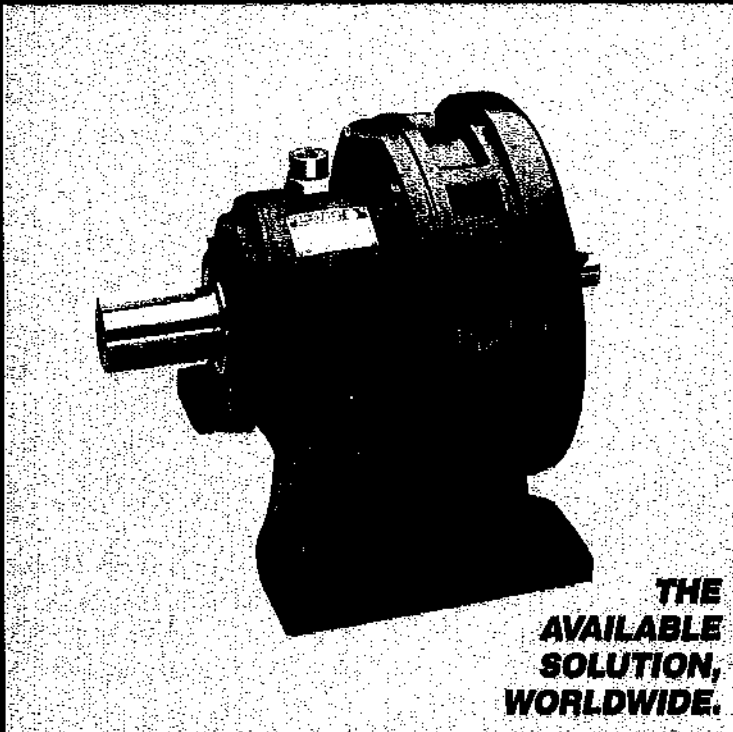
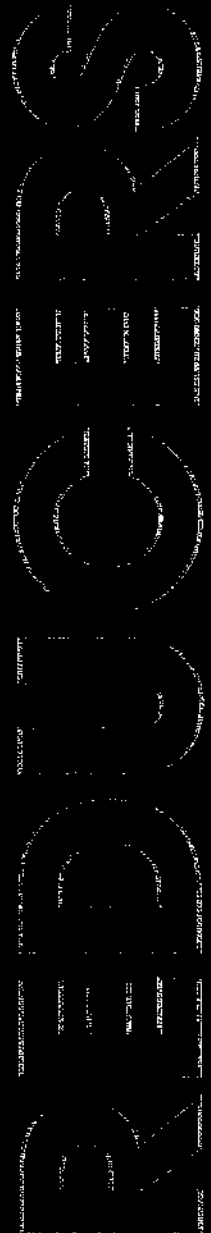


# SM-CYCLO<sup>®</sup> SPEED REDUCERS

Operating and Maintenance Manual  
4000 Series



 **SUMITOMO**  
MACHINERY CORPORATION OF AMERICA



Manual

03.301.60.007

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**NOTE:** If SM-CYCLO® reducers are driven by D.C. motors, variable frequency A.C. drives, or speeds other than standard catalog input speeds—please consult factory. Be sure to install and operate SM-CYCLO® speed reducers in compliance with applicable local and national safety codes. Appropriate guards for rotating shafts should be used and are available from local stocks.

## Mounting

### 1. Mounting on Exact Planes

The Horizontal Type oil-lubricated units must be mounted on horizontal surfaces. Where they are mounted on inclined surfaces, some modifications may be necessary. Specify mounting plane inclination at time of ordering.

### 2. Accurate Alignment

Where the reducer is connected to the motor and the driven machine through couplings, align the shafts accurately. Where the reducer is connected through V pulleys or sprockets, insure that the belts or chains are neither too tight nor too slack.

### 3. Overhung Load Positions

Overhung loads should be located as close to the bearing as possible. (See the SM-CYCLO® 4000 Series Catalog page 124.)

### 4. Foundations

Foundations must be rugged enough to withstand shock and stress applied from the load side through the reducer.

### 5. Secure Housing

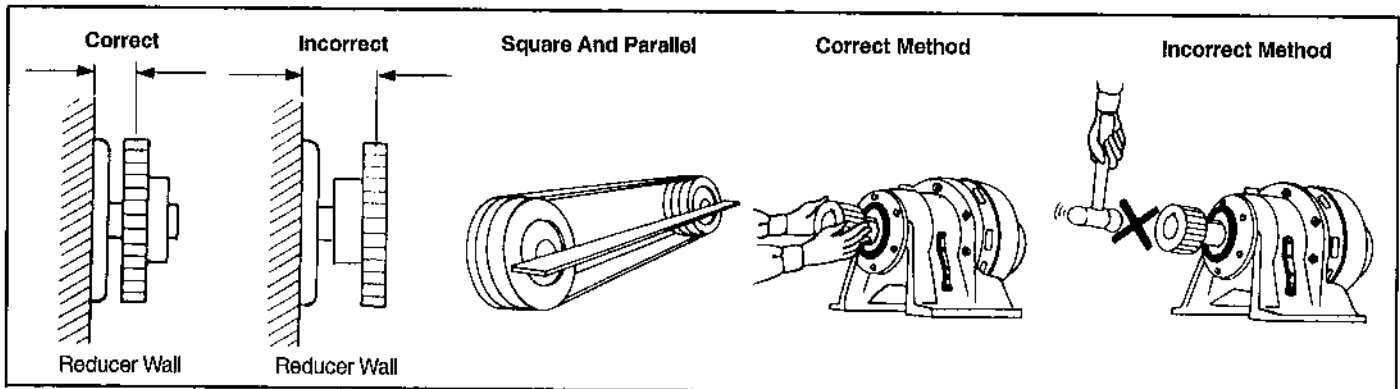
Where the reduction units are operated under conditions of vibration and/or frequent starts and stops, it is recommended to secure them on their mounting surfaces by inserting dowel pins into the knock-holes provided on the foot of the casing. This will insure that bending or shearing forces are reduced on the mounting bolts. Pins must be securely inserted, particularly when the units are to be operated under conditions of severe recurrent peak loads.

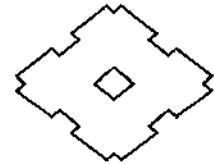
### 6. Mounting Accessibility

The reduction units must be mounted in locations with easy accessibility for lubrication maintenance purposes.

### 7. Ventilation

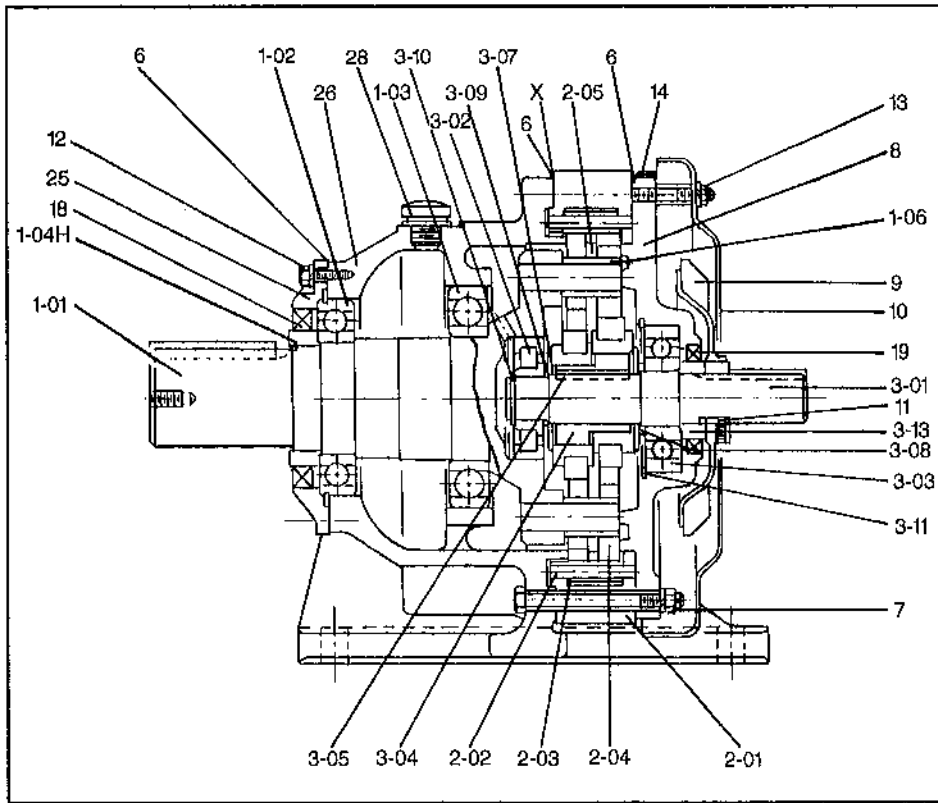
When the SM-CYCLO® Speed Reducer is mounted in a separate enclosure, be sure that adequate ventilation is provided.



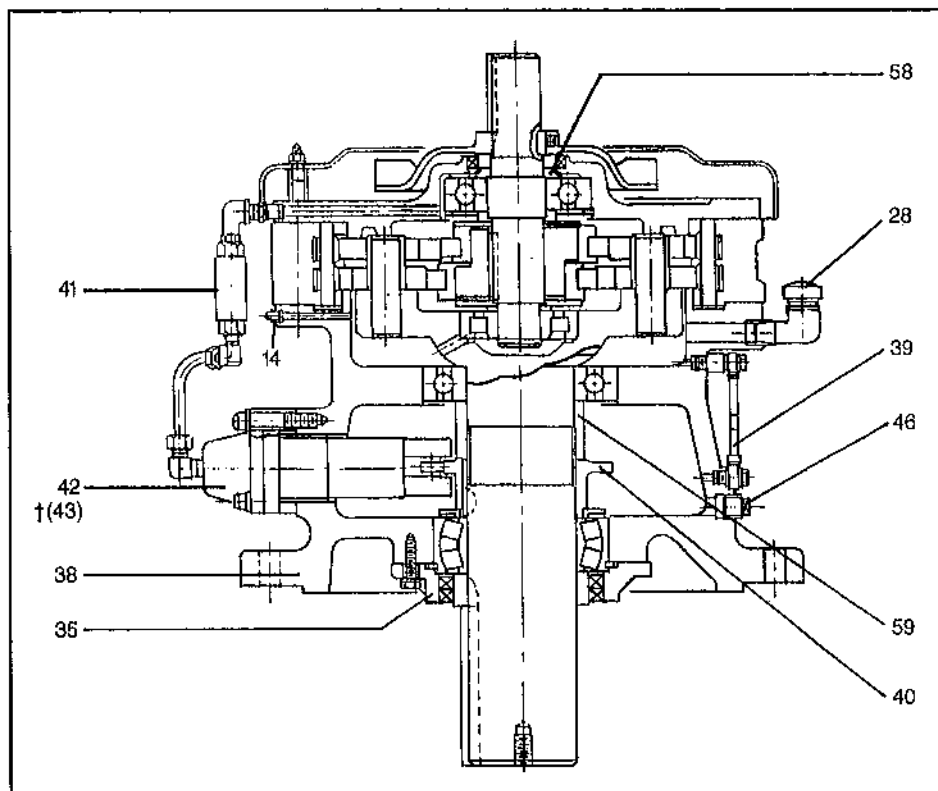


# General Construction

**Fig. 1 Single Reduction (Horizontal Foot Mount)**



**Fig. 2 Single Reduction (Vertical Base Mount)**



**Table 1 Main Parts**

Part No.	Part Name
1-01	Slow Speed Shaft w/pins
1-02	Bearing A
1-03	Bearing B
1-04H	Oil Seal Collar—Horizontal
1-06	Slow Speed Shaft Rollers
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 Bearing Assembly
3-05	Eccentric Key
**3-06	Balance Weight
3-07	Spacer
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 Bearing Assembly
6	Gasket Set
7	Casing Nuts & Bolts
8	High Speed End Shield
9	Cooling Fan & Set Screw
10	Fan Cover
11	Fan Key
12	Bolts For SS Oil Seal Housing
13	Bolts, Spacers For Fan Cover
14	Plug
† 15	Grease Nipple
18	Slow Speed Output Oil Seal
19	High Speed Input Oil Seal
25	Horizontal Oil Seal Housing
26	Horizontal Case
28	Oil Fill Plug
29	Oil Gauge—Horizontal Unit
35	Vertical Oil Seal Housing
38	Vertical Case (Integral V Type)
39	Oil Gauge—Vertical Unit
40	Cam
41	Piping Set & Oil Signal
42	Plunger Pump
43	Positive Displacement Pump
46	Drain Plug
† 55	Intermediate Cover
† 57	Eye Bolt
*58	Oil Slinger
*59	Spacer

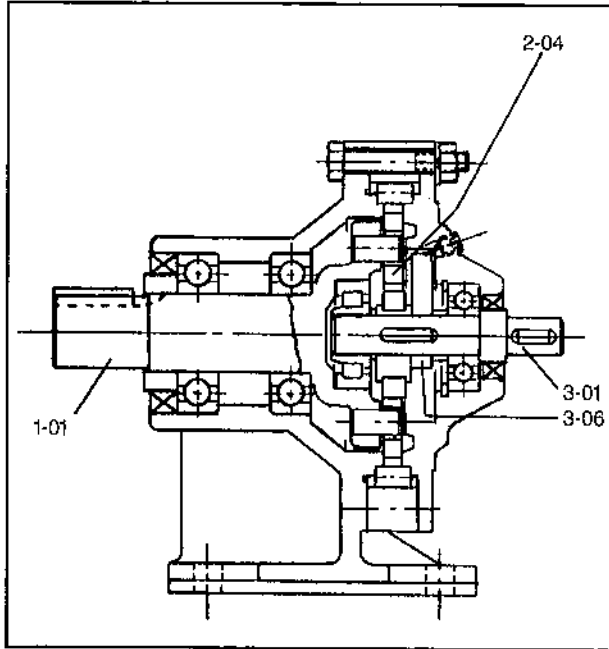
**Note:** For details of oil seals, bearings or gaskets, refer to pages 10 and 11.

†Refer to Table 13 on Pg. 7 for units which require a positive displacement pump.

\*Pt. No. 58 — frame sizes 4195-4275 only; Pt. No. 59 — frame sizes 4205-4275 only.

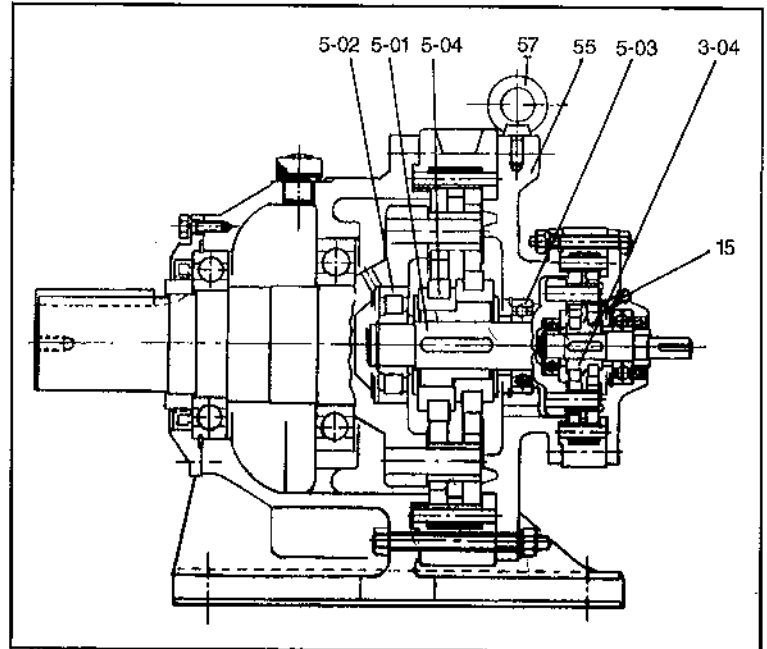
\*\*See Fig. 3, Page 4; †See Fig. 4, Page 4

**Fig. 3 Speed Reducer/Single Disc Type (Frame Size 4075-4095)**



**Speed Reducer — Single Disc**  
 SM-CYCLO® single reduction, Models No. 4075-4095, employ the use of a single planetary gear (Cycloid Disc) and a balance weight.

**Fig. 4 Speed Reducer/Double Reduction**



**Multiple Reduction Reducers**  
 Multiple reduction SM-CYCLO® Reducers are a combination of standard reduction mechanism assemblies connected using an intermediate shaft (Part No. 5-01) and intermediate cover (Part No. 55) between them.

**Table 2 Frame Sizes and Ratio Combination Of Double Reduction Models**

Frame Size Combination

Frame Size	Second Stage	First Stage
4075DA	4075	4075
4085DA	4085	4075
4097DA	4097	4085
4105DA	4105	4085
4115DB	4115	4095
4135DC	4135	4105
4145DB	4145	4095
4165DC	4165	4115
4175DC	4175	4115
4185DB	4185	4135
4190DA	4190	4115
4195DA	4195	4115
4195DB	4195	4135

Frame Size	Second Stage	First Stage
4205DA	4205	4115
4205DB	4205	4135
4215DA	4215	4135
4215DB	4215	4165
4225DA	4225	4135
4225DB	4225	4175
4235DA	4235	4165
4235DB	4235	4185
4245DA	4245	4165
4245DB	4245	4185
4255DA	4255	4175
4255DB	4255	4195
4265DA	4265	4195
4275DA	4275	4195

Reduction Ratio Combination

Total Ratio	Second Stage Ratio	First Stage Ratio
102	17	6
121	11	11
165	15	11
174	29	6
187	17	11
210	35	6
231	21	11
258	43	6
289	17	17
319	29	11
354	59	6
385	35	11
473	43	11
493	29	17
522	87	6
595	35	17
649	59	11
731	43	17
841	29	29

Total Ratio	Second Stage Ratio	First Stage Ratio
957	87	11
1003	59	17
1015	35	29
1225	35	35
1247	43	29
1479	87	17
1505	43	35
1711	59	29
1849	43	43
2065	59	35
2523	87	29
2537	59	43
3045	87	35
3481	59	59
3741	87	43
5133	87	59
7569	87	87



# Lubrication

SM-CYCLO® reducers, frame sizes 4075 through 4125, are grease-lubricated. Sizes 4130 through 4275 are normally oil-lubricated. Double reduction units may be grease or oil-lubricated, depending on size, ratio, and/or application.

## Grease Lubrication

**Table 3 Single Reduction Models**

Frame Size	4075	4085	4090 4095 4097	4100 4105 410H	4110 4115 4125
Horizontal Shaft	Grease (MAINTENANCE FREE)				
Vertical Shaft	Grease (MAINTENANCE FREE)				

For the single reduction units, frame sizes 4075-4125 (maintenance-free type), NLGI No. 2 is designated. NLGI No. 2 is also designated for grease-lubricated multi-reduction units.

Grease-lubricated models are filled with grease before shipment to customer and are ready for use.

**Table 4 Double Reduction Models**

Frame Size	4075DA thru 4145DB	4165DC	4175DC	4185DB	4190DA 4195DA 4195DB	4205DA 4205DB	4215DA 4215DB	4225DA 4225DB	4235DA 4235DB	4245DA 4245DB	4255DA 4255DB	4265DA	4275DA
Horizontal													
V E R T I C A L	<Ratio> 102 ~493												
	522 ~841												
	957 ~1015												
	1225 ~2523	Grease Lubricated Models											
	2537 ~3045												
3045 ~7569													

Oil Lubricated Models

**Table 5 Triple Reduction Models**

Horizontal Shaft	Frame Size of The 1st Reduction Stage: 4105 or Smaller	Grease Lubricated (NLGI Grade 2)
Vertical Shaft	Frame Sizes: 4075TA 4265TA	Grease Lubricated (NLGI Grade 2)
	Frame Sizes: 4270TA 4275TB	Depending On The Operating Condition Consult Factory

**Note:** Tables above are for operation at standard input speed. If the input speed differs from the standard, please consult factory.

**Table 6 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 7 Grease Replenishment And Change Interval**

Model	Condition	Interval	
Single Reduction Maintenance Free Type)	Replenishment	NOT REQUIRED	
	*Overhaul	Every 20,000 Hours Or Every 4 ~ 5 Years	
Double Reduction	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
		Slow Speed Shaft Bearings	Every 3 ~ 5 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 4075-4125 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 6, 7 and 8.

**Table 8 Quantities Of Grease (Ounces)**

Frame Size	4075	4085	4090 4095 4097	4100 4105 410H	4110 4115 4125
Speed Reduction Mechanism	.7	.7	2.1	3.5	8.5
Slow Speed Shaft	.4	.9	2.3	3.9	4.9

Frame Size	4075DA	4085DA	4097DA 4105DA	4115DB	4135DC	4145DB	4165DC	4175DC	4185DB	4190DA 4195DA	4195DB	4205DA
Speed Reduction Mechanism (First Stage)	0.7		0.7	2.1	2.3	1.4	5.3		15.9	5.3	15.9	5.6
Speed Reduction Mechanism (Second Stage)	0.7	0.7	3.5	8.5	15.9	15.9	26.5	35.3	38.8	52.9		52.9
Slow Speed Shaft Bearing (Second Stage)	0.4	0.9	3.9	4.9	10.6	10.6	10.6	17.6	21.2	24.7		24.7

Frame Size	4205DB	4215DA	4215DB	4225DA	4225DB	4235DA	4235DB	4245DA	4245DB	4255DA	4255DB	4265DA
Speed Reduction Mechanism (First Stage)	15.9		26.5	15.9	35.3	26.5	38.8	26.5	38.8	35.3	52.9	
Speed Reduction Mechanism (Second Stage)	52.9	70.5		88.2		141.0		158.7		211.6		282.2
Slow Speed Shaft Bearing (Second Stage)	24.7	28.2		31.7		35.3		38.8		42.3		45.9

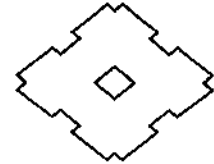
**Note 1:** Replenish grease to the reduction mechanism 1/3 to 1/2 of quantities for the first reduction stage described in Table 8 in accordance with replenishment interval recommended in Table 7.

**Note 2:** When the unit is disassembled for overhauling, refill with grease in quantities indicated in Table 8. 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.



# Oil Lubrication

SM-CYCLO® reducers sizes 4130 through 4275 are normally oil-lubricated. Double reduction units may be grease or oil-lubricated, depending on size, ratio, and/or application.

*Oil-lubricated models are shipped without oil. Units must be filled with recommended oil prior to start-up.*

**Table 9 Single Reduction Models**

Frame Size	4130 4135	4145 4155	4160 4165 416H	4170 4175	4180 4185	4190 4195	4205	4215	4225	4235	4245	4255	4265	4275
Horizontal Shaft	Oil Bath													
Vertical Shaft	Oil Bath			Forced-oil Lubrication										

**Table 10 Double Reduction Models**

Frame Size	4165DC	4175DC	4185DB	4190DA 4195DA 4195DB	4205DA 4205DB	4215DA 4215DB	4225DA 4225DB	4235DA 4235DB	4245DA 4245DB	4255DA 4255DB	4265DA	4275DA
Horizontal					Oil Bath							
V E R T I C A L  S H A F T	<Ratio> 102 ~493											
	522 ~841						Forced-oil Lubrication					
	957 ~1015											
	1225 ~2523	Grease Lubricated Models										
	2537 ~3045											
3045 ~7569												

**Table 11 Triple Reduction Models**

Horizontal	Frame Size Of The 1st Reduction Stage: 4115 Or Larger	Oil Bath Lub. (Refer to Table 12)
Vertical	Frame Size: 4270TA, 4275TB	Depending On the Operating Condition Consult Factory

**Note:** Tables above are for operation at standard input speed. If the input speed differs from the standard, please consult factory.

## Forced Lubrication For Vertical Units

**Table 12 Plunger Pump Type**

Small Size Pump		Large Size Pump	
Frame Size	Ratio	Frame Size	Ratio
4160, 4170, 4180, 4190 4165, 416H, 4175, 4185, 4195	All	4205, 4215, 4225 4235, 4245, 4255, 4265	All
4165DC thru 4195DB	See Table 10	4205DA - 4265DA	See Table 10

### Plunger Lubrication

The plunger pump (Part No. 42) is automatically operated by a cam (Part No. 40) fitted on the slow speed shaft (Part No. 1-01). The number of pumping cam teeth required is in direct relation to the reduction ratio and frame size. For input speeds other than standard, consult factory.

**Table 13 Positive Displacement Type Pump**

SM-CYCLO Reducer		Positive Displacement Pump
Frame Size	Reduction Ratio	
4275	All	TOP-216HAVB-3
4275DA	All	TOP-204HAVB-3

### Positive Displacement Pump Lubrication

Forced oil lubrication is accomplished by using a positive displacement pump and motor that requires an additional electric power source. It is recommended that the main motor be interlocked with the pump motor to avoid misoperation. The pump must be started 30 seconds or longer before the main motor is operated.

**Table 14 Type Of Lubrication Oil**

Mild EP Oil is used for the lubrication of SM-CYCLO® Reducers, Models 4130 and larger. For additional information please refer to Lubrication Specification Sheet No. 03.301.63.002

Ambient Temperature	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.	41.4 ~ 74.8	90 ~ 165	198 ~ 506
ISO Viscosity Grade	46 ~ 68	100 ~ 150	220 ~ 460
AGMA Viscosity Grade	2EP	3EP 4EP	5EP ~ 7EP
SAE Grade (Crankcase Oils)	20 W	30 40	50

**Table 15 Allowable Viscosity Of Oil**

Minimum Allowable Viscosity To Maintain Adequate Lubricating Oil-film	80 SUS During Operation	
Maximum Allowable Viscosity To Allow Easy Starting	Oil Bath	20,000 SUS At Operation Start
	Forced-Oil Lubrication	10,000 SUS At Operation Start

**Table 16 Oil Quantities (Gallons)**

Single Reduction	Frame Size	4130	4160	4170	4180	4190	4205	4215	4225	4235	4245	4255	4265	4275	
		4135	4165	4175	4185	4195									
		4145	416H												
	Horizontal	0.2	0.4	0.5	0.6	1.1	1.5	2.3	2.6	4.0	4.2	5.6	7.7	14.8	
	Vertical	0.3	0.3	0.5	0.5	0.7	1.5	2.0	2.6	3.2	4.0	11.1	13.5	(15.9)	

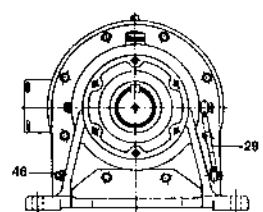
Double Reduction	Frame Size	4165DC	4175DC	4185DB	4190DA	4205DA	4215DA	4225DA	4235DA	4245DA	4255DA	4265DA	4275DA
		4165	4175	4185	4195DA	4205DB	4215DB	4225DB	4235DB	4245DB	4255DB	4265DB	4275DB
		4155	416H	4175	4195DB								
	Horizontal	0.4	0.6	0.9	1.6	1.6	2.7	2.9	4.5	4.8	6.1	8.5	18.5
	Vertical	0.3	0.5	0.5	0.7	2.9	3.7	4.8	6.1	7.7	11.1	13.5	(15.9)

The above quantities shown in parentheses are for the forced-oil lubricated models with a positive displacement pump.

**Table 17 Oil Change**

Oil Change Interval		Operation Condition
Initial Oil Change	After 500 Hours of Primary Operation	Under Every Condition
Subsequent Oil Change	Every 6 Months	Less Than 10 Hours/Day Operation
	Every 2,500 Hours	10~24 Hours/Day Operation
	Every 1 ~ 3 Months	High Ambient Temperature, High Humidity Or Atmosphere Of Active Gas

**Fig. 5**



**Oil Fill Procedure**

Fill the reducer with recommended oil through the filler plug before start-up. The oil levels must be to the upper red line on the oil level gauge while the unit is not operated, and above the lower red line during operation. If too much oil is supplied, the temperature will rise due to the churning heat of the oil, or oil will leak across the high speed shaft oil seal.

**Oil Level Gauge**

When it becomes difficult to check the oil level due to the discoloration of the vinyl hose, the gauge must be replaced. Use the standard vinyl oil gauge for a reducer operating in ambient temperature: -4°F to 100°F. Where the reducer is used at ambient temperatures greater than 100°F (+40°C)

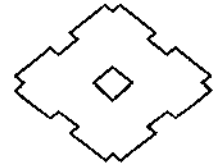
or less than -4°F (-20°C), a glass gauge set or a dipstick is recommended.

**Note 1:** When draining oil, remove drain plug (Part No. 46) or lower side plug of the oil level gauge. See Fig. 5.

**Note 2:** Before filling vertical base type unit with lubrication oil, remove the vent plug (Part No. 14. See Fig. 2 on pg. 3). After filling, apply teflon sealing tape to threads of the vent plug prior to installation.

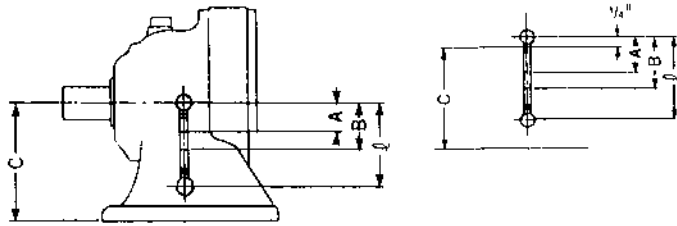
**Note 3:** The oil level gauge can be attached on either side of the casing on horizontal units. Locate on whichever side is more convenient to check oil level. (The oil level gauge is normally attached on the right when viewed from slow speed shaft end.)





# Oil Level Dimensions

**Foot Mount Horizontal Type**  
Fig. 6

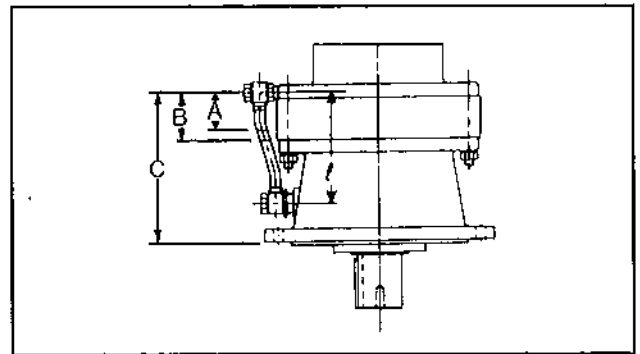


Frame Size:  
Only 4130-4145

**Table 18 Oil Level Dimensions (Inches)**

Frame Size	A	B	C	l
4130-4135	1.38	2.17	5.91	4.65
4145, (4155)	1.38	2.17	5.91 (6.30)	4.65
4160-4165, (416H)	1.57	2.76	6.30 (7.87)	3.70
4165DC	1.18	1.77	6.30	3.70
4170-4175	1.97	3.35	7.87	4.96
4175DC	1.18	1.77	7.87	4.96
4180-4185	2.17	3.94	8.66	5.91
4185DB	1.38	2.17	8.66	5.91
4190-4195	2.26	3.25	9.84	6.61
4190DA-4195DA	1.18	1.77	9.84	6.61
4195DB	1.38	2.18	9.84	6.61
4205	2.12	3.19	9.84	6.06
4205DA	1.26	1.93	9.84	6.06
4205DB	1.26	2.13	9.84	6.06
4215	2.05	3.03	10.84	6.85
4215DA	1.18	1.97	10.43	6.85
4215DB	1.57	2.76	10.43	6.85
4225	2.25	3.43	11.03	6.85
4225DA	1.26	2.05	11.03	6.85
4225DB	1.85	3.43	11.03	6.85
4235	2.48	3.47	11.81	7.64
4235DA	1.57	2.75	11.81	7.64
4235DB	1.97	3.35	11.81	7.64
4245	2.76	3.78	13.19	8.46
4245DA	1.65	2.72	13.19	8.46
4245DB	2.00	3.35	13.19	8.46
4255	3.19	4.17	14.76	9.02
4255DA	1.97	3.35	14.76	9.02
4255DB	2.05	3.23	14.76	9.02
4265	3.23	4.21	15.75	10.16
4265DA	2.28	3.27	15.75	10.16
4275	3.35	4.53	21.26	11.22
4275DA	2.26	3.25	21.26	11.22

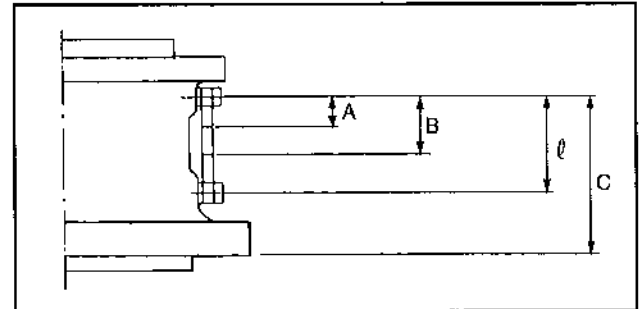
**Base Mount Vertical Type**  
Frame Size: 4130 ~ 4155  
Fig. 7



**Base Mount Vertical Type**  
Table 19 Oil Level Dimensions (Inches)  
Frame Size: 4130-4155

Frame Size	A	B	C	l
4130-4155	1.85	2.72	7.52	5.79

**Base Mount Vertical Type**  
Frame Size: 4160 ~ 4275  
Fig. 8



**Base Mount Vertical Type**  
Table 20 Oil Level Dimensions (Inches)  
Frame Size: 4160 ~ 4275

Frame Size	A	B	C	l
4160-4165, 416H	1.02	1.42	4.68	2.72
4170-4175	1.69	2.48	6.02	3.78
4180-4185	1.93	2.72	6.81	4.25
4190-4195	2.09	3.27	7.87	5.47
4205	1.46	2.05	7.09	3.54
4215	1.46	2.05	7.09	3.54
4225	1.46	2.05	7.87	3.54
4235	1.46	2.05	7.72	3.54
4245	1.46	2.05	7.96	3.54
*4255	4.33	4.92	19.76	6.57
*4265	4.65	5.24	21.69	7.17
4275	1.97	2.76	13.39	5.51

\*NOTE: V4255 & V4265 Oil Gauge is on the Ring Gear Housing instead of V-Casing.

# Bearings, Oil Seals, Gaskets

Fig. 9

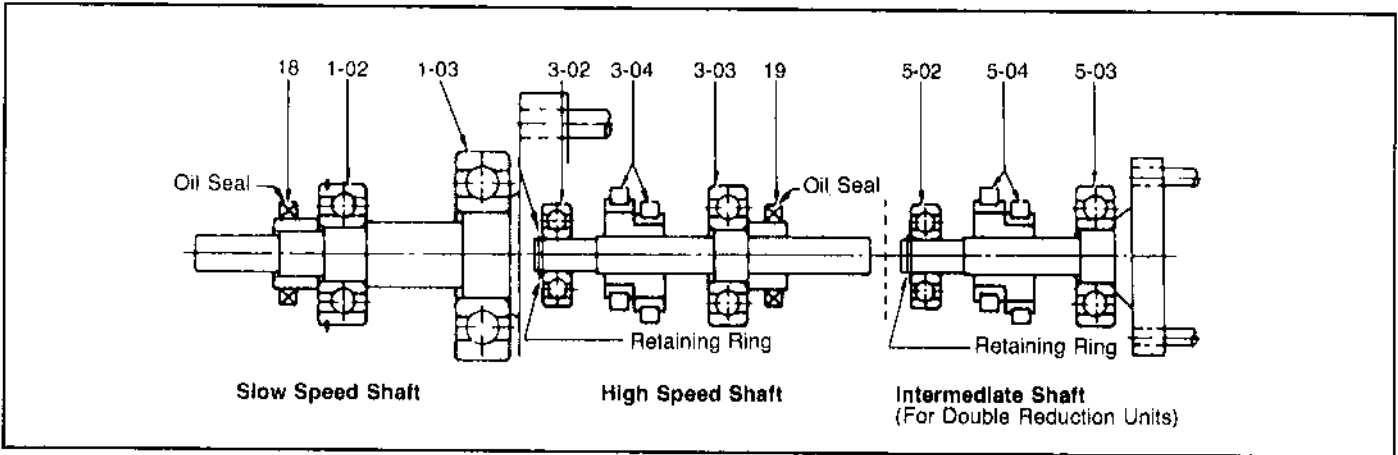
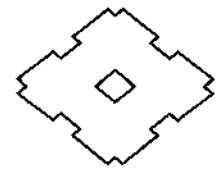


Table 21 Single Reduction Units

Frame Size	BEARINGS					OIL SEAL							
	SLOW SPEED SHAFT		HIGH SPEED SHAFT			SLOW SPEED SHAFT			HIGH SPEED SHAFT				
	Part No. 1-02	Part No. 1-03	Part No. 3-02	Part No. 3-04	Part No. 3-03	Part No. 18			Part No. 19				
Number	Number	Number	Number	Qty	Number	Type	Dimension	Qty		Type	Dimension	Qty	
					Speed Reducer			H	V				
4075	6202Z	6203	6201	19UZS208T2	1	6301Z	D	20/35x7	1	1	S	17/30x6	1
4085	6204Z	6909	6301	19UZS208T2	1	6301Z	D	30/47x8	1	1	S	17/30x6	1
4090-4095 4097	6206Z	6011	6302RSH2	Refer to Table 21	1	6302Z	D	45/62x9	1	1	S	20/35x7	1
4100-4105	6306Z	16011	6302			6302Z	D	50/72x12	1	1	S	20/35x7	1
410H	6306Z	16011	6302			6302Z	D	50/72x12	1	1	S	20/35x7	1
4110-4115 4125	6308Z	6013	6304			6305Z	D	65/90x13	1	1	D	32/52x8	1
4130-4135	6211NR	6213	6305			6306	D	65/88x12	1	2	D	38/58x11	1
4145-4155	22211BNR	6213	6305R			6306	D	65/88x12	1	2	D	38/58x11	1
4160-4165	3TM-6213NR	6215	6307R			6308	D	85/110x13	1	2	D	55/78x12	1
416H	3TM-6213NR	6215	6307R			6308	D	85/110x13	1	2	D	55/78x12	1
4170-4175	6216NR	6218	6406	60UZS-417T2-SX	1	6407	D	95/130x15	1	2	D	60/82x12	1
4180-4185	6218NR	6220	6407	65UZS-418T2-SX	1	6409	D	110/145x15	1	2	D	65/88x12	1
4190-4195	6221NR	6026	6408	85UZS-419T2-SX	1	6411	D	120/155x16	1	2	S	70/88x10	1
4205	22220-BNRC2	6222C2	NJ310EV3	E-85UZS-220	1	21311V1	D	120/155x16	1	2	S	70/88x10	1
4215	23022-BNRC2	6224C2	NJ311EV1	E-95UZS-221	1	21311V1	D	130/160x14	1	2	S	75/100x13	1
4225	23024-BNRC2	6226C2	NJ312EV2	E-100UZS-222	1	21312V1	D	145/175x14	1	2	S	75/100x13	1
4235	23026-BNRC2	NUP228C2	NJ313EV3	E-105UZS-223	1	21314V1	D	160/190x16	1	2	S	85/110x13	1
4245	23028-BNRC2	NUP230C2	NJ314EV5	E-125UZS-224	1	21315V1	D	170/200x16	1	2	S	95/120x13	1
4255	23032-BNRC2	NUP234C2	NJ316EV1	140UZS-425-XX1	1	21318V1	D	190/225x16	1	2	S	110/140x14	1
4265	23034-BNRC2	NUP236C2	NJ317EV1	140UZS-226	1	21318V1	D	200/240x20	1	2	S	110/140x14	1
4275	23136-BNXR	6340	NJ417	180UZS-93	1	22222BL1	D	230/270x20	1	2	S	120/150x14	1



**Table 22 Double Reduction Units Intermediate Shaft Parts**

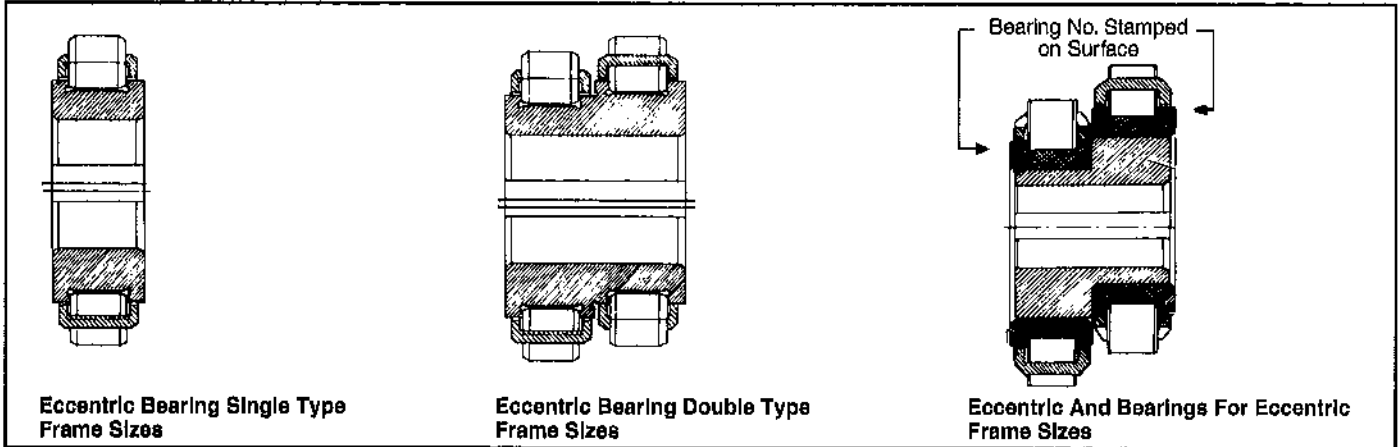
Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04		Part No. 5-03
	Number	Number	Qty	Number
4075DA	6201	19UZS208TZ	1	6909
4085DA	6301	19UZS208T2	1	6909
4097DA	6302RSH2	Refer to Table 21	1	6007
4105DA	6302			6007
4115DB	6304			6205
4135DC	6305			6206
4145DB	6305			6206
4165DC	6307R			6208
4175DC	6406			60UZS417T2-SX
4185DB	6407	65UZS418T2-SX	2	6213
4190DA- 4195DA	6408	65UZS419T2-SX	2	6210
4195DB	6408	65UZS419T2-SX	2	6213

**Note 1:** Required quantity of bearings (Part No. 1-02, 1-03, 3-02, 3-03, 5-02, 5-03) for each unit is one.

**Fig. 10**

Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04		Part No. 5-03
	Number	Number	Qty	Number
4205DA	NJ310EV3	E-85UZS220	1	6210
4205DB	NJ310EV3	E-85UZS220	1	6310
4215DA- 4215DB	NJ311EV1	E-95UZS221	1	6311
4225DA- 4225DB	NJ312EV2	E-100UZS222	1	6313
4235DA 4235DB	NJ313EV3	E-105UZS223	1	6314
4245DA	NJ314EV5	E-125UZS224	1	6315
4245DB	NJ314EV5	E-125UZS224	1	6316
4255DA- 4255DB	NJ316EV1	140UZS425-XX1	1	6318
4265DA	NJ317EV1	140UZS226	1	6320
4275DA	NJ417	180UZS03	1	22220RH

**Note 2:** On Table 15, Bearing for eccentric (Part No. 5-04) suffixed with "V" such as 60UZS87V is roller bearing without retainer.



**Table 23 Identification No. of Eccentric Bearing**

Frame Size	4090 4096 4097	4100 4105 410H 4105DA	4110 4115 4125 4116DB	4130 4135 4135DC	4145 4145DB	4155	4180 4165 4165DC	416H
Ratio	Part No. 3-04							
6	15UZE20906T2	15UZ21006T2	22UZ2110608T2	25UZ21406-11T2	-	25UZ8506-11T2S	35UZ2160608T2S	35UZ2160608T2S
8	15UZE20908-15T2	15UZ21008-15T2	22UZ2110808T2	25UZ21408-11T2	-	25UZ8508-11T2S	35UZ2160808T2S	35UZ2160808T2S
11	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ21406-11T2	25UZ21406-11T2	25UZ28506-11T2S	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/ 814389T2	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	-	-	-	-	-	-

# Disassembly/Assembly

## Disassembly

**SM-CYCLO® Reducers are designed to provide maximum ease when disassembling and reassembling; they require no special maintenance skills.**

1. Remove the complete SM-CYCLO® Reducer with adaptor (motorized type) from the driven machine.
2. Remove the plug at the bottom of the oil gauge to drain all oil from the unit.
3. Remove the cooling fan cover and fan from those Speed Reducers (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, and lift the slow speed side, thus separating the unit into two parts so that the inner mechanism can be removed (Figs. 11-16).

**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.

4. If the unit will not separate easily, gently drive a wedge at the line X shown in Fig. 1 on page 3 (if this produces a burr, be sure to remove it before reassembly).
5. To lift the slow speed side, attach an eyebolt to the tapped hole on the end of the slow speed shaft and use a hoist or chain block (Fig. 11).
6. Take out the slow speed shaft rollers, item 1-06, page 3 (Fig. 12). Check the slow speed shaft pins (1-01) to see whether any rollers have adhered to them.
7. Using both hands, lift out the top cycloid disc (2-04) on the slow speed side (Fig. 13).

8. Remove the spacer ring (2-05).

9. The eccentric (3-04) can be removed from the input shaft (3-01) after taking out the retaining ring (3-10) and the inner bearing raceway (Figs. 14, 15).

**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.

10. Take out the second disc located on the motor side. (Also remove second disc bearings and eccentric with inner bearing raceway if required.)

11. Remove the ring gear housing (2-01).

12. The slow speed shaft (1-01) with its bearings is removed from the casing (26) as follows: (a) Remove the horizontal oil seal housing (25). (b) With a wooden or hard rubber mallet, rap the inner end of the slow speed shaft to expose the retaining ring\* from the outer raceway of the bearing. (c) Remove the retaining ring. (d) Rap the outer end of the slow speed shaft with a wooden or hard rubber mallet, and remove it from the casing.

13. The high speed shaft (3-01) with bearings is removed from the high speed shaft end shield (8) by tapping the shaft end after first taking off the retaining ring (3-11).

14. 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.

The above instructions cover complete disassembly. In ordinary cases, however, only the removal of the cycloid discs and the eccentric, and removal of the slow speed shaft from the slow speed end cap is necessary.

**\*Note:** Retaining ring is part of bearing A (Part No. 1-02).

## 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 see that gaskets are properly placed to make the assembly oil-tight.

Following are some 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. 16.

4. Insert the spacer (3-07) and then insert the eccentric with bearings by rapping with a wooden or hard rubber mallet (Fig. 15).

5. Insert the other spacer and the inner bearing raceway. Secure them with the retaining ring (Fig. 14).

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. 13).**

8. Insert slow speed shaft rollers (Fig. 12).

9. Put the slow speed shaft pins into the rollers (Fig. 11). The above instructions are for eccentric bearings with retainer. Following are the instructions suggested for roller bearings without retainer.

a. First insert the eccentric with inner raceways of bearings by rapping with a wooden or hard rubber mallet.

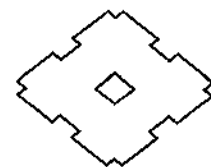


Fig. 11

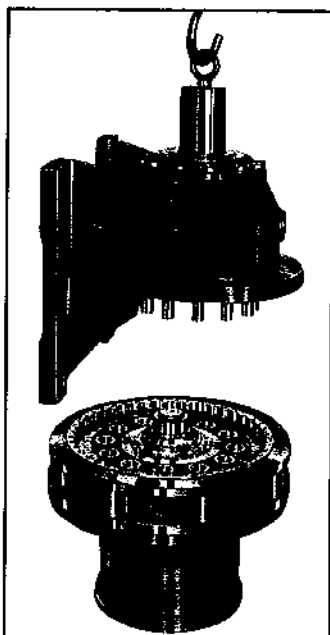


Fig. 12

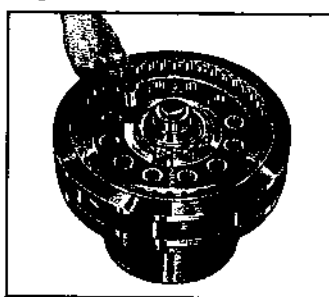


Fig. 13

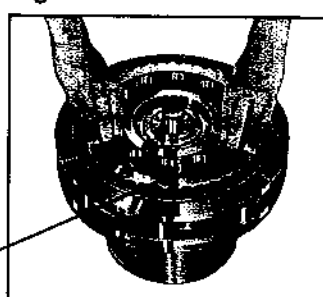


Fig. 14

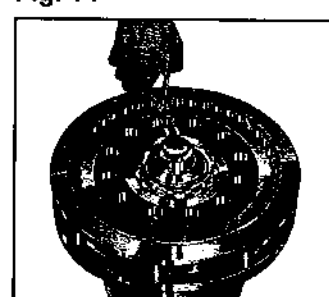


Fig. 15

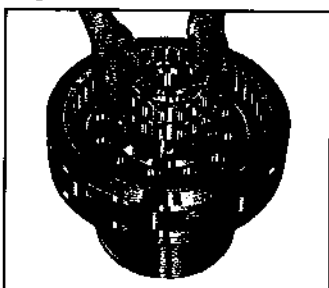
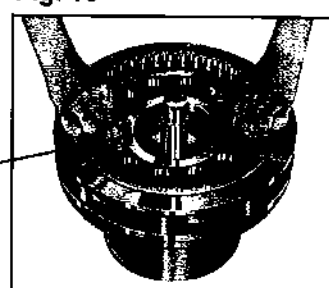


Fig. 16



**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.

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 second disc in such a way that mark is 180° opposed, to mark of 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 11).

It is necessary to insert replacement bearings with numbered surfaces of the inner raceways facing outward. Note that incorrect insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes trouble.

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

Small sizes 4075-4097 have a single disc system, 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. Refer to figure 24.
2. The balance weight must be positioned exactly 180° as opposed to that of the eccentric.
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 under "Disassembly and Assembly".

#### Disassembly Of Output Side (4075-4125)

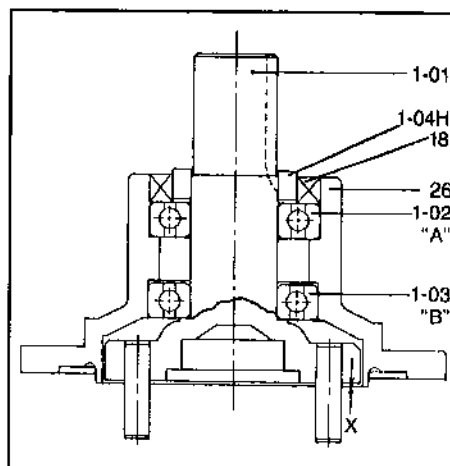
1. With casing supported, tap output shaft until it is disengaged from casing.
2. Remove bearing "A" by using pulling tool.
3. Replace all bearings, gaskets and seats when reassembling. (Pages 10 & 11).

#### Assembly Of Output Side (4075-4125)

1. Assemble the "B" bearing (Part No. 1-03) on the slow speed shaft (Part No. 1-01). Heating of "B" bearing is recommended for easier assembly.
- Note:** Do not exceed temperature of 200°F.
2. Assemble the casing (Part No. 26) over the slow speed shaft (Part No. 1-01), being sure to maintain "X" (Fig. 17).
3. Carefully tap bearing "A" (Part No. 1-02) onto the slow speed shaft (Part No. 1-01) until the bearing is flush with the shoulder of the casing.
4. Place the collar (Part No. 1-04H) onto the slow speed shaft (Part No. 1-01). Heating the collar is recommended for easier assembly.
5. Insert the oil seal (Part No. 18), lip in, into the casing (Part No. 26).

**Note:** Measure for dimension "X" preferably in 3 places to insure proper spacing.

Fig. 17



X" Dimension (Inches)

Frame Size	Dimension
4075	0.046 ± 0.007
4085	0.042 ± 0.007
4090/95/97	0.046 ± 0.007
4100/05/0H	0.046 ± 0.007
4110/15/25	0.042 ± 0.007

# Daily Inspection

1. Visually check the oil level gauge on the vertical unit, forced-lubricated type. Check lubrication flow by viewing piping set and oil signal (Part No. 41). Faulty operation is caused by a lack of lubrication oil, damage to the plunger pump (Part No. 42) or the positive displacement pump (Part No. 43) or the clogging of pipes, etc. In case of faulty operation, stop and inspect the unit immediately.

2. A temperature rise of approximately 105°F above ambient on the surface of the ring gear housing (Part No. 2-01) is allowable if the temperature fluctuation is

small. If temperature rises rapidly from a stable condition, add the recommended oil or grease (Tables 6 & 14). A rapid temperature rise may be caused from a lack of lubrication.

If after lubricating unit, the problem persists, stop operation and consult factory.

3. When an abnormal sound is heard from inside the unit, stop operation and inspect the unit.



4. If the lubrication oil leaks, replace the damaged or worn part with a new one. (Refer to Part No. 1-04H, Page 3.)

## Ordering Correct Replacement Units Or Parts

The SM-CYCLO® is fully standardized to offer maximum part interchangeability among models of the same frame size. However, there are many frame sizes, models and types in the production range of SM-CYCLO®. Therefore to get correct replacement units or parts, proper information to identify the speed reducer in question is essential. The name plate, which is secured to the body of the drive, provides this identifying data.

Please give the full description shown on the name plate to your distributor. Be sure to include the *SERIAL NUMBER* and *MODEL NUMBER*. This information, along with our production records, will enable us to provide you with the correct replacement unit or parts.

Name Plate on SM-CYCLO®

<b>SM-CYCLO®</b> CHESAPEAKE, VIRGINIA			<small>MEMBER OF</small> 
MODEL			
RATIO	SERVICE FACTOR		
INPUT	HP	RPM	
OUTPUT TORQUE		IN-LB	
SERIAL NO.			
 <b>SUMITOMO</b> MACHINERY CORP. OF AMERICA			

## Storage And Operation After Storage

### Storage 6 Months–1 Year

#### Oil-Lubricated

1. Completely fill unit(s) with a rust-preventive oil (NP20 or equivalent) or a circulating oil (Shell VSI No. 100 or equivalent).

2. At approximately 3 month intervals, rotate the input shaft a sufficient number of times to insure all internal components remain coated. (The higher the ratio, the greater the amount of rotations needed for proper lubrication.)

#### Grease-Lubricated

Grease-lubricated models do not require any special attention during storage. (Inspect unit before operation.)

**Note:** For both the *Oil-Lubricated* and *Grease-Lubricated* models, if units are to be stored for a period exceeding 1 year, consult factory.

### Operation After Storage 6 Months–1 Year

#### Oil-Lubricated

1. Completely drain the rust preventive, or circulating oil from unit.

2. Flush unit with the recommended operating oil as shown in Table 14.

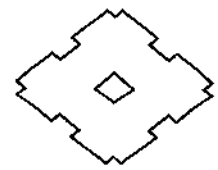
3. After flushing, fill the unit to the proper oil level with the recommended lubricating oil.

#### Grease-Lubricated

Add ½ of the recommended quantity of new grease as shown in Table 8.

**Note:** Consult the factory before operating units stored for periods greater than 1 year.

# Trouble-Shooting and Repair



This trouble shooting guide is to help you identify and overcome common problems of reducers. If you have a problem not listed below, please consult 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 adjust up to recommended levels.
		Excessive lubrication.	Check lubricant level and adjust down to recommended level.
		Wrong lubricant.	Flush out and refill with correct lubricant as recommended.
Runs Noisy	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. Recheck 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	Input 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.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Breather filter may be clogged. Replace or clean filter.
		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.

# CYCLO INTERCHANGE TABLE (3000-4000 SERIES)

CYCLO FRAME SIZE	SINGLE REDUCTION		DOUBLE REDUCTION		TRIPLE REDUCTION	
	Previous	New	Previous	New	Previous	New
	3075	4075	3075/07	4075DA	3075/07/07	4075TA
3085	4085	3085/07	4085DA	3085/07/07	4085TA	
3090	4090	3097/08	4097DA	3097/07/07	4095TA	
3095	4095	3105/08	4105DA	3105/08/07	4105TA	
3097	4097	3115/09	4115DB	3115/08/07	4115TA	
3100	4100	3145/10	4135DC	3115/09/08	4115TB	
3105	4105	3155/09	4145DB	3145/08/07	4135TA	
310H	410H	3165/11	4165DC	3145/09/08	4135TB	
3110	4110	3175/11	4175DC	3145/10/08	4135TC	
3115	4115	3185/14	4185DB	3155/10/08	4145TC	
311H	*4125	3190/11	4190DA	3165/10/08	4165TB	
3140	*4130	3195/11	4195DA	3175/10/08	4175TB	
3145	*4135	3195/14	4195DB	3185/10/08	4185TA	
3155	*4145	3205/11	4205DA	3185/14/09	4185TC	
315H	*4155	3205/14	4205DB	3190/11/08	4190TA	
3160	4160	3215/14	4215DA	3190/14/09	4190TD	
3165	4165	3215/16	4215DB	3195/11/08	4195TA	
316H	416H	3225/14	4225DA	3195/14/09	4195TD	
3170	4170	3225/17	4225DB	3205/14/09	4205TD	
3175	4175	3235/16	4235DA	3215/14/09	4215TB	
3180	4180	3235/18	4235DB	3225/14/09	4225TB	
3185	4185	3245/16	4245DA	3225/14/10	4225TC	
3190	4190	3245/18	4245DB	3235/16/09	4235TA	
3195	4195	3255/17	4255DA	3235/16/10	4235TB	
3205	4205	3255/19	4255DB	3245/16/09	4245TA	
3215	4215	3265/19	4265DA	3245/16/10	4245TB	
3225	4225	3275/19	4275DA	3255/17/09	4255TA	
3235	4235			3255/19/11	4255TD	
3245	4245			3265/19/11	4265TA	
3255	4255			3275/19/11	4270TA	
3265	4265			3275/19/14	4275TB	
3275	4275					

\*Revised Models (Nomenclature)

## Headquarters and Manufacturing

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### U.S. Stocking and Assembly Facilities

**Mid-West**  
 175 West Lake Drive, Glendale Heights, IL 60139  
 (630) 752-0200 • FAX: (630) 752-0208

**West**  
 2375 Railroad Street, Corona, CA 92880-5411  
 (909) 340-4100 • FAX: (909) 340-4108

**Southwest**  
 1420 Halsey Way #130, Carrollton, TX 75007  
 (972) 323-9600 • FAX: (972) 323-9308

### Canadian Stocking and Assembly Facilities

**Toronto (East)**  
 SM-CYCLO OF CANADA, LTD.  
 870A Equestrian Court, Oakville, Ontario, Canada L6L 6L7  
 (905) 469-1050 • FAX: (905) 469-1055

**British Columbia (West)**  
 SM-CYCLO OF CANADA, LTD.  
 740 Chester Road, Annacis Island, Delta  
 B.C., Canada V3M 6J1  
 (604) 525-5403 • FAX: (604) 525-0879

### Mexican Sales and Engineering Facility

**Monterrey**  
 SM-CYCLO DE MEXICO, S.A. DE C.V.  
 Calle "C" No. 506A  
 Parque Industrial Almacentro  
 Apodaca, N.L., Mexico 66600  
 011-52-8-369-3697/8  
 FAX: 011-52-8-369-3699

