SCHAEFFLER

Precision strain wave gears

Series RT

Mounting manual

Contents

About the mounting manual

This mounting manual serves as an aid in mounting strain wave gears safely and correctly.

The manual contains important information on:

- avoiding personal injury or damage to property
- mounting the strain wave gear correctly to ensure functionality

The original language of the manual is German.

All other languages are translations from the German language.

Availability

A current electronic version (PDF) of this manual can be found at https://www.schaeffler.de/std/1F3F

Legal guidelines

The information in this manual reflects the status as of July 2022.

Unauthorised modifications to or improper use of the product are not permitted. Schaeffler does not assume any liability in this respect.

The information and instructions contained in this document, in the catalogue and in the customer delivery drawing must be observed. Special and customer-specific designs may differ in technical detail from the designs covered in this publication. It is strongly recommended that you contact Schaeffler, quoting the type designation and serial number, if any clarification is required.

Symbols

The warning and hazard symbols are defined in accordance with ANSI Z535.6-2011.

NOTICE

In case of non-compliance, damage or malfunctions in the product or the adjacent construction may occur.◁

Images

The images in this manual are examples and may differ from the delivered product.

Further information

For any questions relating to mounting, please consult your local contact at Schaeffler.

General safety guidelines

Usage for the intended purpose

Strain wave gears of series RT are intended for industrial or commercial applications.

Typical application areas include:

- robots and handling
- medical equipment
- industrial machinery
- machine tools

The strain wave gears may only be operated within the operating ranges and environmental conditions specified in the documentation.

Fundamental health and safety requirements were taken into account during the development, design and production stages.

Under the terms of the EC Machinery Directive, strain wave gears of series RT are classified as machine components, not incomplete machines. Machine components do not fall within the scope of the EC Machinery Directive.

Before commissioning equipment and machinery fitted with strain wave gears of series RT, the conformity of the equipment or machine with the EC Machinery Directive must be ensured.

Usage not for the intended purpose

Use of the strain wave gears outside of the aforementioned application areas or under operating ranges and environmental conditions which deviate from those described in the documentation is considered incorrect usage.

Use of the strain wave gears in the following application areas is considered incorrect use:

- aviation and aerospace
- areas with an explosion risk
- machinery specifically designed or used for nuclear applications, the failure of which may result in the emission of radioactivity
- vacuum
- devices for domestic use
- medical equipment that comes into direct contact with the human body
- machinery or equipment used to transport and lift people
- special equipment for use in fairgrounds and amusement parks

Selection and qualification of personnel

Strain wave gears may only be fitted by qualified personnel.

Qualified personnel:

- are authorised
- have all the necessary knowledge
- are familiar with the safety regulations

Personal protective equipment

Personal protective equipment protects against health hazards. For your own safety, always use safety shoes and clean safety gloves.

Depending on the mounting location and on the machine or equipment, it may be necessary to use additional personal protective equipment. Further information on this subject can be obtained from your contact at Schaeffler.

Observe the applicable regulations relating to occupational safety at the mounting location.

Safety specifications

In order to prevent the occurrence of personal injury or damage to property, observe the following safety specifications.

Fundamental specifications

Keep the work area free of trip hazards.

Always carry out all mounting and maintenance work when the machine or equipment is at a standstill. Do not reach into the working area of the gear unit while the shafts are still rotating.

Secure the machine or equipment against unintentional start-up before carrying out mounting or maintenance work.

Observe the safety datasheet for the lubricant. Please address any questions to your contact at Schaeffler.

Transport, storage, mounting

Do not open the strain wave gear packaging until immediately before mounting.

Cleaning

Use volatile cleaning solvents, which allow residue-free cleaning, to clean the surfaces of the gear unit. The solvents must be compatible with the gear unit surfaces and with the corrosion protection used, in order to avoid damage to the gear unit surfaces.

Disposal

Dispose of any cloths soaked with grease or solvents, as well as excess grease, packaging material and any other waste generated in connection with mounting, by environmentally acceptable methods. Observe the applicable legal regulations at the mounting location.

Environmental hazards

Pay attention to any safety risks that are not associated directly with the strain wave gear, but are posed by the ambient conditions at the mounting location. These may include dusts that are hazardous to health or working at a considerable height. Furthermore, the machine or equipment may also be a source of hazards, for example, as a result of moving machine or equipment parts.

Consult with a local safety engineer before starting mounting work and observe all safety specifications that are applicable to the mounting location, the machine or the equipment.

Scope of delivery

Please refer to the customer delivery drawing.

The scope of delivery comprises:

- strain wave gear
- accessories
  - O-rings
  - lubricant (for RT..-H-..-BHS and RT..-H-..-BMS)

Damage during transit

- ▶ Check the delivery immediately upon arrival for any damage during transit.
- ▶ Report any damage during transit promptly as a complaint to the carrier.

Defects

- ▶ Check the strain wave gear immediately upon delivery for externally visible defects.
- ▶ Report any defects promptly as a complaint to the distributor of the strain wave gear.

Preparation for mounting

Cleanliness

NOTICE

No foreign bodies or mounting aids must be allowed to enter the gear unit during mounting.

Contaminants and residues from cleaning agents can shorten the operating life of the strain wave gear.

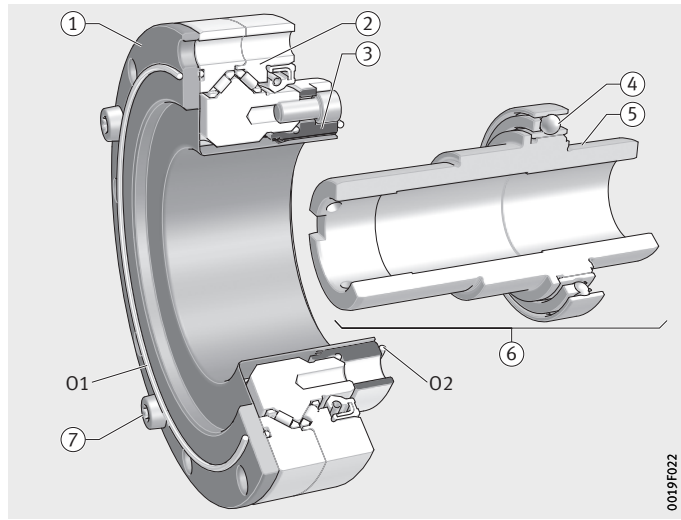
Only use volatile solvents and lint-free cloths for cleaning. ◁

Measures for ensuring cleanliness are as follows:

- ▶ Keep the mounting location, tools and clothing clean and free from magnetic or magnetisable particles.
- ▶ Clean the mounting surfaces on the gear parts.
- ▶ Do not remove the strain wave gear from its packaging until immediately before mounting.

Overview

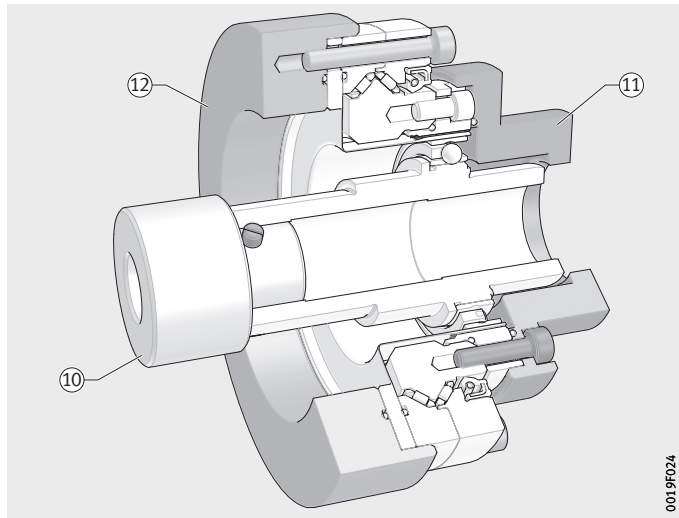
An overview of the components used in the strain wave gear can be found in the following illustration.



O1, O2 = O-rings

① Flexspline
② Double row angular contact needle roller bearing XZU-RTH
③ Circular spline
④ Wave generator bearing
⑤ Input shaft
⑥ Wave generator
⑦ Retaining screws

Figure 1
Components of RT..-H-..-BHS



⑩ Motor shaft
⑪ Adjacent construction (on the circular spline side)
⑫ Adjacent construction (on the flexspline side)

Figure 2
Strain wave gear RT..-H-..-BHS with adjacent construction

Mounting surfaces

Observe the following instructions in relation to the mounting surfaces.

NOTICE

Damage due to anti-corrosion oil.

The gear unit is supplied with anti-corrosion oil.

Remove the anti-corrosion oil prior to mounting. ◁

NOTICE

Damage due to incompatible components.

The main components of the gear unit (flexspline, circular spline, input shaft and wave generator bearing) are matched to each other.

Do not substitute the components for components from other gear units. ◁

Mounting

Wear clean gloves when working on the gear unit to prevent corrosion.

Do not remove the strain wave gear from its packaging until immediately before mounting.

The gear teeth, wave generator bearing and double row angular contact needle roller bearing XZU-RTH are supplied ready lubricated.

NOTICE

Damage to property due to removal of individual parts.

Do not remove any screws from the circular spline. ◁

Lubricate the flexspline and adjacent construction

▶ Lubricate the interior of the flexspline ① using the lubricant provided.

For the amount of lubricant required, please refer to the customer delivery drawing.

▶ Distribute the lubricant evenly.

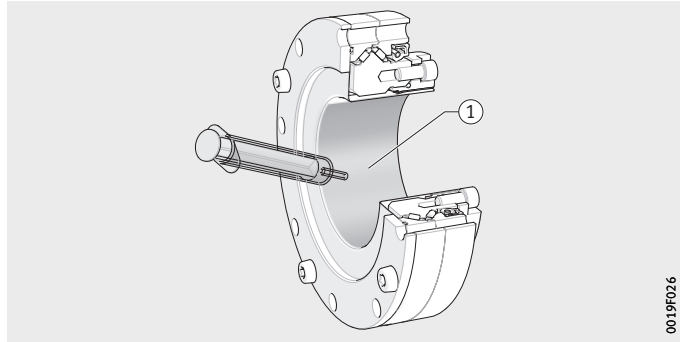


Figure 3
Lubricate the flexspline

▶ Apply the lubricant provided to surface A of the adjacent construction ⑪.

For the amount of lubricant required, please refer to the customer delivery drawing.

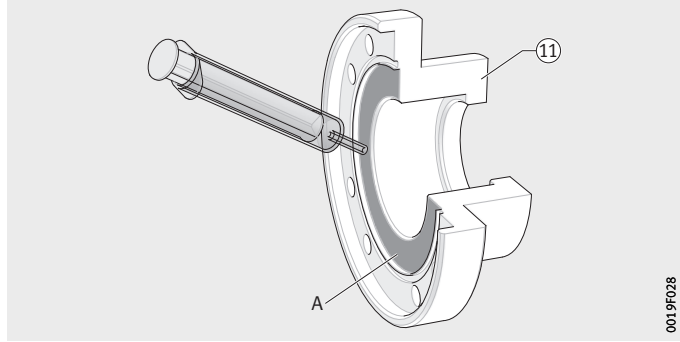


Figure 4
Lubricate the adjacent construction

Fit the wave generator

▶ Fit the wave generator ⑥ in the flexspline ① in the direction of the arrow.

To facilitate fitting, turn and slide the input shaft ⑤ at the same time.

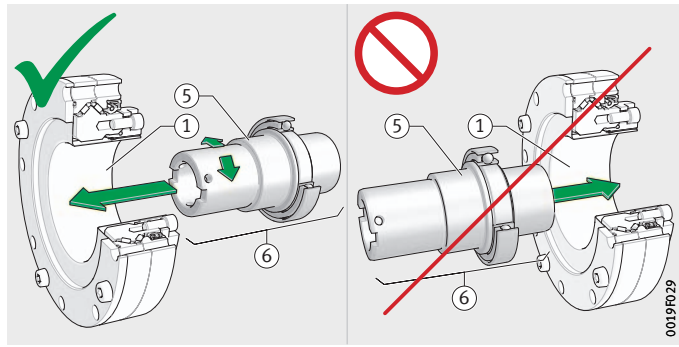


Figure 5
Fit the wave generator in the flexspline

Check the position

Correct positioning of the wave generator bearing ④ is crucial to the functionality and durability of the strain wave gear.

▶ Measure the position of the wave generator bearing ④ (dimension a) and compare this with the target distance a (see customer delivery drawing).

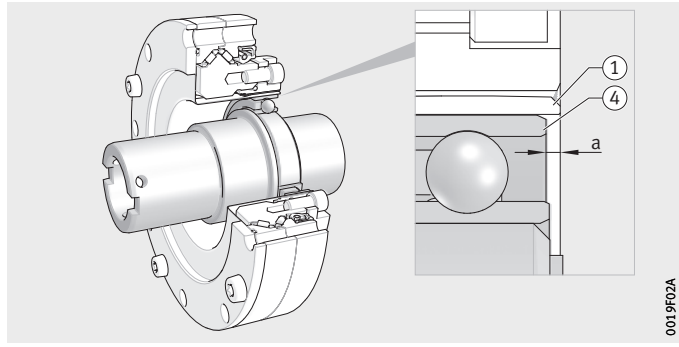


Figure 6
Check the position of the wave generator bearing

Check alignment

If the circular spline ③ is not fitted concentrically to the flexspline ①, the service life and gear accuracy will be reduced. Torque fluctuations can also be attributed to incorrect fitting.

▶ Ensure that the circular spline ③ is fitted concentrically.

The strain wave gear should turn very easily when the circular spline ③ is correctly aligned.

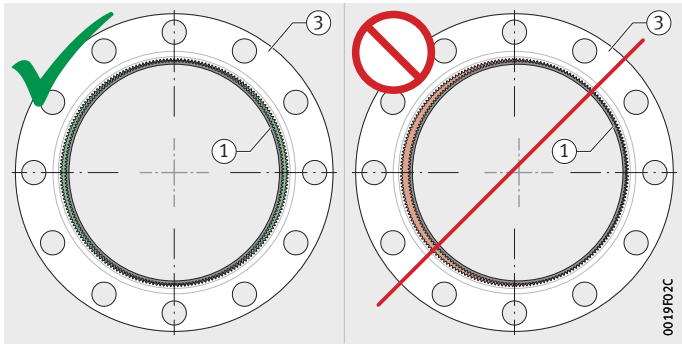


Figure 7
Check alignment of the circular spline

▶ If the circular spline ③ is not correctly aligned, repeat the mounting process for the wave generator ⑥, see page 9.

Remove the retaining screws

▶ If necessary, remove the retaining screws ⑦ from the flexspline ①.

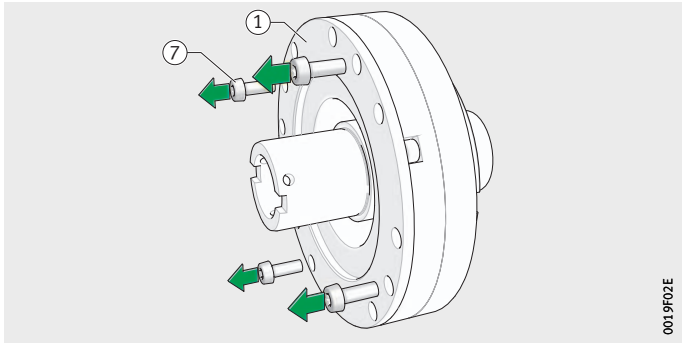


Figure 8
Remove the retaining screws from the flexspline

Mount the input shaft on the motor shaft

- ▶ Slide the motor shaft ⑩ into the input shaft ⑤.
- ▶ Tighten the screws in the motor shaft ⑩ and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

  Size 14 to 17 radial

  Size 20 to 32 axial

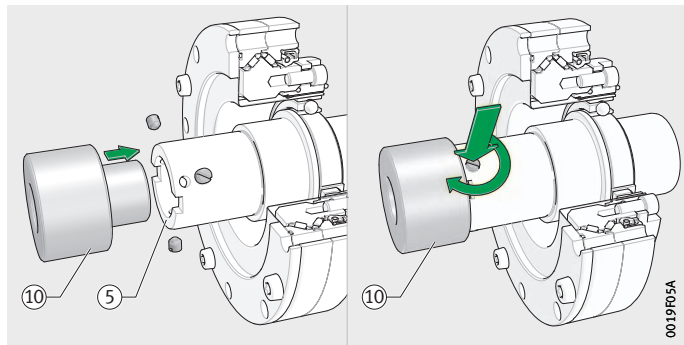


Figure 9
Connect the input shaft to the motor shaft

Mount the flexspline on the adjacent construction

- ▶ Insert the appropriate O-ring into the groove in the adjacent construction ⑫.
- ▶ Mount the flexspline ① on the adjacent construction ⑫.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

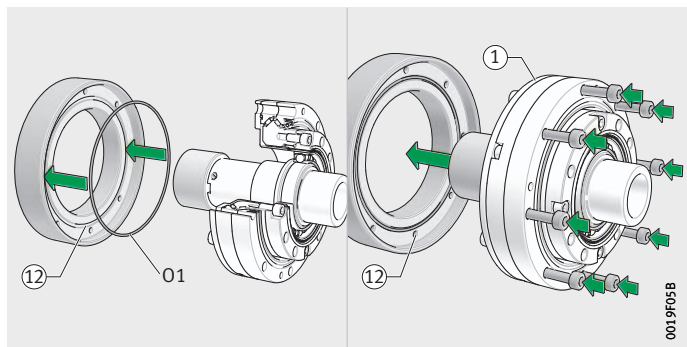


Figure 10
Mount O-ring O1 and the flexspline on the adjacent construction

Mount the circular spline on the adjacent construction

- ▶ Insert the appropriate O-ring into the groove in the adjacent construction ⑪.
- ▶ Mount the circular spline ③ on the adjacent construction ⑪.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

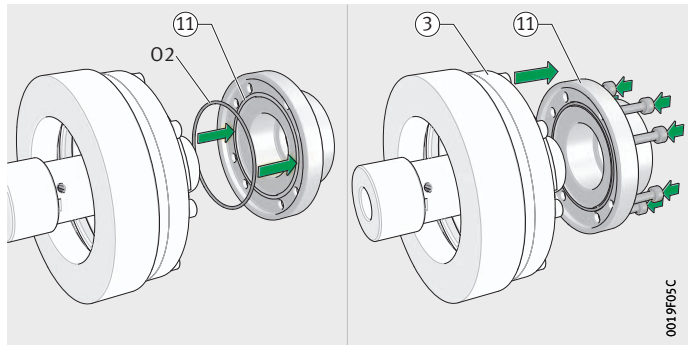


Figure 11
Mount O-ring O2 and the circular spline on the adjacent construction

- ▷ The strain wave gear is mounted.
- ▶ Carry out a running-in process before fully loading the strain wave gear for the first time, see section *Running-in process*.

Running-in process

In order to achieve the best possible performance from the strain wave gear, a running-in process is required before the gear is fully loaded:

- ▶ Operate the strain wave gear under zero load in a clockwise and anti-clockwise direction with a large rotation angle on the output side.

  Input speed: 1 000 min^{-1} to 2 000 min^{-1}

  Duration: approx. 20 min
- ▶ Clean the strain wave gear and relubricate the relevant points, *Figure 3* and *Figure 4*, page 8.

  Observe the stipulated lubricant quantities (see customer delivery drawing).
- ▷ The strain wave gear is now ready for operation.

Preparation for mounting

Cleanliness

NOTICE

No foreign bodies or mounting aids must be allowed to enter the gear unit during mounting.

Contaminants and residues from cleaning agents can shorten the operating life of the strain wave gear.

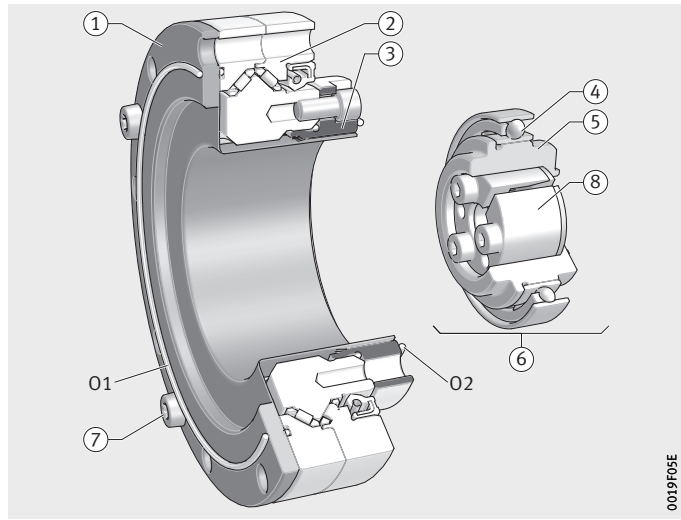
Only use volatile solvents and lint-free cloths for cleaning. ◁

Measures for ensuring cleanliness are as follows:

- ▶ Keep the mounting location, tools and clothing clean and free from magnetic or magnetisable particles.
- ▶ Clean the mounting surfaces on the gear parts.
- ▶ Do not remove the strain wave gear from its packaging until immediately before mounting.

Overview

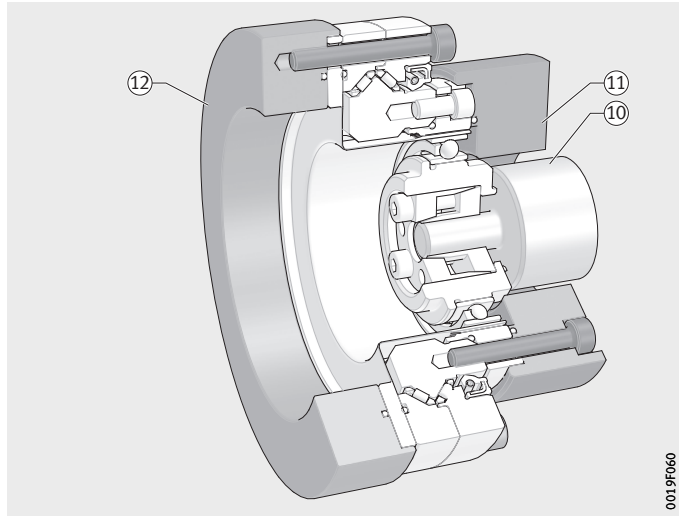
An overview of the components used in the strain wave gear can be found in the following illustration.



O1, O2 = O-rings

① Flexspline
② Double row angular contact needle roller bearing XZU-RTH
③ Circular spline
④ Wave generator bearing
⑤ Input shaft
⑥ Wave generator
⑦ Retaining screws
⑧ Clamping element

Figure 1
Components of RT..-H-..-BMS



⑩ Motor shaft
⑪ Adjacent construction (on the circular spline side)
⑫ Adjacent construction (on the flexspline side)

Figure 2
Strain wave gear RT..-H-..-BMS with adjacent construction

Mounting surfaces

Observe the following instructions in relation to the mounting surfaces.

NOTICE

Damage due to anti-corrosion oil.

The gear unit is supplied with anti-corrosion oil.

Remove the anti-corrosion oil prior to mounting. ◁

NOTICE

Damage due to incompatible components.

The main components of the gear unit (flexspline, circular spline, input shaft and wave generator bearing) are matched to each other.

Do not substitute the components for components from other gear units. ◁

Mounting

Wear clean gloves when working on the gear unit to prevent corrosion.

Do not remove the strain wave gear from its packaging until immediately before mounting.

The gear teeth, wave generator bearing and double row angular contact needle roller bearing XZU-RTH are supplied ready lubricated.

NOTICE

Damage to property due to removal of individual parts.

Do not remove any screws from the circular spline. ◁

Lubricate the flexspline and adjacent construction

▶ Lubricate the interior of the flexspline ① using the lubricant provided.

For the amount of lubricant required, please refer to the customer delivery drawing.

▶ Distribute the lubricant evenly.

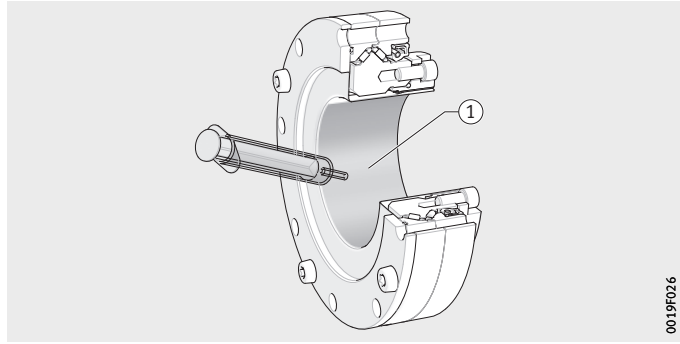


Figure 3
Lubricate the flexspline

▶ Apply the lubricant provided to surface A of the adjacent construction ⑪.

For the amount of lubricant required, please refer to the customer delivery drawing.

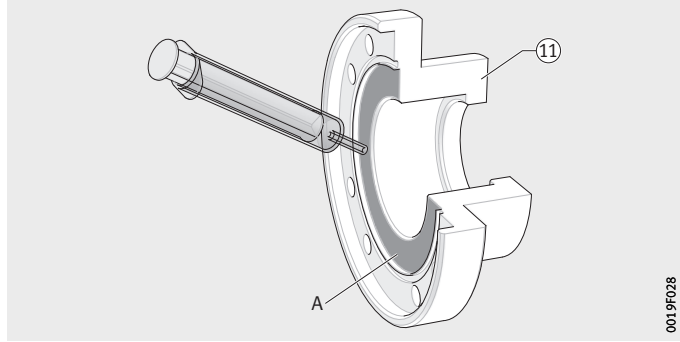


Figure 4
Lubricate the adjacent construction

Fit the wave generator

▶ Fit the wave generator ⑥ in the flexspline ① in the direction of the arrow.

To facilitate fitting, turn and slide the input shaft ⑤ at the same time.

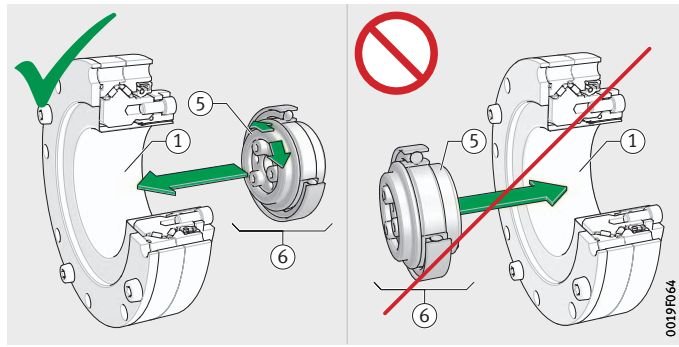


Figure 5
Fit the wave generator in the flexspline

Check the position

Correct positioning of the wave generator bearing ④ is crucial to the functionality and durability of the strain wave gear.

▶ Measure the position of the wave generator bearing ④ (dimension a) and compare this with the target distance a (see customer delivery drawing).

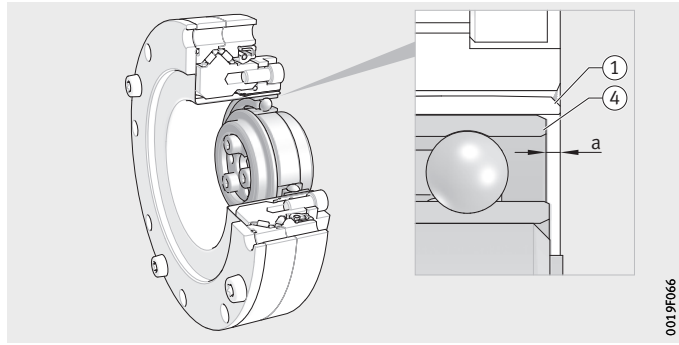


Figure 6
Check the position of the wave generator bearing

Check alignment

If the circular spline ③ is not fitted concentrically to the flexspline ①, the service life and gear accuracy will be reduced. Torque fluctuations can also be attributed to incorrect fitting.

▶ Ensure that the circular spline ③ is fitted concentrically.

The strain wave gear should turn very easily when the circular spline ③ is correctly aligned.

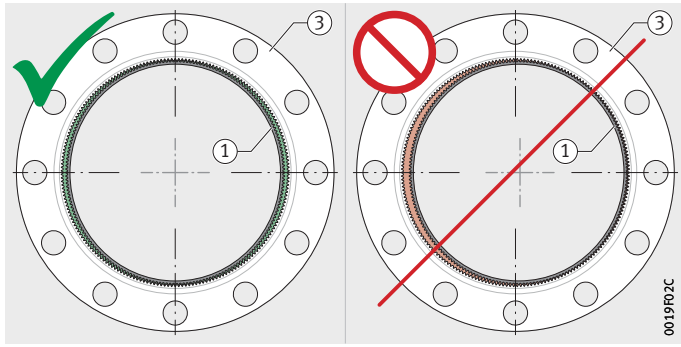


Figure 7
Check alignment of the circular spline

▶ If the circular spine ③ is not correctly aligned, repeat the mounting process for the wave generator ⑥, page 17.

Mount the input shaft on the motor shaft

▶ Slide the motor shaft ⑩ into the input shaft ⑤.

▶ Tighten the screws in the clamping element ⑧ and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

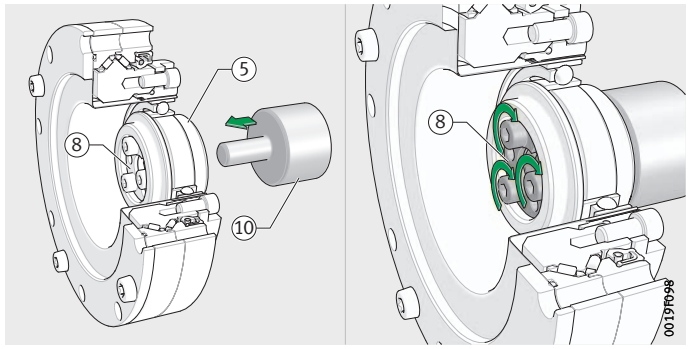


Figure 8
Connect the input shaft to the motor shaft

Mount the circular spline on the adjacent construction

- ▶ Insert the appropriate O-ring into the groove in the adjacent construction ⑪.
- ▶ Mount the circular spline ③ on the adjacent construction ⑪.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

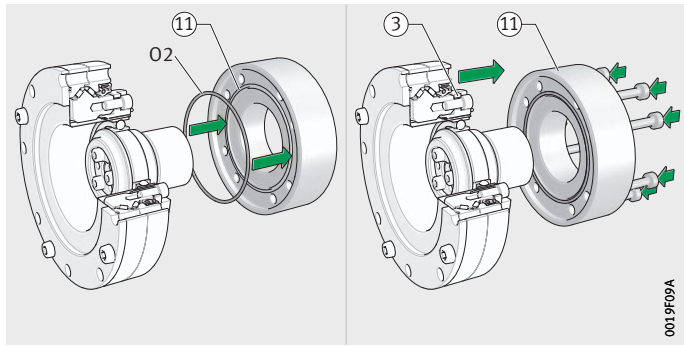


Figure 9
Mount O-ring O2 and the circular spline on the adjacent construction

Remove the retaining screws

- ▶ If necessary, remove the retaining screws ⑦ from the flexspline ①.

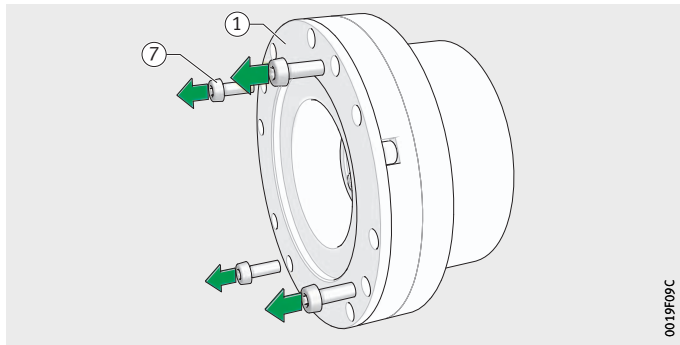


Figure 10
Remove the retaining screws from the flexspline

Mount the flexspline on the adjacent construction

- ▶ Insert the appropriate O-ring into the groove in the adjacent construction ⑫.
- ▶ Mount the flexspline ① on the adjacent construction ⑫.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

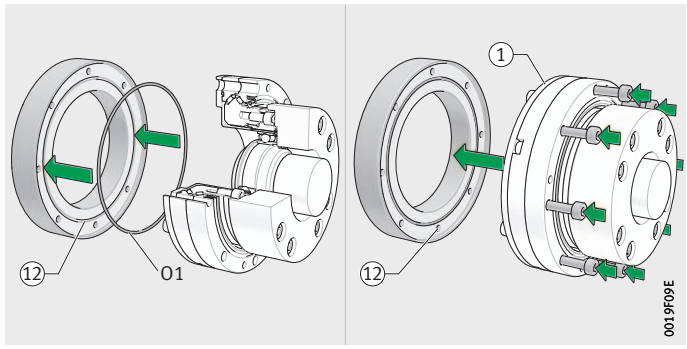


Figure 11
Mount O-ring O1 and the flexspline on the adjacent construction

- ▷ The strain wave gear is mounted.
- ▶ Carry out a running-in process before fully loading the strain wave gear for the first time, see section *Running-in process*.

Running-in process

In order to achieve the best possible performance from the strain wave gear, a running-in process is required before the gear is fully loaded:

- ▶ Operate the strain wave gear under zero load in a clockwise and anti-clockwise direction with a large rotation angle on the output side.

  Input speed: 1 000 min^{-1} to 2 000 min^{-1}

  Duration: approx. 20 min
- ▶ Clean the strain wave gear and relubricate the relevant points, *Figure 3* and *Figure 4*, page 16.

  Observe the stipulated lubricant quantities (see customer delivery drawing).
- ▷ The strain wave gear is now ready for operation.

Preparation for mounting

Cleanliness

NOTICE

No foreign bodies or mounting aids must be allowed to enter the gear unit during mounting.

Contaminants and residues from cleaning agents can shorten the operating life of the strain wave gear.

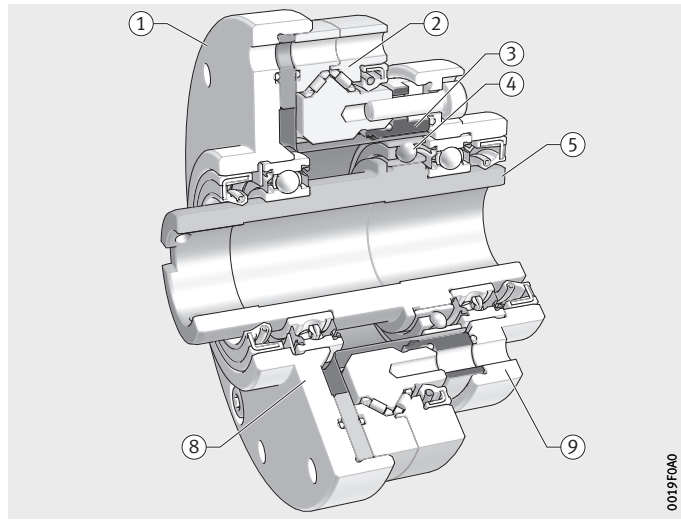
Only use volatile solvents and lint-free cloths for cleaning. ◁

Measures for ensuring cleanliness are as follows:

- ▶ Keep the mounting location, tools and clothing clean and free from magnetic or magnetisable particles.
- ▶ Clean the mounting surfaces on the gear parts.
- ▶ Do not remove the strain wave gear from its packaging until immediately before mounting.

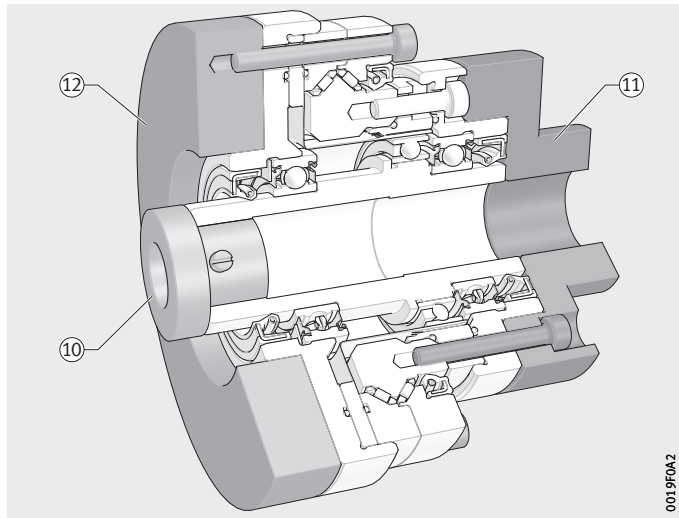
Overview

An overview of the components used in the strain wave gear can be found in the following illustration.



① Flexspline
② Double row angular contact needle roller bearing XZU-RTH
③ Circular spline
④ Wave generator bearing
⑤ Input shaft
⑧ Flexspline flange
⑨ Circular spline flange

Figure 1
Components of RT..-H-..-UHS



⑩ Motor shaft
⑪ Adjacent construction (on the circular spline side)
⑫ Adjacent construction (on the flexspline side)

Figure 2
Strain wave gear RT..-H-..UHS with adjacent construction

Mounting surfaces

Observe the following instructions in relation to the mounting surfaces.

NOTICE

Damage due to anti-corrosion oil.

The gear unit is supplied with anti-corrosion oil.

Remove the anti-corrosion oil prior to mounting. ◁

NOTICE

Damage due to incompatible components.

The main components of the gear unit (flexspline, circular spline, input shaft and wave generator bearing) are matched to each other.

Do not substitute the components for components from other gear units. ◁

Mounting

Wear clean gloves when working on the gear unit to prevent corrosion.

Do not remove the strain wave gear from its packaging until immediately before mounting.

The interior of the strain wave gear is pre-lubricated at the plant with lifetime lubrication.

NOTICE

Damage to property due to removal of individual parts.

Do not remove any screws from the circular spline. ◁

Mount the input shaft on the motor shaft

- ▶ Slide the motor shaft ⑩ into the input shaft ⑤.
- ▶ Tighten the screws in the motor shaft ⑩ and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

  Size 14 to 17 radial

  Size 20 to 32 axial

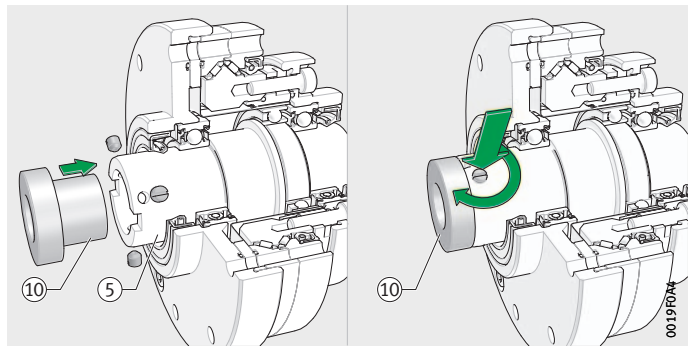


Figure 3
Connect the input shaft to the motor shaft

Mount the strain wave gear on the adjacent construction

- ▶ Mount the circular spline flange ⑨ of the gear unit on the adjacent construction ⑪.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.
- ▶ Mount the flexspline flange ⑧ of the gear unit on the adjacent construction ⑫.
- ▶ Tighten the screws in a crosswise sequence and ensure that the required preload force is achieved. For information on the required preload force, please refer to the customer delivery drawing.

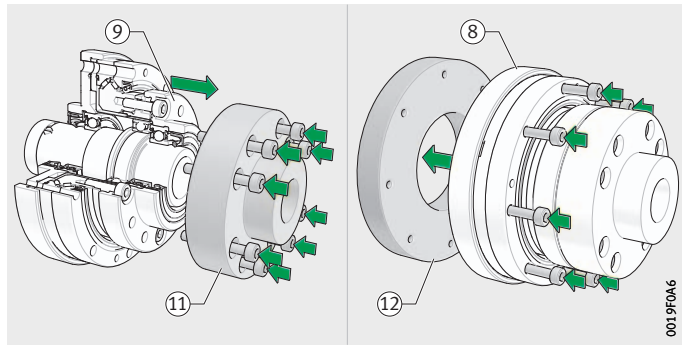


Figure 4
Mount the strain wave gear on the adjacent construction at both ends

▷ The strain wave gear is mounted.

No running-in process is required for strain wave gear RT..-H-..-UHS.

Decommissioning and disposal

NOTICE

Lubricants are hazardous substances.
Observe the safety datasheet for the lubricant.◁

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