

# SM-BEVEL BUDDYBOX SM-HELICAL BUDDYBOX

Right Angle & Parallel Offset

Cyclo Reducer and Gearmotor

Operating and Maintenance Manual



**THE  
AVAILABLE  
SOLUTION,  
WORLDWIDE.**



SM-BEVEL & HELICAL BUDDYBOX

Manual

07.040.60.002

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# MOUNTING SPECIFICATIONS

**Table 1 - Permissible Shaft Tolerance**

Shaft dia.	Tolerance
3/4" - 1 1/8"	+ 0 - .005"
1 3/16" - 2"	+ 0 - .006"
2 1/16" - 3 1/8"	+ 0 - .007"
3 3/16" - 4 3/4"	+ 0 - .008"

Note: Shaft runout TIR should be no greater than .001".

**Table 3 - Stock Bushing Bores**

Size	Inch Sizes	Metric Sizes	Min. Bore **
AA	1 3/16, 1 7/16	30,40	1 3/16
A	1 15/16, 2 3/16	50,55	1 11/16
B	2 3/16, 2 7/16	60,65	1 15/16
C	2 7/16, 2 15/16	65,75	2 3/16
D	2 15/16, 3 7/16	75,85	2 7/16
E	3 7/16, 3 15/16	90,100	2 15/16

\*\* Min. Bore is Also Stock But Needs Slitting.

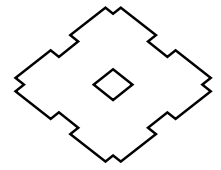
**Table 2 - Bushing Screw Tightening Torques**

Size	Screw Size Qty. & Code	Screw Torque (lb. ft.)
AA	6 X M10 942710	23
A	6 X M12 942727	37.5
B	6 X M12 942727	37.5
C	6 X M16 942735	94
D	6 X M20 942740	180
E	6 X M20 942740	180

**Table 4 - Bushing Bores Tolerances**

Inch	Tolerance	Metric (mm)	Tolerance* (mm)
1 3/16 - 1 15/16	+ .003 / .001	30 - 50	.064 / .025
2 - 2 7/16	+ .003 / .001	50 - 65	.076 / .030
2 1/2 - 3 7/16	+ .003 / .001	65 - 80	.076 / .030
3 1/2 - 3 15/16	+ .003 / .001	80 - 100	.090 / .036

\* Metric Tolerances are F8.



# INSTALLATION – TAPER-GRIP® BUSHING

The Sumitomo Taper-Grip® bushing is a keyless (shrink disk type) shaft/hub locking device integrated into the shaft mounted right angle (SM-Bevel Buddybox) and parallel offset (SM-Helical Buddybox) reducer and gearmotor product lines.

The unique patented design has a number of benefits for the user:

- “Easy on and easy off” mounting and removal of the drive to and from the shaft of the driven machine.
- No key required for torque transmission.
- Backlash free torque transmission.
- No shaft weakening by a key way.
- Tight tolerances not required for shaft machining.
- Automatic axial fixation of the drive on the shaft in any position.
- Shaft can be adjusted prior to final mounting in any position.

**NOTE:** Similar to all shrink disk type devices. It is essential to properly assemble and tighten the mounting bolts. Carefully follow the Sumitomo instructions for selection and installation in order to avoid any slippage. Incorrect mounting or slippage of the bushing will impair function and removal of the drive.

## Fitting the Reducer on the Shaft (Bushing type)

1. Check the size and condition of the shaft to which the reducer will be fitted. Permissible shaft tolerances are given in Table 1 (previous page).
2. Ensure all mating surfaces of the hub, the inside and outside diameters of the Taper-Grip® bushing and the shaft are free from burrs and corrosion. Clean each surface with a solvent to remove all traces of grease and oil.
3. Lightly oil each screw and insert into the bushing flange; ensure they do not protrude beyond the rear face. See Fig. 1.
4. Insert the face keys of the thrust collar into the slots on hub and center. Screw the Taper-Grip® bushing into the hub in a clockwise direction until the flange contacts the thrust collar. See Fig. 2.
5. Unscrew the Taper-Grip® bushing until the screws are aligned with the pockets in the face of the thrust collar and a gap of 1 mm minimum exists between the flange and thrust collar. This may be easier if one of the screws is removed and the pocket viewed through the threaded hole. Finger tighten all screws into the pockets. See Fig. 3.
6. Slide the reducer onto the shaft at least as far as the counter bore in the Taper Grip® bushing. See Fig. 4. For correct mounting alignment, be sure that bushing and shaft are aligned and the drive weight is supported during the entire installation procedure. Gradually tighten each screw in a star pattern to the torque levels shown in Table 2. A torque wrench is required. Proper tightening usually distorts the thrust collar.

7. Grease fill the cavity between the bushing counterbore and shaft to prevent a build-up of corrosion on the shaft end that may affect subsequent removal of the reducer. Do this after assembling the unit. See Fig. 5.

8. Install the torque arm assembly if one is used. See Installing the Torque Arm. (Page 24)

**NOTE:** Be sure to use a torque arm or other device to prevent rotation when mounting by shaft only.

9. After mounting is complete, the SM-Bevel or Helical Buddybox can then be filled with oil. Please follow proper guidelines for oil lubrication.

10. After the reducer has been running for 20 to 30 hours, retorque the screws to the values in Table 2 using a torque wrench. Screw torques should be checked at normal service intervals (every 6 months).

Fig. 1

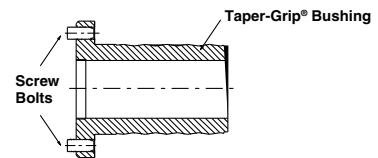


Fig. 2

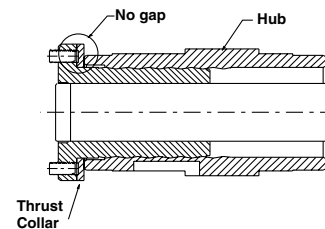


Fig. 3

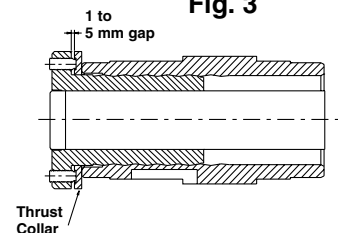


Fig. 4

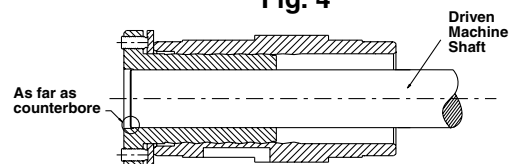
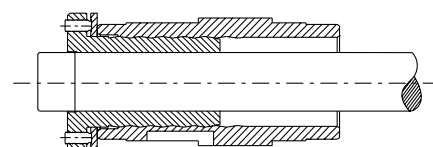


Fig. 5



# REDUCER REMOVAL – TAPER-GRIP® BUSHING

Follow these steps to remove the reducer from the shaft.

1. Ensure that the reducer is supported and cannot fall free when the grip of the Taper-Grip® bushing is released.
2. Release each screw gradually until they are free from the pockets of the thrust collar.
3. If the Taper-Grip® bushing does not self release, give the flange a sharp tap with a brass or copper mallet to break free the taper. This will free the reducer from the shaft. Be careful not to damage the tapped holes.
4. Hand tighten two screws against the thrust collar before attempting to slide the reducer off the shaft. This will stop the hub from pulling up the opposite taper flanks of the Taper-Grip® bushing and prevent it from relocking on the shaft as the reducer is removed.
5. Slide the reducer from the shaft. If corrosion or paint prevents the reducer from sliding off the shaft, it is possible to utilize two of the screw holes to secure a puller plate to the bushing.

# INSTALLATION – KEYED HOLLOWSHAFT

Mounting procedure:

1. Smear the surface of the shaft (e) with molybdenum disulfide compound. See Fig. 6.
2. Turn nut (b) and slide the reducer over the driven shaft. Install spacer (c) if necessary.
3. After mounting the reducer on the shaft, install bolt (f) and washer. See Fig. 7.

**NOTE:** The bore should be protected by a cover (g).

4. If the driven shaft does not have a shoulder, a spacer (h) should be used. See Fig. 8.

Removal procedure:

1. Remove mount bolt (n). Attach bolt (j) to spacer (d) and turn bolt (j) to remove the hollow shaft from the driven shaft. See Fig. 9.

**NOTE:** Parts a through j and n are not provided by Sumitomo.

Fig. 6

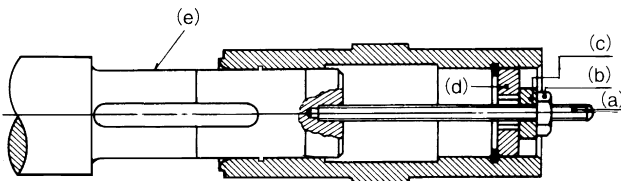


Fig. 8

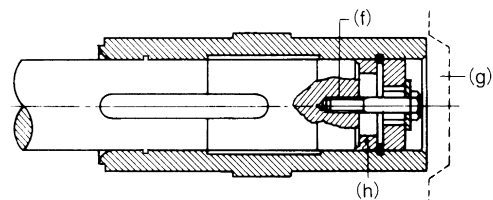


Fig. 7

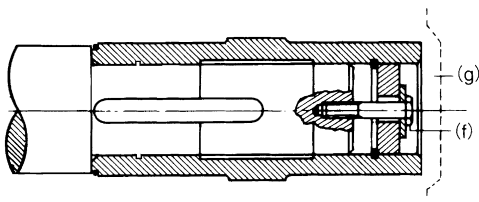
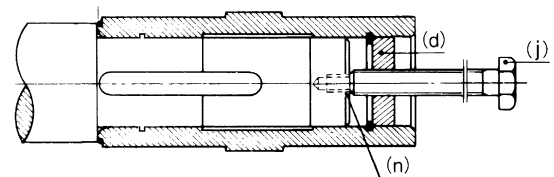
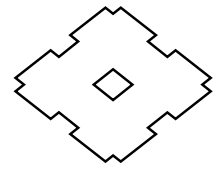


Fig. 9

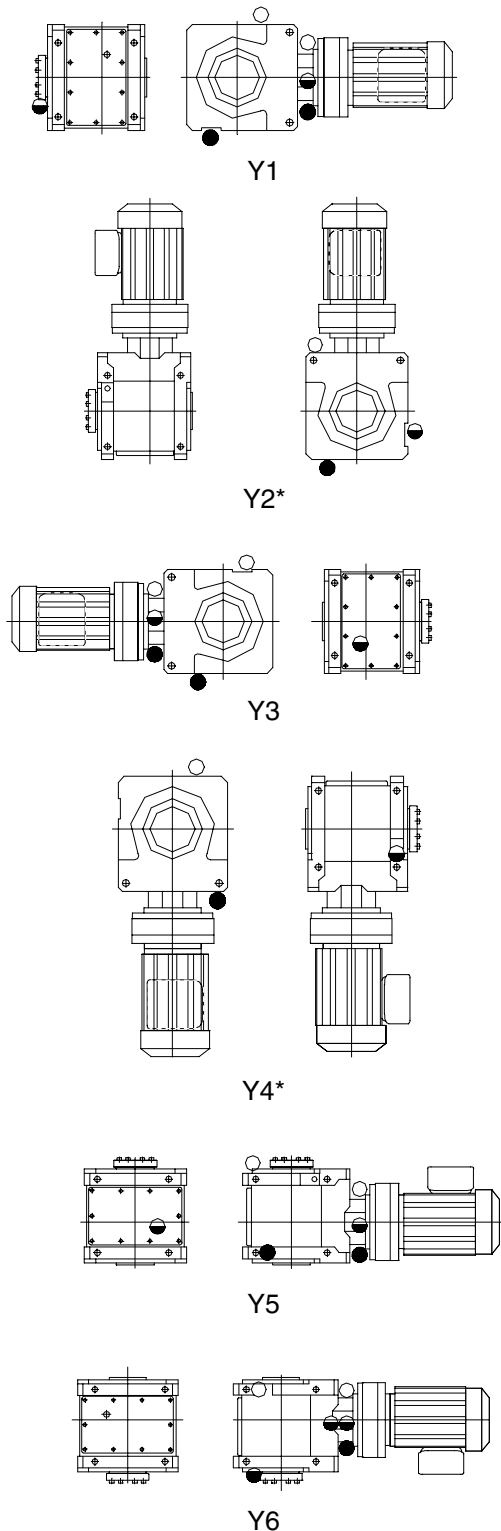




# BEVEL PORTION LUBRICATION

SM-Bevel Buddybox (BBB Series “L”) reducers and gearmotors are shipped without oil. Before running, they should be filled with the appropriate amount of the correct lubricant for their mounting position – see Tables 5 and 6. Please consult the factory for additional information not covered here.

**Fig. 10 Mounting Positions**



**Table 5 Recommended Oil for SM-Bevel Buddybox & Cyclo**

Ambient Temp.	14°F-32°F (-10°C-0°C)	32°F-95°F (0°C-35°C)	95°F-122°F (35°C-50°C)
Viscosity @ 104°F (40°C) cST	61.2 - 74.8	90 - 165	198 - 506
ISO Viscosity Grade	68	100 - 150	220 - 460
AGMA Viscosity Grade	2EP	3EP 4EP	5EP 7 EP
Viscosity @ 100°F (38°C) SSU	284 - 347	417 - 765	916 - 2719

**Table 6 Oil Quantity (In gallons)**

Bevel Buddybox size	Oil Quantity - gear						Oil Quantity - Cyclo					
	Y1	Y2	Y3	Y4	Y5	Y6	Y1	Y2	Y3	Y4	Y5	Y6
A	0.24	0.24	0.27	0.24	0.35	0.27	G	G	G	G	G	G
B	0.40	0.35	0.40	0.40	0.53	0.43	G	G	G	G	G	G
C	0.79	0.79	0.79	0.79	0.79	1.06	0.11	G	0.11	G	0.11	0.11
D	1.37	1.37	1.37	1.37	1.37	1.77	0.19	G	0.19	G	0.19	0.19
E	1.98	1.98	1.98	1.98	1.98	2.50	0.24	G	0.24	G	0.24	0.24

G = Grease

## Oil Replenishment and Change Interval

- Maintain proper oil levels at all times.
- Check oil quantity every 2500 hours. If the oil is contaminated, burned or waxed, change the oil immediately and flush if necessary.
- Under normal operating conditions, Sumitomo recommends an oil change every 5000 hours of operation. The intervals should not exceed 2 years.
- An oil change after the first 500 hours of operation is highly recommended.
- If the unit will be running in a high ambient, high humidity, or corrosive environment, the lubricant will have to be changed more frequently. Consult the factory for recommendations.
- NOTE: The Cyclo portion and Bevel portion, where applicable, must be filled with oil separately. Oil does not flow from one section to the other.**

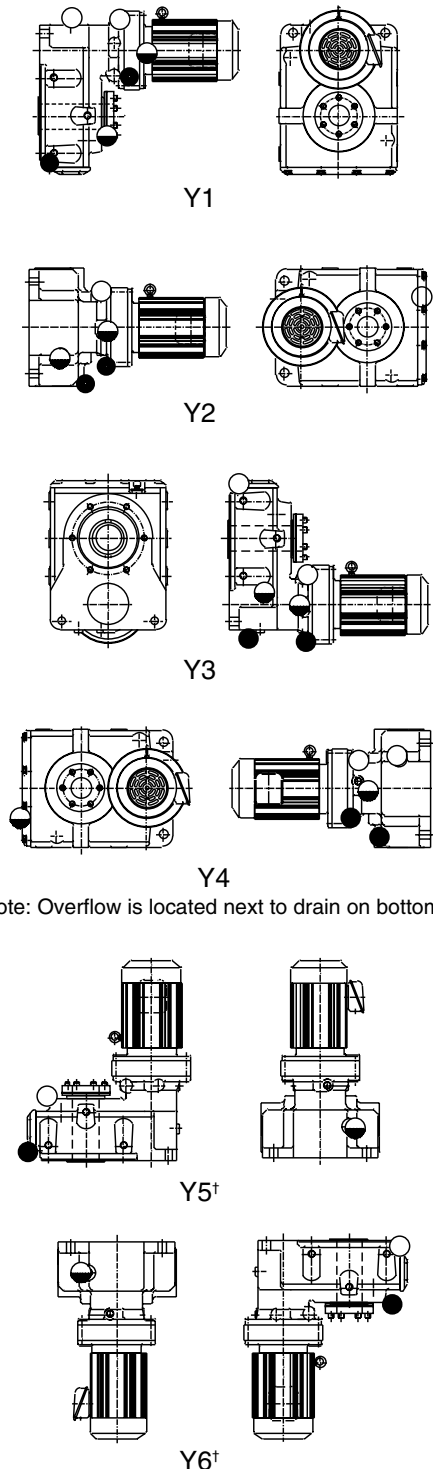
\* Consult factory for Y2 and Y4 mounting.

- Oil Drain Plug
- ◐ Oil Overflow Plug (Oil Level)
- Oil Fill Plug

# HELICAL PORTION LUBRICATION

SM-Helical Buddybox (HBB series “E”) reducers and gearmotors are shipped without oil. Before running, they should be filled with the appropriate amount of the correct lubricant for their mounting position – see Tables 7 and 8. Please consult the factory for additional information not covered here.

**Fig. 11 Mounting Positions\***



Note: Overflow is located next to drain on bottom.

\*Note: For Flange units, the Y is replaced with an F.  
 † Consult factory for Y5 and Y6 mounting.

**Table 7 Recommended Oil for SM-Helical Buddybox & Cyclo**

Ambient Temp.	14°F-32°F (-10°C-0°C)	32°F-95°F (0°C-35°C)	95°F-122°F (35°C-50°C)
Viscosity @ 40°C (104°F) cST	61.2 - 74.8	90 - 165	198 - 506
ISO Viscosity Grade	68	100 - 150	220 - 460
AGMA Viscosity Grade	2EP	3EP 4EP	5EP 7 EP
Viscosity @ 100°F (38°C) SSU	284 - 347	417 - 765	916 - 2719

**Table 8 Oil Quantity (In gallons)**

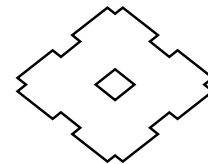
Helical Buddybox Size	Output side (HBB)						Input side (Cyclo)					
	Y1	Y2	Y3	Y4	Y5	Y6	Y1	Y2	Y3	Y4	Y5	Y6
AA	0.16	0.16	0.13	0.16	0.29	0.26	G	G	G	G	G	G
A	0.21	0.24	0.18	0.24	0.40	0.37	G	G	G	G	G	G
B	0.26	0.40	0.26	0.40	0.53	0.48	G	G	G	G	G	G
C	0.45	0.55	0.34	0.55	1.24	0.92	0.11	0.11	0.11	0.11	G	G
D	0.71	0.92	0.53	0.92	1.85	1.45	0.18	0.18	0.18	0.18	G	G
E	0.92	1.11	0.66	1.11	2.38	1.85	0.24	0.24	0.24	0.24	G	G

G = Grease

## Oil Replenishment and Change Interval

- Maintain proper oil levels at all times.
- Check oil quantity every 2500 hours. If the oil is contaminated, burned or waxed, change the oil immediately and flush if necessary.
- Under normal operating conditions, Sumitomo recommends an oil change every 5000 hours of operation. The intervals should not exceed 2 years.
- An oil change after the first 500 hours of operation is highly recommended.
- If the unit will be running in a high ambient, high humidity, or corrosive environment, the lubricant will have to be changed more frequently. Consult the factory for recommendations.
- NOTE: The Cyclo portion and Helical portion, where applicable, must be filled with oil separately. Oil does not flow from one section to the other.**

- Oil Drain Plug
- ◐ Oil Overflow Plug (Oil Level)
- Oil Fill Plug



# CYCLO PORTION LUBRICATION

The information on this page applies only if the Cyclo portion is grease lubricated. Standard Cyclo lubrication is oil, except for Models AA, A and B, and double reduction Cyclos.

**Table 9 Designated Greases**

For additional information, please refer to Lubrication Specification Sheet No. 03.301.63.001.

Ambient Temperature F° (C°)	Single Reduction (Maintenance Free)	Double Reduction
-5 ~ 122 (-15 ~ 50)	NLGI No. 2	NLGI No. 2

**Table 10 Grease Replenishment and Change Interval (Cyclo)**

Model	Condition		Interval
Single & Double Reduction (Maintenance Free Type)	Replenishment		NOT REQUIRED
	*Overhaul		Every 20,000 Hours or Every 4 ~ 5 Years
Double Reduction (Non-Maintenance Free Type)	Replenishment	Less Than 10 Hours Per Day Operation	Every 3 ~ 6 Months
		10 ~ 24 Hours Per Day	Every 500 ~ 1000 Hours
	Change	Speed Reduction Mechanism, High Speed Shaft Bearings (Speed Reducer Type)	Every 2 ~ 3 Years

\*Overhauling consists of disassembling the unit, replacing the seals and gaskets, cleaning the internal parts, and then repacking the unit with designated grease.

**Note 1:** Frame sizes 4085-4125 are maintenance free units. Grease replenishment is not necessary. Where longer life of the drive is expected or if relubricating is preferred before recommended period of time, refer to Tables 9, 10 and 11.

**Table 11 Quantities of Grease (Ounces)**

Frame Size	4085	4090 4095 4097	4100 4105 410H	4110 4115 4125
Speed Reduction Mechanism	.7	2.1	3.5	8.5

Frame Size	4105DA	4115DB	4135DC	4145DB	4165DC*	4175DC*
Speed Reduction Mechanism (First Stage)	0.7	2.1	2.3	1.4	5.3	
Speed Reduction Mechanism (Second Stage)	3.5	8.5	15.9	15.9	26.5	35.3

\*Note: These units oil lubricated as standard.

**Note 1:** Replenish grease to the reduction mechanism 1/3 to 1/2 of quantities for the first reduction stage described in Table 11 in accordance with replenishment interval recommended in Table 10.

**Note 2:** When the unit is disassembled for overhauling, refill with grease in quantities indicated in Table 11. Or alternatively, 80% of the space around reduction mechanism and slow speed shaft bearings of single reduction units and 50% around reduction mechanism of both first and second stage of double reduction units.

Slightly larger quantities may be supplied to lower reduction ratio units, and somewhat smaller quantities for high reduction ratio units.

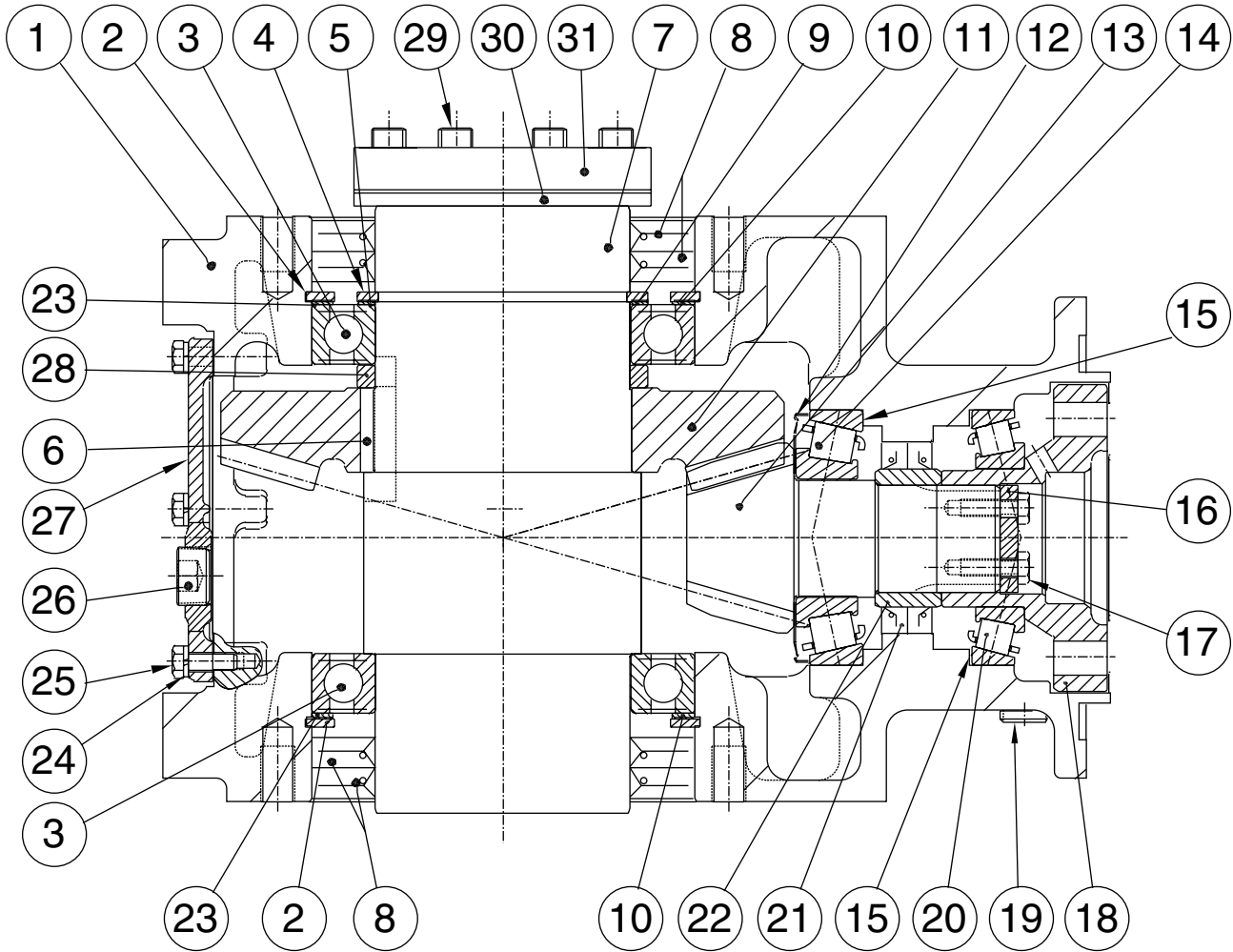
Apply grease liberally to the central part (i.e., around the eccentric bearings) of the mechanism. Apply grease to both the slow speed and high speed shaft bearings as you would do to ordinary bearings at time of re-assembly.

**Note 3:** If excessive grease is added, agitation heating of the grease will raise the operating temperature of the unit. Avoid excessive greasing; however, when the grease is insufficient it will raise the operating temperature due to the breakdown of the lubrication films on the eccentric bearing.

If the operating temperature rises, supply grease immediately.

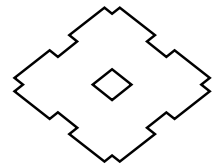
# GENERAL CONSTRUCTION BEVEL GEAR CASE

Fig. 12





# GENERAL CONSTRUCTION BEVEL PARTS LIST



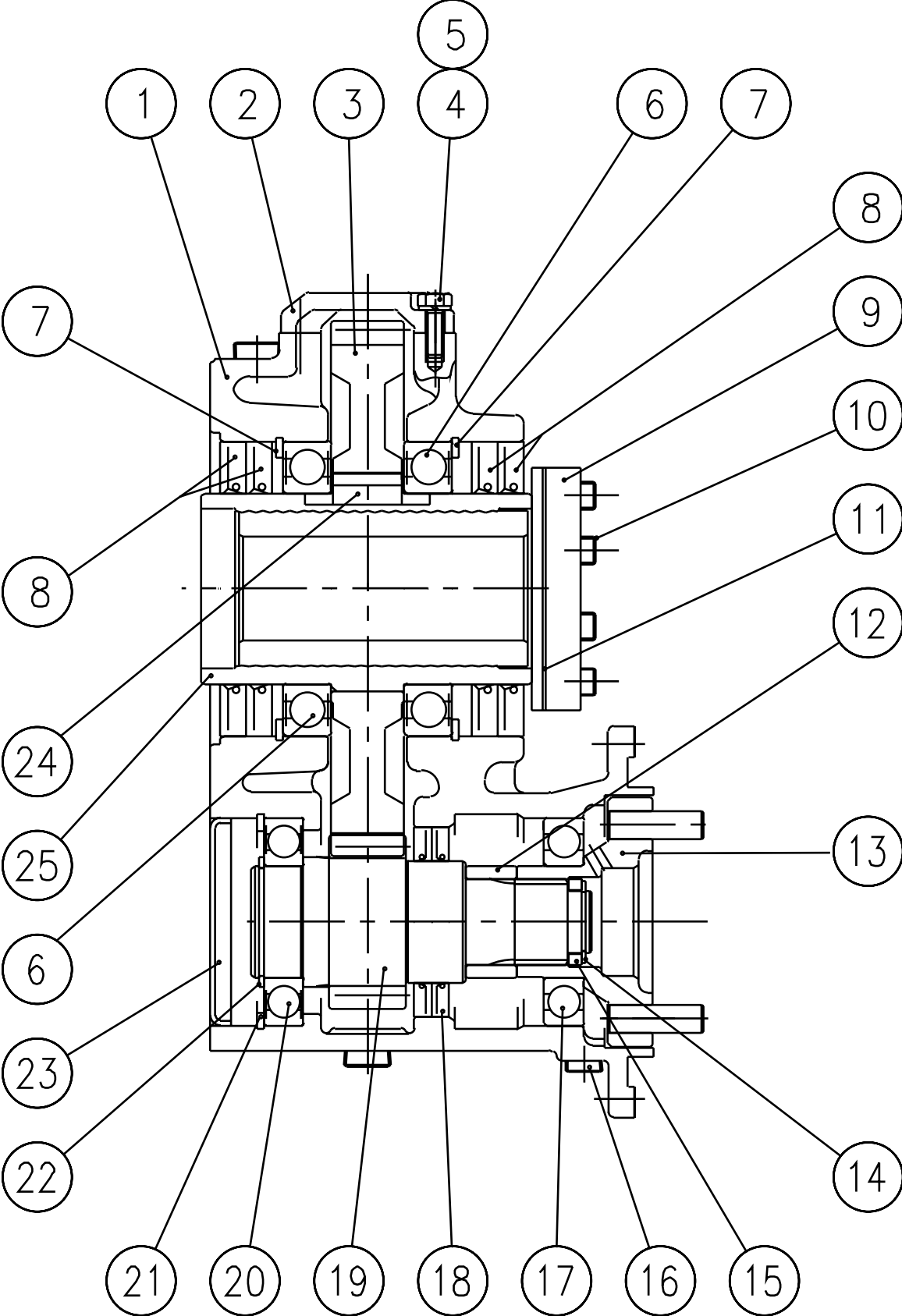
**Table 12 Parts Code Numbers**

REF	DESCRIPTION	QTY	A CODE	B CODE	C CODE	D CODE	E CODE
1	HOUSING	1	AE357LG	AE358LG	AE359LG	AE360LG	AE361LG
2	RETAINING RING	2	241K130—NG	241K150—NG	241K180—NG	241K210—NG	241K240—NG
3	BALL BEARING	2	5006017ZZ	5006020ZZ—G	5006024ZZ—G	5006025ZZ—G	5006032ZZ—G
4	RETAINING RING	1	240K085—NG	240K100—NG	240K120—NG	240K140—NG	240K160—NG
5	SHIM SET	1	284S8600950*G	284SA1011000*G	284SC051350*G	284SE101550*G	284SG201780*G
6	KEY	1	233C2214018NG	233C2514028NG	233C2816040NG	233C3218050NG	233C3620060NG
7	T. G. B. OUTPUT HUB	1	BK649LG	BK650LG	BK646LG	BK651LG	BK652LG
8	OIL SEAL	4	531N8513010-G	531N10015013G	531N12018015G	531N14021015G	531N16024015G
9	SPACER	1	AW4657G	AW4658G	AW4659G	AW4660G	AW4661G
10	SPACER	2	AW4650G	AW4651G	AW4652G	AW4655G	AW4656G
11	BEVEL GEAR	1	AN7148G	AN7149G	AN7150G	AN7151G	AN7152G
12	NILOS RING	1	50530307AV—G	50532309AV—G	50530311AV—G	50530313AV—G	50530315AV—G
13	PINION SHAFT	1	BK478LG	BK478LG	BK480LG	BK481LG	BK482LG
14	TAPER ROLLER BEARING	1	503T4T30307-G	503T4T32309-G	503T4T30311-G	503T30313U—G	503T30315U—G
15	SHIM SET	2	284S8200890*G	284S9000990*G	284SA551190*G	284SB601290*G	284SE001590*G
16	END PLATE (RETAINING RING)	1	(240K030—NG)	(240K036—NG)	AW4569G	AW4570G	AW4571G
17	HEX HEAD BOLT	4	—	—	AW4600G	AW4601G	AW4602G
18	PIN CARRIER	1	BK483LG	BK484LG	BK485LG	BK486LG	BK487LG
19	SOCKET HEAD PLUG	4	343C002R—NG	343C002R—NG	343C008R—NG	343C008R—NG	343C008R—NG
20	TAPER ROLLER BEARING	1	503T4T32011XG	503T4T32012XG	503T4T30213-G	503T32215U—G	503T30218U—G
21	OIL SEAL	2	530N45629—G	530N50689—G	530N659012—G	530N8511013-G	530N9512013-G
22	COLLAR	1	AW4500G	AW0984G	AW2688G	AW2869G	AW4501G
23	SHIM SET	2	284SB601290*G	284SD501490*G	284SG501790*G	284SJ002090*G	284SM002390*G
24	SPRING WASHER	10 (6 <sub>1</sub> )	062W008—NG	062W008—NG	062W008—NG	062W010—NG	062W012—NG
25	HEX HEAD BOLT	10 (6 <sub>1</sub> )	001S008R025NG	001S008R025NG	001S008R025NG	001S010R030NG	001S012R035NG
26	SOCKET HEAD PLUG	7	343C008R—NG	343C008R—NG	343C012R—NG	343C012R—NG	343C012R—NG
27	COVER	1	AN7143G	AN7144G	AN7145G	AN7146G	AN7147G
28	SPACER	1	AW4505G	AW4506G	AW4507G	AW4508G	AW4509G
29	BUSH SCREW	6	942881	942881	942890	942900	942900
30	THRUST PLATE	1	016E6146	016F6146	016G66146	016H6146	016J6146
31	TAPER-GRIP, BUSHING	1	As Required	As Required	As Required	As Required	As Required
32	TORQUE ARM ASSEMBLY <sup>2</sup>	1	040A0001	040B0001	040C0001	040D0001	040E0001

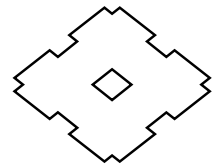
Notes: 1. If disassembly and/or reassembly are required, please consult factory.  
2. Item 32 is not shown.

# GENERAL CONSTRUCTION HELICAL GEAR CASE

Fig. 13



# GENERAL CONSTRUCTION HELICAL PARTS LIST



**Table 13 Parts Code Numbers**

REF	DESCRIPTION	QTY	AA CODE	A CODE	B CODE	C CODE	D CODE	E CODE
1	CASING	1	AE362LG	AE363LG	AE364LG	AE365LG	AE366LG	AE367LG
2	COVER	1	AN7195G	AN7196G	AN7197G	AN7198G	AN7199G	AN7200G
3	GEAR	1	AN7201G	AN7202G	AN7203G	AN7204G	BK504LG	BK505LG
4	HEX HEAD BOLT	8	001S006R020ZG	021S008R025ZG	021S008R025ZG	021S010R030ZG	021S012R040ZG	021S012R040ZG
5	SPRING WASHER	8	062W006---ZG	INCLUDED WITH REF. #4	INCLUDED WITH REF. #4	INCLUDED WITH REF. #4	INCLUDED WITH REF. #4	INCLUDED WITH REF. #4
6	BALL BEARING	2	5006013ZZ---G	5006017ZZ---G	5006020ZZ---G	5006022ZZ---G	5006026ZZ---G	5006030ZZ---G
7	RETAINING RING (INTERNAL)	2	241K100---NG	241K130---NG	241K150---NG	241K170---NG	241K200---NG	241K225---NG
8	OIL SEAL	4	D-65x100x10	D-85x130x10	D-100x150x13	D-110x170x15	D-130x200x15	D-150x225x15
9	TAPER GRIP BUSHING	1	AS REQ.	AS REQ.	AS REQ.	AS REQ.	AS REQ.	AS REQ.
10	BUSHING SCREW	6	942710	942727	942727	942735	942740	942740
11	THRUST PLATE	1	016C6146	016E6146	016F6146	016G6146	016H6146	16J6146
12	PINION SHAFT SPACER	1	AW4544G	AW4545G	AW4546G	AW4547G	AW4548G	AW4549G
13	PIN CARRIER	1	BK503LG	BK483LG	BK484LG	BK485LG	BK486LG	BK487LG
14	RETAINING RING (EXTERNAL)	1	240K035---NG	240K026---NG	240K036---NG	240K036---NG	240K045---NG	240K055---NG
15	PINION SHAFT SPACER	1	-	-	-	AW4502G	AW4503G	AW4504G
16	HEX SOCKET HEAD PLUG	1	AT1287G	AT1287G	AT1287G	343C008R---G	343C008R---G	343C008R---G
17	BALL BEARING	1	5006011----G	50016011----G	5006013----G	5006213----G	5006215----G	5006218----G
18	OIL SEAL	2	S-40x80x10	S-40x80x10	S-55x90x10	S-70x110x10	S-80x128x13	S-95x145x13
19	PINION SHAFT	1	BK506LG	BK507LG	BK508LG	BK509LG	BK510LG	BK511LG
20	BALL BEARING	1	5006207ZZ---G	5006208ZZ---G	5006211ZZ---G	5006213ZZ---G	5006216ZZ---G	5006218ZZ---G
21	RETAINING RING (INTERNAL)	1	241K072---NG	241K080---NG	241K100---NG	241K120---NG	241K140---NG	241K160---NG
22	RETAINING RING (EXTERNAL)	1	240K026---NG	240K040---NG	240K055---NG	240K065---NG	240K080---NG	240K090---NG
23	SEAL CAP	1	413KCAP729--G	413KCAP809--G	413KCAP10010G	413KCAP12010G	413KCAP14009G	413KCAP16015G
24	KEY (SQUARE END)	1	233C1610014NG	233C2214018NG	233C2514028NG	233C3218040NG	233C3620050NG	233C4022060NG
25	OUTPUT HUB	1	037L6107	037A6107	037B6107	037C6107	037D6107	037E6107
26	HEX SOCKET HEAD PLUG	4	343C008R---NG	343C008R---NG	343C008R---NG	343C012R---NG	343C012R---NG	343C012R---NG

Please state full unit part number and serial number when ordering replacement parts.

# GENERAL CONSTRUCTION

## CYCLO PARTS LIST

### Cyclo Reducer Input Section

Fig. 14 Single Reduction

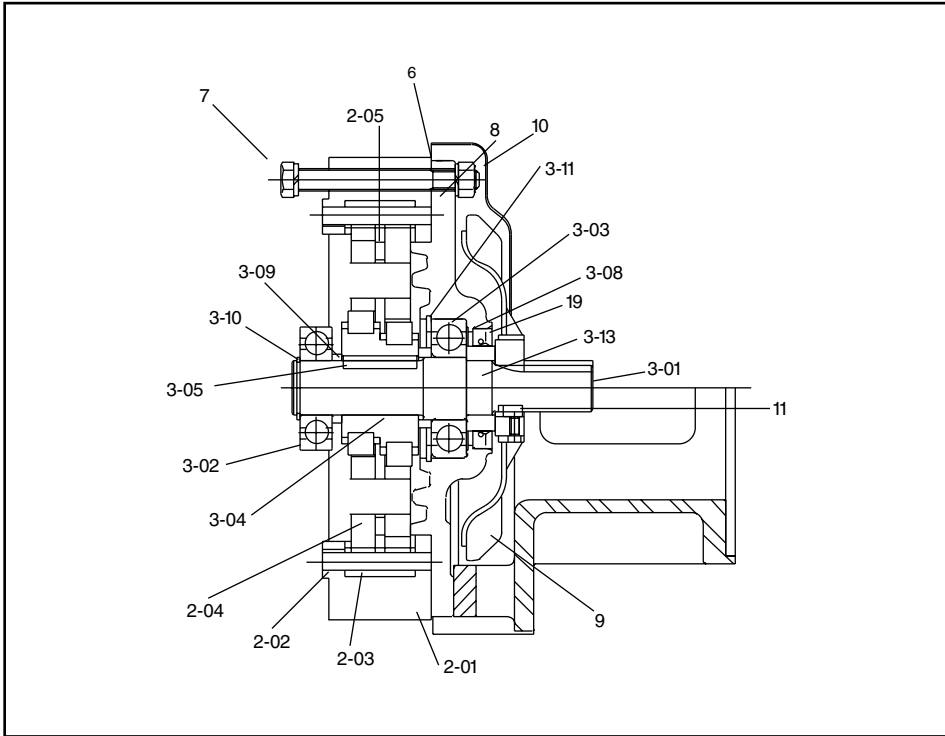


Fig. 15 Double Reduction

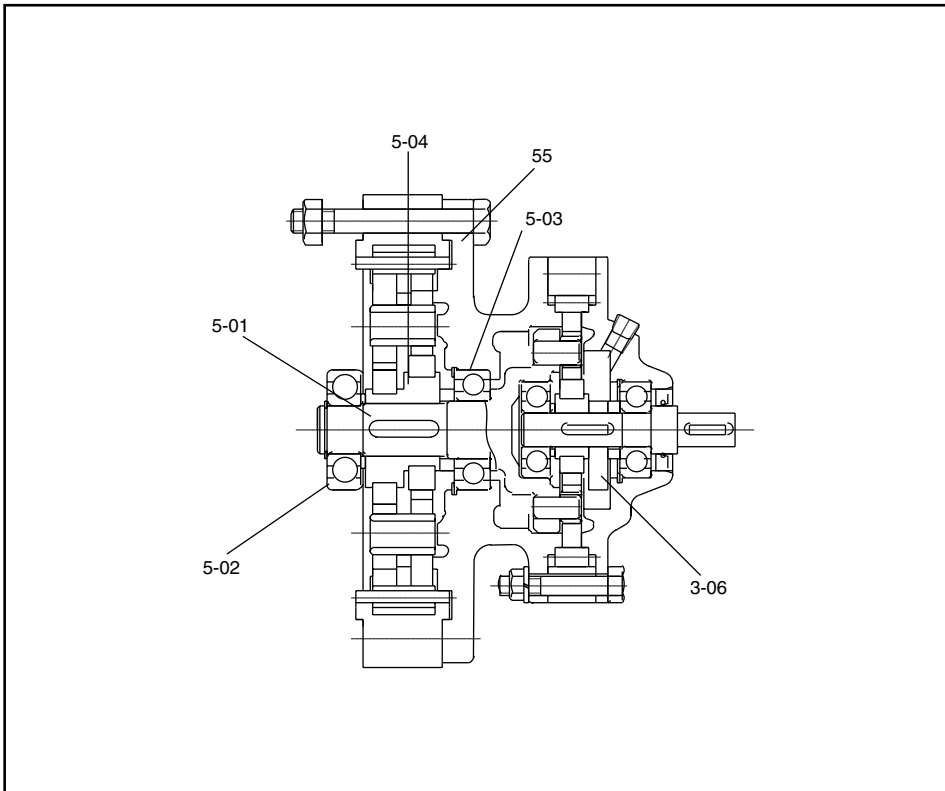
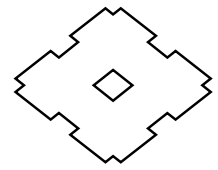


Table 14 Main Parts

Part No.	Part Name
2-01	Ring Gear Housing
2-02	Ring Gear Pins
2-03	Ring Gear Rollers
2-04	Cyclo Disc
2-05	Spacer Ring
3-01	High Speed Shaft
3-02	Bearing C
3-03	Bearing D
3-04	Eccentric CAM Assembly
3-05	Eccentric Key
3-06	Balance Weight*
3-08	Spacer
3-09	Spacer
3-10	Retaining Ring
3-11	Retaining Ring
3-13	Collar
5-01	Intermediate Shaft w/Pins
5-02	Bearing F
5-03	Bearing G
5-04	Eccentric CAM Assembly
6	Gasket Set
7	Casing Nuts & Bolts
8	High Speed End Shield
9	Cooling Fan & Set Screw
10	Fan Cover
11	Fan Key
19	High Speed Input Oil Seal
55	Intermediate Cover

\*Single disc unit only.



# BEARINGS, OIL SEALS, GASKETS

Figure 16

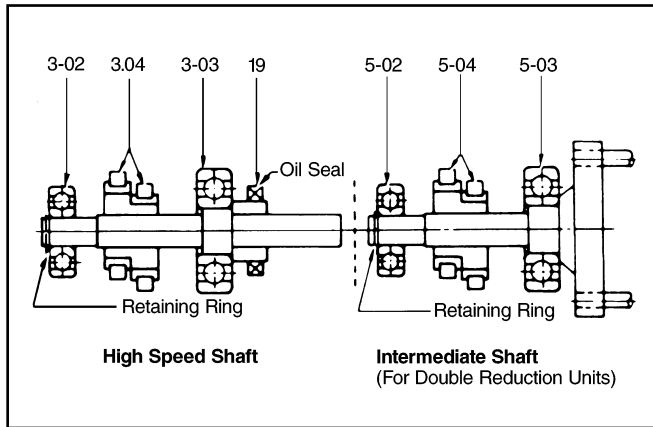


Figure 17

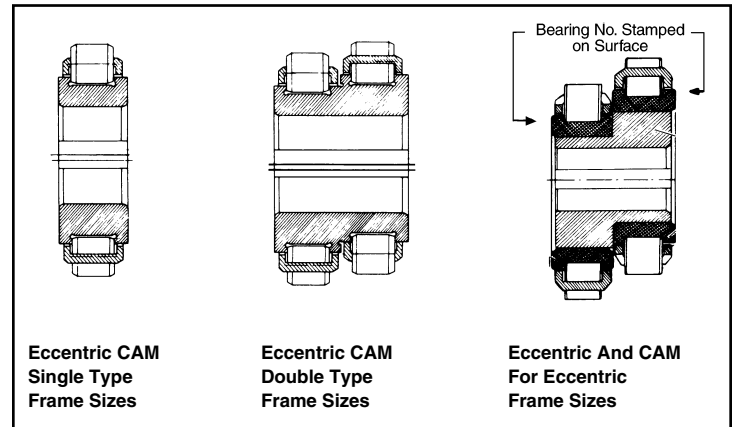


Table 15 Single Reduction Units

Frame Size	BEARINGS				OIL SEAL				
	HIGH SPEED SHAFT				HIGH SPEED SHAFT				
	Part No. 3-02	Part No. 3-04	Part No. 3-03	Part No. 19					
	Number	Number	Qty.	Number	Speed	Type	Dimension	Qty.	
4085	6301	19UZS208T2	1	6301Z	S	17/30x6	1		
4090/05/07	6302RSH2	Refer to Table 17	1	6302Z	S	20/35x7	1		
4100/05	6302			6302Z	S	20/35x7	1		
410H	6302			6302Z	S	20/35x7	1		
4110/15/25	6304			6305Z	D	32/52x8	1		
4130/35	6305			6306	D	38/58x11	1		
4145/55	6305R			6306	D	38/58x11	1		
4160/65	6307R			6308	D	55/78x12	1		
416H	6307R			6308	D	55/78x12	1		
4170/75	6406			60UZS-417T2-SX	2	6407	D	60/82x12	1

Table 16 Double Reduction Units Intermediate Shaft Parts

Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04	Part No. 5-03	
	Number	Number	Qty	Number
4105DA	6302	Refer to Table 17	1	6007
4115DB	6304			6205
4135DC	6305			6206
4145DB	6305			6206
4165DC	6307R			6208
4175DC	6406			60UZS417T2-SX

Table 17 Eccentric Bearing Identification Number

Frame Size	4090 4095 4097	4100 4105 410H 4105DA	4110 4115 4125 4115DB	4130 4135 4135DC	4145 4145DB	4155	4160 4165 4165DC	416H
Ratio \ Part No.	3-04							
6	15UZE20906T2	15UZ21006T2	22UZ2110608T2	25UZ21406-11T2	-	25UZ8506-11T2S	35UZ2160608T2S	35UZ2160608T2S
8	15UZE20908-15T2	15UZ21008-15T2	22UZ2110608T2	25UZ21406-11T2	-	25UZ8506-11T2S	35UZ2160608T2S	35UZ2160608T2S
11	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ21406-11T2	25UZ21406-11T2	25UZ8506-11T2S	35UZ21611-15T2S	35UZ21611-15T2S
13	15UZE20908-15T2	15UZ21008-15T2	22UZ2111317T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21611-15T2S	35UZ21611-15T2S
15	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21611-15T2S	35UZ21611-15T2S
17	15UZE20917T2	15UZ21017T2	22UZ2111317T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21617-25T2S	35UZ21617-25T2S
21	15UZE20921T2	15UZ21021T2	22UZ21121T2	25UZ2142125/417T2	25UZ2142125/417T2	25UZ852125/417T2S	35UZ21617-25T2S	35UZ21617-25T2S
25	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ2142125/417T2	25UZ2142125/417T2	25UZ852125/417T2S	35UZ21617-25T2S	35UZ21617-25T2S
29	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ2142935T2	25UZ2142935T2	25UZ852935T2S	35UZ2162935T2S	35UZ2162935T2S
35	15UZE20935T2	15UZ21035T2	22UZ21135T2	25UZ2142935T2	25UZ2142935T2	25UZ852935T2S	35UZ2162935T2S	35UZ2162935T2S
43	15UZE20943T2	15UZ21043T2	22UZ21143T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ2164351T2S	35UZ2164351T2S
51	15UZE20951/ 814359T2	15UZ21051/ 824359T2	22UZ2115159T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ2164351T2S	35UZ2164351T2S
59	15UZE20959T2	15UZ21059T2	22UZ2115159T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ21659T2S	35UZ21659T2S
71	15UZE20971/ 8187T2	15UZ21071/ 8287T2	22UZ2117187T2	25UZ2147187T2	25UZ2147187T2	25UZ857187T2S	35UZ21671/ 659T2S	35UZ21671/ 659T2S
87	15UZE20987T2	15UZ21087T2	22UZ2117187T2	25UZ2147187T2	25UZ2147187T2	25UZ857187T2S	35UZ21687T2S	35UZ21687T2S
119	15UZE209119T2	15UZ210119T2	-	-	-	-	-	-

# CYCLO – DISASSEMBLY/ASSEMBLY

## Disassembly

**SM-CYCLO® reducers are designed for easy disassembly and reassembly...they require no special maintenance skills.**

The following procedures and precautions are recommended for disassembly and assembly:

- Perform work in a dust-free, humidity-free area.
  - Use a soft or plastic hammer when required.
  - Take care not to damage parts, i.e., coil, bearings, seals, etc.
  - Inspect all components and replace as necessary.
  - Be extremely careful when handling bearings.
1. Remove the complete SM-CYCLO® reducer with adaptor (motorized type) from the driven machine.
  2. Remove the cooling fan cover and fan from the speed reducer (not motorized) equipped with a cooling fan, and stand the unit on a solid base with its high speed shaft side down. Remove the through bolts for the high speed end shield, ring gear housing, thus separating the Cyclo from the bevel gear case so that the inner mechanism can be removed (Figs. 18-23).
- Note:** If the reducer is motorized (C-adaptor and coupling), remove the motor and coupling before following the procedure outlined above. As a final step, remove the adaptor and cooling fan.
3. Take out the slow speed shaft rollers (Fig. 19).  
Check the slow speed shaft pins to see whether any rollers have adhered to them.

4. Using both hands, lift out the top cycloid disc (2-04) on the slow speed side (Fig. 20).
5. Remove the spacer ring (2-05).
6. The eccentric (3-04) can be removed from the high speed shaft (3-01) after taking out the retaining ring (3-10) and the inner bearing raceway (Figs. 21, 22).

**Note:** In certain sizes, the eccentric bearings are roller bearings without a retainer. Remove bearings of the top disc before proceeding with the next step.

7. Take out the second disc located on the motor side. (Also remove second disc bearings and eccentric with inner bearing raceway if required.)
8. Remove the ring gear housing (2-01).
9. Remove the high speed shaft (3-01) with bearings from the high speed shaft end shield (8) by tapping the shaft end after taking off the retaining ring (3-11).
10. The cycloid disc is made from heat-treated bearing steel and the spacer ring is cast iron. Take care not to strike them together while handling.

These instructions cover complete disassembly. In ordinary cases, however, only the removal of the cycloid discs and the eccentric is necessary.

**\*Note:** Retaining ring is part of bearing A.

Fig. 18



Fig. 19



Fig. 20



Fig. 21



Fig. 22

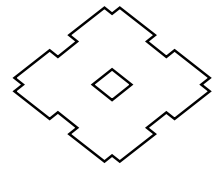


Fig. 23



**Note:** Insert second disc with number facing slow speed side, exactly 180° opposed to number on first disc.

**Note:** Set disc with number facing slow speed side.



# Assembly

SM-CYCLO® reducers are reassembled by reversing the disassembly procedure. Care must be taken to exclude dust or foreign matter from the moving parts, and to ensure that gaskets are properly placed for an oil-tight assembly.

The following are helpful points to remember when assembling SM-CYCLO® reducers.

1. Set the ring gear housing and insert the ring gear pins and rollers; then test-rotate the pins and rollers by hand. (Apply grease liberally to the ring gear pins and rollers before they are inserted in grease lubricated SM-CYCLO® reducers.)
2. Cycloid discs are a matched pair. Each carries the same number stamped on one side of the disc.
3. Set the cycloid disc with the stamped number face up as shown in Fig. 23.
4. Insert the spacer (3-07) and then insert the eccentric with bearings by rapping with a wooden or hard rubber mallet (Fig. 22).
5. Insert the second spacer and the inner bearing raceway. Secure them with the retaining ring (Fig. 21).
6. Set the spacer ring in place.
7. **Insert the top disc in such a way that the mark is 180° opposed to the mark on the bottom disc (Fig. 20).**
8. Insert the slow speed shaft rollers (Fig. 19).
9. Put the slow speed shaft pins into the rollers. The instructions above are for eccentric bearings with retainer. Following are the instructions suggested for roller bearings without retainer.
  - a. Insert the eccentric with inner raceways of bearings by rapping with a wooden or hard rubber mallet.
  - b. Apply grease to the raceway of the eccentric on the disc. Fix the rollers and set disc in place.
  - c. Insert the spacer ring and set the second disc in such a way that the mark is 180° opposed to the mark on the bottom disc.

## Eccentric CAM Replacement Precautions

The eccentric bearings are specially designed for installation on SM-CYCLO® reducers. They are special roller bearings without outer raceways (refer to the list of bearings on page 11).

Replacement bearings for the inner raceways must be inserted with the numbered surfaces facing outward. Note that improper insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes damage.

## Disassembly and Assembly of Sizes 4075-4097 SM-CYCLO® Reducers

Small sizes, 4075-4097, are single disc systems, so they differ in construction from larger sizes in the following ways:

1. A balance weight is provided in lieu of the two-disc system.
2. The balance weight keyway must be in line with the eccentric keyway.
3. There are no end plates on either side of the eccentric. In all other respects, 4075-4097 have exactly the same construction as the larger sizes. Follow the instructions given in the “Disassembly and Assembly” sections.

# GENERAL CONSTRUCTION – PARTS LIST

## Cyclo Gearmotor Input Section

Fig. 24 Single Reduction

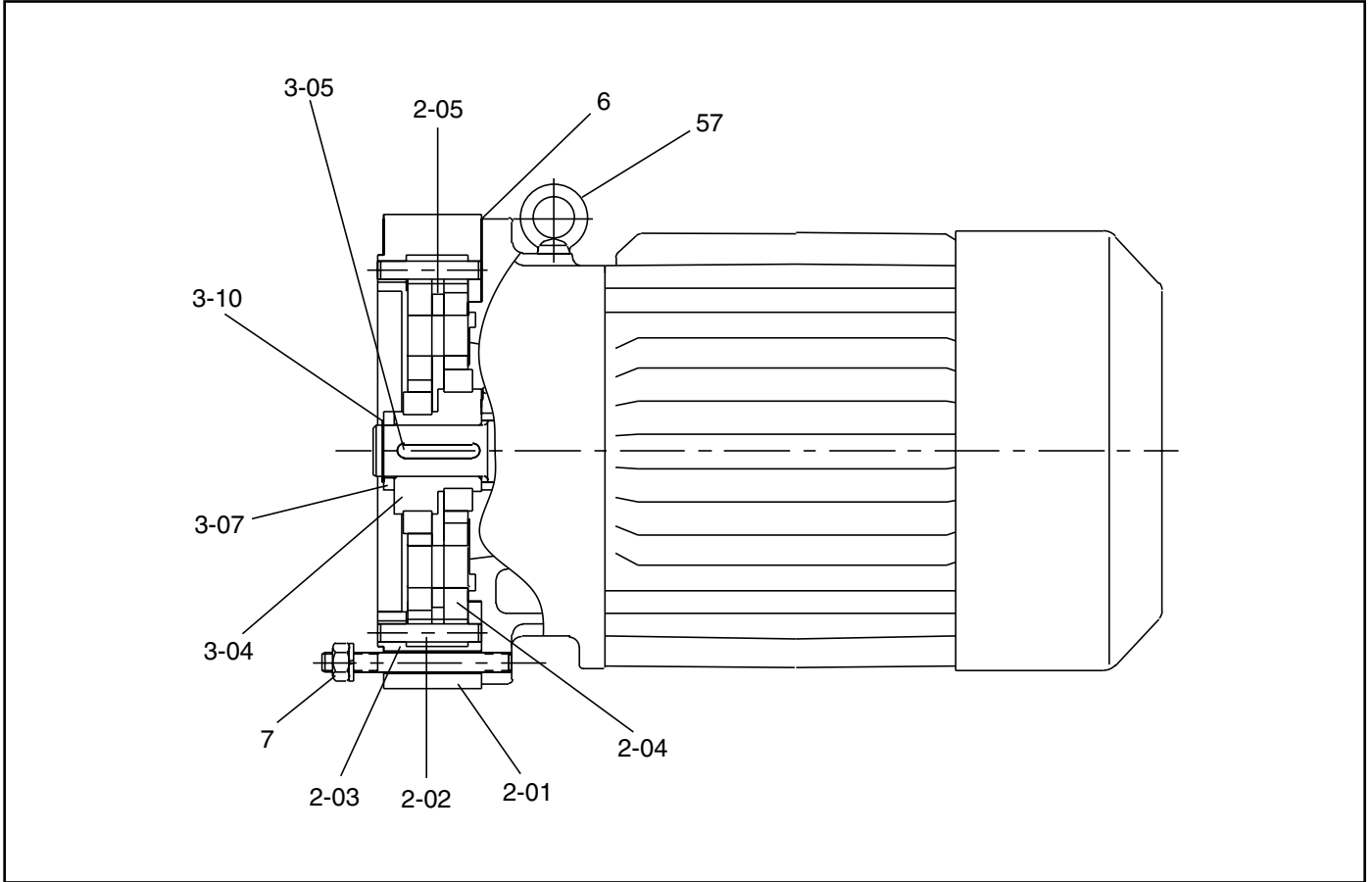
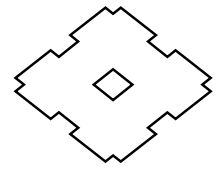


Table 18 Main Parts

Part No.	Part Name
2-01	Ring Gear Housing
2-02	Ring Gear Pins
2-03	Ring Gear Rollers
2-04	Cyclo Disc
2-05	Spacer Ring
3-04	Eccentric Bearing Assembly
3-05	Eccentric Key
3-06	Balance Weight
3-07	Spacer
3-10	Retaining Ring
6	Gasket Set
7	Casing Nuts & Bolts
57	Eye Bolt





# BEARINGS, OIL SEALS, GASKETS

Fig. 25

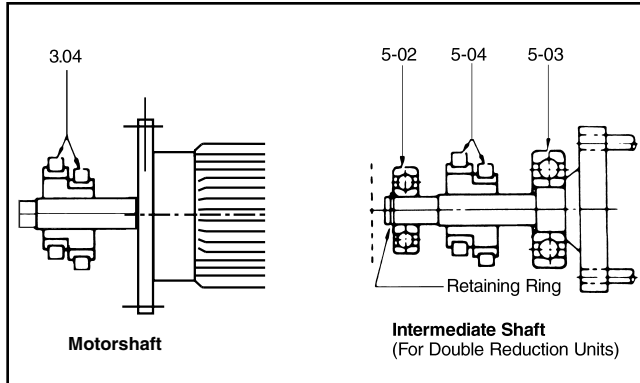


Fig. 26

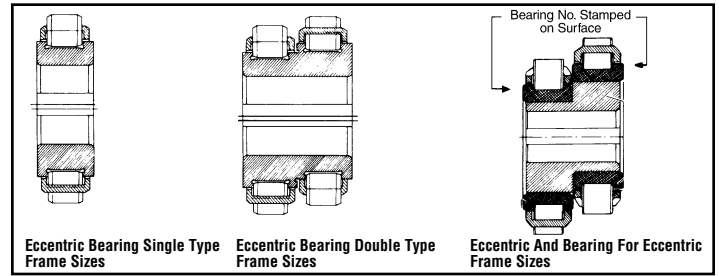


Table 19 Single Reduction Units

Frame Size	BEARING	
	MOTOR SHAFT	
	Part No. 3-04	
	Number	Qty
4085	19UZS208T2	1
4090/05/07	Refer to Table 21	1
4100/05		
410H		
4110/15/25		
4130/35		
4145/55		
4160/65		
416H		
4170/75	60UZS-417T2-SX	2

Table 20 Double Reduction Units Intermediate Shaft Parts

Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04	Part No. 5-03	
	Number	Number	Qty	Number
4105DA	6302	Refer to Table 21	1	6007
4115DB	6304			6205
4135DC	6305			6206
4145DB	6305			6206
4165DC	6307R			6208
4175DC	6406			6208
		60UZS417T2-SX	2	

Table 21 Eccentric Bearing Identification Number

Frame Size	4090 4095 4097	4100 4105 410H 4105DA	4110 4115 4125 4115DB	4130 4135 4135DC	4145 4145DB	4155	4160 4165 4165DC	416H
Ratio \ Part No.	3-04							
6	15UZE20906T2	15UZ21006T2	22UZ2110608T2	25UZ21406-11T2	-	25UZ8506-11T2S	35UZ2160608T2S	35UZ2160608T2S
8	15UZE20908-15T2	15UZ21008-15T2	22UZ2110608T2	25UZ21406-11T2	-	25UZ8506-11T2S	35UZ2160608T2S	35UZ2160608T2S
11	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ21406-11T2	25UZ21406-11T2	25UZ8506-11T2S	35UZ21611-15T2S	35UZ21611-15T2S
13	15UZE20908-15T2	15UZ21008-15T2	22UZ2111317T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21611-15T2S	35UZ21611-15T2S
15	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21611-15T2S	35UZ21611-15T2S
17	15UZE20917T2	15UZ21017T2	22UZ2111317T2	25UZ21413-17T2	25UZ21413-17T2	25UZ8513-17T2S	35UZ21617-25T2S	35UZ21617-25T2S
21	15UZE20921T2	15UZ21021T2	22UZ21121T2	25UZ2142125/417T2	25UZ2142125/417T2	25UZ852125/417T2S	35UZ21617-25T2S	35UZ21617-25T2S
25	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ2142125/417T2	25UZ2142125/417T2	25UZ852125/417T2S	35UZ21617-25T2S	35UZ21617-25T2S
29	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ2142935T2	25UZ2142935T2	25UZ852935T2S	35UZ2162935T2S	35UZ2162935T2S
35	15UZE20935T2	15UZ21035T2	22UZ21135T2	25UZ2142935T2	25UZ2142935T2	25UZ852935T2S	35UZ2162935T2S	35UZ2162935T2S
43	15UZE20943T2	15UZ21043T2	22UZ21143T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ2164351T2S	35UZ2164351T2S
51	15UZE20951/ 814359T2	15UZ21051/ 824359T2	22UZ2115159T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ2164351T2S	35UZ2164351T2S
59	15UZE20959T2	15UZ21059T2	22UZ2115159T2	25UZ21443-59T2	25UZ21443-59T2	25UZ8543-59T2S	35UZ21659T2S	35UZ21659T2S
71	15UZE20971/ 8187T2	15UZ21071/ 8287T2	22UZ2117187T2	25UZ2147187T2	25UZ2147187T2	25UZ857187T2S	35UZ21671/ 659T2S	35UZ21671/ 659T2S
87	15UZE20987T2	15UZ21087T2	22UZ2117187T2	25UZ2147187T2	25UZ2147187T2	25UZ857187T2S	35UZ21687T2S	35UZ21687T2S
119	15UZE209119T2	15UZ210119T2	-	-	-	-	-	-

# CYCLO GEARMOTOR – DISASSEMBLY/ASSEMBLY

## Disassembly

SM-CYCLO® gearmotors are designed for easy disassembly and reassembly...they require no special maintenance skills.

The following procedures and precautions are recommended for disassembly and assembly:

- Perform work in a dust-free, humidity-free area.
  - Use a soft or plastic hammer when required.
  - Take care not to damage parts, i.e., coil, bearings, seals, etc.
  - Inspect all components and replace as necessary.
  - Be extremely careful when handling bearings.
1. Remove the complete SM-CYCLO® gearmotor from the driven machine.
  2. Place the gearmotor in the vertical position with the output shaft upward.
  3. Remove the through bolts from the motor flange, ring gear housing, and lift the slow speed side, thus separating the unit into two parts so that the inner mechanism can be removed (Figs. 27-32).
  4. Take out the slow speed shaft rollers (Fig. 28). Check the slow speed shaft pins to see whether any rollers have adhered to them.

5. Using both hands, lift out the top cycloid disc (2-04) on the slow speed side (Fig. 29).
6. Remove the spacer ring (2-05).
7. The eccentric bearing assembly (3-04) can be removed from the motor shaft after taking out the retaining ring (3-10), or the bearings (3-02) (Figs. 30, 31).

- Note:** In certain sizes, the eccentric bearings are roller bearings without a retainer. Remove rollers of the top disc and the second disc on the motor side before removing the eccentric.
8. Take out the second disc located on the motor side.
  9. Remove the ring gear housing (2-01) from the motor.
  10. The cycloid disc is made from heat-treated bearing steel and the spacer ring is cast iron. Take care not to strike them together when handling.
- \*Note:** If motor needs repair, please send to any authorized EASA shop.

Fig. 27

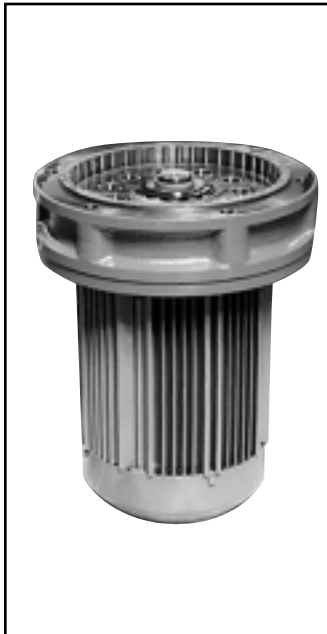


Fig. 28



Fig. 31



Fig. 29

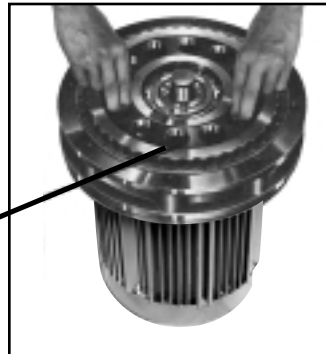
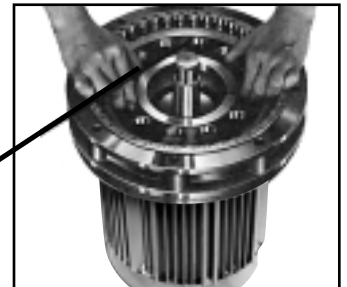


Fig. 30

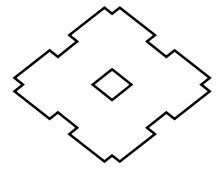


Fig. 32



**Note:** Insert second disc with number facing slow speed side, exactly 180° opposed to number on first disc.

**Note:** Set disc with number facing slow speed side.



# Assembly

SM-CYCLO® gearmotors are reassembled by reversing the disassembly procedure. Care must be taken to exclude dust or foreign matter from the moving parts, and to ensure that gaskets are properly placed for an oil-tight assembly.

Following are some helpful points to remember when assembling SM-CYCLO® gearmotors.

1. Set the ring gear housing and insert the ring gear pins and rollers; then test-rotate the pins and rollers by hand. (Apply grease liberally to the ring gear pins and rollers before they are inserted in grease lubricated SM-CYCLO® gearmotors.)
2. Cycloid discs are a matched pair. Each carries the same number stamped on one side of the disc.
3. Set the cycloid disc with the stamped number face up as shown in Fig. 32.
4. Insert the eccentric bearing by rapping with a wooden or hard rubber mallet (Fig. 31).
5. Insert the spacer and the inner bearing raceway. Secure them with the retaining ring (Fig. 30).
6. Set the spacer ring in place.
7. **Insert top disc in such a way that the mark is 180° opposed to the mark on the bottom disc (Fig. 29).**
8. Insert the slow speed shaft rollers (Fig. 28).
9. Put the slow speed shaft pins into the rollers (Fig. 27). The instructions above are for eccentric bearings with retainer. Following are the instructions suggested for roller bearings without retainer:
  - a. Insert the eccentric with inner raceways of bearings by rapping with a wooden or hard rubber mallet.

- b. Apply grease to the raceway of the eccentric on the disc. Fix the rollers and set disc in place.
- c. Insert the spacer ring and set the second disc in such a way that the mark is 180° opposed to the mark on the bottom disc.

## Eccentric Bearing Replacement Precautions

The eccentric bearings are specially designed for installation on SM-CYCLO® reducers. They are special roller bearings without outer raceways (refer to the list of bearings on page 15).

Replacement bearings for the inner raceways must be inserted with the numbered surfaces facing outward. Note that improper insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes damage.

## Disassembly and Assembly of Sizes 4075-4097 SM-CYCLO® Reducers

Small sizes, 4075-4095, are single disc systems, so they differ in construction from larger sizes in the following ways:

1. A balance weight is provided in lieu of the two-disc system.
2. The balance weight keyway must be in line with the eccentric keyway.
3. There are no end plates on either side of the eccentric. In all other respects, they have exactly the same construction as the larger sizes. Follow the instructions given in the “Disassembly and Assembly” section.

# STANDARD CYCLO INTEGRAL MOTOR CHARACTERISTICS

## Motor Characteristics

The SM-Bevel and Helical Buddybox gearmotors' full load ratings and amperage can be found below in Table 22. These ratings are based on the motor's design values. If additional information is required, please consult factory.

**Table 22 — 230/460 Volt, Synchronous Speed 1800 rpm, 60 Hz, Continuous Duty, TEFC**

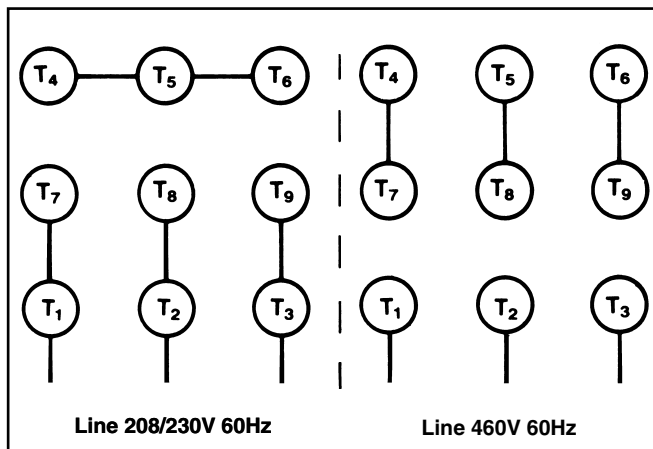
HP	Frame Size	Full Load rpm	Full Load Torque in. lb.	Full Load Current Amperage			Starting Current Amperage		Torque % of F.L. Break-down	Efficiency %	Power Factor %	Code Letter*	Inertia WR <sup>2</sup> lb. ft <sup>2</sup>	
				230V	460V	208V	230V	460V						
1/4	F-63M	1730	9.06	1.1	0.60	1.1	5.2	2.6	300	293	69.8	65.2	K	0.0119
1/2	F-71M	1740	18.3	2.1	1.1	2.0	9.8	4.9	295	280	71.9	65.1	J	0.0154
3/4	F-80S	1730	27.4	2.5	1.2	2.5	12.3	6.2	266	245	76.9	73.0	H	0.0227
1	F-80	1750	36.0	3.4	1.7	3.4	17.6	8.8	269	303	77.2	72.3	H	0.0285
1.5	F-90S	1730	54.7	4.6	2.3	4.7	28.6	14.3	273	281	80.3	74.1	J	0.0451
2	F-90L	1740	72.5	6.0	3.0	6.2	36.8	18.4	263	270	82.3	75.6	J	0.0504
3	F-100L	1730	109	8.4	4.2	8.7	54.8	27.4	277	266	84.4	77.2	J	0.0789
5	F-112M	1730	183	13.0	6.5	13.7	91.5	45.8	308	279	86.3	82.4	J	0.201
7.5	F-132S	1710	277	18.1	9.0	20.1	120	61	223	221	86.7	88.2	H	0.271
10	F-132M	1740	361	23.6	11.8	26.4	147	73.5	212	214	89.6	88.9	G	0.635
15	F-160M	1740	542	34.3	17.2	38.2	231	115	248	221	90.5	89.0	G	0.891
20	G-160L	1740	725	45.8	22.9	51	272	136	222	220	91.6	89.9	F	2.13
25	G-180M	1770	891	57	28.4	63	343	171	199	235	92.6	88.2	F	5.34
30	G-180M	1760	1075	68	34.2	77	388	194	192	226	91.5	88.1	F	5.34

\*Code letter shown is for 230V or 460V operation. Consult factory for other voltages.

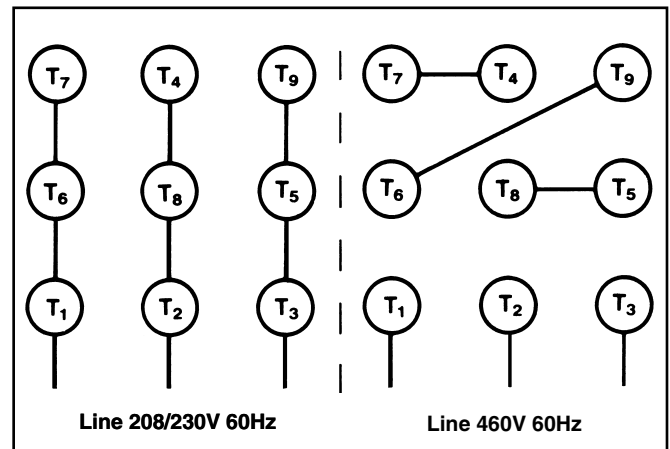
**Fig. 33 Standard Wiring Diagram — 208, 230/460V**

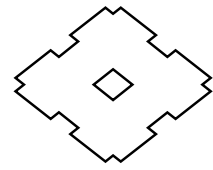
Illustrated below are the wiring diagrams for our standard motor. For additional information, please refer to the motor name plate. Due to changes in design features, this diagram may not always agree with that on the motor. If different, the motor diagram found inside the conduit box cover is correct.

### Y-Connected (5 HP and smaller)



### Delta-Connected (7½ HP and larger)





# GENERAL CONSTRUCTION OF MOTOR

Fig. 34 Motor Construction

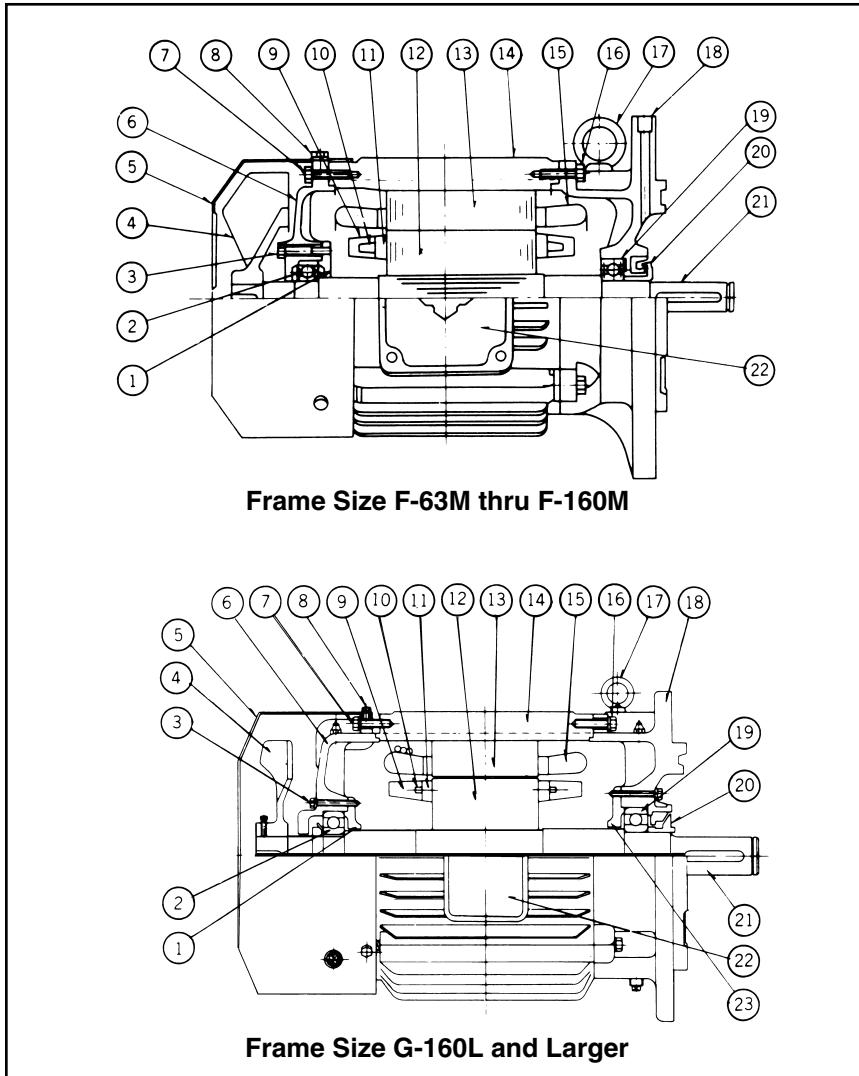


Table 23 Main Parts

Parts No.	Parts Name
1	Bearing Cover**
2	Bearing
3	Bolt**
4	Fan*
5	Fan Cover
6	End Bracket
7	Bolt
8	Bolt
9	Internal Fan
10	Hub
11	Short Circuit Ring
12	Rotor Core
13	Stationary Core
14	Stator Frame
15	Stator Winding
16	Bolt
17	Eye Bolt
18	Cyclo Flange Bracket
19	Bearing
20	Slinger/Oil Seal
21	Motor Shaft
22	Conduit Box
23	Bearing Cover
24	Bearing Sleeve

\* No Fan 1/8 H.P., F-63S frame.  
 \*\* F-132M and larger.

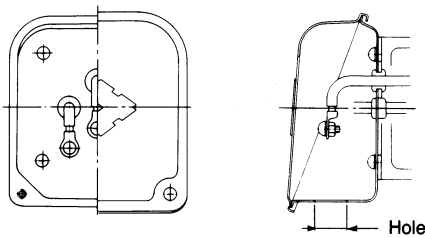


Fig. 35 Conduit Box-Standard Type

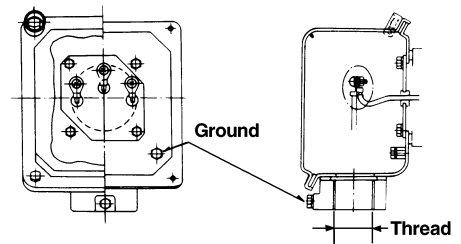


Fig. 36 Weather-Proof Type

## Oil Seal

The reducer and the motor of the SM-CYCLO® gear motor are integrally assembled. In grease lubricated units, a single lip seal is installed between the motor section and reducer section as shown in Fig. 37. On oil lubricated units, a slinger type oil seal is used — Fig. 38.

Fig. 37  
 Single Lip Type:  
 Grease Lubed Units

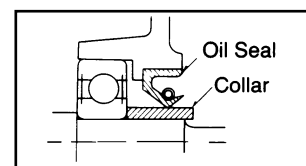
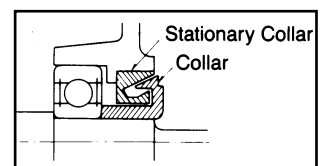


Fig. 38  
 Slinger Type:  
 Oil Lubed Units



Note: For oil seal replacement sizes, see Table 24.

# GENERAL INSPECTION OF MOTOR

The following items should be verified when the motor is received:

1. Check the nameplate horsepower rating (H.P.), number of poles (P), type, voltage (volt) and frequency (Hz).
2. Rotate the motor shaft by hand to check for binding.
3. Check the motor's overall appearance for possible shipping damage.

## Pre-Start Up Inspection

Check the following prior to start-up:

1. **Wiring:** Prior to wiring, refer to the name plate affixed to the motor portion of the gearmotor. Check power supply, interconnects, relays protective starting devices [i.e. Star (Wye) delta — if reduced voltage starting is required], space heaters, thermal sensors and other accessories.
2. **Grounding: Caution:** The motor frame and conduit box must be properly grounded so as to avoid electrical shock.
3. **Insulation Resistance:** Stator winding measurements are to be made at the motor terminals. Stator windings of less than 600 volts are to be measured with a 500 volts megger.

Insulation resistance will vary depending on winding temperature, moisture, cleanliness, duration of usage, and test voltage and charging period.

Other factors that will affect insulation resistance are: output rating, voltage, insulation class and RPM.

Although it is difficult to apply a minimum value to each and every case, for simplicity the following may be used as a guide:

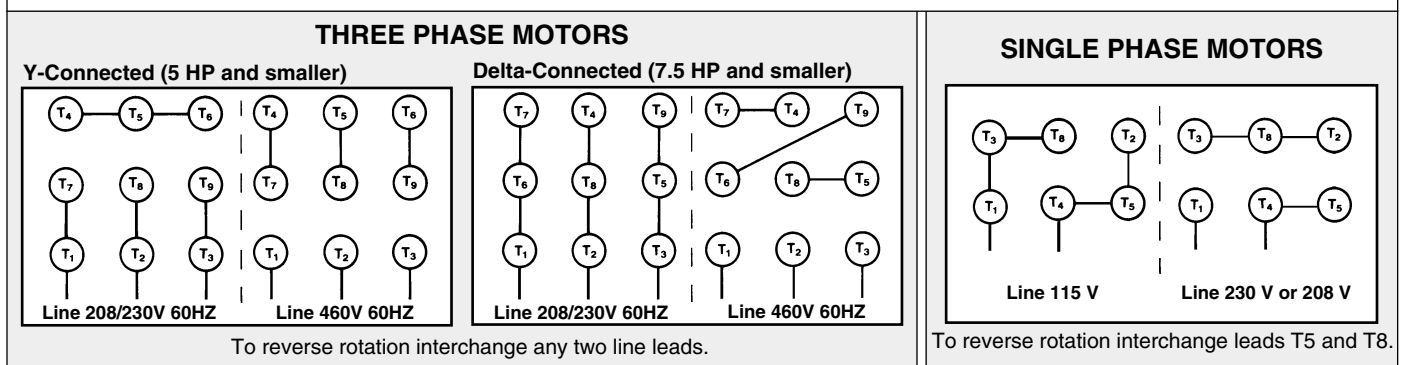
1 Mega ohms for less than 600 volts

If the measured insulation resistance is less than indicated above, the cause may be moisture. The resistance can be increased by subjecting wire to heat, hot air, vacuum, current (short circuit current, low voltage — no load current, or direct current).

If the Mega ohm reading cannot be recovered by drying — consult the factory.

**Fig. 39 Typical Wiring Diagrams**

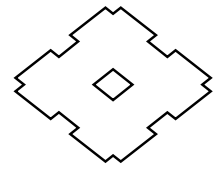
Illustrated below are the wiring diagrams for our standard motor; for additional information please refer to the motor name plate. If the diagram in the conduit box conflicts with diagrams listed below, please refer to the diagram in motor conduit box.



## Preparation and Start-up

Prior to start-up, please check the following under no load:

1. The driven load and the SM-Cyclo gearmotor are properly secured prior to operation.
2. The motor bearings are grease packed when shipped from our factory; however, if the motor is operated after long term storage, you must replenish the grease in the open type bearing only.
3. Check the direction of rotation. If a reverse direction is required, simply reverse any two power leads.
4. Check the voltage supply and current (line and phase) to verify balancing for a 3 phase power source.
5. When power is supplied to the motor and the starting is abnormally long, starting is not completed, or any abnormal sound is heard — immediately shut off the power and consult factory.
6. Measure the current draw. The current measured at full load should not exceed the name plate rating.



# BEARINGS AND OIL SEALS FOR MOTOR

Table 24 Bearings and Oil Seals Sizes†

MOTOR FRAME NO.	MOTOR		CYCLO FRAME SIZE	BEARING		OIL SLINGER PART NO.	OIL SEAL SIZE**
	HP	RPM		NON-DRIVE END	DRIVE END		
F-63S	1/8	1800	4085	6202ZZ-CM	6302ZZ-CM	—	S20358
			4090/95/97	6202ZZ-CM	6303ZZ-CM	—	S22357
F-63M	1/4 1/3	1800	4085	6202ZZ-CM	6302ZZ-CM	—	S20358
			4090/95/97	6202ZZ-CM	6303ZZ-CM	—	S22357
			4100/05	6202ZZ-CM	6303ZZ-CM	—	S22357
F-71M	1/2	1800	4085	6202ZZ-CM	6302ZZ-CM	—	S20358
			4090/95/97	6202ZZ-CM	6303ZZ-CM	—	S22357
			4100/05	6202ZZ-CM	6303ZZ-CM	—	S22357
			4110/15	6202ZZ-CM	6205ZZ-CM	—	S30458
F-80S F-80M	3/4 1	1800	4090/95/97	6203ZZ-CM	6303ZZ-CM	—	S22357
			4100/05	6203ZZ-CM	6303ZZ-CM	—	S22357
			4110/15	6203ZZ-CM	6205ZZ-CM	—	S30458
			4130/35	6203ZZ-CM	6206ZZ-CM	CD4-4501-G01	(S406212)
F-90S F-90L	1 1/2 2	1800	4095/97	6204ZZ-CM	6303ZZ-CM	—	S25458
			4100/05/0H	6204ZZ-CM	6204ZZ-CM	—	S26428
			4110/15/25	6204ZZ-CM	6205ZZ-CM	—	S30458
			4130/35 4145/55	6204ZZ-CM	6206ZZ-CM	CD4-4501-G01	(S406212)
			4160/65	6204ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
F-100L	3	1800	410H	6205ZZ-CM	6204ZZ-CM	—	S26428
			4110/15/25	6205ZZ-CM	6205ZZ-CM	—	S30458
			4130/35 4145/55	6205ZZ-CM	6206ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6205ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
F-112M	5	1800	4110/15/25	6206ZZ-CM	6305ZZ-CM	—	—
			4130/35 4145/55	6206ZZ-CM	6206ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6206ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
			4170/75	6206ZZ-CM	6308ZZ-CM	CD4-4503-G01	(S508014)
F-132S	7 1/2	1800	4125	6206ZZ-CM	6206ZZ-CM	—	(S30458)
			4130/35 4145/55	6206ZZ-CM	6206ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6206ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
			4170/75	6206ZZ-CM	6308ZZ-CM	CD4-4503-G01	(S508014)
F-132M	10	1800	4130/35 4145/55	6307ZZ-CM	6306ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6307ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
			4170/75	6307ZZ-CM	6309ZZ-CM	CD4-4504-G01	(S558514)
F-160M	15	1800	4155	6307ZZ-CM	6306ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6307ZZ-CM	6307ZZ-CM	CD4-4502-G01	(S456812)
			4170/75	6307ZZ-CM	6309ZZ-CM	CD4-4504-G01	(S558514)
G-160L	20 15	1800 1200	4155	6309ZZ-CM	6306ZZ-CM	CD4-4501-G01	(S406212)
			4160/65/6H	6309ZZ-CM	6308ZZ-CM	CD4-4502-G01	(S456812)
			4170/75	6309ZZ-CM	6309ZZ-CM	CD4-4504-G01	(S558514)
F-180MG	25 30 20	1800 1200	4165/6H	6312ZZ-CM	6308ZZ-CM	CD4-4502-G01	(S456812)
			4175	6312ZZ-CM	6309ZZ-CM	CD4-4504-G01	(S558514)

†For 6 pole motors not shown, please consult factory.

Oil slinger is used on oil lubricated cyclo gearmotors.

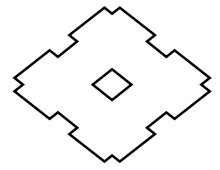
\*\*Oil seal is used on grease lubricated cyclo gearmotors. Where oil lubrication is standard, oil seal is shown in ( ).

# SM-BEVEL AND HELICAL BUDDYBOX TROUBLESHOOTING AND REPAIR

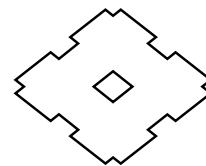
This troubleshooting guide is to help you identify and overcome common problems of reducers and motors. If you have a problem not listed below, please consult the factory.

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load.
	Improper Lubrication	Insufficient lubrication	Check lubricant level and increase to recommended levels.
		Excessive lubrication	Check lubricant level and reduce to recommended level.
		Wrong lubricant	Flush out 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	Overloading unit may result in damage to disc	Disassemble and replace disc. Re-check rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained	Check lubricant level and adjust to factory-recommended level.
Damaged Pins & Rollers	Overloading of reducer	Disassemble and replace ring gear pins and rollers. Check load on reducer.	
Output Shaft Does Not Turn	Motor Shaft Broken	Overloading of reducer can cause damage	Replace broken shaft. Check rated capacity of reducer.
		Key missing or sheared off on input shaft	Replace key.
	Eccentric Bearing Broken	Lack of lubricant	Replace eccentric bearing. Flush and refill with recommended lubricant.
	Motor Doesn't Turn	Motor	Refer to page 23.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal	Replace seals. Breather filter may be clogged. Replace or clean filter.
	Leakage Into Motor	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged	Clean or replace element, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer	Mount horizontally or rework reducer to wall or ceiling mount.





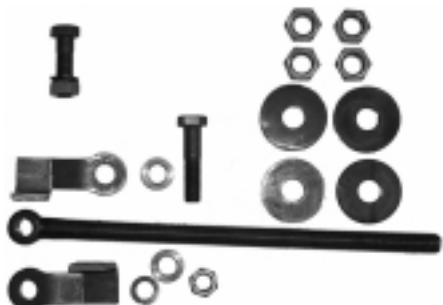
PROBLEM WITH THE MOTOR		POSSIBLE CAUSES	SUGGESTED REMEDY	
Load is disconnected but motor doesn't rotate	Makes a groaning sound	Faulty switch contact	Adjust the contact.	
		Blown fuse	Replace.	
		One phase wire of the power supply open	Replace.	
		Stator coil open	Repair by rewinding or replacing stator 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 single-phase	Check the power source with a voltmeter.	
	Doesn't make any noise	Stator coil open	Repair by rewinding or replacing stator assembly.	
Outside the motor Power failure Open connection wire Faulty switch contact Faulty starter contact		Contact the power company. Check the source wiring. Adjust the contact.		
Rotates with the load disconnected, but:	Rotates in the wrong direction	Connection error	Change any two of the three phase source.	
	Fuse blows	Shorted lead wire	Replace.	
	Speed doesn't increase	Faulty starter contact	Adjust.	
	Groans	Overcurrent/ Overheating	Rotor and stator touching	Repair by rewinding or replacing stator assembly.
		Over-current	One phase of stator coil shorted	Replace the stator winding.
	Makes a high-pitched metallic noise	Faulty bearing	Replace the bearing.	
Rotates when the load is disconnected but when the load is connected:	Switch overheated	Insufficient switch capacity	Replace with one having the rated capacity.	
		Overload	Drop to the rated load.	
	Fuse blows	Insufficient fuse capacity	Replace with one having the rated capacity.	
	Overheats	Overload	Drop to the rated load.	
		Voltage drop	Consult with the power company.	
	Speed suddenly drops	Voltage drop	Consult with the power company.	
		Overload	Drop to the rated load.	
	Stops	Bearing damaged by overheat	Replace the bearing.	



# TORQUE ARM ASSEMBLY

## MODELS AA & A

**Fig. 40 Unassembled Torque Arm**



Verify that the package contains all of the following parts:

Part	Qty	Part	Qty
Tension Rod	1	Connector Bolt	1
Rod Nuts	4	Nut & Lock Washer	2
Rubber Bushings	2	Spacer	2
Bushing Washer	2	Mounting Bolt	1
Side Bars – Bent	2		

## MODELS B, C, D & E

**Fig. 41 Unassembled Torque Arm**



Verify that the package contains all of the following parts:

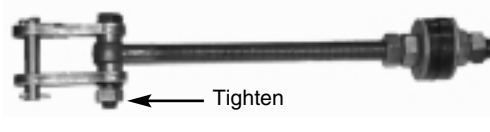
Part	Qty	Part	Qty
Tension Rod	1	Connector Bolt	1
Rod Nuts	4	Nut & Lock Washer	1
Rubber Bushings	2	Spacer	2
Bushing Washer	2	Cotter Pin (with keys)	1
Side Bars – Straight	2		

**Fig. 42 Assembled Torque Arm**



Assemble the torque arm as shown in this picture. Be sure to tighten the torque arm connector bolt.

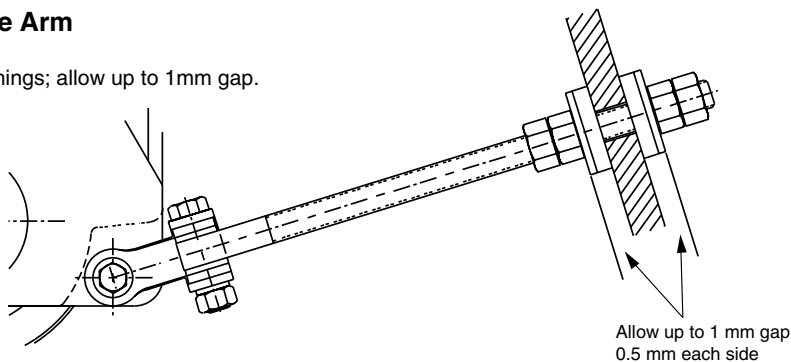
**Fig. 43 Assembled Torque Arm**



Assemble the torque arm as shown in this picture. Be sure to tighten the torque arm connector bolt.

**Fig. 44 Mounted Torque Arm**

Do not preload the rubber bushings; allow up to 1mm gap.



**Table 25 Torque Arm Bolt Tightening Torques**

Unit Size	Torque Arm Thread	Tightening Torque (ft. lb.)	Rod End Bolt	Tightening Torque (ft. lb.)	Case Bolt	Tightening Torque (ft. lb.)
AA	M20	80	M16	41	M12	16
A	M20	80	M16	41	M16	41
B	M20	80	M16	41	M16	41
C	M24	139	M16	41	M20	80
D	M24	139	M16	41	M24	139
E	M24	139	M16	41	M24	139

The torque arm should be mounted to accept loads in tension, not compression. For reversing applications, two torque arms should be used. In use, the SM-Helical Buddybox will try to rotate in the direction opposite from the driven shaft. When the torque arm is installed correctly, the SM Helical Buddybox will try to pull away from the torque arm. The correct mounting angle of the torque arm is

approximately 90° (plus or minus 15°) to a line drawn from the shaft to the point where the torque arm attaches to either mounting corner of the SM-Helical Buddybox. The torque arm should be mounted so that it is in line with the SM-Helical Buddybox case as well as perpendicular to the axis of the output shaft. *The use of multiple torque arm assemblies for greater length is not recommended.*



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#### Chile

SM-Cyclo de Chile Ltda.  
 Avenida Zanartu #1231  
 Comuna Nunoa - Santiago, Chile  
 Tel.: 011-562-237-2407 • FAX: 011-562-237-0225

### Other International Locations

#### Japan

Sumitomo Heavy Industries  
 Power Transmission & Controls Group  
 5-9-11, KITA-Shingawa Shinagawa-Ku  
 Tokyo 141-8686 Japan  
 Tel.: 011-813-5488-8363 • FAX: 011-813-5488-8355

#### United Kingdom

Sumitomo (SHI) Cyclo Drive Europe  
 Marfleet, Kingston upon Hull  
 HU9 5RA, United Kingdom  
 Tel.: 011-44-1482-788022 • FAX: 011-44-1482-713205

#### Southeast Asia

Sumitomo (SHI) Cyclo Drive Southeast Asia  
 No. 2 Tuas Link 2  
 Singapore 638551  
 Tel.: 011-65-863-2238 • FAX: 011-65-863-4238

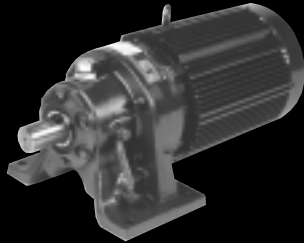


**SPEED REDUCER**



**SM-CYCLO**  
Concentric

**GEARMOTOR**



**SM-CYCLO**  
Concentric

**SHAFT MOUNTED  
GEARMOTOR**



**SM-HELICAL BUDDYBOX**  
Parallel Offset

**BEVEL GEARMOTOR**



**SM-BEVEL BUDDYBOX**  
Right Angle

**LOW RATIO PLANETARY**



**SM-CYCLO**  
Concentric

**PRECISION CYCLO**



Concentric

**MECHANICAL  
VARIABLE SPEED**



**SM-BEIER**

**ELECTRICAL  
VARIABLE SPEED**



**AF-3100α** AC Drive    **NTAC-2000** AC Drive

**HELICAL  
GEAR REDUCER**



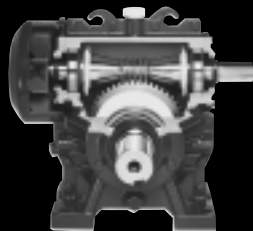
**PARAMAX**  
Parallel Offset  
& Right Angle

**SHAFT MOUNT  
SPEED REDUCER**



**SM-SHAFT MOUNT**  
Parallel Offset

**DOUBLE ENVELOPING  
WORM GEAR**



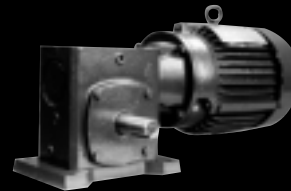
**SM-HEDCON**  
Right Angle

**SHAFT MOUNT  
GEARMOTOR**



**SM-HYPONIC**  
Right Angle

**WORM GEARMOTOR**



**SM-ULYSSES**  
Right Angle

**PARTS & SERVICE**



**WORLDWIDE**

# SUMITOMO

## "QuaDelta" PROGRAM

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- ▲ GEAR BOXES
- ▲ MOTORS
- ▲ CONTROLLERS



- ▲ CONCENTRIC
- ▲ PARALLEL OFFSET
- ▲ RIGHT ANGLE



- ▲ CONSTANT SPEED
- ▲ MECHANICAL VS
- ▲ ELECTRICAL VS



- ▲ THE AMERICAS
- ▲ ASIA
- ▲ EUROPE

### SUMITOMO MACHINERY CORP. OF AMERICA

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