

Instruction Manual

# Dynamatic®

DRIVE SOURCE INTERNATIONAL, INC.

## Caution:

Rotating shafts and above ground electrical potentials of Dynamatic equipment can be hazardous. Therefore, it is strongly recommended that all electrical work conforming to National Electrical Codes and local regulations, installation, alignment and maintenance be performed only by qualified personnel . preferably factory trained.

Only factory recommended test procedures, included in the instruction manual, should be followed. Electrical power should always be disconnected before working inside of the control enclosure.

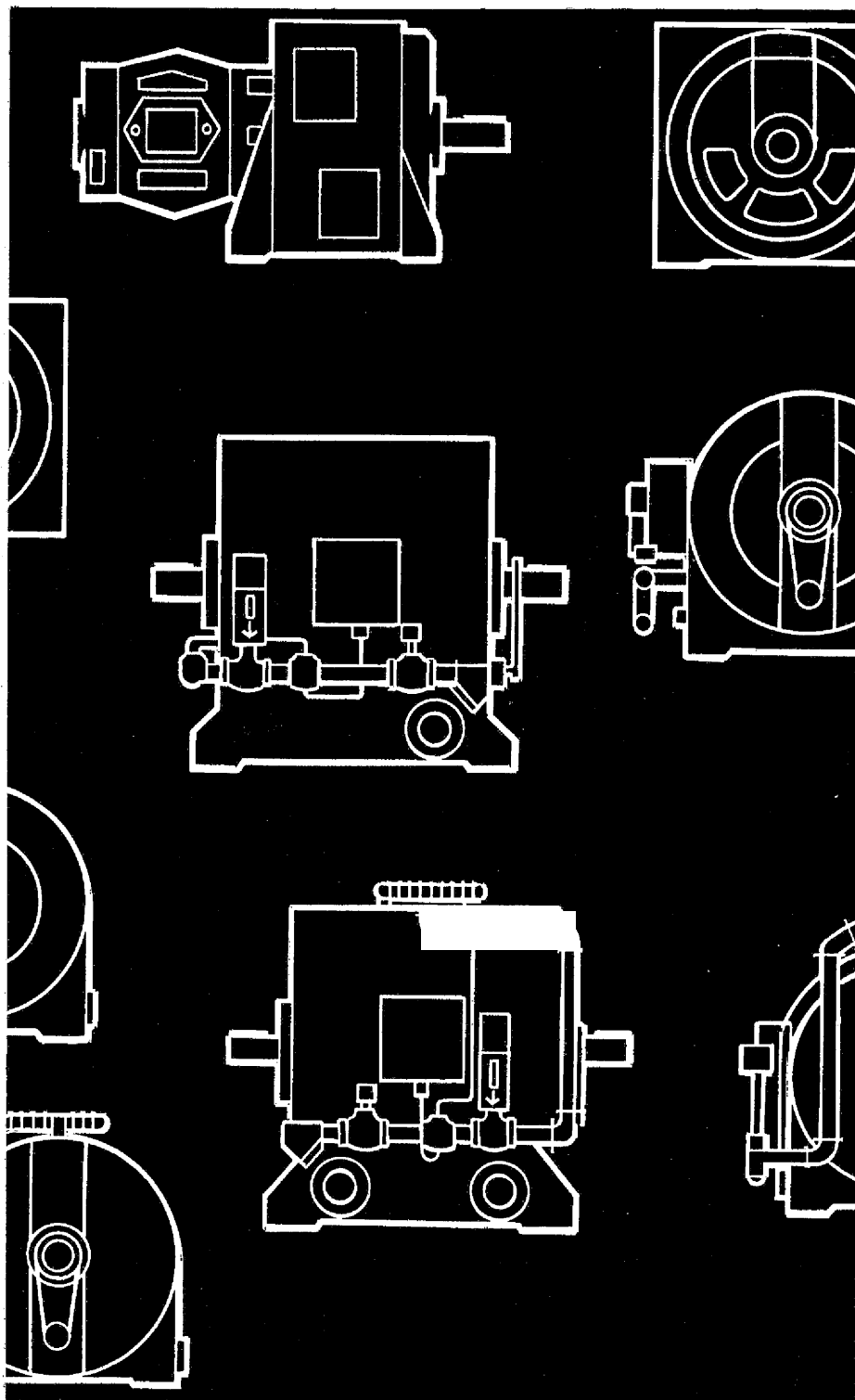
Although shaft couplings are generally not furnished by the manufacturer, rotating shafts and couplings must be protected with securely mounted metal guards that are of sufficient thickness to provide protection against flying particles such as keys, bolts and coupling parts.

**REFER TO OSHA RULES AND REGULATIONS PARAGRAPH 1910.219 FOR GUARDS ON MECHANICAL POWER TRANSMISSION APPARATUS.** Even when the output shaft is motionless, it should be considered "alive" as long as its motor, or prime mover, is running; keep hands away from the output shaft until the motor has completely stopped and power is disconnected from the controller.

Provide immediate corrective measures if abnormal noises are detected. If noise is due to excessive vibration, check for misalignment, build-up of foreign material or internal rotating components or bearing failure. Keep clear of the air discharge vents of air cooled machines. The air temperature may be hot and particles may be propelled through the air stream by internal rotating components.

## Note:

Since improvements are continually being made to available equipment, the enclosed data is subject to change without notice. Any drawings are for reference only, unless certified.



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## MECHANICAL

### Inspection

#### Receiving

The factory has taken special precautions to ship your eddy-current unit in an approved shipping crate so it will arrive at its destination in the best possible condition. In case of rough handling or shipping damage, immediately file claim with the carrier and promptly notify your nearest Industrial Drives Division Sales Office.

#### Shaft Rotation

Hand rotate the shaft(s) to determine that rotation is free and that no binding exists.

#### Exterior

Carefully examine housing, end bells, conduit box, lead wires and terminals. Tighten any exterior screws and nuts if they have become loosened in transit.

#### Handling

Care must be exercised in handling this unit properly. Dropping, jarring, pounding of the shaft or lifting in an unapproved manner can cause serious damage to bearings and other components.

**CAUTION: DO NOT USE lifting eyes to lift the Dynamatic unit while a base or pump is attached to it.**

#### Electrical Connections

Follow National Electrical Code and local regulations to make required electrical connections for operating the unit.

#### Ordering Replacement Parts

All parts should be ordered from the factory in Sturtevant, Wisconsin.

In ordering parts, determine the part number from the bill of material, drawings or diagrams whenever possible. These contain parts lists of all parts ordinarily considered to be subject to replacement, but in case you are unable to find the part number, furnish the plant with the PRO number and serial number of applicable parts, such as the AC motor, eddy-current clutch, brake or controller.

**This will enable the factory to locate records in case you are unable to describe completely the part wanted.**

Additional information on parts is always available at your request.

### Returning Material

Before returning material, contact the nearest factory Regional or District office, representative or the Service Department in Sturtevant, Wisconsin.

### Storage

#### Air Cooled Units

Whenever this unit is to be set aside in storage, a clean, dry area must be provided and it should be kept in its original crate. **If kept in an air tight material such as polyethylene, use silica-gel or some other moisture absorbent to prevent rust. Additional grease is not required until ready for operation.** Shaft(s) should be rotated occasionally to redistribute bearing grease and to prevent bearings from becoming brinelled.

#### Liquid Cooled Units

##### General

Special care must be given to liquid cooled-equipment that will not be operated for an indefinite period of time. Unless equipment is properly cared for, rust will develop to the extent that difficulties will arise when the equipment is put into operation at a later date.

#### Storage Procedure

1. Remove source of power (if connected).
2. Drain all water from the machine.
3. **Pour undiluted rust inhibited ethylene glycol (automobile radiator anti-freeze) through the water inlet while the unit is rotating.**

**CAUTION: Do not use ethylene glycol solutions with stop-leak additives.**

4. Apply approximately 1 ounce of fresh grease into each of the grease fittings (if so equipped).
5. While the unit is set aside it should be protected with a ventilated covering to prevent dust and moisture from accumulating. If wrapped with an air-tight material such as **polyethylene, use silica-gel or some other moisture absorbent to prevent rust.**
6. Once each week hand rotate shaft(s); stop with shaft(s) in a different position each time. This is necessary to prevent the bearings from becoming brinelled.
7. When resuming normal operation normal flow of coolant will automatically flush the unit.

### Storage Procedure For Heat Exchangers

- Stop source of liquid coolant and remove all piping (if connected).
2. Open all drain outlets.
  3. Tip heat exchanger in a vertical position. Allow unit to drain completely.
  4. Purge or blow out the tubes with compressed air.
  5. Close drain outlets and seal all entrance and exit ports.
  6. Fill unit completely with water soluble oil.
  7. Cover unit with a ventilated covering.

### Installation

#### Location (Air Cooled Units Only)

Select a permanent location affording an unobstructed flow of clean cooling air to permit the unit to perform according to its ratings. Locate the unit at least 12 inches away from walls and similar obstructions to ensure sufficient air for cooling. The ambient temperature of input air must not exceed 40° Centigrade (104° Fahrenheit). Higher ambient temperatures reduce the thermal rating by 20 percent for every 10°F. ambient increase.

#### Mounting

The unit should be mounted directly to a bed, base or platform to ensure that it is rigid. Even if it is purchased mounted on a base, the base must still be aligned and secured.

**CAUTION: Failure to properly mount and level this unit may result in distortion to the housing, mechanical failure, misalignment and rapid bearing wear.**

Mount the unit as follows:

1. Push slotted shims under the lowest foot and moderately tighten the bolt.
2. Align the unit (see ALIGNMENT instructions). **Insert** feeler gauges under the remaining feet during the alignment procedure to level the unit.
3. Replace feeler gauges with equal thickness of slotted shims. (Use a few thick shims rather than a large number of thin shims.)
4. Alternately tighten bolts.
5. Recheck alignment and change shims as required.
6. Dowel all directly connected units to prevent creeping and future misalignment.

## Alignment

### General

Proper installation and alignment of this unit, as specified herein, is a condition of the Manufacturer's warranty.

*Angular misalignment* and *Offset misalignment* between directly connected shafts will cause increased bearing loads and vibration, even when the connection is made by means of a flexible coupling. Shaft alignment becomes especially critical if operated at high speeds. For this reason, the alignment of directly connected shafts must be checked with a dial indicator after coupling hubs have been installed.

### Flexible Couplings

A flexible coupling should be used to connect in-line shafts in order to avoid undue bearing stresses. It should never be forced onto a shaft by pounding, or serious damage to the bearings is risked. Moderate heat can be applied to the hubs to locate them in place on the shafts. If the hubs must be pressed on, use the threaded hole in the end of the shaft in order to avoid bearing damage. Be careful to start it true, not cocked, otherwise it is possible to burr the shaft. A light film of oil or other lubricant on the shaft will prove an aid to mounting. Be sure that the shafts are well cleaned before the coupling hubs are installed. When pressed over a considerable length of shaft, it may be necessary to expand the coupling hubs by heating.

**CAUTION: DO NOT drive or force the coupling hubs onto the shafts.**

If a key is used in a coupling, be sure that the key fits snugly in the shaft and coupling, but does not fill the space on top of the key. Some clearance must be left at this point.

### Parallel Offset Alignment

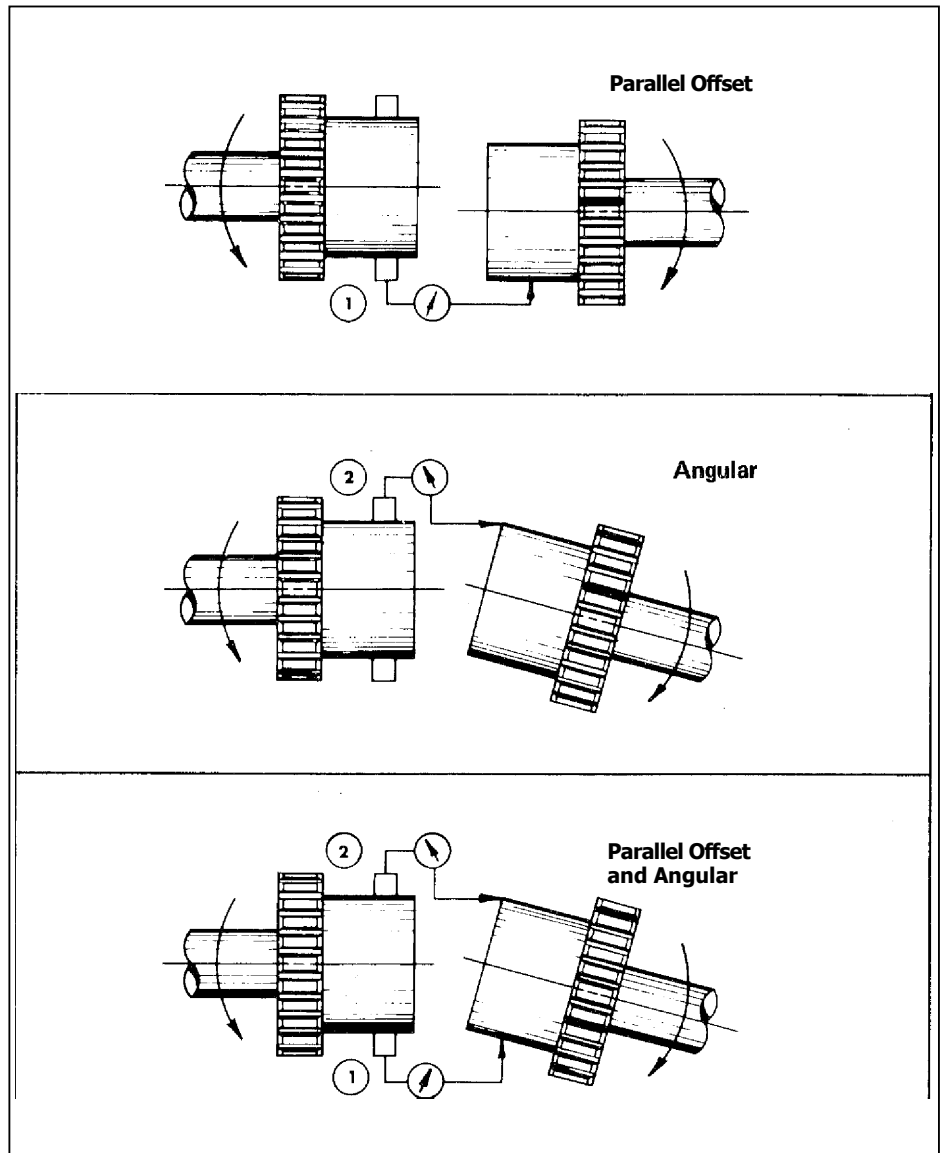
*Offset misalignment* is illustrated in Figure 1. Also shown is the location of the dial indicator. *Offset alignment* can be accomplished as follows:

1. Clamp the dial indicator on the hub and position the finger on the ground or machined diameter of the other hub (Figure 1, Item 1).
2. Scribe a mark on the surface of the hub where the finger is located.
3. Rotate both shafts simultaneously while keeping the finger on the scribe mark. Note the readings at each 1/4 revolution.

**NOTE: Refer to Table 1 for permissible parallel offset misalignment.**

## Misalignments

Figure 1



### Angular Alignment

*Angular misalignment* is illustrated in Figure 1. Also shown is the location of a dial indicator. Angular alignment can be accomplished as follows:

1. Clamp the dial indicator on the hub and position the finger on the other hub face (Figure 1, Item 2).
2. Scribe a mark on the face of the hub where the finger is located.
3. Rotate both shafts simultaneously while keeping the finger on the scribe mark. Note the readings at each 1/4 revolution.

**NOTE: Refer to Table 1 for permissible angular misalignment.**

### For One Rotating Shaft

If it is impossible to rotate both shafts, the dial indicator should still be used by following this procedure for both angular and offset alignment:

1. Clamp the dial indicator to the rotating shaft.
2. Position the finger against the face of the other hub (Figure 1).
3. Rotate the shaft and note the dial indicator reading for a measurement of the *angular misalignment* per Table 1.
4. Position the finger against the diameter of the other hub.
5. Rotate the shaft and note the dial indicator reading for a measurement of *offset misalignment* per Table 1.

# Permissible Operating Misalignment\*

Table 1

Model Number	Basic Coupling Size In.	Parallel Offset ① X, In.	Angular ② Y, In./In. Radius	Maximum Angular ② With a Measured Parallel Offset ① In./In. Radius**
9155, 6	3.5	.0120	.0040	Y ② = .0040 - .3 x ①
9165, 6	4.0	.0120	.0035	Y ② = .0035 - .3 x ①
918	3.0	.0120	.0064	Y ② = .0064 - .5 x ①
215	2.0	.0100	.0058	Y ② = .0058 - .6 x ①
2163, 4, 5	2.5	.0100	.0052	Y ② = .0052 - .5 x ①
2172, 3	3.0	.0120	.0064	Y ② = .0064 - .5 x ①
2192, 3	3.5	.0120	.0040	Y ② = .0040 - .3 x ①
2212, 3	4.0	.0120	.0035	Y ② = .0035 - .3 x ①
2232, 3	4.5	.0120	.0029	Y ② = .0029 - .2 x ①
2252, 3	4.5	.0120	.0029	Y ② = .0029 - .2 x ①
620	1.5	.0050	.0040	Y ② = .0040 - .8 x ①
630	1.5	.0050	.0040	Y ② = .0040 - .8 x ①
640	2.0	.0100	.0058	Y ② = .0058 - .6 x ①
655	2.0	.0100	.0058	Y ② = .0058 - .6 x ①
6163, 4, 5	2.5	.0100	.0052	Y ② = .0052 - .5 x ①
6172, 3	3.0	.0120	.0064	Y ② = .0064 - .5 x ①
6192, 3	3.5	.0120	.0040	Y ② = .0040 - .3 x ①
6212, 3	4.0	.0120	.0035	Y ② = .0035 - .3 x ①
6232, 3	4.5	.0120	.0029	Y ② = .0029 - .2 x ①
6252, 3	4.5	.0120	.0029	Y ② = .0029 - .2 x ①

\*Operating misalignment is dependent on the following factors:  
Initial misalignment, temperature growth and foundation settlement. Initial alignment should allow for the effects of temperature growth and foundation settlement. All above

**NOTE:** Although flexible couplings are designed to accommodate parallel and angular misalignment, care should be taken to align the driving and driven machinery as accurately as possible when the coupling is installed. Even when the

values are (TIR) Total Indicator Run out. To avoid errors in readings due to shaft magnetism, non-magnetic indicators should be used.

\*\*Maximum value for either must not exceed those given in columns 3 and 4.

original alignment has been very accurate, misalignment may occur later because of settling foundations, wear of bearings, etc., and it is well to make periodic checks to see that such misalignment does not become excessive.

# Rough Check

The unit can be roughly aligned without the use of a dial indicator, but alignment as such is not recommended for permanent installations. The degree of *angular misalignment* can be roughly determined by inserting feeler gauges between faces of the coupling hubs. The amount of *offset misalignment* can be roughly determined by positioning a straight edge across the machined diameter of the hubs.

# Allowable Overhung Load

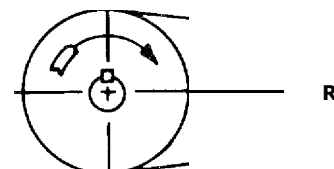
If this unit is to be belt or chain driven, reference must be made to the allowable overhung load, per Table 2.

Table 2 lists the maximum force in pounds that may be applied radially at the center of the output shaft keyway (and on input shaft of WCS and WB units). If a sheave or sprocket is to be installed on a new shaft, the resultant load which is imposed by the belt or chain must not exceed the allowable limit at the speeds specified in the Table.

"P" in Figure 2 represents the pull produced in a chain or belt and is a direct function of the torque of the driving sprocket or sheave. "R" represents the normal, reactive force imposed on the shaft and is equal to "P" plus the tension required to prevent slipping of the belts.

# Reactive Force

Figure 2



When chain and sprocket drives are used, the reactive force "R" will be approximately equal to "P," since no additional tension is required in a chain for an effective transmission of power. However, if "V" belts are used, the reactive force "R" will be approximately 1.5 times the value of "P" because of the belt tension required to prevent the belts and sheaves from slipping. With flat belts and sheaves, "R" will be 2.5 to 3 times "P," depending on the size of the sheaves, since smaller sheaves require tighter belting. Belting strains imposed on the shaft of this unit should never be greater than the amount required to prevent slipping of the sheaves.

# Allowable Overhung Load at Center of Standard Shaft Keyway\*

Table 2

Model No.	Allowable Load - Output End		
	900 RPM	1200 RPM	1800 RPM
9155, 6 **	3800	3800	3800
9165, 6 **	6000	6000	6000
918	2385	2150	-
215	1230	1110	965
2163, 4, 5	1460	1325	1150
2172, 3	2116	1922	1663
2192, 3	2462	2230	1930
2212, 3	3225	2870	2485
2232, 3	3787	3425	2960
2252, 3	3880	3490	2995
215**	1705	1705	1705
2163, 4, 5 **	2175	2175	2045
2172, 3 **	2835	2590	2275
2192, 3 **	3865	3530	3105
2212, 3 **	557.5	5085	4470
2232, 3 **	8460	7725	6795
2252, 3 **	8845	8070	7085

weight at the center of a standard shaft, extension and perpendicular to the shaft axis. The calculations are based on a minimum of 15,000 hours of bearing life for 90% of the

bearings. For 20,000 hours of bearing life, use 91% of the loads given. For models not listed, refer to the factory for allowable overhung loads.

\*\*Spherical Roller Bearings.

## Overhung Load Capacity

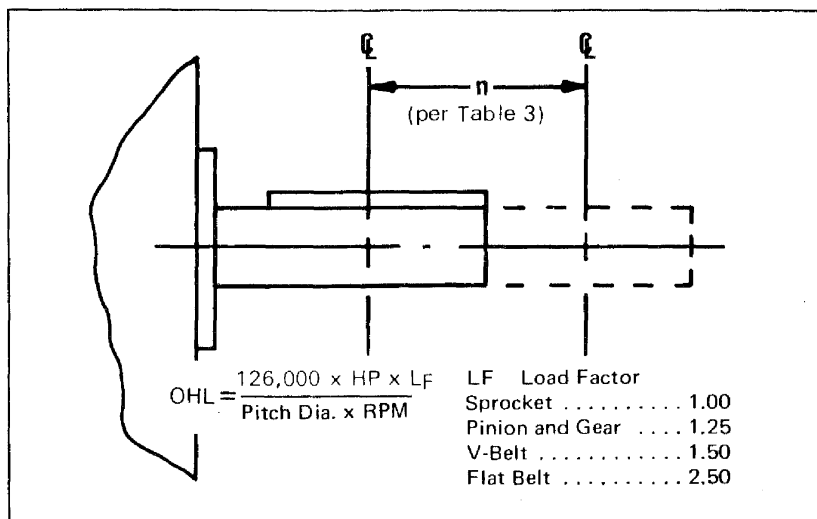
Under certain loading conditions, the point of load application falls beyond the mid point of the standard shaft keyway of the standard key (i.e. long belt sheaves, special shaft extensions, etc.). Under

such circumstances, the overhung load capacity of the unit is reduced and this reduction is dependent upon the point of the applied load. (See Figure 3.)

Reduction of rated overhung load capacity is indicated in Table 3. "K" is the percentage of rated overhung load capacity based on bearing capacity (Table 2) available for a load position (n) inches beyond the center of the standard shaft keyway of the standard shaft. **The maximum overhung load must never exceed shaft capacity.**

## Overhung Load Dimensions

Figure 3



## Reduced Overhung Load Capacity

Reduced Overhung Load Capacity

Table 3

Model	n	1"	2"	3"	4"	5"
215	K	<del>94.3</del>	<del>89.2</del>	<del>84.7</del>	<del>77.2</del>	<del>70.1</del>
		84.9	73.8	65.3	58.5	53.0
	MAX.	1445	1255	1110	995	900
216	K	<del>95.0</del>	<del>90.5</del>	<del>86.4</del>	<del>82.7</del>	<del>79.3</del>
		85.4	74.5	66.1	59.4	54.0
	MAX.	1860	1620	1435	1290	1175
217	K	<del>95.0</del>	<del>90.5</del>	<del>86.5</del>	<del>82.8</del>	<del>79.3</del>
		4570	4020	3590	3240	2950
	MAX.	5600	4975	4470	4060	3720
219	K	<del>95.4</del>	<del>91.3</del>	<del>87.5</del>	<del>84.0</del>	<del>80.8</del>
		5600	4975	4470	4060	3720
	MAX.	5600	4975	4470	4060	3720
221	K	<del>96.3</del>	<del>92.9</del>	<del>89.8</del>	<del>86.8</del>	<del>84.1</del>
		7785	6945	6270	5715	5245
	MAX.	7785	6945	6270	5715	5245
223	K	<del>96.9</del>	<del>94.0</del>	<del>91.3</del>	<del>88.7</del>	<del>86.3</del>
		8235	7460	6830	6285	5830
	MAX.	8235	7460	6830	6285	5830
225	K	<del>97.4</del>	<del>94.9</del>	<del>92.6</del>	<del>90.4</del>	<del>88.3</del>
		8065	7320	6710	6180	5740
	MAX.	8065	7320	6710	6180	5740

 STANDARD BEARINGS

 ROLLER BEARINGS

## MAINTENANCE

### Lubrication (Grease Lubricated Units)

#### General

The unit was sufficiently lubricated at the factory to require no further lubrication for 2,000 hours, if operated under reasonably normal conditions not harmful to bearings and lubricant. Operating conditions and atmospheric conditions existing in the area of installation must be considered when determining how often lubrication is necessary. If operating under favorable conditions that do not warrant frequent lubrication, the grease inlets should be equipped with plugs that are replaced with grease fittings only during lubrication. Refer to Figures 4, 5 and 6.

Allow only experienced maintenance personnel to lubricate this unit. Before attempting to lubricate this unit refer to your specific assembly drawing to review the specific type and location of bearings that are used. In the interest of safety, the machine should be shut down for lubrication.

#### Procedure

The following steps constitute the procedure for lubricating the bearings:

1. Clean the exterior of the unit around the grease and drain plugs.

Remove the drain plugs and if grease holes have plugs, remove the plugs and install grease fittings in their place.

2. On ACM units slowly introduce recommended grease, per Table 4, into the output and motor bearings until clean grease appears at the drain holes. On ACS and WCS, do the same for the output, input and support bearings; on WB, input and output.
3. Slowly introduce approximately one to two ounces of grease into the pilot bearing (4) (on ACM, ACS and WCS units). DO NOT over-lubricate. Churning of grease may result in harmful over-heating of bearings.
4. Before replacing the drain plugs operate the unit for approximately 15 minutes to expel any excess grease from the bearing chambers. Then wipe off all grease from around drain holes and grease fittings. Replace drain plugs.
5. If the unit is being operated under reasonably normal conditions, and does not require frequent lubrication, replace grease fittings with plugs as a precaution against personnel over-lubricating bearings.

NOTE: Separate sheets cover oil lubrication.

#### Recommended Greases

The grease specification is per Dynamatic Engineering Standards MML 4-1.2. This is a general-purpose industrial grease, NLG1 No. 2 grade, mineral oil in a lithium based carrier. Texaco Regal AFB2 is used at the factory. Any equivalent and compatible grease may be used.

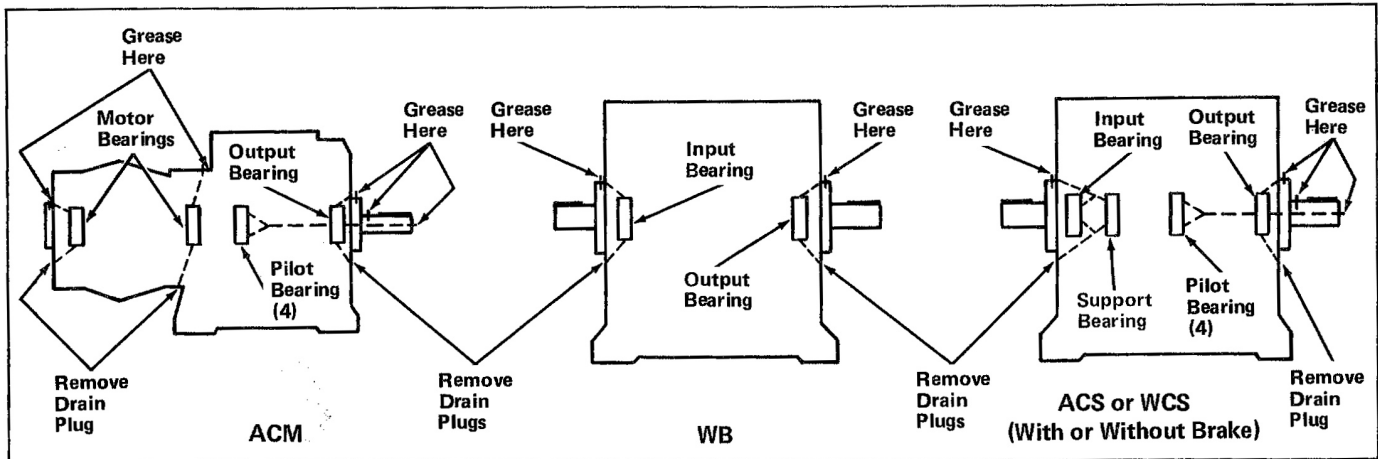
Table 4 is a list of some products that comply with the Dynamatic specifications.

Recommended Greases	Table 4
Company	Grease
Shell	Alvania No. 2
Gulf	Gulfcrown No. 2
Texaco	Multifak No. 2, Premium RB, Regal AFB 2
Mobil	Mobilux No. 2

Figure 4

Figure 5

Figure 6



## Governor Generator

### General

The generator is a permanent-magnet, alternating-current device that produces a linear voltage in direct proportion to the speed at which it is driven. In the governing circuit of the control system, the voltage produced by the generator represents the actual speed of the unit. This voltage is amplified and compared with a constant voltage in the reference circuit, representing the desired speed of the unit, to effect speed control.

At maximum speed the output of the generator is approximately 55 to 60 volts. Frequency varies with the speed to a maximum of **500** to 600 Hz. This generator is designed to operate with equal output and efficiency in either direction of rotation.

The use of an AC governor generator eliminates rotating windings and consequently no maintenance of brushes, slip rings, or commutator is required.

The Alnico magnet employed in this unit retains its field strength over a long period of time, assuring a constant generator output at a given speed. This magnet should not be subjected to sharp impacts, abuse, or temperatures higher than the maximum operating temperature of the unit, as this will result in a weakening of the field strength. Should removal of the magnet be necessary for remagnetization or repairs, the entire generator assembly should be returned to the factory.

### Description

The generator is generally classified as either a separately mounted or around the-shaft-type of unit. A separately mounted type generator is contained within its own housing and is driven by appropriate pulleys and belts from the output shaft. An around-the-shaft type generator has an Alnico rotor that is keyed directly to the output shaft and mounted close to the field.

The specific assembly print will identify the type of generator used in your equipment.

A specific volts per RPM is not essential. Correct adjustment of the controller (see your operating instructions) will compensate for wide variance in generator output.

### Cleaning

#### Air Cooled Units

A certain amount of foreign matter enters with cooling air and accumulates inside, with the amount depending on the purity of surrounding air **and** cleanliness of exposed surfaces.

Therefore, periodic cleaning will be required. To do so, remove excitation, remove air intake screen and use compressed air to dislodge and remove foreign matter. Repeat this procedure as often as necessary to keep the unit clean.

If, after operating a long time, compressed air does not sufficiently remove

all foreign matter, disassemble per disassembly instructions and use compressed air and cleaning solution.

### Liquid Cooled Units

Mineral deposits and corrosion scale on the internal parts of Dynamatic water cooled units retard heat transfer and impede cooling. Considerable accumulations of scale or minerals in the air gap between the driving and driven members of couplings, drives and brakes may cause erratic action and poor control, especially when operating at low excitation. Excessive corrosion and deposition may be caused by the use of cooling water with a high mineral content. Refer to the instructions on installation of water piping for information on the acidity and mineral content of cooling water.

In areas where favorable water conditions are found, it should not become necessary to de-scale a unit until it is disassembled for normal bearing replacement.

The factory recommended procedure for cleaning water cooled units is to disassemble them and manually clean all parts. This procedure guarantees complete removal of scale, rust, etc.

The Dynamatic Plant assumes no responsibility for injuries to personnel or damage to equipment incurred by the use of chemicals used in this suggested cleaning procedure.

G-2 Generator Specifications

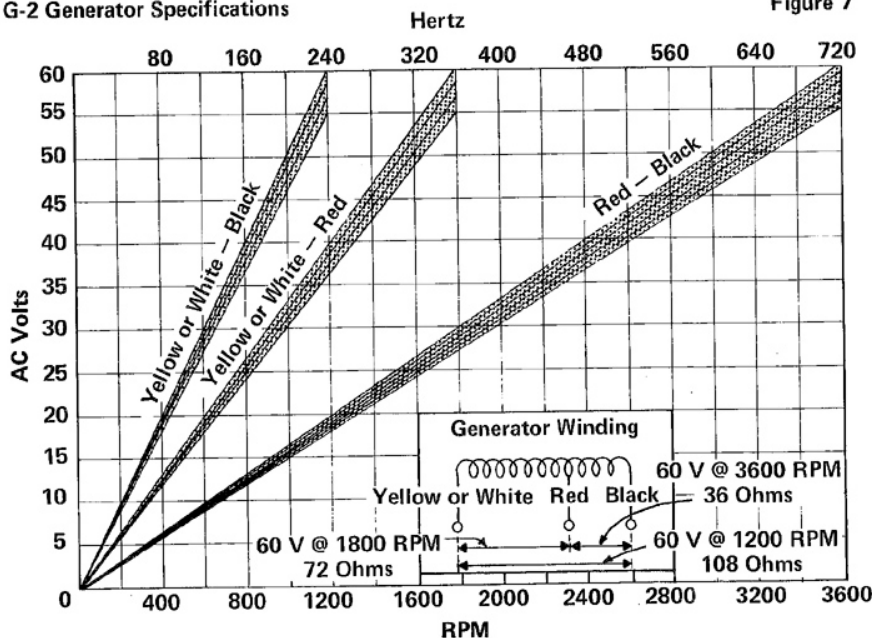
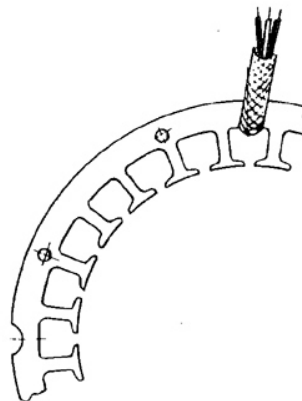


Figure 7

Alnico Stator Lamination Assembly

Figure 8





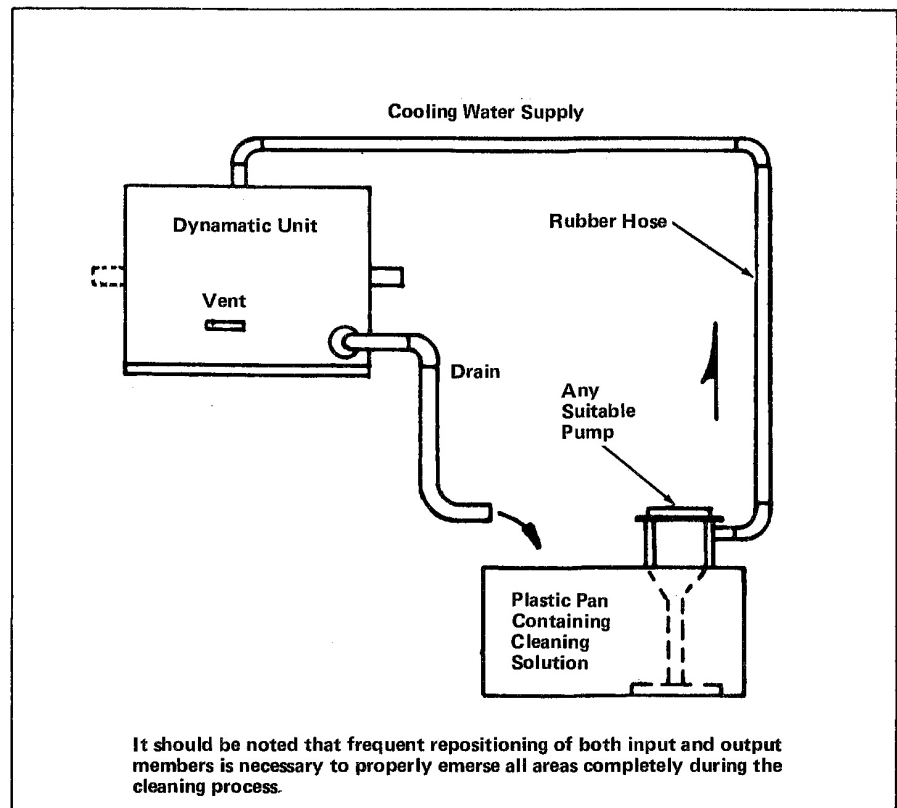
The following steps constitute the procedure for cleaning water cooled units:

1. Refer to Figure 9 for a suggested arrangement for the cleaning of Dynamatic units and Table 5 for manufacturers of cleaning solutions.
2. The solution, per Table 5, should be handled with care. Use it only in a ventilated area, away from all fires, sparks or other ignition sources.
3. Do not permit the solution to come in contact with the eyes or mouth via the hands.
4. **The level of the cleaning solution must be lower than the bearings to prevent bearing damage.**
5. If the unit has a vent, the solution spills from vent when over filled.
6. Use a cleaning solution pump (3 to 12 gallon capacity) for circulating the solution. Slowly rotate both the input and output members through the solution so all areas are immersed until completely cleaned. Instructions with cleaning solutions usually indicate a change in color when cleaning is complete. For separately mounted brakes or couplings, the input and output shaft can be rotated by hand.
7. Start the solution pump. While the solution is actively removing water scale, gas is generated by chemical action which causes a heavy foaming in the return line and tank.

As the equipment is cleaned, the amount of foam greatly decreases. However, some foam may persist due to the agitation of the pumping action on the penetrating agents used in the solution.

**Typical Arrangement for Cleaning Dynamatic Liquid Cooled Units**

**Figure 9**



8. This foaming action indicates that the solution is still active and dissolving scale in the system. if foaming stops and scale is still present in the system, add a small amount of solution. This will cause foaming to resume.
9. Observe the foaming action. When foaming ceases, stop the solution pump and drain the solution from the unit.
10. Connect the unit to the water supply and thoroughly flush it with fresh water. When the unit has been flushed and discharge water is clear, turn the water off and replace the drain plug.
12. For the removal of heavy accumulations of corrosion scale and mineral deposits, the unit should be disassembled and all internal parts should be cleaned and painted. A special corrosion-resistant paint is available upon request from the Service Department of the Dynamatic Plant, Sturtevant, Wisconsin.

**Manufacturers of Cleaner for Scale Removal**

**Table 5**

Calgon Company Post Office Box 1346 Pittsburgh, Pennsylvania 15230	Oakite Products Company 50 Valley Road Berkley Heights, New Jersey 07922	Ohio Valley Chemical Corporation 426 Transportation Building 307 East Fourth Street Cincinnati, Ohio 45202
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**NOTE: When using a particular product, follow the manufacturer's recommendations.**

## Disassembly/Reassembly

### General

Read these instructions carefully and check the appropriate typical Cross Section Drawing with your own assembly drawing to determine the extent of disassembly that is necessary. Should it be necessary to remove bearings, they should be removed by force applied to the outer race when removing from a housing, or to the inner race when removing from a shaft.

Match mark all parts before removing to aid in reassembly.

When reassembling the unit, the USE of new bearings is recommended. After all parts are cleaned and all machine fits have been checked, repaired or replaced, proceed with reassembly.

### Installation of Bearings

Bearings should never be forced onto a shaft or into a housing by blows applied to either race. To do so is to risk serious damage to the bearings. Use either an arbor press or a jack and a piece of soft metal tubing squared on both ends, if necessary. Be careful to start the bearing true, not cocked; otherwise it is possible to burr the shaft. A light film of oil or other lubricant on the shaft will prove an aid to mounting. Be sure that the shaft and bearing bores are well cleaned before the bearing is installed. Also, the mechanic doing the work should be careful that particles of metal or other foreign matter do not enter the bearing during installation. **Do not unwrap bearings until ready for installation.**

When a bearing is to be pressed over a considerable length of shaft, or over a tight fitting seat, it may be necessary to expand the bearing by heating in oil. When a bearing is heated in oil, the temperature of the oil should not exceed 200°F. and the bearing should not be kept in the bath longer than necessary to bring the entire bearing to the required temperature.

## Positive Drive Belt

### General

The positive drive belt has positive grip, is light weight, operates at high speeds and is efficient. However, proper installation and handling are required to gain full advantage of this belt.

### Description

The positive drive belt is composed of four components, as shown in Figure 10. They are as follows: *Tension Member*, *Backing*, *Teeth* and *Facing*.

The *Tension Member*, which is a continuously wound, single layer of cables, provides the belt with strength.

The purpose of the neoprene *Backing* is to protect the load-carrying *Tension Member* from grime, heat, moisture and wear due to friction.

The neoprene *Teeth* are molded integrally with the neoprene *Backing*. The shape of the belt is determined by the form of the *Backing* and *Teeth*.

A neoprene-impregnated, fabric layer facing material is formed along the *Teeth* to reduce belt wear.

### Pitch

The *circular pitch* of the positive drive belt is, as shown in Figure 11, the distance between adjacent tooth centers and is measured on the *belt pitch line*. On the pulley, *pitch* is the distance between adjacent groove centers and is measured as the *pulley pitch circle*. The *pitch line* of the belt is located within the cables of the *tension member*. The *pitch circle* of the pulley coincides with the *pitch line* of the belt. The *pitch diameter* is, as shown, always greater than the *outside diameter* of the pulley.

### Storage

Protect the positive drive belt in storage against sharp bending or creasing. A crimped belt cannot assure smooth operation.

### Installation

Maximum belt life, minimum wear, quiet operation and all around satisfactory operation can be obtained only by correct installation. Particular attention should be given to the following recommendations:

### Rigid Mounting

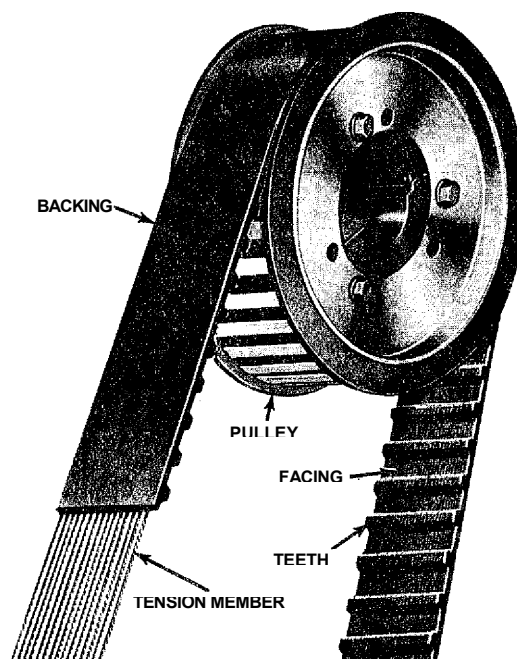
Make sure members supporting pulleys are firm and solid. A non-rigid mounting or pulley support can cause variation in centers, resulting in belt teeth jumping the pulley grooves.

### Drive Alignment

Shafts must be checked for parallelism, and pulley alignment proved with a straight edge. Misalignment of a drive causes unequal tension on the belt, resulting in premature wear and failure. It is sometimes advisable to offset the second pulley slightly to conform to the belt if the belt has a tendency to run against one flange of the driver pulley.

Typical Positive Drive Belt

Figure 10



### Belt Tension

Positive drive belts do not require friction to drive; however, sufficient tension to transmit the load must be maintained. For most applications, a belt should be tightened only enough to provide a snug fit. Run the drive under load and watch how the teeth of the belt enter the grooves of the pulley. If they lead or trail the pulley grooves, tension must be increased or decreased until mis-meshing is eliminated. On long-center drives make sure the belt is sufficiently tight to prevent teeth on the tension and slack sides from clashing in contact.

### Mounting

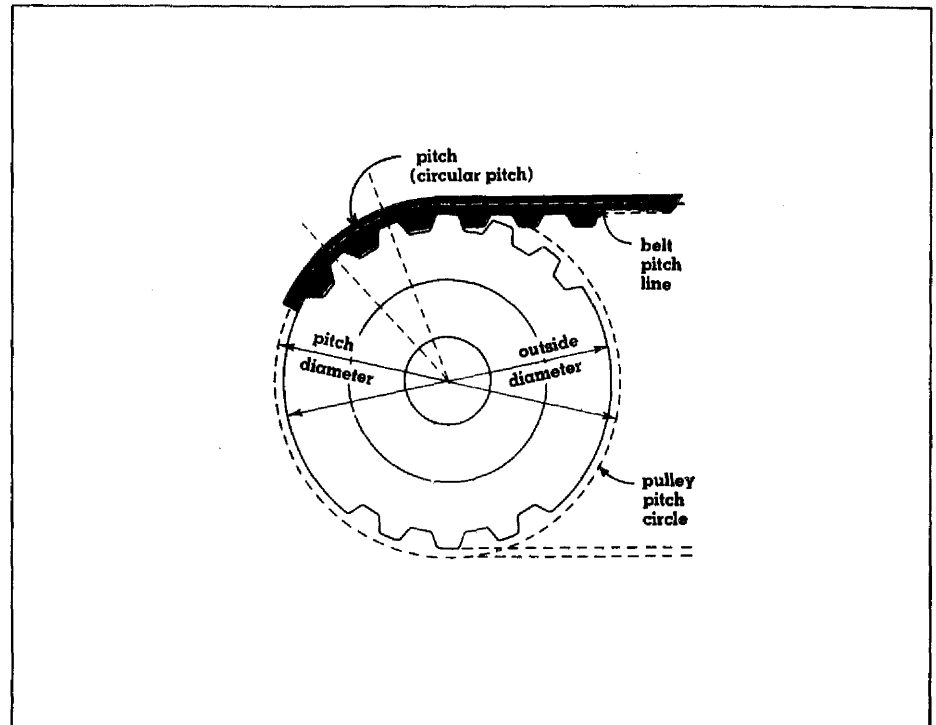
The belt should never be pried or forced over the flange of a pulley. If reduction of center distance or idler tension does not permit the belt to slide on easily, remove one or both pulleys for installation.

### High and Low Temperature

Stock belts have a temperature range of -30°F to +185°F. Belts for operation above or below these limits are available.

### Pitch Specifications

Figure 11



## PRODUCT DESCRIPTION

### Ajusto-Spede Drive

An Ajusto-Spede drive is an integral combination of an open drip proof, D-flange, T-frame, AC squirrel cage induction motor and an air cooled, stationary field eddy-current clutch. The standard drive is horizontal, foot mounted and externally lubricated with grease or oil mist. The constant speed of the motor provides the impetus to rotate the input drum of the eddy-current clutch.

### Air Cooled Coupling

An air cooled, stationary field, eddy-current coupling is virtually an Ajusto-Spede drive without a motor. The motor is replaced with an end bell so the input drum can revolve at the speed of an externally coupled prime mover. Fins cast onto rotating components draw cooling air over heated surfaces to carry generated heat out.

### Liquid Cooled Coupling

A liquid cooled coupling is similar to an air cooled coupling, except that it is equipped with shaft flingers and labyrinth seals to protect bearings from moisture. A liquid (usually water) is introduced into the coupling to draw generated heat out of the clutch.

### Eddy-Current Coupling Operation

The coupling of the Ajusto-Spede drive, the air cooled coupling and the liquid cooled coupling are eddy-current slip devices. They operate from a standard AC power supply to provide infinitely adjustable output speeds. The input member, consisting of an inductor drum keyed to the input shaft, is supported by an input bearing and a pilot bearing. The output member, consisting of a segmented rotor keyed to the output shaft, is supported by the same pilot bearing and an output bearing. These four bearings help to maintain required air gaps between the input and output members.

Until the field coil of the clutch is energized, the input member (drum) and the output member (rotor) rotate independently of each other. As the field coil is energized, magnetic lines of force emanate from the coil. Eddy-currents, which are generated in the drum by these lines of force moving through the drum as it rotates in relation to the rotor, produce a magnetic attraction between the rotor and the drum, thus transmitting motor torque to the output shaft. This attractive force varies in proportion to field coil current. Speed control is obtained by adjusting the relatively small field coil current in order to deliver the torque required to drive or couple the load at the desired output speed.

Heat, developed as slip occurs between the drum and rotor, must be carried away by a coolant, such as air, water or oil. Centrifugal force carries the coolant along the heated surfaces of the drum and rotor where it absorbs the heat and is carried away through an exhaust or drain.

A small, brushless AC governor generator, either integrally mounted around the shaft or externally mounted in its own housing with appropriate pulleys and belt, is used to regulate output speed. This epoxy encapsulated generator produces a small voltage signal that is directly proportional to the output speed. The Dynamatic controller modulates the speed sensing voltage from the generator with the applied field coil voltage to automatically maintain the desired output speed, regardless of load changes.

Some eddy-current couplings are available with a built-in eddy-current brake to provide controlled deceleration. This is essentially the same kind of brake to be described in the following paragraphs.

### **Liquid Cooled Brake**

Eddy-current brakes consist basically of a rotating member keyed to a straight-through shaft and a stationary field assembly. The shaft is supported by an anti-friction bearing in each end bell. Within the torque range available there are two configurations by means of which the rotating and stationary members produce eddy-currents to operate. Low capacity brakes consist of a smooth drum keyed to the shaft and a segmented stationary field assembly mounted inside of it. High capacity brakes consist of a toothed rotor keyed to the shaft with a smooth surfaced field assembly surrounding it.

In both configurations an air gap exists between the smooth surface and the pole or segmented surface.

### **Eddy-Current Brake Operation**

Until the field coil is energized, the brake rotor, or drum, revolves at the speed of the prime mover. When the field coil is energized, a magnetic flux is established between the poles, or segments, and the smooth surface. As the rotor or drum revolves, magnetic lines of force are cut in the air gap and eddy-currents are generated which in turn retard rotation at a rate determined by the amount of excitation applied to the field coil.

Braking torque is a function of speed and field coil excitation. By regulating this excitation, which is infinitely adjustable with Dynamatic controllers, control or brake torque is easily accomplished. Eddy-current brakes cannot be used for holding functions because there is zero torque at zero slip.

Heat, developed as slip occurs between the rotor, or drum, and stationary field, must be carried away by a coolant, such as water or oil. Centrifugal force carries the coolant along the heated surfaces where it absorbs the heat and is carried away through a drain.

# **Dynamatic®**

DRIVE SOURCE INTERNATIONAL, INC.

7900 Durand Avenue, Bldg 3 Sturtevant, WI 53177, USA

PH: 262-554-7977 FAX 262-554-7041

EMAIL: [SALES@DYNAMATIC.COM](mailto:SALES@DYNAMATIC.COM) WEB: [WWW.DYNAMATIC.COM](http://WWW.DYNAMATIC.COM)

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