**Module 1.5**

### Spur Gears

**Steel Spur Gears**

#### Specifications

- **Material:** S45C
- **Hardness:** Rockwell C 40
- **Surface Finish:** 2B grade (approx. 1/28 in. max.)

#### Mounting Method and Precautions

1. **Shaft diameter recommended tolerance is H7.** The limit is H8, but we recommend H6 when minimum runout is required.
2. **Use 1-6 as reference for the surface roughness of the shaft diameter.**
3. **Wipe away any debris, dirt or oil on the shaft surface and hole of the fastened screw with thinner or the like, and lightly apply hydraulic oil.** Do not apply molybdenum-base or oil with additives, as this may cause reduced frictional torque or slipage.
4. **Pass completely through the shaft while pressing the bushing flange against the gear before tightening.** Removal will not be possible, so be sure to leave a clearance of 1mm or more on the gear rear surface side. (Fig.1)
5. **Use a torque wrench on faster bolts on opposite sides when tightening.**
6. **First tighten at 1/4 of the regulated torque, then at 1/2 of the regulated torque, before finally tightening up to the regulated torque.**
7. **Do not tighten without passing through the shaft, or fasten the bolts after insertion on the shaft tap side.** (Fig.2)
8. **If the shaft has a keyway, the fastened section contact area is reduced and the transmission rate is decreased by 15 to 20%.**

#### Removal Method and Precautions

1. **To turn off the power source (supply), check that no load is applied to the gear, and confirm that there is no danger due to falling, etc.**
2. **Insert removed bolts into all draft taps, and gradually and evenly tighten each bolt in diagonal order until removal is complete.**
3. **The washer and thread surfaces will be roughened, compromising tightening strength, if the bolts are reused. Consequently, we recommend using new bolts of the same size.**

#### To order F Series products, please specify: Catalog Number + F+BORE+A.

### Reference

For the permitted torque and backlash of each product, please refer to the dimensional table of the original product.

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**Table: F Series**

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**Notes:**
- *For the specified torque and backlash of each product, please refer to the dimensional table of the F Series.*
- *The product shapes of F Series items are identified by background color.*

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**Fig. 1**

- Gear
- Collar
- Bearing
- Screw

**Fig. 2**

- Draft tap
- Hex socket bolt

**Fig. 3**

- Spur Gearboxes

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**Caution on F Series**

- As available on-request products, these require a lead-time for shipping within 2 working days (excludes the day ordered), after placing an order.
- Number of products can be processed for one order to 1 to 20 units. For quantities of 21 or more pieces, we need to quote price and lead time.
- Additionally, the machined parts of the fastener components and gears are not black oxide coated.
Features of F Series

- No rattling of shaft and gear when fastening.
- Freely positionable mounting for easy meshing of teeth.
- Easily mounted and removed for repeated use.
- The bushing slides when overloaded to reduce damage to the gears.

Mounting Method and Precautions

1. Shaft diameter recommended tolerance: H7. The tolerance of H6, but we recommend H6 when minimizing variance.
2. Use a lead as reference for the surface roughness of the shaft diameter.
3. Wipe away any debris, dirt or oil on the shaft surface and hole of the fastened section with thinner or the like, and lightly apply hydraulic oil. Do not apply molybdenum-based oil or oil with additives, as this may cause reduced fastening torque or slippage.
4. Pass completely through the shaft while pressing the bushing flange against the gear before tightening. Removal will not be possible, so be sure to leave a clearance of 1 mm or more on the gear rear surface side.
5. Use a torque wrench to fasten bolts on opposite sides when tightening. First tighten at 1/4 of the regulated torque, then at 1/2 of the regulated torque, before finally tightening up to the regulated torque. Do not tighten without passing through the shaft; fasten the bolts after insertion on the shaft taper side. Fig.2.
6. If the shaft has a keyway, the fastened section contact area is reduced and the transmission rate is decreased by 15 to 20%.

Removal Method and Precautions

1. Turn off the power source (supply), check that no load is applied to the gear, and confirm that there is no danger due to splitting, etc.
2. Insert removed bolts into draft taps, and gradually and evenly tighten each bolt in diagonal order until removal is complete.
3. When the shaft and thread surfaces will be rounded, compromising tightening strength, if the bolts are reused. Consequently, we recommend using new bolts of the same size.
### Features of F Series

- No rattling of shaft and gear when fastening
- Freely positionable mounting for easy meshing of teeth
- Easily mounted and removed for repeated use
- The bushing slides when overloaded to reduce damage to the gears.

### Mounting Method and Precautions

1. Shaft diameter recommended clearance is h7. The limit is h7, but recommend h6 when minimizing backlash. Use 1.5a as reference for the surface roughness of the shaft diameter.
2. Wipe away any dirt, dust or oil on the shaft surface and hole of the fastened section with thinner or the like, and lightly apply hydraulic oil. Do not apply molybdenum-based oil or oil with additives, as this may cause increasing torque or backlash.
3. Pass completely through the shaft while pressing the bushing flange against the gear before tightening. Remove all grease if removed previously on the gear. (Fig.1)
4. A torque wrench to fasten bolts on opposite sides when tightening.
5. Fasten the shaft with a keyway, the fastened section contact area is reduced and the transmission rate is decreased by 15 to 20%.

### Removal Method and Precautions

1. Turn off the power source (supply), check that no load is applied to the gear, and confirm that there is no danger due to falling, etc.
2. Insert removed bolts into drill shafts, and gradually and evenly tighten each bolt in diagonal order until removal is complete.
3. The washer and thread surfaces will be roughened, compromising tightening strength, if the bolts are reused. Consecutively, we recommend using new bolts of the same size.

### Catalogs

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*For the permitted torque and backlash of each product, please refer to the dimensional table of the original product.*
**Features of F Series**

- No ratting of shaft and gear when fastening
- Freely positionable mounting for easy meshing of teeth
- Easily mounted and removed for repeated use
- The bushing slides when over-loaded to reduce damage to the gears.

**Mounting Method and Precautions**

1. Shaft diameter recommended tolerance is ±0.1mm. The limit is ±0.05mm when mounting using a 1.0mm size. Use 0.6mm as a reference for the surface roughness of the shaft diameter.
2. Wipe away any debris, dirt or oil on the shaft surface and hole of the fastened section with thinner or the like, and lightly apply hydraulic oil to prevent seizure. Do not apply molybdenum-based oil or oil with additives, as this may cause reduced fastening torque or slippage.
3. Pass completely through the shaft while pressing the bushing against the gear before tightening. Removal will not be possible, so be sure to leave a clearance of 0.1mm or more on the gear rear surface side.
4. Use a torque wrench to tighten bolts on opposite sides when tightening.
5. First tighten at 1/4 of the regulated torque, then at 1/2 of the regulated torque, before finally tightening up the regulated torque. Do not tighten without passing through the shaft, or fasten the bolts after insertion on the shaft tap side.
6. If the shaft has a keyway, the fastened section contact area is reduced and the transmission rate is decreased by 15 to 20%.

**Removal Method and Precautions**

1. Turn off the power source (supply), check that no load is applied to the gear, and confirm that there is no danger due to falling, etc.
2. Insert removed bolts into each shaft tap, and gradually and evenly tighten each bolt in diagonal order until removal is complete.
3. The washer and thread surfaces will be roughened, compromising tightening strength, if the bolts are reused. Consequently, we recommend using new bolts of the same size.

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**Specifications**

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**To order F Series products, please specify:**
Catalog Number + F + BORE A

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**Catalog Number**

```
F Series
Module 3

Steel Spur Gears

SS Spur Gears
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**Bore A**

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**Module 3**

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**Other Products**

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**F Series**

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**Material**

1.5MoMn steel