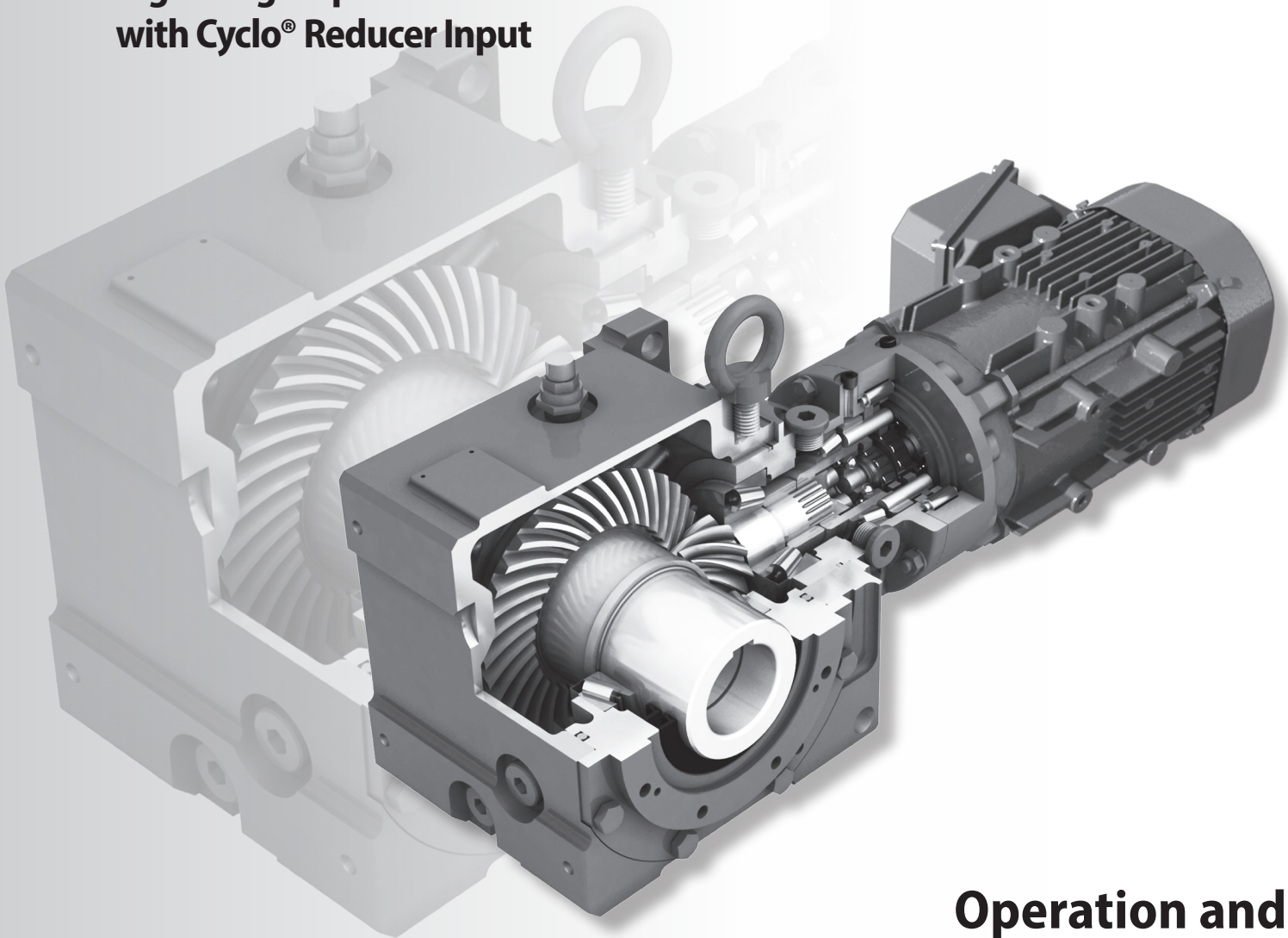


# Cyclo<sup>®</sup> BBB4 Bevel Buddybox<sup>®</sup>

Right Angle Spiral Bevel Gearbox  
with Cyclo<sup>®</sup> Reducer Input



## Operation and Maintenance Manual

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## Important Notes

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### Safety Symbols

These safety symbols appear throughout this manual to indicate important warnings:



**DANGER:** Incorrect handling of the unit and/or failure to follow the instructions may cause physical damage, serious personal injury, and/or death.



**CAUTION:** Incorrect handling of the unit and/or failure to follow the instructions may cause physical damage and/or personal injury.

### Safety Precautions

Review and adhere to the instructions in this manual to ensure:

- trouble-free Cyclo® BBB4 operation
- your rights to make a warranty claim.

Read this manual and all accompanying documents thoroughly before use. Understand the machine, information on safety, and all precautions for correct operation. Sumitomo recommends making this manual easily accessible for reference at the machine location.



- **Only properly trained personnel** should transport, install, align, wire, inspect, operate, and maintain the unit.
- When the unit is to be used in a system for transport of human beings, a secondary safety device should be installed to guard against accidents that may result in injury, death, or damage to the system.
- When the unit is to be used for an elevator, install a safety device on the elevator side to prevent it from falling; otherwise, serious injury, death, or damage to the elevator may result.



**CAUTION:**

- Operate the unit only within its design and performance specifications; otherwise, injury or damage to the system may occur.
- Keep hands and all foreign objects from the internal moving parts of the unit; otherwise, injury or damage to the system may occur.
- Take damaged units off-line immediately and do not resume operation until properly repaired.
- Modifications or alterations of any kind to the unit will void the warranty and all subsequent claims.
- Do not remove the rating plate.

### Disposal

Please refer to local, state, and federal regulations governing disposal of:

**Steel Scrap:**

- Housing (Ductile and Gray Cast Iron)
- Gears
- Shafts
- Bearings

**Lubricants:**

- Gear Oil
- Grease

## Inspection Upon Delivery



- In order to avoid injury, **ensure that the unit is in a stable position** before unpacking.
- **Verify that the unit received matches your order.** Using the incorrect product may cause equipment damage or personal injury.
- **Do not** remove the nameplate from the unit.

Upon delivery, inspect the unit for damage that may have occurred during shipment. Notify the shipping company immediately if you find any damage. **Do not** install or operate a damaged unit.

Upon receipt of the reducer/gearmotor, verify that:

- the model number on the unit nameplate matches the purchase order
- the unit was not damaged during shipping
- all bolts and nuts are fully tightened.

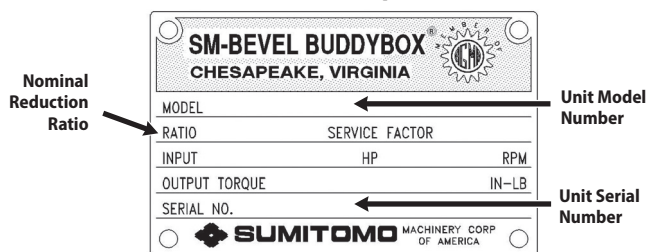
Please consult your Sumitomo agent, distributor, or sales office if you find any defects or if you have any questions.

## Nameplate Inspection

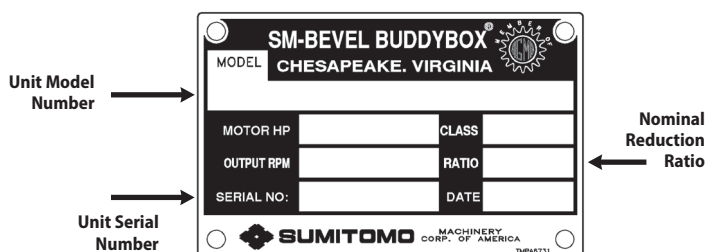
When contacting Sumitomo about this product, please be prepared to provide the following information from the reducer/gearmotor nameplate:

- **reducer or gearmotor model number (nomenclature)**
- **reduction ratio**
- **serial number.**

### Metal Reducer Nameplate



### Metal Gearmotor Nameplate



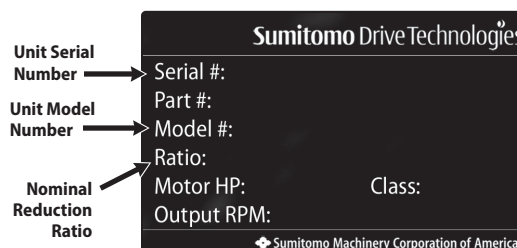
## Lubrication Inspection



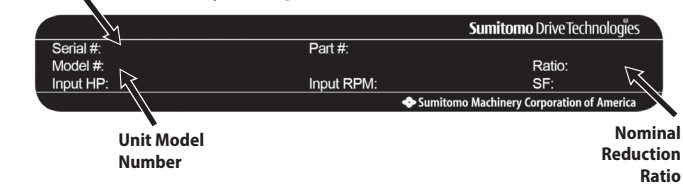
- **Oil lubricated units are shipped without oil, unless the customer specified otherwise when the unit was ordered.** Always fill the unit with the correct type and quantity of lubricant prior to operation.
- **Certain models must be filled with lubricant in two separate locations,** the Bevel Gear portion (output) and the input portion.

Refer to the lubrication section in this manual for detailed lubrication information.

### Non-Metallic Nameplate (when Cyclo input is 613 or larger)



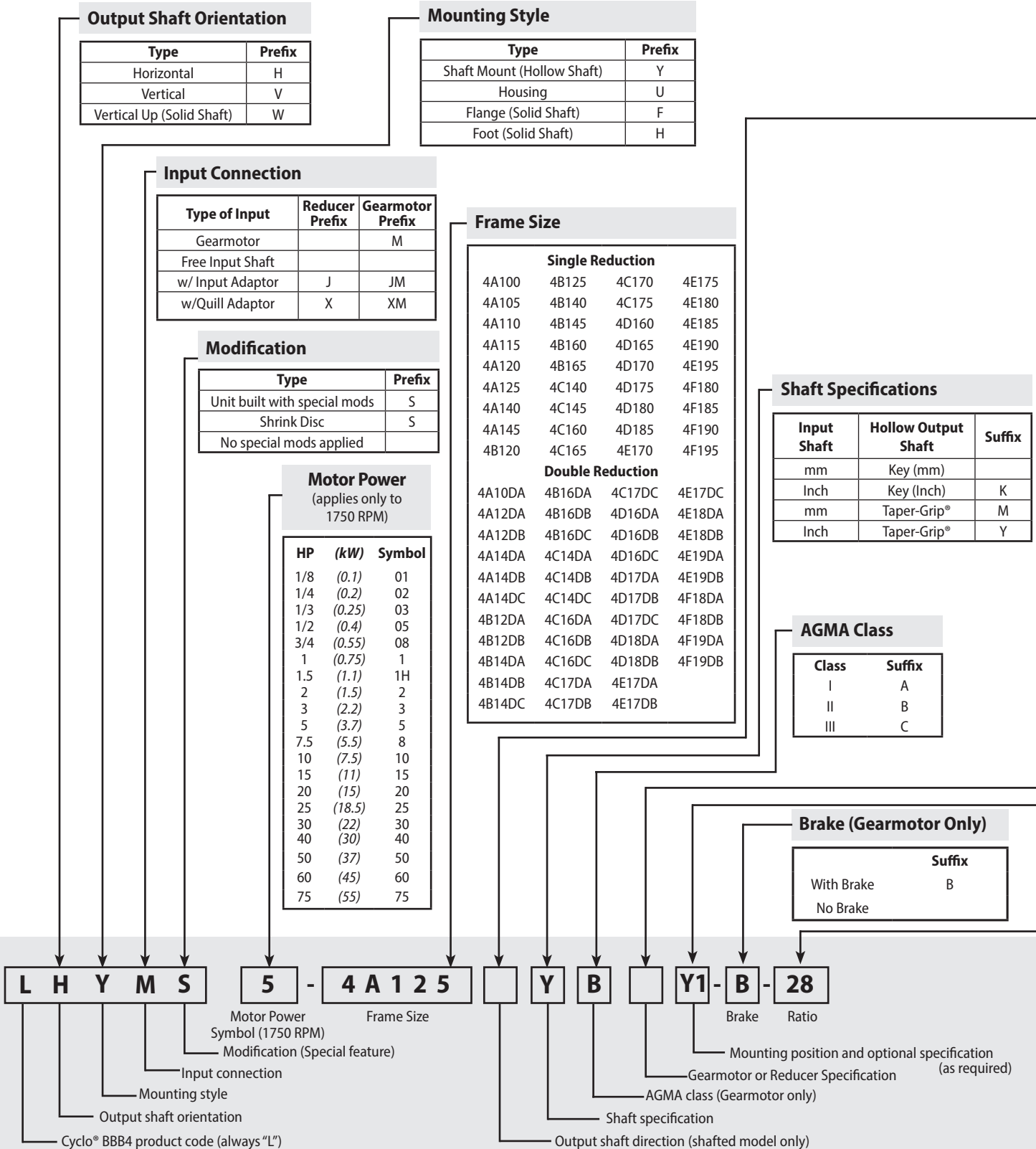
### Non-Metallic Nameplate (when Cyclo Input is 6120 or smaller)



# Nomenclature

## Nomenclature

Our nomenclature details specific information about our products. Verify that the nomenclature of the unit delivered matches your order.



# Nomenclature, continued

### Output Shaft Direction (shafted model only)

|                                   |   |  |
|-----------------------------------|---|--|
| Projects to Left Side             | L |  |
| Projects to Right Side            | R |  |
| Projects to Both Left/Right Sides | T |  |

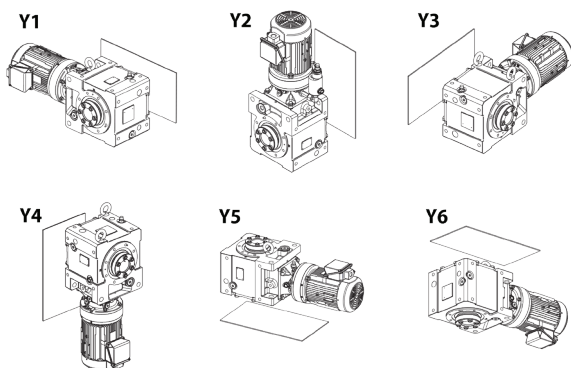
### Gearmotor Specification

| Specification             | Suffix    |
|---------------------------|-----------|
| Three-Phase Motor         |           |
| Single-Phase Motor        | <b>SG</b> |
| AF Motor (Adj. Frequency) | <b>AV</b> |
| Servo Motor               | <b>SV</b> |
| DC Motor                  | <b>DV</b> |
| Torque Limiter            | <b>TL</b> |

### Reducer Specification

| Type        | Suffix    |
|-------------|-----------|
| Standard    |           |
| Baseplate   | <b>BP</b> |
| Shovel Base | <b>SB</b> |
| DC Motor    | <b>DV</b> |

### Mounting Positions



### Nomenclature Example: LHYMS-5-4A125-YB1-B-28

|                                       |                                     |
|---------------------------------------|-------------------------------------|
| <b>L</b> - Cyclo® Bevel Buddybox      | <b>4A125</b> - Frame Size           |
| <b>H</b> - Horizontal                 | <b>Y</b> - Inch Shaft Specification |
| <b>Y</b> - Shaft Mount (Hollow Shaft) | <b>B</b> - AGMA Class               |
| <b>M</b> - Gearmotor                  | <b>Y1</b> - Mounting Position       |
| <b>S</b> - Special Modifications      | <b>B</b> - Brake (gearmotor only)   |
| <b>5</b> - 5 HP (3.7kW), 1750 RPM     | <b>28</b> - Ratio                   |

### Nominal and Exact Ratio

| BBB with Planetary Input |         |            |             | BBB with Cyclo Input |         |            |             |
|--------------------------|---------|------------|-------------|----------------------|---------|------------|-------------|
| Nominal Ratio            |         | Frame Size | Exact Ratio | Single Reduction     |         |            |             |
| Input                    | Overall |            |             | Nominal Ratio        |         | Frame Size | Exact Ratio |
|                          |         |            | Input       | Overall              |         |            |             |
| 3                        | 11      | 4A10       | 10.50       | All                  | 6       | 21         | 21.0        |
|                          |         | 4A12       |             |                      | 7       | 22         | 22.4        |
|                          |         | 4A14       | 8           |                      | 25      | 24.5       |             |
|                          |         | 4B14       | 11          |                      | 28      | 28.0       |             |
|                          |         | 4B16       | 13          |                      | 35      | 35.2       |             |
|                          |         | 4C16       | 15          |                      | 39      | 38.5       |             |
|                          | 4D16    | 10.85      | 4E17        |                      | 17      | 46         | 45.5        |
|                          | 4E18    |            | 21          |                      | 53      | 52.5       |             |
|                          | 4F18    |            | 25          |                      | 60      | 59.5       |             |
|                          | 4E19    | 10.50      | 4F19        |                      | 29      | 67         | 67.2        |
|                          | 4F18    |            | 35          |                      | 74      | 73.5       |             |
|                          | 4       | 13         | 4A10        |                      | 12.99   | 35         | 80          |
| 4A12                     |         |            | 35          | 88                   |         | 87.5       |             |
| 4A14                     |         |            | 35          | 102                  | 101.5   |            |             |
| 4B14                     |         |            | 43          | 112                  | 112.0   |            |             |
| 4B16                     |         |            | 43          | 123                  | 122.5   |            |             |
| 4C16                     |         |            | 51          | 151                  | 150.5   |            |             |
| 4D16                     |         | 12.80      | 4E17        | 51                   | 179     | 178.5      |             |
| 4E17                     |         |            | 59          | 207                  | 206.5   |            |             |
| 4E18                     |         |            | 71          | 249                  | 248.5   |            |             |
| 4E18                     |         | 13.09      | 4F18        | 87                   | 305     | 304.5      |             |
| 4F18                     |         |            | 119         | 417                  | 416.5   |            |             |
| 5                        |         | 14         | 4E19        | 13.01                | All     | 104        | 364         |
|                          | 4F19    |            | 121         |                      |         | 424        | 423.5       |
|                          | 4A10    |            | 14.21       | 143                  |         | 501        | 500.5       |
|                          | 4A12    |            |             | 165                  |         | 578        | 577.5       |
|                          | 4A14    |            | 195         | 683                  |         | 682.5      |             |
|                          | 4B14    |            | 231         | 809                  |         | 808.5      |             |
|                          | 4B16    | 14.00      | 273         | 956                  |         | 955.5      |             |
|                          | 4C16    |            | 319         | 1117                 |         | 1116.5     |             |
|                          | 4D16    |            | 377         | 1320                 |         | 1319.5     |             |
|                          | 4D17    | 14.32      | 473         | 1656                 |         | 1655.5     |             |
|                          | 4E17    |            | 559         | 1957                 |         | 1956.5     |             |
|                          | 4E18    |            | 649         | 2272                 |         | 2271.5     |             |
| 4E18                     | 14.23   | 731        | 2559        | 2558.5               |         |            |             |
| 4F18                     |         | 841        | 2944        | 2943.5               |         |            |             |
| 4E19                     | 15.36   | 1003       | 3511        | 3510.5               |         |            |             |
| 4F19                     |         | 1247       | 4365        | 4364.5               |         |            |             |
| 5                        | 16      | 4A10       | 15.36       | 1479                 | 5177    | 5176.5     |             |
|                          |         | 4A12       |             | 1849                 | 6472    | 6471.5     |             |
|                          |         | 4A14       | 2065        | 7228                 | 7227.5  |            |             |
|                          |         | 4B14       | 2537        | 8880                 | 8879.5  |            |             |
|                          |         | 4B16       | 3045        | 10658                | 10657.5 |            |             |
|                          |         | 4C16       | 16.26       | 3481                 | 12184   | 12183.5    |             |
|                          | 4D16    | 4437       |             | 15530                | 15529.5 |            |             |
|                          | 4D17    | 5133       |             | 17966                | 17965.5 |            |             |
|                          | 4D17    | 16.17      | 6177        | 21620                | 21619.5 |            |             |
|                          | 4E17    |            | 7569        | 26492                | 26491.5 |            |             |
|                          | 4E17    |            | 16.78       |                      |         |            |             |
|                          | 4E18    | 17.10      |             |                      |         |            |             |
| 4E18                     | 15.63   |            |             |                      |         |            |             |
| 4F18                     |         | 15.47      |             |                      |         |            |             |
| 4F18                     | 16.80   |            |             |                      |         |            |             |
| 4F18                     |         | 17.12      |             |                      |         |            |             |
| 4F18                     | 17.50   |            |             |                      |         |            |             |
| 4F18                     |         | 17.78      |             |                      |         |            |             |
| 4F18                     | 17.68   |            |             |                      |         |            |             |
| 4F18                     |         | 17.10      |             |                      |         |            |             |
| 4F18                     | 16.92   |            |             |                      |         |            |             |
| 4F18                     |         |            |             |                      |         |            |             |

| Double Reduction |         |            |             |
|------------------|---------|------------|-------------|
| Nominal Ratio    |         | Frame Size | Exact Ratio |
| Input            | Overall |            |             |
| 104              | 364     | All        | 364.0       |
| 121              | 424     |            | 423.5       |
| 143              | 501     |            | 500.5       |
| 165              | 578     |            | 577.5       |
| 195              | 683     |            | 682.5       |
| 231              | 809     |            | 808.5       |
| 273              | 956     |            | 955.5       |
| 319              | 1117    |            | 1116.5      |
| 377              | 1320    |            | 1319.5      |
| 473              | 1656    |            | 1655.5      |
| 559              | 1957    |            | 1956.5      |
| 649              | 2272    |            | 2271.5      |
| 731              | 2559    | 2558.5     |             |
| 841              | 2944    | 2943.5     |             |
| 1003             | 3511    | 3510.5     |             |
| 1247             | 4365    | 4364.5     |             |
| 1479             | 5177    | 5176.5     |             |
| 1849             | 6472    | 6471.5     |             |
| 2065             | 7228    | 7227.5     |             |
| 2537             | 8880    | 8879.5     |             |
| 3045             | 10658   | 10657.5    |             |
| 3481             | 12184   | 12183.5    |             |
| 4437             | 15530   | 15529.5    |             |
| 5133             | 17966   | 17965.5    |             |
| 6177             | 21620   | 21619.5    |             |
| 7569             | 26492   | 26491.5    |             |

## Storing and Transporting

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### Storage Location

- Store the unit in a clean, dry area.
- **Do not** store outdoors or in an area with high humidity, dust, sudden temperature changes, or corrosive gases.

Generally, the Cyclo® BBB4 gearbox is to be stored indoors, in an ordinary factory or a warehouse. The unit should be sealed, wrapped in plastic and additionally packed with desiccant. Desiccant should be replaced periodically to keep the inside of the box dry. Use of color changing desiccant will aid in identifying when desiccant should be changed.

### Storage Period

- **Do not** store the unit for longer than 3 months without following long-term storage procedures recommended by Sumitomo.
- Consult Sumitomo when storing the unit for more than 3 months. Rust proofing procedures are required.
- Consult Sumitomo when exporting the unit. Rust proofing procedures may be required.

If the Cyclo® BBB4 gearbox will be inactive for a long period of time, long-term storage preparation is required to prevent rust or other degradation to the gearbox.

#### LONG-TERM STORAGE SPECIFIED WITH ORDER:

If long-term storage is specified at the time of order entry, Shell VSI Circulating Oil #32 or NP-20 [JIS] equivalent rust preventative is already sprayed into the Cyclo® BBB4 reducer and the air vent is replaced with a sealing plug before shipping the reducer from Sumitomo factory. External machined surfaces are coated with a suitable NP-19 [JIS] petroleum base corrosion preventative such as Black Bear Par-Al-Ketone, Houghton Rust Veto 342, Daphne Ever Coat No.1 or equivalent.

Consult Sumitomo for Long Term Storage procedures:

- Storage without factory preparations
- Ongoing maintenance during storage period

### Operation After Storage

Before operating the unit after an extended storage period, flush unit of rust preventative and ensure that non-metal parts, i.e., oil seals, o-rings, air breather, have not deteriorated. Non-metal parts may deteriorate easily from exposure to ambient conditions (i.e., extreme temperatures, UV rays). Replace deteriorated parts with new before unit start-up.

After starting the unit, verify that there is no abnormal noise, vibration, and/or temperature rise. Immediately stop the unit and call your local distributor, Original Equipment Manufacturer or Sumitomo directly if you observe any abnormality.

### Transporting



- **Do not** stand directly under a unit suspended by a lifting mechanism. Injury or death may occur if the unit is dropped.
- **Before lifting the unit**, determine its weight (refer to catalog, packing list, etc.) and ensure that the moving equipment will support the unit's weight.
- **Never hoist or move a unit that exceeds the moving equipment's rated capacity** or else personal injury and/or equipment damage may occur.
- **Do not** allow the unit to drop or fall while moving. **Always use the eye bolts** attached to the gear housing (and on motor if supplied) when moving the unit. After securing the unit to the machine, remove the moving hooks/straps from the eyebolts.

## Installation Precautions



- Do not use the reducer/gearmotor for specifications other than those shown on the nameplate or in the manufacturing specification documents. Personal injury and/or equipment damage may occur.
- Do not place combustible material on or around the unit; fire may occur.
- Do not place any objects around the unit that will prohibit proper ventilation. Inadequate ventilation may lead to high unit temperature and/or fire.
- Do not step on or hang from the unit. Excessive weight may cause component breakage leading to personal injury and/or equipment damage.
- Do not touch the shaft, keyway, or motor fan with bare hands; injury may occur.
- For applications in which lubricant leaks could adversely affect operations (i.e., package handling, food processing), place an oil pan below the unit to protect against contamination that may occur if oil seals become damaged or worn.
- Do not remove the eye-bolt from the motor. Should the eye-bolt need to be removed for any reason, install a replacement bolt in the tapped hole to prevent water from entering the motor.

## Installation Location

|                               |  |
|-------------------------------|--|
| Ambient Temperature Range ... | 14° - 104°F (-10° - 40°C)  |
| Ambient Humidity.....         | 85% or less  |
| Ambient Conditions.....       | 14°F minimum   |
| Altitude .....                | 3,280 feet (1,000 m) or less   |
| Atmosphere .....              | The location should not contain corrosive gas, explosive gas, or steam. The location should be free of dust and well ventilated. |
| Location .....                | Indoor – free of dust and water  |

Consult Sumitomo when the unit will operate in conditions other than those specified above. Special unit modifications may be required.

Units manufactured according to customer specified application requirements (i.e. outdoor modifications, high-temperature modifications) are designed to operate within the specified environment.

Install the unit so inspection and/or maintenance procedures may be easily performed. Install all units that are not shaft mounted on a sufficiently rigid base.

Torque arm clearance with machine structure is required to allow for machine shaft run out. Refer to the Torque Arm Installation section in this manual for additional information.

## Installation Angle

**Mount the unit in the specified position** for which it was ordered. Confirm the mounting position from the gearbox nameplate.

Consult your local distributor, Original Equipment Manufacturer or Sumitomo directly if the mounting angle is to be **other than horizontal or vertical**.

## Severe Loading Conditions

For applications with severe vibration and/or frequent starts and stops, Sumitomo recommends the use of high-strength mounting bolts of Grade 8.8 (or greater).

## Installation onto the Driven Machine

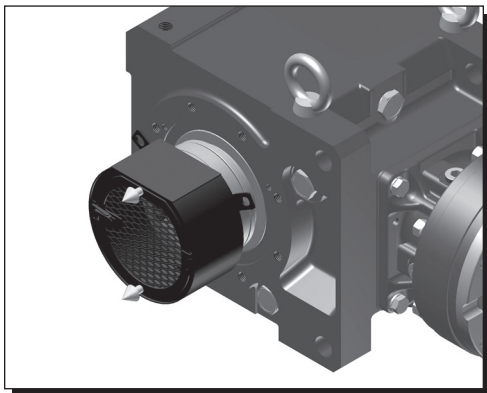
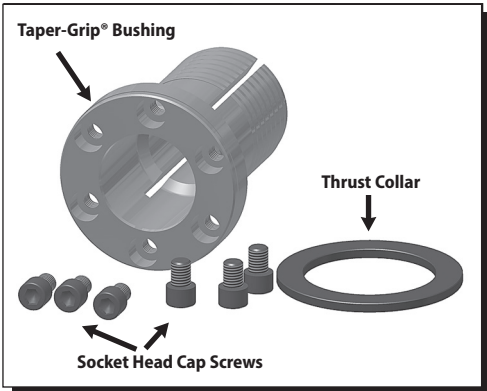
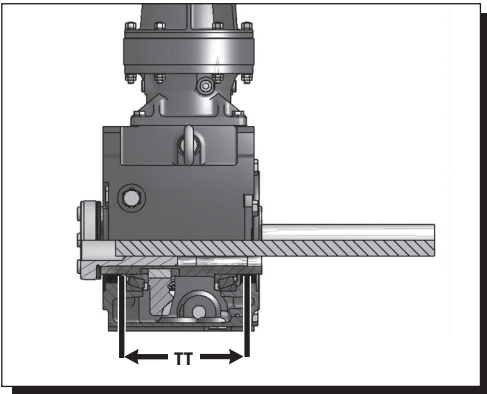
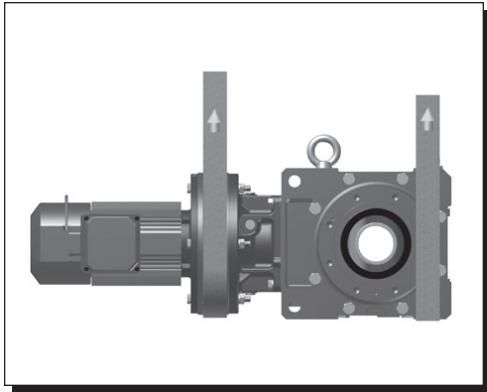


- Before coupling the reducer/gearmotor to the machine, verify the appropriate/desired rotation of the machine. Differences in the rotational direction may cause personal injury and/or equipment damage.
- Before operating the unit, ensure that all safety guards around the rotating components are in-place and secure. Failure to do so may result in personal injury.
- When joining the reducer or gearmotor to the load, ensure that the center alignment, belt tension, and/or parallelism of the coupling device are within the coupling manufacturer's established recommendations. For applications with a belt, ensure that the belt is properly tensioned to the manufacturer's specification, and the bolts securing the pulley and couplings are sufficiently tightened. Failure to follow these precautions may result in personal injury and/or equipment damage.



# Installation onto Driven Shaft

## Taper-Grip® Bushing



### Taper-Grip® Bushing Introduction

The keyless Taper-Grip® bushing system provides a simple and reliable shaft attachment for Sumitomo speed reducers and gearmotors. This system allows bi-directional shaft rotation operation with a powerful, slip-free grip. To assure peak performance of your equipment, please read, understand and follow these installation instructions.



Prior to installation of the Cyclo® BBB4 onto the driven shaft, ensure that the shaft length meets or exceeds the minimum shaft engagement value "TT" detailed in Table 1.



**Do not** operate unit until the torque arm has been attached to the unit and fixed to a rigid structure. The torque arm prevents counter-rotation during unit operation. Refer to torque arm installation section in this manual for instructions.



**CAUTION:** The Cyclo® BBB4 must be externally supported prior to insertion of driven shaft into bushing. External support **MUST** be maintained until all bushing socket head cap screws have been tightened to the appropriate operational torque.

### Components of Taper-Grip® Bushing

As shown in the figure on the left, the Taper-Grip® bushing includes the **bushing**, **thrust collar**, and **socket head cap screws**.

**Table 1. Driven Shaft Tolerance <sup>[1]</sup> and Minimum Shaft Engagement (TT)**

| Shaft Diameter (in) | Tolerance (in) |
|---------------------|----------------|
| 1-3/16 – 1-15/16    | +0 / -0.0015   |
| 2 – 3-1/8           | +0 / -0.0018   |
| 3-3/16 – 4-11/16    | +0 / -0.0021   |
| 4-3/4 – 6-1/2       | +0 / -0.0025   |

| Shaft Diameter (mm) | Tolerance (µm) |
|---------------------|----------------|
| (30 - 50)           | (+0 / -39)     |
| (50 - 80)           | (+0 / -46)     |
| (80 - 120)          | (+0 / -54)     |
| (120 - 180)         | (+0 / -63)     |

| BBB<br>Size | TGB     |         | TGB XL  |         |
|-------------|---------|---------|---------|---------|
|             | TT (mm) | TT (in) | TT (mm) | TT (in) |
| 4A          | 209     | 8.23    | 110     | 4.33    |
| 4B          | 243     | 9.57    | 120     | 4.72    |
| 4C          | 280     | 11.02   | 150     | 5.91    |
| 4D          | 327     | 12.87   | 170     | 6.69    |
| 4E          | 360     | 14.17   | 190     | 7.48    |
| 4F          | 412     | 16.22   | -       | -       |

Note: [1] Based on ISO/JIS/DIN h8

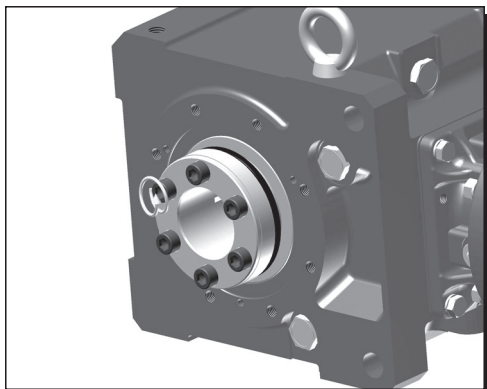
### Taper-Grip® Bushing Installation onto Driven Shaft

#### 1

Remove **bushing cover** if unit was supplied with one.

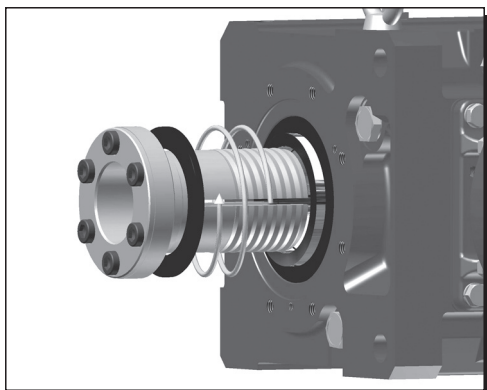
## Installation onto Driven Shaft, continued

### Taper-Grip® Bushing



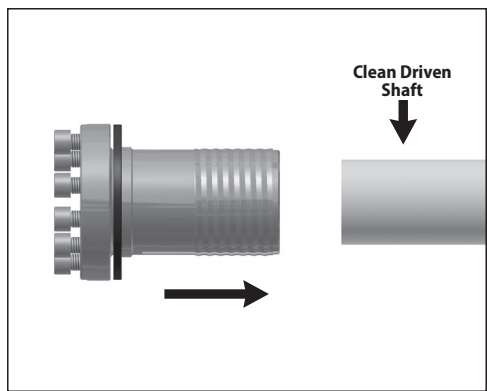
## 2

Loosen **socket head cap screws**.



## 3

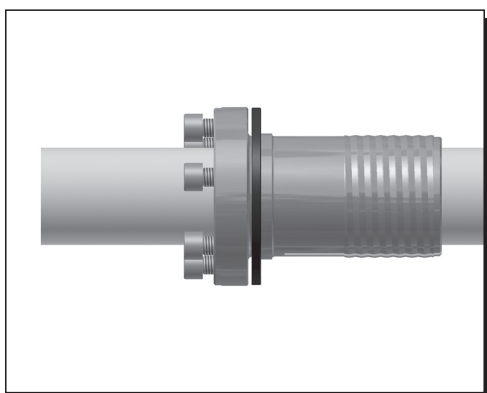
Remove (unscrew) Taper-Grip® bushing from the unit.



## 4

Clean all **grease, oil** and/or **anti-seize paste** from the driven shaft. Failure to do so could result in damage to shaft.

Slide Taper-Grip® bushing onto driven shaft.



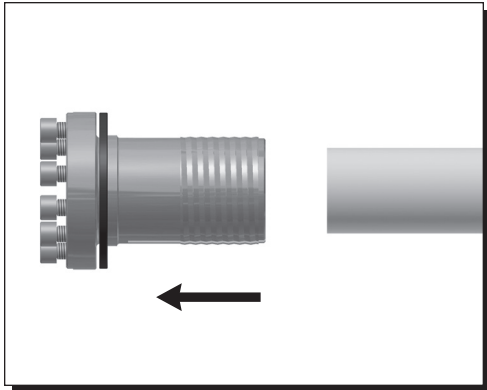
## 5

Inspect and test Taper-Grip® bushing on shaft.

- Check shaft for **burrs, corrosion, or warp**. Repair or replace shaft as necessary.
- Slide bushing back and forth along shaft, checking for surface irregularities and fit.
- Verify bushing is sized correctly for the shaft diameter.

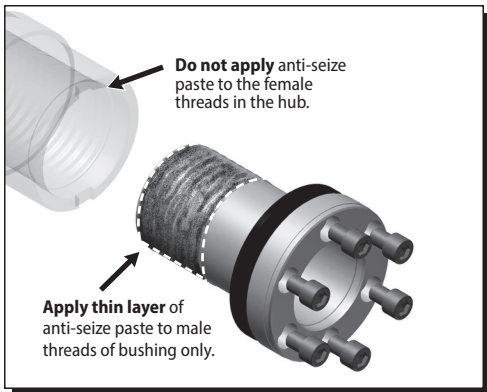
## Installation onto Driven Shaft, continued

### Taper-Grip® Bushing



**6**

Remove Taper-Grip® bushing from driven shaft.



**7**

Apply a thin layer of anti-seize paste to the male threads of the Taper-Grip® bushing only.



Ensure that the anti-seize paste does not enter the Taper-Grip® bushing bore.

**Do not apply anti-seize paste to the female threads in the hub.**

**8**

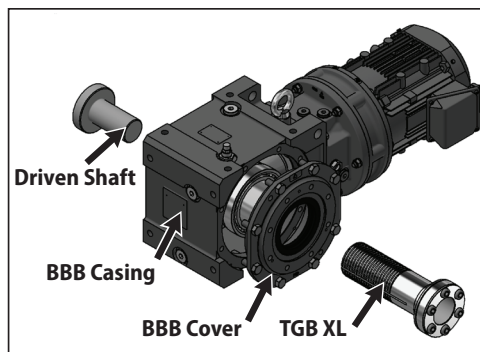
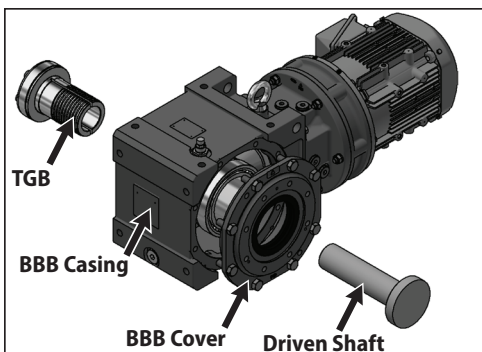
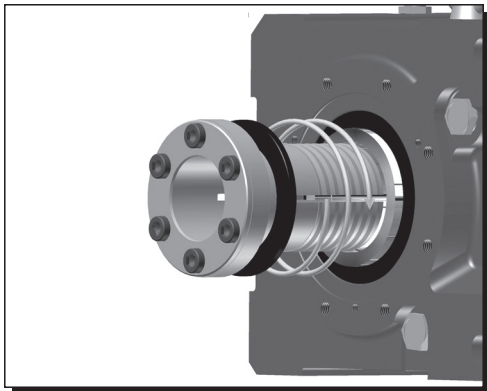
Screw Taper-Grip® bushing (TGB) in Casing side or Extended Taper-Grip® bushing (TGB XL) in Cover side into the reducer. **Leave approximately 1 mm gap between the bushing flange and thrust collar.**



**Do not apply grease, oil, or anti-seize paste to the driven shaft or the bushing bore** before placing the unit onto driven shaft. Use of these friction-minimizing products will adversely affect the ability of the unit to transmit torque.



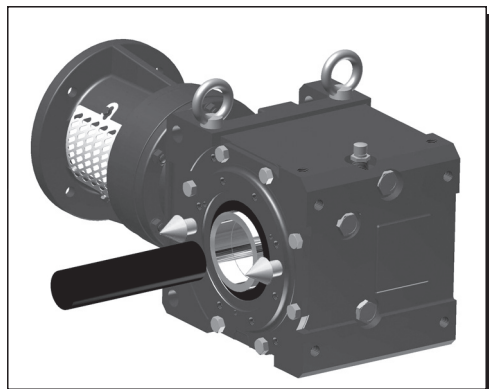
**CAUTION:** The Cyclo® BBB4 must be externally supported prior to insertion of driven shaft into bushing. External support **MUST** be maintained until all bushing socket head cap screws have been tightened to the appropriate operational torque.



NOTE: BBB Casing and Cover are shown disassembled for reference only. Cover should not be removed in order to install either TGB or TGB XL. Disassembling the reducer/gearmotor may result in void warranty.

Installation onto Driven Shaft, *continued*

## Taper-Grip® Bushing

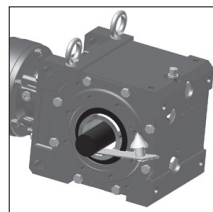
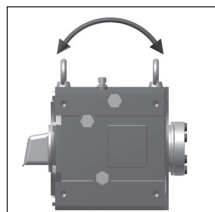


## 9

Mount or slide the Cyclo® BBB4 onto the driven shaft to the desired location.



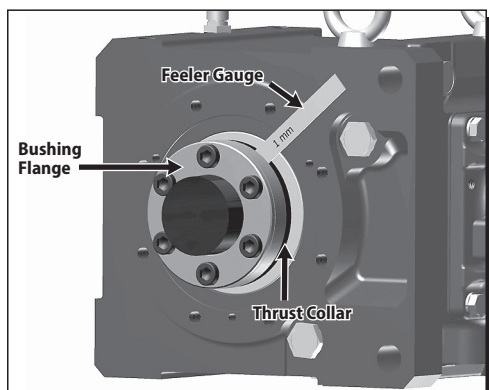
**Do not rock or pry the unit.**



## 10

Screw Bolts into Taper-Grip® bushing.

- Lightly oil threads of each bolt before inserting.
- Finger tighten each bolt to secure in place.
- Be sure to **maintain the 1 mm** (approximate) **gap** between the **thrust collar** and the **bushing flange**.



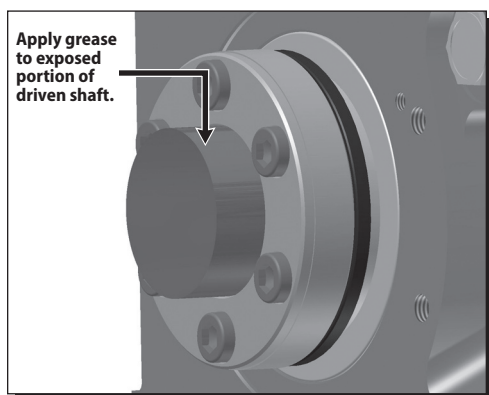
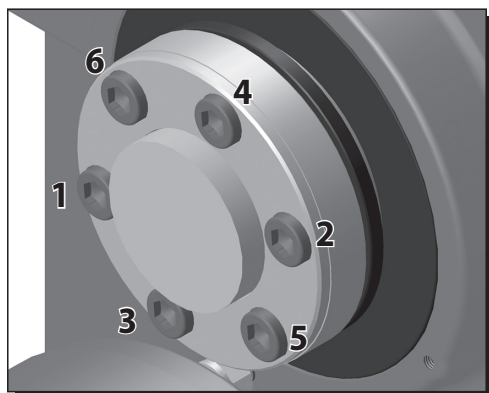
## 11

Tighten bushing bolts to the correct torque value.

- Following a star pattern, use a torque wrench to **gradually tighten each socket head cap screw in 20% increments**.
- Refer to **Table 2, Taper-Grip® Bushing Bolt Tightening Torques**, for the correct operational screw torques.

**Table 2. Taper-Grip® Bushing Bolt Tightening Torques**

| Cyclo® BBB4 Size | Screw Qty x Size | Screw Torque |       |
|------------------|------------------|--------------|-------|
|                  |                  | lb-ft        | (N·m) |
| 4A               | 6 x M12          | 56           | (75)  |
| 4B               | 6 x M12          | 104          | (140) |
| 4C               | 6 x M16          | 185          | (250) |
| 4D               | 6 x M16          | 223          | (300) |
| 4E               | 8 x M16          | 223          | (300) |
| 4F               | 10 x M16         | 223          | (300) |



## 12

**In order to prevent corrosion, apply grease** to the exposed portion of the driven shaft.

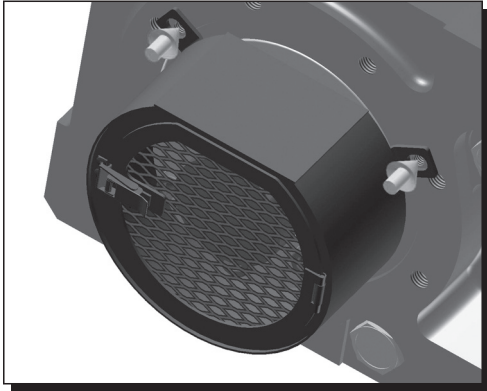
- **After installing and tightening** the bushing bolts with a torque wrench, **apply grease or an anti-corrosion product** to the exposed portion of the shaft.

## 13

After the reducer has been running for 20 to 30 hours, re-torque the screws to the values in Table 2. Screw torques should be subsequently checked at normal service intervals (i.e. every 6 months).

## Installation onto Driven Shaft, continued

### Taper-Grip® Bushing, Keyed Hollow Bore



#### 14

For units that include a bushing safety cover, reinstall the guard over the Taper-Grip® bushing.



**Do not** operate unit until the torque arm has been attached to the unit and fixed to a rigid structure. The torque arm prevents counter-rotation during unit operation. Refer to torque arm Installation section in this manual for instructions.

### Keyed Hollow Bore Installation



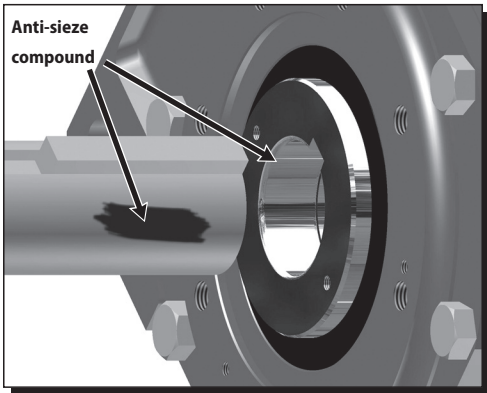
**Do not** operate unit until the torque arm has been attached to the unit and fixed to a rigid structure. The torque arm prevents counter-rotation during unit operation. Refer to torque arm Installation section in this manual for instructions.



**CAUTION:** The Cyclo® BBB4 must be externally supported prior to insertion of driven shaft into hollow bore.

### Bore and Shaft Tolerance Specifications

- Unless otherwise specified, the tolerance of the Hollow Shaft Bore conforms to JIS H8.
- If application involves high shock loading and/or large radial loads, a shaft tolerance of JIS js6 or JIS k6 is recommended.



### Keyed Hollow Bore Installation onto Driven Shaft

#### 1

Apply anti seize compound to the driven shaft surface and inside the reducer keyed hollow bore.

#### 2

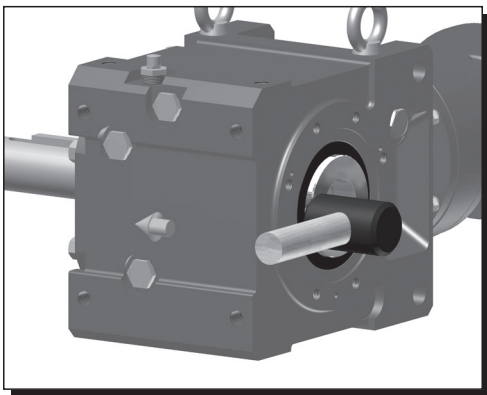
Align the driven shaft with the reducer/gearmotor bore and carefully slide unit onto the driven shaft to the desired location.

If the fit is tight, strike on the keyed hollow bore with a wooden or hard rubber mallet to assist in the assembly.



If using a mallet during installation, strike **only** against the unit's steel keyed hollow bore. Do not strike the reducer housing or oil seal as damage to the bearings, housing and/or seals may occur.

**Note:** If the fit is tight, use a jig such as the one shown in Table 3 to ease assembly. **Sumitomo does not supply a mounting jig. This information is provided for reference only.**

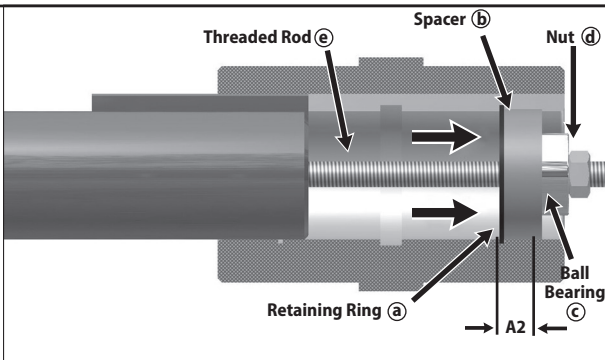
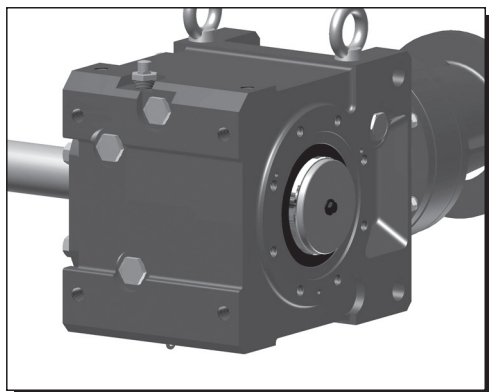


## Installation onto Driven Shaft, continued

### Keyed Hollow Bore, Shrink Disc Type Hollow Bore

**Table 3. Jig Dimensions (mm)**

| Size | a            | b  | c       | d   | e            |
|------|--------------|----|---------|-----|--------------|
|      | CC (ISO/JIS) | A2 | Bearing | Nut | Threaded Rod |
| 4A   | 55           | 25 | 51104   | M16 | M16 x 250    |
| 4B   | 65           | 25 | 51105   | M20 | M20 x 300    |
| 4C   | 75           | 25 | 51105   | M20 | M20 x 300    |
| 4D   | 85           | 35 | 51107   | M24 | M24 x 400    |
| 4E   | 100          | 35 | 51107   | M24 | M24 x 400    |
| 4F   | 120          | 46 | 51109   | M30 | M30 x 450    |

### 3

Once driven shaft has been completely inserted into the unit's keyed hollow bore, secure the shaft in place using a keeper plate as shown to the left, or some other means of securing the unit to the driven shaft.



**Do not operate unit until the torque arm has been attached.** Refer to the Torque Arm Installation section in this manual for instructions.

## Shrink Disc Type Mounting Introduction

The **keyless Shrink Disc** provides a reliable commodity shaft attachment for Sumitomo speed reducers and gearmotors. This system allows bi-directional shaft rotation operation with a powerful, slip-free grip.

To assure peak performance of your equipment, please read, understand and follow these installation instructions.



**Do not** operate unit until the torque arm has been attached to the unit and fixed to a rigid structure. The torque arm prevents counter-rotation during unit operation. Refer to torque arm Installation section in this manual for instructions.



**CAUTION:** The Cyclo® BBB4 must be externally supported prior to insertion of driven shaft into hollow bore. External support **MUST** be maintained until all shrink disc socket head cap screws have been tightened to the appropriate operational torque.


## Bore and Shaft Tolerance Specifications

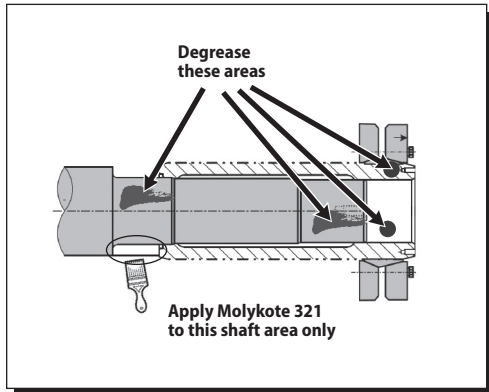
- Refer to the certified outline drawing or Cyclo® BBB4 Catalog for recommended machine shaft dimensions.
- Unless otherwise specified, the tolerance of the Shrink Disc Bore conforms to JIS H8.
- If application involves high shock loading and/or large radial loads, a shaft tolerance of JIS js6 or JIS k6 is recommended.

# Installation onto Driven Shaft, continued

## Shrink Disc Type Hollow Bore

### Shrink Disc Type Hollow Bore Installation onto Shaft

 Before placing unit onto driven shaft, **do not apply grease, oil, or anti-seize paste to the entire driven shaft or to the bore of the shrink disc.** Use of these friction-minimizing products will adversely affect the ability of the unit to transmit torque. Never tighten locking screws before shaft installation. Inner ring may become permanently contracted even at low tightening torques.



#### 1

Clean and degrease contact surfaces; reducer shaft and bore, and the machine driven shaft.

Apply Molykote 321 or an equivalent dry film lubricant to the driven shaft shoulder opposite from the shrink disc.



**Do Not** apply any friction minimizing compound to the driven shaft at or near the shrink disc.

#### 2

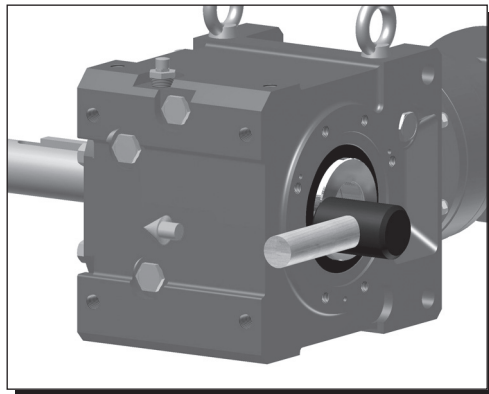
Align the driven shaft with the bore of reducer/gearmotor bore and carefully slide unit onto the driven shaft to the desired location.

- If the fit is tight, strike on the reducer hollow bore with a mallet to assist in the assembly.



If using a mallet during installation, strike **only** against the unit's steel hollow bore. **Do not** strike the reducer housing or oil seal, as damage to the bearings, housing, and/or seals may occur.

If the fit is tight, use a jig such as the one shown in the Keyed Hollow Bore Installation section to ease assembly. **Sumitomo does not supply a mounting jig. This information is provided for reference only.**

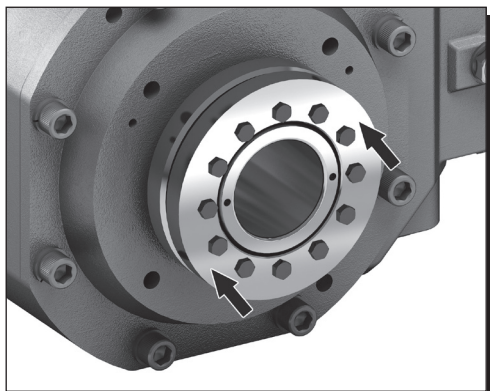


**Table 4. Shrink Disc Bolt Tightening Torques**

| Size | Model (Typical)  | Bolt                              | Bolt Torque |       |
|------|------------------|-----------------------------------|-------------|-------|
|      |                  |                                   | lb-ft       | (N·m) |
| 4A   | TAS-3071-55x68   | 10 x M6x25<br>ISO/JIS grade 10.9  | 9           | (12)  |
| 4B   | TAS-3071-65x80   | 7 x M8x30<br>ISO/JIS grade 12.9   | 26          | (34)  |
| 4C   | TAS-3071-75x100  | 12 x M8x35<br>ISO/JIS grade 12.9  | 26          | (34)  |
| 4D   | TAS-3071-85x110  | 9 x M10x40<br>ISO/JIS grade 12.9  | 51          | (68)  |
| 4E   | TAS-3071-100x140 | 10 x M12x45<br>ISO/JIS grade 12.9 | 87          | (118) |
| 4F   | TAS-3071-120x165 | 8 x M16x55<br>ISO/JIS grade 12.9  | 214         | (290) |

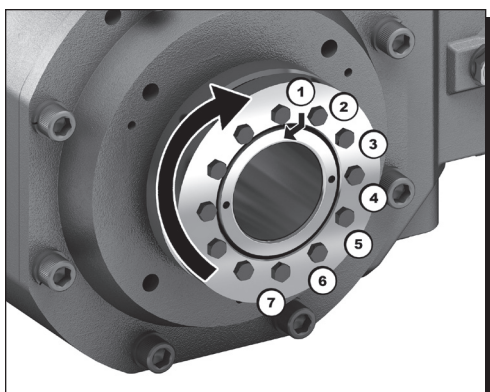
## Installation onto Driven Shaft, continued

### Shrink Disc Type Hollow Bore



### 3

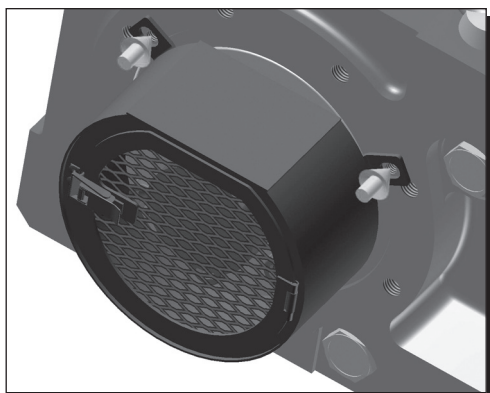
- Set the (untightened) shrink disc on the reducer shaft.



### 4

Tighten Bolts to the correct torque value.

- For 3-piece design shrink disc, make sure that both plates are parallel when tightening bolts.
- After confirming that the shrink disc is set correctly, tighten the bolts uniformly, in a clockwise pattern while keeping both plates parallel (**not** diagonally or 'star' pattern).
- It is recommended to tighten respective bolts by 30 degrees each time – until the specified torque is reached.



### 5

For units with a safety cover, install the guard over the **shrink disc**.

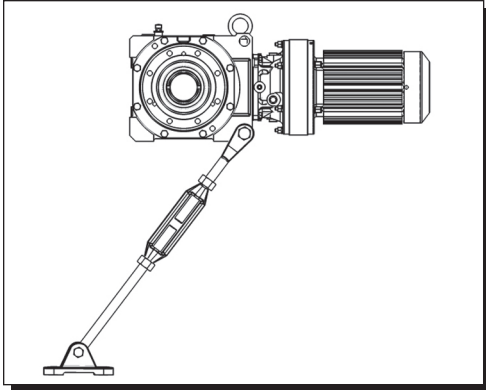


**Do not operate unit until the torque arm has been attached.** Refer to the Torque Arm Installation section in this manual for instructions.



# Torque Arm Installation

## Torque Arm Introduction, Turnbuckle Type Torque Arm



### Torque Arm Introduction

A **torque arm** is a device used to prevent counter-rotation of the shaft mounted reducer/gearmotor during operation.



The torque arm **must** be mounted in **tension** when torque arm mounting point is greater than 6 inches (150mm) from machine mounting point or, tie-rod or turn buckle type torque arm is used.

### Turnbuckle Type Torque Arm Parts

Figure 1. Turnbuckle Rod Type Torque Arm Parts

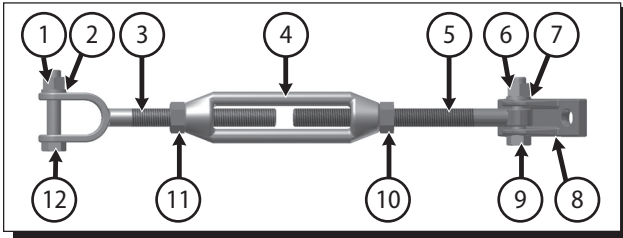
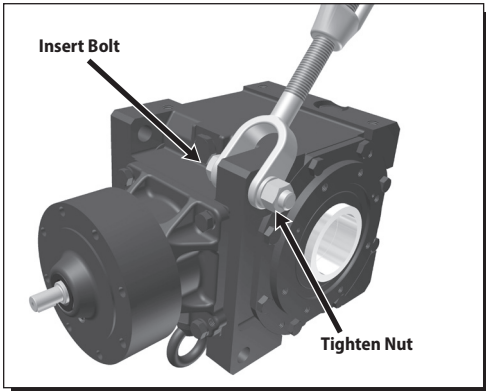


Table 5. Turnbuckle Type Torque Arm Parts

| Item Number | Description            | Item Number | Description               |
|-------------|------------------------|-------------|---------------------------|
| 1           | Hex Nut                | 7           | Locke Washer              |
| 2           | Lock Washer            | 8           | Fulcrum Mounting Bracket  |
| 3           | Threaded Extension Rod | 9           | Hex Bolt                  |
| 4           | Turnbuckle             | 10          | Locking Nut (if supplied) |
| 5           | Threaded Arm           | 11          | Locking Nut (if supplied) |
| 6           | Hex Bolt               | 12          | Hex Bolt                  |



### 1

Attach the torque arm threaded extension rod to the bevel housing, as shown in Figure 1, at the housing corner eyelet, using the appropriate nut, bolt and lockwasher.

- Insert the bolt through the brackets, torque arm sleeve (if supplied) and reducer housing eyelet.
- Place the lockwasher on the bolt and secure with nut.

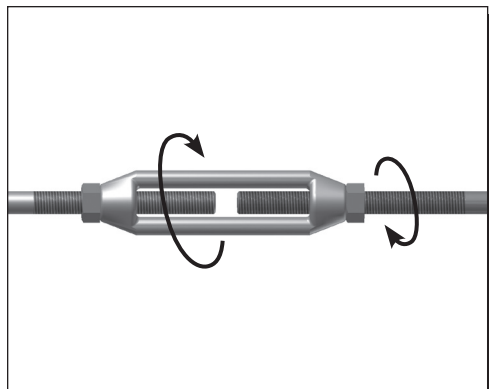
Table 6. Bolt Tightening Torques

| Unit Size | Bolt Size <sup>[1]</sup> | ft·lb <sub>f</sub> | (N·m)       |
|-----------|--------------------------|--------------------|-------------|
| A         | M16 x 75                 | 152 – 167          | (206 – 227) |
| B         | M20 x 100                | 290 – 319          | (392 – 431) |
| C         | M24 x 105                | 507 – 558          | (686 – 755) |
| D         | M24 x 125                | 507 – 558          | (686 – 755) |
| E         | M24 x 125                | 507 – 558          | (686 – 755) |
| F         | Consult Factory          |                    |             |

Note: [1] Bolt Class equal to ISO/JIS Class 8.8

## Torque Arm Installation, continued

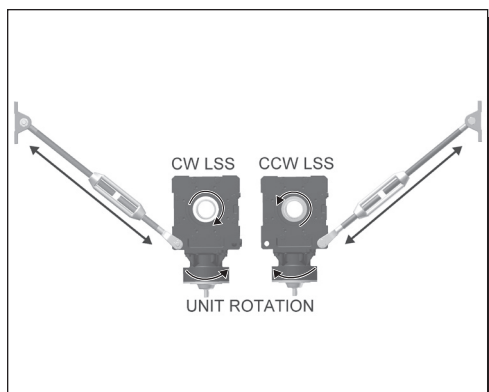
### Turnbuckle Type Torque Arm



#### 2

Install the turnbuckle onto the threaded extension rod (gearbox side) and then threaded arm (foundation side) to the turnbuckle

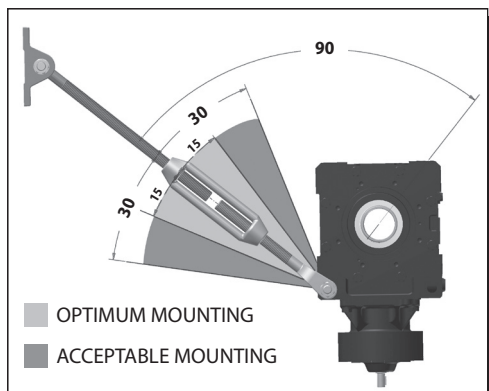
If the assembly was supplied with hex nuts to secure the turnbuckle, install the nuts loosely, ensuring the left hand nut is used on the threaded arm, prior to installing the turnbuckle and threaded arm



#### 3

Position the torque arm so it will be in tension during unit operation and mount the fulcrum mounting bracket to suitable structure or foundation. Consider installing two torque arms for reversing applications to allow torque arm to be in tension for each direction of rotation.

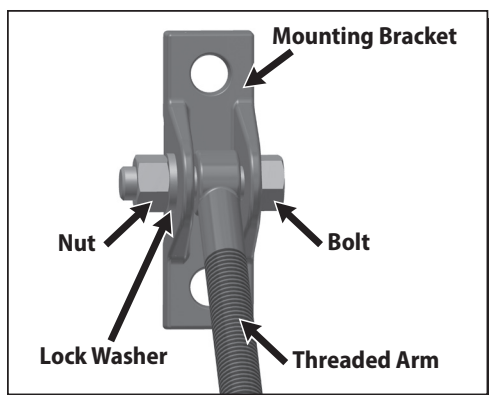
Mounting hardware for fulcrum mounting bracket are NOT supplied by Sumitomo.



#### 4

Position the torque arm as close as possible to 90° relative to the unit output bore / driven equipment shaft.

Sumitomo does not recommend combining torque arm assemblies to achieve a greater overall length.



#### 5

Assemble the threaded arm to the fulcrum mounting bracket, as shown.

Some adjustment of the turnbuckle may be required to lengthen or shorten the overall length.

Secure it with the appropriate nut, bolt and lockwasher.

- Insert the bolt through the brackets and threaded arm eyelet.
- Place the lockwasher on the bolt and secure with nut.

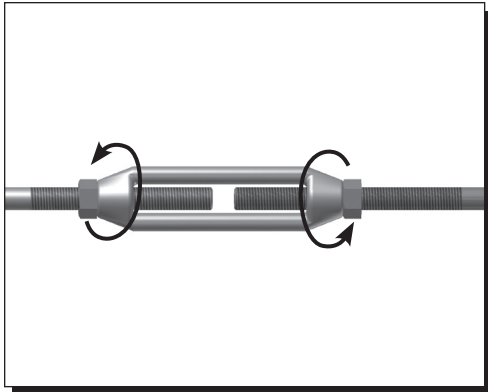
**Table 7. Bolt Tightening Torques**

| Unit Size | Bolt Size <sup>[1]</sup> | ft·lb <sub>f</sub> | (N·m)       |
|-----------|--------------------------|--------------------|-------------|
| A         | M16 x 65                 | 152 – 167          | (206 – 227) |
| B         | M16 x 80                 | 152 – 167          | (206 – 227) |
| C         | M16 x 80                 | 152 – 167          | (206 – 227) |
| D         | M16 x 80                 | 152 – 167          | (206 – 227) |
| E         | M16 x 80                 | 152 – 167          | (206 – 227) |
| F         | Consult Factory          |                    |             |

**Note:** [1] Bolt Class equal to ISO/JIS Class 8.8

# Torque Arm Installation, continued

## Turnbuckle Type Torque Arm, Tie Rod Type Torque Arm



### 6

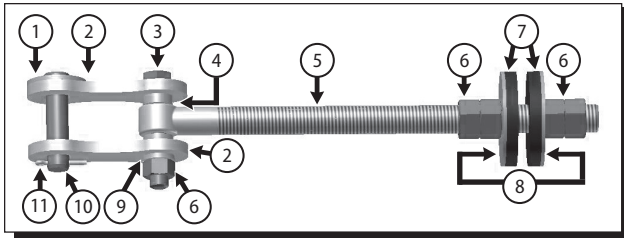
If turnbuckle hex nuts were supplied, secure the turnbuckle position by adjusting the previously installed turnbuckle nuts.

**Table 8. Nut Tightening Torques**

| Unit Size | Nut Size <sup>(1)</sup> | ft·lb <sub>f</sub> | (N·m)       |
|-----------|-------------------------|--------------------|-------------|
| A         | M20                     | 290 – 319          | (392 – 431) |
| B         | M24                     | 507 – 558          | (686 – 755) |
| C         | M24                     | 507 – 558          | (686 – 755) |
| D         | M24                     | 507 – 558          | (686 – 755) |
| E         | M24                     | 507 – 558          | (686 – 755) |
| F         | Consult Factory         |                    |             |

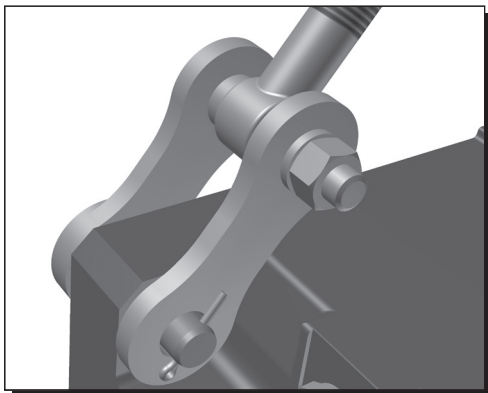
## Tie Rod Type Torque Arm Parts

**Figure 1. Tie Rod Type Torque Arm Parts**



**Table 9. Tie Rod Type Torque Arm Parts**

| Item Number | Description                       | Item Number | Description     |
|-------------|-----------------------------------|-------------|-----------------|
| 1           | Flat Washer                       | 7           | Rubber Bushings |
| 2           | (2) Mounting Brckts or (1) Clevis | 8           | Washers         |
| 3           | Hex Bolt                          | 9           | Lock Washer     |
| 4           | Spacer                            | 10          | Clevis Pin      |
| 5           | Threaded Arm                      | 11          | Cotter Pin      |
| 6           | Hex Nut                           |             |                 |



### 1

Assemble the torque arm mounting brackets or wishbone clevis to the threaded arm, as shown in Figure 1 and attach the torque arm assembly to the bevel housing, at the housing corner eyelet, using the pin and cotter pin.

Tighten mounting bolts according to the values listed in this table:

- Insert the clevis pin through the brackets and housing eyelet.
- Insert the cotter pin into clevis pin and secure assembly.

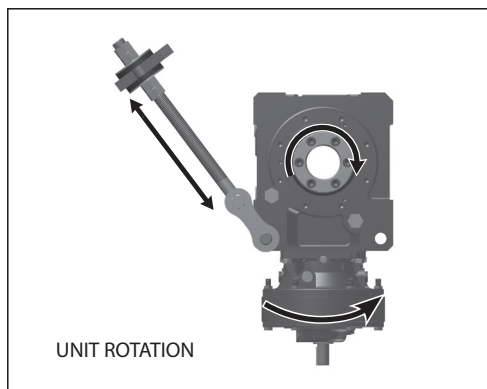
**Table 10. Bolt Tightening Torques**

| BBB4 Size | Bracket Bolt Size <sup>(1)</sup> | Torque    |             |
|-----------|----------------------------------|-----------|-------------|
|           |                                  | lb-ft     | (N·m)       |
| 4A        | 2 x M16                          | 152 – 167 | (206 – 227) |
| 4B        | 2 x M20                          | 290 – 319 | (392 – 431) |
| 4C        | 2 x M24                          | 507 – 558 | (686 – 755) |
| 4D        | 2 x M24                          | 507 – 558 | (686 – 755) |
| 4E        | 2 x M24                          | 507 – 558 | (686 – 755) |
| 4F        | Consult Factory                  |           |             |

**Note:** [1] Bolt Class equal to ISO/JIS Class 8.8

## Torque Arm Installation, continued

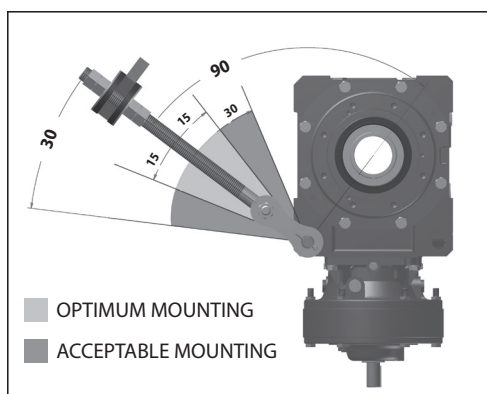
### Tie Rod Type Torque Arm



## 2

Position the torque arm so it will be in tension during unit operation.

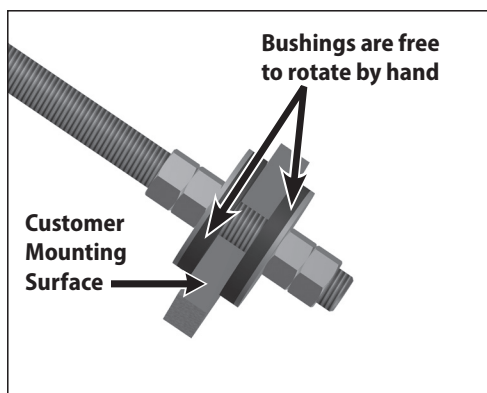
Consider installing two torque arms for reversing applications to allow torque arm to be in tension for each direction of rotation.



## 3

Position the torque arm as close as possible to 90° relative to the unit output bore / driven equipment shaft.

Sumitomo does not recommend combining torque arm assemblies to achieve a greater overall length.



## 4

After inserting the torque rod into the mounting surface, carefully tighten nuts on either side of torque rod.



Do **not** over tighten nuts. Tighten to point where rubber bushings can still be hand rotated when the unit is turned off.

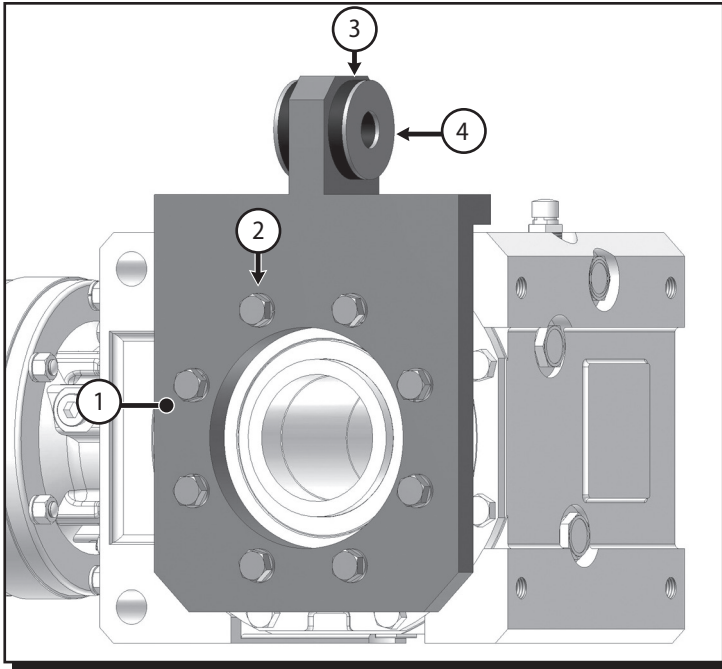


Before starting unit, verify the following:

- The torque arm will be in tension when the unit is in operation.
- The torque arm is aligned with the reducer housing.
- The torque arm is perpendicular to the axis of the output / driven shaft.
- The threaded arm is not touching the reducer housing.

# Torque Arm Installation, continued

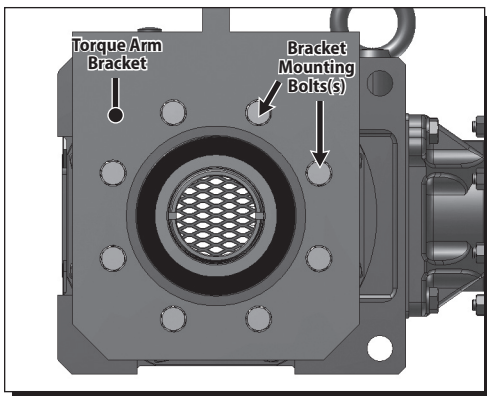
## Flange Mount (Banjo) Type Torque Arm



### Sumitomo Supplied Components of Flange Mount (Banjo) Type Torque Arm

Table 11. Flange Mount (Banjo) Type Torque Arm Components

| Item Number | Description            |
|-------------|------------------------|
| 1           | Torque Arm Bracket     |
| 2           | Bracket Hardware       |
| 3           | Rubber Bushing (qty 3) |
| 4           | Washer (qty 2)         |



### Flange Mount (Banjo) Type Torque Arm Installation Procedure

#### 1

Attach the Flange Mount (Banjo) Torque Arm Bracket to the Cyclo® BBB4 using mounting hardware.

Table 12. Flange Mount (Banjo) Torque Arm Bolt Tightening

| Torques Unit Size | Bracket Bolt Size <sup>(1)</sup> | Torque    |             |
|-------------------|----------------------------------|-----------|-------------|
|                   |                                  | lb·ft     | (N·m)       |
| 4A                | 8 x M10                          | 34 – 38   | (46 – 51)   |
| 4B                | 8 x M12                          | 59 – 65   | (80 – 88)   |
| 4C                | 8 x M16                          | 152 – 167 | (206 – 227) |
| 4D,4E             | 8 x M20                          | 290 – 319 | (392 – 431) |
| 4F                | 8 x M24                          | 507 – 558 | (686 – 755) |

Note: [1] Bolt class equal to ISO/JIS Class 8.8

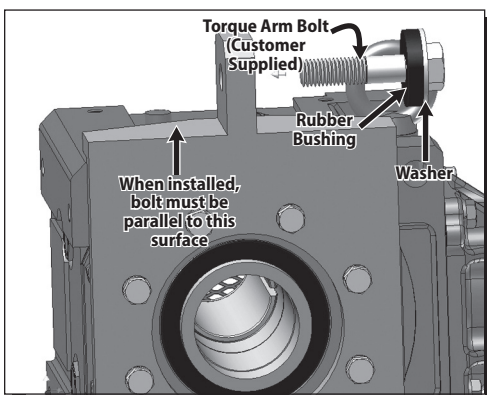
#### 2

Place washer and rubber bushing on bolt.

Insert torque arm bolt (supplied by customer) through mounting tab on Banjo torque arm.

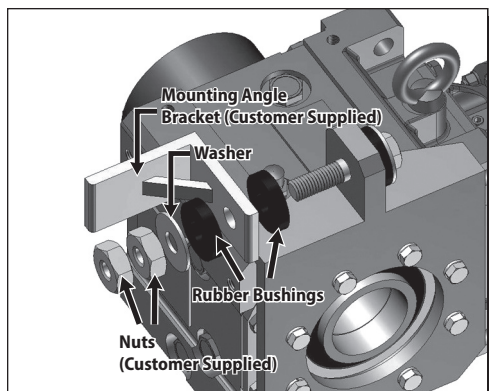


Make sure bolt is parallel to Flange Mount (Banjo) Type Torque Arm surface when fully installed.



## Torque Arm Installation, continued

### Flange Mount (Banjo) Type Torque Arm



### 3

Follow these steps to attach the customer supplied mounting bracket.

- Place rubber bushing and mounting angle bracket on bolt.
- Verify that the mounting angle bracket hole is the correct diameter (see Table 13 in Step 1).
- Place remaining bushing, washer and two nuts on the bolt.

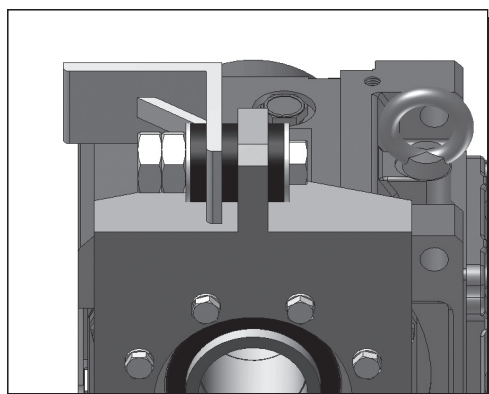


**Do not over-tighten nuts. Tighten to point where rubber bushings can still be hand rotated.**

**Table 13. Flange Mount (Banjo) Torque Arm Bolt Dimensions**

| Unit Size | Bracket Tab Bore | Typical Bolt Size <sup>(1)</sup> |
|-----------|------------------|----------------------------------|
| 4A        | Ø18mm            | M16                              |
| 4B        | Ø18mm            | M16                              |
| 4C        | Ø22mm            | M20                              |
| 4D        | Ø26mm            | M24                              |
| 4E        | Ø33mm            | M30                              |
| 4F        | Ø39mm            | M36                              |

**Note: [1]** Bolt class should be greater or equal to ISO/JIS Class 8.8. Application with multiple start/stops and/or shock loading should use ISO/JIS 10.9 at a minimum.



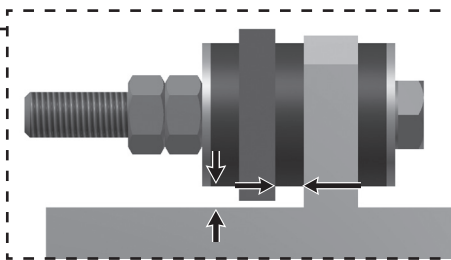
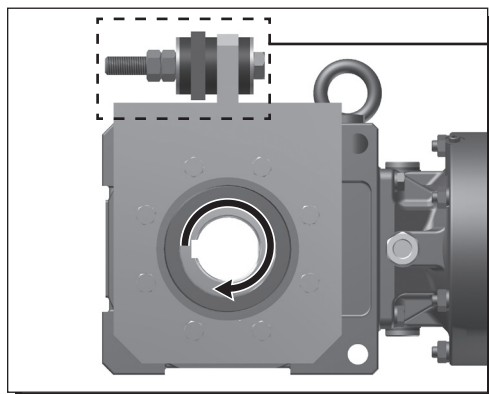
### 4

Confirm that the rubber bushings can still be rotated by hand. This indicates the bushing has not been over tightened.



Compressed bushings will not allow the bushings to properly absorb the loads of the shaft mounted gearbox. This can lead to premature failure.

**Mounting Angle Bracket must be secured to the machine structure.**



During full rotation of driven shaft, there must be no metal-to-metal contact between mounting angle bracket and torque arm.

### 5

**Confirm the mounting angle bracket does not interfere with the torque arm.**

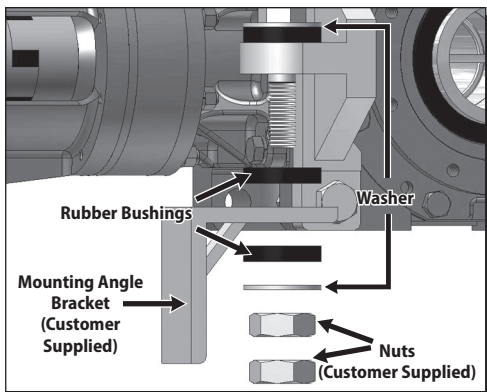
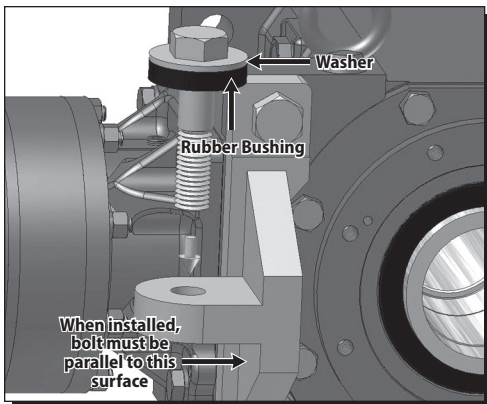
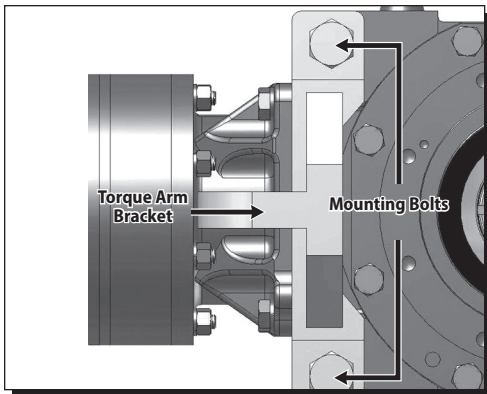
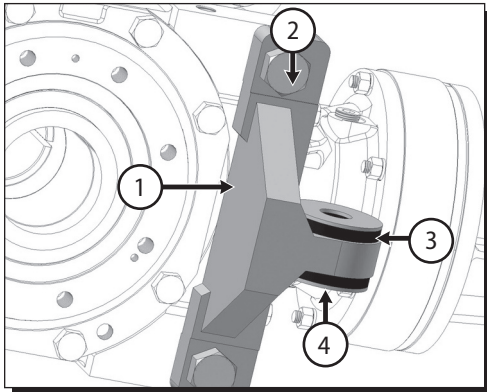
There should be no metal-to-metal contact between the two during a complete revolution of the driven equipment.



Metal-to-Metal contact between these two components may lead to catastrophic failure of the reducer/gearmotor.

# Torque Arm Installation, continued

## T-Type Torque Arm



## T-Type Torque Arm

### Sumitomo Supplied Components for T-Type Torque Arm

Table 14. T-Type Torque Arm Components

| Item Number | Description            |
|-------------|------------------------|
| 1           | Torque Arm Bracket     |
| 2           | Bracket Hardware       |
| 3           | Rubber Bushing (qty 3) |
| 4           | Washer (qty 2)         |

## T-Type Torque Arm Installation Procedure

### 1

Attach the T-Type Torque Arm Bracket to the Cyclo® BBB4 using the supplied mounting hardware.

Tighten mounting bolts according to the values listed in Table 15:

Table 15. T-Bracket Bolt Torques

| BBB4 Size | Bracket Bolt Size <sup>[1]</sup> | Torque      |               |
|-----------|----------------------------------|-------------|---------------|
|           |                                  | lb-ft       | (N·m)         |
| 4A        | 2 x M16                          | 152 – 167   | (206 – 227)   |
| 4B        | 2 x M20                          | 290 – 319   | (392 – 431)   |
| 4C        | 2 x M24                          | 507 – 558   | (686 – 755)   |
| 4D        | 2 x M30                          | 1014 – 1115 | (1373 – 1510) |
| 4E        | 2 x M30                          | 1014 – 1115 | (1373 – 1510) |
| 4F        | 2 x M36                          | 1844 – 2213 | (2500 – 3000) |

Note: [1] Bolt class equal to ISO/JIS Class 8.8

### 2

Place washer and rubber bushing on bolt.

Insert torque arm bolt (supplied by customer) through torque arm mounting tab. T-Type bolt sizes listed in Table 16.



**Make sure bolt is parallel to T-Type Torque Arm side when fully installed.**

### 3

Follow these steps to attach the mounting angle bracket:

- Place rubber bushing and mounting angle bracket on bolt.
- Verify that the mounting angle bracket hole is the correct diameter for customer supplied bolt.
- Place remaining bushing, washer and two nuts on the bolt.



**Do not over-tighten nuts. Tighten to point where rubber bushings can still be hand rotated.**

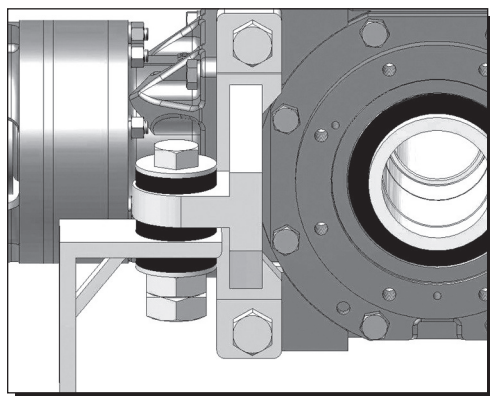
Torque Arm Installation, *continued*

## T-Type Torque Arm

Table 16. T-Type Bolt Dimensions

| Unit Size | Bracket Tab Bore | Typical Bolt Size <sup>[1]</sup> |
|-----------|------------------|----------------------------------|
| 4A        | Ø18mm            | M16                              |
| 4B        | Ø22mm            | M20                              |
| 4C        | Ø26mm            | M24                              |
| 4D        | Ø33mm            | M30                              |
| 4E        | Ø33mm            | M30                              |
| 4F        | Ø39mm            | M36                              |

**Note:** [1] Bolt class should be greater or equal to ISO/JIS Class 8.8. Application with multiple start/stops and/or shock loading should use ISO/JIS 10.9 at a minimum.



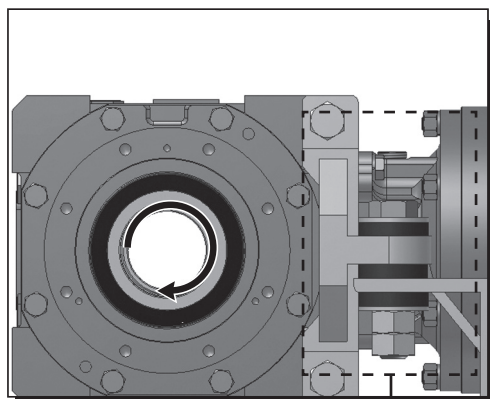
## 4

Confirm that the **rubber bushings** can still be rotated by hand. This indicates the bushing has not been over tightened.



Compressed bushings will not allow the bushings to properly absorb the loads of the shaft mounted gearbox. This can lead to premature failure.

**Mounting angle bracket must be secured to the machine structure.**



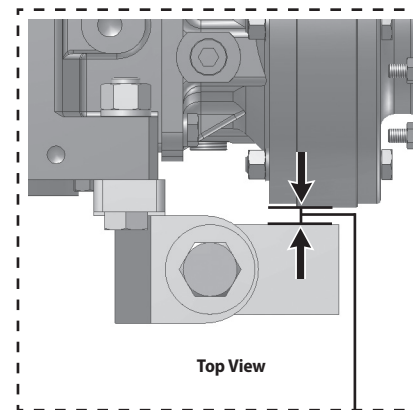
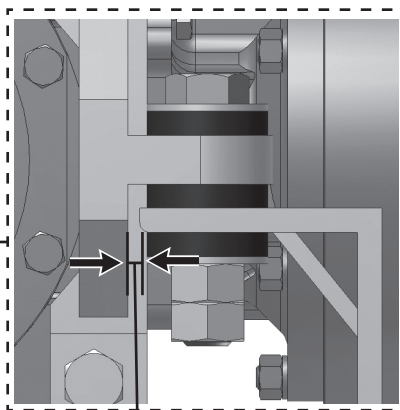
## 5

**Confirm the mounting angle bracket does not interfere with the torque arm.**

There should be no metal-to-metal contact between the two during a complete revolution of the driven equipment.



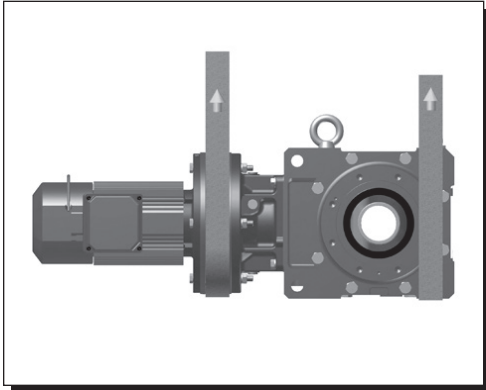
Metal-to-Metal contact between these two components may lead to catastrophic failure of the reducer/ gearmotor.





## Removal from Driven Shaft

### Removal of Cyclo® BBB4 with Taper-Grip® Bushing



### Removal of Cyclo® BBB4 with Taper-Grip® Bushing



Before starting unit removal process, ensure that electrical power to unit has been safely locked out and that electrical connections to the unit have been disconnected.

**1**

Externally support the Cyclo® BBB4 unit such that all unit weight is removed from the driven shaft.

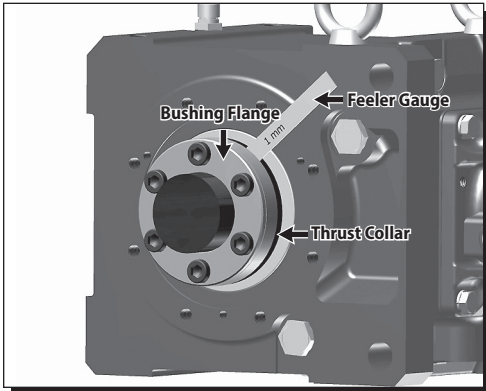


The weight of the Cyclo® BBB4 must be externally supported throughout the entire removal process.

Do not raise the unit too high. Shaft binding may occur.

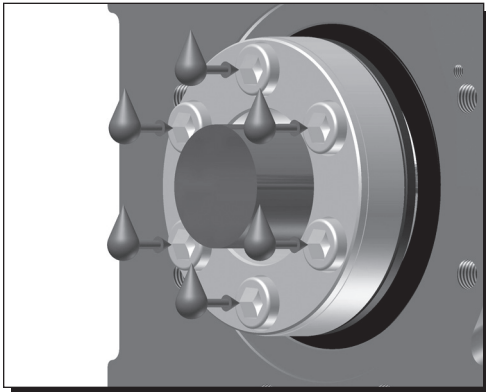
**2**

Remove safety guard from unit. Inspect the Taper-Grip® bushing to ensure that a gap exists between the thrust collar and the bushing flange.



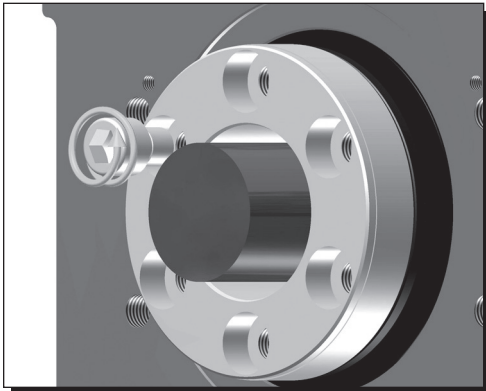
**3**

Apply a liquid-penetrant onto each of the Taper-Grip® bushing socket-head cap screws. Allow time for the penetrant to settle into the threads of the screws.



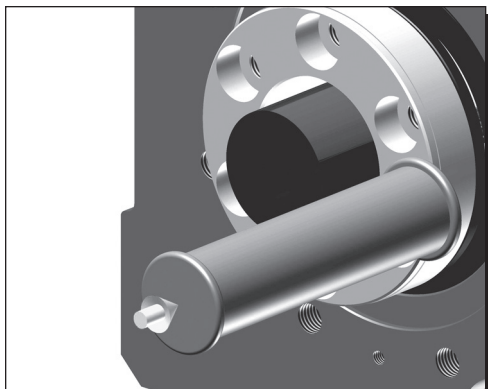
**4**

After the penetrant has settled, remove the socket head cap screws one at a time.



## Removal from Driven Shaft, *continued*

### Removal of Cyclo® BBB4 with Keyed Hollow Bore



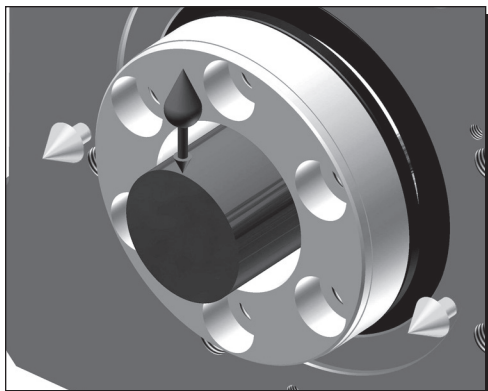
#### 5

Place a soft-metal (i.e. brass) bar against the flange of the Taper-Grip® bushing and carefully strike end of bar with a hammer to release the bushing.

If shaft removal is difficult, a jig such as the one shown in Table 17 may be used to ease the removal process. **Sumitomo does not supply the removal jig. This information is supplied for reference only.**

**Table 17. Removal Jig Dimensions**

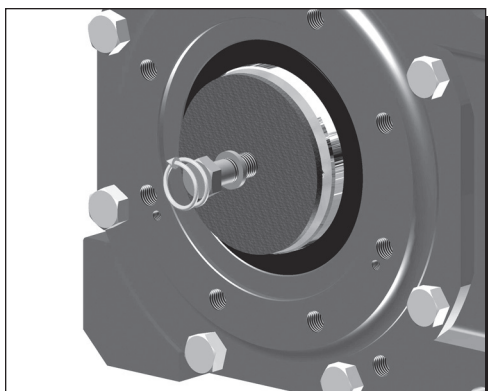
| Size | a            | f  | g       | h  |
|------|--------------|----|---------|----|
|      | CC (ISO/JIS) | A3 | BOLT    | A8 |
| 4A   | 55           | 19 | M24x250 | 6  |
| 4B   | 65           | 19 | M24x300 | 6  |
| 4C   | 75           | 19 | M24x300 | 5  |
| 4D   | 85           | 24 | M30x400 | 5  |
| 4E   | 100          | 19 | M30x400 | 5  |
| 4F   | 120          | 30 | M36x450 | 7  |



#### 6

Apply a liquid penetrant to the shaft where it contacts the bushing. Allow time for the liquid to settle between the shaft and the bushing wall. Once the penetrant has settled adequately, carefully remove the Cyclo® BBB4 from the driven shaft.

If the Taper-Grip® bushing releases but the unit cannot be removed from the driven shaft, a puller may need to be applied to the bushing flange to pull the unit free from the shaft.



### Removal of Cyclo® BBB4 with Keyed Hollow Bore



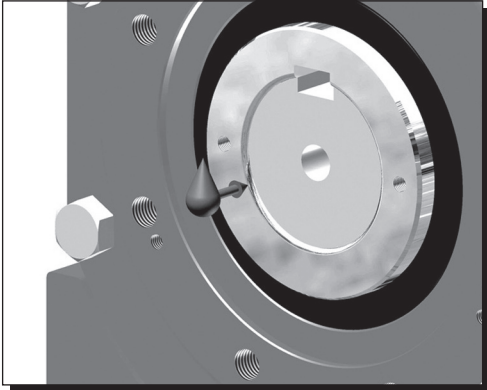
Before starting unit removal process, ensure that electrical power to unit has been safely locked out and that electrical connections to the unit have been disconnected.

#### 1

Remove safety cover and the shaft-retaining device from the driven shaft.

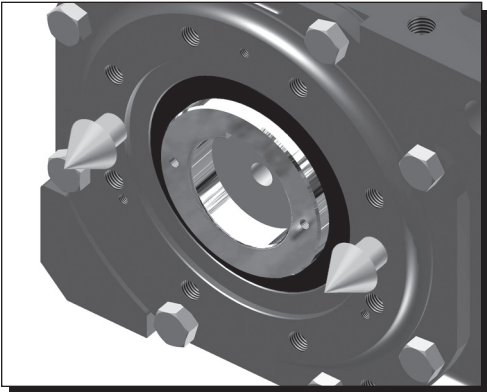
## Removal from Driven Shaft, continued

### Removal of Cyclo® BBB4 with Shrink Disc



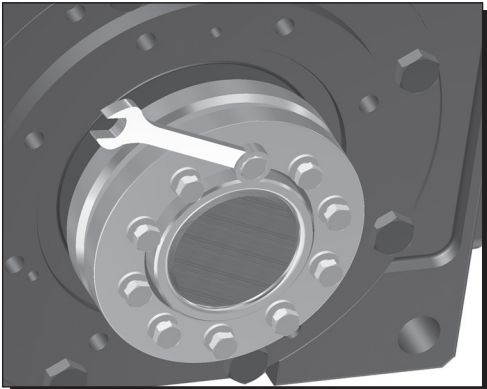
**2**

Apply a liquid penetrant to the shaft where it contacts the keyed hollow bore. Allow time for the liquid to penetrate between the shaft and the wall of the keyed hollow bore.



**3**

Once the penetrant has settled adequately, carefully remove the Cyclo® BBB4 from the driven shaft.



### Removal of Cyclo® BBB4 with Shrink Disc



Before starting unit removal process, ensure that electrical power to unit has been safely locked out and that electrical connections to the unit have been disconnected.

**1**

Remove the safety cover and apply liquid penetrant to the shrink disc bolts and shaft/bore allowing adequate time for proper penetration.

Loosen the locking bolts on the shrink disc.

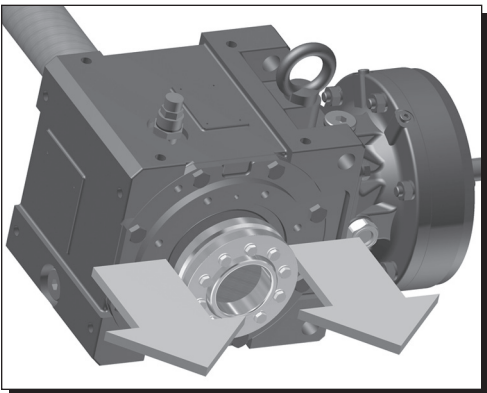
Complete bolt removal should not be required.

Tapping the shrink disc flanges with a rubber dead blow hammer may be required if any fretting corrosion has occurred.

**2**

Remove the gearbox from the shaft.

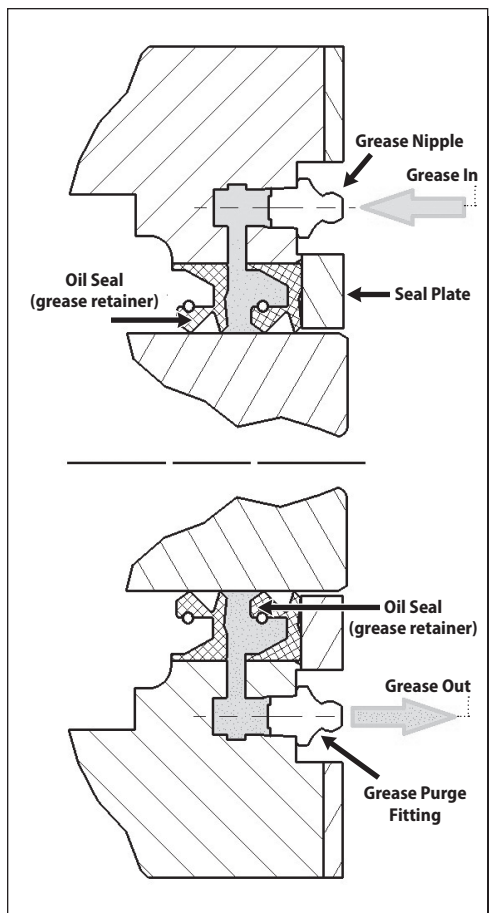
If shaft removal is difficult, a jig such as the one shown in the Removal of Cyclo® BBB4 with Taper-Grip® Bushing section may be used to ease the removal process. **Sumitomo does not supply the removal jig. This information is supplied for reference only.**



# Lubrication

## Taconite Seal Lubrication Procedure

Figure 1. Taconite Seal Assembly



### 1. Introduction

Taconite seals may be used in high dust operating environments. They use a grease purging system to prevent outside contaminants from entering the speed reducer/gearmotor. Figure 1 to the left details the Taconite Seal assembly as utilized in the 4-Series Bevel Buddybox®.

### 2. Procedure

Please follow these instructions to maintain lubrication of the Taconite Seal system:

- a. Unless otherwise specified, the Taconite output seals are each packed with NLGI #2 EP mineral grease prior to unit shipment from the factory location.
- b. **Grease does not need to be added to the seals prior to unit start-up.**
- c. Add grease to the seals according to the guidelines indicated in Table 18. Refer to Table 19 for recommended greases.

Table 18. Lubrication Cycle

| Output Shaft RPM | Hours of Operation |
|------------------|--------------------|
| >200             | 5,000              |

Please note that a highly contaminated environment may require a more frequent lubrication cycle.

Table 19. Recommended NLGI#2 Mineral Greases

| Grease     | BP                    | Castrol         |                        |                        | Chevron/Texaco         |                        | Exxon/Mobil   |                | Shell          | Total         |
|------------|-----------------------|-----------------|------------------------|------------------------|------------------------|------------------------|---------------|----------------|----------------|---------------|
| Mineral    | Ener-Grease<br>LS EP2 | Spheerol<br>AP3 | Olista Longtime<br>3EP | Tribol 3020/<br>1000-2 | Duralith<br>Grease EP2 | Multifak<br>Grease EP2 | Beacon<br>EP2 | Mobilux<br>EP2 | Alvania<br>EP2 | Multis<br>EP2 |
| Food Grade |                       |                 |                        |                        | FM EP2                 |                        |               |                |                |               |

## Lubrication, continued

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### Taconite Seal Lubrication Procedure, continued

- d. If the unit will not be operated for a period greater than 6 months, apply a thin layer of grease to the outside surface of the seals to prevent dry-out. Before starting the unit, check the seals' integrity and replace if required. If seal replacement is required, purge and add grease to the newly installed seals prior to unit operation.
- e. Units may be equipped with either a spring loaded grease relief fitting, or a plug in the grease purge port.
  - If your unit has a plug, begin by removing the plug.
  - While rotating the reducer shafts to ensure even grease distribution, **slowly** add grease until new grease begins to come out of the grease purge port. **NOTE: Rotate shafts by hand in this process. Exercise caution in rotating shaft in order to avoid injury.**
  - Wipe away excess grease and reinstall plug if necessary.

## Lubrication Introduction

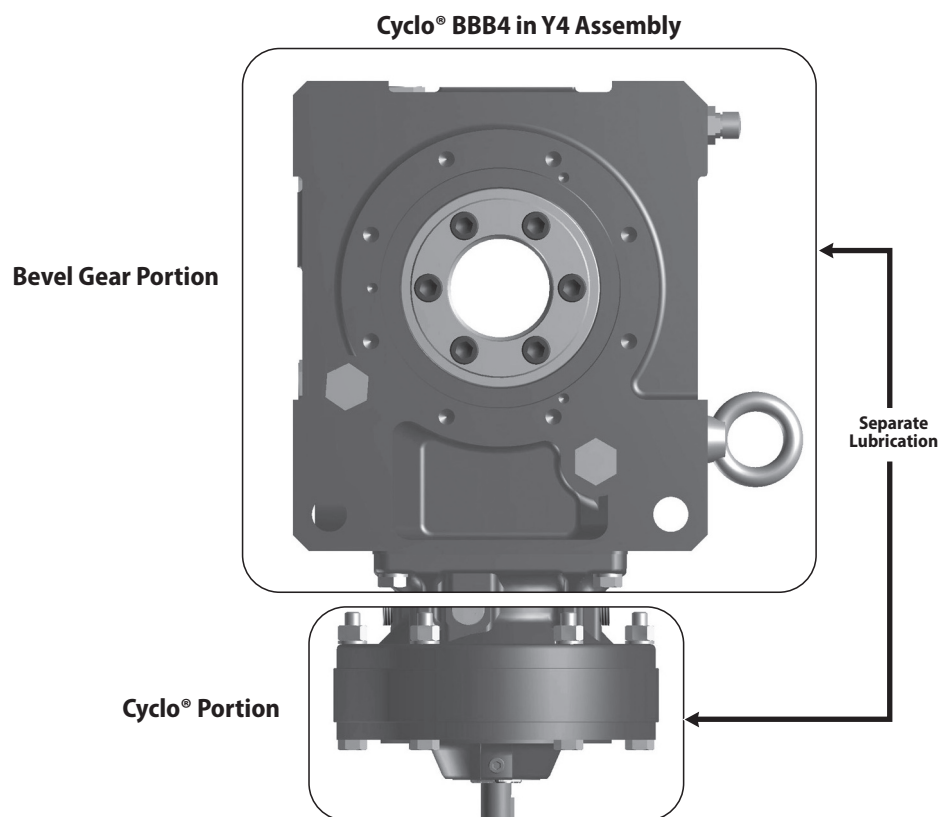


Sumitomo Cyclo® BBB4s units are shipped from the factory **without** lubricating oil, unless the customer specified otherwise when the unit was ordered.

The unit must contain the correct type and amount of lubrication before operating.

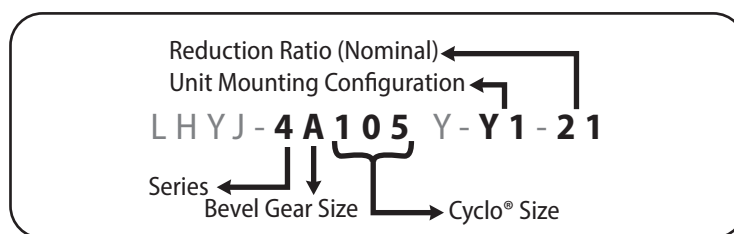
For all Y4 motor down mounting configuration models, the Cyclo® portion is filled at the factory with **grease**. For these units, the Cyclo® portion **does not** need to be filled with lubricant before start-up. The Bevel Gear portion of models built for the Y4 mounting configuration requires filling with gear oil before start-up. Refer to the Lubrication Method section for details.

For the Cyclo® BBB4 built for the Y4 mounting configuration, the Cyclo® and the bevel gear portions **must** be filled with lubricant separately and maintained separately. Lubricant **does not** flow from one section to the other.



## Lubrication Nomenclature

Refer to the **Model** portion of the unit's nameplate to determine the unit size, reduction ratio, and mounting configuration:



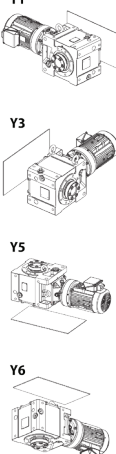
# Lubrication, continued

## Lubrication Method

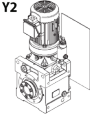
### Lubrication Method

Using the model number and mounting configuration, refer to Tables 20, 21a, and 21b to determine the unit's lubrication method.

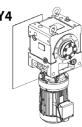
**Table 20. Lubrication Method for Configurations Y1, Y3, Y5, Y6**

| Mounting Configuration   | Unit Size       |   | Lubrication Method                                       |                 |
|--|-----------------|---|--|-----------------|
|  | Bevel Gear Size | Cyclo® Size   |  |                 |
|  | 4A - 4F         | 100, 105,<br>110, 115,<br>120, 125,<br>140, 145                                 | Complete Unit<br>(Bevel Gear Portion and Cyclo® Portion) | Common Oil Sump |
|  |                 | 160, 165,<br>170, 175,<br>180, 185,<br>190, 195                                 |  |                 |
|  |                 | 10DA, 12DA,<br>12DB, 14DA,<br>14DB, 14DC,<br>16DA, 16DB,<br>17DA, 17DB,<br>17DC |  |                 |
|  |                 |   |  |                 |

**Table 21a. Lubrication Method for Y2 Configuration**

| Mounting Configuration  | Unit Size       |   | Lubrication Method                                       |                 |                    |  |
|---|-----------------|---|--|-----------------|--------------------|--|
|   | Bevel Gear Size | Cyclo® Size   |  |                 |                    |  |
|  | 4A-4F           | 100, 105,<br>110, 115,<br>120, 125,<br>140, 145,<br>160, 165,<br>170, 175,<br>180, 185,<br>190, 195 | Complete Unit<br>(Bevel Gear Portion and Cyclo® Portion) | Common Oil Sump |                    |  |
|   |                 | 10DA,<br>12DA,<br>12DB  |  |                 | Cyclo® Portion     | Maintenance Free Grease <sup>[1]</sup> |
|   |                 | 14DA, 14DB, 14DC,<br>16DA, 16DB,<br>17DA, 17DB, 17DC,<br>18DA, 18DB,<br>19DA, 19DB                  |  |                 | Bevel Gear Portion | Oil                                    |
|   |                 |   |  |                 | Cyclo® Portion     | Grease <sup>[2]</sup>                  |
|   |                 | Bevel Gear Portion  | Oil  |                 |                    |  |

**Table 21b. Lubrication Method for Y4 Configuration**

| Mounting Configuration  | Unit Size       |  | Lubrication Method |  |
|---|-----------------|--|--------------------|--|
|   | Bevel Gear Size | Cyclo® Size  |                    |  |
|  | 4A-4F           | 100, 105,<br>110, 115,<br>120, 125   | Cyclo® Portion     | Maintenance Free Grease <sup>[1]</sup> |
|   |                 | 10DA, 12DA, 12DB   | Bevel Gear Portion | Oil                                    |
|   |                 | 140, 145,<br>160, 165,<br>170, 175,<br>180, 185,<br>190, 195                       | Cyclo® Portion     | Grease <sup>[2]</sup>                  |
|   |                 | 14DA, 14DB, 14DC,<br>16DA, 16DB,<br>17DA, 17DB, 17DC,<br>18DA, 18DB,<br>19DA, 19DB | Bevel Gear Portion | Oil                                    |

**Notes:**

[1] Maintenance Free Grease: the input Cyclo® portion is grease lubricated as standard from the factory and usually does not require replacement or replenishment.

[2] Grease: the input Cyclo® portion is grease lubricated as standard from the factory. Please refer to Tables 27, 28 and 29 for the proper grease replenishment and change interval.

## Bevel Gear Portion and Cyclo® Portion Lubricants

### Recommended Oils

**Table 22, Recommended Oils**, lists the oils that may be used to lubricate the Bevel Gear portion of the unit. These oils may also be used in the Cyclo® portion if it is oil lubricated.

|  |                                  |                                       |
|--|----------------------------------|---------------------------------------|
| <b>ExxonMobil:</b> Spartan EP                  | <b>Shell Oil:</b> Omala S2 G     | <b>Kluber:</b> Kluberol GEM1          |
| <b>ExxonMobil:</b> Mobilgear 600XP             | <b>Caltex:</b> Meropa            | <b>Idemitsu Oil:</b> Daphane Mechanic |
| <b>ExxonMobil:</b> Mobil SHC Gear Hi-Shock 150 | <b>Castrol:</b> Alpha SP         | <b>BP Oil:</b> Energol GR-XP          |
| <b>Food Grade Oil:</b> Klübersynth UH1 6-460   | <b>Gulf Oil:</b> EP Lubricant HD | <b>Total:</b> Carter EP               |

**Table 22. Recommended Oils**

| °F     | 14                     | 32 | 50                          | 68 | 86 | 104                              | 122 |
|--------|------------------------|----|-----------------------------|----|----|----------------------------------|-----|
| °C     | -10                    | 0  | 10                          | 20 | 30 | 40                               | 50  |
| ISO VG | 68<br>(14 °F to 41 °F) |    | 100/150<br>(32 °F to 95 °F) |    |    | 220/320/460<br>(86 °F to 122 °F) |     |

- Use lubricants with low viscosity for operation during winter or at relatively low temperatures.
- Use lubricant with a viscosity within the range listed in **Table 23, Recommended Oil Viscosity**.

**Table 23. Recommended Oil Viscosity**

|                             |  |  |
|-----------------------------|--|--|
| Minimum allowable viscosity | 15 cSt ( $mm^2/s$ ) or more at operating temperature | Viscosity that ensures oil film strength adequate for load transmission. |
| Maximum allowable viscosity | 4300 cSt ( $mm^2/s$ ) max.                           | Viscosity that permits start-up of Buddybox®                             |

- Consult local distributor, nearest authorized agent or Sumitomo directly when the unit will be operated in ambient temperatures other than 14° – 104°F (-10° – 40°C). Special unit modifications may be necessary.

## Cyclo® Portion Approved Greases

**Table 24, Cyclo® Portion Approved Greases**, lists the greases that may be used to lubricate the Cyclo® portion if grease is the specified lubrication method (refer to the Lubrication Method section for details).

**Table 24. Cyclo® Portion Approved Greases**

| Ambient Temp.<br>°F (C)      | Overall<br>Reduction Ratio | All Unit Sizes              |
|------------------------------|----------------------------|-----------------------------|
| 14° – 122°F<br>(-10° – 50°C) | 11:1 through 18:1          | Shell Gadus S2 V220 NLGI 00 |
|                              | 19:1 and higher            | ExxonMobil Unirex N2 grease |

Cyclo® portions have unique operating characteristics that require specific lubricant properties. Please consult Sumitomo if alternate lubricants are required.



# Lubrication, continued

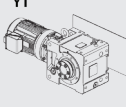
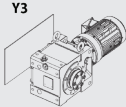
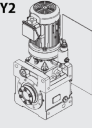
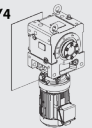
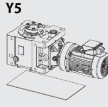
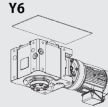
## Oil Quantities

Be sure to check the oil level with the oil gauge. The following listed oil quantities are approximate.

## Oil Quantities

**Table 25. Single Reduction Approximate Oil Quantity**

Units: US liquid gallon (*liter*) **Note: Output = Bevel Gear Portion Input = Cyclo® Portion**

| Bevel Gear Unit Size | Mounting Configuration   |  |  |  |             |  |  |  |             |  |
|----------------------|--|--|--|--|-------------|--|--|--|-------------|--|
|                      | Y1  | Y3  | Y2  | Y4  |             | Y5  | Y6  |  |             |  |
|                      | Output   |  | Input  |  | Output      |  | Input  |  |             |  |
| 4A10                 | 0.43 (1.62)  |  | 0.86 (3.26)  |  | 0.30 (1.13) | Grease   | 0.36 (1.36)  |  | 0.49 (1.84) |  |
| 4A11                 | 0.44 (1.66)  |  | 0.89 (3.36)  |  |             |  | 0.37 (1.40)  |  | 0.50 (1.88) |  |
| 4A12                 | 0.45 (1.71)  |  | 0.93 (3.51)  |  |             |  | 0.38 (1.45)  |  | 0.51 (1.93) |  |
| 4A14                 | 0.50 (1.91)  |  | 1.08 (4.11)  |  |             |  | 0.44 (1.65)  |  | 0.56 (2.13) |  |
| 4B12                 | 0.87 (3.29)  |  | 1.74 (6.61)  |  | 0.45 (1.72) | Grease   | 0.88 (3.34)  |  | 0.85 (3.23) |  |
| 4B14                 | 0.92 (3.49)  |  | 1.93 (7.31)  |  |             |  | 0.94 (3.54)  |  | 0.91 (3.43) |  |
| 4B16                 | 1.04 (3.92)  |  | 2.06 (7.8)   |  |             |  | 1.05 (3.97)  |  | 1.02 (3.86) |  |
| 4C14                 | 1.46 (5.52)  |  | 3.01 (11.4)  |  |             |  | 1.40 (5.30)  |  | 1.55 (5.88) |  |
| 4C16                 | 1.57 (5.96)  |  | 3.18 (12.0)  |  | 0.72 (2.72) | Grease   | 1.52 (5.74)  |  | 1.67 (6.32) |  |
| 4C17                 | 1.67 (6.34)  |  | 3.37 (12.8)  |  |             |  | 1.62 (6.12)  |  | 1.77 (6.70) |  |
| 4D16                 | 2.67 (10.1)  |  | 5.32 (20.1)  |  |             |  | 2.56 (9.69)  |  | 2.75 (10.4) |  |
| 4D17                 | 2.75 (10.4)  |  | 5.48 (20.8)  |  |             |  | 2.64 (10.0)  |  | 2.85 (10.8) |  |
| 4D18                 | 2.83 (10.7)  |  | 5.62 (21.3)  |  | 1.22 (4.61) | Grease   | 2.72 (10.3)  |  | 2.93 (11.1) |  |
| 4E17                 | 3.86 (14.6)  |  | 7.73 (29.3)  |  |             |  | 3.46 (13.1)  |  | 4.25 (16.1) |  |
| 4E18                 | 3.88 (14.7)  |  | 7.85 (29.7)  |  |             |  | 3.49 (13.2)  |  | 4.28 (16.2) |  |
| 4E19                 | 4.15 (15.7)  |  | 8.24 (31.2)  |  |             |  | 3.75 (14.2)  |  | 4.54 (17.2) |  |
| 4F18                 | 5.28 (20.0)  |  | 10.6 (40.3)  |  | 1.92 (7.28) | Grease   | 4.89 (18.5)  |  | 5.65 (21.4) |  |
| 4F19                 | 5.49 (20.8)  |  | 10.9 (41.2)  |  |             |  | 5.10 (19.3)  |  | 5.86 (22.2) |  |

**Table 26. Double Reduction Approximate Oil Quantity**

Units: US liquid gallon (*liter*) **Note: Output = Bevel Gear Portion Input = Cyclo® Portion**

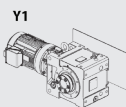
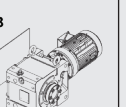
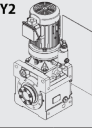
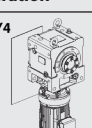
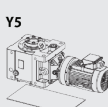
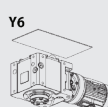
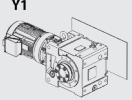
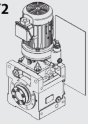
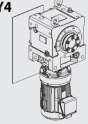
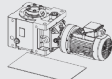
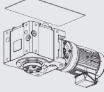
| Bevel Gear Unit Size | Mounting Configuration   |  |  |  |             |  |  |  |             |  |
|----------------------|--|--|--|--|-------------|--|--|--|-------------|--|
|                      | Y1  | Y3  | Y2  | Y4  |             | Y5  | Y6  |  |             |  |
|                      | Output   |  | Input  |  | Output      |  | Input  |  |             |  |
| 4A10DA               | 0.44 (1.65)  |  | 0.88 (3.32)  |  | 0.30 (1.13) | Grease   | 0.37 (1.39)  |  | 0.49 (1.87) |  |
| 4A12DA               | 0.46 (1.74)  |  | 0.92 (3.48)  |  |             |  | 0.39 (1.48)  |  | 0.52 (1.96) |  |
| 4A12DB               | 0.47 (1.78)  |  | 0.94 (3.56)  |  |             |  | 0.40 (1.52)  |  | 0.53 (2.00) |  |
| 4B12DA               | 0.88 (3.32)  |  | 1.76 (6.64)  |  | 0.45 (1.72) | Grease   | 0.89 (3.37)  |  | 0.86 (3.26) |  |
| 4B12DB               | 0.89 (3.36)  |  | 1.78 (6.68)  |  |             |  | 0.90 (3.41)  |  | 0.87 (3.30) |  |
| 4B14DA               | 0.93 (3.52)  |  | 1.86 (6.96)  |  |             |  | 0.94 (3.57)  |  | 0.91 (3.46) |  |
| 4B14DB               | 0.94 (3.56)  |  | 1.88 (7.00)  |  |             |  | 0.95 (3.61)  |  | 0.92 (3.50) |  |
| 4B14DC               | 0.95 (3.61)  |  | 1.90 (7.04)  |  | 0.72 (2.72) | Grease   | 0.97 (3.66)  |  | 0.94 (3.55) |  |
| 4C14DA               | 1.47 (5.55)  |  | 2.94 (11.1)  |  |             |  | 1.41 (5.33)  |  | 1.56 (5.91) |  |
| 4C14DB               | 1.48 (5.59)  |  | 2.96 (11.2)  |  |             |  | 1.42 (5.37)  |  | 1.57 (5.95) |  |
| 4C14DC               | 1.49 (5.64)  |  | 2.98 (11.3)  |  |             |  | 1.43 (5.42)  |  | 1.59 (6.00) |  |
| 4C16DA               | 1.59 (6.03)  |  | 3.18 (12.0)  |  | 0.92 (3.5)  | Grease   | 1.53 (5.81)  |  | 1.69 (6.39) |  |
| 4C16DB               | 1.61 (6.08)  |  | 3.22 (12.2)  |  |             |  | 1.55 (5.86)  |  | 1.70 (6.44) |  |
| 4C17DA               | 1.69 (6.41)  |  | 3.38 (12.8)  |  |             |  | 1.64 (6.19)  |  | 1.79 (6.77) |  |
| 4C17DB               | 1.70 (6.44)  |  | 3.40 (12.9)  |  |             |  | 1.67 (6.32)  |  | 1.80 (6.80) |  |
| 4C17DC               | 1.75 (6.64)  |  | 3.50 (13.3)  |  | 1.22 (4.61) | Grease   | 1.70 (6.42)  |  | 1.82 (6.90) |  |
| 4D16DA               | 2.67 (10.1)  |  | 5.34 (20.1)  |  |             |  | 2.58 (9.76)  |  | 2.77 (10.5) |  |
| 4D16DB               | 2.67 (10.1)  |  | 5.34 (20.1)  |  |             |  | 2.59 (9.81)  |  | 2.80 (10.6) |  |
| 4D16DC               | 2.72 (10.3)  |  | 5.44 (20.6)  |  |             |  | 2.59 (9.82)  |  | 2.83 (10.7) |  |

Table 26. Double Reduction Approximate Oil Quantity, continued

Units: US liquid gallon (*liter*) **Note: Output** = Bevel Gear Portion **Input** = Cyclo® Portion

| Bevel Gear Unit Size | Mounting Configuration   |       |  |        |   |        |  |       |  |       |
|----------------------|--|-------|--|--------|---|--------|--|-------|--|-------|
|                      | Y1  |       | Y2  |        | Y4  |        | Y5  |       | Y6  |       |
|                      | Output   | Input | Output   | Input  | Output  | Input  | Output   | Input | Output   | Input |
| 4D17DA               | 2.69 (10.2)  |       | 1.32 (5.0)   | Grease | 1.22 (4.61)   | Grease | 2.59 (9.81)  |       | 2.80 (10.6)  |       |
| 4D17DB               | 2.77 (10.5)  |       |  |        |   |        | 2.69 (10.2)  |       | 2.88 (10.9)  |       |
| 4D17DC               | 2.83 (10.7)  |       |  |        |   |        | 2.72 (10.3)  |       | 2.91 (11.0)  |       |
| 4D18DA               | 2.85 (10.8)  |       |  |        |   |        | 2.77 (10.5)  |       | 2.96 (11.2)  |       |
| 4D18DB               | 3.09 (11.7)  |       |  |        |   |        | 3.01 (11.4)  |       | 3.20 (12.1)  |       |
| 4E17DA               | 3.86 (14.6)  |       | 1.93 (7.3)   | Grease | 1.65 (6.26)   | Grease | 3.46 (13.1)  |       | 4.25 (16.1)  |       |
| 4E17DB               | 3.88 (14.7)  |       |  |        |   |        | 3.49 (13.2)  |       | 4.28 (16.2)  |       |
| 4E17DC               | 3.91 (14.8)  |       |  |        |   |        | 3.51 (13.3)  |       | 4.31 (16.3)  |       |
| 4E18DA               | 3.91 (14.8)  |       |  |        |   |        | 3.51 (13.3)  |       | 4.31 (16.3)  |       |
| 4E18DB               | 4.15 (15.7)  |       |  |        |   |        | 3.75 (14.2)  |       | 4.54 (17.2)  |       |
| 4E19DA               | 4.62 (17.5)  |       | 3.17 (12.0)  | Grease | 1.92 (7.28)   | Grease | 4.23 (16)  |       | 5.02 (19.0)  |       |
| 4E19DB               | 4.68 (17.7)  |       |  |        |   |        | 4.28 (16.2)  |       | 5.07 (19.2)  |       |
| 4F18DA               | 5.31 (20.1)  |       |  |        |   |        | 4.91 (18.6)  |       | 5.68 (21.5)  |       |
| 4F18DB               | 5.55 (21.0)  |       |  |        |   |        | 5.15 (19.5)  |       | 5.92 (22.4)  |       |
| 4F19DA               | 5.97 (22.6)  |       |  |        |   |        | 5.57 (21.1)  |       | 6.34 (24.0)  |       |
| 4F19DB               | 6.02 (22.8)  |       | 5.63 (21.3)  |        | 6.39 (24.2)   |        |  |       |  |       |

# Lubrication, continued

## Oil Supply and Discharge Procedures

### Oil Supply Procedure

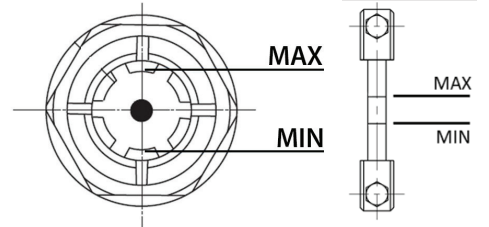


• Always stop the unit before adding oil



- Oil level may drop during operation, depending on the oil viscosity, temperature and direction of rotation. Additional oil is not necessary. Check the oil level when the unit is stopped to ensure that it has the correct amount of oil.
- It may take some time for the oil to settle when the oil viscosity is high. Be careful not to add too much oil.
- There may be two different oil fill locations for some combinations; refer to oil fill/ drain locations figure for details.
- Consider implementing an oil analysis program to ensure lubricant continues to operate at peak performance. Follow your lubrication provider's oil analysis recommendations to ensure reducer performance.
- Always consult factory and warehouses for overhaul of gearmotors and reducers. Familiarity with Cyclo® products is necessary for proper overhaul.

1. Remove the 'Oil filler plug', and 'Oil fill air vent' as referenced in Figure 2.
2. Slowly add oil while checking the level through the oil gauge.
3. After the oil has settled, make sure **the level is visible** in the oil gauge.
4. Re-install 'Oil filler plug', and 'Oil fill air vent' after wrapping it with sealing compound or tape.

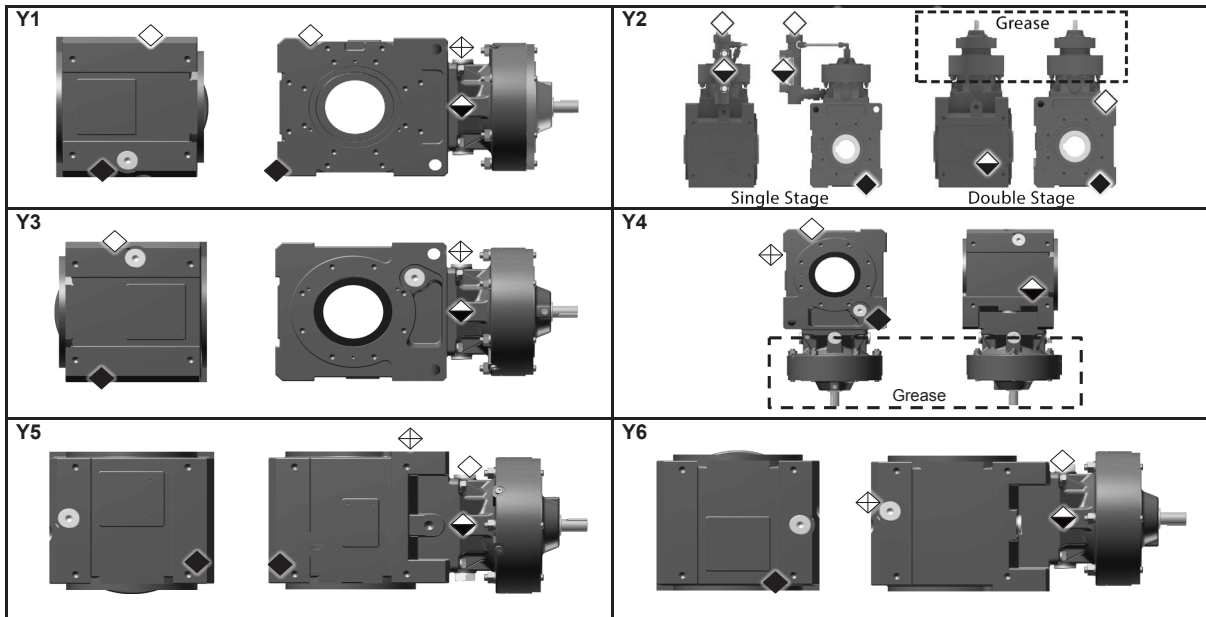


**Table 27. Oil Change Intervals**

| Task          | Change interval              |  | Conditions of use                                      |
|---------------|------------------------------|--|--|
| Supply of Oil | At installation              |  | All  |
| Oil Change    | First Change                 | 500 hrs operation or 6 months, whichever comes first.  | All  |
|               | Second change and thereafter | 2500 hrs operation or 6 months, whichever comes first. | When case oil temperature is 158° F (70° C) or higher  |
|               |                              | 5000 hrs operation or 1 year, whichever comes first.   | When case oil temperature is lower than 158° F (70° C) |

**Note:** Units supplied with Mobil SHC Gear Hi-Shock 150 may double the oil change intervals.

**Figure 2. Oil Fill/Drain Locations**



◇=Oil filler plug    ◊=Oil level (Oil gauge)    ◆=Oil drain plug    ⊕=Oil fill air vent

### Oil Discharge Procedure

1. Remove the drain plug as shown in Figure 2, to discharge oil.
2. Properly discard or recycle lubricant according to applicable regulations.
3. Replace the drain plug after wrapping it with sealing compound or tape.

## Grease Quantities

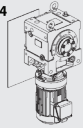


- Grease quantities listed in this section are for the Cyclo® portion of the reducer/gearmotor.
- The Bevel portion is always oil lubricated unless otherwise specified at time of order entry.
- Refer to the Oil Quantities section, Tables 25 & 26, for Bevel portion oil quantities.
- Installing grease into Bevel Gear portion will result in damage to the unit.

The Cyclo® (input) portion of **only Y4 & Y2 double reduction** units is grease lubricated at the factory. Additional grease is not required before initial start-up. All assemblies other than **Y4 & Y2** have oil lubricated Cyclo® portions. The following tables are provided for user rebuild or refurbishment reference.

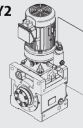
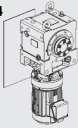
**Table 28. Single Reduction Approximate Grease Quantity**

Units: ounce (*gram*)

| Unit Size | Unit Lubrication Portion | Lube Quantity<br>oz. ( <i>gram</i> )  |
|-----------|--------------------------|---|
|           |                          | Y4  only |
| 4A100/105 | Cyclo®                   | 4.24 (120)  |
| 4A110/115 |                          | 6.71 (190)  |
| 4A120/125 |                          | 8.83 (250)  |
| 4A140/145 |                          | 15.89 (450)   |
| 4B120/125 |                          | 8.83 (250)  |
| 4B140/145 |                          | 15.89 (450)   |
| 4B160/165 |                          | 26.48 (750)   |
| 4C140/145 |                          | 15.89 (450)   |
| 4C160/165 |                          | 26.48 (750)   |
| 4C170/175 |                          | 35.3 (1000)   |
| 4D160/165 |                          | 26.48 (750)   |
| 4D170/175 |                          | 35.3 (1000)   |
| 4E170/175 |                          | 35.3 (1000)   |
| 4F180/185 |                          | 38.8 (1100)   |
| 4F190/195 |                          | 52.9 (1500)   |

**Table 29. Double Reduction Approximate Grease Quantity**

Units: ounce (*gram*)

| Unit Size | Cyclo® Stage  | Lube Quantity<br>oz. ( <i>gram</i> )  |
|-----------|---------------|---|
|           |               | Y2  & Y4  |
| 4A10DA    | First (Input) | 0.88 (25)   |
|           | Second        | 4.24 (120)  |
| 4A12DA    | First (Input) | 0.88 (25)   |
|           | Second        | 8.83 (250)  |
| 4A12DB    | First (Input) | 2.12 (60)   |
|           | Second        | 8.83 (250)  |
| 4B12DA    | First (Input) | 0.88 (25)   |
|           | Second        | 8.83 (250)  |
| 4B12DB    | First (Input) | 2.12 (60)   |
|           | Second        | 8.83 (250)  |
| 4B14DA    | First (Input) | 0.88 (25)   |
|           | Second        | 15.86 (450)   |
| 4B14DB    | First (Input) | 2.12 (60)   |
|           | Second        | 15.86 (450)   |
| 4C14DA    | First (Input) | 0.88 (25)   |
|           | Second        | 15.86 (450)   |
| 4C14DB    | First (Input) | 2.12 (60)   |
|           | Second        | 15.86 (450)   |
| 4C14DC    | First (Input) | 4.24 (120)  |
|           | Second        | 15.86 (450)   |
| 4C16DA    | First (Input) | 2.12 (60)   |
|           | Second        | 26.48 (750)   |
| 4C16DB    | First (Input) | 4.24 (120)  |
|           | Second        | 26.48 (750)   |

# Lubrication, continued

## Grease Replenishment and Draining Procedure, Grease Replacement

### Grease Replenishment and Draining Procedure

**Procedure for adding grease to grease-lubrication models (excluding maintenance-free models)**

1. Remove the grease discharge plug from the outside cover.
2. Add grease with a grease gun from the grease nipple in the inside cover section or motor connection cover.
3. Insert the grease discharge plug.



Add grease while manually rotating the input shaft to ensure proper, uniform circulation. Add grease slowly, to prevent internal pressure and possible seal damage. Do not add more grease than the amount shown in Table 28 and 29. Adding too much grease may cause the grease temperature to rise, or force the grease to leak into the motor.

Always consult factory and warehouses for overhaul of gearmotors and reducers. Familiarity with Cyclo® products is necessary for proper overhaul.

**Table 30. Grease Replenishment Intervals**

| Hours of operation   | Replenishment interval | Remarks   |
|----------------------|------------------------|---|
| 10 hr. max./day      | 3 - 6 months           | Shorten the supply interval when the operating conditions are severe or the frame size is large |
| 10 - 24 hr. max./day | 500 - 1000 hours       |   |

**Table 31. Grease Replacement Intervals**

| Change Interval               | Remarks   |
|-------------------------------|---|
| Every 20,000 hrs or 3-5 years | Shorten the supply interval when the operating conditions are severe or the frame size is large |

### Grease Replacement

- Maintenance free units may be safely operated for an extended time because it is sealed with maintenance free grease. Tables 28 & 29 are provided for generalized reference.



- Adequate care should be taken to ensure the lubricant continues to meet the specified lubrication characteristics.
- If refurbishment or rebuild is required, do not add more grease than the amount shown in Tables 28 and 29.
- Adding too much grease may cause the grease temperature to rise or force the grease to leak into the motor.



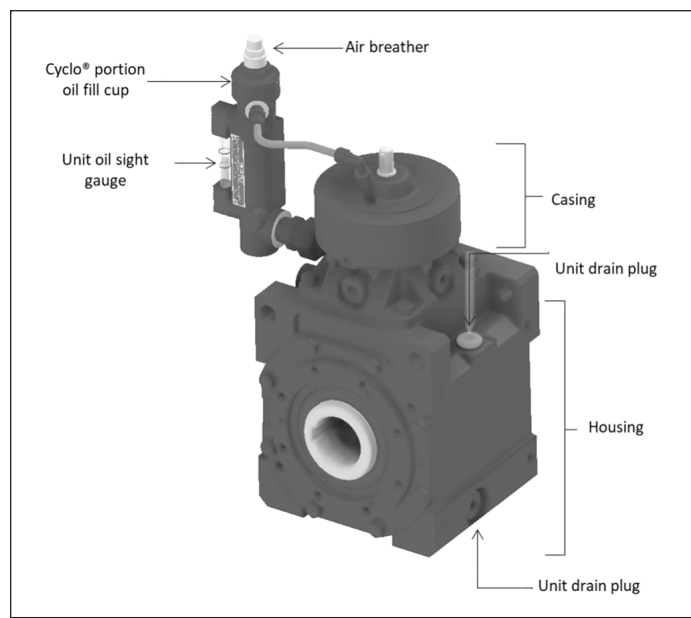
- Consider implementing a lube analysis program to ensure lubricant continues to operate at peak performance.
- Follow your lubrication providers analysis recommendations to ensure reducer performance.
- Always consult factory and warehouses for overhaul of gearmotors and reducers. Experience is necessary for proper overhaul.

# Y2 Oil Fill & Drain Procedures

## Oil Fill Process

### Affected Unit Sizes

This document is intended for all Cyclo® Bevel Buddybox® (BBB) 4 series units built in the Y2 mounting (motor up) configuration.



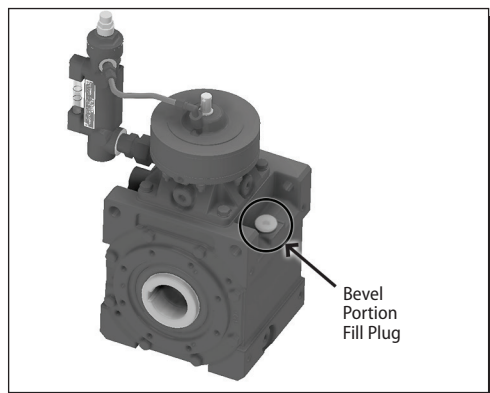
### Oil Fill Process

#### CAUTIONARY NOTE:



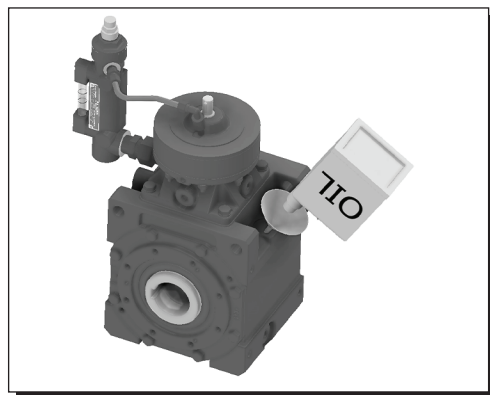
- Use only those lubricating oils approved by Sumitomo Drive Technologies for use in the Cyclo® Bevel Buddybox®.
- Use the appropriate grade of lubricating oil based on ambient operating conditions of the application.
- Refer to the Sumitomo product catalog and/or Operating & Maintenance manual for a list of Sumitomo approved lubricating oils.
- Prior to beginning the fill process, ensure the Unit Drain Plug is in place and adequately tightened.

### Single Reduction



#### 1

Identify the bevel portion oil fill plug on the bevel gear housing. Carefully remove the plug and put aside for reinsertion after oil fill is complete.



#### 2

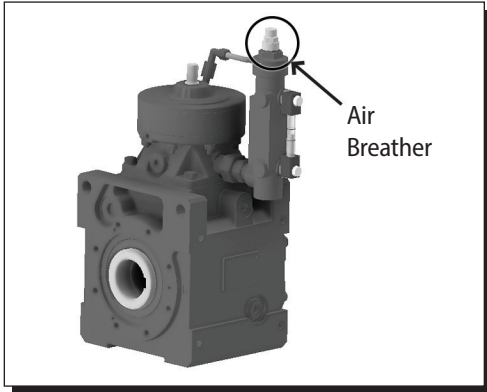
Fill the bevel portion with the appropriate type and grade of oil.

The bevel portion is considered full when the oil level reaches the oil fill port.

Once fill is complete, re-install and tighten the oil plug into the fill port

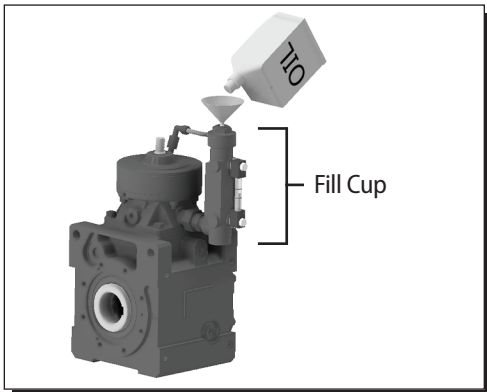
## Y2 Oil Fill & Drain Procedures, continued

### Oil Fill Process



**3**

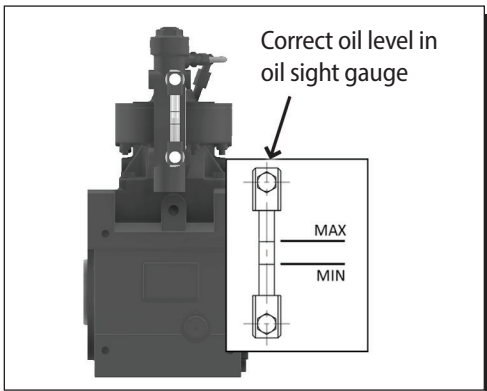
Carefully remove the unit Air Breather assembly and put aside for reinsertion after oil fill process is complete.



**4**

Slowly fill the Cyclo® (input) portion with the correct type and grade of oil as used in STEP #2 of this process.

**NOTE:** The oil fill cup may immediately become full during the process. In such an event, stop the fill process and allow the oil to drain from the cup into the reducer.



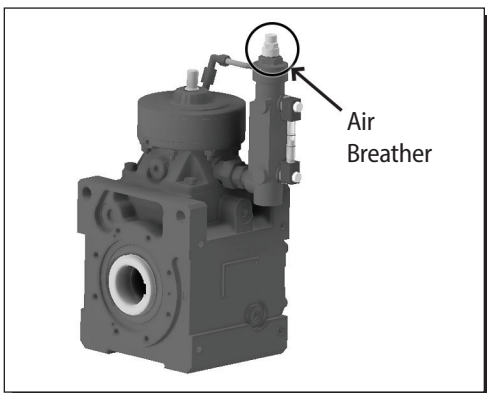
**5**

The input portion is considered full when the oil level stabilizes in the middle of the oil sight gauge.



Check gauge carefully. Oil film from fill procedure can distort view.

Be sure to check the oil level after a few minutes of operation. Stop equipment and check gauge as shown in step 5. Adjust oil level as required.



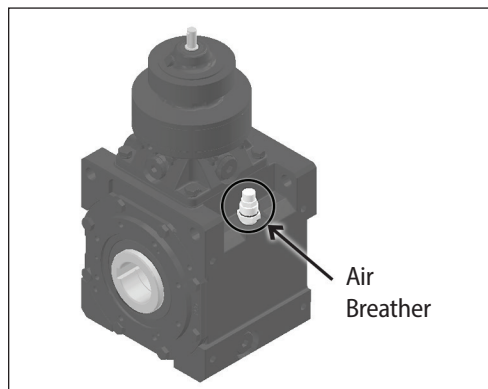
**6**

Once the input portion of the unit is filled to the correct level with lubricant, carefully reinsert the air breather assembly into the oil fill cup.

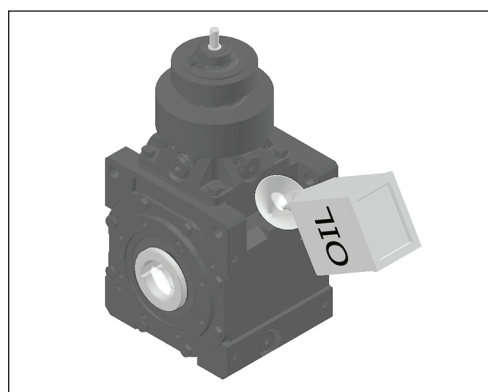
Y2 Oil Fill & Drain Procedures, *continued*

## Oil Fill Process

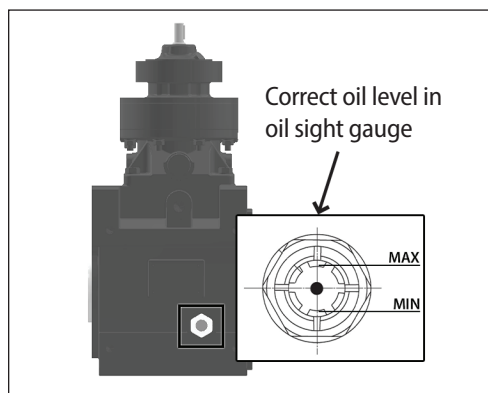
## Double Reduction

**1**

Carefully remove the unit Air Breather assembly and put aside for reinsertion after oil fill process is complete.

**2**

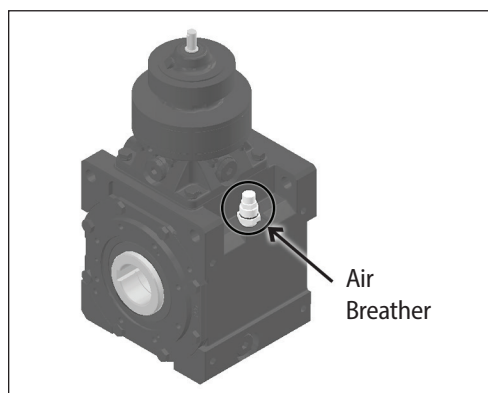
Fill the bevel portion with the appropriate type and grade of oil.

**3**

The output portion is considered full when the oil level stabilizes in the middle of the oil sight gauge.



Check gauge carefully. Oil film from fill procedure can distort view.

**4**

Once the output portion of the unit is filled to the correct level with lubricant, carefully reinsert the air breather assembly into the oil fill cup.



# Y2 Oil Fill & Drain Procedures, continued

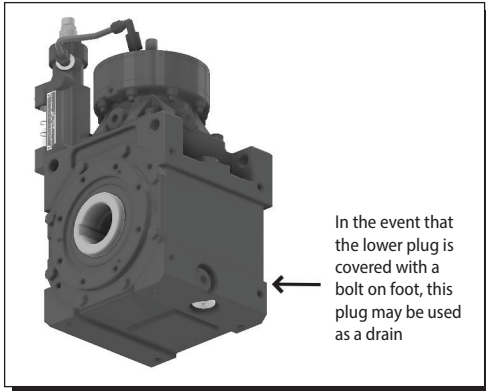
## Oil Drain Process

### Oil Drain Process

CAUTIONARY NOTE:



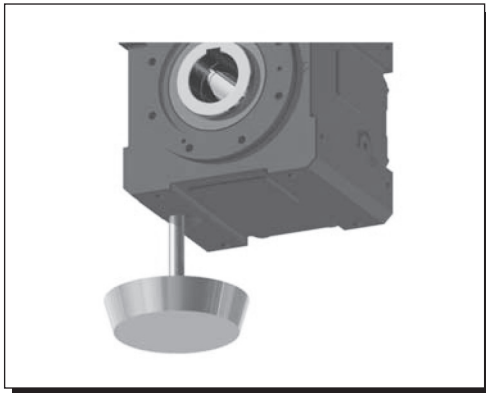
- Exercise extreme caution when draining the lubricating oil from the Cyclo® Bevel Buddybox® as it may be hot.
- Follow all corporate, local, state and federal government regulations in disposing of the used lubricating oil.



#### 1

Identify the bevel portion oil drain plug on the bevel gear housing.

Carefully remove the plug and put aside for reinsertion after oil fill is complete.



#### 2

Carefully remove the unit air breather assembly and put aside for reinsertion after oil fill process is complete.

Allow used oil to freely flow into an approved lubricant container.

Once the unit is completely drained of oil, reinstall the drain plug and tighten.

Refer to torque tightening values in Table 32.

**Table 32. Plug sizes and tightening torque values**

| Plug Sizes |         |        | Torque Value |       |      |
|------------|---------|--------|--------------|-------|------|
| Unit Size  | Housing | Casing | Size         | lb-in | N•m  |
| 4A         | 1/2     | 1/2    | 1/2          | 13.1  | 17.8 |
| 4B         | 1/2     | 1/2    | 3/4          | 22.1  | 30.0 |
| 4C         | 3/4     | 1/2    | 1            | 30.4  | 41.2 |
| 4D         | 3/4     | 1/2    |              |       |      |
| 4E         | 3/4     | 1/2    |              |       |      |
| 4F         | 3/4     | 1/2    |              |       |      |

## Y2 Oil Fill &amp; Drain Procedures, continued

## Oil Drain Process

Table 33. BBB4 Y2 Single Reduction Oil Quantity\*

| Bevel Gear Unit Size | Y2 Configuration Oil Quantity |       |
|----------------------|-------------------------------|-------|
|                      | gallon                        | liter |
| 4A10                 | 0.86                          | 3.26  |
| 4A11                 | 0.89                          | 3.36  |
| 4A12                 | 0.93                          | 3.51  |
| 4A14                 | 1.08                          | 4.11  |
| 4B12                 | 1.74                          | 6.61  |
| 4B14                 | 1.93                          | 7.31  |
| 4B16                 | 2.06                          | 7.80  |
| 4C14                 | 3.01                          | 11.4  |
| 4C16                 | 3.17                          | 12.0  |

| Bevel Gear Unit Size | Y2 Configuration Oil Quantity |       |
|----------------------|-------------------------------|-------|
|                      | gallon                        | liter |
| 4C17                 | 3.37                          | 12.8  |
| 4D16                 | 5.31                          | 20.1  |
| 4D17                 | 5.48                          | 20.8  |
| 4D18                 | 5.62                          | 21.3  |
| 4E17                 | 7.67                          | 29.1  |
| 4E18                 | 7.76                          | 29.4  |
| 4E19                 | 8.10                          | 30.7  |
| 4F18                 | 10.5                          | 39.7  |
| 4F19                 | 10.8                          | 40.9  |

Table 34. BBB4 Y2 Double Reduction Oil Quantity\*

| Bevel Gear Unit Size | Y2 Configuration Oil Quantity |       |
|----------------------|-------------------------------|-------|
|                      | gallon                        | liter |
| 4A10DA               | 0.26                          | 1.00  |
| 4A12DA               | 0.26                          | 1.00  |
| 4A12DB               | 0.26                          | 1.00  |
| 4B12DA               | 0.53                          | 2.00  |
| 4B12DB               | 0.53                          | 2.00  |
| 4B14DA               | 0.53                          | 2.00  |
| 4B14DB               | 0.53                          | 2.00  |
| 4C14DA               | 0.92                          | 3.50  |
| 4C14DB               | 0.92                          | 3.50  |
| 4C14DC               | 0.92                          | 3.50  |

| Bevel Gear Unit Size | Y2 Configuration Oil Quantity |       |
|----------------------|-------------------------------|-------|
|                      | gallon                        | liter |
| 4C16DA               | 0.92                          | 3.50  |
| 4C16DB               | 0.92                          | 3.50  |
| 4C17DA               | 0.92                          | 3.50  |
| 4D16DA               | 1.32                          | 5.00  |
| 4D16DB               | 1.32                          | 5.00  |
| 4D17DB               | 1.32                          | 5.00  |
| 4D17DC               | 1.32                          | 5.00  |
| 4E17DA               | 1.93                          | 7.30  |
| 4E17DB               | 1.93                          | 7.30  |
| 4E17DC               | 1.93                          | 7.30  |

\* All oil quantities are estimates

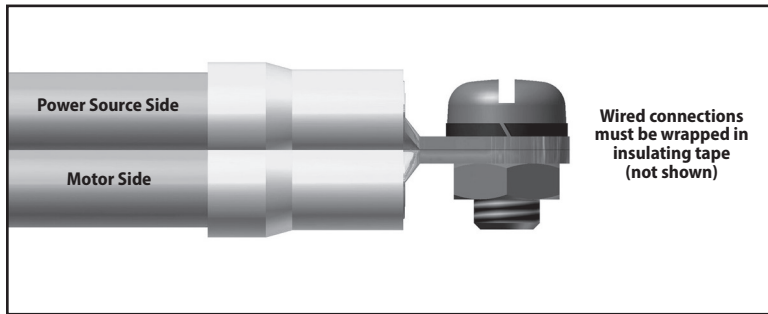
# Motor Wiring

## Motor Wiring

### Wiring Guidelines

This section details wiring for standard Sumitomo three-phase motors and brakemotors. If using a motor manufactured by a company other than Sumitomo, please refer to that manufacturer's instruction manual for wiring, operating and maintenance details. When wiring motors into the power supply, Sumitomo recommends the use of terminal rings to facilitate the connection:

**Figure 3. Terminal Ring Wiring Connection**



- Do not handle the unit when cables are live. Be sure to turn-off the power; otherwise electric shock may result.
- Connect the power cables to the unit according to the connection diagram shown inside the terminal box or in the maintenance manual; otherwise electric shock or fire may result.
- Correctly ground the grounding bolt; otherwise electric shock may result.
- Keep all wiring and electrical parts dry and moisture free.
- Follow local electrical codes and regulations when wiring; otherwise burning, electrical shock, injury and/or fire may result.
- The motor is not equipped with an overload device. Sumitomo strongly recommends that another protective device (i.e.: ground fault interrupters, etc.), in addition to an overload device, be installed in order to prevent burning, electric shock, personal injury and/or fire.
- For single phase motors, exercise caution so as to not damage the vinyl cover of the starting capacitor, otherwise shock may result.
- For brakemotors, do not electrify a brake coil continuously when the motor is stopped otherwise the brake coil may burn and fire may result.



- For brakemotors, install the rectifier where the temperature is less than 140°F (60°C)
- Long wires cause the voltage to drop. Select cables with appropriate diameter so that the voltage drop will be less than 2%.
- After wiring the motor, check that the terminal box mounting bolts are tight.

### Measuring Insulation Resistance

When measuring insulation resistance, disconnect the motor from the control panel. Check the motor separately.



Never touch the terminals when measuring insulation resistance otherwise electrical shock may occur.

Measure the insulation resistance before wiring. Insulation resistance varies according to the motor voltage, insulation type, coil temperature, humidity, length of operation, test electrification time, etc.

Under most conditions, the insulation resistance exceeds the value shown in this table:

**Table 35. Insulation Resistance**

| Mega-Ohm | Insulation Resistance |
|----------|-----------------------|
| 500V     | 1M (Ω)                |

A drop in resistance may be attributed to poor insulation. In such case, do not turn on the power. Contact the nearest Sumitomo representative, distributor, or sales office.

### Motor Protection



- Use a molded case circuit breaker for protection against short circuit.
- Use an overload protection device that protects the unit against voltage surges.

### U.S. Standard Motors Motor Wiring Method



- For additional information please refer to the motor name plate.
- Due to changes in design features, this diagram may not always agree with that on the motor.
- In such cases, connection diagram found inside the conduit box of the motor should be used.

#### 1

Based on motor power, determine if motor is **WYE** or **DELTA** type

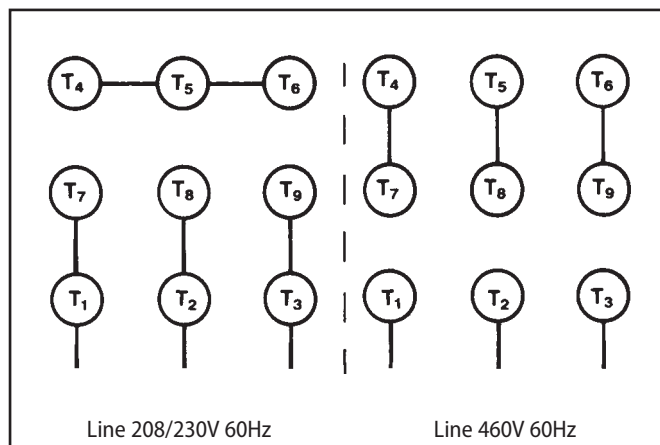
#### 2

Wire the motor to the power source using the correct connection type:

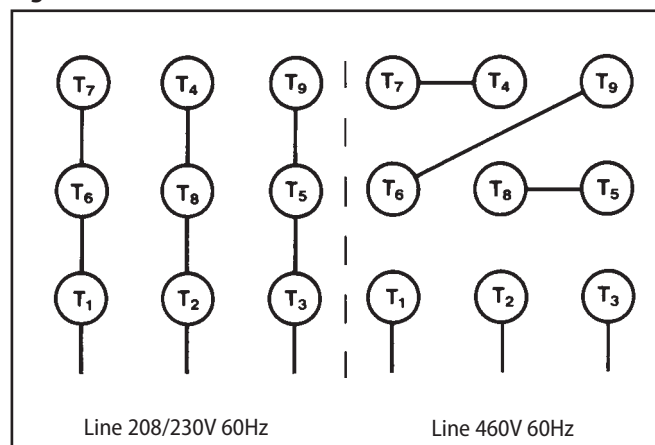
**Table 36. Typical 230/460V, Three-Phase Wiring Configuration by Motor Type**

| Motor<br>HP (kW) x P | Standard |       | AF-Motor |       | EP.NA-Motor |
|----------------------|----------|-------|----------|-------|-------------|
|                      | Non CSA  | CSA   | Non CSA  | CSA   | UL/CSA/CE   |
| 1/8 (0.1) x 4        | WYE      | WYE   | WYE      | WYE   | WYE         |
| 1/4 (0.2) x 4        |          |       |          |       |             |
| 1/3 (0.25) x 4       |          |       |          |       |             |
| 1/2 (0.4) x 4        |          |       |          |       |             |
| 3/4 (0.55) x 4       |          |       |          |       |             |
| 1 (0.75) x 4         |          |       |          |       |             |
| 1.5 (1.1) x 4        |          |       |          |       |             |
| 2 (1.5) x 4          | DELTA    | DELTA | DELTA    | DELTA | DELTA       |
| 3 (2.2) x 4          |          |       |          |       |             |
| 5 (3.7) x 4          |          |       |          |       |             |
| 7.5 (5.5) x 4        |          |       |          |       |             |
| 10 (7.5) x 4         |          |       |          |       |             |
| 15 (11) x 4          |          |       |          |       |             |
| 20 (15) x 4          |          |       |          |       |             |
| 25 (18.5) x 4        |          |       |          |       |             |
| 30 (22) x 4          |          |       |          |       |             |
| 40 (30) x 4          |          |       |          |       |             |
| 50 (37) x 4          | —        | —     | —        | —     | —           |
| 60 (60) x 4          | —        | —     | —        | —     | —           |
| 75 (56) x 4          | —        | —     | —        | —     | —           |

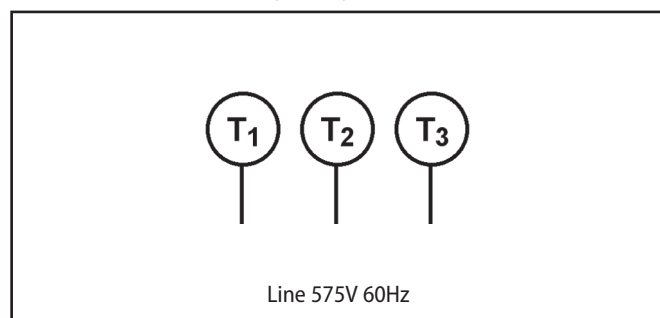
**Figure 4. Three-Phase WYE Connection Motor**



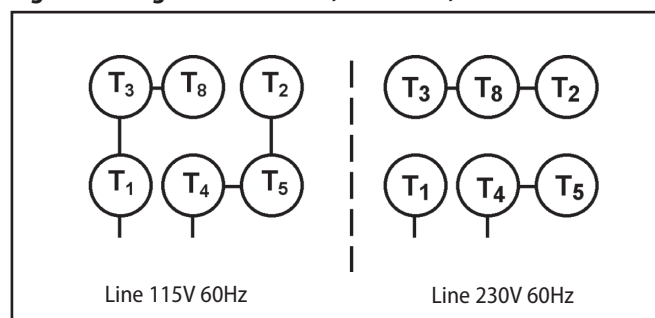
**Figure 5. Three-Phase DELTA connection Motor**



**Figure 6. Three-Phase Motor, 575V, 60Hz**



**Figure 7. Single-Phase Motor, 115/230V, 60Hz**



# Motor Wiring, continued

## Motor Wiring Method, Brake Wiring

### CE Motors

**Table 37. Typical 220/380V, Three-Phase Wiring Configuration by Motor Type**

| Motor HP (kW) x P | Voltage Configuration         | Wiring Configuration   |
|-------------------|-------------------------------|------------------------|
| 1/8 (0.1) x 4     | 220/380V, 50Hz<br>Three Phase | DELTA-WYE              |
| 1/4 (0.2) x 4     |                               |                        |
| 1/3 (0.25) x 4    |                               |                        |
| 1/2 (0.4) x 4     |                               |                        |
| 3/4 (0.55) x 4    |                               |                        |
| 1 (0.75) x 4      |                               |                        |
| 1.5 (1.1) x 4     |                               |                        |
| 2 (1.5) x 4       |                               |                        |
| 3 (2.2) x 4       |                               |                        |
| 4 (3.0) x 4       |                               |                        |
| 5 (3.7) x 4       | 380V, 50Hz<br>Three Phase     | WYE-Start<br>DELTA-Run |
| 7.5 (5.5) x 4     |                               |                        |
| 10 (7.5) x 4      |                               |                        |
| 15 (11) x 4       |                               |                        |
| 20 (15) x 4       |                               |                        |
| 25 (18.5) x 4     |                               |                        |
| 30 (22) x 4       |                               |                        |
| 40 (30) x 4       |                               |                        |

### Motor Wiring Method



- For additional information please refer to the motor name plate.
- Due to changes in design features, this diagram may not always agree with that on the motor.
- In such cases, connection diagram found inside the conduit box of the motor should be used.

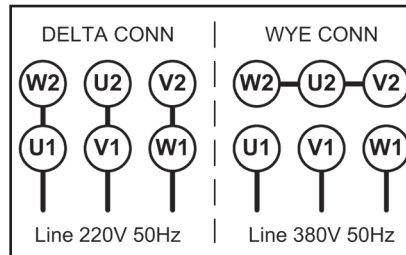
**1**

Based on motor power, determine if motor is **WYE** or **DELTA** type.

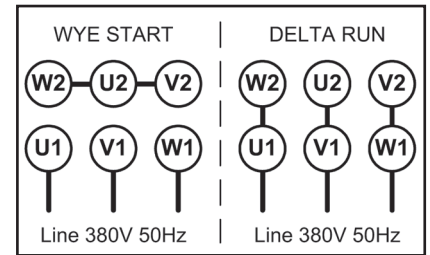
**2**

Wire the motor to the power source using the correct connection type:

**Figure 8. DELTA-WYE Connection Motor**



**Figure 9. WYE-DELTA Start Connection Motor**



## Brake Wiring

### Varistor Selection

For wiring of Fast Brake Action, Sumitomo recommends the use of a Varistor (VR). Refer to Table 38 to assist in the selection of the appropriately sized Varistor.

**Table 38. Varistor Specifications Table**

| Operating Voltage                          |   | 190 - 230V  | 380-460V  | 575V  |
|--|---|---|---|---|
| Varistor Rated Voltage<br>Varistor Voltage |   | AC260-300V<br>430-470V  | AC510V<br>820V  | AC604V<br>1000V   |
| Rated Watts                                | FB01A, 02A<br>FB-05A<br>FB-1D, 1E<br>FB-2D, 3D, 1HE, 2E, 3E<br>FB-5B, 8B, 5E, 8E<br>FB10B, 15B, 10B1, 15B1,<br>10E, 15E | Over 0.4W<br>Over 0.4W<br>Over 0.6W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W | Over 0.4W<br>Over 0.4W<br>Over 0.6W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W | Over 0.4W<br>Over 0.4W<br>Over 0.6W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W<br>Over 1.5W |
|  | FB-20, 30   |   |   | Over 1.5W   |

## U.S. Standard and CSA Approved Motor Brake Wiring

The brake portion (if supplied) of the motor may be wired using one of the following methods

### Models FB-01A through FB-15B/FB-15E

Figure 10. Normal Brake Action, 230V, 575V

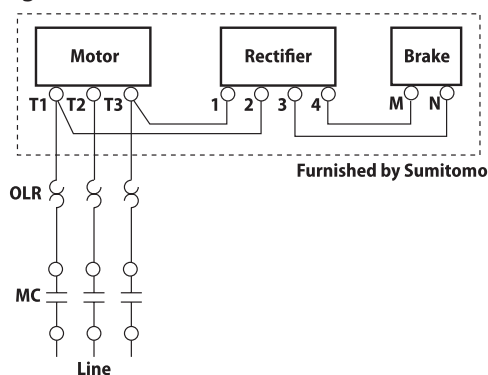


Figure 11. Fast Brake Action, 230V

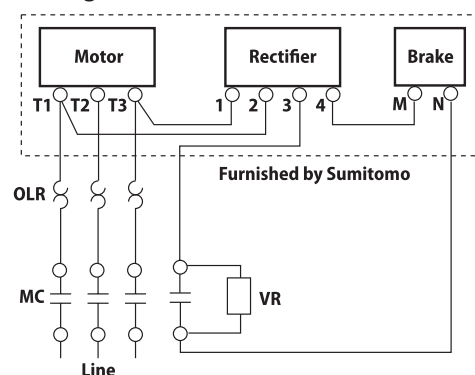


Figure 12. Normal Brake Action, 460V

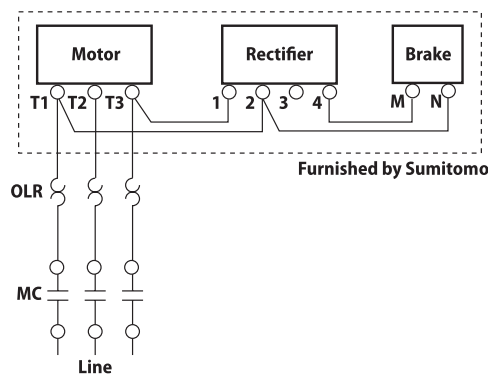
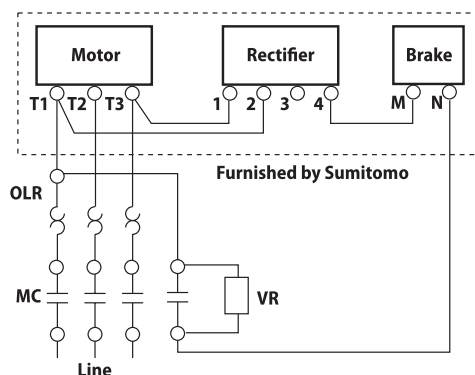


Figure 13. Fast Brake Action, 460V, 575V



MC: Electromagnetic Relay

MCB: Magnetic Circuit Breaker

OLR: Overload or Thermal Relay

VR: Varistor (protective device)<sup>[1]</sup>

**Note:** [1] Refer to Varistor Specifications Table

# Motor Wiring, continued

## U.S. Standard and CSA Approved Motor Brake Wiring

### U.S. Standard and CSA Approved Motor Brake Wiring

The brake portion (if supplied) of the motor may be wired using one of the following methods

#### Models FB-01A through FB-15B/FB-15E with Inverter

Figure 14. Normal Brake Action, 230V

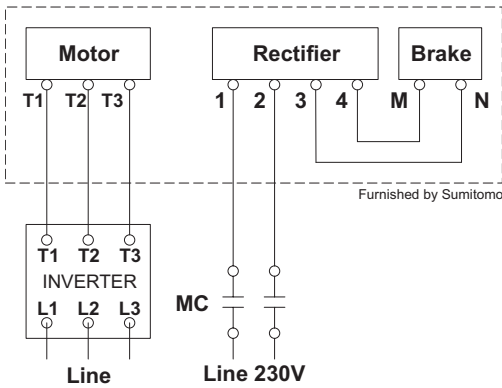


Figure 15. Fast Brake Action, 230V Brake

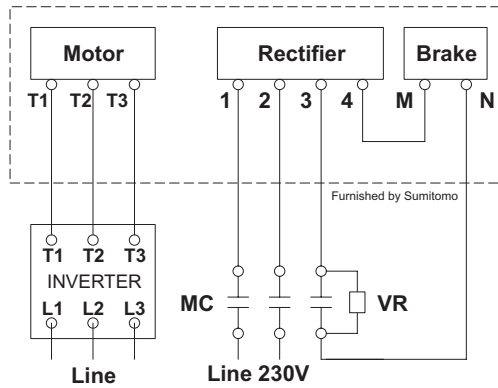


Figure 16. Normal Brake Action, 460V, 575V Brake

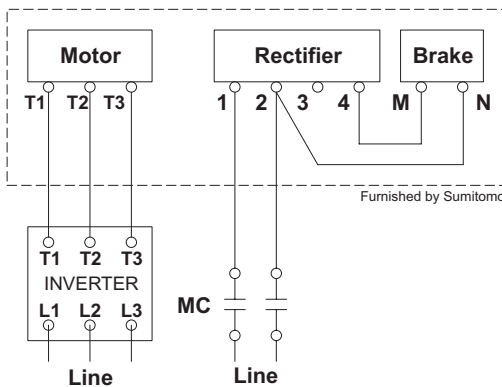
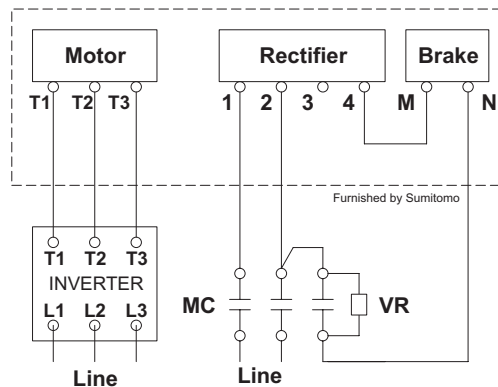
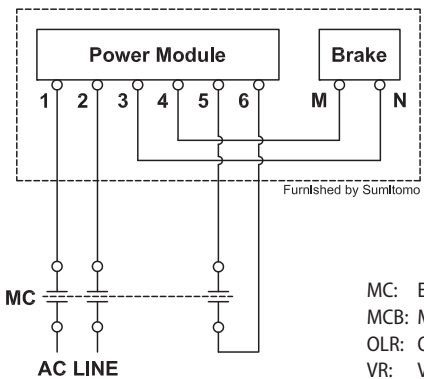


Figure 17. Fast Brake Action, 460V, 575V Brake



### Models FB-20 / FB-30

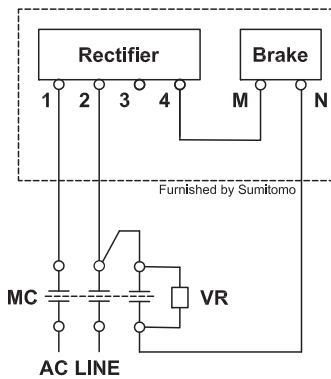
Figure 18. FB-20 and FB-30 Brake Wiring, 480VAC or less



MC: Electromagnetic Relay  
 MCB: Magnetic Circuit Breaker  
 OLR: Overload or Thermal Relay  
 VR: Varistor (protective device)<sup>[1]</sup>

Note: [1] Refer to Varistor Specifications Table

Figure 19. FB-20 and FB-30 Brake Wiring, 575VAC



## CE Motor Brake Wiring

### Models FB-01A through FB-5B/FB-5E, 220/380V, 50Hz

Figure 20. Normal Brake Action, 220V Motor 220V Brake

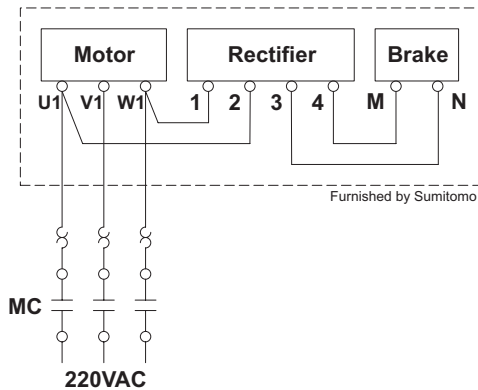


Figure 21. Fast Brake Action, 220V Motor 220V Brake

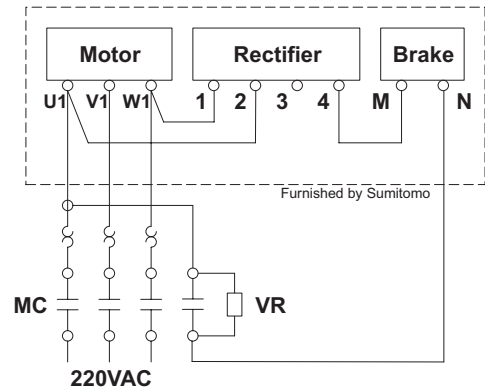


Figure 22. Normal Brake Action, 380V Motor, 220V Brake, Tapped

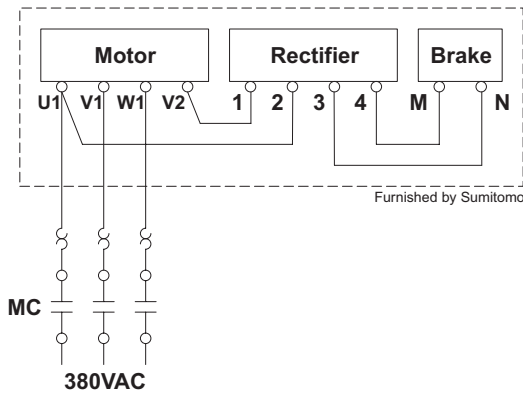


Figure 23. Fast Brake Action, 380V Motor, 220V Brake, Tapped

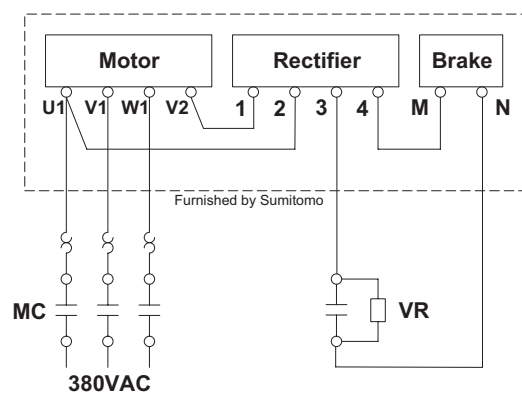


Figure 24. Normal Brake Action, 380V Motor, 220V Brake, Separated

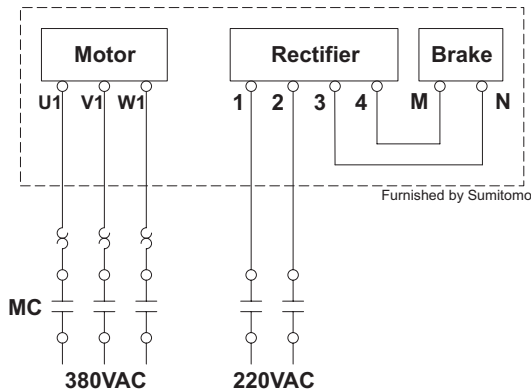
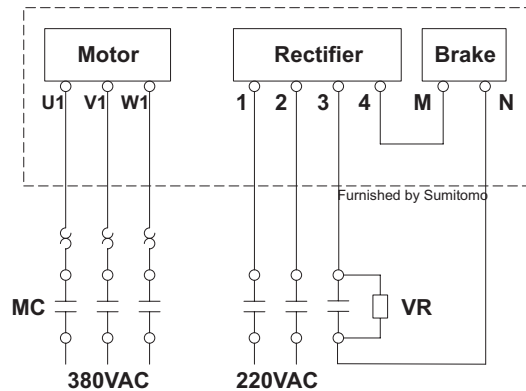


Figure 25. Fast Brake Action, 380V Motor, 220V Brake, Separated



MC: Electromagnetic Relay  
MCB: Magnetic Circuit Breaker  
OLR: Overload or Thermal Relay  
VR: Varistor (protective device)<sup>[1]</sup>

**Note:** [1] Refer to Varistor Specifications Table



# Motor Wiring, continued

## CE Motor Brake Wiring

### Models FB-8B/FB-8E through FB-15B/FB-5E

Figure 26. Normal Brake Action, 380V Motor, 380V Brake

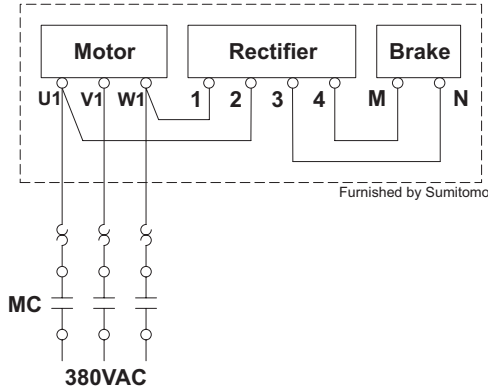
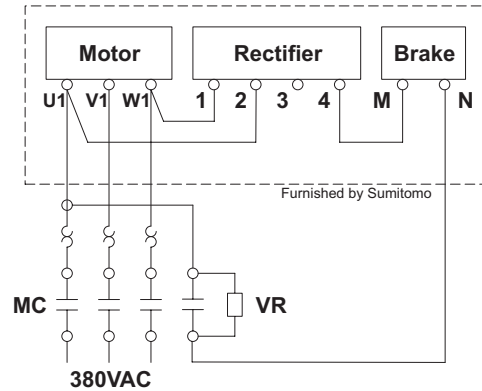


Figure 27. Fast Brake Action, 380V Motor, 380V Brake



## CE Motors Models FB-01A through FB-15B/FB-15E with Inverter

Figure 28. Normal Brake Action

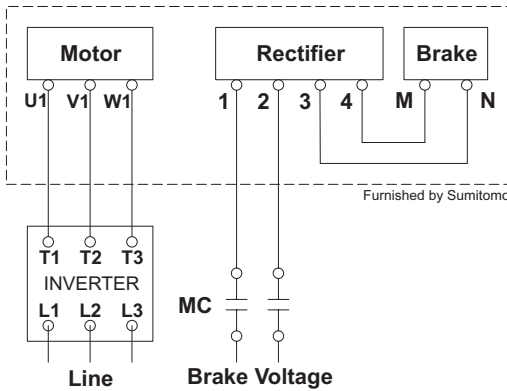
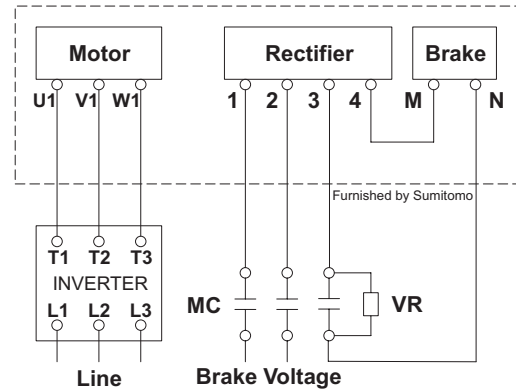


Figure 29. Fast Brake Action



## CE Motor Brake Wiring

### Models FB-20 / FB-30

Figure 30. FB-20 and FB-30 Brake Wiring, 480VAC or less

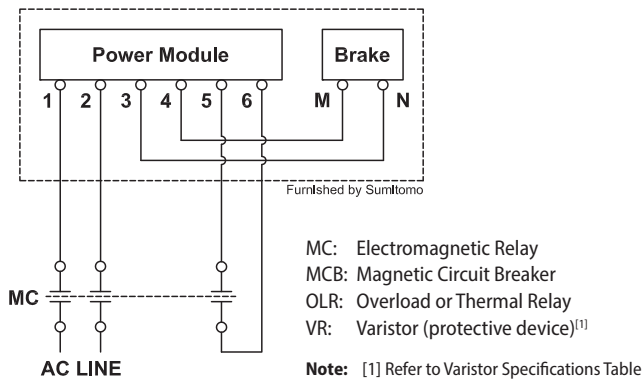


Table 26. Standard CE Motor, Motor / Brake Voltage Table

| HP (kW) x P    | Brake Model        | Motor Voltage  | Brake Voltage |
|----------------|--------------------|----------------|---------------|
| 1/8 (0.1) x 4  | FB-01A             | 220/380V, 50Hz | 220V, 50Hz    |
| 1/4 (0.2) x 4  | FB-02A             |                |               |
| 1/3 (0.25) x 4 | FB-05A             |                |               |
| 1/2 (0.4) x 4  | FB-05A             |                |               |
| 3/4 (0.55) x 4 | FB-1D/FB-1E        |                |               |
| 1 (0.75) x 4   | FB-2D/FB-1HE/FB-2E |                |               |
| 1.5 (1.1) x 4  | FB-2D/FB-1HE/FB-2E |                |               |
| 2 (1.5) x 4    | FB-2D/FB-1HE/FB-2E |                |               |
| 3 (2.2) x 4    | FB-3D/FB-3E        |                |               |
| 4 (3) x 4      | FB-5B/FB-4E/FB-5E  |                |               |
| 5 (3.7) x 4    | FB-5B/FB-4E/FB-5E  | 380V, 50Hz     | 380V, 50Hz    |
| 7.5 (5.5) x 4  | FB-8B/FB-8E        |                |               |
| 10 (7.5) x 4   | FB-10B/FB-10E      |                |               |
| 15 (11) x 4    | FB-15B/FB-15E      |                |               |
| 15 (11) x 4    | FB-15B/FB-15E      |                |               |

## Brake Rectifiers and Power Modules

**Table 40. Standard Brake Rectifiers**

| Brake Type        | Motor<br>HP (kW) x P                        | 230V/460V Rectifier |             | 575V Rectifier |             |
|-------------------|---|---------------------|-------------|----------------|-------------|
|                   |   | Model Number        | Part Number | Model Number   | Part Number |
| FB-01A            | 1/8 (0.1) x 4                               | 25FW-4FB3           | EW107WW-01  | 10F-6FB3       | EW104WW-01  |
| FB-02A            | 1/4 (0.2) x 4<br>1/3 (0.25) x 4             |                     |             |                |             |
| FB-05A            | 1/2 (0.4) x 4                               |                     |             |                |             |
| FB-1D, 1E         | 3/4 (0.55) x 4<br>1 (0.75) x 4              |                     |             |                |             |
| FB-2D, 1HE, 2E    | 1.5 (1.1) x 4<br>2 (1.5) x 4                |                     |             |                |             |
| FB-3D, 3E         | 3 (2.2) x 4                                 |                     |             |                |             |
| FB-5B, 5E         | 5 (3.7) x 4                                 |                     |             |                |             |
| FB-8B, 8E         | 7.5 (5.5) x 4                               |                     |             |                |             |
| FB-10B, 10B1, 10E | 10 (7.5) x 4                                |                     |             |                |             |
| FB-15B, 15B1, 15E | 15 (11) x 4                                 |                     |             |                |             |
| FB-20             | 20 (15) x 4                                 |                     |             |                |             |
| FB-30             | 25 (18.5) x 4<br>30 (22) x 4<br>40 (30) x 4 |                     |             |                |             |

**Table 41. Brake Rectifiers for CE Motors**

| Brake Type        | Motor<br>HP (kW) x P            | 220V Rectifier     |                    | 380V Rectifier     |                    |
|-------------------|---------------------------------|--------------------|--------------------|--------------------|--------------------|
|                   |                                 | Model Number       | Part Number        | Model Number       | Part Number        |
| FB-01A            | 1/8 (0.1) x 4                   | 10F-2FB2           | MP983WW-01         | Consult<br>Factory | Consult<br>Factory |
| FB-02A            | 1/4 (0.2) x 4<br>1/3 (0.25) x 4 |                    |                    |                    |                    |
| FB-05A            | 1/2 (0.4) x 4                   |                    |                    |                    |                    |
| FB-1D, 1E         | 3/4 (0.55) x 4<br>1 (0.75) x 4  |                    |                    |                    |                    |
| FB-2D, 1HE, 2E    | 1.5 (1.1) x 4<br>2 (1.5) x 4    |                    |                    |                    |                    |
| FB-3D, 3E         | 3 (2.2) x 4                     |                    |                    |                    |                    |
| FB-5B, 4E, 5E     | 4 (3.0) x 4<br>5 (3.7) x 4      |                    |                    |                    |                    |
| FB-8B, 8E         | 7.5 (5.5) x 4                   | Consult<br>Factory | Consult<br>Factory | 05F-4FB2           | MP985WW-01         |
| FB-10B, 10B1, 10E | 10 (7.5) x 4                    |                    |                    | 15F-4FB1           | EW397WW-01         |
| FB-15B, 15B1, 15E | 15 (11) x 4                     |                    |                    |                    |                    |

**Table 42. Brake Power Modules**

| Brake Type | Motor<br>HP (kW) x P                        | 170 ~ 300VAC Module |             | 380 ~ 480VAC Module |             |
|------------|---|---------------------|-------------|---------------------|-------------|
|            |   | Model Number        | Part Number | Model Number        | Part Number |
| FB-20      | 20 (15) x 4                                 | 13SR-2              | ES075WW-01  | 10SR-4              | MQ003WW-01  |
| FB-30      | 25 (18.5) x 4<br>30 (22) x 4<br>40 (30) x 4 |                     |             |                     |             |

# Parts

## Cyclo® BBB4 Reducer

Figure 31. Cyclo® BBB4 Reducer Parts

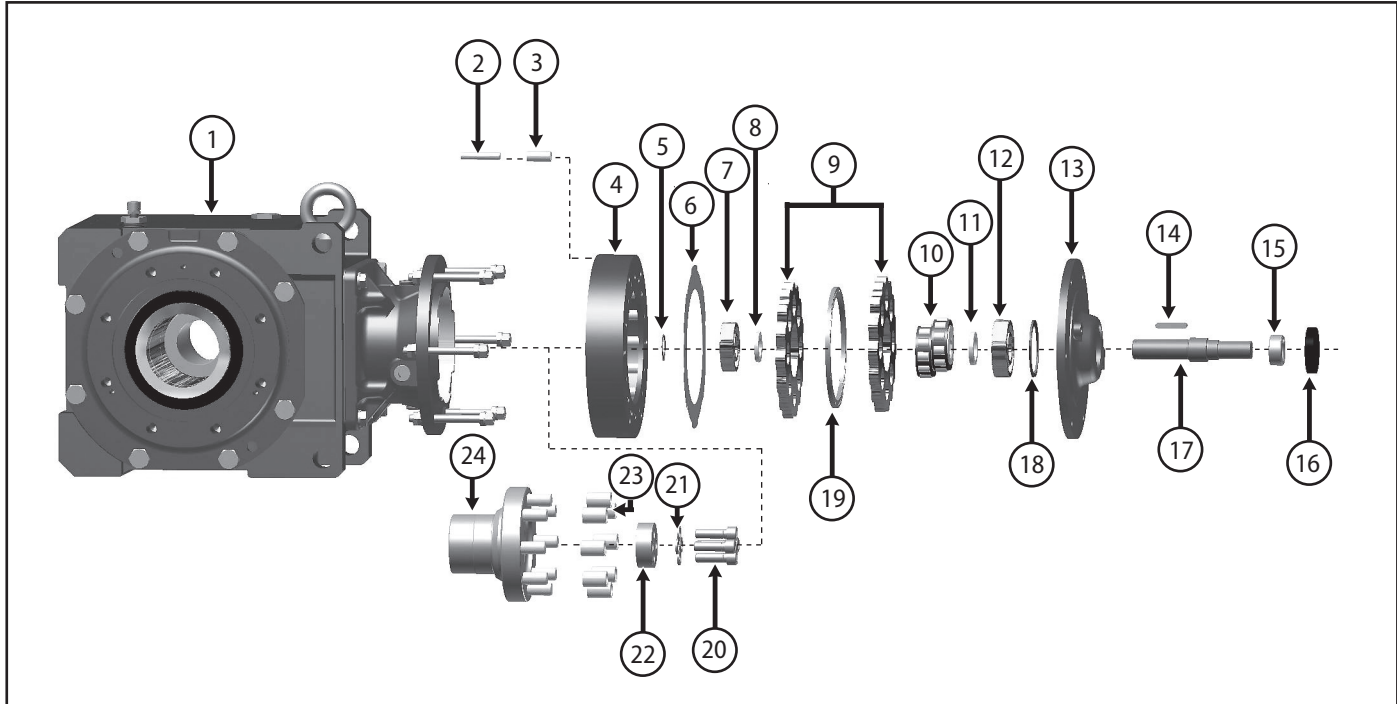


Table 43. Cyclo® BBB4 Reducer Parts

| Number | Description                      |
|--------|----------------------------------|
| 1      | BBB4 Gear Assembly               |
| 2      | Cyclo® Ring Gear Housing Pins    |
| 3      | Cyclo® Ring Gear Housing Rollers |
| 4      | Cyclo® Ring Gear Housing         |
| 5      | Snap Ring                        |
| 6      | Gasket Set                       |
| 7      | High Speed Shaft A Bearing       |
| 8      | Spacer                           |
| 9      | Cycloid Discs                    |
| 10     | Cyclo® Eccentric Cam Assembly    |
| 11     | Spacer                           |
| 12     | High Speed Shaft B Bearing       |

| Number | Description                      |
|--------|----------------------------------|
| 13     | Cyclo® High-Speed End Shield     |
| 14     | Eccentric Key                    |
| 15     | High Speed Shaft Oil Seal Collar |
| 16     | High Speed Shaft Oil Seal        |
| 17     | High Speed Shaft                 |
| 18     | Snap Ring                        |
| 19     | Cycloid Disc Spacer              |
| 20     | Retaining Bolts                  |
| 21     | Lock Washers                     |
| 22     | End Plate                        |
| 23     | Pin Carrier Rollers              |
| 24     | Pin Carrier                      |

Cyclo® Planetary Reduction Component Parts

Cyclo® Planetary Reduction Component Parts (Cyclo® Ratios 11 - 18:1)

Figure 32. Cyclo® Planetary Reduction Component

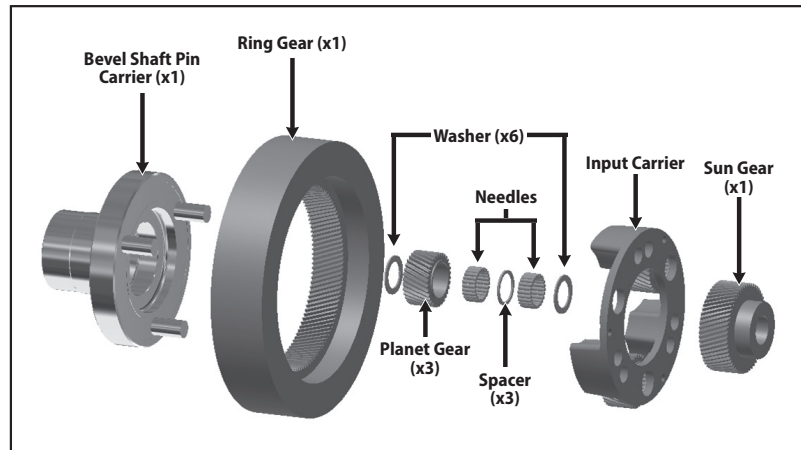


Table 44. Cyclo® Planetary Reduction Component Part Numbers (Ratios 11 - 18:1)

| Unit Size                                       | Reduction Ratio (nominal) |                  | Cyclo® Planetary Reduction Part Numbers |             |           |          |           |         |         |               |  |
|---|---------------------------|------------------|---|-------------|-----------|----------|-----------|---------|---------|---------------|--|
|   | Overall                   | Cyclo® Planetary | Reduction Block Set (gears & bearings)  | Planet Gear | Ring Gear | Sun Gear | Needles   | Spacer  | Washer  | Input Carrier | Bevel Shaft Pin Carrier                                  |
| 4A100<br>4A105                                  | 11                        | 3:1              | 931SD610-003G                           | AN8911G     | AN8303G   | AN8910G  | -         | AW5434G | -       | -             | BL515LG  |
|   | 13, 14                    | 4:1              | 931SD610-004G                           | AN8870G     | AN8871G   | AN8869G  |           |         |         |               |  |
|   | 16, 18                    | 5:1              | 931SD610-005G                           | AN8305G     | AN8306G   | AN8304G  |           |         |         |               |  |
| 4A120, 4A125<br>4B120, 4B125                    | 11                        | 3:1              | 931BB612-003G                           | AP8712G     | CJ584LG   | AP8711G  | AX2806G-3 | AX2543G | AX2761G | CJ244LG       | CJ701LG (for 4A)<br>CJ703LG (for 4B)                     |
|   | 13, 14                    | 4:1              | 931BB612-004G                           | AP8706G     | CJ554LG   | AP8705G  |           |         |         |               |  |
|   | 16, 18                    | 5:1              | 931BB612-005G                           | AP8714G     | CJ585LG   | AP8713G  |           |         |         |               |  |
| 4A140, 4A145<br>4B140, 4B145<br>4C140, 4C145    | 11                        | 3:1              | 931BB614-003G                           | AP8717G     | CJ586LG   | AP8716G  | AX2807G-3 | AX2763G | AX2544G | CJ588LG       | CJ702LG (for 4A)<br>CJ704LG (for 4B)<br>CJ706LG (for 4C) |
|   | 13, 14                    | 4:1              | 931BB614-004G                           | AP8708G     | CJ555LG   | AP8707G  |           |         |         |               |  |
|   | 16, 18                    | 5:1              | 931BB614-005G                           | AP8719G     | CJ587LG   | AP8718G  |           |         |         |               |  |
| 4B160, 4B165<br>4C160, 4C165                    | 11                        | 3:1              | 931BB616-003G                           | AP8721G     | CJ589LG   | AP8720G  | AX2808G-3 | AX2555G | AX2554G | CJ591LG       | CJ705LG (for 4B)<br>CJ707LG (for 4C)                     |
|   | 13, 14                    | 4:1              | 931BB616-004G                           | AP8710G     | CJ556LG   | AP8709G  |           |         |         |               |  |
|   | 16, 18                    | 5:1              | 931BB616-005G                           | AP8726G     | CJ590LG   | AP8722G  |           |         |         |               |  |
| 4C170, 4C175<br>4D170,<br>4D175<br>4E170, 4E175 | 11                        | 3:1              | 931BB617-003G                           | AP9278G     | CJ993LG   | AP9277G  | AX3077G-3 | AX3061G | AX3060G | CJ996LG       | CJ938LG (for 4C)<br>CK009LG (for 4D, 4E)                 |
|   | 13, 14                    | 4:1              | 931BB617-004G                           | AP9280G     | CJ994LG   | AP9279G  |           |         |         |               |  |
|   | 16, 18                    | 5:1              | 931BB617-005G                           | AP9282G     | CJ995LG   | AP9281G  |           |         |         |               |  |
| 4D180,<br>4D185<br>4E180, 4E185<br>4F180, 4F185 | 11                        | 3:1              | 931BB618-003G                           | AP9285G     |           | AP9284G  | AX3077G-3 | AX3061G | AX3060G | CK001LG       | CJ961LG (for 4D, 4E)<br>CJ965LG (for 4F)                 |
|   | 13, 14                    | 4:1              | 931BB618-004G                           | AP9287G     | CJ997LG   | AP9286G  |           |         |         | CK002LG       | CJ960LG (for 4D, 4E)<br>CJ966LG (for 4F)                 |
|   | 16, 18                    | 5:1              | 931BB618-005G                           | AP9289G     |           | AP9288G  |           |         |         | CK003LG       | CJ959LG (for 4D, 4E)<br>CJ967LG (for 4F)                 |
| 4E190, 4E195<br>4F190, 4F195                    | 11                        | 3:1              | 931BB619-003G                           | AP9292G     |           | AP9291G  | AX3077G-3 | AX3061G | AX3060G | CK007LG       | CJ962LG (for 4E)<br>CJ968LG (for 4F)                     |
|   | 13, 14                    | 4:1              | 931BB619-004G                           | AP9294G     | CK004LG   | AP9293G  |           |         |         | CK006LG       | CJ963LG (for 4E)<br>CJ969LG (for 4F)                     |
|   | 16, 18                    | 5:1              | 931BB619-005G                           | AP9296G     |           | AP9295G  |           |         |         | CK008LG       | CJ964LG (for 4E)<br>CJ970LG (for 4F)                     |

Cyclo® Reduction Component Parts

Cyclo® BBB4 Reduction Component Part Numbers (Ratios ≥ 19:1)

Figure 34. Cyclo® BBB4 Reduction Components - 4A100 thru 4F195

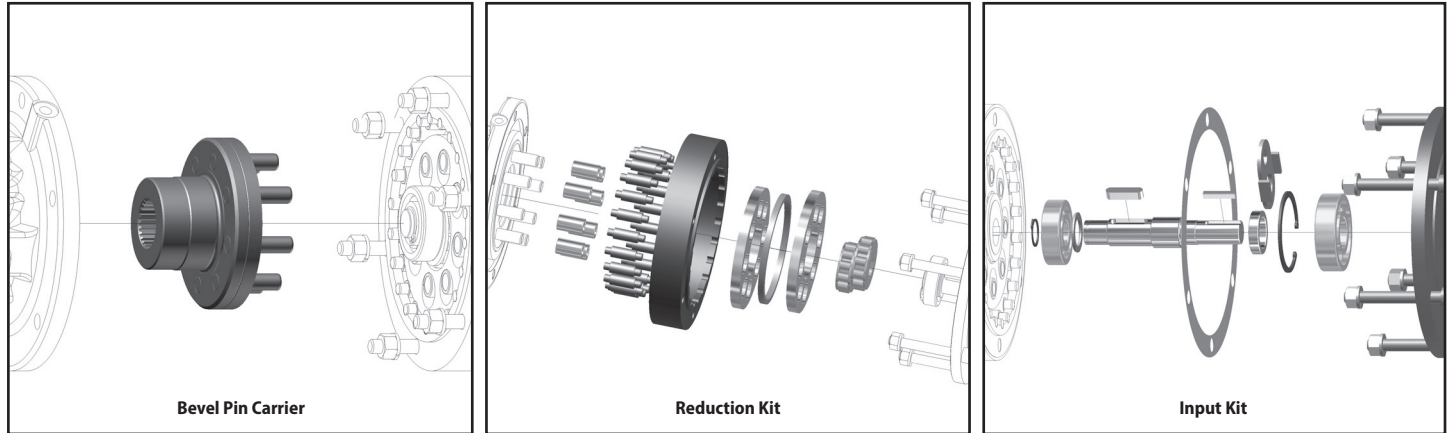


Table 45. Cyclo® BBB4 Reduction Component Part Numbers (Ratios ≥ 19:1)

| Unit Size      | Reduction Ratio |                         | Part Numbers |                         |                   |
|----------------|-----------------|-------------------------|--------------|-------------------------|-------------------|
|                | Overall         | Cyclo®                  | Input Kit    | Reduction Kit           | Bevel Pin Carrier |
| 4A100<br>4A105 | 19, 21          | 6                       | D78622       | D78675                  | BL514LG           |
|                | 22, 25          | 7                       |              | See Note <sup>(1)</sup> |                   |
|                | 26, 28          | 8                       |              | D78676                  |                   |
|                | 35, 39          | 11                      |              | D78677                  |                   |
|                | 42, 46          | 13                      |              | D78678                  |                   |
|                | 48, 53          | 15                      |              | D78679                  |                   |
|                | 54, 60          | 17                      |              | D78680                  |                   |
|                | 67, 74          | 21                      |              | D78681                  |                   |
|                | 80, 88          | 25                      |              | D78682                  |                   |
|                | 93, 102         | 29                      |              | D78683                  |                   |
|                | 112, 123        | 35                      |              | D78684                  |                   |
|                | 138, 151        | 43                      |              | D78685                  |                   |
|                | 163, 179        | 51                      |              | D78686                  |                   |
|                | 189, 207        | 59                      |              | D78687                  |                   |
|                | 227, 249        | 71                      |              | D78688                  |                   |
|                | 278, 305        | 89                      |              | D78689                  |                   |
|                | 364             | 104                     |              | See Note <sup>(1)</sup> |                   |
| 364, 417       | 119             | See Note <sup>(1)</sup> |              |                         |                   |
| ≥ 424          | ≥ 121           | See Note <sup>(1)</sup> |              |                         |                   |

| Unit Size      | Reduction Ratio |                         | Part Numbers |                         |                   |
|----------------|-----------------|-------------------------|--------------|-------------------------|-------------------|
|                | Overall         | Cyclo®                  | Input Kit    | Reduction Kit           | Bevel Pin Carrier |
| 4A110<br>4A115 | 19, 21          | 6                       | D78504       | D78520                  | CJ690LG           |
|                | 22, 25          | 7                       |              | See Note <sup>(1)</sup> |                   |
|                | 26, 28          | 8                       |              | D78521                  |                   |
|                | 35, 39          | 11                      |              | D78522                  |                   |
|                | 42, 46          | 13                      |              | D78523                  |                   |
|                | 48, 53          | 15                      |              | D78524                  |                   |
|                | 54, 60          | 17                      |              | D78525                  |                   |
|                | 67, 74          | 21                      |              | D78526                  |                   |
|                | 80, 88          | 25                      |              | D78527                  |                   |
|                | 93, 102         | 29                      |              | D78528                  |                   |
|                | 112, 123        | 35                      |              | D78529                  |                   |
|                | 138, 151        | 43                      |              | D78530                  |                   |
|                | 163, 179        | 51                      |              | D78531                  |                   |
|                | 189, 207        | 59                      |              | D78532                  |                   |
|                | 227, 249        | 71                      |              | D78533                  |                   |
|                | 278, 305        | 87                      |              | D78534                  |                   |
|                | 364             | 104                     |              | See Note <sup>(1)</sup> |                   |
| 364, 417       | 119             | See Note <sup>(1)</sup> |              |                         |                   |
| ≥ 424          | ≥ 121           | See Note <sup>(1)</sup> |              |                         |                   |

Note: [1] Consult Factory

Cyclo® Reduction Component Parts

Table 46. Cyclo® BBB4 Reduction Components Part Numbers (Ratios >19:1), continued

| Unit Size                        | Reduction Ratio |                         | Part Numbers            |                         |                   |                   | Unit Size  | Reduction Ratio         |        | Part Numbers |               |                   |                   |                   |
|----------------------------------|-----------------|-------------------------|-------------------------|-------------------------|-------------------|-------------------|--|-------------------------|--------|--------------|---------------|-------------------|-------------------|-------------------|
|                                  | Overall         | Cyclo®                  | Input Kit               | Reduction Kit           | 4A12              | 4B12              |  | Overall                 | Cyclo® | Input Kit    | Reduction Kit | 4A14              | 4B14              | 4C14              |
|                                  |                 |                         |                         |                         | Bevel Pin Carrier | Bevel Pin Carrier |  |                         |        |              |               | Bevel Pin Carrier | Bevel Pin Carrier | Bevel Pin Carrier |
| 4A120<br>4A125<br>4B120<br>4B125 | 19, 21          | 6                       | D78623                  | D78690                  | CJ691LG           | CJ693LG           | 4A140<br>4A145<br>4B140<br>4B145<br>4C140<br>4C145 | 19, 21                  | 6      | D78623       | D78535        | CJ692LG           | CJ694LG           | CJ696LG           |
|                                  | 22, 25          | 7                       |                         | See Note <sup>(1)</sup> |                   |                   |  | D78536                  |        |              |               |                   |                   |                   |
|                                  | 26, 28          | 8                       |                         | D78691                  |                   |                   |  | D78537                  |        |              |               |                   |                   |                   |
|                                  | 35, 39          | 11                      |                         | D78692                  |                   |                   |  | D78538                  |        |              |               |                   |                   |                   |
|                                  | 42, 46          | 13                      |                         | D78693                  |                   |                   |  | D78539                  |        |              |               |                   |                   |                   |
|                                  | 48, 53          | 15                      |                         | D78694                  |                   |                   |  | D78540                  |        |              |               |                   |                   |                   |
|                                  | 54, 60          | 17                      |                         | D78695                  |                   |                   |  | D78541                  |        |              |               |                   |                   |                   |
|                                  | 67, 74          | 21                      |                         | D78696                  |                   |                   |  | D78542                  |        |              |               |                   |                   |                   |
|                                  | 80, 88          | 25                      |                         | D78697                  |                   |                   |  | D78543                  |        |              |               |                   |                   |                   |
|                                  | 93, 102         | 29                      |                         | D78698                  |                   |                   |  | D78544                  |        |              |               |                   |                   |                   |
|                                  | 112, 123        | 35                      |                         | D78699                  |                   |                   |  | D78545                  |        |              |               |                   |                   |                   |
|                                  | 138, 151        | 43                      |                         | D78700                  |                   |                   |  | D78546                  |        |              |               |                   |                   |                   |
|                                  | 163, 179        | 51                      |                         | D78701                  |                   |                   |  | D78547                  |        |              |               |                   |                   |                   |
|                                  | 189, 207        | 59                      |                         | D78702                  |                   |                   |  | D78548                  |        |              |               |                   |                   |                   |
|                                  | 227, 249        | 71                      |                         | D78703                  |                   |                   |  | D78549                  |        |              |               |                   |                   |                   |
|                                  | 278, 305        | 89                      |                         | D78704                  |                   |                   |  | See Note <sup>(1)</sup> |        |              |               |                   |                   |                   |
| 364                              | 104             | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |  |                         |        |              |               |                   |                   |                   |
| 364, 417                         | 119             | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |  |                         |        |              |               |                   |                   |                   |
| ≥ 424                            | ≥ 121           | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |  |                         |        |              |               |                   |                   |                   |

| Unit Size  | Reduction Ratio |                         | Part Numbers            |                         |                   |                   | Unit Size | Reduction Ratio                                    |                         | Part Numbers |           |               |                   |                   |
|--|-----------------|-------------------------|-------------------------|-------------------------|-------------------|-------------------|-----------|--|-------------------------|--------------|-----------|---------------|-------------------|-------------------|
|  | Overall         | Cyclo®                  | Input Kit               | Reduction Kit           | 4B16              | 4C16              |           | 4D16   | Overall                 | Cyclo®       | Input Kit | Reduction Kit | 4C17              | 4D17, 4E17        |
|  |                 |                         |                         |                         | Bevel Pin Carrier | Bevel Pin Carrier |           | Bevel Pin Carrier                                  |                         |              |           |               | Bevel Pin Carrier | Bevel Pin Carrier |
| 4B160<br>4B165<br>4C160<br>4C165<br>4D160<br>4D165 | 19, 21          | 6                       | D78625                  | D78720                  | CJ695LG           | CJ697LG           | CJ699LG   | 4C170<br>4C175<br>4D170<br>4D175<br>4E170<br>4E175 | 19, 21                  | 6            | D78626    | D78735        | CJ698LG           | CJ700LG           |
|  | 22, 25          | 7                       |                         | See Note <sup>(1)</sup> |                   |                   |           |  | D78736                  |              |           |               |                   |                   |
|  | 26, 28          | 8                       |                         | D78721                  |                   |                   |           |  | D78737                  |              |           |               |                   |                   |
|  | 35, 39          | 11                      |                         | D78722                  |                   |                   |           |  | D78738                  |              |           |               |                   |                   |
|  | 42, 46          | 13                      |                         | D78723                  |                   |                   |           |  | D78739                  |              |           |               |                   |                   |
|  | 48, 53          | 15                      |                         | D78724                  |                   |                   |           |  | D78740                  |              |           |               |                   |                   |
|  | 54, 60          | 17                      |                         | D78725                  |                   |                   |           |  | D78741                  |              |           |               |                   |                   |
|  | 67, 74          | 21                      |                         | D78726                  |                   |                   |           |  | D78742                  |              |           |               |                   |                   |
|  | 80, 88          | 25                      |                         | D78727                  |                   |                   |           |  | D78743                  |              |           |               |                   |                   |
|  | 93, 102         | 29                      |                         | D78728                  |                   |                   |           |  | D78744                  |              |           |               |                   |                   |
|  | 112, 123        | 35                      |                         | D78729                  |                   |                   |           |  | D78745                  |              |           |               |                   |                   |
|  | 138, 151        | 43                      |                         | D78730                  |                   |                   |           |  | D78746                  |              |           |               |                   |                   |
|  | 163, 179        | 51                      |                         | D78731                  |                   |                   |           |  | D78747                  |              |           |               |                   |                   |
|  | 189, 207        | 59                      |                         | D78732                  |                   |                   |           |  | D78748                  |              |           |               |                   |                   |
|  | 227, 249        | 71                      |                         | D78733                  |                   |                   |           |  | See Note <sup>(1)</sup> |              |           |               |                   |                   |
|  | 278, 305        | 89                      |                         | D78734                  |                   |                   |           |  | See Note <sup>(1)</sup> |              |           |               |                   |                   |
| 364  | 104             | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |           |  |                         |              |           |               |                   |                   |
| 364, 417   | 119             | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |           |  |                         |              |           |               |                   |                   |
| ≥ 424  | ≥ 121           | See Note <sup>(1)</sup> | See Note <sup>(1)</sup> |                         |                   |                   |           |  |                         |              |           |               |                   |                   |

| Unit Size  | Reduction Ratio |        | Part Numbers |                         |                   |                   | Unit Size                        | Reduction Ratio         |         | Part Numbers |                         |               |                   |                   |
|--|-----------------|--------|--------------|-------------------------|-------------------|-------------------|----------------------------------|-------------------------|---------|--------------|-------------------------|---------------|-------------------|-------------------|
|  | Overall         | Cyclo® | Input Kit    | Reduction Kit           | 4D18              | 4E18              |                                  | 4F18                    | Overall | Cyclo®       | Input Kit               | Reduction Kit | 4E19              | 4F19              |
|  |                 |        |              |                         | Bevel Pin Carrier | Bevel Pin Carrier |                                  | Bevel Pin Carrier       |         |              |                         |               | Bevel Pin Carrier | Bevel Pin Carrier |
| 4D180<br>4D185<br>4E180<br>4E185<br>4F180<br>4F185 | 19, 21          | 6      | D78627       | See Note <sup>(1)</sup> | CJ655LG           | CJ657LG           | 4E190<br>4E195<br>4F190<br>4F195 | 19, 21                  | 6       | D78628       | See Note <sup>(1)</sup> | CJ956LG       | CJ931LG           |                   |
|  | 22, 25          | 7      |              | See Note <sup>(1)</sup> |                   |                   |                                  | See Note <sup>(1)</sup> |         |              |                         |               |                   |                   |
|  | 26, 28          | 8      |              | See Note <sup>(1)</sup> |                   |                   |                                  | D78763                  |         |              |                         |               |                   |                   |
|  | 35, 39          | 11     |              | D78749                  |                   |                   |                                  | D78764                  |         |              |                         |               |                   |                   |
|  | 42, 46          | 13     |              | D78750                  |                   |                   |                                  | D78765                  |         |              |                         |               |                   |                   |
|  | 48, 53          | 15     |              | D78751                  |                   |                   |                                  | D78766                  |         |              |                         |               |                   |                   |
|  | 54, 60          | 17     |              | D78752                  |                   |                   |                                  | D78767                  |         |              |                         |               |                   |                   |
|  | 67, 74          | 21     |              | D78753                  |                   |                   |                                  | D78768                  |         |              |                         |               |                   |                   |
|  | 80, 88          | 25     |              | D78754                  |                   |                   |                                  | D78769                  |         |              |                         |               |                   |                   |
|  | 93, 102         | 29     |              | D78755                  |                   |                   |                                  | D78770                  |         |              |                         |               |                   |                   |
|  | 112, 123        | 35     |              | D78756                  |                   |                   |                                  | D78771                  |         |              |                         |               |                   |                   |
|  | 138, 151        | 43     |              | D78757                  |                   |                   |                                  | D78772                  |         |              |                         |               |                   |                   |
|  | 163, 179        | 51     |              | D78758                  |                   |                   |                                  | D78773                  |         |              |                         |               |                   |                   |
|  | 189, 207        | 59     |              | D78759                  |                   |                   |                                  | D78774                  |         |              |                         |               |                   |                   |
|  | 227, 249        | 71     |              | D78760                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |
|  | 278, 305        | 87     |              | D78761                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |

| Unit Size  | Reduction Ratio |        | Part Numbers |                         |                   |                   | Unit Size                        | Reduction Ratio         |         | Part Numbers |                         |               |                   |                   |
|--|-----------------|--------|--------------|-------------------------|-------------------|-------------------|----------------------------------|-------------------------|---------|--------------|-------------------------|---------------|-------------------|-------------------|
|  | Overall         | Cyclo® | Input Kit    | Reduction Kit           | 4D18              | 4E18              |                                  | 4F18                    | Overall | Cyclo®       | Input Kit               | Reduction Kit | 4E19              | 4F19              |
|  |                 |        |              |                         | Bevel Pin Carrier | Bevel Pin Carrier |                                  | Bevel Pin Carrier       |         |              |                         |               | Bevel Pin Carrier | Bevel Pin Carrier |
| 4D180<br>4D185<br>4E180<br>4E185<br>4F180<br>4F185 | 19, 21          | 6      | D78627       | See Note <sup>(1)</sup> | CJ655LG           | CJ657LG           | 4E190<br>4E195<br>4F190<br>4F195 | 19, 21                  | 6       | D78628       | See Note <sup>(1)</sup> | CJ956LG       | CJ931LG           |                   |
|  | 22, 25          | 7      |              | See Note <sup>(1)</sup> |                   |                   |                                  | See Note <sup>(1)</sup> |         |              |                         |               |                   |                   |
|  | 26, 28          | 8      |              | See Note <sup>(1)</sup> |                   |                   |                                  | D78763                  |         |              |                         |               |                   |                   |
|  | 35, 39          | 11     |              | D78749                  |                   |                   |                                  | D78764                  |         |              |                         |               |                   |                   |
|  | 42, 46          | 13     |              | D78750                  |                   |                   |                                  | D78765                  |         |              |                         |               |                   |                   |
|  | 48, 53          | 15     |              | D78751                  |                   |                   |                                  | D78766                  |         |              |                         |               |                   |                   |
|  | 54, 60          | 17     |              | D78752                  |                   |                   |                                  | D78767                  |         |              |                         |               |                   |                   |
|  | 67, 74          | 21     |              | D78753                  |                   |                   |                                  | D78768                  |         |              |                         |               |                   |                   |
|  | 80, 88          | 25     |              | D78754                  |                   |                   |                                  | D78769                  |         |              |                         |               |                   |                   |
|  | 93, 102         | 29     |              | D78755                  |                   |                   |                                  | D78770                  |         |              |                         |               |                   |                   |
|  | 112, 123        | 35     |              | D78756                  |                   |                   |                                  | D78771                  |         |              |                         |               |                   |                   |
|  | 138, 151        | 43     |              | D78757                  |                   |                   |                                  | D78772                  |         |              |                         |               |                   |                   |
|  | 163, 179        | 51     |              | D78758                  |                   |                   |                                  | D78773                  |         |              |                         |               |                   |                   |
|  | 189, 207        | 59     |              | D78759                  |                   |                   |                                  | D78774                  |         |              |                         |               |                   |                   |
|  | 227, 249        | 71     |              | D78760                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |
|  | 278, 305        | 87     |              | D78761                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |

| Unit Size  | Reduction Ratio |        | Part Numbers |                         |                   |                   | Unit Size                        | Reduction Ratio         |         | Part Numbers |                         |               |                   |                   |
|--|-----------------|--------|--------------|-------------------------|-------------------|-------------------|----------------------------------|-------------------------|---------|--------------|-------------------------|---------------|-------------------|-------------------|
|  | Overall         | Cyclo® | Input Kit    | Reduction Kit           | 4D18              | 4E18              |                                  | 4F18                    | Overall | Cyclo®       | Input Kit               | Reduction Kit | 4E19              | 4F19              |
|  |                 |        |              |                         | Bevel Pin Carrier | Bevel Pin Carrier |                                  | Bevel Pin Carrier       |         |              |                         |               | Bevel Pin Carrier | Bevel Pin Carrier |
| 4D180<br>4D185<br>4E180<br>4E185<br>4F180<br>4F185 | 19, 21          | 6      | D78627       | See Note <sup>(1)</sup> | CJ655LG           | CJ657LG           | 4E190<br>4E195<br>4F190<br>4F195 | 19, 21                  | 6       | D78628       | See Note <sup>(1)</sup> | CJ956LG       | CJ931LG           |                   |
|  | 22, 25          | 7      |              | See Note <sup>(1)</sup> |                   |                   |                                  | See Note <sup>(1)</sup> |         |              |                         |               |                   |                   |
|  | 26, 28          | 8      |              | See Note <sup>(1)</sup> |                   |                   |                                  | D78763                  |         |              |                         |               |                   |                   |
|  | 35, 39          | 11     |              | D78749                  |                   |                   |                                  | D78764                  |         |              |                         |               |                   |                   |
|  | 42, 46          | 13     |              | D78750                  |                   |                   |                                  | D78765                  |         |              |                         |               |                   |                   |
|  | 48, 53          | 15     |              | D78751                  |                   |                   |                                  | D78766                  |         |              |                         |               |                   |                   |
|  | 54, 60          | 17     |              | D78752                  |                   |                   |                                  | D78767                  |         |              |                         |               |                   |                   |
|  | 67, 74          | 21     |              | D78753                  |                   |                   |                                  | D78768                  |         |              |                         |               |                   |                   |
|  | 80, 88          | 25     |              | D78754                  |                   |                   |                                  | D78769                  |         |              |                         |               |                   |                   |
|  | 93, 102         | 29     |              | D78755                  |                   |                   |                                  | D78770                  |         |              |                         |               |                   |                   |
|  | 112, 123        | 35     |              | D78756                  |                   |                   |                                  | D78771                  |         |              |                         |               |                   |                   |
|  | 138, 151        | 43     |              | D78757                  |                   |                   |                                  | D78772                  |         |              |                         |               |                   |                   |
|  | 163, 179        | 51     |              | D78758                  |                   |                   |                                  | D78773                  |         |              |                         |               |                   |                   |
|  | 189, 207        | 59     |              | D78759                  |                   |                   |                                  | D78774                  |         |              |                         |               |                   |                   |
|  | 227, 249        | 71     |              | D78760                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |
|  | 278, 305        | 87     |              | D78761                  |                   |                   |                                  |                         |         |              |                         |               |                   |                   |

Note: [1] Consult Factory

Bearings and Oil Seals

Figure 34. Cyclo® BBB4 Bearings and Oil Seals

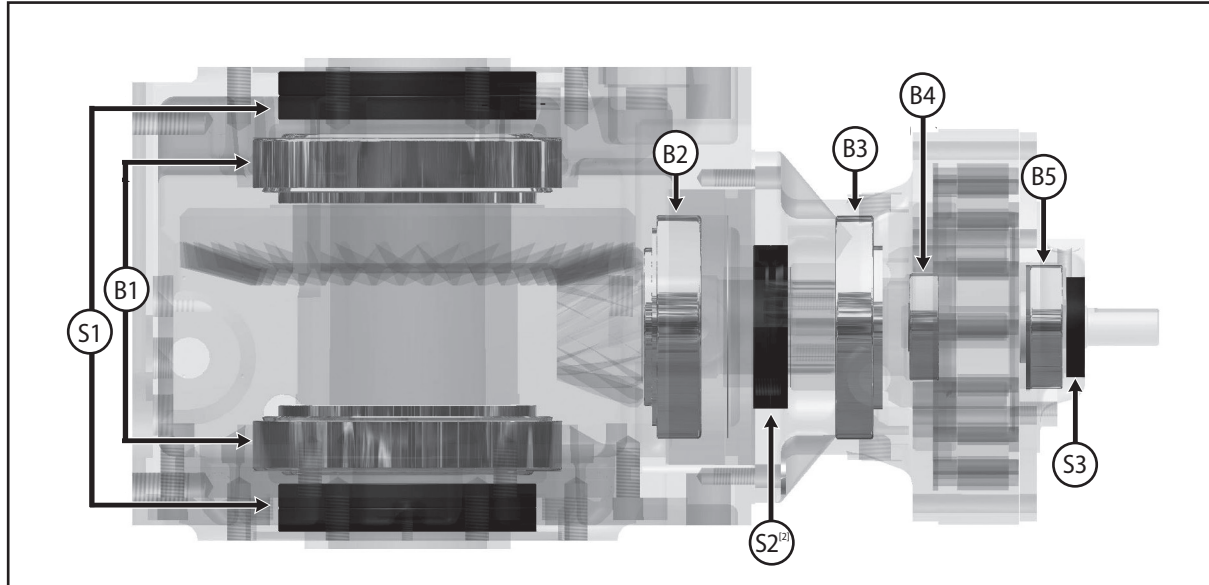


Table 47. Cyclo® BBB4 Reducer Bearings and Oil Seals

| Unit Size  | Bearings |       |       |                   |                   | Oil Seals <sup>[1]</sup> |                   |                  |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
|--|----------|-------|-------|-------------------|-------------------|--------------------------|-------------------|------------------|-------|---------------------|-------------------|------------------|-------|---------------------|-------------------|-------------------|-------|---------------------|--------------------|-------------------|-------|---------------------|--------------------|-------------------|------|---------------------|---------------------|-------------------|
|  | B1       | B2    | B3    | B4                | B5                | S1 <sup>[2]</sup>        | S2 <sup>[3]</sup> | S3               |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
| 4A100<br>4A105<br>4A110<br>4A115<br>4A120<br>4A125<br>4A140<br>4A145 | 32017    | 32308 | 32011 | 6302RSH2          | 6302Z             | D<br>85 x 110 x 13       | S<br>50 x 68 x 9  | S<br>20 x 35 x 7 |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
| 4B120<br>4B125<br>4B140<br>4B145<br>4B160<br>4B165                   |          |       | 32020 | 32310             | 32013             |                          |                   | 6304             | 6305Z | D<br>100 x 125 x 13 | S<br>60 x 75 x 9  | D<br>32 x 52 x 8 |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
| 4C140<br>4C145<br>4C160<br>4C165<br>4C170<br>4C175                   |          |       |       |                   | 32024             |                          |                   | 32312            | 30215 |                     |                   | 6305R            | 6306  | D<br>120 x 150 x 14 | S<br>70 x 95 x 13 | D<br>38 x 58 x 11 |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
| 4D160<br>4D165<br>4D170<br>4D175<br>4D180<br>4D185                   |          |       |       |                   |                   |                          |                   |                  | 32028 |                     |                   | 32314            | 30215 |                     |                   | 6305R             | 6306  | D<br>140 x 170 x 14 | S<br>90 x 115 x 13 | D<br>55 x 78 x 12 |       |                     |                    |                   |      |                     |                     |                   |
| 4E170<br>4E175<br>4E180<br>4E185<br>4E190<br>4E195                   |          |       |       |                   |                   |                          |                   |                  |       |                     |                   |                  | 32032 |                     |                   | 32315             | 30217 |                     |                    | 6307R             | 6308  | D<br>160 x 190 x 16 | S<br>90 x 115 x 13 | D<br>62 x 82 x 12 |      |                     |                     |                   |
| 4F180<br>4F185<br>4F190<br>4F195                                     |          |       |       |                   |                   |                          |                   |                  |       |                     |                   |                  |       |                     |                   |                   | 32036 |                     |                    | 32319             | 30217 |                     |                    | 6307R             | 6308 | D<br>180 x 210 x 16 | S<br>140 x 170 x 14 | D<br>65 x 88 x 12 |
|  |          |       |       |                   |                   |                          |                   |                  |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   | 30220 |                     |                    | 6406              | 6407 |                     |                     | D<br>62 x 82 x 12 |
|  |          |       | 30222 | 6407              |                   |                          |                   |                  |       | 6409                | D<br>65 x 88 x 12 |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
|  | 30226    | 6408  | 6411  | S<br>70 x 88 x 10 |                   |                          |                   |                  |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
|  | 30226    | 6407  | 6409  | D<br>65 x 88 x 12 |                   |                          |                   |                  |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |
|  | 30230    | 6408  | 6411  |                   | S<br>70 x 88 x 10 |                          |                   |                  |       |                     |                   |                  |       |                     |                   |                   |       |                     |                    |                   |       |                     |                    |                   |      |                     |                     |                   |

Notes: [1] D = Double Lip Seal. S = Single Lip Seal. Seal Dimensions are in mm.  
 [2] A total of 4 seals are needed - two on top and two on bottom  
 [3] for "Y4" assembly and grease lubricated units only

## Bevel Gearing Parts and Tooth Count

## Bevel Gearing Parts and Tooth Count

Bevel gear and pinions are sold in sets only. Individual components are not available for purchase. The information below regarding tooth count of the bevel gearset is provided for vibration analysis purposes.

Figure 35. Cyclo® BBB4 Bevel Gearing Tooth Count

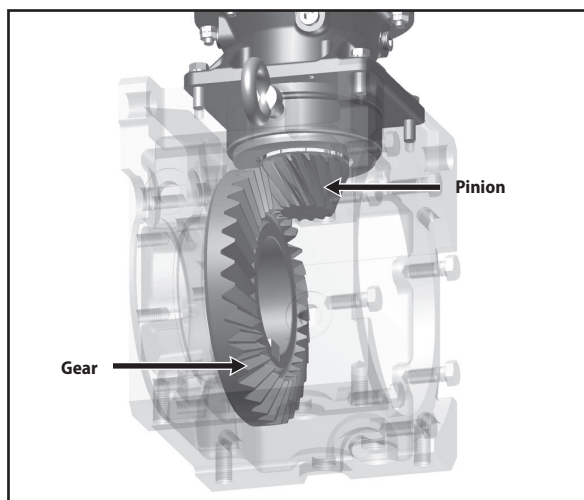


Table 48. Cyclo® BBB4 Ratios

| Cyclo® BBB4 Nominal Ratio | Bevel Ratio | Cyclo® Input Ratio |
|---------------------------|-------------|--------------------|
| 11                        | 3.5         | 3 <sup>[1]</sup>   |
| 13                        | 3.2         | 4 <sup>[1]</sup>   |
| 14                        | 3.5         | 4 <sup>[1]</sup>   |
| 16                        | 3.2         | 5 <sup>[1]</sup>   |
| 18                        | 3.5         | 5 <sup>[1]</sup>   |
| 19                        | 3.2         | 6                  |
| 21                        | 3.5         | 6                  |
| 22                        | 3.2         | 7                  |
| 25                        | 3.5         | 7                  |
| 26                        | 3.2         | 8                  |
| 28                        | 3.5         | 8                  |
| 35                        | 3.2         | 11                 |
| 39                        | 3.5         | 11                 |
| 42                        | 3.2         | 13                 |
| 46                        | 3.5         | 13                 |
| 48                        | 3.2         | 15                 |
| 53                        | 3.5         | 15                 |
| 54                        | 3.2         | 17                 |
| 60                        | 3.5         | 17                 |
| 67                        | 3.2         | 21                 |
| 74                        | 3.5         | 21                 |

Note: [1] Planetary Input

| Cyclo® BBB4 Nominal Ratio | Bevel Ratio | Cyclo® Input Ratio |
|---------------------------|-------------|--------------------|
| 80                        | 3.2         | 25                 |
| 88                        | 3.5         | 25                 |
| 93                        | 3.2         | 29                 |
| 102                       | 3.5         | 29                 |
| 112                       | 3.2         | 35                 |
| 123                       | 3.5         | 35                 |
| 138                       | 3.2         | 43                 |
| 151                       | 3.5         | 43                 |
| 163                       | 3.2         | 51                 |
| 179                       | 3.5         | 51                 |
| 189                       | 3.2         | 59                 |
| 207                       | 3.5         | 59                 |
| 227                       | 3.2         | 71                 |
| 249                       | 3.5         | 71                 |
| 278                       | 3.2         | 87                 |
| 305                       | 3.5         | 87                 |
| 364                       | 3.5         | 104                |
| 417                       | 3.5         | 119                |
| 424                       | 3.5         | 121                |
| 501                       | 3.5         | 143                |
| 578                       | 3.5         | 165                |
| 683                       | 3.5         | 195                |

| Cyclo® BBB4 Nominal Ratio | Bevel Ratio | Cyclo® Input Ratio |
|---------------------------|-------------|--------------------|
| 809                       | 3.5         | 231                |
| 956                       | 3.5         | 273                |
| 1117                      | 3.5         | 319                |
| 1320                      | 3.5         | 377                |
| 1656                      | 3.5         | 473                |
| 1957                      | 3.5         | 559                |
| 2272                      | 3.5         | 649                |
| 2559                      | 3.5         | 731                |
| 2944                      | 3.5         | 841                |
| 3511                      | 3.5         | 1003               |
| 4365                      | 3.5         | 1247               |
| 5177                      | 3.5         | 1479               |
| 6472                      | 3.5         | 1849               |
| 7228                      | 3.5         | 2065               |
| 8880                      | 3.5         | 2537               |
| 10658                     | 3.5         | 3045               |
| 12184                     | 3.5         | 3481               |
| 15530                     | 3.5         | 4437               |
| 17966                     | 3.5         | 5133               |
| 21620                     | 3.5         | 6177               |
| 26492                     | 3.5         | 7569               |

To determine the bevel tooth count, identify the Cyclo® BBB4 nominal ratio and corresponding bevel ratio from Table 49. Then reference Table 45 to identify the actual number of bevel gear and pinion teeth.

Table 49. Bevel Tooth Count and Part Numbers

| Bevel Ratio | Number of Teeth |      | Bevel Gear Set Part Number |                     |                     |               |               |                  |               |
|-------------|-----------------|------|----------------------------|---------------------|---------------------|---------------|---------------|------------------|---------------|
|             | Pinion          | Gear | 4A10, 4A11<br>4A12, 4A14   | 4B12, 4B14,<br>4B16 | 4C14, 4C16,<br>4C17 | 4D16          | 4D17, 4D18    | 4E17, 4E18, 4E19 | 4F18, 4F19    |
| 3.2         | 10              | 32   | 998BBB-4A--BG              | 998BBB-4B--BG       | 998BBB-4C--BG       | 998BBB-4D16BG | 998BBB-4D17BG | 998BBB-4E--BG    | 998BBB-4F--BG |
| 3.5         | 10              | 35   | 998BBB-2A---G              | 998BBB-2B---G       | 998BBB-2C---G       | 998BBB-2D---G | 998BBB-2D17-G | 998BBB-2E---G    | 998BBB-4F--AG |



# Screw Conveyor Options

## Components, Assembly Instructions

### Screw Conveyor Components

Figure 36. Cyclo® BBB4 Screw Conveyor Components

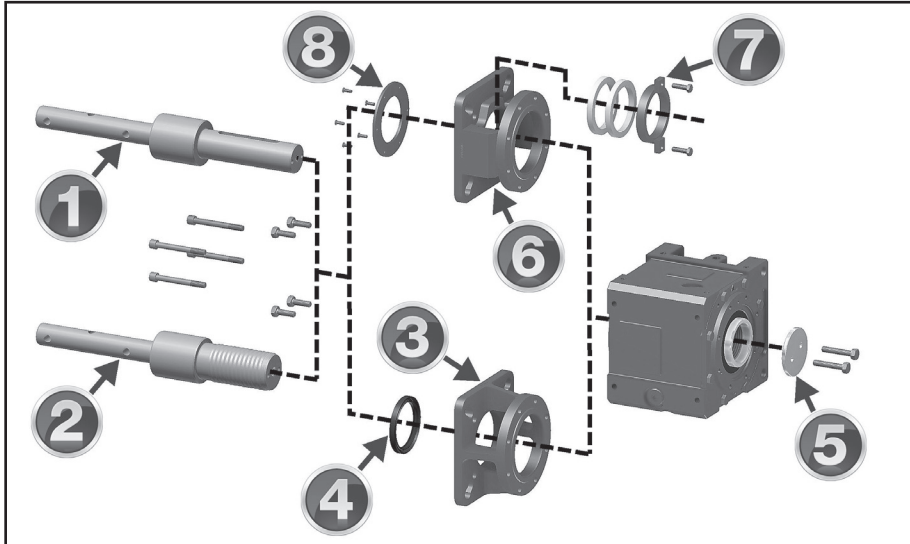
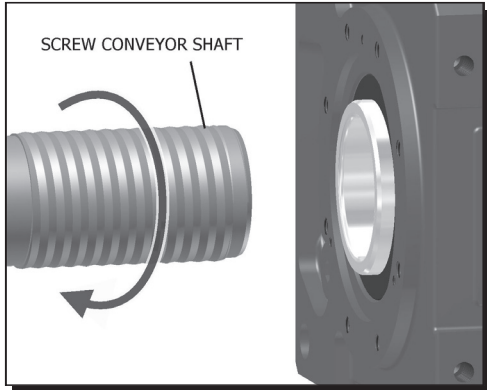


Table 50. Typical Cyclo® BBB4 Screw Conveyor Components

| Item Number | Description                        |
|-------------|------------------------------------|
| 1           | Screw Conveyor Shaft for KHB       |
| 2           | Screw Conveyor Shaft for TGB       |
| 3           | Cast Screw Conveyor Adapter        |
| 4           | Shaft Seal                         |
| 5           | Shaft Retaining Plate              |
| 6           | Fabricated Screw Conveyor Adaptor  |
| 7           | Optional Braided Cord Packing Seal |
| 8           | Optional Gland Cover Plate         |

### Screw Conveyor Assembly Instructions

Tapered Grip Bushing Type

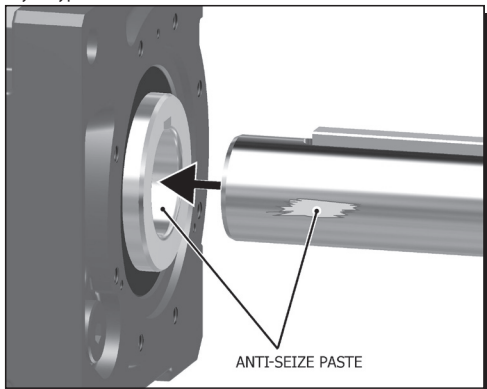


1

Insert the **screw conveyor shaft** completely into the Cyclo® BBB4 **output hub**.

**Tapered Grip Bushing Type** – Screw the threaded end into the BBB unit.

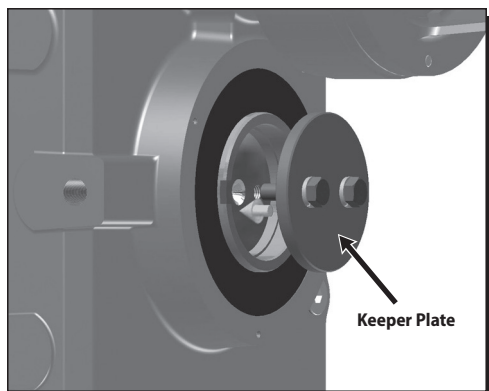
Keyed Type



**Keyed Type** – Apply anti-seize paste to the driven shaft, install key into shaft keyway, align the key and hollow shaft keyway and carefully slide the shaft into the BBB unit

## Screw Conveyor Options, continued

## Assembly Instructions



## 2

Secure the screw conveyor shaft in place using the **keeper plate** with the supplied hardware.

Table 51. Bolt Tightening Torques

| Unit Size | Shaft Retaining Bolts |                      |
|-----------|-----------------------|----------------------|
|           | Qty. x Bolt Size      | Bolt Torque (ft-lbs) |
| 4A        | 2 x M10               | 33                   |
| 4B        | 2 x M10               | 33                   |
| 4C        | 2 x M12               | 59                   |
| 4D        | 2 x M16               | 146                  |
| 4E        | 2 x M16               | 146                  |

## 3

If braided cord is supplied, place the **gland cover** into the screw conveyor adapter and secure it in place with the supplied hardware.

Cover not required with the use of a lipped seal.

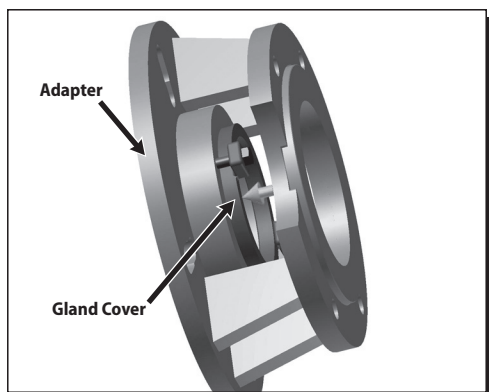


Table 52. Bolt Tightening Torques

| Unit Size | Gland Cover Bolts |                      |
|-----------|-------------------|----------------------|
|           | Qty. x Bolt Size  | Bolt Torque (ft-lbs) |
| 4A        | 2 x M8            | 15                   |
| 4B        |                   |                      |
| 4C        |                   |                      |
| 4D        |                   |                      |
| 4E        |                   |                      |

## 4

Carefully slide the screw conveyor adapter over the shaft and position it against the corresponding threaded holes in the Cyclo® BBB4 housing. Use the included hardware to secure the adapter to the housing.

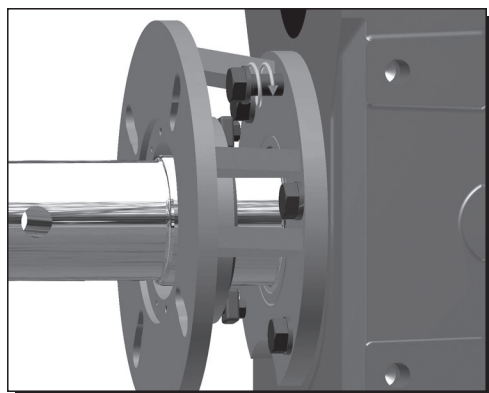
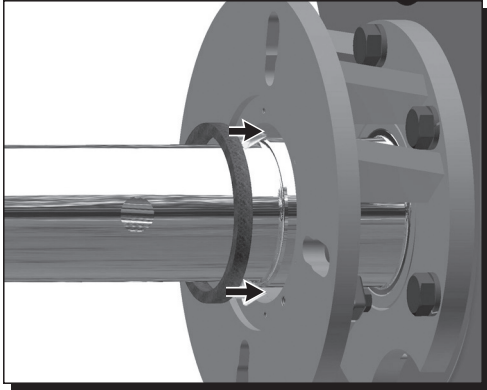


Table 53. Bolt Tightening Torques

| Unit Size | Cast Adapter/Housing Bolts |                      | Fabricated Adapter/Housing Bolts |                      |
|-----------|----------------------------|----------------------|----------------------------------|----------------------|
|           | Qty. x Bolt Size           | Bolt Torque (ft-lbs) | Qty. x Bolt Size                 | Bolt Torque (ft-lbs) |
| 4A        | 8 x M10 (HH)               | 47                   | 4 x M10 (HH)                     | 47                   |
|           |                            |                      | 4 x M10 (SHCS)                   | 57                   |
| 4B        | 8 x M12 (HH)               | 83                   | 4 x M12 (HH)                     | 83                   |
|           |                            |                      | 4 x M12 (SHCS)                   | 100                  |
| 4C        | 8 x M16 (HH)               | 202                  | 4 x M16 (HH)                     | 202                  |
|           |                            |                      | 4 x M16 (SHCS)                   | 247                  |
| 4D        | 8 x M20 (HH)               | 401                  | 4 x M20 (HH)                     | 401                  |
|           |                            |                      | 4 x M20 (SHCS)                   | 285                  |
| 4E        | 8 x M20 (HH)               | 401                  | 8 x M20 (HH)                     | 401                  |

## Screw Conveyor Options, continued

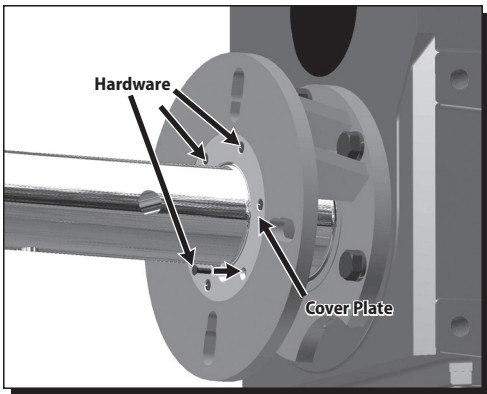
### Assembly Instructions



#### 5

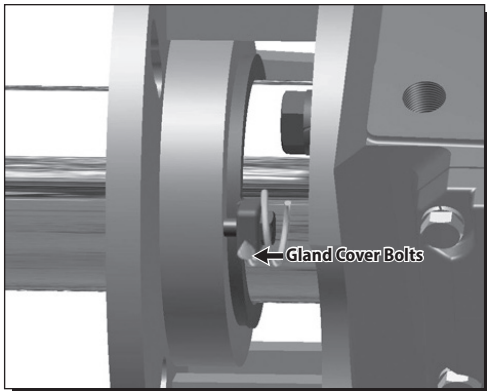
If supplied, carefully insert the application appropriate **sealing material** into the bore of the screw conveyor adapter.

- To seal the output portion of the screw conveyor adapter, Sumitomo provides two different options for each screw conveyor kit:
  - High-Performance Braided Cord: recommended for use if the conveyed material is abrasive.
  - Double-Lip, Nitrile Oil Seal: recommended for use if conveyed material is a nonabrasive liquid.
- Sumitomo **does not** recommend the use of both sealing options at the same time.



#### 6

If using the **braided cord seal**, carefully slide the **cover plate** over the screw conveyor shaft and place it against the screw conveyor adapter. Secure the cover plate using the supplied hardware.



#### 7

If using the **braided cord seal**, tighten the **gland cover bolts** to achieve sufficient sealing on the screw conveyor shaft.

# Cyclo® Portion Disassembly/Assembly

## Disassembly Procedure

### Disassembly/Assembly

The Bevel Gear portion is designed for lower speeds and therefore has lower operating cycles when compared to the Cyclo® input assembly, therefore in most cases does not require rebuilding. Always consult our specialized factory and warehouses for overhaul of gearmotors and reducers. Experience is necessary for proper overhaul.

The Cyclo® portion has significantly higher operating cycles than the Bevel Gear portion, rebuild and repair is a convenient way to extend the useful life of your gearbox.



Cyclo® repairs should be conducted by experienced personnel to prevent damage to components or persons.

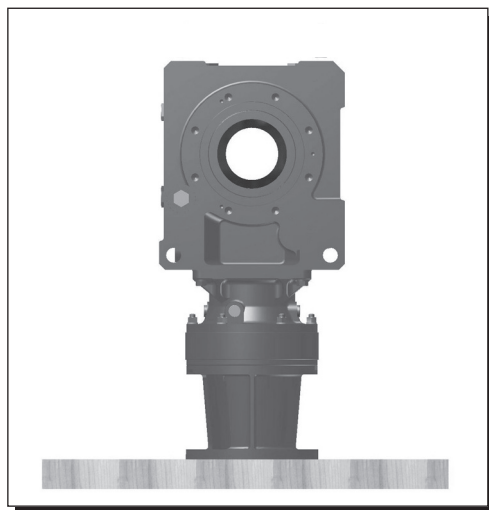
### Cyclo® Portion – General Disassembly

**1**

Before starting the disassembly process, Sumitomo recommends draining and properly disposing of all lubrication.

**2**

Carefully remove the entire Cyclo® BBB4 from the driven shaft by following the instructions outlined in the Removal From Driven Shaft section of this manual.

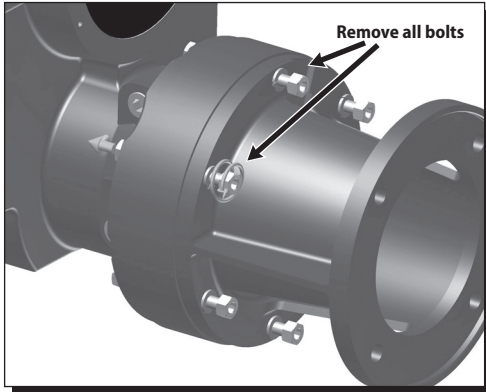


**3**

While carefully supporting the entire unit, place the unit on a level work surface so that the high speed portion (Cyclo® portion) is facing down.

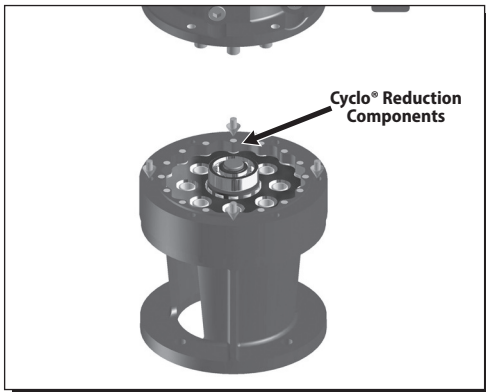
## Cyclo® Portion Disassembly/Assembly, continued

### Disassembly Procedure



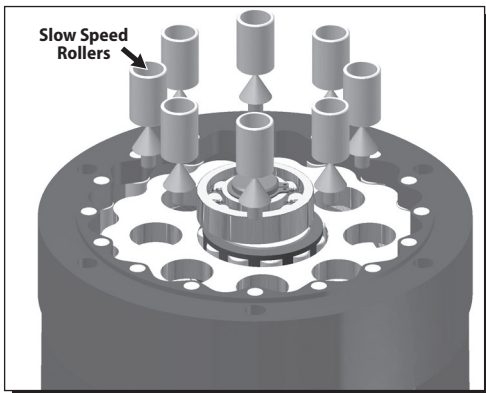
**4**

While continuing to externally support the entire Cyclo® BBB4 unit, remove each of the bolts from the Cyclo® ring gear housing (shown in horizontal position for clarity).



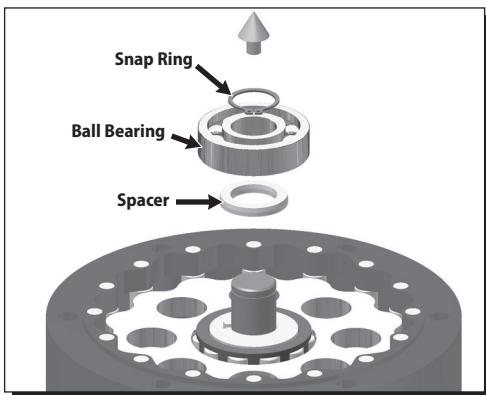
**5**

Carefully separate the **bevel gear housing assembly** from the Cyclo® portion to gain access to the **Cyclo® reduction components**.



**6**

Remove the **slow speed rollers**. Additionally, check the pins on the pin carrier to see if any of the rollers have adhered to them.

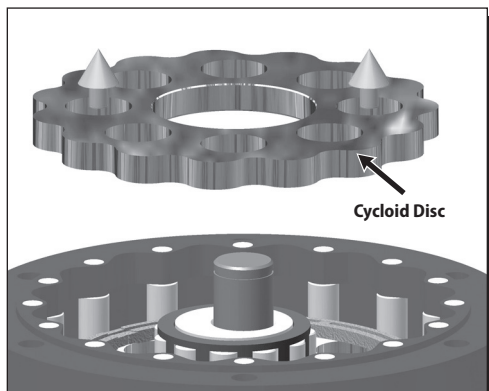
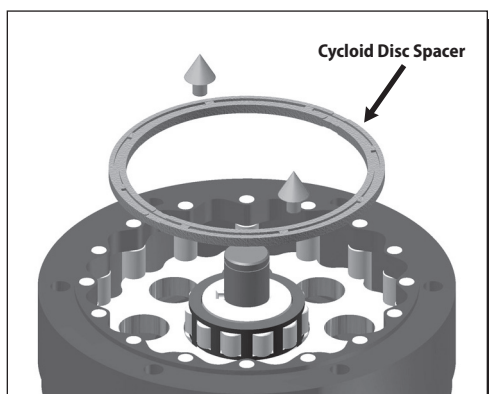
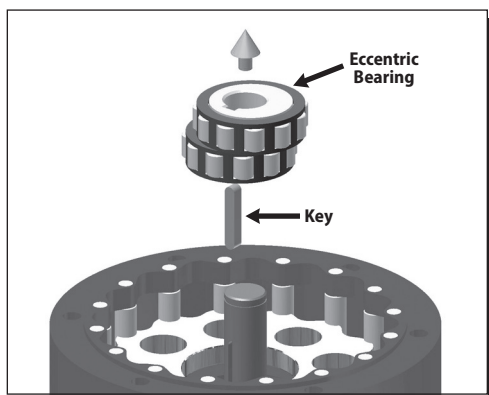
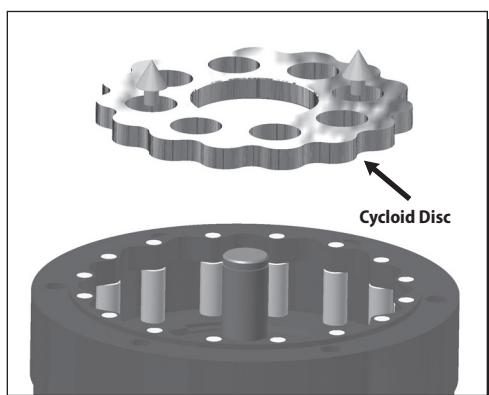


**7**

Remove the **snap ring**, the **ball bearing** and the **spacer** from the high speed shaft.

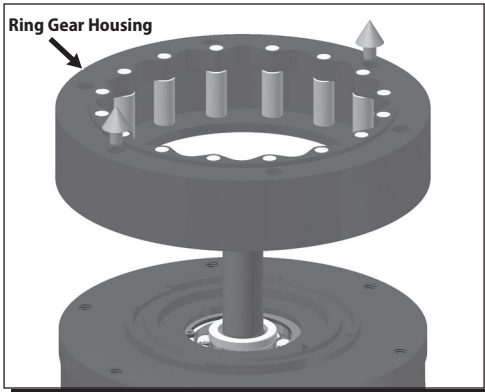
Cyclo® Portion Disassembly/Assembly, *continued*

## Disassembly Procedure

**8**Using both hands, carefully remove the top **Cycloid disc**.**9**For Cyclo® units supplied with a **spacer**, remove the **Cycloidal disc spacer**.**10**Remove the **eccentric bearing** from the high speed shaft.**11**Using both hands, carefully remove the remaining **Cycloid disc**.

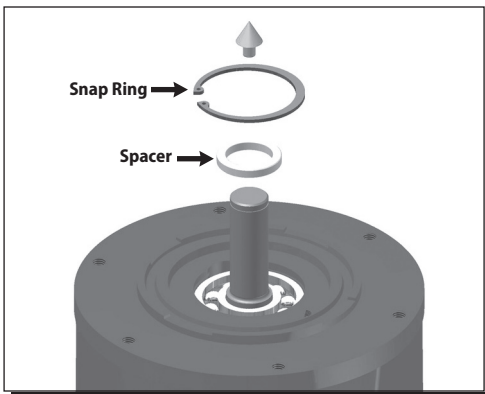
## Cyclo® Portion Disassembly/Assembly, continued

### Disassembly Procedure



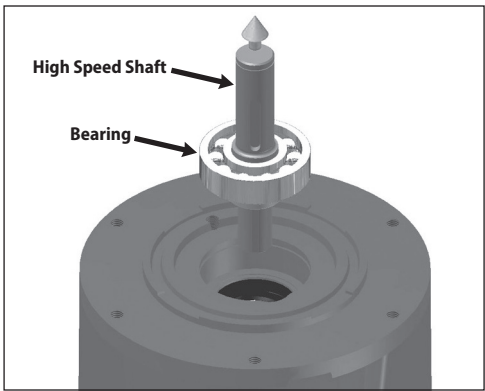
**12**

Remove the **ring gear housing**



**13**

Remove the **spacer** and the **snap ring** from the **high speed end shield**.



**14**

Remove the **high speed shaft**, along with its associated bearing, from the **high speed end shield**.

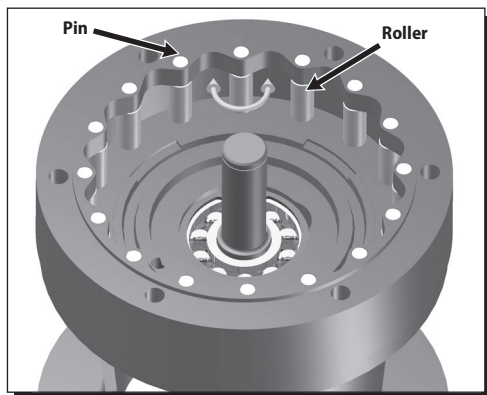
## Cyclo® Portion Disassembly/Assembly, continued

### Reassembly Procedure

## Cyclo® Portion – General Reassembly

The Cyclo® portion of the speed reducer may be reassembled by reversing the disassembly procedure. All parts must be returned to the original order from which they were removed during disassembly. Take care to keep the moving reduction components free of dust or foreign material, and properly align all gaskets in order to keep the assembly oil tight/leak free.

Remember these important notes when assembling the Cyclo® reducer:



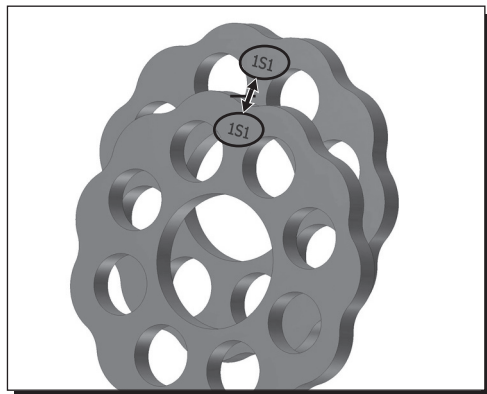
**1**

Place the **ring gear housing** on the Cyclo® **high speed end shield** (or the motor flange) and insert the ring gear housing **pins** and **rollers** (if they had been removed during the disassembly process). Rotate each of the pins and rollers by hand to assure that they freely move/rotate.

If the Cyclo® portion of the Cyclo® BBB4 is grease lubricated, liberally apply grease to the ring gear pins and rollers before they are inserted into the ring gear housing.



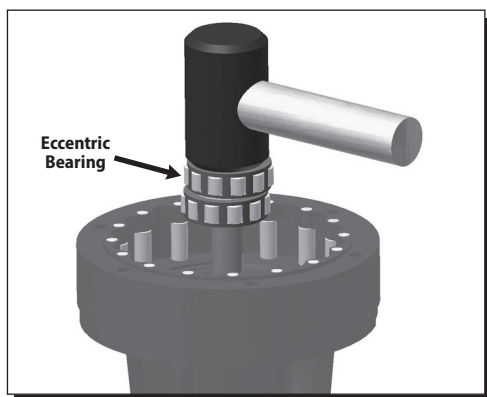
**The Cyclo® portion of the Cyclo® BBB4 unit is oil lubricated – do not apply any grease during the reassembly process.**



**2**

**Cycloid discs** are a matched pair, both discs have the same code etched on one side.

When inserting these discs into the ring gear housing, be sure that the etched number is facing up.



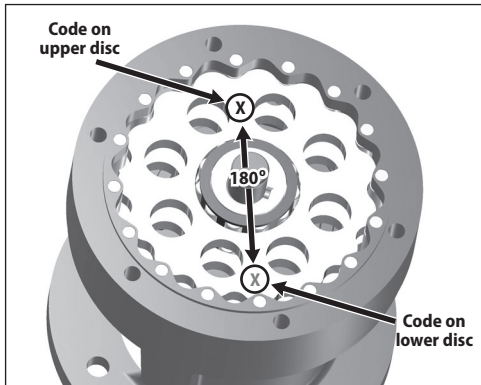
**3**

When reinserting the **eccentric bearing assembly**, use only a wooden or hard rubber mallet to tap it into place.



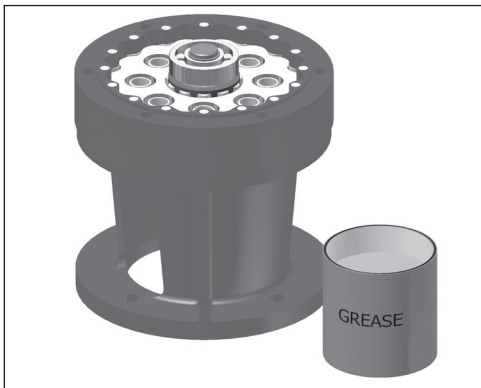
## Cyclo® Portion Disassembly/Assembly, continued

## Reassembly Procedure



## 4

Insert the **top Cycloid disc** so that the code engraved on its surface is 180° opposed to the corresponding etched code on the **lower Cycloid disc**.

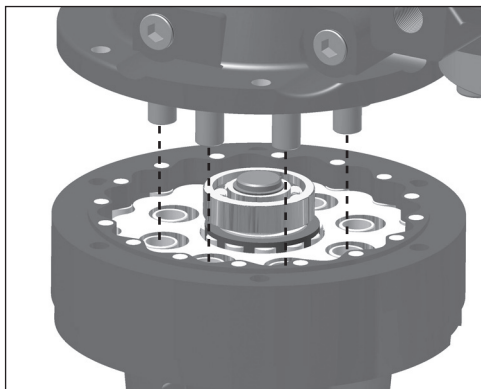


## 5

If the Cyclo® portion of the Cyclo® BBB4 unit is grease lubricated, refill the reduction components with the amount specified in Grease Quantities section of this manual; **or**, fill to 80% of the space around the reduction mechanism and bearings of single reduction units, and 50% of the space around the reduction mechanism of both the first and second stage of double reduction units.



**If the Cyclo® portion of the Cyclo® BBB4 unit is oil lubricated – do not add any grease during the reassembly process.**



## 6

When reassembling the Cyclo® BBB4 gear housing onto the Cyclo® reduction stage, ensure that the **carrier pins** are inserted and aligned with the corresponding bores of the **rollers**.

# Troubleshooting

## Reducer Troubleshooting

### Reducer Troubleshooting

This troubleshooting guide provides assistance in identifying and overcoming common problems with reducers and motors. If a problem with the reducer and/or the motor is not listed below, please consult the factory for assistance.

### Reducer Troubleshooting

| Problem with the Reducer        |   | Possible Causes   | Suggested Remedy  |
|---------------------------------|---|---|---|
| Runs Hot                        | Overloading                               | Load exceeds capacity of the reducer  | Check the rated capacity of the reducer, replace with unit of sufficient capacity or reduce the load  |
|                                 | Improper lubrication                      | Insufficient lubricant  | Check lubricant level and increase to recommended level   |
|                                 |   | Excessive lubricant   | Check lubricant level and reduce to recommended level   |
|                                 |   | Incorrect lubricant   | Flush old lubricant from the unit and refill with correct recommended lubricant   |
| Vibration or Noise              | Loose foundation bolts                    | Weak mounting structure   | Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting & structure  |
|                                 |   | Loose hold-down bolts   | Tighten bolts   |
|                                 | Worn disc and/or bevel gearing            | Load exceeds capacity of reducer  | If bevel gearset is damaged, contact the factory.<br>If Cycloid discs are damaged, disassemble the Cyclo® portion and replace discs.<br>Re-check the rated capacity of the unit                                     |
|                                 | Bearing failure                           | Insufficient lubricant  | If output bearings are damaged, contact the factory<br>If bearings in Cyclo® portion are damaged, replace the affected bearings. Clean & flush the reducer and fill with the correct type and quantity of lubricant |
|                                 |   | Load exceeds capacity of reducer  | Check the rated capacity of the reducer. Replace with unit of sufficient capacity or reduce the driven load   |
|                                 | Insufficient lubricant                    | Insufficient lubricant  | Check lubricant level and adjust to recommended level   |
| Damaged Cyclo® pins and rollers | Load exceeds capacity of reducer          | Disassemble Cyclo® portion of reducer and replace ring gear housing pins and rollers. Check load on reducer |   |
| Output Shaft/Hub does not turn  | Motor shaft broken                        | Load exceeds capacity of reducer or repetitive shock loading  | Replace broken shaft. Check rated capacity of reducer   |
|                                 | Key missing or sheared off on input shaft |   | Replace key   |
|                                 | Eccentric bearing broken                  | Insufficient lubricant  | Replace the Eccentric Bearing in the Cyclo® portion. Flush and refill the unit with the recommended lubricant   |
|                                 | Motor does not turn                       | Motor   | Refer to the "Motor" portion of this Troubleshooting guide  |
| Oil Leakage                     | Worn seals                                | Caused by dirt or grit entering the seal area   | Replace the oil seals   |
|                                 | Leakage into motor                        | Excessive lubricant   | Check the lubricant level and adjust to the recommended level   |
|                                 |   | Air breather clogged  | Clean or replace element, being sure to prevent any dirt from falling into the reducer  |
|                                 |   | Improper mounting position, such as other than designed mounting angle                                      | Mount the unit in its designed mounting angle   |

**Troubleshooting,** continued**Motor Troubleshooting****Motor Troubleshooting**

| Problem with the Motor   |  | Possible Causes  | Suggested Remedy                                     |
|--|--|--|--|
| <b>Load is disconnected but motor does not rotate</b>                        | Makes a "groaning" sound                       | Faulty switch contact                                    | Adjust the contact                                   |
|  |  | Blown fuse   | Replace fuse   |
|  |  | One phase wire of the power supply open                  | Rewire connection                                    |
|  |  | Stator coil open   | Repair by rewinding or replacing the stator assembly |
|  |  | Stator and rotor touching due to bearing housing wear    | Replace the bearing and bracket                      |
|  | Starts in either direction when turned by hand | Three-phase is operating as singlephase                  | Consult the power source with a voltmeter            |
|  | Doesn't make any noise                         | Stator coil open   | Repair by rewinding or replacing stator assembly     |
|  |  | External power failure                                   | Contact the local power company.                     |
| Open connection wire<br>Faulty Switch contact<br>Faulty Starter contact      |  | Check the source wiring<br>Adjust the contacts           |  |
| <b>Rotates with the load disconnected but:</b>                               | Rotates in the wrong direction                 | Connection error   | Change any two of the three-phase source connections |
|  | Fuse blows                                     | Shorted lead wire  | Replace fuse and rewire short                        |
|  | Speed does not increase                        | Faulty starter contact                                   | Replace or adjust starter contact                    |
|  | Makes a "groaning" sound                       | Overcurrent/Overheating due to Rotor and Stator touching | Repair by rewinding or replacing stator assembly     |
|  |  | Overcurrent due to one phase of Stator Coil shorted      | Replace the stator winding                           |
|  | Makes a highpitched "metallic" noise           | Faulty bearing   | Replace the bearing                                  |
| <b>Rotates when the load is disconnected but when the load is connected:</b> | Switch overheats                               | Insufficient switch capacity                             | Replace with switch having the rated capacity        |
|  |  | Overload   | Decrease load to the rated value                     |
|  | Fuse blows                                     | Insufficient fuse capacity                               | Replace with fuse having the rated capacity          |
|  | Overheats                                      | Overload   | Decrease load to rated value                         |
|  |  | Voltage drop   | Consult with local power company                     |
|  | Speed suddenly drops                           | Voltage drop   | Consult with local power company                     |
|  |  | Overload   | Decrease load to rated value                         |
|  | Stops  | Bearing damaged by overheating                           | Replace the bearings                                 |





## Headquarters & Manufacturing

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