# FGC GEAR COUPLINGS

## *INSTALLATION, LUBRICATION, USE & MAINTENANCE MANUAL*

***GGT*** gear couplings are generally supplied assembled (complete gear coupling or half gear coupling), with no lubricant. A proper surface protection coat normally realizes protection against corrosion on the inner and interface surfaces. Different anticorrosion treatments shall be required in the order.

***HANDLING AND STORAGE***

Before handling the couplings, check the weight of the units and their barycenter, looking up in the tables below or in the catalogue and/or in the drawings. Do not employ equipment and procedures that could damage the couplings and their components when handling them. To lift and handle the couplings and their components tighten the eyebolts in their holes, making sure that the equipment you are employing are adequate and that
everything is always done in the maximum safety conditions. Avoid any kind of impact when handling and storing.
Store in a covered and dry place and never at direct contact with the floor. When storing for more than six months, check the status of protection on the non-painted parts and apply a new protection film.

***SAFETY STANDARDS***

Couplings in operation may be dangerous units so the user must provide for adequate protection devices complying with the work safety measures in force in the country of installation. The operations of handling, installation, lubrication and maintenance must be carried out by qualified personnel only. While performing the operations of handling, installation, lubrication and maintenance, wear garments which cannot get entangled with the mechanical components and employ appropriate individual protection devices. If any toxic chemical substances are employed to clean the couplings, provide for adequate protection to personnel and environment. Make sure the machines the coupling connects are off and cannot restart throughout the different operations. Never exceed, in operation, the load data agreed in the order (torque, speed, working angles etc.)

***BORE FINISHING***

The hub bores, when no tolerance finishing is required, or no semi-finishing, are supplied with pilot bores or simply bored. These bores may not be concentrical with the other turned diameters. Finish the hub bores, checking that they are concentric with the reference diameters used in the operations of alignment and that they are orthogonal with the hub face surfaces too. Check by means of a centesimal comparator to get the closest-to-zero centering value.

***KEYWAYED BORES***

In these cases, the finishing of cylindrical or taper bores and their keyways must be strictly complying with the standardization specifications for keyways and/or for taper bores and with the design drawings (see also AGMA 9002-A96 standards). Therefore, special cases excepted, it is always advisable using a fitting with a slight interference of 0.5/1000 of the diameter. To obtain a tight interference fit, we suggest these tolerances: H7 for the bore and m6-r6 for the shaft (never use too high interference in case of keyways). Normally the bore, for roughness, shape and concentricity, does not require any grinding and can be finished by turning. The keyway cutting, in the hubs of the FGC gear couplings with max bore, may create some ovalizations in the hub which can then be eliminated in the following shrink fitting of the hub onto the cylindrical shaft. The keyways too, after fitting, must be slightly forced on the hub and shaft keyway sides; you can therefore use a tolerance of JS9 or P9 for the keyways. For standard keyways in standard hubs, for nominal load conditions in heavy unidirectional duty and no-backlash fit, it is advisable not to exceed these values of specific pressures on the sides, also according to AGMA
420-04 point 5.5:

- for flex hubs made of hardened and tempered steel Pmax = 160 N/mm2
- for rigid hubs made of normalized steel Pmax = 100 N/mm2

On the contrary, when choosing a transition fit or a clearance fit, it is advisable providing for suitable devices for hub and keyway axial blocking, so to avoid that these components slip out of the shafts, when in operation.
The operations of inspection and assembly must be carried out by qualified and skilled personnel only.
Before proceeding with installation, make sure the operation data (nominal and max torque, working misalignment, motor nominal and absorbed power, min and max speed, transient over-loads etc.), as well as the dimensional data and tolerances (DBSE, shaft and keyway diameters and lengths, end floats, strokes etc.) shown in the coupling overview drawing, do correspond to the plant requirements and adaptability. For couplings with particularly long spacers and rotation speed > 300 rpm, check that the max rotation speed does not exceed the 80% of the critical bending speed.
*Never exceed these load and dimensional data.*

Unless different and specific instructions are involved, the standard gear couplings cannot be employed with temperatures lower than -20°C and higher than +120°C. For temperatures constantly lower than -20°C or higher than +60°C, it is necessary to employ special seals and lubricants and to verify the residual end floats (modified according to coupling and connected machine thermal expansions).
Gear couplings in operation, under load, produce resistance to axial sliding (translation of the hub in the sleeve). This movement is opposed by a force which is directly proportional to the transmitted torque and inversely proportional to the pitch diameter of the coupling gear teeth. Besides, the axial force is linked to the friction coefficient present in the gear teeth according to the type of lubrication performed. The friction coefficient may vary from 0,05 to 0,3. Ask GGT Engineering Department for further details.
Unpack the coupling and check its conservation. Should you find any oxidation, ask immediately our technical department to decide about the intervention to perform. Disassemble the coupling into its main components.
Remove anticorrosion protection from machined surfaces. Carefully clean the bore surfaces and the fit chamfers.
*NEVER USE CORROSIVE PRODUCTS*

***HUB FITTING***

BEFORE PROCEEDING WITH THE HUB FITTING, MAKE SURE THE FLANGE SLEEVES OR THE REMOVABLE SIDE FLANGES ARE PROPERLY POSITIONED ON THE SHAFTS.
Uniformly heat the hubs, either in air furnace or in oil bath, both thermostatically controlled, or by suitable induction systems. It is also possible to heat the hubs of limited dimensions by a free flame, provided that you take care of heating uniformly the whole surface, you do not generate overheating and you frequently check the temperature so not to exceed the max allowed value. When heating, do not direct the flame to the gear teeth. To avoid any excessive oxidation, slightly preheat the outer surface of the hub. Work in the maximum safe conditions, far from flammable materials or substances.

**HUB KEY-FITTING**

Before fitting, check that bores, key-seats, shafts and keyways have the suitable fit chamfers, and that the hub has the puller holes and any hole for the screws needed to stop the axial movement of the hub and/or the keyway. Also check that the key is properly fitted in the shaft key-seat. In case of rigid hubs with a max bore, seal by some silicone, so to prevent any possible loss of grease. For taper bores, check that the surface of contact bore/shaft is
> than 75%. Heating temperatures are to be comprised between 110-130°C. Never exceed 180°C.

***ASSEMBLY***

Position the machines to be connected so that the axial distance between the hubs (or between the shaft heads = D.B.S.E.) is according to and in tolerance with dimension A or LA (distance between shaft ends) shown in the catalogue or in the drawings. Obviously, this dimension must be proportionate to any possible thermal expansion or axial movement/stroke of the connected shafts or axial clearance limiting devices. Moreover, in order to enable the half coupling further alignment operations, the flange sleeves shall be allowed to move back as to show the necessary part of the hub; the necessary minimum movement is called "cA" in or in the drawings. To make assembly, alignment and following checks on the gear teeth easier, you should be able to move the flange sleeves back as far as they withdraw from the gear teeth. Shouldn't there be the necessary side space, we recommend asking for gear couplings equipped with removable side flanges. To remove the gear couplings without moving the connected machines, ask for gear couplings with intermediate spacer.
Perform the angular and parallel alignment of the half couplings and of the connected machines. To assure long coupling gear tooth lifetime, once the machines are aligned, in working dynamic conditions and stable temperature, it is advisable that the total residual misalignment between the two half couplings is contained in a value very close to 1/1000 of the distance between the gear teeth of the coupling . The max allowed limit for standard applications correspond to what prescribed for each coupling type, in the paragraph covering alignment, as max dynamic angle. In special cases however, this must always be lower than the allowed working angle complying with the max rotation speed in operation (see kv diagrams shown in the catalogue). Secure the machines to their foundations and frames, by tightening all the locking bolts and nuts. After this operation, check once more the alignment of the half couplings, and remember that the coupling must be aligned both in working dynamic conditions and when the working temperature has settled.
Assemble the flange sleeves and the side flanges on the gear hubs, carefully avoiding damaging the seals; should they be spoiled (cut or burnt), immediately replace them with new seals, then fill with grease the half couplings by means of a spatula, from both sides of the gear teeth.
Close the gear couplings, by assembling all their components and devices (center rings, head discs or spacers, discs and support buttons etc.). To assure a perfect fitting, it is advisable spreading a slight mastic film on the flanges before closing them. During the assembly operations, respect the mutual position of the components; the assembly marks show the correct alignment and orientation of the hubs.
Screw the main bolts of flange connection, by tightening them at the torques shown in TAB.1 or, for the component fitting, in the coupling overview drawing. Carefully fit and tighten all the remaining screws, and employ original bolts, supplied by GGT.
For high speed gear couplings, dynamically balanced, in order to maintain the balancing conditions providing for a limited residual unbalance, besides following the assembly marks used when balancing, it is also recommended to respect the position of the bolts which really must not be replaced or mixed, in these cases. Should you notice any vibration, in operation, we suggest a further dynamic balancing of the coupling, when installed, so to eliminate any residual unbalance.

Complete lubrication through grease nipples or taper plugs, while opening the drain holes. Employ manual grease pumps or pumps equipped with pressure controls set at 15 ± 20 bar; never put the inner parts of the couplings under pressure. Check that the floating items of the coupling (flange sleeves or spacers) are free to move axially of dimension H (see catalogue or drawings). Check that all screws, grease nipples and/or plugs have been properly tightened. Before starting the machines, set adequate safety protections around the coupling. After the machine start-up, the foundation settling, and a certain period (about six months) of operation at the max torques, speed and at different temperatures, check the wear condition. Revise and correct the alignment if necessary.

| SIZE | Quantity of grease [kg.] | Tightening torque [Nm] | Distance between hole centers [mm] | N. of holes | Hole diameter H8-d8 |
|---|---|---|---|---|---|
| FGC.96 | 0,08 | 18 | 96 | 6 | 8/M8 |
| FGC.122 | 0,09 | 36 | 122 | 8 | 10/M10 |
| FGC.148 | 0,16 | 36 | 148 | 10 | 10/M10 |
| FGC.178 | 0,27 | 65 | 178 | 10 | 12/M12 |
| FGC.203 | 0,47 | 65 | 203 | 12 | 12/M12 |
| FGC.236 | 0,68 | 150 | 236 | 12 | 16/M16 |
| FGC.270 | 0,93 | 150 | 270 | 14 | 16/M16 |
| FGC.300 | 1,54 | 150 | 300 | 14 | 16/M16 |
| FGC.335 | 2,28 | 220 | 335 | 14 | 18/M18 |
| FGC.368 | 3,10 | 400 | 368 | 14 | 22/M22 |
| FGC.400 | 3,90 | 400 | 400 | 14 | 22/M22 |
| FGC.460 | 6,20 | 520 | 460 | 16 | 24/M24 |

TAB.1

| SIZE | Quantity of grease [kg.] | Tightening torque [Nm] | Distance between hole centers [mm] | N. of holes | Hole diameter H8-d8 |
|---|---|---|---|---|---|
| FGC.531 | 5 | 670 | 531 | 18 | 25/M24 |
| FGC.581 | 6 | 670 | 581 | 22 | 25/M24 |
| FGC.636 | 8 | 1250 | 636 | 16 | 32/M30 |
| FGC.696 | 10 | 1250 | 696 | 20 | 32/M30 |
| FGC.762 | 12 | 1250 | 762 | 22 | 32/M30 |
| FGC.812 | 18 | 2170 | 812 | 18 | 38/M36 |
| FGC.862 | 21 | 2170 | 862 | 20 | 38/M36 |
| FGC.937 | 25 | 2170 | 937 | 24 | 38/M36 |
| FGC.997 | 38 | 3480 | 997 | 20 | 44/M42 |
| FGC.1097 | 48 | 3480 | 1097 | 24 | 44/M42 |
| FGC.1242 | 60 | 5230 | 1242 | 24 | 50/M48 |
| FGC.1342 | 85 | 5230 | 1342 | 28 | 50/M48 |
| FGC.1477 | 105 | 5230 | 1477 | 32 | 50/M48 |

TAB.2

***ALIGNMENT***

A CORRECT ALIGNMENT IS ESSENTIAL FOR A LONG GEAR COUPLING LIFETIME

The initial static no-load alignment conditions (machines off) must take into consideration what then happens under load and under temperature (dynamic conditions). This implies that they must be able to compensate even misalignments generated by load (yieldings and bendings linked to the stiffness of machines, shafts and connected supports), and to any thermal expansion of the couplings and of the connected units. A coupling submitted to torque, rotation speed and alignment contained within the allowed values, will never show wear on its gear teeth, if properly lubricated. Check the alignment conditions of the half couplings, by means of modern laser equipment. In this case, to perform alignment, you have to follow the instruction procedures of such equipment, by carefully checking both parallel and angular misalignments (repeat alignment both on vertical and horizontal planes on two different positions of the shafts, like on their head and on their shoulder). Shouldn't you have these devices, you must employ a thickness gauge or an inside micrometer with extension and a centesimal test indicator having adequate support devices. In this case, depending on the coupling type, proceed as follows:

To ensure optimum lifetime of the GGT gear coupling is necessary to perform the alignment of the shafts in a scrupulous way. To perform the alignment, use a comparator fixed on one of the two hubs and make it rotate on the other hub (fig.8), reading the value divided by two gives the value of the parallel misalignment. The angular misalignment must be checked with a comparator fixed on a hub and made to rotate on the facade of the other hub (fig.8), or with controlled thickness gauge in at least three position at 120°C (fig.9). In case of installation of gear couplings complete with extensions run laser alignment, if you cannot use the laser, follow the instructions according to the figure 10. After the shaft alignment is executed, proceed with the lubrication of the seals and the installation of the sleeves on the hubs.

| ***Misalignment*** | ***Static*** | ***Dynamic*** |
|---|---|---|
| ***FGC.96 up to FGC.460*** | ***1°00'*** | ***0°20'*** |
| ***FGC.531 up to FGC.1817*** | ***1°40'*** | ***0°30'*** |

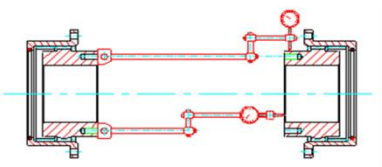

Fig.8

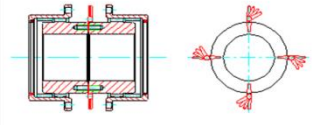

Fig.9

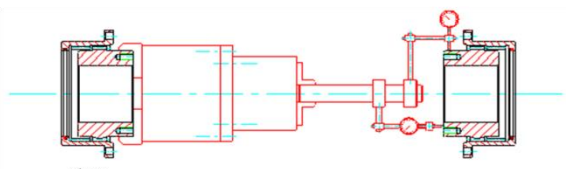

Fig.10

***LUBRICATION***

A CORRECT LUBRICATION IS ESSENTIAL FOR A LONG GEAR COUPLING LIFETIME

After the hub fitting and the positioning of the flange sleeves and the side flanges, fill with grease any space between the hubs and the sleeves by means of a spatula. Then close the coupling and spread a slight mastic film on the flange connection surfaces. Close the coupling and tighten all the screws at the required torques (see TAB. 1 or the drawings), then complete lubrication through all the grease nipples and/or all the plugs (2 each half coupling). For vertical couplings, spacer couplings, safety couplings, limited end float couplings and sliding couplings you'll have to fill with grease the two half couplings separately. To fill the coupling chambers, remove the plug or the grease nipple of each half coupling. Connect the pump to the remaining grease nipple or to the connection hole and pump grease to fill the coupling completely, until the excess of grease comes out of the free holes. For horizontal couplings, to be sure the chambers are filled with grease, pump it from the vertical bore (max 45°) downwards and wait until it comes out from the opposite hole upwards. For the operation, employ manual pumps or pumps equipped with pressure controls. Never put the inner parts of the coupling under pressure. For the grease quantity, in standard couplings, refer to the table below. Once lubrication is performed, make sure the coupling is completely filled with grease, then insert the plugs and/or the grease nipples carefully checking their tightening. At the beginning, re-lubricate the couplings at regular intervals, every 3-4 months. This initial interval is suggested in case of integral seals, industrial applications and average duty, non-corrosive environments, working temperatures between 0 and 60°C. Shouldn't the seals assure a perfect tightness, make any refilling necessary to keep the coupling constantly full of grease and replace the seals soon. After the first use and observation year, and after checking the results, time intervals can be extended up to 6 months. For different conditions, time intervals between lubrications can be still extended, yet never longer than 12 months. When lubricating, you must always have a certain grease turnover. To let the old grease out, remove a plug or a grease nipple at 180° from the new grease filling point and pump the new grease until the worn-out grease comes out of the breather. The worn-out grease shall have to be collected and kept in suitable containers for disposal.

***Do not disperse grease.***

At the end of this operation, reassemble the plugs and/or the grease nipples, checking that they are properly tightened. When lubricating, always check the tangential clearance on the gear teeth - if this is feasible and the dimensions allow it - and check that the floating item of the coupling is axially free. If no movement is allowed or if the tangential clearance is excessive, open the coupling and examine its gear teeth. When employing multipurpose grease, you have to replace it completely every 10000 hours or max every two years. You shall have to open the coupling, clean the flange surfaces, remove the old grease completely, clean any interstice, check the gear tooth condition and perform steps 1 to 4. Never use contaminated grease or grease inadequate to the operating conditions. To open the two flanges of the sleeves do not employ tools that may damage the seal surfaces. To lubricate standard couplings, use new lithium soap or complex lithium grease (not older than three years), composed of paraffinic mineral oils or high viscosity synthetic oils (>= 68 cSt at 40°C), having a max H O content of 0,3% and EP additivated (showing Timken 2 Ok load >= 30 Ib). The flash point must be > 145°C, and grease must be centrifugation resistant, antioxidant, water-repellent, anticorrosive and anti-hygroscopic. The grease NLGI grade (consistence) must be selected according to the ambient temperature and to the coupling rotation speed. If the working rotation speed is not included between 15% and 80% of the coupling nk nominal speed (see our catalogue), you have to select a lower NLGI grade grease, in other words a softer grease. NLGI 0 grade can fit any speed range.

For any further information on gear coupling lubrication, please refer to AGMA 9001-A86 and AGMA 250.03 standards. For all the conditions mentioned below, select the suitable grease, by directly contacting the lubricant producers, then submit the features of the selected grease to GGT Technical Department for acceptance.

**GGT gear couplings are supplied with no lubricant.**

If the coupling is equipped with self-lubricating device you need to fill only once a year, the same will automatically be distributing it evenly to the joint. Suitable lubricants for the proper functioning of the gear coupling GGT respects the features indicated below:

**LUBRICANT FEATURES:**

- **Thickener:** **Lithium complex**
- **NLGI Grade:** **2**
- **Application range of temperature:** **- 30°C + 160°C**
- **Penetration at 25°C:** **265 - 295 (0.1 mm)**
- **Anti-rust performance:** **YES**
- **Dropping Point:** **> 260°C**
- **Base oil viscosity at 40°C:** **340 mm2/s (cSt)**

NEVER MIX DIFFERENT TYPES AND/OR DIFFERENT BRANDS OF GREASE. THEY MAY BE INCOMPATIBLE AND MAY LOSE THEIR LUBRICATING FEATURES. UNLESS OTHER-WISE INSTRUCTED, NEVER USE OIL TO LUBRICATE GEAR COUPLINGS.