

Sumitomo Drive Technologies



PRECISION GEARBOXES

Operating Manual

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1 General information

1.1 Using these operating instructions

Before working with the gearbox (assembly, operation, maintenance, inspection, etc.), read these operating instructions carefully so that you are aware of the correct handling of the precision gearbox, the safety regulations to be applied and the warnings to be observed.

Keep these instructions in a safe way that you can refer to it at any time as required.

1.2 Target group

These operating instructions are intended for trained technical personnel who must be familiar with the transport, assembly, lubrication, operation, maintenance and inspection of the gearbox.

1.3 Text markers

The following text markers are used in these operating instructions:

Text	Symbols
Instructions	Start with a check box ☑
Lists	Start with a bullet point •
Text references to image positions	Are displayed in round brackets ()

1.4 Activity-related safety notes

An activity-related safety note consists of several components:

- a pictogram,
- a signal word that indicates the degree of danger,
- an indication of the nature of the danger and
- one (or several) warning(s) to avert the danger, initially marked with the symbol "☑".

Pictogram	Signal word	Danger	Consequence
	DANGER!	Indicates an imminent danger to persons.	Death or serious injuries.
	WARNING!	Indicates a possible danger to persons or property.	Damage to health or serious damage to property.
	ATTENTION!	Indicates a possible danger to property.	Damage to property.

1.5 Additional notes

Pictogram	Meaning
	Additional information.
	Notes for disposal.
	Notes on explosion protection.

1.6 Basic safety instructions

Transport, assembly, lubrication, operation, maintenance and inspection may only be carried out by trained technically skilled personnel; otherwise there is a risk of injury or damage to the gearbox/machine.

The gearbox may only be used for the intended purpose; otherwise there is a risk of injury or damage to the gearbox/machine.

1.7 Intended use

Precision gearboxes are fixed reduction gearboxes for industrial and commercial systems that can be operated directly or indirectly with motors. Permissible speeds and outputs must comply with according to technical data or the nameplate. If the gearbox loads deviate from the permissible values or if other areas of use than industrial commercial systems are intended, the gearboxes may only be used in consultation with the manufacturer.

When it comes to the use of gearboxes in the food sector, note that additional information on dimensional drawings, are binding for such gearboxes. The additional information refers to the permissible load data of the gearboxes and differ from those of the general technical specifications.

Use in potentially explosive atmospheres is prohibited, unless expressly intended to this end.

For the purposes of the EC Machinery Directive 2006/42/EC, precision gearboxes are considered "partly completed machinery" to be installed in machines and systems. Within the scope of the EC Directive, starting the intended operation is prohibited until it has been established that the end product complies with the Machinery Directive 2006/42/EC.

1.8 Technical data

Ambient temperature	-10°C to +40°C
Relative humidity	85% (no condensation)

If you have different requirements, contact Sumitomo Drive Technologies.

1.9 Instructions on prestage attachments

Prestage attachments to precision gearboxes by means of closed gearboxes, which are carried out by Sumitomo Corporation of America, are technically subject to the considerations in these operating instructions. The type designation of such gearboxes is determined by the precision gearbox on which such an attachment is made. Therefore, the technical conditions and instructions explained in this operating manual must be defined and fulfilled. In particular, it must be taken into account that the ratio of the overall gearbox may change due to the addition of a prestage. If additional technical explanations are necessary for such overall design, or if there are certain restrictions, these are explained on the relevant dimensional sheets of these designs.

Prestage attachments that are designed and made by users of precision gearboxes (e.g. belt stages or external gearboxes) are the responsibility of the user in terms of their function and safety.

2 Transport

Inspect the delivery immediately upon receipt for possible transport damage.

If any damage is found, this must be communicated immediately to the transport company. If it must be assumed that transport damage prevents proper operation, commissioning may not take place.

3 Installation of transmission elements

In the case of gearboxes with hollow input shaft, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft/counterpart before the counterpart is installed.

Caution! Clamp connections may not be treated with MoS₂ paste or spray (e.g. Molykote). Clamp connections must be cleaned and be oil- and grease-free before assembly.

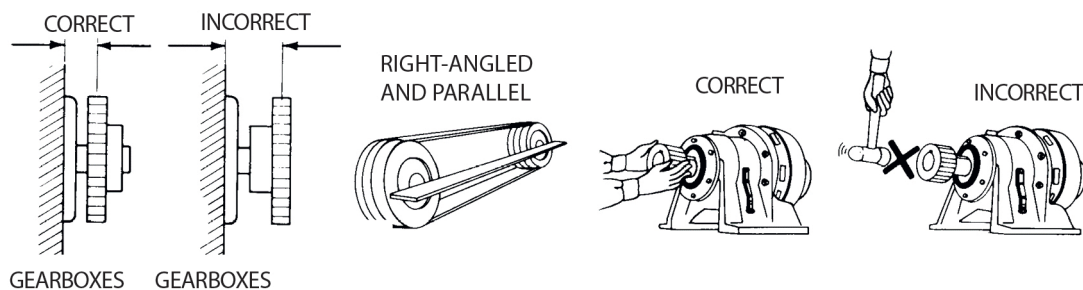


Fig. 1 Correct assembly

In order to prevent storage damage or damage in the gearbox reduction area, couplings, discs, pinions, chains, etc. that are placed on the gearbox shafts may not be pressed on or impacted.

4 Installation

4.1 Required tools

The following tools are required for installation:

- Set of spanners
- Torque wrench
- Pull-on device
- Compensating coupling
- Corrosion protection (e.g. MoS₂- paste)
- Gloves to protect against sharp edges
- Safety goggles

4.2 Inspection before starting the installation work

- The information on the nameplate must correspond to that of the documentation provided (drawings, parts lists, etc.).
- Make sure the input/output is not damaged.

The intended lubricants must be selected according to the environmental conditions and provided if necessary.

4.3 Preparatory tasks

 ATTENTION!	Material damage! Improper cleaning! ☒ Never remove corrosion protection mechanically (e.g. with abrasives). ☒ Use only alkaline cleaning agents for cleaning. ☒ Also make sure that the seals do not come into contact with the cleaning agent.
---	--

	Handling of lubricants and anti-corrosion agents must comply with the safety regulations for persons and the environment in accordance with the corresponding safety regulations and safety data sheets.
---	---

Remove the corrosion protection used for transport and storage on the shaft ends or hollow shafts and on the centering before commissioning, using an alkaline cleaning agent.

4.4 Setup

- ☒ Position the gearbox in such a way that it is easily accessible for any regreasing and maintenance work.
- ☒ Use suitable lifting tools.
- ☒ The basic shape of the precision gearbox is cylindrical. Therefore, during installation, measures must be taken to secure the gearbox against unintentional rolling away of the gearboxes (e.g. if they are briefly put down before the actual assembly).
- ☒ Drives that are installed outdoors or under very unfavourable environmental conditions, e.g. dirt, dust, splash water or heat, must be protected with a cover.
In doing so, the air supply on the surface of the housing must not be impaired. Lubricant ports and lubricant drain plugs must be freely accessible.
- ☒ If there is a risk of electrochemical corrosion between the gearbox and the operating machine (contact between different metals such as cast iron/stainless steel), spacers made of plastic should be used.
If necessary, also ground the housing.

4.5 Safety instructions for installation

Observe the following during installation:

- Do not disassemble the gearbox and pre-assembled units.
All components have been carefully checked and coordinated for maximum precision.
After disassembly and reassembly of individual components, the function of the gearbox can no longer be guaranteed.
If the gearbox has been disassembled, the warranty expires.
- Protect the gearbox against contamination.
Proceed with due care so that no foreign objects can enter the gearbox.
- Do not replace individual parts.
Replacement of individual parts of various gearboxes is not permitted. The individual parts have been paired with each other.
- Observe tightening torques.
The permitted transmissible torque is also limited by the mounting bolts. The number, size and tightening torque as well as the quality of the bolts are described in the corresponding product-specific chapter "Bolt tightening torque and permitted torques". The tightening torques specified for the respective gearbox sizes must be complied with. For this purpose, the bolts must be tightened with a torque wrench. The specified torque values are based on a tightening factor of 1.4 and a friction factor of 0.15 at the parting lines. In addition, a friction range of 0.12 – 0.15 is assumed for the friction in the thread and bolt head. In the event of deviating conditions, the values must be recalculated. If in doubt, contact Sumitomo Drive Technologies. The contact surfaces on the output shaft flange and housing as well as the respective counter surfaces must be clean and dry. Under these conditions, the gearbox bolt connections can safely transmit the torques. The equivalent stress, i.e. the degree of utilisation of the yield stress during tightening, is 0.9. "Yield point controlled tightening" according to VDI 2230 increases the transmissible torque of bolts by about 25%. Higher torques may occur suddenly in crash situations, and are also transmitted by the gearbox without permanent damage. When this happens, the bolt connection should be checked for safety. Contact ask Sumitomo Drive Technologies for further information.
In all cases, the specified values in the corresponding product-specific chapter "Bolt tightening torques and permitted torques" apply to the maximum permitted torques of the gearboxes.



WARNING!

The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed according to the catalogue and the information in this operating manual and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!

4.6 Safety instructions for use in potentially explosive areas



The gearboxes are intended for commercial systems and may only be used in accordance with the information in the technical documentation of Sumitomo Corporation of America and the information on the nameplate. They comply with the applicable standards and regulations and meet the requirements of Directive 2014/34/EU.

Applied standards: ISO 80079-36:2016, ISO 80079-37:2016

Explosive gas mixtures or dust concentrations may cause serious or fatal injuries in conjunction with hot, live and moving parts on the gearbox.

Assembly, connection, commissioning and maintenance and repair work on the gearbox/geared motor, as well as on the additional electrical equipment, may only be carried out by qualified personnel. The following must also be taken into account:

- These instructions
 - The warning and information signs on the gearbox/geared motor
 - All other project planning documentation and circuit diagrams belonging to the drive
 - The system-specific regulations and requirements
 - The national/regional applicable standards and regulations (explosion protection, safety, accident prevention).
- In addition, sealing must be carried out according to IP65 at the following interfaces:
- to the customer's housing
 - to the drive motor

☒ Check oil seals every three months for leakage.
If leakage develops, the seals must be replaced.

☒ Remove dust deposits thicker than 1 mm.

The connection on the customer's side must not impede heat dissipation by convection and heat conduction.

Heat input from the outside into the gearbox is not permitted.

The maximum permitted temperature is 70°C on the outer diameter of the housing (ring gear housing).

Furthermore, the specifications under Chapter 7 (ATEX checklist), as well as the descriptions assigned to the respective gearbox types in these operating instructions, must be adhered to.

Example of marking on the nameplate

 II 2 G Ex h IIC T4 Gb

Marking according to EN ISO 80079-36, -37

Machine marking protection level: Gb = high level of protection, gas

Temperature class: T4 ≤ 135°C

Explosion group IIC: a typical gas is hydrogen

Ignition protection type: h = Constructive safety

Marking according to Directive 2014/34/EU

Machine group: II = Machine for use in above-ground areas

Machine category: 2 = Zone 1 (occasionally explosive atmosphere)

Ex-atmosphere: G = Mixture of air and gases, vapours or mist

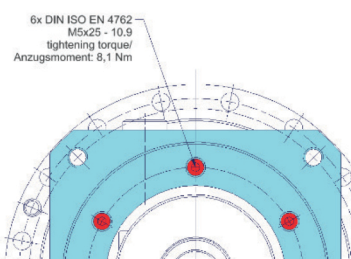
4.7 Safety instructions for operation with motor/inverter

A drive motor connected to the gearbox may only be put into operation after ensuring that the measures described under 4.3 to 4.5 have been taken.

A motor connected to the gearbox may only be operated via an inverter if the information on the nameplate of the gearbox is complied with.

The gearboxes are intended for commercial systems and may only be used in accordance with the information in the technical documentation and the information on the nameplate. They comply with the applicable standards and regulations.

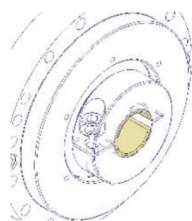
4.8 Motor connection flange supplied loose



For customer-specific designs, in special cases (example shown on the left, motor connection flange dimension larger than the connecting bore pitch circle of the gearbox housing), the motor connection flange is supplied loose to facilitate assembly. In such cases, the dimensional drawing associated with the specific product must be observed, in which the required tightening torque of the mounting bolts for connecting the motor connection flange to the gearbox is indicated. If such a dimensional drawing is not available, contact Sumitomo Corporation of America for the required information.

Always ensure that the flat surfaces (parting joints of the bolt connection) of the elements to be connected between the motor connection flange and the gearbox are clean, as well as free of oil and grease, before they are connected to each other.

4.9 Motor mounting by means of direct clamp ring connection (without bushing)



For correct assembly between motor and gearbox, refer to 4.11 Assembly instructions for clamp ring connections. With regard to the required bolt tightening torques for the clamp ring connections, as well as the transmissible torques, the specific dimensional drawings assigned to the respective product must be observed. The specifications for the tightening torques and transmissible torques according to Table 1 generally refer to clamp ring connections as used in the UA, D and A series (clamp ring version without bushing). If no dimensional drawing is available for your version or if yours is

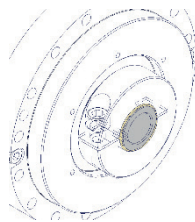
not a standard version of the UA, D or A series (clamp ring version), the necessary information can be obtained from Sumitomo Drive Technologies. In any case, the tightening torques for the corresponding bolt size and bolt quality must be applied

 ATTENTION!	Material damage! Wrong tightening torque! ☒ To tighten, use a torque wrench or a tightening method with lower dispersion (according to VDI 2230). ☒ Use the correct tightening torque according to bolt size and bolt quality (indicated on the end face of the bolt head).
 DANGER!	Frictional connection! The specifications of the transmissible drive torque of the clamp ring connection must not be exceeded.

Motor shaft diameter [mm]	Clamp ring Bolt	Bolt Quality 8.8	Bolt Quality 10.9	Bolt Quality 8.8	Bolt Quality 10.9
		Tightening torque Bolt [Nm]	Tightening torque Bolt [Nm]	Transferrable torque T1 [Nm]	Transferrable torque T1 [Nm]
ø9	M4	2.8	4.1	4.4	6.5
ø10				4.9	7.2
ø11	M5	5.5	8.1	8.7	12.8
ø14				11.1	16.4
ø16				12.7	18.7
ø17				13.5	19.9
ø19	M6	9.5	14	21.5	31.3
ø22	M8	23	34	45.6	66.2
ø24				49.7	72.2
ø28				58.0	84.3
ø30	M10	46	68	99.3	144.5
ø32				106.0	154.1
ø35				115.9	168.6
ø38	M12	-	117	-	269.9

Tab. 1 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection without bushing)

4.10 Motor mounting by means of indirect clamp ring connection (with bushing)



For correct assembly between motor and gearbox, refer to 4.11 Assembly instructions for clamp ring connections. With regard to the required bolt tightening torques for the clamp ring connections, as well as the transmissible torques, the specific dimensional drawings assigned to the respective product must be observed. Tab.2 to Tab.7 refer exclusively to gearboxes according to the standard catalogue version of the DA and ECY series (clamp ring version with bushing). If no dimensional drawing is available for your version or if yours is not a standard version of the DA, D or A series (clamp ring version), the necessary information can be obtained from Sumitomo Drive

Technologies. In any case, the tightening torques for the corresponding bolt size and bolt quality must be applied.

 ATTENTION!	Material damage! Wrong tightening torque! ☒ To tighten, use a torque wrench or a tightening method with lower dispersion (according to VDI 2230). ☒ Use the correct tightening torque according to bolt size and bolt quality (indicated on the end face of the bolt head.)
 DANGER!	Frictional connection! The specifications of the transmissible drive torque of the clamp ring connection must not be exceeded.

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transmissible Torque T1 [Nm]	Bushed
ø9	M12	117	10.9	55	o
ø10				61.5	o
ø11				67.3	o
ø14				84.1	o
ø16				96.8	o
ø17				102.1	o
ø18				107.9	o
ø19				111.7	o
ø22				131	o
ø24				148.2	o
ø28				165.8	o
ø30				177.3	o
ø32				186.1	o
ø35				206.3	o
ø38				269	

Tab. 2 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for DA50 and DA45

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transmissible Torque T1 [Nm]	Bushed
ø9	M10	68	10.9	33.6	o
ø10				35.7	o
ø11				39.7	o
ø14				51.3	o
ø16				59.7	o
ø17				63.6	o
ø18				66.6	o
ø19					o
ø22				83.6	o
ø24				95	o
ø28				107.5	o
ø30				115.5	o
ø32				154	

Tab. 3 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for DA40 and DA35

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transmissible Torque T1 [Nm]	Bushed
ø9	M8	34	10.9	6.3	o
ø10				9	o
ø11				11.3	o
ø14				18.4	o
ø16				23.4	o
ø17				24.9	o
ø18				27.1	o
ø19				28.7	o
ø22				36.2	o
ø24				72.2	

Tab. 4 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for DA25

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transmissible Torque T1 [Nm]	Bushed
ø9	M6	14	10.9	6.1	o
ø10				6.7	o
ø11				11.2	o
ø14				13.6	o
ø16				15	o
ø17				31.3	o
ø19					

Tab. 5 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for DA15

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transmissible Torque T1 [Nm]	Bushed
ø8	M5	8.1	10.9	2.9	o
ø9				3.4	o
ø10				3.7	o
ø11					
ø14				16.4	

Tab. 6 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for DA10, ECY 203 and ECY 205

Motor shaft diameter [mm]	Clamp ring Bolt	Tightening torque [Nm]	Bolt quality	Transferrable torque T1 [Nm]	Bushed
ø8	M6	14	10.9	6.1	o
ø9					
ø10				6.7	o
ø11					
ø14				11.2	o
ø16				13.6	o
ø17				15	o
ø19				31.3	o

Tab. 7 Bolt tightening torque and permissible drive torques for input shafts with direct clamp connections (connection with bushing) for ECY 107

4.11 Assembly instructions for clamp ring connections

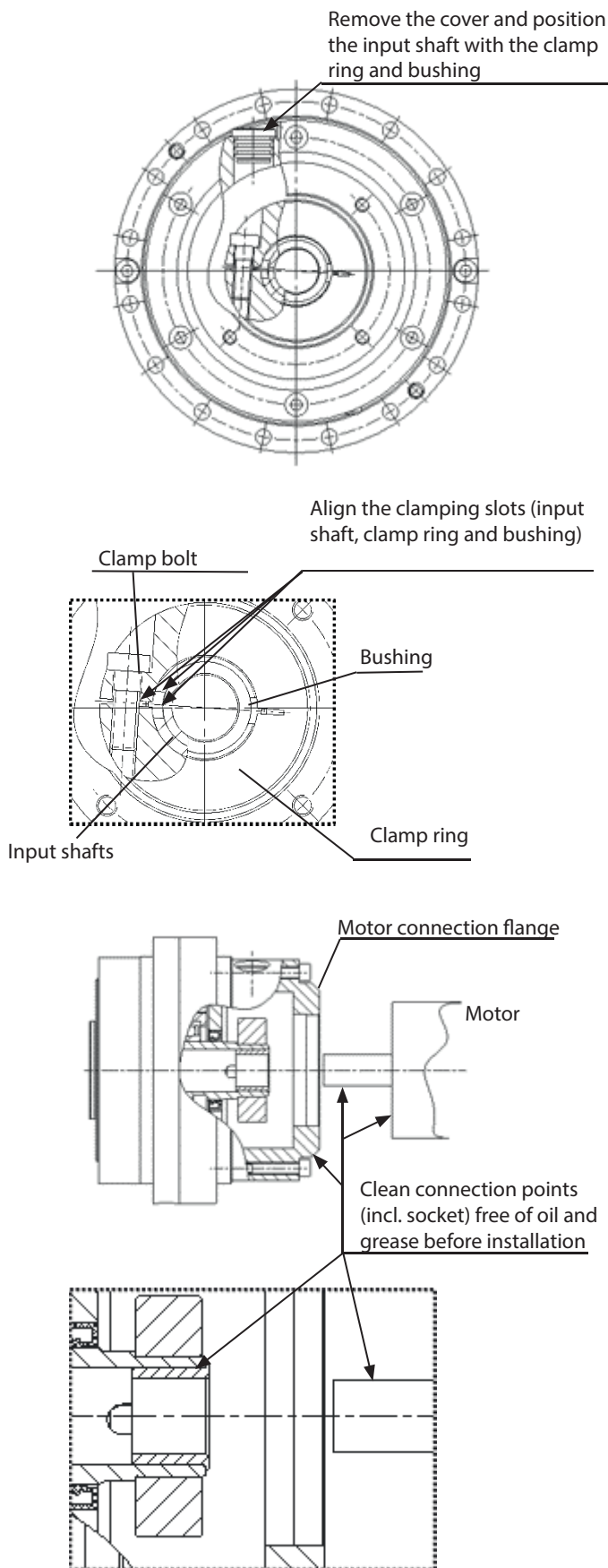


Fig. 2 Motor mounting by means of clamp ring

- ☒ The alignment of the centre axis of the motor (motor shaft) and the gearbox input shaft (gearbox axis) must match (see the chapters on assembly tolerance of the relevant series).
- ☒ In the case of a clamp ring design, the required tightening torques and the transmissible torques under Table 1 to Table 7 or according to the specifications of the dimensional drawing assigned to the specific product must be taken into account.
- ☒ The motor is installed in the order 1-7, as described below. When attaching motors with keys, the key must be removed first.

1. Remove the cover of the mounting opening in the flange.
2. The flat contact surfaces of the motor connection flange and motor, as well as the motor shaft and the clamping bore, must be cleaned until free of oil and grease.
3. Turn the clamp ring in such a way that the fastening bolt is under the mounting opening. Ensure that the slots of the clamp ring, any bushing, if present, and the input shaft are positioned one on top of the other.
4. Insert the motor shaft into the clamping bore.
5. Screw the motor to the motor connection flange.
6. Tighten the fastening bolt of the clamp ring through the mounting opening of the motor connection flange with a torque wrench. For this purpose, the tightening torques according to the information in the dimensional drawing or according to Table 1 to Table 7 must be observed.
7. Insert the cover from the motor connection flange into the mounting opening.

5 Basic information on gearbox lubrication

5.1 Standard lubricant

Specific lubricants are provided as standard for each of the gearbox series described in this instruction (see Tab.8). In principle, these lubricants are suitable for a temperature range from -10°C to +40°C ambient temperature. Only when using the lubricants mentioned in Table 8 are the specifications regarding permissible speed and permissible torque, as described in other technical documentation (catalogue), valid. If other lubricants are used, this information cannot be guaranteed. If the use of non-standard lubricants is required (e.g. in the food industry), consult Sumitomo Drive Technologies.

Gearbox type	Lubricant for gear reduction	Lubricant for main bearing
FC-A	Kyodo Yushi Citrax FA NO. 2	-
F1C-A15 bis A35	Kyodo Yushi Citrax FA NO. 2	
F1C-A45 bis A75	Kyodo Yushi Citrax FA NO. 2	Shell GADUS S2 V220 2
F2C(F)-A	Kyodo Yushi Citrax FA NO. 2	
F3C-A		
F4CF-D	Kyodo Yushi Multemp FZ NO. 00	
F2CF-C		
F4C(F)-C		
F2C(F)-T		
F2CF-UA		
F4CF-UA		
F4C-UA115	Castrol Optigear Synthetic R0 150	
ECY	NIPECCO HGO-3 Nr.00	

Tab. 8 Standard lubricant precision gearbox

5.2 Pre-filling and maintenance

 ATTENTION!	Maintenance work requires experience and expertise and may only be carried out by authorised specialised staff. The lifetime of the gearboxes can be extended by returning them to the factory for overhauling.
	In cases where the ambient temperature is high or subject to significant fluctuations or where the ambient air is contaminated with corrosive gases, consult Sumitomo Drive Technologies or the relevant lubricant manufacturer. Premature "ageing" of the lubricant may occur under such conditions.
	When handling lubricants, the safety regulations for persons and the environment must be observed in accordance with the relevant safety regulations and safety data sheets.

5.2.1 Pre-filling

Unsealed gearboxes, as well as oil lubricated gearboxes, are delivered without lubricant. Observe the instructions assigned to the gearbox in this document or, in the event of special designs, the additional documentation assigned to the specific product (dimensional drawing).

This does not apply to the FC-A series installation kits. These gearboxes are not sealed on the output side, but are filled with lubricant ex-works.

5.2.2 Maintenance with grease lubrication

It is generally recommended to change the gearbox grease after 20,000 operating hours or every 3-5 years regardless of use.

For main bearings (cross roller bearings) of the F1C-A gearboxes in sizes 45G, 65G and 75G, regreasing is required after every 4,000 operating hours, but at least every 6 months. Observe the information in Tab.16.

5.2.3 Maintenance with oil lubrication

The change intervals to be fulfilled depend on the conditions of use. Carry out the relevant maintenance tasks according to the operating conditions in Table 9.

Task	Change intervals	Operating conditions
Fill up with the correct oil volume	For initial commissioning	Under all ambient conditions
Oil change with prescribed quantity of oil	After 2 years	Indoor use, temperatures from -10°C to 40°C
Change the oil and operate the gearbox for a few minutes. When re-commissioning, drain oil and proceed as for initial commissioning.		Preparation for taking the gearbox out of use with a downtime of up to one month.
Flush the gearbox with fresh oil, then completely fill the gearbox with anti-corrosion oil. When re-commissioning, flush the gearbox with the intended oil, then proceed as for initial commissioning.		Preparation for taking the gearbox out of use with a downtime of more than one month.

Tab. 9 Maintenance intervals and tasks with oil lubrication

5.3 Lubricant maintenance for oil lubricated gearboxes with prestage

This section is about gearbox designs for oil lubricated precision gearboxes, which are completely sealed at the factory and whose drive was realised by means of a prestage.

For designs whose sealing is carried out by the customer or where external gearboxes are used as a prestage drive, reference can only be made to the basic procedure described below. In the case of special features caused by customer designs or external gearboxes, the manufacturer's regulations must be observed.

 CAUTION!	Maintenance work requires experience and expertise and may only be carried out by authorised specialised staff. The lifetime of the gearboxes can be extended by returning them to the factory for overhauling.
	Add lubricant when the gearbox is at a standstill. Due to the viscosity of the relevant lubricant and the geometric features in the gearbox interior, it may take a while for the correct lubricant level in the gearbox to be established. However, the prescribed quantity of oil according to the drawing/article number is decisive.



When handling lubricants, the safety regulations for persons and the environment must be observed in accordance with the relevant safety data sheets as per DIN 52 900.

5.3.1 Horizontal or vertical mounting position (output at the bottom)

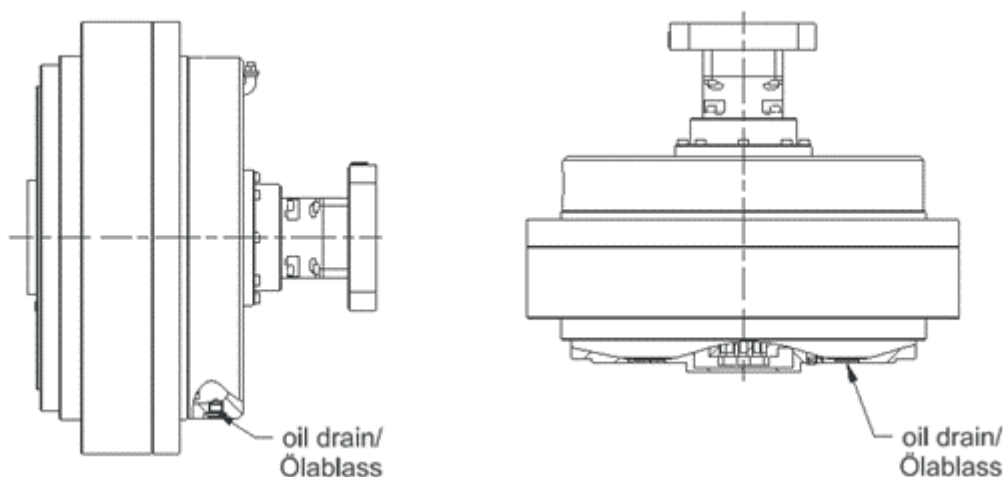


Fig. 3 Oil change horizontal or vertical mounting position (output at the bottom)

- ☒ Open the drain plug(s) and drain the gearbox completely.
- ☒ For support, additional locking bolts on the gearbox should be opened in order to accelerate the draining of the lubricant.
- ☒ Close the drain plug again and refill the gearbox with the required quantity of fresh oil as shown in the drawing.
- ☒ Close and secure all other locking bolts opened for filling.
- ☒ When closing the opened inlet or outlet openings, we recommend securing the relevant closure bolts with Loctite 243.

5.3.2 Vertical mounting position (output at the top)

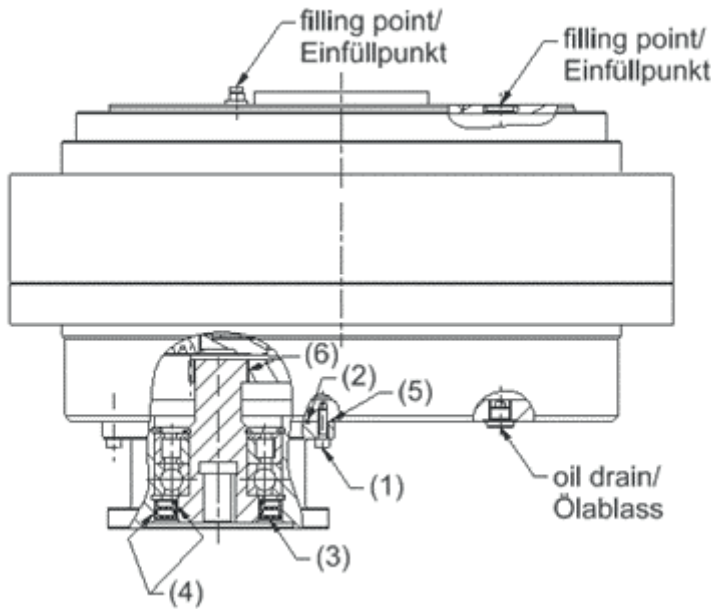


Fig. 4 Oil change vertical mounting position (output at the top)

☒ **Open the drain plug(s) and drain the gearbox completely.**

For support, additional locking bolts on the gearbox should be opened in order to accelerate the draining of the lubricant.

☒ **Remove the prestage attachment.** For this purpose, the bolt connections (1) of the prestage attachment must be loosened.

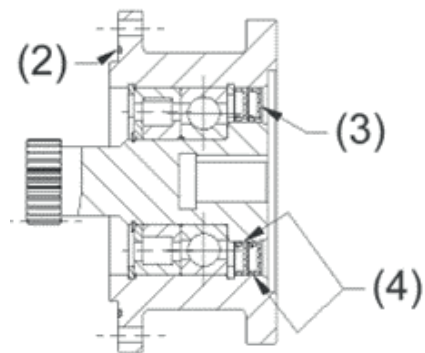
Caution! When removing the prestage attachment, the remaining quantity of used oil in the gearbox will escape.

☒ **Flush the prestage attachment with fresh oil.**

For this purpose, it is recommended to remove the sealing elements of the prestage attachment [(2) and (3)] and to replace them in the event of damage (due to disassembly or wear).

The components or article numbers that may be necessary will vary depending on the gearbox version; inquire with Sumitomo Drive Technologies if necessary.

When replacing such sealing elements, particular care must be taken to ensure that functional surfaces for the sealing elements are not damaged either during disassembly or during assembly [see Example (4)].



☒ **Mounting the prestage attachment.** Start by making sure that the bolt surfaces are clean and that the bolts to be used are in order [(1), (5)], and also that all necessary sealing elements have been installed in a functional and proper manner.

When inserting the prestage attachment, make sure that the gearing is inserted carefully and without resistance (6) into the mating gearing of the gearbox.

Next, the bolt connections of the prestage attachment must be **secured** with Loctite 243 and tightened according to Tab.10 with the required tightening torque using a torque wrench (according to thread size and strength specification on the bolt head).

Size	Quality		
	8.8	10.9	12.9
	Tightening torque Bolt [Nm]	Tightening torque Bolt [Nm]	Tightening torque Bolt [Nm]
M4	2.8	4.1	4.8
M5	5.5	8.1	9.5
M6	9.5	14	16.5
M8	23	34	40
M10	46	68	79
M12	79	117	135
M14	125	185	215
M16	195	280	330

Tab. 10 Tightening torques for prestage attachment

- ☒ **Close the drain bolt connections on the gearbox again** and refill the gearbox with the required quantity of fresh oil in accordance with the drawing.
- ☒ **Close and secure all other locking bolts opened for filling.**
- ☒ When closing the opened inlet or outlet openings, we recommend securing the relevant closure bolts with Loctite 243.

6 Storage

Keep the following important points in mind if you want to store a reduction gearbox for a longer period of time.

- ☒ The maximum storage period is one year.
- ☒ The gearbox must be rotated several times on the input shaft, every 3 months.
- ☒ Requirements for the storage room
 - Closed, vibration-free, moderately ventilated
 - No direct UV radiation
 - Minor temperature fluctuations only, within the limits of +5 to +30 °C
 - Relative humidity <70%

For storage periods of more than one year, contact Sumitomo Corporation of America for special instructions.

7 Checklist for commissioning ATEX approved gearboxes

ATEX = ATmosphères Explosibles



-
- ☐ Does the information on the nameplate of the gearbox correspond to the permissible Ex application on site?

 - ☐ Are the gearbox and components undamaged (check for possible transport or storage damage)?
 - ☐ Does the mounting design correspond to the information on the nameplate?
Please note:
If a design change has been implemented by someone other than Sumitomo Drive Technologies, the ATEX approval expires!
 - ☐ Has the unobstructed supply of cooling air been ensured?
Is no warm exhaust air from other units entering the system?
The cooling air must not exceed a temperature of 40°C.
Are all drive and output elements ATEX-approved?
 - ☒ Where possible, switch on the gearbox without load. If it runs smoothly and without abnormal noises, the gearbox can be used with the working machine.
 - ☒ Measure the surface temperature after approx. 3 hours.
 - ☒ Check the maximum permissible difference value compared with the ambient temperature. If the value exceeds that specified for the relevant type, shut down the drive immediately and consult Sumitomo Drive Technologies.
-

8 Malfunctions

In the event of malfunctions, contact Sumitomo Drive Technologies.

If the gearbox is disassembled and/or individual parts are replaced, the proper functioning of the precision gearbox is no longer guaranteed.

In this case, any warranty claim shall be void.

9 FC-A without output bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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9.1 FC-A installation instructions

The Fine Cyclo gearbox installation kits of the type FC-A are delivered ready for installation, without paint.

Installation kits are delivered without support bearings on the output side. Operation without support bearing on the customer side is not permitted. When installing in the machine to be powered, suitable support bearings with adequate stiffness must be provided.

- ☒ Attach the Fine Cyclo FC-A output shaft flange to your output shaft. The required assembly tolerance must be met in accordance with 9.5.
- ☒ Insert the entire reduction part into the slow speed shaft pin of the output shaft flange. The output shaft flange is connected with the slow-speed shaft rollers of the reduction part via the slow-speed shaft pins. Make sure that none of the slow speed shaft rollers are lost. The ring gear housing should be aligned or centred in the intended mounting position.
- ☒ To attach the motor to the input side flange (see installation example), an adapter is required.
- ☒ For standard installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

 CAUTION!	When attaching the gearbox, pay attention to the correct tightening torque of the bolts (Tab.11).
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9.2 FC-A assembly example

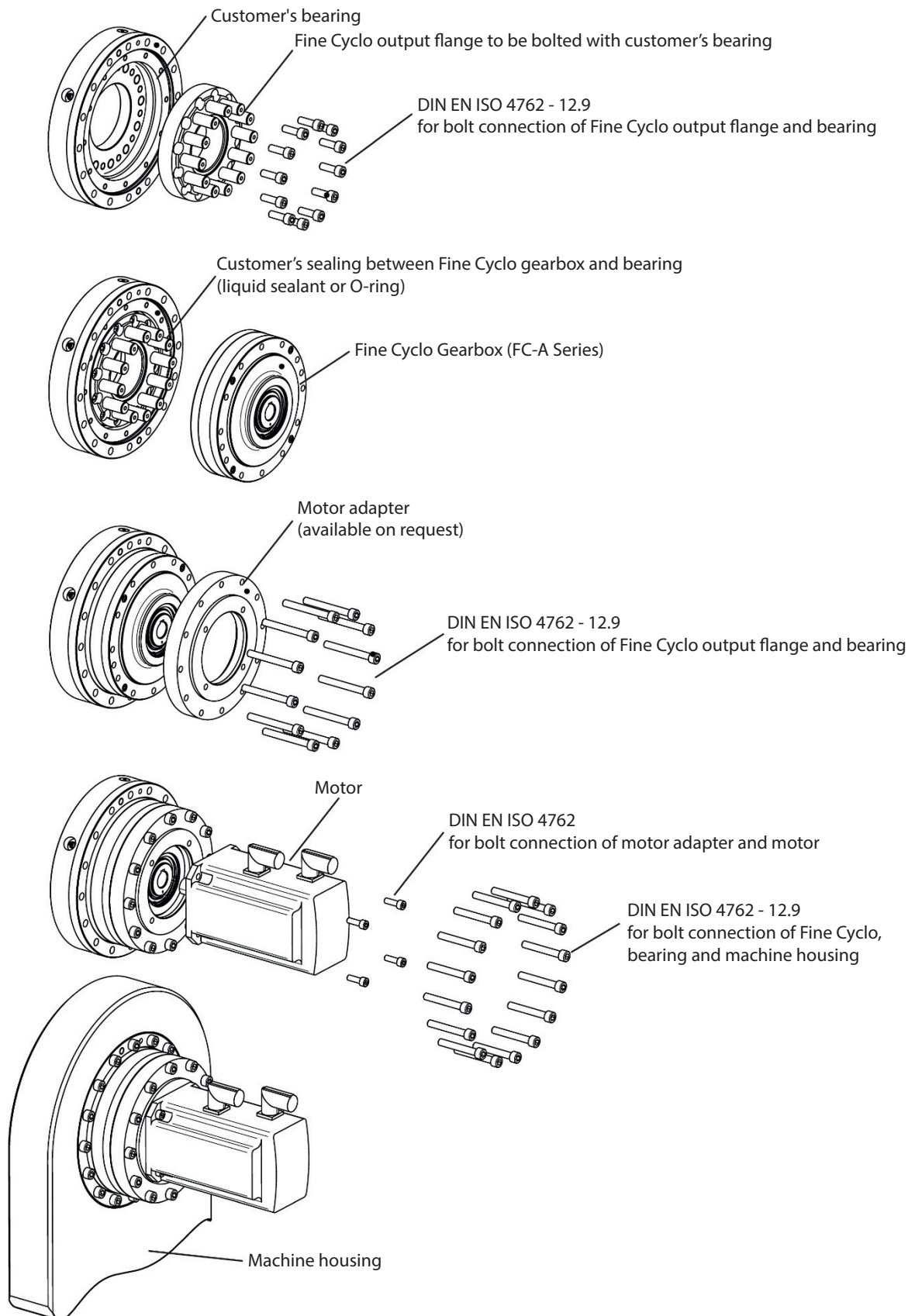


Fig. 5 Assembly example FC-A

9.3 FC-A Bolt tightening torque and allowable torque

The permissible transmissible torque is also limited by bolts. For the number, size and tightening torque of the bolts to fasten the output-side flange and the ring gear housing, refer to Tab.11. Observe the instructions under 4.5.

FC-A	Output side bolts			Ring gear housing bolts			Permissible transmissible torque through bolts [Nm]
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
15G	12	M5	9.2	8	M5	9.2	470
25G	12	M6	16	8	M6	16	830
35G	12	M8	39	8	M8	39	1900
45G	12	M10	77	12	M8	39	3550
65G	12	M12	135	12	M10	77	7000
75G	12	M12	135	12	M10	77	8000

Tab. 11 Fastening FC-A

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762, strength category 12.9.

 WARNING!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
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9.4 FC-A Additional dowel pinning

In cases where higher limit torques (also note 4.5) than in Tab.11 are needed for safety purposes or if the bolt tightening torque cannot be properly maintained, additional dowel pinning is recommended. See Table 12 and Fig. 6. In any case, the values stated in the catalogue apply to the maximum permissible torques of the gearboxes.

FC-A	Output shaft flange				Ring gear housing			
	Number of bolts	Size DIN 4762	Number of cylinder pins	Cylinder pin size [mm]	Number of bolts	Size DIN 4762	Number of cylinder pins	Cylinder pin size [mm]
15G	10	M5	2	6	6	M5	2	6
25G	10	M6	2	8	6	M6	2	8
35G	10	M8	2	10	6	M8	2	10
45G	10	M10	2	12	10	M8	2	10
65G	10	M12	2	16	10	M10	2	14
75G	9	M12	3	16	9	M10	3	16

Tab. 12 Dowel FC-A

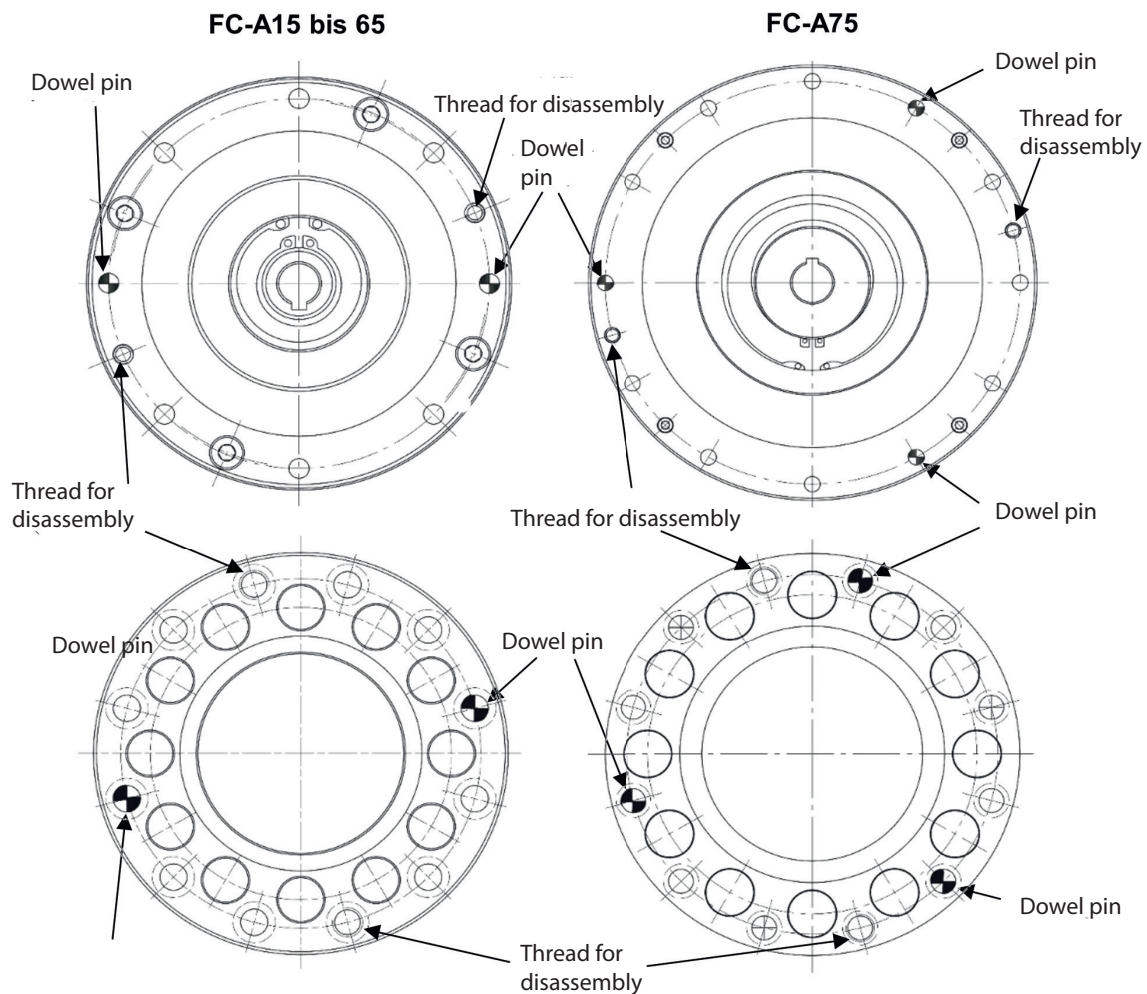


Fig. 6 Additional dowel pinning FC-A

9.5 FC-A assembly tolerance

To make sure that the thrust washer is held by the customer's housing, the inner diameter B must not exceed the specified values. The depth of the centering of the output shaft must be equal to or deeper than the D dimension, in order to prevent jamming of the output flange. Additionally, the E dimension must be observed. The recommended accuracy of the mounting part (housing and output shaft) is within the coaxiality k and the parallelism p.

The recommended diameters of the centering for the housing, output shaft and drive-side flange are shown in the schematic diagram below.

The concentricity of the shaft ends, the coaxiality and the axial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes. The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

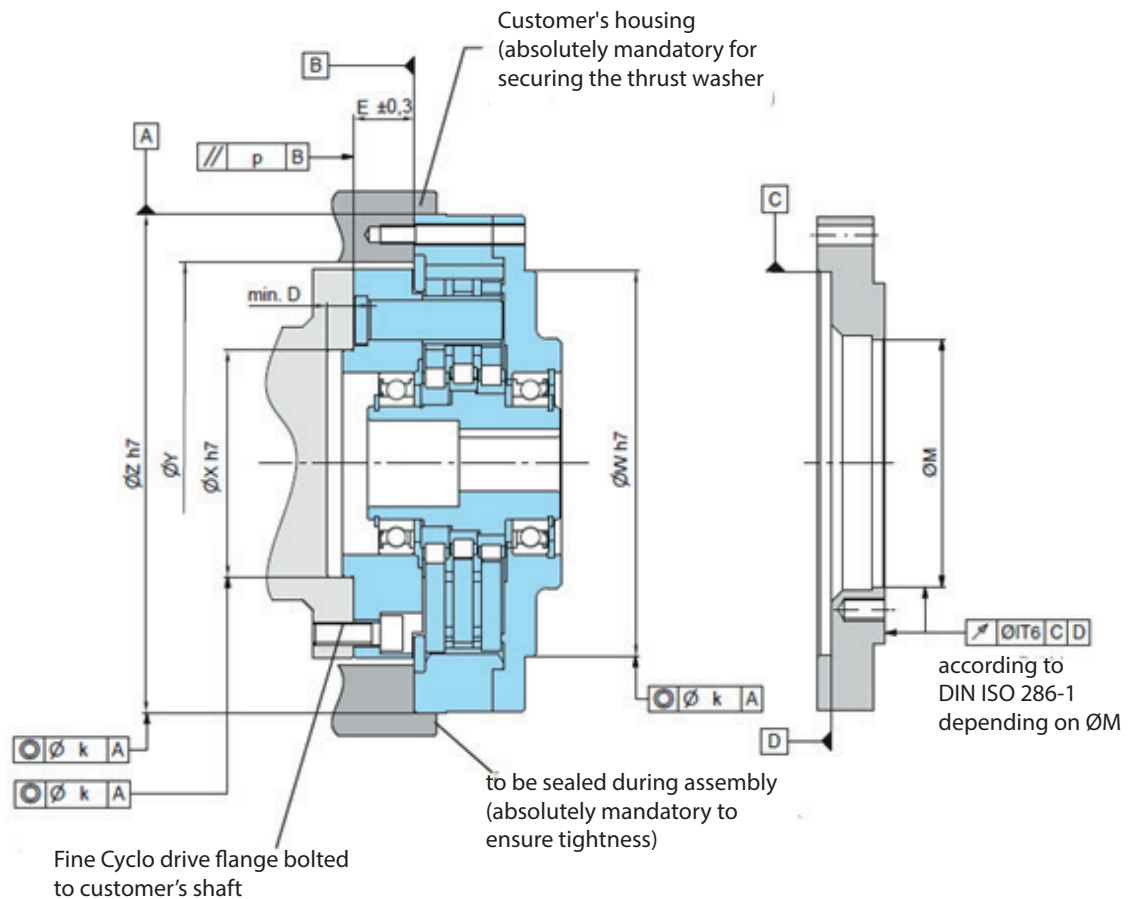


Fig. 7 FC-A assembly tolerances

 ATTENTION!!	Compliance with the specified connection dimensions and tolerances is required for the safe and proper functioning of the installation kits. During this processing, absolute cleanliness must be ensured. The greased transmission part, in particular, must be carefully covered.
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FC-A	Ø X [mm]	Ø Y [mm]	Ø Z [mm]	Ø W [mm]	D [mm]	E [mm]	k [mm]	p [mm]
15G	45	89-90	115	85	5	15.5	0.030	0.025
25G	60	114-115	145	110	6	21	0.030	0.035
35G	80	139-144	180	135	6	24	0.030	0.040
45G	100	174-182	220	170	8	27	0.030	0.050
65G	130	214-226	270	210	8	33	0.030	0.065
75G	150	239-262	310	235	8	38	0.030	0.070

Tab. 13 FC-A assembly tolerances

9.6 FC-A lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Fine Cyclo gearboxes in the FC-A series are filled with lubricant ex works and are suitable for any mounting position.

9.7 FC-A use in the EX area

	The FC-A series gearboxes meet the requirements of Directive 2014/34/EU if the assembly tolerances and regulations for fastening (Tab.11, Tab.12 and Tab.13), as well as the safety measures as described under points 4.6, 4.7 and 7, are observed.
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10 F1C-A with output-side cross roller bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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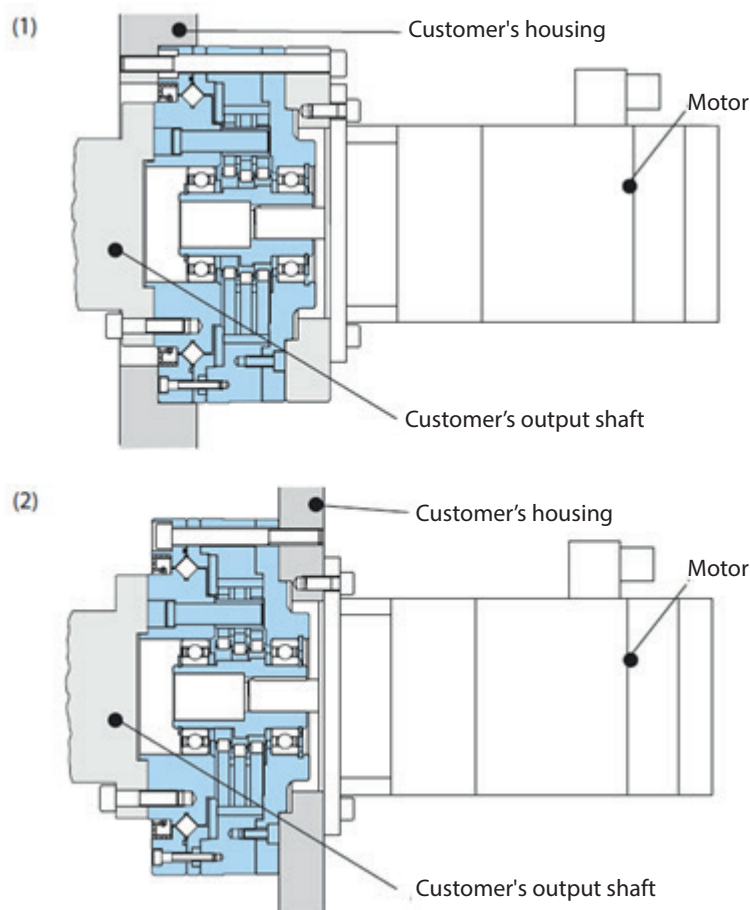
10.1 F1C-A assembly Instructions

Fine Cyclo gearboxes of type F1C-A are delivered ready for installation, unpainted.

- ☒ The output-side flange needs to be attached to the shaft of the machine to be powered.
- ☒ The required assembly tolerances must be met in accordance with 10.4.
- ☒ An adapter is required to attach the motor to the input side flange (see assembly example).
- ☒ For standard installations with hollow shaft and keyway, MoS2 paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

 ATTENTION!!	☒ When attaching the gearbox, pay attention to the correct tightening torque of the bolts (Tab.14). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange.
--	--

10.2 F1C-A assembly example



The motor is connected to the Fine Cyclo F1C-A gearbox via an intermediate flange and bolted together on the customer's housing.

The customer's output shaft is bolted to the output flange of the gearbox.

The engine and the Fine Cyclo F1C-A gearbox are each bolted on the customer side.

The customer's output shaft is bolted to the output flange of the gearbox.

Fig. 8 Assembly examples F1C-A

10.3 F1C-A Bolt tightening torque and permissible torque

The permissible transmissible torque (see Table 14) is also limited by bolts. For the number, size and tightening torque of the bolts to fasten the output-side flange and the ring gear housing, refer to Tab.14. Observe the instructions under 4.5.

F1C-A	Output-side flange bolts			Ring gear housing bolts			Permissible transmissible torque through bolts
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
15	12	M6	16	12	M6	16	750
25	12	M8	39	12	M8	39	1700
35	12	M10	77	12	M10	77	3150
45G	12	M14	210	16	M10	77	3550
65G	16	M16	330	20	M12	135	7000
75G	16	M16	330	20	M12	135	8000

Tab. 14 F1C-A Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread in accordance with DIN 13 Part 13 and DIN EN ISO 4762 strength category 12.9.

 WARNING!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

10.4 F1C-A Assembly tolerances

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes.

The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

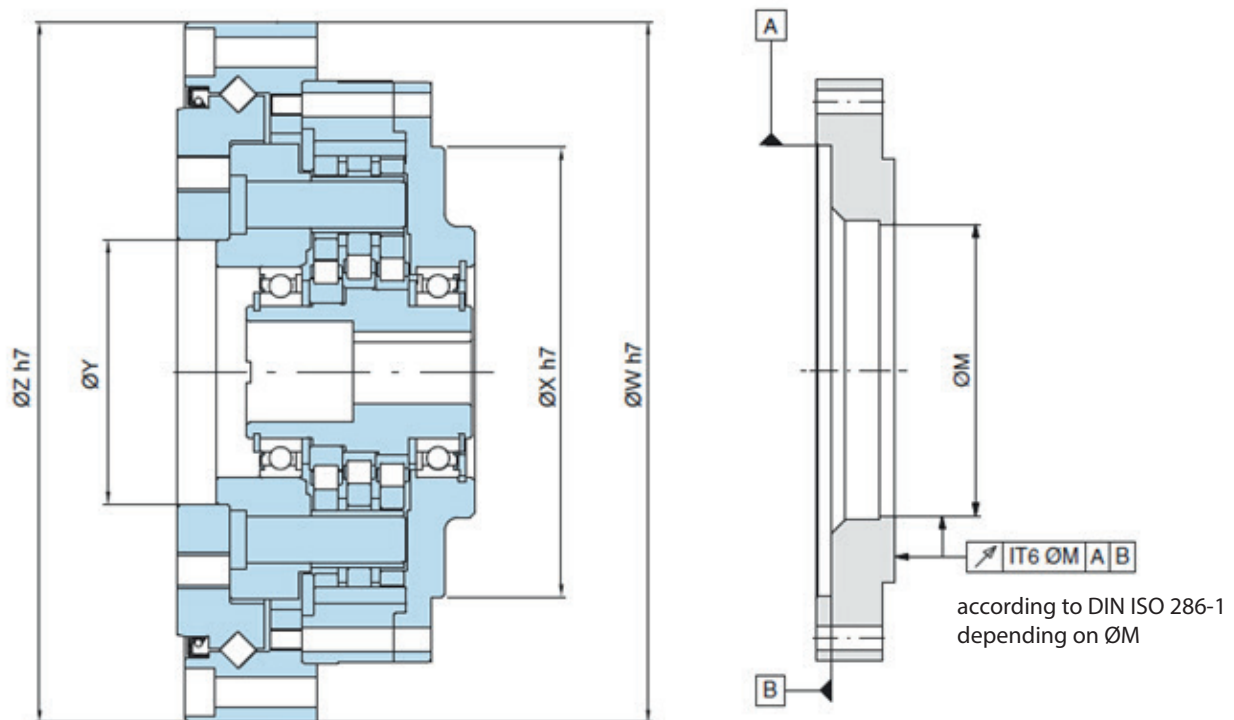


Fig. 9 F1C-A assembly tolerances

F1C-A	Ø X [mm]	Ø Y [mm]	Ø Z [mm]	Ø W [mm]
15	85	45h7	140	
25	110	60h7	170	
35	135	80h7	205	
45G	170	100M7		265
65G	210	130M7		350
75G	235	150M7		430

Tab. 15 F1C-A assembly tolerances

10.5 F1C-A lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Fine Cyclo gearboxes in the F1C-A series are filled with lubricant ex works and are suitable for any mounting position.

The cross roller bearings of the F1C-A gearboxes of sizes 45G, 65G and 75G are also suitable for any mounting position, but will require regreasing after 4,000 operating hours, but at least every 6 months.

Refer to Table 16 for regreasing quantities of the cross roller bearings and grease type.

☒ When regreasing, the bearings must be rotated in order to evenly distribute the fresh grease.

F1C-A	Type of grease	Quantity for initial greasing	Quantity for regreasing	Deadline
45G	SHELL GADUS S2 V220 2	~ 23 g	~ 10–15 g	4,000 h *
65G	SHELL GADUS S2 V220 2	~ 62 g	~ 25–30 g	4,000 h *
75G	SHELL GADUS S2 V220 2	~108 g	~ 45–50 g	4,000 h *

* but at least every 6 months

Tab. 16 Grease quantities/type F1C-A cross roller bearing regreasing

	When handling lubricants and anti-corrosion agents, the safety regulations for persons and the environment must be observed in accordance with the corresponding safety regulations and safety data sheets.
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10.6 F1C-A use in EX area

	The FC-A series gearboxes meet the requirements of Directive 2014/34/EU if the assembly tolerances and regulations for fastening (Tab.11, Tab.12 and Tab.13), as well as the safety measures as described under points 4.6, 4.7 and 7, are observed.
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11 F2C(F)-A with tapered roller bearing

	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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11.1 F2C(F)-A assembly instructions

Fine Cyclo gearboxes of type F2C-(F)A are delivered ready for installation, unpainted.

- ☒ The output-side flange needs to be attached to the shaft of the machine to be powered.
- ☒ The required assembly tolerances must be met in accordance with 11.4.
- ☒ To attach the motor to the ring gear housing (the drive-side flange also rotates at the output speed), an adapter is required – see 11.2.
- ☒ For standard installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

 ATTENTION!!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.17). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange.
--	--

11.2 F2C-A assembly example

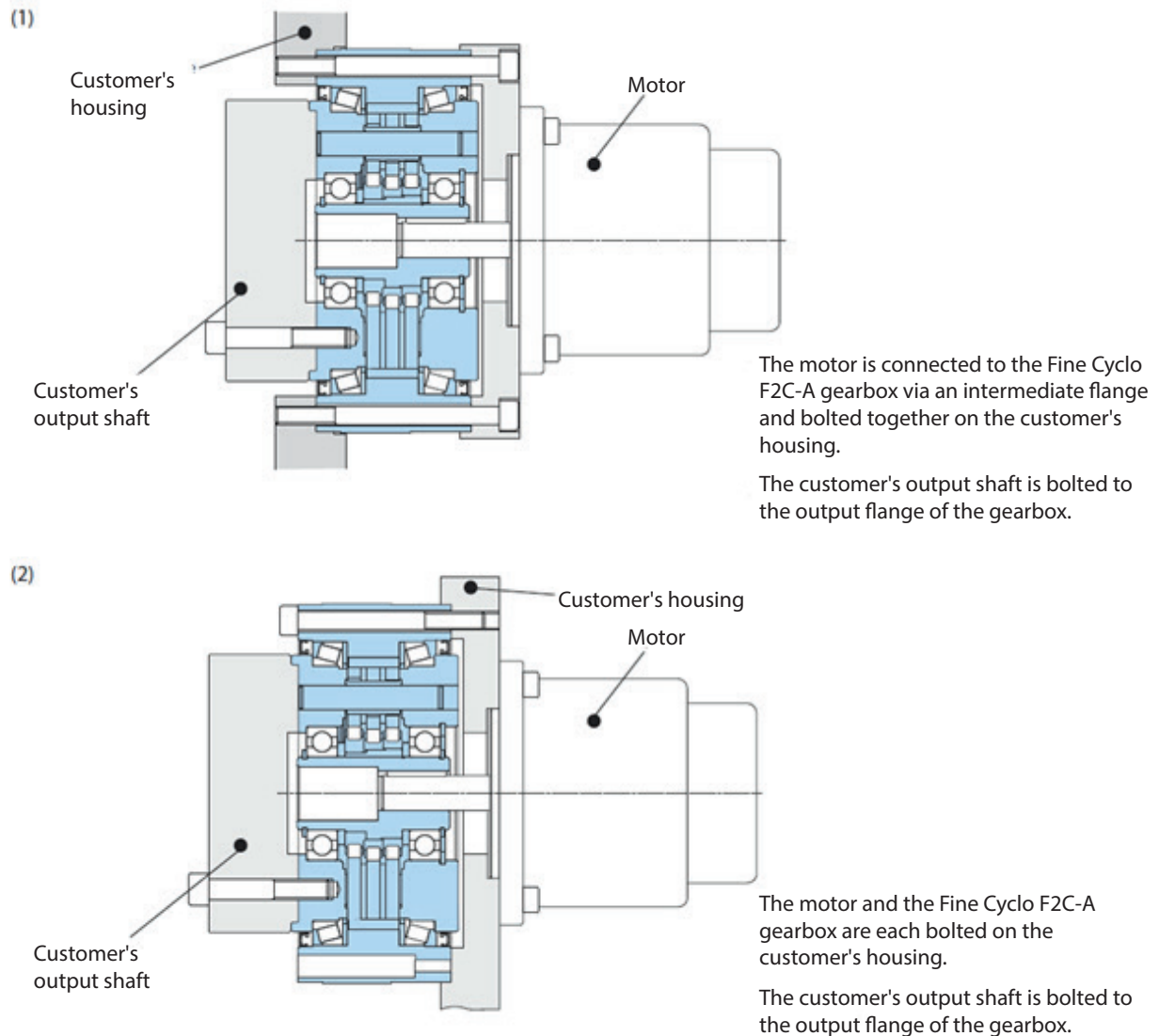


Fig. 10 Installation examples F2C-A

11.3 F2C(F)-A Bolt tightening torque and permissible torques

The permissible transmissible torque (see Table 17) is also limited by bolt connection. For the number, size and tightening torque of the bolts to fasten the output-side flange and the ring gear housing, refer to Tab.17. Observe the instructions under 4.5.

F1C-A	Output-side flange bolts			Ring gear housing bolts			Permissible transmissible torque through bolts
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
15	12	M6	16	16 (8)*	M6	16	700
25	12	M8	39	12 (16)*	M8	39	1500
35	12	M10	77	16	M8	39	3200
45	12	M14	210	12 (16)*	M12 (M10)*	135 (77)*	8200

*Values in brackets only apply to type F2CF-A

Tab. 17 F1C-A Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762, strength category 12.9.

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

11.4 F2C-A assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes.

The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

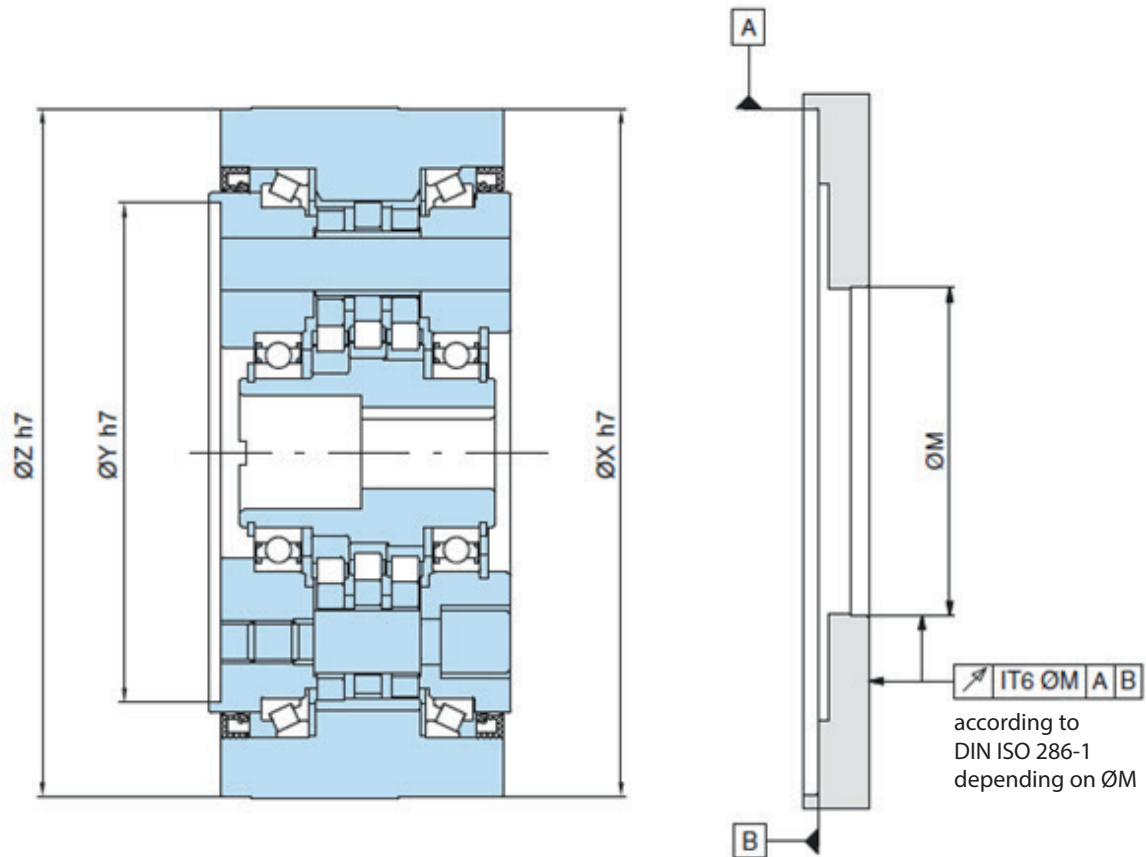


Fig. 11 F2C-A assembly tolerance

	F2C-			F2CF-		
	Ø X [mm]	Ø Y [mm]	Ø Z [mm]	Ø X [mm]	Ø Y [mm]	Ø Z [mm]
15	125	84	125	124	84	123
25	155	106	155	160	106	160
35	185	133	185	190	133	190
45	230	167	230	220	167	220

Tab. 18 Assembly tolerance F2C(F)-A

11.5 F2C(F)-A lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Fine Cyclo gearboxes in the F2C-A series are filled with lubricant ex works and are suitable for any installation position.

11.6 F2C(F)-A Use in EX area

	The F2C(F)-A series gearboxes meet the requirements of Directive 2014/34/EU if the assembly tolerance and regulations for fastening (Tab.17 and Tab.18), as well as the safety measures as described under points 4.6, 4.7, and 7 are observed.
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12 F3C-A with output shaft and tapered roller bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

12.1 F3C-A assembly Instructions

Fine Cyclo gearboxes of type F3C-A are delivered ready for installation.

- ☒ The output-side shaft needs to be attached to the shaft of the machine to be powered.
- ☒ The required assembly tolerances must be met in accordance with 12.5.
- ☒ To attach the motor to the input side flange, an adapter is required.
- ☒ For standard installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.19).
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12.2 F3C-A assembly example

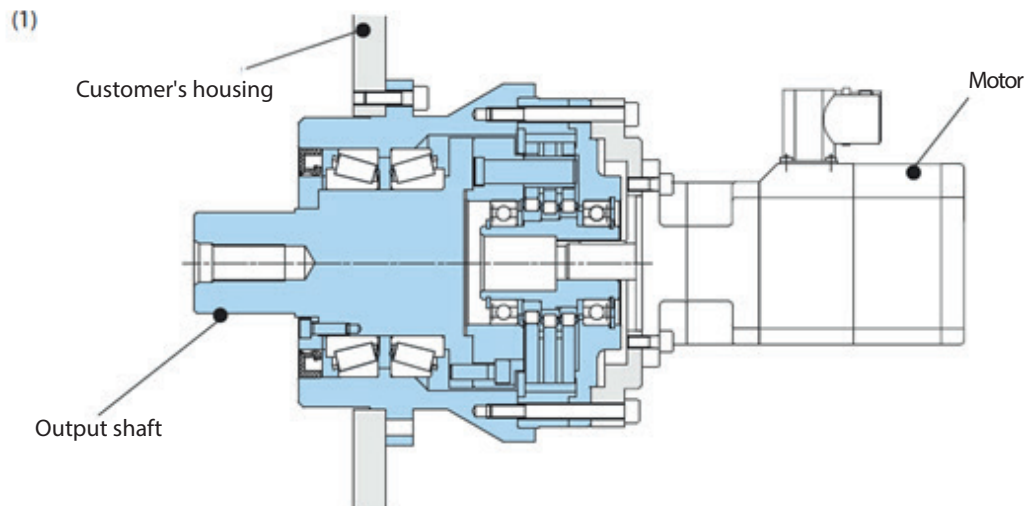


Fig. 12 F3C-A assembly example

12.3 F3C-A paint finish

F3C-A gearboxes are supplied as standard with a two-component polyurethane-based coating according to RAL 9005 (deep black). Other colours are possible in consultation.

12.4 F3C-A Bolt tightening torque and permissible torques

The permissible transmissible torque (see Table 19) is also limited by bolts. For the number, size and tightening torque of the bolts to fasten the output-side flange and the housing, refer to Tab.19. Observe the instructions under 4.5.

F3C-A	Housing bolts			Permissible transmissible torque through bolts [Nm]
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
15G	8	M6	16	550
25G	8	M6	16	1000
35G	8	M8	39	2100
45G	12	M8	39	4000
65G	12	M10	77	7700
75G	12	M10	77	9000

Tab. 19 F3C-A Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762, strength category 12.9.

 WARNING!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
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12.5 F3C-A assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes. The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

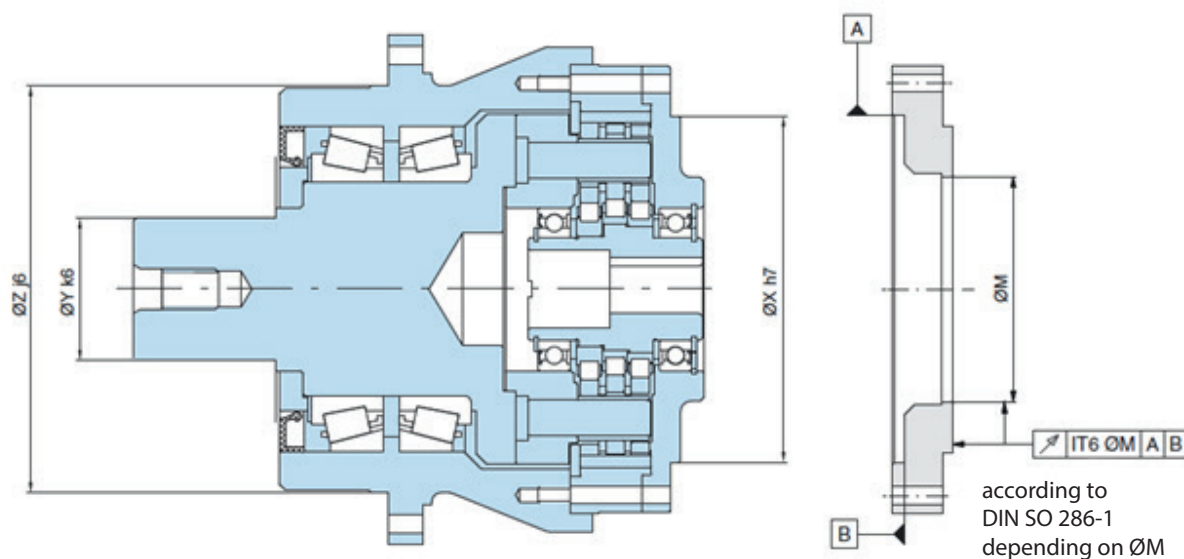


Fig. 13 F3C-A assembly tolerances

F3C-A	Ø X [mm]	Ø Y [mm]	Ø Z [mm]
15G	110	35	85
25G	135	45	110
35G	160	55	135
45G	200	70	170
65G	240	90	210
75G	280	100	235

Tab. 20 F3C-A assembly tolerances

12.6 F3C-A lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Fine Cyclo gearboxes in the F3C-A series are filled with lubricant ex works and are suitable for any mounting position.

12.7 F3C-A use in EX area

	The F3C-A series gearboxes meet the requirements of Directive 2014/34/EU if the assembly tolerance and regulations for fastening (Tab.19 and Tab.20), as well as the safety measures as described under points 4.6, 4.7 and 7 are observed.
--	--

13 F4C(F)-C with integrated angular ball bearing/ F2CF-C with integrated tapered roller bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

13.1 F2/4C(F)-C installation instructions

Fine Cyclo gearboxes of type F2/4C-(F)-C are delivered ready for installation, unpainted.

- ☒ The output-side shaft needs to be attached to the shaft of the machine to be powered.
- ☒ The required assembly tolerances must be met in accordance with 13.4.

 ATTENTION!	☒ When attaching the gearbox, pay attention to the correct tightening torque of the bolts (Tab.21). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange.
--	--

13.2 F2/4C(F)-C assembly example

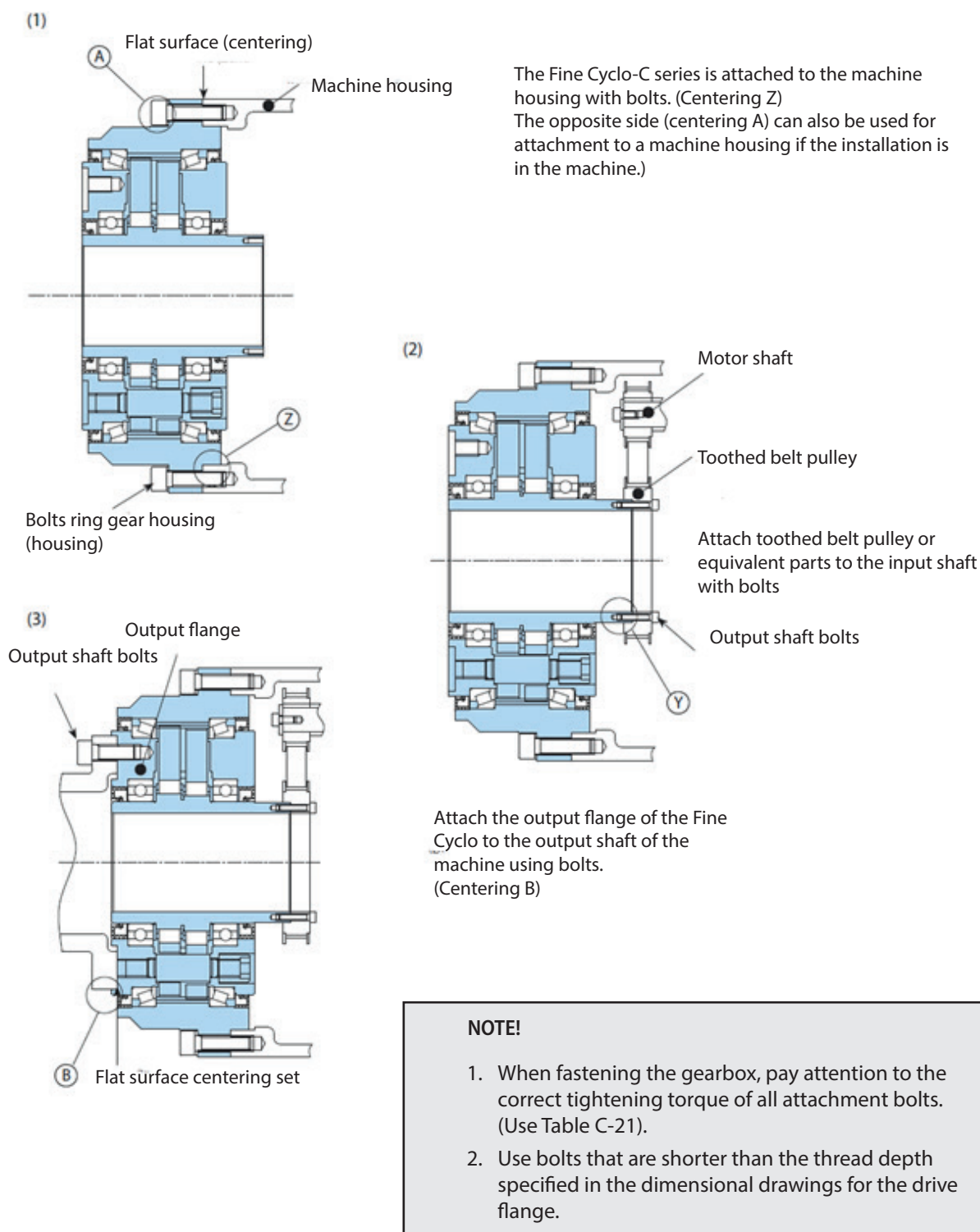


Fig. 14 Fig. 13 F2/4(F)C-C assembly example

13.3 F2/4C(F)-C Bolt tightening torque and permissible torques

The permissible transmissible torque for bolts, the number, size and tightening torque for fastening the output-side flange and the ring gear housing as well as the maximum permissible transmissible torque by bolts is listed in Tab.21. Observe the instructions under 4.5.

F1C-A	Output-side flange bolts			Ring gear housing bolts (housing)			Permissible transmissible torque through bolts
	Number of bolts	Size DIN 4762-10.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-10.9	Tightening torque per bolt [Nm]	
15	16	M6	13.6	12	M6	13.6	1252
25	12	M8	33.4	12	M8	33.4	2080
35	12	M10	65.7	8	M10	65.7	4267
45	12	M12	114	8	M12	114	7191
55	12	M14	181	12	M12	114	10919
65	12	M16	284	16	M12	114	16893

F2/4C(F)-C	Eccentric input shaft			
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Permissible transmissible torque through bolts [Nm]
15	6	M3	2.1	40
25	6	M3	2.1	45
35	6	M4	4.9	120
45	6	M4	4.9	140
55	8	M5	9.8	380
65	12	M5	9.8	600

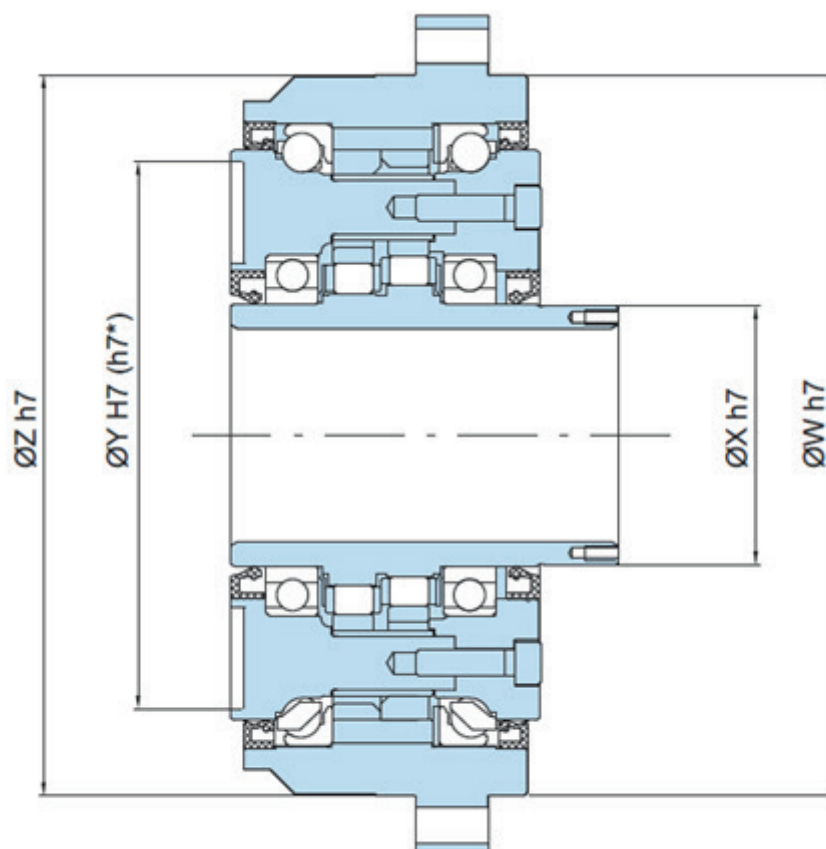
Tab. 21 F2/4C(F)-C Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762 strength category according to the table.

 WARNING!	The permitted transmissible torques of the gearboxes ($T_{2\max}$ and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
--	---

13.4 F2/4CF-C assembly tolerance

Fits for installation of the drive and output parts (toothed belt, pulley, gear, etc.) are shown schematically in the following figure. Use the diameters and tolerances in the table below.



* valid for size C15

Fig. 15 F2/4C(F)-C assembly tolerances

F2/4C(F)-C	Ø W [mm]	Ø X [mm]	Ø Y [mm]	Ø Z [mm]
15	137	49.5	71h7	137
25	185	59	133H7	185
35	220	79	167H7	220
45	250	94	192H7	250
55	284	109	218H7	284
65	320	119	245H7	320

Tab. 22 F2/4C(F)-C assembly tolerances

13.5 F2/4C(F)-C lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication.
Fine Cyclo gearboxes in the C series are filled with lubricant ex works and are suitable for any mounting position.

14 F4CF-D with integrated angular ball bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

14.1 F4CF-D assembly Instructions

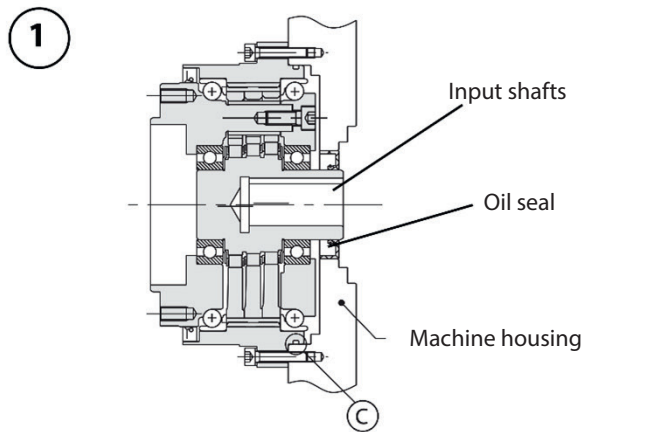
The gearboxes are delivered unpainted.

Fittings for the installation of drive parts (motor adapter plate or machine housing) are shown in Table 27.

- ☒ For installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

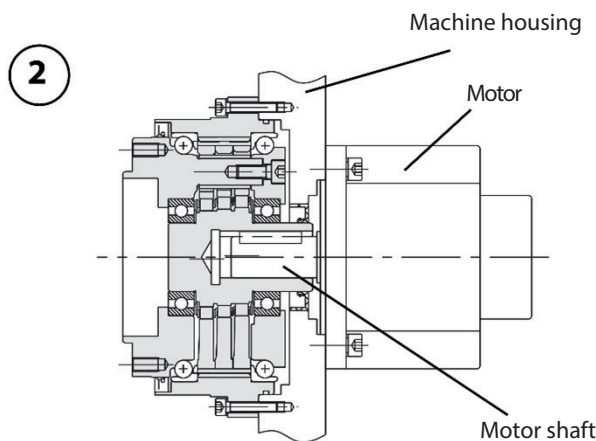
 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.26) ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange. ☒ Recommended liquid seal: Three Bond 1215 by Three Bond Co., Ltd
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14.2 F4CF-D assembly example

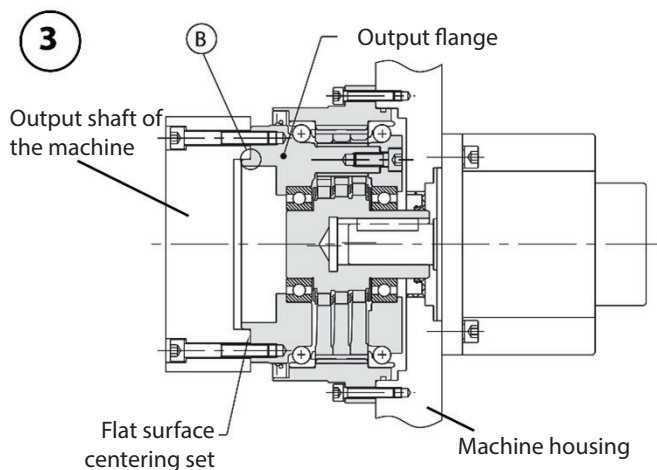


Assembly example 1

- ☒ The D-series gearbox must be attached to the machine housing with bolts according to Table 26 (centering C).
- ☒ In this example, the motor adapter is part of the machine housing. Be mindful of this!

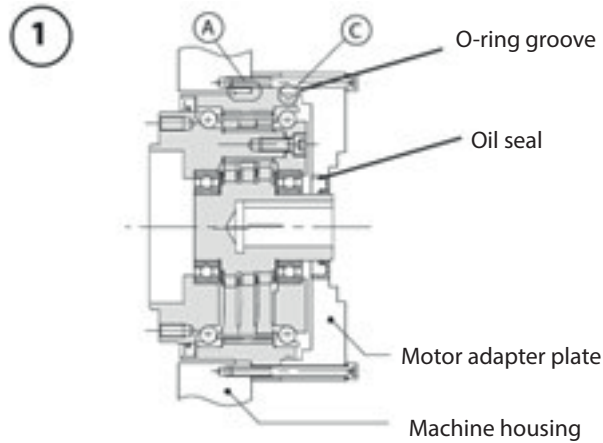


- ☒ The alignment of the centre axis of the motor (motor shaft) and the gearbox input shaft (gearbox axis) must match.
- ☒ Fasten the motor to the motor plate with bolts.
- ☒ Apply corrosion protection to the motor shaft before assembly to prevent fretting rust!



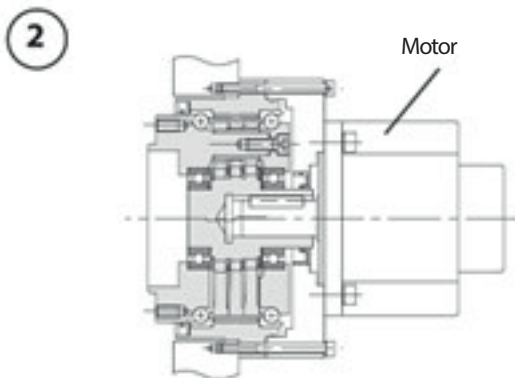
- ☒ Attach the output flange of the Fine Cyclo gearbox to the output shaft of the machine using bolts (centering B).
- ☒ Please note! If the Fine Cyclo gearbox is not sealed on the output side by default, liquid seal must be used on the flat surface of the output flange.
- ☒ Liquid sealing material, washers for bolts and fastening bolts must be provided and installed by the customer.

Fig. 16 F4CF-D assembly example 1

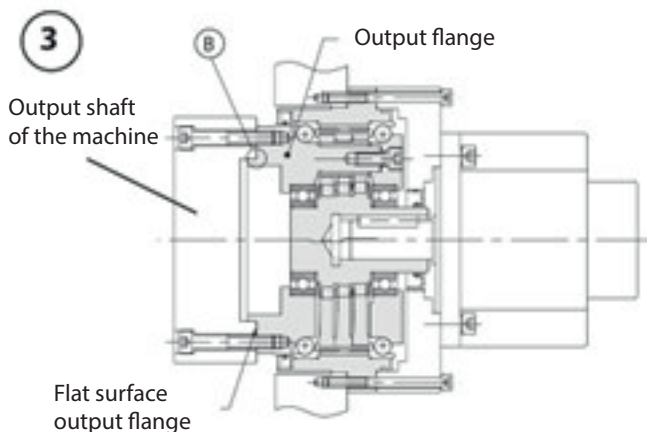


Assembly example 2

- ☒ The D-series gearbox must be attached to the machine housing with bolts according to Table 26 (centering A). When fastening the motor adapter plate, it must be bolted to the gearbox.
- ☒ The gearbox must be sealed between the motor adapter plate and the input shaft using the oil seal and O-ring at centering C. The oil seal is not included in our standard scope of delivery if delivered without motor adapter (assembly example 2).



- ☒ The alignment of the centre axis of the motor (motor shaft) and the gearbox input shaft (gearbox axis) must match.
- ☒ Fasten the motor to the motor plate with bolts.
- ☒ Apply corrosion protection to the motor shaft before assembly to prevent fretting rust!



- ☒ Attach the output flange of the Fine Cyclo gearbox to the output shaft of the machine using bolts (centering B).
- ☒ Please note! If the Fine Cyclo gearbox is not sealed on the output side by default, liquid seal must be used on the flat surface of the output flange.
- ☒ Liquid sealing material, washers for bolts and fastening bolts must be provided and installed by the customer.

Fig. 17 F4CF-D assembly example 2

14.3 F4CF-D Bolt tightening torque and permissible torques

The permissible transmissible torque for bolts, the number, size and tightening torque for fastening the output-side flange and the fixed ring as well as the maximum permissible transmissible torque by bolts is listed in Tab.26. Observe the instructions under 4.5.

F1C-A	Output-side flange bolts			Ring gear housing bolts (housing)			Permissible transmissible torque through bolts
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
15	12	M8	38.3	12	M6	15.7	1478
25	12	M8	38.3	16	M6	15.7	2065
30	16	M8	38.3	16	M8	15.7	2786
35	12	M10	76.5	16	M8	38.3	3962
45	16	M12	133	16	M10	76.5	9347

Tab. 23 F4CF-D Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762 strength category 12.9.

 WARNING!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

14.4 F4CF-D assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes. The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

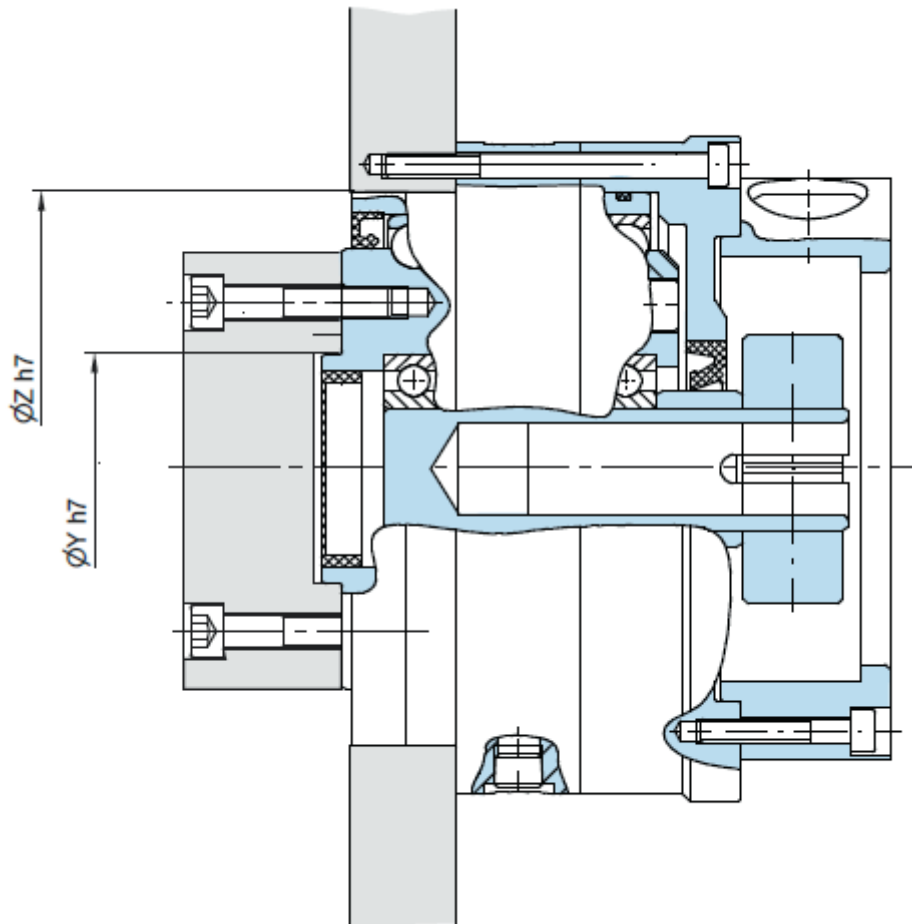


Fig. 18 F4CF-D assembly tolerances

F4CF-D	Ø Z [mm]	Ø Y [mm]
15	124	47
25	145	113
30	163	100
35	174	75
45	220	100

Tab. 24 F4CF-D assembly tolerances

14.5 F4CF-D lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Unsealed gearboxes are delivered without grease filling. Gearboxes of this type must first be filled with grease (Kyodo Yushi Multemp FZ No.00) and sealed in accordance with Table 28 or the dimensional drawing associated with the specific product (see Fig. 23 for filling port).

F4CF-D	Amount of lubricant [g]			Distance to grease filling port A [mm]
	Vertical 1	Vertical 2	Horizontal	
D15	55	40	50	20
D25	100	45	95	26
D30	220	85	200	29
D35	190	150	160	34
D45	320	260	270	39

Tab. 25 Grease quantities F4CF-D (if delivered without grease filling)

The cavity between the gearbox and the adjacent structure must also be taken into account

Horizontal: 50%

Vertical 1: 0 %

Vertical 2: 100 %

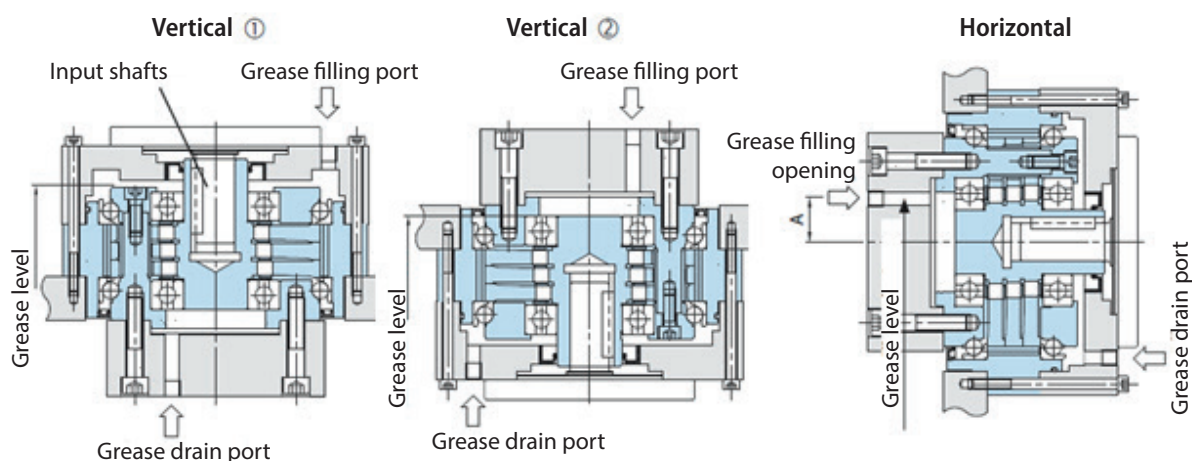


Fig. 19 Grease filling F4CF-D

15 F4CF-DA with integrated angular ball bearing

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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15.1 F4CF-DA assembly Instructions

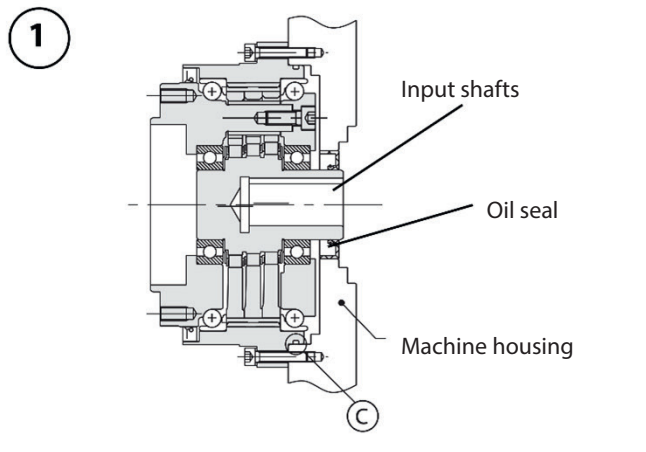
The gearboxes are delivered unpainted.

Fittings for the installation of drive parts (motor adapter plate or machine housing) are shown in Table 27.

- ☒ For installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

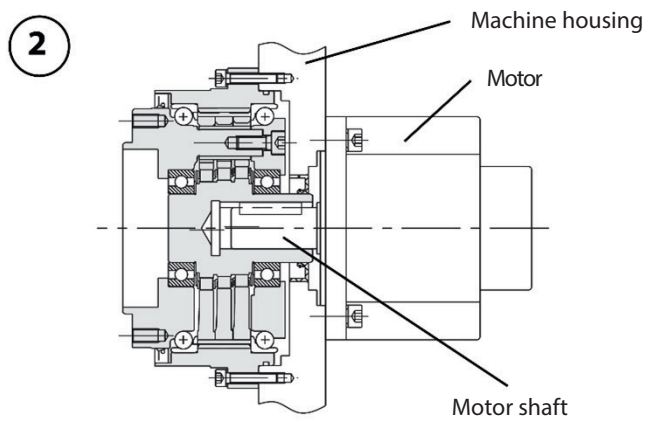
 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.26). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange. ☒ Recommended liquid seal: Three Bond 1215 by Three Bond Co., Ltd.
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15.2 F4CF-DA assembly example

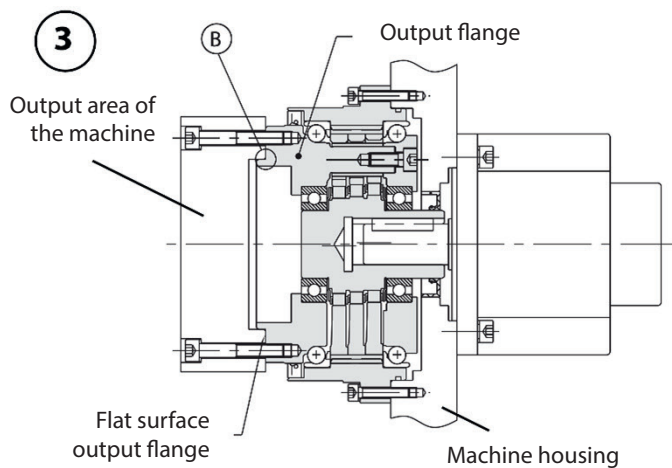


Assembly example 1

- ☒ The DA-series gearbox must be attached to the machine housing with bolts according to Table 26 (centering C).
- ☒ In this example, the motor adapter is part of the machine housing. Be mindful of this!

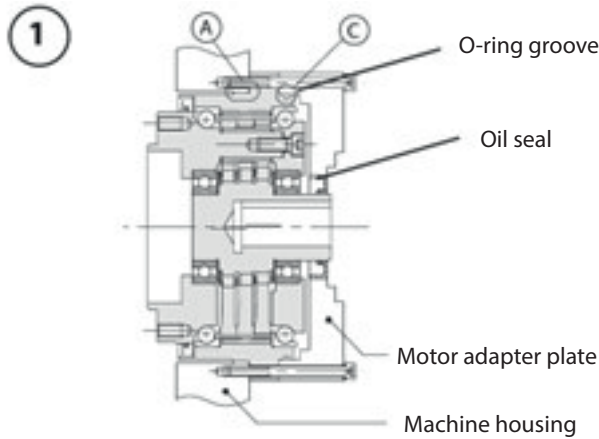


- ☒ The alignment of the centre axis of the motor (motor shaft) and the gearbox input shaft (gearbox axis) must match.
- ☒ Fasten the motor to the motor plate with bolts.
- ☒ Apply corrosion protection to the motor shaft before assembly to prevent fretting rust!



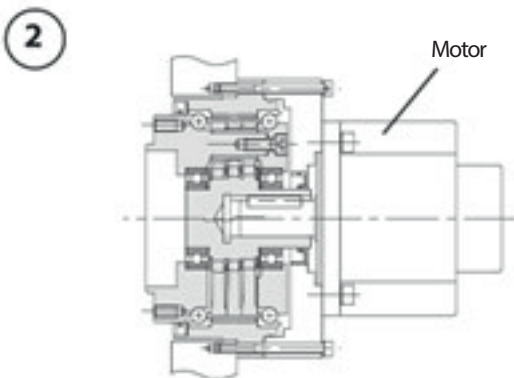
- ☒ Fasten the output flange of the Fine Cyclo gearbox to the output shaft of the machine using bolts (centering B).
- ☒ Please note! If the Fine Cyclo gearbox is not sealed on the output side by default, liquid seal must be used on the flat surface of the output flange.
- ☒ Liquid sealing material, washers for bolts and fastening bolts must be provided and installed by the customer.

Fig. 20 F4CF-DA assembly example 1

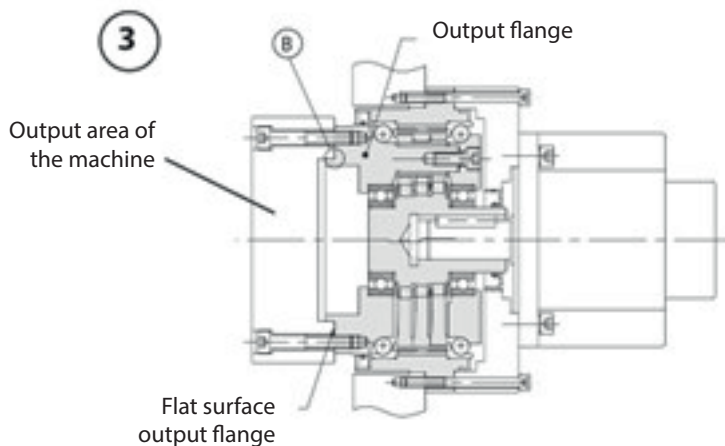


Assembly example 2

- ☒ The DA-series gearbox must be attached to the machine housing with bolts according to Table 26 (centering A). When fastening the motor adapter plate, it must be bolted to the gearbox.
- ☒ The gearbox must be sealed between the motor adapter plate and the input shaft using the oil seal and O-ring at centering C. The oil sealing ring is not included in our standard scope of delivery if delivered without motor adapter (assembly example 2).



- ☒ The alignment of the centre axis of the motor (motor shaft) and the gearbox input shaft (gearbox axis) must match.
- ☒ Fasten the motor to the motor plate with bolts.
- ☒ Apply corrosion protection to the motor shaft before assembly to prevent fretting rust!



- ☒ Attach the output flange of the Fine Cyclo gearbox to the output shaft of the machine using bolts (centering B).
- ☒ Please note! If the Fine Cyclo gearbox is not sealed on the output side by default, liquid seal must be used on the flat surface of the output flange.
- ☒ Liquid sealing material, washers for bolts and fastening bolts must be provided and installed by the customer.

Fig. 21 F4CF-DA assembly example 2

15.3 F4CF-DA Bolt tightening torque and permissible torques

The permissible transmissible torque for bolts, the number, size and tightening torque for fastening the output-side flange and the fixed ring as well as the maximum permissible transmissible torque by bolts is listed in Tab.26. Observe the instructions under 4.5.

F4CF-DA	Output-side flange bolts			Ring gear housing bolts			Permissible transmissible torque through bolts
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
10	12	M6	15.7	16	M4	4.6	709
15	12	M8	38.3	16	M5	9.1	1389
25	18	M8	38.3	16	M6	15.7	2356
35	16	M10	76.5	16	M8	38.3	5073
40	16	M10	76.5	18	M8	38.3	6000
45	18	M12	133	16	M10	76.5	9371
50	18	M12	133	16	M10	76.5	10106

Tab. 26 F4CF-DA Bolt tightening torque and permissible torque

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762 strength category 12.9.



WARNING!

The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!

15.4 F4CF-DA assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes. The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

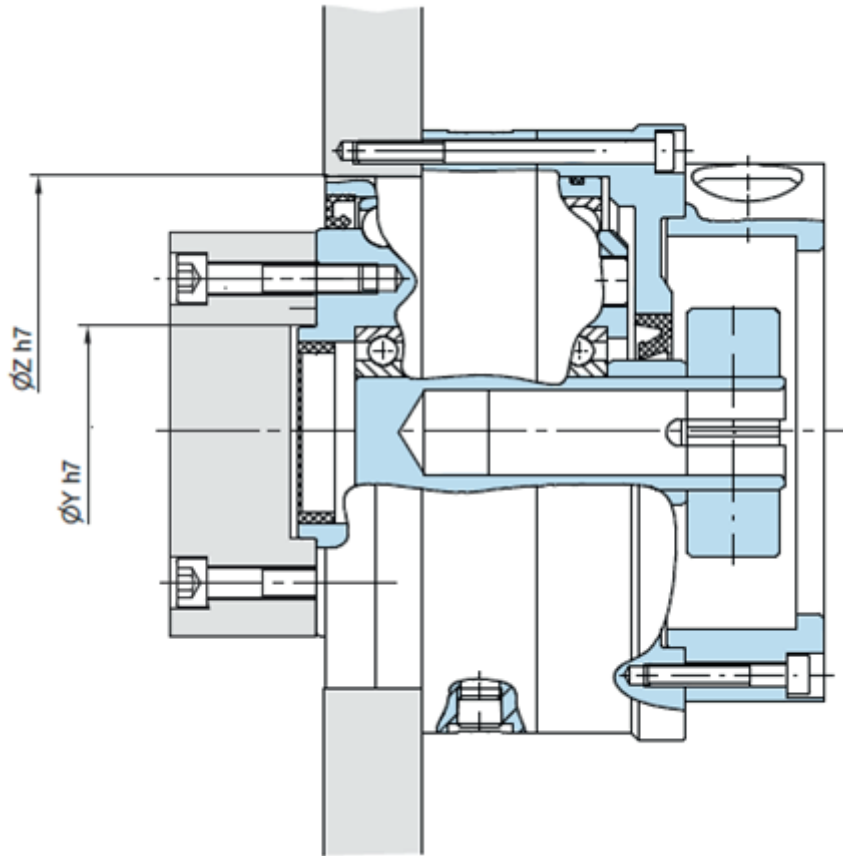


Fig. 22 F4CF-DA assembly tolerances

F4CF-DA	Ø Z [mm]	Ø Y [mm]
10	94	44
15	113	47
25	136	65
35	160	80
40	170	75
45	186	90
50	202	100

Tab. 27 F4CF-DA assembly tolerances

15.5 F4CF-DA lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Unsealed gearboxes are delivered without grease filling. Gearboxes of this type must first be filled with grease (Kyodo Yushi Multemp FZ No.00) and sealed in accordance with Table 28 or the dimensional drawing associated with the specific product (see Fig. 23 for filling port).

F4CF-DA	Amount of lubricant [g]			Distance to grease filling port A [mm]
	Vertical 1	Vertical 2	Horizontal	
DA10	35	35	35	15
DA15	52	52	39	20
DA25	113	113	91	27
DA35	196	196	161	34
DA40	204	204	170	36
DA45	222	222	178	39
DA50	305	305	252	43

Tab. 28 Grease quantities F4CF-DA (if delivered without grease filling)

The cavity between the gearbox and the adjacent structure must also be taken into account

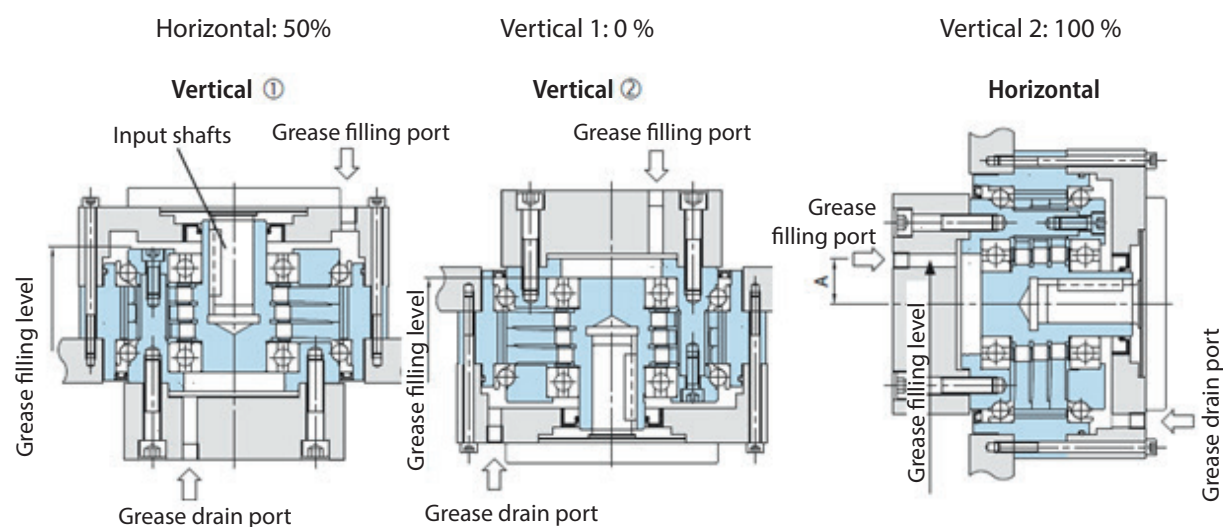


Fig. 23 Grease filling F4CF-DA

16 F2C(F)-T with tapered roller bearing and spur gear prestage

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
--	--

16.1 F2C(F)-T assembly instructions

The gearboxes are delivered unpainted.

- ☒ The output-side flange needs to be attached to the shaft of the machine to be powered.
- ☒ To attach the motor to the input side flange, an adapter is required.
An oil seal must be provided in this adapter.
- ☒ For standard installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free.
See also the assembly instructions under 4.9 and 4.11.

 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.29) ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange. ☒ The input shaft of the gearbox is not mounted in the gearbox in the standard version. ☒ The correct immersion depth of the gearing (shaft distance to the output) must be observed according to the Fine Cyclo catalogue (see dimension sheets).
---	--

16.2 F2C(F)-T assembly example

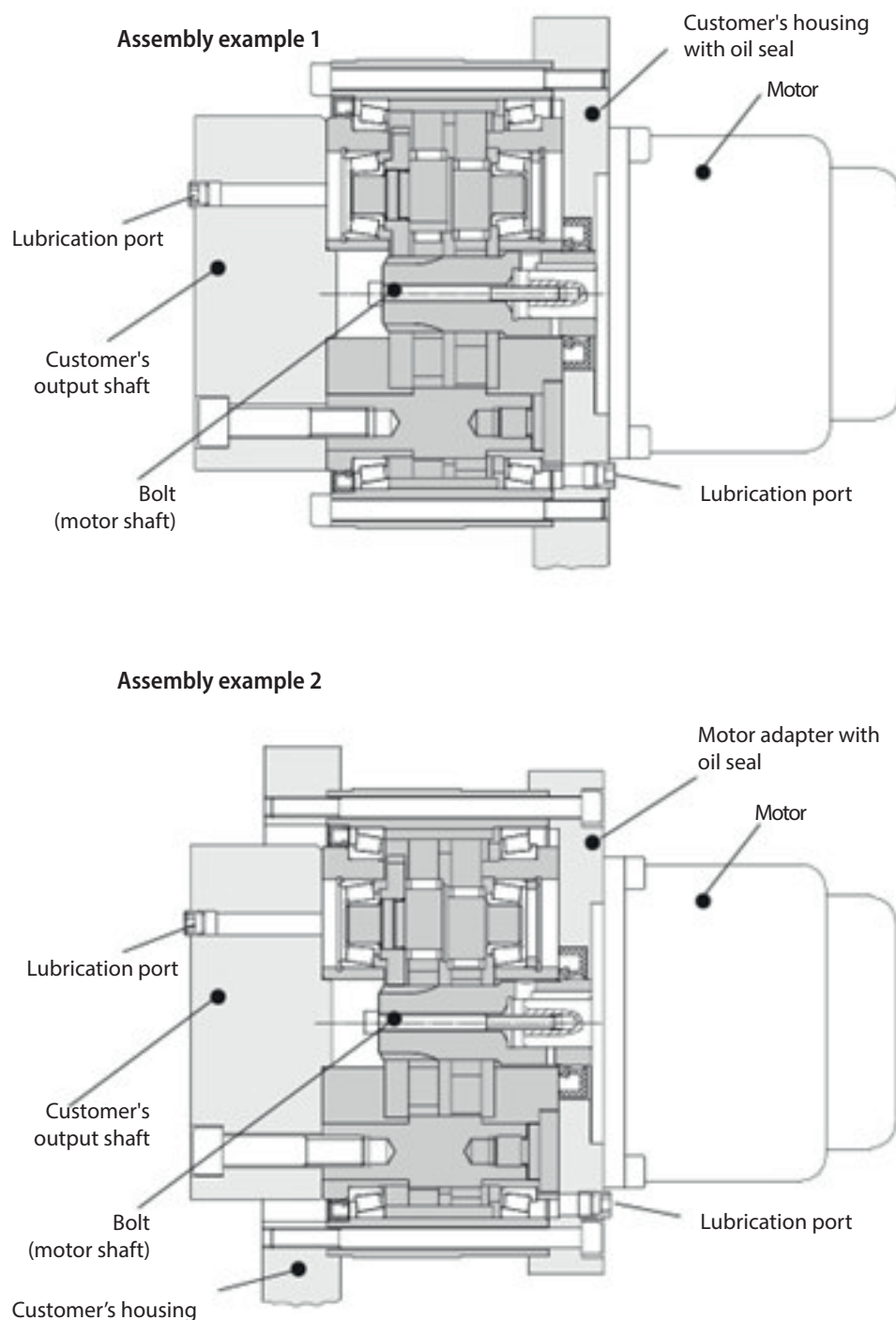


Fig. 24 Assembly examples F2C-T

16.3 Seal F2C(F)-T fits

- ☒ Liquid sealing material must be applied between all the fits of the gearbox with the customer applications.
- ☒ Liquid sealing material and washers for bolts must be provided and installed by the customer.
Recommended liquid seal: Three Bond 1215 by Three Bond Co., Ltd.

16.4 F2C(F)-T Bolt tightening torque and permitted torques

For assembly, all customer bolts must be tightened with the correct tightening torque according to Tab.29. Observe the instructions under 4.5.

F2C(F)-T	Output-side flange bolts					Ring gear housing bolts		Permissible transmissible torque [Nm]
	Number of bolts **	Size DIN 4762-10.9	Pitch circle Ø [mm]	Tightening torque per bolt [Nm]	Number of bolts**	Size DIN 4762-10.9	Tightening torque per bolt [Nm]	
155	6	M6	45	14	16	M6	14	970
	3*	M8	66	33				
	6	M8	72	33				
255	6	M12	84	115	12 (16)**	M8	33	2150 (2160)**
	3*	M8	82	33				
	6	M8	50	33				
355	6	M14	104	180	16	M8	33	3450 (4150)**
	3*	M12	102	115				
	6	M12	63	115				
455	6	M16	135	280	12 (16)**	M12 (M10)**	115 (66)**	7250
	3*	M12	129	115				
	6	M12	93	115				
555	6	M18	165	390	16	M12	115	11200
	3*	M14	150	180				
	6	M14	115	180				
655	6	M22	180	750	16	M14 (M12)**	180 (115)**	180 (115)**
	3*	M16	170	280				
	6	M16	115	280				
755	6	M24	200	950	16 (24)**	M16 (M12)**	280 (115)**	24000
	3*	M18	190	390				
	6	M18	130	390				

* For safe operation of the gearbox and to maintain the warranty, these bolts must be used

** Bracket values only apply to type F2CF-T

Tab. 29 Bolt tightening torque and permitted torques F2C(F)-T

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762, strength category 10.9.

 WARNING!	The permitted transmissible torques of the gearboxes ($T_{2_{max}}$ and T_{2_A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
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16.5 F2C(F)-T assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening surface according to EN 50347:2001 are sufficient to maintain the function, lifetime and characteristics of the gearboxes. The tolerance according to EN 50347:2001 should be reduced by 50% if used in high-precision applications.

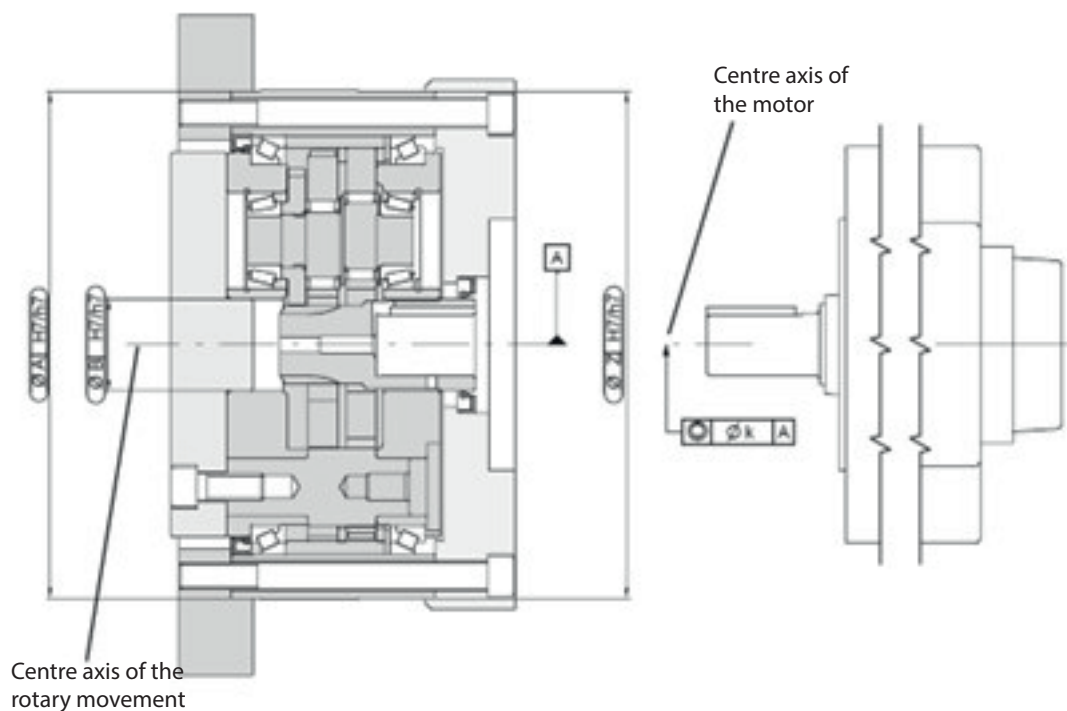


Fig. 25 Assembly tolerances F2C(F)-T

F2C(F)-T	Ø A [mm]	Ø B [mm]	Ø Z [mm]	Ø k [mm]
155	125	23.5	125	0.03
255	155	28	155	0.03
355	185	35	185	0.03
455	230	42	230	0.03
555	160	47	260	0.05
655	295	58	295	0.05
755	330	62	330	0.05

Tab. 30 Assembly tolerances F2C(F)-T

16.6 F2C(F)-T lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. Unsealed gearboxes are delivered without grease filling.

Gearboxes of this type must first be filled with grease (Kyodo Yushi Multemp FZ No.00) and sealed in accordance with Table 31 or the dimensional drawing associated with the specific product (see Fig. 26 for filling port).

F2C(F)-T	Quantity of grease [g] *		
	vertical	horizontal	A [mm]
155	80	60	25
255	120	100	31
355	230	180	39
455	300	240	47
555	400	320	55
655	700	560	63
755	800	640	73

* The quantity of grease refers to the gearbox

Tab. 31 Grease quantities F2C(F)-T

The cavity between the gearbox and the adjacent structure must also be taken into account

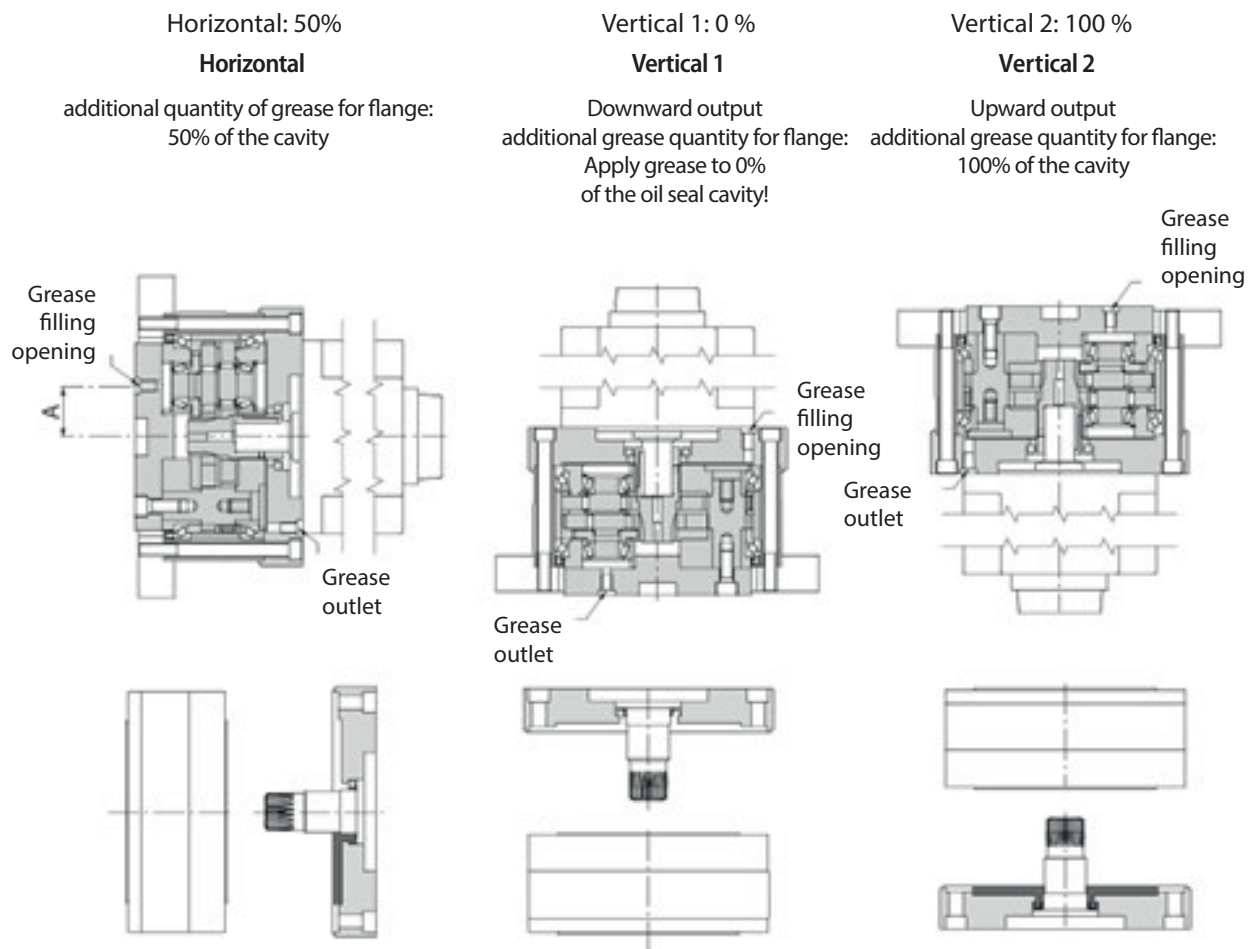


Fig. 26 Grease filling F2C(F)-T

16.7 F2C(F)-T use in EX area

	The F2C(F)-T series gearboxes meet the requirements of Directive 2014/34/EU if the assembly tolerance and regulations for fastening (Tab.29 and Tab.30, as well as the safety measures as described under points 31) 4.6, 4.7 and 7 are observed.
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17 F4CF-UA with angular ball bearing and spur gear prestage/

F2CF-UA with tapered roller bearing and spur gear prestage

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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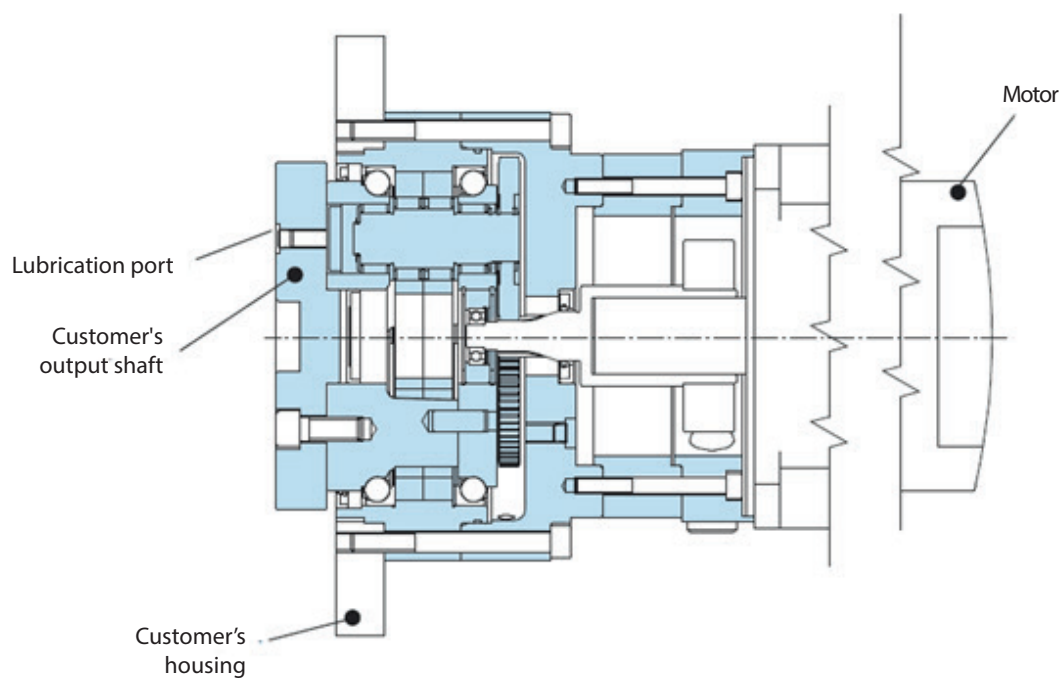
17.1 F2/4CF-UA assembly instructions

The gearboxes are delivered unpainted.

- ☒ The output-side flange needs to be attached to the shaft of the machine to be powered.
- ☒ To attach the motor to the input side flange, an adapter is required.
- ☒ An oil seal must be provided in this adapter.
- ☒ For standard installations with hollow shaft and keyway, MoS₂ paste or spray (e.g. Molykote) must be applied to the motor shaft.
- ☒ For versions with a clamp ring on the input side, the joints must be cleaned until oil- and grease-free. See also the assembly instructions under 4.9 and 4.11.

 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.32). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange. ☒ The input shaft of the gearbox is not mounted in the gearbox in the standard version. ☒ The correct immersion depth of the gearing (shaft distance to the output) must be observed according to the Fine Cyclo catalogue (see dimension sheets).
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17.2 F2/4CF-UA assembly example



The customer's output shaft is bolted to the output flange of the gearbox.

Motor attachment deviating from the catalogue standard:

The correct immersion depth of the gearing (shaft distance to the output) must be observed according to the Fine Cyclo catalogue (see dimension sheets)

Fig. 27 Assembly examples F2/4CF-UA

17.3 Seal F2/4CF-UA fits

- ☒ If an unsealed gearbox is purchased, liquid sealing material must be applied between all fits of the gearbox with the customer applications.
- ☒ Liquid sealing material and washers for bolts must be provided and installed by the customer.
Recommended liquid seal: Three Bond 1215 by Three Bond Co., Ltd.

17.4 F2/4CF-UA Bolt tightening torque and permissible torques

For assembly, all customer bolts must be tightened with the correct tightening torque according to Tab.32. Observe the instructions under 4.5.

F2/4CF-UA	Output-side flange bolts			Ring gear housing bolts			Permissible transmissible torque [Nm]
	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	
15	M6	15.7	24	M5	9.1	16	1389
25	M10	76.5	15	M8	38.3	12	3083
35	M10	76.5	21	M8	38.3	18	5707
45	M10	76.5	18	M10	76.5	18	10262
	M12	133	9				
55	M12	133	24	M10	76.5	20	12406
65	M12	133	33	M12	133	18	20656
80	M16	331	24	M12	133	24	30545
115	M20	650	32	M20	650	28	94500

Tab. 32 Bolt tightening torque and permissible torques UA

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762 strength category 12.9.

 WARNING!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
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17.5 F2/4CF-UA assembly tolerance

The concentricity of the shaft ends, the coaxiality and the radial run-out of the fastening flanges according to EN 50347 are sufficient to maintain the function, lifetime and characteristics of the installation kits.

We recommend reducing the tolerances according to EN 50347 by 50% if used in high-precision applications recommended. For assembly tolerance, see Tab.33.

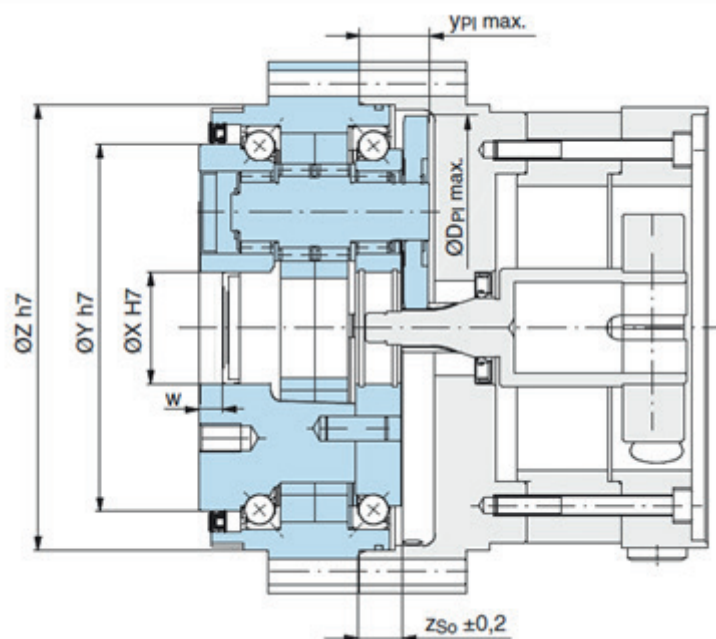


Fig. 28 UA assembly tolerance

F2/4CF-UA	Ø X	Ø Y	Ø Z	Ø DPI	YPI	Z _{So} ±0,2	w
15	28	90	113	104.5	28.4	19.0	6
25	32	110	137	124.3	29.5	18.5	8
35	35	130	160	143.2	31.5	18.5	8
45	47	155	188	179.0	30.2	18.0	8
55	42	174	208	199.7	32.8	17.5	8
65	55	210	255	231.3	41.0	26.5	10
80	62	238	284	262.7	60.7	46.0	10

Tab. 33 Assembly tolerance UA (dimensions in mm)

17.6 F2/4CF-UA lubrication

17.6.1 Grease lubrication

Observe the basic information under 5 Basic information on gearbox lubrication. Unsealed gearboxes are delivered without grease filling. Before commissioning, gearboxes of this type must first be filled with grease (Kyodo Yushi Multemp FZ No.00) and sealed in accordance with Table 34 or the dimensional drawing associated with the specific product (see Fig. 29 for filling port).

F2/4CF-UA	Quantity of grease [g] *			Filling and outlet bore	Grease Filling level
	Horizontal	Vertical 1	Vertical 2	A [mm]	B [mm]
15	122	152	143	29	33
25	209	261	227	34	34
35	313	400	361	39	45
45	383	487	417	49	50
55	679	818	748	54	65
65	940	1180	1090	63	74
80	1700	2140	1995	71	75

* The quantity of grease refers to the gearbox.

Tab. 34 Grease quantities UA series

17.6.2 Oil lubrication

☑ Observe the basic information under 5 Basic information on gearbox lubrication. Unsealed gearboxes, as well as sealed gearboxes, are delivered without oil filling. Before commissioning, gearboxes of this type must first be filled with oil (Castrol Optigear Synthetic Ro 150) in accordance with Table 35 or the dimensional drawing associated with the specific product, and sealed if necessary.

F4CF-UA	Oil quantity [dm3] *		
	vertical	horizontal and vertical 2	A [mm]
	9.4	7.8	136.5

* 1 dm3 ≈ 1 litre.

Tab. 35 Amounts of oil UA series

 WARNING!	Add lubricant when the gearbox is at a standstill. Due to the viscosity of the relevant lubricant and the geometric features in the gearbox interior, it may take a while for the correct lubricant level in the gearbox to be established.
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17.6.3 Filling the gearboxes

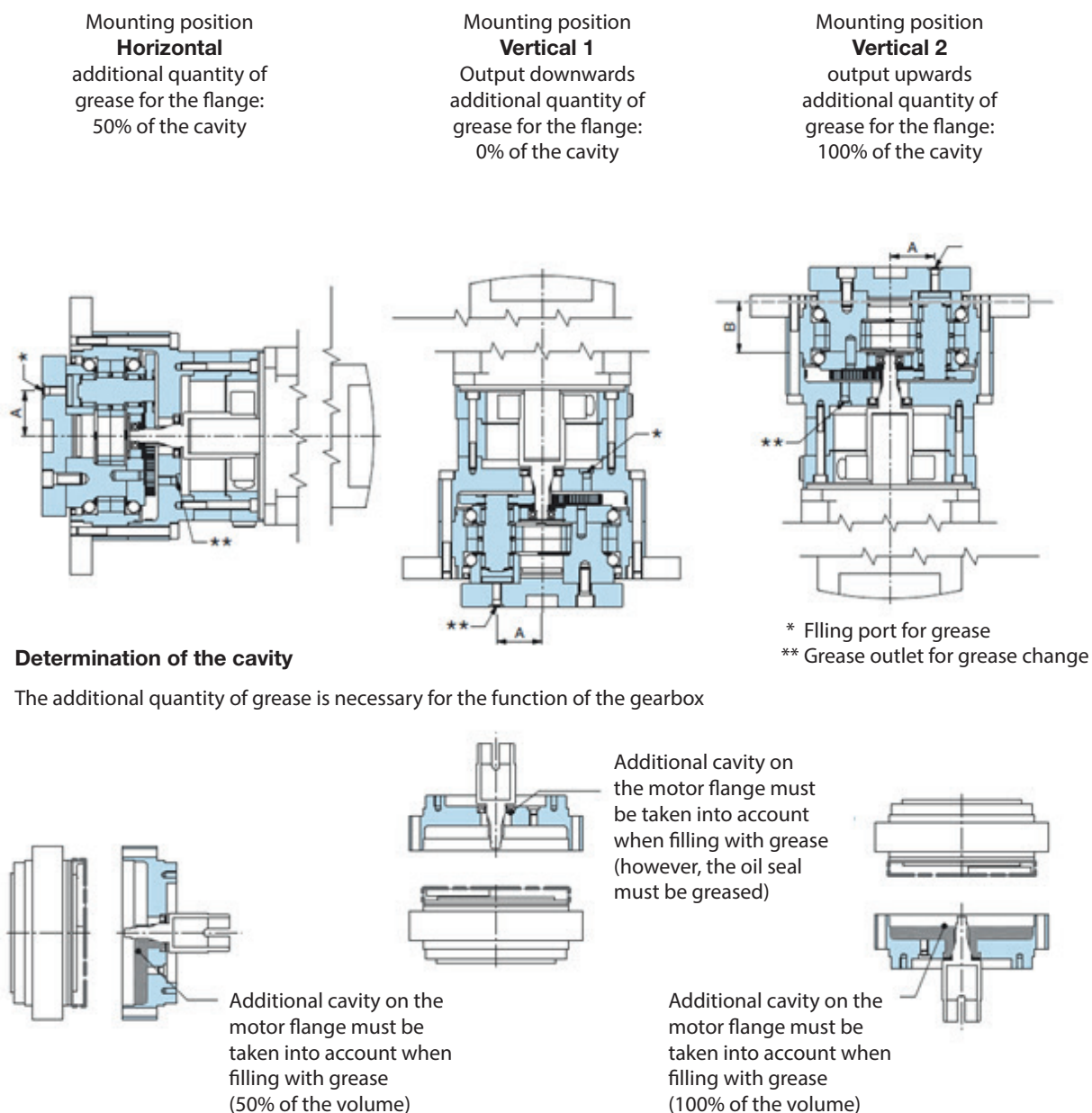


Fig. 29 Filling UA series

18 ECY series with integrated cross roller bearings

 WARNING!	The safety instructions for the installation of points 4 to 7 must be observed. Failure to do so may result in injury, machine damage and loss of warranty!
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18.1 ECY assembly instructions

Precision gearboxes of the ECY type are delivered ready for installation, unpainted.

- ☒ The output-side shaft needs to be attached to the shaft of the machine to be powered.
- ☒ The required assembly tolerances must be met in accordance with 18.4.

 ATTENTION!	☒ When fastening the gearbox, pay attention to the correct tightening torque of the bolts (Tab.36, Tab.21). ☒ Use bolts that are shorter than the depth of the threaded hole indicated in the dimensional drawings for the output flange.
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18.2 ECY assembly example

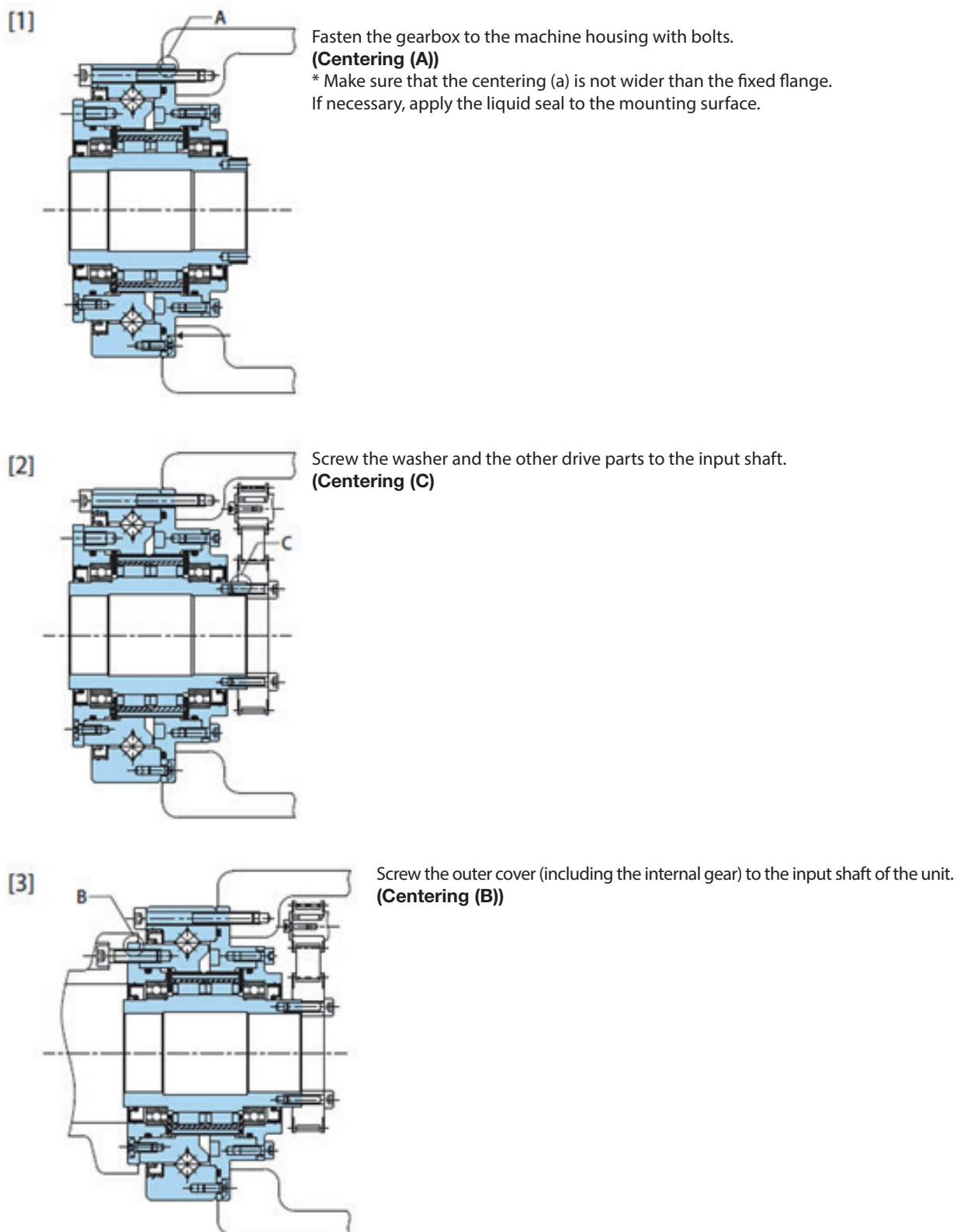


Fig. 30 ECY assembly example

18.3 ECY Bolt tightening torque and permissible torques

The permissible transmissible torque for bolts, the number, size and tightening torque for fastening the output-side flange and the fixed ring as well as the maximum permissible transmissible torque by bolts is listed in Tab.36. Observe the instructions under 4.5.

ECY	Output-side flange bolts			Housing bolts			Permissible transmissible torque through bolts [Nm]
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	
203	16	M3	1.96	16	M3	1.96	163
205	16	M3	1.96	16	M3	1.96	189
107	16	M4	4.61	16	M4	4.61	374

ECY	Input shafts			
	Number of bolts	Size DIN 4762-12.9	Tightening torque per bolt [Nm]	Permissible transmissible torque through bolts [Nm]
203	6	M2	0.55	5
205	8	M2	0.55	8
107	6	M3	1.96	35

Tab. 36 Bolt tightening torque and allowable torque ECY

- ☒ Use all fastening points on the gearbox.
- ☒ We recommend bolt locking aids such as Loctite 243 to secure the bolt connections.
- ☒ Use metric hexagon socket bolts with metric standard thread according to DIN EN ISO 4762, strength category 12.9.

 ATTENTION!	The permitted transmissible torques of the gearboxes (T_{2max} and T_{2A}) must be observed in accordance with the catalogue and the information in these operating instructions, and must not be exceeded. Failure to do so may result in injury, machine damage and loss of warranty!
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18.4 ECY assembly tolerance

Fits for installation of the drive and output parts (toothed belt, pulley, gear, etc.) are shown schematically in the following figure. Use the diameters and tolerances in the table below.

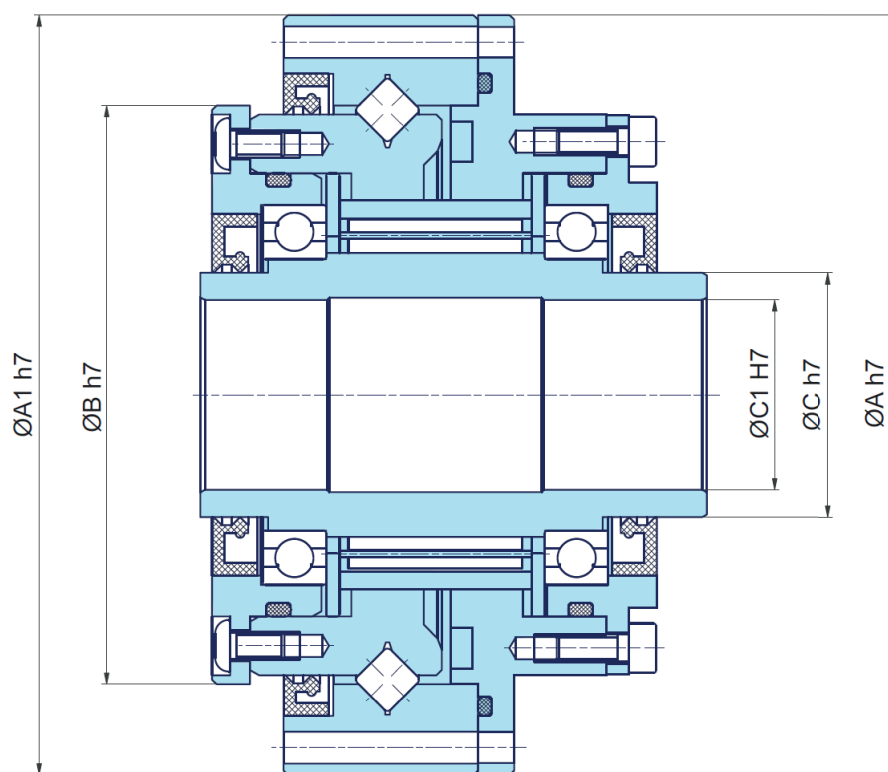


Fig. 31 ECY assembly tolerance

ECY	Ø A [mm]	Ø A1 [mm]	Ø B [mm]	Ø C [mm]	Ø C1 [mm]
203	74	74	54	24.9	19
205	84	84	64	27	21
107	95	95	72	34.5	25.5

Tab. 37 ECY assembly tolerance

18.5 ECY lubrication and maintenance

Observe the basic information under 5 Basic information on gearbox lubrication. ECY precision gearboxes are filled with lubricant ex works and are suitable for any mounting position.

19 Disposal

 ATTENTION!	The gearboxes described in these instructions must be disposed of in accordance with their condition and applicable regulations. Used oil and lubricants must be collected and disposed of as intended.
	The gearbox components must be disposed of as scrap steel.
	When handling lubricants, the safety regulations for persons and the environment must be observed in accordance with the relevant safety regulations and safety data sheets.

MEMO

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