AS Line Ajusto-Spede® Drives
Model AS-14 through AS-27
1 through 30 HP

INSTRUCTION MANUAL

(AS-14 –AS-27 – Revised 02/04)

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Application Engineering ☆ Quality Products ☆ Total Solution

DANGER HIGH VOLTAGE: 

Motor control equipment and electronic controllers are connected to hazardous line voltage. When servicing drives and electronic controllers, there may be exposed components with their cases and protrusions at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power whenever possible to check controllers or to perform maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on an electronic controller or electrical rotating equipment.

CAUTION:

Rotating shafts and above ground electrical components can be hazardous. Therefore, it is strongly recommended that all electrical work conform to National Electrical Codes and local regulations. Installation alignment and maintenance should be performed only by qualified personnel.

Factory recommended test procedures, included in the instruction manual, should be followed. Always disconnect electrical power before working on the unit.

REFER TO OSHA RULES AND REGULATIONS, PARAGRAPH 1910.219 FOR GUARDS ON MECHANICAL POWER TRANSMISSION APPARATUS.

Note: Since Improvements are continually being made to available equipment, the enclosed data is subject to change without notice. All drawings, unless verified, are for reference only. For additional information, contact DSI/Dynamatic® at 1-800/548-2169 or 262/554-7977.

IMPORTANT NOTICE:

The printed contents in this manual are to be used for reference only. Due to periodic engineering design changes and the addition of modifications, this material is provided as a guide only.

Please refer to the engineering drawings, which are available for your specific unit.

For additional information regarding contents of this manual, please send your request to DSI/Dynamatic®, Fax: 262-554-7041, or call: 262/554-7977, or Toll free at 1-800/548-2169.

This notice is provided to clarify the intent of the instruction book contents and to inform our customers how to obtain appropriate technical assistance from the proper source.

⚠ Caution

Please Observe the Following Safety Guidelines:

Allow Installation and Service by Qualified Personnel Only
Electrical rotating equipment and associated controls can be dangerous. Therefore, it is essential that only trained personnel be allowed to work with this equipment, under competent supervision. The danger is increased when the equipment is not handled, installed, maintained or used properly. This equipment must be installed, adjusted and serviced only by qualified personnel familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in equipment damage, personal injury and/or death.

Read Instructions and Warnings:
These instructions should be read and clearly understood before working on the equipment. Become especially familiar with all safety instructions and procedures. Read and heed all danger, warning and caution notices contained in this manual and attached to the equipment and be sure to instruct others in their meaning and importance.

Danger, High Voltage
Disconnect Power before Servicing Equipment
Various component parts and terminals of the drive equipment are at or above line voltage when AC power is connected to the input terminals. All ungrounded conductors of the AC power line must be disconnected before it is safe to touch any internal parts of this equipment. Some control equipment may contain capacitors that retain a hazardous electrical charge for a period of time after power is removed. After power is removed, wait at least two minutes to allow capacitors to discharge before touching any internal parts of the equipment. Failure to observe these precautions could result in fatal injury.

Precautions When Working On Live Circuits:
Stand on an insulating mat. Make a habit of using only one hand. Make sure that there is another person nearby in case emergency assistance is required.

Application of Equipment and Safety Devices:
The adjustable speed drive and all components of the drive system, such as operator control devices, electrical power distribution equipment, the motor and mechanical power transmission equipment, must be properly selected and applied to assure a safe and reliable installation. Each individual installation has unique requirements for safety equipment such as emergency stop pushbuttons, pre-start alarms, motor and power disconnect devices and guards on mechanical power transmission apparatus. The party responsible for the overall design and operation of the facility must make sure that qualified personnel are employed to select and apply all components of the drive system including appropriate safety devices.

Hazard of personal injury/death or equipment damage exists if the drive and/or the driven machine are operated above their rated speed due to maladjustment or electronic failure. Be sure to consider this factor in selecting gear ratios and safety devices.

Always Wear Safety Glasses:
Safety glasses should be worn by all personnel involved in installing or maintaining the equipment. This applies equally to all electrical and mechanical workers. Other safety clothing should be selected as appropriate to the task and work environment.

Handle With Care
Handle the equipment carefully to avoid personal injury or damage to the unit.

Provide Appropriate Guards Around Moving Parts:
Before operating the equipment, make sure that appropriate guards and other safety devices are in place. Refer to OSHA rules and regulations, paragraph 1910.219 for guards on mechanical power transmission apparatus.

Observe Requirements of the National Electric Code
All wiring must be in accordance with the National Electrical Code (NEC) and/or other codes as required by the authority having jurisdiction. The electrical connections completed by the installer must conform to the instructions and diagrams supplied.

National Electric Code Article 430-102 requires a disconnecting means for each motor and controller located in sight from the motor, controller and driven machinery locations or capable of being locked in the open position if not located in sight. This disconnecting means is not included with the drive equipment unless specifically ordered.

Not for Use in Hazardous Locations:
Unless specifically labeled as approved for such use, this equipment is not suitable for use in an explosive atmosphere or in a “Hazardous (Classified) Location” as defined in article 500 of the National Electrical Code.

Provide Adequate Ground Connections:
For personnel safety and reliable equipment operation, firmly earth ground each piece of equipment as directed in this manual and shown on the connection diagrams provided. The ground conductor should be the same size as the incoming power wires or sized according to NEC table 250-95. A copper or aluminum conductor must be used. Grounded conduit connections are not adequate for use as equipment ground connections.

Instruction Material and Drawings:
In addition to this manual, data sheets, drawings, supplementary instruction sheets and errata sheets may be included in the package of instruction material that is furnished for each drive. Be sure to save each of these items for future reference. The drawings and data included in this manual are generally representative of the product line, but do not accurately include every detail pertaining to specific equipment provided for an individual customer order. Drawings and data sheets that are identified by PRO/Serial number as pertaining to a specific piece of equipment take precedence over this manual. **Note:** The information furnished may not cover changes made to the equipment after shipment. **All data is subject to change without notice.**

Technical Assistance:
It is best to request assistance through DSI/Dynamatic’s Service Repair Department, 1-800/548-2169.

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Figures & Tables

Section 1

General Information

Introduction
This manual provides general information and operating instructions for the Dynamatic® stationary clutch coil AS Line of air-cooled, eddy-current Ajusto-Spede® Drives. This line of drives combines an AC motor with an eddy-current clutch in a common housing. The clutch, when connected to an external electronic controller, is used to regulate the speed or torque at the output of the drive. Two versions are available, one with a totally enclosed fan cooled (TEFC) motor (standard), and another with an open drip proof (ODP) motor (consult factory).

The standard drive includes only the AC motor and the eddy-current clutch. There are five different size models of the drive, ranging from 3/4 to 40 horsepower. Also available is a series of add-on modifications, including eddy-current, friction and spring set brakes. These modifications are pre-engineered so they can be added to a basic drive by qualified personnel in the field.

Information on the five basic drive models is included in this manual. The instructions are arranged in a logical sequence. Beginning with general information, the instructions proceed from receiving, handling and storage, through installation, operation, start-up and adjustment to maintenance, service and renewal parts.

Instructions arranged in a similar sequence for add-on modifications are provided in Section 8. A separate manual is provided for the external electronic controller.

While every effort has been made to provide a complete and accurate manual, there is no substitute for trained, qualified personnel to handle unusual situations. Any questions that arise should be referred to DSI/Dynamatic® by calling 1-800/548-2169 or 262-554-7977 or fax us at 262/554-7041.

Safety
Electrical rotating equipment and associated controllers can be dangerous. Therefore, it is essential that only trained personnel be allowed to work with this equipment, under competent supervision. The danger is increased when the equipment is not handled, installed, maintained or used properly.

Read this instruction manual before attempting to install or use this equipment. Become especially familiar with all safety instructions and procedures. Heed any hazard labels on the equipment and be sure to instruct others in the meaning and importance of these labels. The various types of labels used to alert personnel of hazards and their degree of hazard potential are as follows:

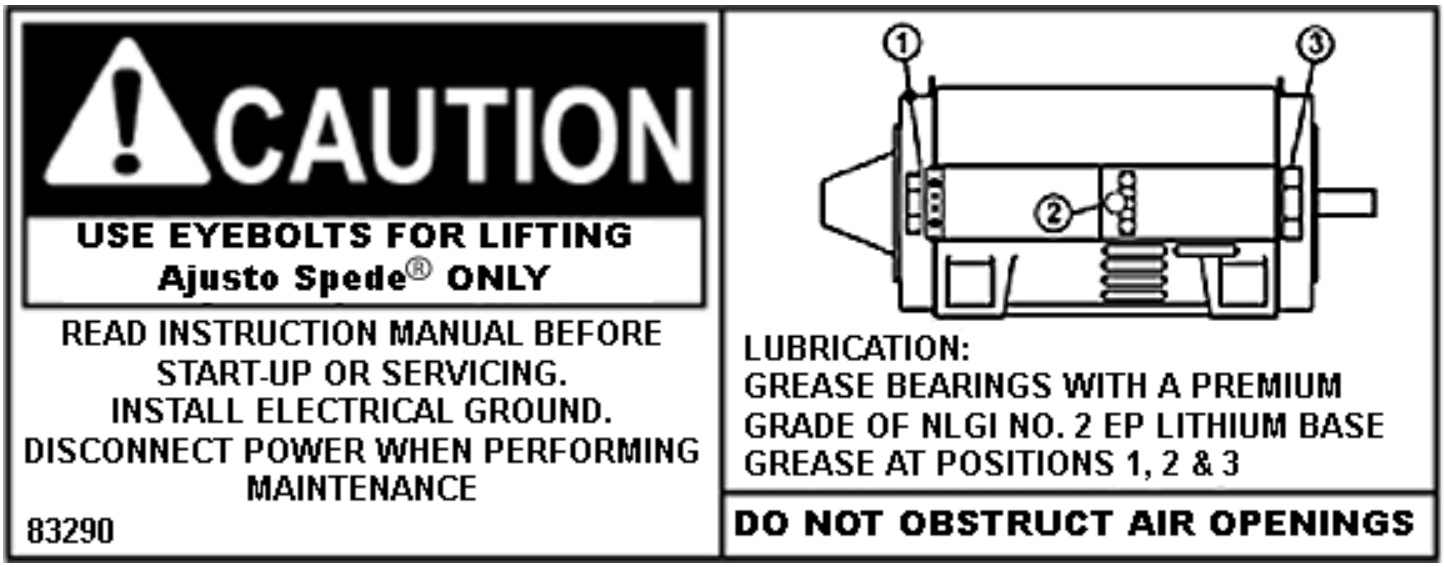
DANGER: Used to call attention to an immediate hazard, where failure to follow instructions could be fatal.

WARNING: Identifies hazards having possibilities for injury to personnel.

CAUTION: Used to warn off potential hazards and unsafe practices.

INSTRUCTION NOTE: Used where there is a need for special instructions relating to safety, proper operation or maintenance.

Caution Label Example
See Figure 1-1 for an example of the caution label that may appear on this equipment. Study it carefully; it is put on the unit for safety. Acquaint maintenance and operating personnel with its appearance and content.



Caution Label **Figure 1-1**

Training
Schools for your equipment can be held in your own plant. There is a small charge for these classes. If you are interested, contact the factory at 1-800/548-2169, or 262/554-7977.

Receiving and Damage Claims
All equipment is assembled and tested prior to shipment. Each unit is then packaged using approved packaging methods so it can arrive at its destination in the best possible condition. Upon receipt, check items against the packing list to be sure the shipment is complete. Then inspect shipment as follows:

1. Inspect the packaging, covering and pallet for signs of mistreatment.

2. Inspect the housing to make sure there is no damage.

3. Manually rotate the shaft to be sure it is free from binding and noise. While rotating shaft, also observe the clutch drum through ventilation slots on the sides of the housing to be sure that the spider and shaft assembly rotates independently of the motor rotor and quill assembly.

4. Look into all openings for signs of moisture or foreign material, which could damage electrical windings, bearings or get caught in the rotating members.

Note - Shipping damages are not covered by the warranty; the carrier assumes responsibility for safe delivery. If you note damage or missing items, **IMMEDIATELY** file claim with the carrier. At the same time, notify DSI/Dynamatic®. If assistance is needed to settle a claim, contact the factory or one of its sales offices. To expedite this service, refer to your equipment by purchase order, model and serial numbers.

Warranty
Your new AS Line Ajusto-Spede® is covered by a 3 year warranty against any manufacturing defect in either material or workmanship. This warranty starts on the day of shipment from our factory. The complete warranty is contained in the Standard Terms and Conditions of Sale printed in the DSI/Dynamatic® Product Catalog.

If a warranty failure occurs, contact DSI/Dynamatic® to obtain a Repair Instruction (RI) form. Fill in this form and return it with the failed unit to the address printed on the form. Any other repair arrangements must be approved by DSI/Dynamatic® in advance. Note that freight charges, both ways, are your responsibility. For Additional information, refer to the "Renewal Parts and Service" section.

Handling
Handling is best accomplished with a forklift or crane. Skilled personnel, following all standard safety practices, should operate the forklift or crane. Never lift the unit by its shaft. Avoid dropping the unit as well as jarring or pounding on the shaft. When using a forklift, be sure the unit is well supported from beneath, without strain or danger of dropping, with the forks adequately spread and centered under the pallet. When using a crane, attach crane cables to all lifting lugs provided on the unit. Horizontal, foot mounted drives are equipped with one lifting lug at accessory end bracket. Drives to be operated vertically with a drip cover are also equipped with two lifting lugs at the top of the cover. Units mounted on a common base with other equipment may be lifted with a suitable sling under the base or by attaching cables to lifting lugs designed and installed into the base for lifting the complete assembly.

CAUTION: Lifting lugs are designed to handle the weight of the unit and any accessory mounted on Dynamatic & Ajusto-Spede® drives that are manufactured the unit. Do not use these lugs to lift a unit attached to other equipment.

Storage
When the unit is not put to immediate use, store it only in a clean, dry and protected area. Moisture content and temperature of the air in the storage area are critical. Maintain the temperature between 32°F and 149°F (0°C and 65°C). Do not allow the temperature to drop below the dew point.

When the storage period is to exceed three months, or when the unit must be stored in an unprotected area, additional precautions must be taken. Be sure the packaging is open on the bottom to allow air circulation. During storage, rotate the shaft by hand at least once a month to redistribute bearing lubricants and to prevent brinelling of the bearings. Before placing a unit into service after storage, repeat the receiving inspection. Correct any problems observed. When the storage period exceeds three years, the bearings should be replaced before using the unit.

Patents
Dynamatic® Ajusto-Spede® drives are manufactured under one or more of the following patents:
3,624,433 3,624,463 3,641,375 3,742,270
3,845,337 3,996,485 4,138,618 4,446,392
4,469,968 4,362,958 4,476,410 4,520,284
4,757,225 4,780,637 4,853,573

Canadian Patents:
931,514/73 962,312/75 983,081/76
1,022,984/77 1,170,301/84 1,201,801/86

Section 2

Equipment Description

The Ajusto-Spede® drive is an integral combination of an air-cooled, eddy-current clutch and an AC induction motor. Both are enclosed in a single housing. The five sizes of units available are similar in design, construction, performance and appearance. They differ primarily in size and torque capacity. Figure 2-1 shows a typical AS Line Ajusto-Spede® Drive.

The Dynamatic® Eddy-Current Drives Catalog contains specifications, application engineering data and outline drawings. Excerpts from the catalog information are reprinted for reference at the end of this section of the manual.

Construction

Inside the housing are two main assemblies: the rotor and quill assembly and the spider and shaft assembly. The rotor and quill assembly consists of a drum fan, quill and motor rotor. The spider and shaft assembly consists of a straight through shaft and spider assembly. The spider has an opening on one side allowing the stationary clutch coil support assembly, which is attached to the output end bracket, to be positioned inside the spider. Two appropriate air gaps separate the stationary clutch coil support assembly from the rotating spider. As a result, no slip rings or brushes are required. The cutaway in Figure 2-2 illustrates how the rotor and quill assembly encompasses the spider and shaft assembly.

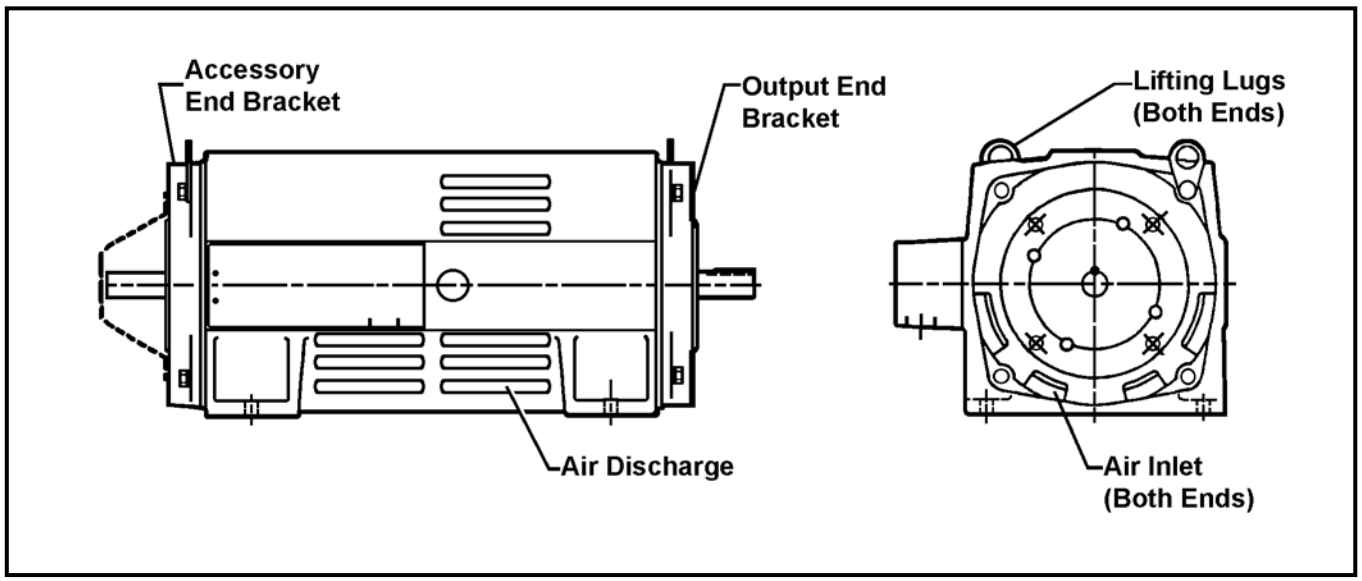
The AC motor is the constant speed member of the drive. The motor stator is pressed into the housing.

The motor rotor is pressed onto a quill tube and aligned inside the stator. A drum is attached to the quill tube and contains the fan used to circulate cooling air. When the motor is turned on, the rotor and quill assembly rotates at the specified motor speed.

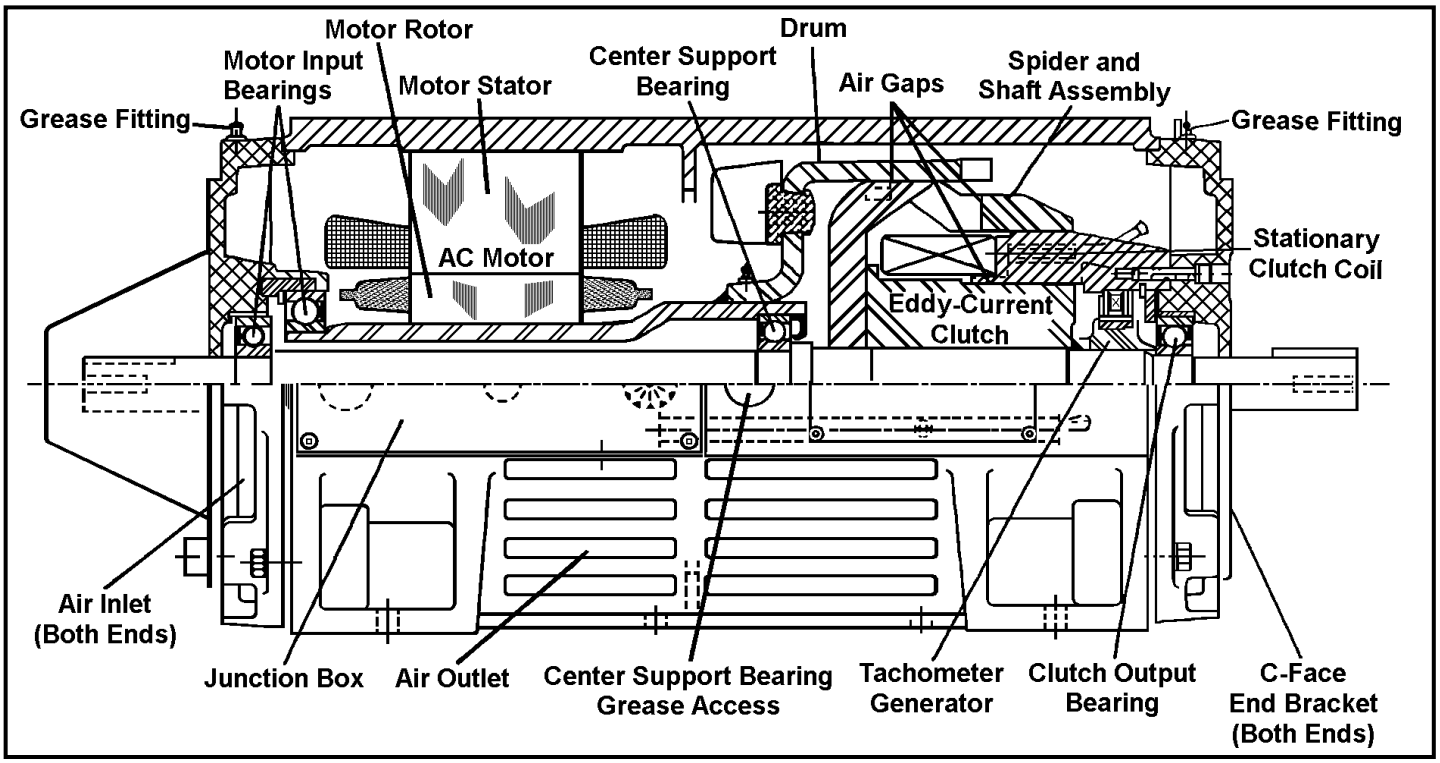
The eddy-current clutch is the variable speed member of the drive. The spider assembly, consisting of two separate spiders with interlocking and alternate north and south magnetic poles, is pressed on and welded to the output shaft. A single shaft runs the full length of the drive, providing an extension on each end.

A tachometer generator is included with the clutch for output shaft speed feedback. The rotor, an Alnico permanent magnet with alternating poles around its outer diameter, is pressed onto the output shaft. The tachometer field assembly is located near the output end bracket. It contains the laminated field with plug-in terminals to connect its coil to the wiring harness that is brought in from the junction box. An AC voltage is generated proportional to shaft speed.

The housing is the main structural member, made of cast iron construction to enclose and support the rotating members. The two opposite ends are open, each with a machined face and concentric pilot bore to locate and align the shaft in the two end brackets. The concentricity and squareness of these faces and pilots are important, as they determine the running clearances. A base and junction box are integral parts of the housing.



Typical AS Line Ajusto-Spede Drive **Figure 2-1**



Typical Ajusto-Spede® Drive Cutaway **Figure 2-2**

Both end brackets have a NEMA C-Face for easy mounting of a brake or other accessory. Although a brake is usually bolted to the accessory end bracket (after removing the cover) it can also be mounted on the other end. When a brake is mounted to the accessory end bracket, the electrical leads are routed from the brake to the junction box for connection to the controller.

All internal wiring from the motor stator, clutch coil and tachometer generator field are routed to the junction box for connection to the controller. The junction box provides entrance from one end or the bottom. The inside face of the junction box cover contains a gasket to seal the interior from moisture and dust. A green hex nut is provided as an electrical ground terminal.

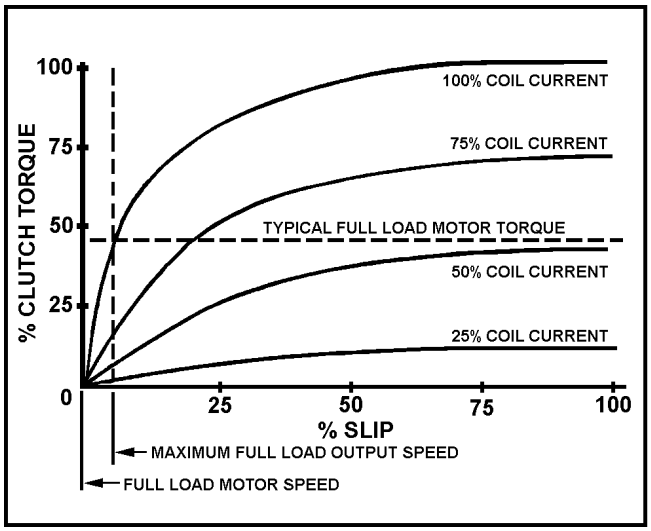
Eddy-Current Theory

The eddy-current principle is utilized to transmit power from the AC induction motor to the load. There is no physical contact between clutch input and output members except for the bearings. The clutch couples the motor to the load through a magnetic field. The motor is not stopped or started each time the load is stopped and started. This prolongs motor and starter life and permits the motor to be started under no-load conditions. The only parts subject to wear during normal operation are the bearings.

The two magnetically active parts of the eddy-current clutch are the drum and the spider assembly. The AC motor rotates the drum at a constant speed, while the spider assembly remains stationary until voltage is applied to the clutch coil. With no load attached to the driving shaft, bearing friction and grease in the inner quill bearing, and windage between the quill and spider assembly, may produce some minimal torque and could cause the shaft to rotate. The driven load is normally sufficient to hold the shaft stationary.

Energizing the clutch coil produces magnetic flux. This flux crosses the air gap between the spider assembly poles and drum, passes through the drum axially and returns across the air gap to the spider assembly-poles. This magnetic flux path is disrupted when the drum is rotating relative to the spider assembly. As a result, eddy-currents are generated in the inner surface of the drum. These eddy-currents produce a series of magnetic poles on the drum surface that interact with the electromagnetic poles of the spider assembly to produce torque. It is this torque that causes the spider and shaft assembly to follow drum rotation.

To generate eddy-currents and produce torque, there must be a relative speed difference between the clutch drum and spider assembly. This speed difference is called "slip." With zero slip, there are no eddy-currents generated and no torque produced. As slip increases, torque increases. Similarly, torque is increased by increasing field coil current. Typical torque versus slip is shown in Figure 2-3 with various current relationships. Actual clutch torque values are listed in the catalog data at the end of this section of the manual. Because no torque is produced at zero slip, some minimum amount of slip must occur to produce the required torque. For this reason, maximum output speed is always less than motor speed.



Typical Torque/Slip Curves **Figure 2-3**

Since the eddy-current clutch is a torque transmitter, it has no inherent speed sense. Without external control, output speed depends on load. This feature is frequently used to advantage in helper drives, tensioning and winder applications where torque is the prime requirement. When speed control is needed, the tachometer generator provides shaft speed feedback to an electronic controller. The controller varies field coil current to match speed output with load demand, thus holding desired preset speed.

Cooling

Air is used to cool the Ajusto-Spede® drive. Motor rotor fins and clutch drum fins draw cooling air into the housing from the end brackets. Heated air is discharged through louvered openings on both sides of the housing. Since the drum is driven by the motor at full speed, maximum cooling is achieved.

Lubrication

The only parts in the clutch requiring lubrication are the four bearings. Standard units are grease-lubricated and are provided with large grease chambers that are packed with sufficient grease during assembly to permit a long period of operation before re-lubricating them becomes necessary. Periodic lubrication is recommended, especially if the drive is operated in a hostile environment at high slip and/or high temperature. Refer to Section 6 for instructions and recommended greases.

Catalog Data

The information contained on the following pages has been excerpted from the DSI/Dynamatic® Product Catalog and reprinted here for reference. Dimensions, weights and ratings listed are approximate and should not be used for construction purposes. Drawings giving exact dimensions are available upon request. All listed product specifications and ratings are subject to change without notice.

Ratings and Model Numbers

60 Hz Models

HP	Speed Range (RPM)	Model Number
1	1730-0 1095-0	AS-140104-01 AS-140106-01
2	1695-0 1130-0	AS-140154-01 AS-180156-01
2	1640-0 1120-0	AS-140204-01 AS-180206-01
3	1710-0 1710-0 1105-0	AS-140304-01 AS-180304-01 AS-180306-01
5	1670-0 1115-0	AS-180504-01 AS-210506-01
8	1670-0 1140-0	AS-210754-01 AS-250756-01
10	1650-175 1120-0	AS-211004-01 AS-251006-01
15	1660-0 1110-0	AS-251504-01 AS-271506-01
20	1660-440 1710-0 1080-100	AS-252004-01 AS-272004-01 AS-272006-01
25	1690-0 1090-320	AS-272504-01 AS-272506-01
30	1665-150	AS-273004-01

50 Hz Models

HP	Speed Range (RPM)	Model Number
1	1405-0 910-0	AS-140104-02 AS-140106-02
2	1390-0 935-0	AS-140154-02 AS-180156-02
2	1330-240 925-0	AS-140204-02 AS-180206-02
3	1405-0 925-0	AS-180304-02 AS-180306-02
5	1335-240 895-0	AS-180504-02 AS-210506-02
8	1375-0 920-0	AS-210754-02 AS-250756-02
10	1320-360 900-0	AS-211004-02 AS-251006-02
15	1380-240 1410-0	AS-251504-02 AS-271504-02
20	1340-545 1395-0 885-230	AS-252004-02 AS-272004-02 AS-272006-02
25	1375-125	AS-272504-02
30	1380-350	AS-273004-02

Engineering Data

Standard Drive Data

Model	Clutch Torque Lb. Ft. at Slip RPM of❶					Rated Dissipation HP at Input RPM of❷					Inertia Lb. Ft. ² Output Member
	50	75	100	150	1750	900	1000	1200	1500	1800	
AS-14	4.0	5.5	7.0	9.0	25.0	1.0	1.0	1.1	1.6	2.0	.86
AS-18	10.0	14.0	16.0	21.0	46.0	2.5	2.6	3.1	4.1	5.0	1.96
AS-21	19.0	25.0	32.0	40.0	74.0	4.5	4.8	5.8	7.5	9.0	3.59
AS-25	42.0	56.0	68.0	82.0	120.0	7.5	8.0	9.6	12.4	15.0	6.22
AS-27❹	60.0	81.0	102.0	132.0	245.0	13.7	15.2	18.3	22.8	27.4	16.00
AS-27❺❻	75.0	102.0	124.0	155.0	250.0	13.7	15.2	18.3	22.8	27.4	16.00

Model	Overhung Load Lbs. at Output RPM of ❸			45V Clutch Coil Current (Hot Amps)	Weight Lbs.
	900	1200	1800		
AS-14	390	390	380	3.40	157
AS-18	600	550	470	3.90	277
AS-21	725	675	560	3.88	412
AS-25	1125	1020	880	4.18	610
AS-27❹	1510	1350	1155	7.20	1080
AS-27❺❻	1465	980	805	7.20	1090

Adjustable Torque (Eddy Current) Brake Data

Model	Brake Torque in Lb. Ft. at Output RPM of			Brake Dissipation HP at Brake RPM of					Brake Inertia Lb. Ft.	Brake Coil 45V Current (Hot Amps)	*Approx. Weight
	900	1200	1800	300	600	900	1200	1800			
AS-14B	5.4	6.0	6.6	.15	.3	.5	.7	1.0	.13	1.84	177
AS-18B	26.0	28.0	30.0	.50	1.0	1.5	2.0	3.0	.60	2.49	322
AS-21B	30.0	32.0	34.0	.50	1.0	1.5	2.0	3.0	.60	2.49	457
AS-25B	40.0	60.0	60.0	.80	1.7	2.5	3.3	5.0	1.96	3.47	690
AS-27B	65.0	70.0	100.0	1.90	3.2	3.7	4.9	7.3	1.75	3.51	1180

Friction Brake Data

Model	Electrically Engaged			*Approx. Weight
	Static Torque Lb. Ft.	Inertia Lb. Ft.^{2}	Brake Model	
AS-14F	40	.054	500	177
AS-18F	40	.054	500	322
AS-21F	80	.371	825	457
AS-25F	80	.371	825	690
AS-27F	240	.967	310	1180

Spring Set Brake Data

Model	Spring Set Electrically Released Static Torque Lb. Ft.	*Approx. Weight
AS-14F	15	177
AS-18F	25	322
AS-21F	35	457
AS-25F	70	690
AS-27F	175	1180

Adjustable Torque And Friction Brake Data

Model	Overhung Load in Lbs. At Output RPM of 1800 Std.	*Approx. Weight
AS-14F	235	197
AS-18F	310	367
AS-21F	550	502
AS-25F	565	770
AS-27F	700	1280

*Approximate weight includes the weight of the drive.

❶ Values are for four-pole motor speeds
❷ Indicates maximum HP that can be safely dissipated at a given input speed. Dissipation should be de-rated 10% for each 10° F above 100° F ambient, to 150° F maximum ambient.
❸ Values are based on B-10 bearing life of 15,000 hours. For 20,000 hours use 91% of the values shown. The figures are the maximum weights at the center of a standard output shaft keyway perpendicular to the axis. Ratings are for ball bearings unless otherwise noted.
❹ AS-27 with 1.875" shaft diameter.
❺ Unit with copper plated clutch drum.
❻ AS-27 with 2.125" shaft diameter.

Engineering Data

Induction Type, 3 Phase AC Motors, 4 Pole, Squirrel Cage Nema Design B

The full load motor currents shown in the table below are typical values for AS-14 through AS-27 drives with 3 phase, 60 Hz., 4 pole, TEFC motors. Full load currents for ODP may be slightly lower. This table is intended for use as an aid in sizing motor branch circuit components.

For full load motor currents of 200 and 208-volt motors, increase the corresponding 230 volt motor full load current by 15% and 10% respectively.

Full Load Currents

HP	Full Load Amperes		
	230 Volt	460 Volt	575 Volt
1	5.8	2.9	2.2
1.5	6.2	3.10	2.5
2	7.0	3.5	2.8
3	10.2	5.1	4.1
5	14.6	7.3	5.8
7.5	20.4	10.2	8.2
10	26.2	13.1	10.6
15	40.4	20.2	16.2
20	52.0	26.0	20.8
25	68.2	34.1	27.3
30	79.2	39.6	31.7

Noise Levels, Ajusto-Spede Drives Model AS Drives

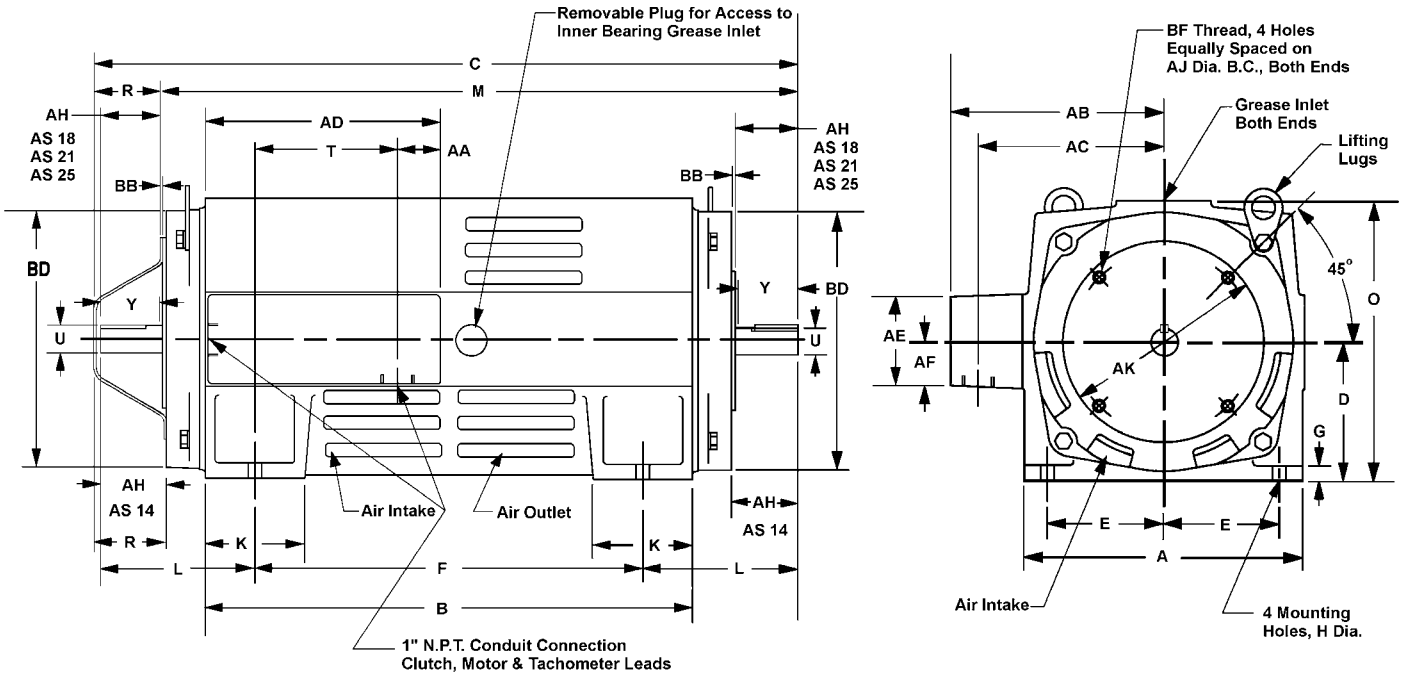
These sound pressure levels are **typical** values given for engineering information only, and it is **not guaranteed** that any particular production unit will not exceed these values. Microphone 3 feet from side of drive, tested in a semi-anechoic chamber above reflecting plane per IEEE-85 spec. All readings are sound pressure level, dB; reference 20 micro Newton's per square meter. Average sound pressure in a 3-foot radius hemispherical free field. Noise level for 1200 RPM drives will be 8 dB less than 1800-RPM values shown, and for 3600 RPM the noise level will be 15 dB greater.

Noise Levels

Model	Sound Pressure dB			
	RPM	A Scale	B Scale	C Scale
AS-14	1800	66.3	-	70.0
AS-18	1800	70.2	-	74.5
AS-21	1800	75.3	-	79.1
AS-25	1800	80.5	-	83.9
AS-27	1800	82.0	-	85.1

Outline Drawings

Dynamatic® Model AS-14 through AS-25 Drives



Outline Drawings "C" Face - AS-14 - AS-25 **D-81255**

AS	A	B	C	D①	E	F	G	H	K	L	M	O	R	T
14	9.00 229	15.72 399	22.72 577	4.50 114	3.75 95	12.52 318	.50 13	.50 13	3.20 81	5.00 127	20.38 518	9.06 230	2.34 59	4.67 119
18	10.50 267	17.60 447	27.90 709	5.25 133	4.25 108	13.75 349	.50 13	.50 13	3.75 95	6.25 159	23.60 599	10.75 273	4.05 103	4.43 113
21	12.50 318	18.60 472	30.27 769	6.25 159	5.00 127	14.12 359	.62 16	.62 16	3.56 90	7.62 194	26.22 666	12.62 321	4.05 103	5.58 142
25	14.00 356	17.75 451	32.84 834	7.00 178	5.50 140	15.06 383	.62 16	.62 16	3.30 84	8.75 222	28.79 731	14.38 365	4.05 103	6.20 157

AS	AA	AB	AC	AD	AE	AF	AH	AJ	AK④	BB	BD	BF	WT
14	1.32 34	7.06 179	6.00 152	7.50 190	2.88 73	1.48 38	2.12 54	5.88 149	4.499 114.3	.12 3	8.38 213	3/8-16 9.52 x 1.58	157 70
18	2.06 52	7.80 198	6.74 171	8.32 211	2.88 73	1.48 38	2.62 67	7.25 184	8.499 215.9	.25 6	10.06 255	1/2-13 12.70x1.95	277 112
21	1.38 35	8.87 225	7.57 192	8.81 224	3.76 96	1.92 49	3.12 79	7.25 184	8.499 215.9	.27 7	11.88 302	1/2-13 12.70x1.95	412 172
25	1.62 41	9.87 251	8.57 218	8.81 224	3.76 96	1.92 49	3.75 95	7.25 184	8.499 215.9	.27 7	13.32 338	1/2-13 12.7x1.95	610 240

AS	Shaft Extensions		
	U②	Y③	Key
14	.8750 22.225	1.94 49	.18 Sq. x 1.38 Lg. 4.76 Sq. x 35 Lg.
18	1.1250 28.575	2.50 64	.25 Sq. x 1.75 Lg. 6.35 Sq. x 44 Lg.
21	1.3750 34.925	3.00 76	.31 Sq. x 2.38 Lg. 7.87 Sq. x 60 Lg.
25	1.6250 41.275	3.62 92	.38 Sq. x 2.88 Lg. 9.65 Sq. x 73 Lg.

Overall dimension on units with modifications will be the total of **M** dimension plus **R** dimension. Unit may be operated vertically (prefer motor end output shaft up).

① **D** dimension will never be exceeded. When exact dimension is needed shims up to .03 inch (.76 mm) may be required.

② **U** shaft diameter tolerance 1.50 inches (38 mm) and smaller: +.0000/-.0005 inch (+.0000/-.0127 mm), over 1.50 inches (38mm): +000/-.001 inch (+.000/-.025 mm).

③ **Y** dimension is maximum usable shaft length.

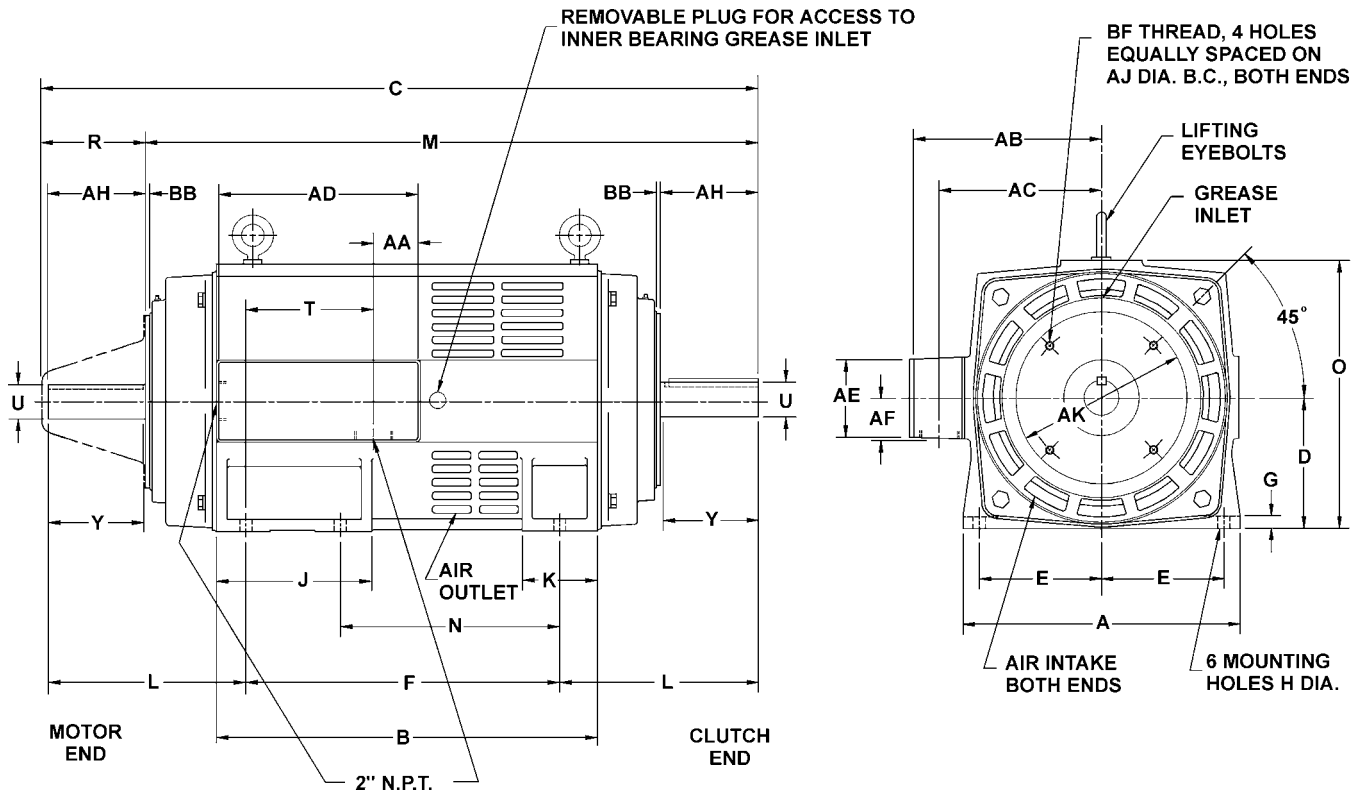
④ **AK**, pilot diameter tolerance +.000/-.002 inch. (+.000/-.051 mm).

⑤ AJ, AK and KEY dimension are the same for both ends.

DIMENSIONS ARE IN INCHES AND MILLIMETERS

Outline Drawings

Dynamatic® Model AS-27 Drive



Outline Drawings "C" Face - AS-27 **D-91127**

AS	A	B	C	D①	E	F	G	H	J	K	L	M	N	O	R
27	17.00 432	23.38 594	39.60 1006	8.00 203	7.50 191	19.26 489	.75 19	.75 19	9.50 241	4.63 118	10.00 254	35.43 900	13.50 343	16.41 417	4.17 106
27⑤	17.00 432	23.38 594	43.94 1116	8.00 203	7.50 191	19.26 489	.75 19	.75 19	9.50 241	4.63 118	12.17 309	37.60 995	13.50 343	16.41 417	6.34 161

AS	Shaft Extensions			AB	AC	AD	AE	AF	AH	AJ	AK④	BB	BF	WT
	U②	Y③	Key											
27	1.875 47.625	3.83 97	.50 Sq. x 3.50 Lg. 12.7 Sq. x 89 Lg.	12.73 323	10.72272	12.25 311	4.75 121	2.46 62	3.83 97	9.00 228.6	10.499 266.67	.25 6	½ -13 12.7 x 1.95	1080 479
27⑤	2.125 53.975	6.00 152	.50 Sq. x 5.50 Lg. 12.7 Sq. x 140 Lg.	12.73 323	10.72272	12.25 311	4.75 121	2.46 62	6.00 152	9.00 228.6	10.499 266.67	.25 6	½ -13 12.7 x 1.95	1090 481

Overall dimension on units with modifications will be the total of **M** dimension plus **R** dimension. Unit may be operated vertically (prefer motor end output shaft up).

① **D** dimension will never be exceeded. When exact dimension is needed shims up to .03 inch (.76 mm) may be required.

② **U** Shaft diameter tolerance +.000/-.001 inch (+.000/-.025 mm).

③ **Y** dimension is maximum usable shaft length.

④ **AK**, pilot diameter tolerance +.000/-.002 inch (+.000/-.052 mm).
AJ, AK and **KEY** dimension are the same for both ends.

⑤ These dimensions with the large shaft diameter and length are standard only on Model AS-274004-01.
All other AS-27 units will be supplied with the smaller shaft unless specifically ordered.
All units below 40 HP will have 1.875 inch (47.625 mm) diameter shaft extension unless special ordered.
All units 40 HP and above will have 2.125 inch (53.975 mm) diameter shaft extension unless special ordered.

DIMENSIONS ARE IN INCHES AND MILLIMETERS

Section 3

Installation

Proper operation and long life of the eddy-current unit depend on its installation, location and environment. These instructions are intended as a guide for a safe and proper installation, but do not cover all possible situations that may arise. Refer any questions to the Service Department.

Location and Environment
The standard drive is a Totally Enclosed Fan Cooled, self-ventilated unit that should be installed in an area suitable to its design. An adequate supply of clean, dry cooling air is required. Locate the unit away from any obstruction, usually at least twelve inches from a wall, to permit free air movement and accessibility for routine maintenance and inspection. Do not obstruct ventilating openings or mount the unit within the base of a machine without making provision for adequate inlet and outlet of cooling air.

CAUTION: Beware of re-circulation of cooling air. Hot air discharged from the slots along the sides of the housing must not be allowed to re-enter the unit or any other adjacent air-cooled unit.

These units are designed to operate under standard service conditions unless purchased for certain specific environmental conditions. Standard service conditions are listed in Table 3-1. If the equipment was purchased for special environmental conditions, consult your purchase order acknowledgement documents for details.

Operation in ambients above 104°F (40°C) requires the HP dissipation to be de-rated 10% for each 10°F (5.5°C) interval to a maximum ambient of 149°F (65°C). For operation above 3300 feet (1000 meters), it is necessary to de-rate the HP dissipation 5% for each 1100 foot (330 meter) interval to an altitude of 10,000 feet (3000 meters). Alternative altitude and ambient temperature ratings can also be calculated by decreasing the maximum ambient temperature rating by 4.6°0F per 1000 Feet (8.33°C/1000 meters) above 3300 Ft. (1000 meters).

The unit should never be placed in any hazardous location restricted by the National Electrical Code, Article 500, unless it is specifically designed for a specific hazardous service and it is approved for such service conditions by the local code inspection and enforcement agencies.

Before installation, make sure the job site is free of debris and all heavy construction, especially overhead. Provide protection for all personnel and equipment in the area, as required by the conditions. Clean up construction dust, dirt and scrap material so it is not pulled into the unit by cooling fan suction.

CAUTION: Electric welding equipment must be solidly earth grounded. Do not use the drive as a current path. Serious bearing and insulation damage may result.

When planning the installation, be sure to include access for maintenance, the correct size, number and location of conduits, and adequate electrical service for the equipment. Remember, the location should provide adequate space for the removal of the unit or any of its components.

Standard Service Conditions **Table 3-1**

Altitude	Not, exceeding 3300 ft. (1,000 meters)
Ambient Temperature	32°F to 104°F (0°C to 40°C)
Coil Voltage	Not exceeding 10% over nameplate rating
Environment	Clear of dust, dirt, high moisture and vapors
Line Voltage Variation	+/-10% of nameplate rating

Mounting surfaces must be machined flat and level to support all feet evenly and be rigid enough to prevent flexing or resonance. Do not set the unit directly on a wood or concrete floor.

Mounting Arrangements
Table 3-2 lists recommendations and restrictions regarding various possible combinations of mounting methods and positions.

Unit Preparation
Move the unit to the job site using proper handling procedures. Refer to Section 1, "Handling," for more information. If the unit has been stored in a cool location, allow it to reach room temperature before removing packing material. Then remove all temporary screens, cover plates, tie-down bolts and banding. Before proceeding, review the application requirements and check the unit nameplate to be sure the correct unit is being installed and electrical service is correct.

Examine the unit for damage or lost accessories. The following check should be made before installation:

1. Turn shaft by hand and observe any binding, rubbing or noise that may indicate damage to bearings or other components.

Recommended Mounting Arrangements **Table 3-2**

Model	End bracket Type	Mounting Description	Pilot Dia. (inc.)	Horizontal	Vertical Clutch End Down	Vertical Clutch End Up
AS-14	C - Face	Foot Mounted	4.449	Yes	Preferred	OK
	C - Face	Face Mounted	4.449	No	Preferred	OK
	D - Flange	Foot or Face Mtd.	7.250	Yes	Yes	No
AS-18	C - Face	Foot Mounted	8.449	Yes	Preferred	OK
	C - Face	Face Mounted	8.449	No	Preferred	OK
	D - Flange	Foot or Face Mtd.	9.000	Yes	Yes	No
AS-21	C - Face	Foot Mounted	8.449	Yes	Preferred	OK
	C - Face	Face Mounted	8.449	No	Preferred	OK
	D - Flange	Foot or Face Mtd.	9.000	Yes	Yes	No
AS-25	C - Face	Foot Mounted	8.449	Yes	Preferred	OK
	C - Face	Face Mounted	8.449	No	Preferred	OK
	D - Flange	Foot or Face Mtd.	11.000	Yes	Yes	No
AS-27	C - Face	Foot Mounted	10.449	Yes	Preferred	OK
	C - Face	Face Mounted	10.449	No	Preferred	OK
	D - Flange	Foot or Face Mtd.	10.999	Yes	Preferred	OK
	P - Flange	Face Mtd.	13.500	No	Yes	No

2. Use a light to check inside openings for foreign material.

3. Remove junction box cover and check continuity and leakage to ground.

4. If unit has been stored outdoors, and especially in humid climates, check for condensation and water damage to insulation and bearings.

5. Make sure accessory equipment is complete and undamaged. Movable devices should be operated to determine if they function freely and correctly.

Correct any deficiency and remove dirt, rust and protective coatings. Use a safe solvent to clean shaft, flange faces and mounting feet. Remove burrs with a fine file or scraper. Do not use emery cloth, sandpaper or any other abrasive.

Sizing Sheaves & Sprockets -- Overhung Load

Before a sheave or sprocket is installed on the shaft, make sure it does not exceed the minimum diameter limitation. This is a limitation established by the overhung load capacity of the unit. Too small a sheave may result in early bearing failure or a broken shaft. Calculate the minimum sheave diameter using the following formula:

$$PD\ min = \frac{(126{,}000 \times HP \times Lf \times Tf)}{(OHL \times Pf \times RPM)}$$

Where:

PD min = Minimum pitch diameter, in inches.

HP = Rated horsepower of clutch from clutch nameplate.

Lf = Load factor of clutch is a ratio of maximum expected load to rated load, usually at least a factor of 1.5. See Table 3-3.

Tf = Tension factor for type of belt drive used. See Table 3-4.

OHL = Overhung load capacity of shaft in pounds. Obtain from factory or consult Table 3-5 for standard units.

Pf = Position factor, a factor used to correct the overhung load capacity when the center of belt pull is not on the center of the shaft keyway extension. Location "L" is on the center of keyway. See Table 3-6 and Figure 3-1.

The pitch diameter of the sheave or sprocket must be equal to or larger than the minimum calculated. When a smaller diameter must be used, mount the pulley on a separate jackshaft, supported by separate bearings. Align the jackshaft to the unit's shaft as described for directly connected shafts.

The overhung load rating is changed when the shaft length is changed. The limit may be based on either bearing capacity or shaft strength. The OHL capacities are provided in Table 3-5 for standard ball bearing units that are without brake, gear or extra long shaft. Refer to the dimensions in the catalog data pages at the end of Section 2 to determine if standard OHL values apply to your unit. If your shaft is longer or your unit is not standard, contact DSI/Dynamatic® for the OHL rating for your unit.

Note that OHL is in pounds force at the center of the shaft keyway. Positioning the pulley so the center of belt pull is not at the center of the keyway changes the OHL capacity. Table 3-6 lists the Position Factors used to correct the OHL. As illustrated in Figure 3-1, factors are provided for 1 inch closer to the bearing (L-1); and 1 inch (L+I), 2 inches (L+2) and 3 inches (L+3) further away from the bearing. If belt center is on the keyway center, Position Factor L is 1.0.

Load Factors (Lf) **Table 3-3**

Type Of Load	Lf
Load never exceeds full load	1.00
Load sometimes equals 125% of full load	1.25
Normal loads	1.50
Occasional loads equal to 200% of full load	2.50

Tension Factors (Tf) **Table 3-4**

Type of Drive	Tf
Chain and sprocket	1.00
Pinion or gear	1.25
V-belt and sheave	1.50
Flat belt and pulley	2.50

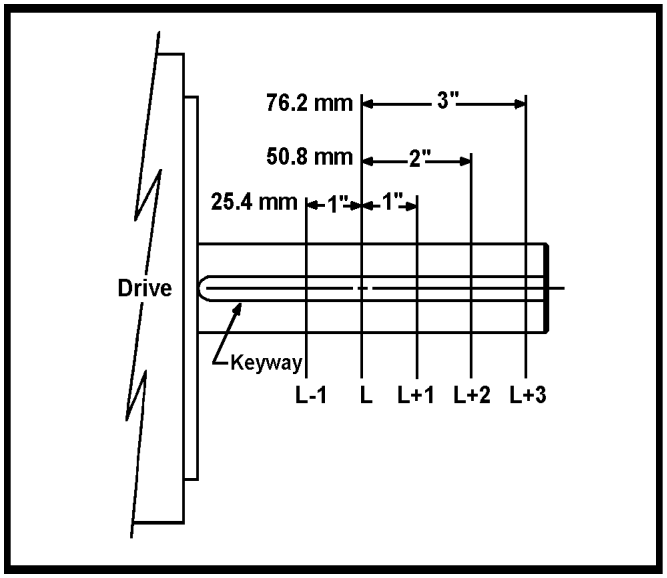
Overhung Load Capacity (OHL) **Table 3-5**

Model	Shaft Dia. (In.)	Overhung Load Capacity Lbs. at Listed Speed		
		900 RPM	1200 RPM	1800 RPM
AS-14	0.875	655	595	515
AS-18	1.125	630	565	490
AS-21	1.375	1180	1070	925
AS-25	1.625	1220	1105	965
AS-27	1.875	1510	1350	1155
AS-27	.2.125	1465	980	805

Note: Values are based on B10 bearing life of 15,000 hours. For 20,000 hours, use 91% of the values listed. The values are the maximum weights at the center of a standard output shaft keyway, perpendicular to the axis. Ratings are for ball bearings.

Position Factors for Standard Bearings (Pf) Table 3-6

Model	Shaft Dia. (In.)	Position Factors for Positions per Fig. 3-1			
		L-1"	L+1"	L+2"	L+3"
AS-14	0.875	1.05	0.94	0.90	NA
AS-18	1.125	1.05	0.96	0.92	NA
AS-21	1.375	1.04	0.96	0.92	NA
AS-25	1.625	1.04	0.96	0.93	NA
AS-27	1.875	1.03	0.97	0.84	0.66
AS-27	2.125	1.03	0.97	0.92	0.80



Locating Pos. Factors on Std. Shafts (Pf) Figure 3-1

Installing Sheaves, Sprockets, or Couplings
Coupling halves, sheaves, sprockets or gears should be installed on the shaft before mounting the unit. Before installing these hubs on the shaft, inspect the shaft and its key. Remove any burrs using a fine file. Do not use emery cloth or other abrasives. Also, be sure the key fits snugly to the sides of the keyways on both the shaft and device hubs. Some clearance between the top of the key and the hub keyway is acceptable and will make installation easier.

Generally, the device should be installed on the shafts by following the device manufacturers instructions. Devices with split hubs or light interference fits that use set screws should not present any problems. Devices with hubs that rely on heavy interference fits, however, must be installed with care. Do not pound such hubs in place. Instead, heat the hub in an oil bath or oven to 275°F (135°C) to expand the bore. Then, after coating the shaft with a light film of oil, slip the hub on the shaft. Be very careful to stop the hub at the correct position on the shaft, as it will quickly shrink once the heat is transferred to the shaft.

Initial Mounting
After preparing the site and drive, place the drive on a metal mounting base or plate. Then proceed as follows:

1. One mounting foot of the drive may not contact the mounting pad. With a feeler gauge, find and measure the gap between this foot and its pad.

2. Place a slotted shim, equal in thickness to the measured gap, under the high mounting foot.

3. Install mounting bolts or nuts finger tight.

Horizontal Alignment
Proper alignment of this unit is a condition of its warranty. Misalignment between directly connected shafts will cause increased bearing loads and vibration, even when a flexible shaft coupling is used. After alignment, other factors can cause the alignment to change. For this reason, the original alignment should be as accurate as possible.

Direct Coupled Shafts
All couplings, even flexible couplings, are designed to permit only a limited amount of misalignment. Generally, the coupling manufacturer specifies limits for both angular and offset misalignment.

When using such limits in place of the values specified in this alignment procedure, remember that the limits are maximums and they cannot be used at the same time. If, as an example, angular misalignment is at its limit, then offset misalignment must be zero. Always use a dial indicator to check alignment. The hub must have true surfaces where readings are taken.

Note - Dial indicators used for alignment must be non-magnetic due to possible magnetism of the unit's shaft. If possible, rotate both facing shafts when required in procedure. If one shaft cannot be turned, alignment can still be checked by rotating the other shaft with indicator attached to it.

1. Clamp base of indicator to hub of unit's shaft and position its indicator button on machined outer diameter of other hub, as shown in Figure 3-2.

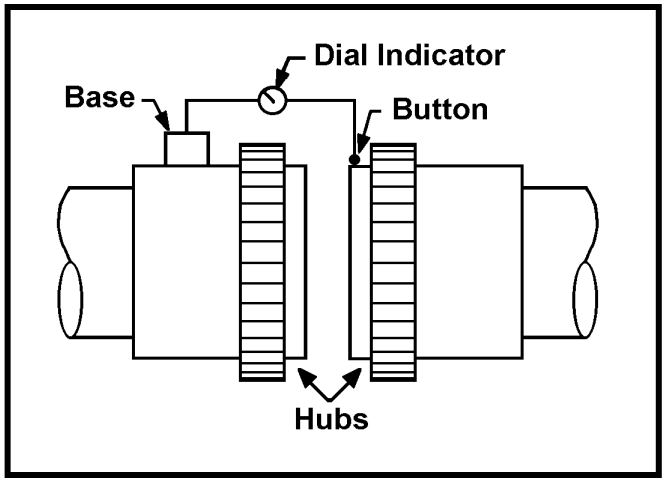
2. Scribe a mark to indicate position of button.

3. Read indicator dial. Zero if convenient. Then rotate both shafts equally, keeping button on scribe mark and noting dial readings. Locate position of maximum reading and record it. Then rotate shafts and take readings at each one-quarter revolution. The maximum difference or run out between any two readings should not exceed 0.002 inch. If it does, realign the units and repeat.

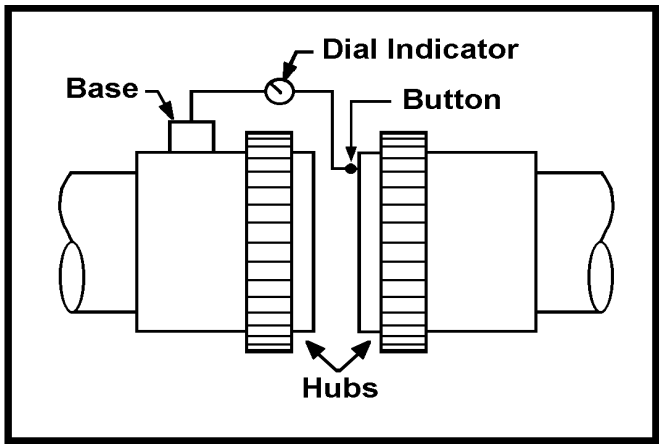
4. Once run out is acceptable reposition indicator button on machined face of driven shaft hub as shown in Figure 3-3.

5. Scribe a mark to indicate position of button.

6. Read indicator dial. Zero if convenient. Then rotate both shafts equally, keeping button on scribe mark and noting dial readings. Locate position of maximum reading and record it. Then rotate shafts and take readings at each one-quarter revolution. Compare four readings and calculate maximum difference between any two readings. Divide resulting value by twice the distance from shaft centerline to button position. The final result, angular misalignment, should not exceed 0.002 inch per inch. If it does, realign units and repeat.



Offset Alignment Check **Figure 3-2**



Angular Alignment **Figure 3-3**

The alignment check is done similarly for both horizontal and vertical shafts. Shimming to correct alignment is done somewhat differently. For horizontal, foot mounted units, the shims are placed under the feet. Because of an uneven mounting surface, it may be necessary to install more shims at one end than at the other to reduce angular misalignment. The shims should be the same size as the mounting foot and slotted to permit inserting without removing the bolt. Try to obtain shims of the thickness required, or use a few thick shims. Do not use many thin shims stacked to make up the thickness required. Deburr shim edges.

Vertical Alignment

Both ends of the standard AS Line drive have a C-Face end bracket that are suitable for vertical mounting. Vertically mounted drives may require that shims be inserted for proper alignment. Shims are not easily inserted between the C-Face and its mounting surface. Therefore shims may have to be inserted between other surfaces. Deburr shim edges and use a few thick shims instead of many thin shims. Use the following procedure to insert the shims:

1. Determine thickness of shim needed to correct angular alignment by calculation or trial and error. This shim is placed at the point where the smallest misalignment reading was taken.

2. Shim should not be wider than necessary and the length should be twice the width. Notch shim for bolt.

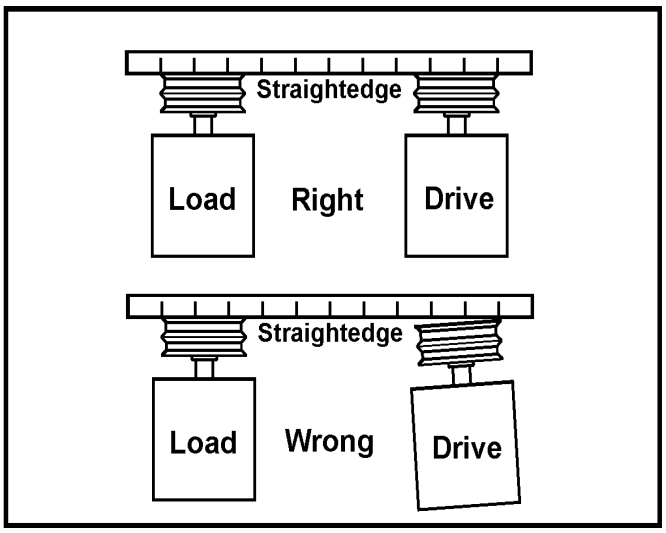
3. Cut two additional shims the same size but one half the thickness and place one on each side 90° from the thick shim. Notch shims to clear hold down bolts.

Parallel Connected Shafts

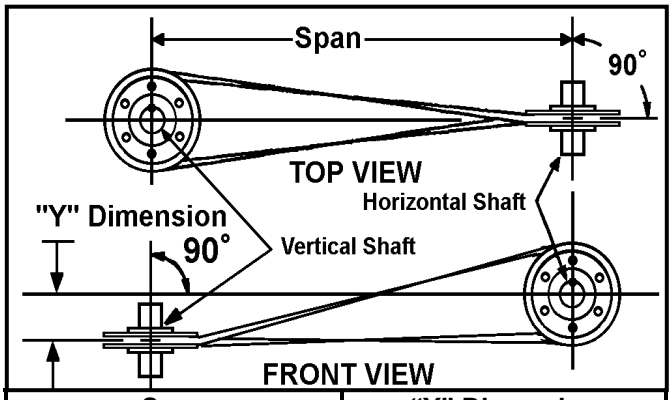
Parallel shafts must be aligned to prevent excessive thrust loads on the unit's shaft and to minimize belt or chain wear. To check parallel shaft alignment, simply place a straightedge across the faces of the two sheaves or sprockets as shown in Figure 3-4. When properly aligned, the straightedge should contact the faces of both devices squarely. The object is to have the belt

enter and leave the groove without rubbing or thrusting against the sides of the groove.

Quarter-twist belts are often used to transmit power between a horizontal and vertical shaft. These shafts must be perpendicular and aligned as shown in Figure 3-5 to minimize belt wear and bearing loads. As shown in the top view, a line perpendicular to the horizontal shaft and through the center of its sheave must pass through the center of the vertical shaft. As shown in the front view, a line perpendicular to the vertical shaft and through the center of its sheave must be parallel to and Y dimension below a line drawn through the center of the horizontal shaft.



Parallel Shaft Alignment **Figure 3-4**



Span		"Y" Dimension	
Inches	**mm**	**Inches**	**mm**
60	1525	2.50	63
80	2030	2.75	70
100	2540	3.00	76
120	3050	4.00	101
140	3560	5.25	133
160	4060	6.50	165
180	4570	7.75	200
200	5080	9.00	230
220	5590	10.50	270
240	6100	12.00	305

Perpendicular Shaft Alignment **Figure 3-5**

Belt Tension

Belt and chain drives are tensioned by sliding the unit sideways after loosening the hold down bolts. It is very important to establish the proper tension, which is one just above the point of slippage. Belts that are too loose will slip, preventing proper acceleration or full output speed while creating belt overheating and pulley groove wear. On the other hand, tightening the belt or chain more than is necessary increases wear of the belt, bearings and shaft.

When available, follow the belt manufacturers instructions for optimum tensioning. When such instructions are not available and the belt and sheave are not sized marginally, a simple check may be made to determine belt tension. To perform this check, place thumb on belt at a point midway between the two sheaves and press downward. The belt should deflect a distance equal to one-half of its thickness for each 24 inches of distance between the sheaves.

Because the simple check described above is not very precise, it is not recommended when the sheave is at or near the minimum size permitted by the unit's overhung load capacity. In such cases, even slight over-tightening of the belts can cause serious damage. To avoid these problems, check tension of marginally sized belts or sheaves as follows:

1. Obtain overhung load capacity (OHL) of unit from Table 3-5 or the factory. If the center of belt pull is not on the center of the shaft extension, multiply by the position factor (Pf) to correct the OHL capacity. Multiply the corrected OHL capacity by 0.03125.

2. Divide result of step 1 by the number of belts being used.

3. To the result of step 2, add one of the following belt modulus factors (Mf), according to the belt type being used:

Belt Type	Modulus Factor	Belt Type	Modulus Factor
A	0.500	E	5.938
B	0.813	3V	0.375
C	2.500	5V	0.750
D	5.000	8V	1.563

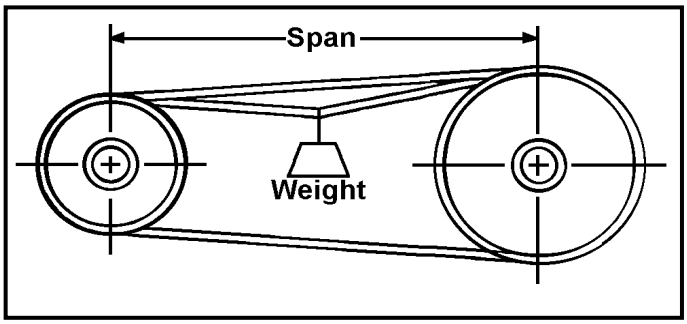
4. Hang a weight on one belt at the midpoint of the belt span, as shown in Figure 3-6. The weight should be equal in pounds to the value obtained in steps 1 to 3 using the following formula:

$$\text{Weight (Lbs.)} = \frac{(\text{OHL} \times \text{Pf} \times 0.03125)}{(\text{Number of Belts Used})} + \text{Mf}$$

The belt should deflect 1/64" for each inch of span length. Adjust tension to obtain this result. Check other belts and adjust tension for average.

5. When belt slips after being tensioned, as described above, sheave or belts are improperly sized.

6. With new belts, tension should be checked and corrected after each 24 hours of operation until belts are broken in.



Precision Tension Check **Figure 3-6**

Final Mounting
After completing the initial mounting procedures and necessary alignment, secure the unit as follows:

1. Make sure unit is level and its feet are still in contact with the mounting pads. If a number of thin shims were installed during alignment, consider replacing them with thicker shims. A few thick shims are preferred to a large number of thin ones.

2. Tighten mounting bolts or nuts to secure unit to base. Recheck alignment and, if necessary, correct it. Tightening bolts may pull unit down, especially when many shims are used.

3. For directly coupled units, dowel all interconnected units to base to ensure that shaft alignment will be maintained. For belt coupled units, recheck belt tension and correct it if necessary. Tightening bolts or nuts may have moved unit, causing over-tensioning, even though tension was proper before bolts were tightened.

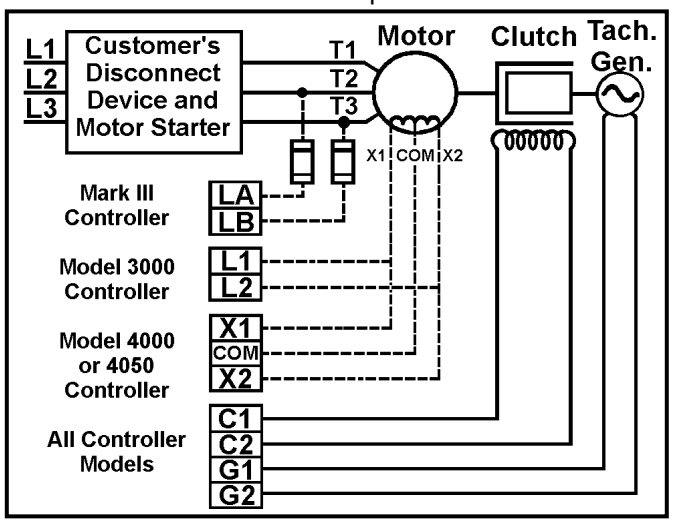
Lubrication
Bearings are grease lubricated and require no special attention unless stored for over one year. Consult the sections on "Storage" and/or “Maintenance" for greasing instructions.

CAUTION: When designing belt and shaft guards, remember to allow access to grease fittings.

Shaft and Belt Guards
Before applying power and starting the unit, install guards over all rotating shafts, couplings, belts and chain devices. Refer to OSHA rules and regulations, paragraph 1910.219, for requirements covering guards on mechanical power transmission apparatus. Be sure machine is safe to operate and all safety devices have been installed, checked out and made operable.

Electrical Wiring
All wiring to the drive, including any accessories, must conform to the National Electrical Code and all other applicable state and local codes. Leads for the motor, clutch and tachometer generator are terminated in a junction box at the side of the housing. Accessories may also be wired to the same junction box or may be terminated in a separate junction box attached to the accessory. Connections from the junction boxes to the controller are made by connecting each lead or terminal to the appropriate lead or terminal in the controller as shown on the connection diagram furnished with the controller. Figure 3-7 shows typical connections for a standard drive without any modifications or accessories. Section 8 of this manual includes typical connection diagrams for common accessories. For specially modified drives, refer to the instructions furnished for the modification or added accessory and to the instructions and diagrams furnished with the controller.

Tachometer generator leads and speed signal reference leads should not be run in the same conduit with motor power leads. The junction box has two openings for connecting conduit. A pipe plug is installed in the opening at one end, and a plastic plug is installed in the opening at the bottom. Use one opening for the conduit carrying the motor leads to the motor starter and use the remaining opening for the conduit carrying the clutch, tach generator, transformer and accessory leads to the controller. If a brake is installed, the opening at the end is used to bring the brake leads into the junction box. In this case, it is necessary to install a T connector or wiring box near the drive to allow separate conduits to be connected. If only one conduit is connected to the junction box, be sure that the pipe plug is threaded into the hole that is not used to keep moisture and dust out.



Typical Wiring Connections **Figure 3-7**

AC Motor Leads
The AC motor in the drive is connected like any other polyphase induction motor. As required by the National Electrical Code (NEC) and/or other applicable codes, it is necessary to provide appropriate disconnect, control and protective devices for the motor. These devices and the motor conductors must be sized, applied and

installed in conformance with the NEC and/or other applicable codes. Consult the instructions provided with these devices for additional information. All motor leads at the conduit box are gray or black. The motor nameplate shows how to connect three phase power to the motor leads. Shaft rotation can be reversed by reversing any two of the three phase power leads. Most motors are dual voltage, nine lead motors; but single voltage, three lead motors and other configurations are sometimes used.

Controller Input Power Leads

The AS Line of drives includes a single phase, 115 volt, center tapped transformer winding that can be used as a power source for the external controller. The leads for this winding are labeled X1, X2 and COM (center tap). The Model 4000 and 4050 controllers must be connected to all three leads while the Model 3000 controller is connected to X1 and X2 only (the COM lead must be taped). The Mark III controller requires a separate power source and is not connected to the transformer leads. The Model EC-2000 and PDC-2000 require a separate 500VA to 1 KVA, 115V power source. The Model DSI-600 requires either a 115v or 230V, 0.5KVA input and does not require an input transformer.

CAUTION: When the transformer windings are not used, the leads for the winding in the junction box must be individually taped to prevent a short circuit.

The Mark III controller must be connected to a separate AC power source that is capable of supplying 350 to 1000VA. Refer to the controller nameplate and instruction manual for complete input power specifications. The Model 3000, 4000 and 4050 controllers can also be connected to a separate power source if you do not want to use the transformer winding in the drive. For Models 4000 and 4050 contact the factory for proper power transformer. Figure 3-7 shows typical power supply arrangements for Mark III, 3000, 4000 and 4050 controller models. Refer to Figure 3-8 shows typical power supply arrangements for the EC-2000, PDC-2000 & DSI 600. The input voltage to these controllers is usually 115VAC. The Mark III controller has an internal transformer to step down from the motor voltage level. The model 4000 and 4050 controllers require an external transformer with a 115V center tapped secondary. Since Models 3000, EC-2000, PDC-2000 & DSI-600 controllers do not require a center tap connection, they can be connected directly to a 115V single phase power source. To assure that the controller is not powered when the motor is not running, the controller power should be taken from the load side of the motor starter, or auxiliary starter contacts should be wired to turn off the controller when the motor is not running, except for the PDC-2000 which requires input power prior to motor start. The auxiliary motor contact must be wired hot to terminals TB1-1& TB1-2 for motor running acknowledgement.

Clutch Coil Leads

The clutch coil leads are terminated in the conduit box mounted on the clutch. They are the two white leads marked C1 and C2. Connect the wires to terminals C1 and C2 in the eddy-current controller or leads marked clutch. Size the wires in accordance with the coil voltage and current ratings listed on the clutch nameplate. Refer also to the diagrams and instructions furnished with the eddy-current controller.

Tachometer Generator Leads

The tachometer generator is internally wired to suit the RPM rating of the drive. The tach generator leads are the two gray leads marked G1 and G2 or leads marked generator.

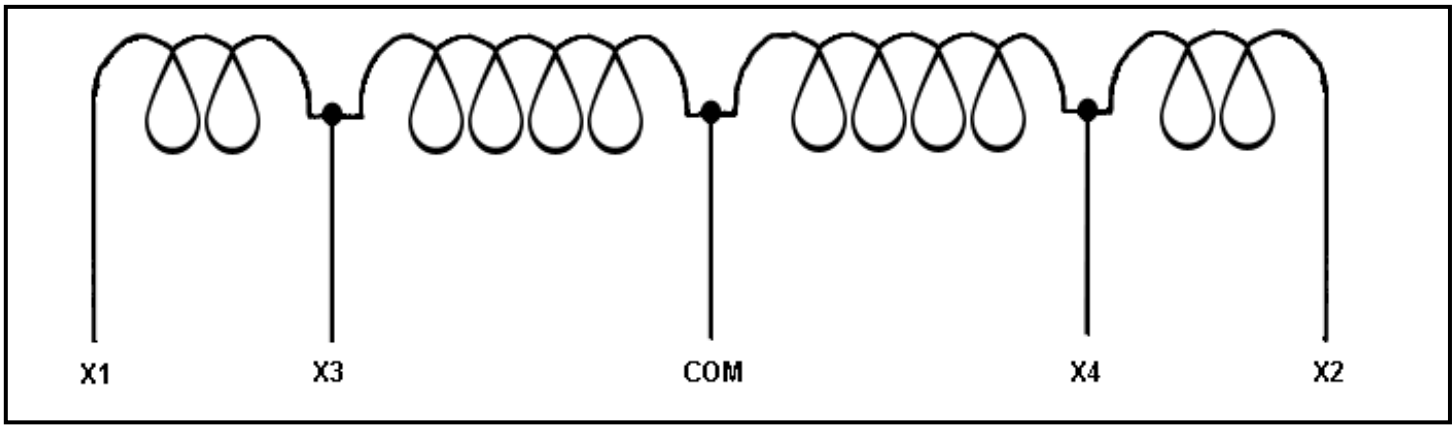
It is necessary to connect a shielded cable from the generator leads in the junction box to the controller and to any tachometer indicator that may be used. The shielded cable should consist of a twisted, insulated pair of conductors having a continuous metallic shield around them with an insulating jacket over the shield.

In the junction box, cut back enough of the ends of the shielded cable to expose sufficient conductor lengths to make required connections. Then, tape the exposed shield to prevent grounding. In the controller enclosure, strip off enough of the outer jacket to expose several inches of shield. Unbraid the shield, twist the strands together to form a conductor and attach it to the ground post just below the terminal strip. Be careful to keep this ground conductor away from other terminals on the terminal strip.

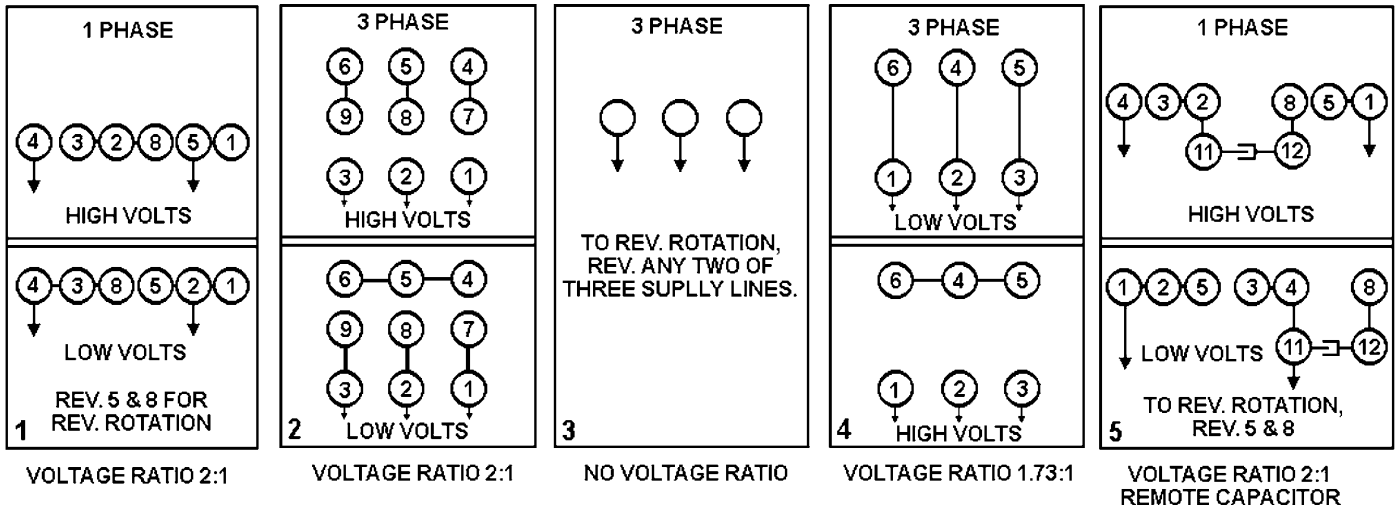
Shielded cable should only be grounded at one end. When shielded cable is used, generator leads may be run in the same conduit as other conductors, but not with the incoming power leads to the motor. If you prefer to not use shielded cable, run a twisted pair through separate conduit with no other conductors.

Electrical Connections Multi-Volt

All of the leads inside the drive are brought out in the junction box located on the side of the drive; and they are all labeled. Locate the five transformer leads identified in Figure 3-8 and the twelve motor leads identified in Figure 3-9. Select the three transformer leads according to available line voltage from Table 8-14. Use either X1, X2 and Common or X4, X4 and Common. Tape the unused leads to prevent a short circuit. Refer to Figure 8-25 and locate the appropriate diagram with the motor lead connections conforming to available line voltage and frequency. Select the twelve leads inside the junction box and connect them according to the diagram chosen. Tape any unused leads to prevent a short circuit.



Transformer Connections For Multi-Volt **Figure 3-8**



Motor Lead Connection Diagrams For Multi-Volt **Figure 3-9**

Modifications

The standard Ajusto-Spede® drive can be modified by adding an eddy-current, friction or spring set brake and several other auxiliary devices such as space heaters and thermal switches. Wiring instructions for these modifications are provided in Section 8 of this manual.

Section 4

Operation

Normal Operation

Before starting the unit, read these operating instructions. The AC motor is usually started first. In this way, the motor will accelerate to, and run at, its design speed under no load condition. This is the easiest and most efficient method. With the motor running and the clutch not energized, a slight torque may still be applied to the output shaft. This is normal, resulting from bearing friction and windage acting on the clutch output assembly. With no load, the torque may even start and accelerate the output shaft. The driven machine friction is usually enough to hold the output stalled.

To start the clutch, the controller must be energized. The speed setting potentiometer can then be set for the desired output speed, which causes excitation to the clutch coil. Coil current produces the magnetic field, resulting in eddy-currents being generated in the clutch. The resulting torque accelerates the driving shaft.

As driving shaft speed increases, the tachometer generator output signal also increases. This signal is fed back to the controller and it is used to regulate the current to the clutch coil. Modulation of coil current adjusts magnetic field strength to hold shaft speed constant under varying load conditions.

Load increases and decreases during operation will cause slight, momentary speed changes. Such changes are detected by the controller, resulting in adjustment of clutch coil current to change the magnetic field strength to the level required for returning the output shaft to the set speed selected by the operator.

An alternative to speed control, as described above, is torque (current) control. When the remote electronic controller is designed for torque or tension purposes, the clutch coil excitation is set to control output torque instead of speed. With this type of controller, the output shaft speed varies with the load being driven.

Operation is normal under the following conditions: motor load current does not exceed the full load nameplate rating; the speed or torque output is being controlled properly; the thermal rating is not exceeded; and the noise or vibration levels have not increased. Although continuous motor current should not exceed nameplate rating, momentary overloads may be applied during acceleration and sudden load changes. If the machine duty cycle requires frequent overloads or frequent motor stops, starts or reversals, the application should be reviewed and specific limits determined. Consult the factory.

Under normal speed control, the controller is constantly regulating clutch coil current to maintain set speed. Motor current and clutch coil excitation will vary in proportion to the amount of regulation required. This is normal; do not expect to measure a constant clutch voltage or current. The constant parameter should be speed or tachometer generator voltage.

Air discharge temperature from the clutch is an important consideration during operation. Air discharge temperature depends on inlet air temperature and operating parameters of the clutch. Operation below the minimum operating speed at rated horsepower, as stamped on the nameplate, or running above rated load, will cause excessive heating, resulting in a thermal overload and possible damage to the unit. Operation under these conditions is not permitted. Supply an adequate amount of clean, dry cooling air to the unit. Hot air discharge from any adjacent unit or from this unit must not be allowed to reenter as cooling air.

Operating Limitations

The clutch, like any other machine, has certain limitations. With speed control, it is possible to select any speed between 0% and 100% of the maximum rated speed. Because of standard controller and tachometer generator characteristics, it is not normally possible to regulate speed below 50 RPM (25 RPM for the digital controller) of the output shaft.

Torque can also be varied over the full torque range of the clutch. Eddy-current clutch capacity is much higher than the motor rating and can easily overload the motor if not limited. Remember, the AC motor used with the eddy-current clutch also has overload considerations.

Cooling capacity places another limit on the clutch. Do not operate it continuously below minimum rated speed at the rated horsepower stamped on the nameplate or the air discharge temperature may become excessive.

Increased noise and vibration are indications of mechanical problems. The operating and maintenance personnel should be familiar with the normal noise and vibration levels. When an increase is detected, shut down the unit and correct the problem.

Note: There are no brakes on the standard unit. If clutch power is removed by turning off or stopping the controller, or lowering the speed setting, the clutch simply coasts to a stop or to the lower speed. The rate at which it decelerates is a function of internal and external inertia and friction.

CAUTION: When power is removed from the unit, causing the motor to stop, clutch coil excitation must also be removed, or excessive coil heating and possible damage may result.

Section 5

Start-Up

This section of the manual contains start-up procedures needed for the initial start-up of the Ajusto-Spede® drive. Before turning AC power ON, read these instructions and those provided with the controller. Any questions regarding the start-up should be referred to the factory. Do not proceed if you are unsure. These start-up procedures also apply to start-up after the replacement or repair of a unit.

Preliminary Checks
Before starting the motor or applying power to the controller make the following visual inspections. The disconnect switch should be locked out.

> **CAUTION**: Rotating machinery and above ground electrical potentials can be hazardous. Alert all personnel in the area that the unit is being checked out and should be considered running. Do not work alone. Your life may depend on prompt help: someone capable of stopping the machine, disconnecting the AC power and capable of providing life saving assistance. Know where the Stop pushbutton and disconnect switch are located.

1. Visually inspect the motor and clutch. Are they safe to operate; and are all required guards and safety devices installed and checked out?

2. Visually inspect all electrical connections. Make sure they are tight and not grounding or shorting. Look for individual strands of wire that may be sticking out of a lug or a terminal.

3. Visually compare the wiring with the connection diagrams and any other certified drawings supplied to make sure the unit is property wired.

4. Visually inspect the starting equipment to make sure fuses, circuit breaker and motor overload heaters are sized and installed properly.

5. Visually inspect all safety interlocks and machine support equipment. Verify that all safety interlocks are connected and that they will perform their functions. Support equipment, required to permit the machine to operate, must be checked out prior to starting the drive.

Initial Start-Up
Do not apply power to any machine until this procedure instructs you to do so. Follow instructions; each step has a purpose.

1. Make sure the machine is ready to be started and all personnel in the area are alerted.

2. Prepare to start the AC motor to check the direction of rotation. If the driven machine can be damaged by reverse rotation, temporarily disconnect the driving shaft. For checking rotation, it is recommended that two people be involved, one to operate the pushbuttons and the other to watch the motor. Turn AC power ON to the motor starting equipment. The electronic controller for the clutch should not be started yet.

3. Using a voltmeter, check the three phase power to determine that proper voltage is present at all three phases.

4. Bump the motor by starting and quickly stopping it. While the motor is coasting to a stop, observe the direction of rotation through the air vents on the side of the housing. If the direction is not correct, turn AC power OFF, lock out the disconnect switch and reverse any two of the three incoming power leads (T1, T2 and T3); then repeat the test to ensure proper rotation.

5. Start the AC motor and observe its operation. Listen for any abnormal noise or vibration. Using a clamp-on ammeter, check motor current. All three phases should be balanced: It any defect is detected shut it down immediately and correct the problem. If the output shaft was disconnected in Step 2, turn AC power OFF, lock out the disconnect switch and reconnect the output shaft. Replace the guards.

6. Turn AC power ON and start the motor. Turn AC power ON to the clutch controller. Turn up the speed setting potentiometer until the clutch is running at a slow speed. If the unit does not run, consult the electrical instruction manual. Run the unit with no load and observe its operation. When normal operation is attained, increase its speed to above minimum and load the drive. Observe motor current; it should be below the full load rating when at a steady state condition.

7. A full load test should be run before turning the machine over to production. Run with a full load and observe all operating parameters. Check motor current and record it for future reference.

8. When the start-up is complete and normal operating conditions are attained, describe normal indicators to operating personnel so they will know how to detect abnormal operation. Be sure they know whom to advise when any abnormality arises. The following paragraph lists some of the indicators to watch for.

Signs of Trouble

There are several indications of trouble to watch for. Since most machines run the same product at the same speed the operator should become familiar with normal conditions. An increase in air discharge temperature of the drive could be an indication of blocked air passages or high temperature ambient. If high temperature is noted, the problem should be reported and investigated. Continuing to run may result in damage to the drive.

Unusual noise or vibration is a sign of mechanical problems. There are a number of causes, such as a shift or loosening of the base, a broken or unbalanced component, impending bearing failure, bent shaft, damaged belt or foreign material inside the drive. Periodically, the operator should check for unusual noise or vibration. Prompt repair can prevent serious machine damage and costly down time.

Erratic speed control or abnormal response will usually affect the product being manufactured. When the drive does not seem to control the way it should, the problem can be either electrical or mechanical. When investigating, check for loose belts, loose set screws, overloading and other mechanical problems. It is not always the fault of the controller. Motor current should be monitored; it can indicate mechanical binding or product overloading.

Section 6

Maintenance

Preventive Maintenance
The service life of the Ajusto-Spede® drive largely depends on routine maintenance received during its lifetime. Lax maintenance increases the probability of sudden, catastrophic failures, which are costly to repair and interrupt production schedules. Routine preventive maintenance is the best assurance of long up time. The purpose of this maintenance section is to help you set up a good maintenance program. Many factors affect the service life of any machine. This manual cannot cover all contingencies, but it will assist experienced maintenance personnel in maintaining the unit. Refer any questions to the factory.

Check List
A checklist provides a record of work completed and serves as a necessary reference for all areas to be checked. Each installation requires a unique checklist that includes all the equipment involved. The maintenance supervisor should prepare this checklist and include all maintenance checkpoints for that equipment, the frequency each item should be checked and the specific parameters that should be observed. Table 6-1 suggests items that may be included; each is followed by its specific parameters.

Inspection
During routine maintenance, perform visual checks for loose bolts, missing guards, lubricant leaks, excessive dirt on cooling surfaces, air inlets and outlets and any other abnormal condition. Question the operator to determine if any abnormal condition exists or if a change in operation has been noted. Compare the overall performance with previous reports. Investigate any changes noted. Specifically, check any brake or other support devices that are used.

Cleaning
Cleaning should be performed as often as dictated by the environment of the unit. The more severe (dirty or hot) the conditions are, the more often these tasks must be performed. Before doing any work, turn AC power OFF, and lock out disconnect switch.

Clean accumulated dust and dirt from the unit and immediate area. Pay special attention to air intake areas under end brackets and air outlets along the side of the housing. Dirt allowed to accumulate there can easily be drawn into the unit or obstruct air flow to cause overheating or mechanical binding.

If unit has a friction brake attached to it, particles will rub off the friction surfaces and collect inside brake cover. Remove cover and clean the brake. Check brake operation to determine if it operates freely. Check to see if parts are worn and need replacing.

Since the drive is open, internal cleaning may occasionally be required. The frequency depends on existing conditions. Oil or coolants in the air are drawn into the unit; the following procedure is suggested if this occurs:

> **CAUTION**: This procedure must be performed only by personnel familiar with drive disassembly and assembly, approved methods of cleaning and drying electrical windings and checking insulation resistance. See Section 7 for information regarding repair instructions and service assistance.

1. Remove end brackets and shaft assembly.
2. Use a vacuum cleaner to remove all loose material.
3. Solidly packed dirt, grease and oil should be cleaned using a high flash safety solvent. Wipe with solvent dampened cloth or use a soft bristled brush. Do not soak the electrical windings.

Maintenance Check List **Table 6-1**

Items to be Included	Description
1. Nameplate Data	Complete nameplate data for reference.
2. Applicable Drawings in Manual	Complete lists of applicable drawings and illustrations, and where located in this manual.
3. Operating Speed Range	Min. and max. speed normal to machine.
4. Load Range	Min. and max. motor current normal to machine or to product.
5. Electric Service	Line Voltage.
6. Coil Ratings	Voltage and current for the clutch and brake coils (when used).
7. Lubrication	Type grease, frequency and amount to be used.
8. Safety Devices	Type and setting of each.
9. Alignment Data	Angular and parallel max. limits.
10. Vibration	Normal readings, where taken and frequency of checking.
11. Service Record	Date and initials of person making periodic check. Space for comments should be provided.
12. Repair Record	Date and description of problem and items repaired or replaced.

4. Check insulation resistance before reassembly. Refer to “Insulation Testing" below for the proper procedure.

5. Reassemble the drive.

Lubrication
The two most prevalent causes of bearing failure are contamination and over-greasing. For most operating conditions the bearings should not be greased more than twice a year. However, if the drive is to be run continuously or operated in a high ambient temperature [86° to 104°F. (30° to 40°C.)] or at a high slip RPM, re-grease bearings more frequently.

When lubrication is required, use the following procedure to grease the bearings:

1. Stop the motor and clutch and allow both to coast to a complete stop.

2. Wipe the areas around the grease inlets at the top of each end bracket. This is important and necessary to prevent contamination of bearings.

3. To lubricate the inner quill bearing, remove the plug button from the side of the housing. Locate the grease fitting on the drum assembly directly along the hole by rotating the drum slowly. Clean the grease fitting and pump 1.5 ounces of recommended grease into it. Excess grease will be dispelled into the motor housing. Do not over-grease. See Table 6-2 for recommended greases.

4. Start AC motor and clutch. Pump approximately 1.5 ounces of recommended grease into each of the two end bracket grease fittings.

5. Run drive for 15 to 20 minutes to expel any excess grease.

6. Wipe off all excess grease. Install the plug button removed in Step 3.

The grease specification is per Dynamatic® Engineering Standard MML 4-1.3. This is a premium grade of lithium base N.L.G.I. #2 EP grease. Recommended greases are listed in Table 6-2. Any equivalent and compatible grease may be used. Special greases may be specified at the time of order entry. Consult your order papers if special grease has been specified.

Recommended greases **Table 6-2**

Shell	Alvania EP#2	Texaco	Multifax EP#2
Gulf	Gulfcrown EP#2	Mobil	Mobilux EP#2

Insulation Testing
Periodically, the insulation resistance of the motor stator and clutch and brake coils should be checked with a megger to determine the condition of the windings. Decreasing megohm readings are an indication that the insulation has become wet or is starting to fail. Check and record the insulation resistance regularly. The recorded readings serve as a reference against which the latest reading can be compared. Use a 500 volt, hand cranked megger; cranked at full speed, until a good, stable reading is obtained. Follow instructions supplied with the megger.

CAUTION: Make sure the AC power to the motor is turned OFF and locked out before attempting to make the test. Disconnect the motor and coils and be sure that control circuits and other electronic devices are disconnected, as they will be damaged by the high voltage. Tachometer generator and other auxiliary devices must not be checked with a megger. Use an ohmmeter for these devices.

A minimum reading of 2 megohms is acceptable for motors with input voltage of 575 volts or less, and 200,000 ohms for clutch and brake coils. Whenever lower megohm readings are found, an authorized service shop or the factory should be consulted.

High-potential tests should never be done by a user because repeated application or improperly applied high voltage AC or DC testing will damage the insulation. If an initial AC, high-potential test is necessary, contact the factory or an authorized Service Repair Shop that is fully qualified in making such tests. This test is applicable only to new equipment, not yet started up.

Motors and coils that have become wet due to water spray or condensation should be dried out before applying power or subjected to an insulation test. Consult the factory or one of the authorized service shops for assistance to dry out a unit.

Troubleshooting
The possibility of a component wearing out or other problem always exists. This section of the manual is intended to provide assistance in finding the fault. Check the obvious first; then follow the Troubleshooting Guide, Table 6-3.

CAUTION: Turn AC power to the unit and controller OFF before making tests. When a voltage measurement is necessary, only qualified personnel, fully acquainted with safety procedures and making Power On tests, should be allowed to service this drive.

Troubleshooting Guide **Table 6-3**

Problem	Possible Fault
Motor does not start.	1. Loss of AC power. 2. Defective switch or breaker. 3. Blown fuses 4. Motor starter not closing. 5. Overload or safety interlock open. 6. Loose or incorrect wiring. 7. Defective AC motor.
Motor runs, but no output.	1. No coil voltage; check controller. 2. Loose or incorrect wiring. 3. Open safety interlock. 4. Brake not releasing. 5. Open or defective clutch coil.
Drive stops during operation.	1. Controller malfunction, check controller. 2. Drive is overloaded. 3. Safety interlock is open. 4. Loss of AC power. 5. Loose connection. 6. Open or defective clutch coil.
Excessive noise or vibration.	1. Rotating parts imbalanced due to build up of dirt or other foreign material. 2. Impending bearing failure. 3. Unit improperly mounted. 4. Unit misaligned. 5. Shaft coupling or hub loose or defective. 6. Interference between clutch drum and spider. 7. Bent shaft.
Unit overheats.	1. Overload; check motor current. 2. Operating below minimum speed. 3. Air passages blocked. 4. Re-circulating cooling air or ambient temperature too high. 5. Brake not releasing or machine binding.
Bearing overheats.	1. Bearing failing. 2. Excessive thrust or overhung load. 3. Lack of, excessive, or wrong lubricant. 4. Unit misaligned. 5. Bent shaft.
Erratic operation.	1. Controller malfunction; check controller. 2. Cyclic or shock loading. 3. Bearing failure. 4. Velocity feedback malfunction (Tach. Gen.) 5. Electric noise or radio frequency interference. 6. Loose winding connection.
Runs at full speed only.	1. Controller malfunction; check controller. 2. Loss of velocity feedback signal (Tach. Gen.) 3. Mechanical lock-up of clutch drum & spider. 4. Center support bearing failure.

Section 7

Service & Renewal Parts

DSI/Dynamatic® provides a total service program to ensure your satisfaction with its products. DSI/Dynamatic® maintains an Aftermarket Sales & Service Department, which offers the following service to you: Technical Assistance, Field Service, Training, Factory Repair Service and Renewal Parts.

The company also maintains a worldwide network of Authorized Service Centers, Major Parts Distributors, Drive Distributors and Field Service Engineers. For addresses of the ones nearest you, contact your sales office or the factory.

Field Service
Trained service engineers, located at the factory and in key industrial centers around the world, are available to provide technical assistance to you. These engineers provide technical advice and counsel relating to the installation, maintenance, adjustment, modification and repair of the equipment.

This assistance may be offered over the telephone or, if required, by a trip to your plant. Requests for field service assistance should be made through the factory.

Repair Service
Repair and overhaul or rebuild services are provided by the factory. These services are also available through Authorized Service Centers located in key industrial centers around the world.

> **Note**: All warranty work must be approved and authorized by the factory.

Any non-warranty item returned will be repaired on a time and material basis if deemed repairable unless a fixed quotation is requested before authorizing the repair. Contact Customer Service at the factory for quotations.

Return Instructions

> **Note**: **DO NOT RETURN ANY ITEM TO THE FACTORY WITHOUT AUTHORIZATION**. Comply with the "Return Instructions" that follow.

Items being returned for repair, including warranty repairs, require a Repair Authorization (RA) Form. Contact the factory for the form and return authorization. Provide all the information requested on the form and return it with the equipment and your purchase order.

Those items not manufactured by DSI/Dynamatic®, such as instruments, meters and digital counters, are repaired by the vendor. Returning them to the factory will only delay the repair. Contact the factory for shipping instructions.

Any return for reasons other than repair requires a Return Authorization (RA) form, available from the factory.

Repair Instructions
Customers wishing to repair or overhaul Ajusto-Spede® drives should contact DSI/Dynamatic® to obtain detailed instructions, bills of material, specifications and drawings. To ensure that the correct information is furnished, the model number, PRO number and serial number must be obtained from the nameplate of the specific unit for which information is being requested.

Renewal Parts
Order renewal parts from the factory, your Major Parts Distributor or Drive Distributor located in your area.

> **Note**: To ensure that correct parts are furnished, include complete nameplate data from your specific unit, a purchase order number, description of the part and the quantity required. The nameplate lists the model number, pro number and serial number. These numbers are necessary to identify the unit(s) and to establish the correct parts for your unit(s).

Renewal parts will be shipped from the factory stock, distributors stock, or will be manufactured on receipt of an order, depending on availability. Inventory quantity and location is based on the level of demand for individual items. Renewal parts are covered by the standard renewal parts warranty, as published in the Company Terms and Condition of Sale for Renewal Parts.

Lists of recommended spare parts, complete parts lists and other renewal parts information is available on request.

Section 8

Modifications

Introduction

This section describes the eddy-current, friction and spring set brakes that can be added to the eddy-current AS drive in the field. Included in this section are instructions covering assembly and installation, wiring, operation, maintenance and troubleshooting. Handling, storage and safety instructions provided in Section 1 also apply to these brakes. Other modifications requiring instructions are included at the end of this section. When an Ajusto-Spede® drive is equipped with a brake, a suffix is added to the model number to identify the type of brake. Model AS-14B designates a model AS-14 equipped with an eddy-current brake. Model AS-14F includes a friction brake and model AS-14SF includes a spring set brake.

Drive Preparation for Brake Installation
A brake can be installed without removing the drive from operation. However, be sure to turn off and lock out electrical power to both the drive and its controller. Other preparations for brake installation are as follows:

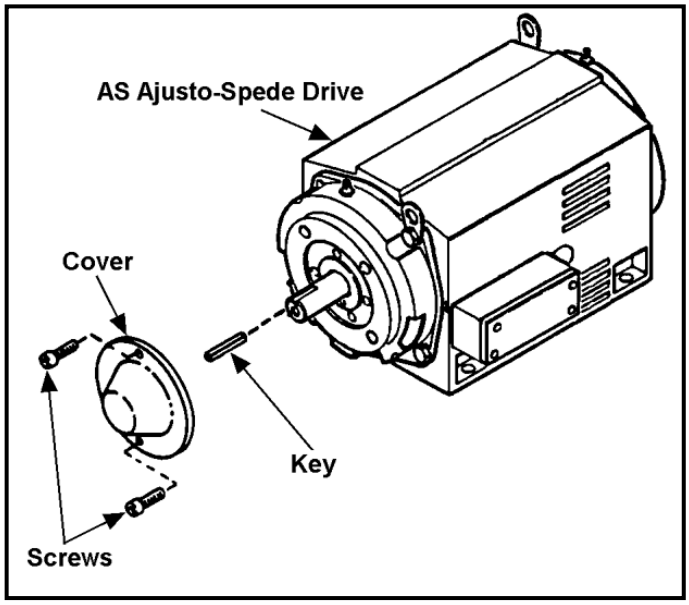
1. Unpack the brake and compare parts with the exploded view and parts list to be sure all parts are furnished. Also check brake nameplate against requirements to be sure proper brake is used. Then check the continuity and insulation resistance of field coil.

2. Remove the screws and cover, as shown in Figure 8-1, from motor end bracket on the drive. Cover and screws will not be reused.

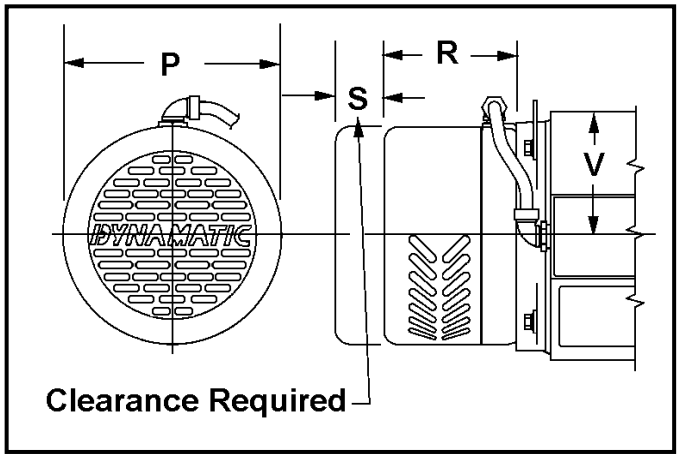
3. Wipe output shaft clean. Then install key from motor brake accessory kit in shaft keyway.

Eddy-Current Brakes

Description
The eddy-current brake can be installed on either end of a standard model AS drive. The brake operates on the same eddy-current principle as the eddy-current clutch. Brake torque may be provided throughout most of the speed range, but drops to zero as the shaft approaches zero RPM. With no braking torque at standstill, the brake cannot serve as a holding brake. Each model drive has a separate size eddy-current brake. Dimensions are provided in Figure 8-2 and Table 8-1.



Drive Preparation **Figure 8-1**



Outline Drawing - Eddy Current Brake **Figure 8-2**

Dimensions - Eddy-current Brake **Table 8-1**

Model	Dimensions in Inches & Millimeters			
	P	R	S*	V
AS-14B	7.38 187	4.69 119	2.92 74	5.19 132
AS-18B	9.50 241	5.84 148	4.56 .116	6.19 157
AS-21 B	9.50 241	5.84 148	4.56 116	6.19 157
AS-25B	10.88 276	7.31 186	6.06 154	6.88 175
AS-27B (1-7/8 shaft)	13.62 346	4.83 123	.5 1.3	8.06 205
AS-27B (2-1/8 shaft)	13.62 346	6.96 177	2.5 64	8.06 205

*The S Dimension is the clearance needed to remove the cover.

Assembly Procedure

Models AS-14B Through AS-27B

Because of the similarity in components, a single assembly procedure follows for the five sizes of brakes. For Models AS-14B to AS-25B, refer to the exploded view in Figure 8-3 and the cross section view in Figure 8-4. For Model AS-27, refer to the cross section view in Figure 8-5. Refer to the cross section views for conduit assembly for all models. Table 8-3 lists the parts for all models. Be sure to review the complete procedure and check off applicable parts for your size brake before starting assembly.

1. Prevent Ajusto-Spede® drive shaft from rotating by locking output end of shaft extension.
2. Be sure key (1) is in the keyway of the shaft. Using a graphitic lubricant, coat the surface of the shaft and hub bore of drum (4).
3. Install conduit elbow on brake coil and field assembly.
4. Align brake coil and field assembly (2) with the C-Face end bracket of the drive and secure with socket head screws and lock washers (3). Torque tighten screws per Item 3 in Table 8-2.
5. Install reducer bushing and conduit elbow on junction box.
6. Install conduit tube between the two conduit elbows and route wires from brake into junction box.
7. On Model AS-27B only, install plate on brake rotor hub using hex head screws and lock washers. Torque tighten screws to 10-12 lbs. ft.
8. Align drum and hub assembly (or rotor assembly for AS-27B) (4) with the stub shaft and key; then press it onto the shaft. Secure it by installing and tightening socket head screw and lock washer (5) or hex head screw and lock washer (5A). Torque tighten screw per Item 5 in Table 8-2.

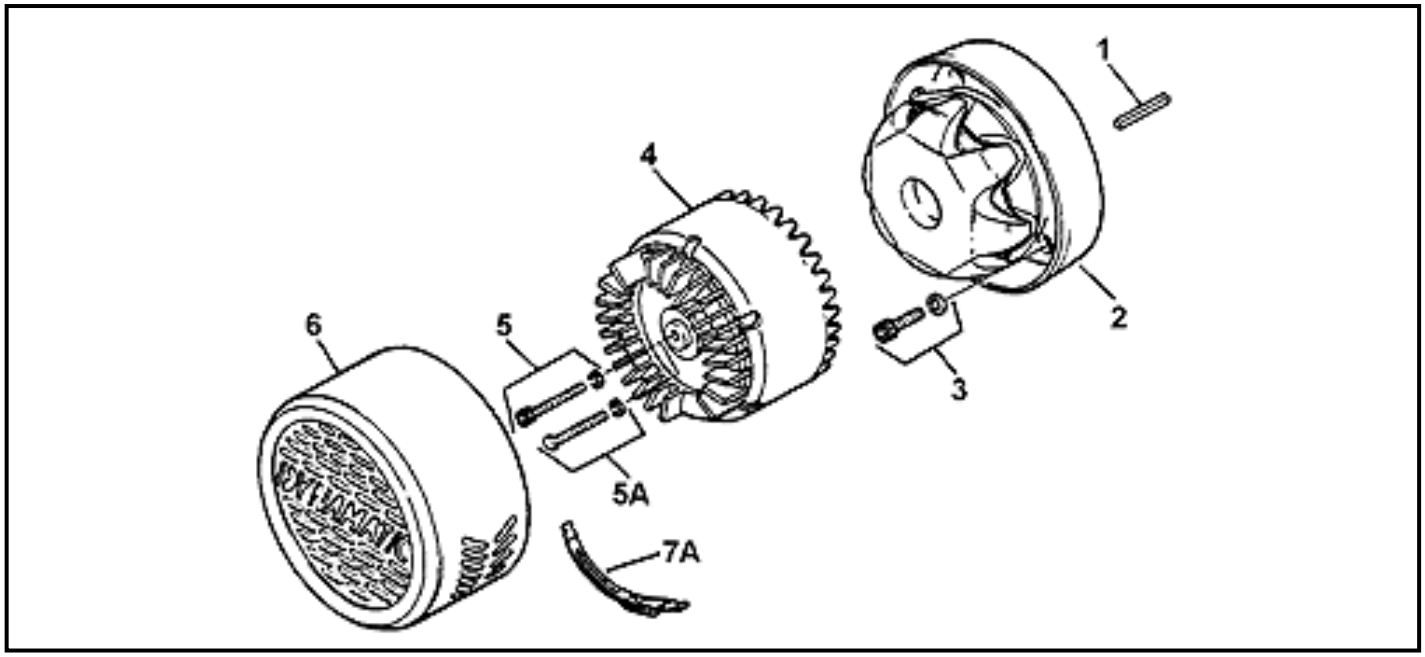
WARNING: Drum and hub assembly must not be hammered onto the shaft.

9. On Models AS-14B to AS-25B, position cover assembly (6) over the brake so it snaps into the outer edge of the brake coil and field assembly.

   Insert each end of clamp (7) into a slot provided in the cover assembly and tighten the screw for a snug fit.
10. On Model AS-27B, install cover using round head screws and flat washers.
11. Rotate the shaft by hand to ensure that brake parts do not bind.

Installation Data **Table 8-2**

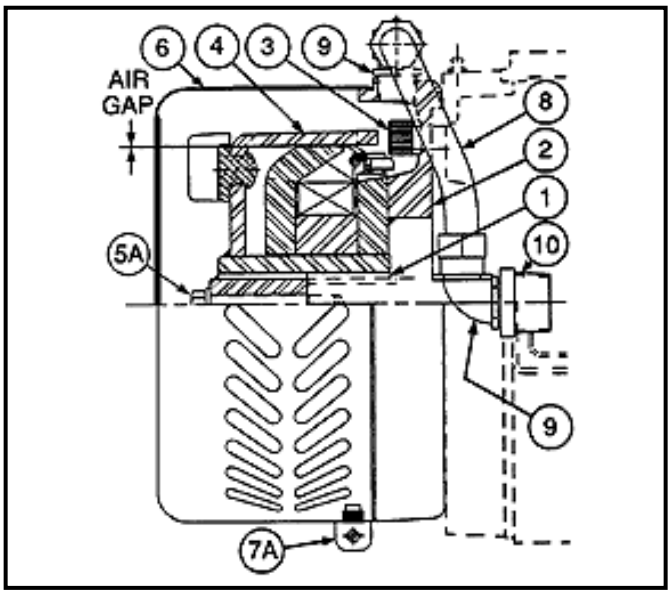
Model	Torque in Lbs. Ft. for Items per Figure 8-3		Air Gap (Inches)
	Item 3	Item 5	
AS-14B	38-40	18-20	.010/.012
AS-18B	95-105	22-24	.016/.018
AS-21B	95-105	22-24	.012/.014
AS-25B	95-105	22-24	.014/.016
AS-27B	55-65	105-120	.026/.028



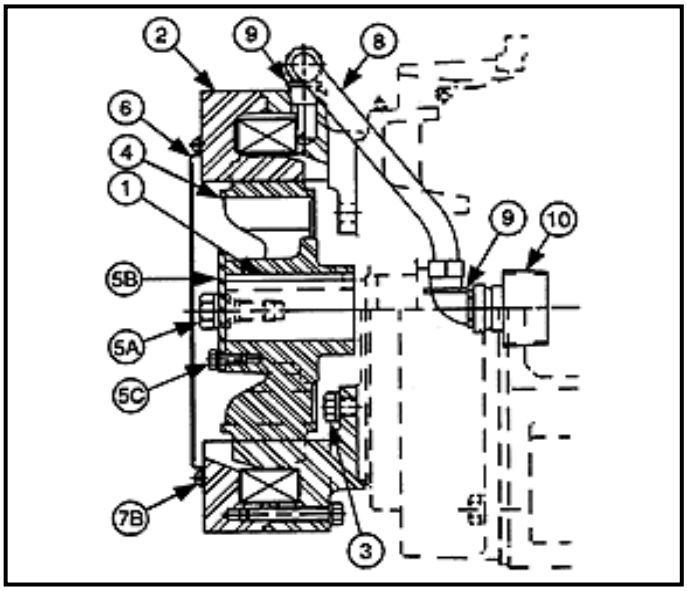
Exploded View - Eddy Current Brake for Models AS-14B through AS-25B Drives **Figure 8-3**

Parts List - Eddy-Current Brake for Model AS-14B to AS-27B Drives **Table 8-3**

Item	Description	Item	Description
1	Key	5C	Hex head screws & lock washers (2) (AS-27B)
2	Brake coil & field assembly	6	Cover assembly
3	Hex head screws & lock washers (4) (Socket head screws for AS-14B)	7A	Clamp (AS- 14B to AS-25B)
		7B	Round head screws & flat washers (4)(AS-27B)
4	Drum & hub assembly (Rotor Assy. for AS-27B)	8	Conduit tube
5A	Hex head screw & lock washer (Socket head screw for AS-14B)	9	Conduit elbows (2)
		10	Conduit reducing bushing
5B	Plate (AS-27B)		



Cross Section - AS-14B to AS-25B **Figure 8-4**



Cross Section - AS-27B **Figure 8-5**

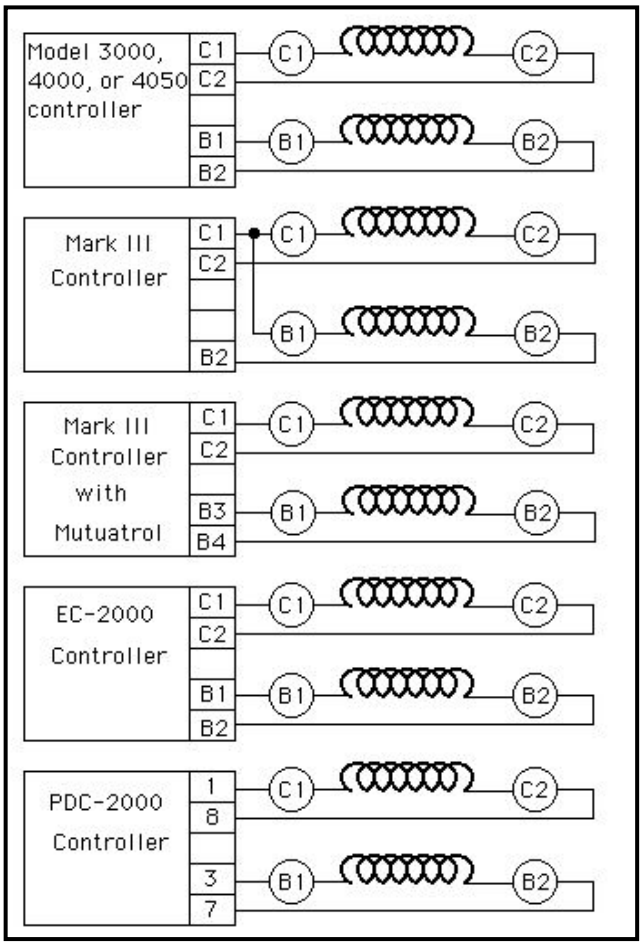
Wiring

To complete installation, connect brake leads from the drive to a suitable power source. Figure 8-6 shows typical connections to a Dynamatic® eddy-current drive controller furnished with brake control circuitry. Refer to the controller instructions and connection diagrams for detailed information.

If the eddy-current drive controller does not include brake control circuitry, select a DC power source matched to the voltage and current rating listed on the nameplate of the brake. Connect the DC power source to the brake through a suitable switching device. The switching device should be interlocked so that power cannot be applied simultaneously to both the clutch and brake. Accidental setting of the brake with the clutch engaged may seriously reduce the life of both units. To prevent overheating the brake coil, power should not be applied to the brake for an extended period of time.

Operation

When the brake is connected to a Dynamatic® eddy-current drive controller with brake control circuitry, operation of the brake is automatic. Power to the brake is turned on and off by a relay within the controller. Power is applied to engage the brake when the Stop pushbutton on the controller is pressed and is removed when the Start pushbutton is pressed. Depending on the controller, the brake voltage may be fixed or adjustable. With adjustable braking, the controller output voltage is adjusted to obtain the desired torque or stopping time. Refer to the controller instructions for additional information.



Typical Wiring Conn. for EC Brake **Figure 8-6**

Maintenance and Troubleshooting

The eddy-current brake is designed to provide continuous operation with a minimum of maintenance. A good preventive maintenance program for the brake should include periodic cleaning and inspection. The application and environment of the unit will dictate how often these tasks should be performed. See Table 8-4.

CAUTION: Disconnect power to drive and controller before proceeding.

1. Remove accumulated dust and grease from external surfaces. Pay special attention to air intake areas. Accumulated dust can obstruct airflow through the brake, resulting in overheating.
2. Dust drawn into the brake can accumulate on interior surfaces and cause mechanical binding. Disassemble the brake to clean interior surfaces.
3. Check for abnormal noises or excessive vibration during operation. Noise or vibration can indicate parts rubbing or binding due to foreign material. Check the air gap per Table 8-2.
4. Observe a number of operating cycles. Irregular brake operation may be caused by loose electrical connections.

Repair

The brake is disassembled as it is removed from the drive. However, be sure to turn OFF and lock out electrical power to the drive, brake and its controller. To remove and disassemble a brake, simply remove parts in the reverse of assembly.

Repair is accomplished by replacing worn or damaged parts. Contact DSI/Dynamatic® for detailed repair instructions.

To remove grease and dirt, immerse parts, except the field coil, in a solvent that complies with air pollution regulations for solvent composition and emission. Such parts cleaned with the solvent should be completely dried before reassembly.

Reassemble or install a new brake as described in the Assembly Procedure for this brake.

Renewal Parts Stocking

If downtime is critical, it is recommended that an extra brake coil and field assembly be kept in stock. For additional information regarding renewal parts, refer to Section 7 of this manual.

Note: To ensure that correct parts are furnished, include complete nameplate data from your specific unit, a purchase order number, description of the part and the quantity required. The nameplate lists the model number, PRO number and serial number. These numbers are necessary to identify the units and to establish the correct parts for your unit(s).

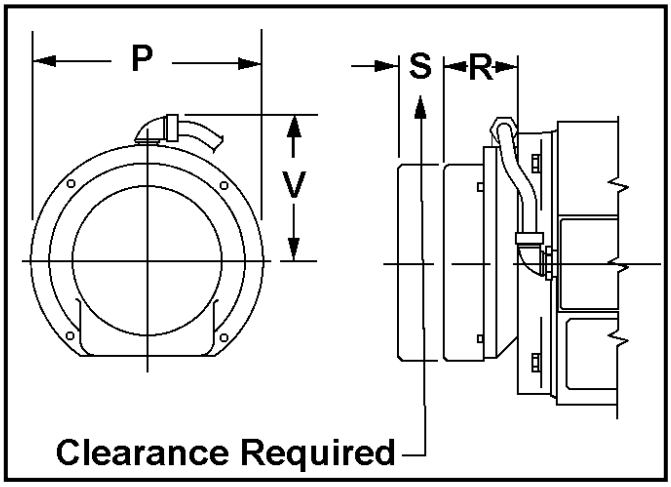
Troubleshooting Guide for Eddy-Current Brakes **Table 8-4**

Problem	Possible Fault
Brake does not slow load.	1. Loss of power to brake. 2. Controller malfunction; check controller. 3. Brake overloaded.
Excessive noise or vibration. .	1. Brake drum unbalanced due to dirt buildup. 2. Interference between rotating & stationary members
Brake overheats.	1. Brake coil excitation exceeding recommended safe value. 2. Air passages blocked. 3. Re-circulating cooling air or ambient temperature too high.
Erratic operation.	1. Controller malfunction. 2. Loose winding connection.

Electromagnetic Friction Brakes

Description
The friction brake mounts on either end of the drive and attaches to the drive's shaft.

Three models of friction brakes are used to meet the size and braking requirements of the different model drives. Dimensions of these brake models are provided in Figure 8-7 and Table 8-5. Note that a Model 500 brake is used on the AS-14F and AS-18F drives, a Model 825 brake is used on the AS-21F and AS-25F drives and a Model 310 brake is used on the AS-27F drives. The AS-27F is not exactly as pictured.



Friction Brake Outline Drawing **Figure 8-7**

Friction Brake Dimensions **Table 8-5**

Model AS	Model Brake	Inches and Millimeters Dimensions in			
		P	R	S*	V
AS-14F	500	7.42 188	2.46 62	1.10 28	4.96 126
AS-18F	500	7.42 188	3.11 79	1.10 28	4.96 126
AS-21 F	825	11.52 M	4.45 113	2.68 W	6.00 152
AS-25F	825	11.52 293	4.45 113	2.68 68	6.00 152
AS-27F (1-7/8 shaft)	310	12.16 309	4.72 120	2.25 57	N/A
AS-27F (2-1/8 shaft)	310	12.16 309	Later	Later	Later

*The S dimension is the clearance needed to remove the cover.

Assembly Procedure

Because of differences in components, two separate assembly procedures are provided. The first assembly procedure covers the Model 500 brakes for AS-14F and AS-18F drives. The second procedure covers Model 825 and 310 brakes for AS-21/25F and Cross Section AS-27F drives. Each procedure includes a parts list and exploded view. Be sure to review the complete procedure for your size brake before starting assembly.

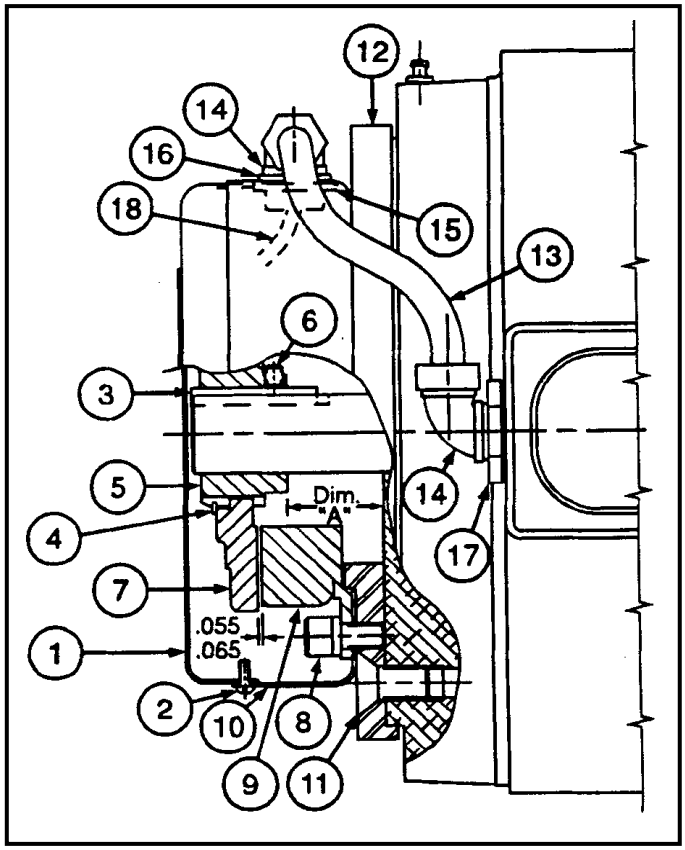
Model 500 Brake For AS-14F & AS-18F Drives
(See Figures 8-8 & 8-9 and Table 8-6)

1. Refer to the cut away drawing, Figure 8-8. Mount a conduit elbow on the brake housing using the sealing washer and locknut. Place the rubberized surface of the washer next to the housing.

2. On Model AS-18F only: Position mounting plate (12) against C-Face of the drive and secure it with four flat head cap screws (11). Apply Loctite to threads before assembling. Tighten to 55-65 lbs. ft torque.

3. Be sure key (3) is in the keyway of the shaft. Using a graphitic lubricant, coat the surface of the shaft and the bore of the armature hub (5). Align hub (5) with the key and push it on the shaft. Locate the hub so its inside face is positioned from the mounting surface of the C-Face end bracket of the drive as follows: AS-14F 0.923/0.913 inch; AS-18F 1.323/1.313 inch (Fig 8-8 Dim. "A"). Secure hub in this position with two cup point set screws (6).

4. Attach the wiring harness to the terminals on the field assembly and cover the terminals with the insulator caps.



Cross Section - AS-14F and AS-18F **Figure 8-8**

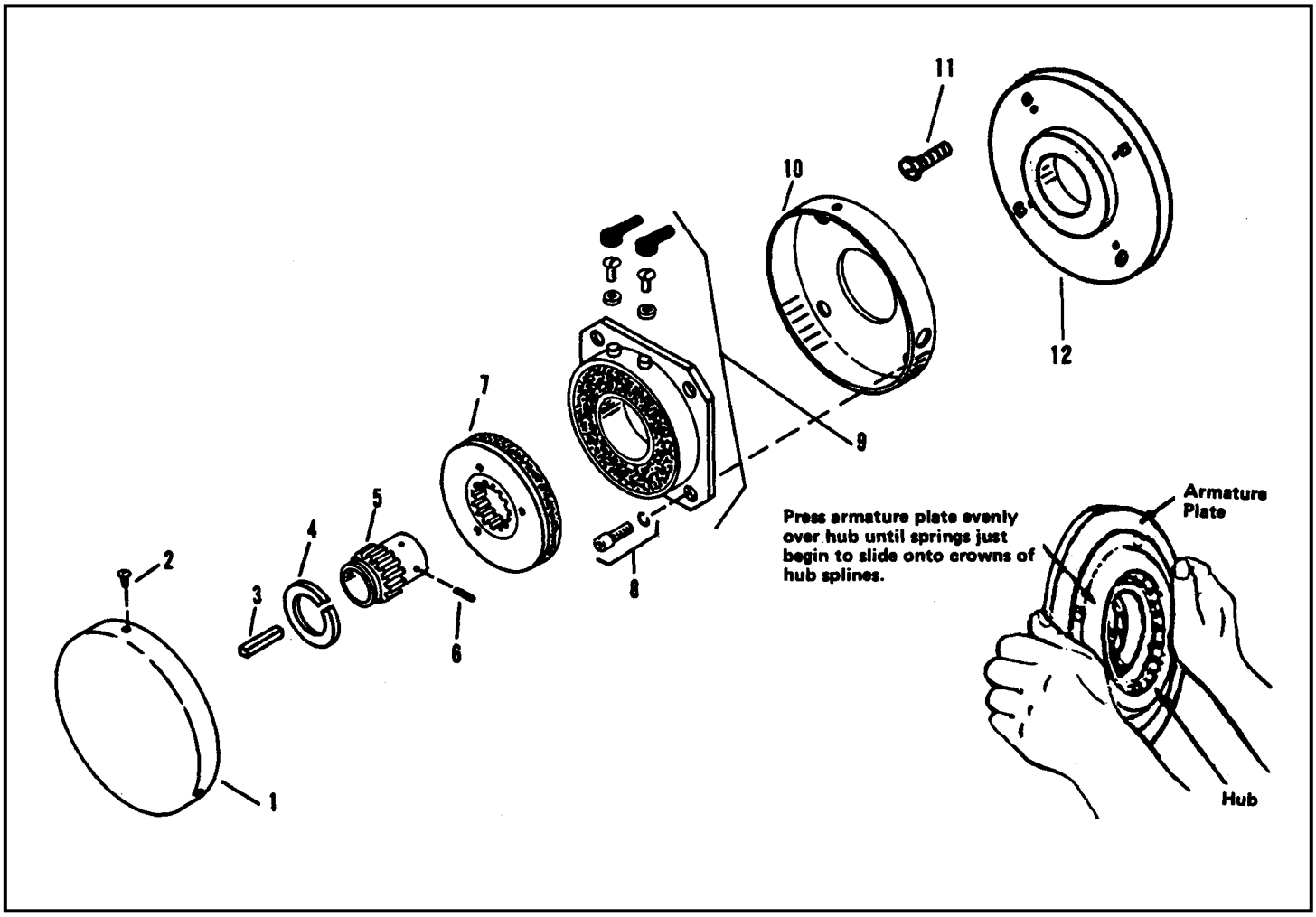
5. Position field magnet assembly (9) inside the cover adapter (10). Align their mounting holes with the mounting holes in the C-Face end bracket (or mounting plate) so the magnet terminals and the hole in the mounting adapter are at the top. Secure with four socket head screws and lock washers (8). Tighten to 38-40 Lbs. Ft. torque.

6. Align friction surface of armature plate (7) toward field magnet and press the armature over the hub, as shown in Figure 8-9. Push it against the magnet face and release. The armature plate should spring back to the prescribed air gap of 0.055/0.065 inch. Secure it in place with snap ring (4).

7. Install reducer bushing and conduit elbow on junction box.

8. Install conduit tube between the two conduit elbows and route wires from brake into junction box.

9. Rotate drive shaft by hand to ensure that brake parts do not bind. Then install brake cover (1) using four sheet metal screws (2).



Exploded View - Model 500 Friction Brake for AS-14F & AS-18F **Figure 8-9**

Parts List - Model 500 Friction Brake for AS-14F & AS-18F **Table 8-6**

Item	Description	Item	Description
1	Brake Cover	9*	Field Magnet Assembly
2	Self-Tapping Screws (4)	10	Cover Adapter
3*	Key: AS-14F: 3/16” sq. x 1-3/8” lg.;	11	Flat Head Cap Screws (4), AS-18F only
	AS-18F: 1/4" sq. x 1-3/4" lg.	12	Mounting Plate, AS-18F only
4*	Snap Ring	13	Conduit tubing
5*	Armature Hub	14	Conduit elbows (2)
6	Cup Point Set Screws (2)	15	Conduit lock nut
7	Armature Plate	16	Sealing washer
8*	Socket Head Screws & Lock washers (4)	17	Conduit reducing bushing
		18	Wiring harness

*Items are included in brake manufacturer's package.

Models 825 & 310 Brakes for AS-21F to AS-27F
(See Figures 8-10 to 8-12 and Table 8-7)

1. Note that the cast opening in the mounting adapter will be at the bottom when the adapter is mounted to the drive. For the model 825, assemble a conduit fitting to the top of the mounting adapter. For the model 310 assemble a conduit fitting to the side of the mounting adapter adjacent to the drive's conduit box. Install pipe plugs in any unused holes.

2. Position mounting adapter (12) against the mounting surface of the C-Face end of the drive so the cast opening is at the bottom. Secure it using four socket head screws and lock washers (11). Tighten to 95-105 Lbs. Ft. torque.

3. Position the field magnet assembly (10) inside the mounting adapter (12) so the magnet terminals are at the top for the model 825 and at the side near the conduit fitting for the model 310. Secure with four socket head screws and lock washers (9). Tighten to 18-20 Lbs. Ft. torque.

4. Attach the wiring harness to the terminals on the field assembly and cover the terminals with the insulator caps.

5. Assemble armature plate (5) to armature hub (8) using pin (3) and spring accessories (4). Refer to the exploded view for part orientation. Be sure that the friction surface of the armature plate faces the hub. Tighten drive pins with a 5/16 inch Allen wrench and lock wire them together.

6. Install reducer bushing and conduit fitting on junction box.

7. Install conduit tube between the two conduit fittings and route wires from brake into junction box.

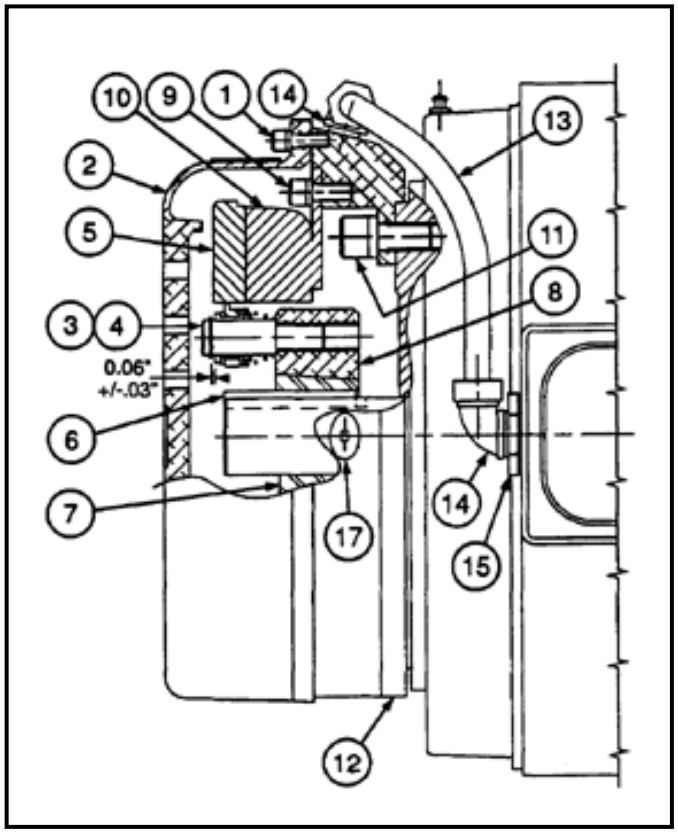
8. Wipe mating friction surfaces clean. Then, slide split taper bushing (7) into bore of hub. Lightly oil set screws before loosely installing them, as shown in Figure 8-11.

9. Be sure key (6) is in the keyway of the shaft. Using a graphitic lubricant, coat the surface of the shaft and the bore of the taper lock bushing (7). Then slip bushing, armature hub and armature plate assembly, over the key on shaft, flush against the field magnet assembly. Using a feeler gauge, position the hub to allow 0.03 to 0.09 inch air gap between the back face of the armature plate and the snap rings on the drive pins (see Figure 8-10).

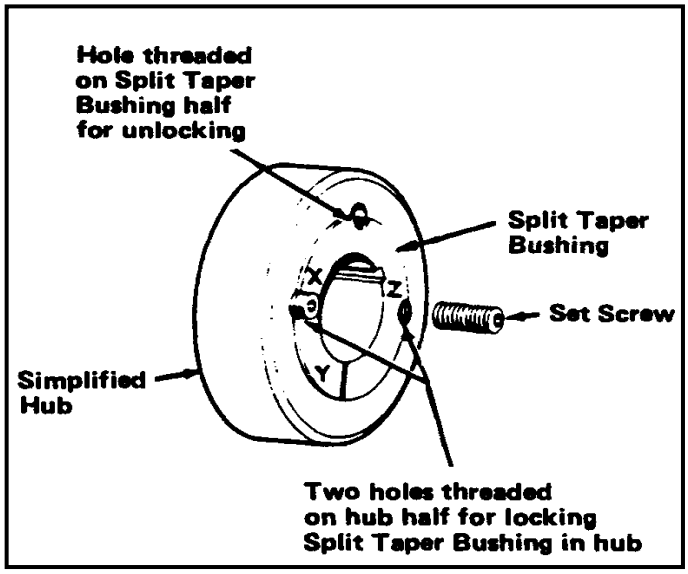
10. Holding hub in position, tighten two set screws in the bushing with 175 inch-pounds of torque. Then tap lightly at points X, Y and Z (shown in Figure 8-11) and re-torque set screws. Repeat until tapping no longer loosens set screws. Remove feeler gauge.

11. Manually press armature plate against magnet face and release. Armature plate should spring back to preset air gap.

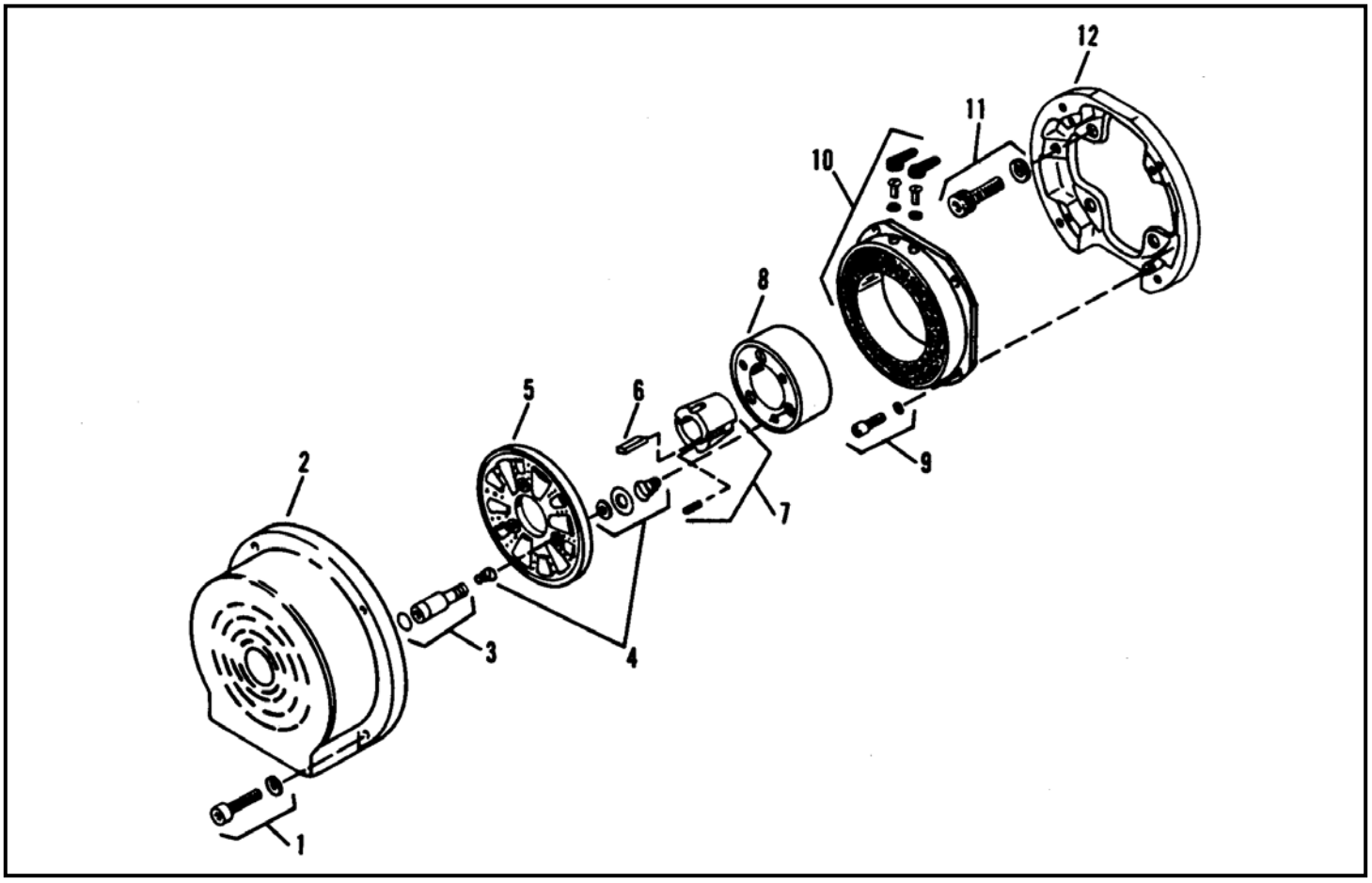
12. Rotate drive shaft by hand to ensure that brake parts do not bind. Then install brake cover (2) using screws and lock washers (1). Tighten to 9-11 Lbs. Ft. torque for model 825 and 5-7 Lbs. Ft. for model 310.



Cross Section - AS-21F & AS-25F **Figure 8-10**
(AS-27F is similar)



Split Taper Bushing Assy. **Figure 8-11**

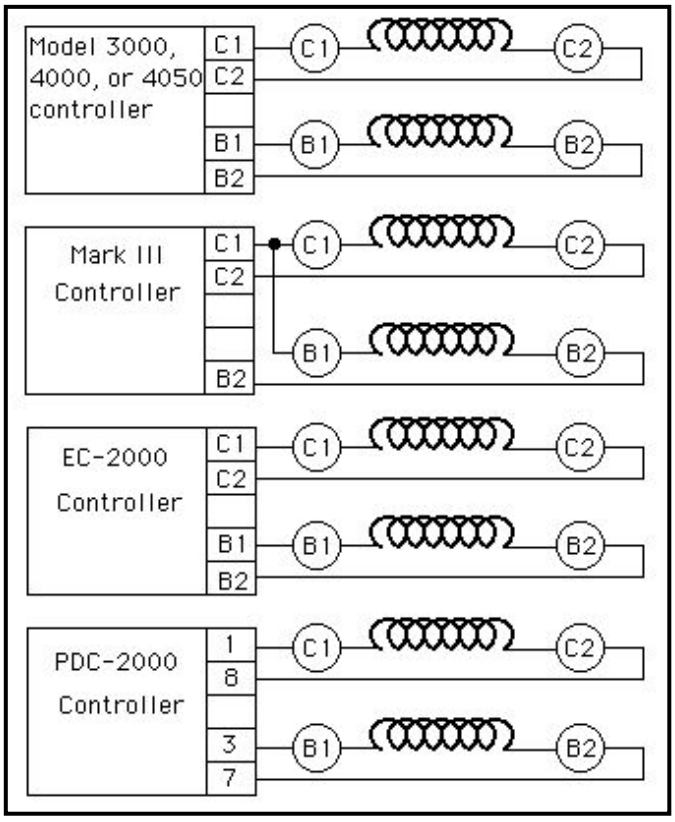


Exploded View - Model 825 for AS-21F & AS-25F **Figure 8-12**

Parts List - Models 825 & 310 Friction Brakes for Model AS-21F to AS-27F Drives **Table 8-7**

Item	Description	Item	Description
1 *	Socket head Screws & Lock washers (4)	10*	Field Magnet Assembly
2*	Brake Cover	11*	Socket Head Screws & Lock washers (4)
3*	Drive Pin & Retainer	12*	Mounting Adapter
4*	Spring Accessory	13	Conduit tubing
5*	Armature Plate	14	Conduit fittings (2)
6	Key	15	Conduit reducing bushing
7*	Split Taper Bushing	16	Wiring harness
8*	Armature Hub	17	Pipe Plugs (2)
9*	Socket Head Screws & Lock washers (4)		

*Items are included in the brake manufacturer's package.



Typical Wiring Conn. For Friction Brakes Figure 8-13

Wiring
To complete installation, connect brake leads from the drive to a suitable power source. Figure 8-13 shows typical connections to a Dynamatic® eddy-current drive controller furnished with brake control circuitry. Refer to the controller instructions and connection diagrams for detailed information.

If the eddy-current drive controller does not include brake control circuitry, select a DC power source matched to the voltage and current rating listed on the nameplate of the brake. Connect the DC power source to the brake through a suitable switching device. The switching device should be interlocked so that power cannot be applied simultaneously to both the clutch and brake. Accidental setting of the brake with the clutch engaged may seriously reduce the life of both units. To prevent overheating the brake coil, power should not be applied to the brake for an extended period of time.

Burnishing (For Optimum Performance)
Burnishing of friction surfaces is recommended to improve brake life and assure rated torque. It is done as follows:

1. With brake assembled, apply 5 to 15 percent of rated voltage to brake coil using a separate DC power source. Then cycle drive on and off or operate ft continuously at speeds of 1000 RPM or more to create brake slippage.
2. Monitor temperature of field magnet assembly metal adjacent to friction material. Remove contaminants and keep temperature below 250°F, (121°C).
3. Continue process until friction surfaces have shiny, glazed appearance across entire area.
4. Stop drive. Brake should engage and bring drive output shaft to a stop.
5. If the controller includes the adjustable brake modification, adjust it as described in instruction sheet supplied with the controller.

Operation
When the brake is connected to a Dynamatic® eddy-current drive controller with brake control circuitry, operation of the brake is automatic. Power to the brake is turned on and off by a relay within the controller. Power is applied to engage the brake when the Stop pushbutton on the controller is pressed and is removed when the Start pushbutton is pressed. Depending on the controller, the brake voltage may be fixed or adjustable. With adjustable braking, the controller output voltage is adjusted to obtain the desired torque or stopping time. Refer to the controller instructions for additional information.

Start-Up and Adjustment
For Start-up of a drive with an electromagnetic friction brake, perform checks as follows:

1. With all power OFF, manually rotate drive's shaft to verify that the brake is released.
2. Turn motor power ON. With controller ON but not started, verify that the brake is engaged by attempting to rotate the drive's shaft.
3. Start drive's controller. Brake must release as clutch is engaged; the drive should accelerate normally.

Maintenance and Troubleshooting
Do not allow grease, oil or excessive dust to enter brake. Keep the exterior of the unit clean and occasionally remove the cover and clean the interior. To remove grease or oil from the friction material, use a cloth dampened with chlorothene or an equivalent, approved cleaning solution. Do allow solution to saturate lining of field magnet assembly. A brake of this type will normally wear with use. When worn out, the brake should be replaced. Refer to the repair section.

Refer to table 8-8 for troubleshooting instructions.

Repair
The brake is disassembled as it is removed from the drive. However, be sure to turn OFF and lock out electrical power to the drive, brake and its controller. To remove and disassemble a brake, simply remove parts in the reverse order of assembly. To remove split taper bushing, remove set screws; coat one set screw with oil

and install it in hole threaded in bushing half (see Figure 8-11). Then tighten this setscrew to jack bushing out of hub. Reassemble and install a new brake as described in the Assembly Procedure of this instruction sheet. If friction members were replaced, burnishing should be performed.

Contact DSI/Dynamatic© for replacement parts.

Note: To ensure that correct parts are furnished, include complete nameplate data from your specific unit, a purchase order number, description of the part and the quantity required. The nameplate lists the model number, PRO number and serial number. These numbers are necessary to identify the units and to establish the correct parts for your unit(s).

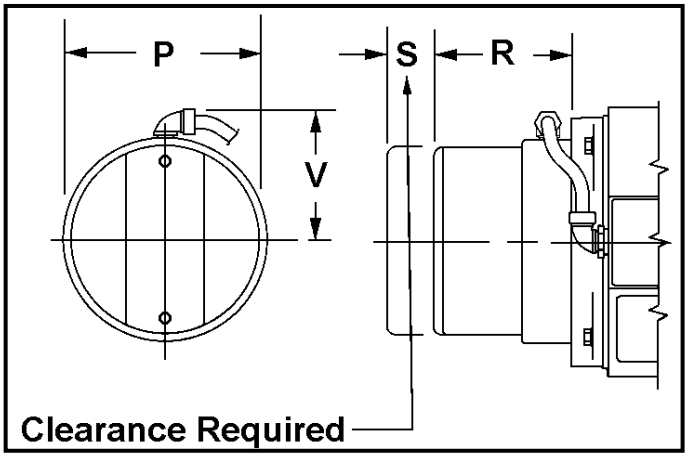
Troubleshooting Guide for Friction Brakes **Table 8-8**

Problem	Possible Fault
Brake does not release.	1. Coil energized; controller or wiring problem 2. Broken or damaged parts; inspect armature plate, hub and armature plate springs
Brake does not engage or hold.	1. Coil voltage not present or too low 2. Gap too large; armature plate spring broken 3. Friction material worn, wet or oily 4. Coil defective 5. Hub or bushing loosened or moved
Friction material wears excessively	1. Abrasive materials in cooling air 2. Coil voltage too high 3. Overheating due to debris or lack of cooling air.

Spring Set Brakes

The spring set brake is installed on either end of a standard, horizontally mounted model AS drive. For vertical operation, consult the factory. Dimensions are in Figure 8-14 and Table 8-9.

Spring set brakes are used for stopping, holding and decelerating the drive's output shaft. They are direct acting, spring set, electro-magnetically released disc brakes.



Spring Set Brakes - Outline Drawing **Figure 8-14**

Dimensions – Spring Set Brakes **Table 8-9**

Model	Brake Series	Dimensions in Inches & Millimeters			
		P	R	S*	V
AS-14SF	60[1]	6.82 173	4.62 117	3.12 79	4.50 114
AS-18SF	70[1]	9.00 229	6.62 168	4.00 102	5.75 146
AS-21SF	70[1]	9.00 229	6.62 168	4.00 102	5.75 146
AS-25SF	70[1]	9.00 229	7.87 200	4.00 102	5.75 146
AS-27SF	310[2]	11.00 279	8.50 216	4.00 102	6.75 171

*The S dimension is the clearances needed to remove the cover.

[1] Warner

[2] Dynacorp

Assembly Procedure

The assembly procedure that follows is applicable to the four sizes of brakes. The brake series for the drives are listed in Table 8-9. Refer to the Typical Brake Assembly illustration shown in Figure 8-15 and review the complete procedure before starting assembly. Then proceed as follows:

1. Remove the splined adapter hub (7) from the brake. Be sure key (6) is in the keyway of the shaft. Using a graphitic lubricant, coat the surface of the shaft and the bore of the hub and install it on the shaft over the key. The stamped part number of the hub must face away from the drive. Align the hub with C-Face (4) according to Hub Dimension H in Figure 8-16. Tighten hub set screws of Series 60 to the shaft with 10 lb. ft. torque and Series 70 with 12 lb. ft. torque.

2. Install a conduit elbow in the conduit hole of the brake housing.

3. Install reducer bushing and conduit elbow on junction box.

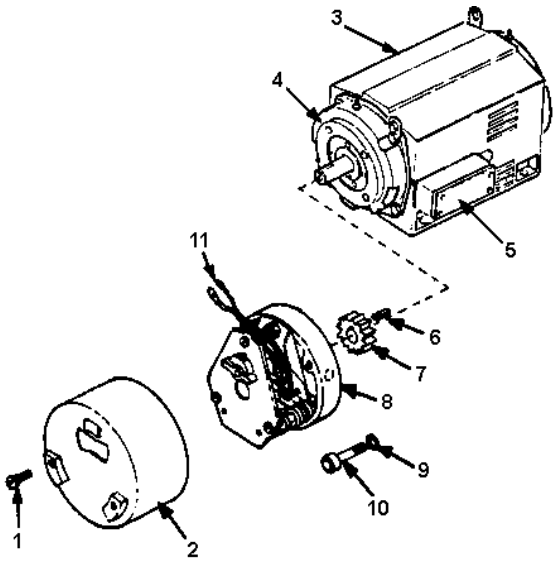
4. Slide the brake over the hub, align the teeth of the discs with the hub and keep the leads snug. Leads must not interfere with rotating parts.

5. Align brake mounting holes by operating the manual release and rotating the brake.

6. Secure brake to the drive with four socket head screws (10) and lock washers (9). Tighten screws for series 60 to 38-40 Lbs. Ft. torque. For series 70, tighten to 95-105 Lbs. Ft. torque.

7. Install conduit tube between the two conduit elbows and route wires from brake into junction box.

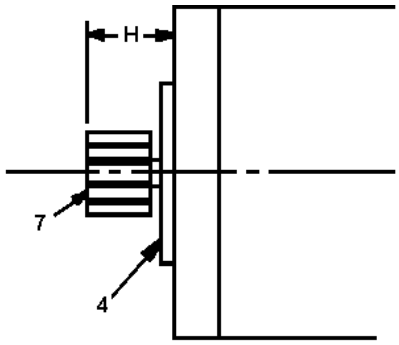
8. Install cover (2) over the brake and secure it with two screws (1) after completing the Start-Up and Adjustment procedure.



Legend:

1. Screw	7. Splined Hub
2. Cover	8. Brake
3. AS Drive	9. Lockwasher
4. Drive C-Face	10. Socket Head Screw
5. Junction Box	11. Coil Leads
6. Key	

Typical Spring Set Brake Assembly Figure 8-15

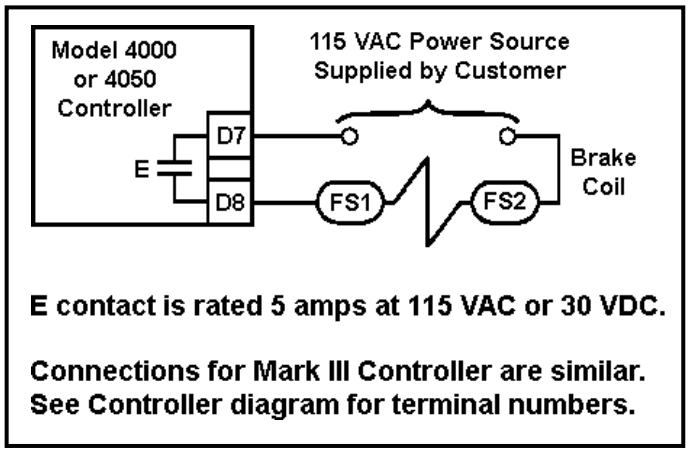


Model	Hub Dimension H (Inches)
AS-14SF	1.44 +/- .03
AS-18SF, 21SF	2.00 +/- .03
AS-25SF	3.00 +/- .03

Splined Hub Alignment Figure 8-16

Wiring

To complete installation, connect brake leads to a suitable power source. Connections shown in Figure 8-17 are recommended when the brake is rated at 115 VAC and the drive is used with a Model 4000 or 4050 controller. With these connections, the brake sets when either the drive motor or the clutch is turned off. Connections are similar for a Mark III controller with an optional brake control contact for 115, 230 or 460 VAC input. Be sure that all wiring matches the brake nameplate voltage and current ratings. Models EC-2000 & PDC-2000 require a special option. Refer to factory.



Typ. Wiring Conn. For Spring Set Brake Figure 8-17

Operation

Operation of the brake is automatic. The brake releases when power is applied to the magnet coil and sets when power is removed. When wired as shown in Figure 8-17, the brake releases only with motor and eddy-current clutch coil energized. When power is interrupted to the motor or controller, or when the controllers Stop button is pressed, the brake sets.

In the absence of power, the brake can be manually released. On a Series 60, simply turn the knob clockwise; on a Series 70, turn the two rods clockwise with a screwdriver. The brake will again automatically lock when the magnet coil is reenergized or when the knob or rods are manually turned counterclockwise.

Start-Up and Adjustment

Note: For numbers in parentheses in the following sections, refer to Figure 8-18 for Series 60 brakes and Figure 8-19 for Series 70 brakes.

The brake was adjusted at the factory to produce its rated static torque. If a slower stop is desired, adjust the brake to produce less torque. To make this adjustment, remove cover from brake and rotate two torque adjust nuts (14) counterclockwise, in equal increments, to lengthen torque springs (22). One full turn reduces torque by about 10%. Do not adjust the brake for higher torque or the coil may burn out. The normal spring lengths for the Series 70 brakes are: AS-18SF = 1.31"; AS-21SF & 25SF = 1.22".

For start-up of a drive with a spring set brake, proceed as follows:

1. With all power OFF and manual release lever or rods in the locked position(s), verify that brake is locked, preventing rotation of the shaft.

2. Turn the manual release lever or rods clockwise. Then rotate shaft to verify that the brake has been released.

3. When starting the drive, observe the manual release lever or rods as power is applied to the brake coil. The manual release should release, permitting the shaft to rotate. The brake should not vibrate or hum during operation and should set when power is removed from the brake coil.

CAUTION: Disconnect power to drive, brake and controller before proceeding with any maintenance, adjustment or repair procedure.

Maintenance and Troubleshooting
A good preventive maintenance program for the brake should include periodic cleaning and inspection as follows:

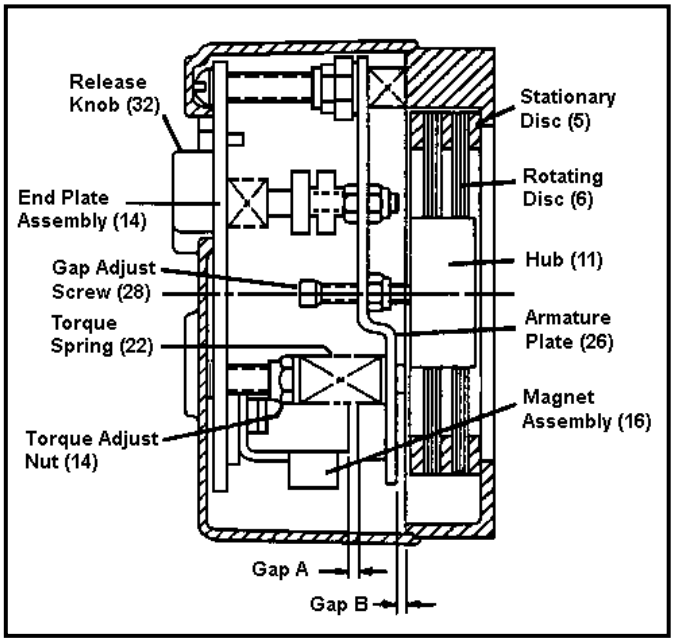
1. Remove accumulated dust and grease from external surfaces. Pay special attention to air intake areas. Accumulated dust can obstruct airflow and cause overheating.

2. Dust drawn into the brake can accumulate on interior surfaces and cause mechanical binding. Remove the brake cover and clean interior surfaces.

3. Check for hum, vibration and misalignment during operation. These can occur from rubbing or binding of parts or brake coil malfunction.

4. Observe a number of operating cycles. Irregular brake operation can result from loose electrical connections.

The application and environment of the brake dictate how often to perform these tasks. Refer to the troubleshooting guide in Table 8-11 if problems arise.



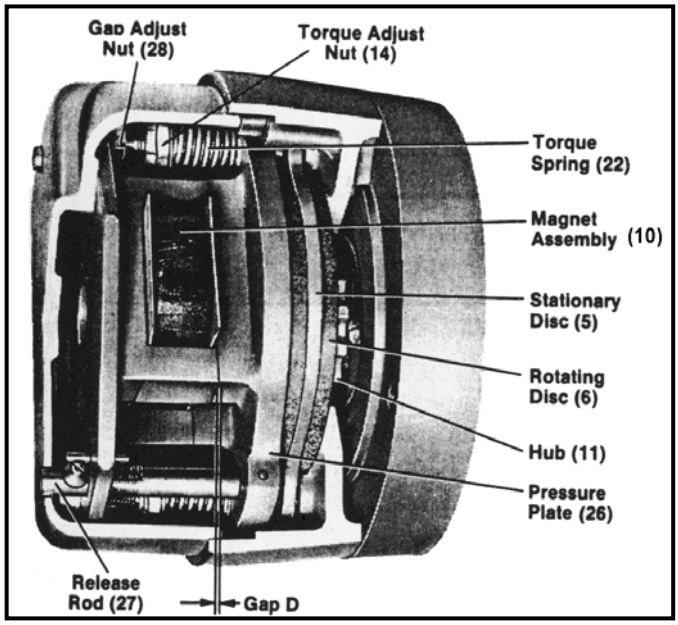
Typical Series 60 Brake - AS-14SF Figure 8-18

The friction discs will wear with use. As they become worn, the brake may not lock or release properly. To avoid this problem, check and adjust for disc wear periodically. Refer to the Wear Adjustment section that follows. When rotating discs are reduced to the minimum thickness allowed, they must be replaced. Refer to the Repair section and replace them.

Wear Adjustment
For a Series 60 brake (Model AS-14SF), remove cover (2) (Figures 8-17 & 8-20). When armature plate (26) touches bracket (9) gap B is closed, requiring adjustment for wear. Turn two gap adjust screws (28) clockwise, in equal increments, until gap A measures 0.050 to 0.055 inch at the narrowest gap. Replace cover. Delaying this adjustment will result in eventual loss of torque.

For a Series 70 brake (Models AS-18SF, 21SF and 25SF), remove cover (2) (Figures 8-18 & 8-21). Gap D, between pressure plate (26) and magnet assembly (16), must measure: AS-18SF = 0.030 to 0.060"; AS-21SF & 25SF = 0.035 to 0.065". When gap D approaches the maximum allowable, turn gap adjust nuts (28) and gap adjust lock nuts (23) to reduce gap D to the minimum. After setting the gap, readjust the length of torque springs (22). Replace cover.

Repair
Repair instructions and parts can be obtained from Dings Company 4740 West Electric Avenue, Milwaukee, WI or from a Dings sales representative.



Typical Series 70 Brake - AS18-25SF Figure 8-19

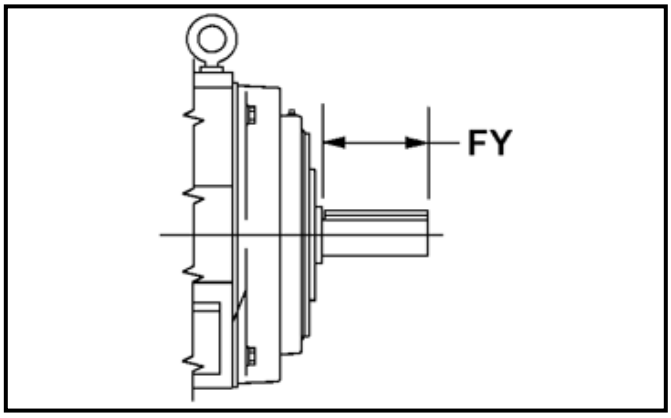
Troubleshooting Guide for Spring Set Brakes **Table 8-10**

Problem	Possible Cause
Brake Does Not Release	1. Lead wires broken or loose. 2. No voltage from controller; check controller. 3. Broken or damaged parts. 4. Voltage not at nameplate value, +/-10%. 5. Coil burned out or failed.
Brake Does Not Stop or Hold	1. Manual release not in locked position. 2. Coil still energized; wire or contact shorted. 3. Springs or other parts broken. 4. Hub moved on shaft and not engaging discs.
	5. Discs oily, wet or overheated. 6. Discs worn or broken; adjust or replace.
Brake Vibrates or Hums	1. Dirty magnet faces; shift paper between faces. 2. Misaligned magnet faces; check bushing or pivot nut. 3. Broken shading coil; replace magnet assembly. 4. Voltage not at nameplate value +/- 10%.

Other Modifications

Shaft Seal

The labyrinth seal affords protection with an intricate path through the seal. The seal is designed to centrifugally expel any material trying to enter. No maintenance is required, but if the labyrinth seal is disassembled, re-coat the labyrinth surfaces with Amolith #8516 grease before re-assembling. The seal shortens the usable shaft length as shown in Figure 8-20 and Table 8-11.



Shaft Seal Outline Drawing **Figure 8-20**

Shaft Seal Dimensions **Table 8-11**

Model	Dimensions in Inches & Millimeters
	FY
AS-14	1.48 38
AS-18	2.18 55
AS-21	2.68 68
AS-25	3.34 85
AS-27 (1-7/8 shaft)	3.39 86
AS-27 (2-1/8 shaft)	5.56 141

Space Heaters

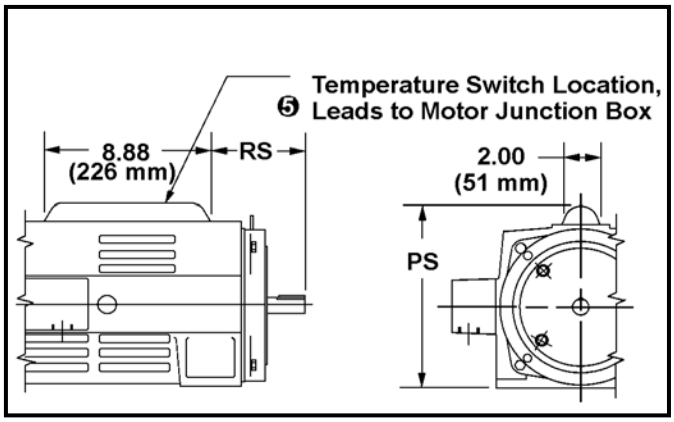
When space heaters are purchased, cartridge type heaters are mounted in the clutch end of the drive. A nameplate is attached to the unit, listing required voltage and wattage. Leads are wired to the junction box and usually marked 27 and 28. When the controller includes provisions for connecting the space heaters, the connections and lead markings will be shown on the connection diagram furnished with the controller. If the controller does not include provisions for the space heaters, connect the heaters to a suitable power source through a normally closed contact on the motor starter (furnished by the customer) so the heaters are energized whenever the motor is shut off.

Thermal Switches

When a clutch thermal switch is purchased, it is mounted so that it senses the air temperature near the clutch drum. Figure 8-21 shows the small housing that is mounted on top of the drive to accommodate the thermal switch. Table 8-12 lists the dimensions. The standard switch provides a normally closed contact that opens on high temperature. The leads are wired to the junction box and usually marked 21 and 22. The temperature switch should be wired to shut down the drive upon

detecting high temperature. It is wired in series with the drive Stop pushbutton or in series with the seal-in contact. Figure 8-22 shows typical winding connections. For terminal markings and other winding details, refer to the diagrams for the controller.

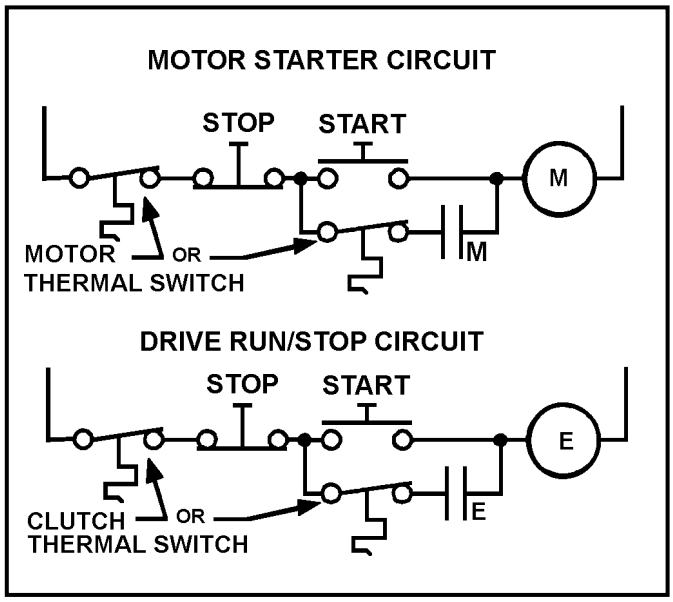
When a motor temperature switch is purchased, the switch is imbedded in the windings of the motor. The normally closed switch contact opens on high motor temperature. The leads are wired to the junction box and usually marked P1 and P2. The temperature switch should be wired to shut down the motor upon detecting high temperature. It is wired in series with the motor Stop pushbutton or in series with the seal-in contact. Figure 8-22 shows typical winding connections. For terminal markings and other winding details, refer to the diagrams for the motor starter.



Temperature Switch Outline Drawing **Figure 8-21**

Temperature Switch Dimensions **Table 8-12**

Model	Dimensions in Inches & Millimeters	
	PS	RS
AS-14	10.06 256	5.00 127
AS-18	11.75 298	7.31 186
AS-21	13.62 346	8.77 223
AS-25	15.38 391	9.56 243
AS-27 (I -7/8 Shaft)	17.38 441	11.03 280
AS-27 (2-1/2 Shaft)	17.38 441	13.20 335



Typical Temperature Switch Wiring **Figure 8-22**

Vertical Drip Cover

When operating the drive vertically, a sheet metal drip cover, as shown in Figure 8-23, is recommended. It is designed to be installed on the top end to prevent water from falling into the unit. Dimensions are provided in Table 8-13.

Drip Cover Installation

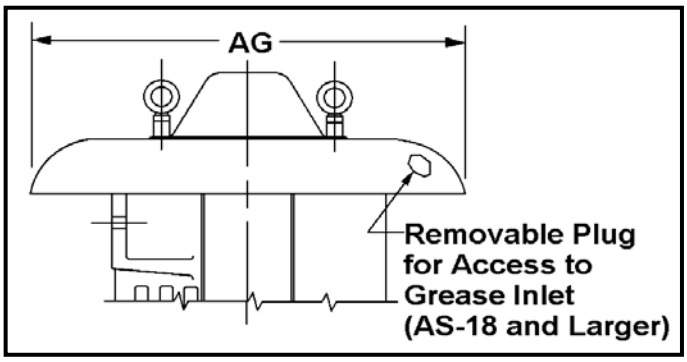
1. Remove the screws and shaft cover from the motor end bracket as shown in Figure 8-1. The cover will be reused.

2. On Model AS-14 only, install label pointing to grease fitting position positioned as not to be obscured by the drip cover.

3. Position the vertical drip cover on the end bracket to that the grease fitting access hole (Model AS-18 and larger only) is adjacent to the grease fitting.

4. Position the shaft extension cover on top of the drip cover. Secure the covers by installing the eyebolts and lock washers.

5. Install the caution label adjacent to an eyebolt.



Drip Cover Outline Drawing **Figure 8-23**

Drip Cover Dimensions **Table 8-13**

Model	Dimensions in Inches & Millimeters
	AG
AS-14	15.75 400
AS-18	18.88 480
AS-21	18.88 480
AS-25	18.88 480
AS-27	22.00 559

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AS-14 –AS-27