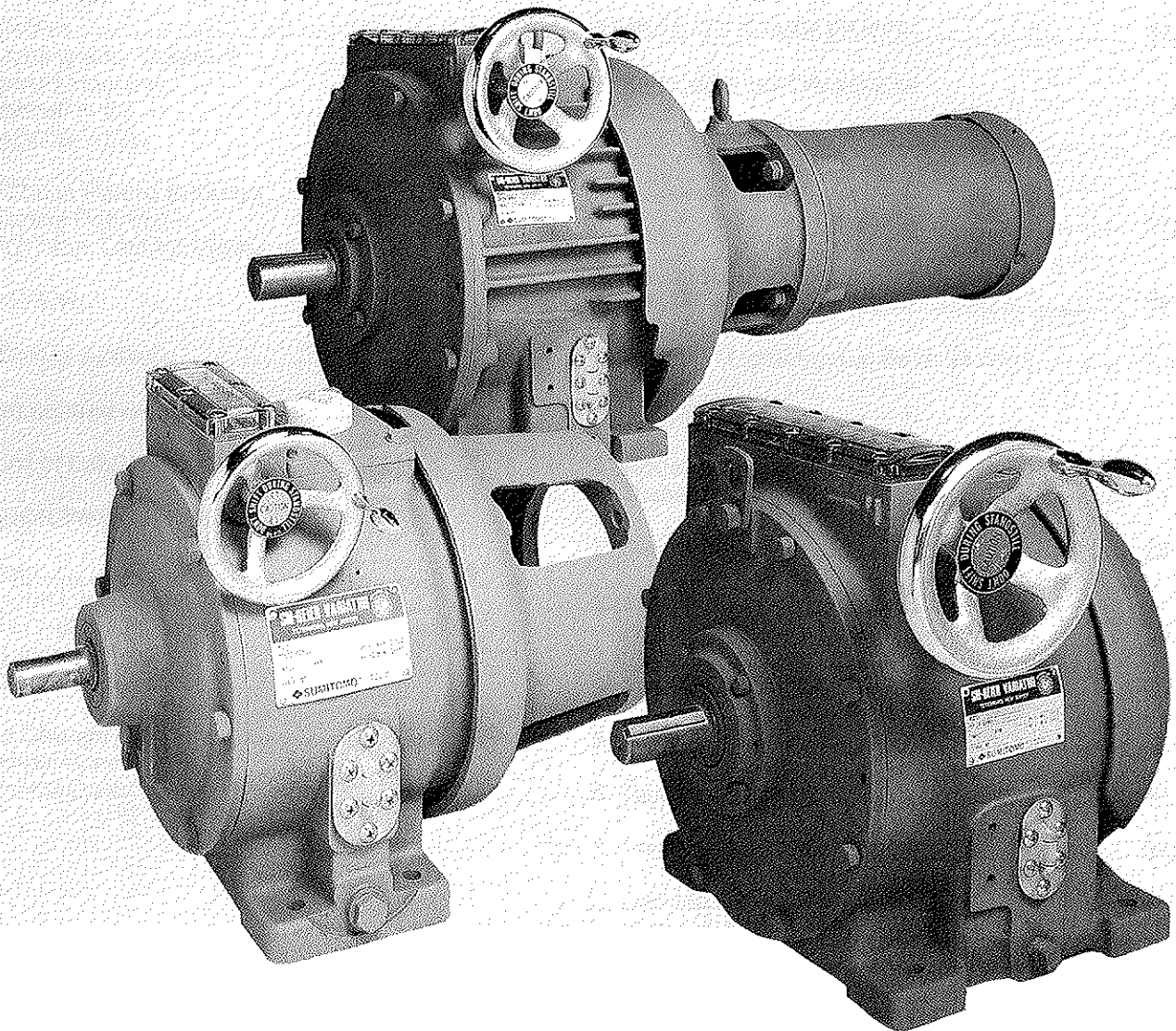


SUMITOMO

MACHINERY CORPORATION OF AMERICA

SM-BEIER VARIATOR

Operating and Maintenance Manual



Manual 06.301.60.005

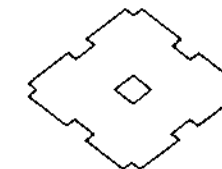


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GENERAL NOTES

1. Two Important Precautions

a) Operation of Handwheel

The speed change handwheel must not be turned unless the Variator is running, otherwise serious damage may occur. The discs are always in firm mesh with each other even when the unit is not running because the spring always produces a constant thrust. Any forcible dislocation of mesh can cause serious damage to the discs and spline shafts. (Therefore, remove handwheel from the drive wherever possible to prevent this occurrence.)

b) Lubrication

Maintenance of the lubrication oil is extremely important. It is the life blood of the wear life of all rotating components. The power is transmitted through the "contacts" of the flange and cone discs by means of hydrodynamic shear of an oil film. The breakage of an oil film due to deteriorated oils results in "galling" of the discs due to metal to metal contact. To maintain correct lubrication, please carefully study the chapter covering "Lubrication" on pages 6 and 7 before operating the drive.

2. How to Identify Models

The Beier Variator is a fully standardized mechanical variable speed (V/S) drive and offers many various types and capacity models. Therefore, the identification of the drive in question is essential for after-sale service. All necessary information is written on the name plate which is secured to the casing. By reading both Model No. and Serial No. our records tell us everything about the drive and the correct spare parts can be issued.

a) Description on Name Plate

(Example of Description for Model 15 AGY)

SM-BEIER VARIATOR

CHESAPEAKE, VIRGINIA

MODEL

SPEED RANGE

INPUT RPM

HP AT MAX. SPEED

HP AT MIN. SPEED

SERIAL NO.

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identifies Model No. of the drive.

shows the output speed range in terms of ratio to the input speed.

shows the rated input power in HP at the maximum and minimum output speeds under rated input speed.

rated input speed.

identifies production Serial No., reference to any special information required for this application.

NOMENCLATURE

The basic nomenclature of the Beier and Beier-Cyclo Variator indicates shaft orientation, rated input power, unit size and input mounting: typical frame size designations follow:

NOTES:

- 1) For vertical Beier, replace "H" with "V" designation.
- 2) C designation is replaced by M when TEFC motor is supplied by factory.
- 3) ¾ HP, 1 HP, 1½ HP and 2 HP Beiers have similar nomenclature. Add SUFFIX -1 to distinguish between ¾ HP (No -1) and 1 HP (which has -1). Same for 1½ and 2 HP. No Dash 2 = 1½ HP. -2 = 2 HP.

Beier Variator

N3

AX

C²

Y

-

C

Size of Beier Variator (3 HP)

AX Series Beier Variator (1750 RPM top output speed)

with C Face Motor Adaptor

SMA Code

C Face output

G Type Beier (Gear Reduction)

N15

A

G

Y

-

BP

2:1

Size of Beier Variator (15 HP)

A Series Beier Variator

G Type Beier Variator

SMA Code

Base Plate

Gear Ratio

Beier - Ulysses Right Angle Variator

N1

AX

C²

Y

-

1

C

+

QTS918

L

-

10:1

Size of Beier Variator (1 HP)

AX Series Beier Variator (1750 RPM top output speed)

with C Face Motor Adaptor

SMA Code

Denotes HP. See note #3

"C" Face output of Beier

SM-Ulysses Right Angle Drive †

Output Shaft Arrangement
L = Left Side Viewed from Input Shaft
R = Right Side Viewed from Input Shaft
B = Double Side Viewed from Input Shaft

Ratio of Right Angle Drive

Beier-Cyclo Variator (Single Reduction)

H¹

A

C²

N2

-

3145-2

17:1

Horizontal Type

Series Beier Variator

with Motor Adaptor

Size of Beier Variator (2 HP)

Size of Cyclo Drive

Denotes HP. See note #3

Reduction Ratio of Cyclo Drive

Beier-Cyclo Variator (Double Reduction)

H¹

A

C²

N10

-

3245/18

121:1

Horizontal Type

Series Beier Variator

with Motor Adaptor

Size of Beier Variator (10 HP)

Size of Cyclo Drive

Reduction Ratio of Cyclo Drive

D Type Beier (Wide Range)

N2

D

C²

Y

Size of Beier Variator (2 HP)

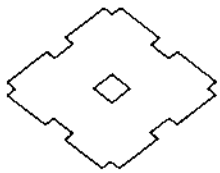
D Type Wide Range Variator

with Motor Adaptor

SMA Code

† Please refer to SM-Ulysses Reducer Catalog 11.000.50.001 for additional mounting configurations and hollow bore options.

PREPARATION BEFORE OPERATION



1. Notes on Application Conditions

- a) **Shock Loading, Frequent Start/Stop, Reversing, High Inertia Load Application**
The Beier Variator is designed to be usable at rated power and speed under steady, 24-hour-per-day load conditions. If the application includes severe operating conditions such as shock loading, frequent start/stop, reversing, and/or high inertia, selection of the Beier Variator should be reconsidered. Please consult our factory or your local distributor.
- b) **Thrust Load, Excessive Radial Load on the Shafts and Bearings**
Thrust or excessive radial load is should not be applied on the shafts of Beier Variator. A quick way to check the Pitch Circle Diameter (P.C.D.) of a sheave or sprocket is that the **P.C.D. MUST NOT BE LESS THAN 5 TIMES THE SHAFT DIAMETER**. For allowable thrust and/or radial load capacity for each frame, please consult our factory.
- c) **Ambient Temperature, Outdoor, Dusty Atmosphere**
Standard Beier Variators are designed to be used from below 17°F to 125°F ambient, indoor and normal atmospheric conditions. For any other atmosphere, some consideration or modification is required. Consult our factory or our local distributor.
- d) **Allowable Input Power**
The power rating for Beier Variator is determined on the basis of **4 pole, 6 pole or 8 pole electric motor drives**, subject to the size. The rated input speeds are fixed at a maximum permissible, and under any circumstances, higher input speeds than specified on the name plate are not to be applied.
- When the drive must be used at certain input speed lower than the catalogued standard rated input speed**, the Input Power to the Beier Variator must be reduced in proportion to the input speed.
- Under such condition, the following applies:
- $$\text{ALLOWABLE INPUT POWER (HP)} = \frac{\text{RATED INPUT POWER (HP)} \times \text{REDUCED INPUT SPEED}}{\text{RATED INPUT SPEED}}$$
- Please note that the above will not apply to certain extremely low input speeds.
- When the input speed goes lower than 500 RPM, the lubrication system must be reconsidered.** Please consult factory or distributor, as forced lubrication may be necessary.

2. Installation

- a) **Mounting and Alignment**
The base on which the Beier Variator is to be mounted must be rigid and smooth. Otherwise torsional external stress will be transmitted onto the casing, causing vibration and possible lubrication failure to the Beier components and bearings, etc. A suitable clear location for maintenance and ventilation is also an essential consideration for the installation. **Shaft alignment and sheave/sprocket mounting should be done properly to minimize the shaft misalignment and overhung load.**
- b) **Inclined Mounting**
The DRIVE MUST BE INSTALLED ON A HORIZONTAL PLANE. Installation on inclined plane may cause oil leakage through labyrinth seals or lubrication failure to SOME BEARINGS. For inclined mounting, standard unit requires some modifications in sealing or oil level index or sometimes different lubrication system. Please consult factory or distributor where necessary.
- c) **Lubrication Oil**
Our Beier Variators are shipped without lubrication oil. **CAUTION: FILL DRIVE WITH LUBRICATION OIL BEFORE STARTING OPERATION.** Lubrication systems vary as does the appropriate volume of oil in the varying models, types and capacities. Please refer to Chapter "Lubrication" for appropriate lubricant, amount, etc.
- The rotation direction of the oil pump for the forced oil lubrication models is one directional and fixed.** Please make sure of this rotation by checking the gauge before starting main drive.
- For the forced lubrication with external oil cooling tank adopted in the model 50A, 50B, and larger, piping is required between the Beier Variator and the cooling tank.** Instructions for this piping are given in the attached information on page 18.
- d) **Electrical Wiring – remote control and oil pump for “fail safe operation” into main motor circuit.**
Other than the wiring to the main motor, when the Beier is equipped with electric remote control or requires external pump lubrication (horizontal type of 50A and larger, vertical type of N8AV and larger), interlocking of wiring connection of the main motor and auxiliary motor(s) is always recommended to avoid any accidental operation. Please refer to information for wiring on page 16.

3. Final Check Before Running

- a) **Rotating Directions**
The rotating direction of the output shaft is tabulated as follows. Please check whether shaft rotation complies with your requirement.
- Output Shaft Rotation vs. Input Shaft Rotation**
- | | |
|------------------------------------|----------------|
| A (Basic) Type | Reverse |
| AG (Reduction Gear) Type | Reverse |
| AE (Exchange Clutch) Type | Reverse |
| D (Wide Range) Type | Same Direction |
| AV (Vertical Basic) Type | Reverse |
| AVG (Vertical Reduction Gear) Type | Reverse |
- b) **Back Stop, Locking Device, etc.**
Before starting operation, all equipment should be examined. Motor fan should be turned manually to see that there are no obstructions. Devices such as back stop, locking device, etc. must be equipped properly so that their free, unobstructed rotation direction is correct, otherwise serious damage could occur.

LUBRICATION

1. Lubrication System

According to the sizes and types, standard lubrication systems for Beier Variators are designated as the table below shows.

Horizontal Type	
Model	Lubrication System
N05A - 40A (G.E.), N05D - N10D	Oil Splash Lubrication
50A - 200A (G)	Forced Lubrication by External Pump with Oil Cooler

Vertical Type	
Model	Lubrication System
N05AV - N5AV (G)	Oil Splash Lubrication
N8AV - N40AV (G)	Forced Lubrication by External Pump
50AV - 200AV (G)	Forced Lubrication by External Pump with Oil Cooler

Exceptions

Grease lubrication is required on the bearings specified below:

N8AV~200AV — Output Shaft Bearing

All AVG models — Slow Speed Shaft Bearing

For forced lubrication and forced lubrication with oil cooler systems, the oil flow chart is shown on pages 17 and 18. Location of the oil filter, drain plug and grease fitting are shown on page 18.

2. Recommended Lubricating Oil

Listed below are the *only* recommended oils to be used in SM-Beier Variable Speed Drives. Use of automotive

motor oils or oils containing extreme pressure additives are not recommended. The use of any oil other than those recommended will void all product warranties.

Recommended Lubricants for NA Type Beier

Recommended oils for use in SM-BEIER Variators — USE NO SUBSTITUTES WARNING: DO NOT USE OILS CONTAINING E.P. ADDITIVES — OR AUTOMOBILE OILS					
Manufacturer	Ambient Temperature F° (C°)				
	14° to 32° (-10° to 0°)		32° to 95° (0° to 35°)		95° to 122° (35° to 50°)
Gulf Oil Corp. Exxon Co. Mobil Oil Corp.	Harmony 46AW Nuto H46 Mobil DTE 25	Harmony 68AW Nuto H68 Mobil DTE 28	Harmony 100AW Terrestic 100 Mobil DTE Heavy	Harmony 150AW Terrestic 150 Mobil DTE Extra Heavy	Harmony 220 Terrestic 220 Mobil DTE BB
Shell Oil Co. Texaco Inc.	Tellus 46 Rando 46	Tellus 68 Rando 68	Tellus 100 Regal R&O 100	— Regal R&O 150	— Regal R&O 220

Recommended Traction Oils for ND Type

Manufacturer	Ambient Temperature F° (C°) 14°-122° (-10°- 50°)
Sun Refining Idemitsu Kosan Mitsubishi Oil	Custom BV 750 Daphne Alpha Drive P150 Diamond TD Oil 150

NOTE: (1) For lubrication of ND Type BEIER VARIATOR, use recommended traction oil.
(2) For CYCLO, use recommended lubricating oils.
(3) Be careful not to mix lubricating oils for ND type BEIER VARIATOR and CYCLO or supply incorrect lubricating oils to these units.

3. Amount of Lubricating Oil

Remove the breather and fill with oil until the oil level reaches the upper red line on the oil level sight gauge. The lower red line on the oil gauge is the index for oil level during running. **The oil level must always be kept above the lower red line during operation.**

Some vertical models of reduction gear types (N05AVG ~ N10AVG) have two separate reservoirs for variable speed mechanism and reduction gear mechanism. Fill the oil in each separate reservoir to proper level. For your reference, appropriate amounts of oil for each model are tabulated at right.

Size	Horizontal Type			Vertical Type	
	A-Type	AG-Type	D-Type	A-Type	AG-Type
N05A, N1A	.18	.29	.32	.37	.69
N2A, N3A	.48	.58	.63	1.08	1.95
N5A, N8A	.98	1.37	1.27	2.00	3.96
N10A	1.14	1.98	2.30	1.72	2.64
15A	2.91	3.43	—	3.17	5.28
20A	2.64	5.28	—	3.43	6.34
30A, 40A	5.28	10.04	—	6.08	10.04
50A, 75A, 100A	14.79	25.89	—	25.36	28.53
150A	22.45	—	—	22.46	—
200A	25.10	—	—	25.10	—

OPERATION PRECAUTIONS

1. Starting

a) Forced Lubrication Drives

Operation of lubricating pump must precede the operation of main drive. Confirmation of oil circulation is strongly recommended before starting. The oil circulation can be checked by the pressure gauge fitted on the oil piping. To avoid operation without lubrication, interlocking of the electrical wiring between the main motor and the pump motor is always recommended.

b) E.R.C. (Electric Remote Control) Equipped Drives

Never switch on the pilot motor for remote control before the main drive is started. Interlocking of the

electrical wiring is always recommended to avoid damage.

c) Comments on Starting — How to Get Longer Wear Life

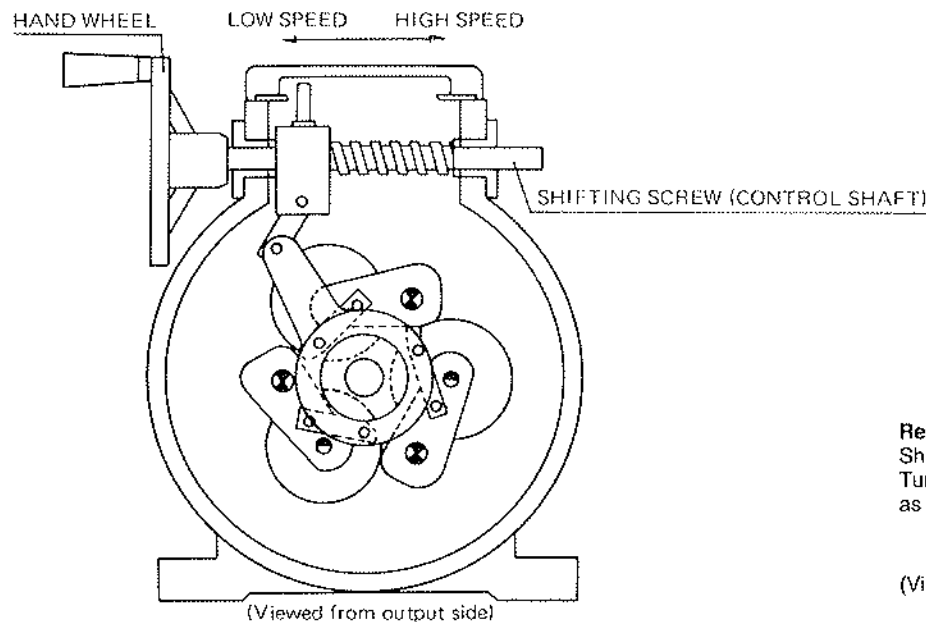
Higher torque than normal running torque could be applied to the power transmission components at starting and the acceleration torque generally increases in proportion of the speed to be reached. Therefore, it is always advisable to start the drive down on the slowest speed range of the Beier Variator. The Beier output torque rating at the lower speed range is much greater than that at the higher speed range by approximately twice for A-type.

2. Speed Change Operation

a) Manual Speed Change

Speed change of Beier Variator is performed by simply turning the handwheel and shifting screw. In the

standard drive, the relation of operation and performance is as follows:



Remark:
Shifting Screw — Right-hand thread
Turn numbers for full range speed change
as per table below.

(Viewed from output side)

Number of Turns for Full Range Speed Change Operation

Models	N05A, N1A	N2A, N3A	N5A, N8A	N10A	15A	20A	30A, 40A	50A, 75A, 100A	150A, 200A
No. of Turns	27.4	25	33	28.5	24	21	26.5	27.5	24
Models	N05D-N1D	N2D-N3D	N5D-N8D	N10D					
No. of Turns	27.5	34.5	31.5	34.5					

The table is also applicable to V-type.

b) Speed Change Operation by Remote Control System

The Remote Control System for Beier Variator is explained in our separate catalog "SM BEIER & SM BEISTER Mechanical Adjustable Speed Drives," Cat. No. 06.002.50.001. Meanwhile, several important points are to be remembered.

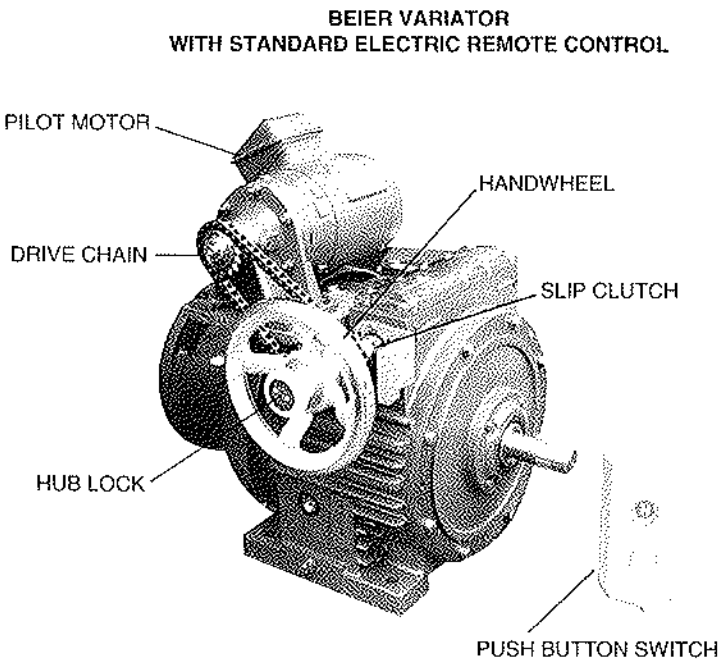
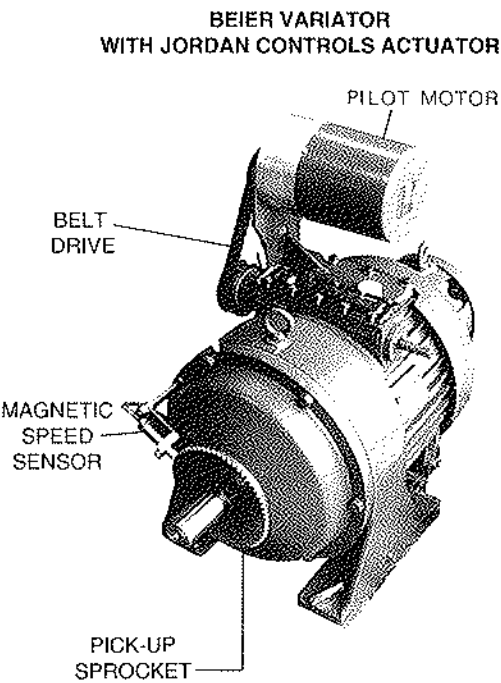
- Appropriate wiring connection to operator's switch box should be made to ensure proper operation by two push button operator device.
- Speed change can be monitored by watching an external speed indicator.
- Never allow slipping at the slip clutch (safety device for overrun) on the shifting screw.

c) Manual Override for Remote Control System

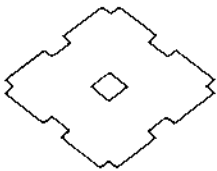
In case of pilot motor failure, chain failure or slip clutch wear, the remote control system can be bypassed by taking the following steps:

- Unscrew yellow hub lock knob in center of handwheel and pull handwheel back until the two (2) roll pins disengage handwheel from clutch hub.
- The handwheel will now operate independently of the remote unit allowing manual speed variation.

- d) There are three (3) adjustment bolts on the slip clutch hub to adjust for wear in the friction discs. These should be checked and tightened slightly if the clutch slips.



NOTE: Chain Guard is removed for display purposes



1. Lubrication

a) Observation of Oil Level

Oil level must be carefully watched as frequently as possible. Keeping the oil at the required level is very important.

The appropriate oil level is:

- Upper Red Mark — not operating
- Lower Red Mark — during operation

It is recommended to routinely observe the oil level in your daily inspection.

b) Oil Change

Suggested interval for oil change for NA type Beier is 500 hours after initial operation and every 2,500 hours thereafter. This is the recommendation for normal operation. Suggested interval for oil change for ND type Beier is 20,000 hours or 4-5 years after initial operation. Oil should be changed more frequently whenever deterioration is detected, since deterioration occurs in different operation hours subject to brand of oil, conditions of loading and surroundings.

c) Oil Selection for Ambient Temperature

The most important factor for the lubricant for Beier Variator is viscosity. When there are seasonal ambient temperature changes, change oil periodically to meet the viscosity requirement due to the respective ambient temperature.

For the maintenance b) and c) above, it is recommended that the maintenance records be attached to the drive. Keep record of (1) Date of the last oil change, (2) Brand of oil supplied, (3) Name of personnel who did it, etc.

d) Lubrication While the Drive Is Not Running

When the drive is brought to a halt for a considerable length of time after a period of operation, internal components tend to get rusted because of the deterioration of lubricating oil. Appropriate care should be taken for long periods with no operation.

- For a halt of 1 month or so, preserve the Drive after running-in with new oil.
- For a halt of 6 months or more, preserve after running-in with rust-preventive oil after complete flushing.

Also note that rust-preventive oil is not suitable for long continuous operation after the drive is restored to normal operation.

2. Other Check Points

During daily oil level inspection, give care to the following abnormalities that may be the first signs of some faults/failures occurring in the drive.

a) Excessive Temperature Rise

Feel or measure temperature on the casing. Allowable temperature rise measured on the surface of the casing is 86°F to 105°F over the ambient temperature. Excessive temperature rise can be attributed to various hidden causes. Please refer to "Trouble Shooting" on page 12 for details.

b) Abnormal Sound

Abnormal sound is the sign of damage or failure of components and it varies with the kind of component damage. Refer to "Trouble Shooting" on page 12 for details.

c) Oil Leakage

Oil leakage arises from various causes such as worn oil seal, loose housing fit, excessive oil, faulty gasket, etc. Since oil leakage causes other troubles, it must be quickly taken care of. For your reference, we show the sealing method for Beier Variator on the attached data on page 20.

d) Other Abnormal Performance

In addition to the above signs, several other abnormal performances may be found during operation though they may occur infrequently. They are increase of power consumption, vibration, fluctuating output speed, inability or difficulty of change speed, etc. These are fully explained in "Trouble Shooting" on pages 12 and 13.

3. Maintenance Overhaul

a) Overhauling Period

After two years of continuous operation, an entire maintenance overhaul is recommended.

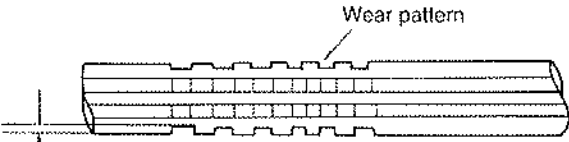
This includes disassembly of the Beier Variator and inspection of the wear on components. For this purpose, assembly procedures and assembly drawings are explained in the following chapters.

b) Recommended Replacement Parts

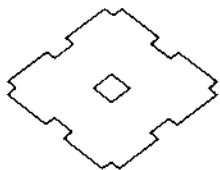
The main components, which yield to wear during operation, are **cone discs, flange discs, spline shafts, gears, bearings and oil seals**. As for numbers and location of spare parts, refer to "Table of Spare Parts" on pages 14 and 15. They must be carefully examined during overhauling, and replaced if necessary.

c) Warning Signals for Replacement

During overhaul, examine the following components carefully and replace them when the components show symptoms mentioned below.

Components	Symptoms
Cone Discs	Breakage, Discolor due to seizure, Wear (reaching 20 microns), Flaw, Pitting/Spalling, Galling
Flange Discs	Wear of rim, Pitting/Spalling, Galling, Discolor due to seizure. Note: Slight pitting, spalling, flaw or burr on the rim of flange disc can be corrected by an oil grind lapping stone.
Bearings	Wear, Fatigue, Discolor, Broken Retainer.
Spine Shafts, Input Shaft with Spline	Fatigue on spline (see fig. below), Discolor due to seizure, Fatigue of Key and keyseat. Fatigue on Spline  Depth exceeding 0.1mm requires replacement.
Oil Seal	Wear, Loss of elasticity.
Gears	Pitting, Spalling, Discolor due to seizure, Flaw, etc.
Casing & Cover	Frequent speed change operation causes wear in the hubs on the casing and cover which supports swing shaft. Creep due to wear exceeding 0.1mm requires replacement.

TROUBLE SHOOTING



Causes	Countermeasures
PROBLEM 1 — TEMPERATURE RISE (Temperature on the casing exceeding 105°F over Ambient temperature.)	
Heat generation due to shortage of oil or deterioration.	Replenish or change oil.
Over-slippage due to overload.	Measure input power of motor at the lowest speed, and remove the causes for overload.
Wear of disc.	Resistance can be felt in manual speed change operation. Replace worn discs.
Broken component or faulty assembly.	Usually attended by abnormal sound. Disassemble and inspect the drive.

Other than the above, lack of oil on the lip(s) of oil seal causes temperature rise on the oil seal. Lubricate lip of oil seal.

PROBLEM 2 — ABNORMAL SOUND	
Rolling Noise Broken discs or bearings.	Replace discs or bearings.
High Cyclic Metallic Sound Damage to the gears.	Correct or replace gears according to the extent of damage.
Grinding Noise Rotating component in contact with unrelated parts due to faulty assembly.	Reassemble properly and replace parts if required.
Rattling Noise Loose fit of coupling, fan, etc. due to worn key.	Inspect the keys and replace if required.
Squeaking Noise Poor lubrication on the lip of oil seal.	Lubricate seal.
Sliding Noise Excessive corrosion on discs and bearings.	Corrosion tends to occur when oil deteriorates during long periods of no operation without appropriate care. Overhaul is required.
Sound Difference at certain speeds during speed change operation Excessive wear on a certain range of cone disc due to operation at one set speed.	Occurs with resistance for speed change operation. Operate drive at other speeds or replace discs.
Sound Difference according to load condition Usually no trouble.	Meshing sound of gears varies subject to load intensity. Care should be taken that no overload is applied to the drive.

Causes	Countermeasures
PROBLEM 3 — INCREASE OF INPUT POWER	
Sudden increase at certain speed during speed change due to excessive wear at a certain range of cone discs.	Select other speed for operation or replace discs.
Higher viscosity of oil or more oil than required.	Replace oil or reduce oil to the proper level.
Rotating component in contact with other unrelated parts.	Occurs with noise. Reassemble properly.
Overload.	Disengage with load and measure the no load input power.

PROBLEM 4 — VIBRATION	
Weak foundation or loose mounting.	Reinforce the foundation and tighten the bolts.
Misalignment.	Correct misalignment.
Loose fitting or broken coupling, sheave or fan.	Replace key or coupling, sheave or fan itself.
Pulsation of belt or chain.	Determine the cause of pulsation.
Resonance caused by the vibration of other element.	Reduce or isolate the vibration of other element.

PROBLEM 5 — FLUCTUATION OF SPEED	
Overload or lack of capacity.	Detect the cause for overload.
Wear of rim on flange disc.	Replace disc.
Movement of shifting screw by vibration.	Lock the handwheel.

PROBLEM 6 — OIL LEAKAGE	
Fatigue or wear of oil seal.	Replace oil seal.
Oil is overfilled.	Reduce oil to appropriate level.
Improper fitting of housing, cover, etc.	Check fit and fasteners.
Oil return hole clogged.	Clear the hole.

PROBLEM 7 — INABILITY OR DIFFICULTY OF SPEED CHANGE OPERATION	
Broken disc (impossible to keep running).	Replace discs.
Fatigue of splined shaft or input shaft, where cone disc slides.	Correct or replace subject to the extent of fatigue.
Disengagement of disc meshing.	This tends to occur when severe peak load is applied under extreme high speed running. Reassembly is required.
Shifting nut is locked at extreme low or high speed.	Release shifting nut.

TABLES OF SPARE PARTS

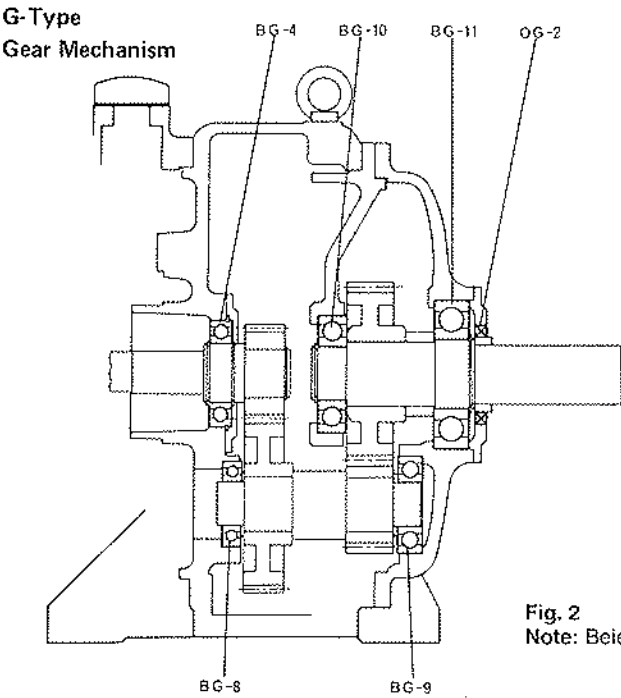
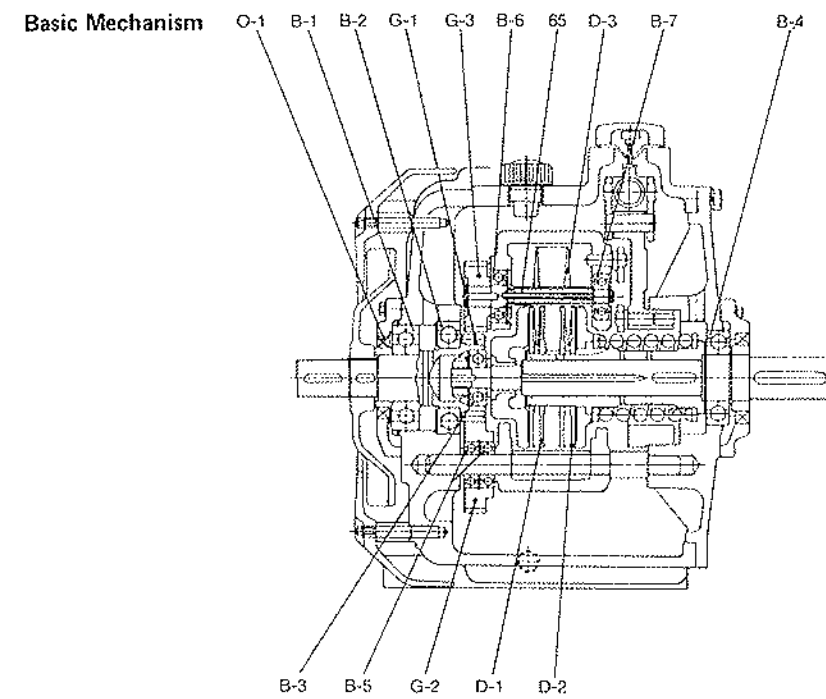
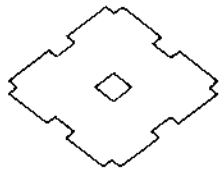


Fig. 2
Note: Beier portion not shown.

TABLE 1. (REFERRING TO FIG. 1, 2)

	BASIC TYPE NA, A (Fig. 1)																BUILT-IN GEAR TYPE AG (Fig. 2)									
Name	BEARING							OIL SEAL		DISC			GEAR				SPLINE SHAFT	BEARING					OIL SEAL			
Location	INPUT SHAFT		OUTPUT SHAFT		SWING SHAFT	SPLINE SHAFT		INPUT SHAFT	OUTPUT SHAFT	FLANGE DISC I	FLANGE DISC II	CONE DISC	INPUT SHAFT	SWING SHAFT	SPLINE SHAFT	OUTPUT SHAFT	INTERMEDIATE SHAFT	SLOW SPEED SHAFT		SLOW SPEED SHAFT						
Part No.	B-1	B-2	B-3	*1 B-4	B-5	B-6	B-7	O-1	O-2	D-1	D-2	D-3	G-1	G-2	G-3	65	BG-4	BG-8	BG-9	BG-10	BG-11	OG-2				
N05A	6003	6003	BUSH	6203NR	BUSH (3)	HK0910 (3)	HK0509T2 (3)	S25408	S26428	—	2	3	1	3	3	3	6203NR	6201	6202	6305	6305LL	S25408				
N1A										1		6														
N2A	6305NR	6305	HK1612	6206NR	6201	6202	629	S35508	S385811	1	2	6	1	3	3	3	6206NR	6203	6203	6307ZZ	6307ZZ	S35551				
N3A										2		9														
N5A	6307NR	6209	6302	6207NR	6202 (6)	6203 (3)	6300 (3)	S45629	S507010	3	2	12	—	3	3	3	6207NR	NJ305	NJ306	NJ306	6309	S457014				
N8A										4		15														
N10A	6307NR	6210	6304	6208NR	6202 (6)	6203 (3)	6300 (3)	S45629	S507212	5	2	18	1	3	3	3	6209NR	6308	6309	NJ308	6312	S608212				
15A	6210NR	6212	6305	6211NR	6204 (6)	6305 (3)	6303 (3)	S628512	S558514	7	2	24	1	3	3	3	6211NR	6208	NJ308	NJ310	6313	S709212				
20A	6213NR	6213	6306	6212NR	6006 (6)	6403 (3)	6303 (3)	S8511013	S609014	8	2	27	1	3	3	3	6312NR	6309	NJ310	NJ312	6412	S8511013				
30A	6314	6314	6307	6313NR	3206 (3)	6405 (3)	6404 (3)	S10012513	S659012	10	2	33	1	3	3	3	6313NR	6212	NJ312	NF315	6416	S10012513				
40A										11		36														
50A	6318ZNRS	6322	22310 51115 51124	23122NR	6207	(6) 6406	(3) 6405	(3) 6405	(3) S11014014	(3) S11014014	8	2	27	1	3	3	3	23122NR	6318	NJ318	SEE TABLE 1-2		S12515514			
75A													(8)		(4)	(4)	36							4	4	4
100A													(12)		(6)	(6)	9							60	6	6

Remark: 1. Figures in above column show the number of the part used for one complete unit or the size No. of bearings and oil seals, whose number used per unit is one (1) unless otherwise specified in parentheses.
2. In G-type, B4 bearings are replaced with BG-4 bearings.
3. For Vertical type, the above table applies except for bearings and oil seals or input and output shaft.

TABLE 1-2

Ratio	50A	75A	100A
1/2	BG-10 : NJ319 BG-11 : 23124		
1/3			
1/4			
1/5			
1/6	BG-10 : NJ321		
1/7	BG-11 : 23126		

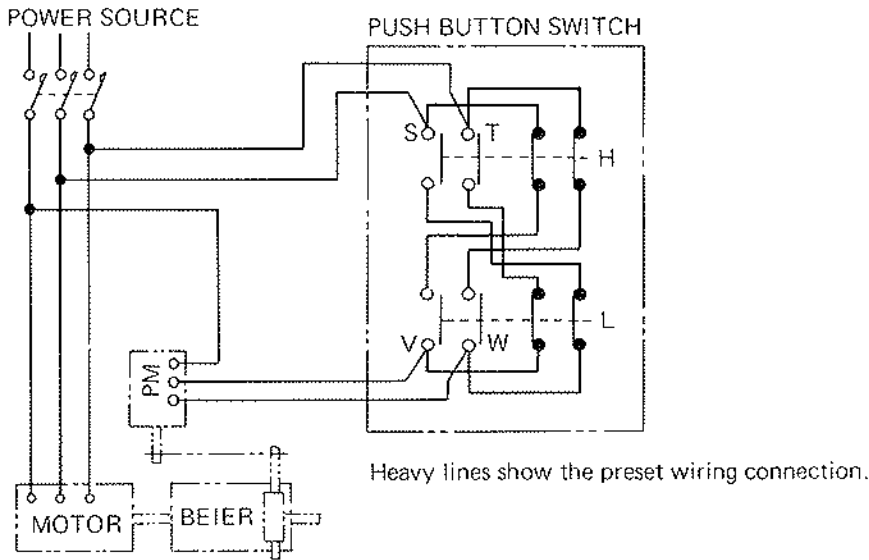
ADDITIONAL INFORMATION

1. Wiring Charts

a) Beier Variator with Electrical Remote Control

Speed change operation, while the main drive is not in use, will damage the internal mechanism of Beier

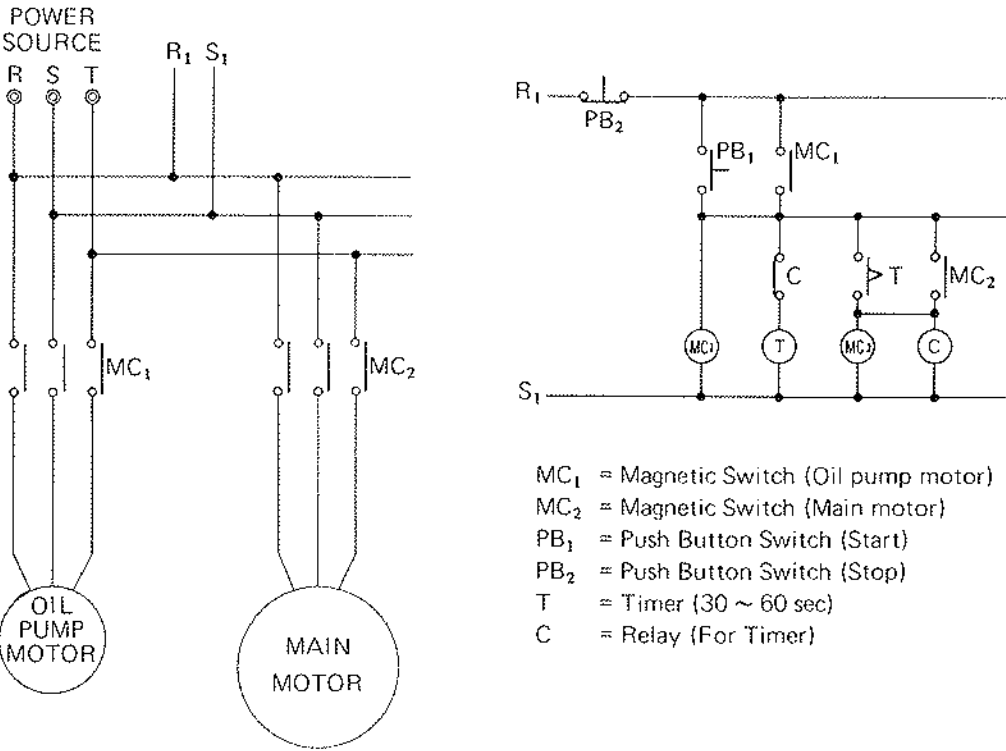
Variator. To prevent misoperation, wiring shown below assures "fail safe" operation.



b) Beier Variator Lubricated with External Pump

As mentioned in previous chapters, vertical units of N8A or larger and horizontal units of 50A or larger are lubricated by an external pump. In these drives,

lubrication system must be put into operation prior to the starting of the main drive. Following is an example of wiring for fail safe operation.



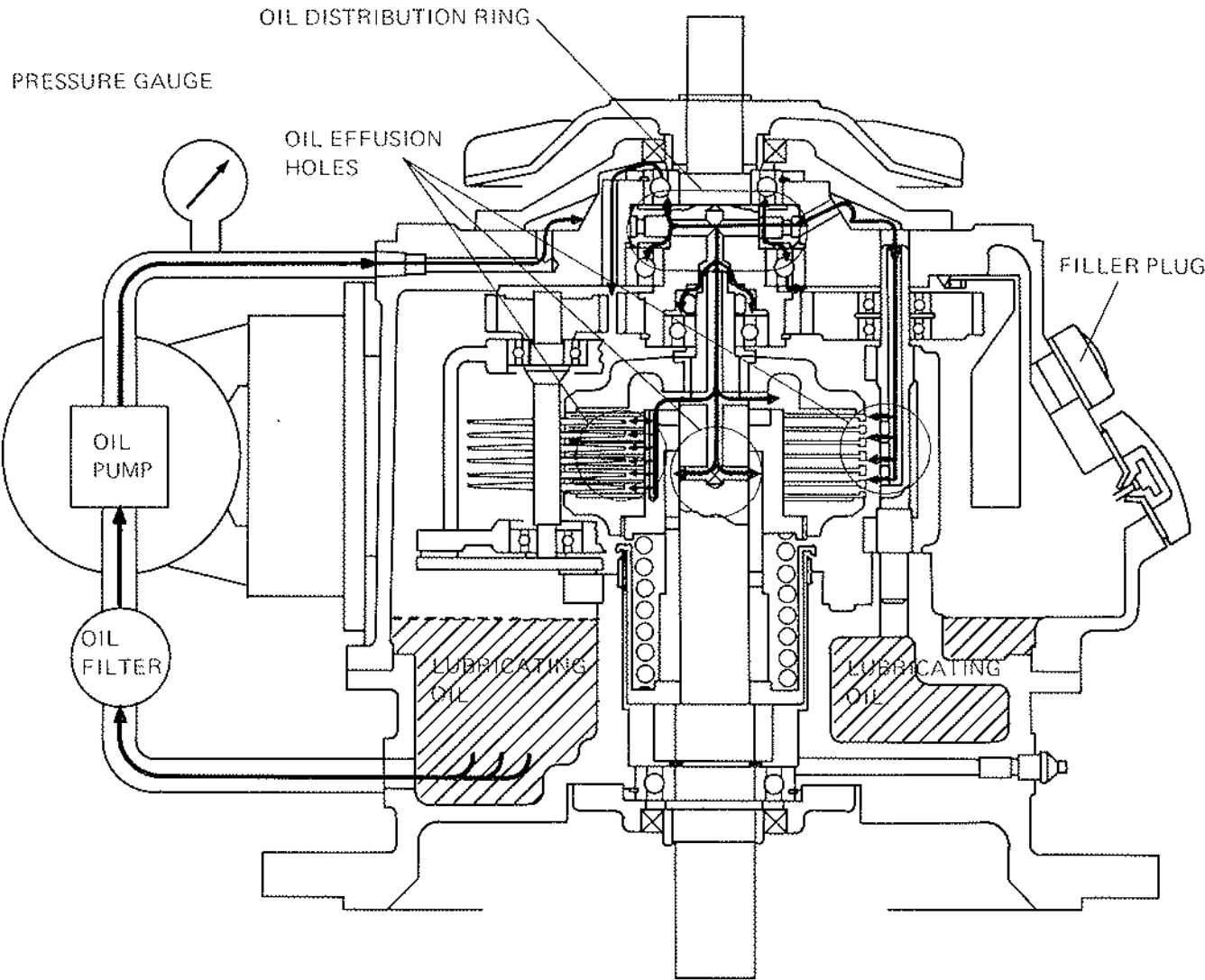
- MC₁ = Magnetic Switch (Oil pump motor)
- MC₂ = Magnetic Switch (Main motor)
- PB₁ = Push Button Switch (Start)
- PB₂ = Push Button Switch (Stop)
- T = Timer (30 ~ 60 sec)
- C = Relay (For Timer)

2. Lubrication System — Piping and Flow Chart

a) Vertical Drives N8A and Larger

These units are shipped fully equipped with a pump incorporating a motor, a filter, an oil flow gauge and piping. The flow chart below shows a typical arrange-

ment of the lubrication system. Oil distribution ring and oil effusion holes marked below play important roles in lubricating all parts of the mechanism.



b) Extra-Large Units Incorporating Oil Cooler — 50A and Larger

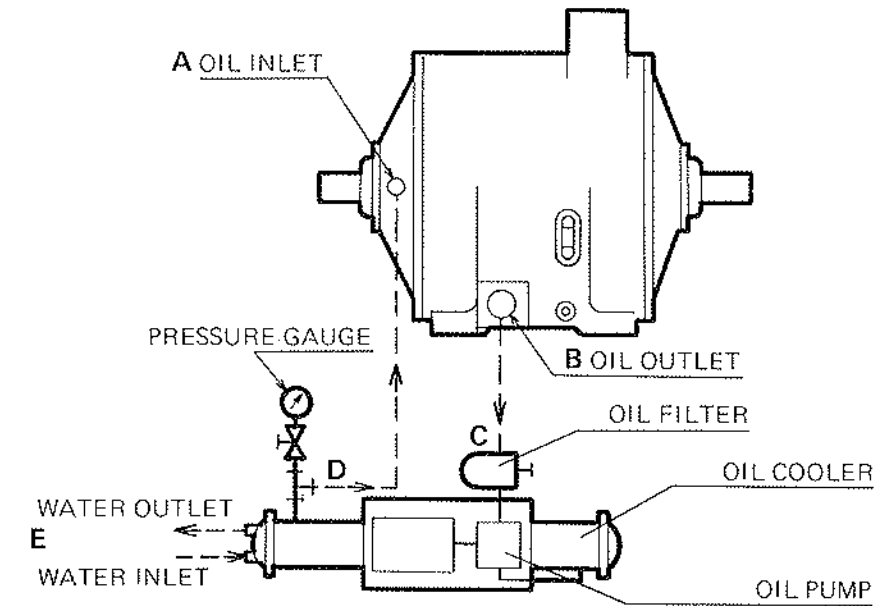
These units, including horizontal and vertical types, are shipped with a separate oil cooling water jacket equipped with an oil pump driven by an electric motor.

The installation of the cooling tank and pipe arrangement should be done properly at the installation site in accordance with instructions given below.

Installation and Pipe Arrangement

- 1) The cooling tank should be installed on a horizontal plane close to the main unit. If installed remote from the main drive insufficient pumping of oil or bad lubrication will result. Appropriate position of the cooling tank is within 0.5 m above or 1.5 m below the level of main drive and within 3 m of the drive.
- 2) Referring to the schematic diagram shown below, pipe arrangement should be done between the main drive and the cooling tank and to water inlet and outlet properly.

Use pipe and assemble with minimum angle. The thread size at the joints of the main drive and oil tank are also tabulated below.

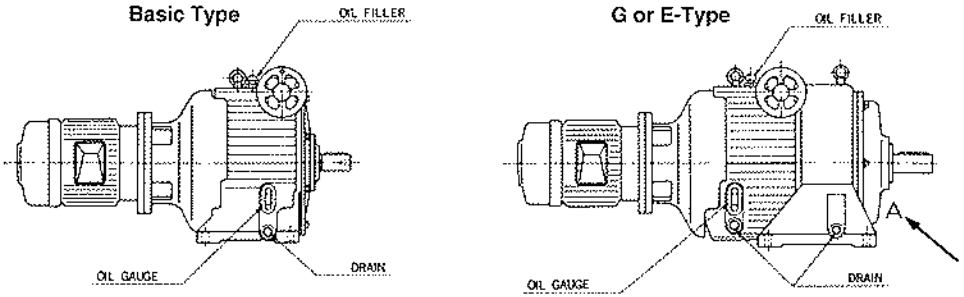


Piping shown by dotted line to be done at installation site.

Frame Size	A	B	C	D	E
	oil inlet	oil outlet	oil intake	oil discharge	water inlet outlet
50 ~ 100A	PS 3/4 x 20 (depth)	PS 1 1/2	PT 1	PT 3/4	PT 3/4
150, 200A	PS 1 x 25 (depth)	PS 2	PT 1 1/4	PT 1	PT 1

3. Positions of Oil Filler, Drain and Grease Fitting

a) Horizontal Unit



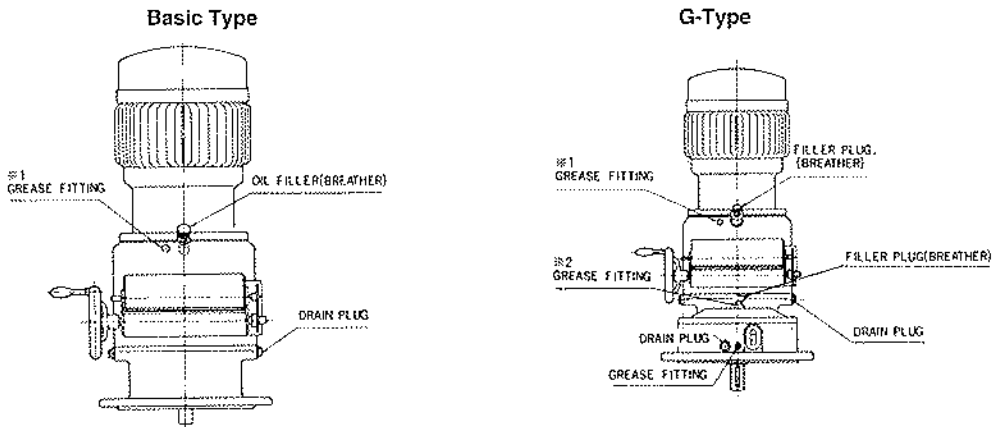
Oil gauges and drain plugs are mounted on both sides of casing.

b) Vertical Unit

As mentioned in the previous chapter, some of the bearings of vertical types are lubricated with grease separately from main oil lubrication system. The sketch

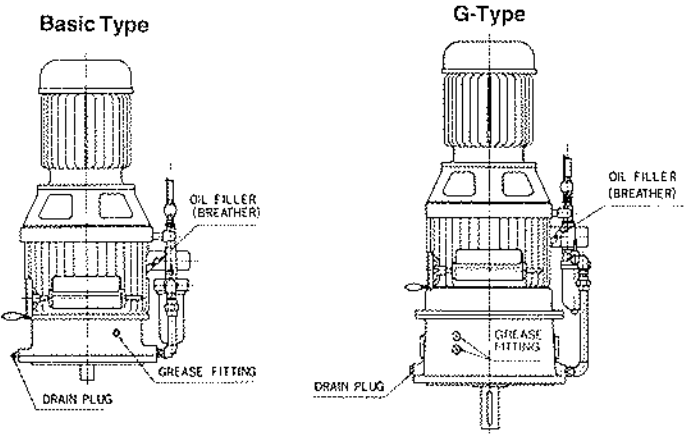
below shows the positions of grease fittings together with the positions of oil filler and drain plugs.

(i) Oil Splash Lubrication for N05 ~ N5AV(G)

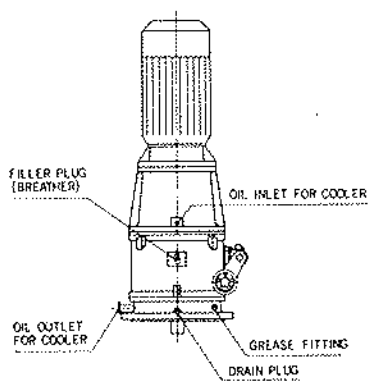


- *1 grease fitting only for N3 and N5AV(G)
- *2 grease fittings are not on N05AVG

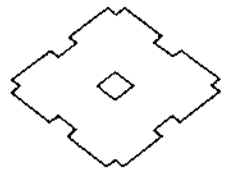
(ii) Forced Lubrication for N8 ~ 40AV(G)



(iii) Forced Lubrication with Cooler for 50 ~ 200AV



Each fitting takes slightly different position in various types.



4. Sealing Mechanism of Beier Variator

Sealing mechanism around the shaft varies in accordance with the sizes and types of Beier Variator as shown in the tables below. The cross-sectional view of each mechanism is also shown in the sketches

below. When oil leakage is inspected, please investigate the problem, referring to the following information.

Sealing Mechanism

a) Horizontal

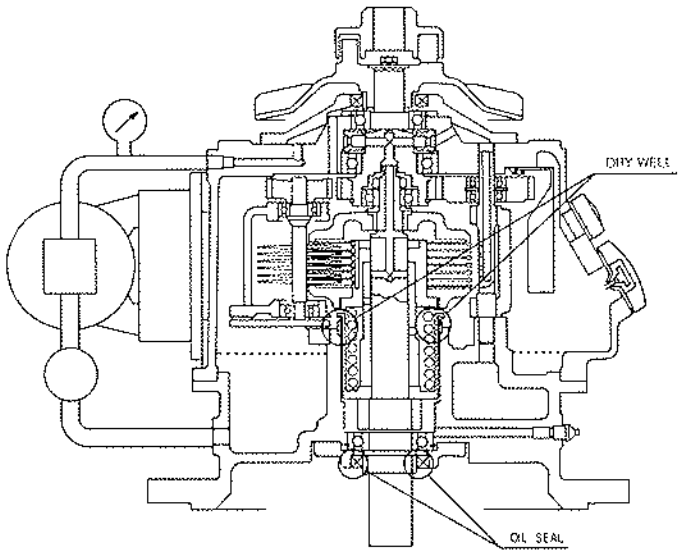
Model No.	Input Shaft	Output Shaft	Slow Speed Shaft for G-Type
N05A, N1A	Oil seal	Oil seal	Oil seal
N2A - 200A	Oil seal	Oil seal	Oil seal

b) Vertical

Model No.	Input Shaft	Output Shaft	Slow Speed Shaft for G-Type
N05AV	Oil seal	Oil seal x 2	Oil seal x 2
N2AV - N5AV	Oil seal	Oil seal x 2	Oil seal x 2
N8AV - 200AV	Oil seal	Dry Well + Oil seal	Dry Well + Oil seal

c) General View of Mechanism

Oil Seal & Dry Well



ASSEMBLY

1. General Notes for Disassembly and Reassembly

The disassembly or reassembly of a Beier Variator should be performed by an experienced fitter, referring to the procedures and assembly drawing shown in succeeding pages.

a) Guide for Dis/Reassembly Procedures

For dis/reassembly procedures, four typical examples are shown. Each can be a reference to specific models as shown in the list below.

Example 1 (15AM featuring a face cam compression mechanism) N05A to 200A

Example 2 (vertical type; oil bath and forced oil lubrication types)

For 20A, procedures in Example 1 can be a guide but these units incorporate a slightly different type of speed control mechanism called "Link Type" instead of "Shifting Ring Type" shown in the example.

b) Dis/Reassembly Tool Kit

It is strongly recommended to prepare and use special tools for dis/reassembly of Beier Variator. Typical tools are shown on the next page and shipped in a handy container assorted for specific size of Beier Variators.

c) General Precautions for Dis/Reassembly

Before Disassembly:

1. Turn down the handwheel of Beier to extreme low speed before stopping the Beier for disassembly. The Beier is so designed to be easily disassembled under deep disc meshed condition (at low speed).
2. Pour out oil through oil drain situated below the oil gauge.

During Dis/Reassembly:

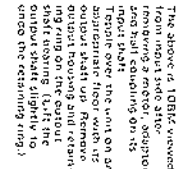
3. Use a copper head or plastic head hammer in all cases. A steel head hammer could harm components.
4. A complete unit of Beier Variator is made up of several distinct sections, which in turn consist of large numbers of components, as shown in the procedures and assembly drawings. Grouping of each section is the key to fail-safe work.
5. For normal replacement or overhauling, it is not required to disassemble Speed Control Section. Leave the section as assembled unless it should actually be required.

For Reassembly:

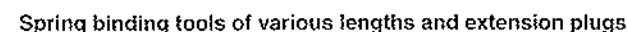
6. Gaskets are to be replaced to restore to original oil-tight conditions.
7. For replacement of discs, it is recommended to replace flange and cone discs completely even if damage found is partial. Cone discs or flange discs meshing with the same central flange disc(s) have to be replaced completely to assure even force distribution between the discs.

Shown below are the disassembling procedures after the unit is dismantled from the installation and input elements such as motor, coupling or sheave is removed from the input shaft.

- a) (p. 25) for N05A, N1A
- c) (p. 26) for N2A-N10A, 15A
- d) (p. 27) for 20A
- e) (p. 28) for 25A, 30A, 40A
- f) (p. 29) for 50A, 75A, 100A



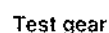
Because of the unique internal mechanism of the Beier Variator, special dis/reassembling tools shown below have been developed for safe and easy work. These tools are classified into several groups by their function and are designed to handle various sizes of Beier Variator. These tools are shipped packed in a steel container to the client requesting them and are assorted for the size of Beier Variator. Usage of those tools is fully explained in the dis/reassembly procedures.



Small size tool kit — N05A, N1A, N2A, N3A, N5A, N8A, N10A, N05D, N1D, N2D, N3D, N5D, N8D, N10D

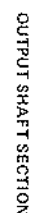
Large size tool kit — 50A, 75A, 100A

Wedges and combs used for disc meshing



Sleeve withdrawer
(for output shaft
bearing of 30AV
and larger)

Specific purpose explained in procedures.



NOTE: STRONG SPRING FORCE
IS STILL CONFINED ON
OUTPUT SHAFT SECTION

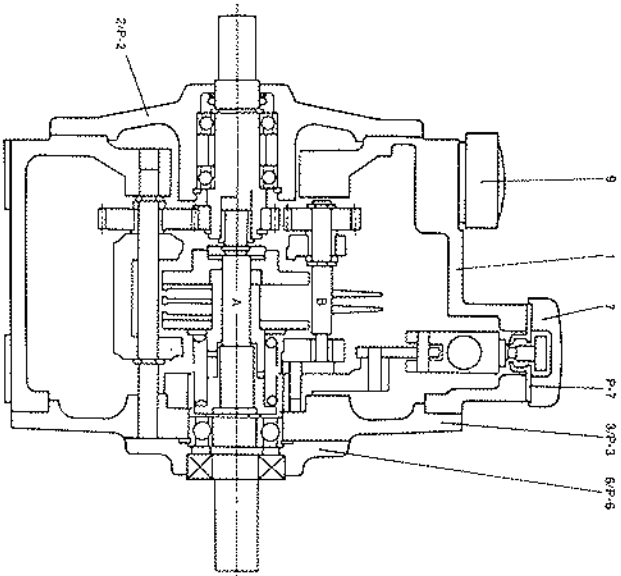
SWING BRACKET SECTION

INPUT SHAFT SECTION

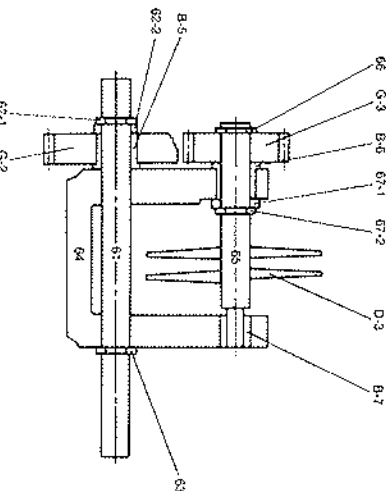
Remove support housing and retaining ring on the bearing and tap the shaft toward inside of casing housing.

5. ASSEMBLY DRAWING
a) Model N05A, N1A

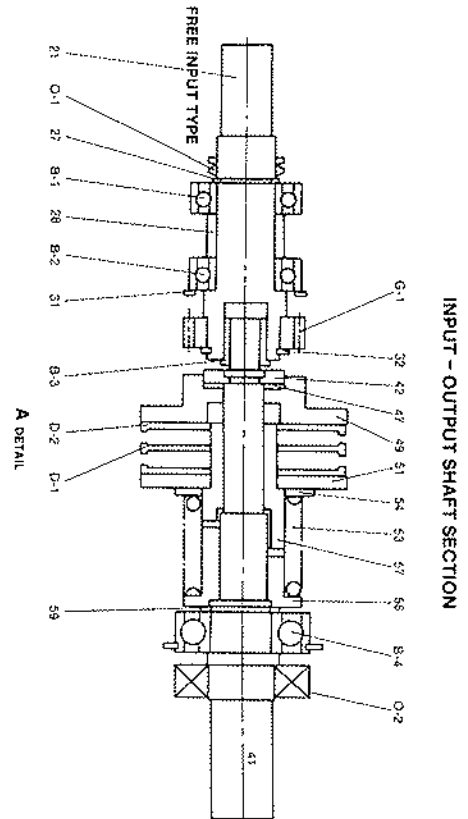
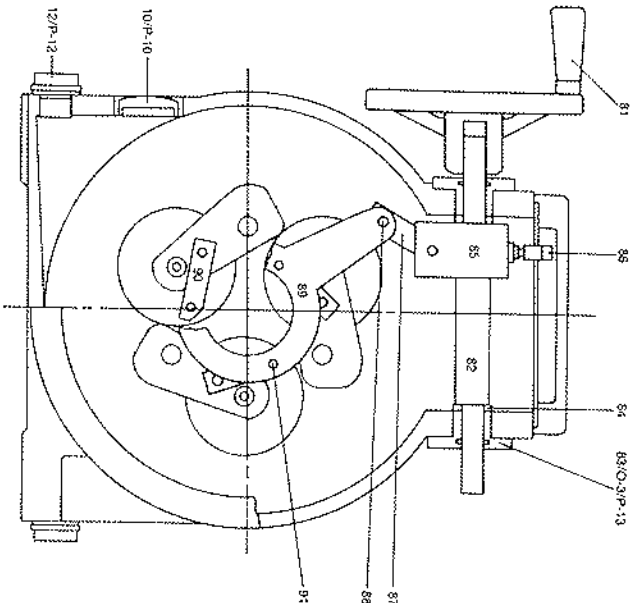
CASING SECTION



SWING BRACKET SECTION



SPEED CONTROL SECTION



EXAMPLE 2 15AM ASSEMBLING PROCEDURE

Also refer to ASSEMBLY DRAWINGS

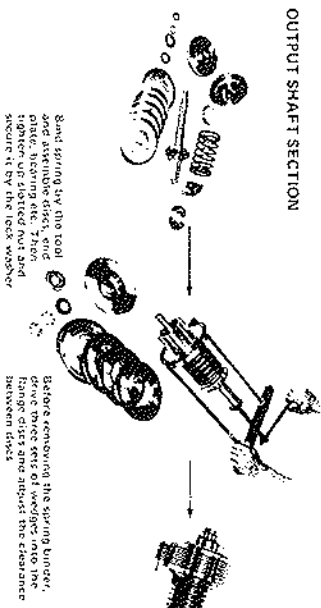
- a) (p. 25) for N05A, N1A
- c) (p. 26) for N2A-N10A, 15A
- d) (p. 27) for 20A
- e) (p. 28) for 25A, 30A, 40A
- f) (p. 29) for 50A, 75A, 100A



F: Fit bearing and gears on the input shaft as above.

F: Fit the input shaft section into the casing and secure it by a retaining ring.

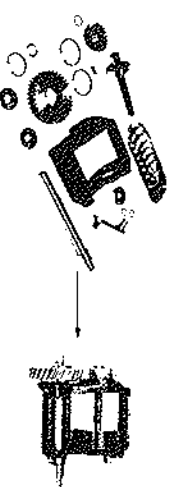
OUTPUT SHAFT SECTION



8: Put spring in the tool and assemble discs, end plate, retaining disc, three wedges, etc. Then secure it by the lock washer.

Before removing the spring binder, drive three sets of wedges into the casing and adjust the clearance between discs.

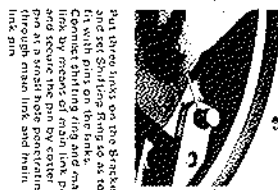
SWING BRACKET SECTION



Assemble retainers to the swing brackets as the right light indicates.

F: Fit three sets of swing brackets into the casing at the ports.

Spacer (No. 67) must be placed on the swing shaft as the light shows. Then the swing bracket sections are fitted into the casing.

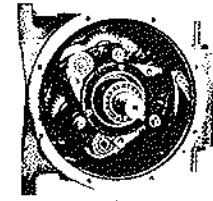


Put three links on the B-7 links and set the links as to fit with pins on the links. Connect spring ring and main pin at a small hole penetrating through main link and main link pin.



Using tool "Comb", arrange cone discs with adequate clearance between them. Tap the cone discs into flange discs, tapping with a hammer around the cone discs until the wedges come out by themselves.

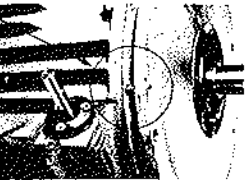
NOTE: DEEP AND EVEN MESHING OF THREE SETS OF CONE DISCS INTO FLANGE DISCS IS THE KEY FOR FURTHER ASSEMBLING PROCEDURE.



The above is the internal mechanism assembly set up. In the above section, the spring ring should be positioned as close to the center of the shaft as possible. If possible, adjust the center of cone discs tapping at the spring bracket.



Mating the dovetail pin on the casing cover onto the casing and secure it by bolts.



NOTE: WHEN THE OUTPUT SHAFT IS CAUGHT TIGHTLY, SLIGHT TURN RELEASE IT.

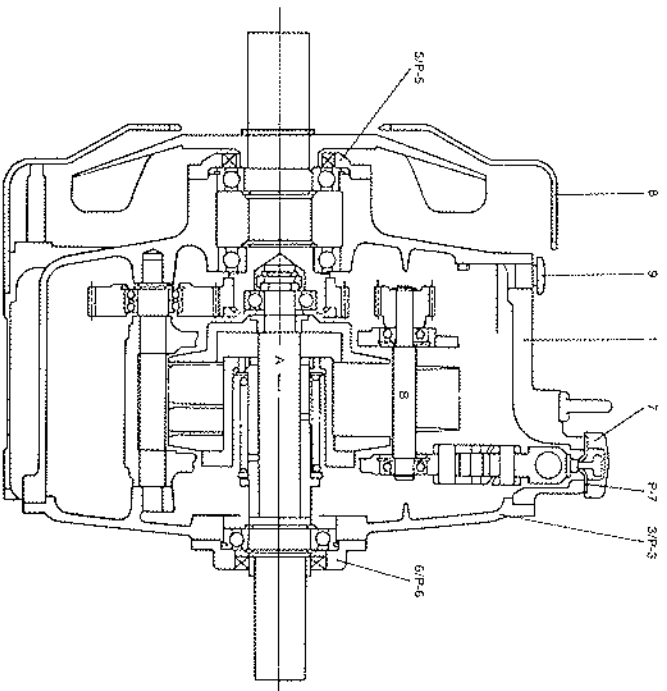
Secure input and output shafts. Take care that the tip on the output shaft should be lubricated with grease or oil and that the bearing shall come to the bottom position when installed.



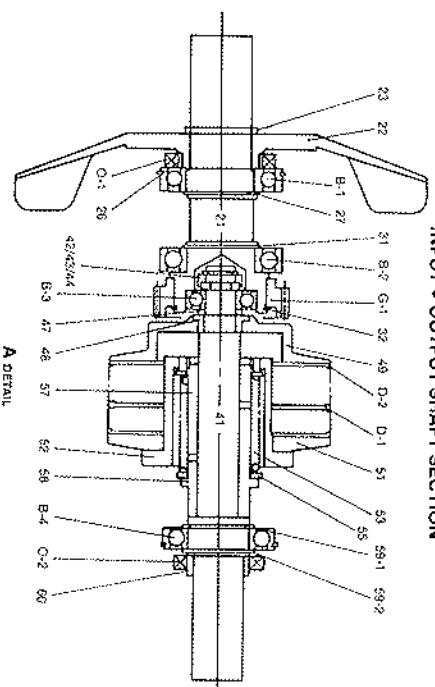
Casing Section			
Part No.	Part Name	Qty	
1	Spring	1	
2	Input Cover	1	
P-2	Gasket	1	
3	Op-Cover	1	
P-3	Gasket	1	
4	Indicator	1	
P-4	Gasket	1	
5	Indicator Plug	1	
P-5	Gasket	1	
6	Indicator	1	
P-6	Gasket	1	
7	Indicator	1	
P-7	Gasket	1	
8	Indicator	1	
P-8	Gasket	1	
9	Indicator	1	
P-9	Gasket	1	
10	Indicator	1	
P-10	Gasket	1	
11	Indicator	1	
P-11	Gasket	1	
12	Indicator	1	
P-12	Gasket	1	

Sprocket Bracket Section			
61	Sprocket Shaft	3	
B-5	Bush	3	
62-1	Retaining Ring	3	
62-2	Sprocket Shaft Gear	3	
63	Retaining Ring	3	
64	Bracket	3	
65	Sprocket Small	3	
66	Retaining Ring	3	
67-1	Sprocket Shaft Gear	3	
B-6	Bush	3	
67-2	Sprocket Shaft Gear	3	
D-3	Core Disc	3	
B-7	Bush	3	
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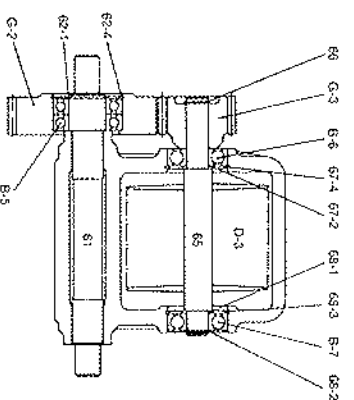
CASING SECTION



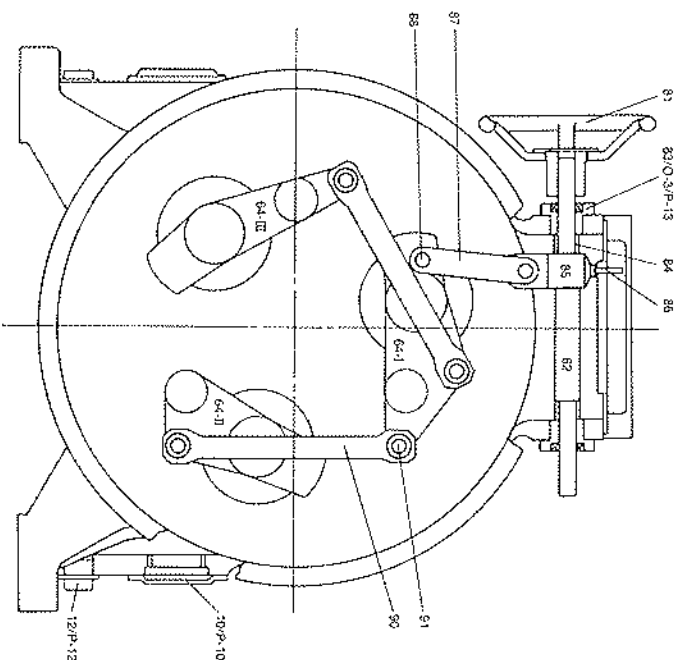
INPUT • OUTPUT SHAFT SECTION



A DETAIL



B. Details



SPEED CONTROL SECTION

Casting Section		
Part No.	Part Name	QTY
1	Core Box	1
2	Gate Box	1
3	Gate	1
4	IP Housing	1
5	OP Housing	1
6	Gate	1
7	Indicator Plate	1
8	Fun Cover	1
9	Brace	1
10	Change	1
11	Gate Plug	2
12	Gate	2
Input Shaft Section		
21	Input Shaft	1
22	Mesh Coupling	1
23	Rotating Ring	1
24	Gate	1
25	OP Collar	1
26	Gate	1
27	Gate	1
28	Rotating Ring	1
29	Gate	1
30	Rotating Ring	1
31	Input Shaft Gear	1
32	Rotating Ring	1

Swing Bracket Section	
41	Culprit Sixth
42	Slipper Ring
43	Slipper Ring
44	Return Ring
45	Sealing
46	Sealing
47	Sealing
48	Burn
49	End Piece 1
50	End Piece 2
51	End Piece 3
52	End Piece 4
53	End Piece 5
54	End Piece 6
55	End Piece 7
56	End Piece 8
57	End Piece 9
58	End Piece 10
59	End Piece 11
60	End Piece 12
61	End Piece 13
62	End Piece 14
63	End Piece 15
64	End Piece 16
65	End Piece 17
66	End Piece 18
67	End Piece 19
68	End Piece 20
69	End Piece 21
70	End Piece 22
71	End Piece 23
72	End Piece 24
73	End Piece 25
74	End Piece 26
75	End Piece 27
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82	End Piece 34
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86	End Piece 38
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165	End Piece 117
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187	End Piece 139
188	End Piece 140
189	End Piece 141
190	End Piece 142
191	End Piece 143
192	End Piece 144

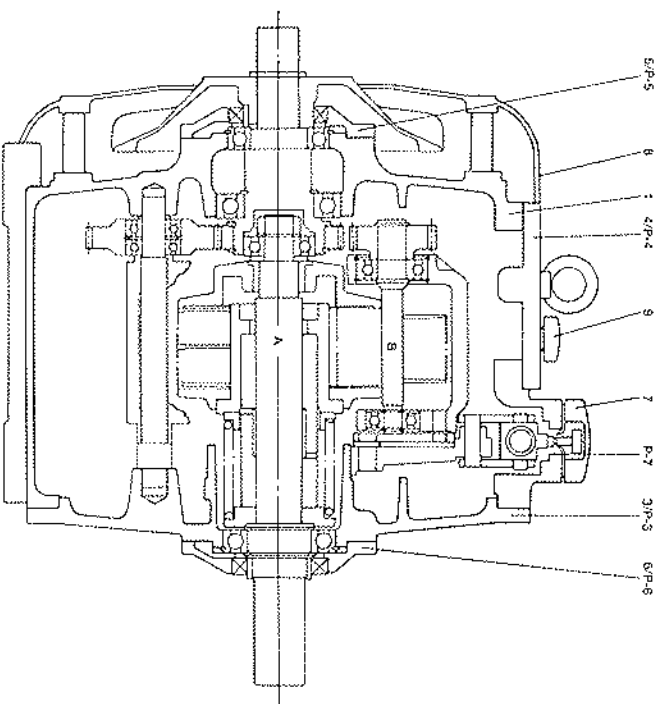
Swing Baster Section	
6-5	Swing Shaft
6-1	Swing Shaft
6-2	Retaining Ring
6-4	Retaining Ring
6-7	Retaining Ring
6-8	Retaining Ring
6-9	Retaining Ring
6-10	Retaining Ring
6-11	Retaining Ring
6-12	Retaining Ring
6-13	Retaining Ring
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6-95	Retaining Ring
6-96	Retaining Ring
6-97	Retaining Ring
6-98	Retaining Ring
6-99	Retaining Ring
6-100	Retaining Ring

81	Hand Wheel	1
82	Shifting Screw	2
83	Bush	2
84	Oil Seal	2
P-13	Gasket	2
84	Spacer	2
85	Shifting Nut	1
86	Pinion	1
87	Main Link	1
88	Main Link Pin	1
90	Link	2
91	Hinge Pin	2

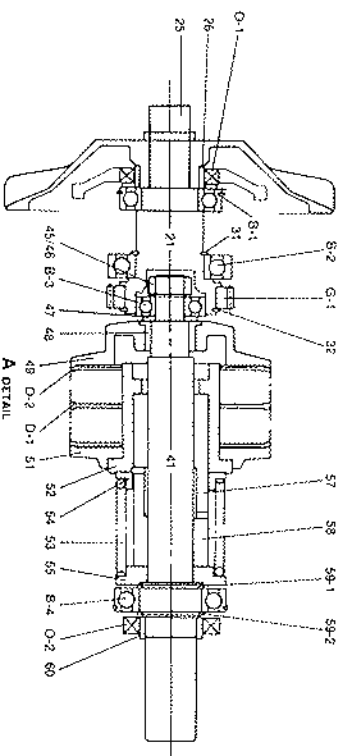
5 ASSEMBLY DRAWING

c) Model N2A, N3A, N5A, N8A, N10A, 15A

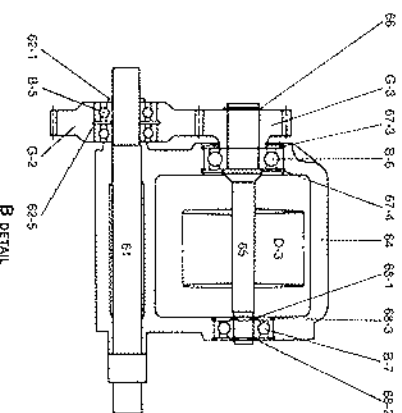
CASING SECTION



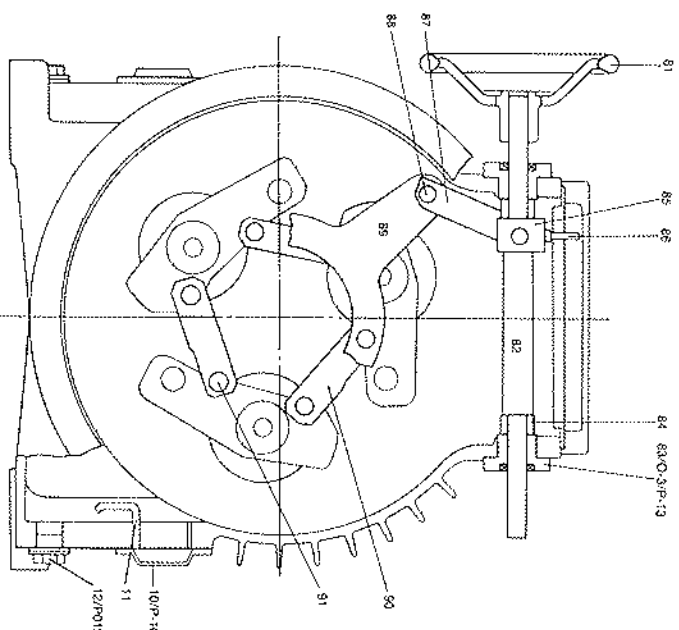
INPUT - OUTPUT SHAFT SECTION



A DETAIL

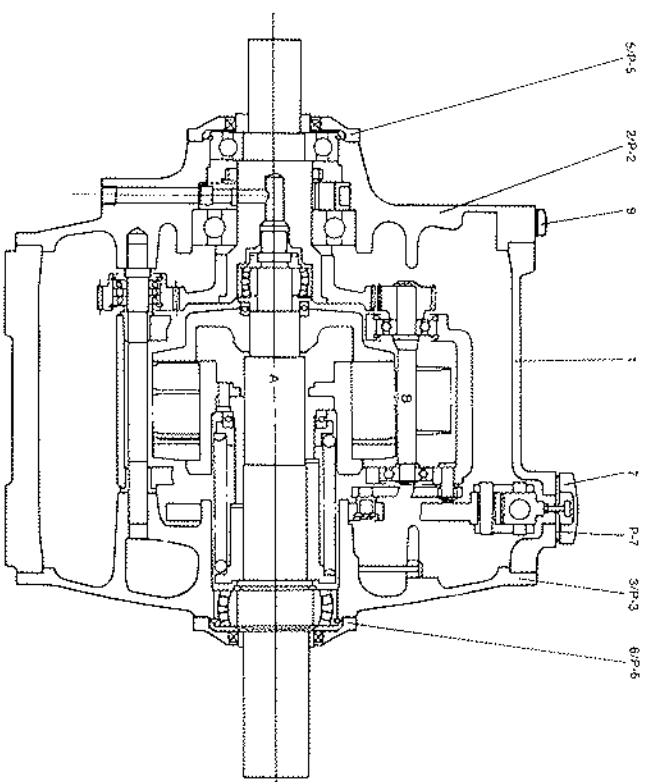


B DETAIL

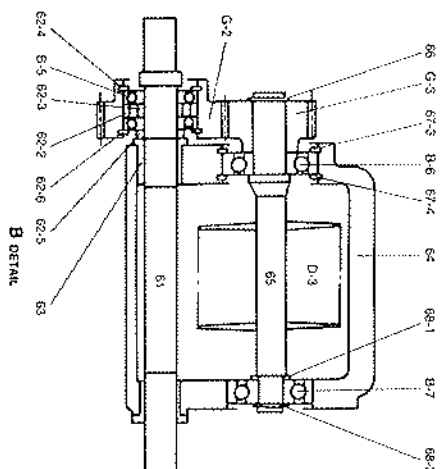
[illegible]

81	Hand Vise	1	15A
82	Sliding Scale	2	
83	Oil Seal	1	
O-3	Oil Seal	2	
P-13	Gasket	2	
84	Spacer	2	
85	Spring Nut	1	
86	Pointer	1	
87	Main Link	1	
88	Main Link Pin	1	
89	Spring Ring	1	
90	Link	2	
91	Pin	6	
	Pin	3	

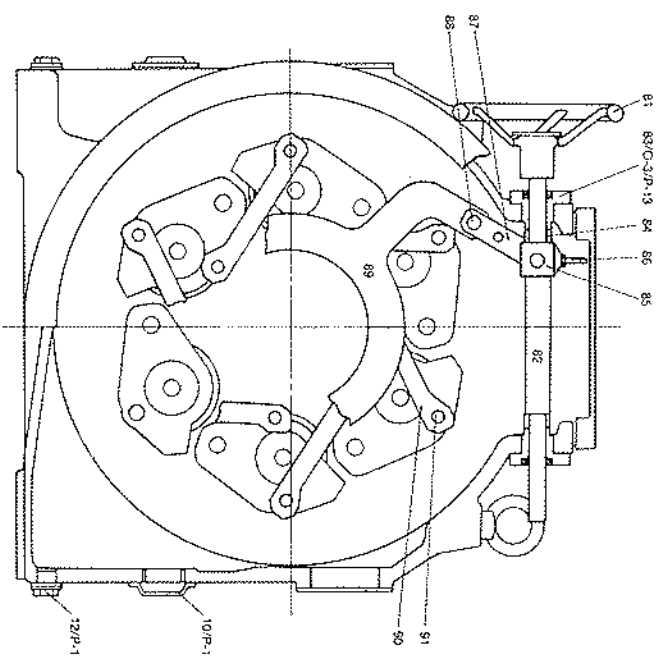
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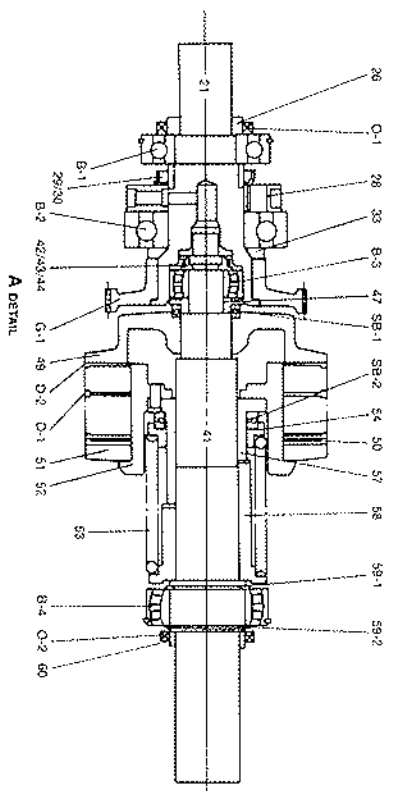
SWING BRACKET SECTION



SPEED CONTROL SECTION



INPUT - OUTPUT SHAFT SECTION

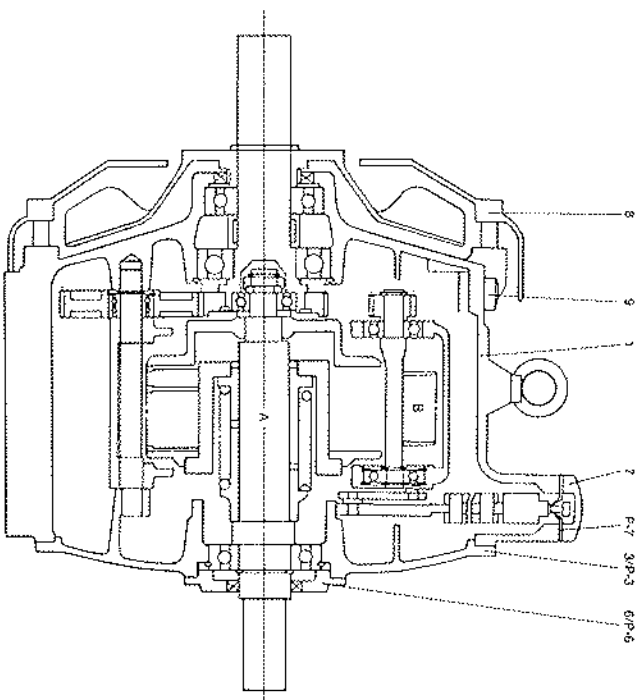


Coasting Section				
Part No.	Part Name	Qty		
Input Shaft Section				
2	Input Shaft	1		
1P-Cover	1P-Cover	1		
P-2	Gasket	1		
O-P-Cover	O-P-Cover	1		
P-3	Gasket	1		
1P-Housing	1P-Housing	1		
P-5	Gasket	1		
P-6	Shaft Housing	1		
G-1	Gasket	1		
P-7	Indicator Plate	1		
P-8	Indicator Plate	1		
10	Oil Gasket	1		
P-10	Gasket	2		
P-12	Oil Plug	2		
	Output	2		
Input Shaft Section				
21	Input Shaft	1		
26	1P-Collar	1		
O-1	Oil Seal	1		
10	Oil Seal	1		
28	Oil Guide	1		
29	Nut	1		
30	Washer	1		
31	Washer	1		
32	Spacer	1		
33	Spacer	1		
G-1	Input Shaft Gear	1		
Output Shaft Section				
41	Output Shaft	1		
42	Stopper Ring	1		
43	Stopper Ring	1		
44	Retaining Ring	1		
B-3	Spacer	1		
58-1	Thrust Bearing	1		
O-1	End Plate-1	1		
	Flange Disc-1	1	50A	75A 50B
D-2	Flange Disc-1	2	100A	75B
50	End Spacer	2	100A	75A 50B
	End Plate-1	1		
51	End Plate-1	1		
52	End Plate Bolt	1		
53	Spring	1		
54	Spring Holder-1	1		
56-2	Thrust Bearing	1		
57	Face Cam-1	1		
58	Face Cam-1	1		
59-1	Retaining Ring	1		
60-2	Retaining Ring	1		
D-2	Oil Seal	1		
Swing Bracket Section				
61	Swing Shaft	3	50A	75A 50B 100A 75B
B-5	Bearing	3		4
62-2	Spacer	6		12
63	Spacer	4		8
62-4	Retaining Ring	6		6
62-5	Retaining Ring	3		6
62-6	Spacer	3		4
C-2	Spacer	3		4
63	Swing Shaft Gear	6		8
64	Gush	6		4
65	Bracket	6		6
66	Retaining Ring	3		6
67	Retaining Ring	3		6
G-3	Swing Shaft Gear	3		4
B-6	Bearing	3		4
67-1	Retaining Ring	3		6
67-2	Retaining Ring	3		6
D-3	Core Disc	27		36
68-1	Bearing	3		6
68-2	Retaining Ring	3		6
68-2	Retaining Ring	3		4
Speed Control Section				

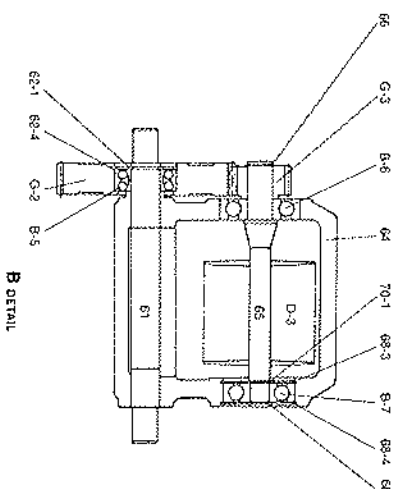
5. ASSEMBLY DRAWING

e) Model 25A, 30A, 40A, 20B, 30B

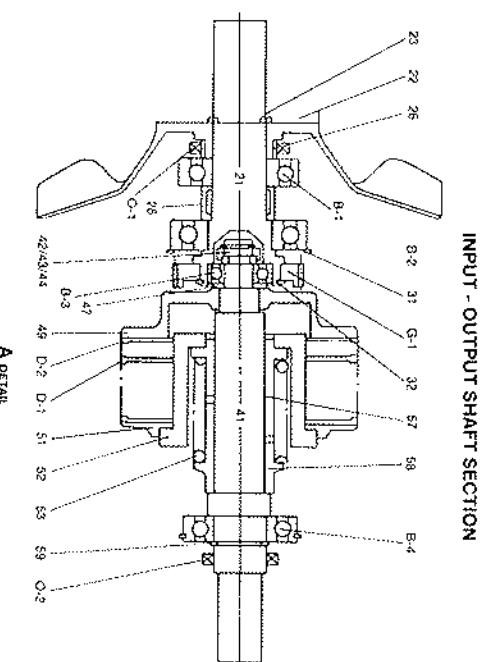
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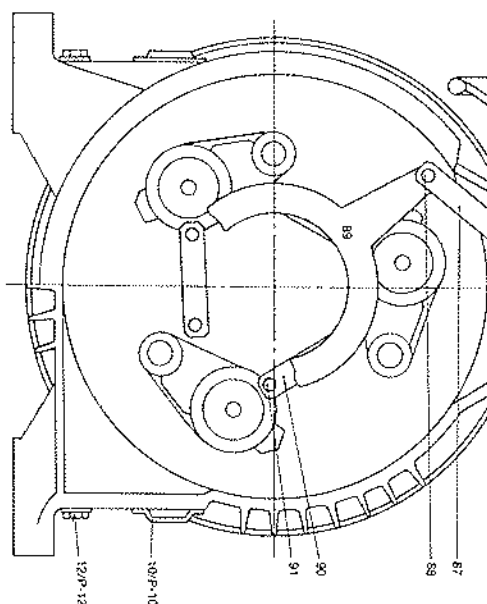
SWING BRACKET SECTION



SPEED CONTROL SECTION

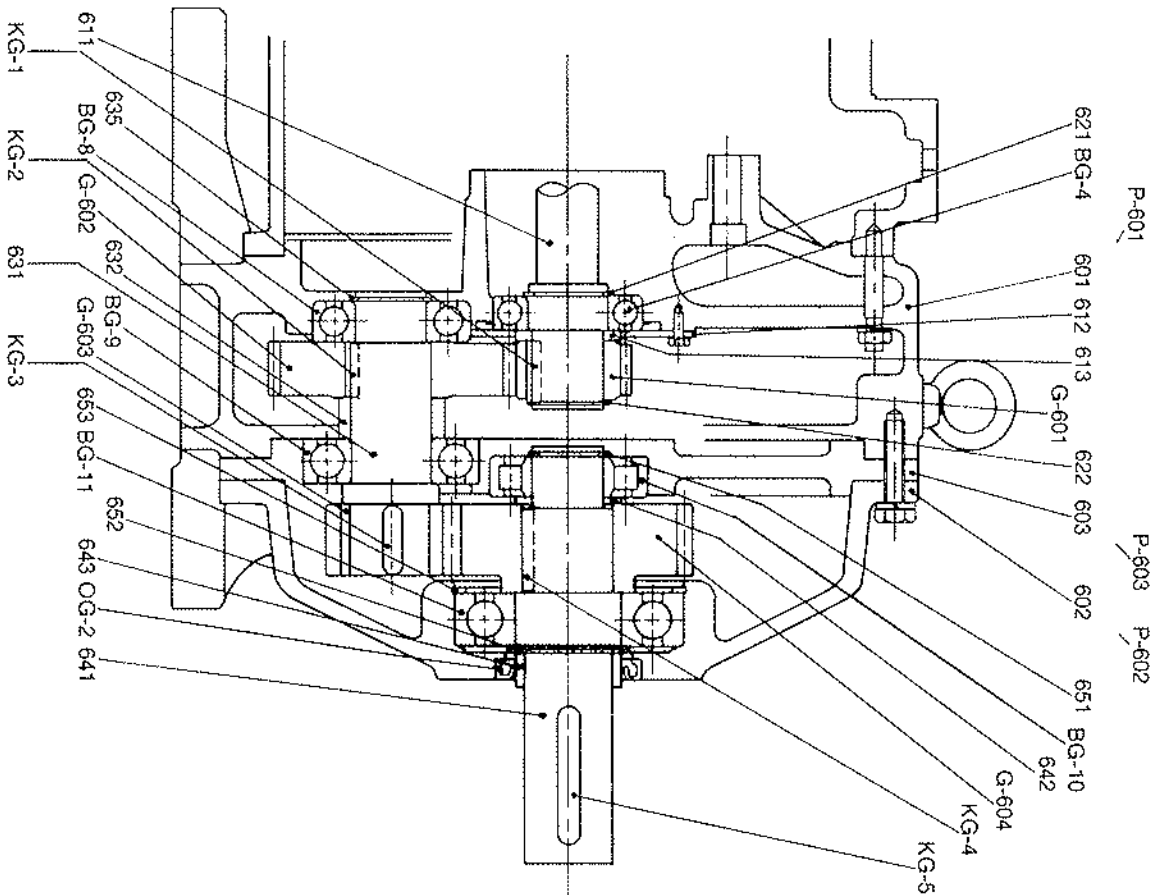


INPUT - OUTPUT SHAFT SECTION



Casting Section		
Part No.	Part Name	Qty
1	Casting	1
2	Co-Collar	1
P-3	Gasket	1
4	OP-Housing	1
P-5	Injector Pipe	1
P-7	Rubber Gasket	1
8	Fan Cover	1
10	Oil Glands	2
P-10	Gasket	2
P-12	Drive Flng	2
	Gasket	2
Input Shaft Section		
2	Input Shaft	1
23	Retaining Ring	1
26	IP-Collar	1
O-1	Oil Seal	1
B-1	Bearing	1
28	Oil Guide	1
B-2	Bearing	1
31	Retaining Ring	1
G-1	Input Shaft Gear	1
32	Retaining Ring	1
Output Shaft Section		
41	Output Shaft	1
43	Stopper Ring	1
44	Retaining Ring	1
B-3	Bearing	1
49	End Plate-I	10
D-1	Flange Disc-I	10
O-2	Flange Disc-II	2
51	End Plate-II	2
B-4	End Plate Bolt	1
52	Face Cam I	1
57	Face Cam II	1
58	Face Cam II	1
B-5	Bearing	1
O-2	Oil Seal	1
Swing Bracket Section		
G-1	Swing Shaft	2
B-5	Bearing	2
O-1	Oil Seal	2
G-2	Retaining Ring	2
G-2	Swing Shaft Gear	2
G-4	Stroke	2
G-5	Stroke	2
G-6	Retaining Ring	2
G-3	Spine Shaft Gear	2
B-6	Bearing	2
O-3	Gate Valve	2
		30A
		40A
B-7	Bearing	2
B-8	Socket	2
68-1	Retaining Ring	2
68-3	Retaining Ring	2
68-4	Retaining Ring	3
Speed Control Section		

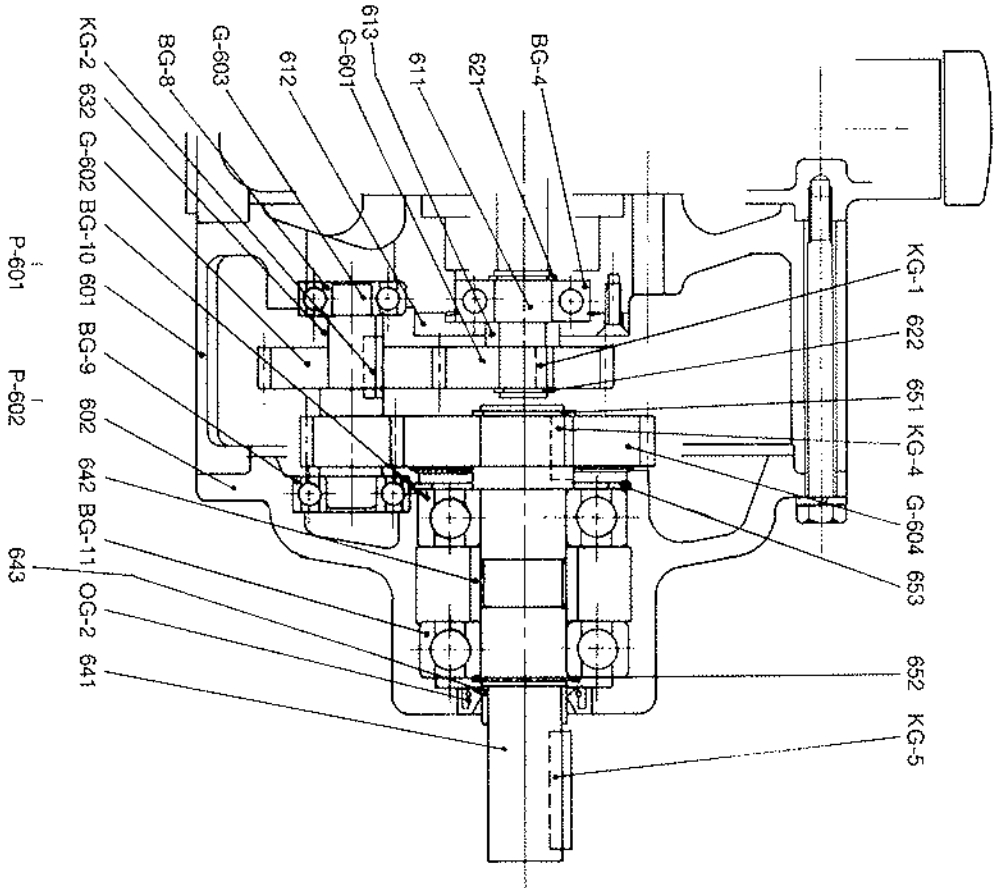
5. ASSEMBLY DRAWING
h) Model NSAG, N8AG, N10AG, 15AG



Part No.	Part Name	Qty.
OG-2	Oil Seal	1
BG-4	Bearing	1
BG-8	Bearing	1
BG-9	Bearing	1
BG-10	Bearing	1
BG-11	Bearing	1
G-601	Gear(I)	1
G-602	Gear(II)	1
G-603	Gear(III)	1
G-604	Gear(IV)	1
601	Gear Case(I)	1
P-601	Gasket	1
602	Gear Case(II)	1
P-602	Gasket	1
603	Bearing Holder	1
P-603	Gasket	1
611	Primary Output Shaft	1
612	Cover	1
613	Spacer (N10G only)	1
621, 622	Retaining Ring	2
631	Intermediate Shaft (15G w/o Gear)	1
632	Spacer	1
635	Retaining Ring (Except 15G)	1
641	Slow Speed Shaft	1
642	Spacer	1
643	Wear Sleeve Collar	1
651-653	Retaining Set	3
KG-1	Key	1
KG-2	Key (15G only)	1
KG-3	Key	1
KG-4	Key	1
KG-5	Key	1

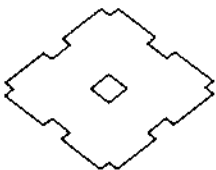
NOTE: * 1 Intermediate Shaft and Gear (III) are integral

5. ASSEMBLY DRAWING
g) Model N05AG, N1AG, N2AG, N3AG

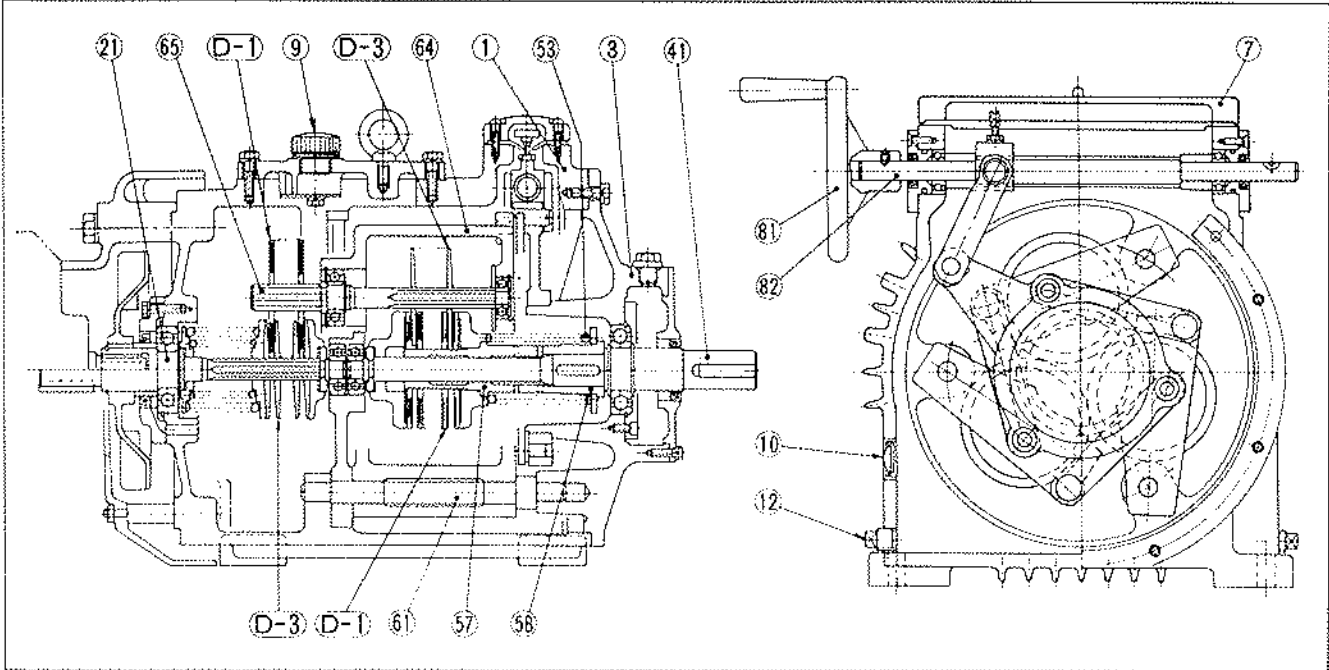


Part No.	Part Name	Qty.
OG-2	Oil Seal	1
BG-4	Bearing	1
BG-8	Bearing	1
BG-9	Bearing	1
BG-10	Bearing	1
BG-11	Bearing	1
G-601	Gear(I)	1
G-602	Gear(II)	1
G-603	Gear(III)	1
G-604	Gear(IV)	1
601	Gear Case (I)	1
P-601	Gasket	1
602	Gear Case(II)	1
P-602	Gasket	1
611	Primary Output Shaft	1
612	Cover	1
613	Spacer (N2G, N3G only)	1
621, 622	Retaining Ring	2
631	*Intermediate Shaft	1
632	Spacer	1
641	Slow Speed Shaft	1
642	Spacer	1
643	Wear Sleeve Collar (N2G, N3G only)	1
651-653	Retaining Set	3
KG-1	Key	1
KG-2	Key	1
KG-4	Key	1
KG-5	Key	1

NOTE: * 1 Intermediate Shaft and Gear (III) are integral



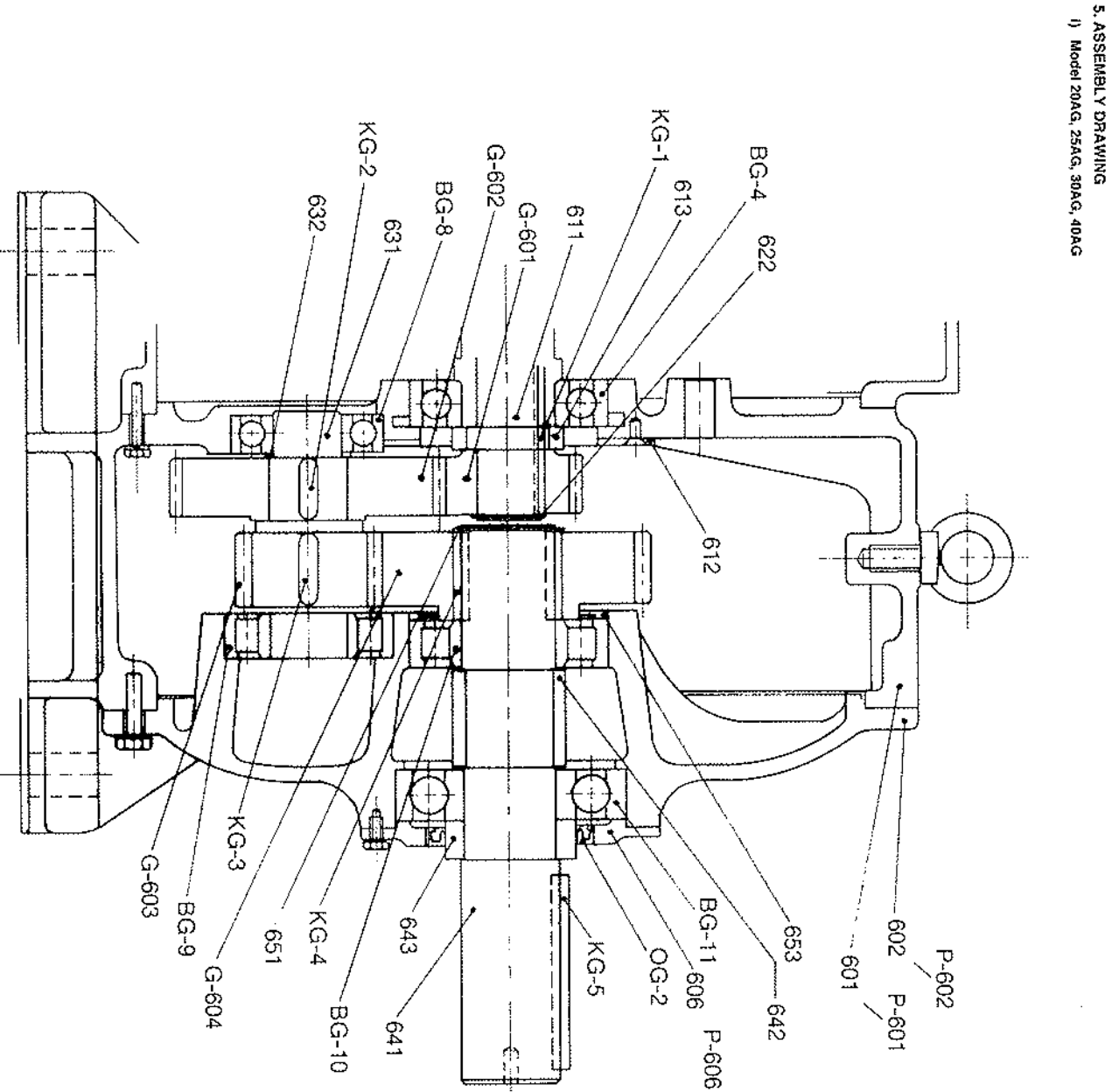
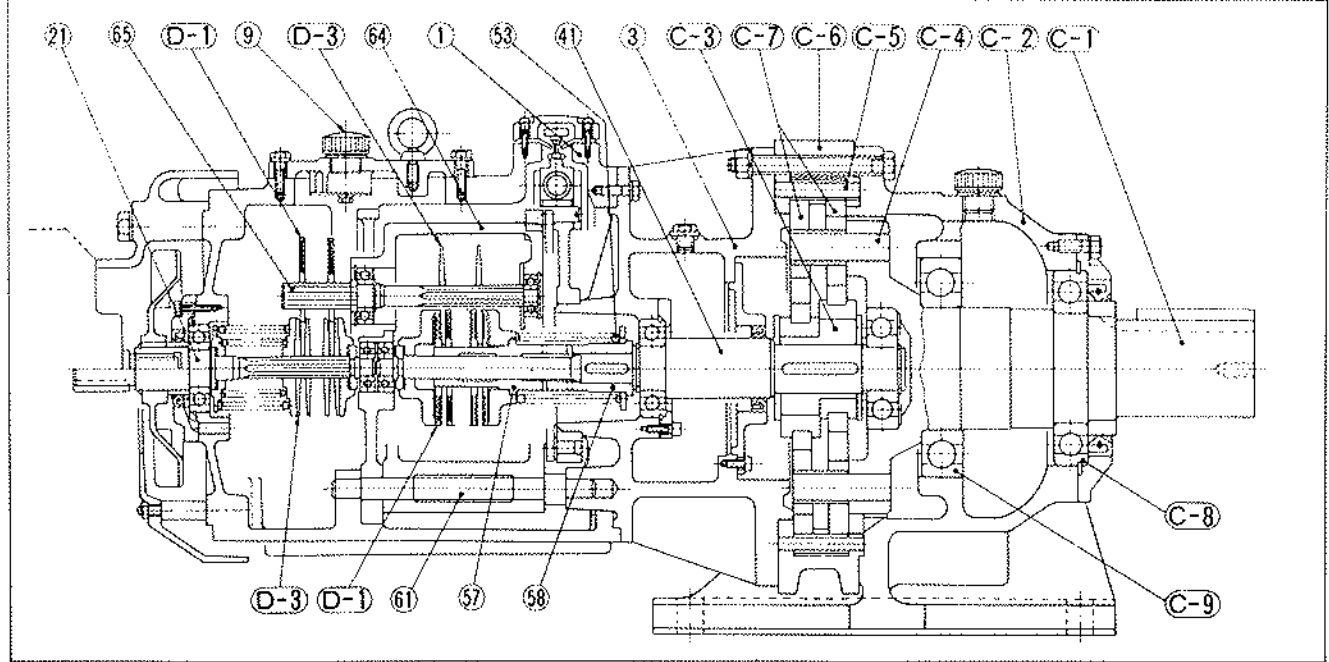
Basic ND Type BEIER VARIATOR



Main Parts

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Casing	41	Output shaft (High speed shaft in Fig. 13)	81	Hand wheel	C-4	Slow speed shaft pin
3	Cover (flange cover in Fig. 13)	53	Spring	82	Shifting screw	C-5	Ring gear pin
7	Indicator plate	57	Face cam I	D-1	Flange disc	C-6	Ring gear housing
9	Oil filler plug	58	Face cam II	D-3	Cone disc	C-7	Cycloid disc
10	Oil gauge	61	Swing shaft	C-1	Slow speed shaft	C-8	Slow speed shaft bearing A
12	Drain plug	64	Bracket (Arm)	C-2	Horizontal casing	C-9	Slow speed shaft bearing B
21	Input shaft	65	Spline shaft	C-3	Eccentric		

Type ND BEIER CYCLO VARIATOR



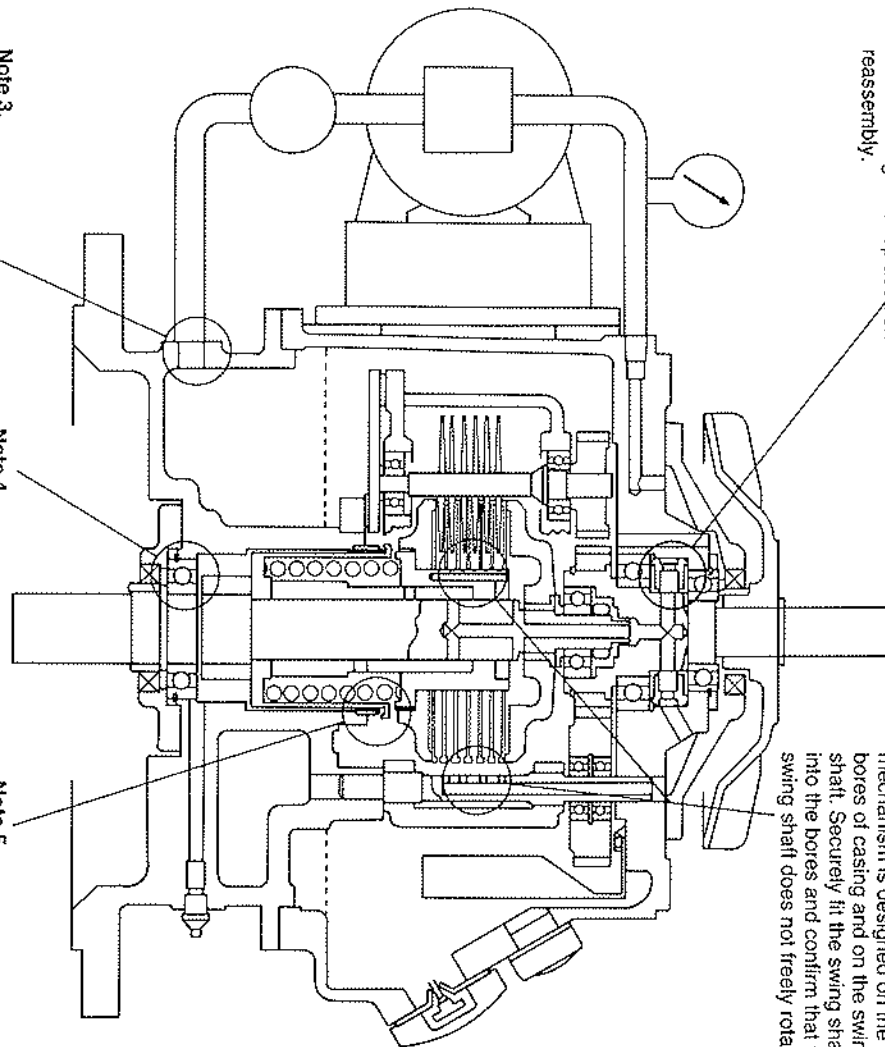
Part No.	Part Name	Qty.
OG-2	Oil Seal	1
BG-4	Bearing	1
BG-8	Bearing	1
BG-9	Bearing	1
BG-10	Bearing	1
BG-11	Bearing	1
G-601	Gear(I)	1
G-602	Gear(II)	1
G-603	Gear(III)	1
G-604	Gear(IV)	1
P-601	Gear Case(I)	1
P-602	Gear Case(II)	1
P-603	Gasket	1
P-604	Gasket	1
P-605	Gasket	1
P-606	Gasket	1
P-607	Gasket	1
P-608	Gasket	1
P-609	Gasket	1
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P-618	Gasket	1
P-619	Gasket	1
P-620	Gasket	1
P-621	Gasket	1
P-622	Gasket	1
P-623	Gasket	1
P-624	Gasket	1
P-625	Gasket	1
P-626	Gasket	1
P-627	Gasket	1
P-628	Gasket	1
P-629	Gasket	1
P-630	Gasket	1
P-631	Gasket	1
P-632	Gasket	1
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NOTE: * Intermediate Shaft and Gear (II) are integral

Forced Lubrication Type

Note 1.

Oil distributor ring is to be fitted between the bearing on the input shaft. Properly assemble this ring when bearings are replaced on reassembly.



Note 2.

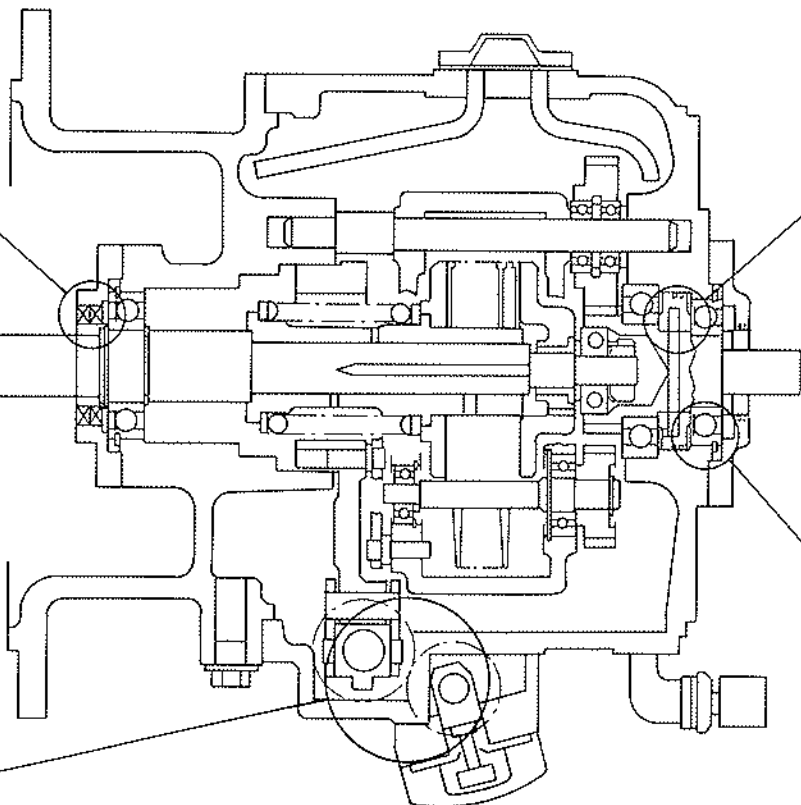
To lubricate the discs, oil effusion holes are machined on the swing shafts and endplate boss. These holes on the swing shafts must face to the center when assembled. In order to assure correct positioning, securing the mechanism is designed on the bores of casing and on the swing shaft. Securely fit the swing shaft into the bores and confirm that the swing shaft does not freely rotate.

Note 3.

On reassembly, clean the bearing on the output shaft and apply new grease. For 30AV and larger... Spherical roller bearings with withdrawal sleeve are used on the output shaft of 30AV and larger. Use a sleeve withdrawer for its removal.

Note 4.

The oil flinger mechanism is devised between the flinger on the output shaft and the internal edge of the output cover. The flinger should be properly fitted on the output shaft when reassembled.



Oil-Bath Type

Note 1.

For models N2A, N3A, N5A and N8A, an oil flinger is fitted between the bearings on the input shaft. Make sure not to dislocate the flinger when the bearings are replaced.

Note 2.

Refill grease in the shield type bearing on input shaft or apply grease on the input bearing before the input shaft is fitted into the casing. Suitable grease is lithium grease of NLGI No. 2.

Note 3.

Two oil seals are fitted in the housing at output shaft to prevent oil leakage.

Note 4.

Shifting nut and indication pointer are located on the separate screw shafts interrelated by spur gears mounted on the shafts. Therefore, position of the pointer and the shifting nut is adjusted at factory. Do not disassemble this section unless actually required.

7. Vertical Units Disassembly/Reassembly

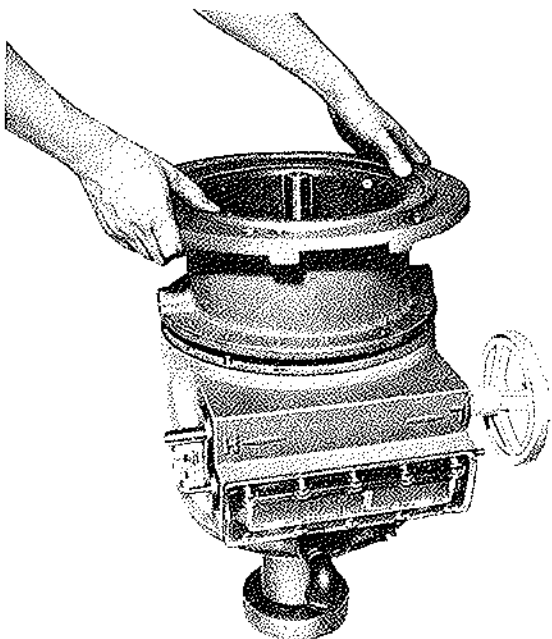
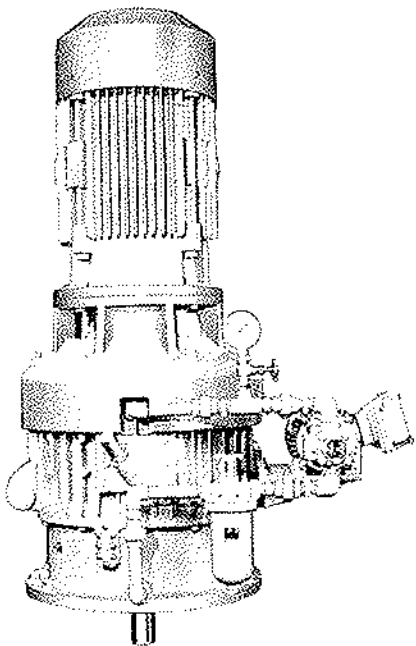
Vertical types of Beier Variator incorporate a different mounting style and lubrication system from the horizontal types and considerable differences prevail in the design of external components. However, the internal mechanism is almost identical with horizontal

type except for a few components related to lubrication and sealing mechanism. Therefore, please refer to the procedures and assembly drawing for horizontal units except for the specific precautions shown below.

DISASSEMBLY

Note 1.

When the unit is equipped with external lubrication pump, this equipment should be removed prior to the disassembly of the main unit. Disconnect piping at the pipe joints and remove motor/pump unit together with the base attached to the casing of Beier Variator. Motor, adaptor (fan cover) and coupling on input shaft are also to be dismantled prior to disassembly..



After draining oil, remove output housing (oil seals fitted within), a retaining ring on the shaft bearing and the cover (with mounting flange) as shown above. Please note that the casing and the cover are fitted with a dowel pin. When reassembled, the cover should be properly positioned at the pin.

Note 2.

The access to the internal mechanism of Vertical unit can be done by removing the output cover from the casing.

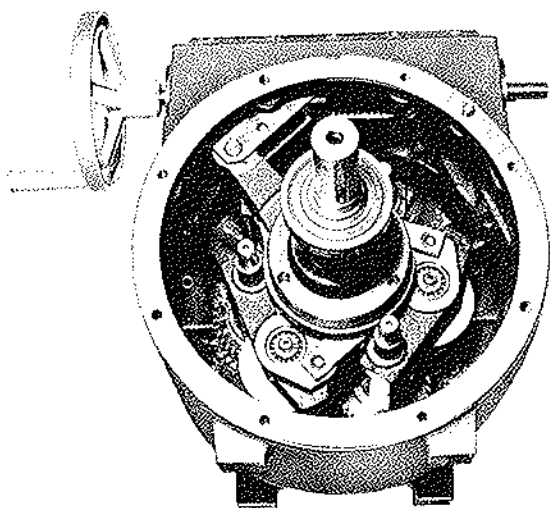


TABLE 4. Bearing and Oil Seal Table for Vertical Type

Basic Type					G-Type								
Bearing					Oil Seal		Bearing						Oil Seal
Location	Input Shaft		Output Shaft		Spline Swing	Input	Output	Output	Intermediate		S.S. Shaft		S.S. Shaft
Part No.	B-1	B-2	B-3	B-4	B-5, 6, 7	0-1	0-2	BG-4	BG-8	BG-9	BG-10	BG-11	OG-2
N05AV N1AV	6003Z	6003	BUSH	6203NR	SEE HORIZONTAL TYPE TABLE		S25408 S26428 G26426	6203NR	6201	6202	6305	6305ZZ	S32457x2
N2AV N3AV	6305ZNR	6305	HK1612	6206NR		S35508	S40587x2	6206NR	6203	6203	6307	6307	S385811x2
N5AV N8AV	6307ZNR	6209	6302	6207NR		S45629	S40587x2	6207NR	NJ305	NJ306	NJ306	6309	S456812x2
N10AV	6307NR	6210	6304	6208NR		S45629	S507212	6209NR	6308	6309	NJ308	6312	S608212x2
15AV	6210ZNR	6212Z	6305	6310NR		S628512	S558514	6211NR	NJ309	6310	NU312	6315Z	S8511013
20AV	6213ZNR	6213Z	6306	6313NR		S8511013	S609014	6312NR	NF211	6312	NU314	6317Z	S10513514
30AV 40AV	6314Z	6316Z	6307Z	22217BK +AH317		S10012513	S659012	6313NR	NJ213	6313	NU317	6320Z	S11014014
50AV 100AV	6318ZNRS	6322ZZ	22310	23024BK +AH3024		S11014014	S10513514						

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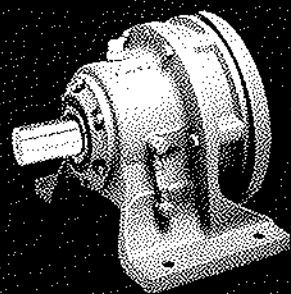
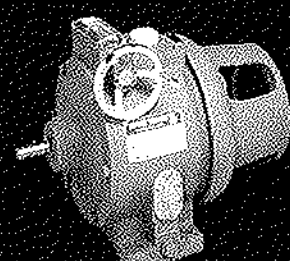
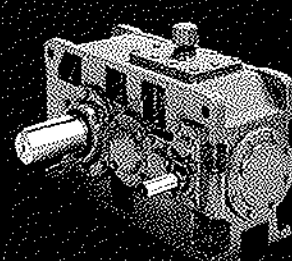
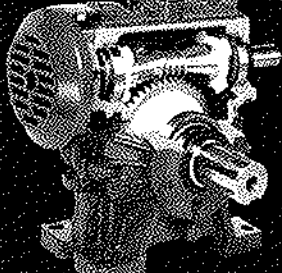
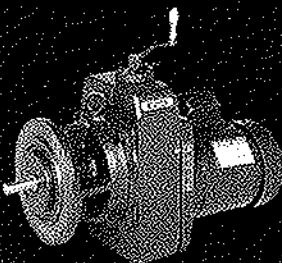
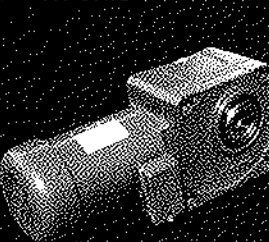
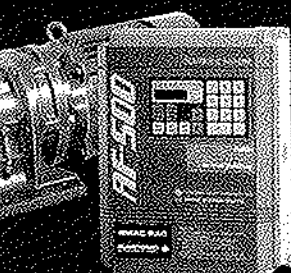
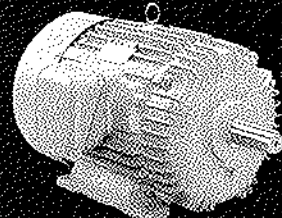
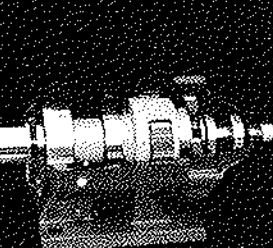
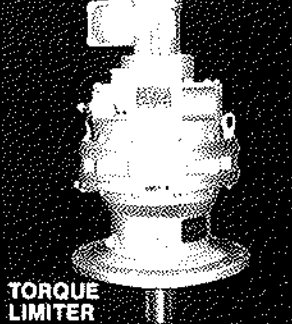
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