

Installation and Maintenance Manual

Helical and bevel-helical gear reducers Brevini EvoMax™

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1 GENERAL INFORMATION

1.1 ABOUT THIS MANUAL

An indispensable part of this manual is the gear unit-specific technical specification, TS for short, in the appendix.

This manual allows safe and efficient handling of the gear unit. This manual is considered a component of the gear unit and must be kept in the immediate vicinity of the gear unit and must be accessible to the personnel at any time.

Prior to any work, the personnel must have carefully read and understood the entire manual. For safe work, it is imperative that all safety notes and instructions in this manual be observed.

In addition, all local work health and safety regulations and the general safety provisions for the gear unit's site of operation apply.

Illustrations in this manual are intended to assist in general comprehension and may differ from the actual version.

This manual is for the following gear unit types:

- Brevini EvoMax™
 - Helical gear reducers E2H, E3H, E4H
 - Bevel helical gear reducers E3B, E4B
 - Compact gear units E3C, E4C
- Brevini EvoMax™ N
- Brevini EvoMax™ D
- Brevini EvoMax™ TS

1.2 VERSION TRACKING

Table 1:

File name	Revision	Date	Changes description
IMM-0012EN_Rev.00 EvoMax	00	22/03/2022	- Document issued
IMM-0012EN_Rev.01 EvoMax	01	24/08/2022	- Added split housing sizes

1.3 MANUAL APPLICABILITY AND SUPPORTED MODELS

Table 2:

Models		
EvoMax product	lines	

GENERAL INFORMATION

1.4 EXPLANATION OF SYMBOLS

Safety notes

Safety notes in this manual are indicated by symbols. The safety notes are introduced using signal words that express the hazard's degree of danger.

A DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

↑ WARNING

Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

This combination of symbol and signal word indicates a potential hazard that can cause slight or minor injury if not avoided.

NOTICE

This combination of symbol and signal word indicates a potential hazard that can cause property damage if not avoided.

NOTICE

This combination of symbol and signal word indicates a potential pollution hazard.

Tips and recommendations

MOTE:

This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:

A DANGER

This combination of symbol and signal word indicates an immediately-dangerous situation due to electric shock. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

▲ DANGER



This combination of symbol and signal word indicates information and instructions regarding the proper use of the gear unit in potentially explosive areas. Failure to observe such a note increases the risk of explosion and may cause serious or fatal injury.

GENERAL INFORMATION

Additional symbols

This manual uses the following symbols to indicate instructions, effects, lists, references and other elements:

Table 3:

Additional symbols	Explanation
	Step-by-step instructions
\Rightarrow	Effects of actions
₽	References to sections within this manual and to other applicable documents
•	Lists without specific order
	Overview of alternative procedures

1.5 CUSTOMER SERVICE

In case of technical queries, please contact our customer service:

Table 4:

Address	Dana Motion Systems Deutschland GmbH Werner-Reimers-Straße 6 61352 Bad Homburg
Phone	+49 (0) 6172 102-0
e-mail	service-piv@dana.com
Internet	www.piv-extruderdrives.com www.dana-industrial.com

We are also always interested in hearing about information and experiences obtained through use and which may be of value in improving our products.

2 SAFETY

This section provides an overview of all safety aspects important for the protection of people and for safe and fault-free operation. Additional, task-related safety notes are included in the following sections.

2.1 PROPER USE

The Brevini EvoMax[™] gear unit is designed to convert speed and torque after connection to the target system and is intended for use in explosive areas in accordance with the ATEX indication.

Proper use also includes observance of all specifications within this manual.

Any use other or beyond proper use shall be deemed improper use.

A DANGER



Danger through improper use!

Improper use of the Brevini EvoMax™ gear unit may result in danger.

- Operate the gear unit only within the specified limits (See "Technical data" page 21) and in accordance with the gear unit-specific order confirmation.
- Never exceed the speed and torque specifications listed on the type plate.
- Never thermally overload the gear unit by applying excessive power.
- Never allow the roller bearings to slip through application of insufficient load.
- Never change the oil viscosity or oil type without prior consultation with DANA Motion System Deutschland GmbH.
- Never change the direction of rotation specified as permissible in the technical specifications or drawing.
- Operation in the wrong driving direction
- Operation outside specified ambient conditions
- Stepping on the gearbox or equipment
- Operation without proper lubrication

2.2 GENERAL HAZARDS

2.2.1 DANGER THROUGH EXPLOSIVE ATMOSPHERES

Incorrect site of operation

A DANGER



Risk of explosion through operation at incorrect sites!

The standard version of the gear unit is not designed for operation in explosive areas. Use of a standard gear unit in explosive areas may result in danger.

- If you plan to use a standard gear unit in an explosive area, always consult DANA Motion System Deutschland GmbH first.
- Never work on, in or in the vicinity of the gear unit in an explosive atmosphere. Observe the ATEX specifications listed on the type plate. Observe the maximum permissible surface temperatures.

Explosion protection

A DANGER



Risk of explosion!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Obtain a written work permit before beginning work in the explosive area.
- Never perform work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Electrostatic charge generation through belt drives, fans, siphoning of synthetic oils

A DANGER



Risk of injury and explosion through static charge of moving materials!

Belt drives, running fans and siphoning or decanting synthetic oils can produce an electrostatic charge. Electrostatic charge may cause serious injury. In explosive areas, there is a risk of explosion.

- Establish an electrically conductive connection between all parts of the casing and ensure equipotential bonding.
- Operate the gear unit in explosive areas only in accordance with the ATEX certification.
- Never work on, in or in the vicinity of the gear unit in an explosive atmosphere.

2.2.2 DANGER THROUGH HIGH TEMPERATURES

Hot surfaces

MARNING

Risk of burning through hot surfaces!

The gear unit's surface can reach high temperatures during operation. Skin contact with hot surfaces can cause severe skin burns.

- Always wear thermally resistant safety clothing and protective gloves when working in the vicinity of hot surfaces.
- Always ensure that all surfaces have cooled to ambient temperature prior to performing any work.
- If the gear unit reaches a temperature of more than 90°C, contact DANA Motion System Deutschland GmbH immediately. Gear unit cooling may be necessary.

Hot gear oil

MARNING

Risk of burning through hot gear oil!

The gear oil can become very hot during operation. Skin contact can result in burns. Inhaling oil vapours can cause lung damage.

- Always allow the gear unit and gear oil to cool before performing any work.
- Never open covers while hot.
- Wear thermally resistant safety clothing and protective gloves.
- Wear breathing protection if there are oil vapours.

2.2.3 DANGERS THROUGH ELECTRICAL ENERGY

Connecting electrical components

MARNING

Risk of injury when connecting electrical components!

Incorrect connection of electrical components may result in danger.

- When connecting electrical components (e.g. motor or hydraulic unit), observe the gear unit design and the intended site of operation.
- Observe the components' electrical connection values.

Faults due to short circuit

MARNING

Danger of injury due to faults!

Through short circuit in the electrical equipment faults in the entire system can occur. Faults can cause serious injuries.

- Connect all housing parts coupled to the local equipotential bonding busbar.
- Install an earth leakage circuit breaker to prevent ignition sparks and touch voltages if there is a fault.

2.2.4 DANGER THROUGH MOVING PARTS

Rotating parts on the shafts

WARNING

Risk of injury through rotating parts!

Input and output shafts or flanges may rotate. Contact with them can cause injury.

- A corresponding protective barrier must be installed over freely rotating gear unit parts.
- Perform work on the gear unit only when it is at a standstill and the drive unit is switched off.
- When working on the gear unit, the switched-off drive unit must be secured against switching on inadvertently.

Belt drive

MARNING

Risk of catching through belt drive!

There is a risk of injury through being caught and trapped by the belt drive.

- Perform work on the gear unit only when it is at a standstill and the drive unit is switched off.
- When working on the gear unit, the switched-off drive unit must be secured against switching on inadvertently.
- Observe the separate instructions issued by the belt's manufacturer.

Pretensioned springs on thrust plate and brake

↑ WARNING

Risk of injury through springs under tension!

Pretensioned springs on the thrust plate and brake can cause serious injury.

- Relieve all spring tension before performing any work on the thrust plate or brake.

Vibrations

MARNING

Risk of injury through heavy vibration!

Heavy vibrations can lead to serious injury and chronic impairments to health over the long term. The source of vibrations must be mechanically isolated from its environs by means of vibration dampers.

- Never disable the vibration dampers.
- Keep out of the vibrating area during operation.

High weight

WARNING

Risk of crushing through high weight!

Due to its high weight, moving the gear unit can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See "Transport, packaging and storage" page 39.
- Always secure the gear unit before releasing any connections.

Torsional moment

MARNING

Risk of injury through torsional momenta!

Tension within the system can produce torsional momenta in the shaft connections. When disconnecting the shafts, the torsional momenta can cause injury and damage.

- Before beginning any work, relieve the system tension at suitable points.

Sharp edges and pointed corners

MARNING

Danger of injury posed by sharp edges and pointed corners!

Sharp edges and pointed corners may cause skin grazes and cuts.

- Proceed with caution when working in the vicinity of sharp edges and pointed corners.
- If in doubt, wear safety gloves.

Risk of slipping on slippery surfaces

MARNING

Risk of slipping on slippery surfaces!

Soiling can make smooth surfaces slippery.

- Always remove any soiling immediately.
- Collect any oil that may have been spilled during this process immediately and dispose of it in an environmentally sound manner.
- Wear non-slip safety shoes.
- Set up warning signs if necessary.

2.2.5 DANGER THROUGH NOISE

Noise generated by gear units or fans

↑ WARNING

Risk of injury through noise!

The noise level produced at the site of operation can cause serious damage to your hearing.

- Always wear hearing protection when working with loud gear units and systems.
- Only remain on the gear unit's site of operation for as long as necessary.
- The standard DIN EN ISO 11690 "Acoustics recommended practice for the design of low-noise workplaces containing machinery" must be observed.

2.2.6 DANGER THROUGH OPERATING FLUIDS

Lubricants, gear oils, preservatives

MARNING

Danger to health through lubricants!

Contact with operating fluids can cause allergic reactions and skin irritation.

- Always wear protective gloves and safety goggles when handling operating fluids.
- Do not swallow, do not inhale vapours.
- In the event of inadvertent eye contact, rinse out the operating fluid with copious amounts of water and seek medical attention if necessary.
- In the event of skin contact, rinse off with copious amounts of water and soap.
- Observe the safety data sheets issued by the operating fluid's manufacturer.

Pressurised gases and liquids in the lubricant system

WARNING

Lethal danger through hydraulic energies!

The lubricant system contains gases and liquids under pressure. This may cause serious injury.

- Before beginning any work on the lubricant system, relieve the system pressure completely. Fully depressurise the pressure reservoir.

Bacteria in the coolant

WARNING

Danger to health through bacteria in the coolant!

Bacteria can propagate in the coolant that may be detrimental to health in the event of skin contact, swallowing or inhaling.

- Replace coolant regularly.
- If there is a risk of skin contact, swallowing or inhaling, wear personal protective equipment:
- Protective work clothing
- Protective gloves
- Light breathing protection
- Safety goggles

2.2.7 RISKS FOR THE GEAR UNIT

Improper handling

A DANGER



Risk of damage through improper handling of the gear unit!

Improper handling can cause the gear unit to overheat. The gear unit's leak tightness cannot be guaranteed if it is overloaded.

- Avoid improper handling.
- Observe the specifications and information listed on the type plate.
- Only run a connected drive motor with a frequency converter if the specifications on the gear unit's type plate and the technical specifications in the order confirmation are observed.
- Do not perform any welding work on the gear unit.
- Do not use the gear unit as an earth point for welding work. Toothing and bearings may suffer irreversible damage through fusing.

Loss of oil

NOTICE

Gear unit damage due to lack of oil!

Insufficient oil supply can result in the gear unit overheating, thus causing damage.

- Check the oil supply regularly. See "Oil change schedule" page 108.
- If you notice a loss of oil, immediately stop the gear unit. Further operation is permissible only after examination of the fault cause. Consult DANA Motion System Deutschland GmbH immediately. For contact details, see "Customer service" page 9.

2.3 OPERATOR'S RESPONSIBILITY

Operator

fore ap-plies:

The operator is that entity who runs the gear unit for commercial pur-poses or entrusts the gear unit to third parties for use and who is le-gally responsible for the product during operation, including responsi-bility for the protection of the user, personnel and third parties.

Operator's duties

The gear unit is used commercially. The operator is therefore subject to the legal provisions governing work health and safety. In addition to the safety notes in this manual, the safety, work health and safety and environmental protection regulations applicable for the site of operation must be observed.

The following applies in particular:

- The operator is under obligation to obtain information on the applicable work health and safety regulations and to draft a
 hazard assessment determining any additional risks resulting from the specific work conditions at the gear unit's site of operation. The operator is obliged to implement this in the form of operating instructions for the operation of the gear unit.
- The operator needs to check constantly throughout the period of operation of the gear unit whether the operating instructions drafted correspond to the latest version of the regulations and, if necessary, must amend the instructions.
- The operator must clearly define and specify responsibilities regarding installation, operation, fault remedy, maintenance and cleaning.
- The operator must ensure that all persons handling the gear unit have read and understood this manual. In addition, the operator must regularly train the personnel (see appendix for instruction protocol) and inform them of the risks.
- The operator must supply the personnel with the required protective equipment and obligate the personnel to wear it.

 The operator is further responsible for ensuring that the gear unit is always in technically flawless condition. The following there-
- The operator must ensure that the maintenance intervals specified in this manual are observed.
- The operator must regularly check all safety equipment for correct operation and completeness.

2.4 PERSONNEL REQUIREMENTS

2.4.1 QUALIFICATIONS

The various tasks described in this manual demand a varying degree of qualification of the persons appointed to perform the tasks.

A DANGER



Danger through insufficiently qualified personnel!

Insufficiently qualified personnel are unable to correctly assess the risks of handling the gear unit and risk causing serious or fatal injury to themselves or other persons or ignition sources.

- Only allow specifically qualified persons to perform any work.
- Keep insufficiently qualified persons out of the work area.
- Cease all work while unauthorised persons remain in the danger zone and work area.

Only such persons are permitted to perform any work that can be expected to perform the respective work reliably. Persons with impaired reactions, e.g. due to intoxication by drugs, alcohol or medica-tion, are not permitted.

This manual lists the following qualifications for the persons appointed to perform the various tasks:

Electrically skilled person with additional explosion protection qualifications

Electrically skilled persons with additional explosion protection qualifi-cation are specifically trained for the tasks they are to perform and knows the relevant standards and regulations.

Due to their technical training and their experience, electrically skilled persons with additional explosion protection qualification can perform work on electrical systems and can identify and avoid potential risks.

Specialist for explosive areas

Specialists for explosive areas, due to their technical training, skills and experience as well as their knowledge of the applicable standards and regulations, are able to perform work on systems or components in explosive areas. Specialists for explosive areas are able to identify and avoid potential risks.

In addition, specialists for explosive areas are qualified to perform typical work on gear units such as aligning the shaft.

Service personnel

The following work may be performed by the customer's qualified personnel:

- Oil change (caution: risk of scalding observe the separate chapter in this manual!)
- Temperature measurements
- · Visual inspection through oil sight glass. Check gear wheels, shafts and bearings visually
- Filter change on external oil-coolant-lubricant system (observe the operating manual issued by the oil-coolant-lubricant system's manufacturer)
- Replacement of the elastic segments if a corresponding coupling is used (observe the operating manual issued by the coupling's manufacturer)
- Regreasing the couplings if a corresponding coupling is used (observe the operating manual issued by the coupling's manufacturer)
- Vibration measurements
- Frequency analyses
- Regreasing of taconite labyrinth shaft seals
- Replacement of brake shoes (observe operating manual issued by brake shoes' manufacturer)
- Take an oil sample and send to PIV for an oil analysis
- For spare parts, repair or any other requests always have the type and serial number available and as well a detailed failure description

Dana Motion Systems Deutschland GmbH service personnel

Other work may be performed only by Dana Motion Systems Deutschland GmbH specialist personnel. Other personnel is not permitted to perform such work. To have the necessary work performed, contact Dana Motion Systems Deutschland GmbH customer service, see "Customer service" page 9.

2.4.2 UNAUTHORISED PERSONS

MARNING

Risk to life for unauthorised persons due to hazards in the danger and working zone!

Unauthorised persons who do not meet the requirements described here will not be familiar with the dangers in the working zone. Therefore, unauthorised persons face the risk of serious injury or death.

- Unauthorised persons must be kept away from the danger and working zone.
- If in doubt, address the persons in question and ask them to leave the danger and working zone.
- Cease work while unauthorised persons are in the danger and working zone.

Instruction

The operator must instruct the personnel regularly. For ease of verifi-cation, the instruction protocol (see appendix) must be filled in com-pletely and kept on record.

2.5 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment is designed to keep people safe and protect them from health hazards during work.

When working with or on the gear unit, the personnel must wear the personal protective equipment indicated in the individual sections of this manual.

Description of the personal protective equipment

The personal protective equipment is explained below:

Table 5:

Protective work clothing
Protective work clothing is tight-fitting work clothing with low re-sistance to tearing, with tight sleeves, and without projecting parts. Protective suits protect against dusts during cleaning operations.
Breathing protection
Breathing protection protects from hazardous dusts and oil mists.
Hearing protection
Hearing protection protects your hearing from damage through noise.
Industrial hard hat
Industrial hard hats protect the head from falling objects, swinging loads and impacts on stationary objects.
Safety goggles
Safety goggles protect your eyes from flying debris and fluid sprays.

SAFETY



Protective gloves

Protective gloves protect hands from friction, abrasion, puncture wounds, or deeper injuries, aggressive chemicals, as well as from contact with hot surfaces.



Safety footwear

Safety footwear protects the feet from crushing injuries, falling parts and slipping on a slippery substrate.

2.6 SAFETY DEVICES

A DANGER



Danger to life from nonfunctional safety devices!

If safety devices are not functioning or are disabled, there is a danger of serious injury or death or causing an ignition source.

- Check that all safety devices are fully functional and correctly installed before starting work.
- Never disable or bypass safety devices.
- Ensure that all safety devices are always accessible.

O NOTE:

Observe the operating manuals of additionally purchased parts.

2.6.1 SAFETY BARRIERS

Protection covers for rotating shaft ends and fans

Safety barriers prevent moving parts from being touched.

2.6.2 ADDITIONAL SAFETY EQUIPMENT FOR USE IN EXPLOSIVE AREAS

A DANGER



The proper use of the equipment in potentially explosive atmospheres requires the compliance with the Directive 2014/34/EU and its standards as well with the relevant national regulations.

In particular we refer to Chapter 1 Article 1 (1) b) of the said Directive. The adequate connection and the adequate processing of the electrical signals of the sensors (e.g. via controlling devices and regulating devices) are essential elements of the safety concept.

Resistance thermometer

Monitors the gear oil's temperature.

A DANGER



Exceeding specified limits can cause an ignition source. Shutdown gearbox if it reaches these limits. For limits see "EX marking" page 21.

Earth connection point

Establish potential equalisation.

A DANGER



Insufficient earthing can cause ignition sources.

Thermosensor

Monitors the gear oil's temperature.

A DANGER



Exceeding specified limits can cause an ignition source. Shutdown gearbox if it reaches these limits. For limits see "EX marking" page 21.

Float-switch oil level monitor

Monitors the gear unit's oil level and switches off the drive unit in the event of an impermissible oil level drop in the gear unit.

A DANGER



Sensor used at category 2 = zone 1 / 21

Low oil level can cause an ignition source shut down gearbox when it reaches limit specified for operation.

Flow switch

Monitors the oil flow.

Pressure switch

Monitors the oil pressure.

A DANGER



Flow switch + Pressure switch

These are used if pump and overpressure valve are present

Circulation through overpressure valve and / or too small amount of oil flowing through pump can cause ignition sources by overheating (see "Normal mode" page 104).

Heating

A DANGER



Heating may be needed to reach specified viscosities. Too high viscosity can cuase excessive heat and thus an igniton source.

Oil filter contamination indicator

Indicates the oil filter's contamination level.

Vibration sensor

Transmits generation of vibration to a monitor point.

2.6.3 OPERATOR'S SAFETY EQUIPMENT

If required, the operator must retrofit the following safety

- equipment:
- Emergency-off concept for the entire system in which the gear unit is installed
- · Potential equalisation and residual-current device
- Safety equipment for moving parts such as the input and output shaft
- Safety equipment for shutting down the electrical power supply, protecting against inadvertent reactivation and prevention
 of uncontrolled/unintended operating states

2.7 ADDITIONAL SYMBOLS

The following symbols and instruction signs are affixed in the work area. These symbols and instruction signs refer to the immediate vi-cinity in which they are affixed.

A DANGER



Danger due to illegible signage!

Over time, stickers and signs can get dirty or in some other manner become illegible, so that dangers cannot be recognized and necessary operating instructions cannot be followed. Thus an injury hazard occurs.

- Keep all safety, warning, and operating instructions that are affixed to the device in legible condition.
- Replace damaged signs or stickers immediately.



The correct direction of rotation is indicated by an arrow.



The earth connection points are marked.

2.8 ENVIRONMENTAL PROTECTION

NOTICE

Danger of pollution through incorrect handling of environmentally hazardous substances!

Incorrectly handled environmentally hazardous substances may seriously damage the environment, particularly if disposed of incorrectly.

- Always observe the notes below on handling environmentally hazardous substances and their disposal.
- If environmentally hazardous substances enter the environment by accident, immediately take appropriate measures. If in doubt, notify the local authorities responsible of the damage and enquire as to suitable measures.

The following environmentally hazardous substances are employed:

Gear oil

Gear oil may contain toxic substances. These must not enter the envi-ronment. Disposal must be handled by a disposal specialist.

Cooling lubricant and filters

Cooling lubricant and the filters used in cooling lubricant systems may contain toxic substances. These must not enter the environment. Dis-posal must be handled by a disposal specialist.

Corrosion protection

Corrosion protection can contain toxic substances. These substances should not get into the environment. Disposal must be carried out by a specialised disposal company.

Paper on the shaft ends

The paper protecting the shaft ends and the blank function surface contains corrosion protection. Corrosion protection may contain toxic substances. These must not enter the environment. Disposal must be handled by a disposal specialist.

Electrical and electronic components

Electrical and electronic components can be installed in attachment parts. Electrical and electronic components can contain toxic materials. The-se components must be collected separately and taken to municipal collection points or disposed of by a specialised company. These components include light bulbs, capacitors that contain PCB, components that contain mercury, printed circuit boards, fluid crystal displays, batteries, external electrical lines and electrolytic capacitors.

3 TECHNICAL DATA

MOTE:

The data on the type plate and in the technical specification in DANA Motion System Deutschland GmbH's order confirmation's applies.

3.1 EX MARKING

Overview

The EX marking contains the following information:

Table 6:

Group I Mining		
Category		
M1	M2	
for safe operation in explosive atmosphere	Shutdown if explosive atmosphere occurs	

Table 7:

Group II all other explosive areas					
Category 1		Category 2		Category 3	
G	D	G	D	G	D
Gas	Dust	Gas	Dust	Gas	Dust
Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22
for safe operation in explosive atmosphere		highly safe in occasional explo-sive atmosphere		suitable for rarely occurring ex-plosive atmosphere	
constant to frequent > 100 h per year		occasional 10 to 100 h per year		rare and only briefly < 10 h per year	

Table 8:

Temperature class for gas	Maximum permissible surface temperature	Maximum permissible oil temperature if not stated otherwise in order-specific documentation
T1	450 °C	90 °C
T2	300 °C	90 °C
ТЗ	200 °C	90 °C
T4	135 °C	80°C
Т5	100 °C	Temperature class not permitted
T6	85 °C	Temperature class not permitted

Table 9:

max. surface temperature (for dust)	max. permissible oil temperature if not stated otherwise in order-specific documentation	
>160°C	90°C	
150°C <t≤160°c< td=""><td>80°C</td></t≤160°c<>	80°C	
135°C <t≤150°c< td=""><td>70°C</td></t≤150°c<>	70°C	
100°C <t≤135°c< td=""><td>60°C</td></t≤135°c<>	60°C	
T≤100°C	not permitted	
The layer of dust must be kept ≤ 5mm		

TECHNICAL DATA

All gearboxes are protection type "h" according to ISO 80079-37. This means "Non-electrical equipment for use in potentially explosive atmospheres".

Example

Figure 1: Example of an EX marking

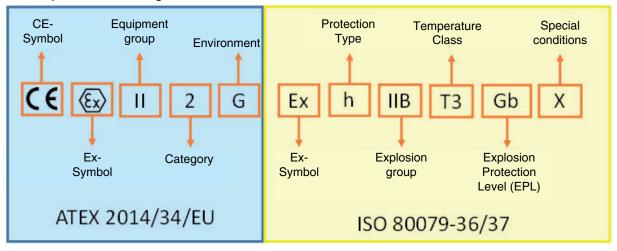


Table 10:

Symbols	Designation	Meaning
CE	CE symbol	Conformity mark in accordance with article 5.4 to Directive 2006/42/EC. Applied by the manufacturer prior circulating.
II	Device group	The gear unit is approved for use in explosive areas other than mining.
2G	Device category	For device category 2G, an atmosphere rendered explosive through gas (G) may occur occasionally. The device guarantees a high degree of safety and may be used in zone 1 and zone 2.
h	Ignition protection type	Non-electrical equipment for use in potentially explosive atmospheres according to ISO 80079-37.
ТЗ	Temperature class	Surface temperature does not exceed 200°C
х	Additional marking	Indicates the requirement of observing special envi-ronmental conditions, in this case ambient tempera-ture (see section on "Technical data").

3.2 TYPE PLATE

Figure 2: Type plates standard

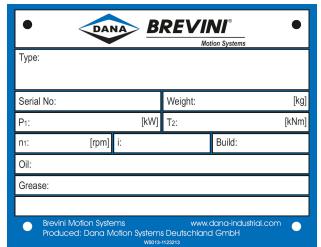
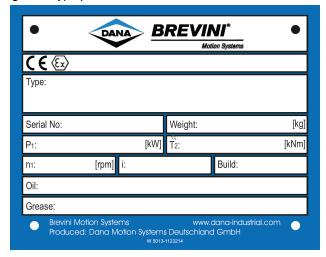


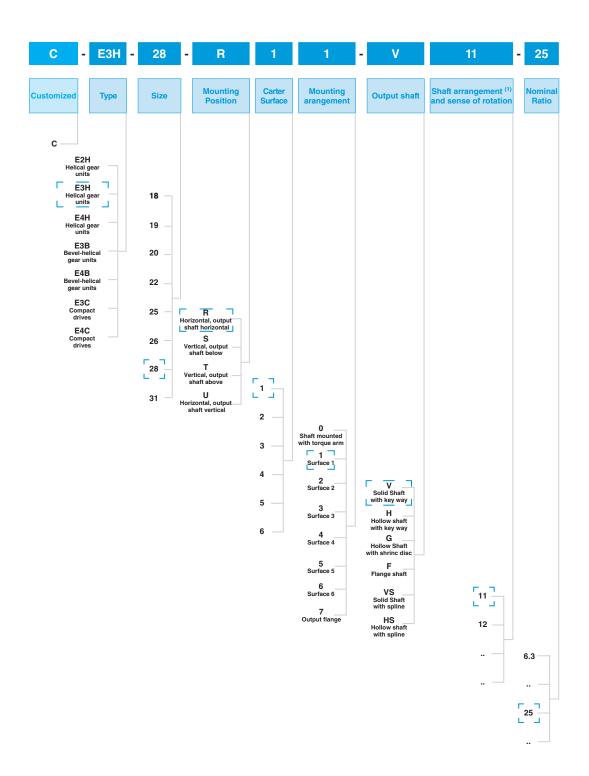
Figure 3: Type plates ATEX

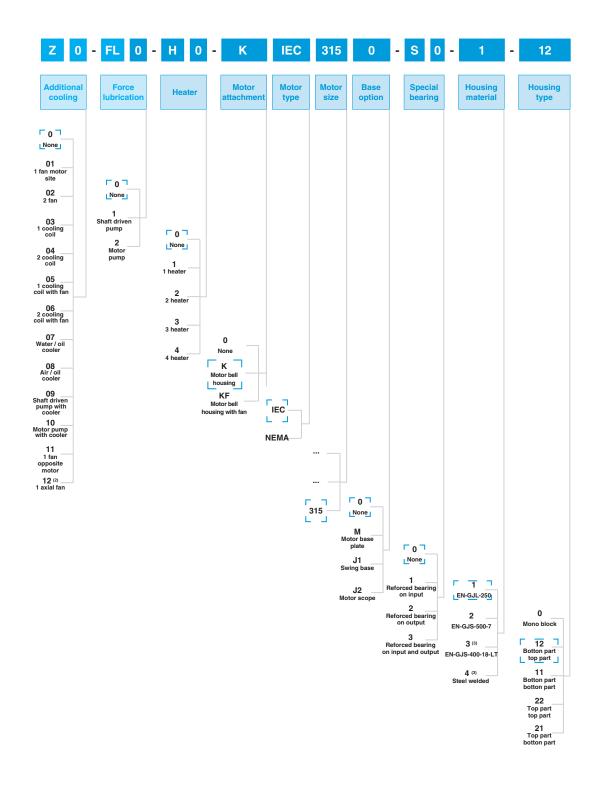


The type plate is affixed to the gear unit casing and lists the following data:

- ATEX version: ATEX marking
- Type
- Serial number
- Gear unit weight
- Drive power P1 [kW]
- Output torque T2 [kNm]
- Input speed n1 [rpm]
- Transmission ratio i
- Date of gear unit production
- Oil type, viscosity grade VG and oil quantity [I]
- · Grease type, regreasing quantity and number of greasing points
- Customer-specific data
- Manufacturer

4.1 ORDER DESIGNATION





4.2 BRIEF DESCRIPTION

General information

The gear unit converts a drive unit's speed and torque. Drive is provided solely through torque. The drive power is transferred from the input shaft to the output shaft via a reduction gearing.

Design

See separate technical specifications and spare parts drawing.

Lubrication

See separate technical specifications.

Cooling

See separate technical specifications.

Monitoring and control devices

See separate technical specifications.

Environment

If not stated otherwise in technical specification gearbox has to be stored and used in enclosed spaces protected from corrosive environment and lightning.

4.2.1 GEAR CASING

Housing consists of split part or monoblock construction is of compact design and torsionally rigid. The shape of housing imparts favorable noise, vibration and thermal characteristics.

Assembled gear casing comes with the following components

- 1 Air Breather /Oil Filler (Exhaust Ventilation / Oil Filling)
- 2 Inspection Window (Inspection)
- 3 Magnetic Drain Plug (To drain Oil)
- 4 Oil Level Indicator (Max & Min Level of oil shown)
- 5 Lifting Eyebolts (For lifting the gear unit)

4.2.2 GEAR INTERNALS

Gear/Pinion Shafts are manufactured from alloy steels case carburized hardened/tempered to a hardness of 58-62HRC and ground to a quality class of DIN 5/6. This facilities smooth running and vibration free operation. Spiral tooth gear pairs are designed in constant tooth (Klingelnberg Zyklo-Palloid) depth system to transmit high torque and ensure higher contact ratio . Slow Speed Shafts are medium carbon steels quenched and tempered fitted to the Bull Gear by high interference fits with parallel keys transmits the maximum torque with reliability.

4.2.3 BEARINGS

All roller bearings are antifriction type designed suitably to absorb the gear radial/axial loads and L10 life is more than 50000 hours.

4.2.4 OIL SEALS

Oil Seals are (Nitrile Butadyne Rubber or Viton) materials depends on the ambient and operating conditions with single or double lip for dust prevention. Special labyrinth seals are supplied for special applications.

4.2.5 LUBRICATION

- **a** Splash Lubrication: Gears dipped into the lubricant carrying oil around the rating parts and adequately dissipate the heat from the meshes.
- **b** Force Lubrication: Gear units with high pitch line velocities or high input speeds are supplied with force lube system by shaft driven pumps or motorized pumps for lubrication

For critical applications and higher heat dissipation gear units are supplied with external lube systems with heat exchangers. (Stand by systems are supplied upon request)

Motor - Pump - Filters - Heat Exchanger - Control Switches (Flow/Pressure/Temperature) - Condition Monitoring.

4.2.6 COOLING SYSTEMS

- a Fan cooling; Gear Units with fan fitted on high speed shafts dissipates more heat protects the gear unit from overheating.
- **b** Fin Tubes: Fin tubes are assembled into the oil sump for normal or chilled water circulation to carry more heat from the lubricant.
- c External Lube System: Gear unit supplied along with heat exchangers supply for higher heat dissipation required with elevated thermal rating, if limiting with fan and cooling coil. Refer "Lubrication" page 26 Point No a for details.

4.2.7 AUXILIARY DRIVE UNITS

Gear units are supplied with auxiliary gear units are supplied with over running clutch for initial inching or maintenance operations of few applications.

4.2.8 ADDITIONAL ACCESSSORIES

Over Running freewheel

Are provided with sprays operated centrifugally. The output shaft of auxiliary gear unit coupled with input or intermediate shaft of main gear unit shaft with over running clutches. For initial inching operation torque transmits via auxiliary gear unit and higher speeds the sprags will lift off while main gear unit take over and over running clutch will operate without wear. This also helps in doing the maintenance activities by slow speed operation.

Holdbacks

Gearbox supplying for belt conveyor applications designed with backstops from preventing the reverse rotation avoiding accidents in-case of any power failures.

Shrink Disc

Output Hollow Shafts are supplied with Shrink disc in few applications to hold the equipment shaft to transmit the designed torque. Detailed fitment procedure is given in "Positioning the shrink disk on the output shaft of the gearbox (hollow shaft)" page 88.

Oil Heaters

Space heaters are inserted in the lube oil sump to maintain the min operating temperature of the lubricant(above the pour point) for start up of the gear unit in few applications.

Torque Arm Mounting

Shaft mounted gear units are designed with suitable torque arm mounting to absorb the reaction force for smooth operation of the equipment. Swing base gear units are also supplied with torque arm depends on the scope including base frame.

4.2.9 VERTICAL GEAR UNITS

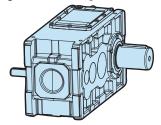
Slow speed shafts of vertical application are designed with grease lubrication to avoid any oil leakages and process safeties. Such gear units are also with oil retaining flanges to restrict oil flow to the Output Shaft drive end bearing and further leakages.

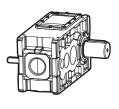
4.3 GEAR UNIT POSITION

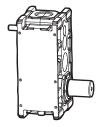
4.3.1 MONOBLOCK HOUSING

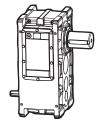
Helical gear units E2H, E3H, E4H

Figure 4: Parallel gear unit





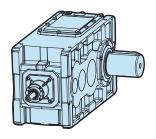


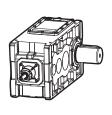


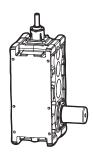


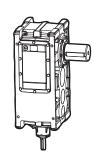
Bevel helical gear units E3B, E4B

Figure 5: Right-angle gear unit





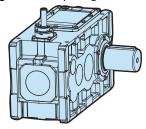




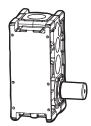


Compact drives E3C, E4C

Figure 6: Compact gear unit







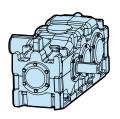




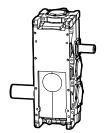
4.3.2 SPLIT HOUSING

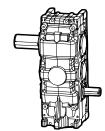
Helical gear units E2H, E3H, E4H

Figure 7: Housing version 12









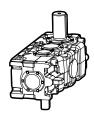
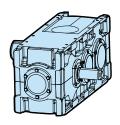
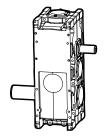
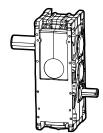


Figure 8: Housing version 11





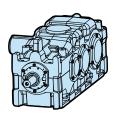




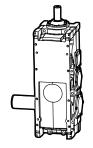


Bevel helical gear units E3B, E4B

Figure 9: Housing version 12







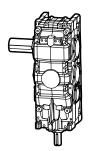
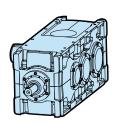
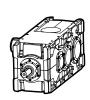
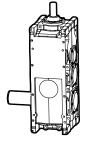


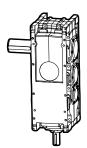


Figure 10: Housing version 11



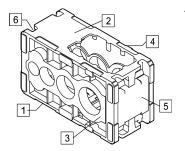








4.4 CASING SURFACES



The casing surfaces are numbered 1 to 6 for ease of identification. Refer to the gear unit's dimensions sheet for the permissible setup.

Example

Table 11:

D1	R – gear unit horizontal
KI	1 – surface 1 below

4.5 SHAFT LAYOUTS AND DIRECTIONS OF ROTATION

Table 12:

input output	Indication of directions of rotation
R1	Indication of bottom surface
3	Additional shaft end or continuous shaft
4	Position of pawl
5	Hollow shaft with shrink disc only as of size 31

Overview



Overview of designs and gear unit positions:

Table 13:

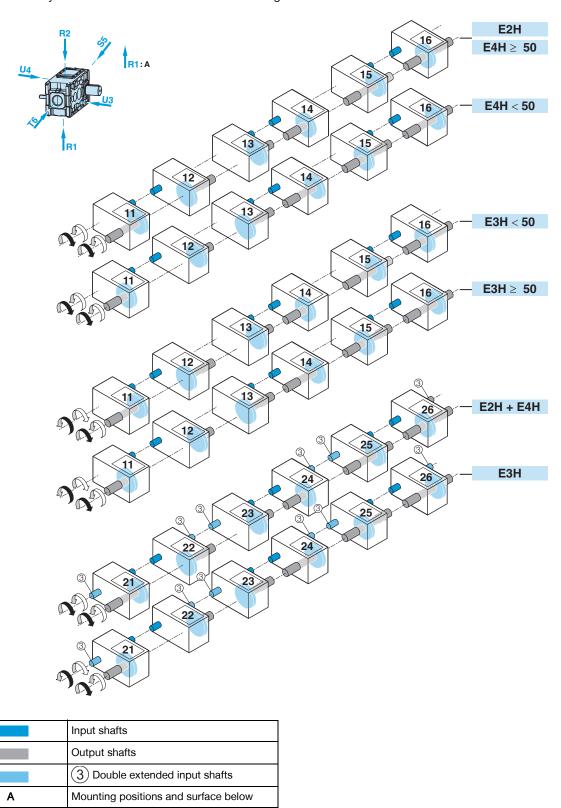
Туре	MONOBLOCK HOUSING	Mounting positions and surfaces		Pag.
		E2H	R1, R2, S5, T6, U3, U4	
		ЕЗН	R1, R2, S5, T6, U3, U4	
Helical gears		E4H	R1, R2, S5, T6, U3, U4	"Helical gear units E2H, E3H, E4H" page 32
		E3B	R1, R2, S5, T6, U3, U4	
Bevel-helical gears		E4B	R1, R2, S5, T6, U3, U4	"Bevel helical gear units E3B, E4B" page 34
		E3C E4C	R1	"Compact drives E3C, E4CR1" page 36
Compact gears		E3C E4C	S5, T6, U3, U4	"Compact drives E3C, E4CS5, T6, U3, U4" page 37

Table 14:

Туре	SPLIT HOUSING		Mount	ing positions and surfaces	Pag.
	Housing version 12	Housing version 11	E2H	R1, R2, S5, T6, U3, U4	
			ЕЗН	R1, R2, S5, T6, U3, U4	"I lolical goor
Helical gears			E4H	R1, R2, S5, T6, U3, U4	"Helical gear units E2H, E3H, E4H" page 32
	Housing version 12	Housing version 11	E3B	R1, R2, S5, T6, U3, U4	
Bevel-helical gears			E4B	R1, R2, S5, T6, U3, U4	"Bevel helical gear units E3B, E4B" page 34

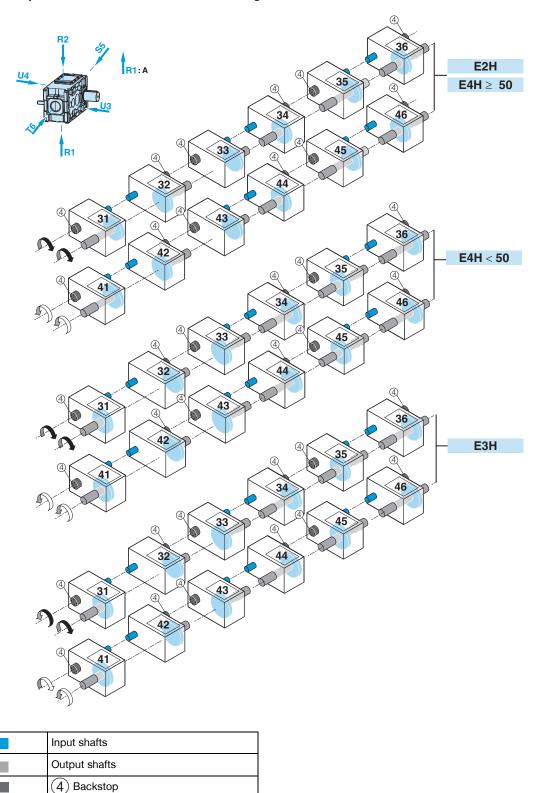
4.6 HELICAL GEAR UNITS E2H, E3H, E4H

Figure 11: Shaft layouts and directions of rotation for helical gear units



Helical gear units E2H, E3H, E4H

Figure 12: Shaft layouts and directions of rotation for helical gear units

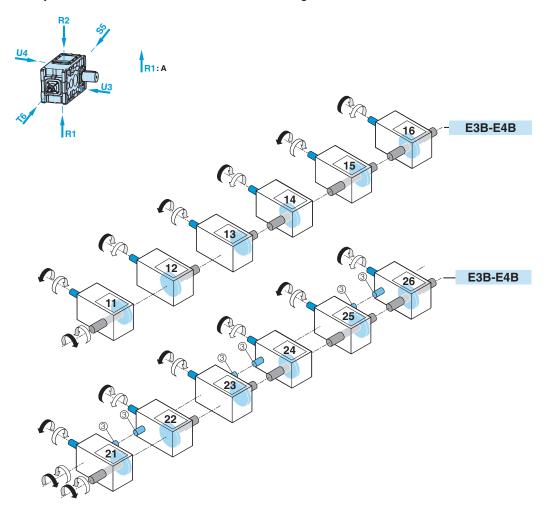


Mounting positions and surface below

Α

4.7 BEVEL HELICAL GEAR UNITS E3B, E4B

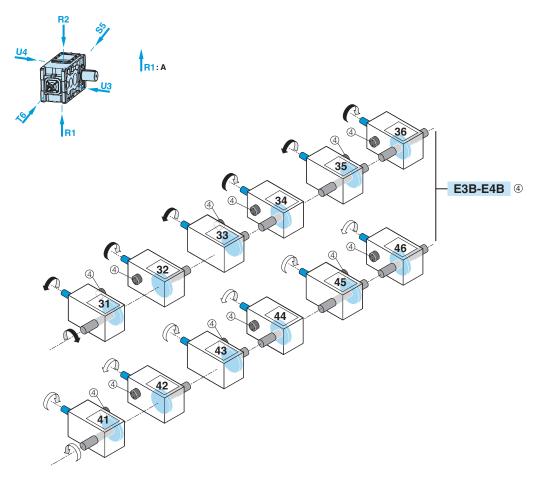
Figure 13: Shaft layouts and directions of rotation for bevel helical gear units



	Input shafts
	Output shafts
	3 Double extended input shafts
Α	Mounting positions and surface below

Bevel helical gear units E3B, E4B

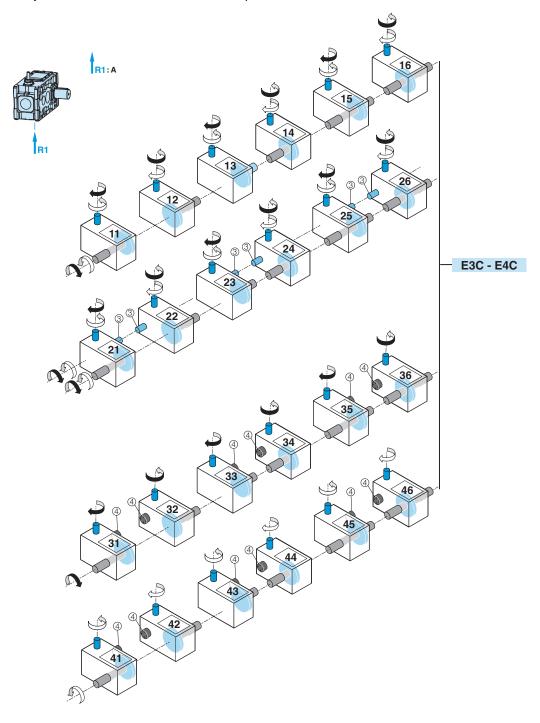
Figure 14: Shaft layouts and directions of rotation for bevel helical gear units



	Input shafts
	Output shafts
	4 Backstop
Α	Mounting positions and surface below

4.8 COMPACT DRIVES E3C, E4C ...R1

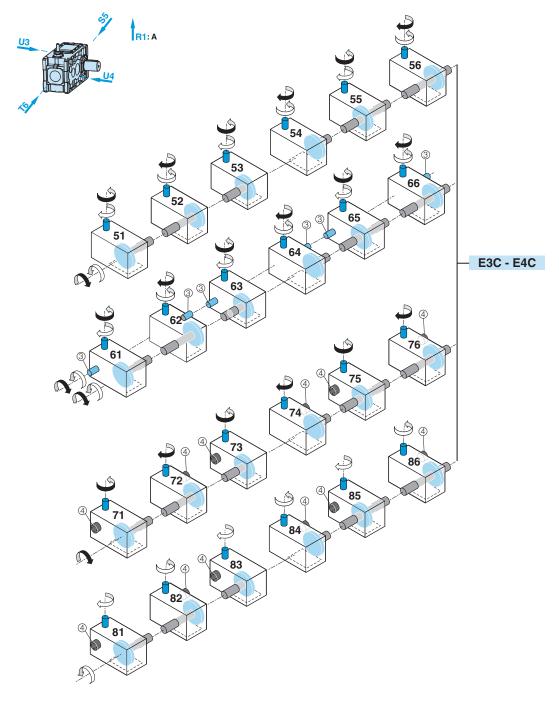
Figure 15: Shaft layouts and directions of rotation for compact drives



	Input shafts
	Output shafts
	3 Double extended input shafts
	4 Backstop
A	Mounting positions and surface below

4.9 COMPACT DRIVES E3C, E4C ...S5, T6, U3, U4

Figure 16: Shaft layouts and directions of rotation for compact drives



	Input shafts
	Output shafts
	3 Double extended input shafts
	4 Backstop
Α	Mounting positions and surface below

DESIGN AND FUNCTION

4.10 DISPLAYS AND CONTROLS

The following displays may be featured:

- Oil dipstick standard, Oil gauge, Oil sight glass
- Oil thermometer
- Pressure gauge
- · Filter contamination indicator
- Level limit switch
- · Resistance thermometer
- Flow switch
- Manometric switch
- Accelerometer

4.11 TOOLS AND UTILITIES DESIGNED TO BE USED IN AREAS EXPOSED TO EXPLOSIVE HAZARDS

Zones 0 and 20

In zones 0 and 20, use only tools that cannot generate sparks and are appropriate for coresponding ATEX environment.

A DANGER



Danger of ignition source.

Zones 1 and 2

In zones 1 and 2, use only steel tools that can generate no more than a single spark when used and are appropriate for coresponding ATEX environment. Tools that generate spark showers are only permissible if it is ensured that there is no explosive atmosphere at the workplace.

llc

If there is a risk of explosion through group-IIc explosive substances, no kind of steel tool may be used in zone 1 at all.

Tools and utilities

The following tools and utilities designed for use in explosive areas are required:

- Spanner set
- Torque wrench set
- Screwdriver set
- · Hexagon-socket spanner set
- Retractor
- possibly Compensator elements (washers, spacer rings)
- Fastening materials for drive/power take-off elements
- Lubricant (Molycote®)
- Screw locking materials, e.g. Loctite 243

4.12 ACCESSORIES

Electric gear unit

Heating element

Additionally purchased parts, see included operating manuals

Additional accessories, see catalogue

The various versions of the gear unit can differ substantially in terms of size and weight.

The transport utilities are not included by DANA Motion System Deutschland GmbH.

5.1 SAFETY NOTES FOR TRANSPORT

Suspended loads

↑ WARNING

Danger to life through suspended loads!

Loads may swing and drop during transport. This can cause serious or even fatal injury.

- Always secure the transport path.
- Never enter the swing range or area beneath suspended loads.
- Only trained personnel are permitted to carry out transport. See the instruction protocol in the appendix.
- Only move loads under supervision.
- Only use approved lifting equipment and fastening gear with sufficient load capacity. Observe the operating manuals of the lifting equipment.
- Never use damaged lifting equipment, ropes and belts.
- Use a suitable cross bar.
- Lower the load when leaving the workplace.

Risk of slipping

WARNING

Risk of injury through slipping!

Oil may leak from damaged seals. Slipping on this oil can cause serious injuries.

- Collet any oil that may have been spilled during this process immediately and dispose of it.
- Clean the floor area.

Improper transport

NOTICE

Damage to property due to improper transport!

Transport units may fall or tip over as a result of improper transport. This can cause a significant level of property damage.

- Proceed carefully when unloading transport units at delivery and during in-house transport; observe the symbols and instructions on the packaging.
- Only use the attachment points provided.
- Only remove the packaging shortly before assembly.

5.2 TRANSPORT INSPECTION

On receipt, immediately inspect the delivery for completeness and transport damage.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.

O NOTE:

Issue a complaint in respect of each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

5.3 PACKAGING

Packaging

The individual packing items are packaged in accordance with the expected transport conditions.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage until assembly. There-fore, do not destroy the packaging and remove it only immediately prior to assembly.

Tensioning straps

The gear unit is lashed to the pallet using tensioning straps.

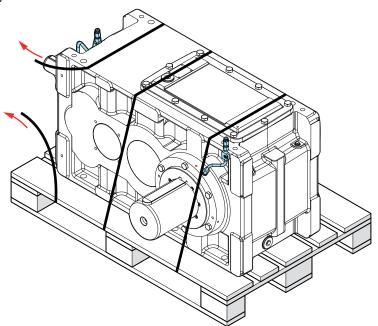
CAUTION

Risk of injury through sharp edges and corners on the tensioning straps!

The tensioning straps used to lash the gear unit to the pallet have sharp edges. The tensioning straps spring back when cut and have sharp ends. Contact with sharp-edged tensioning straps can cause injury.

- Wear protective gloves.
- When cutting the tensioning straps, position yourself in such a way that the straps pose no danger when they spring back.
- Dispose of tensioning straps correctly.

Figure 17: Tensioning straps



Protective equipment:

- Protective gloves
- Protective goggles

Undoing tensioning straps

CAUTION

Risk of injury when tensioning straps spring back!

- 1 Cut the tensioning straps using tin snips.
- 2 Dispose of tensioning straps correctly.

Handling packaging materials

Dispose of packaging material in accordance with the respectively applicable legal provisions and local regulations.

NOTICE

Danger of pollution through incorrect disposal!

Packaging materials are valuable resources and can in many cases be reused or reconditioned and recycled. Incorrect disposal of packaging materials may cause pollution.

- Dispose of packaging materials in an environmentally sound manner.
- Observe the locally applicable disposal regulations. If necessary, have disposal handled by a specialist.

Packaging materials

The packaging is adapted to the transport route and to the expected climatic conditions. The following packaging materials may be used:

- Wood
- Film
- Poly-nets
- BRANOrost corrosion-protection paper
- · Protective varnish
- Desiccant sachets
- · Tensioning straps
- Cardboard
- UCI paper/UCI bags

5.4 SYMBOLS ON THE PACKAGING

The packaging features the following symbols. Always observe the symbols for the purposes of transport.

Sling here



Attach lifting equipment only to the points indicated by this symbol.

This way up



The tips of the arrows indicate the top of the package. They must al-ways point upwards or the contents may be damaged.

Centre of gravity



Indicates a package's centre of gravity.

Observe the centre of gravity when lifting and during transport.

Keep dry



Protect package from damp and keep it dry.

Fragile



Indicates packages with fragile or sensitive contents.

Handle the package with care, do not drop it and protect it from im-pacts.

Forklift



The package can be transported using lifter trucks.

Lift the package with the lifter truck at this point.

Keep away from heat



Use a cover to protect the gear unit from heat and direct sunlight.

Keep away from cold



Use a cover to protect the gear unit from cold.

Do not open



Read the instructions before opening the packaging.

Do not use hooks



Hooks are prohibited to prevent damage to the gear unit and attached parts.

Do not unpack

Do not unpack.

The contents of this package is protected by BRANOrost corrosion-protection paper. This paper works by constantly evaporating an ac-tive substance.



Only open the packaging prior to use of the gear unit.

Reseal BRANOrost packaging as quickly as possible after inspec-tions. Damaged BRANOrost packaging must be replaced.

The layer of grease on the bare surfaces that acts as corrosion pro-tection has to be checked and renewed if necessary. See Chapter "Corrosion protection for the remaining bare surfaces" page 100

Do not step here



Never step onto gear units, even if they are still packaged.

5.5 TRANSPORT

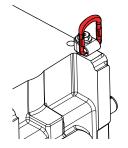
5.5.1 SLING POINTS ON THE GEAR UNIT

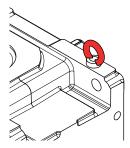
The individual gear units can be lifted using shackles, ring bolts in accordance with DIN 580 or load rings (not included by DANA Motion System Deutschland GmbH).

Select the lifting devices according to the total weight of the assembly to be lifted.

In case of accessories attached to the housing please consider the additional weight for the selection.

Figure 18: Shackles, ring bolts and load rings



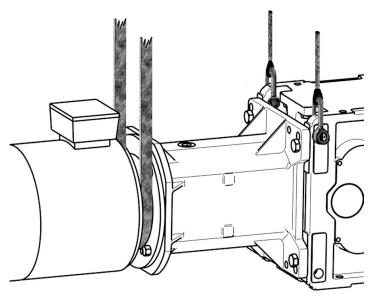


Transport together with motor

- Protective equipment:
 - Protective work clothing
 - Safety footwear
 - Industrial hard hat
 - Protective gloves
- Special tool:
 - Cross bar

Belt

Figure 19: Transport together with motor



MARNING

Risk of crushing through incorrect attachment of gear unit If attached incorrectly, the package may drop. This can cause serious injury and major damage.

1 - Use a belt to stabilise motors bolted to the gear unit via a bell housing.

Gear unit suspension points

2 - Suspend the main weight of gear unit and motor from the gear unit's suspension points.

MOTE:

The belt is for additional support only. Any lifting eyelets on the motor must not be used when transporting the gear unit-motor combination.

3 - Always pull the belt upwards perpendicular to the central axis. Use a transport cross bar when doing so.

5.5.2 NOTES ON TRANSPORTING GEAR UNITS

The following notes must be observed for every gear unit transport:

- The casings of the Brevini EvoMax[™] models are dimensioned so that the forces resulting from operation are safely transmitted. The attachment points on the casings can only support the gear unit's weight.
- The attachment points are not dimensioned for transport of an entire machine, only for transport of the gear unit. For drive units consisting of a gear unit and motor on a frame, the attachment points are located on the frame. See Chapter "Example of gear unit transport" page 46.
- Incorrect transport can damage the gear unit or the entire machine. If additional accessories (oilpump, pressure gauges and thermometers) are mounted the transport requires special care.
- For the total weight of the gear unit and connected parts, see the delivery note.
- The gear units may be lifted only by the corresponding suspension points. These are indicated by stickers on the gear unit.
- No lateral forces may be applied to the attachment points. Ropes and chains must always be positioned perpendicularly to
 the attachment surface. This means the gear unit with and without frame or the gear unit-motor unit must always be transported using a cross bar (see application example illustrations).
- Never use the front threads on the shaft ends to affix ring bolts for transport.
- Never use the shaft ends as attachment points for transport.
- Lifting gear must be designed to handle the weight of the gear unit with sufficient safety.
- The gear unit must be transported in such a way that nobody gets injured and damage to the gear unit is avoided. Impacts on the free shaft ends, for example, can damage the gear unit.
- The gear units may be transported only using suitable transport equipment. Cranes and hoists must be designed for the transport packages' weights. Protect transport ropes from damage through sharp edges.
- The operator must be authorised to operate cranes.
- Transport the gear unit drained of oil. If transporting the gear unit while filled with oil cannot be avoided, transport the gear unit with extra care. Oil sloshing back and forth can set the gear unit swinging.
- If possible, keep the gear unit or entire machine on its transport packaging (pallet) and transport it using a forklift.
- Make sure that any oil lines or attached parts on the gear unit are not damaged, crushed or bent.
- Do not tilt the gear unit during transport.
- · Gear units may not be stacked even when packaged.
- Do not store the gear unit in pathways or escape routes.
- Do not store the gear unit in front of fire alarms or fire extinguishing equipment.

5.5.3 EXAMPLE OF GEAR UNIT TRANSPORT

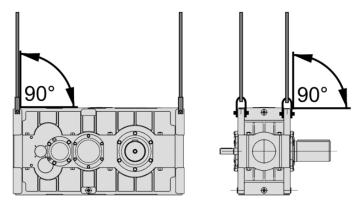
Overview of examples



- Brevini EvoMax™ 2 gear units
- Brevini EvoMax™ 2 gear units with bell housing and motor
- Brevini EvoMax[™] 2 gear units with motor and clutch/brake on frame
- Brevini EvoMax™ gear units with motor and belt drive

Brevini EvoMax™ 2

Figure 20: Brevini EvoMax™ 2



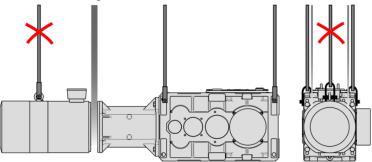
Transport using ropes or chains and cross bar. Suspension as far as possible using shackles or load blocks.

M NOTE:

Any ropes, belts or chains must be used at right angles to the suspension point.

Brevini EvoMax™ 2 with bell housing and motor

Figure 21: Brevini EvoMax™ 2 with bell housing and motor



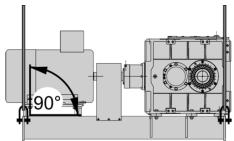
Transport with cross bar.

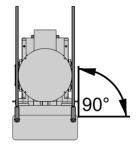
M NOTE:

The motor must be stabilised using additional suspension. Suspend the main weight of gear unit and motor from the gear unit's suspension points. The additional suspension is for support and alignment only. Do not use the lifting eyelets on the motor (marked X in "Figure 21" page 47) for this purpose.

Brevini EvoMax™ 2 with motor and clutch/brake on frame

Figure 22: Brevini EvoMax™ 2 with motor and clutch/brake on frame



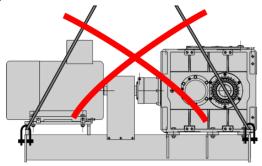


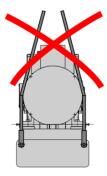
Transport with cross bar.

• NOTE:

The ropes or chains may be attached only vertically and only to the suspension points indicated on the frame.

Figure 23: Incorrect transport



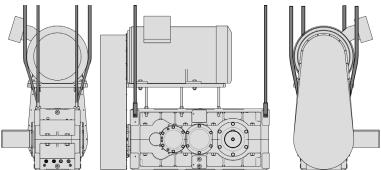


0 NOTE:

Never pull the ropes/chains at an oblique angle to the suspension.

Brevini EvoMax™ with motor and belt drive

Figure 24: Brevini EvoMax™ with motor and belt drive



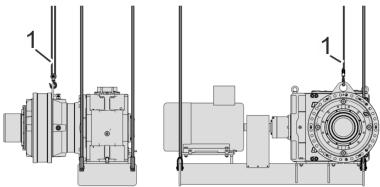
Transport with cross bar.

M NOTE:

Never use the motor mount or any suspension points on the motor for lifting.

High-power gear unit combination with motor on frame

Figure 25: High-power gear unit combination with motor on frame



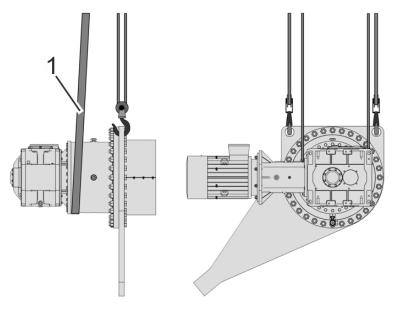
Transport with cross bar.

MOTE:

Suspend the main weight of the gear unit combination from the gear unit frame. The planetary gear's suspension ("Figure 25" page 49) is for alignment and support. Never attach ropes/chains at an oblique angle to the frame.

High-power gear unit combination with motor and torque bracket

Figure 26: High-power gear unit combination with motor and torque bracket



Transport with cross bar.

M NOTE:

Suspend the main weight of the gear unit combination from the gear unit's suspension points. The additional tension belt ("Figure 26" page 50) is for alignment and support only. Never use the torque bracket's arm as an attachment point. Protect it against impacts during transport.

5.5.4 LIFTING

- Protective equipment:
 - Protective work clothing
 - Safety footwear
 - Industrial hard hat
 - Protective gloves
- · Special tool:
 - Cross bar

A DANGER



Risk of crushing through falling packages!

If attached incorrectly, the gear unit may drop. This can cause serious injury.

- 1 Always tension ropes or chains at a right angle to the foundation frame. See: "Sling points on the gear unit" page 44, "Notes on transporting gear units" page 46, "Example of gear unit transport" page 46.
- 2 Make sure that the transport package is suspended straight. Observe any eccentric centre of gravity if applicable.
- 3 Begin transport.

5.6 STORAGE

MOTE:

Note that there may be storage instructions included on the packages that go beyond the requirements listed here. Observe these accordingly.

The following notes must be observed:

- Irrespective of the later assembly position, the gear unit should preferably be stored in R position. See Chapter "Gear unit position" page 28.
- Stacking gear units on one another is not permitted.
- Gear units must not be stacked on top of one another even if packed in boxes.
- The gear unit must be stored in a dry place and be protected from the weather.
- The permissible temperature range for the storage location is +5 °C to +35 °C.
- If stored outdoors, the gear unit must be covered with extra care so that neither dampness nor foreign matter (dirt, dust) can accumulate on the gear unit.
- Water must be prevented from accumulating under all circumstances. The permissible relative humidity is max. 60%.
- The gear unit must not be subjected to rapid temperature fluctuation.
- The gear unit must not be exposed to aggressive chemical products or similar adverse effects.
- The gear unit's coating must not be damaged. Any damage can lead to failure of the external corrosion protection.
- The layer of grease on the bare surfaces that acts as corrosion protection has to be checked and renewed if necessary.
- If storing the gear unit for more than 3 months, regularly check the general condition of all parts and the packaging.
- To avoid damage, the gear unit must be protected from vibrations throughout the entire storage period, for example by setting it on rubber mounts.
- If the gear unit was stored for longer than 6 months, we recommend replacing the shaft seal rings before commissioning the gear unit.
- · Transport and store the gear unit in its original packaging.
- The BRANOrost paper shaft protection must not be damaged.
- If the shaft protection is damaged, it must be renewed. While undamaged, the BRANOrost paper will provide sufficient corrosion protection for up to 3 years.

5.7 PRESERVATION

O NOTE:

The following preservation instructions applies only to gear units by Dana Motion Systems Deutschland GmbH. The operating manuals and preservation instructions issued by the respective manufacturers apply to all attached parts.

The gear unit is supplied without oil as standard.

At the DANA Motion System Deutschland GmbH plant, basic preservation as per Chapter "Basic gear unit preservation" page 53 was performed.

If the gear unit was supplied with oil, please consult DANA Motion System Deutschland GmbH for details on preservation (see Chapter "Customer service" page 9 for contact details).

MOTE:

Polyglycols are not covered in this manual and are only permissible as lubricants for the gear units after consulting Dana Motion Systems Deutschland GmbH.

Preservation instructions



Overview of preservation instructions:

- State of preservation of gear unit upon delivery "State of preservation of gear unit upon delivery" page 52
- Basic gear unit preservation "Basic gear unit preservation" page 53
 - Basic gear unit preservation by Dana Motion Systems Deutschland GmbH using mineral, synthetic (poly-alpha-olefin) and biodegradable lubricant "Basic gear unit preservation by DANA Motion System Deutschland GmbH using mineral, synthetic (poly-alpha-olefin) and biodegradable lubricant" page 53
 - Basic gear unit preservation by Dana Motion Systems Deutschland GmbH using physiologically harmless lubricants "Basic gear unit preservation by DANA Motion System Deutschland GmbH using physiologically harmless lubricants" page 54
- Subsequent preservation by customer "Subsequent preservation by customer" page 55
 - Gear unit preservation with anti-corrosion mineral oil or physiologically harmless lubricant "Gear unit preservation with anti-corrosion mineral oil or physiologically harmless lubricant" page 56
 - Gear unit preservation through completely filling gear unit with lubricant "Gear unit preservation through completely filling gear unit with lubricant" page 57
- Machine trial with subsequent preservation "Machine trial with subsequent preservation" page 59
 - Machine trial using anti-corrosion mineral oil "Machine trial using anti-corrosion mineral oil" page 59
 - Machine trial with a gear unit filled completely with lubricant for corrosion protection "Machine trial with a gear unit filled completely with lubricant for corrosion protection" page 59

5.7.1 STATE OF PRESERVATION OF GEAR UNIT UPON DELIVERY

The casing's inner and outer sides are painted with a base coat.

The outer surfaces are painted with an additional coat.

The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged and must remain on the shafts until the gear unit is finally connected to the machine.

If damaged, the BRANOrost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

All other blank surfaces are greased.

See "Corrosion protection for the remaining bare surfaces" page 100

Food industry

If the order states application in the food industry, ex-works preserva-tion takes the form of physiologically harmless oil.

Otherwise, an oil is used that guarantees corrosion protection for 18 months, provided the gear unit remains hermetically sealed.

Basic preservation

This basic preservation guarantees preservation of the gear unit for 18 months (mineral, synthetic poly-alpha-olefin and biodegradable oil) or 6 months (physiologically harmless oil), provided the gear unit re-mains hermetically sealed.

After this period, the gear unit's preservation must be checked.

The preservation period is indicated by a sticker on the gear unit.

Basic preservation by Dana Motion Systems Deutschland GmbH

Table 15:

Basic preservation by Dana Motion Systems Deutschland GmbH using	Mineral oil with special corr	Physiologically harmless oil with special corrosion protection for 6 months			
Lubricant used during later operation	Mineral oil	Synthetic oil (poly-alpha- olefin)	Biodegradable oil	Physiologically harmless oil	
Basic preservation	Mineral oil	Mineral oil	Mineral oil	Physiologically harmless oil	
Possible preservation period of basic preservation	18 months	18 months	18 months	6 months	
Flushing required before filling the operation lubricant	No	No	Yes, in accord-ance with oil manufacturer's specifications and VDMA 24569	No	

Basic preservation by Dana Motion Systems Deutschland GmbH using	ana Motion Systems Mineral oil with special corrosion protection for 18 months						
Service life of BRANOrost paper shaft preservation	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months			

Subsequent preservation by customer

Table 16:

Subsequent preservation by customer using	Mineral oil with special corr	Mineral oil with special corrosion protection for 18 months								
Lubricant used during later operation	Mineral oil	Synthetic oil (poly-alpha- olefin)	Biodegradable oil	Physiologically harmless oil						
Possible preservation period of the respective subsequent preservation	18 months	18 months	18 months	6 months						
Number of subsequent preservations by customer	1	1	1	2						
Maximum possible total	maximum 36 months	maximum 36 months	maximum 36 months	maximum 18 months						
preservation period in- clud-ing basic preserva- tion by Dana Motion Systems Deutschland GmbH	Further preservation possible only after consultation with Dana Motion Systems Deutschland GmbH.									
Service life of BRANOrost paper shaft preservation	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months						

5.7.2 BASIC GEAR UNIT PRESERVATION

5.7.2.1 BASIC GEAR UNIT PRESERVATION BY DANA MOTION SYSTEM DEUTSCHLAND GMBH USING MINERAL, SYNTHETIC (POLY-ALPHA-OLEFIN) AND BIODEGRADABLE LUBRICANT

Irrespective of the oil used during later application by the customer, the gear unit is preserved using a special mineral oil for corrosion protection.

The special mineral oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 18 months, provided the gear unit remains hermetically sealed. To hermetically seal the gear unit, the bleeder screw is replaced by a dummy plug. DANA Motion System Deutschland GmbH securely stows the bleeder screw on the gear unit.

The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged. If damaged, the BRANOrost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

These measures preserve the gear unit for 18 months.

All of the bare surfaces have been greased.

See "Corrosion protection for the remaining bare surfaces" page 100

Prior to commissioning

A DANGER



Risk of explosion through flammable gases!

When removing the breather plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.
- **1** Before commissioning, replace the dummy plug with the original breather plug.
- 2 Fill fresh oil of the type and viscosity intended for operation up to the specified oil level using a oil filling filter (filter unit 25 μm).

Sticker

The gear unit features a sticker noting:

"Gear unit was preserved by the manufacturer using mineral oil. If the customer is using a different lubricant type, the oil manufacturer's specifications must be observed."

Flushing the gear unit

MOTE:

Always observe any additional legal provisions.

If the gear unit has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegradable oil, flush the gear unit particularly thoroughly.

5.7.2.2 BASIC GEAR UNIT PRESERVATION BY DANA MOTION SYSTEM DEUTSCHLAND GMBH USING PHYSIOLOGICALLY HARMLESS LUBRICANTS

If DANA Motion System Deutschland GmbH has been informed that the gear unit will be employed in the food industry, the gear unit will be preserved using a phys-iologically harmless lubricant approved in accordance with NSF-H1.

The special mineral oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 6 months, provided the gear unit remains hermetically sealed. To hermetically seal the gear unit, the bleeder screw is replaced by a dummy plug. DANA Motion System Deutschland GmbH securely stows the bleeder screw on the gear unit.

The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged. If damaged, the BRANOrost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

This measure preserves the gear unit for 6 months.

All of the bare surfaces have been greased. See "Corrosion protection for the remaining bare surfaces" page 100

Prior to commissioning

DANGER



Risk of explosion through flammable gases!

When removing the breather plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.
- **1** Before commissioning, replace the dummy plug with the original bleeder screw.
- 2 Fill fresh oil of the type and viscosity intended for operation up to the specified oil level using a oil filling filter (filter unit 25 μm).

Sticker

The gear unit features a sticker noting:

"Gear unit was preserved by the manufacturer using physiologically harmless lubricant (according to specification NSF-H1)."

Flushing the gear unit

MOTE:

Always observe any additional legal provisions.

If the gear unit is to be operated using a lubricant other than the physiologically harmless oil, flush the gear unit particularly thoroughly.

5.7.3 SUBSEQUENT PRESERVATION BY CUSTOMER

After the 18- or 6-month period of the DANA Motion System Deutschland GmbH basic preserva-tion has elapsed, the gear unit can be preserved for further planned stor-age as follows:

Flammable gases

DANGER



Risk of explosion through flammable gases!

Oil mist can cause explosions.

- Open flames, sparks and hot objects are prohibited.

Working with oil

WARNING

Danger to health through oil!

Inhaling oil mist and skin contact with oil can be hazardous to health.

- Wear a breathing mask, protective clothing and protective gloves when working with oil.

Working on the gear unit

NOTICE

Risk of damage to gear unit through improper work on gear unit!

Work performed improperly on the gear unit can result in major damage to the gear unit.

- Never allow foreign bodies to enter the gear unit.
- Never mix lubricants based on different oils. Always observe the oil manufacturers' specifications.
- Do not damage pipelines or gear unit attachments.
- Do not damage the BRANOrost paper shaft protection. If the shaft protection is damaged, it must be renewed.
- Observe all safety provisions.

NOTICE

Risk of pollution through oil!

Escaped oil can pollute the environment.

- Collect escaping oil and dispose of it in accordance with the applicable regulations or store it appropriately.

5.7.3.1 GEAR UNIT PRESERVATION WITH ANTI-CORROSION MINERAL OIL OR PHYSIOLOGICALLY HARMLESS LUBRICANT

The gear unit can be preserved with anti-corrosion mineral oil or phys-iologically harmless lubricant as follows:

A DANGER



Risk of explosion through flammable gases!

1 - Remove the maintenance cover.

Corrosion

- **2 -** Check the gear unit interior for corrosion.
- 3 If there is any corrosion, contact DANA Motion System Deutschland GmbH.
- 4 If there is no corrosion, apply preservation to the gear unit through suitable measures.
- 5 The lubricant used must, in a hermetically sealed gear unit, guar-antee at least 18 months of corrosion protection, or at least 6 months if a physiologically harmless lubricant is used.
- **6** Clean and degrease sealing surfaces on casing and bearing manufacturer. When doing so, it is important to comply with the surface re-quirements for permanently elastic sealants specified in the manufacturer's specifications.
- **7** Coat the casing's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for perma-nently elastic sealants specified in the manufacturer's specifica-tions.
- 8 Close the maintenance cover. Observe the tightening torques (Chapter "Tightening torque" page 66).

Filling oil

- 9 Fill oil up to the specified oil level. Use a oil filling filter to fill the oil (filter unit 25 µm).
- 10 Rotate the input shaft by hand a number of times until the output shaft has completed at least one full turn.
 - The oil is now fully distributed throughout the gear unit.

Draining oil

- 11 Drain the oil.
 - The oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 18 or 6 months, provided the gear unit remains hermetically sealed.
- 12 To hermetically seal the gear unit, replace the bleeder screw by a dummy plug.
- 13 Securely stow the bleeder screw on the gear unit.

Non-contact seals

MOTE:

Refer to the documentation or technical specification to find out whether the gear unit features non-contact seals.

- 14 If the gear unit features non-contact seals and grease chambers, relubricate the grease chambers. See Chapter "Relubricating taconite seals and non-contact labyrinth-type seals with lubricating grease" page 115.
- 15 If there are no grease chambers, tape off the gap around the shaft outlet hermetically.
 - This prevents air from escaping through the non-contact seals and seals the gear unit hermetically.

BRANOrost paper

M NOTE:

The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged.

- **16 -** If damaged, replace the BRANOrost paper.
 - While undamaged, it will provide sufficient corrosion protec-tion for up to 3 years.

This measure preserves the gear unit for 18 months or, if using physi-ologically harmless oil, for 6 months.

Bare surfaces

See Chapter "Corrosion protection for the remaining bare surfaces" page 100

Maximum storage period

The preservation procedure described above may be performed by the customer once if using a mineral oil with special corrosion protection or at most twice when using a physiologically harmless lubricant with special corrosion protection.

Thus, including the basic preservation by DANA Motion System Deutschland GmbH, the gear unit can be stored for a maximum period of 36 months.

Gear units with physiologically harmless lubricant can be preserved for a maximum of 18 months.

If you wish to store the gear unit for a longer period of time, contact DANA Motion System Deutschland GmbH.

For such cases, DANA Motion System Deutschland GmbH offers a maintenance contract and corresponding staff. For contact details, see Chapter "Customer service" page 9.

Prior to commissioning

DANGER



Risk of explosion through flammable gases!

When removing the breather plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.
- 1 Before commissioning, replace the dummy plug with the original breather plug.
- 2 Fill fresh lubricant of the oil type and viscosity intended for opera-tion up to the specified oil level using a oil filling filter (filter unit 25 µm).

Flushing the gear unit

O NOTE:

Always observe any additional legal provisions.

If the gear unit is to be operated using a lubricant other than the physiologically harmless oil, flush the gear unit particularly thoroughly.

Preservation record

O NOTE:

Document application of long-term preservation in the preservation record (see appendix).

5.7.3.2 GEAR UNIT PRESERVATION THROUGH COMPLETELY FILLING GEAR UNIT WITH LUBRICANT

0 NOTE:

Gear unit preservation through completely filling the gear unit with lubricant is not possible if the gear unit features non-contact seals. Use the variant using special anti-corrosion oil described above (Chapter "Gear unit preservation with anti-corrosion mineral oil or physiologically harmless lubricant" page 56). Refer to the documentation or technical specification to find out whether the gear unit features non-contact seals.

The gear unit can be preserved through completely filling it with lubri-cant as follows:

DANGER



Risk of explosion through flammable gases!

- 1 Completely drain off the lubricant in the gear unit. To do so, open the oil drain screw, all filler openings and all breather plug. **Corrosion**
- 2 Check the gear unit interior for corrosion.
- 3 If there is any corrosion, contact DANA Motion System Deutschland GmbH.

Dry cartridge

- 4 If there is no corrosion, replace the breather plug with a dry car-tridge including an intermediate oil expansion tank.
- 5 Regularly check the dryer cartridge in accordance with the manu-facturer's specifications and replace it if necessary.
- 6 Securely stow the breather plug on the gear unit as it needs to be reinstalled on the gear unit before commissioning.
- 7 Irrespective of the later assembly position, the gear unit should preferably be stored in R position (Chapter "Tightening torque" page 66).

Filling lubricant

- 8 Fill fresh lubricant of the oil type and viscosity intended for operation into the maintenance cover opening up to the lower edge of the maintenance opening using a oil filling filter (filter unit 25 μm).
- **9** Clean and degrease sealing surfaces on casing and bearing cover. When doing so, it is important to comply with the surface requirements for permanently elastic sealants specified in the manufacturer's specifications.
- **10** Coat the casing's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for permanently elas-tic sealants specified in the manufacturer's specifications.
- 11 Close the maintenance cover. Observe the tightening torques (Chapter "Gear unit preservation through completely filling gear unit with lubricant" page 57).
- 12 For gear units of the "S", "T" and "U" versions, which cannot be stored in R-position due to attached parts, fill the gear unit entirely up to the top edge of the gear unit through the oil filler neck.

BRANOrost paper

MOTE:

The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged.

If damaged, replace the BRANOrost paper.

- While undamaged, it will provide sufficient corrosion protection for up to 3 years.

The lubricant used must, in a hermetically sealed gear unit, guarantee at least 18 months of corrosion protection, or at least 6 months if a physiologi-cally harmless lubricant is used.

Bare surfaces

See "Gear unit preservation through completely filling gear unit with lubricant" page 57

Maximum storage period

The preservation procedure described above may be performed by the customer once if using a mineral oil with special corrosion protection or at most twice when using a physiologically harmless lubricant with special corrosion protection.

Thus, including the basic preservation by DANA Motion System Deutschland GmbH, the gear unit can be stored for a maximum period of 36 months.

Gear units with physiologically harmless lubricant can be preserved for a maximum of 18 months.

If you wish to store the gear unit for a longer period of time, contact DANA Motion System Deutschland GmbH.

For such cases, DANA Motion System Deutschland GmbH offers a maintenance contract and corresponding staff. For contact details, see Chapter "Customer service" page 9.

Prior to commissioning

1 - Check the lubricant for compliance with the permissible water content and permissible lubricant ageing. The limit values as specified by the respective lubricant's manu-facturer apply.

A DANGER



Risk of explosion through flammable gases!

When removing the breather plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.

Before commissioning, drain the lubricant down to the specified oil level and replace the dryer cartridge with intermediate oil expansion tank with the original bleeder screw.

Flushing the gear unit

O NOTE:

Always observe any additional legal provisions.

If the gear unit has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegrada-ble lubricant, flush the gear unit particularly thoroughly.

Preservation record

O NOTE:

Document application of long-term preservation in the preservation record (see appendix).

5.7.4 MACHINE TRIAL WITH SUBSEQUENT PRESERVATION

5.7.4.1 MACHINE TRIAL USING ANTI-CORROSION MINERAL OIL

Filling lubricant

1 - If the gear unit is installed in a machine and the machine is to be commissioned for trial-run purposes, fill fresh lubricant of the lubricant type and viscosity intended for operation up to the speci-fied oil level using a oil filling filter (filter unit 25 μm).

M NOTE:

Filling with lubricant rinses off the corrosion protection.

Flushing the gear unit

NOTE:

Always observe any additional legal provisions.

- 2 If the gear unit has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegrada-ble lubricant, flush the gear unit particularly thoroughly.
- 3 If corrosion protection is required once more after the trial run, proceed as per Chapter "Subsequent preservation by customer" page 55.

BRANOrost paper

4 - Preserve free input and output shafts using BRANOrost paper.

Bare surfaces

- 5 Lightly grease all other blank surfaces.
- 6 See Chapter "Corrosion protection for the remaining bare surfaces" page 100

5.7.4.2 MACHINE TRIAL WITH A GEAR UNIT FILLED COMPLETELY WITH LUBRICANT FOR CORROSION PROTECTION

Draining Iubricant

1 - If the gear unit is installed in a machine and the machine is to be commissioned for trial-run purposes, drain the lubricant filled for preservation down to the oil level specified for operation.

Dryer cartridge

2 - Replace the dryer cartridge with intermediate oil expansion tank with the bleeder screw.

O NOTE:

Draining the oil level eliminates the corrosion protection.

Flushing the gear unit

O NOTE:

Always observe any additional legal provisions.

If the gear unit has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegrada-ble lubricant, flush the gear unit particularly thoroughly.

Corrosion protection

If corrosion protection is required once more after the trial run, proceed as per Chapter "Subsequent preservation by customer" page 55.

Check the lubricant for compliance with the permissible water content and permissible lubricant ageing.

The limit values as specified by the respective lubricant's manu-facturer apply.

BRANOrost paper

3 - Preserve free input and output shafts using BRANOrost paper.

Bare surfaces

Lightly grease all other blank surfaces.

See Chapter "Corrosion protection for the remaining bare surfaces" page 100

MOTE:

Installation and commissioning may be performed only by qualified persons or by DANA Motion System Deutschland GmbH's service personnel.

Incorrect installation and commissioning

A DANGER



Danger to life through incorrect installation and commissioning!

Errors during installation or commissioning can lead to life-threatening situations and cause substantial damage.

- Observe all specifications issued by DANA Motion System Deutschland GmbH in the following chapters and perform all checks.
- Never perform unauthorised modifications. Failure to observe these notes will eliminate the explosion protection.
- In any case of doubt, always consult DANA Motion System Deutschland GmbH.

Qualification

The following applies to all installation and commissioning work:

- · Personnel:
 - Specialist for explosive areas
 - Dana Motion Systems Deutschland GmbH
- Special tool:
 - Tools approved for the existing explosive area

6.1 SAFETY NOTES FOR INSTALLATION AND COMMISSIONING

Explosion protection

A DANGER



Risk of explosion during assembly!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning assembly, obtain written work permission and keep it outside the danger zone.
- Never perform assembly work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.
- Only use drive and power take-off elements with ATEX approval.
- Only use belts with sufficient shunt resistance $< 10^9 \Omega$.
- No explosive atmosphere allowed during assembly.
- Make sure gearbox is correct for given ATEX environment.
- Use only washers for screws and bolts suitable for existing explosive environment.
- Earth the gear unit and make sure not to generate static electricity.

Failure to observe these notes will eliminate the explosion protection.

Motor start-up

MARNING

Risk of crushing through inadvertent starting!

Inadvertent starting can cause serious injury or death.

- Secure the drive against inadvertent starting. To do so, disconnect the motor from its power source and prevent it from being switched on inadvertently.
- Affix a note saying "Do not switch on!" to the motor switch.

Hot oil and hot surfaces

⚠ WARNING

Danger of burning through hot oil and hot gear unit surfaces!

During operation, the oil and the gear unit become hot. Skin contact can result in serious burns.

- Before beginning work, allow the gear unit and the gear oil to cool.

Falling parts

MARNING

Risk of crushing through falling heavy parts!

Falling or toppling components (motor, clutch, gear unit, attached parts) can cause serious injury or death.

- Secure all components against inadvertent motion.
- Never stand under suspended loads.
- Restrict access for unauthorised persons.

Shaft torsional moment

↑ WARNING

Risk of crushing through shaft torsional moment!

The shafts' torsional momenta can cause crushing at the shaft connections.

- Before releasing shaft connections, prevent shaft torsional momenta.

Incorrect gear oil

NOTICE

Gear unit damage through incorrect gear oil!

If incorrect gear oil is used, the required lubricant properties are no longer guaranteed and there is a risk of serious gear unit damage.

- Only fill with the gear oil specified on the gear unit's type plate.
- Use a oil filling filter (25 µm).
- Make sure that no foreign bodies enter the gear unit.
- For more information, see Chapter "Oil change" page 112.

Incorrect assembly

MARNING

Gear unit damage through incorrect assembly!

Incorrect assembly can lead to serious gear unit damage.

- Observe the instruction manuals for the parts attached to the gear unit.
- Tighten the fastening bolts on the gear unit in accordance with Chapter "Tightening torque" page 66.
- After performing any work on the gear unit, always perform a function test and a safety check.
- Never use a high-pressure jet for cleaning. Hosing down the gear unit with detergent and water is prohibited. This may damage seals and attached parts.
- Observe the assembly and safety notes in the respective sections of this operating manual and in the operating instructions for the attached parts.

6.2 PREPARATIONS

Installation site

The installation site must meet the following requirements:

- · The floor must be capable of supporting sufficient weight, must be free of vibrations and resistant to buckling
- There must be sufficient space for assembly.
- Ensure that the ambient conditions listed in the technical specification upon conclusion of the contract are matched.
- · Protect from direct sunlight.
- Prevent substantial temperature fluctuation.
- In damp locations and when installing outdoors, use only gear units with paint coat.
- The oil filler necks, oil level inspection ports, oil drain locations and all maintenance covers must be freely accessible.
- All attached transmission elements must be balanced. They may not produce impermissible radial or axial forces.

6.3 ADDITIONAL ATEX REQUIREMENTS

The drive may be assembled under the following conditions only:

- The specifications on the gear unit's type plate match the permissible explosive area on site.
 - Device group
 - EX category
 - EX zone
 - Temperature class
 - Maximum surface temperature
- The drive must be free of damage (no transport or storage damage).
- The following requirements must be met during assembly:
 - No explosive atmospheres
 - No oils
 - No acids
 - No gases
 - No radiation

Electrochemical corrosion

If there is a risk of electrochemical corrosion between gear unit and working unit (connection of different metals such as cast iron/stainless steel, for example):

- Use plastic inserts (2 to 3 mm thick) suitable for existing explosive environment.
- Use plastic washers for screws and bolts suitable for existing explosive environment.
- Shunt resistance of plastic used < 109 Ω.
- Earth the gear unit and make sure not to generate static electricity.

6.4 INSTALLING THE GEAR UNIT IN ALL CATEGORY ATEX ENVIRONMENTS

DANGER



Not following these instructions can result in generating ignition sources.

The following requirements must be met for all category atex environments gear units:

Ambient temperature

Only use category II2G and II2D in ambient temperatures of -20 °C to +60 °C.

For operational restrictions, see the technical gear unit specification.

Ambient pressure

0,8...1,1 bar

Temperature class

Depending on their speed, ratio and design, the category II2G (explo-sive atmosphere gas) gear units can be approved for temperature classes up to T4 and/or max surface temperatures for dust >100°C..

For the gear unit's temperature class, refer to the type plate.

Ambient conditions

Ventilate the gear units sufficiently and prevent external heat trans-mission (e.g. via couplings).

Accumulating dust must not exceed a thickness of 5 mm.

High-pressure jets are not permissible for cleaning the gear unit. Hos-ing down the gear unit with detergent and water is prohibited. This may damage seals and attached parts.

Protection type

All gear unit versions comply with protection type IP55.

A DANGER



Additional equipment has to be used according to "Additional safety equipment for use in explosive areas" page 18 and order-specific documentation.

6.5 FASTENING BOLTS

The following table lists the fastening bolts of strength class 10.9 that are required for attachment to the foundation in the respective position:

Table 17:

T	0'	Gear unit position								
Туре	Size	R1/R2	S5	T6	U3/U4					
E2H/E3H E3B/E4B E3C/E4C			1							
E2H/E3H E3B/E4B E3C/E4C	14	6x M10x45	4x M12x90	4x M12x90	4x M14x65					
E2H/E3H E3B/E4B E3C/E4C	16	6x M10x80	4x M12x90	4x M12x90	4x M14x65					
E2H/E3H E3B/E4B E3C/E4C	18	6x M12x55	4x M14x100	4x M14x100	4x M20x80					
E2H/E3H E3B/E4B E3C/E4C	20	6x M12x90	4x M14x100	4x M14x100	4x M20x80					
E2H/E3H E3B/E4B E3C/E4C	22	6x M16x65	4x M20x130	4x M20x130	4x M24x100					
E2H/E3H E3B/E4B E3C/E4C	25	6x M16x90	4x M20x130	4x M20x130	4x M24x100					
E2H/E3H E3B/E4B E3C/E4C	28	6x M20x80	4x M24x150	4x M24x150	4x M30x120					
E2H/E3H E3B/E4B E3C/E4C	31	6x M20x110	4x M24x160	4x M24x160	4x M30x120					
E2H/E3H E3B/E4B E3C/E4C	35	8x M20x85			4x M36x330					
E2H/E3H E3B/E4B E3C/E4C	40	8x M20x120			4x M36x330					
E2H/E3H E3B/E4B E3C/E4C	42	8x M24x100			4x M42x400					
E2H/E3H E3B/E4B E3C/E4C	45	8x M24x120			4x M42x400					
E2H/E3H E3B/E4B E3C/E4C	47	8x M24x250			4x M48x400					
E2H/E3H E3B/E4B E3C/E4C	50	8x M30x120			4x M56x400					
E2H/E3H E3B/E4B E3C/E4C	53	8x M30x180			4x M56x400					
E2H/E3H E3B/E4B E3C/E4C	56	8x M30x250			4x M56x400					
E2H/E3H E3B/E4B E3C/E4C	63	8x M36x200								
E2H/E3H E3B/E4B E3C/E4C	67	8x M36x250								
E2H/E3H E3B/E4B E3C/E4C	71	8x M42x250								
E2H/E3H E3B/E4B E3C/E4C	75	8x M42x320								
E2H/E3H E3B/E4B E3C/E4C	80	8x M42x360								
E2H/E3H E3B/E4B E3C/E4C	85	8x M42x450								

6.6 TIGHTENING TORQUE

Table 18:

Tightening torque at fri	ction coefficient µ=0.12		
Screw size	Strength class		
	12.9	10.9	8.8
M4	5,1 Nm	4,4 Nm	3 Nm
M5	10 Nm	8,7 Nm	5,9 Nm
M6	18 Nm	15 Nm	10 Nm
M8	43 Nm	36 Nm	25 Nm
M10	84 Nm	72 Nm	49 Nm
M12	145 Nm	125 Nm	85 Nm
M14	235 Nm	200 Nm	135 Nm
M16	365 Nm	310 Nm	210 Nm
M18	500 Nm	430 Nm	300 Nm
M20	710 Nm	610 Nm	425 Nm
M22	970 Nm	830 Nm	580 Nm
M24	1220 Nm	1050 Nm	730 Nm
M27	1800 Nm	1550 Nm	1100 Nm
M30	2450 Nm	2100 Nm	1450 Nm
M36	4100 Nm	3500 Nm	2460 Nm
M39	5440 Nm	4530 Nm	3230 Nm
M42	6730 Nm	5610 Nm	3990 Nm

6.7 INSTALLATION AT OPERATION SITE

Requirements

1 - Ensure that all preparations are performed and all requirements are met. See "Preparations" page 63, Chapter "Additional ATEX requirements" page 63 and Chapter "Installing the gear unit in all category atex environments" page 64.

Setup and screwing fast

- 2 Set up the gear unit at the installation site.
- **3** Screw the gear unit to the foundations. Observe the specifications under Chapter "Fastening bolts" page 65 and the tight-ening torques under Chapter "Tightening torque" page 66.

Aligning

A DANGER



Alligning not precise enough can cause early bearing, shaft and sealing damage resulting in a potential ignition source.

CAUTION

If the shafts' axes are not precisely aligned with one another, they can break!

Risk of death and severe injury

- Please refer to the corresponding instructions for the alignment accuracies of attached parts.
- 4 Align the shaft.
- 5 Fill with gear oil. See Chapter "Filling oil" page 102.
- **6** Check the shaft alignment by measuring. The shafts, bearings and couplings' life expectancy largely de-pends on the accuracy with which the shaft axes are aligned with one another. For this reason, it is important to aim for zero devia-tion when fitting them. The shafts' alignments and any deviations have to be recorded in a log.

A DANGER

Connecting motor to the gearbox before securing gearbox at the foundation can cause the gearbox to tilt.

- 7 Setting up motor and gear unit on their bases:
 - Align the motor and connect it to the gear unit via the coupling.

Motor bell housing and gear unit set up on its base:

- Align the motor and connect the flanges without generating stresses.

Gear unit and motor on a frame:

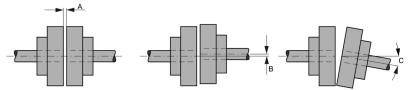
DANA Motion System Deutschland GmbH has aligned and connected the gear unit and motor appropriately.

Connecting additional components

- 8 To connect the lubrication system, connect it to the gear unit and connect any water lines to the water supply correctly.
- 9 Mount any additional parts such as brake, pawl etc. in accordance with the respective manufacturers' operating instructions.

Transmission elements

Figure 27: Transmission elements



- A Maximum and minimum distance
- **B** Axial offset
- C Angular offset
- **4 -** Attach the transmission elements.

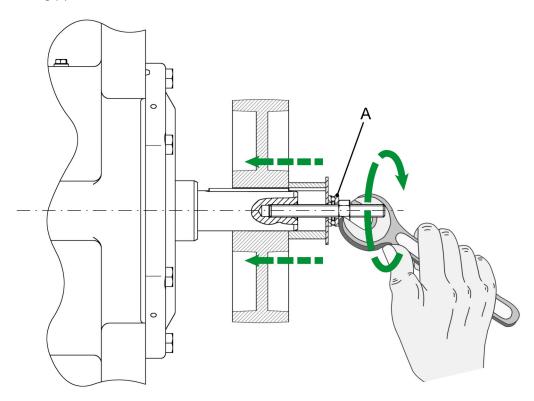
For couplings, belts etc. observe the maximum permissible tor-ques. Observe the maximum and minimum distance (A), axial offset (B) and angular offset (C) specified by the coupling manu-facturer.

M NOTE:

If the gear unit dimensions sheet specifies positions for the transmission elements on the shaft, observe these specifications during assembly.

Belt pulleys

Figure 28: Axial bearing (A)



- **5 -** Slide belt pulleys fully onto the shaft towards the centre of the gear unit.
- 6 "Figure 28" page 68 shows a retractor for fitting hubs to gear unit or motor shaft ends.
- 7 If necessary, leave out the axial bearing (Fig. 32/A) on the retrac-tor.

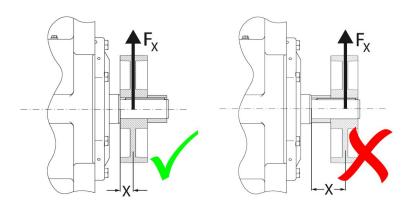
Transverse forces

NOTICE

Damage through insufficient alignment! Insufficient alignment of transmission elements can result in increased vibration and premature wear.

8 - To avoid excessive transverse forces, assemble gear wheels or sprockets in accordance with "Figure 29" page 69.

Figure 29: Alignment: Left is right, right is wrong



Barriers

MARNING

Risk of crushing through moving parts!

Cover transmission elements such as gear wheels or sprockets, clutches, belt pulleys etc. with a barrier to protect against inadvertent contact.

6.8 OVERVIEW OF OUTPUT SHAFT ASSEMBLY

Output shaft assembly

Overview of options for output shaft assembly:

- "Assembly of output shaft as hollow shaft with keyway" page 70
- "Assembly of output shaft as hollow shaft with shrink disc" page 81
- "Assembly of output shaft as flanged coupling" page 91

6.9 ASSEMBLY OF OUTPUT SHAFT AS HOLLOW SHAFT WITH KEYWAY

General information

A DANGER

Connecting machine to the gearbox before securing gearbox at the foundation can cause the gearbox to tilt.

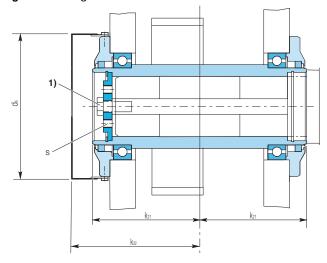
MOTE:

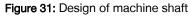
Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads. Observe the minimum key length specified in the dimensions sheet. If a longer key is to be used, align it symmetrically with the hollow shaft's longitudinal axis.

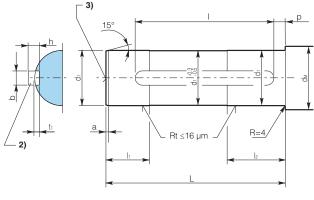
6.9.1 MACHINE SHAFT DIMENSIONS

6.9.1.1 SEALING USING SHAFT SEAL RINGS

Figure 30: Design of hollow shaft







- **1 -** Bolt
- **2** Key
- **3 -** Size
 - 10: DS M16 DIN 332
 - 12 ...16: DS M20 DIN 332
 - ≥ 18: DS M24 DIN 332

Table 19:

		а	Ø d ₁	Ø d _M min	Ø d _s	k ₂₁	k ₂₂	4	l ₂	L	I _{min}	р	t ₁	s	x) 1) ISO4014	y) 2) b x h
	18	5	90 h6	107	230	157	173	70	95	279	250	18	6.2	M 12	M 24 x 60	25 x 9
	19	5	90 h6	107	230	157	173	70	95	279	250	18	6.2	M 12	M 24 x 60	25 x 9
	20	5	100 h6	120	285	157	173	80	109	276	220	24	10	M 16	M 24 x 65	28 x 16
- E4H 4B	22	5	110 h6	128	285	189	205	90	119	340	280	24	10	M 16	M 24 x 65	28 x 16
E2H - E3H - E4H E3B - E4B	25	6	130 h6	150	310	215	250	100	132	388	280	26	11	M 20	M 24 x 70	32 x 18
EZH	26	6	130 h6	150	310	246	285	110	147	450	280	49	11	M 20	M 24 x 70	32 x 18
	28	6	140 h6	160	340	250	300	110	147	453	320	29	12	M 20	M 24 x 70	36 x 20
	31	6	160 h6	180	365	250	300	125	162	453	320	27	13	M 20	M 24 x 70	40 x 22

		а	Ø d ₁	Ø d _M min	Ø d _s	k ₂₁	k ₂₂	I ₁	l ₂	L	I _{min}	р	t ₁	s	x) 1) ISO4014	y) 2) b x h
	35	6	170 h6	190	380	285	320	135	180	515	400	35	13	M 20	M 24 x 70	40 x 22
	36	6	190 h6	210	410	285	320	150	195	515	400	32	15	M 20	M 24 x 70	45 x 25
	40	6	190 h6	210	410	285	320	150	195	515	400	32	15	M 20	M 24 x 70	45 x 25
	42	6	200 h6	220	470	315	360	160	215	565	400	40	15	M 20	M 24 x 70	45 x 25
B E	43	6	220 h6	240	495	320	360	175	225	578	400	34	17	M 20	M 24 x 70	50 x 28
E2H - E3H - E4H E3B - E4B	45	6	220 h6	240	495	320	360	175	225	578	400	34	17	M 20	M 24 x 70	50 x 28
12H	47	6	235 h6	255	540	330	355	190	235	603	400	26	20	M 20	M 24 x 70	56 x 32
	48	6	235 h6	255	540	385	410	190	235	713	400	26	20	M 20	M 24 x 70	56 x 32
	50	6	250 h6	270	570	390	425	205	250	723	400	26	20	M 20	M 24 x 70	56 x 32
	53	6	270 h6	290	615	390	600	220	275	715	400	25	20	M 20	M 24 x 70	63 x 32
	56	6	290 h6	310	615	390	600	235	290	715	400	25	20	M 20	M 24 x 70	63 x 32

^{1 -} Key of machine shaft and secured bolt are not in scope of delivery.

^{2 -} Type of tolerance of the keyway width in the hollow shaft: P9.

x) Bolts

y) Key

6.9.1.2 LABYRINTH-TYPE SEALS

Figure 32: Design of hollow shaft

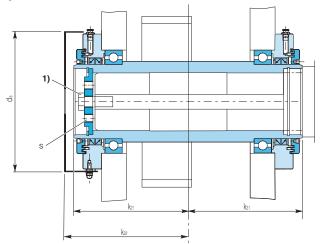
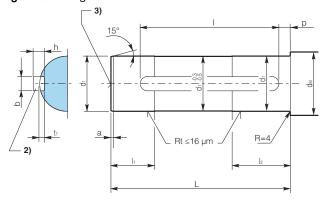


Figure 33: Design of machine shaft



- **1 -** Bolt
- **2** Key
- **3 -** Size
 - 10: DS M16 DIN 332
 - 12 ...16: DS M20 DIN 332
 - ≥ 18: DS M24 DIN 332

Table 20:

		а	Ø d ₁	Ø d _M min	Ø d _s	k ₂₁	k ₂₂	I ₁	l ₂	L	I _{min}	р	t ₁	s	x) 1) ISO4014	y) 2) b x h
	18	5	90 h6	107	200	206	280	85	110	378	250	18	6.2	M 12	M 24 x 60	25 x 9
	19	5	90 h6	107	200	206	280	85	110	378	250	18	6.2	M 12	M 24 x 60	25 x 9
	20	5	100 h6	120	250	205	285	80	110	372	220	24	10	M 16	M 24 x 65	28 x 16
- E4H 4B	22	5	110 h6	128	310	240	335	90	120	442	280	24	10	M 16	M 24 x 65	28 x 16
4 - E3H - E E3B - E4B	25	6	130 h6	150	310	235	250	100	132	428	280	26	11	M 20	M 24 x 70	32 x 18
E2H -	26	6	130 h6	150	310	266	280	100	148	490	320	29	11	M 20	M 24 x 70	32 x 18
	28	6	140 h6	160	340	280	315	110	148	513	320	29	12	M 20	M 24 x 70	36 x 20
	31	6	160 h6	180	365	280	315	125	162	513	320	27	13	M 20	M 24 x 70	40 x 22

		а	Ø d ₁	Ø d _M min	Ø d _s	k ₂₁	k ₂₂	I ₁	l ₂	L	I _{min}	р	t ₁	s	x) 1) ISO4014	y) 2) b x h
	35	6	170 h6	190	380	305	335	135	180	555	400	35	13	M 20	M 24 x 70	40 x 22
	36	6	190 h6	210	410	305	345	150	195	555	400	32	15	M 20	M 24 x 70	45 x 25
	40	6	190 h6	210	410	305	345	150	195	555	400	32	15	M 20	M 24 x 70	45 x 25
	42	6	200 h6	220	470	315	352	160	215	565	400	40	15	M 20	M 24 x 70	45 x 25
B E	43	6	220 h6	240	495	335	385	175	225	607	400	34	17	M 20	M 24 x 70	50 x 28
E2H - E3H - E4H E3B - E4B	45	6	220 h6	240	495	335	385	175	225	607	400	34	17	M 20	M 24 x 70	50 x 28
HZH M	47	6	235 h6	255	540	355	375	190	235	652	400	26	20	M 20	M 24 x 70	56 x 32
	48	6	235 h6	255	540	410	430	215	270	762	400	26	20	M 20	M 24 x 70	56 x 32
	50	6	250 h6	270	570	390	425	205	250	723	400	26	20	M 20	M 24 x 70	56 x 32
	53	6	270 h6	290	615	390	600	220	275	715	400	25	20	M 20	M 24 x 70	63 x 32
	56	6	290 h6	310	615	390	600	235	290	715	400	25	20	M 20	M 24 x 70	63 x 32

^{1 -} Key of machine shaft and secured bolt are not in scope of delivery.

^{2 -} Type of tolerance of the keyway width in the hollow shaft: P9.

x) Bolts

y) Key

6.9.2 FITTING THE GEAR UNIT ONTO THE MACHINE SHAFT

Machine shaft dimensions

MOTE:

The machine shaft must meet the requirements of Chapter "Sealing using shaft seal rings" page 71 or Chapter "Labyrinth-type seals" page 73.

Scope of supply

The scope of supply includes:

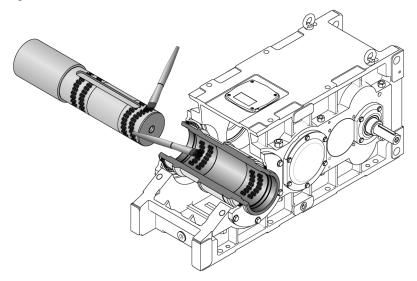
- · One retainer ring
- One end plate

The scope of supply does not include:

- Threaded rod
- Nut
- Fastening bolt
- Ejector screws

Assembly

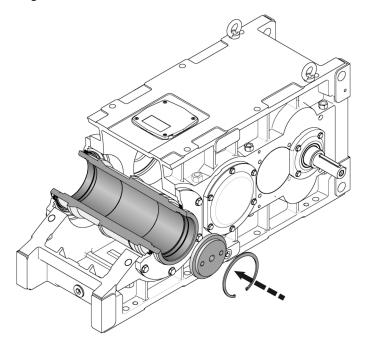
Figure 34: Applying lithium grease



1 - Apply lithium grease (Chapter "Grease" page 109) into the hollow shaft and onto the machine shaft's end.

End plate and retainer ring

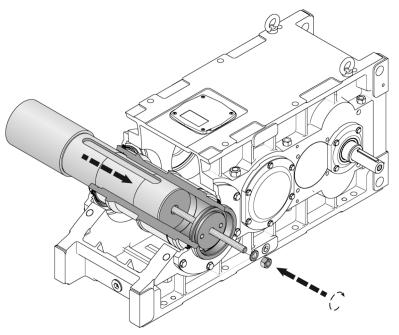
Figure 35: End plate and retainer ring



2 - Place end plate on the hollow shaft's offset and secure using the retainer ring.

Screwing in threaded rod

Figure 36: Screwing in threaded rod



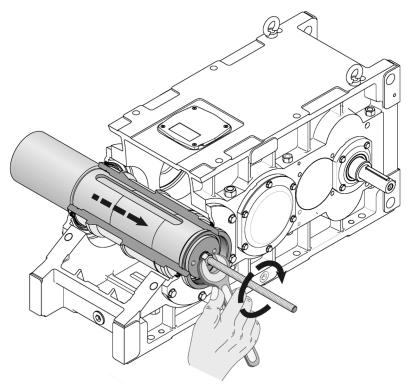
0 NOTE:

For ease of assembly, grease the threaded rod and nut with lubricant.

3 - Screw the threaded rod into the machine shaft. Observe the specified tightening torques (Chapter "Tightening torque" page 66).

Tightening machine shaft

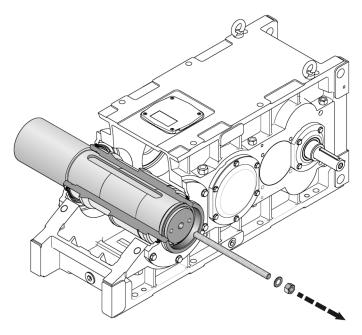
Figure 37: Tightening machine shaft



4 - Tighten the machine shaft using a nut until the shaft end con-nects with the end plate.

Unscrewing threaded rod

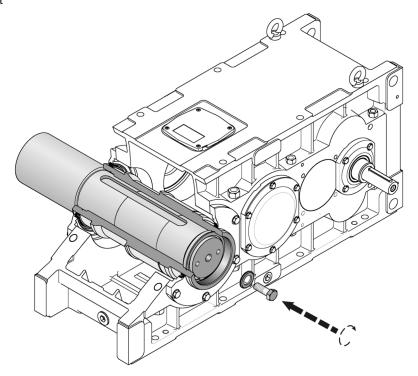
Figure 38: Unscrewing threaded rod



5 - Undo the nut and screw out the threaded rod.

Fastening bolt

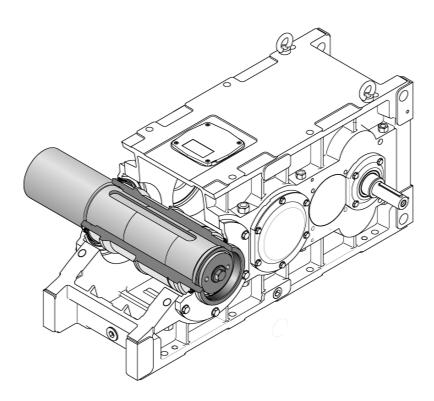
Figure 39: Fastening bolt



6 - Secure the machine shaft with a fastening bolt.

Bolt locking

Figure 40: Bolt locking



7 - Additionally secure the fastening bolt with a suitable bolt lock. Observe the specified tightening torques (Chapter "Tightening torque" page 66).

6.9.3 REMOVING THE GEAR UNIT FROM THE MACHINE SHAFT

High weight

MARNING

Risk of crushing through high weight!

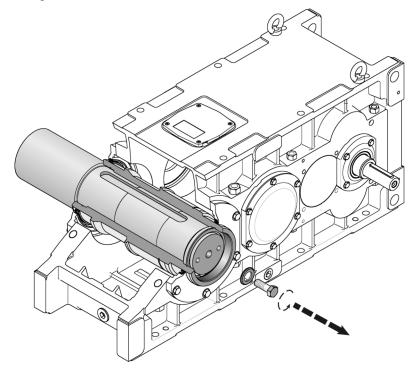
Due to its high weight, moving the gear unit can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See Chapter "Transport, packaging and storage" page 39.
- Always secure the gear unit before releasing any connections.

Disassembly

1 - Secure the gear unit against falling.

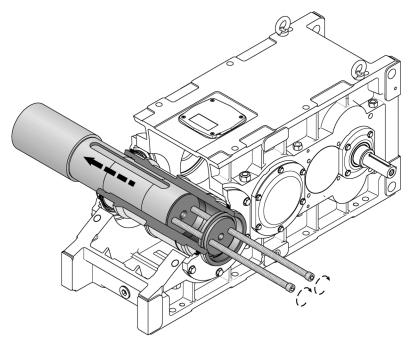
Figure 41: Undoing the fastening bolt



2 - Undo the fastening bolt and remove it.

Ejector screws

Figure 42: Screwing in ejector screws



MOTE:

For ease of disassembly, grease the ejector screws and the threads in the end plate with lubricant.

3 - Screw the two ejector screws into the threads in the end plate in order to detach the gear unit from the machine shaft.

6.10 ASSEMBLY OF OUTPUT SHAFT AS HOLLOW SHAFT WITH SHRINK DISC

General information

NOTE:

Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads.

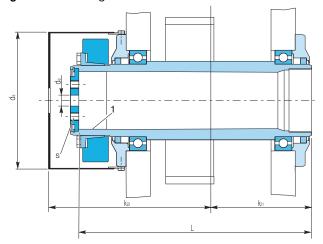
O NOTE:

Assemble and disassemble the shrink disc as per the instructions issued by the shrink disc's manufacturer.

6.10.1 MACHINE SHAFT DIMENSIONS

6.10.1.1 SEALING USING SHAFT SEAL RINGS

Figure 43: Mounting of shrink disc



2 15° 15° 15° 15° 15° 15° 15°

 $Rt \leq \! 16 \; \mu m$

Figure 44: Design of machine shaft

1 - Degreased

2 - Thread

Instructions for assembling and replacing the shrink disc are in scope of delivery.

Table 21:

	Hollow shaft								N	lachine sha	ıft	
		Ø d _s	k ₂₁	k ₂₂	Ø d _e	s	L	а	Ø d ₁	Ø d ₃	l ₁	l ₂
	18	200	157	231	25	M 12	367	5	90 h6	90 f6	50	325
	19	200	157	231	25	M 12	367	5	90 h6	90 f6	50	325
# ~ (20	250	157	247	27	M 16	371	5	100 h6	105 f6	54	324
H - H - H - H - H - H - H - H - H - H -	22	250	189	279	27	M 16	443	5	110 h6	115 f6	58	392
E2H - E3H - E4H E3B - E4B E3C - E4C	25	315	215	340	27	M 20	504	6	130 h6	135 f6	70	442
	26	315	246	370	27	M 20	566	6	130 h6	135 f6	70	504
	28	345	250	360	33	M 20	576	6	140 h6	150 f6	70	514
	31	365	250	375	33	M 20	594	6	160 h6	170 f6	85	517
	35	385	285	430	33	M 20	677	6	170 g6	180 f6	104	581
	36	420	285	435	33	M 20	682	6	190 g6	200 f6	108	582
	40	420	285	435	33	M 20	682	6	190 g6	200 f6	108	582
I	42	470	315	475	33	M 20	750	6	210 g6	220 f6	119	639
- E4	43	500	320	485	33	M 20	763	6	230 g6	240 f6	130	641
E2H - E3H - E4H E3B - E4B	45	500	320	485	33	M 20	763	6	230 g6	240 f6	130	641
불區	47	540	330	515	33	M 20	800	6	245 g6	250 f6	138	670
M T	48	540	385	570	33	M 20	910	6	245 g6	250 f6	138	780
-	50	555	390	574	33	M 20	918	6	260 g6	270 f6	138	788
-	53	615	390	600	33	M 20	933	6	270 g6	280 f6	152	789
	56	615	390	600	33	M 20	939	6	290 g6	300 f6	158	789

6.10.1.2 LABYRINTH-TYPE SEALS

Figure 45: Mounting of shrink disc

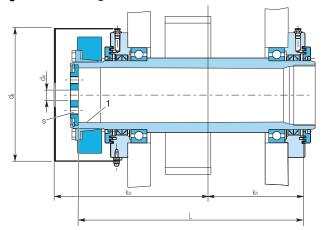
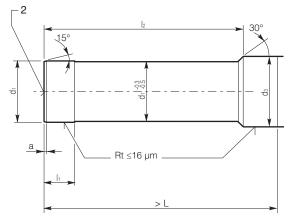


Figure 46: Design of machine shaft



- 1 Degreased
- 2 Thread

Instructions for assembling and replacing the shrink disc are in scope of delivery.

Table 22:

Hollow shaft								N	lachine sha	ıft		
		Ø d _s	k ₂₁	k ₂₂	Ø d _e	s	L	а	Ø d ₁	Ø d ₃	I ₁	l ₂
	18	200	206	280	25	M 12	463	5	90 h6	90 f6	50	420
	19	200	206	280	25	M 12	463	5	90 h6	90 f6	50	420
E4H	20	250	205	285	27	M 16	464	5	100 h6	105 f6	55	417
E2H - E3H - E4H E3B - E4B E3C - E4C	22	250	240	335	27	M 16	546	5	110 h6	115 f6	60	495
1- E3	25	315	235	340	27	M 20	544	6	130 h6	135 f6	70	482
EZH	26	315	266	370	27	M 20	606	6	130 h6	135 f6	70	544
	28	345	280	380	33	M 20	629	6	140 h6	150 f6	70	567
	31	365	280	390	33	M 20	640	6	160 h6	170 f6	85	565
	35	385	305	445	33	M 20	710	6	170 g6	180 f6	105	615
	36	420	305	460	33	M 20	722	6	190 g6	200 f6	110	622
	40	420	305	460	33	M 20	722	6	190 g6	200 f6	110	622
Ŧ.	42	470	315	475	33	M 20	750	6	210 g6	220 f6	120	639
E2H - E3H - E4H E3B - E4B	43	500	335	505	33	M 20	800	6	230 g6	240 f6	130	678
4 - E3H - E E3B - E4B	45	500	335	505	33	M 20	800	6	230 g6	240 f6	130	678
2H -	47	540	355	540	33	M 20	847	6	245 g6	250 f6	140	717
E	48	540	410	594	33	M 20	957	6	245 g6	250 f6	140	827
	50	555	390	574	33	M 20	918	6	260 g6	270 f6	140	788
	53	615	390	600	33	M 20	933	6	270 g6	280 f6	155	788
	56	615	390	600	33	M 20	939	6	290 g6	300 f6	160	789

6.10.2 FITTING THE GEAR UNIT ONTO THE MACHINE SHAFT

Machine shaft dimensions

NOTE:

The machine shaft must meet the requirements of Chapter "Sealing using shaft seal rings" page 82.

Scope of supply

The scope of supply includes:

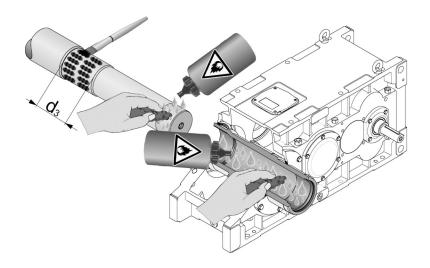
- · One retainer ring
- One end plate

The scope of supply does not include:

- Threaded rod
- Nut
- Fastening bolt
- · Ejector screws

Assembly

Figure 47: Greasing



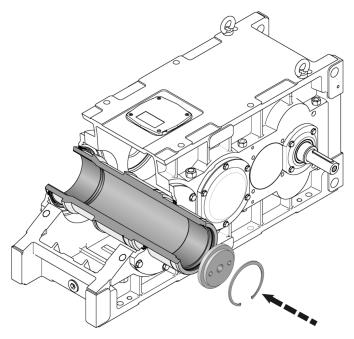
MOTE:

The shrink disc's clamping range between the hollow shaft and the machine shaft must remain free of grease under all circumstances.

- 1 Prior to assembly of the gear unit, grease the hollow shaft and the machine shaft.
- 2 Apply lithium grease to the machine shaft in the area of Ød3.

End plate and retainer ring

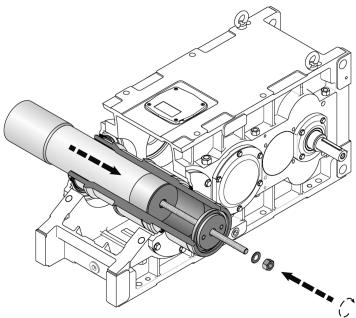
Figure 48: End plate and retainer ring



3 - Place end plate on the hollow shaft's offset and secure using the retainer ring.

Screwing in threaded rod

Figure 49: Screwing in threaded rod



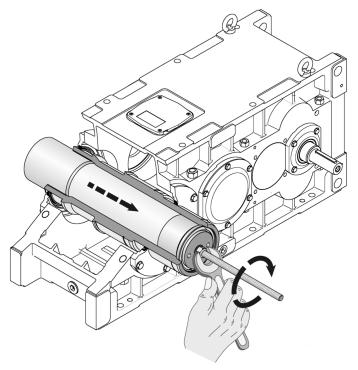
MOTE:

For ease of assembly, grease the threaded rod and nut with lubricant.

4 - Screw the threaded rod into the machine shaft. Observe the specified tightening torques (Chapter "Tightening torque" page 66).

Tightening machine shaft

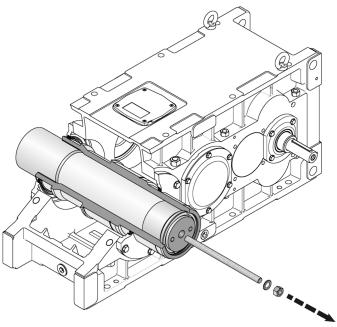
Figure 50: Tightening machine shaft



5 - Tighten the machine shaft using a nut until the shaft end con-nects with the end plate.

Unscrewing threaded rod

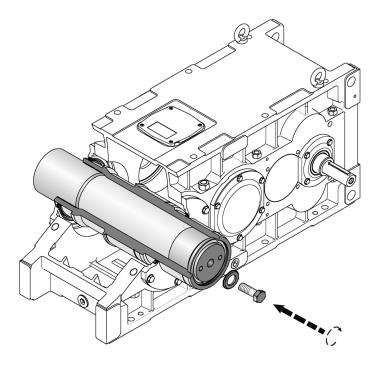
Figure 51: Unscrewing threaded rod



6 - Undo the nut and screw out the threaded rod.

Fastening bolt

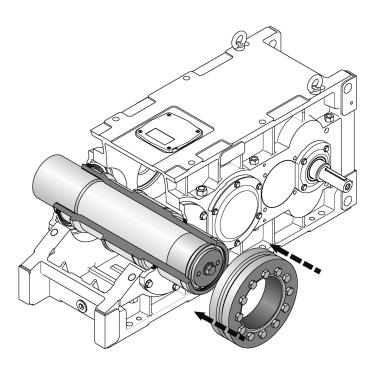
Figure 52: Fastening bolt



7 - Secure the machine shaft with a fastening bolt. Additionally secure the fastening bolt with a suitable bolt lock. Observe the specified tightening torques (Chapter "Tightening torque" page 66).

Shrink disc

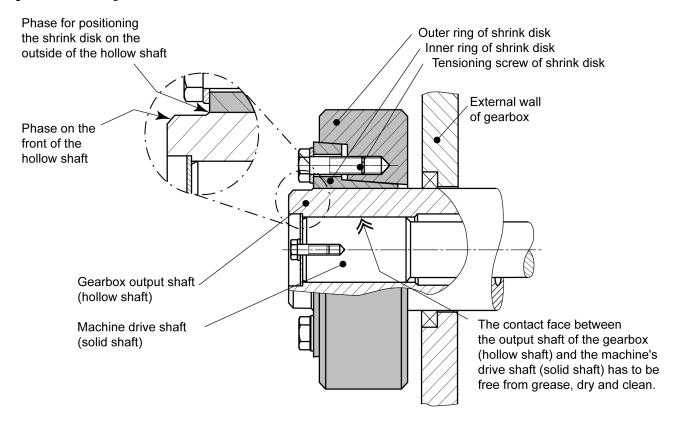
Figure 53: Bolt locking



8 - Slide the untightened shrink disc onto the hollow shaft. For fitting the shrink disc, observe the separate instructions issued by the manufacturer.

6.10.3 POSITIONING THE SHRINK DISK ON THE OUTPUT SHAFT OF THE GEARBOX (HOLLOW SHAFT)

Figure 54: Positioning the shrink disk



Slide the inner ring of the shrink disk onto the hollow shaft until it is flush with the positioning phase or up to the position specified on the dimen-sional drawing. This ensures that the shrink disk will be able to load-bear to maximum capacity. Next, tighten the screws to the torque speci-fied in the shrink disk manual. The contact face between the hub and shaft has to be free from grease, dry and clean.

Once the shrink disk has been fitted, all of the bare surfaces have to be protected from corrosion. When doing so, do not use a preservative that would damage the sealing lips of the shaft seals or would harden on the sealing lip. Please refer to the manufacturer's specifications for infor-mation on the life of the preservative.

See Chapter "Corrosion protection for the remaining bare surfaces" page 100

NOTICE

Using the wrong tightening torques can cause damage to property!

6.10.4 REMOVING THE GEAR UNIT FROM THE MACHINE SHAFT

High weight

MARNING

Risk of crushing through high weight!

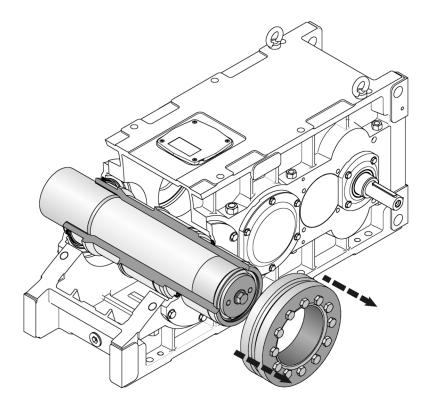
Due to its high weight, moving the gear unit can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See Chapter "Transport, packaging and storage" page 39.
- Always secure the gear unit before releasing any connections.

Disassembly

1 - Secure the gear unit against falling.

Figure 55: Shrink disc



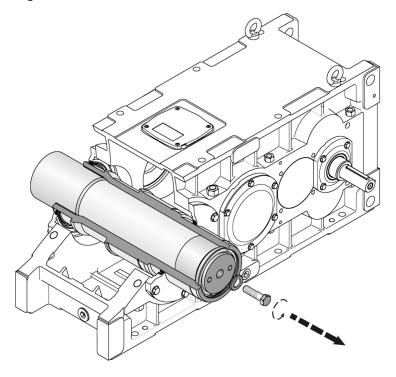
2 - Remove the shrink disc in accordance with the instructions is-sued by the manufacturer.

A CAUTION

Slightly loosen each screw by the same number of turns without fully removing them. Failure to loosen them evenly can result in individual screws becoming overloaded, which will result in a high risk of injury!

Fastening bolt

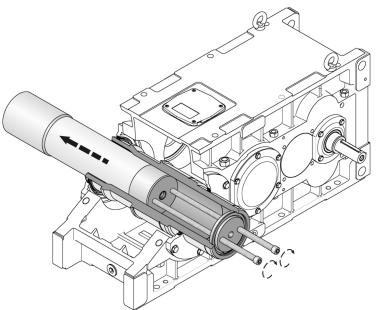
Figure 56: Undoing the fastening bolt



3 - Undo the fastening bolt and remove it.

Ejector screws

Figure 57: Screwing in ejector screws



MOTE:

For ease of disassembly, grease the ejector screws and the threads in the end plate with lubricant.

4 - Screw the two ejector screws into the threads in the end plate in order to detach the gear unit from the machine shaft.

6.11 ASSEMBLY OF OUTPUT SHAFT AS FLANGED COUPLING

General information

MOTE:

Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads.

6.11.1 FLANGED COUPLING DIMENSIONS

Figure 58: Flanged coupling dimensions

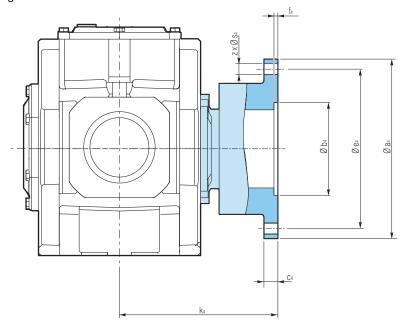


Table 23:

		k ₄	a ₄	e ₄	b ₄	f ₄	С4	z	s ₄	Bolt 1)
	18	265	360	320	150 H7	10	25	16	22	M20x70
	19	275	380	340	150 H7	10	25	18	22	M20x70
EAH C	20	275	360	320	160 H7	10	25	18	22	M20x70
E3H - E B - E4B C - E4C	22	320	370	320	180 H7	10	30	16	26	M24x90
1 E E	25	345	390	340	190 H7	10	30	18	26	M24x90
HZI H III	26	355	390	340	190 H7	10	30	18	26	M24x90
	28	387	470	420	220 H7	12	38	20	26	M24x100
	31	397	500	450	240 H7	12	38	22	26	M24x100

		k ₄	a ₄	е ₄	b ₄	f ₄	C ₄	z	S ₄	Bolt 1)
	35									
	36									
	40									
Į	42									
E2H - E3H - E4H E3B - E4B	43									
B - B	45					On request.				
HZ <u>EB</u>	47									
ŭ	48									
	50									
	53									
	56									

1 - Minimum bolt property class 8.8 according to ISO 898.

6.11.2 ASSEMBLY OF FLANGED COUPLING WITH COMPRESSED-OIL INTERFERENCE FIT Incorrect assembly

↑ **WARNING**

Risk of injury through incorrect assembly!

Incorrectly performed work on the flanged coupling with compressed-oil interference fit can cause serious injury and major damage.

- Observe the instruction manuals of the ejector tool, retractor and pumps.
- The oil pressure must not exceed the specified maximum pressure of 3,000 bar.
- Protect the seals on the input and output side from damage and heating up beyond 80 °C.
- Observe the maximum force of the hydraulic cylinder.
- Observe the tightening torques.

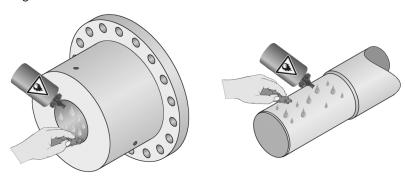
Requirements

The following components are required for relief after joining:

- A number of high-pressure oil pumps (maximum 3,000 bar each) corresponding to the number of oil bores on the hub
- · Pressure gauge
- · Connection lines as necessary

Assembly

Figure 59: Cleaning the mating faces



- 1 Clean and degrease the mating faces, oil connection bores and oil distributor grooves.
- 2 Make sure that the transitions between the mating faces, side-walls and oil distributor and drain grooves are smoothly rounded and free of burrs.

Joining temperature

MARNING

Risk of burning through hot surfaces!

MOTE:

Protect the seals on the input and output side from damage and heating up beyond 80 °C.

- **3** Heat the hub to the specified joining temperature (max. 250 °C) in an oven.
- **4 -** Quickly fit the hub to the shaft, preferably vertically.
- 5 Make sure that the fitted hub is fixed and that it can cool in the intended position on the shaft.
- 6 After joining, wait for the parts to cool to a temperature of approx. 20 to 25 °C.

Stresses

WARNING

Risk of injury through pressurised oil!

- 7 To relieve any stresses that may be produced during the shrink-ing process, use a suitable number of pumps to pump SKF mounting fluid LHMF 300 or suchlike around the hub until a fully closed ring of oil escapes from both sides of the gap. If necessary, correct the hub position while constantly pressing oil into the gap.
- 8 Observe the permissible maximum pressure of 3,000 bar.

Relieving oil pressure

MARNING

Risk of injury through ejecting oil!

- 9 Carefully relieve the oil pressure by opening the return valve.
- 10 Allow the joint to rest for 24 hours so that the oil can escape through the gap.

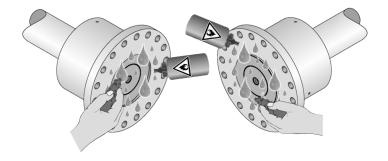
NOTICE

Pollution through escaping oil!

- 11 Collect escaped oil and dispose of it in an environmentally re-sponsible manner and in accordance with the local regulations.
- 12 Once the waiting period has elapsed, screw the locking bolts into the connector threads.
 - The joint can be loaded.

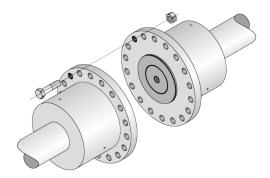
Flange surfaces

Figure 60: Flange surfaces



13 - Clean the two front flange surfaces.

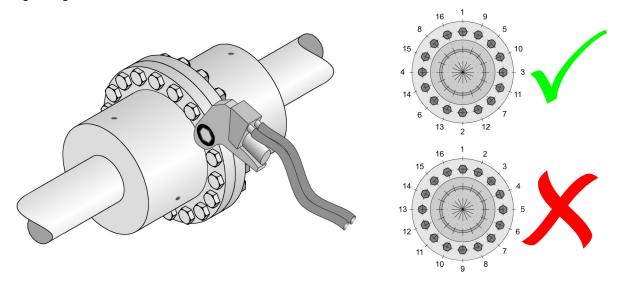
Figure 61: Aligning



14 - Align the bores of the two flange halves with one another and join them together.

Tightening bolts

Figure 62: Tightening bolts



NOTICE

Damage through incorrect tightening torques!

Tightening bolts Sequence according to "Figure 62" page 95. Observe the tightening torques (Chapter "Tightening torque" page 66).

If necessary, use a hydraulic torque wrench.

6.11.3 DISASSEMBLY OF FLANGED COUPLING WITH COMPRESSED-OIL INTERFERENCE FIT Incorrect disassembly

MARNING

Risk of injury through incorrect assembly!

Incorrectly performed work on the flanged coupling with compressed-oil interference fit can cause serious injury and major damage.

- Observe the instruction manuals of the ejector tool, retractor and pumps.
- The oil pressure must not exceed the specified maximum pressure of 3,000 bar.
- The sequence for oil pump activation must be observed under all circumstances.
- Observe the maximum force of the hydraulic cylinder.
- For couplings with a conical bore, apply an axial arrester to secure against sudden movements of the coupling part to be released.

Requirements

The following components are required for disassembly of the com-pressed-oil interference fit:

- . One hydraulic cylinder (Lukas) with oil pump for shifting the flanged coupling along the shaft
- A number of high-pressure oil pumps (at least 3,000 bar each) corresponding to the number of oil bores on the hub for forcing oil between shaft and flanged coupling
- · Pressure gauge
- · Connection lines as necessary

Hydraulic cylinder

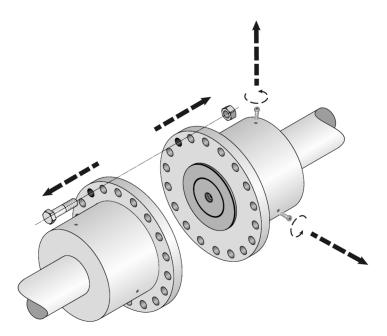
The displacement and compression force of the hydraulic cylinder must be observed.

The hydraulic cylinder (Lukas) is used only for shifting the hub along the shaft.

When retracting it, the hub must float on an oil film to prevent the shaft and hub from being damaged. Retraction must be performed in an even motion and without jarring.

Separating flanges

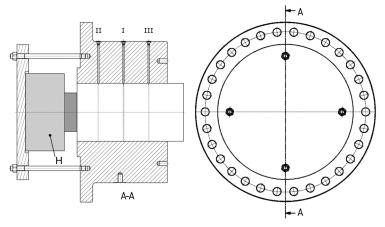
Figure 63: Separating flanges



- 1 Undo the bolts and separate the flanges.
- 2 Remove the locking bolts of the hydraulic ducts for the disassem-bly tool.
- 3 Clean and degrease the mating faces, oil connection bores and oil distributor grooves.
- **4 -** Make sure that the transitions between the mating faces, side-walls and oil distributor and drain grooves are smoothly rounded and free of burrs.

Disassembly utilities

Figure 64: Disassembly utilities



- **5 -** To avoid damage to the mating surfaces, continue pumping dis-assembly oil (e.g. SKF LHDF 900) into the gap and pull the hub off vertically, keeping it afloat on the oil film produced.
- 6 Fit the disassembly utilities and the hydraulic cylinder "H" accord-ing to "Figure 64" page 97.

NOTICE

Pollution through escaping oil!

7 - Remove the screw plugs from all oil ducts.

WARNING

Risk of crushing through falling components!

For couplings with a conical bore, apply an axial arrester to se-cure against sudden movements of the coupling part to be released.

Oil pump

MOTE:

Always generate pressure using the oil pumps from the centre outwards. The sequence for oil pump activation must be observed under all circumstances.

8 - Bleed the first oil pump and connection line and connect it to the centre ("Figure 64" page 97/I) oil duct.

MARNING

Risk of injury through pressurised oil!

- **9** Use the oil pump to generate oil pressure until oil begins escap-ing from the adjacent oil ducts. Observe the maximum oil pump pressure during all work steps.
- 10 Bleed the second oil pump and connection line and connect it to the next ("Figure 64" page 97/II) oil duct.
- 11 Generate pressure until oil escapes in an even ring at the shaft's front end.
- 12 Bleed the third oil pump and connection line and connect it to the next ("Figure 64" page 97/III) oil duct.
- 13 Generate pressure until oil escapes in an even ring at the cou-pling's front end.
- 14 Keep the oil pressure constant in all connected oil lines through-out the entire retraction process.

MOTE:

Damage to shaft or hub through lack of oil!

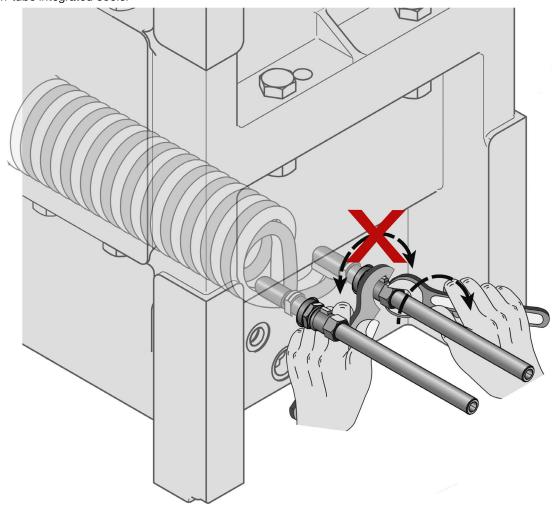
- 15 When the oil film escaping at both faces has become constant, pull the hub of the shaft using a hydraulic cylinder.
- 16 Make sure that the oil escaping from the gap always forms an uninterrupted ring.
- 17 Observe the maximum force of the hydraulic cylinder.

Additional notes

- If the hub does not begin to float despite constant pumping of oil, use oil with a higher viscosity.
- If, with a hub featuring several oil bores, the hydraulic cylinder fails to remove the hub from the shaft in a single stroke and thus needs to be repositioned, make sure that the hydraulic cylinder stops between two oil bores.

6.12 ASSEMBLY OF FIN-TUBE INTEGRATED COOLER

Figure 65: Fin-tube integrated cooler



NOTICE

Incorrectly fitting the water connections to the fin tube cooler can cause damage to property!

If the cooling coil connections outside of the gear unit become twisted, the cooling coil's connection points inside the gear unit may tear free and coolant may enter the oil.

1 - The cooling coil connections fitted to the gearbox must be protected from twisting by using a hook wrench or similar tool when connecting the customer-side water connections. See "Figure 65" page 99, left hand. Protecting customer-side connections. See "Figure 65" page 99, right hand. When doing so,do not turn the hook wrench held in the left hand.

The connection points at risk are indicated by a sticker on the gear unit

NOTICE

Damage through condensation inside the gear unit body!

If the gear unit is out of service, cooling water supply should be turned off to prevent condensation inside the gear unit body.

6.13 CONNECTING TO POWER SUPPLY

Personnel:

Electrically skilled person with additional explosion protection qualifications

NOTE:

Observe the wiring diagram.

1 - Establish the correct connections in the terminal box in accord-ance with the attachment parts' wiring diagrams.

A DANGER



Risk of explosion through differences in potential!

Differences in potential can generate ignition sparks and trigger explosions.

2 - Secure the earthing points.

6.14 CORROSION PROTECTION FOR THE REMAINING BARE SURFACES

Once the gearbox and all of the attached parts have been fitted, the re-maining bare surfaces on the gearbox have to be cleaned and protected from corrosion. Bare surfaces on attached parts from component suppliers have to be protected as specified in the relevant suppliers' operating instructions.

When doing so, do not use a preservative that would damage the sealing lips of the shaft seals or would harden on the sealing lip. Apply grease to the area around the sealing lip to protect the shaft seals from the pre-servative.

We recommend using a lubricating grease that is highly water resistant and offers good corrosion protection, such as e.g. lith-ium-based anti-friction bearing grease.

Other areas can be protected using permanent preservative.

The life of the preservative depends on the manufacturers' specifications and use instructions. These specifications and instructions must be ob-served in full.

NOTICE

Unsuitable corrosion protection agents can be a burden on the environment and can damage the product and environment...

6.15 CHECKS PRIOR TO COMMISSIONING (CHECKLIST)

- Personnel:
 - Service personnell
- **1 -** Carefully work through every single item on the following check list.

Table 24:

Activity	Check notes
Remove transport safeguards	
Make sure that the values specified on the gear unit's type plate are not ex-ceeded.	
The design must match that listed on the gear unit's type plate and in the order confirmation.	
The oil level must match that listed on the gear unit's type plate.	
Make sure that the gear units are sufficiently ventilated and that external heat transmission (e.g. via couplings) is prevented. The cooling air may not exceed a temperature of 40 °C.	
For mains-powered motors: Check that the data specified on the gear unit's and the motor's type plate and in the order confirmation match the ambient conditions at the site of op-eration.	
When assembling gear units with hollow shaft and shrink disc: The hood must be installed correctly.	
Make sure that the ambient temperature is observed in accordance with the order confirmation and type plate.	
Check the gear unit's earthing for correct function. Additional electrical attachments must feature their own fully functional earth-ing.	
All oil level inspection ports, drain plugs and bleeder screws and valves must be freely accessible.	
When assembling a coupling: Do not use spacer sleeves as an assembly aid!	
Check the gearbox's alignment again after tightening the fastening elements for the final time.	
When assembling a belt drive: The belt must feature sufficient shunt resistance $< 109~\Omega$ between the input-side shaft end and the motor shaft. The belt pulley must be balanced. During operation, no radial or axial forces may be generated.	
The gearbox must not be operated without a load, i.e. disconnected from the downstream machine. Operating the gearbox with less than the minimum load can cause damage to the gearbox' anti-friction bearing.	
Protect any oil drain valves from being accidentally opened.	
Protect any oil level indicators from potential damage.	
Make sure that the gearbox and attached parts cannot be damaged by falling objects.	
Make sure that at least 30° of any fans attached on the drive shaft are unob-structed to ensure sufficient air flow. See catalogue - Brevini EvoMax™, section on fan cooling	
302	

6.16 ADDITIONAL PRE-COMMISSIONING TESTS FOR EXPLOSIVE ENVIRONMENTS (CHECKLIST)

- · Personnel:
 - Specialist for explosive areas
- **1 -** Carefully work through every single item on the following check list.

Table 25:

Activity	Check notes
The following specifications on the gear unit's type plate must match the permissible explosive area on site: - Device group - EX category - EX zone - Temperature class - Maximum surface temperature	
Make sure that there no explosive atmosphere, no oils, acids, gases, va-pours, dusts or radiation exists during assembly of the gear unit.	
All input and output elements to be assembled must be ATEX approved.	
When assembling a belt drive: The belt must feature sufficient shunt resistance $< 109 \Omega$ between the in-put-side shaft end and the motor shaft.	
Before assembly of the integrated protective cover: The manufacturer must verify by way of an ignition source analysis that no ignition sources (e.g. spark showers through grinding) can be produced.	
For mains-operated motors: Check whether the motor and the motor assembly meets ATEX require-ments.	
All added equipment and sensors have to have correct ATEX certification	
Sensors have to be connected correct to gearbox and to analysis unit	
Oil has to be specified viscosity	
Alerts and shutdown for sensors have to be setup correct	

6.17 FILLING OIL

- Personnel:
 - Service personnel

MOTE:

Only fill oil while the gear unit is at a standstill.

1 - Close all gear unit apertures apart from the oil filler opening and the gear unit bleeder aperture and secure them against inadvertent opening.

NOTICE

Pollution through escaping oil!

- 2 Fill the specified oil type and quantity (Chapter "Oil type selection" page 109) into the filler opening.
- **3 -** When the gear unit is standstill, the oil level must reach the mark-ing on the dipstick or the centre of the oil sight glass. If neces-sary, adjust the oil level.
- 4 If a gearbox is fitted at an angle, check the oil level in the installa-tion position. In tilting gearboxes, move the gearbox into the home position, which is generally 0° in all directions. Please note the information in the order-specific documentation.
- 5 Close all oil filler openings and secure them against inadvertent opening.

6.18 COMMISSIONING

- The following checks must be performed during the trial run:
 - Personnel:
- · Specialist for explosive areas
- Dana Motion Systems Deutschland GmbH

Requirements: If a cooling and lubrication system exists, it must be running.

- **1** Remove corrosion protection using environmentally compatible solvents.
- 2 Check oil level and top up if necessary (Chapter "Filling oil" page 102).
- 3 Check that the oil drain cocks are "closed".
- 4 Check temperature switches and all other sensors for correct function.
- 5 Check that all protective covers are complete and fully functional.
- 6 For long-term corrosion protection, screw plugs are used. Check that these have been replaced with the bleeder screws; do so if this is not the case.
- **7 -** Check the gear unit's alignment.
- 8 Start up the gear unit within the operating temperature and condition pa-rameters.

NOTE:

If a pawl is installed, the minimum release speed needs to be achieved.

- **9** Check all fastening bolts for firm seating and retighten if necessary. Observe the tightening torques (Chapter "Tightening torque" page 66).
- 10 Ensure that the cooling air supply is unobstructed. Exhaust air from other machines must not impair cooling.
- 11 Inspect for abnormal noise, leaks, vibration and temperatures. Fill in commissioning report.
- 12 Refill the cooling and lubrication system with oil.
- 13 Check the attachment parts for correct function.

NOTICE

Damage through condensation inside the gear unit body!

If the gear unit is out of service, cooling water supply should be turned off to prevent condensation inside the gear unit body.

6.19 CHECKS DURING GEAR UNIT TRIAL RUN IN EXPLOSIVE AREA

MOTE:

Design modifications or a change of the tilt angle if set up at an angle require prior approval by DANA Motion System Deutschland GmbH.

Prior consultation is required to maintain ATEX approval!

- Personnel:
 - Specialist for explosive areas
- 1 Carefully work through every single item on the following check list.

Table 26:

Activities	Check notes
Measure surface temperature after 3 hours. The difference to the operating temperature may not exceed 5 K. If the difference ex-ceeds 5 K, immediately shut down the drive and consult Dana Motion Systems Deutschland GmbH.	
Measure oil temperature. Add 10 K to the measured value. Use this value to determine the lubricant change interval.	
For gear units with pawl: The minimum release speeds for the pawls may not be fallen below during nominal operation.	
check pressure in lubrication/cooling system	
check overpressure valve is fully closed in working conditions	

7 OPERATION

7.1 NORMAL MODE

After starting the lubrication system, drive and installed auxiliary units and once it has reached the desired output speed, the gear unit is running in normal mode.

Protective equipment:

- · Protective work clothing
- Light breathing protection
- Safety goggles
- · Protective gloves
- Hearing protection

A DANGER



Pressure <1bar or >4 bar and/or viscosity for shaft pumps > 5000mm²/s or for motor pumps with filtration > 2000 mm²/s can cause overheating and thus a potential ignition source.

- 1 Observe the output torques and permissible transverse forces.
- 2 Regularly inspect the gear unit for temperature-induced discol-ouration and for leaks.
- 3 In explosive areas, regularly check for accumulated dust. Re-move dust Chapter "Removing dust" page 110.

7.2 SHUTTING DOWN THE GEAR UNIT

MARNING

Risk of injury through inadvertent motor start-up!

- 1 Switch off the drive motor, see the drive motor's operating manual. Secure the drive motor against unauthorised activation. Disconnect the drive motor from its power source.
- 2 Switch off any auxiliary units or linked systems connected to the gear unit, see the the corresponding units' and systems' operat-ing manuals. Secure heaters, auxiliary drives, pumps and other electrical de-vices against unauthorised activation.

NOTICE

Risk of pollution through coolant!

- **3 -** On gear units with external coolant supply, disconnect the pump from its power source and secure it against unauthorised activa-tion. Drain the coolant and dispose of it in an environmentally respon-sible manner.
- **4 -** On gear units with cooling and lubrication system, disconnect the oil pump from its power source and secure it against unau-thorised activation. Consult DANA Motion System Deutschland GmbH on any further activity.
- 5 Depending on the ambient conditions and the gear unit's service life, even a short planned gear unit downtime may necessitate preservation. In case of questions, please contact service or a representative. See Chapter "Customer service" page 9.

8 MAINTENANCE

8.1 SAFETY NOTES FOR MAINTENANCE

Explosion protection

A DANGER



Risk of explosion during maintenance!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning maintenance work, obtain written work permission and keep it outside the danger zone.
- Never perform maintenance work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.
- Do not perform welding work on the gear unit.
- Do not use the gear unit as an earth point for welding work.

Failure to observe these notes will eliminate the explosion protection.

Risk of crushing

↑ CAUTION

There is a risk of crushing if the drive accidentally starts up

Death or serious injury

- Disconnect the drive motor from the power supply before performing any work.
- Protect the motor from accidental activation.

Risk of burns

A CAUTION

Risk of burns from hot gearbox and hot gear oil

Serious injury

Allow the gearbox and gear oil to cool to a safe temperature before starting work.

Risk of injury from parts attached to the drive

⚠ CAUTION

Risk of injury from attached parts falling off the whole drive

Death or serious injury

- Make sure that none of the parts on the entire drive train are able to fall off.

Risk of damage to the gearbox

CAUTION

Incorrect maintenance can cause damage to the gearbox

- Read and follow the instructions for the individual tasks in the next sections.
- Make sure that there are no torsional moments acting on the shafts before opening the shaft connections.
- Make sure that no foreign objects find their way into the gearbox during maintenance.
- Make sure to use the correct gear oil. Do not mix different synthetic lubricants with one another or with a mineral lubricant.
- Do not clean the gearbox with a high-pressure cleaner, see Chapter "Removing dust" page 110
- Perform a safety and function test on completion of the maintenance work.

MAINTENANCE

Maintenance personnel qualifications

▲ DANGER



Maintenance work performed by inadequately qualified personnel can give rise to hazards Severe injury

- All work must only be performed by correspondingly qualified personnel
- Gearboxes used in ATEX environments must only be maintained by personnel with special ATEX qualifications. see Chapter "Personnel requirements" page 16

8.2 SPARE PARTS

A DANGER



Risk of injury through use of incorrect spare parts!

The use of incorrect or faulty spare parts can put the personnel at risk, lead to damage, malfunctions or complete failure and to explosions in explosive areas.

- Only use genuine DANA Motion System Deutschland GmbH spare parts or spare parts approved by DANA Motion System Deutschland GmbH.
- In any case of doubt, always consult DANA Motion System Deutschland GmbH.
- Use of incorrect spare parts can cause ignition sources.

MOTE:

Loss of warranty

Using non-approved spare parts voids the warranty and invalidates approval for explosive areas.

To ensure that the gear unit remains ready for operation, stock wear parts and spare parts that may be needed quickly at the site of opera-tion. In case of questions, contact customer service Chapter "Customer service" page 9.

When ordering spare parts, use the information provided in the en-closed spare parts lists and the package and spare parts drawings referenced in the spare parts lists.

Procure spare parts from authorised dealers or directly from DANA Motion System Deutschland GmbH. Contact details Chapter "Customer service" page 9.

Provide the following information when ordering spare parts:

- Gear unit designation
- Serial no. (see type plate)
- · Order no.
- Photo of component if necessary

8.3 HUMIDITY

Increased humidity

CAUTION

The permissible average humidity is 75%. Over brief periods, a maxi-mum of 85% humidity is permissible.

- If the humidity exceeds 85% a dry cartridge must be used.
- If humidity remains higher for longer periods, check the water content of the oil by means of an oil analysis.
- The values specified by the oil's manufacturer must not be exceeded.

8.4 MAINTENANCE SCHEDULE

The following sections describe the maintenance work required for optimal and fault-free operation of the gear unit. If regular inspections show increased wear, reduce the maintenance intervals to match the actual wear. In case of questions regarding the maintenance work and intervals, contact DANA Motion System Deutschland GmbH Chapter "Customer service" page 9.

A DANGER



Not doing the maintenance correct can result in potential ignition sources.

Table 27:

Interval	Maintenance work
For the first time time after 500 operating hours	Perform first oil change after commissioning See Chapter "Oil change schedule" page 108
	Check housing temperature
	Check drive for unusual noises
	Check oil level. See Chapter "Checking oil level" page 110.
Daily	Check gearbox parts for temperature-related discolouration. If necessary, shut down the gear unit and consult Dana Motion Systems Deutschland GmbH.
	Check the earth connections and lines for correct function. Replace if ne-cessary.
	Check for accumulated dust and remove dust if necessary. Using a high-pressure jet to clean the gear unit and hosing down the gear unit with detergent and water is prohibited. Venting the gearbox during inspection can. This may damage seals and attached parts. See Chapter "Removing dust" page 110.
Weekly	Top up or replace oil, see oil change schedule See Chapter "Oil change schedule" page 108.
Every 3000 operating hours, at least every 6 months	Re-grease Taconite seals and contactless labyrinth seals with grease See Chapter "Relubricating taconite seals and non-contact labyrinth-type seals with lubricating grease" page 115
	Check cooling and heating elements for deposits and scaling. See Chapter "Checking heater elements for deposits" page 113.
	Make sure fastening screws are properly tightened and check for damage
During inspection of the gearbox,	Check the alignment and function of the transmission elements on the drive and output shaft
depending on operating conditions, at least every 12 months	Clean fans that are directly operated through shafts through the gearbox. Follow the instructions in the associated manual for cleaning electrically powered fans from component suppliers.
	Check pipe and screw connections for tightness. Check rubber hoses for age-related damage.
	Clean the top of the gearbox and touch-up or renew corrosion protection. See Chapter "Corrosion protection for the remaining bare surfaces" page 100
	Check belt tension and re-tension if necessary. See Chapter "Checking and adjusting belt tension" page 114.
	Clean filter elements or replace if necessary.
Maintenance work specified by	Check return stop
manufacturer	Replace coolant. See Chapter "Replacing coolant" page 116.
	Service external oil circuit. See Chapter "Servicing external oil circuit" page 113.
For ATEX	Before reaching Lnmr2 for Zone 1 and 21 or Lnmr10 for Zone 2 and 22: exchange bearings

MAINTENANCE

8.5 OIL CHANGE SCHEDULE

Overview



- Oil types Chapter "Oil type selection" page 109
- Grease types Chapter "Grease" page 109
- Check oil level Chapter "Checking oil level" page 110
- Oil change Chapter "Oil change" page 112
- Service external oil circuit Chapter "Servicing external oil circuit" page 113

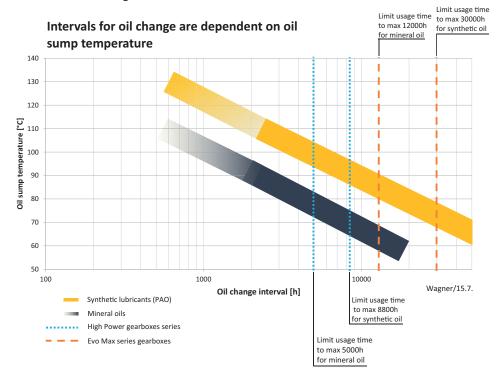
A DANGER



Not doing the maintenance correct can result in potential ignition sources.

Interval	Maintenance work
Initially after 500 h	Change oil.
Illitially after 500 ff	Clean the oil sight glass /oil gauge.
	Check oil level and top up if necessary.
Daily	Check the gear unit for leaks.
	Check the oil temperature.
Weekly	Fill in oil up to centre of oil sight glass, dipstick marking or oil gauge.
For intervals, see dia-gram	Change oil.
"Figure 65" page 99.	Clean the oil sight glass/oil gauge.

Figure 66: Guideline values for oil change intervals



The oil change intervals specified are guideline values and may be longer or shorter depending on the application's boundary conditions.

By regularly performing oil analyses, it is possible to substantially extend the oil change intervals in consultation with the respective oil manufacturer, at least each 6 months (or each 3000h) oil analysis required.

IMPORTANT:

Oil change interval according to operating temperature and used oil (graph);

For EvoMax gearboxes series:

- latest after 5 years (30000h) for synthetic oil;
- latest after 2 years (12000h) for mineral based oil.

For High Power gearboxes series:

- latest after 1 year (8800h) for synthetic oil
- latest after 1 year (5000h) for mineral based oil

8.6 OIL TYPE SELECTION

The lubricants used must meet the minimum requirements CLP in accordance with DIN 51517 part 3.

The order confirmation and type plate list the oil viscosity and oil type.

8.7 GREASE

For relubrication of the labyrinth-type seals, only lithium greases with mineral base oil of NLGI class 2 (DIN 51818) may be used.

8.8 MAINTENANCE WORK

8.8.1 PREPARATION

Perform the following steps prior to all maintenance work:

- Personnel:
 - Service personnel
 - Electrically skilled person with additional explosion protection qualifications
- Special tool:
 - Tools approved for the existing explosive area

Requirements: The spare parts drawings are available in order to prevent damage through incorrect disassembly or assembly.

- 1 Make sure that there is no explosive atmosphere.
- 2 Switch off the gear unit and wait for it to stop running.
- **3 -** Depressurise the cooling lubrication system. Relieve the pressure.
- 4 Disconnect drives and auxiliary units from their power supplies and secure them against reactivation.

A DANGER



Risk of explosion through thermal resistor!

A hot thermal resistor can evaporate the remaining oil and cause it to explode.

- **5** Switch off any existing heaters and prevent them from being switched on inadvertent ly.
- 6 Allow the gear unit to cool.
- 7 Mechanically secure the gear unit against inadvertent start-up or rotation.
- 8 Disconnect any electrical power supply and secure against reactivation.
- 9 If maintenance covers need to be opened for the maintenance work, be ready for oil mists.

NOTICE

Damage through condensation inside the gear unit body!

If the gear unit is out of service, cooling water supply should be turned off to prevent condensation inside the gear unit body.

NOTICE

In the event that the paintwork on the gearbox is damaged (e.g. by opening the maintenance cover, oil filler plug or assembly work such as installing and removing the gearbox), the operator must carry out paint repairs. In the case of rust or other damage resulting from previous compromise to paintwork, any liability is excluded.

If the gearbox is subsequently painted, the sealing lips of the oil seals, breather screws, hoses, nameplate, stickers and rubber elements must be masked off.

MAINTENANCE

8.8.2 REMOVING DUST

- Personnel:
 - Service personnel
- Protective equipment:
 - Safety goggles
 - Protective gloves
 - Breathing protection
 - Protective suit

NOTICE

Damage through high-pressure jet!

Incorrect cleaning can damage seals and attachment parts.

- Never use a high-pressure jet.
- Do not hose down the gear unit with detergents and water.
- Avoid any contact of a cleaning agent with oil seals.

MOTE:

Do not disperse dust.

A DANGER



Dust layers increase heat and can ignite or cause potential ignition sources.

They have to be removed before exceeding 5mm.

8.8.3 CHECKING OIL LEVEL

O NOTE:

Only check the oil level once the gear unit has cooled down and come to standstill.

If a gearbox is fitted at an angle, check the oil level in the installation position. In tilting gearboxes, move the gearbox into the starting position, which is normally 0° in all directions. Please note the information in the order-specific documentation.

Oil gauge, oil sight glass

Figure 67: Example marking



In gear units with an oil gauge or oil level sight glass, the oil level must be at the marking or in the center of the gauge while the gear unit is not in operation and the oil surface has calmed down.

Oil dipstick

- · Personnel:
 - Service personnel
- Protective equipment:
 - Protective work clothing
 - Protective gloves
 - Safety goggles
 - Light breathing protection

Figure 68: Example marking



- 1 Undo and remove oil dipstick.
- 2 Wipe the dipstick with a clean cloth.
- 3 Reinsert the dipstick fully and then pull it back out again.
 - The oil level must lie between the markings.
- 4 Top up the oil if necessary Chapter "Filling oil" page 102.
- **5** Dispose of the cloth correctly.

MAINTENANCE

8.8.4 OIL CHANGE

- Personnel:
 - Service personnel
- Protective equipment:
 - Protective work clothing
 - Protective gloves
 - Safety goggles
 - Breathing protection
- Special tool:
 - Oil collection pan
- 1 Shut down gear unit and secure against restart.

MOTE:

In cold state, the oil's fluidity is limited and complete draining is difficult. To drain the oil, the gear unit must therefore be at operating temperature.

Oil collection pan

2 - Place the oil collection pan under the oil drain screw.

A CAUTION

Risk of burning through hot oil!

For ease of processing, the oil's temperature is still high. There is thus a risk of burning.

- 3 Open the oil drain screw. Open all filler openings and ventilation screws and valves.
 - The oil drains into the oil collection pan.

Oil sight glass

4 - Clean the oil sight glass.

Filter

- **5 -** Change filter. See the manufacturer's operating instructions.
- 6 Open the oil filler opening.

Oil type

NOTICE

Damage through different oil types!

Never mix different oil types.

If the oil type is to be changed, flush with the new oil type. To do so, fill the new oil and drain it again.

NOTICE

Damage through contaminants in oil barrel!

Fill the gear unit with fresh oil using a oil filling filter (filter unit max. 25 µm).

- This will prevent any contaminants from the oil barrel entering the gear unit.
- The correct fluid level can be seen using the oil sight glass, dipstick, oil gauge or overflow opening.

Magnetic bolt

- 7 If necessary, flush with new oil to remove oil sludge and grit from the gear unit.
- 8 Clean the magnetic bolt.
- 9 Close all filler openings, ventilation screws and valves and secure them against inadvertent opening.

O NOTE:

If the gear unit is operated using an external lubrication system, the pipelines need to be bled.

10 - Collect any oil that may have been spilled during this process.

Used oil

- 11 Dispose of used oil in an environmentally sound manner.
- 12 Document oil change using the oil change log (Appendix "Documentation" page 130).

8.8.5 SERVICING EXTERNAL OIL CIRCUIT

M NOTE:

See the manufacturer's operating instructions.

Personnel:

Service personnel

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety goggles
- Light breathing protection
- **1 -** Clean filter elements or replace if necessary.
- 2 For gear units with cooling and lubrication system, change the oil in the lubrication system.

8.8.6 CHECKING LINKING ELEMENTS

- Personnel:
 - Service personnel
- Protective equipment:
 - Protective work clothing
 - Protective gloves
 - Safety goggles
 - Light breathing protection
- 1 Check all links between the gear unit and the surrounding system or attachment parts for correct operation and firm seating.
- 2 Check hoses for damage.
- 3 Replace any damaged hoses.
- 4 Observe the hoses' maximum service life.

8.8.7 CHECKING HEATER ELEMENTS FOR DEPOSITS

- Personnel:
 - Electrically skilled person with additional explosion protection qualifications
- **e** Protective equipment:
 - Protective gloves
 - Protective work clothing
 - Safety goggles
 - Light breathing protection
- 1 Disconnect heater element from power supply and allow to cool.
 - Secure heater from being switched on inadvertently.
- 2 Allow oil to cool.
- **3 -** Check heater elements for deposits and damage.
- 4 Remove any deposits or replace heater element.

MAINTENANCE

8.8.8 CHECKING FLEXIBLE TRANSMISSION ELEMENTS ON COUPLINGS

1 NOTE:

See the manufacturer's operating instructions.

- Personnel:
 - Service personnel
- Protective equipment:
 - Protective work clothing
 - Protective gloves
 - Safety goggles
 - Light breathing protection
- 1 Check elastomer in accordance with the coupling manufacturer's operating instructions and replace the transmission elements if necessary.

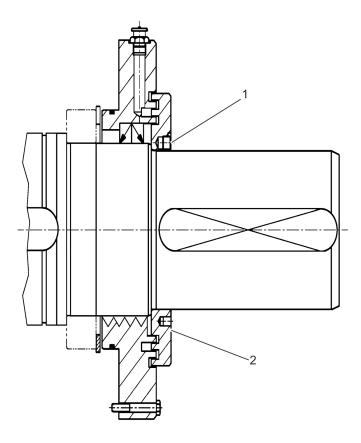
Observe the elastomer's service life.

8.8.9 CHECKING AND ADJUSTING BELT TENSION

- · Personnel:
 - Service personnel
- Protective equipment:
 - Protective gloves
 - Safety goggles
- **1** Check the belt tension and adjust if necessary, see the manufac-turer's operating instructions.

8.8.10 RELUBRICATING TACONITE SEALS AND NON-CONTACT LABYRINTH-TYPE SEALS WITH LUBRICATING GREASE

Figure 69: Seals



- 1 Taconite seal variant
- 2 Non-contact labyrinth-type seal variant
- Personnel:
 - Service personnel
- Protective equipment:
 - Protective work clothing
 - Protective gloves
- Materials:
 - Lithium roller bearing grease for seals
- 1 Shut down the gear unit by switching off the motor and secure against inadvert-ent start-up.
- 2 Every 3,000 operating hours or after 6 months at the latest, inject lithium grease into the lubrication points of the taconite seals or non-contact labyrinth-type seals (flat-type grease nipple AR 1/4 DIN 3404) until lithium grease is expelled from the seal.

MAINTENANCE

Grease quantity [ml]

Table 28:

	Gear unit size	14/16	18/20	22/25	28/31	35/40	42/45/47	50/53/56	60/63/67
Type of gear	unit								
E2H, E3H, E4H	AN	45	60	70	70	90	120	130	180
	AB	110	170	190	250	220	290	400	370
E3B, E3C	AN	20	40	55	60	110	110	130	130
	AB	110	170	190	250	220	290	400	370
E4B, E4C	AN	15	20	40	40	55	60	110	110
	AB	110	170	190	250	220	290	400	370

AN Input shaft side

AB Output shaft side

- 3 Evenly and slowly rotate the shaft to distribute the grease evenly.
- 4 Collect escaped used grease and dispose of it in an environmentally sound man-ner.

8.8.11 REPLACING COOLANT

MOTE:

See cooling system's operating instructions.

8.8.12 POST-MAINTENANCE MEASURES

- Personnel:
 - Service personnel

After completion of the maintenance work and prior to restarting the gear unit, perform the following:

- 1 Check unusual all previously undone threaded connections for tightness and secure them against inadvertent release.
- 2 Check whether all previously removed safety equipment and covers have been reinstalled correctly.
- 3 Make sure that all tools, materials and other equipment used have been removed from the workspace.
- 4 Clean the workspace and remove any escaped substances such as fluids, processing materials or similar.
- **5 -** Make sure that all the gear unit's safety equipment is fully func-tional.
- **6** Make sure that nobody remains inside the danger zone.
- 7 Remove any warning signs and notices that were attached.

9 FAULTS

The following chapter describes possible fault causes and the work required to remedy them.

If faults occur frequently, reduce the maintenance intervals to match the actual loads.

Observe the shorter intervals for employment in explosive areas.

In the event of faults that cannot be remedied based on the following notes, consult DANA Motion System Deutschland GmbH Chapter "Customer service" page 9.

9.1 SAFETY NOTES FOR TROUBLESHOOTING

Explosion protection

A DANGER



Risk of explosion during troubleshooting!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning troubleshooting, obtain written work permission and keep it outside the danger zone.
- Never perform troubleshooting in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Conduct in the case of faults

General conduct:

- 1 In the case of faults that pose an immediate danger to persons or property, immediately shut down the gear unit.
- 2 Immediately notify the person responsible on site of the fault.
- 3 Identify the fault cause.
- 4 Depending on the type of fault, have it remedied by Dana Motion Systems Deutschland GmbH or have your own specialist personnel remedy it.

O NOTE:

All of the faults lists in the following fault table may be remedied by:

- Specialist for explosive areas
- Dana Motion Systems Deutschland GmbH

9.2 FAULT INDICATORS

The following indicate a fault:

- · Motor or gear unit not turning
- Increased temperature
- Unusual noises
- Vibrations
- Accumulated dust
- Measurement sensor displays (if included)
- · Leaking fluids or mist formation

9.3 FAULT TABLE

- · Personnel:
 - Specialist for explosive areas
 - Dana Motion Systems Deutschland GmbH
- Protective equipment:
 - Protective work clothing
 - Protective gloves
 - Safety footwear
 - Breathing protection
 - Safety goggles
- Special tool:
 - Tools approved for the existing explosive area

FAULTS

Table 29:

Fault description	Cause	Remedy	Personne
	Storage	damage Check oil, replace bear-ings	
Unusual, uniform noises	Irregularities in the tooth-ing	Contact Dana Motion Systems Deutschland GmbH customer service.	
	Casing stress	Check the gear unit's fastening and correct if necessary.	
	Faulty gear unit founda-tions	Reinforce gear unit foun-dations.	
	Unsuitable motor speeds	Check frequency conver-ter.	
	Insufficient alignment	Align the gear unit.	
Unusual, irregular noises	Oil contaminated by for-eign bodies	Shut down the gear unit. Check the oil. Contact Dana Motion Systems Deutschland GmbH customer service.	
	System sluggish	Check system.	
Noises from gear unit fastening loos		Replace fastening ele-ments if necessary and secure them. Observe the tightening torques (Chapter "Tightening torque" page 66).	
	Oil level too low. Oil too old.	Correct oil level or change oil.	
Bearings overheated	Bearings damaged	Check bearings and re-place if necessary. Contact customer ser-vice.	
Increased temperature at pawl or impaired locking function	Pawl faulty	Check pawl and replace if necessary. Contact Dana Motion Systems Deutschland GmbH customer service.	
	Correct oil level.		
Oil level too high	Oil viscosity too high	Use the oil specified in the technical specification.	
	Oil too old	Change oil.	
	Oil contaminated	Change oil.	
	Ambient temperature too high	Limit external tempera-ture.	
	For gear units with fans: Fan or gear unit soiled	Clean air intake and cas-ing.	
	For gear units with inte-grated cooler: Deposits in cooling system. Coolant flow rate too low. Tem-perature too high.	See operating manual of fin-tube integrated cooler.	
	Cooling system malfunc-tion	See operating manual of cooling system.	
	Gear unit sluggish	Contact Dana Motion Systems Deutschland GmbH customer service.	
	System sluggish	Check system.	
	Gear unit surface too heavily soiled	Clean the gear unit sur-face.	
Oil leaking from oil drain or bleeder	Too much oil.	Correct oil level.	
	Drive in unfavourable position	Correct position.	
	Oil foaming	Check oil type and re-place if necessary.	
	Awkward position of bleeder screw	Contact Dana Motion Systems Deutschland GmbH customer service.	
	Unusual, uniform noises Unusual, irregular noises Noises from gear unit fastening Bearings overheated Increased temperature at pawl or impaired locking function Oil level too high	Unusual, uniform noises Irregularities in the tooth-ing	Unusual, uniform noises Irregularities in the tooth-ing Contact Dana Motion Systems Deutschland GmbH customer service.

No.	Fault description	Cause	Remedy	Personne
8	Oil leaking from other locations	Seals leaking	Retighten bolts on corre-sponding cover. Observe the tightening torques (Chapter "Tightening torque" page 66). If oil continues to leak, contact Dana Motion Systems Deutschland GmbH customer service.	
		Sealing lip of shaft seal ring folded over	Replace shaft seal ring. If oil continues to leak, con-tact Dana Motion Systems Deutschland GmbH customer service.	
		Shaft seal ring faulty	Replace shaft seal ring. Contact Dana Motion Systems Deutschland GmbH customer service.	
9	Heavy V-belt wear	Incorrect alignment of V-belt pulley	Align V-belt pulley and check belt tension.	
		Ambient effects	Limit ambient effects as far as possible.	
		Overload	Contact Dana Motion Systems Deutschland GmbH customer service.	
	No intake by oil pump. Pressure switch not switching.	Air in oil pump's intake line	Bleed. See operating manual of oil pump.	
		Oil pump faulty	Replace oil pump. Con-tact Dana Motion Systems Deutschland GmbH customer service.	
11	Pressure switch not switching	Pressure switch faulty	Replace pressure switch. Contact Dana Motion Systems Deutschland GmbH customer service.	
12	Cooling system mal-functions		See cooling system's operating instructions.	
13	Cold-start temperature not	Oil heater faulty or incor-rectly connected	Check oil heater for cor-rect connection and func-tion, replace if necessary.	
	reached	Ambient conditions cause excessive heat loss	Limit heat loss. Contact Dana Motion Systems Deutschland GmbH cus-tomer service.	
14	Safety equipment faults: thermosensor, thermome- ter-resistor, float switch		See safety equipment's operating instructions.	

9.4 TROUBLESHOOTING WORK

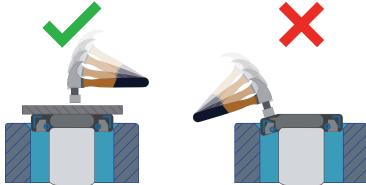
9.4.1 REPLACING SHAFT SEALS

Contact customer service.

- Personnel:
 - Specialist for explosive areas
 - Dana Motion Systems Deutschland GmbH
- Special tool:
 - Sandpaper grain size 400
- · Materials:
 - Permanently elastic sealant
- 1 Check shaft's seal ring clearance fit for damage.
- 2 Eliminate damage through unrifled grinding with grain-size 320 sandpaper.
- 3 Remove old seal ring from bearing cover.
- **4 -** Clean and degrease sealing surfaces on casing and bearing cover. When doing so, it is important to comply with the surface requirements for permanently elastic sealants specified in the manufacturer's specifications.
- 5 Insert new seal ring into bearing cover.
- 6 Grease seal ring clearance fit.
- 7 Radial shaft seals with dust and seal lip shall be filled with approximately 40% of grease.
- **8** Coat the casing's sealing surfaces with sealant. When doing so, it is important to comply with the surface re-quirements for permanently elastic sealants specified in the manufacturer's specifications.

MOTE:

Do not damage the seal during fitment, select the right assembly method.



Double lip seal (grease in between) packed with grease between the primary and secondary lips. When two seal are installed in tandem, the entire space between the seals may be packed with grease.

- **9 -** Fit bearing cover by carefully turning it back and forth.
- 10 Tighten bearing over. Observe the tightening torques (Chapter "Tightening torque" page 66).

9.4.2 REPLACING ROLLER BEARINGS ON GEAR UNITS WITH SPLIT CASINGS IN EXPLOSIVE AREAS

In explosive areas the bearings require replacement at shorter inter-vals.

Check order-specific documentation.

A DANGER



Not replacing or replacing late can cause a potential ignition source.

MOTE:

Before beginning work on the roller bearings, contact DANA Motion System Deutschland GmbH, Chapter "Customer service" page 9.

FAULTS

Zones 1 and 21

Replacement interval: latest at the calculated service life Lnmr2.

For storage shelf-life, see technical gear unit specification.

Personnel:

- · Dana Motion Systems Deutschland GmbH
- Specialist for explosive areas

Special tool:

- · Tools approved for the existing explosive area
- 1 Drain oil Chapter "Oil change" page 112.
- 2 Mark bearing cover, undo fastenings and remove bearing cover.

MOTE:

Bearing covers made of rubber-coated sheet metal cannot be reused after disassembly.

3 - Undo the split casing's connection bolts and remove them.

O NOTE:

Take the weight into account. Secure with lifting gear if necessary.

4 - Remove the top casing.

M NOTE:

Do not damage the seal ring clearance fit.

- 5 Remove the entire shaft from the casing.
- 6 Pull the faulty bearings from the shaft.

CAUTION

Risk of burning through hot components!

Gear wheels and bearings are hot. Skin contact may cause burns.

- 7 Bearings can be assembled by heating up to max 120 degree and gear wheels to be max 160 degree to obtain adequate clearances for fitment on shafts. Induction or oil bath heating is preferred for uniform bore expansion. (Flame heating is not recommended)
- 8 Coat shaft with lubricant, e.g. MoS2.
- 9 Clean and degrease the casings sealing surfaces.
- 10 Coat the casing's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for perma-nently elastic sealants specified in the manufacturer's specifica-tions.
- **11 -** Place the top casing in position.
- 12 Measure bearing play and correct if necessary. Numerical values are available from customer service upon request.
- 13 Screw in the casing's connection bolts.
- **14 -** Observe the tightening torques (Chapter "Tightening torque" page 66.
- **15** Clean and degrease sealing surfaces on casing and bearing manufacturer When doing so, it is important to comply with the surface re-quirements for permanently elastic sealants specified in the manufacturer's specifications.
- **16 -** Coat bearing cover's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for permanently elastic sealants specified in the manufacturer's specifications.
- 17 Fit bearing cover by carefully turning it back and forth.
- 18 Tighten cover.
- 19 Observe the tightening torques (Chapter "Tightening torque" page 66).
- 20 Secure the casing's connection bolts.
- 21 Fill with new oil. See Chapter "Oil change" page 112.
- 22 Check and, if necessary, reconnect all earth and potential equali-sation lines.

Zones 2 and 22

Replacement interval: latest at the calculated service life Lnmr10.

For storage shelf-life, see technical gear unit specification.

Personnel:

- · Dana Motion Systems Deutschland GmbH
- · Specialist for explosive areas

Special tool:

- Tools approved for the existing explosive area
- 1 Drain oil Chapter "Oil change" page 112.
- 2 Mark bearing cover, undo fastenings and remove bearing cover.

MOTE:

Bearing covers made of rubber-coated sheet metal cannot be reused after disassembly.

3 - Undo the split casing's connection bolts and remove them.

O NOTE:

Take the weight into account. Secure with lifting gear if necessary.

4 - Remove the top casing.

M NOTE:

Do not damage the seal ring clearance fit.

- **5** Remove the entire shaft from the casing.
- **6** The faulty/damaged bearings using bearing pullers. For gear wheels use hydraulic power presses for removal from the shafts. Handle the gear internals with Steel/Nylon ropes. (Steel Chains are not recommended).

⚠ CAUTION

Risk of burning through hot components!

Gear wheels and bearings are hot. Skin contact may cause burns.

- 7 Preheat new gear wheels and bearings to 110 °C and slide them on.
- 8 Coat shaft with lubricant, e.g. MoS2.
- **9 -** Clean and degrease the casings sealing surfaces.
- **10 -** Coat the casing's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for perma-nently elastic sealants specified in the manufacturer's specifica-tions.
- **11** Place the top casing in position.
- 12 Measure bearing play and correct if necessary. Numerical values are available from customer service upon request.
- 13 Screw in the casing's connection bolts.
- 14 Observe the tightening torques (Chapter "Tightening torque" page 66.
- 15 Clean and degrease sealing surfaces on casing and bearing manufacturer When doing so, it is important to comply with the surface re-quirements for permanently elastic sealants specified in the manufacturer's specifications.
- **16 -** Coat bearing cover's sealing surfaces with sealant. When doing so, it is important to comply with the surface requirements for permanently elastic sealants specified in the manufacturer's specifications.
- 17 Fit bearing cover by carefully turning it back and forth.
- 18 Tighten cover.
- 19 Observe the tightening torques (Chapter "Tightening torque" page 66).
- 20 Secure the casing's connection bolts.
- 21 Fill with new oil. See Chapter "Oil change" page 112.
- 22 Check and, if necessary, reconnect all earth and potential equali-sation lines.

FAULTS

9.5 REPLACING ROLLER BEARINGS ON GEAR UNITS WITH MONOBLOC CASINGS IN EXPLOSIVE AREAS

Zones 1 and 21

Replacement interval: latest at the calculated service life Lnmr2.

For storage shelf-life, see technical gear unit specification.

Zones 2 and 22

Replacement interval: latest at the calculated service life Lnmr10.

For storage shelf-life, see technical gear unit specification.

M NOTE:

Contact DANA Motion System Deutschland GmbH customer service. For contact details, see Chapter "Customer service" page 9.

9.6 COMMISSIONING AFTER TROUBLESHOOTING

After troubleshooting, perform the following steps for recommission-ing:

- 1 Check all previously undone threaded connections for tightness and secure them against inadvertent release.
- 2 Check whether all previously removed safety equipment and covers have been reinstalled correctly.
- 3 Make sure that all tools, materials and other equipment used have been removed from the workspace.
- 4 Clean the workspace and remove any escaped substances such as fluids, processing materials or similar.
- **5 -** Make sure that all the gear unit's safety equipment is fully func-tional.
- 6 Make sure that nobody remains inside the danger zone. Remove any warning signs and notices that were attached.
- 7 Clear gear unit for use.

10 DISMANTLING AND DISPOSAL

Once the gear unit's service life has expired, the gear unit needs to be dismantled and disposed of in an environmentally sound manner.

Disposal service

If desired, DANA Motion System Deutschland GmbH can provide professional disposal. Contact customer service Chapter "Customer service" page 9.

10.1 SAFETY NOTES FOR DISMANTLING

Explosion protection

A DANGER



Risk of explosion during dismantling!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning dismantling, obtain written work permission and keep it outside the danger zone.
- Never perform dismantling work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Incorrect dismantling

MARNING

Risk of injury through incorrect dismantling!

Stored residual energies, hard-edged components, tips and corners on and in the gear unit or the required tools can cause injury.

- Before beginning work, ensure that there is sufficient space.
- Handle open, sharp-edged components with care.
- Ensure that the workspace is tidy and clean. Loosely stacked or spread out components can cause accidents.
- Dismantle components correctly. Take into account the sometimes high weight of the components. If necessary, employ lifting gear.
- Secure components against dropping or toppling.
- In any case of doubt, always consult DANA Motion System Deutschland GmbH.

Torsional moment

MARNING

Risk of injury through torsional momenta!

Tension within the system can produce torsional momenta in the shaft connections. When disconnecting the shafts, the torsional momenta can cause injury and damage.

- Before beginning any work, relieve the system tension at suitable points.

A DANGER

Remove machine and motor from gearbox before disconnecting gearbox from foundation, otherwise it can tilt.

DISMANTLING AND DISPOSAL

10.2 DISASSEMBLY

Before beginning dismantling:

- Switch off gear unit, allow it to stop running and mechanically secure it against restarting.
- Completely physically disconnect the entire power supply from the gear unit and discharge stored residual energies.
- Remove operating fluids and auxiliary materials as well as any remaining processing materials and dispose of them in an environmentally responsible manner.
- Disassemble the protective barriers on the transmission elements of input and output shaft.
- To disconnect the gear unit from the drive, disconnect the transmission elements.
- Disconnect the earth lines and earthing bolts.
- Secure the gear unit with suitable lifting gear.
- Undo the fastening bolts.

Properly clean the assemblies and components and dismantle them in accordance with the locally applicable work health and safety and environmental regulations.

Dismantling the output shaft



- Dismantling the output shaft as hollow shaft with keyway linkage
- Chapter "Removing the gear unit from the machine shaft" page 79
- Dismantling the output shaft as hollow shaft with shrink disc
- Chapter "Removing the gear unit from the machine shaft" page 89
- Dismantling the output shaft as flanged coupling
- Chapter "Assembly of output shaft as flanged coupling" page 91

DISMANTLING AND DISPOSAL

10.3 DISPOSAL

If no return or disposal agreement has concluded, introduce disman-tled components to recycling:

- Scrap metals.
- Submit plastic elements for recycling.
- Dispose of remaining components in accordance with material properties.

Incorrect disposal

NOTICE

Danger of pollution through incorrect disposal!

Incorrect disposal may cause pollution.

- Have electrical waste, electronic components, lubricants and other auxiliary materials disposed of by certified professional disposal services.
- If in doubt, consult your local municipal authorities or special disposal companies on matters of environmentally sound disposal.

Gear oil, grease, cooling lubricant and filters

NOTICE

Pollution through gear oil, grease, cooling lubricant and filters!

Gear oil, grease, cooling lubricant and filters may contain toxic substances.

- Have environmentally hazardous substances disposed of by certified professional disposal services.
- If in doubt, consult your local municipal authorities or special disposal companies on matters of environmentally sound disposal.
- If desired, we can provide professional disposal. Please contact our service department.

11 APPENDIX

11.1 CHECK LISTS

11.1.1 CHECKS PRIOR TO COMMISSIONING (CHECK LIST)

Table 30:

Activity	Check notes
Remove transport safeguards	
Make sure that the values specified on the gear unit's type plate are not ex-ceeded.	
The design must match that listed on the gear unit's type plate and in the order confirmation.	
The oil level must match that listed on the gear unit's type plate.	
Make sure that the gear units are sufficiently ventilated and that external heat transmission (e.g. via couplings) is prevented. The cooling air may not exceed a temperature of 40 °C.	
For mains-powered motors: Check that the data specified on the gear unit's and the motor's type plate and in the order confirmation match the ambient conditions at the site of op-eration.	
When assembling gear units with hollow shaft and shrink disc: The hood must be installed correctly.	
Make sure that the ambient temperature is observed in accordance with the order confirmation and type plate.	
Check the gear unit's earthing for correct function. Additional electrical attachments must feature their own fully functional earth-ing.	
All oil level inspection ports, drain plugs and bleeder screws and valves must be freely accessible.	
When assembling a coupling: Do not use spacer sleeves as an assembly aid!	
Check the gearbox's alignment again after tightening the fastening elements for the final time.	
When assembling a belt drive: The belt must feature sufficient shunt resistance $<$ 109 Ω between the input-side shaft end and the motor shaft. The belt pulley must be balanced. During operation, no radial or axial forces may be generated.	
The gearbox must not be operated without a load, i.e. disconnected from the downstream machine. Operating the gearbox with less than the minimum load can cause damage to the gearbox' anti-friction bearing.	
Protect any oil drain valves from being accidentally opened.	
Protect any oil level indicators from potential damage.	
Make sure that the gearbox and attached parts cannot be damaged by falling objects.	
Make sure that at least 30° of any fans attached on the drive shaft are unob-structed to ensure sufficient air flow. See catalogue - Brevini EvoMax™, section on fan cooling	
30	

11.1.2 ADDITIONAL CHECKS PRIOR TO COMMISSIONING IN EXPLOSIVE AREA (CHECK LIST)

Table 31:

Activity Remove transport safeguards Make sure that the values specified on the gear unit's type plate are not ex-ceeded. The design must match that listed on the gear unit's type plate and in the order confirmation. The oil level must match that listed on the gear unit's type plate. Make sure that the gear units are sufficiently ventilated and that external heat transmission (e.g. via couplings) is pre-	Check notes
Make sure that the values specified on the gear unit's type plate are not ex-ceeded. The design must match that listed on the gear unit's type plate and in the order confirmation. The oil level must match that listed on the gear unit's type plate.	
The oil level must match that listed on the gear unit's type plate.	
J 77 1	
Make sure that the gear units are sufficiently ventilated and that external heat transmission (e.g. via couplings) is pre-	
vented. The cooling air may not exceed a temperature of 40 °C.	
For mains-powered motors: Check that the data specified on the gear unit's and the motor's type plate and in the order confirmation match the ambient conditions at the site of op-eration.	
When assembling gear units with hollow shaft and shrink disc: The hood must be installed correctly.	
Make sure that the ambient temperature is observed in accordance with the order confirmation and type plate.	
Check the gear unit's earthing for correct function. Additional electrical attachments must feature their own fully functional earth-ing.	
All oil level inspection ports, drain plugs and bleeder screws and valves must be freely accessible.	
When assembling a coupling: Do not use spacer sleeves as an assembly aid!	
Check the gearbox's alignment again after tightening the fastening elements for the final time.	
When assembling a belt drive: The belt must feature sufficient shunt resistance $< 109~\Omega$ between the input-side shaft end and the motor shaft. The belt pulley must be balanced. During operation, no radial or axial forces may be generated.	
The gearbox must not be operated without a load, i.e. disconnected from the downstream machine. Operating the gearbox with less than the minimum load can cause damage to the gearbox' anti-friction bearing.	
Protect any oil drain valves from being accidentally opened.	
Protect any oil level indicators from potential damage.	
Make sure that the gearbox and attached parts cannot be damaged by falling objects.	
Make sure that at least 30° of any fans attached on the drive shaft are unob-structed to ensure sufficient air flow. See catalogue - Brevini EvoMax TM , section on fan cooling	

11.1.3 CHECKS DURING GEAR UNIT TRIAL RUN (CHECK LIST)

Table 32:

Activities	Check notes
Measure surface temperature after 3 hours. The difference to the operating temperature may not exceed 5 K. If the difference ex-ceeds 5 K, immediately shut down the drive and consult the manufacturer.	
Measure oil temperature. Add 10 K to the measured value. Use this value to determine the lubricant change interval.	
For gear units with pawl: The minimum release speeds for the pawls may not be fallen below during nominal operation.	

APPENDIX

11.2 DOCUMENTATION

The following documents serve as templates for copying:

- Preservation record
- Oil change log
- Instruction protocol

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