

# Technical Documentation

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## HIGH PRECISION REDUCERS FOR SERVO MOTORS

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# Servo Motor Assembly Procedure

## APG Type

**Step 1.** Turn the input shaft and align the clamping bolt head to the wrench hole for clamping bolt.

**Step 2.** Wipe with rust-preventive agent, oil, etc. off the internal surface of the input shaft and the output shaft of the servo motor.

**Step 3.** Insert the servo motor shaft.

When a bushing is provided, align the position of the slit of the bushing with that of the input tightening portion as shown in [Figure-1].

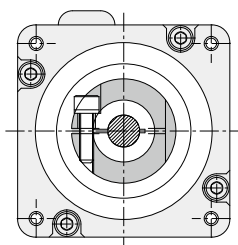
Additionally, when a key groove is provided, align the position of the slit of the bushing with the key groove as shown in [Figure-2].

\* When using an IP65 reducer, insert a sheet gasket between the input flange and the servo motor before inserting the servo motor into the reducer body.

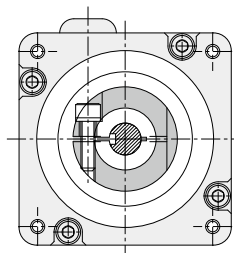
**Step 4.** Tighten the servo motor and the flange portion of the reducer using the flange clamping bolts.

**Step 5.** Tighten the clamping bolt of the input shaft to the specified torque.

**Step 6.** Mount the rubber cap (accessory) to the wrench hole.



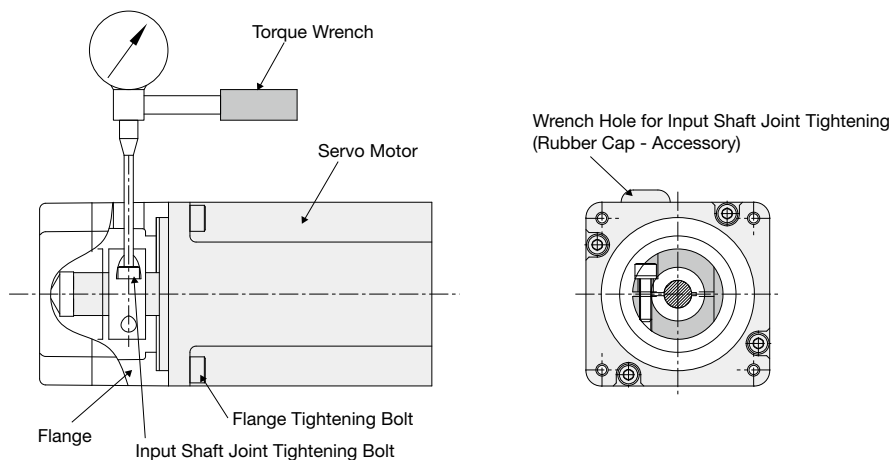
[Figure-1] Without a key groove



[Figure-2] With a key groove

## Tightening Torques for Input Shaft Joint Tightening Bolts

| Power Class             | 100 W | 200 W | 400 W | 750 W | 1000 W | 1500 W | 2000 W | 3000 W |
|-------------------------|-------|-------|-------|-------|--------|--------|--------|--------|
| Tightening Torque (N·m) | 5.1   | 5.1   | 5.1   | 9     | 35     | 35     | 35     | 35     |
| Tightening Bolt Size    | M4    | M4    | M4    | M5    | M8     | M8     | M8     | M8     |



Note 1: Do not tighten the tightening bolt with no shaft applicable to the flange type inserted in the input shaft joint.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

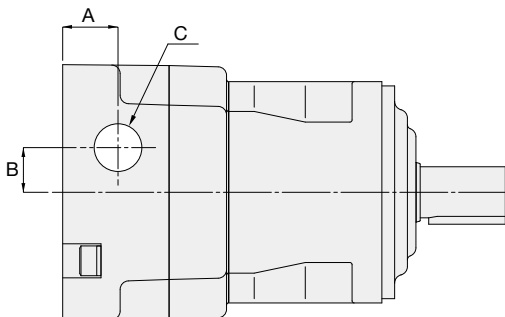
AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

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Option

# Servo Motor Assembly Procedure

## ■ Detailed Diagram of Wrench Hole for Input Shaft Joint Tightening

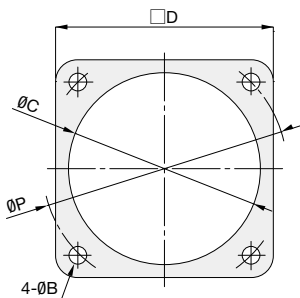


| Power Class |                           | Dimension A | Dimension B | Dimension C |
|-------------|---------------------------|-------------|-------------|-------------|
| 100 W       |                           | 13          | 9           | ∅10         |
| 200 W       |                           | 13          | 10.5        | ∅10         |
| 400 W       |                           | 13          | 10.5        | ∅10         |
| 750 W       |                           | 14.5        | 15          | ∅10         |
| 1000 W      |                           | 20          | 20          | ∅11.5       |
| 1500 W      | Flange Type Code K1*, K2* | 20          | 20          | ∅11.5       |
|             | Flange Type Code K3*      | 25          | 20          | ∅11.5       |
| 2000 W      | Flange Type Code K1*, K2* | 20          | 20          | ∅11.5       |
|             | Flange Type Code K3*      | 25          | 20          | ∅11.5       |
| 3000 W      | Flange Type Code K1*, K2* | 20          | 20          | ∅11.5       |
|             | Flange Type Code K3*      | 25          | 20          | ∅11.5       |

Note 1: For flange type codes, please refer to the Motor Matching / Motor Power Design Lists on pages 696 to 703.

## ■ IP65 Specification Servo Motor Assembly Procedure

When using an IP65 reducer, insert a sheet gasket between the input flange and the servo motor before inserting the servo motor into the reducer body.



### ● Dimensions of Sheet gasket for Input Flange Area

| Sheet Gasket | ∅Dimension B | ∅Dimension C | □ Dimension D | ∅Dimension P |
|--------------|--------------|--------------|---------------|--------------|
| □40          | ∅4.5         | ∅30.5        | □40           | ∅46          |
| □60          | ∅5.5         | ∅50.5        | □60           | ∅70          |
| □80          | ∅6.5         | ∅70.5        | □80           | ∅90          |
| □100         | ∅9           | ∅95.5        | □100          | ∅115         |
| □130         | ∅9           | ∅110.5       | □130          | ∅145         |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

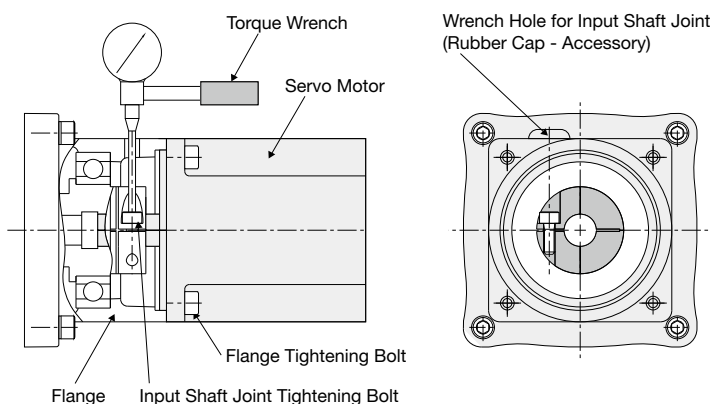
Option

## AFC Type

- Step 1.** Turn the input shaft and align the clamping bolt head to the wrench hole for clamping bolt.
- Step 2.** Wipe with rust-preventive agent, oil, etc. off the internal surface of the input shaft and the output shaft of the servo motor.
- Step 3.** Insert the servo motor shaft.
- Step 4.** Tighten the servo motor and the flange portion of the reducer using the flange clamping bolts.
- Step 5.** Tighten the clamping bolt of the input shaft to the specified torque.
- Step 6.** Mount the rubber cap (accessory) to the wrench hole.

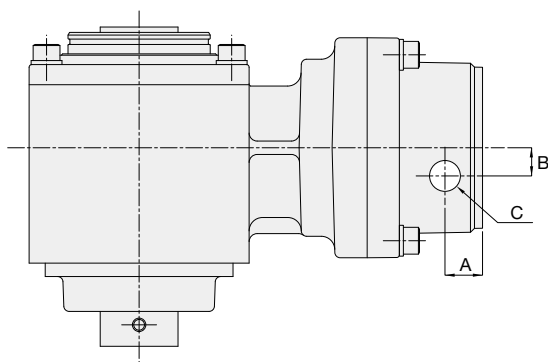
## Tightening Torques for Input Shaft Joint Tightening Bolts

| Power Class             | 100 W | 200 W | 400 W | 750 W | 1000 W | 2000 W | 3000 W |
|-------------------------|-------|-------|-------|-------|--------|--------|--------|
| Tightening Torque (N-m) | 5.1   | 5.1   | 5.1   | 9     | 35     | 35     | 35     |
| Tightening Bolt Size    | M4    | M4    | M4    | M5    | M8     | M8     | M8     |



Note 1: Do not tighten the tightening bolt with no shaft applicable to the flange type inserted in the input shaft joint.

## Detailed Diagram of Wrench Hole for Input Shaft Joint Tightening



| Power Class | Dimension A                     | Dimension B | Dimension C |
|-------------|---------------------------------|-------------|-------------|
| 100 W       | 12                              | 8           | Ø11.5       |
| 200 W       | 14                              | 10.5        | Ø11.5       |
| 400 W       | 14                              | 10.5        | Ø11.5       |
| 750 W       | 14                              | 15          | Ø11.5       |
| 1000 W      | 18.5                            | 20          | Ø11.5       |
| 2000 W      | Flange Type Code Other than K75 | 18.5        | 20          |
|             | Flange Type Code K75            | 18.5        | 24.5        |
| 3000 W      | Flange Type Code Other than K75 | 18.5        | 20          |
|             | Flange Type Code K75            | 18.5        | 24.5        |

\* For the position of the wrench hole for input shaft joint tightening, refer to page 872.

Note 1: For flange type codes, please refer to the Motor Matching / Motor Power Design Lists on pages 704 to 711.

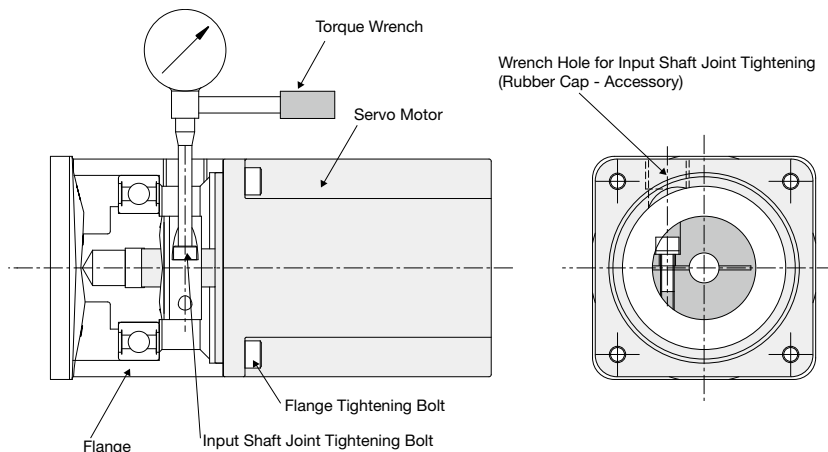
# Servo Motor Assembly Procedure

## AG3/AH2/AF3 Types

- Step 1.** Turn the input shaft and align the clamping bolt head to the wrench hole for clamping bolt.
- ▼
- Step 2.** Wipe with rust-preventive agent, oil, etc. off the internal surface of the input shaft and the output shaft of the servo motor.
- ▼
- Step 3.** Insert the servo motor shaft.
- ▼
- Step 4.** Tighten the servo motor and the flange portion of the reducer using the flange clamping bolts.
- ▼
- Step 5.** Tighten the clamping bolt of the input shaft to the specified torque.
- ▼
- Step 6.** Mount the cap screw (accessory) to the wrench hole.

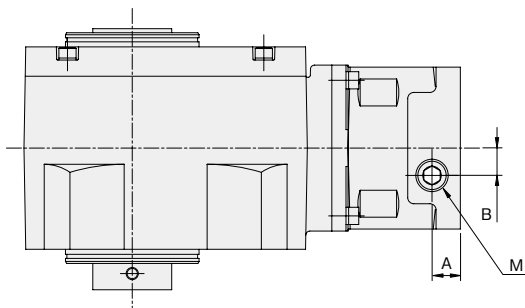
## ■ Tightening Torques for Input Shaft Joint Tightening Bolts

| Power Class             | 100 W | 200 W | 400 W | 750 W | 1000 W | 2000 W |
|-------------------------|-------|-------|-------|-------|--------|--------|
| Tightening Torque (N·m) | 8.33  | 8.33  | 8.33  | 12.74 | 29.40  | 29.40  |
| Tightening Bolt Size    | M5    | M5    | M5    | M6    | M8     | M8     |



Note 1: Do not tighten the tightening bolt with no shaft applicable to the flange type inserted in the input shaft joint.

## ■ Detailed Diagram of Wrench Hole for Input Shaft Joint Tightening



\* For the position of the wrench hole for input shaft joint tightening, refer to page 872.

| Power Class  | Dimension A                                    |         | Dimension B | Dimension M |         |     |
|--|--|---------|-------------|-------------|---------|-----|
|  | AF3  | AH2/AG3 |             | AF3         | AH2/AG3 |     |
| 100 W<br>(Only precision 1 arc min and 3 arc min specifications) | 14   | 14      | 10          | M8          | M8      |     |
| 100 W<br>(Only low backlash specifications)                      | 14   | 14.5    | 10          | M16         | M8      |     |
| 200 W  | 14   | 14.5    | 13.5        | M16         | M8      |     |
| 400 W  | 14   | 14.5    | 13.5        | M16         | M8      |     |
| 750 W  | 15   | 15      | 16          | M16         | M10     |     |
| 1000 W   | 19   | 19      | 20          | M16         | M12     |     |
| 2000 W   | Flange Type Code<br>K21/K22/K23<br>K31/K32/K33 | 18.5    | 17          | 20          | M16     | M12 |
| 2000 W   | Flange Type Code<br>F31/F33                    | 28.5    | 27          | 20          | M16     | M12 |

Note 1: For flange type codes, please refer to the Motor Matching / Motor Power Design Lists on pages 712 to 718.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

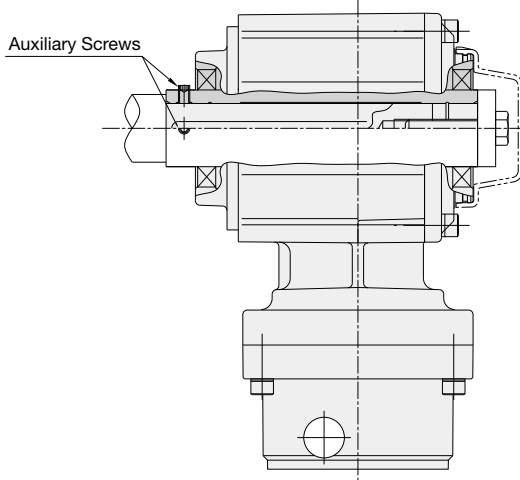
AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

# Examples of Tightening Driven Shafts

## In the case of a right angle hollow bore type

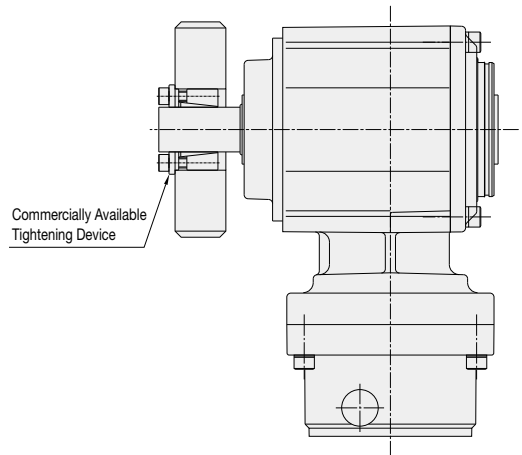
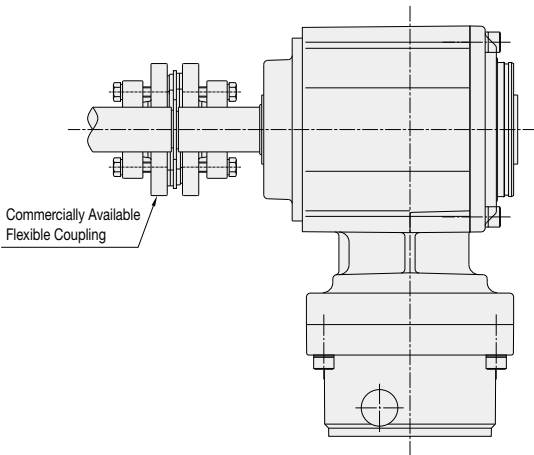


Note 1: This method prevents backlash by inserting a stepped driven shaft with a key into the right angle hollow bore and fixing the shaft on the end face with a screw etc. and then with the two auxiliary screws.

## In the case of parallel shaft and right angle shaft types without a key

■ Item to be installed on a shaft  
(Tightening with a ball screw etc.)

■ Item to be installed in a hole  
(Tightening with a pulley etc.)



\* The figure shows the AFC Type. These tightening methods also apply to the AF3 Type.

|   |                                |                               |   |   |                         |        |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|
| Motor Matching /<br>Motor Power Design List | APG/AG3 Type<br>Parallel Shaft | AH2 Type<br>Right Angle Shaft | AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft | AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | Technical Documentation | Option |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|

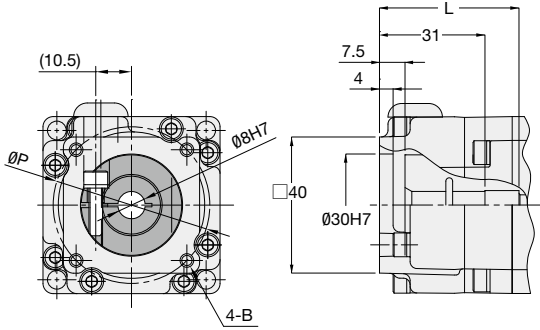
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|        |                                |   |   |                               |                                |   |
|--------|--------------------------------|---|---|-------------------------------|--------------------------------|---|
| Option | <b>Technical Documentation</b> | AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft | AH2 Type<br>Right Angle Shaft | APG/AG3 Type<br>Parallel Shaft | Motor Matching /<br>Motor Power Design List |
|--------|--------------------------------|---|---|-------------------------------|--------------------------------|---|

# Detailed Diagrams of Input Shaft and Flange Shapes

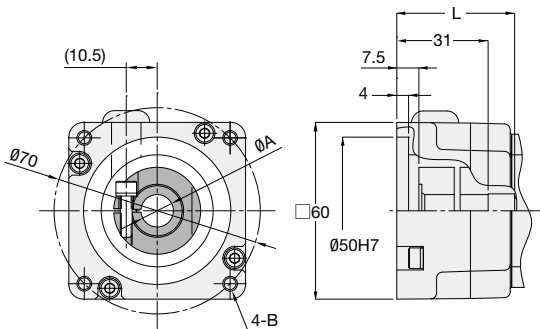
## APG Type

### 100 W Class S1/S3



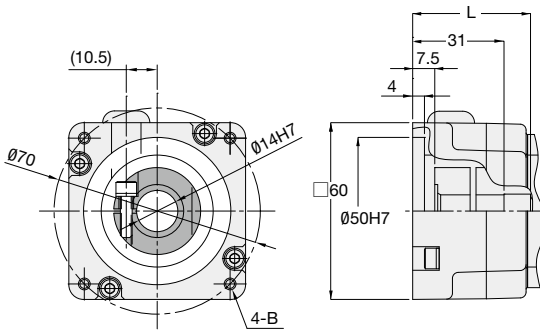
| Type | Reduction Ratio | Dimension L | Dimension P | Dimension B  | Bushing |
|------|-----------------|-------------|-------------|--------------|---------|
| S1   | Up to 1/10      | 39          | Ø46         | M4, Depth 10 | Yes     |
|      | From 1/15       | 34.5        |             |              |         |
| S3   | Up to 1/10      | 39          | Ø45         | M3, Depth 10 | Yes     |
|      | From 1/15       | 34.5        |             |              |         |

### 200 W Class S1/S2/S3



| Type | Reduction Ratio | Dimension L | Dimension A | Dimension B              | Bushing |
|------|-----------------|-------------|-------------|--------------------------|---------|
| S1   | Up to 1/10      | 39          | Ø11H7       | M5, Depth 13.5 (Through) | Yes     |
|      | From 1/15       | 34.5        |             |                          |         |
| S2   | Up to 1/10      | 39          | Ø14H7       | M5, Depth 13.5 (Through) | No      |
|      | From 1/15       | 34.5        |             |                          |         |
| S3   | Up to 1/10      | 39          | Ø11H7       | M4, Depth 13.5 (Through) | Yes     |
|      | From 1/15       | 34.5        |             |                          |         |

### 400 W Class S1/S3



| Type | Reduction Ratio | Dimension L | Dimension B              | Bushing |
|------|-----------------|-------------|--------------------------|---------|
| S1   | Up to 1/5       | 39          | M5, Depth 13.5 (Through) | No      |
|      | 1/10            |             | M5, Depth 10             |         |
|      | From 1/15       | 34.5        | M5, Depth 13.5 (Through) |         |
| S3   | Up to 1/5       | 39          | M4, Depth 13.5 (Through) | No      |
|      | 1/10            |             | M4, Depth 9              |         |
|      | From 1/15       | 34.5        | M4, Depth 13.5 (Through) |         |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

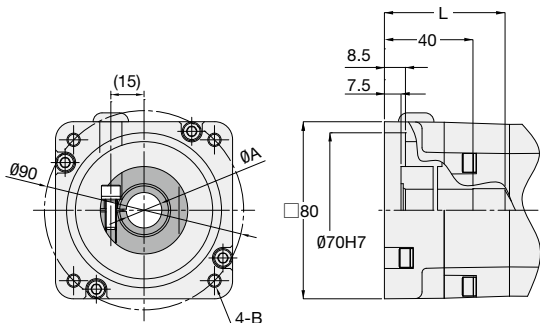
Technical Documentation

Option



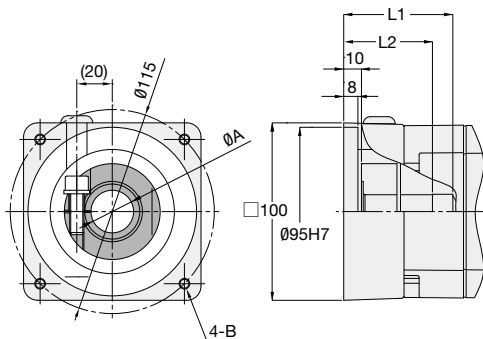
# Detailed Diagrams of Input Shaft and Flange Shapes

## 750 W Class S1/S2/S3/S4



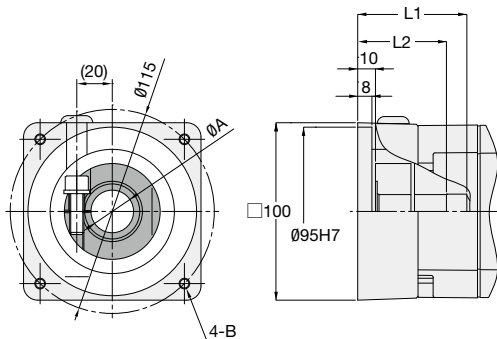
| Type | Reduction Ratio | Dimension L | Dimension A | Dimension B            | Bushing |
|------|-----------------|-------------|-------------|------------------------|---------|
| S1   | Up to 1/10      | 54.5        | Ø16H7       | M6, Depth 17 (Through) | Yes     |
|      | From 1/15       | 44.5        |             |                        |         |
| S2   | Up to 1/10      | 54.5        | Ø19H7       | M6, Depth 17 (Through) | No      |
|      | From 1/15       | 44.5        |             |                        |         |
| S3   | Up to 1/10      | 54.5        | Ø19H7       | M5, Depth 17 (Through) | No      |
|      | From 1/15       | 44.5        |             |                        |         |
| S4   | Up to 1/10      | 54.5        | Ø16H7       | M5, Depth 17 (Through) | Yes     |
|      | From 1/15       | 44.5        |             |                        |         |

## 1000 W Class K13/K21/K22/K23



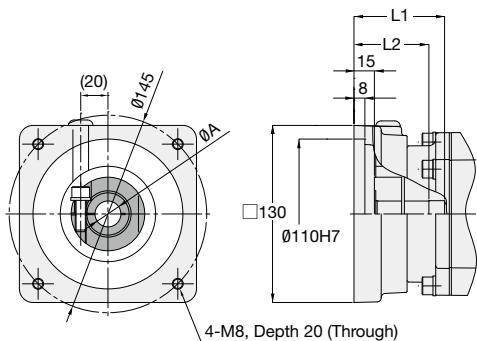
| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Dimension B  | Bushing |
|------|-----------------|--------------|--------------|-------------|--------------|---------|
| K13  | Up to 1/10      | 61           | 50           | Ø24H7       | M6, Depth 15 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K21  | Up to 1/10      | 61           | 50           | Ø19H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K22  | Up to 1/10      | 61           | 50           | Ø22H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K23  | Up to 1/10      | 61           | 50           | Ø24H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |

## 1500 W Class K13/K21/K22/K23



| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Dimension B  | Bushing |
|------|-----------------|--------------|--------------|-------------|--------------|---------|
| K13  | Up to 1/10      | 61           | 50           | Ø24H7       | M6, Depth 15 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K21  | Up to 1/10      | 61           | 50           | Ø19H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K22  | Up to 1/10      | 61           | 50           | Ø22H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K23  | Up to 1/10      | 61           | 50           | Ø24H7       | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |

## 1500 W Class K31/K32/K33



| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Bushing |
|------|-----------------|--------------|--------------|-------------|---------|
| K31  | Up to 1/10      | 66           | 55           | Ø19H7       | Yes     |
|      | From 1/15       | 64           | 46           |             |         |
| K32  | Up to 1/10      | 66           | 55           | Ø22H7       | Yes     |
|      | From 1/15       | 64           | 46           |             |         |
| K33  | Up to 1/10      | 66           | 55           | Ø24H7       | Yes     |
|      | From 1/15       | 64           | 46           |             |         |

Motor Matching /  
Motor Power Design List

AFC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AFC3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

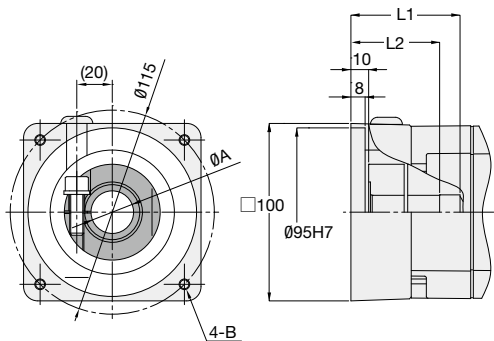
AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

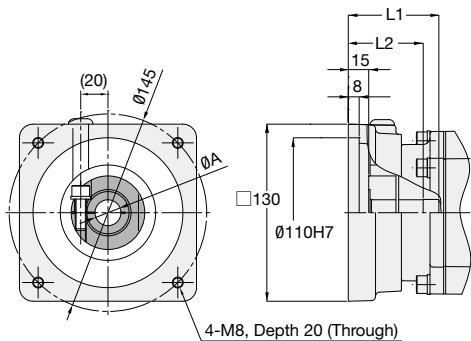
Option

2000 W Class K13/K21/K22/K23



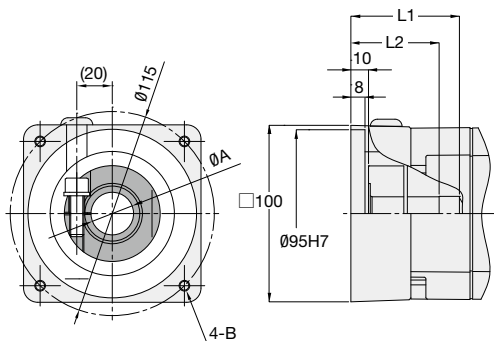
| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Dimension B  | Bushing |
|------|-----------------|--------------|--------------|-------------|--------------|---------|
| K13  | Up to 1/10      | 61           | 50           | $\phi 24H7$ | M6, Depth 15 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K21  | Up to 1/10      | 61           | 50           | $\phi 19H7$ | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K22  | Up to 1/10      | 61           | 50           | $\phi 22H7$ | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |
| K23  | Up to 1/10      | 61           | 50           | $\phi 24H7$ | M8, Depth 16 | Yes     |
|      | From 1/15       | 59           | 41           |             |              |         |

2000 W Class K31/K32/K33



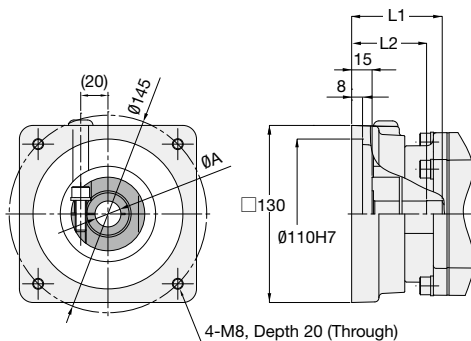
| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Bushing |
|------|-----------------|--------------|--------------|-------------|---------|
| K31  | Up to 1/10      | 66           | 55           | $\phi 19H7$ | Yes     |
|      | From 1/15       | 64           | 46           |             |         |
| K32  | Up to 1/10      | 66           | 55           | $\phi 22H7$ | Yes     |
|      | From 1/15       | 64           | 46           |             |         |
| K33  | Up to 1/10      | 66           | 55           | $\phi 24H7$ | Yes     |
|      | From 1/15       | 64           | 46           |             |         |

3000 W Class K13/K21/K22/K23



| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Dimension B  | Bushing |
|------|-----------------|--------------|--------------|-------------|--------------|---------|
| K13  | Up to 1/10      | 61           | 50           | $\phi 24H7$ | M6, Depth 15 | Yes     |
| K21  | Up to 1/10      | 61           | 50           | $\phi 19H7$ | M8, Depth 16 | Yes     |
| K22  | Up to 1/10      | 61           | 50           | $\phi 22H7$ | M8, Depth 16 | Yes     |
| K23  | Up to 1/10      | 61           | 50           | $\phi 24H7$ | M8, Depth 16 | Yes     |

3000 W Class K31/K32/K33/K34

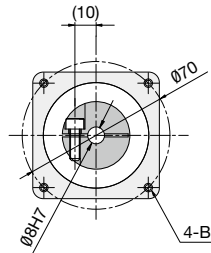
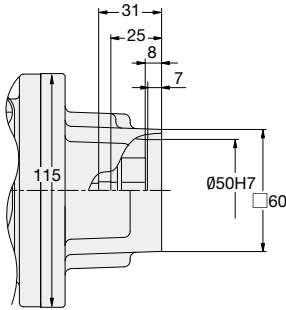


| Type | Reduction Ratio | Dimension L1 | Dimension L2 | Dimension A | Bushing |
|------|-----------------|--------------|--------------|-------------|---------|
| K31  | Up to 1/10      | 66           | 55           | $\phi 19H7$ | Yes     |
| K32  | Up to 1/10      | 66           | 55           | $\phi 22H7$ | Yes     |
| K33  | Up to 1/10      | 66           | 55           | $\phi 24H7$ | Yes     |
| K34  | Up to 1/10      | 66           | 55           | $\phi 28H7$ | No      |

# Detailed Diagrams of Input Shaft and Flange Shapes

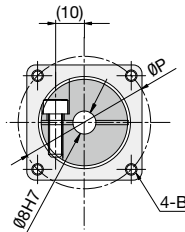
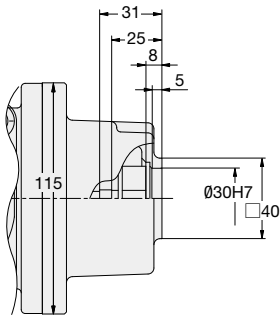
## AG3-AH2 Type

### 100 W Class (only low backlash specifications) F1/F3



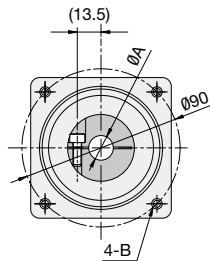
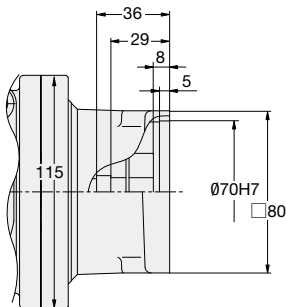
| Type | Dimension B  |
|------|--------------|
| F1   | M5, Depth 10 |
| F3   | M4, Depth 10 |

### 100 W Class (only low backlash specifications) S1/S3



| Type | Dimension B  | Dimension P |
|------|--------------|-------------|
| S1   | M4, Depth 10 | Ø46         |
| S3   | M3, Depth 10 | Ø45         |

### 200 W Class F1/F2/F3



| Type | Dimension A | Dimension B            |
|------|-------------|------------------------|
| F1   | Ø11H7       | M6, Depth 12 (Through) |
| F2   | Ø14H7       | M6, Depth 12 (Through) |
| F3   | Ø11H7       | M5, Depth 12 (Through) |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

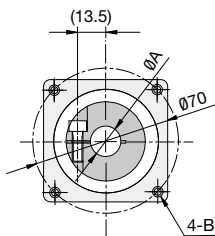
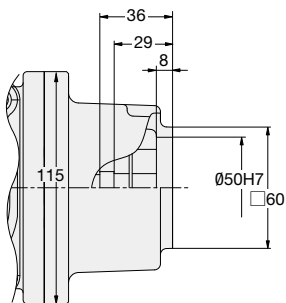
Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

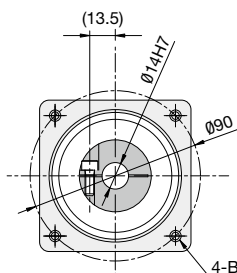
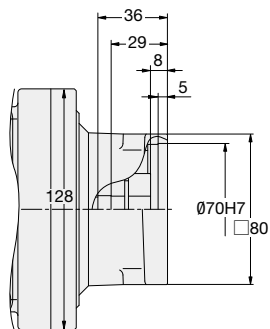
■ 200 W Class S1/S2/S3



| Type | Dimension A | Dimension B  |
|------|-------------|--------------|
| S1   | Ø11H7       | M5, Depth 10 |
| S2   | Ø14H7       | M5, Depth 10 |
| S3   | Ø11H7       | M4, Depth 10 |

AH2 Type  
Right Angle Shaft

■ 400 W Class F1/F3

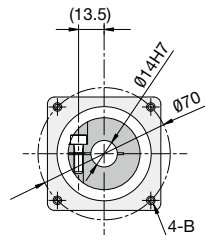
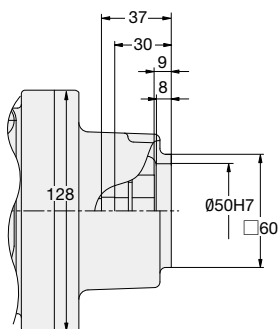


| Type | Dimension B            |
|------|------------------------|
| F1   | M6, Depth 12 (Through) |
| F3   | M5, Depth 12 (Through) |

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

■ 400 W Class S1/S3



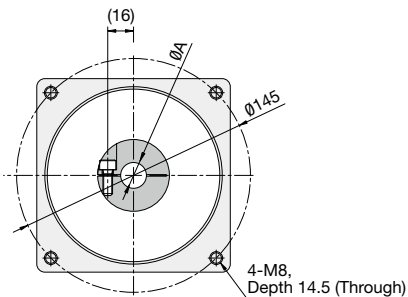
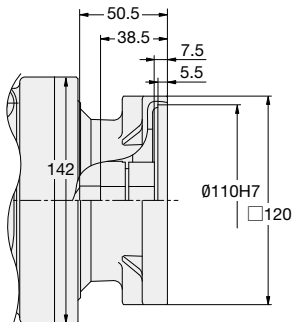
| Type | Dimension B  |
|------|--------------|
| S1   | M5, Depth 10 |
| S3   | M4, Depth 10 |

Technical Documentation

Option

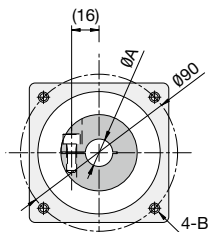
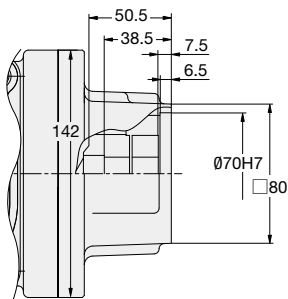
# Detailed Diagrams of Input Shaft and Flange Shapes

## 750 W Class F1/F2



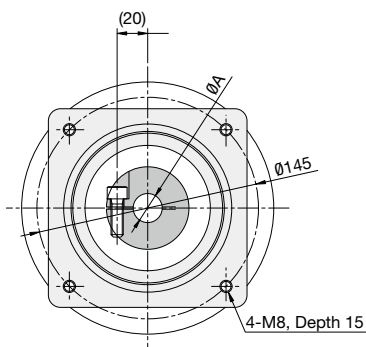
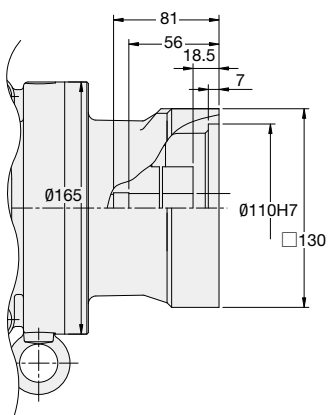
| Type | Dimension A |
|------|-------------|
| F1   | Ø16H7       |
| F2   | Ø19H7       |

## 750 W Class S1/S2/S3/S4



| Type | Dimension A | Dimension B  |
|------|-------------|--------------|
| S1   | Ø16H7       | M6, Depth 12 |
| S2   | Ø19H7       | M6, Depth 12 |
| S3   | Ø19H7       | M5, Depth 10 |
| S4   | Ø16H7       | M5, Depth 10 |

## 2000 W Class F31/F33



| Type | Dimension A |
|------|-------------|
| F31  | Ø19H7       |
| F33  | Ø24H7       |

Motor Matching /  
Motor Power Design List

AFC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

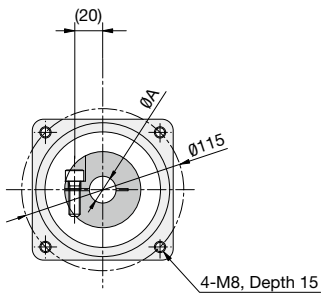
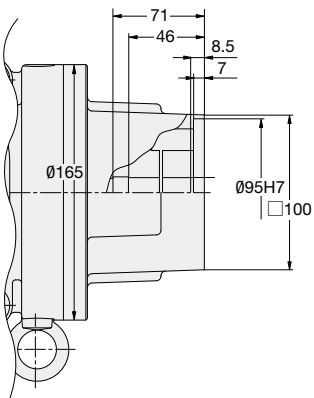
AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

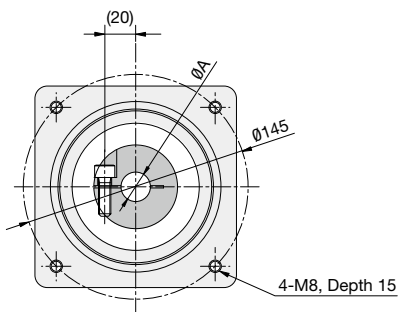
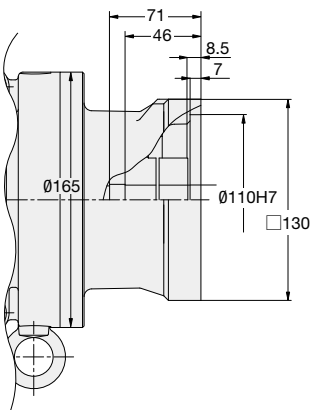
Option

2000 W Class K21/K22/K23



| Type | Dimension A |
|------|-------------|
| K21  | Ø19H7       |
| K22  | Ø22H7       |
| K23  | Ø24H7       |

2000 W Class K31/K32/K33

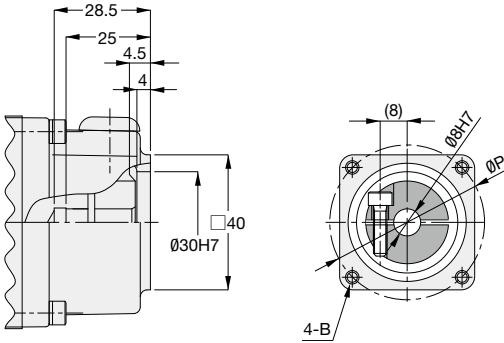


| Type | Dimension A |
|------|-------------|
| K31  | Ø19H7       |
| K32  | Ø22H7       |
| K33  | Ø24H7       |

# Detailed Diagrams of Input Shaft and Flange Shapes

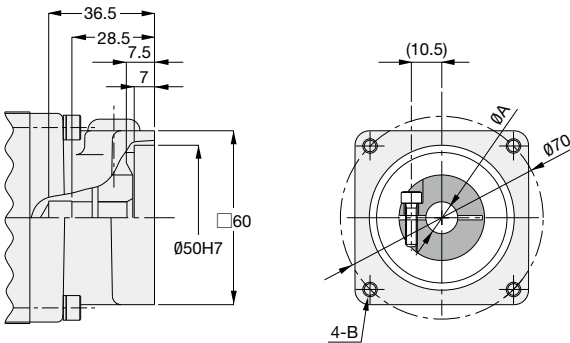
## AFC Type (Right Angle Hollow Bore/Right Angle Shaft) Backlash 3 arc min/30 arc min Specifications

### 100 W Class S1/S3



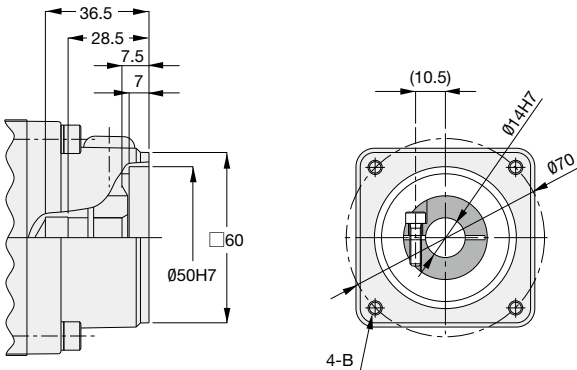
| Type | Dimension B  | Dimension P |
|------|--------------|-------------|
| S1   | M4, Depth 10 | Ø46         |
| S3   | M3, Depth 10 | Ø45         |

### 200 W Class S1/S2/S3



| Type | Frame Size | Dimension A | Dimension B            |
|------|------------|-------------|------------------------|
| S1   | 12/18      | Ø11H7       | M5, Depth 10 (Through) |
|      | 15/22      | Ø11H7       | M5, Depth 15 (Through) |
| S2   | 12/18      | Ø14H7       | M5, Depth 10 (Through) |
|      | 15/22      | Ø14H7       | M5, Depth 15 (Through) |
| S3   | 12/18      | Ø11H7       | M4, Depth 10 (Through) |
|      | 15/22      | Ø11H7       | M4, Depth 15 (Through) |

### 400 W Class S1/S3



| Type | Frame Size | Dimension B            |
|------|------------|------------------------|
| S1   | 15/22      | M5, Depth 15 (Through) |
|      | 18/28      | M5, Depth 10           |
| S3   | 15/22      | M4, Depth 15 (Through) |
|      | 18/28      | M4, Depth 10           |

Motor Matching /  
Motor Power Design List

AFC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

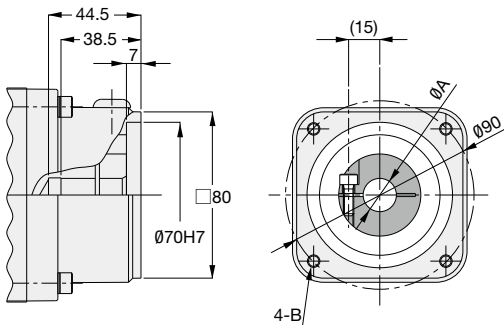
AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

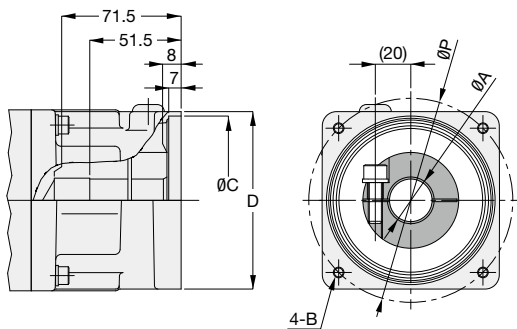
Option

### 750 W Class S1/S2/S3/S4



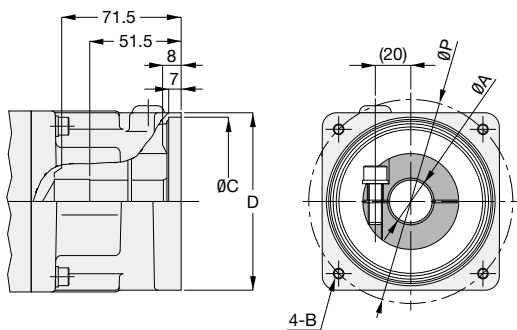
| Type | Frame Size | Dimension A | Dimension B            |
|------|------------|-------------|------------------------|
| S1   | 18/28      | Ø16H7       | M6, Depth 10 (Through) |
|      | 22/32      | Ø16H7       | M6, Depth 12           |
| S2   | 18/28      | Ø19H7       | M6, Depth 10 (Through) |
|      | 22/32      | Ø19H7       | M6, Depth 12           |
| S3   | 18/28      | Ø19H7       | M5, Depth 10 (Through) |
|      | 22/32      | Ø19H7       | M5, Depth 12           |
| S4   | 18/28      | Ø16H7       | M5, Depth 10 (Through) |
|      | 22/32      | Ø16H7       | M5, Depth 12           |

### 1000 W Class K13/K22/K23/K61



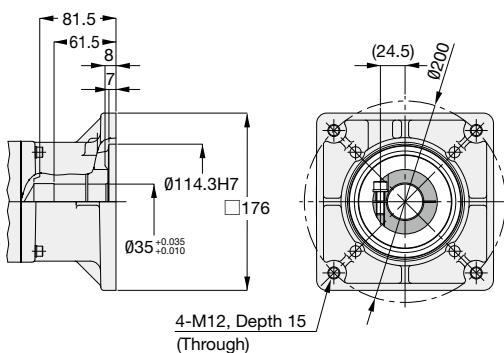
| Type | Dimension A | Dimension B            | Dimension C | Dimension D | Dimension P |
|------|-------------|------------------------|-------------|-------------|-------------|
| K13  | Ø24H7       | M6, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K22  | Ø22H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K23  | Ø24H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K61  | Ø19H7       | M6, Depth 12           | Ø80H7       | □90         | Ø100        |

### 2000 W Class K13/K21/K22/K23/K31/K32/K33/K41



| Type | Dimension A | Dimension B            | Dimension C | Dimension D | Dimension P |
|------|-------------|------------------------|-------------|-------------|-------------|
| K13  | Ø24H7       | M6, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K21  | Ø19H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K22  | Ø22H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K23  | Ø24H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K31  | Ø19H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K32  | Ø22H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K33  | Ø24H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K41  | Ø19H7       | M8, Depth 15 (Through) | Ø110H7      | □120        | Ø145        |

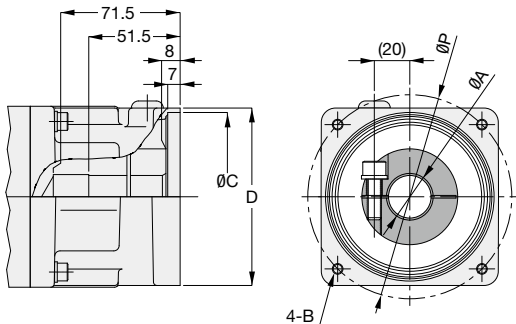
### 2000 W Class and 3000 W Class K75





## Detailed Diagrams of Input Shaft and Flange Shapes

### 3000 W Class K13/K21/K22/K23/K32/K33/K34/K52



| Type | Dimension A | Dimension B            | Dimension C | Dimension D | Dimension P |
|------|-------------|------------------------|-------------|-------------|-------------|
| K13  | Ø24H7       | M6, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K21  | Ø19H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K22  | Ø22H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K23  | Ø24H7       | M8, Depth 15 (Through) | Ø95H7       | □100        | Ø115        |
| K32  | Ø22H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K33  | Ø24H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K34  | Ø28H7       | M8, Depth 15 (Through) | Ø110H7      | □130        | Ø145        |
| K52  | Ø22H7       | M8, Depth 15 (Through) | Ø110H7      | □120        | Ø130        |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

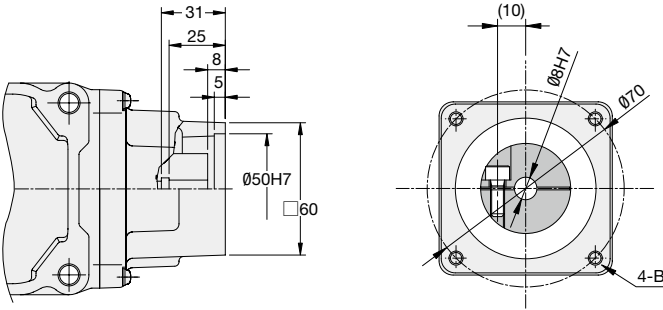
AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

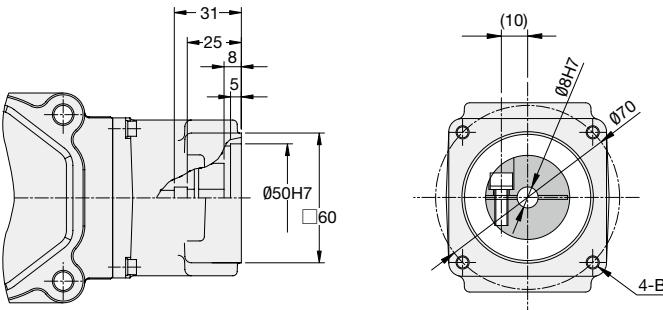
**AF3 Type**

■ 100 W Class (only backlash 1 arc min/3 arc min specifications) F1/F3



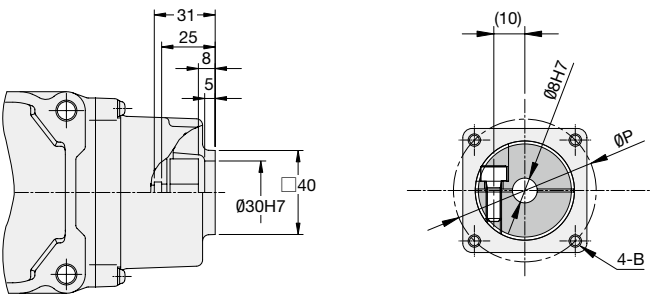
| Type | Dimension B  |
|------|--------------|
| F1   | M5, Depth 10 |
| F3   | M4, Depth 10 |

■ 100 W Class (only low backlash specifications) F1/F3



| Type | Dimension B  |
|------|--------------|
| F1   | M5, Depth 12 |
| F3   | M4, Depth 12 |

■ 100 W Class (only backlash 1 arc min/3 arc min specifications) F1/F3



| Type | Dimension B  | Dimension P      |
|------|--------------|------------------|
| S1   | M4, Depth 10 | $\varnothing 46$ |
| S3   | M3, Depth 10 | $\varnothing 45$ |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

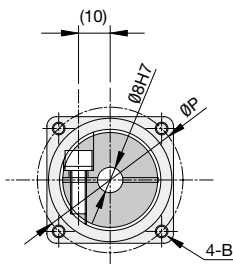
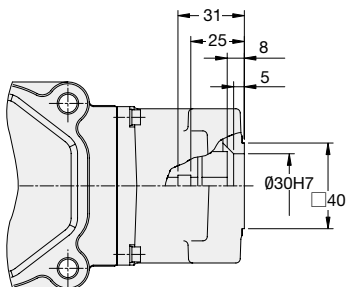
AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

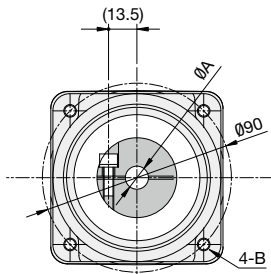
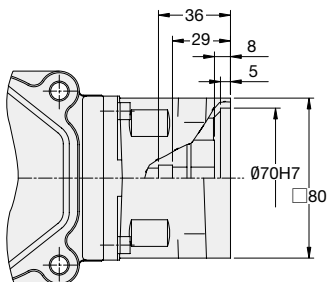
## Detailed Diagrams of Input Shaft and Flange Shapes

### 100 W Class (only low backlash specifications) S1/S3



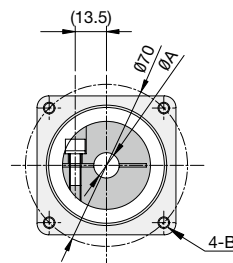
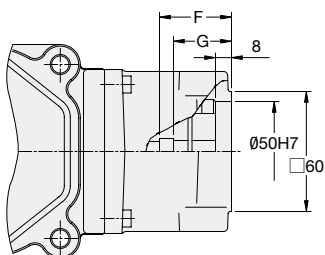
| Type | Dimension B  | Dimension P |
|------|--------------|-------------|
| S1   | M4, Depth 10 | Ø46         |
| S3   | M3, Depth 10 | Ø45         |

### 200 W Class F1/F2/F3



| Type | Dimension A | Dimension B            |
|------|-------------|------------------------|
| F1   | Ø11H7       | M6, Depth 12 (Through) |
| F2   | Ø14H7       | M6, Depth 12 (Through) |
| F3   | Ø11H7       | M5, Depth 12 (Through) |

### 200 W Class S1/S2/S3/S5



| Type | Dimension A | Dimension B  | Dimension F | Dimension G |
|------|-------------|--------------|-------------|-------------|
| S1   | Ø11H7       | M5, Depth 12 | 36          | 29          |
| S2   | Ø14H7       | M5, Depth 12 | 36          | 29          |
| S3   | Ø11H7       | M4, Depth 12 | 36          | 29          |
| S5   | Ø9H7        | M5, Depth 12 | 32          | 25          |

\* S5 is available only for backlash 1 arc min and 3 arc min specifications.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

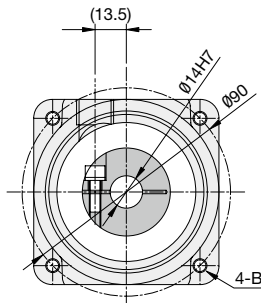
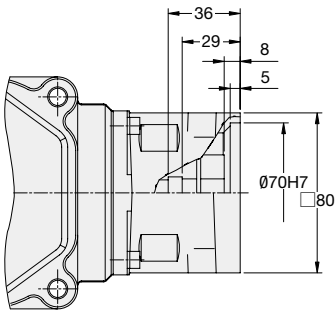
AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

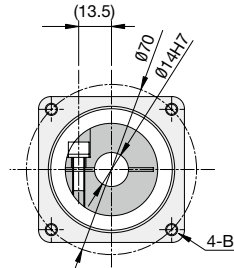
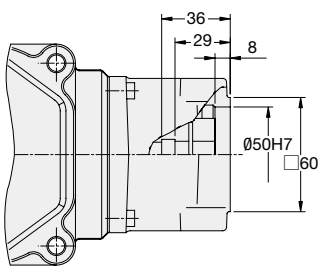
Option

### 400 W Class F1/F3



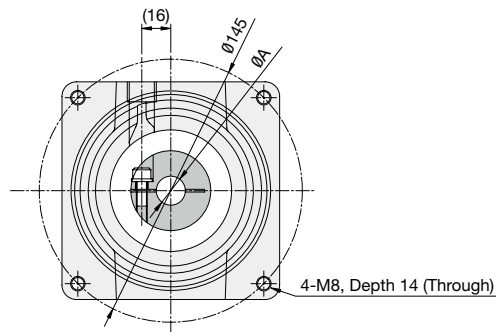
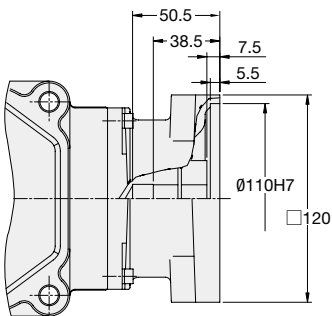
| Type | Dimension B            |
|------|------------------------|
| F1   | M6, Depth 12 (Through) |
| F3   | M5, Depth 12 (Through) |

### 400 W Class S1/S3



| Type | Dimension B  |
|------|--------------|
| S1   | M5, Depth 12 |
| S3   | M4, Depth 12 |

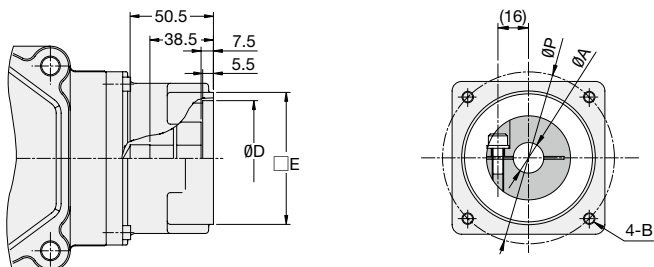
### 750 W Class F1/F2



| Type | Dimension A        |
|------|--------------------|
| F1   | $\varnothing 16H7$ |
| F2   | $\varnothing 19H7$ |

## Detailed Diagrams of Input Shaft and Flange Shapes

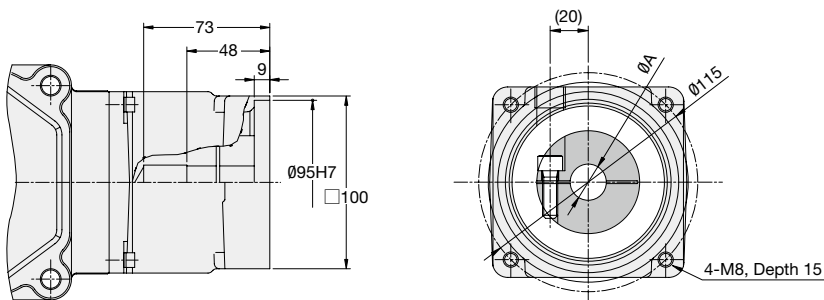
### 750 W Class S1/S2/S3/S4/S6



| Type | Dimension A                               | Dimension B  | Dimension D | Dimension E | Dimension P |
|------|---|--------------|-------------|-------------|-------------|
| S1   | Ø16H7                                     | M6, Depth 12 | Ø70H7       | □80         | Ø90         |
| S2   | Ø19H7                                     | M6, Depth 12 | Ø70H7       | □80         | Ø90         |
| S3   | Ø19H7                                     | M5, Depth 10 | Ø70H7       | □80         | Ø90         |
| S4   | Ø16H7                                     | M5, Depth 10 | Ø70H7       | □80         | Ø90         |
| S6   | Ø14 <sup>+0.030</sup> / <sub>+0.012</sub> | M6, Depth 12 | Ø80H7       | □90         | Ø100        |

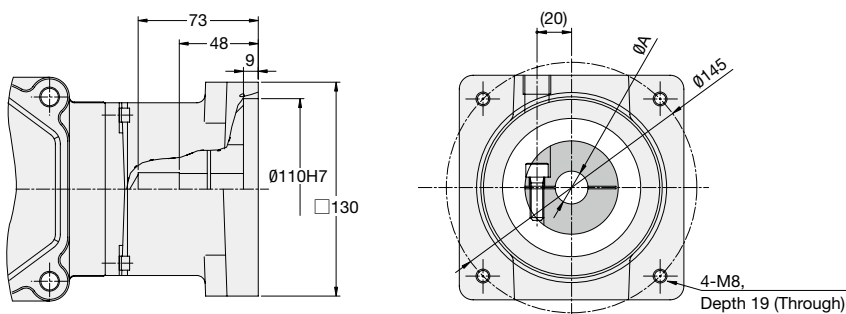
\* S6 is available only for backlash 1 arc min and 3 arc min specifications.

### 1000 W Class (only backlash 1 arc min/3 arc min specifications) K21/K22/K23



| Type | Dimension A |
|------|-------------|
| K21  | Ø19H7       |
| K22  | Ø22H7       |
| K23  | Ø24H7       |

### 1000 W Class (only backlash 1 arc min/3 arc min specifications) K31/K32/K33



| Type | Dimension A |
|------|-------------|
| K31  | Ø19H7       |
| K32  | Ø22H7       |
| K33  | Ø24H7       |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

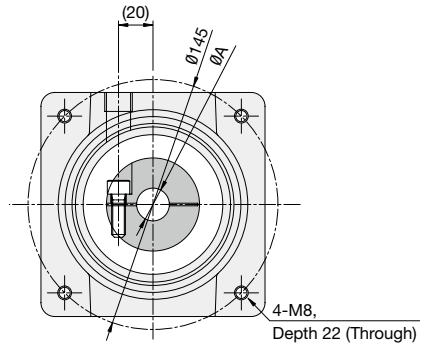
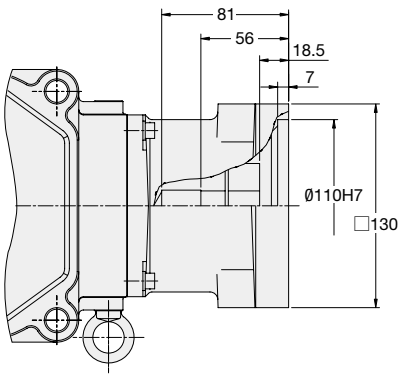
AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

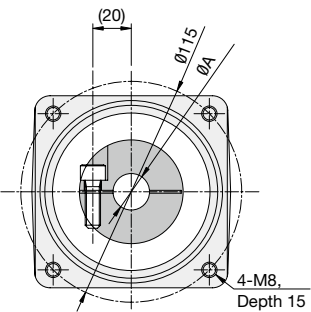
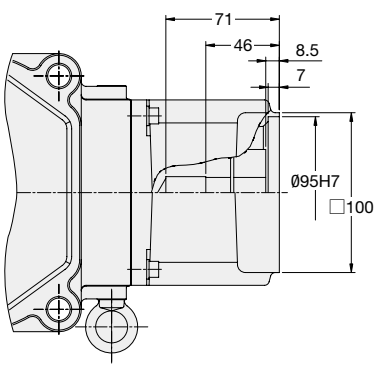
Option

2000 W Class F31/F33



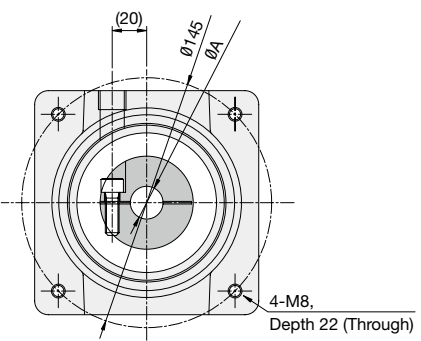
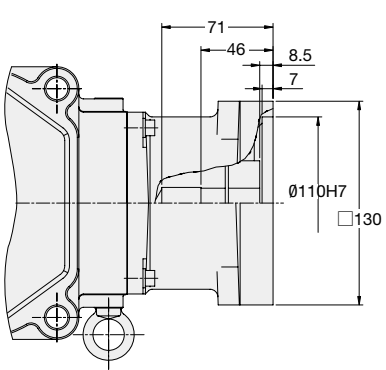
| Type | Dimension A |
|------|-------------|
| F31  | Ø19H7       |
| F33  | Ø24H7       |

2000 W Class K21/K22/K23



| Type | Dimension A |
|------|-------------|
| K21  | Ø19H7       |
| K22  | Ø22H7       |
| K23  | Ø24H7       |

2000 W Class K31/K32/K33



| Type | Dimension A |
|------|-------------|
| K31  | Ø19H7       |
| K32  | Ø22H7       |
| K33  | Ø24H7       |

## MEMO

|        |                         |   |   |                               |                                |   |
|--------|-------------------------|---|---|-------------------------------|--------------------------------|---|
| Option | Technical Documentation | AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft | AH2 Type<br>Right Angle Shaft | APG/AG3 Type<br>Parallel Shaft | Motor Matching /<br>Motor Power Design List |
|--------|-------------------------|---|---|-------------------------------|--------------------------------|---|

# Performance Tables [for Calculation and Selection]

## APG Type Backlash 3 arc min/15 arc min Specifications

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/3             | 12                    | 100               | 0.57                                      | 55                      |
|                 | 12                    | 200               | 1.5                                       | 75                      |
|                 | 12                    | 400               | 3.4                                       | 85                      |
|                 | 18                    | 750               | 6.4                                       | 85                      |
|                 | 22                    | 1000              | 7.2                                       | 70                      |
|                 | 22                    | 1500              | 11.5                                      | 75                      |
|                 | 22                    | 2000              | 17.2                                      | 85                      |
|                 | 28                    | 3000              | 25.8                                      | 85                      |
| 1/5             | 12                    | 100               | 1.0                                       | 55                      |
|                 | 12                    | 200               | 2.5                                       | 75                      |
|                 | 12                    | 400               | 5.7                                       | 85                      |
|                 | 18                    | 750               | 10.7                                      | 85                      |
|                 | 22                    | 1000              | 12.7                                      | 75                      |
|                 | 22                    | 1500              | 21.5                                      | 85                      |
|                 | 22                    | 2000              | 28.6                                      | 85                      |
|                 | 28                    | 3000              | 43.0                                      | 85                      |
| 1/10            | 12                    | 100               | 2.1                                       | 60                      |
|                 | 12                    | 200               | 5.1                                       | 75                      |
|                 | 18                    | 400               | 10.8                                      | 80                      |
|                 | 18                    | 750               | 21.5                                      | 85                      |
|                 | 22                    | 1000              | 26.4                                      | 75                      |
|                 | 22                    | 1500              | 43.0                                      | 85                      |
|                 | 22                    | 2000              | 57.3                                      | 85                      |
|                 | 28                    | 3000              | 85.9                                      | 85                      |
| 1/15            | 12                    | 100               | 3.3                                       | 65                      |
|                 | 12                    | 200               | 7.6                                       | 75                      |
|                 | 18                    | 400               | 16.2                                      | 80                      |
|                 | 22                    | 750               | 30.4                                      | 80                      |
|                 | 28                    | 1000              | 40.6                                      | 80                      |
|                 | 28                    | 1500              | 60.9                                      | 80                      |
|                 | 28                    | 2000              | 81.2                                      | 80                      |

Motor Matching / Motor Power Design List  
 APG/AG3 Type Parallel Shaft  
 AH2 Type Right Angle Shaft  
 AFC Type Right Angle Hollow Bore/ Right Angle Shaft  
 AF3 Type Concentric Right Angle Hollow Bore/ Concentric Right Angle Shaft  
 Technical Documentation  
 Option



## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/20            | 12                    | 100               | 4.5                                       | 65                      |
|                 | 12                    | 200               | 10.2                                      | 75                      |
|                 | 18                    | 400               | 21.6                                      | 80                      |
|                 | 22                    | 750               | 40.6                                      | 80                      |
|                 | 28                    | 1000              | 54.1                                      | 80                      |
|                 | 28                    | 1500              | 81.2                                      | 80                      |
|                 | 28                    | 2000              | 108.2                                     | 80                      |
| 1/30            | 12                    | 100               | 6.7                                       | 65                      |
|                 | 18                    | 200               | 15.3                                      | 75                      |
|                 | 18                    | 400               | 32.5                                      | 80                      |
|                 | 22                    | 750               | 60.9                                      | 80                      |
|                 | 28                    | 1000              | 81.2                                      | 80                      |
|                 | 28                    | 1500              | 121.8                                     | 80                      |
| 1/40            | 18                    | 100               | 8.3                                       | 60                      |
|                 | 18                    | 200               | 19.1                                      | 70                      |
|                 | 22                    | 400               | 40.7                                      | 75                      |
|                 | 28                    | 750               | 81.2                                      | 80                      |
|                 | 28                    | 1000              | 108.2                                     | 80                      |
| 1/50            | 18                    | 100               | 10.3                                      | 60                      |
|                 | 18                    | 200               | 25.5                                      | 75                      |
|                 | 22                    | 400               | 50.9                                      | 75                      |
|                 | 28                    | 750               | 95.5                                      | 75                      |
|                 | 28                    | 1000              | 135.3                                     | 80                      |
| 1/60            | 18                    | 100               | 12.4                                      | 60                      |
|                 | 18                    | 200               | 28.6                                      | 70                      |
|                 | 22                    | 400               | 61.1                                      | 75                      |
|                 | 28                    | 750               | 121.8                                     | 80                      |
| 1/100           | 18                    | 100               | 20.7                                      | 60                      |
|                 | 22                    | 200               | 44.6                                      | 65                      |
|                 | 28                    | 400               | 95.5                                      | 70                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## AG3 Type Low Backlash Specification

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.
- The “\*\*\*” mark indicates a limited torque type. Please make sure to check the motor rated output torque.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/5             | 18                    | 100               | 0.9                                       | 55                      |
|                 | 18                    | 200               | 1.9                                       | 60                      |
|                 | 22                    | 400               | 4.0                                       | 65                      |
|                 | 28                    | 750               | 9.6                                       | 80                      |
|                 | 32                    | 2000              | 25  | 80                      |
| 1/10            | 18                    | 100               | 1.9                                       | 60                      |
|                 | 18                    | 200               | 3.9                                       | 60                      |
|                 | 22                    | 400               | 8.0                                       | 65                      |
|                 | 28                    | 750               | 19  | 80                      |
|                 | 32                    | 2000              | 51  | 80                      |
| 1/15            | 18                    | 100               | 2.9                                       | 60                      |
|                 | 18                    | 200               | 5.8                                       | 60                      |
|                 | 22                    | 400               | 13  | 65                      |
|                 | 28                    | 750               | 29  | 80                      |
|                 | 32                    | 2000              | 76  | 80                      |
| 1/20            | 18                    | 100               | 3.8                                       | 60                      |
|                 | 18                    | 200               | 7.7                                       | 60                      |
|                 | 22                    | 400               | 16  | 65                      |
|                 | 28                    | 750               | 39  | 80                      |
|                 | 32                    | 2000              | 102                                       | 80                      |
| 1/25            | 18                    | 100               | 4.8                                       | 60                      |
|                 | 18                    | 200               | 10  | 60                      |
|                 | 22                    | 400               | 20  | 65                      |
|                 | 28                    | 750               | 46  | 80                      |
|                 | 32                    | 2000              | 130                                       | 80                      |
| 1/30            | 18                    | 100               | 5.8                                       | 60                      |
|                 | 22                    | 200               | 12  | 60                      |
|                 | 28                    | 400               | 25  | 65                      |
|                 | 32                    | 750               | 59  | 80                      |
|                 | 40                    | 2000              | 153                                       | 80                      |
| 1/40            | 18                    | 100               | 7.7                                       | 60                      |
|                 | 22                    | 200               | 16  | 65                      |
|                 | 28                    | 400               | 35  | 70                      |
|                 | 32                    | 750               | 71  | 75                      |
|                 | 40                    | 2000              | 211                                       | 80                      |
| 1/50            | 18                    | 100               | 10  | 60                      |
|                 | 22                    | 200               | 20  | 65                      |
|                 | 28                    | 400               | 43  | 70                      |
|                 | 32                    | 750               | 88  | 75                      |
|                 | 40                    | 2000              | 261                                       | 80                      |

|   |                                |                               |   |   |                         |        |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|
| Motor Matching /<br>Motor Power Design List | APG/AG3 Type<br>Parallel Shaft | AH2 Type<br>Right Angle Shaft | AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft | AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | Technical Documentation | Option |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|

## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/60            | 22                    | 100               | 13  | 65                      |
|                 | 22                    | 200               | 26  | 65                      |
|                 | 28                    | 400               | 52  | 70                      |
|                 | 32                    | 750               | 107                                       | 75                      |
|                 | 40                    | 2000              | 302                                       | 80                      |
| 1/80            | 22                    | 100               | 16  | 65                      |
|                 | 22                    | 200               | 33  | 65                      |
|                 | 28                    | 400               | 71  | 70                      |
|                 | 32                    | 750               | 142                                       | 75                      |
|                 | 40                    | 2000              | 423                                       | 80                      |
| 1/100           | 22                    | 100               | 20  | 65                      |
|                 | 28                    | 200               | 43  | 65                      |
|                 | 32                    | 400               | 88  | 70                      |
|                 | 40                    | 750               | 177                                       | 75                      |
|                 | 50                    | 2000              | 533                                       | 80                      |
| 1/120           | 22                    | 100               | 25  | 65                      |
|                 | 28                    | 200               | 50  | 65                      |
|                 | 32                    | 400               | 108                                       | 70                      |
|                 | 40                    | 750               | 218                                       | 75                      |
|                 | 50                    | 2000              | 594                                       | 80                      |
| 1/160           | 22                    | 100               | 32  | 65                      |
|                 | 28                    | 200               | 68  | 65                      |
|                 | 32                    | 400               | 141                                       | 70                      |
|                 | 40                    | 750               | 278                                       | 75                      |
|                 | 50                    | 2000              | 844                                       | 80                      |
| 1/200           | 22                    | 100               | 40  | 65                      |
|                 | 28                    | 200               | 81  | 65                      |
|                 | 32                    | 400               | 180                                       | 70                      |
|                 | 40                    | 750               | 348                                       | 75                      |
|                 | 50                    | 2000              | * 862                                     | 80                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## AH2 Type Low Backlash Specification

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.
- The “\*\*\*” mark indicates a limited torque type. Please make sure to check the motor rated output torque.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/5             | 22                    | 100               | 0.9                                       | 55                      |
|                 | 22                    | 200               | 2.0                                       | 60                      |
|                 | 28                    | 400               | 3.9                                       | 60                      |
|                 | 32                    | 750               | 7.8                                       | 65                      |
|                 | 40                    | 2000              | 24  | 70                      |
| 1/10            | 22                    | 100               | 2.2                                       | 65                      |
|                 | 22                    | 200               | 4.3                                       | 65                      |
|                 | 28                    | 400               | 8.4                                       | 65                      |
|                 | 32                    | 750               | 16  | 65                      |
|                 | 40                    | 2000              | 47  | 70                      |
| 1/15            | 22                    | 100               | 3.4                                       | 70                      |
|                 | 22                    | 200               | 7.1                                       | 70                      |
|                 | 28                    | 400               | 14  | 70                      |
|                 | 32                    | 750               | 26  | 70                      |
|                 | 40                    | 2000              | 73  | 75                      |
| 1/20            | 22                    | 100               | 4.6                                       | 70                      |
|                 | 22                    | 200               | 9.4                                       | 70                      |
|                 | 28                    | 400               | 19  | 70                      |
|                 | 32                    | 750               | 35  | 70                      |
|                 | 40                    | 2000              | 98  | 75                      |
| 1/25            | 22                    | 100               | 5.6                                       | 70                      |
|                 | 22                    | 200               | 12  | 70                      |
|                 | 28                    | 400               | 25  | 75                      |
|                 | 32                    | 750               | 45  | 75                      |
|                 | 40                    | 2000              | 122                                       | 75                      |
| 1/30            | 22                    | 100               | 6.9                                       | 70                      |
|                 | 22                    | 200               | 15  | 75                      |
|                 | 28                    | 400               | 29  | 75                      |
|                 | 32                    | 750               | 56  | 75                      |
|                 | 40                    | 2000              | 145                                       | 75                      |
| 1/40            | 22                    | 100               | 9.2                                       | 70                      |
|                 | 22                    | 200               | 20  | 75                      |
|                 | 28                    | 400               | 39  | 75                      |
|                 | 32                    | 750               | 74  | 75                      |
|                 | 40                    | 2000              | 196                                       | 75                      |
| 1/50            | 22                    | 100               | 11  | 70                      |
|                 | 22                    | 200               | 25  | 75                      |
|                 | 28                    | 400               | 49  | 75                      |
|                 | 32                    | 750               | 94  | 75                      |
|                 | 40                    | 2000              | 243                                       | 75                      |

Motor Matching / Motor Power Design List  
 APG/AG3 Type Parallel Shaft  
 AH2 Type Right Angle Shaft  
 AFC Type Right Angle Hollow Bore/ Right Angle Shaft  
 AF3 Type Concentric Right Angle Hollow Bore/ Concentric Right Angle Shaft  
 Technical Documentation  
 Option

## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/60            | 22                    | 100               | 14  | 70                      |
|                 | 22                    | 200               | 27  | 70                      |
|                 | 28                    | 400               | 55  | 70                      |
|                 | 32                    | 750               | 110                                       | 75                      |
|                 | 40                    | 2000              | 292                                       | 75                      |
| 1/80            | 22                    | 100               | 19  | 70                      |
|                 | 22                    | 200               | 34  | 65                      |
|                 | 28                    | 400               | 71  | 65                      |
|                 | 32                    | 750               | 141                                       | 70                      |
|                 | 40                    | 2000              | 380                                       | 70                      |
| 1/100           | 22                    | 100               | 24  | 70                      |
|                 | 28                    | 200               | 43  | 65                      |
|                 | 32                    | 400               | 88  | 65                      |
|                 | 40                    | 750               | 172                                       | 70                      |
|                 | 50                    | 2000              | 476                                       | 70                      |
| 1/120           | 22                    | 100               | 30  | 75                      |
|                 | 28                    | 200               | 57  | 70                      |
|                 | 32                    | 400               | 110                                       | 70                      |
|                 | 40                    | 750               | 212                                       | 70                      |
|                 | 50                    | 2000              | 584                                       | 75                      |
| 1/160           | 22                    | 100               | 40  | 75                      |
|                 | 28                    | 200               | 75  | 70                      |
|                 | 32                    | 400               | 149                                       | 70                      |
|                 | 40                    | 750               | 282                                       | 70                      |
|                 | 50                    | 2000              | 775                                       | 75                      |
| 1/200           | 22                    | 100               | 50  | 75                      |
|                 | 28                    | 200               | 94  | 70                      |
|                 | 32                    | 400               | 188                                       | 70                      |
|                 | 40                    | 750               | 353                                       | 70                      |
|                 | 50                    | 2000              | * 862                                     | 70                      |
| 1/240           | 22                    | 100               | 60  | 75                      |
|                 | 28                    | 200               | 110                                       | 70                      |
|                 | 32                    | 400               | 221                                       | 70                      |
|                 | 40                    | 750               | 423                                       | 70                      |
|                 | 50                    | 2000              | * 862                                     | 70                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

### AFC Type (Right Angle Hollow Bore) Backlash 3 arc min/30 arc min Specifications

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/3             | 15                    | 400               | 2.9                                       | 70                      |
|                 | 18                    | 750               | 5.7                                       | 75                      |
|                 | 22                    | 1000              | 7.7                                       | 75                      |
|                 | 28                    | 2000              | 16.2                                      | 80                      |
|                 | 32                    | 3000              | 24.4                                      | 80                      |
| 1/5             | 12                    | 200               | 2.1                                       | 60                      |
|                 | 15                    | 400               | 4.8                                       | 70                      |
|                 | 18                    | 750               | 9.5                                       | 75                      |
|                 | 22                    | 1000              | 12.9                                      | 75                      |
|                 | 28                    | 2000              | 27.1                                      | 80                      |
| 1/7.5           | 32                    | 3000              | 40.6                                      | 80                      |
|                 | 12                    | 100               | 1.4                                       | 55                      |
|                 | 15                    | 200               | 3.3                                       | 60                      |
|                 | 18                    | 400               | 7.2                                       | 70                      |
|                 | 22                    | 750               | 14.3                                      | 75                      |
| 1/10            | 28                    | 1000              | 20.1                                      | 75                      |
|                 | 32                    | 2000              | 40.6                                      | 80                      |
|                 | 12                    | 100               | 1.9                                       | 55                      |
|                 | 15                    | 200               | 4.5                                       | 65                      |
|                 | 18                    | 400               | 9.5                                       | 70                      |
| 1/10            | 22                    | 750               | 19.1                                      | 75                      |
|                 | 28                    | 1000              | 26.7                                      | 75                      |
|                 | 32                    | 2000              | 54.1                                      | 80                      |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/10            | 15                    | 100               | 1.9                                       | 55                      |
|                 | 18                    | 200               | 4.1                                       | 60                      |
|                 | 22                    | 400               | 9.5                                       | 70                      |
|                 | 28                    | 750               | 19.1                                      | 75                      |
|                 | 32                    | 1000              | 26.7                                      | 75                      |
| 1/12            | 15                    | 100               | 2.4                                       | 55                      |
|                 | 18                    | 200               | 5.2                                       | 60                      |
|                 | 22                    | 400               | 11.9                                      | 70                      |
|                 | 28                    | 750               | 23.9                                      | 75                      |
|                 | 32                    | 1000              | 32.6                                      | 75                      |
| 1/15            | 15                    | 100               | 2.9                                       | 55                      |
|                 | 18                    | 200               | 6.2                                       | 60                      |
|                 | 22                    | 400               | 14.3                                      | 70                      |
|                 | 28                    | 750               | 28.6                                      | 75                      |
|                 | 32                    | 1000              | 39.2                                      | 75                      |
| 1/20            | 15                    | 100               | 3.8                                       | 55                      |
|                 | 18                    | 200               | 8.9                                       | 65                      |
|                 | 22                    | 400               | 19.1                                      | 70                      |
|                 | 28                    | 750               | 38.2                                      | 75                      |
|                 | 32                    | 1000              | 52.2                                      | 75                      |
| 1/25            | 15                    | 100               | 4.8                                       | 55                      |
|                 | 18                    | 200               | 11.1                                      | 65                      |
|                 | 22                    | 400               | 23.9                                      | 70                      |
|                 | 28                    | 750               | 47.7                                      | 75                      |
|                 | 32                    | 1000              | 65.3                                      | 75                      |
| 1/30            | 15                    | 100               | 5.7                                       | 55                      |
|                 | 18                    | 200               | 13.4                                      | 65                      |
|                 | 22                    | 400               | 28.6                                      | 70                      |
|                 | 28                    | 750               | 57.3                                      | 75                      |
|                 | 32                    | 1000              | 78.3                                      | 75                      |
| 1/40            | 18                    | 100               | 8.3                                       | 60                      |
|                 | 22                    | 200               | 19.1                                      | 70                      |
|                 | 28                    | 400               | 40.7                                      | 75                      |
|                 | 32                    | 750               | 79.3                                      | 80                      |
| 1/50            | 18                    | 100               | 10.3                                      | 60                      |
|                 | 22                    | 200               | 23.9                                      | 70                      |
|                 | 28                    | 400               | 50.9                                      | 75                      |
|                 | 32                    | 750               | 99.1                                      | 80                      |
| 1/60            | 18                    | 100               | 12.4                                      | 60                      |
|                 | 22                    | 200               | 28.6                                      | 70                      |
|                 | 28                    | 400               | 61.1                                      | 75                      |
|                 | 32                    | 750               | 118.9                                     | 80                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

### AFC Type (Right Angle Shaft) Backlash 3 arc min/30 arc min Specifications

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/3             | 15                    | 400               | 2.9                                       | 70                      |
|                 | 18                    | 750               | 5.7                                       | 75                      |
|                 | 22                    | 1000              | 7.7                                       | 75                      |
|                 | 28                    | 2000              | 16.2                                      | 80                      |
|                 | 32                    | 3000              | 24.4                                      | 80                      |
| 1/5             | 12                    | 200               | 2.1                                       | 60                      |
|                 | 15                    | 400               | 4.8                                       | 70                      |
|                 | 18                    | 750               | 9.5                                       | 75                      |
|                 | 22                    | 1000              | 12.9                                      | 75                      |
|                 | 28                    | 2000              | 27.1                                      | 80                      |
| 1/7.5           | 32                    | 3000              | 40.6                                      | 80                      |
|                 | 12                    | 100               | 1.4                                       | 55                      |
|                 | 15                    | 200               | 3.3                                       | 60                      |
|                 | 18                    | 400               | 7.2                                       | 70                      |
|                 | 22                    | 750               | 14.3                                      | 75                      |
| 1/10            | 28                    | 1000              | 20.1                                      | 75                      |
|                 | 32                    | 2000              | 40.6                                      | 80                      |
|                 | 12                    | 100               | 1.9                                       | 55                      |
|                 | 15                    | 200               | 4.5                                       | 65                      |
|                 | 18                    | 400               | 9.5                                       | 70                      |
| 1/10            | 22                    | 750               | 19.1                                      | 75                      |
|                 | 28                    | 1000              | 26.7                                      | 75                      |
|                 | 32                    | 2000              | 54.1                                      | 80                      |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option



## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/10            | 15                    | 100               | 1.9                                       | 55                      |
|                 | 18                    | 200               | 4.1                                       | 60                      |
|                 | 22                    | 400               | 9.5                                       | 70                      |
|                 | 28                    | 750               | 19.1                                      | 75                      |
|                 | 32                    | 1000              | 26.7                                      | 75                      |
| 1/12            | 15                    | 100               | 2.4                                       | 55                      |
|                 | 18                    | 200               | 5.2                                       | 60                      |
|                 | 22                    | 400               | 11.9                                      | 70                      |
|                 | 28                    | 750               | 23.9                                      | 75                      |
|                 | 32                    | 1000              | 32.6                                      | 75                      |
| 1/15            | 15                    | 100               | 2.9                                       | 55                      |
|                 | 18                    | 200               | 6.2                                       | 60                      |
|                 | 22                    | 400               | 14.3                                      | 70                      |
|                 | 28                    | 750               | 28.6                                      | 75                      |
|                 | 32                    | 1000              | 39.2                                      | 75                      |
| 1/20            | 15                    | 100               | 3.8                                       | 55                      |
|                 | 18                    | 200               | 8.9                                       | 65                      |
|                 | 22                    | 400               | 19.1                                      | 70                      |
|                 | 28                    | 750               | 38.2                                      | 75                      |
|                 | 32                    | 1000              | 52.2                                      | 75                      |
| 1/25            | 15                    | 100               | 4.8                                       | 55                      |
|                 | 18                    | 200               | 11.1                                      | 65                      |
|                 | 22                    | 400               | 23.9                                      | 70                      |
|                 | 28                    | 750               | 47.7                                      | 75                      |
|                 | 32                    | 1000              | 65.3                                      | 75                      |
| 1/30            | 15                    | 100               | 5.7                                       | 55                      |
|                 | 18                    | 200               | 13.4                                      | 65                      |
|                 | 22                    | 400               | 28.6                                      | 70                      |
|                 | 28                    | 750               | 57.3                                      | 75                      |
|                 | 32                    | 1000              | 78.3                                      | 75                      |
| 1/40            | 18                    | 100               | 8.3                                       | 60                      |
|                 | 22                    | 200               | 19.1                                      | 70                      |
|                 | 28                    | 400               | 40.7                                      | 75                      |
|                 | 32                    | 750               | 79.3                                      | 80                      |
| 1/50            | 18                    | 100               | 10.3                                      | 60                      |
|                 | 22                    | 200               | 23.9                                      | 70                      |
|                 | 28                    | 400               | 50.9                                      | 75                      |
|                 | 32                    | 750               | 99.1                                      | 80                      |
| 1/60            | 18                    | 100               | 12.4                                      | 60                      |
|                 | 22                    | 200               | 28.6                                      | 70                      |
|                 | 28                    | 400               | 61.1                                      | 75                      |
|                 | 32                    | 750               | 118.9                                     | 80                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

### AF3S Type (Concentric Right Angle Hollow Bore) Backlash 1 arc min/3 arc min Specifications

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.
- The “\*” mark indicates a limited torque type. Please make sure to check the motor rated output torque.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/10            | 15                    | 100               | 2.2                                       | 60                      |
|                 | 25                    | 200               | 3.8                                       | 60                      |
|                 | 30                    | 400               | 7.8                                       | 60                      |
|                 | 35                    | 750               | 16  | 60                      |
|                 | 35                    | 1000              | 22  | 70                      |
|                 | 45                    | 2000              | 44  | 70                      |
| 1/15            | 15                    | 100               | 3.5                                       | 65                      |
|                 | 25                    | 200               | 6.4                                       | 65                      |
|                 | 30                    | 400               | 13  | 65                      |
|                 | 35                    | 750               | 26  | 65                      |
| 1/20            | 15                    | 100               | 5.0                                       | 70                      |
|                 | 25                    | 200               | 8.9                                       | 65                      |
|                 | 30                    | 400               | 18  | 65                      |
|                 | 35                    | 750               | 36  | 70                      |
|                 | 35                    | 1000              | 45  | 70                      |
|                 | 45                    | 2000              | 90  | 70                      |
| 1/25            | 15                    | 100               | 6.4                                       | 70                      |
|                 | 25                    | 200               | 12  | 65                      |
|                 | 30                    | 400               | 23  | 70                      |
|                 | 35                    | 750               | 46  | 70                      |
| 1/30            | 15                    | 100               | 7.6                                       | 75                      |
|                 | 25                    | 200               | 14  | 65                      |
|                 | 30                    | 400               | 27  | 70                      |
|                 | 35                    | 750               | 55  | 70                      |
|                 | 35                    | 1000              | 67  | 70                      |
|                 | 45                    | 2000              | 144                                       | 75                      |
| 1/40            | 15                    | 100               | 10  | 75                      |
|                 | 25                    | 200               | 19  | 65                      |
|                 | 30                    | 400               | 36  | 70                      |
|                 | 35                    | 750               | 76  | 75                      |
|                 | 35                    | 1000              | 96  | 75                      |
|                 | 45                    | 2000              | 191                                       | 75                      |

# Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/50            | 15                    | 100               | 13  | 75                      |
|                 | 25                    | 200               | 24  | 65                      |
|                 | 30                    | 400               | 45  | 70                      |
|                 | 35                    | 750               | 95  | 75                      |
|                 | 35                    | 1000              | 120                                       | 75                      |
|                 | 45                    | 2000              | 239                                       | 75                      |
| 1/60            | 15                    | 100               | 15  | 75                      |
|                 | 25                    | 200               | 29  | 65                      |
|                 | 30                    | 400               | 54  | 70                      |
|                 | 35                    | 750               | 115                                       | 75                      |
|                 | 35                    | 1000              | 143                                       | 75                      |
|                 | 45                    | 2000              | 287                                       | 75                      |
| 1/75            | 15                    | 100               | 18  | 70                      |
|                 | 30                    | 200               | 31  | 60                      |
|                 | 35                    | 400               | 63  | 65                      |
|                 | 45                    | 750               | 135                                       | 70                      |
| 1/90            | 15                    | 100               | 22  | 70                      |
|                 | 30                    | 200               | 37  | 60                      |
|                 | 35                    | 400               | 75  | 65                      |
|                 | 45                    | 750               | 162                                       | 70                      |
| 1/120           | 15                    | 100               | 29  | 70                      |
|                 | 30                    | 200               | 50  | 60                      |
|                 | 35                    | 400               | 100                                       | 65                      |
|                 | 45                    | 750               | 217                                       | 70                      |
| 1/150           | 30                    | 200               | 57  | 60                      |
|                 | 35                    | 400               | 124                                       | 65                      |
|                 | 45                    | 750               | 251                                       | 70                      |
| 1/180           | 30                    | 200               | * 57                                      | 60                      |
|                 | 35                    | 400               | * 124                                     | 65                      |
|                 | 45                    | 750               | * 251                                     | 70                      |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

### AF3F Type (Concentric Right Angle Shaft) Backlash 1 arc min/3 arc min Specifications

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.
- The “\*” mark indicates a limited torque type. Please make sure to check the motor rated output torque.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/10            | 18                    | 100               | 2.2                                       | 60                      |
|                 | 22                    | 200               | 3.8                                       | 60                      |
|                 | 28                    | 400               | 7.8                                       | 60                      |
|                 | 32                    | 750               | 16  | 60                      |
|                 | 32                    | 1000              | 22  | 70                      |
|                 | 40                    | 2000              | 44  | 70                      |
| 1/15            | 18                    | 100               | 3.5                                       | 65                      |
|                 | 22                    | 200               | 6.4                                       | 65                      |
|                 | 28                    | 400               | 13  | 65                      |
|                 | 32                    | 750               | 26  | 65                      |
| 1/20            | 18                    | 100               | 5.0                                       | 70                      |
|                 | 22                    | 200               | 8.9                                       | 65                      |
|                 | 28                    | 400               | 18  | 65                      |
|                 | 32                    | 750               | 36  | 70                      |
|                 | 32                    | 1000              | 45  | 70                      |
|                 | 40                    | 2000              | 90  | 70                      |
| 1/25            | 18                    | 100               | 6.4                                       | 70                      |
|                 | 22                    | 200               | 12  | 65                      |
|                 | 28                    | 400               | 23  | 70                      |
|                 | 32                    | 750               | 46  | 70                      |
| 1/30            | 18                    | 100               | 7.6                                       | 75                      |
|                 | 22                    | 200               | 14  | 65                      |
|                 | 28                    | 400               | 27  | 70                      |
|                 | 32                    | 750               | 55  | 70                      |
|                 | 32                    | 1000              | 67  | 70                      |
|                 | 40                    | 2000              | 144                                       | 75                      |
| 1/40            | 18                    | 100               | 10  | 75                      |
|                 | 22                    | 200               | 19  | 65                      |
|                 | 28                    | 400               | 36  | 70                      |
|                 | 32                    | 750               | 76  | 75                      |
|                 | 32                    | 1000              | 96  | 75                      |
|                 | 40                    | 2000              | 191                                       | 75                      |

## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/50            | 18                    | 100               | 13  | 75                      |
|                 | 22                    | 200               | 24  | 65                      |
|                 | 28                    | 400               | 45  | 70                      |
|                 | 32                    | 750               | 95  | 75                      |
|                 | 32                    | 1000              | 120                                       | 75                      |
|                 | 40                    | 2000              | 239                                       | 75                      |
| 1/60            | 18                    | 100               | 15  | 75                      |
|                 | 22                    | 200               | 29  | 65                      |
|                 | 28                    | 400               | 54  | 70                      |
|                 | 32                    | 750               | 115                                       | 75                      |
|                 | 32                    | 1000              | 143                                       | 75                      |
|                 | 40                    | 2000              | 287                                       | 75                      |
| 1/75            | 18                    | 100               | 18  | 70                      |
|                 | 28                    | 200               | 31  | 60                      |
|                 | 32                    | 400               | 63  | 65                      |
|                 | 40                    | 750               | 135                                       | 70                      |
| 1/90            | 18                    | 100               | 22  | 70                      |
|                 | 28                    | 200               | 37  | 60                      |
|                 | 32                    | 400               | 75  | 65                      |
|                 | 40                    | 750               | 162                                       | 70                      |
| 1/120           | 18                    | 100               | 29  | 70                      |
|                 | 28                    | 200               | 50  | 60                      |
|                 | 32                    | 400               | 100                                       | 65                      |
|                 | 40                    | 750               | 217                                       | 70                      |
| 1/150           | 28                    | 200               | 57  | 60                      |
|                 | 32                    | 400               | 124                                       | 65                      |
|                 | 40                    | 750               | 251                                       | 70                      |
| 1/180           | 28                    | 200               | * 57                                      | 60                      |
|                 | 32                    | 400               | * 124                                     | 65                      |
|                 | 40                    | 750               | * 251                                     | 70                      |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

### AF3S Type (Concentric Right Angle Hollow Bore) Low Backlash Specification

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/5             | 30                    | 400               | 3.8                                       | 60                      |
|                 | 35                    | 750               | 7.4                                       | 60                      |
|                 | 45                    | 2000              | 24  | 70                      |
| 1/7.5           | 30                    | 400               | 5.9                                       | 60                      |
|                 | 35                    | 750               | 11  | 60                      |
|                 | 45                    | 2000              | 35  | 70                      |
| 1/10            | 20                    | 100               | 2.0                                       | 60                      |
|                 | 25                    | 200               | 3.8                                       | 60                      |
|                 | 30                    | 400               | 7.8                                       | 60                      |
|                 | 35                    | 750               | 15  | 60                      |
| 1/12            | 45                    | 2000              | 47  | 70                      |
|                 | 30                    | 400               | 11  | 65                      |
|                 | 35                    | 750               | 20  | 65                      |
| 1/15            | 45                    | 2000              | 57  | 70                      |
|                 | 20                    | 100               | 3.1                                       | 65                      |
|                 | 25                    | 200               | 6.4                                       | 65                      |
|                 | 30                    | 400               | 13  | 65                      |
| 1/20            | 35                    | 750               | 25  | 65                      |
|                 | 45                    | 2000              | 69  | 70                      |
|                 | 20                    | 100               | 4.7                                       | 70                      |
|                 | 25                    | 200               | 8.8                                       | 65                      |
|                 | 30                    | 400               | 17  | 65                      |
| 1/25            | 35                    | 750               | 34  | 70                      |
|                 | 45                    | 2000              | 92  | 70                      |
|                 | 20                    | 100               | 5.9                                       | 70                      |
|                 | 25                    | 200               | 12  | 70                      |
|                 | 30                    | 400               | 23  | 70                      |
| 1/30            | 35                    | 750               | 44  | 70                      |
|                 | 45                    | 2000              | 120                                       | 75                      |
|                 | 20                    | 100               | 7.1                                       | 70                      |
|                 | 25                    | 200               | 14  | 70                      |
|                 | 30                    | 400               | 27  | 70                      |
| 1/40            | 35                    | 750               | 53  | 70                      |
|                 | 45                    | 2000              | 144                                       | 75                      |
|                 | 20                    | 100               | 9.4                                       | 70                      |
|                 | 25                    | 200               | 19  | 70                      |
|                 | 30                    | 400               | 36  | 70                      |
| 1/50            | 35                    | 750               | 74  | 75                      |
|                 | 45                    | 2000              | 191                                       | 75                      |
|                 | 20                    | 100               | 12  | 70                      |
|                 | 25                    | 200               | 24  | 70                      |
|                 | 30                    | 400               | 45  | 70                      |
| 1/50            | 35                    | 750               | 94  | 75                      |
|                 | 45                    | 2000              | 239                                       | 75                      |

Motor Matching / Motor Power Design List

APG/AG3 Type Parallel Shaft

AH2 Type Right Angle Shaft

AFC Type Right Angle Hollow Bore/ Right Angle Shaft

AF3 Type Concentric Right Angle Hollow Bore/ Concentric Right Angle Shaft

Technical Documentation

Option

## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/60            | 20                    | 100               | 14  | 70                      |
|                 | 25                    | 200               | 27  | 70                      |
|                 | 30                    | 400               | 55  | 70                      |
|                 | 35                    | 750               | 113                                       | 75                      |
|                 | 45                    | 2000              | 287                                       | 75                      |
| 1/80            | 25                    | 100               | 17  | 65                      |
|                 | 30                    | 200               | 34  | 65                      |
|                 | 35                    | 400               | 71  | 65                      |
|                 | 45                    | 750               | 141                                       | 70                      |
| 1/100           | 25                    | 100               | 22  | 65                      |
|                 | 30                    | 200               | 44  | 65                      |
|                 | 35                    | 400               | 86  | 65                      |
|                 | 45                    | 750               | 172                                       | 70                      |
| 1/120           | 25                    | 100               | 28  | 70                      |
|                 | 30                    | 200               | 55  | 70                      |
|                 | 35                    | 400               | 102                                       | 65                      |
|                 | 45                    | 750               | 212                                       | 70                      |
| 1/160           | 25                    | 100               | 37  | 70                      |
|                 | 30                    | 200               | 74  | 70                      |
|                 | 35                    | 400               | 141                                       | 65                      |
|                 | 45                    | 750               | 282                                       | 70                      |
| 1/200           | 25                    | 100               | 47  | 70                      |
|                 | 30                    | 200               | 94  | 70                      |
|                 | 35                    | 400               | 181                                       | 70                      |
|                 | 45                    | 750               | 353                                       | 70                      |
| 1/240           | 25                    | 100               | 57  | 70                      |
|                 | 30                    | 200               | 110                                       | 70                      |
|                 | 35                    | 400               | 221                                       | 70                      |
|                 | 45                    | 750               | 423                                       | 70                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## AF3F Type (Concentric Right Angle Shaft) Low Backlash Specification

**[Notes]**

- This performance table is based on pairing with a servo motor running at the rated input speed of 3000 r/min.
- The motor rated output torque is based on values after a warm-up operation of the unit.
- The transmission efficiency percentage is only a reference value.
- The transmission efficiency varies greatly depending on the input speed and the load on the product. Please be cautious.

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/5             | 28                    | 400               | 3.8                                       | 60                      |
|                 | 32                    | 750               | 7.4                                       | 60                      |
|                 | 40                    | 2000              | 24  | 70                      |
| 1/7.5           | 28                    | 400               | 5.9                                       | 60                      |
|                 | 32                    | 750               | 11  | 60                      |
|                 | 40                    | 2000              | 35  | 70                      |
| 1/10            | 18                    | 100               | 2.0                                       | 60                      |
|                 | 22                    | 200               | 3.8                                       | 60                      |
|                 | 28                    | 400               | 7.8                                       | 60                      |
|                 | 32                    | 750               | 15  | 60                      |
| 1/12            | 40                    | 2000              | 47  | 70                      |
|                 | 28                    | 400               | 11  | 65                      |
|                 | 32                    | 750               | 20  | 65                      |
|                 | 40                    | 2000              | 57  | 70                      |
| 1/15            | 18                    | 100               | 3.1                                       | 65                      |
|                 | 22                    | 200               | 6.4                                       | 65                      |
|                 | 28                    | 400               | 13  | 65                      |
|                 | 32                    | 750               | 25  | 65                      |
|                 | 40                    | 2000              | 69  | 70                      |
| 1/20            | 18                    | 100               | 4.7                                       | 70                      |
|                 | 22                    | 200               | 8.8                                       | 65                      |
|                 | 28                    | 400               | 17  | 65                      |
|                 | 32                    | 750               | 34  | 70                      |
|                 | 40                    | 2000              | 92  | 70                      |
| 1/25            | 18                    | 100               | 5.9                                       | 70                      |
|                 | 22                    | 200               | 12  | 70                      |
|                 | 28                    | 400               | 23  | 70                      |
|                 | 32                    | 750               | 44  | 70                      |
|                 | 40                    | 2000              | 120                                       | 75                      |
| 1/30            | 18                    | 100               | 7.1                                       | 70                      |
|                 | 22                    | 200               | 14  | 70                      |
|                 | 28                    | 400               | 27  | 70                      |
|                 | 32                    | 750               | 53  | 70                      |
|                 | 40                    | 2000              | 144                                       | 75                      |
| 1/40            | 18                    | 100               | 9.4                                       | 70                      |
|                 | 22                    | 200               | 19  | 70                      |
|                 | 28                    | 400               | 36  | 70                      |
|                 | 32                    | 750               | 74  | 75                      |
|                 | 40                    | 2000              | 191                                       | 75                      |
| 1/50            | 18                    | 100               | 12  | 70                      |
|                 | 22                    | 200               | 24  | 70                      |
|                 | 28                    | 400               | 45  | 70                      |
|                 | 32                    | 750               | 94  | 75                      |
|                 | 40                    | 2000              | 239                                       | 75                      |

Motor Matching / Motor Power Design List  
 APG/AG3 Type Parallel Shaft  
 AH2 Type Right Angle Shaft  
 AFC Type Right Angle Hollow Bore / Right Angle Shaft  
 AF3 Type Concentric Right Angle Hollow Bore / Concentric Right Angle Shaft  
 Technical Documentation  
 Option



## Performance Tables [for Calculation and Selection]

| Reduction Ratio | Output Shaft Diameter | Motor Power Class | Motor Rated Output Torque<br>(3000 r/min) | Transmission Efficiency |
|-----------------|-----------------------|-------------------|---|-------------------------|
|                 |                       | W                 | N·m                                       | %                       |
| 1/60            | 18                    | 100               | 14  | 70                      |
|                 | 22                    | 200               | 27  | 70                      |
|                 | 28                    | 400               | 55  | 70                      |
|                 | 32                    | 750               | 113                                       | 75                      |
|                 | 40                    | 2000              | 287                                       | 75                      |
| 1/80            | 22                    | 100               | 17  | 65                      |
|                 | 28                    | 200               | 34  | 65                      |
|                 | 32                    | 400               | 71  | 65                      |
|                 | 40                    | 750               | 141                                       | 70                      |
| 1/100           | 22                    | 100               | 22  | 65                      |
|                 | 28                    | 200               | 44  | 65                      |
|                 | 32                    | 400               | 86  | 65                      |
|                 | 40                    | 750               | 172                                       | 70                      |
| 1/120           | 22                    | 100               | 28  | 70                      |
|                 | 28                    | 200               | 55  | 70                      |
|                 | 32                    | 400               | 102                                       | 65                      |
|                 | 40                    | 750               | 212                                       | 70                      |
| 1/160           | 22                    | 100               | 37  | 70                      |
|                 | 28                    | 200               | 74  | 70                      |
|                 | 32                    | 400               | 141                                       | 65                      |
|                 | 40                    | 750               | 282                                       | 70                      |
| 1/200           | 22                    | 100               | 47  | 70                      |
|                 | 28                    | 200               | 94  | 70                      |
|                 | 32                    | 400               | 181                                       | 70                      |
|                 | 40                    | 750               | 353                                       | 70                      |
| 1/240           | 22                    | 100               | 57  | 70                      |
|                 | 28                    | 200               | 110                                       | 70                      |
|                 | 32                    | 400               | 221                                       | 70                      |
|                 | 40                    | 750               | 423                                       | 70                      |

Motor Matching /  
Motor Power Design List

APC/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

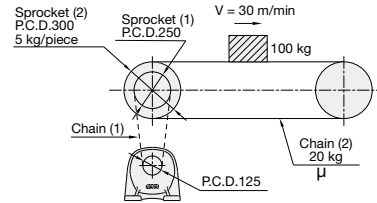
Technical Documentation

Option

# Selection Process Steps and Examples

## Selection Examples High Precision Reducers for Servo Motors

Application ..... Conveyor (light shock load)  
 Connection method ..... Chain (located in the center of the shaft)  
 Conveyance velocity V ..... 30 m/min  
 Workpiece weight ..... 100 kg  
 Operation time ..... 12 hours/day  
 Number of startups and stops ... 720 times/day  
 Friction coefficient of chain and guide  $\mu$  ... 0.2  
 Servo motor rated speed ..... 3000 r/min



The chain (1), the sprocket (1), and other conditions shall not be included in this calculation.

Please utilize the calculation and selection tool on our website. ([https://sentei.nissei-gtr.co.jp/english/servo\\_calculation](https://sentei.nissei-gtr.co.jp/english/servo_calculation))  
 You may calculate the necessary power by inputting the usage conditions and the series on our website.

|   | Selection Process Steps   | Selection Examples   |
|---|---|--|
| AH2 Type<br>Right Angle Shaft   | <b>Determining Series and Backlash</b><br><b>Determining a right angle hollow bore, parallel shaft, or right angle shaft</b><br>- Compact Parallel Shaft/Planetary Type APG<br>- Compact Right Angle Hollow Bore Type AFC<br>- Compact Right Angle Shaft Type AFC<br>- Right Angle Hollow Bore Type AF3<br>- Right Angle Shaft Type AF3<br>- Parallel Shaft Type AG3<br>- Right Angle Shaft Type AH2<br>*Backlash differs depending on the series.  | Based on the mounting space, decide on the compact parallel or planetary type APG.<br>Since repeated stop precision is not required, determine 15 arc min for backlash.  |
| AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft                       | <b>Determining the reduction ratio</b><br>$i = \frac{\text{Required Speed of Output Shaft}}{\text{Input Shaft Speed}}$  | Required speed of output shaft = $\frac{30 \times 1000}{300 \times \pi} \times \frac{250}{125} \approx 63.66$ r/min<br>$i = \frac{63.66}{3000} \approx \frac{1}{47.12}$<br>Select 1/40 for the reduction ratio since the speed will exceed the servo motor rated speed of 3000 r/min if 1/50 is selected for the reduction ratio.<br>Selected reduction ratio $i = \frac{1}{40}$   |
| AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | <b>Examining the load torque</b><br><b>Calculating the actual load torque (<math>T_{LE}</math>)</b><br>Service factor (Sf) in [Table-1] on page 864   | Based on the load condition (light shock load) the service factor (Sf) is 1.25.<br>$T_{LE} = 9.8 \times (100 + 5 \times 2 + 20) \times 0.2 \times \frac{300}{2 \times 1000} \times \frac{125}{250} \times 1.25 = 23.89$ N-m  |
| Technical Documentation   | <b>Examining the inertia</b><br><b>Calculating the load's moment of inertia of reducer input shaft equivalent (<math>J_r</math>)</b><br>Correction coefficient (C) in [Table-1] on page 865   | Based on operation conditions, the correction coefficient (C) is 3.<br>$J_r = \left(100 + \frac{1}{2} \times 5 \times 2 + 20\right) \times \left(\frac{300}{2 \times 1000}\right)^2 \times \left(\frac{125}{250}\right)^2 \times \left(\frac{1}{40}\right)^2 \times 3 = 0.00131836$ kg-m <sup>2</sup>  |
| Option  | <b>Examining the O.H.L.</b><br><b>Calculating the O.H.L. based on the actual load torque (<math>T_{LE}</math>)</b><br>$\text{O.H.L.} = \frac{T_{LE} \times fb \times fw}{R}$<br>R : Pitch Circle Radius (m) of sprocket, pulley, gear, etc. attached to reducer shaft<br>fb: Coefficient for the connection method in [Table-1] on page 867<br>fw: Coefficient for the load level in [Table-2] on page 867<br><br><b>Correcting the tolerance based on the O.H.L. position</b><br>[Table-1] on page 868 | Based on the operation conditions, the coefficient for the connection method (fb) is 1.3, and the coefficient for the load level (fw) is 1.3.<br>$\text{O.H.L.} = \frac{23.89 \times 1.3 \times 1.3}{\frac{125}{2 \times 1000}} = 645.99$ N<br><br>The tolerance does not need to be corrected because the load position of the O.H.L. is at the middle of the shaft.<br><br>* Please add values as needed if there are other factors that may affect the O.H.L. of the product, such as belt tension. |
|   | <b>Tentative selection of a model</b><br><b>Based on the torque, the inertia, and the O.H.L., select a model that meets all conditions.</b>   | $T_{LE} \leq$ Motor rated output torque (N-m) in the Performance Table [for Calculation and Selection] on page 844<br>$\text{O.H.L.} \leq$ Allowable output shaft O.H.L. (N) <Performance Table> Select a model that meets these conditions.<br><br>* When a tolerance for the load's moment of inertia is set for the servo motor itself, check it as well.<br><br>Tentatively selected model <b>APG222K-40Q400</b> △N * A flange type code for servo motor mounting will be shown in △.              |

# Selection Process Steps and Examples

| Selection Process Steps                                    | Selection Examples   |
|--|--|
| <p>Examining the acceleration and deceleration torques</p> | <p>Check whether the torques required for accelerating and decelerating the load within the specified time are equal to or lower than the allowable peak torque of startup/stop of the tentatively selected model.</p> <p>[Figure-1]</p> <p> <math>T_p</math>: Acceleration Torque<br/> <math>T_i</math>: Isokinetic Torque<br/> <math>T_s</math>: Deceleration Torque                 </p> <p>                     Acceleration Torque: <math>T_p = \left[ \frac{2\pi \times (J + C) \times n^2}{60 \times t_1} + T_i \right] \times \frac{1}{i_2} \times \frac{1}{\eta}</math><br/>                     Isokinetic Torque: <math>T_i = \frac{T_{LE}}{Sf}</math><br/>                     Deceleration torque: <math>T_s = \left[ \frac{2\pi \times (J + C) \times n^2}{60 \times t_3} - T_i \right] \times \frac{1}{i_2} \times \frac{1}{\eta}</math> </p> <p>Load Torque of Input Shaft Equivalent: <math>(T_i) = T_{LE} \times i_2</math><br/>                     Jr: Internal Moment of Inertia of Input Shaft Equivalent (kg·m<sup>2</sup>) &lt;Performance Table&gt;<br/>                     i<sub>2</sub>: Actual Reduction Ratio &lt;Performance Table&gt;<br/>                     η: Transmission Efficiency (%) in Performance Table [for Calculation and Selection] on page 844</p>   |
| <p>Examining the average load torque</p>                   | <p>Since the selected reduction ratio is 1/40, the servo motor speed at V = 30 m/min is 2547 r/min.</p> <p>[Operation conditions]<br/>                     Acceleration time t1: 0.2 sec.    Input speed during acceleration n1: 1273.5 r/min<br/>                     Isokinetic time t2: 1.0 sec.    Input speed during isokinetic operation n2: 2547 r/min<br/>                     Deceleration t3: 0.4 sec.    Input speed during deceleration n3: 1273.5 r/min</p> <p>* The input speed during acceleration n1 and the input speed during deceleration n3 shall be the average value (n2/2) of the input speed during isokinetic operation n2.</p> <p>Performance values of the tentatively selected model APGZ22K-40Q400△N<br/>                     J: Internal Moment of Inertia of Input Shaft Equivalent (kg·m<sup>2</sup>) ... 0.000143<br/>                     i<sub>2</sub>: Actual reduction ratio ... 1/40<br/>                     η: Transmission Efficiency (%) ... 75</p> <p>Calculate the load torque of input shaft equivalent (T<sub>i</sub>). T<sub>i</sub> = 23.89 × <math>\frac{1}{40}</math> = 0.6 N·m</p> <p>Acceleration Torque<br/> <math>T_p = \left[ \frac{2\pi \times (0.0000686 + \frac{0.00131836}{3}) \times 2547}{60 \times 0.2} + 0.6 \right] \times \frac{1}{40} \times \frac{1}{\frac{75}{100}}</math><br/>                     = 64.3 N·m ≤ 122 N·m    Allowable peak torque of startup/stop of the tentatively selected model APGZ22K-40Q400△N &lt;Performance Table&gt;<br/>                     Verdict: Acceptable</p> <p>Isokinetic Torque<br/> <math>T_i = \frac{23.89}{1.25} = 19.1 \text{ N·m}</math></p> <p>Deceleration Torque<br/> <math>T_s = \left[ \frac{2\pi \times (0.0000686 + \frac{0.00131836}{3}) \times 2547}{60 \times 0.4} - 0.6 \right] \times \frac{1}{40} \times \frac{1}{\frac{75}{100}}</math><br/>                     = 15.9 N·m ≤ 122 N·m    Allowable peak torque of startup/stop of the tentatively selected model APGZ22K-40Q400△N &lt;Performance Table&gt;<br/>                     Verdict: Acceptable</p> |
| <p>Result of model selection</p>                           | <p>Check whether the average load torque is equal to or lower than the allowable average torque of the tentatively selected model.</p> <p>Average Load Torque<br/> <math>T_M = \sqrt[3]{\frac{n_1 \times t_1 \times  T_p ^3 + n_2 \times t_2 \times  T_i ^3 + n_3 \times t_3 \times  T_s ^3}{n_1 \times t_1 + n_2 \times t_2 + n_3 \times t_3}}</math></p> <p>Average Load Torque<br/> <math>T_M = \sqrt[3]{\frac{1273.5 \times 0.2 \times  64.3 ^3 + 2547 \times 1 \times  19.1 ^3 + 1273.5 \times 0.4 \times  15.9 ^3}{1273.5 \times 0.2 + 2547 \times 1 + 1273.5 \times 0.4}}</math><br/>                     = 29.8 N·m ≤ 40.7 N·m    Allowable average torque of the tentatively selected model APGZ22K-40Q400△N &lt;Performance Table&gt;<br/>                     Verdict: Acceptable</p> <p>Since the judgment results of all of the acceleration, deceleration, and average load torques are acceptable, select the model <b>APGZ22K-40Q400△N</b>. * A flange type code for servo motor mounting will be shown in △.</p> <p>If even one of the verdicts is unacceptable, reexamine a model with the next higher level of power, or reexamine the tentatively selected model by reducing the load torque and other conditions.</p>   |

 Motor Matching /  
Motor Power Design List

 APG/AG3 Type  
Parallel Shaft

 AH2 Type  
Right Angle Shaft

 AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

 AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

# Service Factor/Allowable Moment of Inertia

## Service Factor (Sf)

A reducer is designed under the condition of operating for ten hours/day under a light shock load. When you use a reducer under a condition of a longer operation time under a heavier shock load, correct the load torque based on the service factor shown in the table below.

[Table-1]

| Load Condition   | Service Factor (Sf)                     |                                      |                                       | Application Example   |
|------------------|---|--------------------------------------|---------------------------------------|---|
|                  | Operating for less than three hours/day | Operating for three to ten hours/day | Operating for more than ten hours/day |   |
| Uniform load     | 1                                       | 1                                    | 1                                     | Conveyors (uniform load), screens, agitators (low viscosity), water treatment machines (light load), machine tools (feed shafts), elevators, extruders, distillers  |
| Light shock load | 1                                       | 1                                    | 1.25                                  | Conveyors (nonuniform or heavy load), agitators (high viscosity), machines for vehicles, water treatment machines (moderate load), hoists (light load), paper mills, feeders, food machines, pumps, sugar making machines, textile machines |
| Heavy shock load | 1                                       | 1.25                                 | 1.5                                   | Hoists (heavy load), hammer mills, metal working machines, crushers, tumblers   |

## Allowable Moment of Inertia J

If a reducer with a high inertia load is operated intermittently, high torque may be instantaneously produced when it starts to run (or when it stops if it is provided with a brake), resulting in an unexpected accident. Keep the level of the inertia of the application within the allowable value shown in the table below in accordance with the connection method and the frequency of startup.

### APG/AFC Types

[Table-2]

| Motor Power Class (W) | Allowable Moment of Inertia (Input Shaft Equivalent) ( $\times 10^{-4} \text{kg} \cdot \text{m}^2$ ) |
|-----------------------|--|
| 100                   | 1.1  |
| 200                   | 3.2  |
| 400                   | 4.2  |
| 750                   | 13.8   |
| 1000                  | 16.3   |
| 1500                  | 21.0   |
| 2000                  | 26.0   |
| 3000                  | 35.0   |

Note: The power indicates the power designation of the model and type codes of the reducer.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## AG3/AH2/AF3 Types

### Backlash 1 arc min/3 arc min Specifications

| Motor Power Class (W) | Frame Size | Reduction Ratio | Allowable Moment of Inertia (Input Shaft Equivalent) ( $\times 10^{-4}\text{kg}\cdot\text{m}^2$ ) |
|-----------------------|------------|-----------------|---|
| 100                   | 15 (18)    | 1/10 to 1/120   | 2.5   |
| 200                   | 25 (22)    | 1/10 to 1/60    | 5.0   |
|                       | 30 (28)    | 1/75 to 1/120   | 3.5   |
|                       |            | 1/150           | 2.2   |
| 400                   | 30 (28)    | 1/180           | 1.5   |
|                       |            | 1/10 to 1/60    | 10.0  |
|                       | 35 (32)    | 1/75 to 1/120   | 7.0   |
|                       |            | 1/150           | 4.5   |
| 750                   | 35 (32)    | 1/180           | 3.1   |
|                       |            | 1/10 to 1/60    | 16.3  |
|                       | 45 (40)    | 1/75 to 1/120   | 11.4  |
| 1/150                 |            | 7.3             |   |
| 1000                  | 45 (40)    | 1/180           | 5.0   |
|                       |            | 1/10 to 1/60    | 16.3  |
| 2000                  | 45 (40)    | 1/10 to 1/60    | 32.6  |

Note: The power indicates the power designation of the model and type codes of the reducer.

### Low Backlash

| Motor Power Class (W) | Allowable Moment of Inertia (Input Shaft Equivalent) ( $\times 10^{-4}\text{kg}\cdot\text{m}^2$ ) |
|-----------------------|---|
| 100                   | 2.5   |
| 200                   | 5   |
| 400                   | 10  |
| 750                   | 16.3  |
| 2000                  | 32.6  |

### Correction coefficient of moment of inertia J according to operating conditions

[Table-1]

| Connection Method  | Frequency of Startup   | Correction Coefficient |
|--|------------------------|------------------------|
| When no looseness occurs because of direct coupling etc. | 70 times/day max       | 1                      |
|  | More than 70 times/day | 1.5                    |
| When looseness occurs due to chain fastening etc.        | 70 times/day max       | 2                      |
|  | More than 70 times/day | 3                      |

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

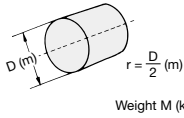
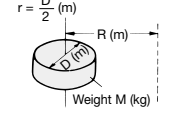
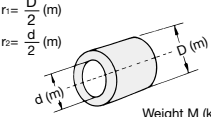
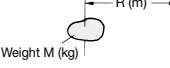
AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

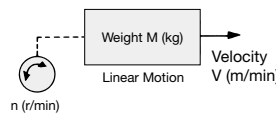
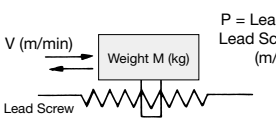
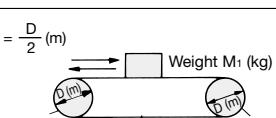
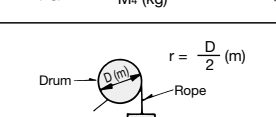
Option

# Method for Calculating the Moment of Inertia

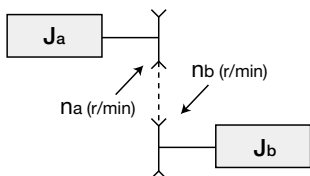
## ■ Rotor's moment of inertia J

| If the center of rotation is aligned with the center of gravity  |  | If the center of rotation is not aligned with the center of gravity                                    |   |
|--|--|--|---|
|  | SI Units   |  | SI Units  |
|  <p>Weight M (kg)</p> | $J = \frac{1}{2} Mr^2$ <p>(kg·m<sup>2</sup>)</p>             |  <p>Weight M (kg)</p> | $J = \frac{1}{2} Mr^2 + MR^2$ <p>(kg·m<sup>2</sup>)</p>                 |
|  <p>Weight M (kg)</p> | $J = \frac{1}{2} M(r_1^2 + r_2^2)$ <p>(kg·m<sup>2</sup>)</p> |  <p>Weight M (kg)</p> | <p>(If the size is negligible)</p> $J = MR^2$ <p>(kg·m<sup>2</sup>)</p> |

## ■ Moment of inertia J in linear motion

|   | SI Units  |
|---|---|
| <p>General case</p>  <p>Linear Motion<br/>Velocity V (m/min)<br/>n (r/min)</p>   | $J = \frac{1}{4} M \cdot \left( \frac{V}{\pi \cdot n} \right)^2$ <p>(kg·m<sup>2</sup>)</p>  |
| <p>In the case of horizontal linear motion (When moving an object with a lead screw)</p>  <p>Weight M (kg)<br/>Lead Screw<br/>V (m/min)<br/>P = Lead of Lead Screw (m/rev)</p>                     | $J = \frac{1}{4} M \cdot \left( \frac{P}{\pi} \right)^2$ $= \frac{1}{4} M \cdot \left( \frac{V}{\pi \cdot n} \right)^2$ <p>(kg·m<sup>2</sup>)</p> |
| <p>In the case of horizontal linear motion (Conveyor etc.)</p>  <p>Weight M<sub>1</sub> (kg)<br/>M<sub>2</sub> (kg) M<sub>4</sub> (kg) M<sub>3</sub> (kg)<br/>r = <math>\frac{D}{2}</math> (m)</p> | $J = M_1 r^2 + \frac{1}{2} M_2 r^2 + \frac{1}{2} M_3 r^2 + M_4 r^2$ <p>(kg·m<sup>2</sup>)</p>   |
| <p>In the case of vertical linear motion (Crane, winch, etc.)</p>  <p>Drum → r = <math>\frac{D}{2}</math> (m)<br/>Rope<br/>M<sub>2</sub> (kg) Weight M<sub>1</sub> (kg)</p>                        | $J = M_1 r^2 + \frac{1}{2} M_2 r^2$ <p>(kg·m<sup>2</sup>)</p>   |

## ■ Conversion of the moment of inertia J when the speed ratio is available



Convert the load's moment of inertia  $J_b$  into the equivalent value on the  $n_a$  shaft.

$$J = J_a + \left( \frac{n_b}{n_a} \right)^2 \times J_b$$

# Overhung Load (O.H.L.)

## Overhung Load (O.H.L.)

An overhung load (O.H.L.) is a suspending load imposed on a shaft. When a chain, belt, gear, etc. are used to couple the reducer shaft with the machine working with it, this O.H.L. must be taken into consideration.

### APG/AFC Types

$$O.H.L. = \frac{T_{LE}}{R} \times fb \times fw \quad \left\{ \begin{array}{l} T_{LE} : \text{Equivalent output torque acting on the reducer shaft (N}\cdot\text{m)} \\ R : \text{Pitch circle radius (m) of the sprocket, pulley, gear, etc. attached to reducer shaft} \\ fb : \text{Refer to the coefficient for the connection method [Table-1].} \\ fw : \text{Refer to the coefficient for the load level [Table-2].} \end{array} \right.$$

Be sure to make the O.H.L. value calculated from the equation shown above smaller than the corrected O.H.L.  $F_x$  (page 868).

### ■ Connection Coefficient $fb$ [Table-1]

| Connection Method               | $fb$ |
|---------------------------------|------|
| Timing belt                     | 1.2  |
| Gear, chain                     | 1.3  |
| V belt                          | 2    |
| Flat belt (with tension pulley) | 3    |
| Flat belt                       | 4    |

### ■ Load Factor $fw$ [Table-2]

| Load Level                             | $fw$ |
|--|------|
| Smooth operation without shock         | 1.2  |
| Ordinary operation                     | 1.3  |
| Operation with vibration or shock load | 2    |

### AG3/AH2/AF3 Types

$$O.H.L. = \frac{T_{LEX} K_1 \times K_2}{R} \quad \left\{ \begin{array}{l} T_{LEX} : \text{Equivalent output torque acting on the reducer shaft (N}\cdot\text{m)} \\ R : \text{Pitch circle radius (m) of the sprocket, pulley, gear, etc. attached to reducer shaft} \\ K_1 : \text{Refer to the coefficient for the connection method [Table-3].} \\ K_2 : \text{Refer to the coefficient for the load point [Table-4].} \end{array} \right.$$

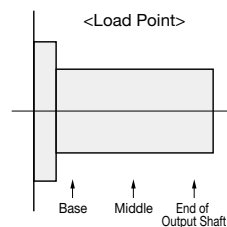
Be sure to make the O.H.L. value calculated from the equation shown above smaller than the allowable O.H.L. value listed in the performance table.

### ■ Coefficient $K_1$ [Table-3]

| Connection Method  | $K_1$ |
|--------------------|-------|
| Chain, timing belt | 1.00  |
| Gear               | 1.25  |
| V belt             | 1.50  |

### ■ Coefficient $K_2$ [Table-4]

| Load Point          | $K_2$ |
|---------------------|-------|
| Base of the shaft   | 0.75  |
| Middle of the shaft | 1.00  |
| End of Output Shaft | 1.50  |



Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

## Correcting the tolerance based on the O.H.L. position

### APG Type

(1) Point of O.H.L.

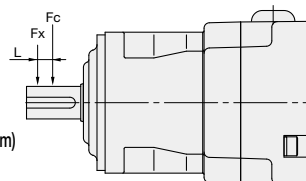
Allowable output shaft O.H.L. of the APG Type is calculated at the middle of the shaft.

(2) Correcting the allowable output shaft O.H.L.

Correct the allowable output shaft O.H.L. with the equation shown below in accordance with the conditions under which the motor will be used.

$$F_x = F_c \times \frac{A}{A+L}$$

- $F_x$  : Corrected O.H.L. (N)
- $F_c$  : Allowable Output Shaft O.H.L. (N)
- $A$  : Parameter (mm)
- $L$  : O.H.L. load point (amount of displacement from the middle of the shaft) (mm)



### Constant A [Table-1]

| Frame Size | A (mm) |
|------------|--------|
| 12         | 23.5   |
| 18         | 32     |
| 22         | 38.5   |
| 28         | 43.5   |

### AFC Type

(1) Load point of O.H.L.

Allowable output shaft O.H.L. is calculated at Bmm from the flange surface.

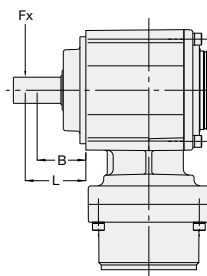
(2) Correcting the load of the allowable output shaft O.H.L.

Correct the allowable output shaft O.H.L. with the equation shown below in accordance with the conditions under which the motor will be used.

a. When one end of the output shaft is not borne by a pillow

$$F_x = F_c \times \frac{C+B}{C+L}$$

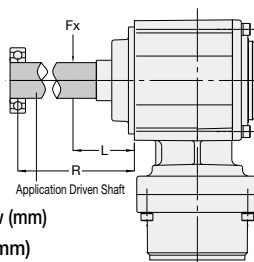
- $F_x$  : Corrected O.H.L. (N)
- $F_c$  : Allowable Output Shaft O.H.L. (N)
- $B$  : Parameter (mm)
- $C$  : Parameter (mm)
- $L$  : O.H.L. load point (distance from the flange surface) (mm)



b. When one end of the output shaft is borne by a pillow

$$F_x = F_c \times \frac{R}{R-L}$$

- $F_x$  : Corrected O.H.L. (N)
- $F_c$  : Allowable Output Shaft O.H.L. (N)
- $R$  : Distance from the flange surface to the center of the pillow (mm)
- $L$  : O.H.L. load point (distance from the flange surface) (mm)



### Constant B

(Load point of the allowable output shaft O.H.L.)

| Frame Size | B (mm) |
|------------|--------|
| 12         | 22     |
| 15         | 35     |
| 18         | 35     |
| 22         | 41     |
| 28         | 43.5   |
| 32         | 48.5   |

### Constant C

| Frame Size | C (mm) |
|------------|--------|
| 12         | 50     |
| 15         | 52     |
| 18         | 58     |
| 22         | 68     |
| 28         | 78.5   |
| 32         | 91.5   |



**AF3S Type <Backlash 1 arc min/3 arc min Specifications>**

(1) Load point of O.H.L.

The load point of the allowable O.H.L. is calculated at 20 mm from the flange surface.

(2) Correcting the load of the allowable output shaft O.H.L.

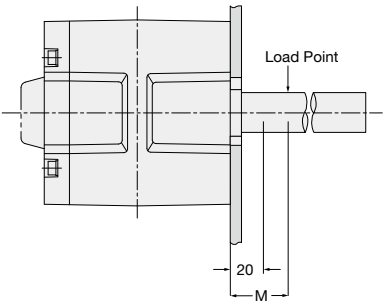
Correct the allowable output shaft O.H.L. with the equation shown below in accordance with the conditions under which the motor will be used.

a. When one end of the output shaft is not borne by a pillow

If the load point M of the O.H.L. is more than 20 mm, adjust via:

Please correct using the following formula:

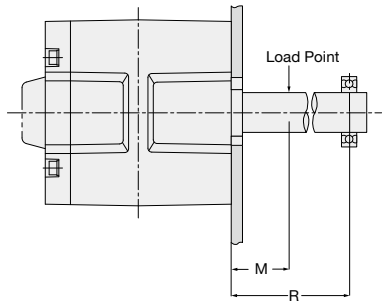
$$\text{Corrected O.H.L. (N)} = \frac{B+20}{B+M} \times \text{Allowable O.H.L. (N)}$$



b. When one end of the output shaft is borne by a pillow

Please correct using the following formula:

$$\text{Corrected O.H.L. (N)} = \frac{R}{R-M} \times \text{Allowable O.H.L. (N)}$$



**Constant B**

| Frame Size | B (mm) |
|------------|--------|
| 15         | 55     |
| 25         | 56     |
| 30         | 61     |
| 35         | 70     |
| 45         | 85     |

Motor Matching / Motor Power Design List

APG/AG3 Type Parallel Shaft

AH2 Type Right Angle Shaft

AFC Type Right Angle Hollow Bore/ Right Angle Shaft

AF3 Type Concentric Right Angle Hollow Bore/ Concentric Right Angle Shaft

Technical Documentation

Option

### AF3S Type <Low Backlash Specification>

(1) Load point of O.H.L.

The load point of the allowable O.H.L. is calculated to be 20 mm from the end of the output shaft.

(2) Correcting the load of the allowable output shaft O.H.L.

Correct the allowable output shaft O.H.L. with the equation shown below in accordance with the conditions under which the motor will be used.

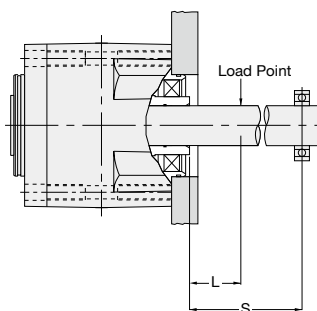
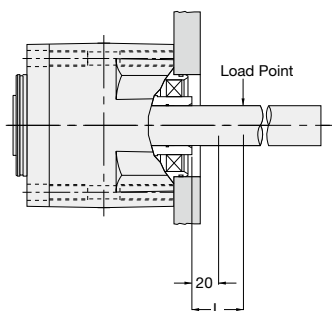
a. When one end of the output shaft is not borne by a pillow

If the load point L of the O.H.L. is more than 20 mm,

$$\text{Corrected O.H.L. (N)} = \frac{A+20}{A+L} \times \text{Allowable O.H.L. (N)}$$

b. When one end of the output shaft is borne by a pillow

$$\text{Corrected O.H.L. (N)} = \frac{S}{S-L} \times \text{Allowable O.H.L. (N)}$$



### Constant A

| Frame Size | A (mm) |
|------------|--------|
| 20         | 68.5   |
| 25         | 84.5   |
| 30         | 91     |
| 35         | 98     |
| 45         | 113    |

### Thrust Load

Use the motor under a condition that meets the equation shown below.

$$\text{Thrust load (N)} \times f_w \leq \text{Allowable output shaft thrust load (N)} \quad [f_w: \text{coefficient based on the load level}]$$

### Load factor fw

| Load Level                             | fw  |
|--|-----|
| Smooth operation without shock         | 1.2 |
| Ordinary operation                     | 1.3 |
| Operation with vibration or shock load | 2   |

If an excessive thrust load is applied under the usage conditions, contact your nearest Sales Office or the CS Center.

# Continuous Rated Input Torque of Reducers

If the rated speed of the servo motor is below 3000 r/min, be careful with the continuous rated torque of the servo motor. Select a reducer whose continuous rated input torque (table below) is higher than the continuous rated torque of the servo motor.

| Reducer Power | Continuous Rated Input Torque (N·m) |
|---------------|-------------------------------------|
| 100 W Class   | 0.32                                |
| 200 W Class   | 0.64                                |
| 400 W Class   | 1.3                                 |
| 750 W Class   | 2.4                                 |
| 1000 W Class  | 3.2                                 |
| 1500 W Class  | 4.8                                 |
| 2000 W Class  | 6.4                                 |
| 3000 W Class  | 9.6                                 |

## Backlash Value

Backlash value is defined as the amount of return(converted to angle unit) to point zero upon applying a small torque ( $\pm 5\%$  of the rated torque) on the output shaft whilst having the input shaft locked in, then releasing the output shaft.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

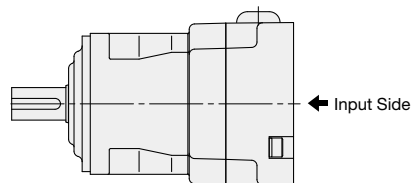
# Change of Position of Wrench Hole for Input Shaft Joint Tightening

## Order Method

If you intend to use the wrench hole for input shaft joint tightening in a position other than the standard position, order it with the appropriate option code shown below.

| Design      | Standard | Wrench Hole (Right) | Wrench Hole (Lower) | Wrench Hole (Left) |
|-------------|----------|---------------------|---------------------|--------------------|
| Option Code | Standard | B3                  | B6                  | B9                 |

- Note 1: All diagrams are views from the input side of the motor.
- Note 2: Instructions not necessary if ordered standard.
- Note 3: The side in which the nameplate is attached for a standard product shall be the standard position of the wrench hole for input shaft joint tightening.
- Note 4:  $\Rightarrow$  indicates the attachment position of the nameplate.



## List of Applicable Models (AFC/AG3/AH2/AF3)

The APG Type can be installed by turning 90 ° because its four mounting holes are provided on the four corners of the square. The AFC type is available for all models. For the AG3, AH2, and AF3 Types, refer to the table shown below.

### Backlash 1 arc min/3 arc min Specifications

| Power (W) | Frame Size | AF3 Type |
|-----------|------------|----------|
| 100       | 18 (15)    | △        |
|           | 22 (25)    | ○        |
| 200       | 28 (30)    | ○        |
|           | 28 (30)    | ○        |
| 400       | 32 (35)    | ○        |
|           | 32 (35)    | ○        |
| 750       | 40 (45)    | ○        |
|           | 32 (35)    | ○        |
| 1000      | 32 (35)    | ○        |
|           | 40 (45)    | ○        |
| 2000      | 40 (45)    | ○        |

- Note 1: The figures in the parentheses indicate the frame sizes of right angle hollow bore types.
- Note 2: The model marked with "△" in the table is available only for a low wrench hole for input shaft joint tightening.
- Note 3: For the models marked with \*, please contact your nearest Sales Office or the CS Center.

### Backlash 30 arc min Specification

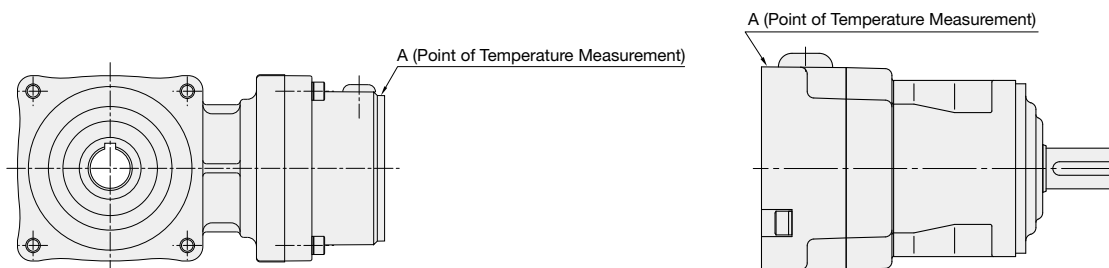
| Power (W) | Frame Size | AG3 Type | AH2 Type | AF3 Type |
|-----------|------------|----------|----------|----------|
| 100       | 18 (20)    | *        | *        | ○        |
|           | 22 (25)    | *        | *        | ○        |
| 200       | 18         | *        | *        | *        |
|           | 22 (25)    | *        | *        | ○        |
|           | 28 (30)    | *        | *        | ○        |
| 400       | 22         | ○        | *        | *        |
|           | 28 (30)    | ○        | ○        | ○        |
|           | 32 (35)    | ○        | ○        | ○        |
| 750       | 28         | ○        | *        | *        |
|           | 32 (35)    | ○        | ○        | ○        |
|           | 40 (45)    | ○        | ○        | ○        |
| 2000      | 32         | ○        | *        | *        |
|           | 40 (45)    | ○        | ○        | ○        |
|           | 50         | ○        | ○        | *        |

# Precautions for Installation

## Installation Environment

|                          |  |
|--------------------------|--|
| Ambient Temperature      | 0 °C to 40 °C  |
| Ambient Humidity         | 85 % or less   |
| Altitude                 | 1,000 m or lower   |
| Installation Environment | A place free from corrosive gas, explosive gas, and/or vapor.<br>Well ventilated place with no dust. |
| Installation Place       | Indoors  |

Take care to keep the surface temperature (area A) below 90 °C.  
If the surface temperature exceeds 90 °C, cool it with an external fan or heat sink to keep it below 90 °C.



## Installation Procedure

Secure the reducer with four bolts on a vibration-free and flat machine-processed surface.  
If the foundation is bad or the mounting surface is not flat enough, vibration may occur during operation and the service life of the reducer may be shortened.  
Make sure the flatness of the mounting surface is 0.1 mm or less.

## Installation Orientation

All models adopt a grease lubrication method and can therefore be installed in any orientation.

## Connection with application

1. H7 fit is recommended for a coupling, sprocket, pulley, gear, etc. to be attached to the reducer shaft.
2. In direct coupling, accurately align the center of the reducer shaft and that of the mating shaft.
3. In chain or gear engagement, keep the reducer shaft and the mating shaft parallel accurately to each other, and install the device so that the line connecting the centers of both shafts is perpendicular to the shafts.
4. When attaching a coupling or application to the output shaft, do not apply strong impacts via hammer or similar tool. The bearing may get damaged and cause an abnormal sound, vibrations, or damage.

Motor Matching /  
Motor Power Design List

APG/AG3 Type  
Parallel Shaft

AH2 Type  
Right Angle Shaft

AFC Type  
Right Angle Hollow Bore/  
Right Angle Shaft

AF3 Type  
Concentric Right Angle Hollow Bore/  
Concentric Right Angle Shaft

Technical Documentation

Option

# MEMO

|   |                                |                               |   |   |                         |        |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|
| Motor Matching /<br>Motor Power Design List | APG/AG3 Type<br>Parallel Shaft | AH2 Type<br>Right Angle Shaft | AFC Type<br>Right Angle Hollow Bore/<br>Right Angle Shaft | AF3 Type<br>Concentric Right Angle Hollow Bore/<br>Concentric Right Angle Shaft | Technical Documentation | Option |
|---|--------------------------------|-------------------------------|---|---|-------------------------|--------|