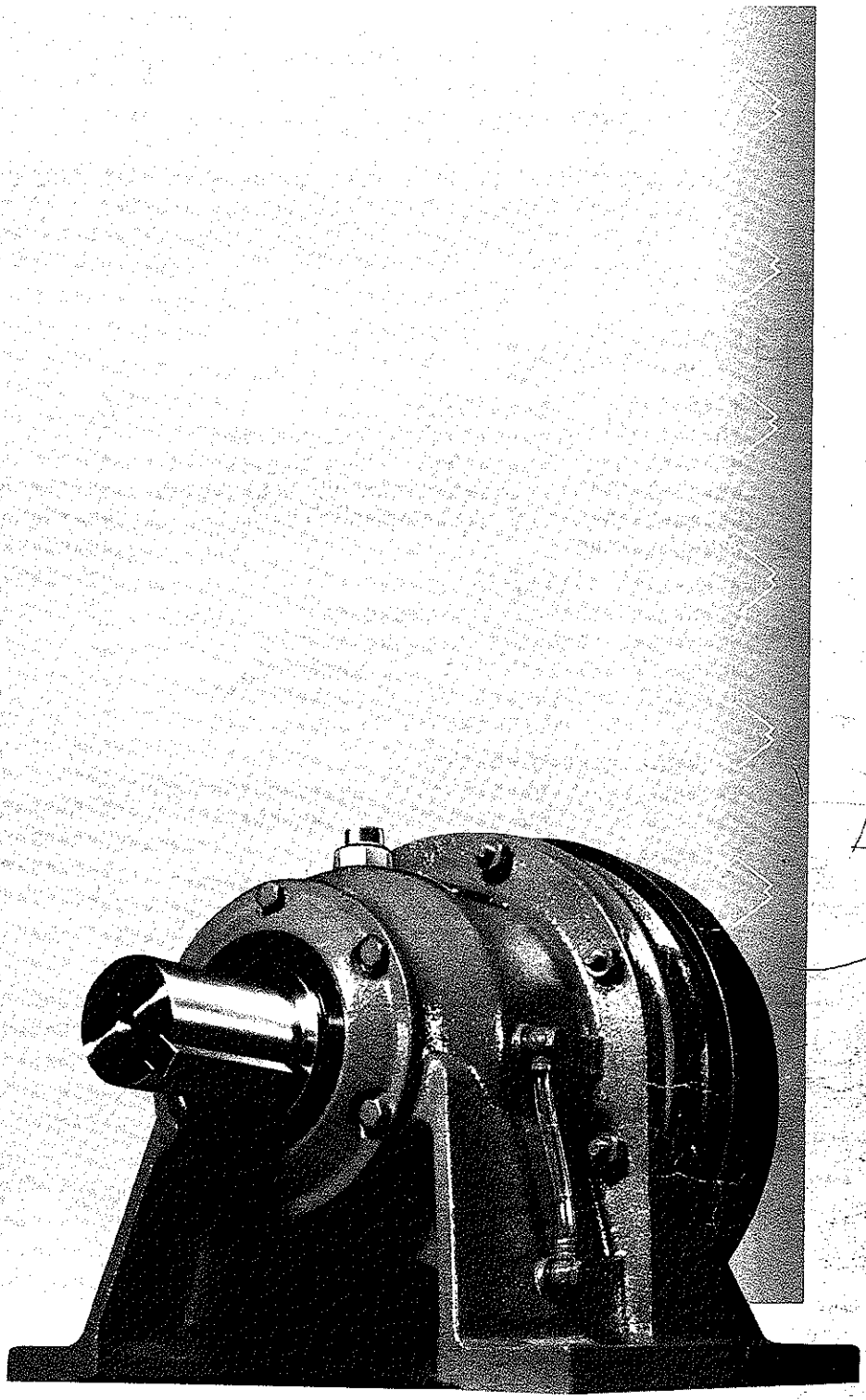
SUMITOMO
MACHINERY CORPORATION OF AMERICA

SM-CYCLO® SPEED REDUCERS

Operating and Maintenance Manual

3000 Series



Manual 03.301.60.005

Index

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.

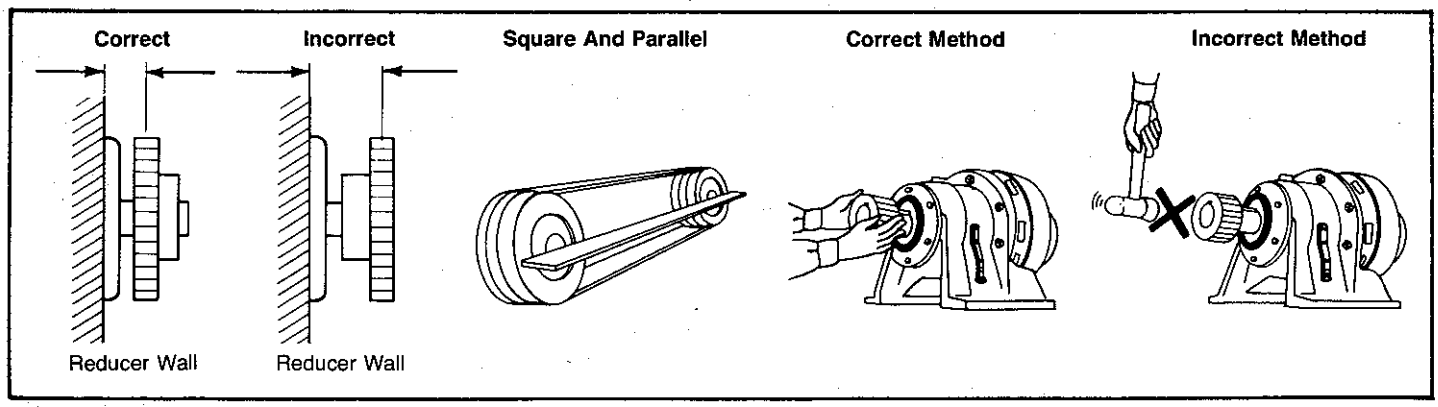
3. Overhung Load Positions
Overhung loads should be located as close to the bearing as possible. (See the Catalogue page 23.)

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 on places with easy accessiblity 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)

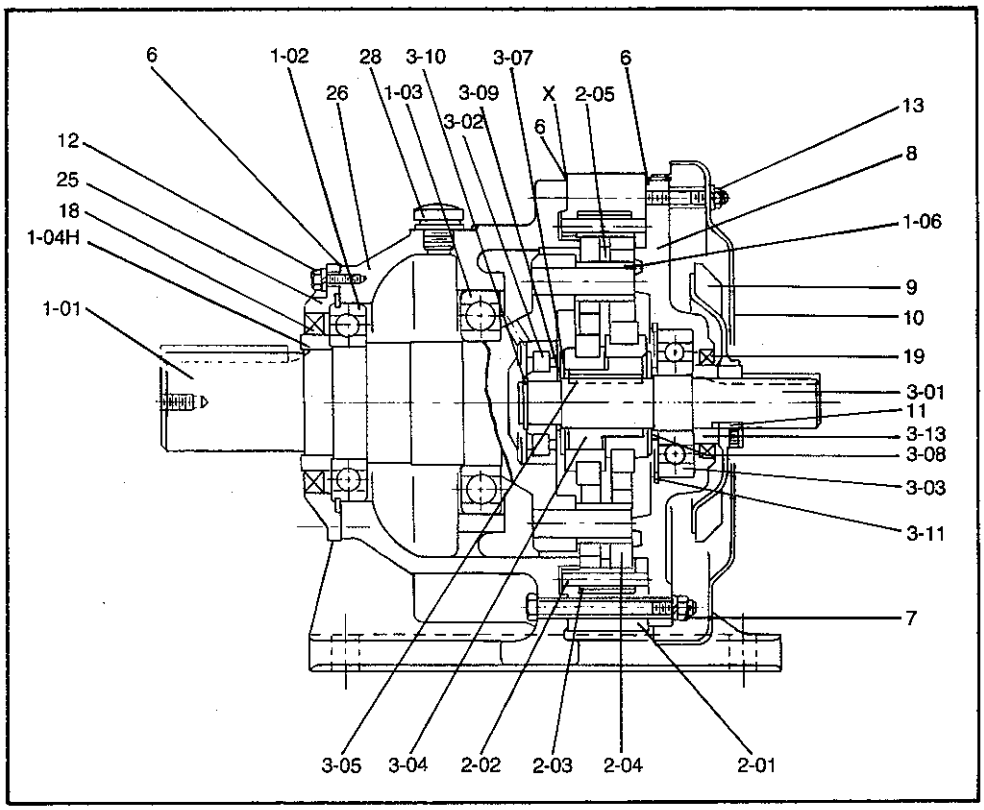
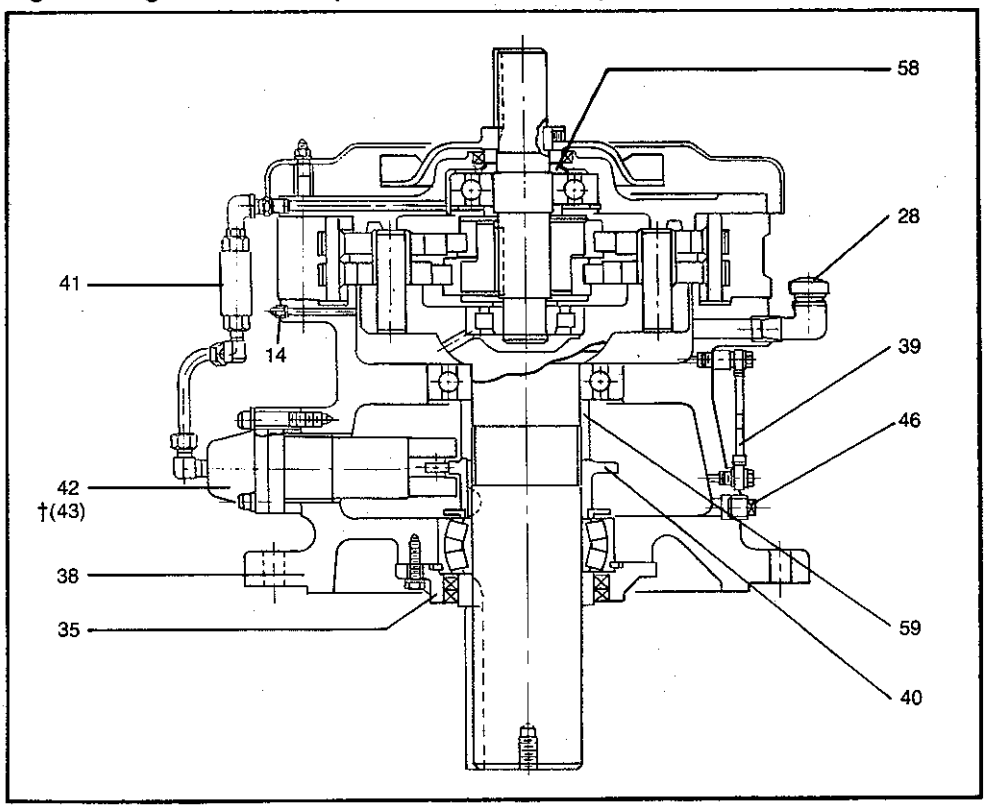


Fig. 2 Single Reduction (Vertical Base Mount)



Note: For details of oil seals, bearings or gaskets, refer to pages 10 and 11.
†Refer to Table on Pg. 7 for units which require a positive displacement pump.
*Pt. No. 58 — frame sizes 3195-3275 only.
*Pt. No. 59 — frame sizes 3205-3275 only.

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

Fig. 3 Speed Reducer/Single Disc Type (Frame Size 3075-3095)

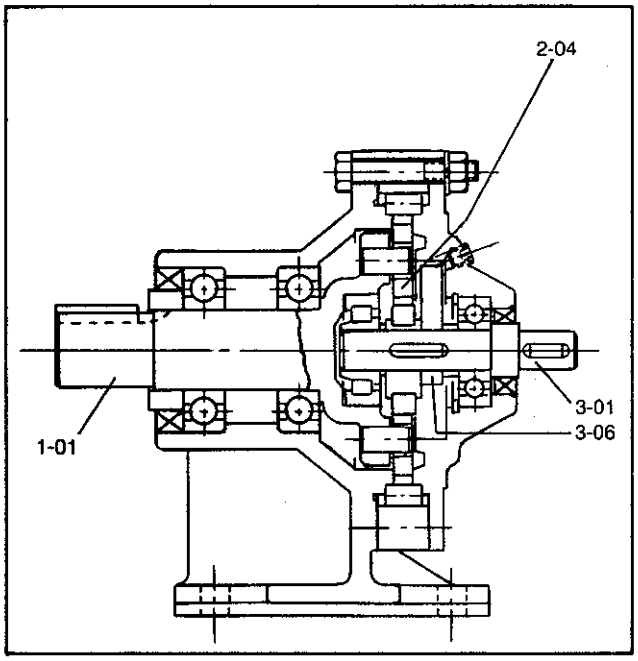
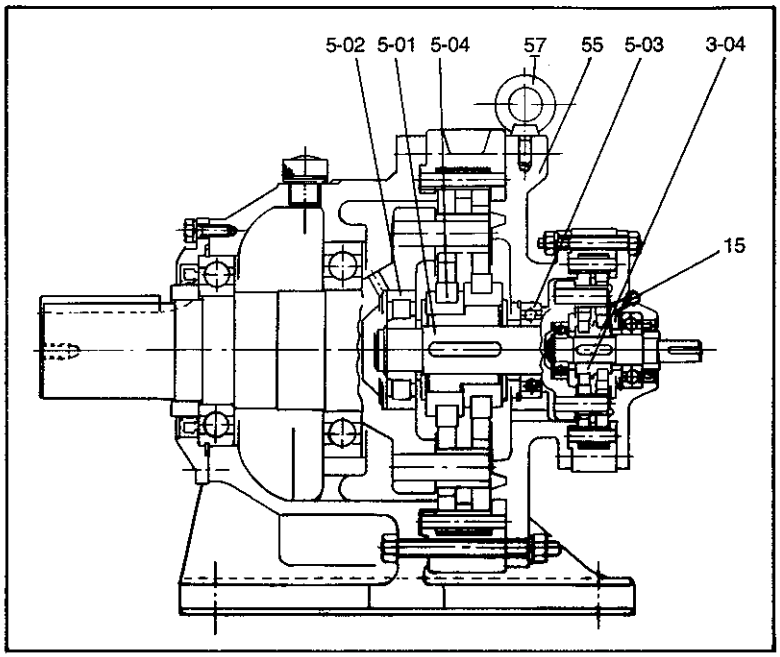


Fig. 4 Speed Reducer/Double Reduction



Speed Reducer — Single Disc

SM-CYCLO® single reduction, Models No. 3075-3095 employ the use of a single planetary gear (Cycloid Disc) and a balance weight.

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
3075/07	3075	3075
3085/07	3085	3075
3105/08	3105	3085
3115/09	3115	3095
3145/10	3145	3105
3155/09	3155	3095
3165/11	3165	3115
3175/11	3175	3115
3185/14	3185	3145
3190/11	3190	3115
3195/11	3195	3115
3195/14	3195	3145

Frame Size	Second Stage	First Stage
3205/11	3205	3115
3205/14	3205	3145
3215/14	3215	3145
3215/16	3215	3165
3225/14	3225	3145
3225/17	3225	3175
3235/16	3235	3165
3235/18	3235	3185
3245/16	3245	3165
3245/18	3245	3185
3255/17	3255	3175
3255/19	3255	3195
3265/19	3265	3195
3275/19	3275	3195

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 3075 through 311H are grease-lubricated. Sizes 3140 through 3275 are normally oil-lubricated. Double reduction units may be grease or oil-lubricated, depending on size, ratio, and/or application.

Grease Lubrication

Single Reduction Models—Table 3

Frame Size	3075	3085	3090 3095 3097	3100 3105 310H	3110 3115 311H
Horizontal Shaft	Grease (MAINTENANCE FREE)				
Vertical Shaft	Grease (MAINTENANCE FREE)				

For the single reduction units, frame sizes 3075-311H (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.

Double Reduction Models—Table 4

Frame Size		3075/07 thru 3155/09	3165/11	3175/11	3185/14	3190/11 3195/11 3195/14	3205/11 3205/14	3215/14 3215/16	3225/14 3225/17	3235/16 3235/18	3245/16 3245/18	3255/17 3255/19	3265/19	3275/19
Horizontal		Grease Lubricated Models												
VERTICAL	< Ratio > 102 ~ 493													
	522 ~ 841													
	957 ~ 1015													
	1225 ~ 2523													
	2537 ~ 3045													
	3045 ~ 7569													

Oil Lubricated Models

Triple Reduction Models—Table 5

Horizontal Shaft	Frame Size of The 1st Reduction Stage: 3105 or Smaller	Grease Lubricated (NLGI Grade 2)
Vertical Shaft	Frame Sizes: 3075/07/07 3265/19/14	Grease Lubricated (NLGI Grade 2)
	Frame Sizes: 3275/19/11 3275/19/14	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.

Designated Greases—Table 6

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

Grease Replenishment And Change Interval—Table 7

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 Month
		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 3075-311H are maintenance free units. Grease replenishment and change not being 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.

Quantities Of Grease (Ounces)—Table 8

Frame Size	3075	3085	3090 3095 3097	3100 3105 310H	3110 3115 311H
Speed Reduction Mechanism	.7	.7	2.1	3.5	8.5
Slow Speed Shaft Bearings	.4	.9	2.3	3.9	4.9

Frame Size	3075/07	3085/07	3105/08	3115/09	3145/10	3155/09	3165/11	3175/11	3185/14	3190/11 3195/11	3195/14	3205/11
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	3205/14	3215/14	3215/16	3225/14	3225/17	3235/16	3235/18	3245/16	3245/18	3255/17	3255/19	3265/19
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, as the reverse case, when the grease is insufficient it will raise the operating temperature due to the breakdown of the lubrication films on the eccentric bearing.

If a rise in the operating temperature is found supply grease immediately.

Oil Lubrication

SM-CYCLO® reducers sizes 3140 through 3275 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.

Single Reduction Models — Table 9

Frame Size	3140 3145	3155 315H	3160 3165 316H	3170 3175	3180 3185	3190 3195	3205	3215	3225	3235	3245	3255	3265	3275
Horizontal Shaft	Oil Bath													
Vertical Shaft	Oil Bath	Forced-oil Lubrication												

Double Reduction Models—Table 10

Frame Size		3165/11	3175/11	3185/14	3190/11 3195/11 3195/14	3205/11 3205/14	3215/14 3215/16	3225/14 3225/17	3235/16 3235/18	3245/16 3245/18	3255/17 3255/19	3265/19	3275/19
Horizontal		Oil Bath											
VERTICAL SHAFT	< Ratio > 102 ~ 493												
	522 ~ 841	Grease Lubricated Models					Forced-Oil Lubrication						
	957 ~ 1015												
	1225 ~ 2523												
	2537 ~ 3045												
	3045 ~ 7569												

Triple Reduction Models—Table 11

Horizontal	Frame Size Of The 1st Reduction Stage: 3115 Or Larger	Oil Bath Lub. (Refer to Table 12)
Vertical	Frame Size: 3275/19/11 and 3275/19/14	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

Plunger Pump Type

Small Size Pump		Large Size Pump	
Frame Size	Ratio	Frame Size	Ratio
3160 3170 3180 3190 3165 316H 3175 3185 3195	All	3205 3215 3225 3235 3245 3255 3265	All
3165/11 thru 3195/14	All	3205/11-3265/19	All

Positive Displacement Type Pump

SM-CYCLO Reducer		Positive Displacement Pump
Frame Size	Reduction Ratio	
3275	All	TOP-216HAVB-3
3275/19	All	TOP-204HAVB-3

1-1 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.

1-2 Positive Displacement Pump Lubrication

Forced oil lubrication is accomplished by using a positive displacement pump and motor which 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.

Type Of Lubrication Oil—Table 12

Mild EP Oil is used for the lubrication of SM-CYCLO® Reducers, Models 3140 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
Viscosity @ 100°F (38°C) SSU	214 ~ 389	468 ~ 871	1047 ~ 2719
SAE Grade (Crankcase Oils)	20 W	30 40	50

Allowable Viscosity Of Oil—Table 13

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

Oil Quantities (Gallons)—Table 14

	Frame Size	3140 3145 3155 315H	3160 3165 316H	3170 3175	3180 3185	3190 3195	3205	3215	3225	3235	3245	3255	3265	3275
Single Reduction	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)

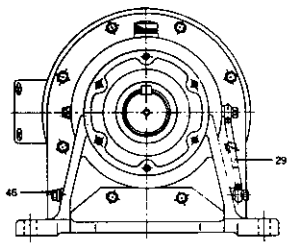
	Frame Size	3165/11	3175/11	3185/14	3190/11 3195/11 3195/14	3205/11 3205/14	3215/14 3215/16	3225/14 3225/17	3235/16 3235/18	3245/16 3245/18	3255/17 3255/19	3265/19	3275/19
Double Reduction	Horizontal	0.4	0.6	0.9	1.6	1.6	2.7	2.9	4.5	4.8	6.1	8.5	18.5
	Vertical	0.3	0.5	0.5	0.7	2.9	3.7	4.8	6.1	7.7	11.1	13.5	(15.9)

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

Oil Change—Table 15

1. All oil levels and oil quantity must be **checked every 5,000 hours.** If the oil is contaminated, burned or waxed, change the oil immediately and flush out the box if necessary.
2. Under normal operating conditions, we recommend an oil **change every 10,000 hours** of operation. The intervals should, however, not exceed 2 years.
3. An oil change for the first time after approximately 500 hours of operation is highly recommended, and a more frequent oil change will give you a much longer life (3,000 - 5,000 hours).
4. The above suggestions are however, subject to change if the units are running in high temperature, high humidity or corrosive environments. If any of these situations exist, the lubricant may have to be changed more frequently.

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. The standard vinyl oil gauge shall be used at 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 picture 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

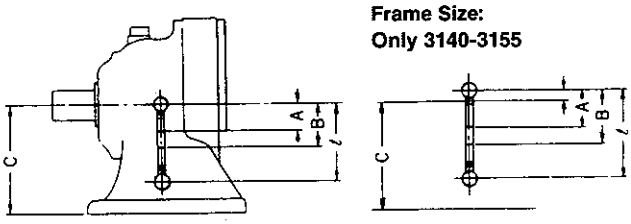
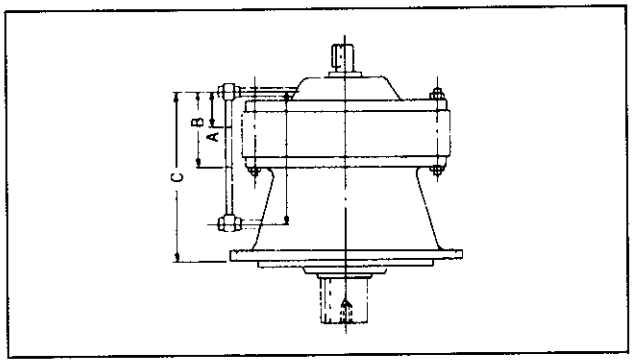


Table 16 Oil Level Dimensions (Inches)

Frame Size	A	B	C	ℓ
3140-3145	1.38	2.18	5.91	4.66
3155, (315H)	1.38	2.18	5.91 (6.30)	4.66
3160-3165, (316H)	1.57	2.75	6.30 (7.87)	3.70
3165/11	1.18	1.78	6.30	3.70
3170-3175	1.97	3.34	7.87	4.96
3175/11	1.18	1.78	7.87	4.96
3180-3185	2.18	3.93	8.66	5.91
3185/14	1.38	2.18	8.66	5.91
3190-3195	2.25	3.25	9.84	6.61
3190/11-3195/11	1.18	1.78	9.84	6.61
3195/14	1.38	2.18	9.84	6.61
3205	2.12	3.18	9.84	5.47
3205/11	1.25	1.93	9.84	5.47
3205/14	1.25	2.13	9.84	5.47
3215	2.05	3.03	10.43	6.03
3215/14	1.18	1.97	10.43	6.03
3215/16	1.57	2.75	10.43	6.03
3225	2.25	3.43	11.03	6.50
3225/14	1.25	2.05	11.03	6.50
3225/17	1.85	3.43	11.03	6.50
3235	2.48	3.47	11.81	7.17
3235/16	1.57	2.75	11.81	7.17
3235/18	1.97	3.35	11.81	7.17
3245	2.76	3.78	13.19	7.76
3245/16	1.65	2.72	13.19	7.76
3245/18	2.00	3.35	13.19	7.76
3255	3.18	4.17	14.76	8.47
3255/17	1.97	3.35	14.76	8.47
3255/19	2.25	3.22	14.76	8.47
3265	3.22	4.22	15.75	9.49
3265/19	2.28	3.25	15.75	9.49
3275	3.35	4.53	21.25	11.22
3275/19	2.75	4.33	21.25	11.22

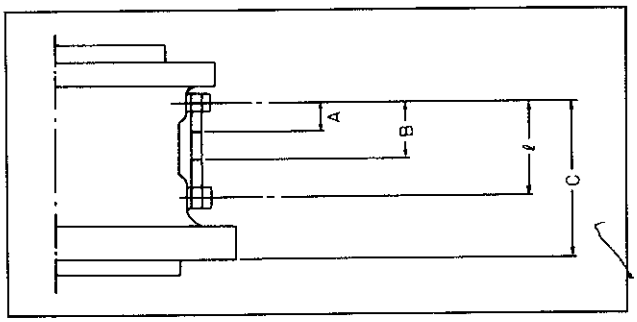
Base Mount Vertical Type
Frame Size: 3140-315H
Fig. 7



Base Mount Vertical Type
Table 17 Oil Level Dimensions (Inches)
Frame Size: 3140-315H

Frame Size	A	B	C	ℓ
3140-315H	1.85	2.72	7.46	5.78

Base Mount Vertical Type
Frame Size: 3160-3275
Fig. 8



Base Mount Vertical Type
Table 18 Oil Level Dimensions (Inches)
Frame Size: 3160 ~ 3275

Frame Size	A	B	C	ℓ
3160-3165, 316H	1.03	1.42	4.68	2.71
3170-3175	1.69	2.48	6.03	3.78
3180-3185	1.93	2.71	6.73	4.25
3180-3195	2.09	3.27	7.87	5.47
3205	1.46	2.04	7.09	3.54
3215	1.46	2.04	7.09	3.54
3225	1.46	2.04	7.87	3.54
3235	1.46	2.04	7.72	3.54
3245	1.46	2.04	8.01	3.54
3255	1.46	2.04	8.64	3.54
3265	1.46	2.04	9.61	3.54
3275	1.97	2.75	13.38	5.50

Bearings, Oil Seals, Gaskets

Fig. 9

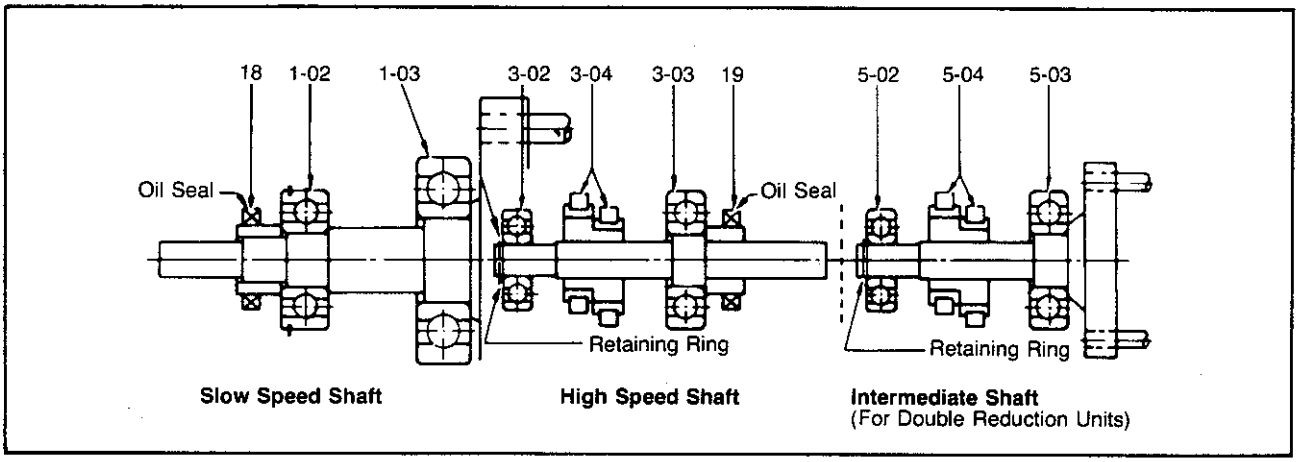


Table 19 Single Reduction Units

	BEARINGS						OIL SEALS					
	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	
Frame Size	Number	Number	Number	Number	Q'ty	Number Speed Reducer only	Type	Dimension	Q'ty H Type	Q'ty V Type	Type	Dimension	Q'ty
3075	6202Z	6203	6201	19UZS208T2	1	6301Z	D	20/ 35x 7	1	1	S	17/ 30x 6	1
3085	6204Z	6909	6301	19UZS208T2	1	6301Z	D	30/ 47x 8	1	1	S	17/ 30x 6	1
3090-3095 3097	6206Z	6011Z	6302RSH2	Refer to Table 21	1	6302Z	D	45/ 62x 9	1	1	S	20/ 35x 7	1
3100-3105	6306Z	6011Z	6302			6302Z	D	50/ 72x12	1	1	S	20/ 35x 7	1
310H	6306Z	16011	6302			6302Z	D	50/72x12	1	1	S	20/35x7	1
3110-3115 311H	6308Z	6013	6304			6305Z	D	65/ 90x13	1	1	D	32/ 52x 8	1
3140-3145	6211NR	6213	6305			6306	D	65/ 88x12	1	2	D	38/ 58x11	1
3155-315H	22211BNR	6213	6305R			6306	D	65/ 88x12	1	2	D	38/ 58x11	1
3160-3165	6213NR	6215	6307R			6308	D	85/110x13	1	2	D	55/ 78x12	1
316H	3TM-6213NR	6215	6307R			6308	D	85/110x13	1	2	D	55/78x12	1
3170-3175	6216NXR	6218	6406	60UZS87	2	6407	D	95/130x15	1	2	D	60/ 82x12	1
3180-3185	6218NR	6220	6407	65UZS88	2	6409	D	110/145x15	1	2	D	65/ 88x12	1
3190-3195	6221NR	6026	6408	85UZS89	2	6411	D	120/155x16	1	2	S	70/ 88x10	1
3205	22220BNRC2	6222C2	NJ310EV3	E-85UZS220	2	21311V1	D	120/155x16	1	2	S	70/ 88x10	1
3215	23022BNRC2	6224C2	NJ311EV1	E-95UZS221	2	21311V1	D	130/160x14	1	2	S	75/100x13	1
3225	23024BNRC2	NUP226C2	NJ312EV2	E-100UZS222	2	21312	D	145/175x14	1	2	S	75/100x13	1
3235	23026BNRC2	NUP228C2	NJ313EV3	E-105UZS223	2	21314V1	D	160/190x16	1	2	S	85/110/13	1
3245	23028BNRC2	NUP230C2	NJ314EV5	E-125UZS224	2	21315V1	D	170/200x16	1	2	S	95/120x13	1
3255	23032BNRC2	NUP234C2	NJ316EV1	140UZS225	2	21318V1	D	190/225x16	1	2	S	110/140x14	1
3265	23034BNRC2	NUP236C2	NJ317EV1	14OUZS226	2	21318V1	D	200/240x20	1	2	S	110/140x14	1
3275	23136BNXR	6340	NJ417	180UZS93	2	22222BL1	D	230/270x20	1	2	S	120/150x14	1

Table 20 Double Reduction Units Intermediate Shaft Parts

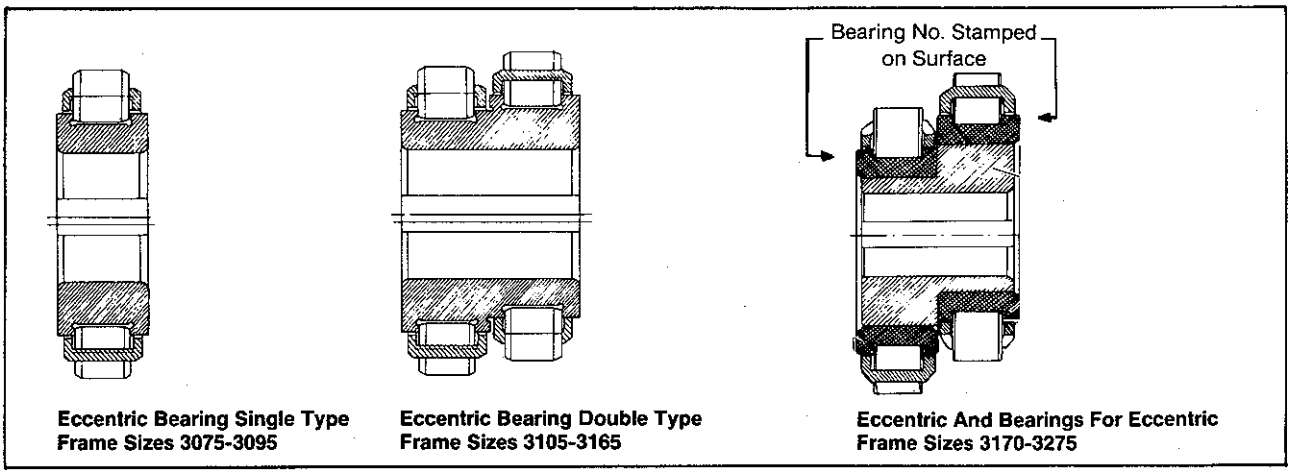
Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04		Part No. 5-03
	Number	Number	Q'ty	Number
3075/07	6201	19UZS208	1	6909
3085/07	6301	19UZS208	1	6909
3105/08	6302	Refer to Table 21	1	6007
3115/09	6304			6205
3145/10	6305			6206
3155/09	6305			6206
3165/11	NJ307G1			6208
3175/11	NJ406G1	60UZS87V	2	6208
3185/14	NJ407G1	65UZS88V	2	6213
3190/11-3195/11	NJ408G1	85UZS89V	2	6210
3915/14	NJ408G1	85UZS89V	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.

Frame Size	BEARINGS			
	Part No. 5-02	Part No. 5-04		Part No. 5-03
	Number	Number	Q'ty	Number
3205/11	NJ310EV3	E-85UZS220	2	6210
3205/14	NJ310EV3	E-85UZS220	2	6310
3215/14-3215/16	NJ311EV1	E-95UZS221	2	6311
3225/14-3225/17	NJ312EV2	E-100UZS222	2	6313
3235/16-3235/18	NJ313EV3	E-105UZS223	2	6314
3245/16	NJ314EV5	E-125UZS224	2	6315
3245/18	NJ314EV5	E-125UZS224	2	6316
3255/17-3255/19	NJ316EV1	140UZS225	2	6318
3265/19	NJ317EV1	140UZS226	2	6320
3275/19	NJ417	180UZS93	2	6420CS30

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

Fig. 10



Eccentric Bearing Single Type Frame Sizes 3075-3095

Eccentric Bearing Double Type Frame Sizes 3105-3165

Eccentric And Bearings For Eccentric Frame Sizes 3170-3275

Table 21 Identification No. of Eccentric Bearing

Frame Size	3090 3095 3097	3100 3105 310H 3105/08	3110 3115 311H 3115/09	3140 3145 314H 3145/10	3155 3155/09	315H	3160 3165 3165/11	316H
Ratio \ Part No.	3-04							
6	15UZE20906T2	15UZ21006T2	22UZ2110608T2	25UZ8506-11T2	—	25UZ8506-11T2S	35UZ860608T2	35UZ860608T2S
8	15UZE20908-15T2	15UZ21008-15T2	22UZ2110608T2	25UZ8506-11T2	—	25UZ8506-11T2S	35UZ860608T2	35UZ860608T2S
11	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ8506-11T2	—	25UZ28506-11T2S	35UZ8611-15T2	35UZ8611-15T2S
13	15UZE20908-15T2	15UZ21008-15T2	22UZ2111317T2	25UZ8513-17T2	25UZ8513-17T2	25UZ8513-17T2S	35UZ28611-15T2	35UZ8611-15T2S
15	15UZE20908-15T2	15UZ21008-15T2	22UZ2111115T2	25UZ8513-17T2	25UZ8513-17T2	25UZ8513-17T2S	35UZ8611-15T2	35UZ8611-15T2S
17	15UZE20917T2	15UZ21017T2	22UZ2111317T2	25UZ8513-17T2	—	25UZ8513-17T2S	35UZ8617-25T2	—
21	15UZE20921T2	15UZ21021T2	22UZ21121T2	25UZ8521/25 417T2	25UZ852125/ 417T2	25UZ852125/ 417T2S	35UZ88617-25T2	35UZ8617-25T2S
25	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ852125/ 417T2	—	25UZ852125/ 417T2S	35UZ8617-25T2	35UZ8617-25T2S
29	15UZE2092529T2	15UZ2102529T2	22UZ2112529T2	25UZ852935T2	—	25UZ852935T2S	35UZ862935T2	—
35	15UZE20935T2	15UZ21035T2	22UZ21135T2	25UZ2852935T2	25UZ852935T2	—	35UZ862935T2	—
43	15UZE20943T2	15UZ21043T2	22UZ21143T2	25UZ8543-59T2	—	25UZ8543-59T2S	35UZ864351T2	35UZ864351T2S
51	15UZE20951/ 814359T2	15UZ21051/ 824359T2	22UZ2115159T2	25UZ8543-59T2	25UZ8543-59T2	—	35UZ864351T2	35UZ864351T2S
59	15UZE20959T2	15UZ21059T2	22UZ2115159T2	25UZ8543-59T2	25UZ8543-59T2	—	35UZ8659T2	—
71	15UZE20971 8187T2	15UZ21071/ 8287T2	22UZ2117187T2	25UZ857187T2	—	25UZ857187T2S	35UZ8671/ 659T2	35UZ8671/ 659T2
87	15UZE20987T2	15UZ21087T2	22UZ2117187T2	25UZ857187T2	25UZ857187T2	—	35UZ8687T2	—
119	15UZE209119T2	15UZ210119T2	—	—	—	—	—	—

Disassembly

SM-CYCLO® Reducers are designed to provide maximum ease in 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 . . . X shown in Fig. 1 on page 3 (if in so doing a burr is produced, 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. The top cycloid disc (2-04) on the slow speed side can be easily lifted out with both hands (Fig. 13).

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

9. 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 (Fig. 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 on the high speed 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 slow speed end cap (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 end shield (8) by tapping the shaft end after first taking off the retaining ring (3-11).

14. The cycloid disc is made from bearing steel and heat treated while 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 carrying the same number which is stamped on one side of each disc.

3. Set the cycloid disc with the stamped number face up as shown in figure 16.

4. Insert the end plate (35) and then insert the eccentric with bearings by rapping with a wooden or hard rubber mallet (Fig. 15).

5. Insert the other end plate 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 marking of 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

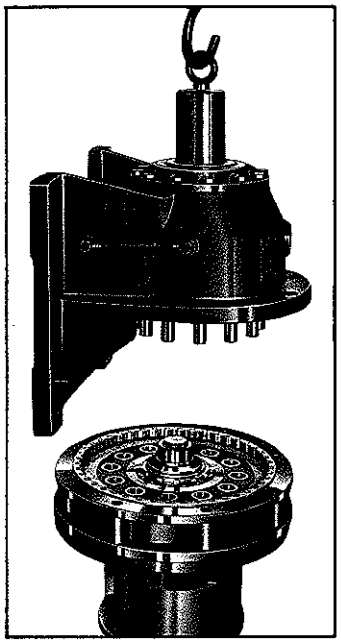


Fig. 12

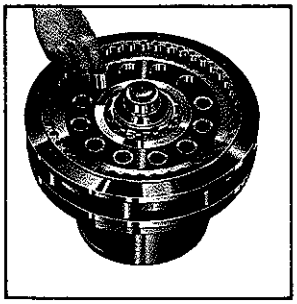


Fig. 13

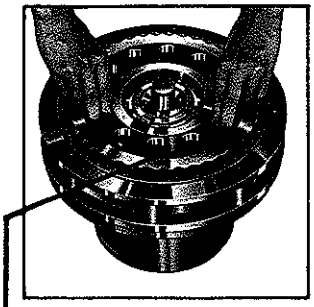


Fig. 14

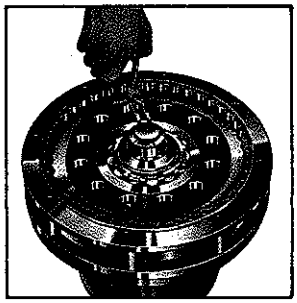


Fig. 15

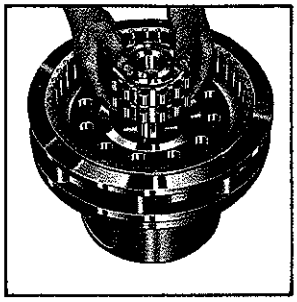
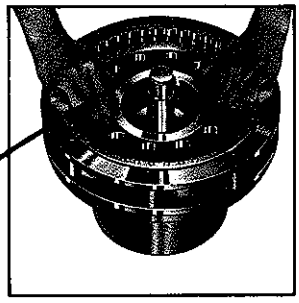


Fig. 16



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 the wrong insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes trouble.

Disassembly and Reassembly of Sizes 3075-3097 SM-CYCLO® Reducers

Small sizes 3075-3097 are of 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 3 on pg. 4.

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, 3075-3095 have exactly the same construction as the larger sizes. Follow the instructions given under "Disassembly and Reassembly".

Disassembly Of Output Side (3075-311H)

1. With casing supported, tap output shaft until it is disengaged from casing.

2. Remove bearing "A" (Part No. 1-02) by using pulling tool.

3. Replace all bearings, gaskets and seals when reassembling. (Page number 10 & 11).

Assembly Of Output Side (3075-311H)

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.

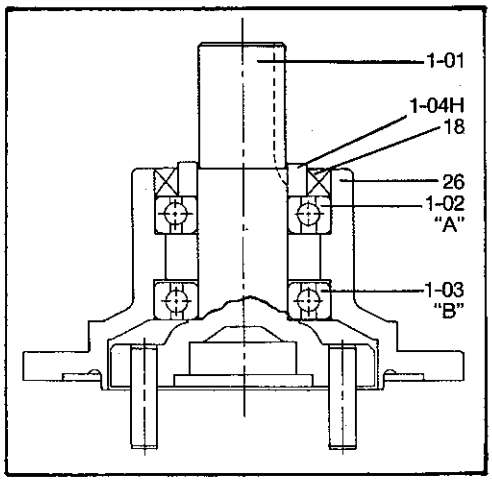
2. Assemble the casing (Part No. 26) over the slow speed shaft (Part No. 1-01).

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).

Fig. 17



Daily Inspection

1. Visually check the oil level gauge on the vertical unit, forced-lubricated type. Check lubrication flow by viewing pressure gauge (Part No. 41), whose 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 & 12). 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 abnormal sound is heard from inside the unit, stop operation and inspect the unit.

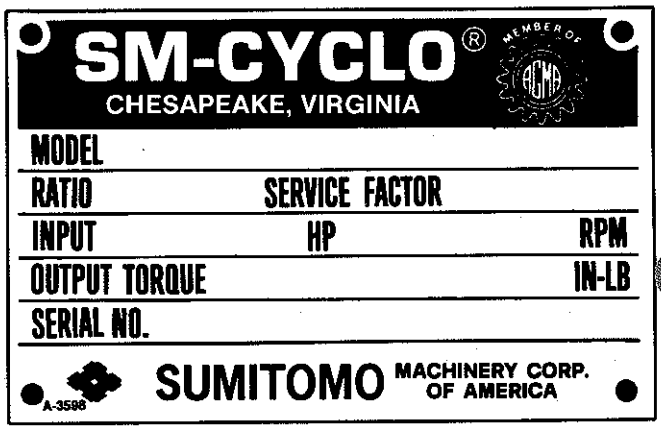
4. If the lubrication oil leaks, replace the damaged or worn part with new one. (Refer to Part No. 1-04H, Page 3).

Ordering Correct Replacement Units Or Parts

The SM-CYCLO® is fully standarized 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 provides this identifying data which is secured to the body of the drive.

By reading the name plate, please give the full description, being sure to include the *SERIAL NUMBER* and *MODEL NUMBER,* to our distributors. Our production records will supply us with all the necessary information so as to provide you with the correct unit or parts if such information is provided.

Name Plate On SM-CYCLO®



Storage And Operation After Storage Of SM-CYCLO®

Storage 6 Months-1 Year

Oil-Lubricated

1. Completely fill unit(s) with a rust-preventive oil (NP 20 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 Of 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 12.

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

Grease-Lubricated

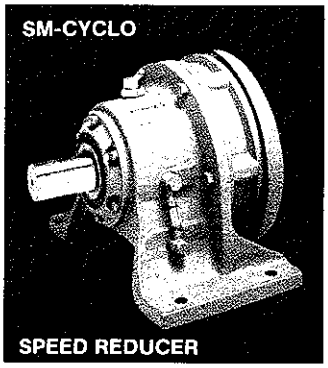
Add ½ of the recommended quantity of new grease as shown in Table 8.

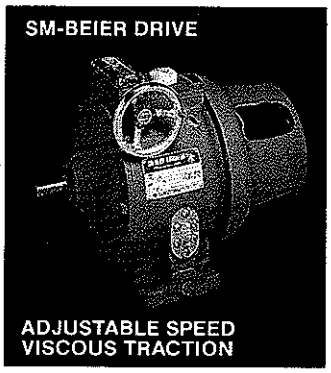
Note: Before operation of units stored for periods greater than 1 year, consult factory.

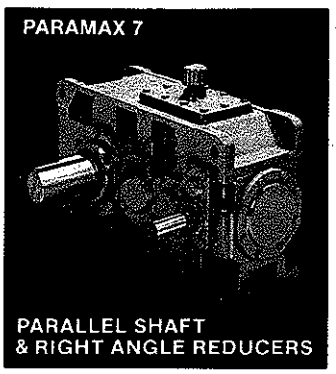
TROUBLE SHOOTING AND REPAIR

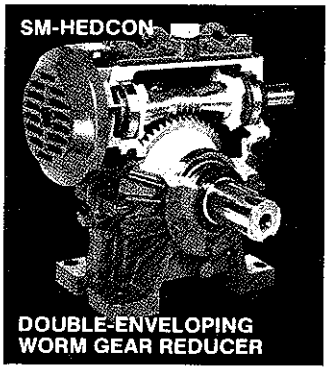
This trouble shooting guide is to help you identify and overcome common problems of reducers. If you have a problem not listed below, please consult factory at Teterboro.

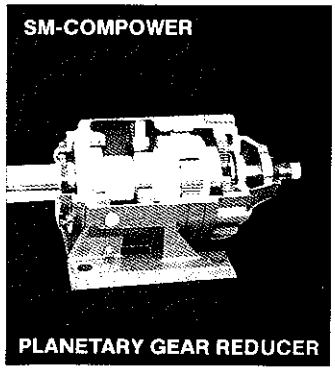
PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer.	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load.
	Improper Lubrication	Insufficient lubrication.	Check lubricant level and adjust up to recommended 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 imput 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.











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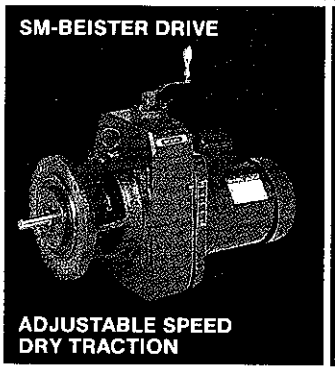

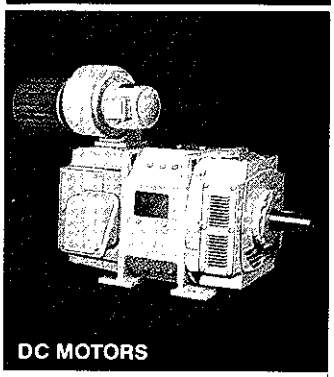

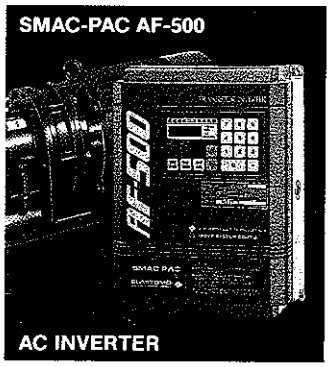

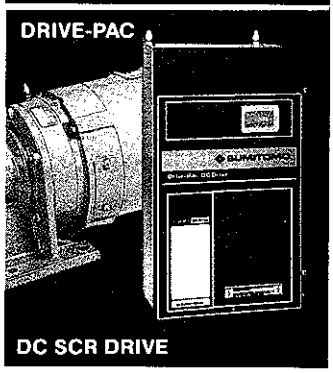

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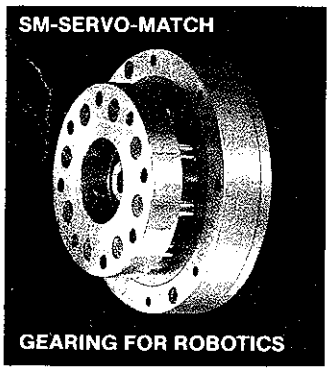

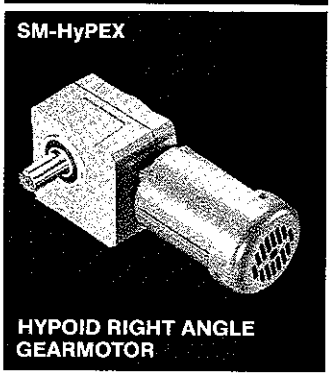

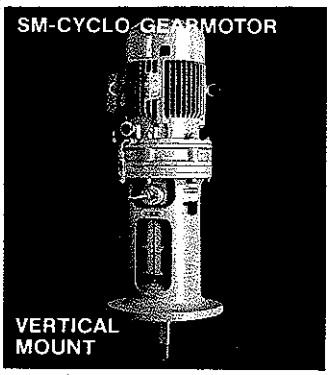

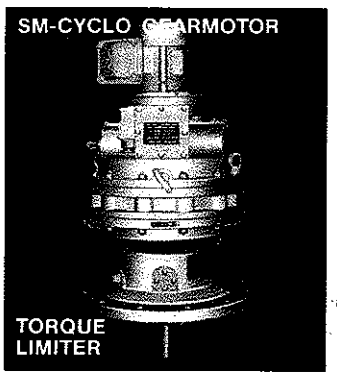

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