkivoitelu:

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 81.

2.1.2 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.

2.1.3 Suora tai tähtikolmiokäynnistys

Vakioyksinopeusmoottorin liitântäkotelossa 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 D-kytkentää voidaan käyttää. Esimerkiksi 660 VY, 380 VD tarkoittaa Y-kytkentää 660 V ja D-kytkentää 380 V.

Tähtikolmiokäynnistys:

Verkkojännitteen on oltava sama kuin koneen jännite D-kytkennässä. Poista kaikki kytkentäliuskat liitântäalustasta.

Kaksinopeus-, yksivaihe- ja erikoismoottoreilla kytkentä on suoritettava liitântäkotelon sisällä olevien ohjeiden mukaisesti.

Jos suoraikäynnistys 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.

2.1.4 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.

2.2 Käsittely

2.2.1 Varastointi

Kaikki moottorit tulee varastoida sisätiloissa, kuivissa, tärinättömissä ja pölyttömissä olosuhteissa.

Moottorin suojaamattomat kohdat (akselin päät ja laipat) tulee suojata korroosionestoaineella.

Akselia suositellaan pyörítettävän säännöllisin väliajoin käsin rasvan muuttumisen estämiseksi.

Mahdollisten seisontalämmitysvastusten pitäisi olla kytkettynä.

Mikäli yksivaihemoottoireihin on asennettu elektrolyttiset kondensaattorit, on ne "herätettävä" uudelleen varastointiajan ylittäessä 1 - 2 vuotta. Ota yhteyttä ABB:n tuotemyyntiin saadaksesi lisäohjeita.

2.2.2 Kuljetus

Moottorit, joissa on rullalaakerit tai viistokuulalaakerit, tulee varustaa lukituksella kuljetuksen ajaksi.

2.2.3 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.

2.2.4 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	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Taulukko 1

2.3 Asennus

2.3.1 Jäähdytys

Moottoristandardien mukaan ympäristön lämpötila ei saa ylittää +40 °C (laivamoottoristandardissa +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.

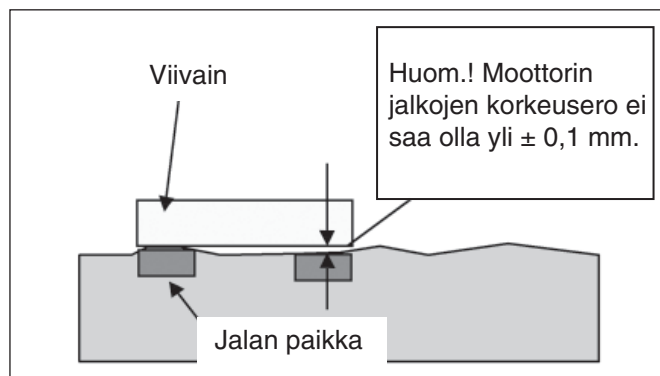
2.3.2 Alusta

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.

Ennen kuin moottori asennetaan, sovitelevyjä tai jalkoja vasten tulevat perustan pinnat täytyy puhdistaa paksusta maalista, maalipisaroista ja liasta. Tämän jälkeen pinnat on tarkistettava jalkojen mahdollisten korkeuserojen varalta. Myös kunkin jalan alla olevan alueen tasaisuus on tarkastettava. Vaatimukset on ilmoitettu alla olevassa kuvassa.



Jalkalaatat

Kiinnitä jalkalaatat moottorin jalkoihin ja asenna väliin 1 - 2 mm:n 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.

2.3.3 Linjaus

Oikea linjaus on erittäin tärkeää laakerivaurioiden, tärinän ja akselitapin murtumisen estämiseksi.

2.3.4 Kiristyskiskot ja hihnakäytöt

- Kiinnitä moottori kiristyskiskoihin kuvan 2 mukaan.
- Asenna kiristyskiskot vaakasuoraan samaan tasoon.
- Tarkista, että moottorin akseli on samassa suunnassa käyttöakselin kanssa.
- Hihnat tulee kiristää toimittajan ohjeiden mukaan.

VAROITUS

Liiallinen hihnojen kiristys vaurioittaa laakereita ja voi aiheuttaa akselin katkeamisen.

Älä ylitä maksimihhnavoimia (laakerin radiaali-kuormituksia), jotka on ilmoitettu tuote-esitteissä.

2.4 Kytcentä

Vakiomallin moottoreissa liitântäkotelo on moottorin päällä, kaapeliaukot molempiin suuntiin.

Erikoisratkaisuna tietyt moottorit voidaan varustaa 4 x 90 asteen käännettävällä moottorin päällä olevalla liitântäkotelolla tai sivulle asennettavalla liitântäkotelolla. Nämä vaihtoehdot on kuvattu tuote-esitteissä.

Käyttämättömät kaapeliaukot täytyy sulkea.

Moottorin pääliittimien ja maadoitusliittimien lisäksi liitântäkotelossa voi olla kytkennät termistoreille, seisontalämmitysvastuksille, bimetallikytkimille, tai PT100-vastuselementeille.

VAROITUS

Jännite voi olla kytkettynä moottorin seisoessa liitântäkotelon sisällä lämmitysvastuksille tai suoraan käämityksen lämmitykselle.

Lisävarusteiden kytkentäkaaviot ovat kytkentärasian kannen alla tai erillisissä koneen runkoon kiinnitetyissä tarroissa.

VAROITUS

Yksivaihemoottorin kondensaattorissa voi olla sähkövaraus moottorin liittimissä, vaikka moottori on pysähdyksissä.

2.4.1 Taajuusmuuttajakäytöt

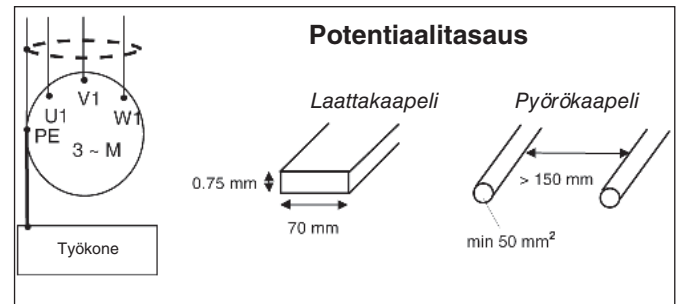
Taajuusmuuttajakäyttö aiheuttaa suurtaajuisia akseli-jännitteitä ja laakerivirtoja sekä verkkokäyttöä suurempia jänniterasituksia moottorin käämitykselle. Tämän johdosta tulee moottorin käämien ja laakereiden eristysten sekä taajuusmuuttajan lähtösuotimien olla valittu Selection rules for VSD applications/Insulation (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 työkonen väliseen potentiaalintasaukseen, mikäli moottori ja työkonet eivät ole asennettu samalle teräspedille.

Potentiaalitasausta käytetään runkokooltaan IEC 280 ja suuremmissa moottoreissa. Tasaukseen käytettävän johtimen tulee olla vähintään 0,75 x 70 mm laattakaapeliä tai vähintään 2 x 50 mm² pyöreää kaapeliä. Pyöreiden kaapeleiden välinen etäisyys pitää olla vähintään 150 mm.

Potentiaalitasauksella ei ole merkitystä sähköturvallisuuden kannalta. Sen tarkoituksena on pitää moottorin ja työkonen runko samassa suurtaajuuspotentiaalissa. Mikäli moottori ja työkonet ovat galvaanisesti yhteenkytkettyjä, potentiaalitasausta ei tarvita.



EMC-vaatimukset täyttyvät käyttämällä tarkoitukseen määriteltäviä kaapeleita ja liitântäosia. (Katso taajuusmuuttajaohjeistot.)

Taajuusmuuttajakäytössä (M2BA/M3BP) olevien valurautamoottorien suurin sallittu pyörimisnopeus ei saa ylittää alla olevassa taulukossa 2 ilmoitettuja enimmäisnopeuksia tai arvokilpeen painettua nopeutta. 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
450	3600	1800

Taulukko 2

Mikäli moottorin sopivuus taajuusmuuttajakäyttöön on epäselvä, ota yhteys ABB:n tuotemyyntiin.

VAROITUS

Voiteluaineen ja laakerin maksimikäyttölämpötilaa ei saa ylittää.

2.5 Tasapainotus

Moottorin roottori on dynaamisesti tasapainotettu.

Akselit tasapainotetaan normaalisti **puolella kiilalla**, akselissa **punainen** teippi tekstillä "tasapainotettu puolella kiilalla" (Balanced with half key). Jos moottoreissa ei toimitettaessa ole tasapainotusta määrittävää teippiä, myös nämä moottorit tasapainotetaan **puolikiilan avulla**.

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

3.1 Ympäristö

3.1.1 Käyttöolosuhteet

Moottorit on tarkoitettu teollisuuskäyttöihin, normaali-ympäristön lämpötilan ollessa -20 °C... +40 °C, asennuskorkeus enintään 1 000 m merenpinnasta.

3.2 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 lämpökytkimillä, voivat käynnistyä automaattisesti.

3.2.1 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.

3.3 Kokoonpano ja purku

3.3.1 Yleistä

Pätevän henkilökunnan on suoritettava moottorin purku ja kokoonpano käyttäen tarkoituksenmukaisia työvälineitä ja työtapoja. Kaikki korjaukset on suoritettava standardin IEC-60079-19 mukaisesti.

3.3.2 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.

3.3.3 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

4.1 Huolto ja voitelu

4.1.1 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.

4.1.2 Voitelu

VAROITUS

Varo pyöriä osia!

VAROITUS

Monet voiteluaineet saattavat ärsyttää ihoa tai aiheuttaa silmätulehduksia. Seuraa valmistajan antamia turvaohjeita.

4.1.3 Kestovoidelluilla laakereilla varustetut moottorit

Moottorit ovat yleensä vakiona varustettu kesto-voidelluilla laakereilla, tyypit Z tai 2Z.

Laakerityypit on lueteltu tuote-esitteissä ja lukuunottamatta muutamaa pienintä runkokokoa laakerityyppi on mainittu myös arvokilvessä.

Runkokokoon 200 asti ohjeellinen käyttötuntien määrä, jolloin moottorit ovat edelleen hyvin voideltuja, L_1 -periaatteen mukaisesti ympäristön lämpötilan ollessa $+25\text{ °C}$ (tarkoittaa, että 99 % moottoreista toimii häiriöttömästi voiteluvälin ajan). Ohjeet käyttöihin, joissa ympäristön lämpötila on yli $+25\text{ °C}$, ovat tuote-esitteissä.

Runkokokoo	Napaluku	Käyttötunnit
56-80	2-8	elinikäinen
90-112	2-8	40 000
132	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Taulukko 3

Riippuen sovelluksesta ja kuormitusolosuhteista, katso kyseisen moottorin tuote-esitteestä.

Pystyasentoon asennettujen moottoreiden voiteluvälit ovat puolet yllämainituista arvoista.

Moottorien, joissa on rullalaakerit, voitelu on uusittava huomattavasti muita useammin, Jatkuva käyttöä varten suositellaan voitelunippoja.

4.1.4 Voitelunipoilla varustetut moottorit

Voiteluohjekilpi ja yleistä voitelusta

Jos moottorissa on voiteluohjekilpi, noudata siinä olevia arvoja.

Voiteluohjekilvestä voidaan määrittää jälkivoiteluväli asennusasennon, lämpötilan ja kierrosluvun suhteen.

Ensimmäisen käynnistyksen aikana tai laakerin voitelun jälkeen voi esiintyä väliaikaista lämpötilan kohoamista noin 10 - 20 tunnin ajan.

ABB:n lähtökohtana voiteluvälejä määriteltäessä on käyttövarmuus. Siksi noudatamme L_1 -periaatetta.

A. 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.

B. 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.

Suosittelemme vain sähkömekaanisten järjestelmien käyttöä, lisätietoja ABB:n tuotemyynnistä.

Taulukoissa 4 ja 5 mainitut voiteluainemäärät voiteluväliä kohti on kaksinkertaistettava, jos automaattivoitelu on käytössä.

Jos automaattivoitelun piirissä on 2-napaisia moottoreita noudattakaa kappaleessa "Voiteluaineet", suurnopeusmoottorit ja esim. M2BA 355 ja 400, annettua huomautusta (HUOM.!) voiteluaineesta.

4.1.5 Voiteluvälit ja -ainemäärät

Runko- koko	Voiteluaine- määrä g/laakeri	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
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
450	140			2400	4000	8000	8800

Taulukko 4

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
450	140			1200	2000	4000	4400

Taulukko 5

¹⁾ Arvot IEC-koolle 280–450 (valurauta- ja teräsmoottorit) tietyissä moottorityypeissä (3600 ja 3000 r/min), katso taulukot 6 ja 7.

Voiteluvälit ja -ainemäärät, 2-napaiset, IEC-runkokoot 280 ja 450

Runko- koko	Voiteluaine- määrä g/laakeri	3600 r/min	3000 r/min
Kuulalaakerit			
Voiteluväli käyttötunteina			
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	1200
400	M3B*	40	1000
450	M3B*	40	1000

Taulukko 6

Rullalaakerit			
Voiteluväli käyttötunteina			
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	600
400	M3B*	40	500
450	M3B*	40	500

Taulukko 7

Voiteluväleihin vaikuttavat tekijät

Taulukko koskee vaakasuoraan asennettuja mootto-reita. Pystysuoraan asennettujen moottorien voiteluvälit ovat puolet taulukon arvoista.

Voiteluväli perustuu laakerin käyntilämpötilaan 80 °C (ympäristön lämpötila noin +25 °). On huomattava, että ympäristön lämpötilan nousu nostaa vastaavasti laakerin lämpötilaa. Arvot puolitetaan, jos laakerin lämpötila nousee 15 °C. Arvot voidaan hyvissä olosuhteissa kaksinkertaistaa, jos laakerin lämpötila laskee 15 °C.

VAROITUS

Voiteluaineen ja laakerin maksimikäyttölämpötilaa ei saa ylittää.

4.1.6 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 korkeampaa NLGI-astetta.

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 - 450.

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 tai S2 (litiumkompleksipohja)
- Mobil Mobilith SHC 100 (litiumkompleksipohja)
- Shell Albida EMS 2 (litiumkompleksipohja)
- SKF LGHQ 3 (litiumkompleksipohja)
- Klüber Klüberplex BEM 41-132 (erikoislitiumpohja)
- FAG Arcanol TEMP110 (litiumkompleksipohja).

Lisäohjeita voiteluväleistä muille, vaaditut ominaisuudet täyttävälle voiteluaineille saat ABB:n tuotemyynnistä.

HUOM.!

Suurnopeusmoottoreissa ja esim. M2BA 355 ja 400 2-napaisissa moottoreissa, kun kierroslukutekijä ($Dm \times n$, missä Dm = keskimääräinen laakerien halkaisija mm:nä ja n = pyörimisnopeus, rpm) on korkeampi kuin 400 000, käytä suurnopeusvoiteluaineita.

Seuraavia voiteluaineita voidaan käyttää:

- FAG L69 (polyureapohja)
- Klüber Klüber quiet BH 72-102 (polyureapohja)
- Lubcon Turmogrease PU703 (polyureapohja).

Mikäli käytetään muita voiteluaineita, on varmistettava valmistajalta, että ominaisuudet vastaavat yllämainittuja voiteluaineita, tai voiteluaineen yhteensopivuuden ollessa epävarmaa, ottakaa yhteyttä ABB:n tuotemyyntiin.

VAROITUS

Liiallinen voitelu voi aiheuttaa vaurioita erityisesti suurilla pyörimisnopeuksilla (nopeuskerroin > 400 000).

4.1.7 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

Moottorin suurinta sallittua pyörimisnopeutta ei saa ylittää (katso taulukko 2).

Laakereiden soveltuvuus suuriin nopeuksiin on myös tarkistettava.

4.1.8 Varaosat

Tilatessasi varaosia ilmoita moottorin arvokilpeen leimattu täydellinen lajimerkki ja tuotekoodi.

Ilmoita myös moottorin valmistusnumero, mikäli se on leimattu arvokilpeen.

Lisätietoja on kotisivuillamme osoitteessa www.abb.com/partsonline.

4.1.9 Uudelleenkäämintä

Uudelleenkäämintään tulee käyttää vain luotettavia moottorikorjaamoita.

Ota aina yhteys ABB:n tuotemyyntiin ennen savukaasun poistoon tarkoitettujen moottoreiden ja muiden erikoismoottoreiden uudelleenkäämintää.

5. Ympäristövaatimukset**5.1 Äänitaso**

Suurin osa moottoriemme äänitasoista ei ylitä 82 dB(A), arvot perustuvat 50 Hz:n sinimuotoiseen käyttöön, hyväksyttävä toleranssi ± 3 dB(A).

Yksittäisten moottorien arvot on annettu vastaavissa tuote-esitteissä.

60 Hz:n sinimuotoisen käytön sekä ei-sinimuotoisen käytön äänitasoista ota yhteys ABB:n tuotemyyntiin.

Äänenpainetasot kaikille koneille, joilla on erilliset jäähdytysjärjestelmät, sekä sarjojen M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ ja M2LJ/M3LJ koneille on ilmoitettu erillisissä käyttöoppaissa.

6. Moottorin vianetsintätaulukko

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 vianetsintäkaavio

Moottorin huoltoa ja korjaustoimenpiteitä suorittavan henkilön on oltava pätevä ja turvallisuusmääräyksen tunteva ammattilainen, jolla on asianmukaiset työkalut ja -välineet.

ONGELMA	AIHEUTTAJA	SUOSITELTAVA 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.
	Kytkenä väärä	Tarkista kytkennät moottorin mukana toimitettavasta kytkentäkaavioista ja arvokilvestä.
	Katkos käämissä tai ohjauspiirissä	Kytkimen ollessa suljettuna tunnistetaan se surisevasta 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 mittaamalla. 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 nimellisa nopeutta	Vääränlainen moottori	Ota yhteyttä toimittajaan oikean moottorin valinnasta.
	Jännite moottorinliittimillä liian alhainen johtuen jännitehäviöistä	Käytä korkeampaa jännitettä tai käynnistysmuuntajaa. 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 käytönmitoitus.
	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.

ONGELMA	AIHEUTTAJA	SUOSITELTAVA TOIMENPIDE
Moottori ylikuumenee	Ylikuormitus	Vähennä kuormitusta.
	Runko tai jäähdytysaukot saattavat olla likaiset tai tukossa ja haittaavat moottorin asianmukaista tuuletusta	Puhdista moottori ja varmista esteetön ilman-kierto.
	Moottorissa voi olla yksi vaihe poikki	Tarkista kytkentä.
	Maasulku	Paikallista ja korjaa.
	Epäsymmetrinen syöttöjännite moottoriliittimille	Tarkista johtimet, kytkennät ja muuntajat.
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 yksivaiheisena	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 käyntiääni	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.
	Hihnapyörä liian leveä	Tarkista leveys.
	Hihnapyörän halkaisija liian pieni	Käytä halkaisijaltaan suurempaa hihnapyörää.
	Moottori ei ole linjassa	Linjaa moottori uudelleen.

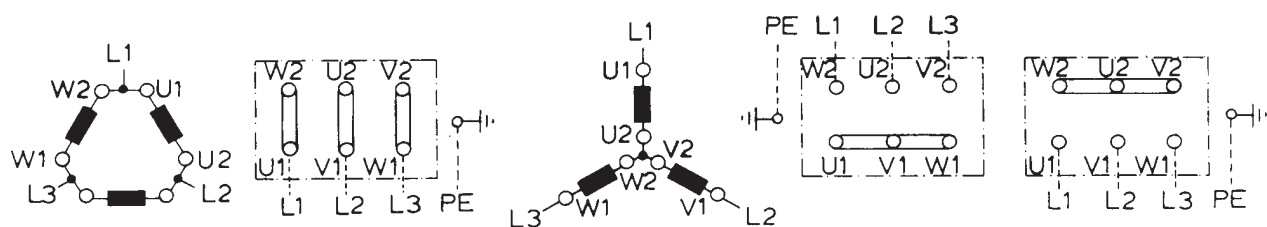


Figure 1. Connection diagram

Bild 1. Anschlußdiagramm

Figure 1. Connection

Figura 1. Conexión

Figura 1. Collegamento

Figur 1. Anslutningdiagramm

Kuva 1. Kytentäkaavio

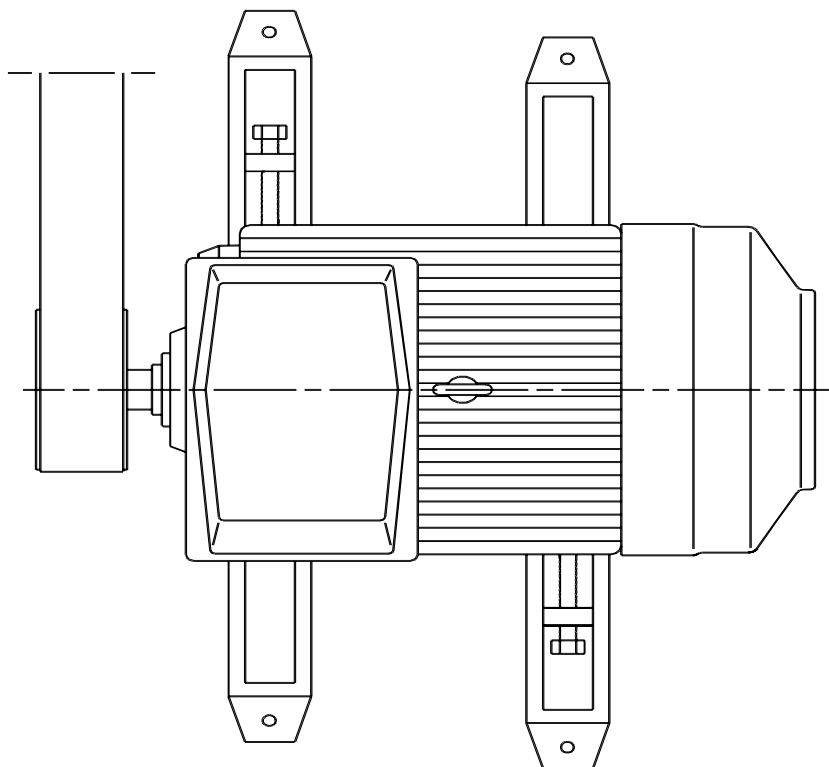


Figure 2. Belt drive

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

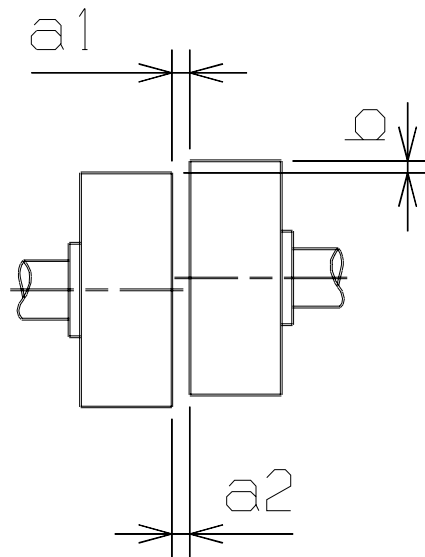


Figure 3. Mounting of half-coupling or pulley
 Bild 3. Anbau von Kupplungshälften und Riemenscheiben
 Figure 3. Montage des demi-accouplements et des poulies
 Figura 3. Montaje de mitades de acoplamiento y poleas
 Figura 3. Montaggio di semigiunti e pulegge
 Figur 3. Montering av kopplinshalvor och drivskivor
 Kuva 3. Kytkinpuolikkaan ja hihnapyörän asennus

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

Austria

ABB AG
Wienerbergstrasse 11 B
AT-1810 Wien
Tel: +43 (0) 1 601 090
Fax: +43 (0) 1 601 09 8305

Belgium

Asea Brown Boveri S.A.-N.V.
Hoge Wei 27
BE-1930 Zaventem
Tel: +32 (0) 2 718 6311
Fax: +32 (0) 2 718 6657

Canada

ABB Inc., BA Electrical Machines
10300 Henri-Bourassa Blvd, West,
Saint-Laurent, Quebec
Canada H4S 1N6
Tel: +1 514 832-6583
Fax: +1 514 332-0609

China*

ABB Shanghai Motors
Company Limited
8 Guang Xing Rd., Rong Bei
Town, Songjiang County,
Shanghai 201613
Tel: +86 21 5778 0988
Fax: +86 21 5778 1364

Chile

Asea Brown Boveri S.A.
P.O.Box 581-3
Santiago
Tel: +56 (0) 2 5447 100
Fax: +56 (0) 2 5447 405

Denmark

ABB A/S
Automation Technology Electrical
Machines
Petersmindevej 1
DK-5000 Odense C
Tel: +45 65 477 070
Fax: +45 65 477 713

Finland*

ABB Oy
LV Motors
P.O.Box 633
FI-65101 Vaasa
Tel: +358 (0) 10 22 11
Fax: +358 (0) 10 22 47372

France

ABB Automation
Rue du Général de Gaulle
Champagne-sur-Seine
FR-77811 Moret-sur-Loing Cedex
Tel: +33 (0) 1 60 746 500
Fax: +33 (0) 1 60 746 565

Germany

ABB Automation Products GmbH
Edisonstrasse 15
DE-68623 Lampertheim
Tel: +49 (0) 6206 503 503
Fax: +49 (0) 6206 503 600

Hong Kong

ABB (Hong Kong) Ltd.
Tai Po Industrial Estate,
3 Dai Hei Street,
Tai Po, New Territories,
Hong Kong
Tel: +852 2929 3838
Fax: +852 2929 3505

India*

ABB Ltd.
32, Industrial Area, N.I.T
Faridabad 121 001
Tel: +91 (0) 129 502 3001
Fax: +91 (0) 129 502 3006

Indonesia

PT. ABB Sakti Industri
JL. Gajah Tunggal Km.1
Jatiuwung, Tangerang 15136
Banten, Indonesia
Tel: + 62 21 590 9955
Fax: + 62 21 590 0115 - 6

Ireland

Asea Brown Boveri Ltd
Components Division
Belgard Road
Tallaght, Dublin 24
Tel: +353 (0) 1 405 7300
Fax: +353 (0) 1 405 7327

Italy*

ABB SACE SpA
LV Motors
Via Della Meccanica, 22
IT-20040 Caponago - MI
Tel: +39 02 959 6671
Fax: +39 02 959 667216

Japan

ABB K.K.
26-1 Cerulean Tower
Sakuragaoka-cho, Shibuya-ku
Tokyo 150-8512
Tel: +81 (0) 3 578 46251
Fax: +81 (0) 3 578 46260

Korea

ABB Korea Ltd.
7-9fl, Oksan Bldg., 157-33
Sungshung-dong, Kangnam-ku
Seoul
Tel: +82 2 528 2329
Fax: +82 2 528 2338

Malaysia

ABB Malaysia Sdn. Bhd.
Lot 608, Jalan SS 13/1K
47500 Subang Jaya, Selangor
Tel: +60 3 5628 4888
Fax: +60 3 5631 2926

Mexico

ABB México, S.A. de C.V.
Apartado Postal 111
CP 54000 Tlalnepantla
Edo. de México, México
Tel: +52 5 328 1400
Fax: +52 5 390 3720

The Netherlands

ABB B.V.
Dept. LV motors (APP2R)
P.O.Box 301
NL-3000 AH Rotterdam
Tel: +31 (0) 10 4078 879
Fax: +31 (0) 10 4078 345

Norway

ABB AS
P.O.Box 154 Vollebekk
NO-0520 Oslo
Tel: +47 22 872 000
Fax: +47 22 872 541

Singapore

ABB Industry Pte Ltd
2 Ayer Rajah Crescent
Singapore 139935
Tel: +65 6776 5711
Fax: +65 6778 0222

Spain*

ABB Automation Products S.A.
Division Motores
P.O.Box 81
ES-08200 Sabadell
Tel: +34 93 728 8500
Fax: +34 93 728 8741

Sweden*

ABB Automation Technologies AB
LV Motors
SE-721 70 Västerås
Tel: +46 (0) 21 329 000
Fax: +46 (0) 21 329 140

Switzerland

ABB Schweiz AG
Normelec/CMC Components
Motors&Drives
Badenerstrasse 790
Postfach
CH-8048 Zürich
Tel: +41 (0) 58 586 0000
Fax: +41 (0) 58 586 0603

Taiwan

ABB Ltd.
6F, No. 126, Nanking East Road,
Section 4i
Taipei, 105 Taiwan, R.O.C.
Tel: +886 (0) 2 2577 6090
Fax: +886 (0) 2 2577 9467

Thailand

ABB Limited (Thailand)
161/1 SG Tower,
Soi Mahadlekluang 3,
Rajdamri, Bangkok 10330
Tel: +66 2 665 1000
Fax: +66 2 665 1042

The United Kingdom

ABB Automation Ltd
9 The Towers, Wilmslow Road
Didsbury
Manchester, M20 2AB
Tel: +44 (0) 161 445 5555
Fax: +44 (0) 161 448 1016

USA

ABB Inc.
Low Voltage Motors
16250 W. Glendale Drive
New Berlin, WI 53151
Tel: +1 262 785 3200
Fax: +1 262 785 8628

Venezuela

Asea Brown Boveri S.A.
P.O.Box 6649
Carmelitas,
Caracas 1010A
Tel: +58 (0) 2 238 2422
Fax: +58 (0) 2 239 6383



14.9 Heat exchanger

14.9.1 Working oil cooler:

Voith Article No.: ____

Type: not supplied by Voith-Crailsheim

14.9.2 Lube oil cooler

Voith Article No.: ____

Type: not supplied by Voith-Crailsheim

Assembly Plan

Working oil cooler ____

Lubricating oil cooler. ____

Installation and instruction manual ____

14.10 Shutoff valve - oil reservoir

Voith Article No.: 49904001
Type: BOA-H

Description BOA-H



**Maintenance-free
globe valves
with metallic seat**

with bellows

flanged

**PN 16
DN 10-350**

Fields of application

- Warm water heating systems DIN 4751
 - Hot water heating systems DIN 4752
 - Heat-transfer systems DIN 4754
 - Pressure vessel equipment to TRB 801 no. 45¹⁾
 - Boiler installations to TRD 108/110¹⁾
- ¹⁾ Please contact KSB for limitations imposed by the applicable technical codes.

Operating data

- Temperature range:
 - 10 up to +300 °C for GG-25
 - 10 up to +350 °C for GGG-40.3
 - 30 °C for GGG-40.3 with bolts for low-temperature service
- Pressure range up to: $\Delta p = 16$ bar

Materials

Body:

- Straight way pattern: Flake graphite cast iron GG-25
Nodular cast iron GGG-40.3
- Angle pattern: Flake graphite cast iron GG-25
- For further details see table of materials

Design

- Straight way or angle pattern with straight upper part
- Compact body cover
- Maintenance-free stem sealed by bellows and safety gland
- Rising handwheel
- Asbestos-, CFC-, PCB-free
- External painting: blue similar to RAL 5002

Standard variants

- Cone with PTFE-gasket (max. 200 °C, DN 10-200, for throttling cone DN 10-150)
- Variant unit (throttling cone, position indicator, locking device and travel stop)
- Lead-sealable cap (against unauthorized closing)
- Pressure relief cone (from DN 200)
- Handwheels of cast iron
- Chain wheel with accessories
- Position switch
- Oil- and grease-free design
- Remote manual actuation
- Other flange designs

Remarks

- Flow characteristic curves: 7116.4
- Operating instructions 0570.8
- For use in steam plants at high temperatures and pressures we recommend BOA[®]-HV globe valves type leaflet 7151.11
- Approved by the German federal office for civil defence for installation in shelters.
- Shock resistance RK 0,63/6,3 Safety class A.

On all inquiries/orders please specify

Globe valve

1. BOA[®]-H acc. to type leaflet 7116.1
2. PN 16
3. GG-25 or GGG-40.3
4. Straight way or angle pattern (angle pattern only in GG-25)
5. DN 10-350 (DN 350 only in GGG-40.3)
6. Standard variants



Working pressures

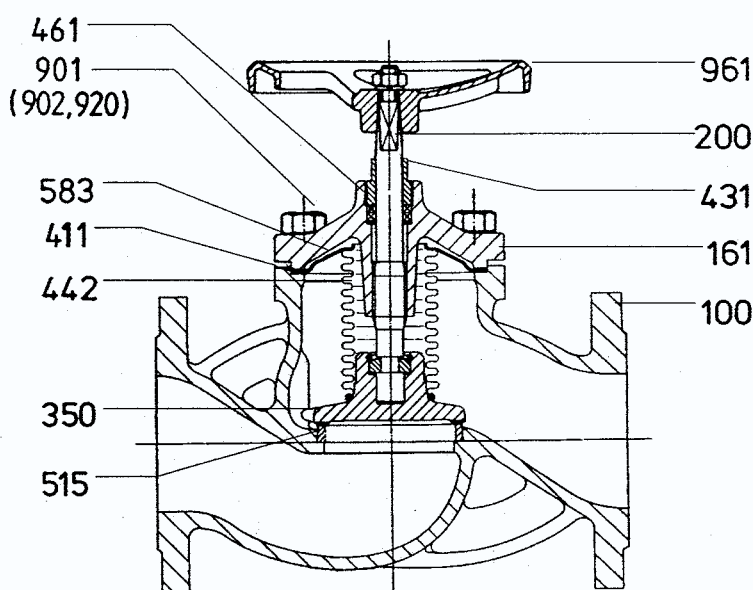
Nominal pressure PN	Material	Body pressure test in bar with water		Permissible working pressures in bar at temperatures in °C ³⁾ to V-DIN 2401 (1.66)				
		Body ¹⁾	Seat ²⁾	- 10 up to + 120 °C	200	250	300	350
16	GG-25	24	16	16	13	13 ⁴⁾	13 ⁴⁾	-
	GGG-40.3			16	13	13 ⁴⁾	13 ⁴⁾	10

¹⁾ DIN 3230 - BQ (ISO 5208)

²⁾ DIN 3230 BN/leakage rate 1 (ISO 5208/leakage rate 3)

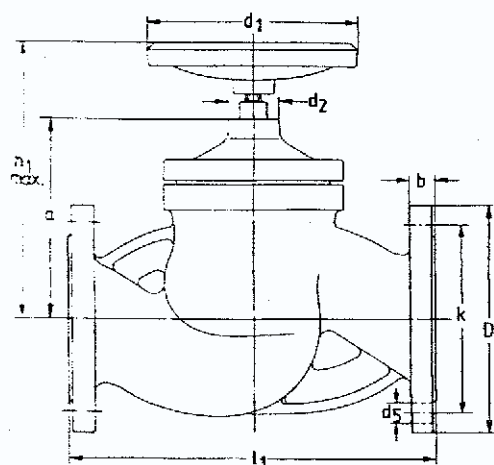
³⁾ For intermediate temperatures use straight-line interpolation.

⁴⁾ Note: The connection bolts between valve and pipe flange must also have a guaranteed hot yield strength (e.g. material 5.6 or CK 35 V).

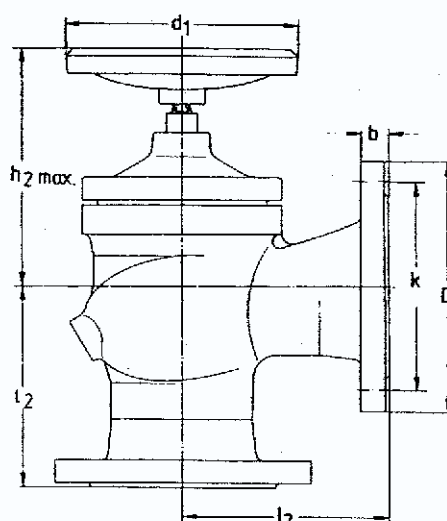


Materials

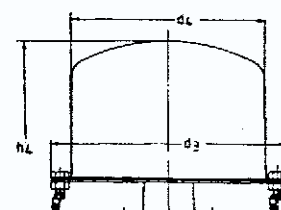
Part-no.	Designation	DN	Material
100	Body	10-300	GG-25 (mat. No. 0.6025)
		10-350	GGG 40.3 (mat. No. 0.7043)
161	Body cover	10-300	GG-25 (mat. No. 0.6025)
		10-350	GGG-40.3 (mat. No. 0.7043)
411	Gasket		CrNiSt-graphit
431	Gland		9S Mn 28 K (mat. No. 1.0718) chemically nickel-plated
440	Bellows set comprising:		
200	Steam		X 20 Cr 13 (mat. No. 1.4021)
350	Cone	10-150	X 5 CrNi 18 10 (mat. No. 1.4301)
		200-350	C 22 (mat. No. 1.0402)/X 15 CrNi 18 8 (mat. No. 1.4370)
442	Bellows		X 6 CrNiTi 18 10 (mat. No. 1.4541)
583	Supporting plate		X 5 CrNi 18 10 (mat. No. 1.4301)
461	Gland packing		pure graphite
515	Seat ring		X 20 Cr 13 (mat. No. 1.4021)
901	Hexagon head bolt	10-200	5.6 (for GG-25)
902	Stud	250-300	CK 35 V (for GG-25)
		10-350	CK 35 V (for GGG-40.3)
920	Nut	10-350	C 35
961	Handwheel	10-125	GD-AISI 8
		150-350	GG-20 (mat. No. 0.6020)



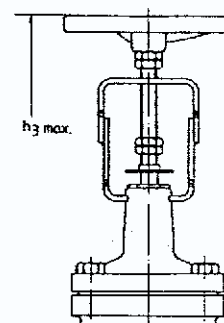
Straight way pattern



Angle pattern

 a and d₂ insulation dimensions


with cap



with variant unit

Dimensions (mm)
Weight approx.

PN	DN	l ₁	l ₂	h ₁	h ₂	h ₃	h ₄	d ₁	d ₂ ¹⁾	d ₃	d ₄	a	D	k	n x d ₅	b	Straight way pattern		Angle pattern
																	kg	kg ²⁾	kg
16	10	130	85	155	135	205	210	100	34	166	130	104	90	60	4 x 14	14	2,6	3,4	2,7
	15	130	90	155	135	205	210	100	34	166	130	104	95	65	4 x 14	14	2,8	3,6	3,0
	20	150	95	170	140	215	220	100	34	166	130	115	105	75	4 x 14	16	4,0	4,8	4,0
	25	160	100	175	140	215	225	100	34	166	130	121	115	85	4 x 14	16	4,5	5,3	4,6
	32	180	105	200	160	250	235	125	36	166	130	133	140	100	4 x 18	18	7,3	8,1	7,5
	40	200	115	205	160	250	240	125	36	166	130	138	150	110	4 x 18	18	8,4	9,2	8,4
	50	230	125	215	175	275	300	160	40/55	206	170	149	165	125	4 x 18	20	11,3	12,9	10,7
	65	290	145	240	185	290	315	160	40/55	206	170	166	185	145	4 x 18	20	17,6	20,1	16,9
	80	310	155	280	225	340	395	200	50/70	256	220	196	200	160	8 x 18	22	23,0	25,5	21,8
	100	350	175	310	250	375	435	200	50/70	256	220	237	220	180	8 x 18	24	34,0	36,5	30,8
	125	400	200	365	290	460	475	250	56/90	390	340	271	250	210	8 x 18	26	52,0	58,0	48,3
	150	480	225	390	300	495	505	315	56/90	390	340	301	285	240	8 x 22	26	72,0	78,5	65,7
	175	550	-	390	-	-	505	315	56/90	390	340	301	315	270	8 x 22	28	100,0	106,5	-
	200	600	275	485	380	620	535	400	90	470	420	334	340	295	12 x 22	30	130,0	139,0	114,2
	250	730	325	585	455	735	625	400	90/110	470	420	420	405	355	12 x 26	32	230,0	239,0	180,5
	300	850	375	670	515	845	710	500	90/110	570	520	483	460	410	12 x 26	32	328,0	343,0	267,5
	350	980	-	670	-	845	710	500	90/110	570	520	483	520	470	16 x 26	36	375,0	390,0	-

DN 175 and 350 only in GGG-40.3 on request

¹⁾ larger dimensions for GGG-40.3

²⁾ with cap/with variant unit

Installation instructions

The flow direction in BOA®-H globe valves should correspond to the integral arrow on the body. An alternating flow direction is permissible for the standard cone, but not for the throttling cone. If the differential pressure on valves with standard cone and DN 200 or greater exceeds the values stated in the table below, a pressure relief cone is required.

Valves with throttling cones can only be used up to these differential pressures.

DN	200	250	300/350
Δp bar	12	9	6

Connection dimensions - standards:

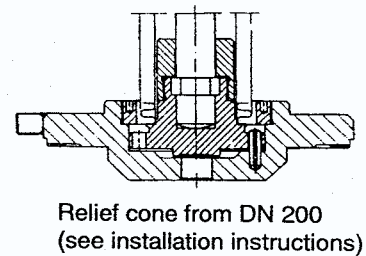
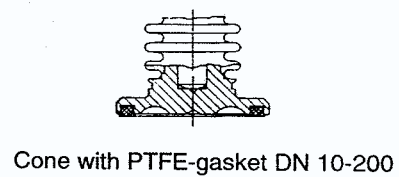
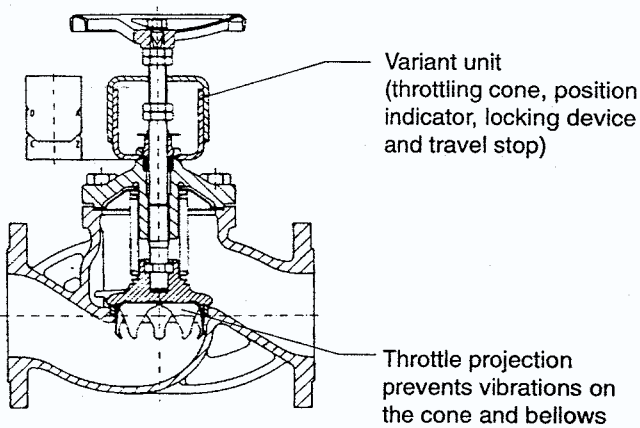
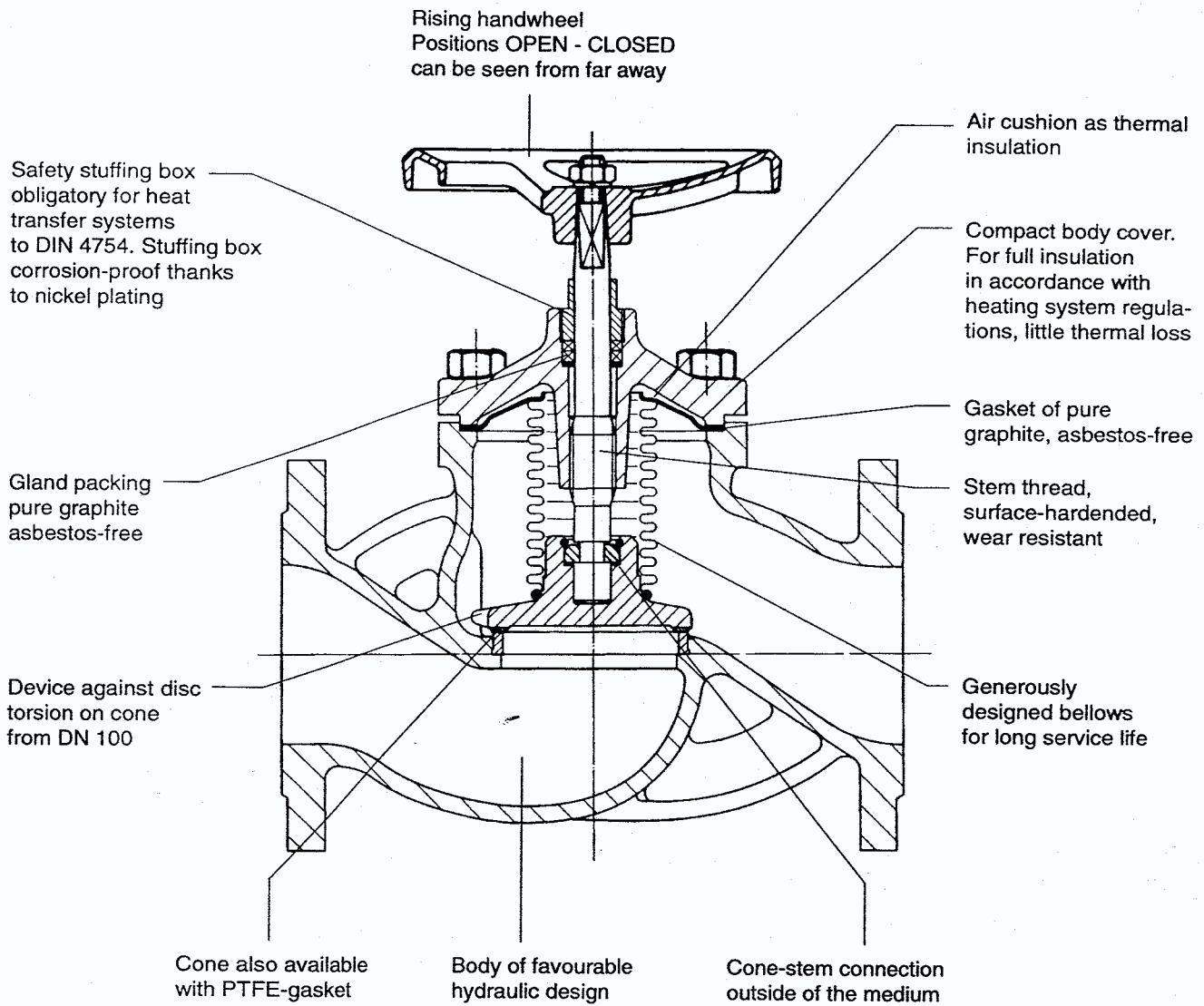
Flanges: DIN 2501 (ISO 7005-2 pr EN 1092-2, BS 4504)

Raised face: Type C DIN 2526

Face-to-face lengths:

Straight way pattern: EN 558-1/1 (formerly: DIN 3202/F 1) ISO 5752/1

Angle pattern: EN 558-1/8 (formerly: DIN 3202/F 32) ISO 5752/8



14.11 Vent filter - Geared variable speed coupling

Voith Article No.: 4188931002

Type: TLFI 3-40 G 25.... SO

Description EPE-10

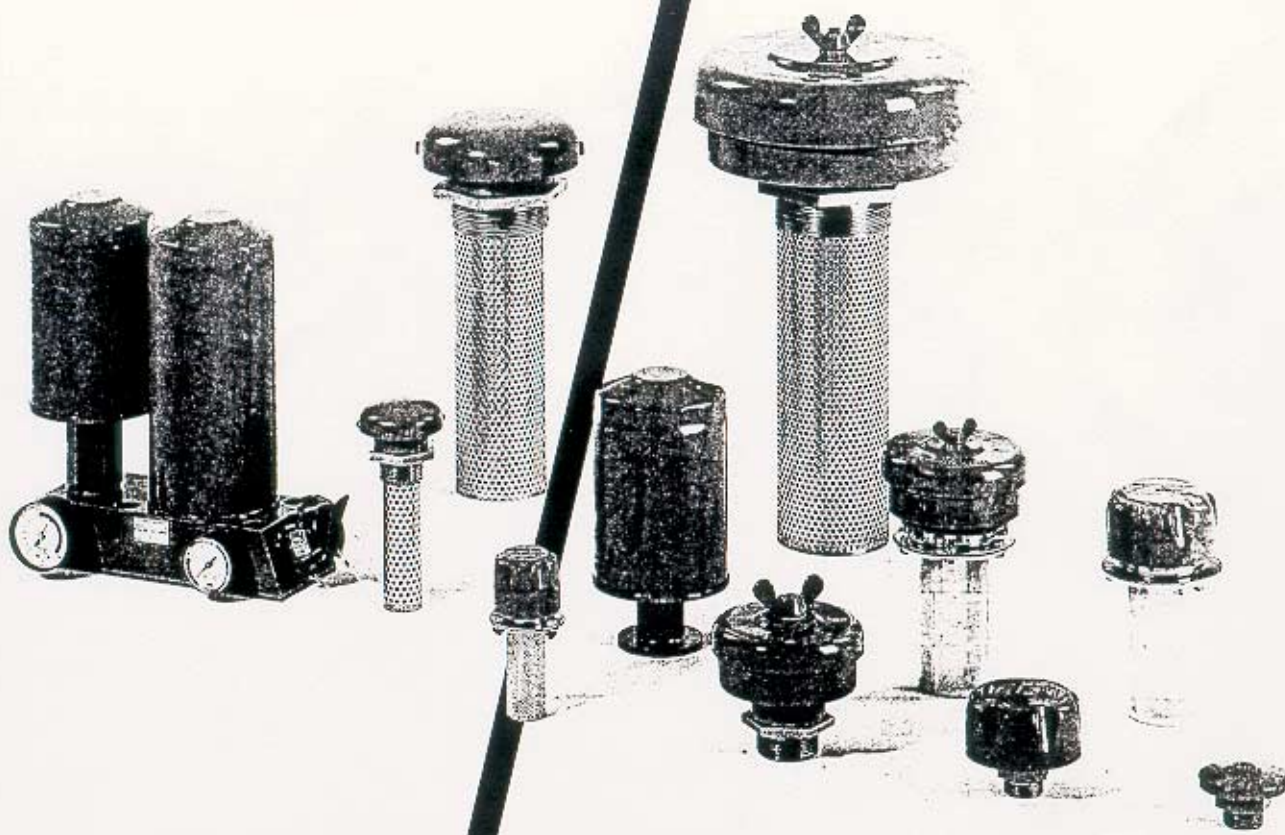
Filler Breather Filters

*Breather filters
for many applications*

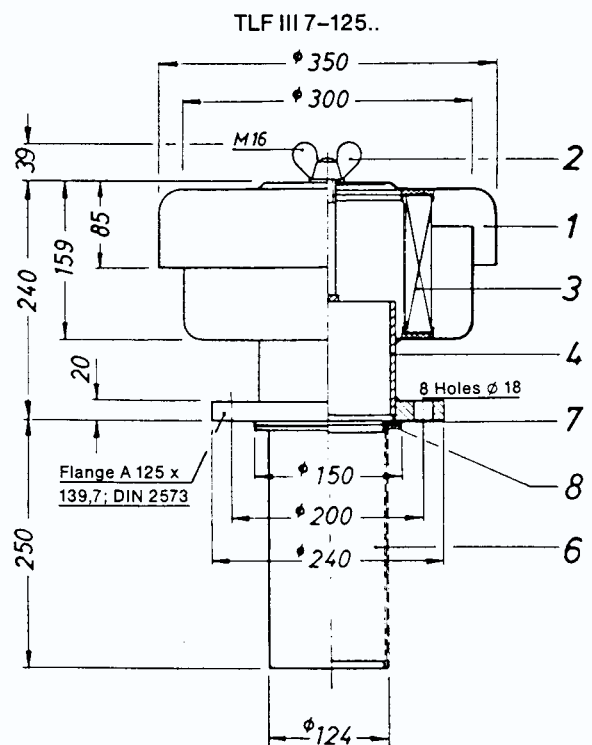
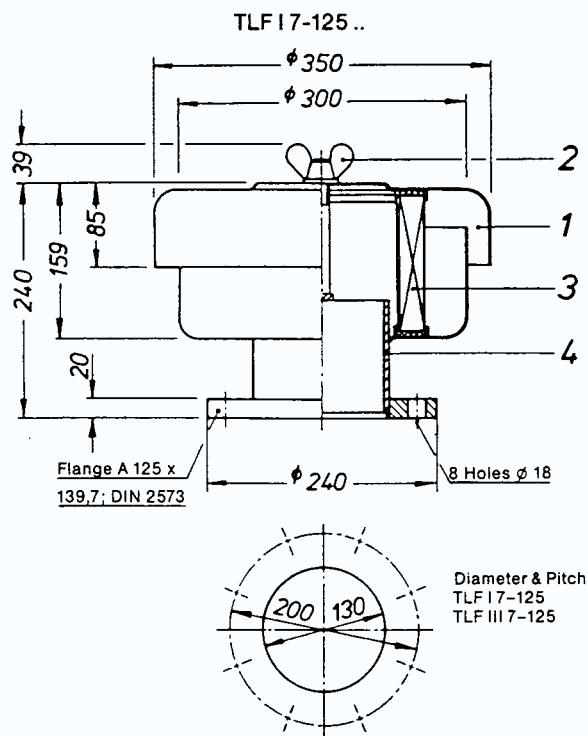
*Tank air breather
with replacement elements*

10

Venting Filter
Type: TLF I 3-40



€P€



Dimensions

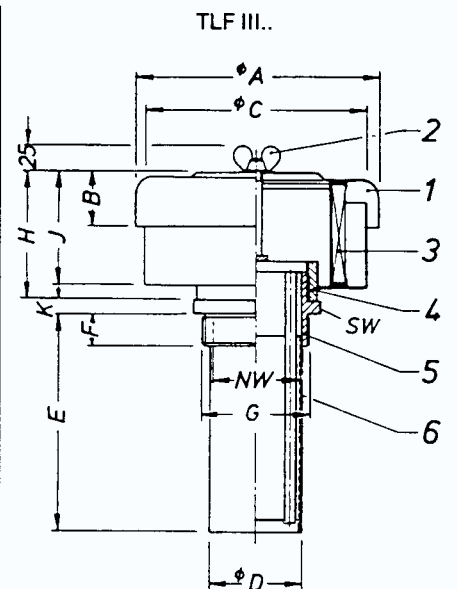
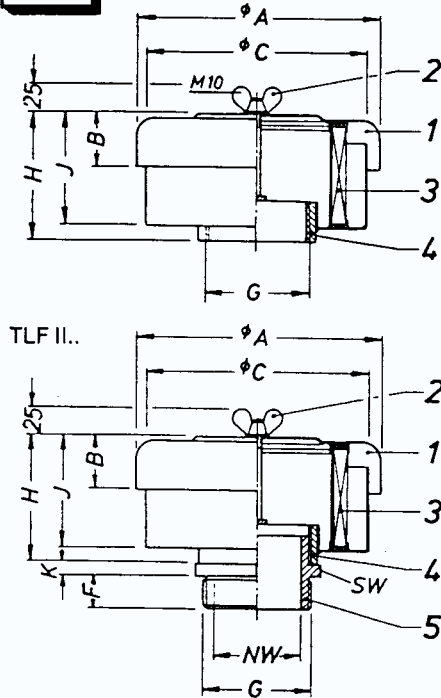
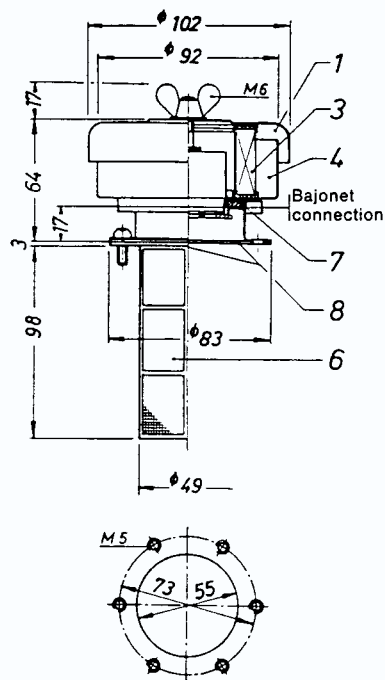
Type	TLF I, II or III						
Size-NW	1-25	2-32	3-40	4-50	5-65	6-80	7-125
Air Q l _n /min*	750		3 200			4 000	8 500
Filter area cm ²	680		3 100			3 100	7 200
Filter Q l/min	9	14	21	32	47	70	105
SW	46	55	60	75	90	105	
A	102		177			210	
B	24		46			45	
C	92		162			190	
D	28	34	42	53	67	82	
E	107	131	155	187	218	256	
F	17	19	19	22	24	26	
G ISO 228	G 1	G 1¼	G 1½	G 2	G 2½	G 3	
H	53	63	98			88	
I	43		88			78	
K	6		7	7	9	9	
I	0.5	0.6	2.1	2.1	1.6	1.9	8.0
Weight kg II	0.6	0.7	2.3	2.3	2.0	2.3	-
III	0.7	0.8	2.5	2.5	2.3	2.7	8.8

* at Δp 0.03 bar

TLFO 2-32...

TLF 2-32...

TLF I...



Tank Air Breather

A combination air breather filler filter designed to filter air in both directions. Can be supplied as an inlet or an outlet filter.

Construction: TLF

The metal housing is fitted with a paper element partially immersed in an oil bath. A wing nut allows the cap to be removed and the element changed. The filler oil filter is a stainless steel mesh element. Can also be supplied in plastic (T.L.F.O.).

Filter media

Oil Strainer: stainless steel 130µm;
TLFO plastic 500 µm
Air Filter: Elements P25, P10, H6LL, H3LL
Other filter media available on request.

Types available:

0.. and without numbers
I..
II.. and III..
I-7 and III-7

Flanged collar and bayonet fitting
Female screwed connection
Male screwed connection
Air filter with flange connection

Parts list

1 Cover	1		1	1	1
2 Wing nut	M 10		M 10	M 10	M 16
3 Filter element	7.002..		7.004..	7.006..	7.007..
4 Mounting	1		1	1	1
5 Coupling	1	1	1	1	1
6 Oil strainer	1	1	1	1	1
7 Seal P	-	58 x 40 x 2	-	-	ø 150 x ø 117 x 2
8 Seal P	-	83x51x1 Abil	-	-	ø 150 x ø 130 x 2

14.12 Oil sight glass - Geared variable speed coupling

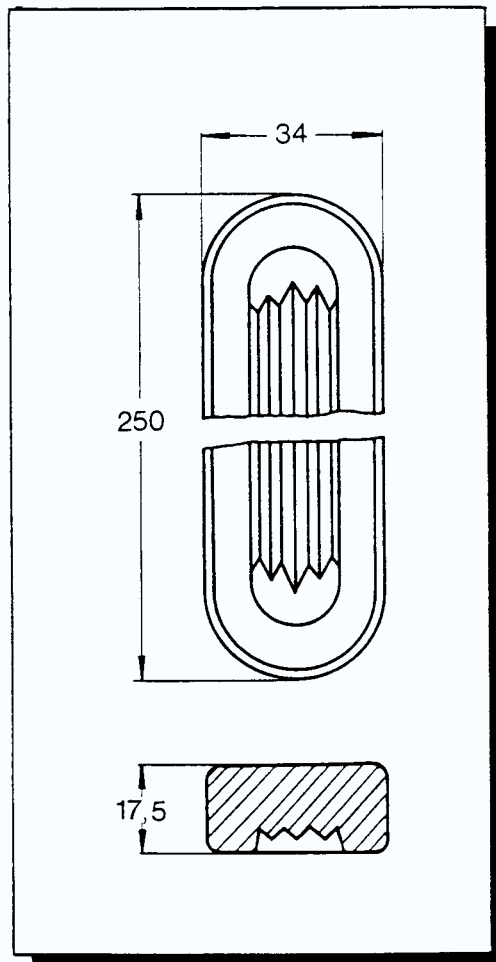
Voith Article No.: 49912001

Type: Size 6 - Form R

Description85.6157.29

Ölstandsglas Größe 6 (Reihe R)
Sight-glass plate size 6 (form R)

REFLEXIONS - SCHAUGLASPLATTE
REFLECTION - SIGHT-GLASS PLATE



Größe: 6 (Form R)
Size

85.6157.29

14.13 Measuring connection

Meas. tubing

Voith Article No.: 03039001

Type: SMS 20-800 B

Pressure gauge connection

Voith Article No.: 03039002

Type: MAV 1/2 - MA3

Measuring connection

Voith Article No.: 41417048

Type: EMA 3 R1/4

Drawing 3626-010430

Measuring Connection Type EMA3 with Screw Connection M16
Example of Application

Identification Color
of Screw Connection
Yellow

Pressure gauge
(Supplied upon receipt
of an order)

Pressure gauge connection
MAV $\frac{1}{2}$ MA3

Measuring hose
Typ SMA 3
Length 800mm

Screw cap

O - Ring

Thread M16

SW 19

Test connection EMA3

max. 10 mm

G $\frac{1}{2}$

Zeichnungs-Nr.: 3.623 - 10430 e

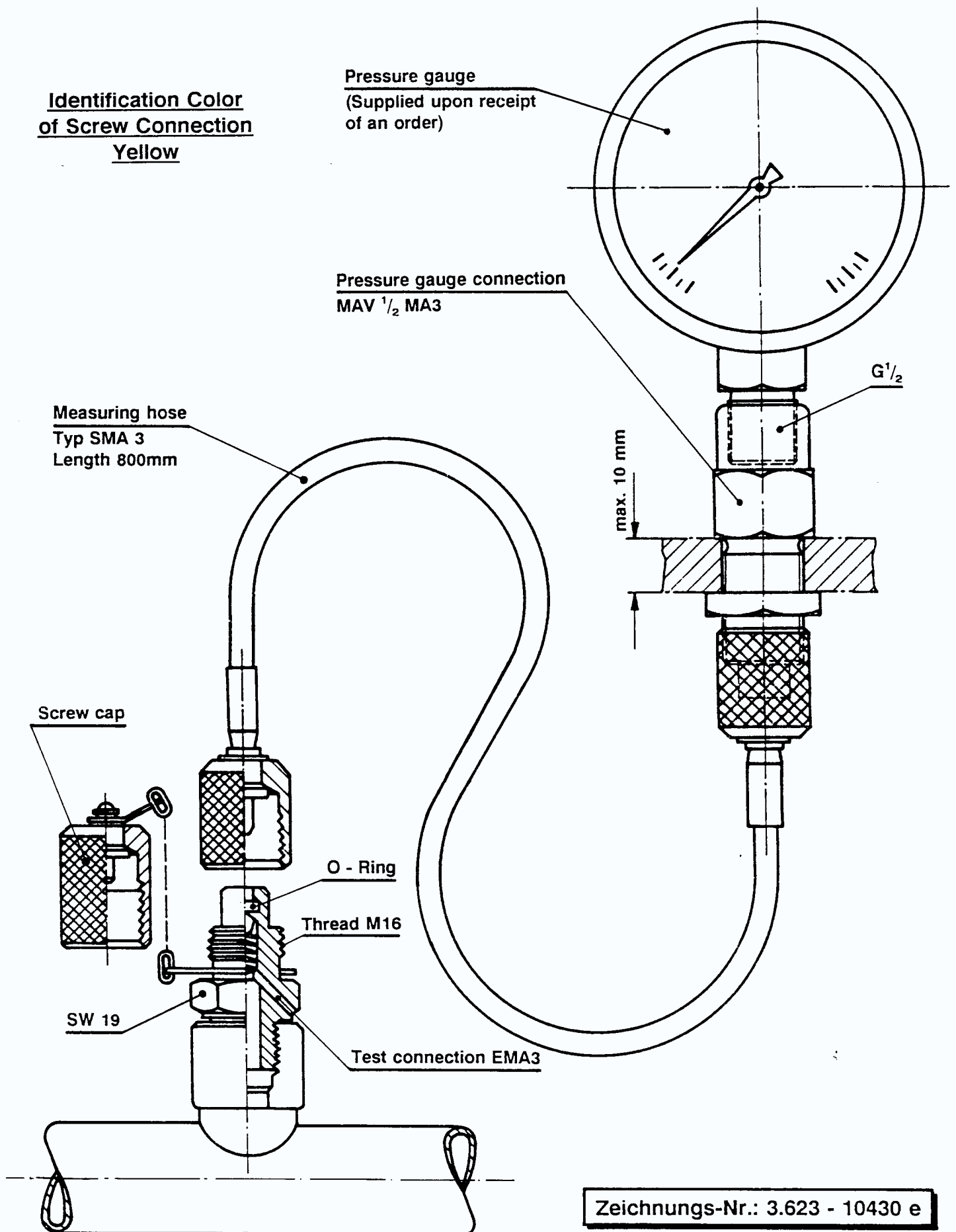


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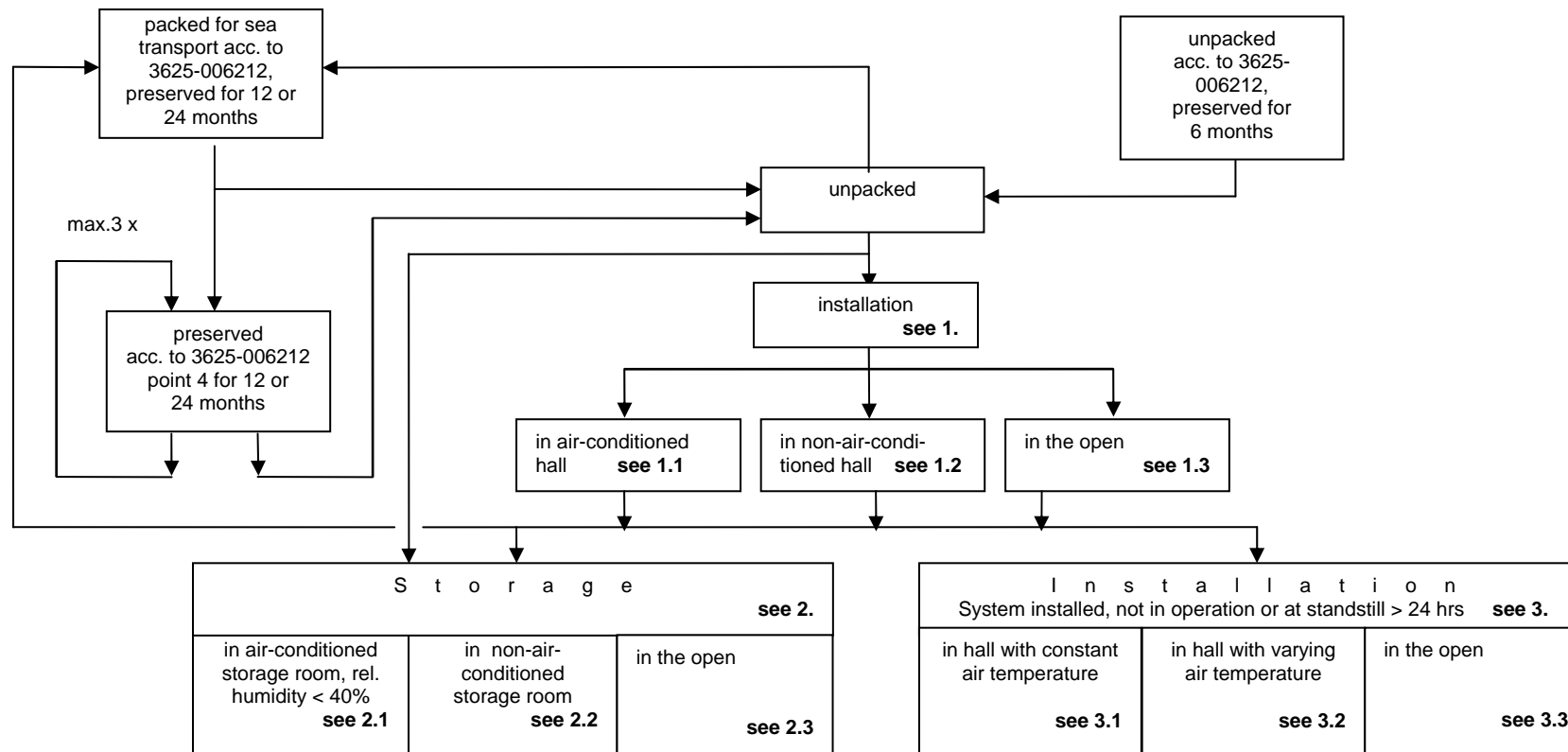
Appendix_A_

Preservation method and instructions for storage after delivery 3625-006714

VOITH

Preservation methods and storage instructions after delivery for coupling types R, RW, S, MDC and torque converters, as well as for assemblies

This regulation contains an overview of preservation methods, storage and inspections of machines and assemblies after delivery, as well as general instructions.



Replacing:
3625-006714, 2004-06-01

2008-01-16; airee-TRg
airev - KHi

Voith Turbo GmbH & Co. KG - D-74555 Crailsheim - Postfach 1555 ·
Tel. +49 7951 32-0 · Fax 32-500

3625-006714en
Rev. 1 Page 1/13

General

Voith units and their assemblies are high quality investment goods whose perfect condition is to be preserved during installation and assembly work, long periods of storage and after installation or in cases of standstill for operational reasons. The measures necessary during these phases and the necessary inspections are described in the following. The work carried out is to be documented.

When carried out carefully, the storage and preservation procedures described are suitable for maintaining the perfect condition of the deliveries in the period between dispatch from Voith Crailsheim and commissioning.

In addition to protection of the external corrodible surfaces by applying film forming, water displacing anticorrosive agents, the measures described are based on the creation of a dry, or alternatively a dry and oxygen-free climate in the interior of the units. The aim is to achieve and maintain relative air humidity in the interior $\leq 40\%$, as below this air humidity no corrosion occurs.

The following can be used to create the dry climate in the interior of the units:

- sorption air dehumidifiers
- dry compressed air
- technical nitrogen with a sufficiently low dew point

Assemblies, such as gear stages, are to be treated as exposed external iron parts and are generally to be stored packed in accordance with Voith no. 3625-006212 points 2 – 4 or in air-conditioned rooms, unless agreed otherwise, or delivered in special containers for long-term storage.

1. Installation of Voith units in a system: general instructions:

Special attention is to be paid to the efficacy of the preservation, as it is frequently subject to additional dangers due to water, severe dirt accumulation and mechanical damage.

During installation, maintenance of the efficacy of the preservation is to be checked regularly and documented.

- Installation is to be carried out preferably in buildings but at least under a roof or tent providing protection against weather conditions.
- For assembly purposes, cleaned exposed external iron surfaces are to be sprayed on the same day with a film forming anticorrosive agent, e.g. Shell Ensis Fluid S, or to be painted.
- Do not unpack cold units (below dew point) in warm rooms but only after temperature equalisation.

Attention: When installing in rooms, do not use nitrogen for protection against corrosion due to toxic hazard!

1.1 Installation of a Voith unit in a system in an air-conditioned hall

See also point 1.

The following measures apply to an air-conditioned hall which is defined as follows:

- Temperature range 18 to 26 °C
- Relative air humidity within the range 35 to 65 %
- Low airflow
- Temperature fluctuation within 24 hrs < 8°C

If one of the conditions stated is not met, the measures according to point 1.2 for "Non-air-conditioned hall" are to be applied.

Spray exposed iron parts with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S. (Clean surfaces of the units sprayed with preserving agents with a suitable cleaning agent, white spirit or paraffin before fitting or mounting parts, e.g. tightening hubs). After fitting or mounting parts, re-coat remaining exposed iron surfaces with anticorrosive agent, spray or coat with paint.

To protect the interiors of the units against corrosion during installation, the following methods are recommended:

a) Dehumidification of the air in the interior of the units with sorption air humidifier.*

- Provided no covers, flanges etc. of the units are opened, the air in the interior of the machine is to be dried every 3 days with a sorption air dehumidifier. Permissible relative residual humidity $\leq 20\%$. The ventilation filter is to be sealed with a plastic film.
 - After opening the housing by removing covers, flanges etc., the interior of the unit is to be dried immediately with a sorption air dehumidifier. *
- Unscrewed covers, flanges etc. are to be refitted as quickly as possible, at least after ½ hour, or replaced by provisional covers, to reduce the penetration of humidity to an unavoidable minimum.

The permanent supply of the interior of the unit with dehumidified air via a sorption air dehumidifier is permitted. It is recommended to control the unit with a hygrostat. The relative air humidity in the interior of the machine should be $\leq 40\%$.

b) Supply of the interior of the unit with dry compressed air. Volume flow approx. 5 to 10 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below -5°C.

- Provided no covers, flanges etc. of the unit are opened, the interior of the machine is to be filled after with dry compressed air every 3 days. The purging process is to be carried out with at least 5 times the volume of the interior.
- After opening covers, flanges etc., the interior of the unit is to be flowed through immediately with dry compressed air.

* see page 12

Unscrewed covers, flanges etc. are to be refitted as quickly as possible, at least after ½ hour, or replaced by provisional covers, to reduce the penetration of humidity to an unavoidable minimum.

The permanent supply of the interior of the unit with dry compressed air is permitted. The atmospheric dew point of the compressed air must be below -5°C.

1.2 Installation of a Voith unit in a system in non-air-conditioned hall

See also point 1.

The following measures apply to a non-air-conditioned hall which is defined as follows:

- Temperature range 10 to 30 °C
- Relative air humidity within the range 35 to 70 %
- Moderate airflow
- Temperature fluctuation within 24 hrs < 15°C

If one of the conditions stated is not met, the measures according to point 1.3 for “In the open” are to be applied.

Spray exposed iron parts with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S. (Clean surfaces of the units sprayed with preserving agents with a suitable cleaning agent, white spirit or paraffin before fitting or mounting parts, e.g. tightening hubs). After fitting or mounting parts, re-coat remaining exposed iron surfaces with anticorrosive agent, spray or coat with paint.

To protect the interiors of the units against corrosion during installation, the following methods are recommended:

- a) Dehumidification of the air in the interior of the units with sorption air humidifier.*
- Provided no covers, flanges etc. of the units are opened, the air in the interior of the machine is to be dried every 3 days with a sorption air dehumidifier. Permissible relative residual humidity $\leq 15\%$. The ventilation filter is to be sealed with a plastic film.
 - After opening the housing by removing covers, flanges etc., the interior of the unit is to be dried immediately with a sorption air dehumidifier. *

Unscrewed covers, flanges etc. are to be replaced by provisional covers immediately to reduce the penetration of humidity to an unavoidable minimum.

The permanent supply of the interior of the unit with dehumidified air via a sorption air dehumidifier is permitted. It is recommended to control the unit with a hygrostat. The relative air humidity in the interior of the machine should be $\leq 40\%$.

- b) Supply of the interior of the unit with dry compressed air. Volume flow approx. 10 to 15 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below -10°C.

*see page 12

- Provided no covers, flanges etc. of the units are opened, the air in the interior of the machine is to be dried every 3 days with a sorption air dehumidifier. The ventilation

filter is to be sealed with a plastic film. The purging process is to be carried out with at least 5 times the volume of the interior.

- After opening the housing by removing covers, flanges etc., the interior of the unit is to be dried immediately with dry compressed air.

Unscrewed covers, flanges etc. are to be replaced by provisional covers immediately to reduce the penetration of humidity to an unavoidable minimum.

Permanent supply of the interiors of the unit with dry compressed air is permitted (10 – 15 l/min). The atmospheric dew point of the compressed air must be below -10°C.

1.3 Installation of a Voith unit in a system in the open

See also point 1.

Installation of the units and work during which covers, flanges etc. are unscrewed, are to be carried out under a roof or in a tent.

Spray exposed iron parts with a film forming, water displacing anticorrosive agent, e.g. Shell Ensic Fluid S. (Clean surfaces of the units sprayed with preserving agents with a suitable cleaning agent, white spirit or paraffin before fitting or mounting parts, e.g. tightening hubs). After fitting or mounting parts, re-coat remaining exposed iron surfaces with anticorrosive agent, spray or coat with paint.

To protect the interiors of the units against corrosion during installation, the following methods are recommended:

- a) - permanent supply of the interiors of the units with dehumidified air with sorption air dehumidifier.*
 - Unscrewed covers, flanges etc. are to be replaced by provisional covers immediately to reduce the penetration of humidity to an unavoidable minimum.
- b) - permanent supply of the interiors of the machines with dry compressed air.
 - Atmospheric dew point of the compressed air $\leq -40^{\circ}\text{C}$.
 - Volume flow approx. 10-15 l/min (sufficient for up to 6 m³ volume of the interior)
 - Unscrewed covers, flanges etc. are to be replaced by provisional covers immediately to reduce the penetration of humidity to an unavoidable minimum.
- c) - permanent supply of the interiors of the machines with technical nitrogen, volume flow approx. 10 – 15 l/min. (sufficient for up to 6 m³ volume of the interior), required pressure approx. 0.002 bar. Dew point of nitrogen $\leq -70^{\circ}\text{C}$.

Attention: All works on the unit must be performed under special safety measures when using nitrogen.

Toxic hazard!

* see page 12

2. Storage, general instructions

Requirements for the storage of Voith units or systems in closed rooms:

- The storage room should be dry, with low dust levels, moderately ventilated and free of vibrations.
- The basic condition for storage is that no aggressive media, such as gases, vapours or aerosols of acids, alkaline solutions or salts can act upon the machines.
- Ensure sufficient stability, also on inclined surfaces.
- Packed machines must only be stacked or placed on top of one another in such a way that the air circulation is maintained.
- All machines must be easily accessible for inspection and maintenance work for:
 - reading off moisture indicators
 - inspection of the machines
 - repairs to packaging
- Do not unpack cold machines (below dew point) in warm rooms, but only after temperature equalisation.
- Filling or permanent supply of machines with nitrogen is not permitted in rooms due to toxic hazard.

For storage of assemblies, see page 2, "General"

Requirements for storage in the open:

- Unpacked machines may only be stored in the open if they are intended for outside installation.
- The storage temperature should be within the range 0 to 40 °C.
- The storage area must be free of vibrations. It should preferably have a sturdy foundation, e.g. concrete slab, it must at least be safe against flooding and fixed in such a way that the machines and components do not sink into the mud even during long periods of rain. The formation of puddles and stagnant water are to be avoided. Machines are to be placed on squared timbers.
- Direct sunlight is to be avoided, as apart from the damaging effect of the ultra-violet radiation, it leads to great temperature fluctuations.
- Tarpaulins are to be secured against gale-force winds. It must be ensured that no rain can accumulate and that air circulation is possible under the tarpaulins.
- The condition of the tarpaulins and packaging is to be inspected regularly for damage due to weather conditions, rotting and being eaten by animals. Defects are to be remedied immediately.

For storage of assemblies, see page 2, "General".

2.1 Storage in air-conditioned storage room

See also 2.

The following measures apply to an air-conditioned hall which is defined as follows:

- Temperature range 18 to 26 °C
- Relative air humidity < 40%
- Low airflow
- Temperature fluctuation within 24 hrs < 8°C

Adherence to the storage conditions is to be checked regularly and documented.

unpacked units

The following measures are to be carried out during the period of storage:

- spray external exposed iron parts at least every 2 years with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S. (Clean sprayed surfaces with white spirit or paraffin before installing the machines).
- turn the shafts of roller bearing units at least every 2 years by approx. a quarter to a half turn in order to prevent standstill marks (false brinelling) in the roller bearings.
- spray interior surfaces every 2 years with solvent-free anticorrosive agent, e.g. Shell Ensio engine oil 20.

Storage in packing according to Voith no. 3626-006212 points 2 to 4 is permitted.

2.2 Storage in a non-air-conditioned storage room

See also 2.

The following regulation applies to a non-air-conditioned storage room which is defined as follows:

- Temperature range 10 to 30 °C
- Relative air humidity within the range 35 to 70 %
- Moderate airflow
- Temperature fluctuation within 24 hrs < 15°C

If one of the conditions stated is not met, the regulations according to point 2.3 for "Storage in the open" are to be applied.

The following methods can be used to protect the units against corrosion:

- a) - Packing in accordance with Voith no. 3625-006212 point 4. It is recommended to check the efficacy of the drying agent regularly with moisture indicators, see table page 11
- the condition of the packaging is to be checked regularly for damage. Defects are to be remedied immediately.
 - the aluminium compound foil is to be replaced after 2 years. (Aluminium compound foil is not UV-proof).

The efficacy of the preservation of the exposed iron parts is to be checked.

If necessary, the preservation is to be touched up with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S.

- turn the shafts of roller bearing units at least every 2 years by approx. a quarter to a half turn in order to prevent standstill marks (false brinelling) in the roller bearings.

b) Unpacked units

permanent supply of the interior of the unit with sorption air dehumidifier.*

- at least after 1 year check external parts for efficacy of the preservation, if necessary preserve exposed iron parts again with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S.
- turn the shafts of roller bearing units at least every 2 years by approx. a quarter to a half turn in order to prevent standstill marks (false brinelling) in the roller bearings.

Permanent supply of the interior of the units with dry compressed air may be used as alternative to the sorption air dehumidifier. Volume flow approx. 10 to 15 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below -10°C.

2.3 Storage in the open

See also 2.

The following methods can be used to protect the units against corrosion:

a) Packaging in accordance with Voith no. 3625-006212 point 4. It is recommended to check the efficacy of the drying agent regularly with moisture indicators, see table page 11

- after at least 1 year, the exposed external iron parts are to be checked for efficacy of the preservation. If necessary, the preservation is to be restored with Shell Ensio Fluid S. (Clean sprayed surfaces with white spirit or paraffin before installing the machines)
- turn the shafts of roller bearing units at least every 2 years by approx. a quarter to a half turn in order to prevent standstill marks (false brinelling) in the roller bearings.
- the aluminium compound foil is to be replaced after 2 years (Aluminium compound foil is not UV-proof).

b) unpacked units:

- provide rain protection (roofing, tent, tarpaulin etc.)
- spray exposed iron parts with a film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S.

For preservation of the interior of the units, the following procedures can be used:

- permanent supply of the interior of the machine with a sorption air dehumidifier.*
- permanent supply of the interior of the machine with technical nitrogen, approx. 10 – 15 l/min (sufficient for up to 6 m³ volume of the interior), required pressure approx. 0.002 bar. Dew point of the nitrogen =< -70°C

* see page 12

- permanent supply of the interior of the unit with dry compressed air.
Atmospheric dew point of the compressed air $\leq -70^{\circ}\text{C}$.
Volume flow approx. 10-15 l/min (sufficient for up to 6m³ volume of the interior)

3. Mounted systems installed on the foundation; not yet in operation or at standstill

Special attention is to be paid to the efficacy of the preservation, as it is frequently subject to additional dangers due to water, severe dirt accumulation and mechanical damage.

Spray exposed external iron parts with film forming, water displacing anticorrosive agent, e.g. Shell Ensio Fluid S. Grease and move functional parts, e.g. joints, monthly.
Fill systems with operating oil wherever possible, please refer to operating manual.

3.1 The following measures apply to systems installed on the foundation in hall with constant temperature

See also point 3.

The following methods can be used to protect the interiors of the units against corrosion:

a) Operable systems

Start up system at least every 3 months and operate it briefly (approx. 5 minutes) for oil moistening of the internal parts and surfaces.

b) Non-operable systems

- With operable electrical start-up lubrication pump, this is to be put into operation every 3 months for approx. 5 minutes. (Do not run up to hot condition!)
- With a non-operable electrical start-up lubrication pump, remove oil from the sump every 3 months, spray through housing openings in the interior and circulate oil by pumping with separate oil pump through pipelines for approx. 5 minutes. Race system where possible.

c) Alternatively the following methods of internal anticorrosive protection can be used, especially for non-oil-filled systems:

- dry air in the interior of the unit monthly. The permissible relative air humidity should be $\leq 40\%$ at the lowest expected ambient temperature.

d) Supply of the interior of the unit with dry compressed air. Volume flow approx. 10 to 15 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below 0°C .

* see page 12

3.2 The following measures apply to systems installed on the foundation in a hall with slightly varying air temperature

See also point 3.

The following methods can be used to protect the interiors of the units against corrosion:

a) Operable systems

Start up at least every 2 months and operate briefly (approx. 5 minutes) for oil moistening of the internal parts and surfaces.

b) Non-operable systems

- With operable electrical start-up lubrication pump, this is to be put into operation every 2 months for approx. 5 minutes. (Do not run up to hot condition!)
- With a non-operable electrical start-up lubrication pump, remove oil from the sump every 2 months, spray through housing openings in the interior and circulate oil by pumping with separate oil pump through pipelines for approx. 5 minutes. Race system where possible.

c) Alternatively the following methods of internal anticorrosive protection can be used, especially for non-oil-filled systems:

- dry air in the interior of the unit monthly. The permissible relative air humidity should be $= < 40\%$ at the lowest expected ambient temperature. If this is not possible in one pass through the sorption dehumidifier due to the climatic conditions, the air must be dehumidified in a closed circuit.

In case of extensive temperature variations and/or high air humidity, measures d) or e) (optionally) are required in addition.

d) The permanent supply of the interior of the unit with dehumidified air via a sorption air dehumidifier is permitted. *

e) Supply of the interior of the unit with dry compressed air. Volume flow approx. 10 to 15 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below -10°C.

3.3 The following measures apply to systems installed in the open on the foundation

See also point 3.

The following methods can be used to protect the interiors of the units against corrosion:

a) The permanent supply of the interior of the unit with dehumidified air via a sorption air dehumidifier is permitted. It is recommended to control the unit with a hygostat. The relative air humidity in the interior of the machine must be $= < 40\%$.

* see page 12

- b) - Supply of the interior of the unit with dry compressed air. Volume flow approx. 10 to 15 l/min (sufficient for up to 6m³ volume of the interior). The atmospheric dew point of the compressed air must be below -40°C.
- c) - permanent supply of the interiors of the machines with technical nitrogen, volume flow approx. 10 – 15 l/min. (sufficient for up to 6 m³ volume of the interior), required pressure approx. 0.002 bar. Dew point of nitrogen =< -70°C.

Attention: All works on the unit must be performed under special safety measures when using nitrogen.

Toxic hazard!

With operable electrical start-up lubrication pump, this is to be put into operation every 3 months for approx. 5 minutes.

Table for inspection intervals of humidity indicators to TL 6685..

Display value of the humidity indicators	Inspection intervals
Blue	every 8 weeks
30 % pink	every 2 weeks
40 % pink	Weekly
50 % pink	Correctly restore preservation

* Anticorrosive protection with dehumidified air is based on the fact that no corrosion occurs below a relative air humidity of 40%. The relative air humidity depends on the temperature. Permissible residual humidity is to be determined in accordance with the lowest expected ambient temperature. At this temperature it should be $\leq 40\%$.

The relative permissible air humidity at which the air in the interior of the units is to be dried is determined with the aid of the hx diagram for humid air (see example).

Example:

See hx diagram for humid air page 13

Assumptions:

- Ambient condition: temperature 30 °C, rel. air humidity 70%
- Lowest expected ambient temperature 18 °C, permissible relative air humidity $\leq 40\%$.

Determination of the permissible relative air humidity at which the air is to be dried at 30°C:

- Determine intersection of temperature 30°C and relative air humidity 70% (state of air before drying)
- Determine intersection of temperature 18°C and relative air humidity 40% (nominal state of air after drying)
- Read off the corresponding water vapour content for the nominal state of the air: 5g/kg air.
- Read off the intersection with the curve of the relative air humidity on the line for the water vapour content vertically upwards at approx. 2 to 4°C above the initial temperature (30°C), selected 34°C: 15%.

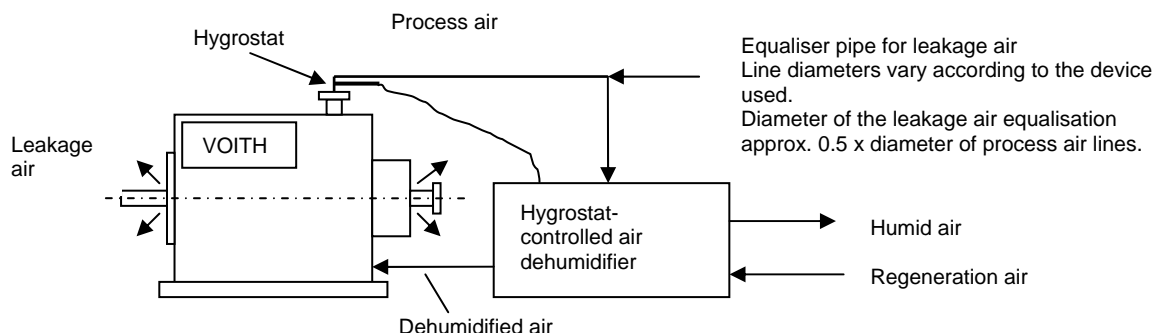
Result of the example:

The air is to be dried for a lowest expected ambient temperature of 18°C to a relative air humidity of 15%.

Connection of a sorption air dehumidifier to dry the air in the interior:

Pipe diameters vary according to the device used and are to be agreed with the manufacturer of the sorption dehumidifier.

Drying is carried out in a closed circuit:



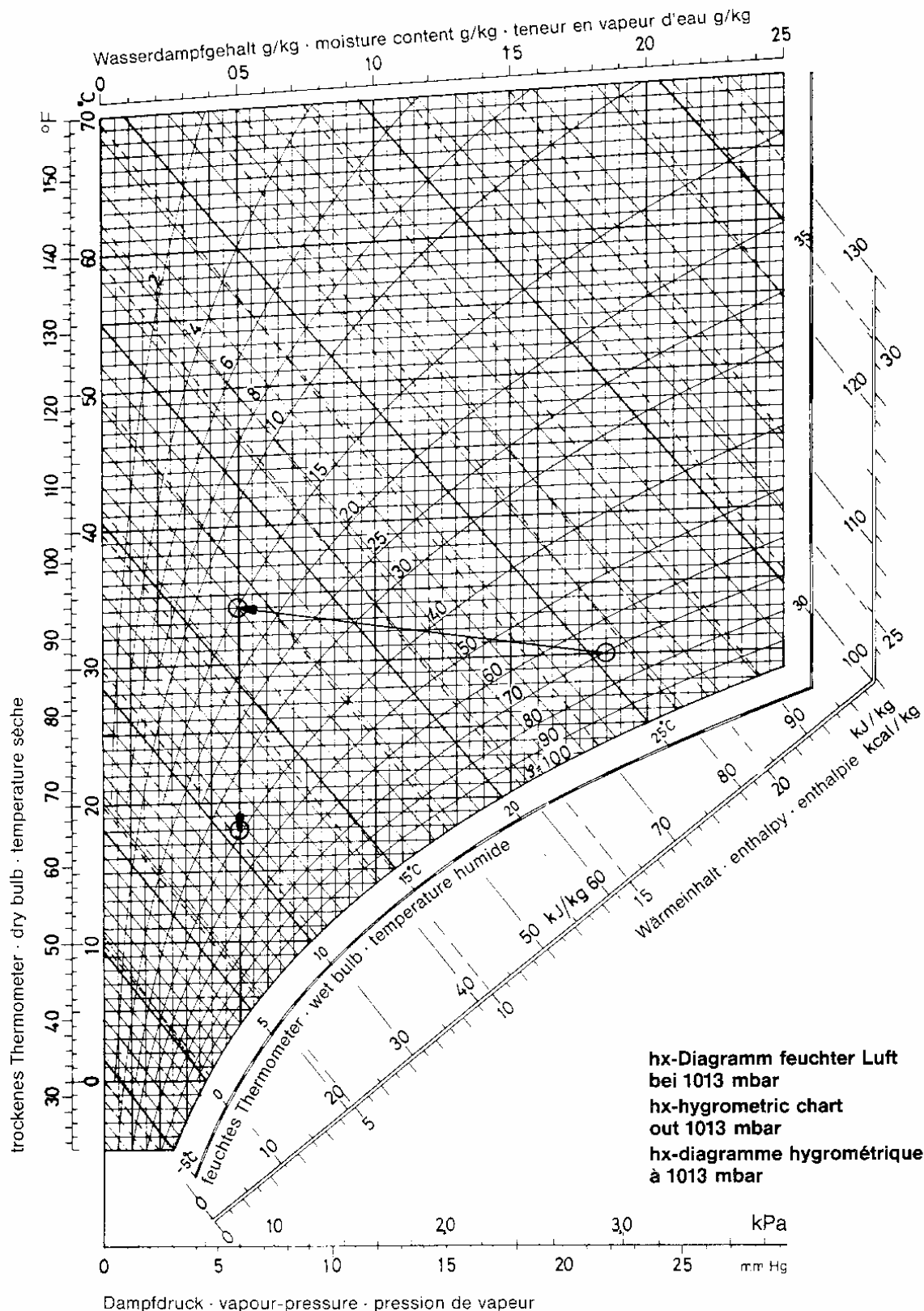


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Appendix_B_

Operating fluids ISO VG 32 for hydrodynamic circuits with gearing 3625-006073

1. Field of Application

This specification applies to:

- geared variable speed couplings of type "R"
- torque converters with gear stage(s) of types "EA" and "EH".

This list may not be applicable in individual cases involving special requirements. In such cases, the appropriate specifications will be agreed when handling the order and/or stated in the instruction manual.

2. Requirements to be fulfilled by Operating Fluids

Characteristic Value	Test procedure	Test conditions	Unit	Requirements
Kinematic viscosity	DIN ISO 3104 ASTM D 445	40°C (104°F)	mm ² /s (cSt)	ISO VG 32
Viscosity index	DIN ISO 2909 ASTM D 2270		-	≥ 95
Density	DIN 51 757 ASTM D 1298	15°C (59°F)	kg/m ³ kg/L °API	850 - 900 0,85 - 0,9 34.9 - 25.6
Pour point ¹⁾	DIN ISO 3016 ASTM D 97		°C (°F)	≤ -24 (-11.2)
Flash point	DIN EN ISO 2592 ASTM D 92		°C (°F)	> 175 (347)
Ignition temperature ²⁾	DIN 51794 ASTM E 659		°C (°F)	> 250 (482)
Corrosive effect on copper	DIN EN ISO 2160 ASTM D 130	3h at 100°C (212°F)	-	≤ 2
Protection against corrosion of steel	DIN ISO 7120 ASTM D 665	Procedure A	-	passed
Demulsibility	DIN ISO 6614 ASTM D 1401	Time in minutes at 54°C (129.2°F)	minutes	≤ 30
Aging characteristic ³⁾	DIN 51 587	1000 h at 95°C (203°F)	mg KOH/g	ΔNZ _{max} =2 mg KOH/g
Aging stability (TOST) ³⁾	ASTM D 943	ΔNZ=2 mg KOH/g at 95°C (203°F)	hours	> 1000
Air release property	DIN ISO 9120 ASTM D 3427	0,2% at 50°C (122°F)	minutes	≤ 5
Foaming behavior	ISO 6247 ASTM D 892	Sequence I Sequence II Sequence III	ml/ml	≤ 150/0 ≤ 75/0 ≤ 150/0
Mechanical test in the FZG gears-bracing-testing machine, failure load stage ⁴⁾	DIN ISO 14635-1	A/8,3/90		≥ 10
Neutralization number (new oil)	DIN 51 558 ASTM D 974		mg KOH/g	indicate
Compatibility with sealing material SRE-NBR 1	DIN ISO 1817 (+ DIN 53505)	SRE-NBR 1 as per DIN 53 538-1 7 days at 100°C (212°F)	% Shore A	relative change in volume: 0 bis 12 change in hardness: 0 bis -7

¹⁾ Pourpoint is depending on the conditions at the installation site (ambient temperature).
Startup viscosity by oil supply

- with centrifugal pumps: ≤ 250 mm²/s (cSt)
- with positive displacement pumps with sufficient input power (to be enquired): ≤ 1000 mm²/s (cSt)

²⁾ to be fulfilled for explosion protection requirements as per EC Directive 94/9/EC (ATEX - ⚡) Temperature Class T3 (max. surface temperature 200°C (392°F))

³⁾ alternatively

⁴⁾ < 10 only after individual approval

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Voith Turbo GmbH & Co. KG - D-74555 Crailsheim
P.O.Box 1555 · Telefon +49 7951 32-0 · Fax 32-500

3625-006073en

Revision 6

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3. Oil Selection by Operators and Mineral Oil Companies

Considering the requirements of section 2, the following types may be used:

- hydraulic oils HLP to DIN 51524 part 2,
- turbine oils to DIN 51515-1 and -2 with sufficient load-carrying capacity (FZG) for gear lubrication.

4. Selection of Oils

The following list contains hydraulic oils to DIN 51524 part 2, turbine oils to DIN 51515 as well as oils that meet the requirements according to section 2 and oils that have proven well in practice under normal operating conditions.

As the local conditions and the oil qualities vary, we cannot assume any liability for the oil itself mentioned in this list. In case of negative operating result, due to this oil selection, warranty claims made in this connection will not be accepted.

Supplier	Designation	Ignition temperature > 250 °C
Addinol	Hydraulic Oil HLP 32 ^{*)}	yes
	Hydrod. Transmission Oil SGL 18	yes
Agip	Blasia 32	yes
	OSO 32	yes
AP OIL International Ltd.	AP Torque Oil 32	yes
Aral	Degol BG 32	yes
	Vitam GF 32	yes
Autol	Hydraulic Oil HY-S 32 ISO	yes
Avia	Gear RSX 32-S	yes
Bharat	Hydrol HLP-32 ^{*)}	no data
bp	Energol HL-XP 32	yes
	Energol HLP-HM 32	yes
Caltex	Torque Fluid 32	no data
Castrol	Hyspin AWS 32	yes
	Hyspin SP 32	no
Cepsa	EP 125	yes
	Hidraulico HM 32	yes
Chevron	Hydraulic Oil AW 32	no data
	Clarity Hydraulic AW ISO 32	no data
ConocoPhillips	Hydroclear AW Hydraulic Fluid 32	yes
ExxonMobil	Mobilfluid 125	yes
	Mobil Nuto H 32	yes
	Mobil DTE 24	yes
Fuchs Europe	Renofluid TF 1500	yes
	Renolin ZAF 32 B	yes
	Renolin Eterna 32 ^{*)}	yes

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Voith Turbo GmbH & Co. KG - D-74555 Crailsheim
P.O.Box 1555 · Telefon +49 7951 32-0 · Fax 32-500

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Supplier	Designation	Ignition temperature > 250 °C
Fuchs Lubricants PTE LTD	Titan RR TF	yes
Gulf Oil Corp. Ltd. India	Gulf Harmony AWT 32 ^{*)}	yes
Hindustan Petroleum Corp. Ltd.	Enklo HLP 32 ^{*)}	no data
Indian Oil Corporation Ltd.	Servo Torque 10	no data
	Servo System HLP 32 ^{*)}	no data
Klüber Lubrication	Lamora HLP 32 ^{*)}	yes
KNPC	Kuwaitoil Hydraulic Oil ISO 32	no data
Kuwait Petroleum Intern. Lubricants	Q8 Haydn 32	yes
	Q8 Holst 32	yes
	Q8 van Gogh EP 32 ^{*)}	yes
Paramo / Mogul	HM 32	yes
	OT-HP 3	yes
OEST	Hydraulic Oil H-LP 32	yes
OMV	hyd HLP 32	yes
Petro-Canada	Hydrex AW 32	yes
Petro-Oil	Hydrol HLP 32	no data
Petrobras	Lubrax Industrial HR-32-EP	no data
	Lubrax Industrial EGF-32-PS ^{*)}	no data
	Lubrax Industrial Turbina EP 32 ^{*)}	no data
Petrol Ofisi	Hydro Oil HD 32	no data
Repsol	Telex E-32	yes
Shell	Tellus 32	yes
	Tellus S 32	yes
SK Corporation	SK ZIC Supervis AW 32 ^{*)}	no data
SRS Schmierstoff Vertrieb GmbH	Wiolan HF 32	yes
	Wiolan HX 32	yes
Statoil	HydraWay HMA 32	yes
Texaco	Rando HD 32	yes
	Textran V 32	no data
Total	Azolla ZS 32	yes
Valvoline Cummins Ltd.	Valvoline HLP 32 ^{*)}	no data
Wisura	Kineta 32 V	yes

^{*)} Pour point higher than specified. Check viscosity on startup.

This list does not claim to be complete.

For an updated oil selection list, please contact Voith Turbo GmbH & Co. KG.

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checked by: aire-HSi

Voith Turbo GmbH & Co. KG - D-74555 Crailsheim
P.O.Box 1555 · Telefon +49 7951 32-0 · Fax 32-500

3625-006073en
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