High-Speed, Parallel Shaft Gear Unit

Type:	HC 63-2
Serial No.:	517 815
Order No.:	723850
Code Word:	Kosair 2004
Year of manufacture:	2005

Knowledge of this instruction manual is necessary for device operation. Please get familiar with its contents and especially the precautions for save device operation.

Changes due to further technical development are reserved; this manual is not covered by an update service.

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Register Structure

I Operating instructions
High Speed, Parallel Shaft Gear Unit

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Revision history

Revision	Content of change	Document pages total :
01	Corrections to the address/telephone numbers in chapter 8	39
02	Revision of layout	39

Contents

Chapter **Page**

1 GENERAL INFORMATION

BHS gearboxes are developed to the most current know-how and , processes in gearbox engineering for special applications, e.g. compressors, turbines ventilators, cooling water pumps, etc.

The calculation of the gear dimensions is performed in accordance with standard dimensioning rules, like DIN 3990, ISO 6336, AGMA 421.06, API 613 and others.

BHS gearboxes are available in different constructions, according to different revolutions and torques. For more information see our brochures which we send you on demand.

BHS offers different monitoring sensor elements, e.g. temperature detectors, vibration and speed probes.

1.1 Notes on warranty

BHS gear units must only be used under the field conditions which are described in this instruction manual.

The manufacturer is not liable for any malfunction or damage caused by any other than the intended use of the gear units or individual modules or parts of it. The same also applies to any repair or other service operation performed or attempted by persons other than duly authorized service staff. Such action will invalidate any claim under warranty, including for parts not directly affected.

Opening or disassembling of the gear unit without approval of the manufacturer will render all warranty claims null and void.

The manufacturer is not liable for any malfunction or damage caused by ignorance of this instruction manual respectively non-observance of safety requirements, warnings and cautions. The same also applies to any consequential damages.

The gear unit must be operated by properly trained and well instructed staff. The proper operating condition of the gear unit and the associated equipment must be verified before putting into operation.

Any device modification, particularly the removal or replacement of device parts or the use of accessories from other manufacturers is not permitted. Mind that any such action will render all warranty claims null and void.

Annotation: Technical device upgrading by the manufacturer are subject to change without prior notice.

1.2 Technical data

Gearbox data

Power rating ..... 8600 kW
Input speed ..... 1492 rpm
Output speed ..... 7264 rpm
Total weight ..... 6350 kg
Assembly between ..... E-Motor / Compressor

Lubrication

FZG-failure load stage (DIN 51354) ..... min. 7
Used lubricant ..... ISO VG 46
Gear oil requirement ..... 220 l/min
Working oil pressure (overpressure) ..... 1,8 bar g
Switch-off oil pressure (overpressure) ..... 0,8 bar g
Oil inlet temperature ..... 45°C
Heat to be dissipated by the lube oil ..... 137,6 kW

Gearbox noise

Average sound pressure @ 1 m* ..... 90 dB(A)
Sound power level* ..... 107 dB(A)

For further information to the gearbox refer to outline drawing.

*Refer to chapter 2.5, "Safety instructions for the user".

1.3 Functional verification

Each gearbox has been checked by a mechanical test run **before** delivery.

The functional verification is confirmed in a test certificate.

Please also pay attention to the notes in case of shipping damages (refer to chapter 3.2).

1.4 Terms of Delivery

The general terms of delivery of BHS Getriebe GmbH, Sonthofen are valid in their actual version.

2 SAFETY INSTRUCTIONS

The following instructions include fundamental notes and warnings which have to be observed for installation, operation and maintenance.

To fulfil the safety aspects, these instructions must be read in particular **before** performing any installation, operation or maintenance work.

2.1 Symbols for important instructions/operations

The following symbols are marking important manual instructions. Disregarding these instructions may result in damage to the equipment respectively in injury to the operator of the equipment.

NOTE
This symbol (hand) indicates an information, which should be especially observed.

CAUTION
This symbol (warning triangle) indicates danger to the equipment.

WARNING
This symbol (varying with each danger) indicates danger to personnel.
The symbol shown warns of dangerous rotating parts.

2.2 Personnel qualification

Operation, maintenance and service work must be performed by properly qualified personnel. The specific areas of responsibility must be observed and inspected by the customer.

Personnel without the specific qualification must be properly trained before working at the equipment. Ensure that the necessary operating instructions have been completely understood. This encloses all actions on installation, connection, operation and maintenance.

2.3 Non-observance of safety instructions

Non-observance of the safety instructions may result in serious damage to the equipment and the direct environment as well as in serious injury to the personnel. In addition this will render all warranty claims of the manufacturer null and void.

2.4 Safety regulations

Together with the instructions in this manual, the relevant national safety regulations as well as the legal directives for installation, commissioning and operation of the plant and the corresponding prevention of accidents regulations must be observed.

The following are safety regulations in the EU:

DIN VDE 0100

DIN VDE 0113

EN 60204 Part 1

EN 50110-1 VDE 0105

Beyond this the internal safety precautions and regulations of the company must be observed by the personnel.

The customer is responsible for the observance of all legal directives and regulations at the plant.

2.5 Safety instructions for the user

Rotating shafts of gearboxes must be protected and not be touched during operation. It is recommended to use coupling covers.

NOTE
Gear specific technical data must be noticed.

WARNING
Safety devices must not be dismantled during operation.
Danger of injury!

According to the third rule concerning the machinery safety law (machinery noise information rule – 3. GSGV), the following data is provided about gearbox noise:

- The sound pressure level quoted in the "Technical Data" chapter is the mean value.
- The measurement is performed at a distance of 1 m from the surface of the gearbox, at the height of the shaft center line
- The measuring process takes place according to DIN 45635-01-KL2 or DIN 45635-01-KL3 and DIN 45635 part 23.

NOTE
We are firmly instructing that in the installed state, some coupling and installation circumstances beyond our control could cause substantial changes of noise emission as a result of solid-body sound transmission, ensuing mutually from the aggregates in addition to secondary emission from neighboring components.

2.6 Safety instructions for installation and maintenance

At the plant, the customer is responsible for carrying out installation and maintenance work only by qualified personnel..

WARNING
It is only allowed to work on gearboxes when the plant is in standstill. Switch off the complete plant and protect it against switching on. Attach the following warning sign:

Do not switch on! Personnel is working on the plant.

NOTE
Refer to chapter 7 for further maintenance instructions and the scheduled maintenance!

2.7 Safety requirements for spare parts

The manufacturer is not liable for any damage caused by unauthorized work, particularly as the result of any removal or replacement of device parts or as the result of using spare parts from other manufacturers than BHS.
Such action will render all warranty claims null and void.

Changes and modifications at system components must be carried out by service staff of the manufacturer or persons expressly authorized and trained by the manufacturer. Use original spare parts from BHS only.

NOTE
For further information about original spare parts from BHS refer to Chapter 8 respectively to register IV of this instruction manual.

2.8 General summary of safety requirements

Safety and reliability of the gearbox can only be guaranteed when observing **all** of the installation instructions, operation instructions and the system parameters of the data sheets (Chapter 1.2).

3 PACKING, SHIPPING, STORAGE, WASTE DISPOSAL

3.1 Packing

If not desired by the customer otherwise, the gearbox is dispatched on a stable wooden base ready to build in. Every opening of the gearbox is closed with a lid or a plug. Modules and attachments to be dispatched separately are packed in wooden boxes.
Spare parts are normally provided with wax-based conservation (e.g. Tectyl), wrapped in aluminum-coated paper or polyethylene flat foil and dispatched in stable wooden boxes.

3.2 Shipping

CAUTION
Observe the shipping dimensions and the maximum save load of the transporter.

Please refer to the shipping documents for the exact weight. Observe the shipping and loading instructions on the wooden base respectively on the shipping container. The following means:

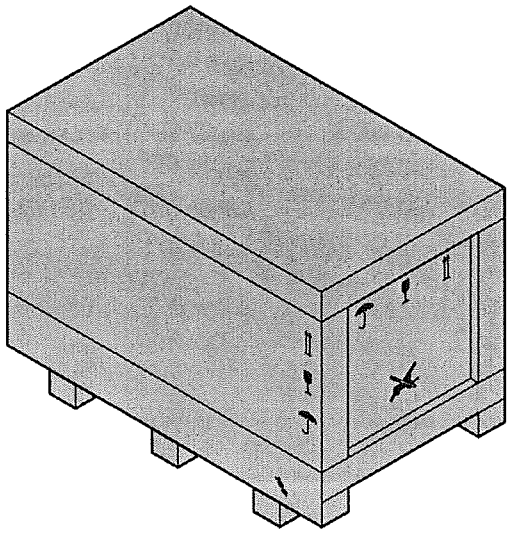
Fragile ware

Protect from moisture

Upside

Sling here

Do not lift with a fork stacker



Example of a shipping container

The transportation of the gearbox has to take place cautiously in order to avoid damages through an exertion of force or careless loading and unloading. Adequate loading security devices (transport belts, anti-skid devices etc.) should be provided during shipping. High temperature fluctuations and strong impacts should be avoided.

CAUTION
The gearbox may only be slung at the points provided! For this, see also the gearbox installation plan!

VERY IMPORTANT!
Please exactly observe our instructions in cases of shipping damage. If you don't observe the formal requirements the transport insurer is not liable.

NOTE
The shipping documents contain a red information sheet which eases handling in case of shipping damages.
If this sheet is missing in the shipping documents, you can simply copy the following page to handle shipping damages.

To determine the extent of shipping damages, consult the commissioner of the transport companies timely, according to their relevant regulations. This guarantees the claims for damage in your interest.

EXTERNAL RECOGNIZABLE DAMAGES OR LOSSES

- Damages or losses must be attested on the way-bill by a specific note **before** taking the ware. On railway transports demand a factual statement from the railway company. On postal transports the damage has to be attested in writing **before** taking damaged packets from the postal service.

NOT RECOGNIZABLE DAMAGES

- Inform the transport company **immediate and in writing** about damages which expose during unpacking. Observe the following terms for notification:

a) Postal service ..... Immediate (not later than 24 hours) after delivery by the transport company.

b) Railway company ..... Not later than 7 days after delivery by the transport company.

c) Forwarding agency transports together with railway transports ..... Not later than 4 days after delivery by the transport company.

The following text is recommended to use for the required notifications to the transport companies:

To the goods office in .....
(respectively to the postal service, forwarding agency, transport company).

The consignment with date.....(sender.....) from.....
.....to.....(statement of the way-bill, parcel, signature)

has been taken without reclamation since no external damages were recognized. However on opening the consignment there was found out that the content has been damaged and / or stolen during shipping. We consider that you are responsible for the damage occurred. If it is necessary from your point of view you can convince yourself

in our company.....
in our depot (road, number)

about the extent of damage.

In addition we would like you to inform the sender of our company by telling us the number of the delivery note and / or the bill number.

BHS

3.3 Storage

In case the customer does not persist on special preservation rules, our gearboxes are delivered in preserved condition under use of our test stand preservation oils of the ARAL Konit series or equivalent types.

These oil types are highly endurable (FZG-standard test DIN 51354/2 Load Stage 10) and correspond in their viscosity to the ISO viscosity classes VG 32, VG 46 or VG 100

Without additional packing but with all gearbox openings closed (delivery state), the corrosion protection with the oil types mentioned above would last for approximately 6 months.

CAUTION
Storage is only allowed in a well ventilated room under normal temperature conditions and a non-corrosive atmosphere!

If the gearbox has been taken in operation after delivery even for a short time (e.g. on a customer test stand), then the protection against corrosion would be washed out and thereby raised.

Should you have questions regarding long-term conservation, please contact our Service Department (for the address refer to Chapter 8)

The above mentioned preservation oils as well as equivalent products of other manufacturers can be used for subsequent treatment of preservation.

If a further test run becomes necessary, we recommend a preservation test stand oil to the customer. This type of oil sticks to the moistened surfaces and protects against corrosion. The maximum reachable preservation time will be given by the manufacturer of the oil. The remaining oil is usually compatible with the later used kind of oil. But always customer and oil manufacturer may decide whether the remaining test stand oil must be washed out.

CAUTION
We are expressly warning against the use of preserving wax or similar agents inside the gearbox!

These preservatives can lead to clogged lubricant jets, lubricant sprays, small lubricant holes and to clogged or damaged filter elements. When applying such agents, the gearbox should be dismantled and carefully washed prior to starting. Opening the gearbox is only allowed to BHS service personal (refer to Chapter 1.1, Notes on warranty).

For an external preservation of metallic bright parts we recommend the application of tangible (when dry) type of wax products as Tectyl 846 or something similar.

External preservation is to be washed carefully before further assembly or installation inside the machinery is done. Parts not delivered with the gearbox in the mounted state should be cleaned as mentioned above; the same applies to spare parts.
We recommend cold cleaner (e.g. Eskapon) for washing. You should certainly prevent the cleaning agent from entering into the interior of the gearbox..

CAUTION
When using a cleaning agent, the respective working rules and instructions of the manufacturer should be observed.

3.4 Waste Disposal

In addition to the details given here, observe the relevant national waste disposal provisions and legal requirements.

- Housing parts, gears as well as gear shafts shall be disposed of like steel scrap. The same goes for parts made of gray cast iron if they are not collected separately.
- Sealing rings and hydrodynamic bearings are partly made of nonferrous metal and shall be disposed of accordingly.
- Waste oil shall be collected and disposed of according to regulations.

4 DESCRIPTION

4.1 Design

The design of the BHS gearboxes is determined by the latest research and developments in gearing technology and by the requirements of the main applications.

4.1.1 Housing

Gearcases are of massive and rigid designs assuring optimum vibrations and noise damping. Amply dimensioned inspection holes allow an easy inspection of the gear sets.

4.1.2 Gear set

The gear sets are designed as single stage, parallel shaft gears. All gearings are manufactured from high alloy steels, hardened and ground.

4.1.3 Bearings

The shafts are running in easy to service and split hydrodynamic bearings of a high load carrying capacity and stable running behavior also under partial load.

An adjustable radial bearing at the pinion shaft or at the gear shaft allows to optimize the tooth contact pattern for full load. The adjustment of the bearings to correct the tooth contact pattern may only be done by BHS service personnel.

Axial forces are absorbed by an axial bearing.

A hydraulic jacking oil system for the slide bearings is provided in case of severe starting conditions.

4.1.4 Oil supply

The gearboxes are lubricated via a central pressure oil supply. Every bearing and gearing is fed with oil separately, via internal connections.

The oil leaving the lubrication points is collected in the oil sump, from where it flows back either directly or through a conduit to the oil tank.

4.1.5 Seals

For static sealing of the partition joints, a non-hardening surface sealing is used.

The shafts are sealed with contact-less labyrinth seals. These are made of two pieces.

4.1.6 Instrumentation

Instrumentation supplied by BHS is described on the outline drawing, register II.

5 ASSEMBLY AND INSTALLATION

5.1 Preparing the gearbox

- Carefully remove the packing material completely.
- Remove corrosion protection on shaft ends just before the couplings are mounted. For the cleaning agent refer to Chapter 3.3, "Storage".
- Clean the base surfaces.
- Put the gearbox onto the base.
- Mount loosely delivered sensors and parts only after the installation, so long as conditions allow, in order to avoid damages.

5.2 Mounting instructions

Coupling hubs will be mounted onto the shafts and misalignment of the coupled shafts will be corrected. After the alignment and mounting of the gearbox on the base, the pipes of the pressure oil supply will be laid.

5.2.1 Mounting the couplings

If the coupling is mounted at the customer, the coupling hub must be cleaned carefully and mounted either with suitable mounting device or mounted by warming-up the gear shaft.

CAUTION
Do not use impact tools!

NOTE
Use suitable dismounting devices for dismounting coupling elements from the shafts.

All gearbox shafts are carefully dynamical balanced. If the coupling hub is mounted later, verify if further balancing is necessary.

5.2.2 Alignment of shafts

For aligning the shafts refer to guideline VDI 2726, "Alignment of gearboxes" as well as to the operating instructions of the coupling manufacturer.
It would be an advantage to correct first the angular alignment before correcting the radial alignment. When the angular alignment is done, the shafts remain to be corrected only axially parallel in horizontal and vertical direction.
In the operation state, the shafts to be coupled must be in true alignment, so that disadvantageous effects cannot influence either the safety or on the connected machines. This also applies to the application of flexible couplings. Note the alignment tolerances of the plant and the coupling manufacturer.
Following effects for shaft alignment must be considered when shaft alignment is done:

- Heat dilatation of the machine foundation
- Heat dilatation of the machine housing
- Deflection of the machine shafts
- Variation of shaft position during operation condition against mounting condition because of shaft displacement in bearings, bearing loading, hydrodynamic lubrication and tooth forces on gearboxes.
- Slant positioning of the shafts because of outside mounted masses.

NOTE
Displacements which can be expected in respect of the gearbox can be determined on the alignment diagram in the appendix.

For the admissible alignment tolerances of the inserted coupling please see the operating instructions of the coupling manufacturer.

CAUTION
If a very heavy coupling is mounted onto the low speed shaft the displacement of the center of gravity may cause an overturning of the gearbox.

Overturning of the gearbox must be avoided in any case. Therefore the shaft must be supported near the coupling and the central position has to be determined by means of a dial gauge. After the first times of running under full load the accuracy of the alignment should be ascertained once more.

5.2.3 Mounting the gearbox

The gearbox has to be fastened on a foundation absorbing reaction forces and torques. Avoiding deformations and vibrations it is necessary to use a stiff construction of the foundation with plane horizontal and clean surfaces. The mounting of the gearbox has to be done as follows:

- The gearbox is fastened on its location on the foundation, using fixtures (e.g. tapered pins or parallel keys).
- When tightening foundation screws, ensure that the tightening torque is uniform, in order to avoid deforming the housing
- After tightening the gearbox on the foundation, it is necessary to recheck the alignment of the shafts relating to the demanded accuracy.

Housing deformations result in an unfavorable variation of the tooth contact pattern.

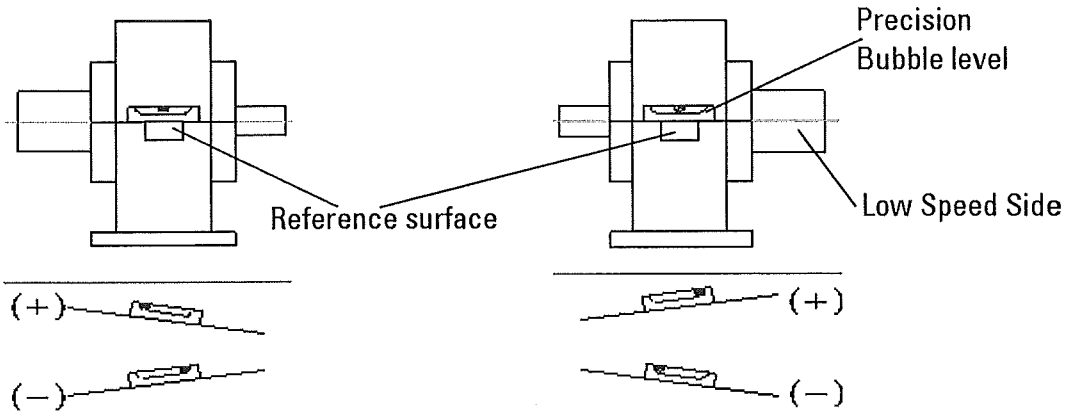
The reference surfaces at the two front sides of the gearbox are used for ascertaining and eliminating housing deformations. This has to be done as follows:

- Remove the protection cover of reference surfaces.
- Put a bubble level (precision 0.05 mm/m) on the first reference surface and read the horizontal deviation (for definition of (+) and (-) refer to next page).
- Repeat procedure with the second reference surface.
- Beside the two reference surfaces the actual value is imprinted. The difference between the read horizontal deviations must correspond to the difference of the imprinted actual values.
- Level the gearbox until the difference correspond. For this put shims between gearbox and foundation. A twisting of the gearbox up to 0.1 mm/m is acceptable.
- Preserve reference surface (rust protection).
- Reconnect the protection cover on the reference surfaces.

The following table and figure illustrate the correct gearbox:

Ref. surface	Imprinted actual value	Read value
I	0,10 mm/m	0,05 mm/m
II	-0,15 mm/m	-0,20 mm/m
Difference	0,25 mm/m	0,25 mm/m

Definition for (+) and (-) values on reference surfaces



5.2.4 Mounting of the pipes

Mounting of the pipes must be done in such a manner, that no impurities, transported with the lubricant can get inside the gearbox.
Impurities in the lubricant are damaging or prematurely destroying the slide bearings and running teeth. Special care should be taken to ascertain that these pipes are free from scales and slag particles in their interior after welding (if possible the pipes should be washed with acid or welded with protective gas).
Both the suction pipe and the return pipe should lead to the oil tank, with as short length as possible, without sharp curves.

CAUTION
It should be ensured that neither gearbox nor pump parts become subjected to deformation by connected lubricant pipes.

Deformations caused by lubricant pipes can be avoided under use of expansion joints. The lubricant return pipe from the gearbox to the tank should be laid inclined as much as possible.

The following lubricant velocities should be reached:

- Suction pipe 1.0 to 1.5 m/s
- Pressure pipe 2.0 to 2.5 m/s
- Lubricant drainage pipe < 0.15 m/s

5.2.5 Flushing of the pipes

Prior to initial starting, the whole pipe system should be flushed for several hours, using the auxiliary oil pump. Thereby, the oil inlet to the gearbox should be separated (insert blanks) and led to the tank via a provisional oil pipe. Flushing through the gearbox is not permitted.

Care should also be taken when flushing the pipes so that no dirt collects at the blanks, and eventually drop into the gearbox when the discs are removed.

CAUTION
After flushing the pipes it must be checked whether all blanks are disconnected from the gear oil input.

5.3 Oil supply

5.3.1 Lubrication oil supply

Lubrication oil for the lubrication and cooling of the gearbox avoids scuffing at the high loaded tooth flanks. The lubrication oil supply of the gearbox is integrated in the lubrication system of the unit mutually using the pressure and temperature control. It should be ascertained that the oil is running calmly and free of bubbles into the gearbox

The oil temperature at the input of the gearbox can be taken from Chapter 1.2, "Technical Data".
The lubrication oil of the gearbox must be refined by means of filters. Following notes must be considered:

- The oil filter must filter dirt particles until a size of 25 µm
- A filtration is recommended according to fineness class --/15/12, ISO 4406
- Bypass micro-filters are recommendable.
- In the initial operation period, the filter must be cleaned frequently.

5.3.2 Lubrication oil pump

In many cases the lubrication oil supply will be done by a lubrication oil pump mounted at the gearbox (refer to pump documentation in Register V).

The pump is sucking up the oil with an underpressure which can be taken from the gearbox outline drawing.

6 OPERATION

6.1 Commissioning

The delivered gearbox has been submitted to a mechanical test run. If no other special agreements are made and installation conditions are fulfilled the gear box can be taken into operation according to the commissioning procedure as described in chapter 6.1.1.
The exact working oil pressure has to be noted and can be referred to on the nameplate. Further technical data are shown in chapter1.2.

CAUTION
Changes on bearings and lubricant devices may not be implemented without the permission of BHS!

CAUTION
During the initial operation period, filter elements should be cleaned at shortened intervals.

After the first 200 service hours, a first oil sample should be taken and its characteristics analyzed (refer to chapter 7). The filter elements should be cleaned or replaced if necessary.

6.1.1 Commissioning procedure

Step	Activities
1	Mounting of the gearbox according to chapter 5
2	Check list A according to chapter 6.1.2. • All points okay continue with step 3. • If faulty, stop the commissioning process and repair the defects. Restart with step 2.
3	Start the oil plant.  **CAUTION** Observe the guidelines given by the person responsible for the complete system!  **CAUTION** Observe the guidelines of the oil supplier!
4	Check list B according to chapter 6.1.3. • All points okay continue with step 5. • If faulty, stop the commissioning process and repair the defects. Restart with step 2.
5	Start the plant.  **NOTE** During the starting phase, monitor the behavior of the plant, especially vibrations and noise.  **CAUTION** Observe the guidelines given by the person responsible for the complete system!
6	Check list C according to chapter 6.1.4. • All points okay continue commissioning process. • If faulty, stop the commissioning process and repair the defects. Restart with step 2.

6.1.2 Check list A

Check the gearbox prior to starting:

- Inspection cover closed.
- Temperature and shaft vibration sensor installed and connected.
- Unused connection holes closed with metal plugs.
- Oil inlet and outlet pipes connected and sealed, all closing discs removed (see chapter 5).
- Sense of rotation checked prior to coupling the driving machine.
- Alignment of individual aggregates according to the alignment instructions (prepare a report of actual values).
- Screw connections provided on the shaft line fitted according to supplier's instructions (tightening torque or bolt extension).
- Tightening torque of foundation bolts checked.
- Gearbox connected to earth.
- Pressure gauges installed right at the entry of the oil into the gearbox.
- Couplings mounted and checked according to supplier's instructions
- Driving machine, engine, oil system etc. checked according to supplier's instructions.
- Axial assembly dimensions according to outline drawing.
- Devices to avoid shaft currents installed.
- Loose parts such as tools, free hanging cables etc. removed away from rotating parts.
- Protective devices installed.

6.1.3 Check list B

Check the oil supply of the gearbox prior to commissioning the machinery:

- Oil pressure p, at oil inlet.
  Nominal value: See chapter 1.2, "Technical data".
- Oil temperature T_{Oil} at oil inlet:
  Nominal value: See chapter 1.2, "Technical data".
- Bearing temperature T_L at the bearing metal.
  Nominal value: T_L approximately T_{Oil}.
- Check whether oil system are tight.

6.1.4 Check list C

After commissioning, check the gearbox at nominal speed, at nominal load and upon reaching the steady condition:

- Oil pressure p, at oil inlet.
  Nominal value: See chapter 1.2, "Technical data".
- Oil temperature T_{Oil} at oil inlet:
  Nominal value: See chapter 1.2, "Technical data".
- Bearing temperature T_L at the bearing metal.
  Nominal value: $T_L < T_{L\,Alarm}$ (3)
- Check weather casing, oil pipes, partial joints, instrument connections and sealing ring are tight.
- Casing vibrations v_{eff}.
  Nominal value: $v_{eff} < v_{eff\,Alarm}$ (1).
- Shaft vibrations s.
  Nominal value: $s < s_{Alarm}$ (1).
- Noise L_{PA}, summed level (mean value at 1 m distance).

  Nominal value: According to regulation (2).

(1) Alarm and trip values for vibrations according to outline drawing.

(2) Refer to chapter 2, "Safety instructions"

(3) The bearing temperatures measured during mechanical test run do not allow a reliable assessment of the full load temperatures. It is recommended to adjust the alarm values not before the real indications are stabilized under full load with regard to variations of the oil inlet temperature.

The alarm value should be set 5°C above the real temperature indication under full load, the trip value should be set 5°C above the alarm value.

The limits given on the outline drawing must not be exceeded.

6.2 Operation

During operation the gearbox should be checked continuously in accordance to check list C. In the event of substantial deviation from the mentioned operation parameter, the plant should be switched off immediately and the cause investigated, in order to prevent a gearbox failure.

Lubrication oil and filter elements should be checked regularly (refer to chapter 7.1).

6.3 Slow down and standstill

Also during the slow down period, the gearbox has to be fed with sufficient lubricant. The indicated gearbox switch-off pressure, the "Plant-Quick-Stop" must not be fallen short of (switch on the auxiliary pump). Check at which oil pressure the auxiliary oil pump begins to work.

It is recommended to keep running the auxiliary oil pump even after standstill of the plant until the gearbox and lubricant have considerable cooled down. Thus the formation of condensed water inside the gearbox will be prevented.

If the standstill period extends over several months, preservation measures will become necessary for the gearbox (refer to chapter 3.3, "Storage").

7 SERVICE AND MAINTENANCE

For all service and maintenance works, chapter 2, "Safety instructions" is to be observed!

NOTE
All maintenance and repair works may only be performed by competent personnel.

7.1 Inspection and maintenance

7.1.1 Notes for inspection and maintenance

The operating performance of the gearbox or the whole plant is to be submitted to a continuous monitoring process. Reasonably, this should be realized with a kind of an automatic system.

Following items have to be noted especially for inspection and maintenance of the gearbox:

- The oil filling of the lube oil system or the system itself should have to be checked.
- Any changes are to be reported immediately to the person or authority responsible for the operation, or if necessary the machinery should be brought to a standstill immediately!
- At continuous operation, the inspection of the whole gearbox (bearings, gearing, lubricating devices, etc.) is recommended at 2 to 3-year intervals or the adjustment to inspection schedules of the adjoining machines.
- Please be aware that maintenance and repair work may only be performed by BHS fitters.

CAUTION
Operation faults, which result from inadequate or inappropriate maintenance, may involve high costs of repair and long standstill periods.

Spare parts may be ordered using the attached spare parts list (refer to register IV).

For further information please contact the specialists of our service department.

7.1.2 Maintenance of the oil

Quality and maintenance of the oil and fineness of the filters have a positive influence on the preservation of the failure load stage. Micro filters, mounted in bypass will increase the durability of the lubrication oil efficiently. It is also useful for a good oil maintenance to remove the condensation water at the lowest point of the oil tank.

CAUTION
You should pay particular attention to the fact, that no dust penetrates into the oil system, even during inspection or other times of standstill. Please bear in mind that the lowest failure load stage required for a gearbox must be retained practically throughout the whole life of the lubricating oil.

It has to be ensured that the quality of the oil corresponds over the hole working time of the gearbox to the data given in chapter 7.1.3.

Because of this the lubrication oil has to be checked and perhaps changed according to the information given by the manufacturer of the complete plant.

A precise analysis of the oil has to be performed according to the requirements/recommendations of the oil manufacturer or when color of the oil has changed substantially or not later than 4000 operation hours.

Following approximate values can be taken for the assessment. But only a detailed check can show whether single values can be exceeded.

• Consistency	±10 - 15 %	Opposite to origin state
• Viscosity	±10 - 15 %	Opposite to origin state
• Neutralizing number	Origin value + 0,5 mg KOH/g	
• Infrared diagram	when origin diagram is changed	
• Impurity	min. class of purity —/15/12 to ISO 4406	

Before filling the oil system, the oil tank, oil filter and the pipes have to be cleaned thoroughly.

NOTE
Rules for disposal waste of oil and filter elements must be noticed.

7.1.3 Selection of lubricating oils for high capacity gearboxes

Usually the gearbox will operate in a common oil circulation with several machines. For this reason oil producers developed special types of oil, which become fair the request of the different applications.

The following points are to be particularly considered:

• Oil type	Industrial Oil	ISO 6743-6
• Viscosity	See chapter 1.2	ISO 3448
• Failure load stage	See chapter 1.2	ISO 14635
• Flash point	> 200°C	ISO 2592
• Additives	No zinc-dithiophosphates (ZnDTP)	
• Undissolved air in oil supply	max. 2 %	

CAUTION
A low flash point may result in spontaneous ignition of the lube oil.

NOTE
Obtain written confirmation of the failure load stages of these oils from your oil supplier.

Higher FZG failure load stages are not disadvantageous for the gearbox.

The technical services of the oil producers should be included to the lubricating oil selection. All possible loads soiling the lubricant oil are to be declared to the oil manufacturer (e.g. condensed water, water vapour, process gases etc.).

CAUTION
Synthetic lubricants may only be used after consultation and permission of BHS.

For reasons of operation safety no oil containing zinc-dithiophosphate (ZnDTP) may be used in BHS gearboxes.

Scientific investigations have shown that lubricating oils including the oil additive zinc-dithiophosphate (ZnDTP) may react with copper in the oil system.

Since the oil circulation system contains copper-bearing items (e.g. oil cooler, copper plated teeth) resulting deposits may damage the gearbox.

Lubricating oils have to be kept basically in clean closed containers (doses, cans, barrels) in order to avoid the penetration of dust and humidity into the interior, and to keep the risk of oxidation with air as low as possible. The storage location should be dry and cool. Moreover, the instructions of the oil manufacturer should be observed.

7.2 Repair

With the beginning of the repairs is to be waited until oil and gearbox are cooled down (danger of scalding or burn)!

NOTE
With all repairs, chapter 2 "Safety instructions" is to be particularly considered.

WARNING
All repairs may be executed only in the standstill of the gearbox. It must be guaranteed that the plant cannot be set into operation while working on it.

CAUTION
Larger components or modules are to be fastened carefully to the lifting device while removing or mounting
Only use suitable and perfect lifting device and lifting attachment!
Stay of persons under the floating load is forbidden!

Additionally to this manual the generally accepted legal and other obligatory regulations are to be observed for accident prevention.

While standstill of the gearbox a visual check of teeth can be made regarding the tooth contact pattern and the abrasion. To do this the inspection cover must be removed and the shafts be turned. The evaluation must be executed by expert personnel or by our service department.

7.3 Troubleshooting

The following table serves the definition of possibly occurring disturbances at the gearbox. If disturbances occur during operation, which are not specified in the table, we recommend to contact our service department.

Fault	Possible causes	Measures
Oil pressure low or irregular	- Pump damaged, Safety valve damaged or not correct adjusted	- Repair pump, check valve or repair
	- Filter clogged	- Clean or perhaps change filter
	- Air in the inlet pipe	- Repair leak
	- Oil level low in oil tank	- Find cause, refill oil
	- Leak in oil pipe	- Repair leak
	- Oil pressure insufficient	- Increase inlet pressure, perhaps enlarge diaphragm
High bearing temperature	- Oil pressure insufficient in the bearing	- Check oil system, increase quantity of oil flow to the gearbox
	- Oil cooling insufficient	- Check oil cooling unit, change heat exchanger
	- Misalignment of the shafts	- Realign the gearbox
High gearbox temperature	- Quantity of oil flow too high	- Check oil pressure, check whether orifice has been dismounted erroneously
	- Oil return insufficient	- Enlarge oil return and check slope of pipe system
	- Foaming of lubricant oil	- Change oil, inform oil manufacturer

Fault	Possible causes	Measures
High vibrations	- Failure in balancing	- Balance the shaft
	- Misalignment	- Check alignment
	- Deformation of gearbox housing	- Check foundation
	- Shaft bent	- Check true running of shaft
		- Mount spare gear set
	- Bearings damaged or used up	- Change bearings
	- Tooth system damaged	- Mount spare gear set
Unusual noises	- Oil pump damaged (when directly mounted pumps are used)	- Change pump and drive unit
	- Toothing damaged	- Mount spare gear set
	- Bad tooth contact pattern	- Check foundation, new alignment
Tooth damaged (scuffing, corrosion, overheating)	- Viscosity of lubricant oil insufficient	- Change lubricant oil, inform the oil manufacturer
	- chemically aggressive constituents in the lubricant oil	- Analyze oil, change oil, inform the oil manufacturer
	- Oil supply insufficient at gearing	- Check oil system, clean nozzle orifice
	- Dirt in lubricant oil	- Clean system and gearbox
Tooth breakage	- Bad tooth contact pattern	- Check foundation, new alignment, mount spare gear set
	- Impact load, caused by foreign matter between the teeth	- Mount spare gear set
	- Fatigue damages	- Mount spare gear set

8 SPARE PARTS

When placing orders for spare parts, please use the attached spare parts list in Register IV.

We only give a warranty according to Chapter 1.1 for spare parts and accessories supplied by us.

We expressly inform you that we do not approve spare parts from other suppliers. Installing such products therefore can under circumstances impair the safety. We rule out any liability for damages which result from using non-original spare parts and accessories.

Please be aware that there are production and delivery specifications for original and non-original parts and we always offer you spare parts according to the latest technical standard and legal directives.

For the most prompt processing of your spare parts order the following data should be quoted:

- Serial No. as per nameplate
- Type of gearbox as per nameplate
- Part-no. according to Register IV
- Denomination according to Register IV
- Quantity

Likewise for other correspondence, please always quote the serial number of your gearbox.

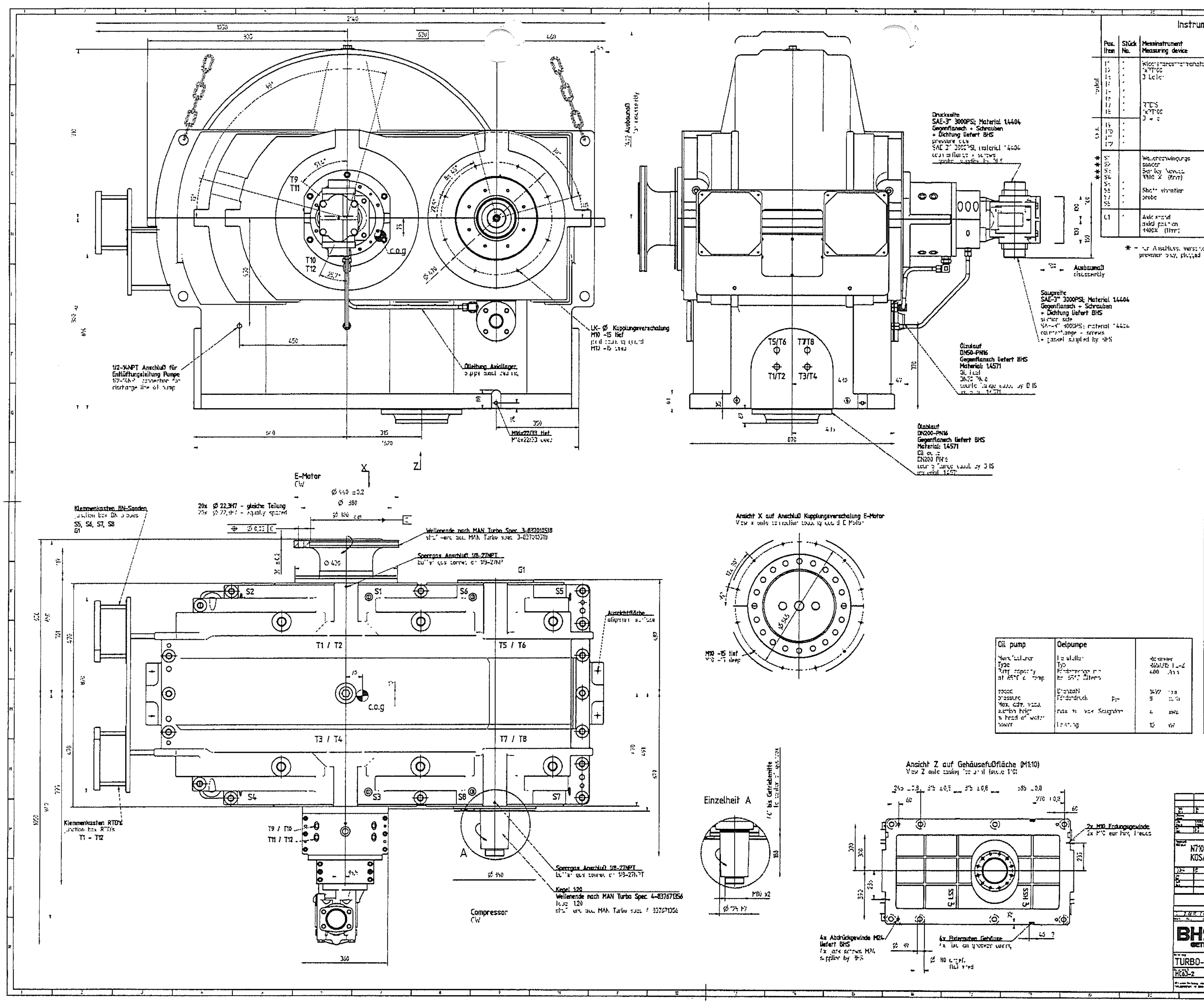
Thus the processing of your order will be quickened significantly.

The following is our address for service and spare parts sales:

BHS Getriebe GmbH
"Service Department"
Postfach 12 51
D-87516 Sonthofen

Phone:	(0 83 21) 8 02-0	
	Divisions:	
	Sales, spare parts:	-541
	Sending of technicians:	-541 or –540
	Technical advice:	-541
Telefax:	+49 8321 / 802-545	
eMail:	info@bhs-getriebe.de	

II Drawings and alignment diagram



Instrumentierung — Instrumentation

Pos. Item	Stück No.	Messinstrument Measuring device	Gewinde thread	Einbaulängen ca. mounting length appr.		liefert supplied	TAG No.
T1–T8	[illegible]	Widerstandsthermometer 1xPT100 3 Leiter / RTD'S 1xPT100 3 wire	1/2 14NPT	im Gehäuse verlegt / wired inside casing	←	BHS	siehe Klemmenplan / see wiring diagram
T9–T12	[illegible]			70 / 70 / 70 / 70	←		
S1–S8		Wellenschwingungs sensor / Bently Nevada 3300 X (8mm) / Shaft vibration probe	1-1/2" / 3/8 24UNF	214 / 298 / 298 / 343 / 249 / 292 / 218 / 280		BHS	
G1		Axial stand / axial position 3300X (11mm)		60			

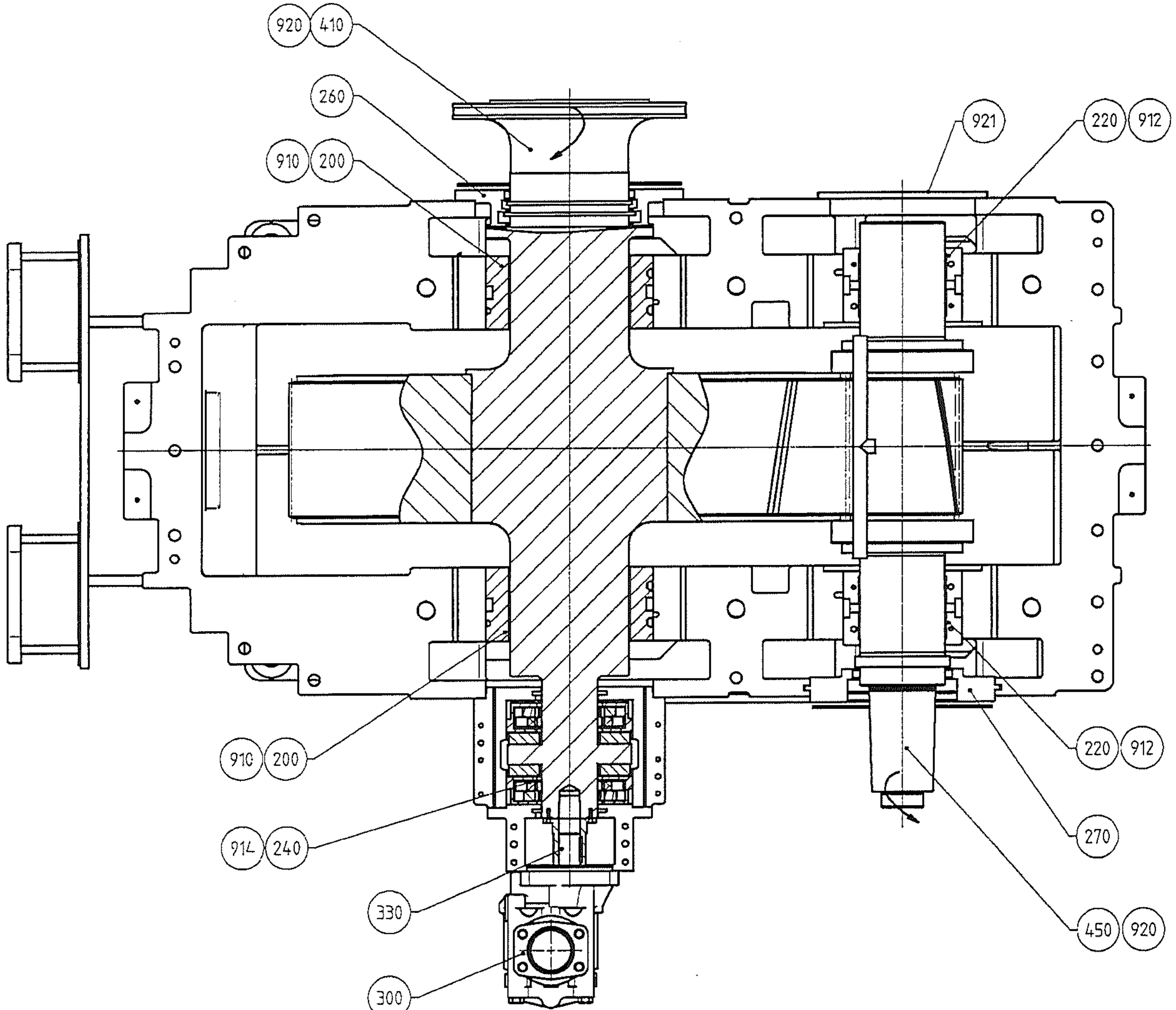
* = nur Anschluss verschlossen / provision only, plugged

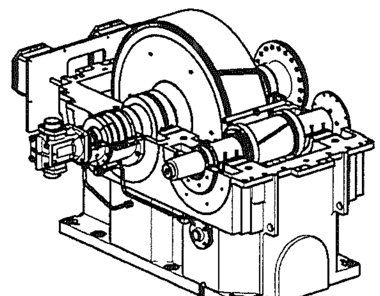
← = Messung im Lagermetall / measurement on bearing metall

Oil pump — Oelpumpe

Oil pump	Oelpumpe	
Manufacturer / Type / Pump capacity at 65°C oil temp.	Hersteller / Typ / Fördermenge bei 65°C Öltemp.	[illegible] 400 l/min
speed / pressure / Max. adm. vacuum suction height in head of water / power	Drehzahl / Förderdruck / max. zul. Saughöhe / Leistung	1492 1/min / 9 bar / 4 mWS / 15 kW

Total weight including oil pump / heaviest weight for revision	Gesamtgewicht einschließlich Ölpumpe / größtes Wartungsgewicht (low speed shaft)	6350 kg / 2500 kg
Oil pressure / Oil requirement gear / Oil for aggregates / Oil inlet temp. / Oil starting temp. / Lube oil type / Failure load stage to DIN 51354	Öldruck norm / Alarm / Shut down / Ölmenge Getriebe / Fremdöl / Öleingangstemperatur norm / max / Öl-Anfahrtemperatur min / Schmieröl typ / Schadenskraftstufe DIN 51354 FZG min	1,8 barü / 1,2 barü / 0,8 barü / 220 l/min / 140 l/min / 45 °C / 55 °C / 20 °C / ISO VG 46 / 7
Rated power / Power loss without pump	Nennleistung / Verlustleistung ohne Pumpe	8402 kW / 137,4 kW
Input speed / Output speed	Antriebsdrehzahl / Abtriebsdrehzahl	1492 rpm / 7964 rpm
No. of teeth / Gear ratio / Service factor (AGMA)	Zähnezahlen / Übersetzung / Servicefaktor (AGMA 421)	192 : 36 / 5,338 / 1,4
Shaft vibration input shaft / output shaft	Wellenschwingung Antriebswelle (peak to peak) norm / Alarm / Stop / Abtriebswelle (peak to peak) norm / Alarm / Stop	0,050 mm / 0,083 mm / 0,104 mm / 0,033 mm / 0,055 mm / 0,066 mm
Casing vibration	Gehäuseschwingung	
velocity mm/s RMS 10 Hz – 2,5 kHz / acceleration tooth meshing g peak 2,5 kHz – 10 kHz	Geschwindigkeit norm / Alarm / Stop / Beschleunigung Zahneingriff norm / Alarm / Stop	2,8 mm/s / 7 mm/s / 11 mm/s / 1 g / 8 g / 12 g
Bearing temp. on bearing metal	Lagertemperaturen am Lagermetall Alarm / Stop	120 °C / 125 °C
Shaft axial position a = axial bearing clearance / Unloaded side / Loaded side	Axialstand a = Lagerspiel axial / Unbelastete Seite Alarm / Stop / Belastete Seite Alarm / Stop	a=0,3-0,5 mm / a+0,1 mm / a+0,2 mm / +0,1 mm / +0,2 mm





Für Schrauben ohne Anziehmomentenangabe gilt: for screws and bolts without indication of tightening torque applies Gehäusewerkstoff: St / Grauguss casing material: steel / grey cast		
Gewinde thread	**Anziehdrehmoment[Nm]** tightening torque [Nm] ohne NORD-LOCK without NORD-LOCK	mit NORD-LOCK with NORD-LOCK
M 6	10	11
M 8	24	27
M 10	48	53
M 12	61	91
M 16	190	230
M 20	390	450
M 24	680	770
M 30	1380	1530
M 36	2450	2680
M 42	3970	4300

gültig für Sechskant- und Zylinderschrauben
Festigkeitsklasse 8.8 Reibwert 0,135.

Valid for hexagon head and cheese head screws and bolts property class 8.8. Friction coefficient 0,135.

**Alle Schrauben vom Getriebe außen zum Getriebeinnenraum mit LOCTITE 572 und Aktivator gesichert.
Alle nicht rotierenden Schrauben mit Nord Lock Scheiben gesichert**

Threads from outside to the gearbox interior have been locked by LOCTITE 572 and activator.
All non rotating screws and bolts have been locked by Nord Lock rings.

Rated power Power loss	Nennleistung Verlustleistung ohne Pumpe	8600 kW 137,6 kW
Input speed Output speed	Antriebsdrehzahl Abtriebsdrehzahl	1492 rpm 7264 rpm

	Lagerspiel bearing clearance min.	 max.	Axiallagerspiel axial. bearing clearance min.	 max.	Dichtringspiel axial min.
Ritzelwelle high speed sh.	0,240	0,283			0,6
Radwelle low speed sh.	0,270	0,319	0,3	0,5	0,6

Stand	Datum	gezeichnet	geprüft	freigegeben	Anzahl	Bemerkung
A	08.03.05	fischer	braendl	fischer		Erstzustand

BHS GETRIEBE

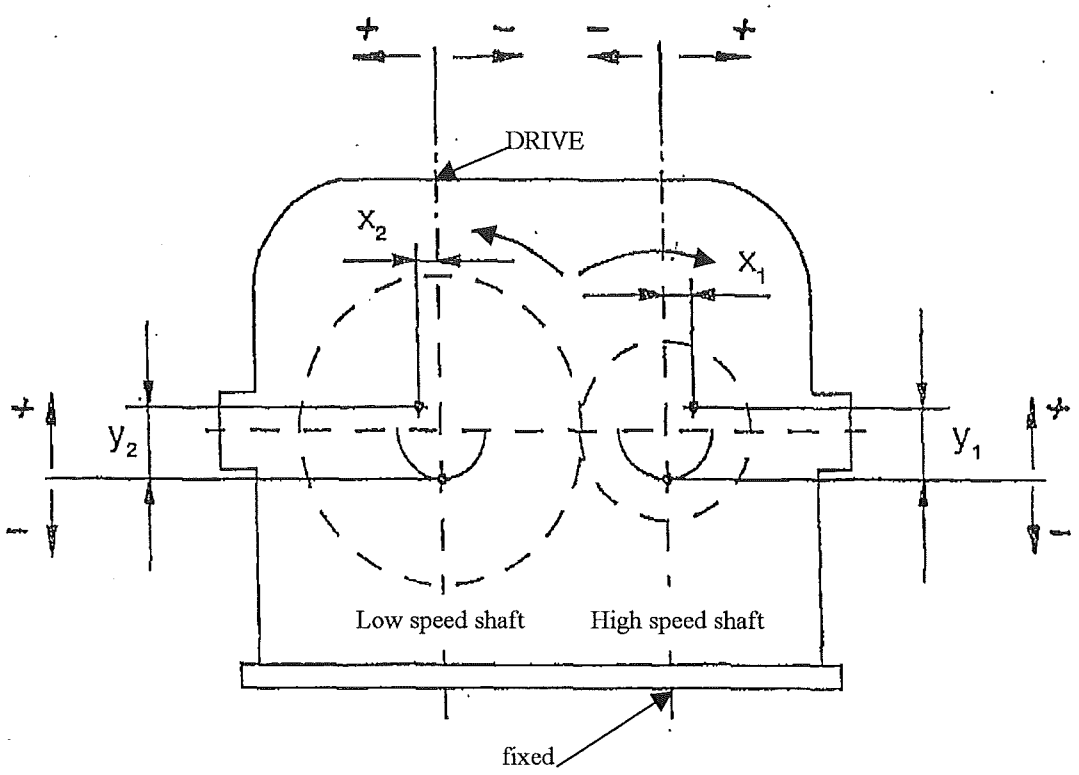
Werkstoff: -
Gewicht: kg
Maßstab: -
Kanten DIN ISO 13715
Oberflächen DIN-ISO 1302
Rauheitswerte in Bereich a sind Ra-Werte
Tolerierung ISO 8015
Für Maße ohne Toleranzangabe DIN ISO 2768 mittel

Benennung 1: SCHNITTZEICHNUNG
Benennung 2: CROSS SECTIONAL DRAWING HC63-2

Erstauftrag Nr: 517815
Ersatz für:
Ersetzt durch:
Ähnliche Zeichg Nr:
Zeichnungstyp:

Für diese Zeichnung behalten wir uns alle Rechte vor Schutzvermerk ISO 16016 beachten.

Produktgruppe: GST
Zeichnungsnummer: 600 828 200
Format: 2
Blattnummer: 1
Blattanzahl: 1



Alignment values are constituted of the following components:
(Values are based on a temperature difference of 42°C)

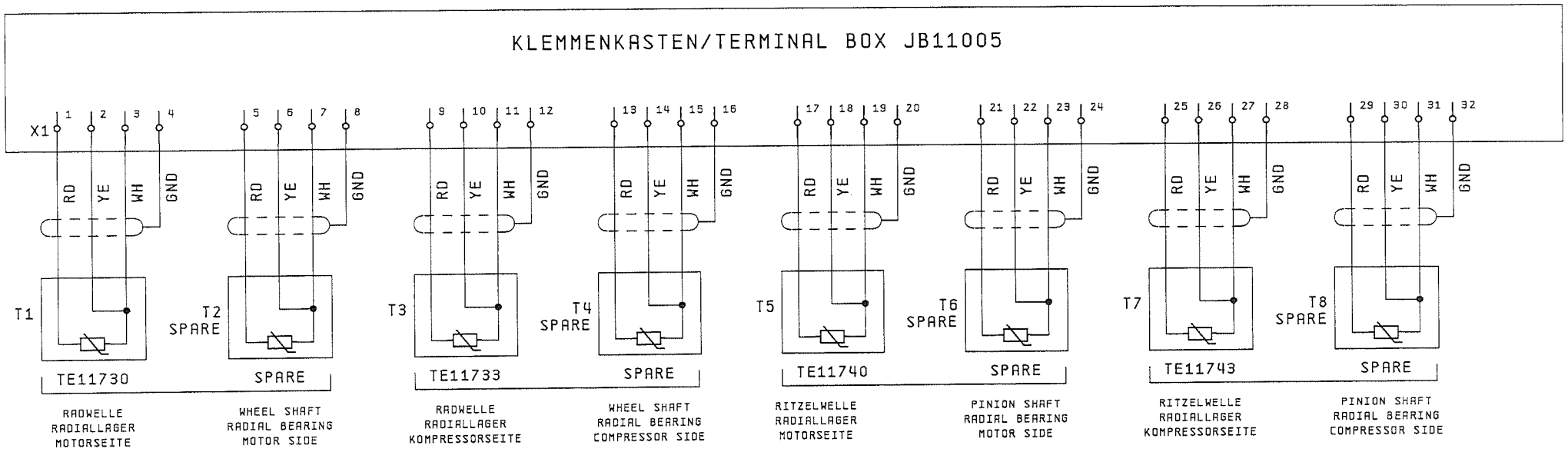
	Due to housing heat-up temperature [mm]	Due to bearing clearance [mm]	Total [mm]
HS shaft: x-direction	0,00	-0,09	X1 = -0,09
y-direction	0,30	0,21	Y1 = 0,51
LS shaft: x-direction	0,24	-0,09	X2 = 0,15
y-direction	0,30	0,09	Y2 = 0,39

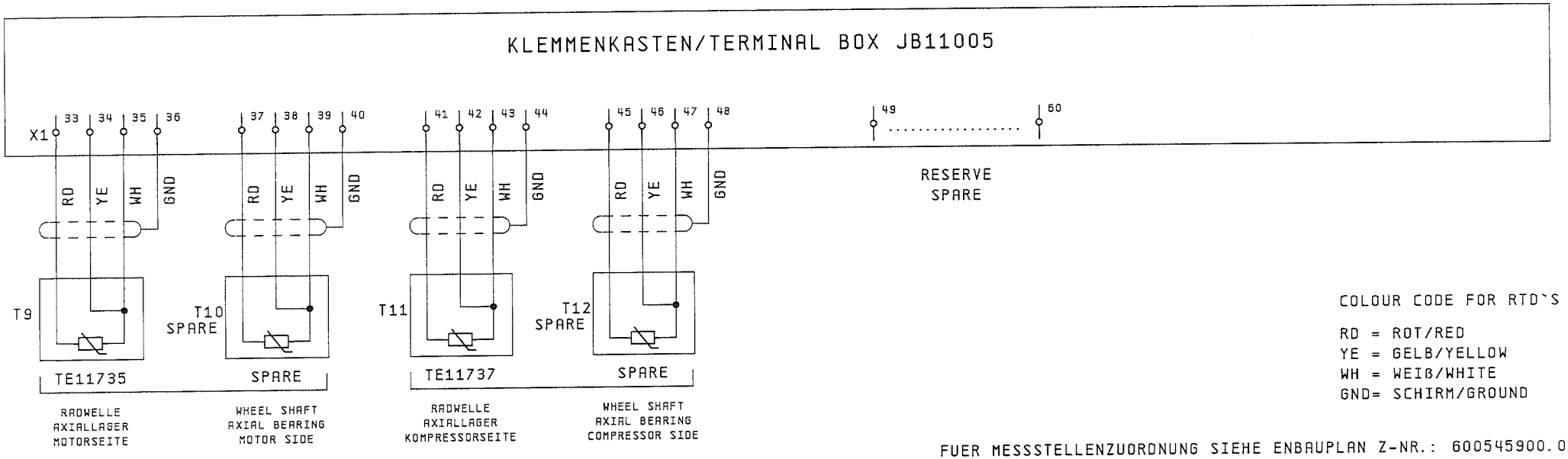
Lenght Expansion: Pinion shaft: 0,21 mm
Wheel shaft: 0,30 mm

The above given theoretical shaft displacements (radial displacements) are based on the following values :

Alignment temperature (room temperature) [°C]	: 20
Pressure angle of gearing	: 20,0°
Bearing clearance of low speed shaft [mm]	: 0,270-0,319
Bearing clearance of high speed shaft [mm]	: 0,240-0,283
Oil inlet temperature [°C]	: 45
Oil heat-up temperature [°C]	: 17

III Terminal diagram





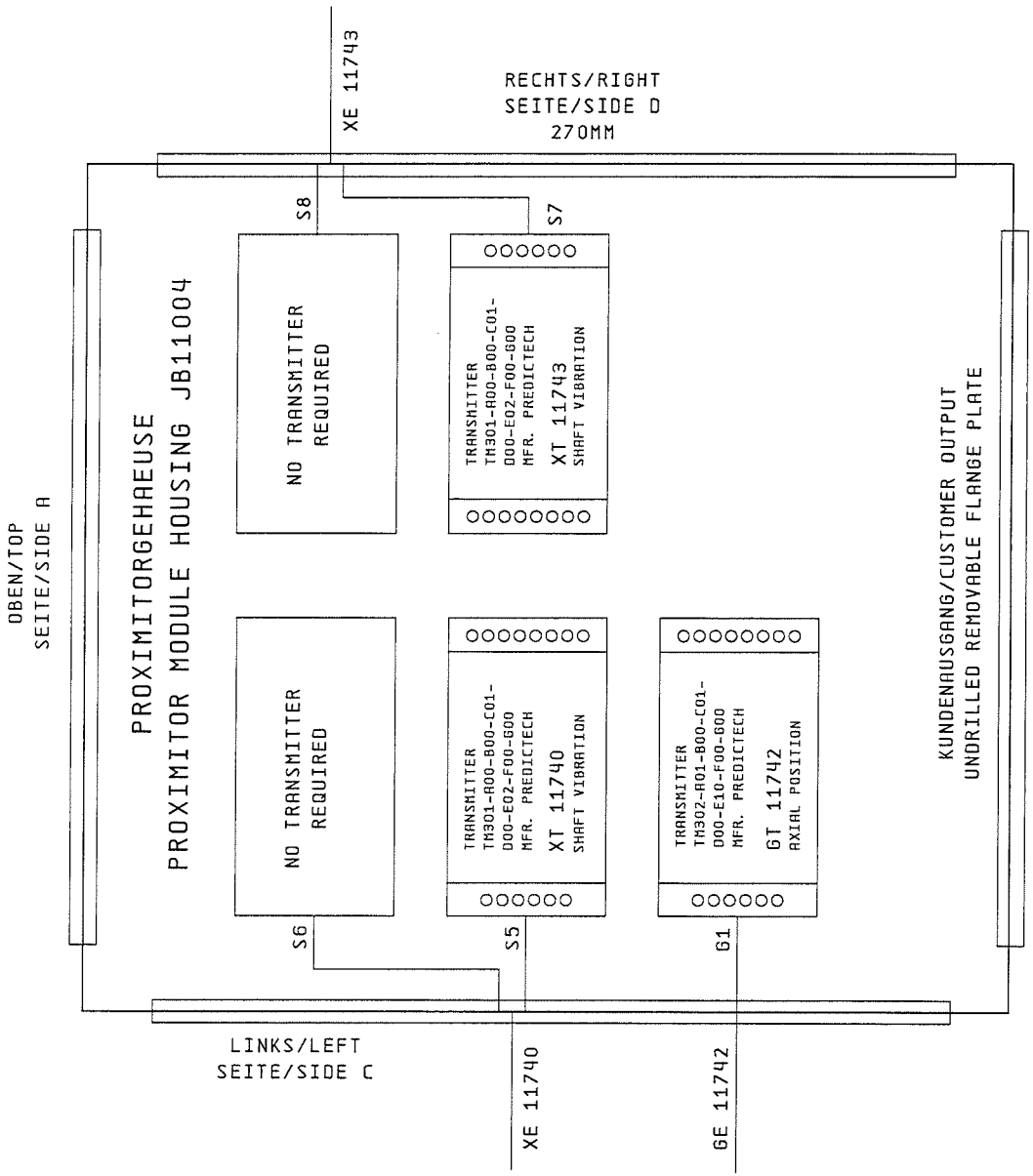
COLOUR CODE FOR RTD`S

RD = ROT/RED
YE = GELB/YELLOW
WH = WEIß/WHITE
GND= SCHIRM/GROUND

FUER MESSSTELLENZUORDNUNG SIEHE ENBAUPLAN Z-NR.: 600545900.0
FOR MEASURING POINTS SEE INSTALLATION DRWG-NO. : 600545900.0

2

B	21.02.05	HLU	Datum	26. Nov. 2004	GETRIEBE/GEAR BOX	BHS GETRIEBE	KLEMMENPLAN WIRING DIAGRAM	Z-NR.: 600657100.4B	- +
			Bearb.	HLU					
			Gepr.	HLU	HC63-2			KOSAIR 2004	W-NR.: 517815
Aenderung	Datum	Name	Norm		Urspr.	Ers. f.	Ers. d.		Bl. 1 / 3 Bl.

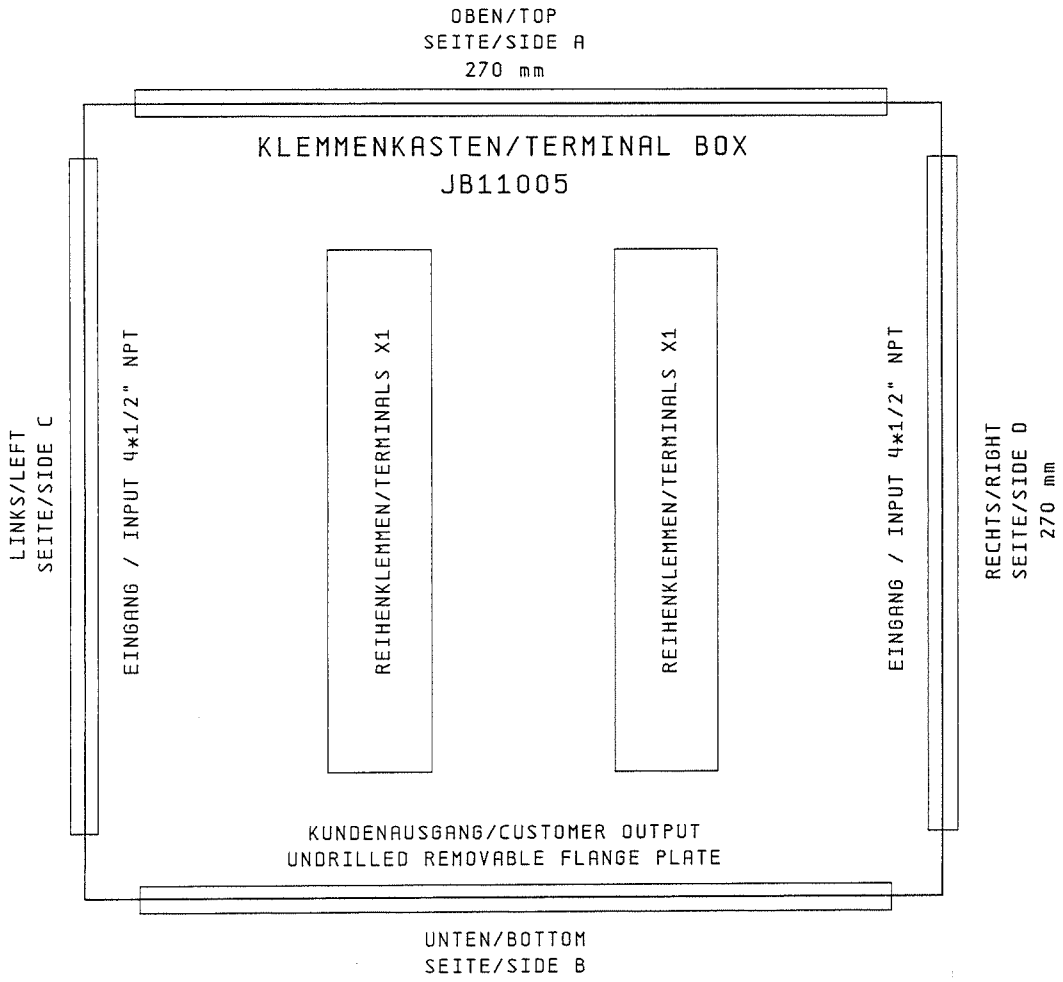


FUEHLER : WELLENSCHWINGUNGSAUFNEHMER
SENSOR : BENTLY PROBE

FUER MESSSTELLENZUORDNUNG SIEHE ENBAUPLAN Z-NR.: 600545900.0
FOR MEASURING POINTS SEE INSTALLATION DRWG-NO. : 600545900.0

CABLE GLAND SIZE: 1/2" NPT

B	21.02.05	HLU	Datum	26.Nov.2004	GETRIEBE/GEAR BOX		BHS GETRIEBE	KLEMMENPLAN WIRING DIAGRAM	Z-NR.: 600657100.4B	
			Bearb.	HLU						
			Gepr.	HLU	HC63-2				KOSAIR 2004	W-NR.: 517815
Renderung	Datum	Name	Norm		Urspr.	Ers.f.	Ers.d.			Bl. 2 / 3 Bl.



VERWENDETE TEILE:

- KLEMMENKASTEN TYP 14.020000
  MAT. POLYESTER FA. ROSE
- SCHRAUB-REIHENKLEMMEN TYP WDU 2,5 BEIGE
  FA. WEIDMUELLER
- T&B-VERSCHRAUBUNGEN FUER ANACONDA
  SCHUTZSCHLAUCH MAT. STAHLGUSS MIT
  VERNICKELTER UND CHROMATIERTER
  OBERFLAECHE

PARTS USED:

- TERMINAL BOX TYPE 14.020000
  MAT. POLYESTER MFR. ROSE
- SCREW TERMINALS TYPE WDU 2,5 BEIGE
  MFR. WEIDMUELLER
- T&B-CABLE GLANDS FOR ANACONDA TUBE
  MAT. NICKEL-PLATED AND CHROMATE
  COATED MALLEABLE IRON

INTERN:
- KLEMMENKASTEN MIT REIHENKLEMMEN BESTUECKEN
- 8 DURCHGANGSLOECHER FUER 1/2" NPT BOHREN
- VERSCHRAUBUNGEN MIT DICHTRING MONTIEREN

2

B	21.02.05	HLU	Datum	26. Nov. 2004	GETRIEBE/GEAR BOX		BHS GETRIEBE	KLEMMENPLAN WIRING DIAGRAM	Z-NR.: 600657100.4B	= +
			Bearb.	HLU	HC63-2				KOSAIR 2004	W-NR.: 517815	Bl. 3
			Gepr.	HLU							3 Bl.
Aenderung	Datum	Name	Norm		Urspr.	Ers. f.	Ers. d.				

IV Spare parts

BHS GETRIEBE

BHS Getriebe GmbH

Ersatzteilestückliste / Spare part List: TURBO-STIRNRADGETRIEBE HC63-2 Z.Nr. 600545900

Schnittzeichnung / Cross Sectional Drawing: 600828200 Auftragsnummer: 517815ETL

Pos. *Pos.*	*Artikel-Nr* *Part-no.*	*Stk.* *Qty.*	*Bezeichnung 1* *Denomination 1*	*Bezeichnung 2* *Denomination 2*	*Material* *Material*	*Gewicht Kg/Stck* *Weight Kg/pc.*
0200	513328800	2	RADIALLAGER RADIAL BEARING	Z315/225X140	ST/WM	38
0220	600157400	2	RADIALLAGER RADIAL BEARING	W225/160X140	St/WM	18,6
0240	004571508	1	AXIALKIPPSEGMENTLAGER AXIAL TILTING PAD BEARING	GMH AK227,8/112,3X76,2		32,8
0260	513937100	1	DICHTRING SEALING RING	355/225X68	ALMG4,5MN	8
0270	600155900	1	DICHTRING SEALING RING	350/160X60	ALMG 4,5MN	0
0300	101004597	1	ZAHNRADPUMPE GEAR PUMP	R65/315FL-Z WERDOHLER	GG-25	41
0330	101004070	1	KUPPLUNG ROTEX ROTEX COUPLING	KTR 28/38 CF92 3b-GGG 1b St040		0
0410	600590500	1	RADWELLE KPL WHEEL SHAFT COMPLETE	M=5,5 Z=185		2195
0450	600590000	1	RITZELWELLE KPL PINION SHAFT COMPLETE	Z=38 M=5,5		224
0910	955721500	4	WIDERSTANDSTHERMOMETER RESISTANCE THERMOMETER	L1=1500 MM , L2=3000 MM	IEC 751 B	0
0912	955696700	4	WIDERSTANDSTHERMOMETER RESISTANCE THERMOMETER	L1=2500 MM , L2=4000 MM	IEC 751 B	0
0914	512385901	4	WIDERSTANDSTHERMOMETER RESISTANCE THERMOMETER	L1=160MM,L2=40MM,LK=1500MM	IEC 751 B	0
0920	955543100	4	MESSWERTGEBER TRANSDUCER	330105-02-12-10-02-00		0
0921	101003387	1	MESSWERTGEBER TRANSDUCER	330705-02-18-10-02-00		0

Ende *Druckdatum: 08.03.2005 18:32*

V Pump

1 General

1.1 Application

RICKMEIER gear pumps are intended for installation in a machine or for assembly with other machinery components to be assembled into a machine unit. Commissioning of the pump is prohibited until it has been proved beyond doubt that the machine into which these gear pumps are to be mounted or of which these gear pumps shall form an integral part is in conformity with the applicable provisions of the EU Machinery Guidelines 89/392 EWG.

Gear pumps must exclusively be used for conveying lubricating liquids that do neither attack the pump component materials nor contain additives that promote wear.

1.2 Operating Data

The relevant data applicable to the individual operating conditions are specified in the framework of an order, usually by means of job specifications, item-specific instructions, separate data sheets, drawings or similar documents. In the event that the equipment operating conditions vary from what has been agreed before this must be clarified with and agreed by the pump manufacturer, otherwise any warranty obligations will become void.

2 Safety

These operating notes contain basic requirements that must be met during mounting, operation and maintenance. Therefore, it is mandatory that these operating notes are carefully read by fitters as well as responsible personnel/Operator before mounting and commissioning work is carried out These operating notes must always be at hand at the place where the machine/plant is operated.

Due attention must be paid not only to the general notes on safety as described in this main safety section but also to the specific safety instructions prescribed in other paragraphs.

2.1 Symbols Used in these Operating Notes

This danger sign identifies general safety issues related to the protection of personnel.

Notes intended to safeguard the gear pump have been signified by this symbol.

Signs directly provided on the pump, such as

- rotational direction arrow
- identification of fluid ports

must by all means be observed and maintained in well legible state.

2.2 Qualification and Training of Personnel

Personnel responsible for operation, maintenance, inspection and mounting must have adequate qualifications to perform these activities. Areas of responsibility, duties and supervision of personnel must have been clearly defined by the Operator. In the event that personnel lacks the necessary technical knowledge appropriate training and teaching must be initiated. Moreover, the Operator must ensure that the contents of these operating notes has been clearly understood by the staff involved.

2.3 Dangers Associated with Disregarding these Notes on Safety

Any failure to observe the safety instructions may endanger not only personnel and machine but also the environment. Please note that claims for damages may become forfeited if the safety instructions are not duly followed. In particular, a failure to observe these instructions may give rise to the following dangerous situations:

- Failure of important functions of the machine/plant
- Ineffectiveness of prescribed maintenance and repair methods
- Hazards to personnel as a result of mechanical and chemical effects
- Environmental risks due to leakage of harmful substances

2.4 Working in a Safety-conscious Manner

The safety notes included in these operating instructions, any applicable national regulations governing accident prevention as well as any in-house working, operating and safety instructions issued by the Operator must be duly observed.

2.5 Safety Instructions for Operator/Staff

- In case that hot or cold machinery parts create danger these components must be safeguarded by the Plant Owner to prevent accidental contact.
- In case of pump types that have not been provided with a coupling guard in the factory a suitable safeguard has to be provided by the Plant Operator.

Rickmeier GmbH
Langenholthauser Str 20 22 D 58802 Balve
Postfach 13 40 D 58797 Balve
Telefon +49 (0) 23 75 / 9 27 0
Telefax +49 (0) 23 75 / 9 27 26
E mail kontakt@rickmeier.de www.rickmeier.de

- Touch guards meant to prevent contact with moving parts (eg coupling) must not be removed from an operating pump.
- Any leakage (eg of the shaft seal) of hazardous media conveyed by the pump (eg of explosive, toxic, hot nature) must be disposed of in such a manner that no danger to persons or the environment can occur. Any applicable legal provisions have to be duly followed.

2.6 Safety Instructions regarding Maintenance, Inspection and Mounting Work

The Operator must take due care that all maintenance, inspection and mounting work is exclusively performed by authorized and qualified expert personnel that has informed itself sufficiently by having studied these operating notes thoroughly.

Basically, all work carried out on the machine must be performed when the machine is at a standstill. Instructions included in these operating notes about taking the pump out of service must by all means be followed.

Pumps conveying liquids constituting a hazard to health have to be decontaminated.

All safety and protective systems must be replaced or made fully functionable again as soon as the work has been completed.

Before re-commissioning the system the remarks given in Section 6 - Commissioning - must be carefully read.

2.7 Pump Conversion and Use of Original Spare Parts

A conversion of or modification to the gear pump is only permissible if agreed to by the manufacturer. By the use of original spares and accessories approved by the manufacturer a satisfactory level of safety shall be warranted. If spare parts of other makes are employed the liability for consequences arising from this may be denied.

2.8 Inadmissible Operating Modes

The operational safety of the gear pump supplied can only be ensured if it is used as described under Section 1 - General - of these operating notes. The limiting values specified in the order must never be exceeded.

3 Transportation and Intermediate Storage

The gear pumps are usually installed shortly after they have been delivered. Special measures to be taken for packing, preservation etc. must be separately agreed upon.

4 Description

WP gear pumps are rotating displacement-type pumps. When the input shaft is turning the teeth of drive gear and impeller engage in a reciprocating manner with the respective gaps in the mating gear. On the suction side the gap spaces created are filled with medium to be conveyed. On the delivery side the medium is displaced by the teeth engaging with the gap spaces.

The theoretical delivery rate is only achieved in pressure-less pump operating mode, it is reduced by the internal losses as the pressure builds up in the system. The losses increase as the viscosity decreases but for the main part the losses are not related to speed.

The basic pump design comprises the housing, the drive and end covers as well as conveying gears. Radially, the shafts are carried in plain bearing sleeves lubricated by the medium to be conveyed. The drive shaft is normally sealed off by means of a radial shaft seal ring.

Loads acting on the shaft, eg from a gear drive system, must not exceed the specified admissible radial and axial load figures.

In case of pumps provided with built-in pressure relief valve care must be taken that this valve is only allowed to have a pure safety valve function eliminating pump overpressure states. If this valve is actuated the branched off output is led to the suction side. In the event that the valve is expected to be actuated for a prolonged time span a separate valve equipped with return system connecting to the reservoir has to be employed, such as our RSn or DB9 models.

Special design types and other pump variants may feature deviating technical details.

5 Mounting/Installation

Drive elements such as couplings and gearwheels must be mounted onto the pump shaft providing for an ISO H7 fit.

These components must not be driven onto the shaft by hammering, otherwise pump damage may occur.

The alignment between the pump shaft and driven machine must be carried out such that admissible drive element mismatch tolerances are not exceeded

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and unnecessary forces prevented from acting on the shaft.

The pipework must be laid to avoid undue stresses. For the suction and delivery connections of pump types with female threads only male components with exactly fitting straight (cylindrical) thread must be employed. When connecting these elements care must be taken to avoid impermissible stresses from acting on the pump.

The size of the pump suction connection does not govern the cross sectional area of the piping. In most cases a suction line cross section will be sufficient that matches the pump inlet cross section. It is nevertheless recommendable to determine all elements of resistance in the system (gravity suction head, pressure losses in the piping and across piping components - non-return valve etc.) to check whether there is a cavitation hazard.

The suction line must be absolutely tight. Any unusual noise may be indicative of air being sucked into the pump or of the pump operating in the cavitation range.

If suction filters are used it must be made sure that these filters are regularly serviced. It is recommendable to monitor the pump inlet for negative pressure to make sure the admissible pressure of -0.4 bar is not exceeded as a result of filter fouling. The pressure measuring point must be arranged directly ahead of the pump inlet nozzle.

All parts in contact with the medium to be conveyed must be carefully cleaned to prevent dirt from entering the pump and cause damage or destruction. Especially with hot-bent or welded piping systems care must be exercised to remove any remnants that may cause hazards.

6 Comissioning/Taking out of Service

Before the pump is taken into service it must be checked whether the rotational direction of the driver matches the direction of pump rotation.

During the check a pressure buildup (eg due to a built-in non-return valve) in the suction line must be avoided, otherwise the shaft seal may suffer damage.

For initial start-up and when again being commissioned the gear pump must be filled with the medium to be conveyed to wet the gears inside the pump.

If the pump is to deliver into a closed system it must be vented on the delivery side during start-up. Suitable venting arrangements have to be provided in the delivery line. When operating two pumps in parallel that are safeguarded against each other by non-return valves both pumps must be vented.

In the event of difficult suction conditions the pump should be mounted in such a manner that input shaft and running axle are arranged one above the other. This mounting position will make sure that the residual oil volume remaining in the pump promotes pump suction on re-starting. Alternatively, a pipe siphoning arrangement can be provided.

There is always a residual amount of liquid in the gear pump. If a non-return valve has been integrated into the suction line and/or if suction and delivery lines are arranged such that the gear pump cannot run dry all hollow spaces of the gear pump remain filled with liquid. Therefore, appropriate steps must be taken when dismantling the pump to collect this liquid.

Depending on the type of medium conveyed exiting liquids may endanger man and environment! For that reason effective steps must be taken in conformity with the safety data sheets of the respective liquids.

7 Maintenance/Repair

Normally, the gear pumps do not require maintenance.

When the pump is dismantled the housing parts must not be forced apart but should only be separated by applying light blows with an elastic (rubber) hammer to housing and drive end cover. When reassembling the pump cleanliness (paint remnants!) and correct seating of seals are of utmost significance.

The shaft seal ring need only be replaced if leakage arises or if the input gear shaft has been renewed. Running marks on the shaft are not necessarily indicative of a defective sealing location.

A bearing sleeve replacement is not recommendable. In case of a defective bearing the shafts and housing components usually have suffered damage as well.

If a gear pump is worn out and cannot be used any longer, it must be replaced. The installation of spare parts cannot restore the pump's original performance and service life. It is recommended to keep spare pumps on stock and return the dismantled pump to our Factory for repair.

For ordering purposes please indicate the required technical details shown on the nameplate.

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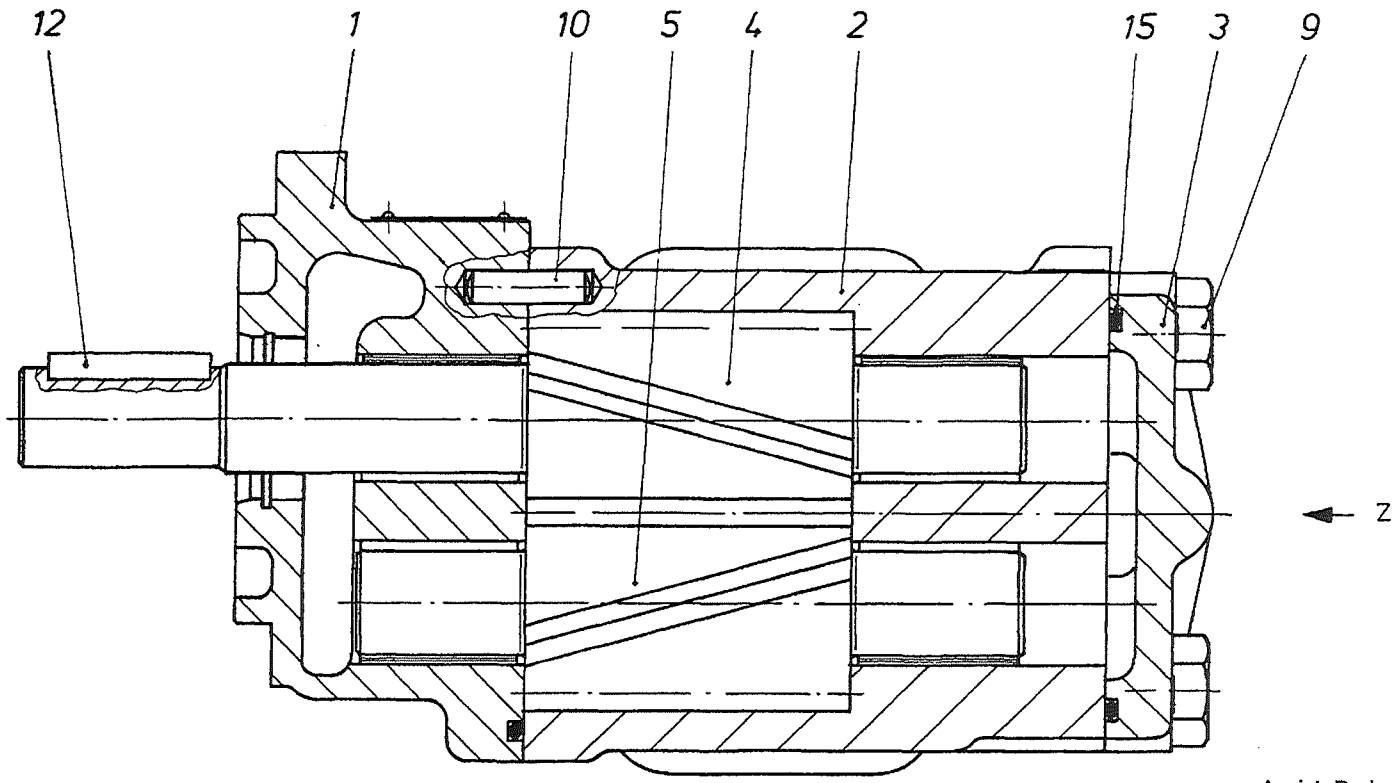
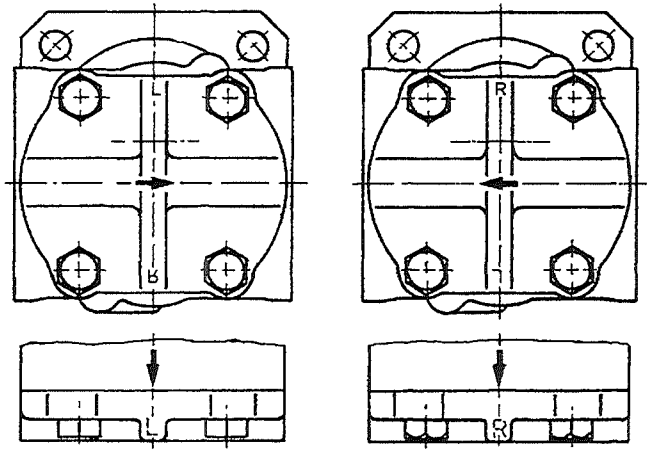
① gear pump
② turning moment

① pompe à engrenages
② couple de serrage

① bomba de engrenajes
② par de apriete

① pompa ad ingranaggi
② coppia di serraggio





Anzieh-Drehmoment ②
Pos. 9

R25	14 Nm
R35	50 Nm
R45	86 Nm
R65	150 Nm

			TOLERIERUNG DIN 7167 ONr Ø-4106				
			Allgemeintoleranzen für Gußrohteile nach DIN 1680 T1 ONr Ø-4120/01 und DIN 168 ONr Ø 412 GT				
			Zulässige Abweichungen für thermisches Schneiden nach DIN EN ISO 9013 ONr Ø-4116/03 Gute ☐I ☐II Toleranzklasse ☐A ☐B				
			Werkstückkanten nach DIN 6784 ONr Ø-5231	AN-ZU	Änd.-Mittig.-Nr	Datum	Name
			Zeichnungs-Zusatzangaben nach ONr Ø-5291	Maßstab Scale	Gez	14.01.02	Web
			Schutzvermerk nach DIN 34 beachten! Reprint with our permission only!		Gepr		
Paßmaß	Oberes Abmaß	Unteres Abmaß			Norm'g		

Vorstufengegenstand/Bemerkung: Originalerneuerung

Werkstoff

Ursprungs-Zeichnung

Ersetzt durch

Ersatz für 26295/3

RICKMEIER WERDOHLER PUMPENFABRIK

Benennung / Denomination: Zahnradpumpe ①

R.5/... FL-Z-SO

Sach-Nr / Object number: FZ 3-1002-332451-4/3

Format-Kennz

Zeichnung besteht aus | Blatt | Blatt Nr

DIN 6

Rickmeer GmbH Werdohler Pumpenfabrik Postfach 1340 D-58797 Balve Hausadresse Garbeck Langenholthausener Straße D-58802 Balve Germany

WP Form 226618-4

☒ Zutreffendes bitte ankreuzen

Declaration by the manufacturer

as defined by machinery directive 89/392/EEC Annex II B

FW/26.01.95

Herewith we declare that

the gear pumps **R25**
R35
R45
R65
R95

are intended to be incorporated into machinery covered by this directive and must not be put into service until the machinery into which these gear pumps to be incorporated have been declared in conformity with the provisions of the directive.

Applied standards

E DIN EN 809

DIN 24346

WERDOHLER PUMPENFABRIK
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Rietdorf
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Zahnradpumpen
Ventile · Anlagenbau
Sonderprodukte

WERDOHLER PUMPENFABRIK
RICKMEIER

X Manufacturer's Declaration

Revision History

Revision	Contents of revision	Document pages total :
01	Amendment of directives to 98/37/EC	4
02	Update of norm standards and telephone numbers	4
03	Revision of layout	4

Manufacturer's Declaration
according to the EC Directive for Machinery 98/37/EC
Annex II B

The product

Type:	HC 63-2
Serial No.:	517 815

complies with the following applicable regulations of:

EC Directive 98/37/EC (Directive for Machinery)

Applied harmonised standards, especially:

EN 292	Safety of Machinery; Part 1 and Part 2

Applied national standards, especially:

3. GSGV	(3rd Ordinance to Equipment Safety Law) Machinery Noise Information Ordinance
9. GSGV	(9th Ordinance to Equipment Safety Law) Machinery Ordinance

The above mentioned product is no independently operating machine in the sense of the EC Machinery Directive 98/37/EC. Therefore a CE marking must not be applied.
As the a.m. product is operative only after assembly with other machines, its initial operation is prohibited until it has been ascertained that the complete plant in which this product has been installed meets the requirements of the EC Machinery Directive.

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