ADCO MANUFACTURING

# *Service Manual*

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Model # AFH-60-2-EC

Serial # 3061TK

'WISCONSIN CHEESEMAN'

1-24-91

Please have this information available when calling

7093001

Phone hours 8:00am to 12:00noon and 1:00pm to 5:00pm PDT

Monday through Friday

CONTENTS

FORMERS

# SAFETY REQUIREMENTS
## FORMING MACHINES

All persons involved with this machine and its components whether operating, working on it, or near it, shall read these safety instructions, or be instructed by their supervisor or a qualified person. No one should be allowed to operate this equipment, or perform any type of maintenance, unless they have read these safety instructions or have been instructed by the above mentioned individuals.

## GENERAL SAFETY INFORMATION:

This equipment has been designed to perform its purpose of operation. It has been guarded for the safety of the operator and those who work on it or near it.

While operating this equipment all guards must be in place. Guards, safety switches and interlocks shall not be bypassed for any reason. Any change or modification to the safety equipment of this machinery may produce a hazardous condition which could cause injury or be fatal to persons working with the machine. Operators, and maintenance personnel shall read the entire service manual. No one who has not read the service manual shall be allowed to operate the machinery.

## SAFETY RULES:

1. NO ONE SHALL OPERATE THIS EQUIPMENT UNLESS THEY HAVE READ THE SERVICE MANUAL AND HAVE BEEN INSTRUCTED ON THE SAFETY AND OPERATION OF THE MACHINE BY A QUALIFIED INDIVIDUAL.
2. GUARDS MUST BE IN THEIR PROPER PLACE BEFORE STARTING OR RUNNING THE MACHINE.
3. THE OPERATOR SHOLD LOOK TO INSURE THAT THE MACHINE IS CLEAR BEFORE STARTING UP, AND POSSIBLY CALLING OUT A WARNING TO ALERT THAT THE MACHINE IS BEING STARTED.
4. DO NOT REACH INTO THE MACHINE UNTIL IT HAS COME TO A COMPLETE STOP.
5. ACTIVATE AN EMERGENCY STOP WHEN CLEARING JAMS OR REACHING INTO MACHINE.
6. TURN OFF POWER WHEN PERFORMING MAINTENANCE ON THE MACHINE.
7. WEAR SAFETY GLASSES AND GLOVES WHEN WORKING ON PRESSURIZED HOT GLUE SYSTEMS. (READ INSTUCTIONAL MATERIAL PROVIDED BY HOT GLUE SYSTEMS MANUFACTURER)

SAFETY RULES CONTINUED:

8. DO NOT WEAR LOOSE CLOTHING, JEWELRY WHEN OPERATING EQUIPMENT.

9. ON MACHINES WITH "AUTOMATIC RESTART" PERSONNEL SHALL STAY CLEAR OF MACHINE WHEN STOPPED, TO AVOID POSSIBLE INJURY UPON RESTART.

10. PERSONNEL SHALL BE FAMILIAR WITH THE LOCATION OF STOP SWITCHES OF THE MACHINE.

11. ELECTRICAL CABINETS AND BOXES SHALL NOT BE OPEN UNLESS POWER HAS BEEN DISCONNECTED.

12. DO NOT LEAVE TOOLS IN MACHINE WHEN RUNNING OR START ING UP EQUIPMENT.

13. DO NOT USE MACHINE OR EQUIPMENT FOR ANY OTHER PURPOSE EXCEPT FOR THAT WHICH IT WAS DESIGNED.

14. DO NOT EXCEED THE SPEED FOR WHICH THE MACHINE WAS DESIGNED TO OPERATE AT.

15. ONLY QUALIFIED PERSONNEL SHALL ADJUST, REPAIR AND MAINTAIN THIS EQUIPMENT.

THE FOLLOWING IS A LIST OF AREAS THAT STRONG SAFETY PRECAUTION SHOULD BE OBSERVED:

1.1 DO NOT REACH INTO THE MACHINE AROUND HOPPERS WHILE MACHINE IS RUNNING.

1.2 DO NOT REACH INTO THE MACHINE THROUGH THE CARTON DIS-CHARGE OPENING.

1.3 USE CAUTION AROUND FLIGHT LUGS AND INFEED CONVEYOR LUGS AND TRACK.

1.4 ON HAND LOAD MACHINES KEEP CLEAR OF THE END OF THE LOAD TABLE WHEN IN OPERATION.

1.5 DO NOT REACH OR CRAWL UNDER THE EQUIPMENT WHILE IT IS RUNNING.

Personnel shall be trained and familiarized with said safety rules of this equipment. It is the responsibility of the owner of this equipment to insure the safety of his employees.

## MACHINE ARRIVAL

Your machine and/or equipment has been thoroughly tested at the ADCO facilities prior to shipment, and is ready for your use. Before shipment the machine has been checked to make sure that all nuts, bolts, set screws, and fastening devices are tight. However when machinery is shipped on long distances and even short distances, hardware sometimes has a tendency to work loose.

**THE FOLLOWING IS A GUIDELINE OF WHAT TO DO WHEN YOUR MACHINE FIRST ARRIVES:**

1 INSPECT THE MACHINE THOROUGHLY FOR DAMAGE.

2 (IF POSSIBLE) CHECK THE VEHICLE IN WHICH THE MACHINE WAS SHIPPED FOR HARDWARE WHICH MAY HAVE FALLEN FROM THE MACHINE.

3 CHECK PACKING LIST TO INSURE ALL ACCESSORIES ARE PRESENT.

**BEFORE MOVING THE MACHINE TO ITS FINAL DESTINATION:**

1.1 WATCH FOR HOSES AND ELECTRICAL CONDUITS WHEN MOVING THE MACHINE WITH A FORK LIFT OR OTHER POWERLIFT DEVICE.

1.2 MAKE SURE THE FEET OF THE MACHINE ARE UP AND WILL NOT HIT FLOOR HIGH SPOTS WHEN ROLLING THE MACHINE.

1.3 CHECK PATHWAYS FOR CLEARANCE SO THAT PROPERTY OR MACHINE DAMAGE WILL NOT OCCUR.

1.4 IF SPACE IS LIMITED, MAKE SURE THE MACHINE GOES IN THE RIGHT DIRECTION.

**ONCE THE MACHINE IS IN OR AT ITS FINAL DESTINATION, PERSONNEL INVOLVED SHOULD READ AND EXAMINE THE SERVICE MANUAL, ESPECIALLY THE SECTION ON SAFETY BEFORE GOING ANY FARTHER WITH THE MACHINE.**

## SET-UP AND START-UP

> ONLY QUALIFIED PERSONNEL SHALL BE ALLOWED TO WORK ON THIS EQUIPMENT WHO HAVE READ THE SERVICE MANUAL AND ARE FAMILIAR WITH THE SAFETY AND OPERATION OF THE MACHINE.

As stated in the machine arrival section, machine hardware may have worked loose or fallen off. Your machine may have been shipped in two pieces or with machine accessories. This section helps guide you in setting up your machine, and bring to your attention items you may have missed otherwise.

## SETTING UP THE NEW MACHINE:

1 CHECK THE ENTIRE MACHINE FOR TIGHT, (i.e. NUTS, BOLTS, SPROCKET SET SCREWS, AND FASTENERS).

2 MAKE SURE ALL SPROCKETS HAVE KEYS IN THEM.

3 CHECK INSIDE THE ELECTRICAL CABINET, MAKE SURE NO COMPONENTS HAVE FALLEN.

4 CHECK WIRE TERMINAL STRIP FOR LOOSE CONNECTIONS.

5 INSPECT THE MACHINES WIRE CONDUITS FOR BREAKS, CRUSHED AREAS, AND THAT THE FITTING CONNECTORS ARE TIGHT.

6 ON PRESSURIZED HOT GLUE APPLICATORS CHECK HOSES FOR DAMAGE.

7 ON HOT AIR SEALERS CHECK AIR HOSES LEADING TO HEATERS FOR LEAKS AND TIGHTNESS

## PUTTING THE NEW MACHINE TOGETHER:

Your new machine may have been shipped in two or more pieces, use the machine floor plan prints for proper set up.

1 POSITION THE MACHINE (MAIN MACHINE IF IN TWO PIECES)

2 CHECK DISCHARGE HEIGHT AND INFEED HEIGHT IF MATCHING UP TO OTHER EQUIPMENT.

3 WITH THE MACHINES FEET, LEVEL THE MACHINE. DO NOT USE THE MACHINES CASTERS FOR SET-UP, REMOVE THEM IF THEY OBSTRUCT WHEN TRYING TO LEVEL.

## PUTTING THE MACHINE TOGETHER CONTINUED:

4 CONNECT ADDITIONAL EQUIPMENT TO THE MACHINE (IF ANY), A LIST OF CONNECTING SEQUENCES MAY HAVE BEEN SHIPPED WITH THE MACHINE, IF THERE IS NO LIST, CONNECT COMPONENT(S) AS THEY MATCH UP. CONNECT CHAINS, MATCHING UP TIMING MARKS (IF ANY).

5 INSURE CONNECTIONS ARE TIGHT.

6 MOUNT GUARD ACCESSORIES (IF ANY).

## ELECTRICAL:

**ONLY QUALIFIED PERSONNEL SHOULD PERFORM ELECTRICAL CONNECTIONS TO MACHINE. ALL LOCAL AND STATE REGULATIONS FOR ELECTRICAL CONNECTION SHOULD BE FOLLOWED.**

## BEFORE CONNECTING ELECTRICAL POWER:

1 CHECK THE MACHINES SERIAL NAME PLATE AND THE ELECTRICAL PRINT TO INSURE THE MACHINE IS SET-UP AT THE PROPER VOLTAGE, OR THAT THE PROPER VOLTAGE IS BEING CONNECTED TO THE MACHINE. (IF THE VOLTAGE IS DIFFERENT THAN SPECIFIED, CONTACT ADCO TO NOTIFY THEM OF THE DISCREPANCY, ADDITIONAL EQUIPMENT MAY HAVE TO BE ADDED (i.e. TRANSFORMERS, OVERLOAD HEATERS)).

2 THE ELECTRICIAN SHOULD INSPECT ALL ELECTRICAL APPARATUS'S

3 AN ELECTRICIAN SHOULD CONNECT WIRE CONNECTIONS TO OTHER EQUIPMENT, OR IF MACHINE WAS SHIPPED IN TWO OR MORE PIECES, REWIRING ASSEMBLED MACHINE USING THE ELECTRICAL DIAGRAM.

3 A 1 - 1/8 INCH HOLE IS SUPPLIED AT THE BOTTOM OF THE MAIN ELECTRICAL CABINET FOR CONNECTING POWER TO THE MACHINE.

4 THE MACHINE NAME PLATE SUPPLIES THE AMPERAGE RATING OF THE MACHINE, THE BREAKER AND/OR FUSE SIZE, WIRE SIZE AND TYPE SHOULD CONFORM TO LOCAL AND STATE CODES.

5 A GROUND WIRE MUST ALSO BE SUPPLIED FROM THE PLANTS GROUNDING SYSTEM, AND BE ABLE TO CARRY THE FULL AMPERAGE LOAD OF THE MACHINE.

6 AN ELECTRICIAN SHOULD MAKE SURE THE GUARD INTERLOCK SYSTEM (IF SUPPLIED) IS IN PROPER WORKING CONDITION.

## START-UP:

With all connections made, the machine gone over for tight and the machine guards in their proper place, the machine can be safely started.

## START-UP SEQUENCE:

1 BEFORE TURNING ON THE MACHINE POWER;

A. MAKE SURE THERE IS NO TOOLS LEFT IN THE MACHINE.

B. ALL PERSONNEL SHOULD BE CLEAR OF MACHINE.

2 THE CONTROLS SWITCH ON THE PUSH BUTTON PANEL SHOULD BE OFF AND THE EMERGENCY STOP PRESSED DOWN.

3 TURN ON THE DOOR DISCONNECT OF THE MACHINE.

4 TURN ON THE CONTROLS SWITCH ON PUSH BUTTON PANEL, THE LIGHT ON THE EMERGENCY STOP SHOULD GO ON, IF NOT THEN A PROBLEM EXISTS, IF "ON" GO TO POSITION 5. IF THERE IS A PROBLEM AN ELECTRICIAN SHOULD CHECK THE SYSTEM.

5 PULL UP THE EMERGENCY STOP, MAKE SURE THE MACHINE IS CLEAR, PUT MACHINE IN JOG (IF NO JOG SWITCH THEN HOLD THE STOP BUTTON DOWN AND JOG WITH THE START BUTTON RELEASING THE STOP BUTTON TO JOG).

6 JOG THE MACHINE ONCE, THE MACHINE SHOULD CYCLE, IF THE MACHINE DOES NOT CYCLE, TRY JOGGING AGAIN (SOME MACHINES ARE CONTROLLED BY OTHER EQUIPMENT OR AUTOMATICALLY. THE PUSH BUTTON PANEL MAY HAVE A "MANUAL - AUTOMATIC" SWITCH, IF SUPPLIED, SWITCH TO MANUAL. BE SURE OF THE MACHINES FUNCTION BY READING THE SECTION ON THE OPERATION OF THE MACHINE), IF THE MACHINE WILL NOT JOG AND IT APPEARS THAT THE LUGS ARE TRYING TO MOVE OR YOU CAN HEAR THE MOTOR TRYING TO TURN, POSSIBLY KICKING OUT THE OVERLOAD CLUTCH. STOP JOGGING AND CHECK OVER THE MACHINE AND LOCATE THE JAM OR OBSTRUCTION. ONCE THE MACHINE IS JOGGING AND NO PROBLEM IS SEEN THEN SWITCH TO RUN AND RUN THE MACHINE.

7 ONCE RUNNING, PRODUCTION CAN BEGIN. HOWEVER THE OPERATION SEQUENCE OF THE MACHINE SHOULD BE KNOWN, READ THE "OPERATING THE MACHINE" SECTION OF THIS MANUAL TO BE FAMILIAR WITH THE MACHINES FUNCTION.

**FOLLOW SAFETY RULES WHEN OPERATING THIS EQUIPMENT, SAFETY RULES ARE SUPPLIED IN SECTION 1 OF THIS MANUAL.**

# MAINTENANCE

## CONTENTS

# MAINTENANCE

## MAINTENANCE OVERALL:

Because not all machines are alike and differ from one another, common sense and discretion should be used when setting up a maintenance schedule. It is recommended that the machine be kept clean and well lubricated. GOOD MAINTENANCE means longer machine life and less down time. That means more production time.

## CLEANING:

THE MACHINE SHOULD BE CLEANED IN ACCORDANCE WITH STATE AND LOCAL SANITATION RULES.

It is recommended that the machine be kept clean and well lubed. Areas where the environment is poor, such as dairies or meat packing plants, machines should be washed down on a daily basis. Areas with a cleaner environment can be done just on a visual basis only, using a mild detergent and wiping it down. A clean machine requires less repair time and is much easier to service.

Next is a list of safeguards to observe when cleaning the machine with high pressure cleaning systems.

**WHEN WASHING DOWN MACHINE:**

1. AVOID SPRAYING DIRECTLY AT ELECTRICAL BOXES, WHEN POSSIBLE TURN OFF POWER TO THE MACHINE.
2. DO NOT SPRAY DIRECTLY AT THE PUSH BUTTON PANEL, EMERGENCY STOP STATIONS, PHOTO-EYES, SOLENOIDS, ELECTRIC CLUTCHES, OR ANY ELECTRICAL APPARATUS.
3. IF NECESSARY COVER ELECTRICAL DEVICES WITH PLASTIC.
4. AVOID SPRAYING DIRECTLY AT MOTORS.
5. DO NOT ALLOW WATER TO SIT ON MACHINE, BLOW OFF WITH AIR.
6. CLEAN ELECTRICAL DEVICES SUCH AS CONTROL PANEL, EMERGENCY STOP STATIONS, PHOTO-EYES, ETC. WITH A WET WASH CLOTH.
7. AVOID SPRAYING ADHESIVE POTS, HOT AIR GUNS/NOZZLES OR GAS BURNERS.
8. NO WATER SHOULD BE USED NEAR THE HOT AIR GUNS, IF MOISTURE ENTERS THESE UNITS IT WILL DESTROY THEM.

# MAINTENANCE

## LUBRICATION:

The importance of maintenance cannot be stressed enough, if machinery is left alone and not taken care of it will break down when you least expect . If machine is well maintained of coarse it will last longer, but, because the machine is maintained on a regular basis, maintenance personnel can see trouble before it strikes, avoiding costly down time.

This section gives a generic lubrication schedule for the machine. The schedule can be followed safely, but we recommend you refer to the manufacturers parts information for a more accurate lubrication schedule of each particular item, (e.i. Gearboxes, Bearings, etc.). Manufacturers parts list and instructions are kept at the end of this manual.

## BEARINGS:

Bearing manufacturers usually do not supply information pamphlets with their product, it is commonly placed in their equipment catalog. A particular catalog for a specific bearing may not be available at your facilities, so a general lubrication schedule is set up here to aid you in making a lubrication timetable for your machine.

**SUGGESTED BEARING LUBRICATION:**

| MACHINE SPEED | LUBE SCHEDULE |
|---|---|
| SEALED BEARINGS | |
| 0 - 60 CPM | TWICE MONTHLY |
| 60 - 120 CPM | BI-WEEKLY |
| 120 - 300 CPM | ONCE WEEKLY |
| 300 CPM AND ABOVE | DAILY |
| OPEN BEARINGS (NON SEALED) | |
| 0 - 60 CPM | BI-WEEKLY |
| 60 - 120 CPM | ONCE WEEKLY |
| 120 - 300 CPM | ALTERNATE DAYS |
| 300 CPM AND ABOVE | TWICE DAILY |

(This list is based on an average 10 hour operating day, 5 days a week, and in average conditions. If the machine is subject to extended operating hours, or the machine is set in a harsh environment such as wet or very dusty conditions, the schedule should be adjusted to a more frequent application).

## BUSHINGS AND CAM RACEWAY'S:

LINEAR BUSHINGS:

Most of ADCO'S bushing type applications, as in the Barrel Cam section, utilize self lubricating Delrin bushings that do not require lubrication, only that the linear traveling shafts be kept clean and sprayed with a light oil to keep them from rusting. Also wipers are placed at both ends of the bearing(s) to help keep foreign materials out.

Although these bushings and shafts can operate satisfactory without added lubricants, in severe conditions where dust and contaminants are a factor, lubrication should be added.

## BUSHINGS AND CAM RACEWAY'S:

BRASS OR BRONZE TYPE BUSHINGS:

Brass or bronze bushings require a daily application of lubricant. If bushings run dry, lubricate immediately.

CAM TRACKS OR RACEWAYS:

Grease weekly, (grease immediately if dry).

Cam followers with grease fittings can be lubed according to the sealed bearing schedule.

## CHAINS:

DRIVE CHAINS:

Keep oiled, do not allow to run dry. Check weekly.

Lubricate with a medium grade oil or spray on type lube.

PRODUCT INFEED CONVEYOR CHAINS:

DO NOT RUN DRY. Lube with a medium grade oil. Avoid getting oil on product carrying surfaces. (In food packaging applications use an approved food grade lubricant).

## CHAINS CONTINUED:

FLIGHT CHAINS (CARTON CARRIER CHAIN):

DO NOT RUN DRY. Lubricate with a medium grade oil. Avoid getting oil on the chain lugs and the carton runners. (Use food grade lubricant in food packaging applications).

## GEARBOXES:

Gearbox (i.e. inline reducers, right angle drives, indexers, tolomatics, etc.) manufacturers differ widely in brand and as well as model type, size, and application. Because of this, no lubrication schedule is set up here. Instead we recommend that you follow the manufacturers lubrication schedule and requirements for that particular device, (manufacturers specification pamphlets are located at the end of this manual). However, here is a list of items that would suggest a gearbox may need attention.

1 GEAR BOX OPERATING AT A HIGH TEMPERATURE.

2 OIL DIRECTLY UNDER GEARBOX.

3 LOUD OPERATING NOISE.

## OPEN GEARS:

DO NOT RUN DRY. See recommended lubricant at the end of this section. Keep well lubed, checking weekly, or daily for high speed applications.

## VACUUM PUMPS:

Some vacuum pumps are equipped with an oil bottle that lubricate the pump while it runs, keep full with a 10 weight detergent oil. Do not run dry or reuse old oil. Used oil will show up (fill up) in the muffler bottle, (this is normal).

Clean the vacuum bottles and filters weekly, if left alone vacuum pressure response time will be reduced, which may cause carton feed failure. Inspect hoses and vacuum cups rugularly for cracks.

## AIR-LINE LUBRICATORS:

CHECK FLUID LEVEL IN BOTTLE WEEKLY. FILL WITH PNEUMATIC OIL TO INDICATED LEVEL.

CLEAN OR DRAIN FILTER BOTTLE AS NEEDED.

## RECOMMENDED LUBRICANTS:

| | LUBRIPLATE | MOBIL |
|---|---|---|
| FLIGHT CHAINS | FMO-85 | |
| CHAINS (DRIVE AND PRODUCT CONV) | APG 80W-140 | |
| OPEN GEARS | FML-2 | MOBILTAC E |
| BEARINGS | FML-1 | MOBILUX EP2 |
| CAM FOLLOWERS, CAM RACES | FML-2 | MOBILUX EP2 |
| VACUUM PUMPS | FMO-85 | AD220 (GAST) |
| AIR LINE LUBRICATORS | FMO-85 | |

AUTO LUBE SYSTEMS OR GROUP LUBE SYSTEMS:

GREASE.....930-AA (LUBRIPLATE)

OIL.....FM754 NO. 3 (G-C LUBRICANTS)

GEARBOX (G.B.) LUBRICATION

| | |
|---|---|
| BOSTON G.B. | R&0 150,HD 150,MOBIL SHC-634 SYNTH. |
| ECONOGEAR | MOBIL 636 150 V.E. 680 |
| EURODRIVE | MOBIL 636 150 V.E. 680 |
| HUB CITY G.B | HUB CITY ALL TEMP. SYNTH GEAR OIL MOBIL 636 150 V.E. 680 |
| OHIO G.B | MOBIL 636 150 V.E. 680 |
| SM-CYCLE GEAR | MOBIL 636 150 V.E. 680 |
| U.S. MOTOR G.B | MOBIL 636 150 V.E. 680 |
| VON RUDEN | MOBIL 636 150 V.E. 680, SAE 140 W/ANTI FOAM AGENT |

NOTE: CHANGE GEARBOX OIL EVERY SIX MONTHS. IF OPERATING TEMPERATURE OF GEARBOX IS ABOVE 180 DEGREES FARENHEIT CHANGE GEARBOX OIL MORE FREQUENTLY.

## GENERAL DESCRIPTION OF MACHINE FUNCTION:

The Forming Machine forms cartons from simple die-cut (flat) blanks. A blank is picked from the hopper and placed on the forming frame; the plunger then pushes the blank through the formingframe where the tabs, corner posts, end panels, and lid are folded up to make a finished erect carton.

The Forming Machine has variable speed control to meet production requirements or to match speeds of other equipment. Cartons are called for by means of either a foot switch or selector switch on the control panel, or automatically where feeding is controlled by a backup eye that stops the former from picking cartons when the takeaway conveyor becomes full and is automatically restarted when the eye becomes clear.

From the Forming Machine the cartons are then ready for loading, whether by hand or automatically. Then top sealed by other equipment.

## STARTING, STOPPING AND SPEED CONTROL:

CONTROL SWITCH:

The control switch controls all switches on the main panel, when this switch is off all the button and selector switches on the main panel are inactive.

START BUTTON:

The machine can only be started at the main push button station, where other machine functions are controlled. When starting up for production, all necessary switches should be on (i.e. Vacuum, Glue, Hot Air, Conveyors, etc.). The machine will only start when all guards are closed. (DO NOT DEFEAT THE GUARD INTERLOCK CIRCUIT, OR OPERATE THE MACHINE WITH GUARDS REMOVED OR PERSONAL INJURY COULD RESULT).

STOP BUTTONS:

There are two stop buttons located on the main panel, one is labeled "STOP" and the other "EMERGENCY STOP". The emergency stop button is a maintained button which stays in position whether it is pushed down or pulled up. When pushed down it prevents the machine from being accidentally started.

JOG SWITCH:

A "JOG / RUN" selector switch is supplied on the main panel to aid in change-over and set-up of the machine. When in jog mode the machine can be jogged or inched by the start button on the main panel when the guard doors are closed.

A hand held Jog Button with cord is supplied that allows easier access to different area's of the machine for set-up and change-over. The jog button only operates when the machine is in the jog mode, and bypasses the guard interlock circuit.

SPEED CONTROL:

This control switch can be used to adjust the machine speed to match your production needs. Care should be taken that the machine is not used at higher than recommended speeds.

EMERGENCY STOP:

A micro switch has been provided to insure stopping of the former with the vacuum cups away from the heating nozzles. If the speed on the machine is changed drasticly the cam, activating this micro switch should be adjusted to stop the machine in the correct position.

HOT AIR GUNS (IF APPLICABLE)

Check that blower is truning in the correct direction. This will assure correct air supply to the heaters, hoses should be checked once a week for good connections and leaks. Settings for air and heat at the guns should be kept to a minimum, enough to get a good seal on the carton. Too much air on the setting switch could result into blow back in the guns and a shorter life expectency.

## OPERATING THE MACHINE:

Depending on the sealing or flap locking system of the machine a warmup time may be required. Example, if your cartons use locking tabs no warmup time is necessary. If your machine has a Hot Air sealing system then the hot air guns should be allowed to warm up to operating temperature, which only takes a few minutes. On Hot Melt sealing systems the glue must have at least a 30 minute warm-up time to achieve operating temperature and melt enough glue in the reservoir for operation. After warming up the sealing system (when required), the machine can then be started.

VACUUM:

Once ready for picking the blanks the vacuum switch can be turned on. At this time carton blanks can be picked for forming. Depending on the system to call cartons for picking, one or more of the items below may apply to your forming machine.

FOOTSWITCH:

To pick a blank, depress the pedal on the footswitch. As long as the switch is held down carton blanks will be picked continuously until the footswitch is released. (Some machines may have the footswitch working opposite than stated above, where the carton blanks are picked continuously until the footswitch is pressed to stop the picking).

AUTOMATIC:

An "AUTO - MANUAL" selector switch may be supplied on the main panel. When in Manual mode a footswitch or other similar device is used to control picking. When in Auto mode (Automatic), carton blanks will be picked automatically until some device signals to stop picking (i.e. Photo-eye, switch, or machine interface).

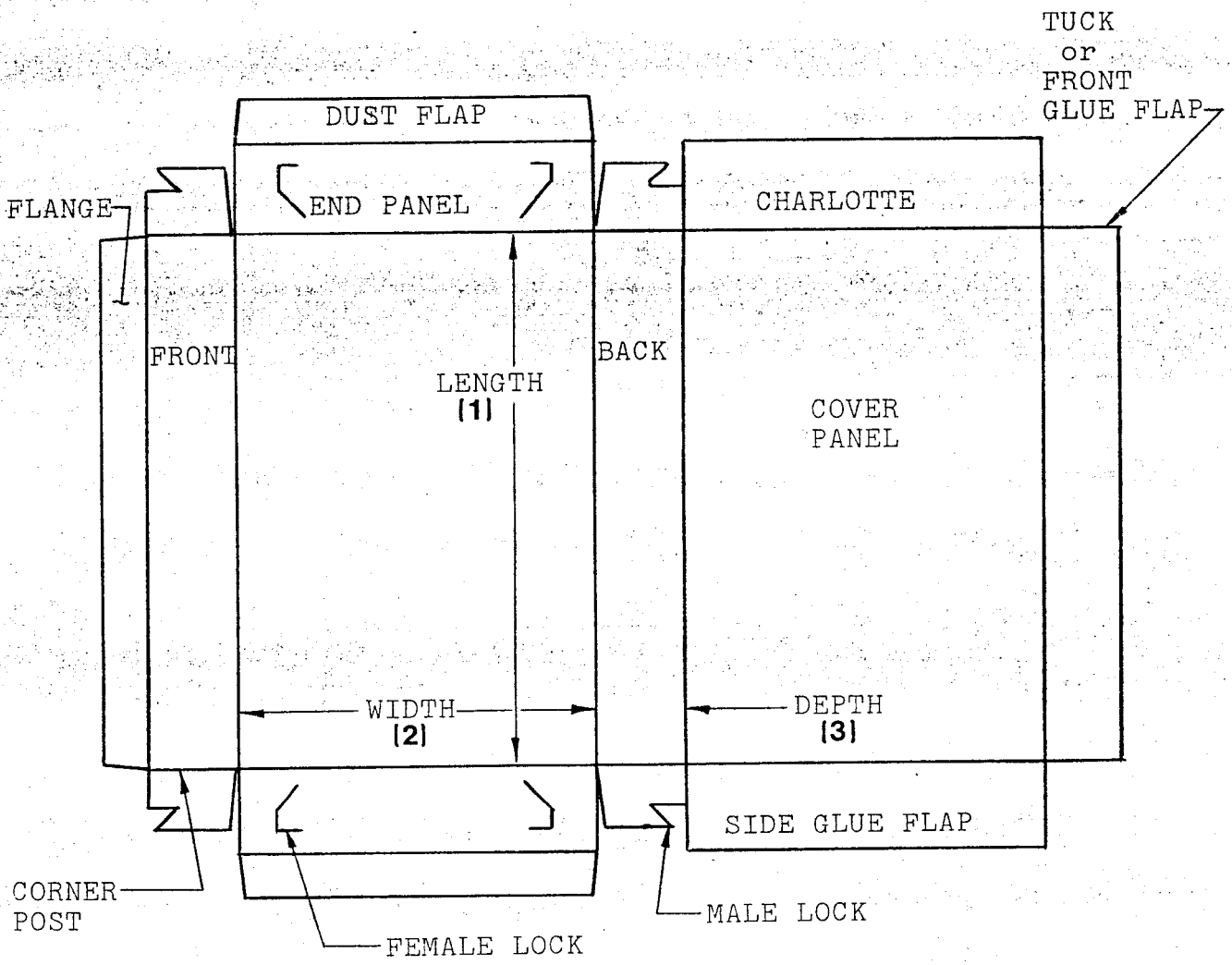
Once in production, Hot Melt reservoirs (where applicable) and hoppers should be periodically checked, refilling as necessary. (With pressurized Hot Melt systems if the glue runs out it takes about 15 minutes for the glue to warm up enough to start production again).

## GUARD DOOR INTERLOCKS:

The machine is provided with electrically interlocked guards that stop the machine when a door is opened. This is to protect operators and keep them from reaching into the machine while it is running. DO NOT ALTER THE GUARD INTERLOCK SYSTEM, AS PERSONAL INJURY MAY OCCUR. (See SAFETY section).

# SET-UP SEQUENCE
FORMING MACHINE
STRIPPER LOCK STYLE

# CARTON TERMINOLOGY




NOTE: GRAIN DIRECTION SHOULD BE DIRECTION OF CORNER POST

4. Lower the plunger with the bottom edge level with the bottom edge of the brass Fig.2-G. Follow instructions as described to set brass folding shoes. Fig. 2-F

5. Install vacuum bar (see Fig. 6 before installation of this bar.)

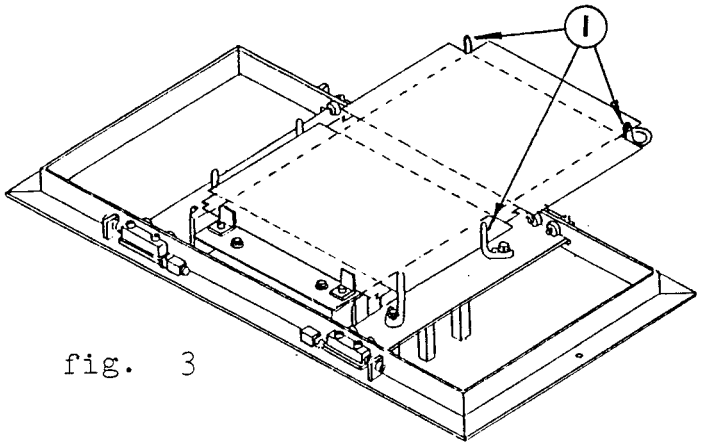



fig. 3

6. Raise plunger, place carton on forming frame, lower plunger to touch carton. Locate carton under plunger as shown in Fig.2-H and place register pins to hold the carton in the correct place under the plunger. Fig.3-I. (Carton should not be allowed to move more than 1/32" overall)

7. With a carton on the forming frame, bring the vacuum cups to just touch the carton, mark the position of the cups on the carton. (The cups should be positioned as low as possible on the carton as shown on Fig.4) Place the carton in the hopper frame, position the stack support rods and side guide rods to place the carton correctly on the cup marks as shown in Fig.4

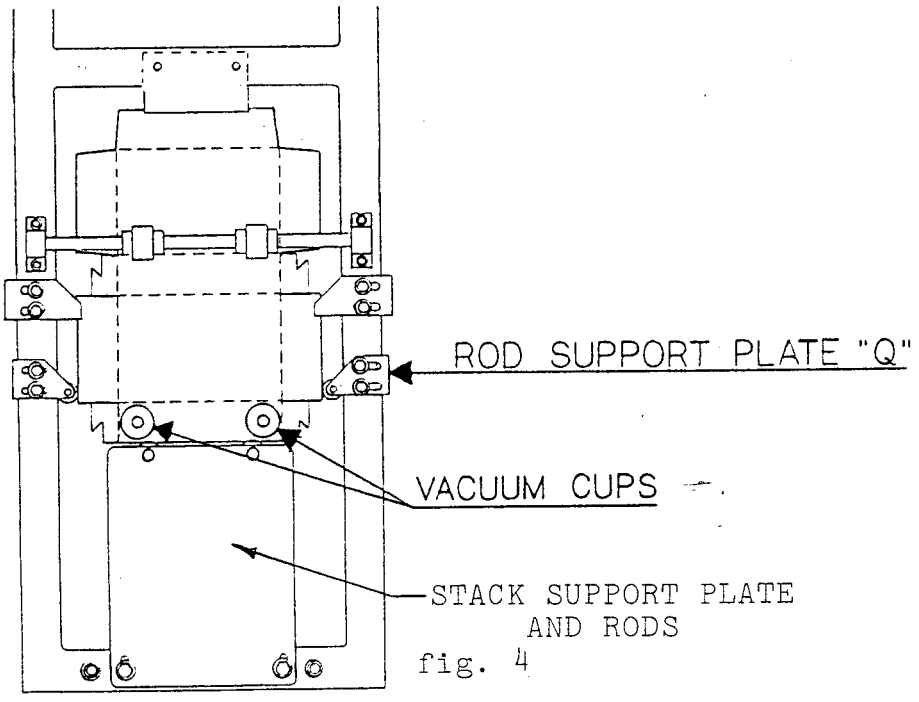



fig. 4

SET-UP SEQUENCE

FORMING MACHINES
(STRIPPER LOCK STYLE)

FORMING ASSEMBLY SET-UP

1. Lower plunger into cavity about halfway, make sure that the plunger front face is perpendicular with the front edge of the forming frame. Fig. 1-A

2. Plunger should then be equally spaced between the sides in the forming frame. Fig 1-B. The sides should then be adjusted to leave a space of no more than two board thicknesses between the plunger sides and the side frame cam bars. Fig 2-D

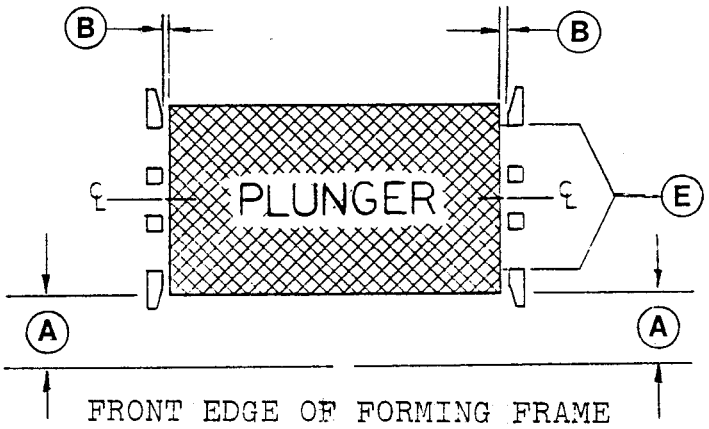


fig. 1

3. The Fig.2-C side bars should now be adjusted with edges Fig.1-E equally spaced to the lock tip cut-outs of the plunger.

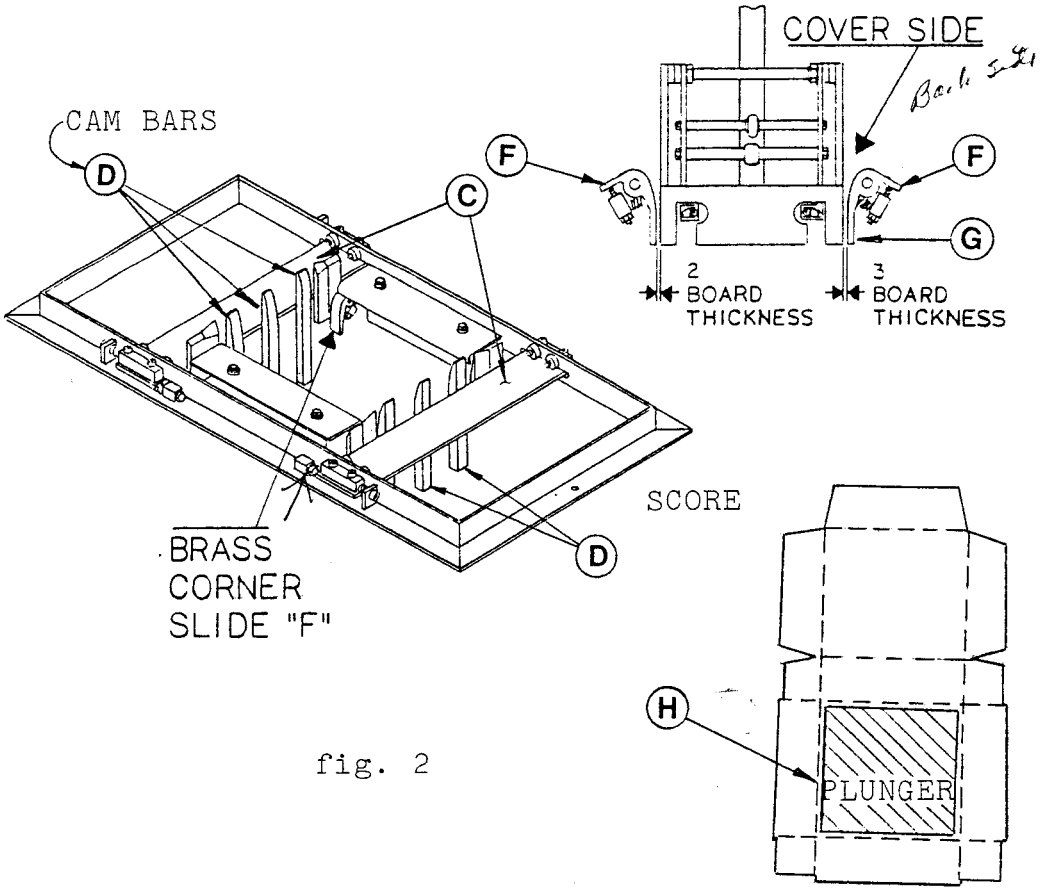


fig. 2

* If the plunger needs to be moved to make the adjustments in paragraph 2-3, capscrews "E" Fig.5 should be loosened to make the necessary adjustments. Once the plunger is centered these should not have to use again.

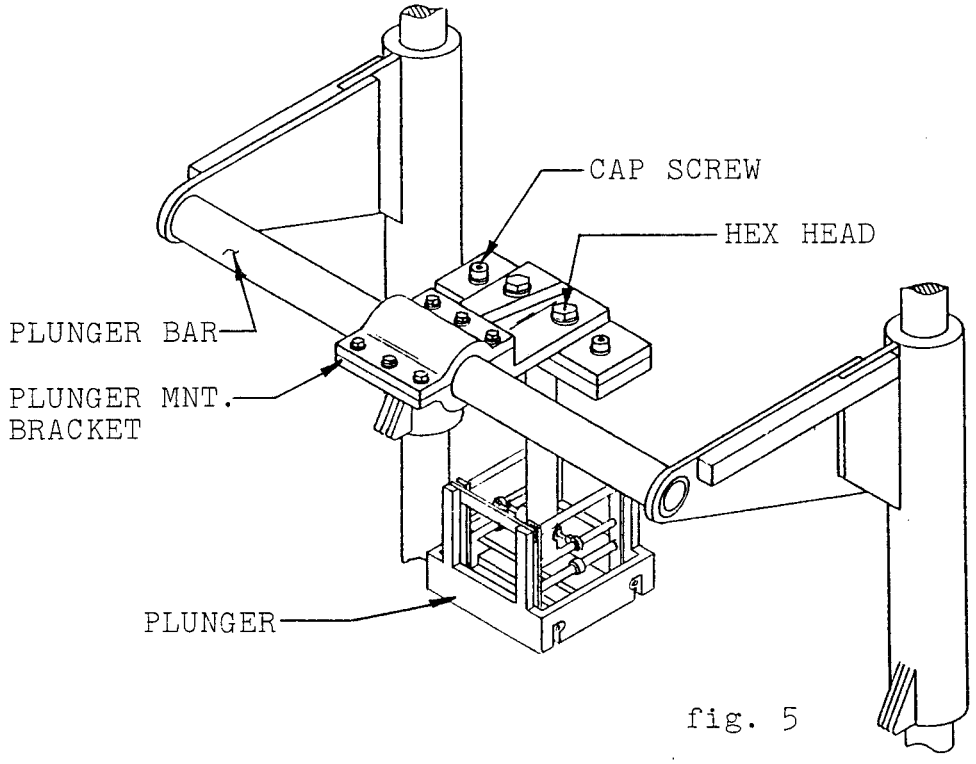



fig. 5

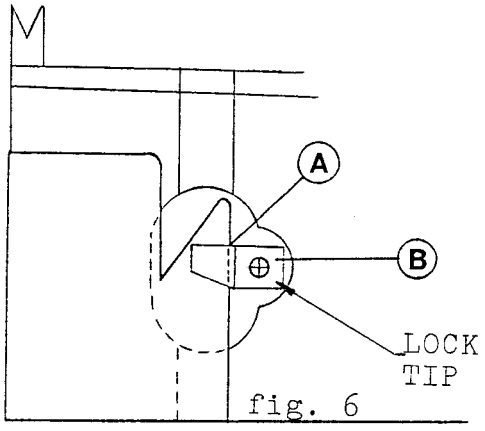



fig. 6

# TROUBLE SHOOTING HINTS
## FORMING MACHINES
## STRIPPER LOCK STYLE

# TROUBLE SHOOTING HINTS

## FORMING MACHINES
## (STRIPPER LOCK STYLE)

SETTING LOCK TIPS:

When the male tab of the carton is folded up against the plunger, with the scores foded on the edge of the plunger, the outer edge of the locking tab Fig.6-A and Fig.8-A should fold inside the lock tip Fig 6-B. Care should be taken that the tip is not too far outward to buckle the carton locking tab.

* If locking tips do not pull lock tabs completely through the female portion of the carton.

Move arm (Fig. 7-A) outward will add more travel to cam follower (Fig.7-C) and will pull the carton male locking tab deeper into the plunger. Care should be taken that dimension (Fig.7-B) does not become less than one board thickness.

INCONSISTENT LOCKING:

Check carton register from hopper to forming frame. Carton should have no more than 1/32" overall play within the rigister pins.

VACUUM PROBLEMS:

Check vacuum cups for cracks and hoses for clogging, paper dust will clog the lines. Cups should not be set on scores unles the board is light enough not to break the vacuum avoid placing vacuum cups over cuts or cut scores.

CARTONS NOT STRIPPING OF PLUNGERS:

Spring loaded mechanical strippers are used on some equipment on others the cam bars on each side are used to strip the carton. When the locktabs are not pulled through, the carton does not bow out on the side, this creates stripping problems. Lock tip adjustment will be necessary or check distance between cam bars and plungers.

DOUBLE FEEDING:

Careful when fanning cartons, thumb pressure on the lock areas when handling a stack of cartons, could result in cartons interlocking and pulling out a second carton from the hopper. Keep vacuum cups as far down and outward on the carton as possible.

# TROUBLE SHOOTING/DO'S AND DONT'S
## FORMING MACHINES
## (STRIPPER LOCK STYLE)

At no time should the plunger mounting bracket (Fig.5-D) be loosened at the six bolts, clamping it to the plunger bar, (Fig.5-CC) This will change the plunger position and could cause severe damage to the plunger and forming frame.

If your machine has a rotary vaccuum valve, at no time should this valve be oiled. An oily film will suck into the vacuum line causing a clogged line.

Check the stettings of the brass folding shoes often. They should not be set against the plunger, this will cause unnecessary wear. Check the jam nut for tightness.

Make sure stack hold-down in the hopper is down on the stack double feeding could result if the cartons are not held down on the bottom support rods.

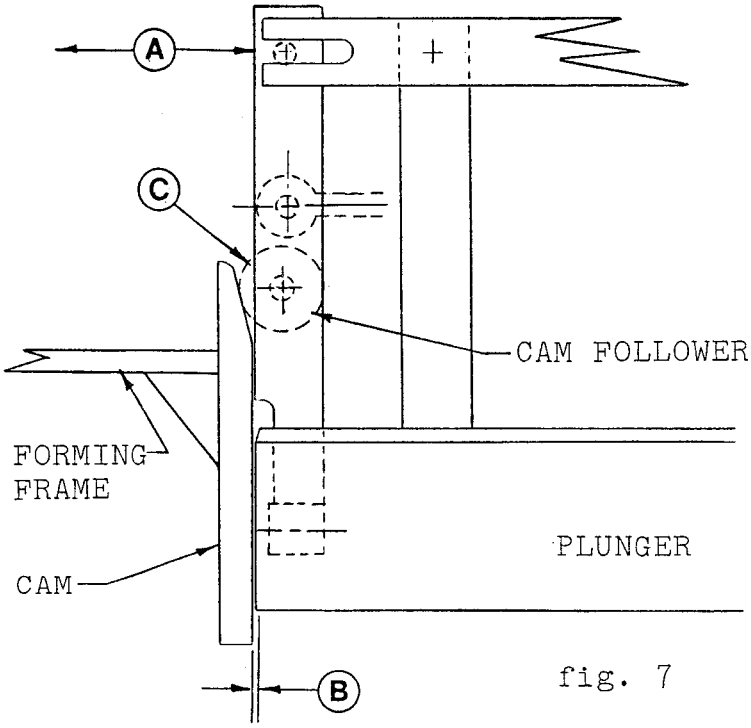



fig. 7

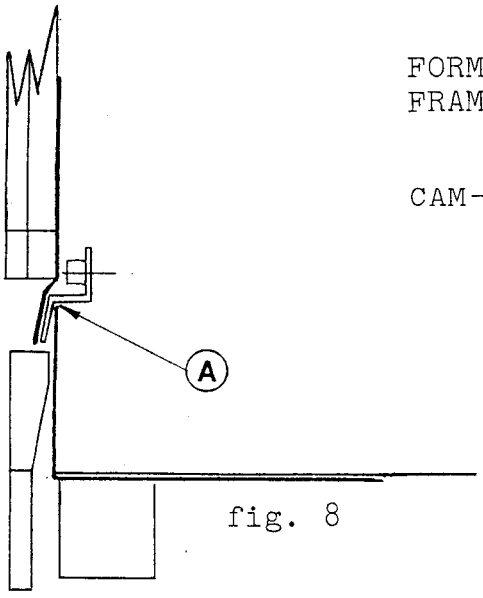



fig. 8

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# Parts Drawings &

# Recommended Spare Parts List

# PARTS ORDERING PROCEDURE

I. WHEN ORDERING PURCHASED PARTS, ALWAYS SPECIFY:

A. BRAND NAME
B. PART NUMBER (IF AVAILABLE)
C. VOLTAGE (IF APPLICABLE)
D. MACHINE MODEL #
E. MACHINE SERIAL #

IF THIS INFORMATION IS NOT AVAILABLE, PLEASE SPECIFY WHERE THE PART IS USED ON THE MACHINE.

II. WHEN ORDERING ALL OTHER PARTS

A. USE PARTS DRAWINGS SUPPLIED (ILLUSRTATED PARTS SECTION), BY ADCO WHENEVER POSSIBLE.
B. WHEN DRAWINGS ARE NOT AVAILABLE FROM ADCO, PLEASE DESCRIBE WHERE THE PART IS USED ON THE MACHINE

E.G,-

*WHICH SIDE OF THE MACHINE, THE LEFT HAND OR THE RIGHT HAND SIDE LOOKING DOWNSTREAM.

*WHAT ASSEMBLY THE PART IS USED IN, THE TUCKER ASSEMBLY, THE HOPPER ASSEMBLY ETC.

NOTE: WHEN ORDERING SHAFTS, ALWAYS SPECIFY LOCATION OF SHAFT ON MACHINE, DIAMETER OF SHAFT AND THE LENGTH OF THE SHAFT. ALSO, WHEN ORDERING SPROCKETS AND GEARS, ALWAYS SPECIFY PITCH, NUMBER OF TEETH ADN BORE SIZE.

ADCO MANUFACTURING, INC.
2170 ACADEMY
SANGER, CALIFORNIA 93657

# RECOMMENDED SPARE PARTS LIST

CUSTOMER: WISCONSIN CHEESEMAN
MODEL: AFH60-2-EC
SERIAL NO: 3061TK

## MECHANICAL

| PART NO. | QTY REC | QTY TOTAL | DESCRIPTION | PRICE |
|---|---|---|---|---|
| 5100-25 | 2 | 4 | "WALDES" TRUARC RETAINING RING .250 O.D. SHAFT | |
| FB46-2 | 2 | 4 | "BOSTON" BOST-BRONZE FLANGE BEARING | |
| LE-081B-2 | 8 | 4 | "LEE" EXTENSION SPRING 3/16 O.D. X .018 DIA MUSIC WIRE X 7/8 FREE LENGTH | |
| LC-072H-3M | 1 | 1 | "LEE" COMPRESSION SPRING 1" FREE LENGTH | |
| LC-063J-3 | 4 | 4 | "LEE" COMPRESSION SPRING 1" FREE LENGTH | |
| 5100-31 | 2 | 4 | "WALDES" TRUARC EXTERNAL RETAINING RING 5/16 DIA SHAFT | |
| LC-063H-7 | 1 | 2 | "LEE" COMPRESSION SPRING (.600 O.D. X .063 WIRE DIA X 1 3/4 FREE LENGTH) | |
| MM-4 | 1 | 2 | "AURORA" MALE ROD END BRG. W/1/4-28 R/H THDS | |
| CYR-1 | 1 | 2 | "MC GILL" CAMROL BRG-1" O.D | |
| LC-045E14 | 2 | 4 | "LEE" COMPRESSION SPRING | |
| 66-P | 1 | 1 | "IMPERIAL" POLY-FLO TUBING 3/8 | |
| 3/8 ODX1/4ID | 1 | 1 | CLEAN VINYL TUBING-VAC LINE | |
| 5/8 ODX1/2ID | 1 | 1 | CLEAN VINYL TUBING-VAC LINE | |
| 390H150 | 1 | 1 | "DODGE" DYNA-SYNC BELT 1/2 PITCH-1 1/2" WIDE | |

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# RECOMMENDED SPARE PARTS LIST

CUSTOMER: WISCONSIN CHEESEMAN
MODEL: AFH60-2-EC
SERIAL NO: 3061TK

## MECHANICAL

| PART NO. | QTY REC | QTY TOTAL | DESCRIPTION | PRICE |
|---|---|---|---|---|
| FC2-25-1 1/2 | 1 | 2 | "MCGILL" FLANGE BRG 1 1/2 BORE | |
| FC2-25-3/4 | 2 | 4 | "MCGILL" FLANGE BRG 3/4 BORE | |
| CF-3/4 | 1 | 2 | "MCGILL" CAMROL CAMFOLLOWER BRG 3/4 BORE | |
| M2428-24 | 2 | 4 | "BOSTON" BRONZE BRG | |
| 1480 | 2 | 2 | "CR SEALS" TYPE HM14-LIP V (VITON) | |
| 77R4 | 4 | 6 | "NEW DEPARTURE" RADIAL B/B SERIES "R" | |
| DW6 | 2 | 2 | "FAFNIR" EXTRA WIDE, DBL ROW BRG (3/8 BORE) | |
| RR-106 | 2 | 4 | "SPIROLOX" RETAINER RING FOR 1 OD BRG | |
| KP12 A | 4 | 4 | "FAFNIR" RADIAL TYPE BRG 3/4 BORE | |
| DW 8 | 2 | 2 | "FAFNIR" EXTRA WIDE DBL ROW BRG 1/2 BORE | |
| DW6 | 2 | 2 | "FAFNIR" EXTRA WIDE BRG | |
| RR-162 | 2 | 2 | "SPIROLOX" RETAINER RING FOR 1 5/8 | |
| 5555-50 | 2 | 4 | "WALDES" TRUARC GRIP RING FOR 1/2 DIA SHAFT | |
| 240L050 | 1 | 1 | "BROWNING" GEARBELT 3/8" PITCH STOCK "L"-1/2 WIDE | |

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# RECOMMENDED SPARE PARTS LIST

CUSTOMER: WISCONSIN CHEESEMAN
MODEL: AFH60-2-EC
SERIAL NO: 3061TK

## MECHANICAL

| PART NO. | QTY REC | QTY TOTAL | DESCRIPTION | PRICE |
|---|---|---|---|---|
| MM-4 | 2 | 5 | "AURORA" MALE ROD END, 1/4 BORE 1/4 28 R/H THDS | |
| MB-4 | 1 | 1 | "AURORA" MALE ROD END BRG 7/16 BORE 1/4-28 L/H THDS | |
| AM-7T | 2 | 6 | "AURORA" MALE ROD END BRG 7/16 BORE 7/16-20 R/H THDS | |
| AB-7T | 2 | 6 | "AURORA" MALE ROD END BRG 7/16 BORE 7/16-20 L/H THDS | |
| 01CLA3 | 1 | 1 | "NUMATICS" 3-WAY ROLLER LEVER LIMIT VALVE | |
| K247 | 1 | 1 | "GAST" VACUUM PUMP REPAIR KIT | |
| AE274 | 1 | 2 | PLASTIC JAR, INTAKE/EXHAUST VAC PUMP GAST | |
| B62A | 1 | 2 | GASKET FOR ABOVE JAR-GAST | |
| #56 | 6 | 2 | VACUUM CUPS | |

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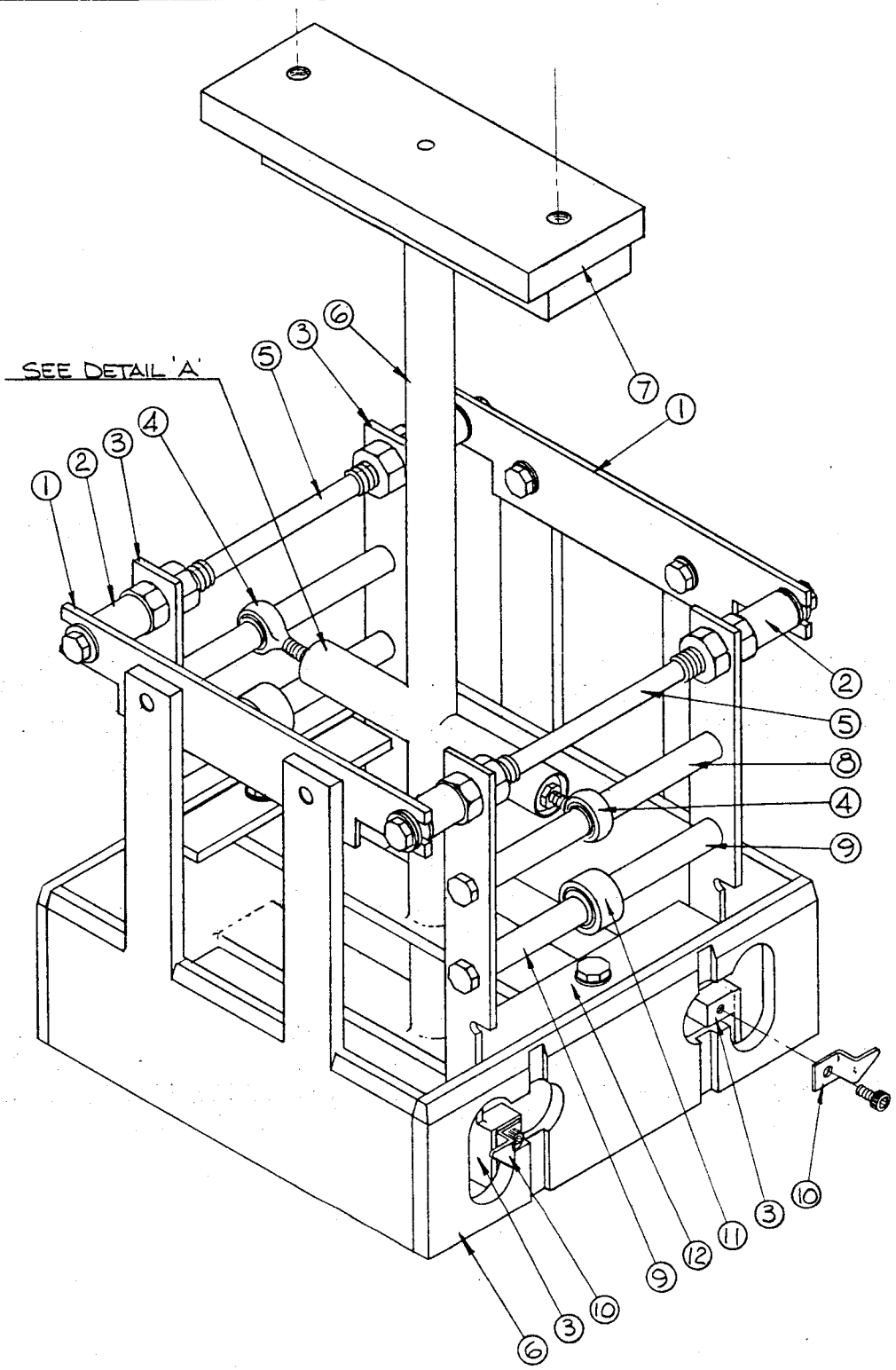
# RECOMMENDED SPARE PARTS LIST

CUSTOMER: WISCONSIN CHEESEMAN
MODEL: AFH60-2-EC
SERIAL NO: 3061TK

## ELECTRICAL

| COMPUER NO./ PART NO. | QTY REC | QTY TOTAL | DESCRIPTION | PRICE |
|---|---|---|---|---|
| BZE6-2RN | 1 | | LIMIT SWITCH, "MICRO" | |
| 802T-ALP | 1 | | LIMIT SWITCH, "A.B." | |
| 802T-W1 | 1 | | ROLLER LIMIT SWITCH, "A.B." | |
| 531F-012 | 1 | | "MAC" VALVE | |
| W-47 | 2 | | STARTER HEATER | |
| 227-833B | 1 | | "NUMATIC" 120V COIL | |
| KTK-R-1 | 1 | | FUSE | |
| KTK-R-2 | 1 | | FUSE | |
| KTK-R-3 | 1 | | FUSE | |
| KTK-R-10 | 1 | | FUSE | |
| PET 1481 | 1 | | TD RELAY | |
| 800T-XA | 1 | | CONTACT BLK. | |
| 800M-N15 | 1 | | LAMP, JOG/RUN SELECTOR | |
| 800T-N65 | 1 | | LAMP, E-STOP INDICATOR | |
| 800T-16HA2KB6AX | 1 | | 2 POSITION ILLUM. | |




DETAIL 'A'

ADCO MANUFACTURING, INC.

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| | | |
|---|---|---|
| SCALE: ~ | APPROVED BY: | DRAWN BY: DK |
| DATE: 2-7-90 | STRIPER LOCK "STYLE" | REVISED |

# FORMING HEAD

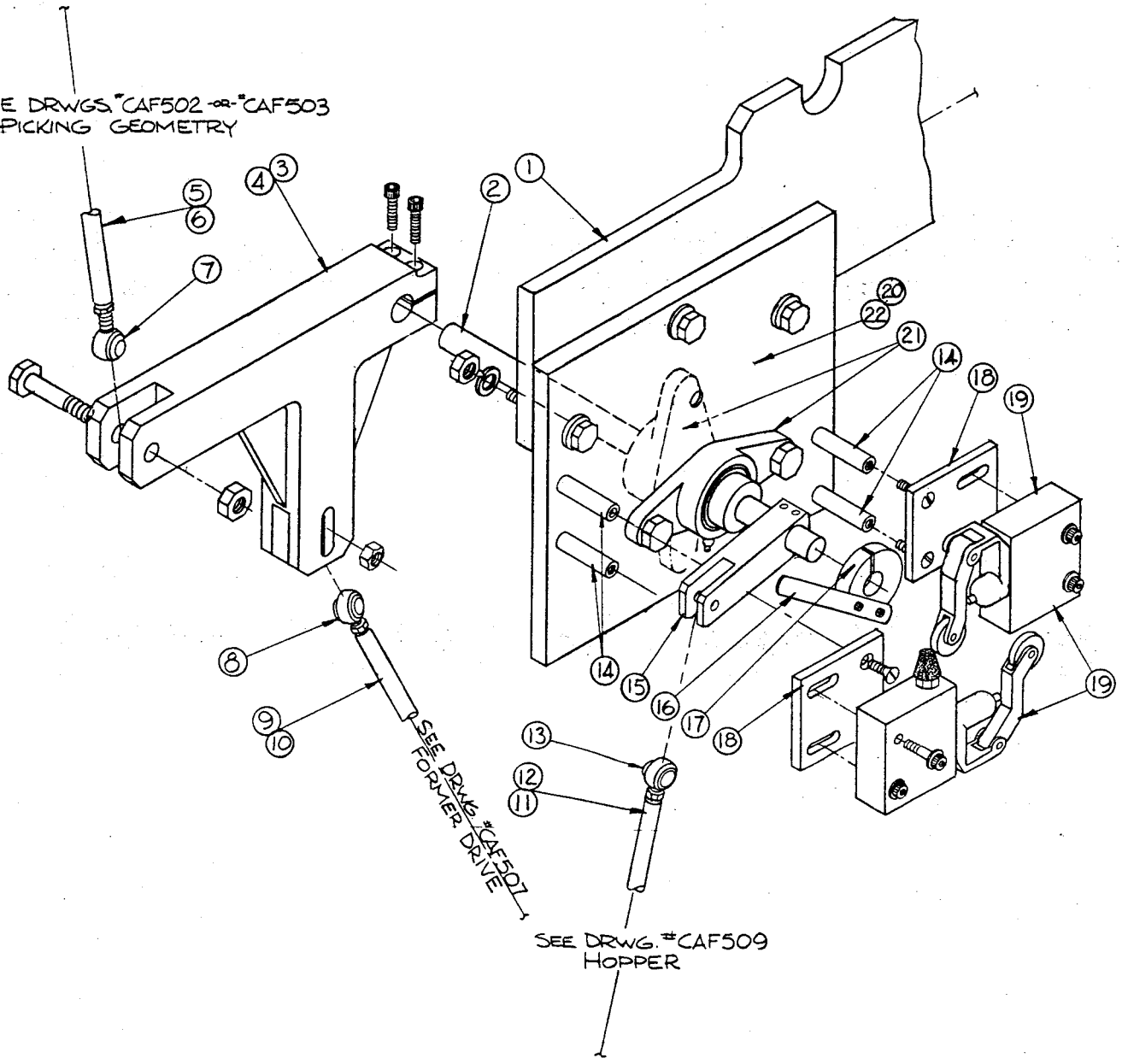
FORMING MACHINES

DRAWING NUMBER: CAF505

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## FORMING HEAD
## STRIPPER LOCK STYLE
## CAF505

| ITEM | ASSEMBLY/PART | PART NO | QTY |
|---|---|---|---|
| 1 | CROSS ARM | | 2 |
| 2 | SPACER | A09S-.62-.375- | 4 |
| 3 | PLUNGER TIP MOUNT ARM | | 4 |
| 4 | "AURORA" MALE ROD END 1/4"-28 R/H | MM-4 | 2 |
| 5 | PIVOT ROD, ADJUSTING | | 2 |
| 6 | CARTON PLUNGER HEAD MNT | | 1 |
| 7 | FORMING HEAD MOUNING PLATE | | 1 |
| 8 | SPACER | A09-S-.50-.250 | 4 |
| 9 | SPACER | A09-S-.56-.312 | 4 |
| 10 | TABLOCK FINGER | | 4 |
| 11 | CAMROL BRG 1" O.D. "MCGILL" | | 2 |
| 12 | PLUNGER TIP MTG ARM GUIDE | | 2 |
| 13 | PIVOT SPRING STOP | | 2 |
| 14 | PIVOT SPRING SPACER PLUG | | 2 |
| 15 | COMPRESSION SPRING "LEE" | LC-063H-7 | 2 |

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|---|---|---|
| DATE: 12-19-89 | | REVISED |

# PICKING VACUUM

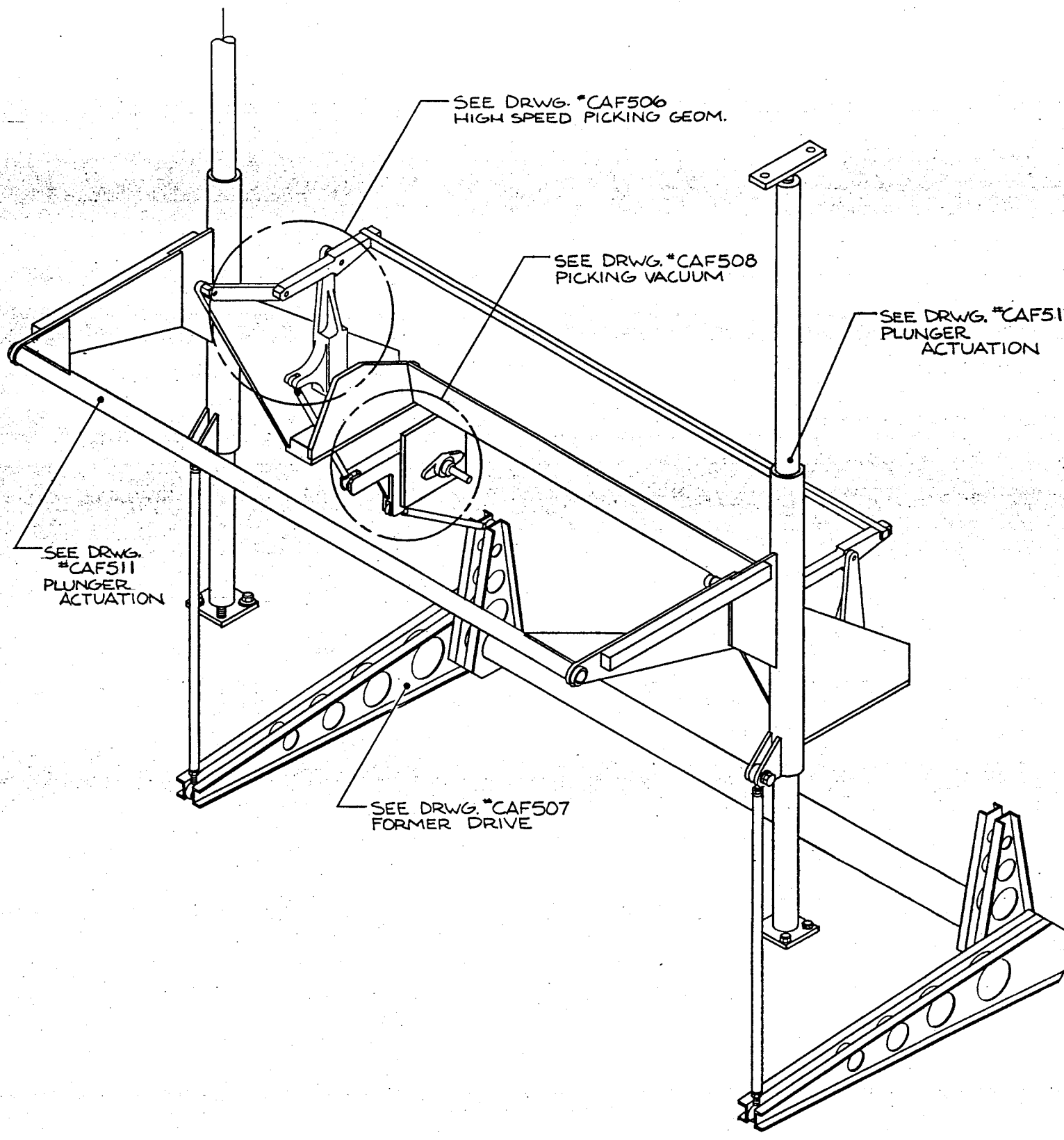
FORMING MACHINE

DRAWING NUMBER: CAF508

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## PICKING VACUUM
## CAF508

| ITEM | ASSEMBLY/PART | PART NO | HIGH SPEED QTY | LOW SPEED QTY |
|---|---|---|---|---|
| 1 | PIVOT SHAFT & FD ARM MTG PLT | B55CFW-504 | 2 | 2 |
| 2 | PIVOT SHAFT CENTER ARM | A55CFW-93 | 2 | 2 |
| 3 | CENTER CONN. LINK ARM | B55CFW-520 | 2 | |
| 4 | CENTER CONN. LINK ARM | B55CFW-92 | | 2 |
| 5 | VACUUM ARM CONN. LINK | A55CFW-73 | | 2 |
| 6 | VACUUM ARM CONN. LINK | A55CFW-511 | 2 | |
| 7 | MALE ROD END BRG,7/16-20 L/H THDS | AB-7T | 2 | 2 |
| 8 | MALE ROD END BRG,7/16-20 R/H THDS | AM-7T | 2 | 2 |
| 9 | PLUNGER ARM CONN. LINK | A55CFW-74 | | 2 |
| 10 | PLUNGER ARM CONN. LINK | A55CFW-510 | 2 | |
| 11 | AGITATOR BAR CONN. LINK | A55CFW-107 | | 1 |
| 12 | AGITATOR BAR CONN. LINK | A55CFW-512 | 1 | |
| 13 | MALE ROD END BRG. 1/4-28 R/H THDS | AM-4 | 1 | 1 |
| 14 | SPACER | | 8 | 8 |
| 15 | ARM, HOPPER AGITATOR | A55CFW-99 | 1 | 1 |
| 16 | VAC. VALVE ACUTATOR ARM | A55CFW-227 | 2 | 2 |
| 17 | CAM HUB, VAC. ACTUATOR | A55CFW-189 | 2 | 2 |
| 18 | MTG. PLATE, AIR VALVE | ACFW-148 | 4 | 4 |
| 19 | VALVE | | 2 | 2 |
| 20 | MTG. PLATE, PIVOT SHAFT R/H | A55CFW-95 | 1 | 1 |
| 21 | FLANGE BRG., 2-HOLE "HUB CITY" | | 4 | 4 |
| 22 | MTG. PLATE, PIVOT SHAFT L/H | A55CFW-95 | 1 | 1 |

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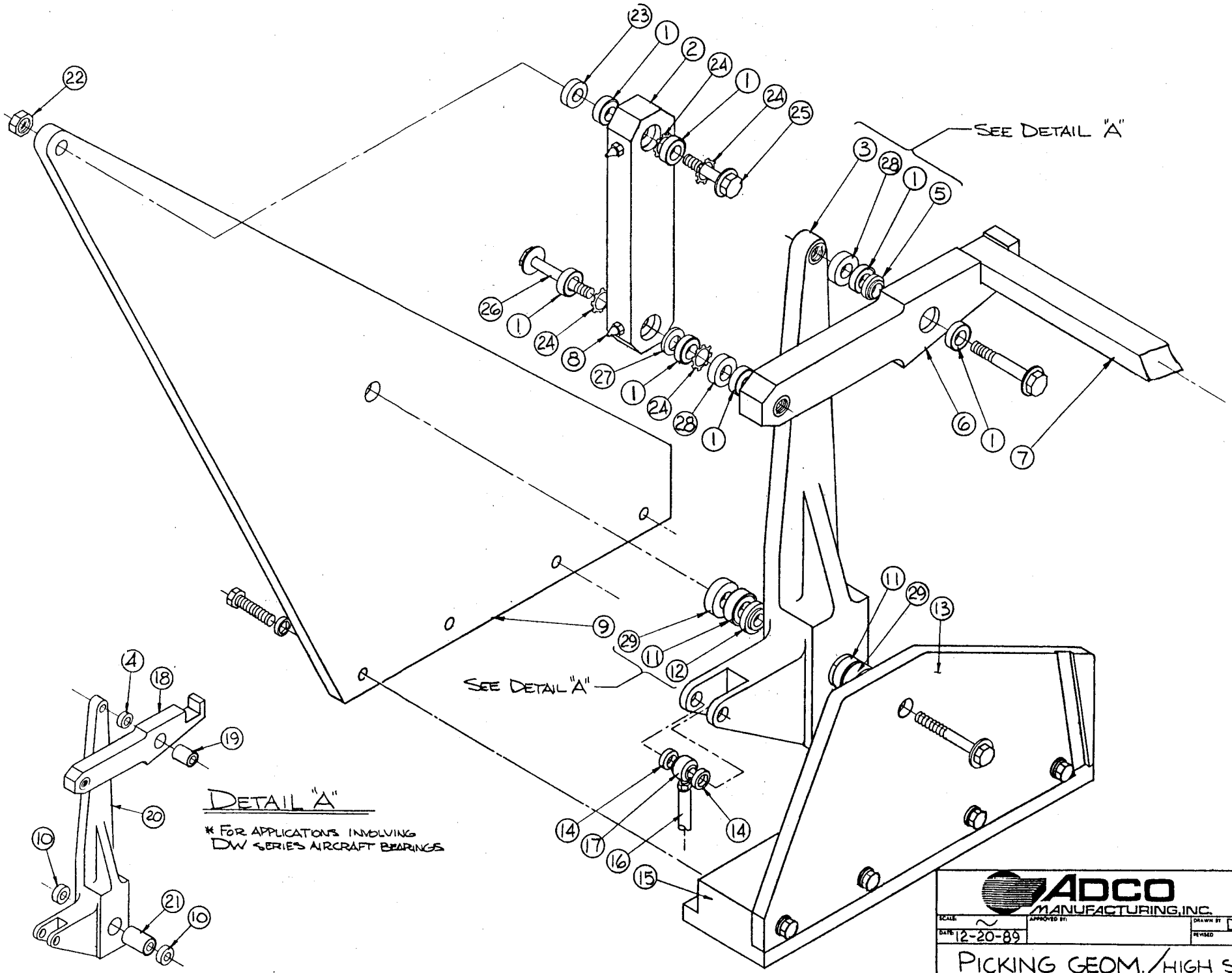
| DATE 12-11-89 | | REVISED |

# HIGH SPEED GEOM.

FORMING MACHINE

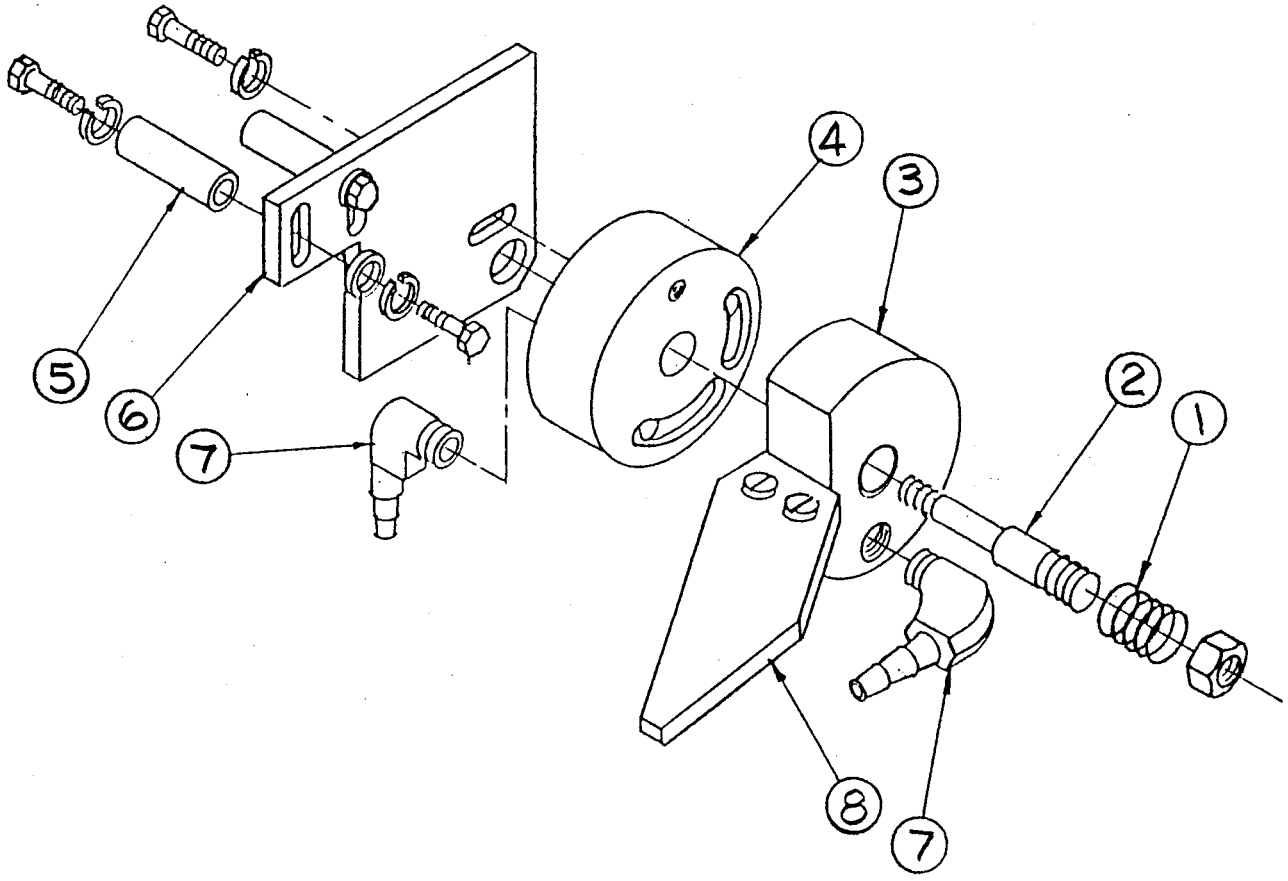
DRAWING NUMBER CAF503

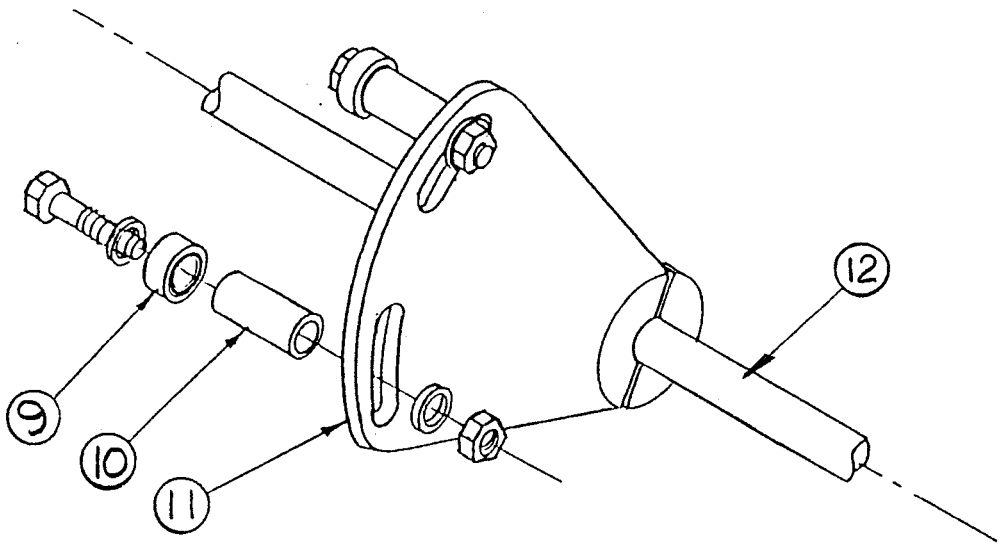

SEE DETAIL "A"
SEE DETAIL "A"
DETAIL "A"
* FOR APPLICATIONS INVOLVING DW SERIES AIRCRAFT BEARINGS
ADCO MANUFACTURING, INC.
SCALE ~
DATE 12-20-89
APPROVED BY:
DRAWN BY DK
REVISED
PICKING GEOM./HIGH SPEED FORMING MACHINE
DRAWING NUMBER CAF506

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## PICKING GEOM, HIGH SPEED
## CAF506
## FORMING MACHINE

| ITEM | ASSEMBLY/PART | PART NO | QTY |
|---|---|---|---|
| 1 | BEARING "NICE" | 1614 BC | 12 |
| 2 | FEED BAR INVERTING LINK | A55CFW500 | 2 |
| 3 | FEED BAR ACTUATING ARM | B55CFW502A | 1L/1R |
| 4 | FEED BAR ACT. SP. A11-S-.69-.75-.438-.218 | | 4 |
| 5 | FEED BAR BRG. SPACER | A55CFW284 | 2 |
| 6 | FEED BAR INVERTING ARM | B55CFW501A | 2 |
| 7 | VAC. CUP FEED BAR | A55CFW72 | 1 |
| 8 | ZERT FITTING 1/4" | ——— | |
| 9 | FEED ARM MTG. PLATE | B55CFW507 | 1L/1R |
| 10 | FEED BAR ACT. SP. A11-S-.69-.375-.312-1-XX | | 4 |
| 11 | BEARING "NICE" | 1621 | 4 |
| 12 | SPACER, BRG ACT. ARM | A55CFW285 | 2 |
| 13 | FEED ARM & HOPPER MTG. PLATE | B55CFW506 | 1L/1R |
| 14 | SPACER A09-S-.75-.438-.218 | | 4 |
| 15 | SPACER, FEED ARM MTG. BRKT. | B55CFW-505 | 2 |
| 16 | CONN. LINK, VACUUM ARM | A55CFW511 | 2 |
| 17 | MALE ROD END BRG 7/16-20 RH | AM-7T | 2 |
| 18 | FEED BAR INVERTING ARM | B55CFW501A | 2 |
| 19 | AIRCRAFT BEARING | DW-6 | 2 |
| 20 | FEED BAR ACTIVATING ARM | B55CFW502A | 1L/1R |
| 21 | AIRCRAFT BEARING | DW8 | 2 |
| 22 | JAM NUT | 3/8-24 ESNA | 1 |
| 23 | SPACER | A55CFW-78-4 | 1 |
| 24 | SPIROLOX RING | RR-87 | 4 |
| 25 | BOLT 3/8-24 X 37/64 | ANG-14 | 1 |
| 26 | BOLT 3/8-24 X 21/64 | ANG-12 | 1 |
| 27 | FLAT WASHER | AN960-616 | 1 |
| 28 | SPACER A11-S-.69-.375-.312-1-XX | | 1 |
| 29 | SPACER A11-S-.93-.50-.321-1-XX | | 1 |

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|---|---|---|
| DATE: 10-16-89 | | REVISED 9-6-90 |

# FEEDER VACUUM VALVE

FORMING MACHINE

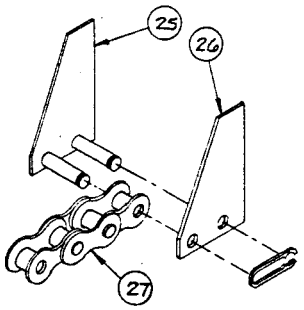
DRAWING NUMBER AAF512

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

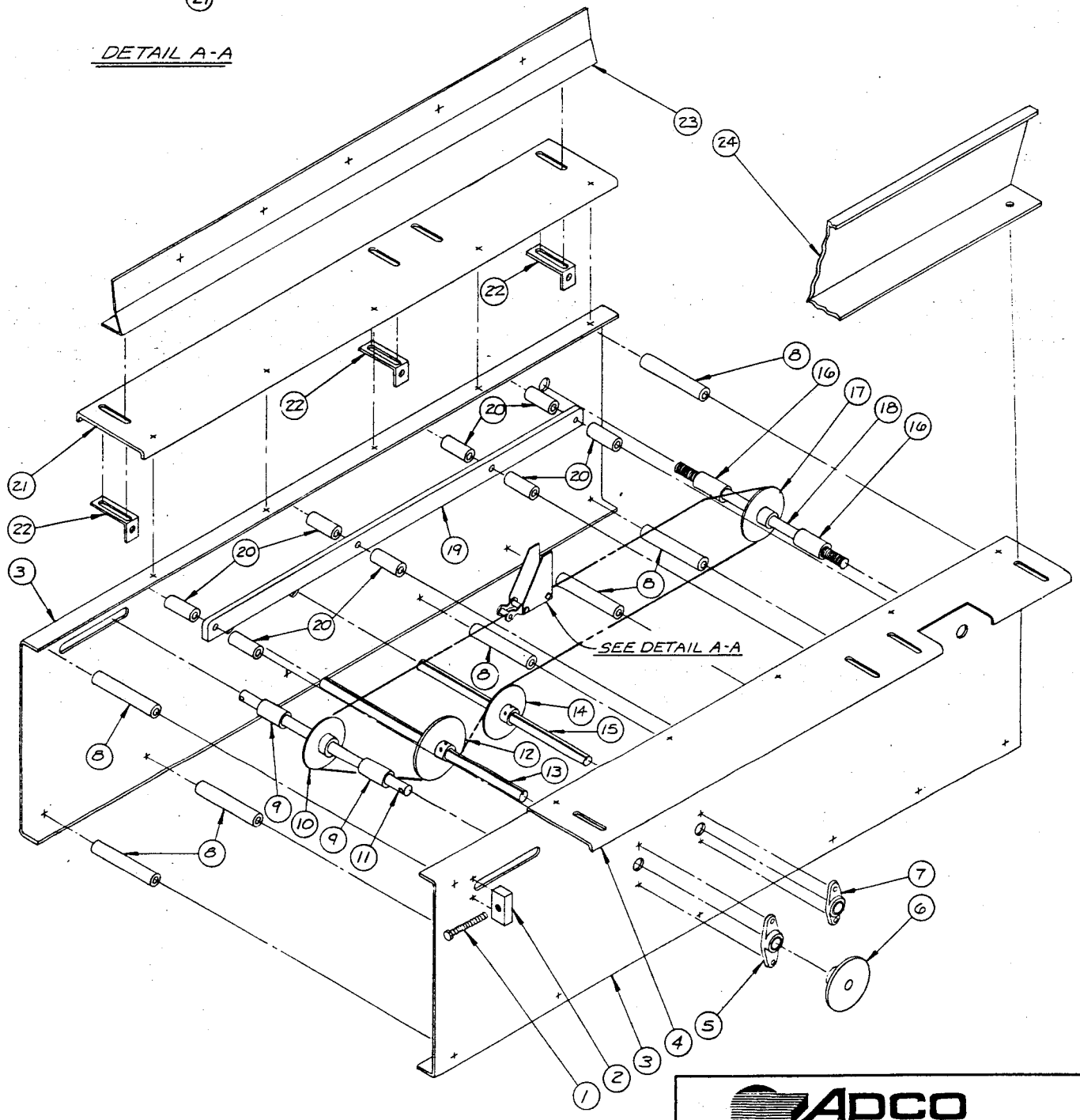
# LIST OF MATERIALS

## FEEDER VACUUM VALVE
## AAF512
## FORMING MACHINE

| ITEM | ASSEMBLY/PART | PART NO | QTY |
|---|---|---|---|
| 1 | COMP. SPRING, LEE 1" | LC-072H-3M | 1 |
| 2 | VALVE MTG. STUD | A2872-118 | 1 |
| 3 | ROTATOR, VACUUM VALVE | A2872-117-3 | 1 |
| 4 | VALVE, VACUUM | A2872-116-3 | 1 |
| 5 | SPACER | A10-S-.50-C4-1.25-C4 | 2 |
| 6 | VALVE MTG. PLATE LH | A2872-120 | 1 |
| 7 | HOSE FITTING, 90 DEG. BRASS | KF05-02-PS90 | 2 |
| 8 | ACTUATOR PLATE | A2801-01 | 1 |
| 9 | BEARING NHBB | SSR4SS | 2 |
| 10 | SPACER | A09-S-.50-.25-.375 | 2 |
| 11 | RELEASE VALVE ACTUATOR | B2728-903K | 1 |
| 12 | SHAFT (SEE MAIN FRAME ASSY) | | 1 |




DETAIL A-A

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| | | |
|---|---|---|
| SCALE ~ | APPROVED BY: | DRAWN BY G.D.C |
| DATE 11-27-89 | | REVISED |

OUTFEED CONVEYOR

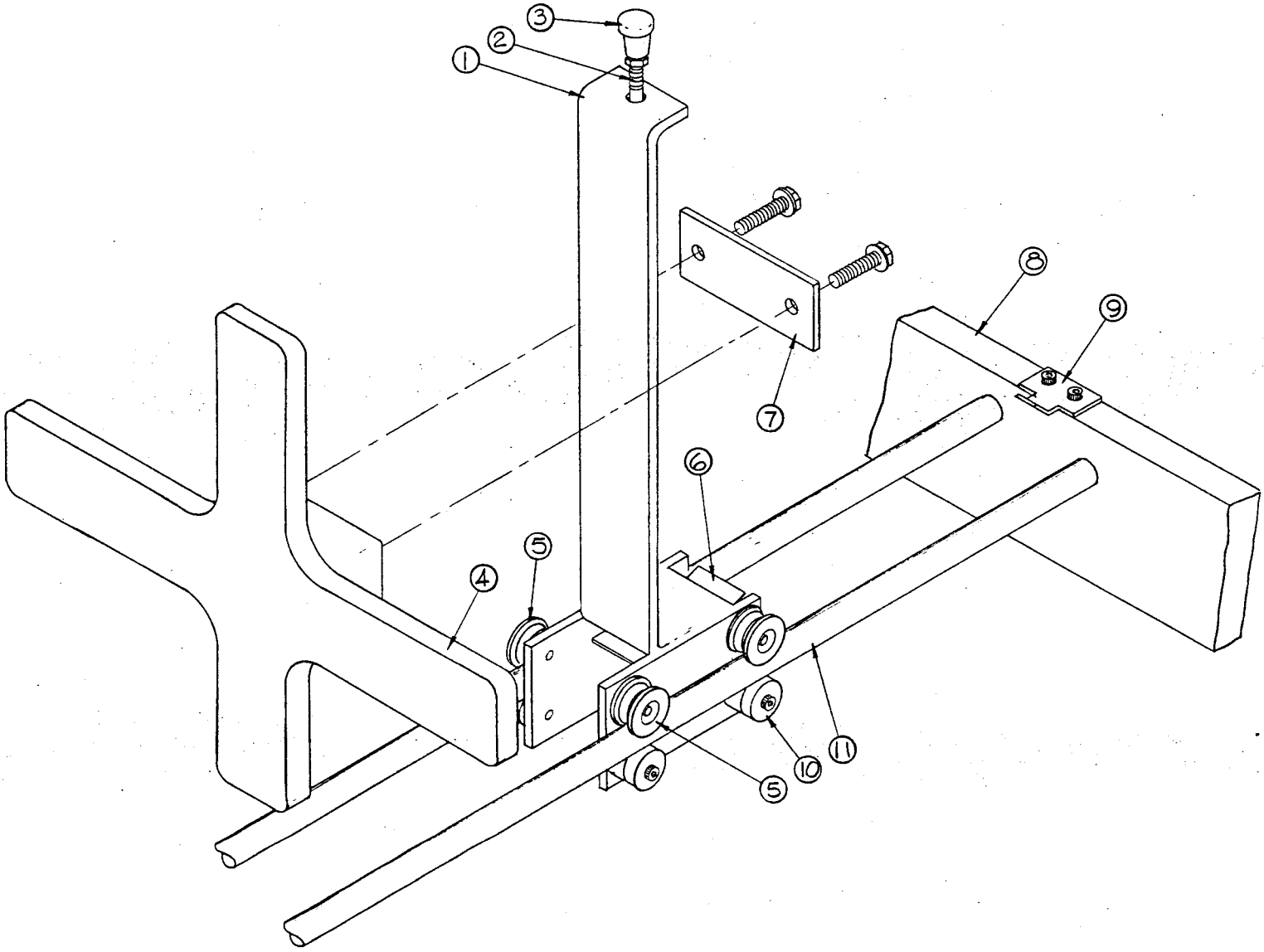
FORMER

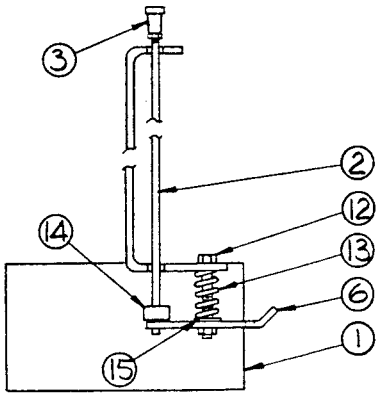
DRAWING NUMBER CAF501

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## OUTFEED CONVEYOR
## CAF501

| ITEM | ASSEMBLY/PART | PART NO | QTY |
|---|---|---|---|
| 1 | CHAIN TAKE-UP STUD | A56SS-38B | 2 |
| 2 | CHAIN TAKE-UP BLOCK | A56SS-38A | 2 |
| 3 | | | |
| 4 | BOX BOTTOM GUIDE R/H | B56SS-41 | 1 |
| 5 | BEARING-HUB CITY | FB260 X 1 | 2 |
| 6 | SPROCKET 1" BORE | 40B18 | 1 |
| 7 | BEARING-HUB CITY | FB260 X 5/8 | 2 |
| 8 | SPACER | A09-0.62-0.375-4.000 | 8 |
| 9 | SPACER | A09-1.00-0.625-1.640 | 2 |
| 10 | SPROCKET-IDLER ADJ | 40BB17H | 1 |
| 11 | IDLER ADJ SHAFT | A56SS-21 | 1 |
| 12 | SPROCKET 1" BORE | | 1 |
| 13 | SHAFT-MAIN DRIVE | A56SS-19 | 1 |
| 14 | SPROCKET 5/8 BORE | | |
| 15 | SHAFT-REV. WRAP IDLER | A56SS-20 | 1 |
| 16 | SPACER | A09-1.00-0.625-1.640 | 8 |
| 17 | SPROCKET-IDLER | 40BB17H | 1 |
| 18 | | | |
| 19 | CHAIN RAIL | A56SS-18 | 1 |
| 20 | SPACER-CHAIN RAIL | A09-H-0.62-0.375-1.875 | 8 |
| 21 | BOX BOTTOM GUIDE | B56SS-12-3 | 1 |
| 22 | SUPPORT BRACKET | A56SS-22A | 6 |
| 23 | CARTON DROP GUIDE | C56SS-13A | 1 |
| 24 | CARTON DROP GUIDE | C56SS-14 | 1 |
| 25 | LUG CONNECTING LINK | A56SS-27 | |
| 26 | LUG-LINK PLATE | A56SS-28 | |
| 27 | CHAIN #40 | | |




DETAIL 'A'

ADCO MANUFACTURING, INC.
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TELEX #703797 FAX (209) 875-7665

| | | |
|---|---|---|
| SCALE: ~ | APPROVED BY: | DRAWN BY: DK |
| DATE: 2-1-90 | | REVISED |

# STACK PUSHER

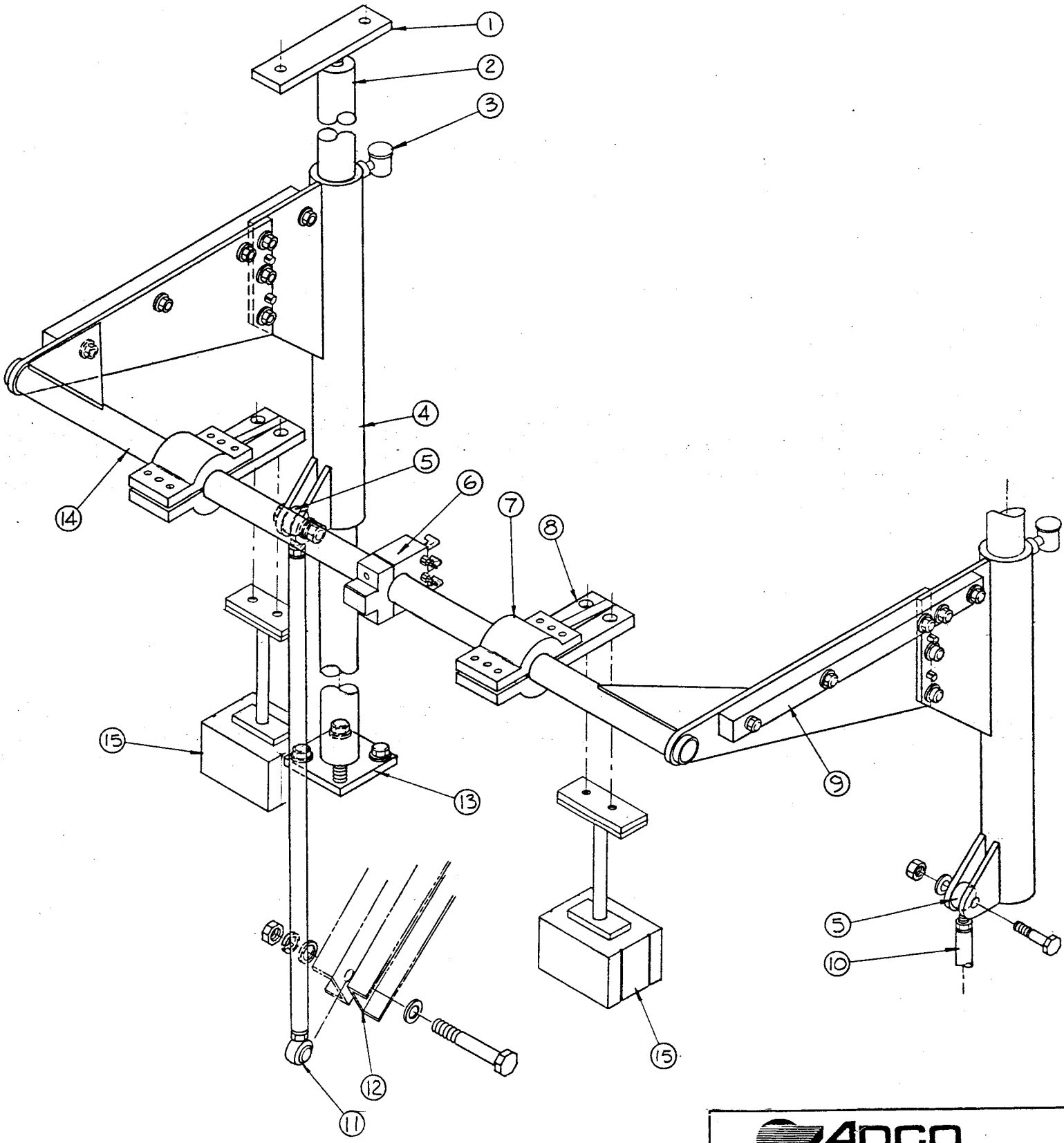
FORMING MACHINE

DRAWING NUMBER: CAF500

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## STACK PUSHER
## CAF500

| ITEM | ASSEMBLY/PART | PART NO | QTY |
|---|---|---|---|
| 1 | PEDESTAL UPRIGHT,STACK PUSHER | A55CFW152 | 1 |
| 2 | LATCH RELEASE ROD | A55CFW157 | 1 |
| 3 | KNOB, STACK PUSHER | A55CFW191 | 1 |
| 4 | CROSS, STACK PUSHER | B55CFW159 | 1 |
| 5 | ROLLER, STACK PUSHER | A55CFW155 | 4 |
| 6 | LATCH, STACK PUSHER | A55CFW156 | 1 |
| 7 | CROSS CLAMP | A55CFW158 | 1 |
| 8 | MTG. BRKT. REAR HOPPER | B55CFW246 | 1 |
| 9 | CATCH, STACK PUSHER | A55CFW149 | 1 |
| 10 | ROLLER, TOP HOLD DOWN | A15AT229 | 4 |
| 11 | GUIDE, STACK PUSHER | A55CFW112 | 2 |
| 12 | BOLT, HEX HEAD, 1/4-20 X 1" | ---------- | 1 |
| 13 | SPRING | ---------- | 1 |
| 14 | SET COLLAR 1/4" | ---------- | 1 |
| 15 | FLAT WASHER 1/4" | ---------- | 1 |




NOTE : DOUBLE FORMING HEADS SHOWN.

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|---|---|---|
| DATE: 7-10-90 | | REVISED |

# PLUNGER ACTUATION

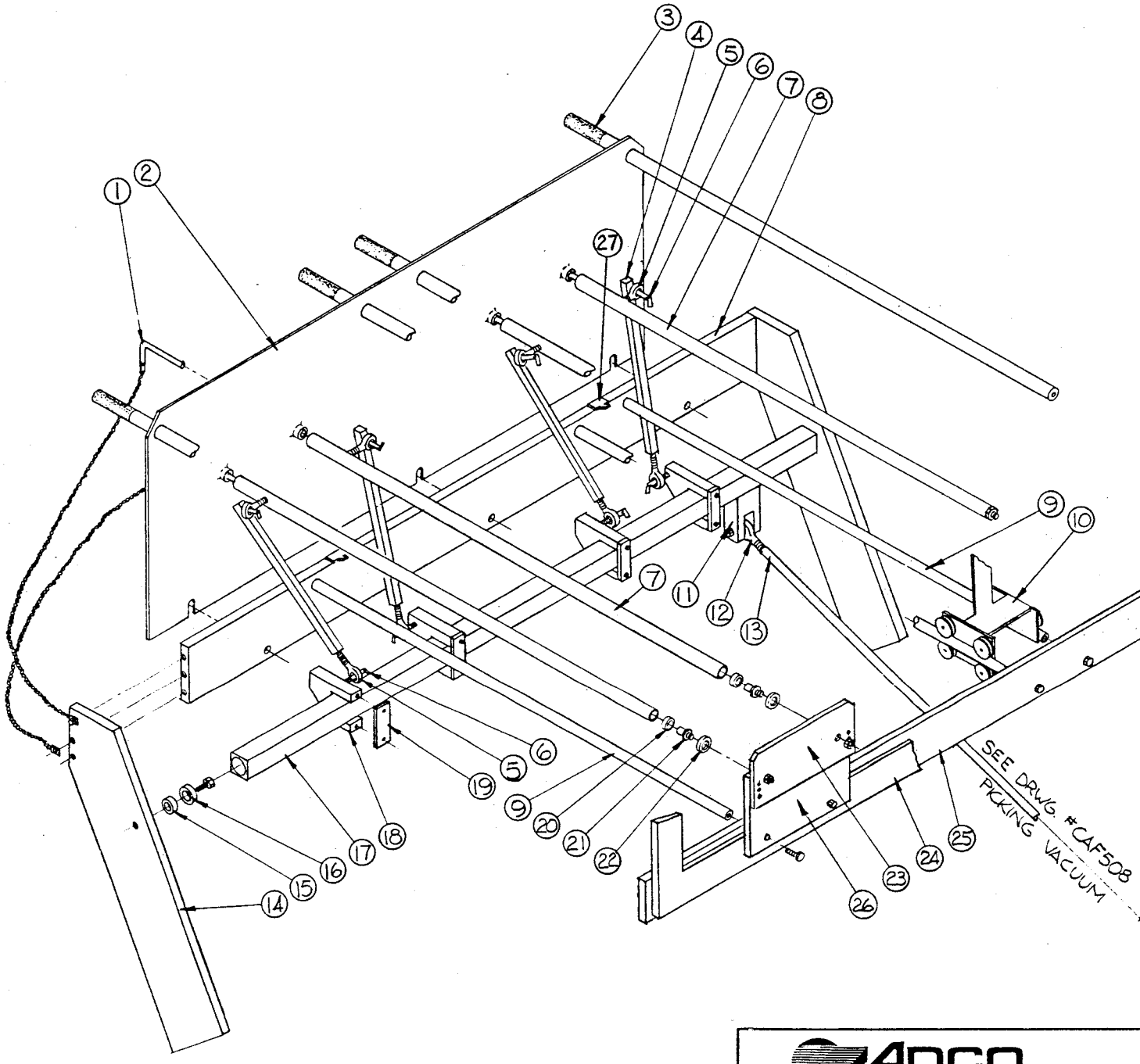
FORMING MACHINE

DRAWING NUMBER: CAF51

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
PLUNGER ACTUATOR
CAF511
FORMING MACHINE

| ITEM | ASSEMBLY/PART | PART NO | SGL QTY | DBL QTY |
|---|---|---|---|---|
| 1 | SLIDE POST ADJ PLATE | A55CFW83 | 2 | 2 |
| 2 | PLUNGER SLIDE POST | A55CFW82 | 2 | 2 |
| 3 | OIL CUP | 30234 | 2 | 2 |
| 4 | PLUNGER SLIDE | C55CFW85 | 2 | 2 |
| 5 | MALE ROD END BRG 7/16"-20 RH | AM7T | 2 | 2 |
| 6 | MANIFOLD, PLUNGER TUBE | B55CFW278 | 1 | 1 |
| 7 | PLUNGER MOUNT CLAMP | B55CFW90 | 1 | 2 |
| 8 | PLUNGER MOUNT | B55CFW517 | 1 | 2 |
| 9 | PLUNGER BAR BRACE | B55CFW516 | 2 | 2 |
| 10 | PLUNGER DRIVE ROD (HIGH SPEED) | A55CFW509 | 2 | 2 |
| 11 | MALE ROD END BRG 7/16"-20 LH | AB-7T | 2 | 2 |
| 12 | PLUNGER ACTIVATING ASSY. | D55CFW15 | 1 | 1 |
| 13 | SLIDE POST MTG. PLATE | A55CFW84A | 2 | 2 |
| 14 | PLUNGER BAR WELDMENT (HI SPD) | C55CFW517 | 1 | 1 |
| | PLUNGER BAR WELDMENT (LO SPD) | C55CFW69 | 1 | 1 |
| 15 | FORMING HEAD (REF.) | | | |

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|---|---|---|
| DATE: 2-2-90 | | REVISED |

# HOPPER, AGITATOR

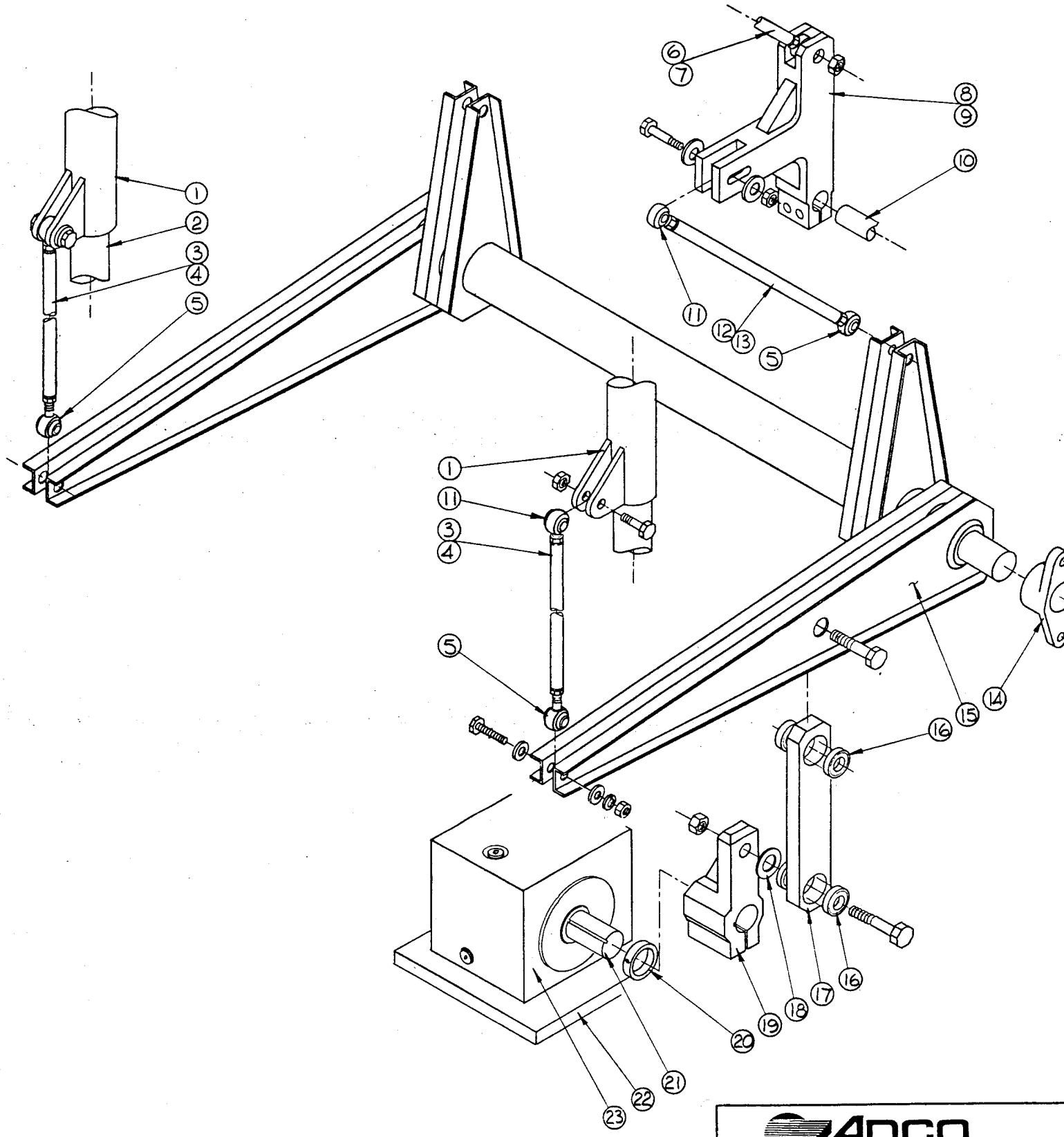
FORMING MACHINE

DRAWING NUMBER: CAF50

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
## HOPPER AGITATOR
## DOUBLE HEAD
## CAF509

| ITEM | ASSEMBLY/PART | PART NO | HIGH SPEED QTY | LOW SPEED QTY |
|---|---|---|---|---|
| 1 | REMOVABLE BRG. SPINDLE | A55CFW-132 | 4 | 4 |
| 2 | HOPPER REAR SUPPORT PLATE | B2808-134 | 1 | 1 |
| 3 | STACK SUPPORT ROD | A55CFW-113 | 4 | 4 |
| 4 | AGITATOR LINK | A2808-136 | 4 | 4 |
| 5 | MALE ROD END BRG 1/4-28 R/H | | 8 | 8 |
| 6 | AGITATOR LINK LOCK LEVER | B55CFW-192 | 8 | 8 |
| 7 | STACK AGITATOR ROD | A55CFW-108A | 4 | 4 |
| 8 | REAR HOPPER MTG. BRACKET | B55CFW-246 | 1 | 1 |
| 9 | STACK PUSHER GUIDE | A55CFW-112 | 4 | 4 |
| 10 | STACK PUSHER | CAF500 | 2 | 2 |
| 11 | AGITATOR LINK MTG. BRACKET | A55CFW-109 | 1 | 1 |
| 12 | MALE ROD END BRG 1/4-28 R/H | | 2 | 2 |
| 13 | AGITATOR BAR CONN. LINK | A55CFW-107 | 1 | |
| | AGITATOR BAR CONN. LINK | A55CFW-512 | | 1 |
| 14 | HOPPER SUPPORT BRACKET | A55CFW-100 | 1 | |
| | HOPPER SUPPORT BRACKET | A55CFW-508 | | 1 |
| 15 | BEARING SPACER | A55CFW-104 | 2 | 2 |
| 16 | BEARING 1/4" I.D. | | 1 | 1 |
| 17 | HOPPER AGITATOR BAR | A55CFW-103 | 1 | 1 |
| 18 | AGITATOR CLAMP | A55CFW-105 | 1 | 1 |
| 19 | AGITATOR CLAMP PLATE | A55CFW-106 | 1 | 1 |
| 20 | BRG. "NEW DEPARTURE" A SERIES | 77R4 | 2 | 2 |
| 21 | AGITATOR BRG. SPINDLE | A55CFW-111 | 4 | 4 |
| 22 | HOPPER WASHER TAB | A2808-133 | 4 | 4 |
| 23 | HOPPER FRONT SUPP. PLATE | A2808-132 | 2 | 2 |
| 24 | HOPPER GATE FRAME | | 1 | 1 |
| 25 | FRONT HOPPER MTG. BRACKET | B55CFW-245 | 1 | 1 |
| 26 | FRONT SUPP. PLATE MOUNT | A2808-131 | 2 | 2 |
| 27 | STACK PUSHER CATCH | A55CFW-149 | 2 | 2 |

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| SCALE | APPROVED BY: | DRAWN BY: DK |
|---|---|---|
| DATE 12-19-89 | | REVISED |

# FORMER DRIVE

FORMING MACHINE

DRAWING NUMBER: CAF5C

ADCO MANUFACTURING
2170 ACADEMY
SANGER, CALIFORNIA 93657

# LIST OF MATERIALS
FORMER, DRIVE
CAF507

| ITEM | ASSEMBLY/PART | PART NO | HIGH SPEED QTY | LOW SPEED QTY |
|---|---|---|---|---|
| 1 | PLUNGER SLIDE | C55CFW-83 | 2 | 2 |
| 2 | PLUNGER SLIDE POST | A55CFW-82 | 2 | |
| 3 | PLUNGER DRIVE, LOW SPEED | A55CFW-75 | | 2 |
| 4 | PLUNGER DRIVE, HIGH SPEED | A55CFW-509 | 2 | |
| 5 | ROD END BRG, MALE 7/16-20 L/H | AB-7T | 2 | |
| 6 | VAC. ARM CONN. LINK, LOW SPD | A55CFW-73 | | 2 |
| 7 | VAC. ARM CONN. LINK, HIGH SPD | A55CFW-511 | 2 | |
| 8 | CNTR CONN. LINK ARM HIGH SPD | B55CFW-520 | 2 | |
| 9 | CNTR CONN. LINK ARM LOW SPD | B55CFW-92 | | 2 |
| 10 | PIVOT SHAFT CENTER ARM | A55CFW-93 | 2 | |
| 11 | ROD END BRG. MALE 7/16-20 R/H | AM-7T | 2 | |
| 12 | PLNGR ARM CONN. LINK HIGH SPD | A55CFW-510 | 2 | |
| 13 | PLNGR ARM CONN. LINK LOW SPD | A55CFW-74 | | 2 |
| 14 | 2 BOLT FLNG BRG "HUB CITY" | FB260-1 1/2 | 2 | |
| 15 | PLUNGER ACTUATING ASS'Y | D55CFW-15 | 2 | |
| 16 | BRG 3/4 BORE X 1 5/8 O.D. X 7/16 | KP12A FAFNIR | 2 | |
| 17 | PLUNGER ARM DRIVE LINK | A55CFW-514 | 1 | |
| 18 | FLAT WASHER | | 1 | |
| 19 | PLUNGER CRANK | B55CFW-521 | 1 | |
| 20 | SPLIT COLLAR "HOLOKROME" | 1 7/8" X .688 | 1 | |
| 21 | PLUNGER CRANKSHAFT | A55CFW-522 | 1 | |
| 22 | PLATE, MOTOR MOUNT | A55CFW-523 | 1 | |
| 23 | MOTOR "ECONOGEAR" HOLLOW SHFT | 90E3.2-H-Z-1S | 1 | |

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# Manufacturers Parts Lists

# and Instructions

# AC Tech

## Variable Speed AC Motor Drives

L—SERIES

# Installation and Operation Manual

CONTENTS

# THE L1000 SERIES

## ADJUSTABLE FREQUENCY AC MOTOR CONTROLS

| DRIVE VOLTAGE AND MODEL | | | | |
|---|---|---|---|---|
| RATED HORSEPOWER | 208/230VAC | 380/415VAC | 460VAC | 575VAC |
| 1 | L12010_ | L13010_ | L14010_ | ---- |
| 2 | L12020_ | L13020_ | L14020_ | L15020_ |
| 3 | L12030_ | L13030_ | L14030_ | L15030_ |
| 5 | L12050_ | L13050_ | L14050_ | L15050_ |
| 7.5 | L12075_ | L13075_ | L14075_ | L15075_ |
| 10 | L12100_ | L13100_ | L14100_ | L15100_ |
| 15 | L12150_ | L13150_ | L14150_ | L15150_ |
| 20 | L12200_ | L13200_ | L14200_ | L15200_ |
| 25 | L12250_ | L13250_ | L14250_ | L15250_ |
| 30 | L12300_ | L13300_ | L14300_ | L15300_ |
| 40 | ---- | L13400_ | L14400_ | L15400_ |
| 50 | ---- | L13500_ | L14500_ | L15500_ |
| 60 | ---- | L13600_ | L14600_ | L15600_ |
| 75 | ---- | ---- | L14750_ | ---- |

CAUTION!
**********

READ ALL INSTRUCTIONS BEFORE INSTALLING OR OPERATING DRIVE

## (1.1) DESIGN SPECIFICATIONS

### L1000 SERIES DESIGN SPECIFICATIONS

| | |
|---|---|
| **ENVIRONMENTAL:** | |
| Storage Temperature | -20 - 70 C All Models |
| Ambient Temperature | 0 - 55 C Chassis Models<br>0 - 50 C Type 1 Enclosed Models<br>0 - 40 C Type 4 and Type 12 Enclosed Models |
| Ambient Humidity | Less than 93% (non-condensing) |
| Maximum Altitude | 3300 feet above sea level |
| **CONTROL:** | |
| Reference Voltage | 0-5 VDC, 0-10 VDC, 4-20 mADC<br>(Isolated, but common to control voltage) |
| Control Voltage | 12 VDC<br>(Isolated, but common to reference voltage) |
| Wave Form | Sine Coded Pulse Width Modulated |
| Output Signals | 0-1 mADC proportional to output frequency<br>0-5 DC proportional to output frequency<br>Pulse train at 6 or 192 times output frequency<br>0-1 mADC proportional to output current |
| Frequency Stabiltity | +/- 0.005%/VAC, +/- 0.05%/ C |
| Speed Regulation | 3% Induction motors, 1% with slip compensation<br>0% Synchronous motors |
| Service Factor | 1.15 |
| Overload Capacity | 180% for one minute (typical) |
| Output Frequency | 0-60 Hz constant torque; 60-72,90, or 120 Hz constant hp<br>0-120 Hz constant torque; 120-144,180, or 240 Hz constant hp<br>Special ranges to 400 Hz |

## (1.2) DRIVE MODEL DESIGNATION CODE

THE CHARACTERS WHICH MAKE UP AN AC TECH DRIVE MODEL NUMBER DESIGNATE THE SERIES, INPUT VOLTAGE, HORSEPOWER, AND ENCLOSURE TYPE OF THE DRIVE.

EXAMPLE: L14250AB

(25 HP, 460 VAC, TYPE I ENCLOSURE)

L1 4 250 * AB

SERIES:
L1 = L1000 SERIES

INPUT VOLTAGE:

| | |
|---|---|
| 1 = 120 VAC (SPECIAL) | 4 = 460 VAC |
| 2 = 208/230 VAC | 5 = 575 VAC |
| 3 = 380/415 VAC | 6 = 346/380 VAC (SPECIAL) |

RATED HORSEPOWER:

| | | |
|---|---|---|
| 010 = 1 HP | 100 = 10 HP | 400 = 40 HP |
| 020 = 2 HP | 150 = 15 HP | 500 = 50 HP |
| 030 = 3 HP | 200 = 20 HP | 600 = 60 HP |
| 050 = 5 HP | 250 = 25 HP | 750 = 75 HP |
| 075 = 7.5 HP | 300 = 30 HP | |

*:
S = SPECIAL (NON-STANDARD DRIVE MODEL OR OPTIONS)
T = THREE PHASE INPUT ON DRIVE MODEL WHICH USUALLY HAS HAS SINGLE PHASE INPUT

(WHEN PRODUCT IS STANDARD THIS CHARACTER SPACE IS ABSENT)

ENCLOSURE TYPE:

| | |
|---|---|
| A = CHASSIS | NONE |
| AB = TYPE 1 | REMOVEABLE VENTED COVER WITH HINGED DOOR |
| C = TYPE 4 | TOTALLY ENCLOSED WATER TIGHT |
| CX = TYPE 4X | STAINLESS STEEL TOTALLY ENCLOSED WATER TIGHT |
| D = TYPE 12 | TOTALLY ENCLOSED DUST TIGHT |

## L1200 SERIES RATINGS

| MODEL | | INPUT | | | | | OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FREQUENCY: 50-60 HZ | | | | | FREQUENCY: 0-60/72,90,120 HZ OR 0-120/144,180,240 HZ | | | |
| NUMBER | RATED HP | MAIN FUSE | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) |
| L12010_ | 1 | 10 | 208/230 | 1 | 8.2 | 1.9 | 0-208/230 | 3 | 4 | 1.6 |
| L12020_ | 2 | 20 | 208/230 | 1/3 | 15.3/8.3 | 3.5/3.3 | 0-208/230 | 3 | 6.8 | 2.7 |
| L12030_ | 3 | 30 | 208/230 | 1/3 | 21.8/11.8 | 5.0/4.7 | 0-208/230 | 3 | 9.6 | 3.8 |
| L12050_ | 5 | 30 | 208/230 | 3 | 15 | 6.0 | 0-208/230 | 3 | 15.2 | 6.1 |
| L12075_ | 7.5 | 30 | 208/230 | 3 | 21.7 | 8.7 | 0-208/230 | 3 | 22 | 8.8 |
| L12100_ | 10 | 45 | 208/230 | 3 | 27.5 | 11.0 | 0-208/230 | 3 | 28 | 11.2 |
| L12150_ | 15 | 60 | 208/230 | 3 | 41.4 | 16.5 | 0-208/230 | 3 | 42 | 16.7 |
| L12200_ | 20 | 90 | 208/230 | 3 | 53.3 | 21.3 | 0-208/230 | 3 | 54 | 21.5 |
| L12250_ | 25 | 90 | 208/230 | 3 | 67.1 | 26.8 | 0-208/230 | 3 | 68 | 27.1 |
| L12300_ | 30 | 120 | 208/230 | 3 | 79 | 31.6 | 0-208/230 | 3 | 80 | 31.9 |

## L1300 SERIES RATINGS

| MODEL | | INPUT | | | | | OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FREQUENCY: 50-60 HZ | | | | | FREQUENCY: 0-50/60,75,100 HZ OR 0-100/120,150,200 HZ | | | |
| NUMBER | RATED HP | MAIN FUSE | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) |
| L13010_ | 1 | 10 | 380/415 | 1 | 5.0 | 1.9 | 0-380/415 | 3 | 2.4 | 1.6 |
| L13020_ | 2 | 15 | 380/415 | 1/3 | 9.3/5.1 | 3.5/3.3 | 0-380/415 | 3 | 4.1 | 2.7 |
| L13030_ | 3 | 20 | 380/415 | 1/3 | 13.2/7.1 | 5.0/4.7 | 0-380/415 | 3 | 5.8 | 3.8 |
| L13050_ | 5 | 20 | 380/415 | 3 | 9.1 | 6.0 | 0-380/415 | 3 | 9.2 | 6.1 |
| L13075_ | 7.5 | 20 | 380/415 | 3 | 13.2 | 8.7 | 0-380/415 | 3 | 13.3 | 8.8 |
| L13100_ | 10 | 30 | 380/415 | 3 | 16.7 | 11.0 | 0-380/415 | 3 | 17.0 | 11.2 |
| L13150_ | 15 | 45 | 380/415 | 3 | 24.8 | 16.3 | 0-380/415 | 3 | 25.0 | 16.5 |
| L13200_ | 20 | 45 | 380/415 | 3 | 32.7 | 21.5 | 0-380/415 | 3 | 33.0 | 21.7 |
| L13250_ | 25 | 60 | 380/415 | 3 | 40.6 | 26.7 | 0-380/415 | 3 | 41.0 | 27.0 |
| L13300_ | 30 | 60 | 380/415 | 3 | 47.6 | 31.3 | 0-380/415 | 3 | 48.0 | 31.6 |
| L13400_ | 40 | 100 | 380/415 | 3 | 62.2 | 40.9 | 0-380/415 | 3 | 63.0 | 41.4 |
| L13500_ | 50 | 120 | 380/415 | 3 | 78.0 | 51.3 | 0-380/415 | 3 | 79.0 | 51.8 |
| L13600_ | 60 | 150 | 380/415 | 3 | 92.0 | 60.6 | 0-380/415 | 3 | 93.0 | 61.2 |

## L1400 SERIES RATINGS

| MODEL | | INPUT | | | | | OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FREQUENCY: 50-60 HZ | | | | | FREQUENCY: 0-60/72,90,120 HZ OR 0-120/144,180,240 HZ | | | |
| NUMBER | RATED HP | MAIN FUSE | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) |
| L14010_ | 1 | 5 | 460 | 1 | 4.1 | 1.9 | 0-460 | 3 | 2.0 | 1.6 |
| L14020_ | 2 | 10 | 460 | 1/3 | 7.7/4.2 | 3.5/3.3 | 0-460 | 3 | 3.4 | 2.7 |
| L14030_ | 3 | 15 | 460 | 1/3 | 10.9/5.9 | 5.0/4.7 | 0-460 | 3 | 4.8 | 3.8 |
| L14050_ | 5 | 15 | 460 | 3 | 7.5 | 6.0 | 0-460 | 3 | 7.6 | 6.1 |
| L14075_ | 7.5 | 20 | 460 | 3 | 10.9 | 8.7 | 0-460 | 3 | 11.0 | 8.8 |
| L14100_ | 10 | 20 | 460 | 3 | 13.8 | 11.0 | 0-460 | 3 | 14.0 | 11.2 |
| L14150_ | 15 | 30 | 460 | 3 | 20.7 | 16.5 | 0-460 | 3 | 21.0 | 16.7 |
| L14200_ | 20 | 45 | 460 | 3 | 26.7 | 21.3 | 0-460 | 3 | 27.0 | 21.5 |
| L14250_ | 25 | 60 | 460 | 3 | 33.6 | 26.8 | 0-460 | 3 | 34.0 | 27.1 |
| L14300_ | 30 | 60 | 460 | 3 | 39.6 | 31.6 | 0-460 | 3 | 40.0 | 31.9 |
| L14400_ | 40 | 100 | 460 | 3 | 51.4 | 41.0 | 0-460 | 3 | 52.0 | 41.4 |
| L14500_ | 50 | 100 | 460 | 3 | 64.2 | 51.1 | 0-460 | 3 | 65.0 | 51.8 |
| L14600_ | 60 | 120 | 460 | 3 | 76.0 | 60.6 | 0-460 | 3 | 77.0 | 61.4 |
| L14750_ | 75 | 120 | 460 | 3 | 95.0 | 75.6 | 0-460 | 3 | 96.0 | 76.5 |

## L1500 SERIES RATINGS

| MODEL | | INPUT | | | | | OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FREQUENCY: 50-60 HZ | | | | | FREQUENCY: 0-60/72,90,120 HZ OR 0-120/144,180,240 HZ | | | |
| NUMBER | RATED HP | MAIN FUSE | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) | VOLTS (VAC) | PHASES | CURRENT (AMPS) | POWER (KVA) |
| L15020_ | 2 | 10 | 575 | 1/3 | 6.2/3.4 | 3.5/3.3 | 0-575 | 3 | 2.7 | 2.7 |
| L15030_ | 3 | 15 | 575 | 1/3 | 8.7/4.7 | 5.0/4.7 | 0-575 | 3 | 3.9 | 3.9 |
| L15050_ | 5 | 15 | 575 | 3 | 6.0 | 6.0 | 0-575 | 3 | 6.1 | 6.1 |
| L15075_ | 7.5 | 15 | 575 | 3 | 8.8 | 8.8 | 0-575 | 3 | 9.0 | 8.9 |
| L15100_ | 10 | 20 | 575 | 3 | 10.9 | 10.9 | 0-575 | 3 | 11.0 | 11.0 |
| L15150_ | 15 | 30 | 575 | 3 | 16.8 | 16.7 | 0-575 | 3 | 17.0 | 16.9 |
| L15200_ | 20 | 45 | 575 | 3 | 21.4 | 21.3 | 0-575 | 3 | 22.0 | 21.5 |
| L15250_ | 25 | 45 | 575 | 3 | 27.0 | 26.9 | 0-575 | 3 | 27.0 | 26.9 |
| L15300_ | 30 | 60 | 575 | 3 | 31.7 | 31.6 | 0-575 | 3 | 32.0 | 31.9 |
| L15400_ | 40 | 60 | 575 | 3 | 40.7 | 40.5 | 0-575 | 3 | 41.0 | 40.9 |
| L15500_ | 50 | 100 | 575 | 3 | 51.6 | 51.3 | 0-575 | 3 | 52.0 | 51.8 |
| L15600_ | 60 | 100 | 575 | 3 | 61.5 | 61.2 | 0-575 | 3 | 62.0 | 61.7 |

**AC Tech**

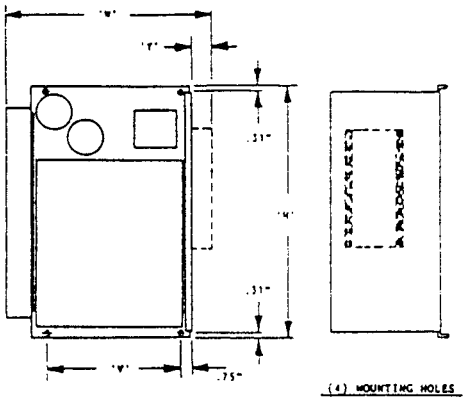
Variable Speed AC Motor Drives

AC Technology Corporation
Uxbridge, Massachusetts 01569

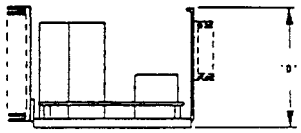
# The L1000 CHASSIS AND TYPE 1 DIMENSIONS

| Drawing no 1003.100.2 | Sheet 1 of 1 | Date 3-29-89 |
|---|---|---|
| Drawn RMP | Checked FEL | Ref. L12010A - L15400AB |

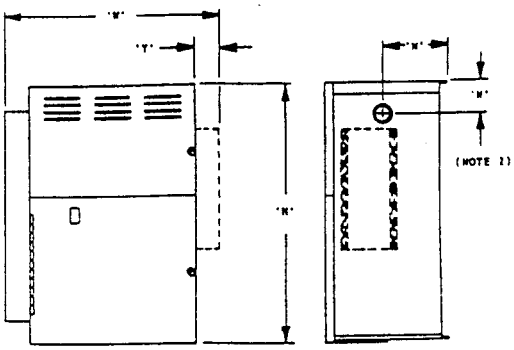
CHASSIS



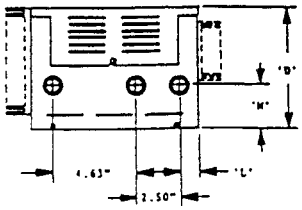

(4) MOUNTING HOLES
.25" DIA. IF 'H' LESS THAN 26"
.31" DIA. IF 'H' MORE THAN 26"




TYPE 1




NOTE 1: CONDUIT KNOCKOUTS ARE .88"/1.13" DIA.
2: IF 'H' IS LESS THAN 20", NO KNOCKOUT ON RIGHT SIDE




| HP | VOLTAGE | CHASSIS | TYPE 1 | 'H' | 'W' | 'D' | 'L' | 'M' | 'N' | 'V' | 'Y' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 230VAC | L12010A | L12010AB | 14.00" | 10.00" | 6.60" | 1.13" | 2.50" | N/A" | 7.88" | 0.00" |
| | 460VAC | L14010A | L14010AB | | | | | | | | |
| 2 | 230VAC | L12020A | L12020AB | 14.00 | 10.50 | 6.60 | 1.13 | 2.50 | N/A | 7.88 | 0.00 |
| | 460VAC | L14020A | L14020AB | | | | | | | | |
| | 575VAC | L15020A | L15020AB | | | | | | | | |
| 3 | 230VAC | L12030A | L12030AB | 14.00 | 11.00 | 6.60 | 1.13 | 2.50 | N/A | 7.88 | 0.00 |
| | 460VAC | L14030A | L14030AB | | | | | | | | |
| | 575VAC | L15030A | L15030AB | | | | | | | | |
| 5 | 230VAC | L12050A | L12050AB | 16.50 | 11.25 | 8.90 | 1.13 | 3.50 | N/A | 7.88 | 0.00 |
| | 460VAC | L14050A | L14050AB | | | | | | | | |
| | 575VAC | L15050A | L15050AB | | | | | | | | |
| 7½ | 230VAC | L12075A | L12075AB | 24.00 | 13.00 | 8.90 | 2.13 | 3.50 | 1.75 | 9.75 | 0.00 |
| | 460VAC | L14075A | L14075AB | 16.50 | 11.25 | 8.90 | 1.13 | 3.50 | N/A | 7.88 | 0.00 |
| | 575VAC | L15075A | L15075AB | | | | | | | | |
| 10 | 230VAC | L12100A | L12100AB | 24.00 | 13.00 | 8.90 | 2.13 | 3.50 | 1.75 | 9.75 | 0.00 |
| | 460VAC | L14100A | L14100AB | | | | | | | | |
| | 575VAC | L15100A | L15100AB | | | | | | | | |
| 15 | 230VAC | L12150A | L12150AB | 29.00 | 18.50 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 0.00 |
| | 460VAC | L14150A | L14150AB | 24.00 | 13.00 | 8.90 | 2.13 | 3.50 | 1.75 | 9.75 | 0.00 |
| | 575VAC | L15150A | L15150AB | | | | | | | | |
| 20 | 230VAC | L12200A | L12200AB | 29.00 | 20.50 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 2.00 |
| | 460VAC | L14200A | L14200AB | 29.00 | 13.50 | 10.50 | 2.13 | 4.50 | 1.75 | 9.75 | 0.00 |
| | 575VAC | L15200A | L15200AB | | | | | | | | |
| 25 | 230VAC | L12250A | L12250AB | 29.00 | 21.00 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 2.50 |
| | 460VAC | L14250A | L14250AB | 29.00 | 18.50 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 0.00 |
| | 575VAC | L15250A | L15250AB | 29.00 | 13.50 | 10.50 | 2.13 | 4.50 | 1.75 | 9.75 | 0.00 |
| 30 | 460VAC | L14300A | L14300AB | 29.00 | 20.50 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 2.00 |
| | 575VAC | L15300A | L15300AB | | | | | | | | |
| 40 | 460VAC | L14400A | L14400AB | 29.00 | 21.00 | 10.50 | 7.13 | 4.50 | 1.75 | 14.25 | 2.50 |
| | 575VAC | L15400A | L15400AB | | | | | | | | |

**AC Tech**

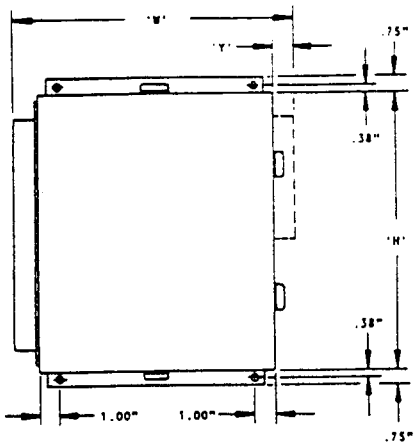
Variable Speed AC Motor Drives

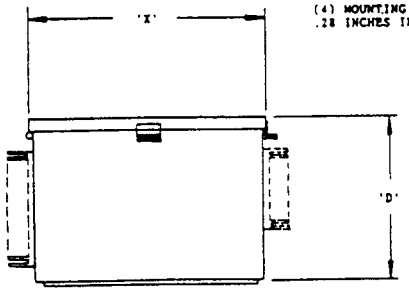
AC Technology Corporation
Uxbridge, Massachusetts 01569

Title L1000 TYPE 4 AND TYPE 12 DIMENSIONS

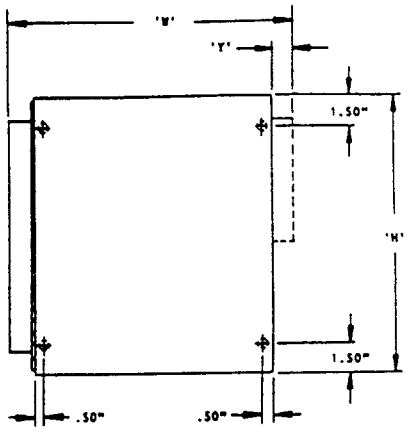
| Drawing no 1003.101.2 | Sheet 1 of 2 | Date |
|---|---|---|
| Drawn RMP | Checked FEL | Ref. L12010C - L15600D |

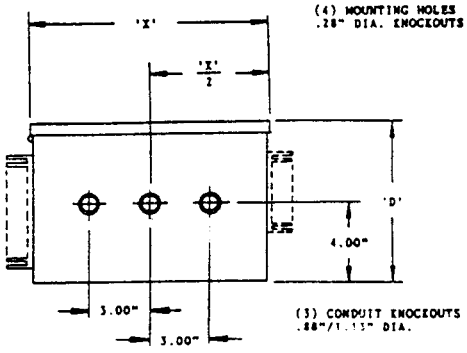
TYPE 4




TYPE 12

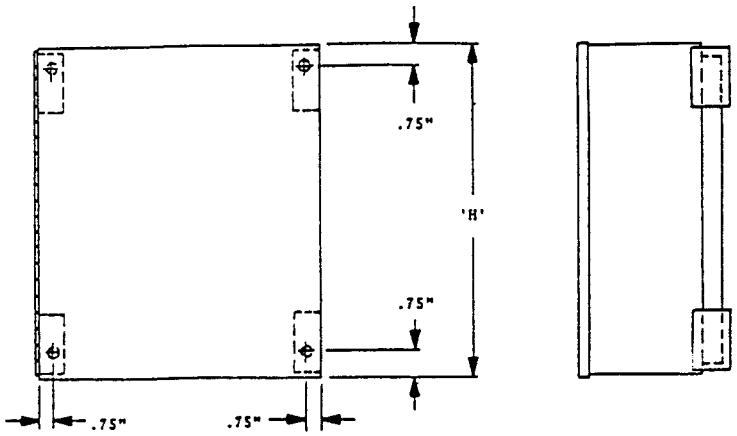


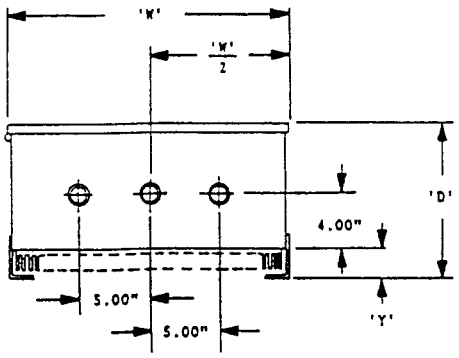




| HP | VOLTAGE | TYPE 4 | TYPE 12 | 'H' | 'W' | 'D' | 'X' | 'Y' |
|---|---|---|---|---|---|---|---|---|
| 1 | 230VAC | L12010C | L12010D | 14.00" | 12.75" | 8.00" | 12.00" | 0.00" |
| | 460VAC | L14010C | L14010D | | | | | |
| 2 | 230VAC | L12020C | L12020D | 14.00 | 13.25 | 8.00 | 12.00 | 0.00 |
| | 460VAC | L14020C | L14020D | | | | | |
| | 575VAC | L15020C | L15020D | | | | | |
| 3 | 230VAC | L12030C | L12030D | 14.00 | 13.75 | 8.00 | 12.00 | 0.00 |
| | 460VAC | L14030C | L14030D | | | | | |
| | 575VAC | L15030C | L15030D | | | | | |
| 5 | 230VAC | L12050C | L12050D | 16.50 | 14.00 | 10.00 | 12.00 | 0.00 |
| | 460VAC | L14050C | L14050D | | | | | |
| | 575VAC | L15050C | L15050D | | | | | |
| 7½ | 230VAC | L12075C | L12075D | 24.00 | 17.25 | 10.00 | 14.00 | 1.25 |
| | 460VAC | L14075C | L14075D | 16.50 | 14.00 | 10.00 | 12.00 | 0.00 |
| | 575VAC | L15075C | L15075D | | | | | |
| 10 | 230VAC | L12100C | L12100D | 24.00 | 17.75 | 10.00 | 14.00 | 1.75 |
| | 460VAC | L14100C | L14100D | 24.00 | 17.25 | 10.00 | 14.00 | 1.25 |
| | 575VAC | L15100C | L15100D | | | | | |
| 15 | 230VAC | L12150C | L12150D | 29.00 | 21.50 | 12.00 | 17.00 | 2.00 |
| | 460VAC | L14150C | L14150D | 24.00 | 17.75 | 10.00 | 14.00 | 1.75 |
| | 575VAC | L15150C | L15150D | | | | | |
| 20 | 460VAC | L14200C | L14200D | 29.00 | 21.25 | 12.00 | 17.00 | 1.75 |
| | 575VAC | L15200C | L15200D | | | | | |
| 25 | 575VAC | L15250C | L15250D | 29.00 | 21.50 | 12.00 | 17.00 | 2.00 |

| AC Tech<br>Variable Speed AC Motor Drives<br>AC Technology Corporation<br>Uxbridge, Massachusetts 01569 | Title L1000 TYPE 4 AND 12 DIMENSIONS | | |
|---|---|---|---|
| | Drawing no. 1003.101.2 | Sheet 2 of 2 | Date 3-29-89 |
| | Drawn RMP | Checked FEL | Ref. L12010C - L15600D |

## TYPE 4 AND TYPE 12




(3) CONDUIT KNOCKOUTS
1.38"/1.63" DIA.
(NOT ON TYPE 4)

| HP | VOLTAGE | TYPE 4 | TYPE 12 | 'H' | 'W' | 'D' | 'Y' |
|---|---|---|---|---|---|---|---|
| 20 | 230VAC | L12200C | L12200D | 32.00" | 27.00" | 14.00" | 2.50" |
| 25 | 230VAC | L12250C | L12250D | 36.00 | 32.00 | 16.00 | 3.00 |
| | 460VAC | L14250C | L14250D | 32.00 | 27.00 | 14.00 | 2.50 |
| 30 | 230VAC | L12300C | L12300D | 36.00 | 32.00 | 16.00 | 3.00 |
| | 460VAC | L14300C | L14300D | 32.00 | 27.00 | 14.00 | 2.50 |
| | 575VAC | L15300C | L15300D | | | | |
| 40 | 460VAC | L14400C | L14400D | 36.00 | 32.00 | 16.00 | 3.00 |
| | 575VAC | L15400C | L15400D | | | | |
| 50 | 460VAC | L14500C | L14500D | 36.00 | 32.00 | 16.00 | 3.00 |
| | 575VAC | L15500C | L15500D | | | | |
| 60 | 460VAC | L14600C | L14600D | 36.00 | 32.00 | 16.00 | 3.00 |
| | 575VAC | L15600C | L15600D | | | | |

## (1.5) PRODUCT CHANGES

AC Technology Corporation reserves the right to discontinue or make modifications to the design of its products without prior notice, and holds no obligation to make modifications to products sold previously. AC Technology also holds no liability for losses of any kind which may result from this action.

## (1.6) WARRANTY

AC Technology Corporation warrants the L1000 series AC motor control to be free of defects in material and workmanship for a period of eighteen months from the date of sale to the user, or two years from the date of manufacture, which ever occurs first. Any control component, which under normal use, becomes defective, within the stated warranty time period, shall be returned to AC Technology, freight prepaid, for examination. AC Technology Corporation reserves the right to make the final determination as to the validity of a warranty claim, and sole obligation is to repair or replace only components which have been rendered defective due to faulty material or workmanship. No warranty claim will be accepted for components which have been damaged due to mishandling, improper installation, unauthorized repair and/or alteration of the product, operation in excess of design specifications or other misuse, or improper maintenance.

AC Technology Corporation makes no claim that its products are compatible with any other equipment, or to any specific application, to which they may be applied and shall not be held liable for any other consequential damage or injury arising from the use of its products.

This warranty is in lieu of all other warranties, expressed or implied. No other person, firm or corporation is authorized to assume, for AC Technology Corporation, any other liability in connection with the demonstration or sale of its products.

## (1.7) RECEIVING

Inspect all cartons for damage which may have occurred during shipping. Carefully unpack equipment and inspect thoroughly for damage or shortage. Report any damage to carrier and/or shortages to supplier.

All major compenents and connections should be examined for damage and tightness, with special attention given to PC boards, plugs, knobs, and switches.

## (1.8) CUSTOMER MODIFICATION

AC Technology, it's sales representatives and distributors, welcome the opportunity to assist our customers in applying our products. Many customizing options are available to aide in this function. AC Technology cannot assume responsibility for any modifications which have not been authorized by it's engineering department.

## (2.0) THEORY OF OPERATION

The AC Tech L1000 series drive is a high performance, sine coded, pulse width modulated (PWM), transistorized AC motor control. Many years of product development and refinements are utilized in its compact, cost effective design. The L1000 can efficiently control the output speed and torque of both induction and synchronous three phase AC motors.

### (2.1) AC MOTOR OPERATION

Three phase AC motors are comprised of two major components, the stator and the rotor. The stator is a set of three electrical windings held stationary in the motor housing. The rotor is a metal cylinder, fixed to the motor drive shaft, which rotates within the stator. The arrangement of the stator coils and the presence of three phase AC voltage give rise to a rotating magnetic field which drives the rotor.

The speed at which the magnetic field rotates is known as the synchronous speed of the motor. Synchronous speed is a function of the frequency at which the voltage is alternating and the number of poles in the stator windings. The following equation gives the relation between synchronous speed, frequency, and the number of poles:

$$Ss = 120\ f/p$$

Where: Ss = Synchronous speed (rpm )
f = frequency (Hz)
p = number of poles

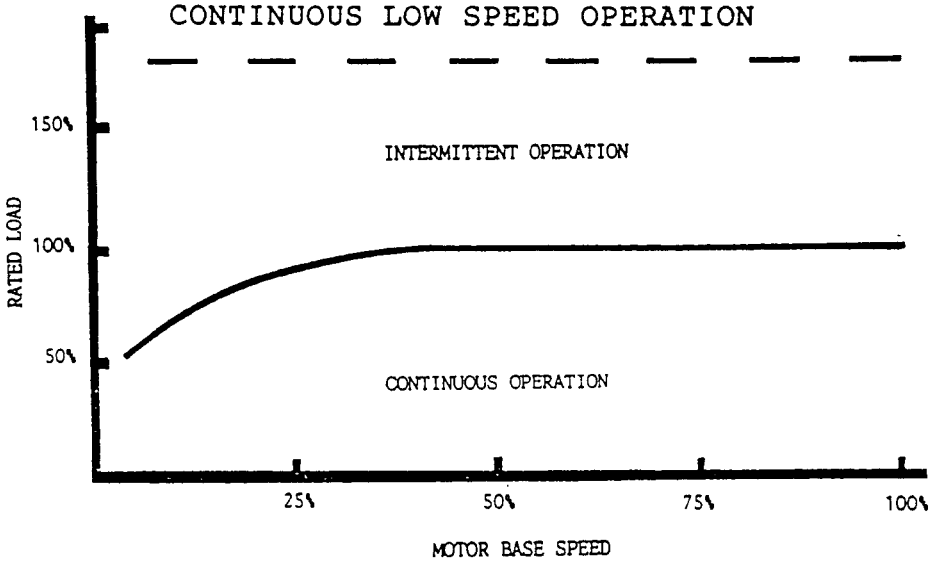
In three phase induction motors the actual shaft speed differs from the synchronous speed as load is applied. This difference is known as "slip". Slip is commonly expressed as a percentage of synchronous speed and common values are usually about three percent.

The strength of the magnetic field in the gap between the rotor and stator is proportional to the amplitude of the voltage at a given frequency. The output torque capability

of the motor is, therefore, a function of the applied voltage amplitude and frequency.

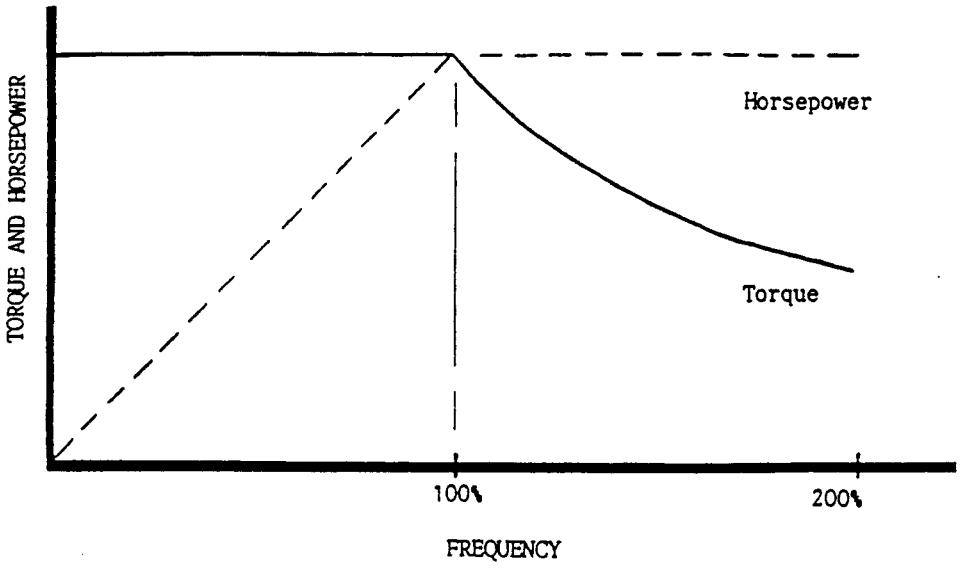
When operated below base (rated) speed, AC motors are commonly run in a mode known as "constant torque". Constant torque output is obtained by maintaining a constant ratio between voltage amplitude (volts) and frequency (hertz). For 60 hertz 230, 460, and 575 volt motors, common values for this volts to hertz ratio are 3.83, 7.66, and 9.58 respectively. Operating with these values of the volts to hertz ratio generally yields optimum torque capability. Operating at lower ratio values would lower torque and power capability. Operating at higher ratio values would cause the motor to overheat. Most standard motors are capable of providing full torque output from 3 to 60 hertz. However, at lower speeds, where motor cooling fans become less effective, supplemental cooling may be needed to operate at full torque output continuously. A typical motor derating curve is depicted below.

TYPICAL DERATING CURVE FOR
CONTINUOUS LOW SPEED OPERATION



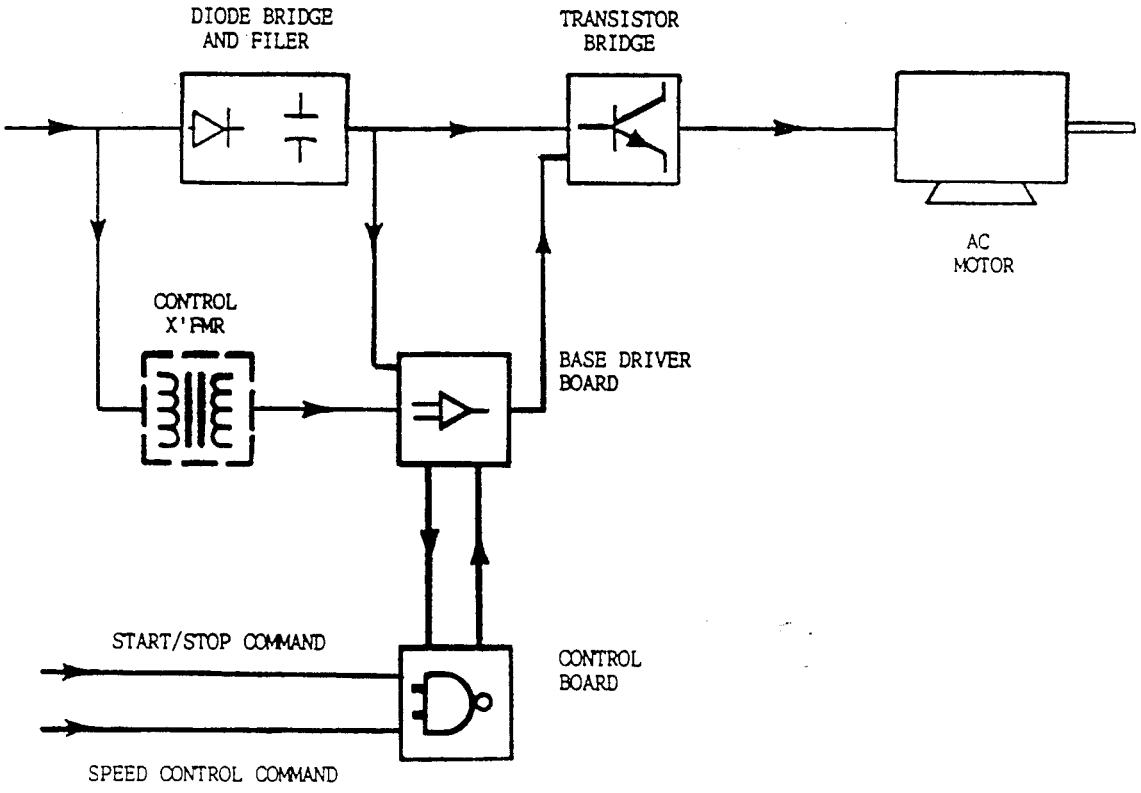

If the motor's applied frequency is increased while voltage remains constant, its torque capability will decrease as speed increases. This will cause horsepower capability of the motor to remain approximately constant. Motors are commonly run in this mode when operated above base speed, where drive output voltage is limited by the input line voltage. This operating range is known as the "constant horsepower" range. The typical maximum range for constant horsepower is about 2.3 to 1 (60 to 140 Hz). The diagram below depicts the operating characteristics of a typical AC induction motor.

AC MOTOR OPERATING RANGES




## (2.2) DRIVE CONFIGURATION AND OPERATION

The L1000 series AC motor control has four major sections; an input diode bridge and filter, a driver board, a control board, and an output transistor bridge.



## (2.2 CONT.) DRIVE OPERATION

Incoming AC line voltage is converted to a pulsating DC voltage by the input diode bridge. The DC voltage is supplied to the BUS filter capacitors through a charge circuit which limits inrush current to the capacitors during power-up, and discharges the capacitors after power is removed.

```
*******************************************
*  CAUTION!  ELECTRICAL SHOCK HAZARD!     *
*  DISCHARGE TIME FOR THE BUS CAPACITORS  *
*  IS APPROXIMATELY THREE MINUTES!        *
*******************************************
```

The pulsating DC voltage is filtered by the BUS capacitors which reduces the ripple level. The filtered DC voltage enters the inverter section of the drive, composed of six output transistors which make up the three output legs of the drive. Each leg has one transistor connected to the positive voltage and one connected to the negative voltage. Alternately switching on each leg transistor produces an alternating voltage on each of the corresponding motor windings. By switching each output transistor at a very high frequency (known as the carrier frequency) for varying time intervals, the inverter is able to produce a smooth, three phase, sinusoidal current wave which optimizes motor performance.

## (2.3) CIRCUIT DESCRIPTION

The flexible design of the L1000 drive allows for frequency (speed) control from four different input signals; a speed potentiometer (0-5 VDC), or an external 4-20 mA, 0-5 VDC or 0-10 VDC signal. The start/stop, reversing, jog, and speed select circuits are operated from 12 VDC. The start/stop circuit allows for either three wire (two contact) control or two wire (one contact) control. All input and output functions on the control board share a single power supply and a common terminal (number 2). The control board is isolated from the power section and can be grounded if necessary.

The rate at which the drive attempts to accelerate or decelerate the motor, to the speed commanded by the input speed signal, is determined by the ramp time of the "ACCEL-DECEL" circuit. The rates of the acceleration and deceleration ramps are separately adjustable by setting the "ACCEL" and "DECEL" potentiometers.

The L1000 has several adjustments available that can alter output voltage, frequency, and wave shape. One of these adjustments is the slip compensation which helps maintain motor speed with increased loading. Slip compensation slightly increases the output frequency as output current (load) increases. The amount of slip compensation is adjusted by the "SLIP COMP" potentiometer. The voltage output can be altered by adjusting the "VOLTS/HERTZ" potentiometer and biased at low frequency by adjusting the "BOOST" potentiometer. Biasing the volts to hertz ratio at low frequency increases the low frequency torque capability of the motor by compensating for resistance.

The Base Driver Board of the L1000 incorporates six amplifiers and protection circuits which supply power to the six output transistors. The Base Driver Board also contains a charging and discharging circuit for the BUS filter capacitors, an isolated motor current feedback circuit, a voltage feedback circuit, and a fault signal circuit.

The L1000 has many built in protection circuits. These include phase-to-phase and phase-to-ground short circuit protection, high and low line voltage protection (+/- 12%), protection against excessive ambient temperature and against continuous excessive output current (adjustable by the "OL" potentiometer). Activation of any of these circuits will cause the drive to shut down in a protection mode ("trip") and diagnostic display to indicate an "F", "H", "L", "A", or "P".

The L1000 has terminals for three output signals, which are proportional to output frequency; a 0-1 mA signal, a 0-5 VDC signal, and a pulse train at 6 or 192 times the output frequency. A terminal for a 0-1 mA output signal, which is proportional to motor current, is available for load indication.

The L1000 series control board comes equipped with a control relay which has an isolated form "C" contact rated at 1.5 amps resistive at 28 VDC or 120 VAC. This relay can be programed to indicate either drive run or fault.

## (3.0) INSTALLATION

**********
* WARNING! *
* *
* DRIVES MUST NOT BE INSTALLED WHERE SUBJECTED TO ADVERSE *
* ENVIRONMENTAL CONDITIONS! *
* DRIVES MUST NOT BE INSTALLED WHERE SUBJECTED TO: *
* COMBUSTIBLE, OILY,OR HAZARDOUS VAPORS OR DUST; EXCESSIVE *
* MOISTURE OR DIRT; STRONG VIBRATION; EXCESSIVE AMBIENT *
* TEMPERATURES. CONSULT AC TECHNOLOGY FOR MORE INFORMATION *
* ON THE SUITABILITY OF THE L1000 SERIES DRIVE TO A *
* PARTICULAR ENVIRONMENT. *
* *
**********

All models of the L1000 series drive must be mounted in a vertical position for proper heatsink cooling. Chassis models should be installed in an electrical enclosure which will provide ample protection and is capable of maintaining internal ambient temperatures below 55 C (130 F). Drives with ventilated (Type 1) enclosures can be installed in ambient temperatures up to 50 C (122 F). Drives with Type 4 and Type 12 enclosures require ambient temperatures which are not above 40 C (104 F). Adequate space (2-4 inches) must be maintained around the drive to allow for convective cooling. Fans or blowers may be used to insure proper cooling in tight quarters. Other heat producing equipment should not be allowed to interfere with the proper cooling of the L1000 drive.

Extreme care must be taken to avoid damaging drive components or contaminating the drive with metal fragments (which may cause shorting of electrical circuits), when drilling holes for wiring. Cover drive components with a clean cloth to keep out metal chips and other debris when drilling. Use a vacuum cleaner to clean drive components after drilling, even if chips do not appear to be present. Do not use positive air pressure to blow chips out of drive components, (as this tends to lodge chips under drive components).

Type 4 and type 12 enclosures have brackets or knockout holes for mounting. Chassis models and Type 1 enclosures have pre-drilled mounting holes. Mounting holes on type AB enclosures can be accessed by removing the top cover and bottom plate. To remove the top cover; open the enclosure door and loosen the screw holding the top cover to the heatsink, remove the screws on the upper right (front) of the top cover and loosen the screws on the top of the drive, then slide the cover forward. The bottom plate of the enclosure can be removed by loosening the four retaining screws, pivoting the front of the plate dow (about 1") and sliding the plate forward and off.

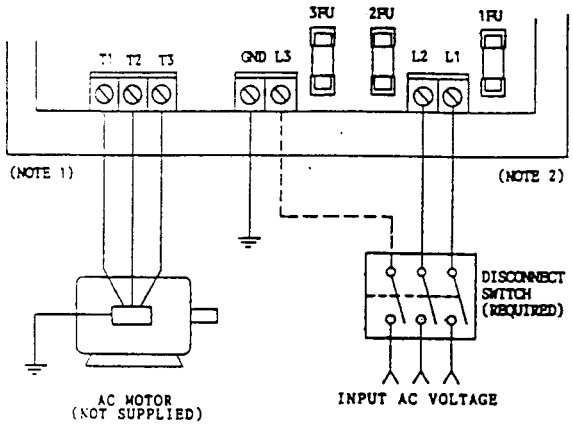
AC Technology Corporation
Douglas Street. Uxbridge, MA 01569
508-278-6781 FAX 508-278-7873

| AC Tech<br>Variable Speed AC Motor Drives | Title: L1000 POWER WIRING DIAGRAM | | |
|---|---|---|---|
| AC Technology Corporation<br>Uxbridge, Massachusetts 01569 | Drawing no. 1004.018.0 | Sheet 1 of 1 | Date 4-17- |
| | Drawn RMP | Checked JF | Ref. |

**********
* DO NOT WIRE INCOMING AC TO TERMINALS T1, T2, OR T3! *
**********

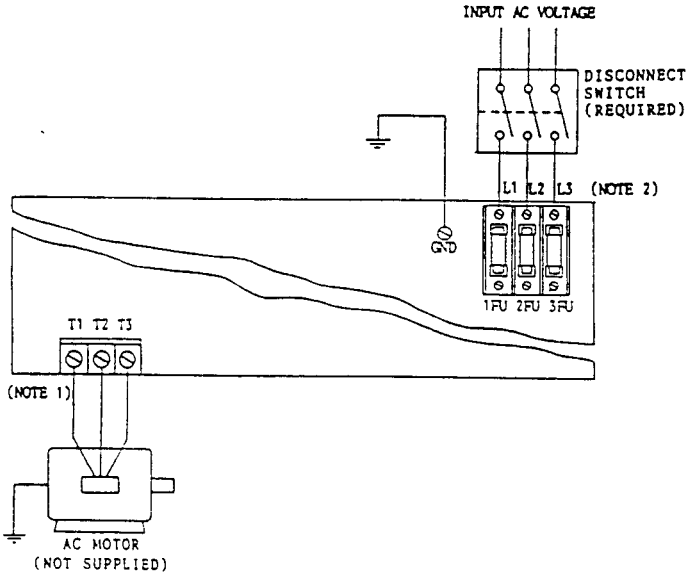
MODELS:

L12010-L12050
L13010-L13075
L14010-L14075
L15020-L15075




MODELS:

L12075-L12030
L13100-L13600
L14100-L14750
L15100-L15600




INSTALL, GROUND, AND WIRE IN ACCORDANCE WITH ALL APPLICABLE ELECTRICAL CODES

NOTE: 1.) WIRE THE MOTOR FOR THE PROPER VOLTAGE PER THE OUTPUT RATING OF THE DRIVE. MOTOR WIRES SHOULD BE RUN IN A SEPARATE CONDUIT AWAY FROM CONTROL WIRING AND INCOMMING AC POWER WIRES.

2.) USE TERMINALS L1 AND L2 FOR DRIVES NAMEPLATED AS SINGLE PHASE INPUT. USE TERMINALS L1 AND L2 FOR SINGLE PHASE INPUT, AND L1, L2, AND L3 FOR THREE PHASE INPUT FOR DRIVES NAMEPLATED AS SINGLE OR THREE PHASE INPUT. USE TERMINALS L1, L2, AND L3 FOR DRIVES NAMEPLATED AS THREE PHASE INPUT.

## (4.0) WIRING THE L1000 SERIES DRIVE

Check applicable electrical codes for required wire type and size, grounding requirements, over-current protection, and incoming power disconnect, before wiring the L1000 drive. Input and output wire should have insulation rated to a minimum of 105 C (221 F ) and should be sized conservatively to minimize the voltage drop.

Extreme care must be taken to avoid damaging drive components or contaminating the drive with metal fragments (which may cause shorting of electrical circuits), when drilling holes for wiring. Cover drive components with a clean cloth to keep out metal chips and other debris when drilling. Use a vacuum cleaner to clean drive components after drilling, even if chips do not appear to be present. Do not use positive air pressure to blow chips out of drive components, (as this tends to lodge chips under drive components).

## (4.1) POWER WIRING

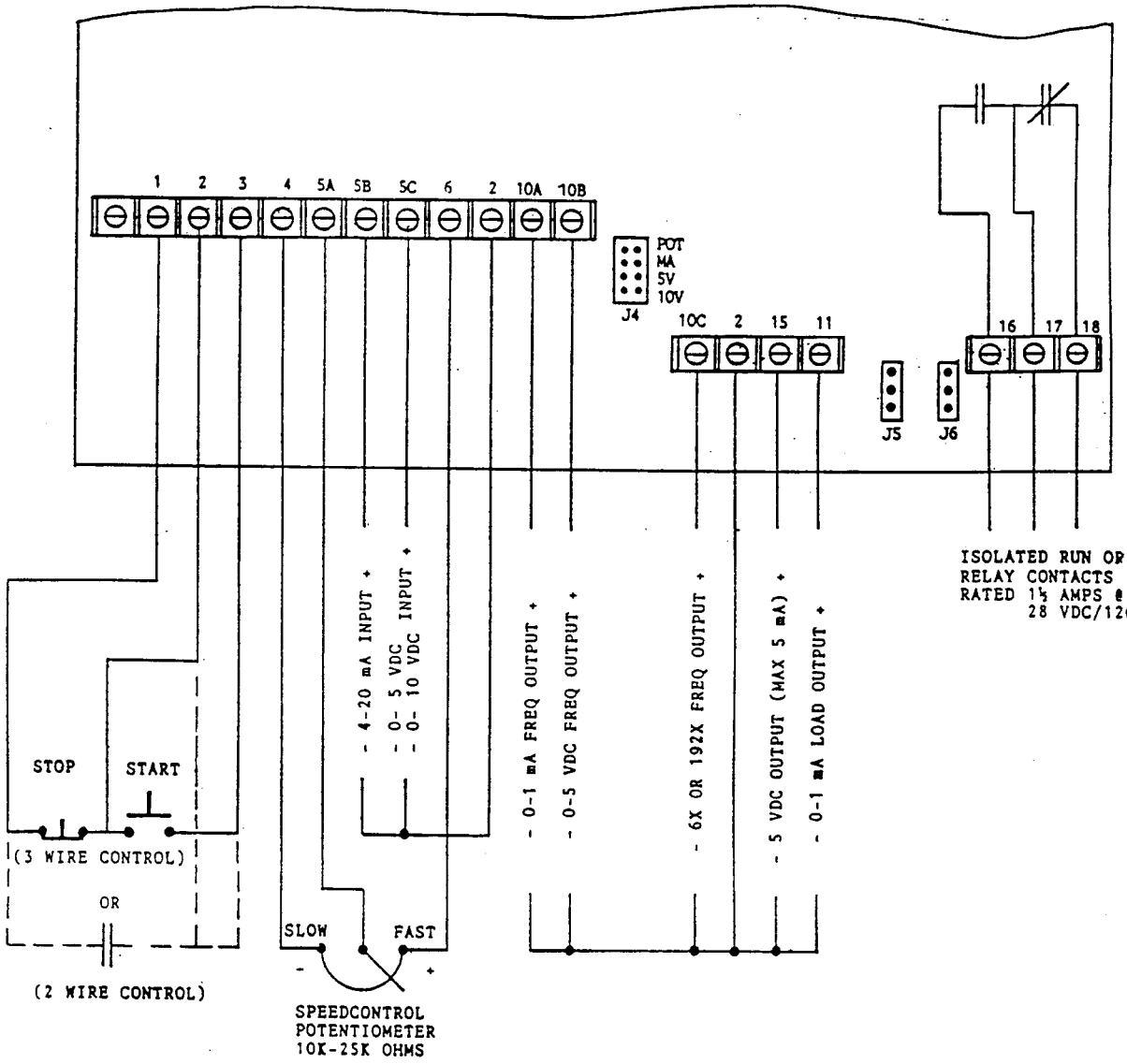
```
**********************************************************
*                                                        *
* DO NOT WIRE INCOMMING AC POWER TO TERMINALS T1, T2, OR T3! *
* THIS WILL CAUSE SEVERE DAMAGE TO THE DRIVE             *
*                                                        *
**********************************************************
```

An input power disconnect switch or contactor MUST be wired in series with terminals L1, L2, and L3 (L1 and L2 if input is single phase). This may be supplied by AC Tech as an option. If one has not been supplied by AC TECH, a disconnect means must be wired in during installation. This disconnect must be used to power down the drive when servicing, or when drive is not to be operated for a long period of time.

If the drive is nameplated for single phase input, wire to terminals L1 and L2. If the drive is nameplated for single or three phase input, wire to terminals L1 and L2 for single phase input, or L1, L2, and L3 for three phase input. If the drive is nameplated for three phase input, wire to terminals L1, L2, and L3.

All three power output wires, from terminals T1, T2, and T3 to the motor, must be kept tightly bundled and run in a separate conduit away from other wiring. Any switch or contactor installed in the power output wiring should NOT be operated while the drive is in operation, as this will cause the drive to "trip". Consult AC Technology for more information if disconnection during drive operation is required.

| AC Tech<br>Variable Speed AC Motor Drives<br>AC Technology Corporation<br>Uxbridge, Massachusetts 01569 | Title L1000 CONTROL WIRING DIAGRAM | | |
|---|---|---|---|
| | Drawing no. 1004.018.0 | Sheet 1 of 1 | Date 4- |
| | Drawn RMP | Checked JF | Ref. |




INSTALL, GROUND, AND WIRE IN ACCORDANCE WITH ALL APPLICABLE ELECTRICAL CODES

NOTE: 1.) ALL TERMINALS LABELED "2" ARE COMMON AND ANY ONE MAY BE EARTH GROUNDED IF REQUIRED.

2.) CONTROL WIRES MUST BE RUN IN A SEPARATE CONDUIT AWAY FROM MOTOR AN INCOMING AC VOLTAGE WIRES.

3.) ALL CONTROL WIRES MUST BE TWISTED IN WITH A WIRE CONNECTED TO TERMINAL 2, EXCEPT FOR SPEED CONTROL POTENTIOMETER WIRES (THESE J BE TWISTED).

4.) IF CONTROL WIRES ARE RUN MORE THAN TWELVE FEET FROM THE DRIVE PANE SHIELDED WIRE WITH THE SHIELD GROUNDED TO THE PANEL MUST BE USED.

## (4.3) CONTROL WIRING

Control signal wiring, when run external to the drive, MUST be in a separate conduit and away from all input and output power wiring. Use twisted wires or shielded cable grounded at drive panel ONLY.

### RUN COMMAND

Start-stop control of the L1000 series can be accomplished by either a two wire or a three wire circuit. For two wire control, terminal 2 is connected to terminal 3 and the run contact is wired to terminals 1 and 2. For three wire control, a normally closed switch is wired to terminals 1 and 2 (stop signal) and a normally open switch is wired to terminals 2 and 3 (start signal).

### SPEED REFERENCE SIGNAL

The L1000 allows for four speed reference signal types; a speed potentiometer (0-5 volt), 4-20 mA, 0-5 VDC or 0-10 VDC signals. The type of speed reference signal is selected by connecting to the proper control board terminals and moving the jumper plug on the "J4 Select Input" header to the proper position. For control by a speed pot, the pot wiper lead is connected to terminal 5A, the high and low end leads are connected to terminals 6 and 4, and the jumper plug is moved to the "POT" position on the "J4 Select Input" header. For 4-20 mA control, wire the positive to terminal 5B and the negative to terminal 2 and move the jumper plug to the "MA" position. For 0-5 VDC control or 0-10 VDC control, wire the positive to terminal 5C and the negative to terminal 2 and move the jumper plug to the "5V" or "10V" position. The input impedance of the speed control potentiometer and 0-5 VDC input is 100 K ohms, the 0-10 VDC input is 200 K ohms and the 4-20 Ma input is 100 ohms (0.4 to 2.0 VDC). Terminal 2 is circuit common (-).

### OUTPUT FREQUENCY AND LOAD SIGNALS

The L1000 is equipped with output signals that are proportional to output frequency and current (load). These signals can be used to interface with other equipment or to operate speed and load meters.

Three signals proportional to frequency are available. Two of these are a 0-5 VDC signal with a source impedance of 560 ohms between terminals 2 and 10B and a 0-1 mA DC signal with an open circuit voltage of 6 VDC between terminals 2 and 10C. Both of

these signals are calibrated by adjusting the "SPD METER CAL" pot. There is a frequency output signal (pulse train) between terminals 2 and 10C. This frequency output signal can be selected as either 6 or 192 times the frequency of the drive power output by moving the jumper plug on the "J5 6X-192X" header to the corresponding position. The open circuit voltage of this signal is 12 VDC with a source impedance of 2200 ohms.

A 0-1 mA DC signal between terminals 2 and 11 is proportional to output current and can be used to indicate the motor load. This signal has a source impedance of 4700 Ohms and can be calibrated by adjusting the "LOAD METER CAL" pot.

See the "USER ADJUSTMENTS" section for information on how to make adjustments to these output signals.

RUN OR FAULT RELAY

The L1000 control board has a control relay with a form "C" contact which is connected to terminals 16, 17 , and 18. This relay can be used as either a run relay or a fault relay by positioning the jumper plug of the "J6 RUN-FAULT" header.

When used as a fault relay, the relay energizes when incoming power is applied and will remain energized, unless one of the drive protection circuits ("A," "F", "H", "L", or "P") is activated. When used, the fault relay is reset by removing the run command.

When used as a run relay, the relay energizes when a start command is present and remains energized until the output frequency returns to zero after a stop command. Activation of any of the protection circuits ("A", "F", "H", "L", or "P") will also de-energize the run relay.

Note the section on Drive Diagnostics for an explanation of protection circuit display symbols.

## (5.0) VOLTAGE SELECTION

L1200 and L1300 series drives can operate, not only on input voltages of 230 VAC and 380 VAC, but also on input voltages of 208 VAC and 415 VAC respectively. Be sure the drive is properly set for the corresponding input voltage.

### (5.1) 208 VOLT INPUT ON SERIES L1200 DRIVES (230 VAC MODELS)

Model L1200 is normally shipped set to operate on 230 VAC. Models L12010 - L12050 can be operated on 208 VAC by moving plug (PL3), on the driver board, to the 208 V position. For operation on 230 VAC, plug PL3 MUST be in the 230 V position. On models L12075 -L12300, 208 VAC or 230 VAC operation can be set with switch SW901 on the Line Voltage Board. Moving this switch selects the proper primary winding in the Control Transformer.

```
**************************************************************
*  WARNING: Operation of the drive on 230 VAC input while    *
*  the drive is set for 208 VAC input will damage the        *
*  Control Transformer, Control Board, and Output            *
*  Transistors.                                              *
**************************************************************
```

### (5.2) 415 VOLT INPUT ON SERIES L1300 DRIVES (380 VAC MODELS)

Model L1300 is normally shipped set to operate on 380 VAC. Models L13010 - L13075 can be operated on 415 VAC by moving plug (PL3), on the driver board, to the 415 V position. For operation on 380 VAC, plug PL3 MUST be in the 380 V position. On models L13100 - L13600, 380 VAC or 415 VAC operation can be set with switch SW901 on the Line Voltage Board. Moving this switch selects the proper primary winding in the Control Transformer.

```
**************************************************************
*  WARNING: Operation of the drive on 415 VAC input while    *
*  the drive is set for 380 VAC input will damage the        *
*  Control Transformer, Control Board, and Output            *
*  Transistors.                                              *
**************************************************************
```

## (6.0) SETTING DIP SWITCHES (SW101)

### (6.1) COAST TO STOP (SWITCH S101-1)

When the "COAST STOP" switch is in the "off" position and the drive is issued a stop command, the output frequency of the drive is reduced to zero at the rate set by "SW101-6", "SW101-7", or "SW101-8"and adjusted with the "DECEL" pot. Stopping in this mode causes the motor to stop in a controlled fashion.

When the "COAST STOP" switch is in the "on" position, the drive is in the coast to stop mode. When a stop command is given, the drive instantaneously de-energizes the motor, allowing the motor to coast. Brake motors are usually run in this mode.

### (6.2) AUTO START (SWITCH S101-2)

Putting this switch in the "off" position prevents the drive from starting when line voltage is applied with the start command already closed. If input voltage is applied while the start command is closed, the diagnostic display will show "e" indicating a start error. To start the drive, open the start command to clear the error and re-apply the start. Drives are usually shipped with this switch in the "off" position.

This switch is placed in the "on" position for applications requiring automatic start whenever power is applied to the drive. To run in this mode the "AUTO START" switch is put in "on" position and the start circuit is kept closed. The drive should not be started frequently (more than three times per hour), using the auto start feature.

```
**********************************************************
*                                                        *
*                        CAUTION!                        *
*   INSURE THAT AUTOMATIC START WILL NOT CAUSE INJURY!   *
*                                                        *
**********************************************************
```

## (6.3) EXTENDED FREQUENCY RANGES (SWITCHES 101-3, 4, AND 5)

The output frequency range of 0-60 Hz constant torque can be extended to 72, 90, or 120 Hz constant horsepower or 0-120 Hz constant torque and 144, 180, or 240 constant horsepower by positioning switches SW101-3, SW101-4, SW101-5, and either removing (open) or not removing (close) jumper wire J3. These switches are labeled "WAVE SEL", "FREQ SEL A", and "FREQ SEL B". The table below lists these setting combinations as well as those for 50 hertz input models (L1300 series).

**********
* CAUTION! *
* OPERATING MOTORS OR DRIVEN LOADS ABOVE THE MANUFACTURER'S *
* RATED SPEED CAN CAUSE DAMAGE TO EQUIPMENT AND INJURY TO *
* PERSONNEL. CONSULT MOTOR AND EQUIPMENT MANUFACTURER FOR *
* INFORMATION CONCERNING SAFE OPERATION ABOVE RATED SPEEDS. *
**********

DIP SWITCH SETTINGS FOR 60 HERTZ INPUT DRIVES
(SERIES L1200, L1400, AND L1500)

| SW101-3 | SW101-4 | SW101-5 | J3 | DESIRED OUTPUT FREQUENCY RANGE |
|---|---|---|---|---|
| ON | ON | ON | EITHER | 0-60 Hz (CT) SINE WAVE |
| ON | OFF | ON | EITHER | 0-60 Hz (CT) 60-72 Hz (CHP) SINE WAVE |
| ON | ON | OFF | EITHER | 0-60 Hz (CT) 60-90 Hz (CHP) SINE WAVE |
| ON | OFF | OFF | EITHER | 0-60 Hz (CT) 60-120 Hz (CHP) SINE WAVE |
| OFF | ON | ON | CLOSED | 0-60 Hz (CT) SQUARE WAVE |
| OFF | OFF | ON | CLOSED | 0-60 Hz (CT) 60-72 Hz (CHP) SQUARE WAVE |
| OFF | ON | OFF | CLOSED | 0-60 Hz (CT) 60-90 Hz (CHP) SQUARE WAVE |
| OFF | OFF | OFF | CLOSED | 0-60 Hz (CT) 60-120 Hz (CHP) SQUARE WAVE |
| OFF | ON | ON | OPEN | 0-120 Hz (CT) SQUARE WAVE |
| OFF | OFF | ON | OPEN | 0-120 Hz (CT) 120-144 Hz (CHP) SQUARE WAVE |
| OFF | ON | OFF | OPEN | 0-120 Hz (CT) 120-180 Hz (CHP) SQUARE WAVE |
| OFF | OFF | OFF | OPEN | 0-120 Hz (CT) 120-240 Hz (CHP) SQUARE WAVE |

DIP SWITCH SETTINGS FOR 50 HERTZ INPUT DRIVES
(SERIES L1300)

| SW101-3 | SW101-4 | SW101-5 | J3 | DESIRED OUTPUT FREQUENCY RANGE |
|---|---|---|---|---|
| ON | ON | ON | EITHER | 0-50 Hz (CT) SINE WAVE |
| ON | OFF | ON | EITHER | 0-50 Hz (CT) 50-60 Hz (CHP) SINE WAVE |
| ON | ON | OFF | EITHER | 0-50 Hz (CT) 50-75 Hz (CHP) SINE WAVE |
| ON | OFF | OFF | EITHER | 0-50 Hz (CT) 50-100 Hz (CHP) SINE WAVE |
| OFF | ON | ON | CLOSED | 0-50 Hz (CT) SQUARE WAVE |
| OFF | OFF | ON | CLOSED | 0-50 Hz (CT) 50-60 Hz (CHP) SQUARE WAVE |
| OFF | ON | OFF | CLOSED | 0-50 Hz (CT) 50-75 Hz (CHP) SQUARE WAVE |
| OFF | OFF | OFF | CLOSED | 0-50 Hz (CT) 50-100 Hz (CHP) SQUARE WAVE |
| OFF | ON | ON | OPEN | 0-100 Hz (CT) SQUARE WAVE |
| OFF | OFF | ON | OPEN | 0-100 Hz (CT) 100-120 Hz (CHP) SQUARE WAVE |
| OFF | ON | OFF | OPEN | 0-100 Hz (CT) 100-150 Hz (CHP) SQUARE WAVE |
| OFF | OFF | OFF | OPEN | 0-100 Hz (CT) 100-200 Hz (CHP) SQUARE WAVE |

"CT" = CONSTANT TORQUE "CHP" = CONSTANT HORSEPOWER

## (6.4) ACCEL AND DECEL TIME RANGES (SWITCHES SW101-6,7,8)

The L1000 series has three ranges in which the ACCEL (acceleration) and DECEL (deceleration) times can be adjusted. These ranges, 6 to 75, 1 to 12, or 0.2 to 2.4 seconds, are set by switching on SW101-6, 7, or 8 respectively. Note one, but only one, of these switches must be in the "on" position. After the ACCEL and DECEL time range has been chosen, the ACCEL and DECEL times can be adjusted individually by following the procedure in the adjustment section.

## (6.5) DELAY OVERLOAD (SWITCH SW101-9)

This switch puts the overload protection circuit in either a delay mode (switch "on") or in an instantaneous mode (switch "off"). When the overload protection circuit senses current overload, it shuts down the drive and displays a "P" on the diagnostic display.

In the instantaneous mode, the overload protection circuit is triggered instantaneously upon sensing a current level above that set with the "OL" potentiometer.

In the delay mode, the overload protection circuit trigger time is delayed. The length of this delay is inversely proportional to the amount by which the overload limit (set with the "OL" potentiometer) has been exceeded.

## (7.0) DIAGNOSTIC DISPLAY

The diagnostic display indicates the status of the drive by displaying one of the symbols in the table below. The display is located in the enclosure door on enclosed models or on the the control board of chassis models.

TABLE I DIAGNOSTIC DISPLAY CODES

| SYMBOL | MEANING | DRIVE STATUS |
|---|---|---|
| - | (INPUT) | INPUT POWER TO DRIVE IS ON - DRIVE NOT IN RUN MODE |
| O | (OUTPUT) | OUTPUT POWER PRESENT - DRIVE IN RUN MODE ("O" WILL BE 5/6 LIT AND ROTATING) |
| A | (AMBIENT) | DRIVE IN PROTECTION TRIP DUE TO HIGH AMBIENT TEMPERATURE, ABOVE 75 C |
| C | (CURRENT) | DRIVE OPERATING IN "CURRENT LIMIT" |
| F | (FAULT) | DRIVE IN PROTECTION TRIP DUE TO GROUND OR PHASE TO PHASE SHORT CIRCUIT |
| H | (HIGH) | DRIVE IN PROTECTION TRIP DUE TO HIGH INPUT LINE VOLTAGE |
| L | (LOW) | DRIVE IN PROTECTION TRIP DUE TO LOW INPUT LINE VOLTAGE |
| P | (PROTECT) | DRIVE IN PROTECTION TRIP DUE TO EXCESSIVE MOTOR LOAD |
| 8 | (OVER RIDE) | DRIVE OPERATING IN DECEL OVER-RIDE MODE |
| e | (ERROR) | START ERROR - INCOMING VOLTAGE HAS BEEN APPLIED WITH START CIRCUIT CLOSED |
| . | (REVERSE) | DRIVE OPERATING IN REVERSE (DOT IS IN LOWER RIGHT OF DISPLAY - NEXT TO "O" |

## (8.0) INITIAL POWER UP

```
**********************************************************************
*                                                                    *
*          WARNING!   HAZARD OF ELECTRICAL SHOCK!                    *
*                                                                    *
*  THE DRIVE'S POWER COMPONENTS, BASE DRIVER BOARD AND MOTOR         *
*  ARE AT LINE VOLTAGE WHEN THE INCOMING LINE IS ENERGIZED           *
*  AND FOR UP TO THREE MINUTES AFTER LINE VOLTAGE IS                 *
*  REMOVED.  ALWAYS REMOVE LINE VOLTAGE AND CHECK TO BE SURE         *
*  BUS CAPACITORS HAVE DISCHARGED BEFORE SERVICING DRIVE.            *
*                                                                    *
**********************************************************************
```

Before attempting to operate drive, motor, and driven equipment follow the procedures in this section.

Disconnect the driven load from the motor. Verify that the drive input terminals L1, L2, and L3 (L1 and L2 for single phase input) are wired to the proper input voltage (per the nameplate rating of the drive). For L1200 and L1300 series drives, verify the control transformer voltage has been properly selected, as noted in the "VOLTAGE SELECTION" section. Verify output terminals T1, T2, and T3 are wired to the proper (correct voltage) leads on the motor. Set the external speed control signal and the "MIN FREQ", "ACCEL", and "DECEL" potentiometers to minimum.

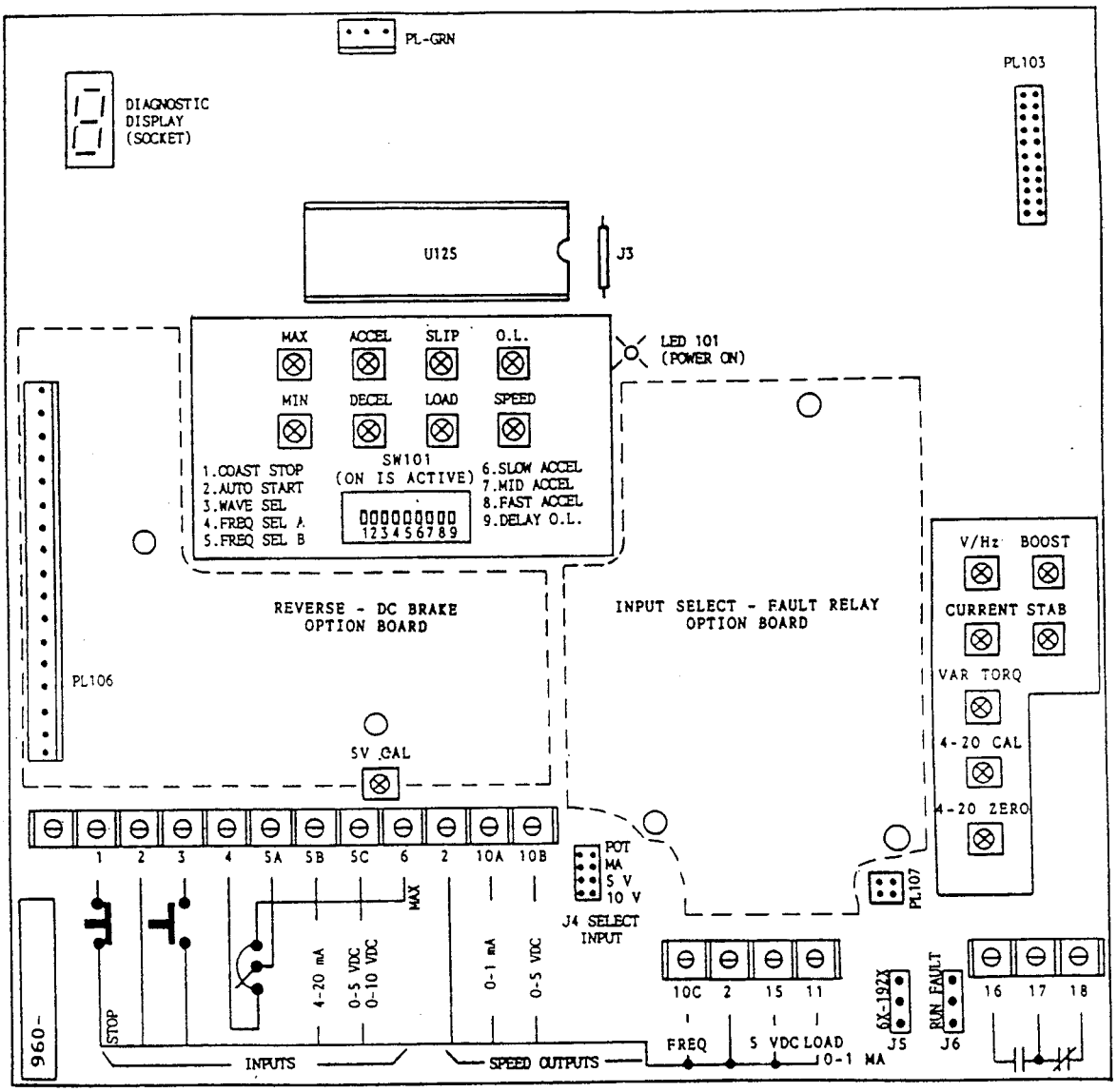
```
**********************************************************************
*                                                                    *
*   INCOMING AC POWER MUST NOT BE WIRED TO T1, T2, OR T3!            *
*                                                                    *
**********************************************************************
```

Energize the incoming power line. The diagnostic display should display a "-". Close the start command, the drive should now be in the run mode and displaying the run symbol (5/6 of an "O"). Increasing the speed control signal (increasing the setting on the speed pot) should increase the motor speed and the speed at which the "O" on the display rotates. Decreasing the speed control signal should decrease the speed of the motor and the display. Opening the start command (issuing a stop command) should decelerate the motor to a stop and return the display to a "-".

If the motor rotates in the wrong direction, remove the incoming power, wait three minutes, check to be sure the bus capacitors have discharged and swap motor wires connected to T1 and T2. If the "O" on the display does not apear or will not

rotate, remove the incoming power, wait three minutes, check to be sure the bus capacitors have discharged, and verify correct installation of wiring. If wiring is correct, re-apply incoming power, note display for drive status, and consult the trouble shooting guide.

## (9.0) CONTROL BOARD ADJUSTMENTS




THE L1000 SERIES CONTROL BOARD (960-3XX)

## (9.1) MAXIMUM AND MINIMUM SPEED ADJUSTMENT

The "MAX FREQ" and "MIN FREQ" potentiometers are used to set maximum and minimum motor speeds when the speed control signal is from an external potentiometer (wired to terminals 4, 5A, and 6), but have no effect on 4-20 mA, 0-5 VDC, or 0-10 VDC speed control reference signals.

Select the desired frequency range per the "SETTING DIP SWITCHES - EXTENDED FREQUENCY RANGES" section, before setting the "MAX FREQ" and "MIN FREQ" potentiometers. Turn the external speed potentiometer to minimum, full counterclockwise. Start the drive and slowly turn the "MIN FREQ" potentiometer clockwise until the motor reaches the desired minimum speed. Minimum frequency can be set from 0% to 50% of the selected frequency range.

Slowly turn the external speed potentiometer to maximum, full clockwise. With the drive running at full speed, slowly turn the "MAX FREQ" potentiometer counterclockwise until the motor reaches the desired maximum speed. Maximum frequency can be set down to 50% of the selected frequency range.

## (9.2) ACCELERATION AND DECELERATION TIME ADJUSTMENT

These adjustments affect the rate of speed change during starts, stops, or when the speed control reference signal is raised or lowered. The acceleration or deceleration times can be adjusted within the ranges selected with dip switches 6, 7, and 8 (see "DIP SWITCH SETTING"). Turning the "ACCEL" or "DECEL" potentiometer counterclockwise will increase the acceleration or deceleration time.

If the inertia of the driven load requires greater torque (current) to accelerate than can be provided by the drive at the existing "CURRENT LIMIT" setting, the acceleration time will automatically increase. This will cause the diagnostic display to indicate a "C" as the motor accelerates.

Minimum deceleration time for large inertia loads is typically three to four times the minimum acceleration time. With the use of an optional dynamic braking assembly, deceleration time can equal minimum acceleration time (See "DYNAMIC BRAKING"). If the inertia of the driven load requires a greater deceleration time than the rate set on the "DECEL" potentiometer, the time will automatically increase and the center bar of the diagnostic display will flash. This condition is more prevalent at higher motor speeds.

## (9.3) SLIP COMPENSATION

The slip compensation circuit increases output frequency to compensate for motor slippage caused by increased load (see the "AC MOTOR OPERATION" section for an explanation of slip).

Turning the "SLIP COMP" potentiometer clockwise increases slip compensation. If the "SLIP COMP" potentiometer is set too high, the motor speed may become unstable and "hunting" may occur. This may cause one of the drive protection circuits to activated ("H", "F", "P", or "C" on status indicator).

## (9.4) OVERLOAD LEVEL SET

The "O.L. LEVEL SET" potentiometer sets the level of motor current (load) that will activate the protection circuit and shut the drive down ("trip the drive"). This adjustment is used in either an instantaneous or delayed mode, depending on the setting of dip switch SW101-9 (see "DIP SWITCH SETTINGS"). The overload level adjustment has a range of 70% (full counterclockwise) to 180% (full clockwise) on the "O.L. LEVEL SET" potentiometer.

When operated in the instantaneous trip mode (SW101-9 "OFF"), any load which causes motor current to exceed the set overload level will instantaneously cause the drive to trip. When in the delayed mode, a motor load causing motor current to exceed the overload level will not trip the drive until a delay period has passed. The length of this delay period is inversely proportional to the amount by which the overload limit has been exceeded.

To adjust the "O.L. LEVEL SET" setting, first determine the type of trip required for the given application and set dip switch 101-9. Note the full load current rating of both the drive and the motor. Turn the "O.L. LEVEL SET" potentiometer, fully counterclockwise. Operate the drive and motor under load for thirty minutes. The output current should remain within the rated limits. If a nuisance trip occurs during operation, turn the "O.L. LEVEL SET" clockwise one division. Repeat this procedure until satisfactory performance is achieved.

## (9.5) SPEED METER CALIBRATION

The "SPD METER CAL" potentiometer is used to adjust the analog output frequency indicating signals, which are used to indicate motor speed (see "OUTPUT FREQUENCY AND LOAD SIGNALS" in the "CONTROL BOARD WIRING" section). Turning the "SPD

METER CAL" potentiometer clockwise increases the level of the 0-1mA and 0-5 VDC signal with respect to the output frequency of the drive.

(9.6) LOAD METER CALIBRATION

The "LOAD METER CAL" potentiometer is used to adjust the 0-1 mA DC current indicating signal. This signal can be used to power a load meter (see "OUTPUT FREQUENCY AND LOAD SIGNALS" in the "CONTROL BOARD WIRING" section). Turning the "LOAD METER CAL" potentiometer clockwise increases the level of this signal with respect output current of the drive. This signal has approximately a 4 to 1 range. When used with digital meters , a 22 MFD, 16 VDC tantalum capacitor connected between terminals 2 (negative) and 11 (positive) on the control board may be needed for filtering.

(9.7) VOLTS TO HERTZ RATIO ADJUSTMENT

The "V/Hz" potentiometer is used to change the ratio between drive output voltage (Volts) and frequency (Hertz). This ratio has a unique value which optimizes motor output (see the "AC MOTOR OPERATION" section).

Standard L1200, L1400, and L1500 series are preset at the factory for full rated output voltage of 230, 460, and 575 VAC at 60 Hz, with V/Hz ratios of 3.83, 7.67, and 9.58 respectively. Standard L1300 series drives are set for full rated voltage output of 380 VAC at 50 Hz, with a V/Hz ratio of 7.60. Factory settings are marked in red but can be changed if needed for special motors or applications. Adjustable range is 60% to 110% of normal ratio.

To re-set volts per hertz ratio, first turn the "V/Hz" potentiometer to a near fully counterclockwise position and place an ANALOG AC voltmeter (must be analog) across output terminals T1 and T2. Start the drive and, using a tachometer (not the speed meter on the drive), set the motor to 90% of the rated motor speed. Turn the "V/Hz" potentiometer clockwise until the measured voltage reaches 90% of rated voltage (207 VAC for 230 VAC drives, 342 VAC for 380 VAC drives, 414 VAC for 460 VAC, and 518 VAC for 575 VAC drives).

(9.8) BOOST VOLTAGE ADJUSTMENT

The "BOOST" potentiometer is used to increase the amount of voltage applied to the motor when the drive is operated at very low output frequencies.

At lower motor speeds, a large percentage of available output

voltage is used to overcome resistance in the motor windings rather than producing motor current (torque). Increasing the voltage at low speed can compensate for resistance in the motor windings and increase low speed torque.

Turn the "BOOST" clockwise to increase the motor starting and low speed torque. Decrease the setting if the motor exhibits excessive low speed cogging or heating.

(9.9) VARIABLE TORQUE ADJUSTMENT

The variable torque adjustment is used for applications where less torque is required as speed decreases and lower motor noise is desirable. Centrifugal fans and pumps, installed in commercial buildings, are typical applications of this type.

When the "VAR TORQ" potentiometer is full counterclockwise the drive is in the standard operating (constant torque) mode. Turning the "VAR TORQ" potentiometer clockwise will reduce motor torque and noise at lower speeds, but may cause the motor to stall if set too high.

(9.10) CURRENT LIMIT ADJUSTMENT

The "CURRENT" potentiometer is used to limit the maximum power output current the drive will produce. The limit is increased by turning the potentiometer clockwise, and has a 0 to 180% range. The limit is set at maximum current at the factory, but can be decreased if an application requires a limited maximum setting of the torque or power (current) level.

(9.11) STABILITY ADJUSTMENT

Some high efficiency or low slip motors may exhibit instability (speed oscillation) when operated at low speeds. This generally occurs between 12 and 24 hertz. The L1000 is equipped with a stability circuit which usually can eliminate this condition.

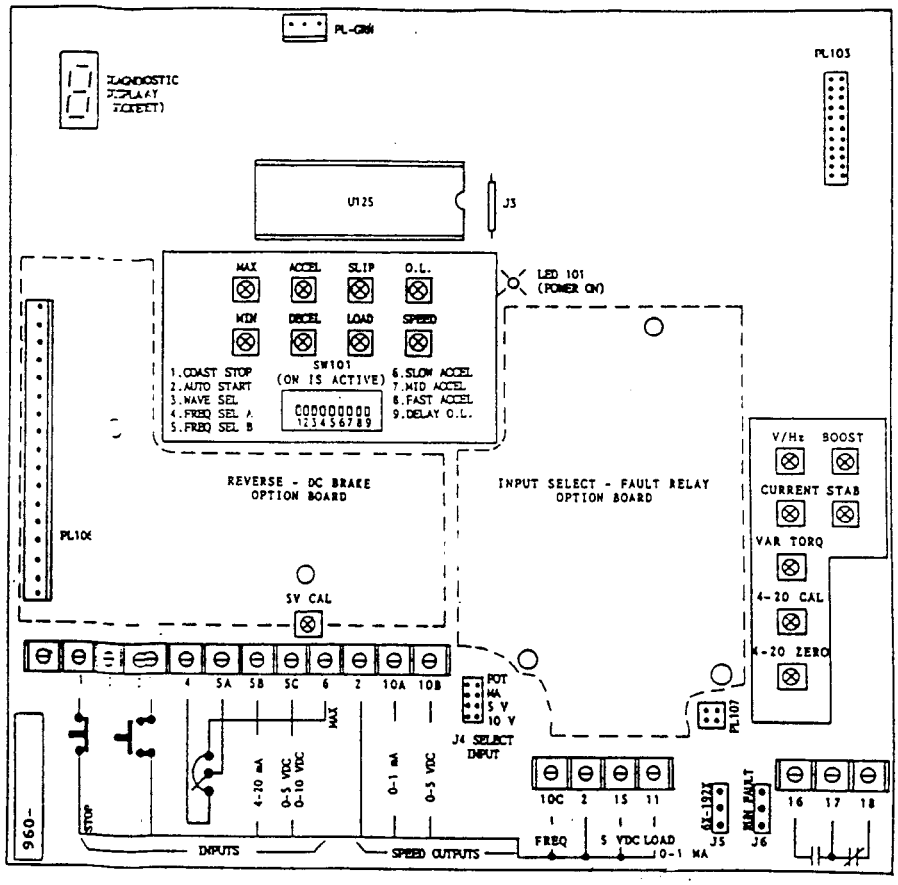
To make the stability adjustment, first turn the "STAB" potentiometer fully counterclockwise and operate the motor at the speed where the greatest degree of instability occurs. Turn the "STAB" potentiometer clockwise, slightly, until the condition is minimized. Setting this adjustment too high may cause instability at higher speeds and/or a drive protection trip which displays "F" or "H" on the diagnostic.

## (9.12) 4-20 mA ZERO AND CALIBRATION ADJUSTMENTS

A 4-20 mA reference signal (follower), used to control speed (see "SPEED REFERENCE SIGNALS" in the "CONTROL BOARD WIRING" section), can be zeroed and calibrated using the "4-20 ZERO" and "4-20 CAL" potentiometers. These potentiometers are preset at the factory for the full speed range of operation and marked in red, but can be changed if necessary.

The "4-20 ZERO" potentiometer is used to "zero" the output frequency corresponding to a 4 mADC input signal. Turning the potentiometer clockwise increases output frequency which corresponds to a 4 mA input signal.

The "4-20 CAL" potentiometer calibrates the signal by setting the output frequency which corresponds to a 20 mADC input signal. Turning the potentiometer clockwise increases the frequency which corresponds to a 20 mA input signal.




THE L1000 SERIES CONTROL BOARD (960-3XX)

## (10.0) OPTIONS

### (10.1) REVERSE-DC BRAKE BOARD (P/N 970-XXX)

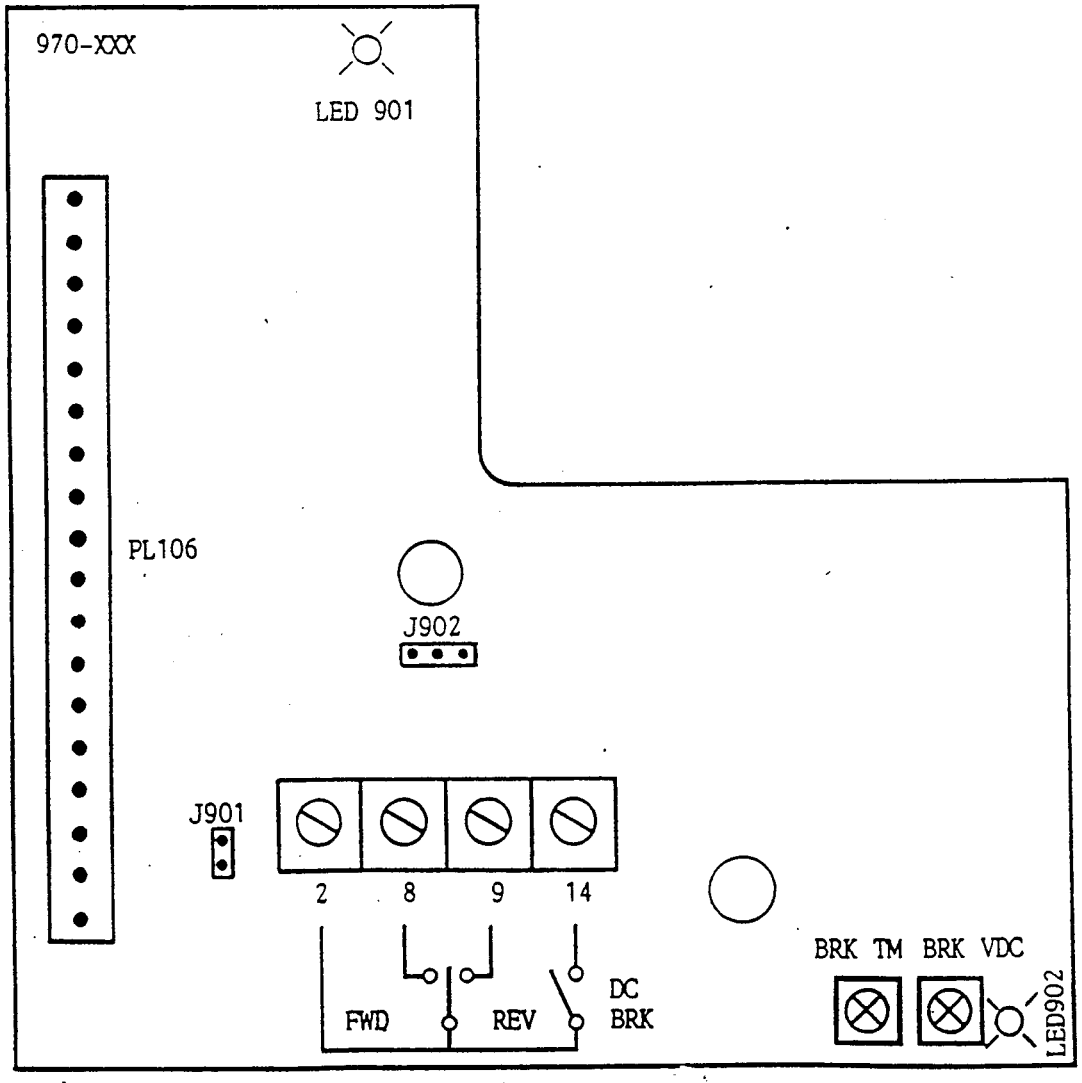
The L1000 series "REVERSE-DC BRAKE BOARD" features both electronic reversing and DC braking. Electronic reversing allows motor rotation to be switched from one direction to the other. DC braking applies low level DC voltage to the motor stator coils, which produces shaft stopping (holding) torque. This can be used to help bring a coasting motor shaft to a stop or to hold a stopped motor shaft.

The reversing circuit can be used to change the direction of motor rotation, either while the motor is rotating or when the motor is stopped. If the reversing circuit is activated while the motor shaft is rotating, the drive's output frequency is reduced at the rate set by the selected ACCEL/DECEL range and the deceleration adjustment, and reverse rotation is subsequently increased at the rate set by the acceleration adjustment. If the motor is stopped and a reversing command is given, the direction of motor rotation will be opposite that which it was prior to stopping when it is restarted. A direction signal is given by closing a contact between terminals 8 or 9 (forward or reverse) on the reversing board and terminal 2. If neither terminal 8 or 9 are closed to terminal 2, LED 901 will light, and the drive will decelerate to a stop.

The DC braking circuit applies low level DC voltage to the motor after a stop command is given. The DC voltage is applied to the motor after the output frequency of the drive has gone to zero, or instantaneously, if the drive is in the "coast to stop mode" (switch SW101-1 "on"). The DC braking voltage may be selected to be applied continuously by placing the jumper plug in the "CONT" position on the J902 header or it may be set for a duration which can range from 0.25 to 10 seconds by placing the jumper plug in the "TMD" position and adjusting the "BRK TM" pot. The DC braking circuit can be de-activated externally by closing a contact wired between terminal 2 and terminal 14 on the "REVERSE-DC BRAKE BOARD". The magnitude of the applied DC voltage is adjusted with the "BRK VDC" pot.

```
**********************************************************
*                      CAUTION!                          *
*  SETTING A CONTINUOUSLY APPLIED DC BRAKING             *
*  VOLTAGE TOO HIGH MAY CAUSE OVERHEATING OF THE         *
*  MOTOR!  MOTOR TEMPERATURE SHOULD BE MAINTAINED        *
*  WITHIN RATED LIMITS.                                  *
**********************************************************
```

The Reverse-DC Braking Board can be installed on any 960-3XX series control board which is equipped with plug "PL106". To install, clip supplied standoffs into the bottom of the option board, plug into "PL106", and secure with the screws supplied. Wire the board per the diagram on the board itself (shown below). Note, that closing terminal 14 to terminal 2 DE-ACTIVATES the DC brake.




THE REVERSE-DC BRAKING OPTION BOARD (970-XXX)

## (10.2) DYNAMIC BRAKING

### STANDARD DUTY DYNAMIC BRAKING (P/N DB1XXXX)

The standard duty dynamic braking option consists of a circuit board on models L1X010 through L1X030 and a circuit board and separate resistor assembly on models L1X050 through L1X750. Circuit boards are mounted to the drive panel with two 8-32x3/8 thread forming (chip free) screws and the resistor assembly, when required, is mounted to the inside of the enclosure using 10-32x3/8 thread forming (chip free) screws, lockwashers, and nuts. When field mounting the standard dynamic brake option, note the accompanying installation and wiring instructions.

Standard duty dynamic brakes are not recommended for continuous cycling applications which require stopping inertial loads greater than twice that of the; motor from 1800 rpm more than eight times, from 2500 rpm more than four times, or from 3600 rpm more than two times, during a five minute period.

### HEAVY DUTY DYNAMIC BRAKING (P/N HDB1XXXX)

The heavy duty dynamic braking option is capable of providing more frequent stopping and stopping larger inertia loads than the standard duty dynamic braking option by using externally mounted resistors.

All heavy duty dynamic braking options consist of a circuit board, a separate resistor assembly (mounted external to the enclosure containing the drive) and a protective ventilated cover for the resistor assembly. Circuit boards are mounted to the drive panel with two 8-32x3/8 thread forming (chip free) screws and the resistor assembly and ventilated cover are mounted using 10-32x3/8 thread forming (chip free) screws, lockwashers, and nuts. When field mounting the heavy duty dynamic brake option, note the accompanying installation and wiring instructions.

Continuous braking ("hold back") of; 100% (of motor rated torque) at output frequencies up to 15 Hz (25% of motor base speed), 50% at output frequencies up to 30 Hz (50% of motor base speed), and 25% at output frequencies up to 60 Hz (100 of motor base speed) is possible.

Intermittent (once per minute) braking ("hold back") at 180% of motor rated torque is possible for; thirty seconds at output frequencies up to 15 Hz (25% of motor base speed) fifteen seconds at output frequencies up to 30 Hz (50% of

motor base speed), and seven seconds at output frequencies up to 60 Hz (100% of motor base speed).

Heavy duty dynamic braking is not recommended for continuous cycling applications which require stopping inertial loads greater than twice that of the motor from 1800 rpm more than eight times, from 2500 rpm more than four times, or from 3600 rpm more than two times, during a one minute period.

Consult AC Technology if assistance is needed when selecting or sizing a dynamic brake option. Please have available information concerning the number of stops per minute, required stopping time, motor operating speed, inertia of the driven load, and the motor frame size.

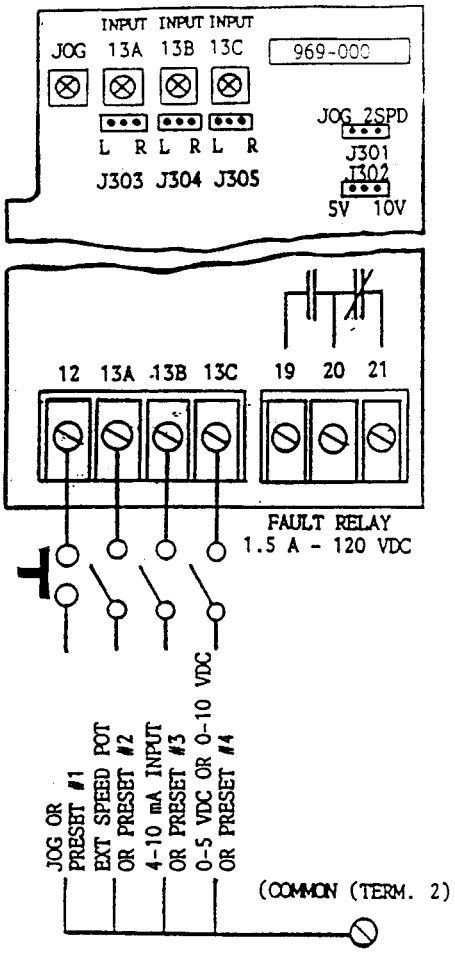
## (10.3) INPUT SELECT-FAULT RELAY BOARD (P/N 969-XXX)

The "INPUT SELECT-FAULT RELAY BOARD" combines a fault relay circuit, four internal speed potentiometers, and a control signal selection circuit. This option allows for jogging, switching from auto to manual speed control, up to four internal preset speeds, a fault indicating relay, and switching between a variety of speed references.

This board augments the existing choice of speed references with four internal potentiometers for use as preset speeds. One of these potentiometers can be set to override any active speed reference for jogging applications. The fault relay is similar to the run/fault relay built into the L1000 series control board except that it functions only as a fault relay.

The INPUT SELECT-FAULT RELAY board can be installed on any 960-3XX series control board which is equipped with jumper header "J4 SELECT INPUT" and plug "PL107". To install clip the supplied standoffs into the bottom of the option board, plug into the "J4 SELECT INPUT" plug and "PL107", and secure with the supplied screws.

The input selection circuit allows selection of the active speed reference signals by an external switches. Control can be switched between a maximum of four possible selections. The position of jumper plugs J301 through J305 set the type of reference at each selection and closure of contacts between terminal 2 on the control board and terminals 12, 13A, 13B, and 13C on the option board determine which reference signal is active. Note the diagram and INPUT SELECTION AND SETTING table below.




INPUT SELECTIONS AND SETTINGS

| SPEED REFERENCE AT EACH SELECTION | SELECTION NUMBER | TERMINALS CLOSED TO ACTIVATE SELECTION | JUMPER PLUG POSITIONS | | | | |
|---|---|---|---|---|---|---|---|
| | | | J301 | J302 | J303 | J304 | J305 |
| JOG BUTTON | ONE | 12 AND 2 | JOG | — | — | — | — |
| or | | | | | | | |
| PRESET SPD. #1 (JOG POT.) | | 12 AND 2 | 2SPD | — | — | — | — |
| EXT. POT. | TWO | 13A AND 2 | — | — | R | — | — |
| or | | | | | | | |
| PRESET SPD. #2 (INPUT 13A) | | 13A AND 2 | — | — | L | — | — |
| 4-20 mA | THREE | 13B AND 2 | — | — | — | R | — |
| or | | | | | | | |
| PRESET SPD. #3 (INPUT 13B) | | 13B AND 2 | — | — | — | L | — |
| 0-5 VDC | FOUR | 13C AND 2 | — | 5V | — | — | R |
| or | | | | | | | |
| 0-10 VDC | | 13C AND 2 | — | 10V | — | — | R |
| or | | | | | | | |
| PRESET SPD. #4 (INPUT 13C) | | 13C AND 2 | — | — | — | — | L |

Possible selections are:

1.) JOG BUTTON OR PRESET SPEED #1

a) JOG: If J301 is in the "JOG" position and terminal 12 to terminal 2 is closed the drive will START AND RUN at the speed set on the "JOG" potentiometer. NOTE: THIS SETUP AND SELECTION OVERRIDES ANY OTHER REFERENCE THAT MIGHT BE ACTIVE INCLUDING "STOP".

b) If J301 is in the "2SPD" position, terminal 12 to terminal 2 is closed and the drive run command is closed, the drive will run at the speed set on the "JOG" potentiometer (preset #1).

2.) EXTERNAL POTENTIOMETER OR PRESET SPEED #2

a) EXT. POTENTIOMETER: If J303 is in the "R" position, terminal 13A to terminal 2 is closed, terminal 12 to terminal 2 is open and the drive run command is closed, the drive will run at the speed set by the external speed potentiometer signal applied at terminal 5A.

b) If J303 is in the "L" position, terminal 13A TO terminal 2 is closed, terminal 12 to terminal 2 is open and the drive run command is closed, the drive will run at the speed set on the internal "Input 13A" potentiometer (preset #2).

3.) 4-20 mA INPUT OR PRESET SPEED #3

a) 4-20 mA INPUT: If J304 is in the "R" position, terminal 13B to terminal 2 is closed, terminal 12 to terminal 2 is open and the drive run command is closed, the drive will run at the speed set by the external 4-20mA DC signal applied to terminal 5B.

c) If J304 is in the "L" position, terminal 13B to terminal 2 is closed, terminal 12 to terminal 2 is open and the drive run command is closed, the drive will run at the speed set on the internal "Input 13B" potentiometer (preset #3).

4.) 0-5 VDC OR 0-10 VDC OR PRESET SPEED #1

a) 0-5 VDC INPUT: If J305 is in the "R" position, terminal 13C to terminal 2 is closed, terminal 12 to terminal 2 is open, J302 is in the "5V" position and drive run command is closed the drive will run at the speed set by the external 0-5 VDC signal applied to terminal 5C.

b) 0-10 VDC: If J305 is in the "R" position, terminal 13C to terminal 2 is closed, terminal 12 to terminal 2 is open, J302 is in the "10V" position and drive run command is closed the drive will run at the speed set by the external 0-10 VDC signal applied to terminal 5C.

c) If J305 is in the "L" position, terminal 13C to terminal 2 is closed, terminal 12 to terminal 2 is open and the drive run command is closed, the drive will run at the speed set on the internal "Input 13C" potentiometer (preset #4).

L1000 SERIES TROUBLE SHOOTING GUIDE

**********
*
*
*  WARNING!
*
*  HAZARD OF ELECTRICAL SHOCK
*
*  ELECTRICAL COMPONENTS OF THE DRIVE AND MOTOR ARE AT LINE VOLTAGE
*  WHEN THE INCOMING LINE IS ENERGIZED AND FOR UP TO ONE MINUTE AFTER
*  LINE VOLTAGE IS REMOVED.  ALWAYS REMOVE LINE VOLTAGE AND VERIFY
*  THAT BUS CAPACITORS HAVE FULLY DISCHARGED BEFORE TOUCHING ANY
*  ELECTRICAL PART OF THE DRIVE OR MOTOR.  ALL DRIVE SERVICING MUST
*  PREFORMED BY QUALIFIED PERSONNEL USING APPROPRIATE CAUTION.
*  CONNECTING GROUNDED OR NON-INSULATED TEST LEADS TO THE L1000
*  SERIES DRIVE MAY DAMAGE THE DRIVE AND THE TEST EQUIPMENT.
*
**********

REQUIRED EQUIPMENT

1) Analog type V.O.M. meter (Simpson #260/270 or equivalent)
2) Clamp-on ammeter
3) Basic hand tools

GENERAL
Do not alter the setting of any of the drive's adjustments unless instructed to do so.

This guide contains information to aid in identifying which drive component(s) may be defective. It does not contain information on how to service the drive's circuit boards. Servicing circuit boards requires a higher level of equipment and greater understanding of the drive's circuit than is available in this manual. If the drive contains a defective circuit board, it is recommended that the board be replaced or returned to the factory for servicing.

Under the heading of REMEDY, component test (number) are called for. Refer to the end of the trouble shooting guide for information on how to perform these tests.

If further assistance is needed in locating a drive problem, consult your local sales representative or AC Technology Corporation.

DIAGNOSTIC DISPLAY

The diagnostic display indicates the status of the drive by displaying one of the symbols shown below. The display is located in the enclosure door on enclosed models or on the control board of chassis models

TABLE I DIAGNOSTIC DISPLAY CODES

| SYMBOL | MEANING | DRIVE STATUS |
|---|---|---|
| - | (INPUT) | INPUT POWER TO DRIVE IS ON - DRIVE NOT IN RUN MODE |
| O | (OUTPUT) | OUTPUT POWER PRESENT - DRIVE IN RUN MODE ("O" WILL BE 5/6 LIT AND ROTATING) |
| A | (AMBIENT) | DRIVE IN PROTECTION TRIP DUE TO HIGH AMBIENT TEMPERATURE (ABOVE 75 DEGREES CELISIUS) |
| C | (CURRENT) | DRIVE OPERATING IN "CURRENT LIMIT" |
| F | (FAULT) | DRIVE IN PROTECTION TRIP DUE TO GROUND OR PHASE TO PHASE SHORT CIRCUIT |
| H | (HIGH) | DRIVE IN PROTECTION TRIP DUE TO HIGH INPUT LINE VOLTAGE |
| L | (LOW) | DRIVE IN PROTECTION TRIP DUE TO LOW INPUT LINE VOLTAGE |
| P | (PROTECT) | DRIVE IN PROTECTION TRIP DUE TO EXCESSIVE MOTOR LOAD |
| 8 | (OVER RIDE) | DRIVE OPERATING IN DECEL OVER-RIDE MODE |
| e | (ERROR) | START ERROR - INCOMING VOLTAGE HAS BEEN APPLIED WITH START CIRCUIT CLOSED |
| . | (REVERSE) | DRIVE OPERATING IN REVERSE (DOT IS IN LOWER RIGHT OF DISPLAY - NEX ) "O" |

| DIFFICULTY | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| 1. Diagnostic Display is not lit, motor does not operate and: | | |
| A. No AC line power at terminals L1, L2, and L3 (with 3 phase input) | a. An open line disconnect switch, fuse, circuit breaker or incoming wiring | a. Locate and correct |
| B. Drive Main Fuse (s) 1FU and/ or 2FU blown | a. Defective fuse | a. Replace |
| | b. Short or ground in motor or motor wiring | b. Repair or replace |
| | c. short or ground in drive wiring | c. Locate and correct |
| | d. Defective Input Dode Bridge | d. Test (#1), replace if defective |
| | e. Defective Bus Filter Capacitor(s) | e. Test (#2), replace if defective |
| | f. Defective Transistor Module(s) | f. Test (#3), replace if defective |
| | g. Defective Control Transformer | g. Test (#4), replace if defective |
| | h. Defective Base Driver Board | h. Replace and return to AC Tech for service |
| | i. Defective Control Board | i. Replace and return to AC Tech for service |
| C. Control Fuse 6FU Blown (This fuse is labeled 901FU on some models) | a. Defective Fuse | a. Replace |
| | b. Defective Base Driver Board | b. Replace and return to AC Tech for service |
| | c. Defective Control Board | c. Replace and return to AC Tech for service |
| | d. Defective Control Transformer | d. Test (#4), replace if defective |
| D. AC line voltage is present and all fuses are good | a. Defective Control Transformer | a. Test (#4), replace if defective |
| | b. Defective Control Board | b. Replace and return to AC Tech for service |
| | c. Defective Line Voltage Board (not used on all models) | c. Replace and return to AC Tech for service |
| 2. Diagnostic Display indicates 'e' when incoming power is applied to drive. | a. Start Command is closed when incoming power is applied | a. 1. Open and close start command<br>2. Note 'Auto-Start Section in 'DIP SWITCH SETTINGS' |
| | b. Defective Control Board | b. Replace and return to AC Tech for service |

| DIFFICULTY | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| 3. Diagnostic Display Indicates - and motor does not operate | a. Defective Start Command or Wiring<br>b. Defective Control Board | a. Repair or replace<br>b. Replace and return to AC Tech for service |
| 4. Diagnostic Display Indicates 'A' and Motor does not operate | a. Drive is in an excessive ambient temperature<br>b. Defective Control Board | a. Reduce temperature around Drive, note drive Specifications<br>b. Replace and return to AC Tech for service |
| 5. Diagnostic Display indicates 'F' and motor does not operate | a. Defective motor or motor wiring<br>b. Improper setting of 'Boost' and/or 'Volts/Hertz' potentiometer<br>c. Defective Transistor Module(s)<br>d. Defective Base Driver Board<br>e. Defective Control Board | a. Repair or replace<br>b. Adjust per 'ADJUSTMENTS' section<br>c. Test (#3), replace if defective<br>d. Replace and return to AC Tech for service<br>e. Replace and return to AC Tech for service |
| 6. Diagnostic Display indicates 'H' and motor does not operate | a. Input line voltage greater than 110% of drive's nameplate rating<br>b. Defective Control Board | a. Check line power and correct problem<br>b. Replace and return to AC Tech for service |
| 7. Diagnostic Display indicates 'H' as motor is decelerating | a. Excessive mechanical load (inertia) connected to motor<br>b. Defective optional Dynamic Braking assembly<br>c. Defective Control Board<br>d. Defective Base Driver Board | a. Increase 'Decel' adjustment potentiometer<br>b. Test (#6), replace if defective<br>c. Replace and return to AC Tech for service<br>d. Replace and return to AC Tech for service |
| 8. Diagnostic Display indicates 'L' and motor does not operate | a. Input line voltage less than 90% of drive's nameplate rating<br>b. Defective fuse(s) 5FU and/or 4FU (on some models)<br>c. Defective Control Board<br>d. Defective Base Drive Board | a. Correct voltage problem<br>b. Replace<br>c. Replace and return to AC Tech for service<br>d. Replace and return to AC Tech for service |

| DIFFICULTY | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| 9. Diagnostic Display indicates 'L' as motor is accelerating or at set speed | a. "Soft" input AC power line, drops to less than 90% of drive's nameplate rating when motor is drawing current | a. Check and correct if defective |
| | b. Defective Control Board | b. Replace and return to AC Tech for service |
| | c. Defective Base Driver Board | c. Replace and return to AC Tech for service |
| 10. Diagnostic Display indicates 'C' and motor does not operate | a. Excessive mechanical load (inertia) connected to motor | a. Reduce drive's load or increase gear ratio |
| | b. Improper setting of 'Boost'; Volts/ Hertz' or 'Slip Comp.' potentiometer | b. Adjust per set-up adjustments |
| | c. Defective motor or motor wiring | c. Replace or repair |
| | d. Defective Transistor Module(s) | d. Test (#3), replace if defective |
| | e. Defective Control Board | e. Replace and return to AC Tech for service |
| | f. Defective Base Driver Board | f. Replace and return to AC Tech for service |
| 11. Diagnostic Display indicates 'C' as motor is accelerating or at set speed | a. Excessive motor load for setting of 'Accel' and/or 'Current Limit' potentiometer | a. Increase 'Accel' and/or 'Current Limit' adjustment |
| | a. Excessive mechanical load (inertia) connected to motor | a. Reduce drive's load or increase gear ratio |
| | c. 'Stability' potentiometer improperly set | c. Adjust 'Stability' per 'Set-up' instructions |
| | d. Defective Control Board | d. Replace and return to AC Tech for service |
| | e. Defective Base Driver Board | e. Replace and return to AC Tech for service |
| 12. Diagnostic Display indicates 5/6 of an '0' and does not rotate | a. Defective Speed Control potentiometer or 'External Speed Reference' signal | a. Test (#5), repair or replace if defective |
| | b. Line Voltage 10% high | b. Reduce to less than +10% |
| | c. Defective Control Transformer | c. Test (#4), replace if defective |
| | d. Defective Control Board | d. Replace and return to AC Tech for service |

| DIFFICULTY | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| 13. Diagnostic Display indicates a rotating '0' or 'c', motor operates and | | |
| A. Motor will not reach desired minimum speed when the 'Speed Control' potentiometer is fully decreased | a. Improper setting of 'Min' Speed potentiometer<br>b. Defective 'Speed Control' potentiometer and/or wiring<br>c. Defective 'External Speed Reference Signal'<br>d. Defective Control Board | a. Set 'Min' adjustment per 'Set-up' instructions<br>b. Test (#5), repair or replace if defective<br>c. Locate and correct<br>d. Replace and return to AC Tech for service |
| B. Motor will not reach desired maximum speed when the 'Speed Control' potentiometer is fully increased | a. Improper setting of 'Max Speed potentiometer<br>b. Motor load too great for setting of 'Current Limit' potentiometer<br>c. Motor overloaded<br>d. Defective 'Speed Control' potentiometer<br>e. Defective 'External Speed Reference'<br>f. Improper seting of "Volts/Hertz' potentiometer<br>g. Defective Control Board | a. Set 'Max' adjustment per 'Set-up' instructions<br>b. Increase 'Current Limit' adjustment, but do not allow continuous overloads<br>c. Reduce motor load to within drive nameplate rating<br>d. Test (#5), repair or replace if defective<br>e. Locate and correct<br>f. Adjust per Set-up adjustments<br>g. Replace and return to AC Tech for service |
| C. Motor runs at one speed and cannot be varied by 'Speed Control' potentiometer | a. Defective 'Speed Control' potentio meter and/or wiring<br>b. Defective 'External Speed Reference Signal'<br>c. Defective Control Board | a. Test (#5), repair or replace if defective<br>b. Locate and correct<br>c. Replace and return to AC Tech for service |

| DIFFICULTY | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| D. Motor speed drops excessively | a. 'Current Limit' potentiometer set too low | a. Increase 'Current Limit' adjustment |
| | b. Motor being loaded beyond nameplate rating | b. Reduce motor load or change gear ratio |
| | c. Improper setting of 'Volts/Hertz' 'Boost' and/or 'Slip Compensation' potentiometer(s) | c. Adjust per drive 'Set-up' instructions |
| 14. Drive and Motor operates, then stops and diagnostic display indicates 'P' | a. Motor load too great for setting of 'O.L.' potentiometer | a. Increase 'O.L.' adjustment but do not exceed the rating of the motor and drive |
| | b. Defective Control Board | b. Replace and return to AC Tech for service |
| | c. Defective Base Driver Board | c. Replace and return to AC Tech for service |

COMPONENT TEST PROCEDURES

TEST (#1) - INPUT DIODE BRIDGE

This test procedure can be used for a single or three phase rectifier.

1. Disconnect incoming AC voltage.
2. Remove all (4 or 5) push-on wires from bridge terminals.
3. Set V.O.M. on R x 1 scale.
4. Place meter red (+) lead on bridge (-) terminal and meter black (-) lead separately on each of the three bridge AC terminals. Meter should read about one-half scale. (5-20 Ohms).
5. Place meter black (-) lead on bridge (+) terminal and red (+) lead separately on each of the bridge AC terminals. Meter should read about one half scale. (5-20 Ohms).
6. Set V.O.M. on R x 10K scale (or highest scale).
7. Place meter black (-) lead on bridge (-) terminal and red (+) lead separately on each of the three bridge AC terminals. Meter should read open circuit (infinite resistance).

8. Place meter red (+) lead on bridge (+) terminal and black (-) lead separately on each of the three bridge AC terminals. Meter should read open circuit (infinite resistance).

9. If any test fails, replace diode bridge.

TEST (#2) - BUS FILTER CAPACITOR

If the L1000 drive is equipped with two or more filter capacitors, test each separately.

1. Disconnect incoming AC voltage.

2. Place V.O.M. on 250 VDC scale and check that all voltage has discharged from capacitor(s).

3. Remove wires from capacitor(s) terminals.

4. If capacitor shows signs of leaking oil, it MUST BE REPLACED.

5. Set V.O.M. or R x 1K scale.

6. Place meter red (+) lead on capacitor (+) terminal and meter black (-) lead on capacitor (-) terminal. Meter needle should deflect to near zero ohms followed by a steady movement of the needle toward open circuit (infinite resistance) as the capacitor charges. Charge time should be 1 to 1 1/2 minutes.

7. If test fails, replace capacitor.

TEST (#3) - OUTPUT TRANSISTOR MODULE(S)

1. Disconnect incoming AC voltage.

2. Remove all power leads from transistor module(s) and control wiring plug(s) from Base Driver Board.

3. Test the transistor module(s) using the same series of tests as in Test #1-3 through #1-8.

4. If any test fails, replace transistor module(s) and check the condition of Base Driver fuses 301FU through 801FU. If any fuse is defective, replace.

5. If drive still fails to operate, re-test transistor module(s) and replace Base Driver Board. Return defective Base Driver Board to AC Technology Corporation for repair.

TEST (#4) - CONTROL TRANSFORMER

1. Disconnect incoming AC voltage.

2. Remove all transformer plugs except PL1 and pull them free of all other components.
3. Apply incoming AC Voltage.

4. Set VO.M. on 50VAC scale.

5. On plugs PL(RD), PL(OR), PL(BU), and PL(VI) the measured voltage should be 10VAC (+10%,-10%) from pin 1 to pin 2 and 20VAC (+10%-10%) from pin 1 to pin 3.

6. On plug PL(GR) the measured voltage should be 16VAC (+10%-10%) from pin 1 to pin 2 and 32VAC (+10%,-10%) from pin 1 to pin 3.

7. Disconnect incoming AC voltage.

8. If any test fails, replace transformer.

TEST (#5) - SPEED CONTROL POTENTIOMETER

1. Disconnect incoming AC voltage

2. Remove wires from drive terminals 4, 5 and 6.

3. Set V.O.M. on R x 1K scale.

4. Measure resistance from wire which was on terminal 4 to wire which was on terminal 6. Reading should be 10 (10,000 ohms).

5. Measure resistance from wire which was on terminal 4 to wire which was on terminal 5. Turn potentiometer up; resistance should increase proportionately to potentiometer setting. At full rotation, resistance should be 10,000 ohms.

6. Replace potentiometer or wiring if defective.

TEST (#6) - DYNAMIC BRAKING ASSEMBLY (OPTION)

1. Disconnect incoming AC voltage.

2. Check fuse on Dynamic Braking Board, REPLACE WITH SAME VALUE if defective.

3. Set V.O.M. on 600 VDC scale.

4. Using alligator clips, connect V.O.M. across the braking resistor(s).

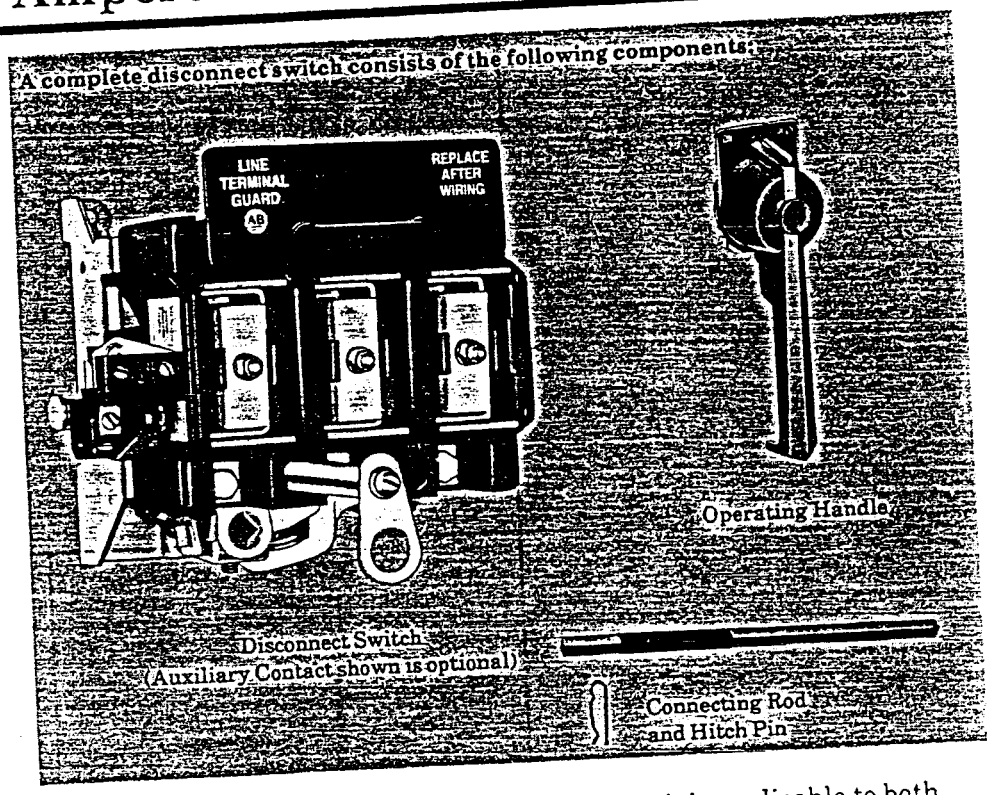
5. Apply incoming AC voltage and operate drive at low speed. Meter should read zero.

6. Turn Speed Control potentiometer up. Meter should read zero.

7. Rapidly turn Speed Control down; meter should read voltage as the motor is decelerating (20 to 600 VDC) . The amplitude of voltage across the resistor is a function of the inertial load and the deceleration rate . When motor arrives at new speed, the meter should return to zero.

8. If any test fails, replace Dynamic Braking assembly and return to AC Technology Corporation for repair.

# ROD OPERATED DISCONNECT SWITCHES - 30 Through 200 Ampere Size




## Description

The Bulletin 1494R rod operated disconnect switch is applicable to both NEMA Type 1 and 12 enclosures. It is designed to meet industrial requirements for a dependable manual type disconnect device. The complete Disconnect Switch consists of the disconnect switch, operating handle, connecting rod and hitch pin.

## Warning

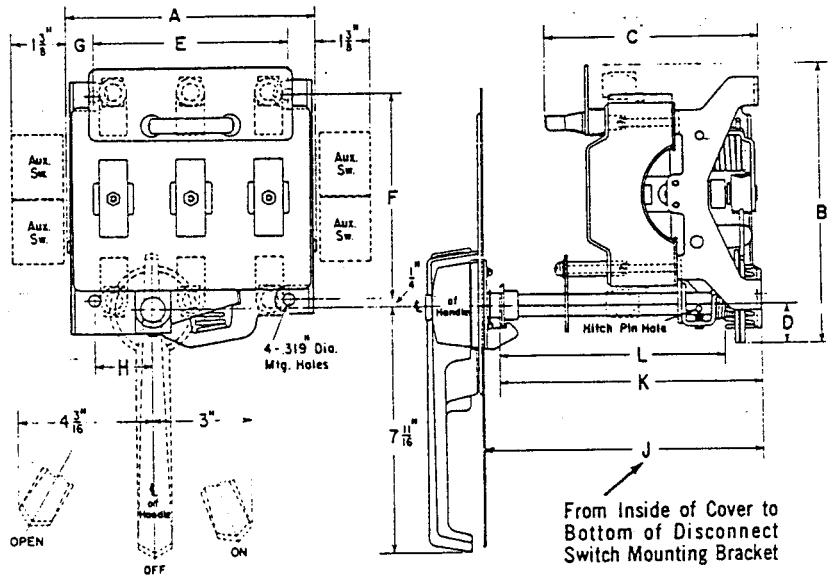
To avoid hazards of electrical shock ,remove all power to the panel before proceeding. Auxiliary contacts commonly control separate sources of power. Be sure they and all sources of power are disconnected. **The outlined procedures should only be performed by qualified personnel familiar with the operation of the equipment in which the switch is mounted.**

40050-390-01(C)

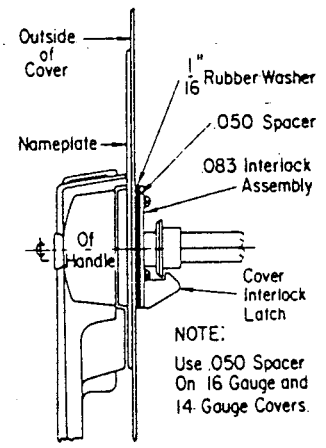
Publication 1494R-5.0 – February, 1988
Supersedes Publication 1494R-5.0 dated November, 1974

# 100 Ampere and 200 Ampere Size Installation

## 100 Ampere Size - Catalog No. 1494R-N100
## 200 Ampere Size - Catalog No. 1494R-N200

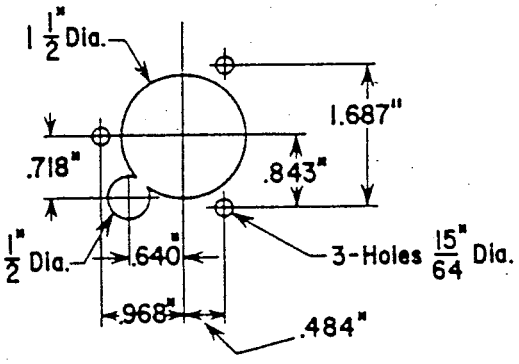



### Side View




**Cabinet Cover Thickness #16 Ga. Min. to #10 Ga. Max.**

### Top (Outside) View




**Cover Drilling Dimensions**

| NEMA Designation | Dimensions In Inches | | | | | | | | | | | | Approximate Shipping Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A Wide | B High | C Deep | D | E | F | G | H | J Standard Shaft | J Long Shaft | K | L | |
| 100 Amperes | 6-7/16 | 7-3/16 | 5-7/16 | 15/16 | 5 | 5-1/4 | 23/32 | 1-1/2 | 6-1/4 Min. 12-7/8 Max. | 6-1/4 Min. 25-7/8 Max. | ① | ② | 9 Lbs. |
| 200 Amperes | 7-1/4 | 9-1/2 | 6-1/2 | 1-7/16 | 5-3/4 | 6-1/2 | 3/4 | 1-23/32 | 7-7/16 Min. 12-7/8 Max. | 7-7/16 Min. 25-7/8 Max. | ① | ② | 15 Lbs. |

① The Adjusted Coupling Position is determined by measuring the cabinet depth and subtracting 15/16" ± 1/16".
② The Shaft Length is determined by measuring the cabinet depth (Dimension "J") and subtracting 1-7/8".

## Mounting the Disconnect Switch

1. Measure the cabinet depth (Dimension "J" on Page 4) to insure that your cabinet is within the minimum and maximumsize range.
2. Select desired location on disconnect switch mounting surface for mounting the disconnect switch.
3. From the line drawing and dimension table on Page 4, locate the mounting holes of the switch.
4. Mount the disconnect switch on the enclosure mounting surface. Use $\frac{1}{4}$" or 4/16" screws. Torque to 40-50 lb-in.

## Mounting the Activating Rod

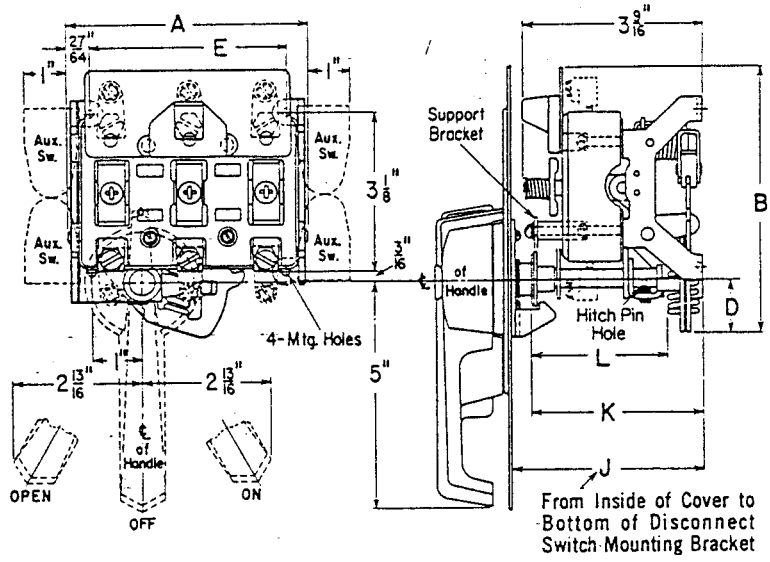
1. Determine shaft length (Dimension "L" on Page 4) from table and cut uninsulated end of shaft to size.
2. Insert the insulated end of the shaft through the hole in the support bracket and into the two square holes in the switch lever. Torque the set screw (or screws) to 35-40 lb-in. to secure shaft to switch lever. Insert hitch pin furnished into hole in shaft (see side view above).
3. Determine the adjusted coupling position (Dimension "K") and attach the coupling to the shaft with set screws. The word "On" and the arrow molded on the face of the coupling must be at the bottom with the switch in the "Open" position. Torque the set screws to 25-30 lb-in.

## Mounting the Handle Assembly

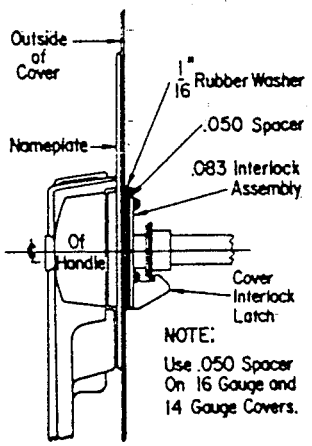
1. Using the template and dimension table on Page 4 as a guide, determine the point on the cover, within 1/8", at which the center of the rod and the center of the handle assembly should meet.
2. With the template located, center-punch the location of the five mounting holes. Drill the 15/64" diameter holes. Drill pilot holes for Greenlee cutters for the $\frac{1}{2}$" and $1\frac{1}{2}$" diameter holes. Cut the $\frac{1}{2}$" diameter hole with Greenlee cutter first, then the $1\frac{1}{2}$" diameter hole, overlapping the $\frac{1}{2}$" diameter hole.
3. Close the cover and check the coupling spear-point for alignment with the center of the large diameter hole. Adjust the support bracket, if necessary to center the spear-point within 1/16".
4. On the outside surface of the cover, mount the nameplate and handle so that the handle passes through the nameplate and enclosure cover. Peel off the adhesive protective shield from the back of the nameplate before installing. On the inside surface of the cover the rubber washer, the spacer (used only on 14 and 16 gauge covers) and the interlock are assembled, in that order, around the protruding shoulder of the handle assembly. Torque the three mounting screws to 25-30 lb-in.
5. 

   CAUTION:
   Make sure the cover interlock latch swings freely.
6. With the handle in the "Open" position, the cover should open freely. With the handle in either the "On", "Off", or "Lock" position, the cover interlock MUST prevent opening the cover unless the defeater is used.

## 30 Ampere Size - Catalog No. 1494R-N30
## 60 Ampere Size - Catalog No. 1494R-N60

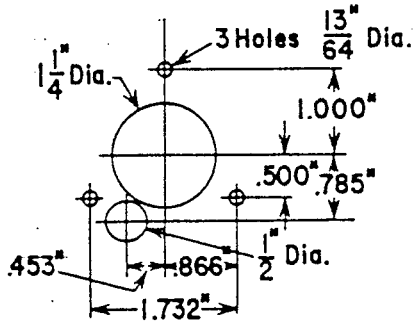



Side View




Cabinet Cover Thickness
#16 Ga. Min. to #10 Ga. Max.

Top (Outside) View




Cover Drilling Dimensions

| NEMA Designation | Dimensions In Inches | | | | | | | | Approximate Shipping Weight |
|---|---|---|---|---|---|---|---|---|---|
| | A Wide | B High | D | E | J Standard Shaft | J Long Shaft | K | L | |
| 30 Amperes | 3-31/32 | 4-13/16 | 1-1/8 | 3-1/8 | 4-3/8 Min. 10-7/8 Max. | 4-3/8 Min. 19-3/8 Max. | ① | ② | 4 Lbs. |
| 60 Amperes | 4-21/32 | 5-1/4 | 1-1/16 | 3-13/16 | 4-1/2 Min. 10-7/8 Max. | 4-1/2 Min. 19-3/8 Max. | ① | ② | 4-1/2 Lbs. |

① The Adjusted Coupling Position is determined by measuring the cabinet depth and subtracting 9/16" ± 1/16".
② The Shaft Length is determined by measuring the cabinet depth (Dimension "J") and subtracting 1-3/8".

## Mounting the Disconnect Switch

1. Measure the cabinet depth (Dimension "J" on Page 2), to insure that your cabinet is within the minimum and maximum size range.
2. Select desired location on disconnect switch mounting surface for mounting the disconnect switch.
3. From the line drawing and dimension table on Page 2, locate the mounting holes of the switch.
4. Mount the disconnect switch on the enclosure mounting surface. Use 3/16" or #10 screw. Torque to 25-30 lb-in.

## Mounting the Activating Rod

1. Determine shaft length (Dimension "L" on Page 2) from table and cut uninsulated end of shaft to size.
2. Insert the insulated end of shaft through the hole in the support bracket and into the two square holes in the switch lever. Torque the set screw to 35-40 lb-in to secure shaft to switch lever. Insert hitch pin furnished into hole in shaft (see side view on Page 2).
3. Determine the adjusted coupling position (Dimension "K" on Page 2) and attach the coupling to the shaft with set screws. The "D" molded on the face of the coupling must be at the bottom and the "C" at the top, with the switch in "Off" position. Torque the set screws to 25-30 lb-in.

## Mounting the Handle Assembly

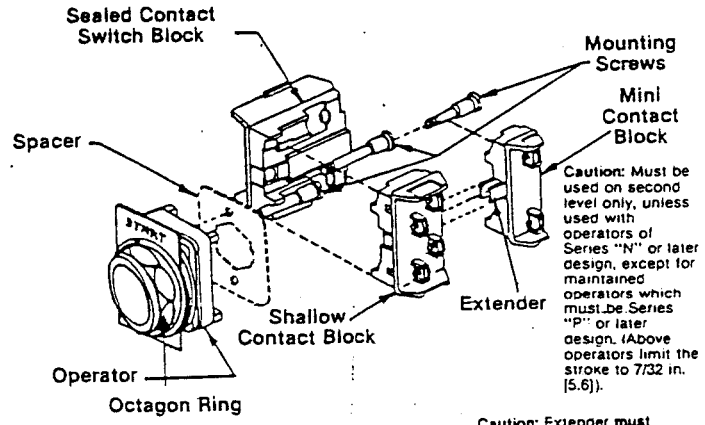
1. Using the template and dimension table as a guide, determine the point on the cover, within 1/8", at which the center of the rod and the center of the handle assembly should meet.
2. With the template located, center-punch the location of the five mounting holes. Drill the 13/64" diameter holes. Drill pilot holes for Greenlee cutters for the ½"and 1¼" diameter holes. Cut the ½" diameter hole with Greenlee cutter first, then the 1¼" diameter hole.
3. Close the cover and check the coupling spear-point for alignment with the center of the large diameter hole. Adjust the support bracket, if necessary, to center the spear-point within 1/16".
4. On the outside surface of the cover, mount the nameplate and handle so that the handle passes through the nameplate and enclosure cover. Peel off the adhesive protective shield from the back of the nameplate before installing. On the inside surface of the cover the rubber washer, the spacer (used only on 14 and 16 gauge covers) and the interlock are assembled, in that order, around the protruding shoulder of the handle assembly. Torque the three mounting screws to 16-20 lb-in.
5. 

   CAUTION:
   Make sure the cover interlock latch swings freely.
6. With the handle in the "Open" position, the cover should open freely. With the handle in either the "On", "Off" or "Lock" position, the cover interlock MUST prevent opening the cover unless the defeater is used.

# INSTRUCTIONS

## Bulletin 800T, Shallow, Mini And Sealed Switch Contact Blocks

The contact blocks of the sealed switch, shallow and mini construction cannot be mixed with the 1-5/8 inch deep (Series A) construction contact block. A sealed switch contact block may be mounted on either or both sides of an operator, one deep only (no other contact blocks on that side). A shallow contact block may be mounted on either or both sides of an operator, two deep maximum or in conjunction with a mini contact block on the second level. A sealed switch contact block may be mounted on one side with shallow and mini contact blocks on the other side, observing above restrictions. Each additional contact block will contain enough mounting hardware to mount one block. When mounting two or more contact blocks discard all excess hardware. Contact block retaining clips cannot be used with an XA1, XA2, XA4, XA7 and a sealed contact switch block.




Note:

1) Contact blocks used on operators with projections at four corners of adapter plate must be mounted without spacer.
2) Contact blocks used on operators without projections must be mounted with one spacer.

Caution: Extender must not be used when block is mounted directly to operator; extender can be easily removed. Extender must be used when block is mounted in tandem as illustrated.

(Continued on other side)

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NOTE: The sealed switch contact block contacts are hermetically sealed in a glass envelope. Dust, dirt, oxidation, oil laden air, o other air-borne contaminants do not affect the continuity of th contacts. The contacts of the shallow and mini contact blocks an the operating mechanism of all the blocks are not sealed however, and must be protected by an enclosure and an externa operator suitable for the environment. Contact blocks must b protected from dirt or contamination that might enter enclosure during installation, maintenance or any time the enclosure i open. Never blow dirt off of electrical components, as this ma force dirt into internal mechanisms - use vacuum.

Sealed switch contact blocks can be used with any operator excep the following (these operators are not mechanically compatibl with the sealed switch contact blocks):

800 - T - 2,3,4 Way Switch
800 - K - Selector Push Button

**IMPORTANT - Do Not Use**
Catalog Number 800T-XD3 Contact Block with the followin Selector Switch Operators:

Cat. No. 800T-J-KE7
Cat. No. 800T-J-KR1
Cat. No. 800T-J-KR7
Cat. No. 800T-J-KT1
Cat. No. 800T-J-KT7
Cat. No. 800T-J-KU7
Cat. No. 800T-N-KK4
Cat. No. 800T-N-KM4
Cat. No. 800H-JR-KE7
Cat. No. 800H-JR-KR1
Cat. No. 800H-JR-KR7
Cat. No. 800H-JR-KT1
Cat. No. 800H-JR-KT7
Cat. No. 800H-JR-KU7
Cat. No. 800H-NR-KK4

# INSTALLATION and MOUNTING INSTRUCTIONS for BULLETIN 800T PUSH BUTTON UNITS

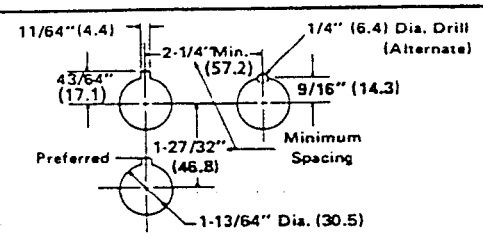
This device is for use on a flat, smooth surface of a NEMA Type 4 or 13 enclosure.

**WARNING:** To prevent injury, this device must be disconnected from all power sources prior to initiating work.

**CAUTION:** When installing in a metal enclosure, maintain 1/2" (12.7) minimum clearance between exposed metal parts of contact block and enclosure.

**Installation:** Place the unit (less mounting ring, thrust washer, legend plate and with proper number of gaskets per Figure 1) in the mounting hole. Install legend plate (if legend plate is not use install trim washer). Install thrust washer and tighten mounting ring. See Figure 2 for illustrated assembly. Bulletin 800T push button operators will accept one to four contact blocks. The following blocks may be used:

Catalog No. 800T-XD1, XD2, XD3, XD4, XA (Series C or higher) and Catalog No. 800T-XD1R, XD2R, XAR, XA4R (Series A or higher). Catalog No. 800T-XD5, XD6, (Series B or higher) may be used on second level only. A device bonding kit, Catalog No. 800T-N300 is available to meet the bonding requirements of CSA Standard C22.2 No.0.4.




| Panel Thicknesses, Inches | Number of Gaskets Required for Various Panel Thicknesses. Units are Shipped with Three 1/16" (1.6) Gaskets |
|---|---|
| 16 Gage 1/16" (1.6) | 3 |
| 12 Gage 7/64" (2.8)<br>10 Gage 9/64" (3.6) | 2 |
| 3/16" (4.8) | 1 |
| Panels thicker than 3/16" (4.8) must be counterbored | |

NOTE: Dimensions shown in parentheses are in millimeters.

Figure 1

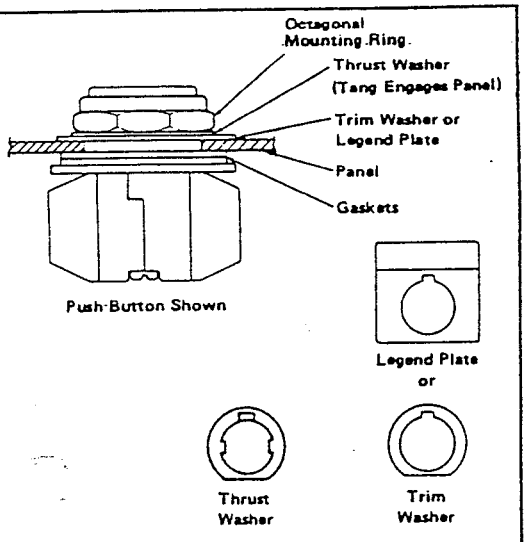



Figure 2

40060-331-01 (A)
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## CONTACT TARGET TABLE FOR 3 POSITION SELECTOR SWITCHES

To determine the contact targets of Allen-Bradley three position selector switches, proceed as follows:

1. Determine on which SIDE of the selector switch the contact block is mounted: WHITE or BLACK. On the back of the selector switch is a molded plastic cover. On this cover is a nameplate indicating Catalog No. of the operator and location of side 1 (white actuator). Side 2 (black actuator) is the opposite side.
2. Identify the CONTACT BLOCK used by looking at the contact block cover plate and finding a Catalog No., such as 800T-XA.
3. Identify the CIRCUIT for which the contact target is desired by looking again at the contact block cover plate for a wiring symbol such as "A", "B", "A1", etc.
4. Identify the CAM used by looking again at the nameplate on the molded plastic cover on the back of the selector switch operator. The Catalog No., with exceptions listed below, contains the cam identification following the flag letter "K".

   Example Catalog Nos.: 800T-J2KA1 or 800H-JR2KA1

   The A1 is the cam identification (there may be digits following).

   Exceptions: Selector switches where a special cam was not specified. On standard maintained and spring return three position, a B7 cam is used.

   Example Catalog Nos. of standard selector switches: 800T-J2A, 800T-J17C, 800T-J2B, 800T-J42B.
5. Refer to the table below and find the actuator color, contact block, and wiring symbol. Read across the top to find the cam and knob position. Where these two columns intersect will be the contact target.

| Actuator Color | Contact Block 800-T | Single Circuit Or Optional | Normal Circuit Operation | Wiring Symbol | Cams and Knob Positions [1] A1 | A7 | B7 | C1 | C7 | D7 | E7 [2] | Q1 | Q7 | A1 [2] | N7 [2] | T1 [2] | T7 [2] | U7 [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WHITE | XA, XAR, XAP | XD2 or XD6 XD2R, XD2P | NC | B | OXO | OXO | OOX | OXO | OXO | OXO | OXX | OXO | OXO | OXO | OXO | XOO | OOX | OXO |
| | | XD1 or XD5 XD1R, XD1P | NO | A | XOO | OOX | XOO | OOX | XOO | OOX | XOO | XOX | XOX | XOX | XOX | OOX | XOO | XOO |
| | XA1 | XD4 | NCLB | BZ1 | OXX | XXO | OXX | XXO | OXX | XXO | OXX | OXO | OXO | OXO | OXO | XXO | OXX | OXX |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | XOO | OOX | XOO | OOX | XOO | OOX | XOO | XOX | XOX | XOX | XOX | OOX | XOO | XOO |
| | XA2, XA2R | XD1 or XD5 XD1R, XD1P | NO | A1 | XOO | OOX | XOO | OOX | XOO | OOX | XOO | XOX | XOX | XOX | XOX | OOX | XOO | XOO |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | XOO | OOX | XOO | OOX | XOO | OOX | XOO | XOX | XOX | XOX | XOX | OOX | XOO | XOO |
| | XA4, XA4R | XD2 or XD6 XD2R, XD2P | NC | B1 | OXO | OXO | OOX | OXO | OXO | OXO | OXX | OXO | OXO | OXO | OXO | XOO | OOX | OXO |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | OXO | OXO | OOX | OXO | OXO | OXO | OXX | OXO | OXO | OXO | OXO | XXO | OXX | OXX |
| | XA7 | XD4 | NCLB | BZ1 | OXX | XXO | OXX | XXO | OXX | XXO | OXX | OXO | OXO | OXO | OXO | XOO | OOX | OXO |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | OXO | OXO | OOX | OXO | OXO | OXO | OXX | OXO | OXO | OXO | OXO | XOO | OOX | OXO |
| | XD3 | — | NOEM | AZ | XOX | XOX | XXO | XOX | XOX | XOX | N/A | XOX | XOX | N/A | N/A | OXX | XXO | N/A |
| | XD4 | — | NCLB | BZ | OXX | XXO | OXX | XXO | OXX | XXO | OXX | OXO | OXO | OXO | OXO | XXO | OXX | OXX |
| BLACK | XA, XAR, XAP | XD2 or XD6 XD2R, XD2P | NC | B | OXO | OXO | OOX | XOO | OOX | OXO | XXO | OXO | OXO | XXO | OXX | XXO | OXX | XXO |
| | | XD1 or XD5 XD1R, XD1P | NO | A | XOO | OOX | XOO | OOX | XOO | XOO | OOX | OOX | XOO | OOX | XOO | OOX | XOO | OOX |
| | XA1 | XD4 | NCLB | BZ1 | OXX | XXO | OXX | XXO | OXX | OXX | XXO | XXO | OXX | XXO | OXX | XXO | OXX | XXO |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | XOO | OOX | XOO | OOX | XOO | XOO | OOX | OOX | XOO | OOX | XOO | OOX | XOO | OOX |
| | XA2, XA2R | XD1 or XD5 XD1R, XD1P | NO | A1 | XOO | OOX | XOO | OOX | XOO | XOO | OOX | OOX | XOO | OOX | XOO | OOX | XOO | OOX |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | XOO | OOX | XOO | OOX | XOO | XOO | OOX | OOX | XOO | OOX | XOO | OOX | XOO | OOX |
| | XA4, XA4R | XD2 or XD6 XD2R, XD2P | NC | B1 | OXO | OXO | OOX | XOO | OOX | OXO | XXO | OXO | OXO | XXO | OXX | XXO | OXX | XXO |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | OXO | OXO | OOX | XOO | OOX | OXO | XXO | OXO | OXO | XXO | OXX | XXO | OXX | XXO |
| | XA7 | XD4 | NCLB | BZ1 | OXX | XXO | OXX | XXO | OXX | OXX | XXO | XXO | OXX | XXO | OXX | XXO | OXX | XXO |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | OXO | OXO | OOX | XOO | OOX | OXO | XXO | OXO | OXO | XXO | OXX | XXO | OXX | XXO |
| | XD3 | — | NOEM | AZ | XOX | XOX | XXO | OXX | XXO | XOX | N/A | XOX | XOX | N/A | N/A | N/A | N/A | N/A |
| | XD4 | — | NCLB | BZ | OXX | XXO | OXX | XXO | OXX | OXX | XXO | XXO | OXX | XXO | OXX | XXO | OXX | XXO |

[1] The slanted lines represent the knob positions.

[2] Noted CAMS cannot be used with wing lever operators.

Abbreviations and Symbols

NO = Normally Open
NC = Normally Closed
LB = Late Break
EM = Early Make
X = Closed
O = Open
N/A = Not Available

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Milwaukee, Wisconsin 53204

## INSTALLATION AND MOUNTING INSTRUCTIONS
### Bulletin 800T Illuminated Pilot Devices

CAUTION: When installing in a metal enclosure, maintain 1/2" (12.7) minimum clearance between exposed metal parts of contact block and enclosure.

INSTALLATION – Place the unit (less lens, mounting ring, thrust washer and legend plate or trim washer) with proper number of gaskets per Figure 1 in mounting hole. Position legend plate or trim washer and thrust washer. Install mounting ring and tighten securely against thrust washer. Install lens: see Figure 2. Use legend plate with notch instead of tang (800T-X500 and -X600 Series).

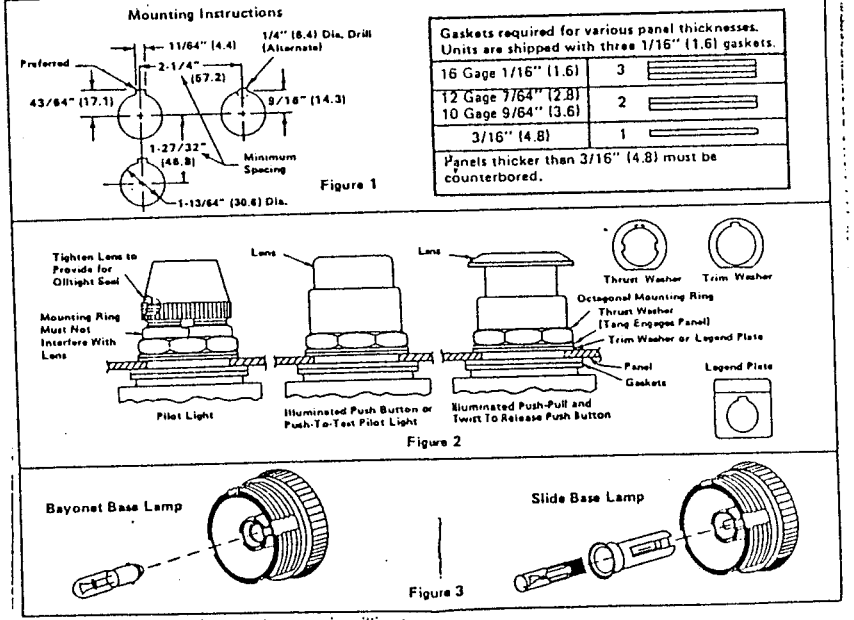
CAUTION: Lens must be tight against bushing to provide an oiltight seal; see Figure 2.

Illuminated pushbutton operators will accept one or two contact blocks mounted in tandem. Following blocks may be used: Catalog No. 800T-XD1, -XD2, -XD3, -XD4, -XA (Series C or higher) and Catalog No. 800T-XD1R, -XD2R, -XAR, -XA2R, -XA4R (Series A or higher). Catalog No. 800T-XD5, -XD6 (Series B or higher) may be used on second level, but may not be mounted adjacent to the transformer (first level).

REPLACING LAMP – Bayonet Base: Remove lens. Push lamp inward and turn to the left. To install new lamp, insert in socket, push down and turn to the right; see Figure 3.

REPLACING LAMP – Slide Base: Remove lens. Pull out lamp holder approximately 1/4" (6.4) and push back in. Lamp may now be removed; see Figure 3.

NOTE: Lens must be assembled to Pilot Light for use in Class I, Division 2 Hazardous Locations.




Note: Dimensions shown in parentheses are in millimeters.

Illuminated push button and pilot light units will accept dual input modules: Catalog Nos. 800T-N290 (120V) and 800T-N291 (24V). These kits are mounted in place of the transformer or the full voltage module.

A (6V) flashing lamp, Catalog No. 800T-N212, is available for any illuminated device which utilizes the No. 755 or No. 1866 lamp.

A device bonding kit, Catalog No. 800T-N300 is available to meet the bonding requirements of CSA Standard C22.2 No. 0.4.

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Milwaukee, Wisconsin 53204

# MOUNTING INSTRUCTIONS

## Bulletin 800T — 2 Position Selector Switches

This device is for use on a flat, smooth surface of a NEMA Type 4 or 13 enclosure.

**WARNING:** To prevent injury, this device must be disconnected from all power sources prior to initiating work.

**CAUTION:** When installing in a metal enclosure, maintain 1/2" (12.7) min. clearance between exposed metal parts of contact block and enclosure.

### INSTALLATION

The knob assembly or coin slot cap may be installed having any one of four orientations with respect to the switch body. To obtain proper orientation, proceed as follows:

A. Unscrew mounting ring and remove knob assembly or coin slot cap from switch. Place correct number of gaskets on switch bushing as indicated in Figure 1.

B. Place switch in panel and place the legend plate and thrust washer on the bushing. Note: Trim washer must be used if legend plate is not used. Use legend plate with notch instead of tang (800T-X500 and -X600 Series).

C. With the help of the diagram shown in Figure 2, determine the switch setting. (Note the position of the stop projection on the shaft with respect to the opening in the bushing.)

D. Place the knob assembly or coin slot cap over the end of the shaft and arrange the indicator to point to the position on the legend plate which corresponds to the switch setting.

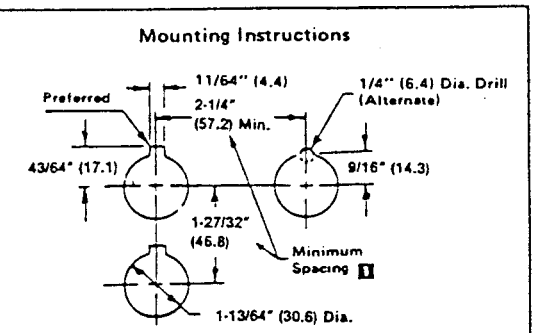
E. Keying — Knob assemblies having 3 legs may be keyed to interfere with assembly of the knob except in the selected position. If keying is desired, determine which of the four holes in the shaft will not be occupied by one of the 3 legs of the knob assembly or coin slot cap when the knob or cap is properly oriented. Fill the unused hole with a rigid material. (A No. 8 x 1/4" (6.4) long set screw or other similarly sized "plug" may be used, apply light pressure only).

Knob assemblies having only 2 legs may be partially keyed. (When keyed, a 2-leg knob will fit in either of 2 positions, 180° apart.) If such keying is desired, fill either of the two unoccupied holes in the shaft according to the instructions above.

F. Thread mounting ring onto bushing with knob assembly or coin slot cap in place, and tighten securely.

G. Ground operator as shown in Figure 3, when required.

H. Note: For illustration of mounted assembly, see Figure 4.




1 Two position selector switch with wing lever requires 3" (76.2) minimum vertical spacing and 3-1/4" (82.6) minimum horizontal spacing.

| Gaskets required for various panel thicknesses. Units are shipped with three 1/16" (1.6) gaskets. | |
|---|---|
| 16 Gage 1/16" (1.6) | 3 |
| 12 Gage 7/64" (2.8)<br>10 Gage 9/64" (3.6) | 2 |
| 3/16" (4.8) | 1 |
| Panels thicker than 3/16" (4.8) must be counterbored. | |

Figure 1

Note: Dimensions shown in parentheses are in millimeters.

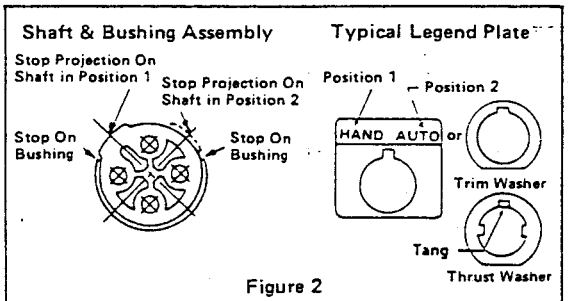



Figure 2

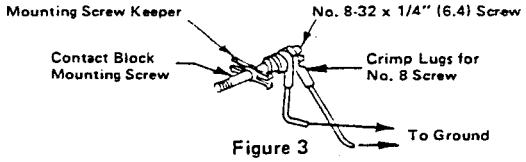



Figure 3

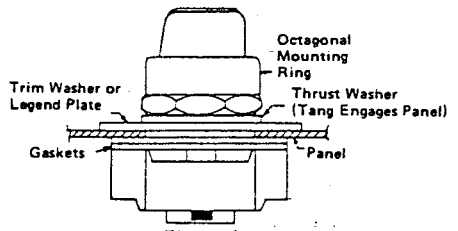



Figure 4

**INDICATOR INSERT REMOVAL/INSTALLATION** — Except wing lever and coin operated types.

(Note: Have a replacement insert on hand — insert may break during removal.) To remove indicator insert, place a knife blade or sharp instrument under edge of insert at mounting ring and pry up. Grasp insert and remove from operator (Figure 5). To install insert, place into slot in operator and apply a small amount of pressure to assure seating.

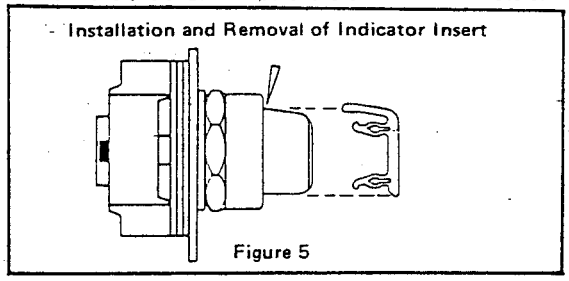



Figure 5

**CONTACT BLOCK MOUNTING:** An operator may be used with 1 to 4 of the contact blocks listed in Table 1. The contact blocks may be mounted in tandem, and in various combinations, two tiers deep maximum.

Table 1

| Standard Block Cat. No. 800T- | Logic Reed Block Cat. No. 800T- | Number of Contacts 2 |
|---|---|---|
| XA | XAR | 1 N.O. - 1 N.C. |
| XA1 | | 1 N.C. L.B. - 1 N.O. |
| XA2 3 | XA2R | 2 N.O. |
| XA4 | XA4R | 2 N.C. |
| XA7 | | 1 N.C. L.B. - 1 N.C. |
| XD1 & XD5 | XD1R | 1 N.O. |
| XD2 & XD6 | XD2R | 1 N.C. |
| XD3 | | 1 N.O. E.M. |
| XD4 | | 1 N.C. L.B. |

2 N.O. — Normally Open N.C. — Normally Closed
E.M. - Early Make L.B. - Late Break

3 XA2 contact blocks must be used only on the 2 NO level if stacked.

Sealed Contact Switch Blocks. 800T-XAP, XD1P, and XD2P may be mounted singly, or side-by-side, directly to an operator. (No stacking.)

A device bonding kit, Catalog No. 800T-N300 is available to meet the grounding requirements of CSA Standard C22.2 No. 0.4.

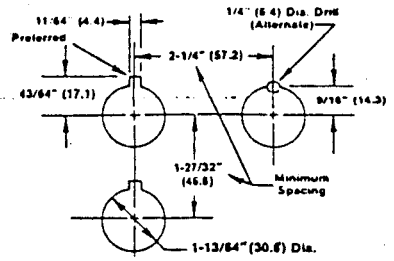
**CAUTION:** When installing in a metal enclosure, maintain 1/2" (12.7) minimum clearance between potentiometer housing terminals and enclosure.

**POWER RATING:** Maximum Power (P) = 2 watts, provided maximum working voltage is not exceeded! Maximum Working Voltage (EMAX) shall not exceed 300 volts (RMS or DC), or as determined by EMAX = $\sqrt{PR}$, where R = Resistance, whichever is less. See Table 1 for power derating with respect to rotation for rheostat application.

**INSTALLATION:** See Figure 2 for illustrated assembly. Place the unit (less mounting ring, thrust washer and legend plate or trim washer) with number of gaskets per Figure 1, in mounting hole. Position legend plate by rotating knob all the way counterclockwise and aligning "Min." on legend plate with white indexer on knob. (Note: Trim washer must be used if legend plate is not used.) Place thrust washer over knob inserting tang through notch on legend plate or trim washer into panel. Install mounting ring and tighten securely against thrust washer.

A device bonding kit, Catalog No. 800T-N300 is available to meet the bonding requirements of CSA Standard C22.2 No. 0.4.

## MOUNTING INSTRUCTIONS




| Gaskets Required for Various Panel Thicknesses. Units are Shipped with Three 1/16" (1.6) Gaskets. | |
|---|---|
| 16 Gage 1/16" (1.6) | 3 |
| 12 Gage 7/64" (2.8)<br>10 Gage 9/64" (3.6) | 2 |
| 3/16" (4.8) | 1 |
| Panels thicker than 3/16" (4.8) must be counterbored. | |

**Note:** Dimensions shown in parentheses are in millimeters.

**Figure 1**

| TABLE 1<br>Power Derating with Respect to Rotation for Rheostat Application | | | |
|---|---|---|---|
| Percent Rotation | Multiply Wattage Rating By | Percent Rotation | Multiply Wattage Rating By |
| 100 | 1.00 | 40 | 0.81 |
| 90 | 0.99 | 30 | 0.68 |
| 80 | 0.98 | 20 | 0.49 |
| 70 | 0.96 | 10 | 0.23 |
| 60 | 0.93 | 0 | 0.11 |
| 50 | 0.89 | | |

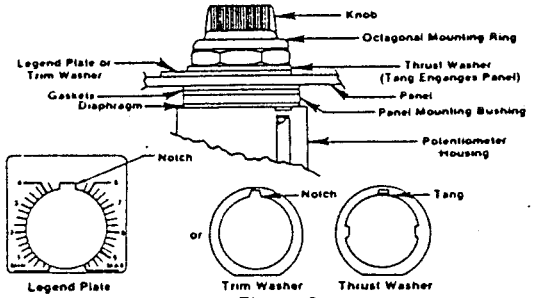



**Figure 2**

(Continued on Opposite Side)

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Milwaukee, Wisconsin 53204

**REPLACING POTENTIOMETER:** See Figure 3 for illustrated assembly.

**Note 1:** Refer to nameplate on housing for original potentiometer resistance.

**Note 2:** Unit need not be removed from panel to replace potentiometer.

**POTENTIOMETER REMOVAL:**

1. Remove the two screws on the rear of the housing and pull the housing from the panel mounting bushing.
2. Disconnect the three wire leads from the potentiometer terminals.
3. Pull the potentiometer and knob through the panel mounting bushing.
4. Loosen the set screws in the knob with a 1/16" (1.6) hex socket wrench and remove knob from potentiometer shaft.
5. Remove diaphragm to expose nut on the potentiometer bushing.
6. Remove nut, lock washer and mounting plate.

**POTENTIOMETER INSTALLATION:**

1. Before installing potentiometer, bend the three terminals 80° - 90° and remove the nut and lock washer from bushing. (See Figure 4.)
2. Install mounting plate, printed side up, over potentiometer shaft, aligning locating tab on potentiometer with slot in mounting plate.
3. Tighten nut and lock washer on potentiometer shaft and bend locating tab flush with mounting plate.
4. Place diaphragm over potentiometer shaft.
5. Position shaft at maximum clockwise (C.W.) rotation and align white indexer on knob with white mark on mounting plate (diaphragm flange will need to be lifted up to expose mounting plate). Secure set screws using a 1/16" (1.6) hex socket wrench. (See Figure 5.)
6. Insert wire leads onto the potentiometer terminals making sure the leads identified as 1, 2 & 3 are attached to the corresponding identified potentiometer terminals. (See Figure 3 for terminal and lead identification.) If the potentiometer housing does not have wires with terminal lugs, then solder the wire end to the appropriate potentiometer terminal.
7. Line up holes in diaphragm, potentiometer mounting plate and housing and push the unit through the panel mounting bushing. Rotate knob all the way counterclockwise (C.C.W.). Orientate unit so that the white indexer on knob is pointing to "MIN" on legend plate.
8. Secure by threading in the two screws from the rear of the potentiometer housing.

**Note:** On special potentiometer units such as switch type and/or multiples, discard the housing and secure the potentiometer mounting plate to the panel mounting bushing with the special short screws included.

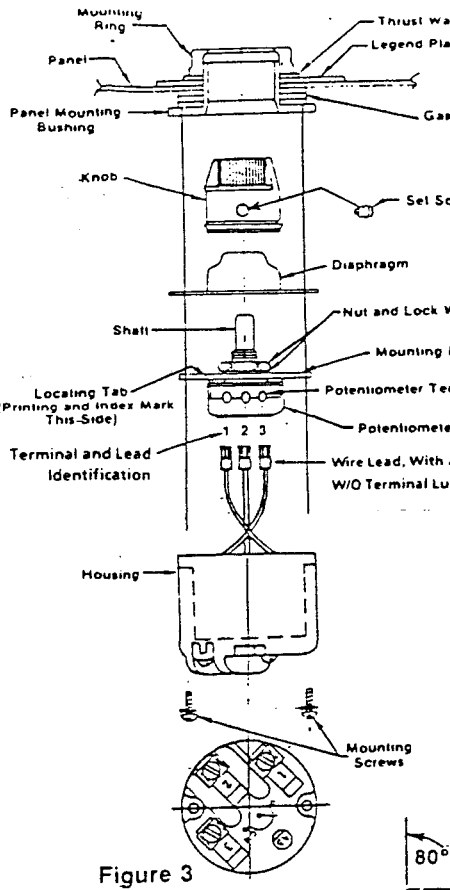
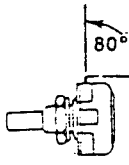



**Figure 3**



**Figure**

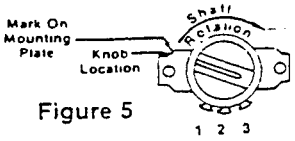



**Figure 5**

# INSTALLATION AND MOUNTING INSTRUCTIONS
## Bulletin 800T Illuminated Pilot Devices

This device is for use on a flat, smooth surface of a NEMA Type 4 or 13 enclosure.

**WARNING:** To prevent injury, this device must be disconnected from all power sources prior to initiating work.

**CAUTION:** When installing in a metal enclosure, maintain 1/2" (12.7) min. clearance between exposed metal parts of contact block and enclosure.

**Installation:** Place the unit (less lens, mounting ring, thrust washer and legend plate or trim washer) with proper number of gaskets per Figure 1 in mounting hole. Position legend plate or trim washer and thrust washer. Install mounting ring and tighten securely against trust washer. Install lens: see Figure 2. Use legend plate with notch instead of tang (800T-X500 and -X600 Series).

**CAUTION:** Lens must be tight against bushing to provide an oiltight seal; see Figure 2.

Illuminated pushbutton operators will accept one or two contact blocks mounted in tandem. Following blocks may be used: Catalog No. 800T-XD1, -XD2, -XD3, -XD4, -XA (Series C or higher) and Catalog No. 800T-XD1R, -XD2R, -XAR, XA2R, -XA4R (Series A or higher). Catalog No. 800T-XD5, -XD6 (Series B or higher) may be used on second level, but may not mounted adjacent to the transformer (first level).

**REPLACING LAMP-** Bayonet Base: Remove lens. Push lamp inward and turn to the left. To install new lamp, insert in socket, push down and turn to the right; see Figure 3.

**NOTE:** Lens must be assembled to Pilot Light for use in Class I, Division 2 Hazardous Locations.

### Mounting Instructions

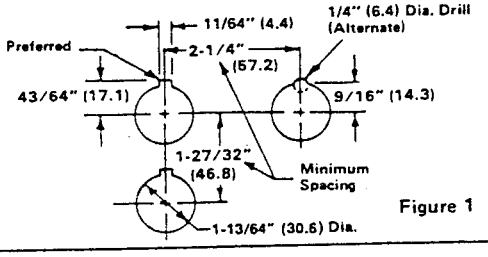



Figure 1

| Gaskets required for various panel thicknesses. Units are shipped with three 1/16" (1.6) gaskets. | |
|---|---|
| 16 Gage 1/16" (1.6) | 3 |
| 12 Gage 7/64" (2.8)<br>10 Gage 9/64" (3.6) | 2 |
| 3/16" (4.8) | 1 |
| Panels thicker than 3/16" (4.8) must be counterbored. | |

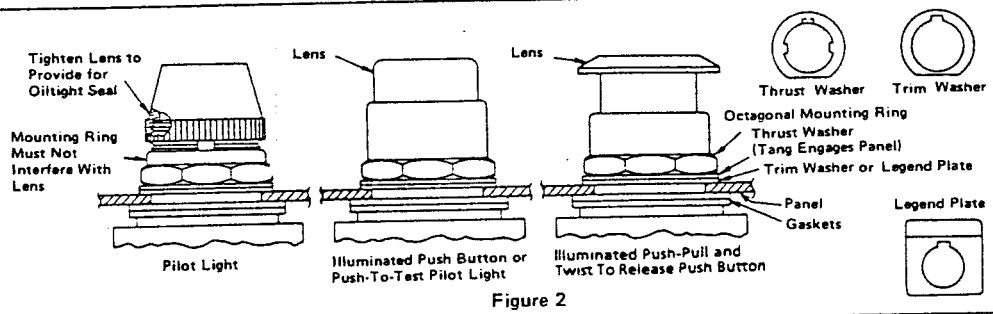



Figure 2

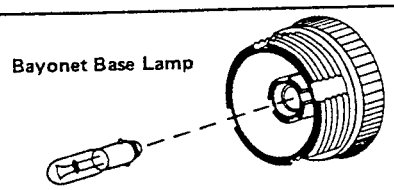



Figure 3

Note: Dimensions shown in parentheses are in millimeters.

Illuminated push button and pilot light units will accept dual input modules: Catalog Nos. 800T-N290 (120V) and 800T-N291 (24V). These kits are mounted in place of the transformer or the full voltage module.

A (6V) flashing lamp, Catalog No. 800T-N212 is available for any illuminated device which utilizes the No. 755 or No. 1866 lamp.

A device bonding kit, Catalog No. 800T-N300 is available to meet the bonding requirements of CSA Standard C22.2 No. 0.4.

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ALLEN-BRADLEY
A Rockwell International Company

# CONTACT TARGET TABLE FOR 2 POSITION SELECTOR SWITCHES

To determine the contact targets of Allen-Bradley two position selector switches, proceed as follows:

1. Determine on which **SIDE** of the selector switch the contact block is mounted: **WHITE** or **BLACK.** On the back of the selector switch is a molded plastic cover. On this cover is a nameplate indicating Catalog No. of the operator and location of side 1 (white actuator). Side 2 (black actuator) is the opposite side.
2. Identify the **CONTACT BLOCK** used by looking at the contact block cover plate and finding a Catalog No., such as 800T-XA.
3. Identify the **CIRCUIT** for which the contact target is desired by looking again at the contact block cover plate for a wiring symbol such as "A", "B", "A1", etc.
4. Identify the **CAM** used by looking again at the nameplate on the molded plastic cover on the back of the selector switch operator. The Catalog No., with exceptions listed below, contains the cam identification following the flag letter "K".

   Example Catalog Nos.: 800T-H2KE8 or 800H-HR2KE8.

   The E8 is the cam identification (there may be digits following).

   **Exceptions:** Selector switches where a special cam was not specified. On standard two position maintained, a **B6** cam is used. On standard two position spring return, an **L8** cam is used.

   Example Catalog Nos. of standard selector switches: 800T-H2A, 800T-H17C, 800T-H2B, 800T-H32H.
5. Refer to the table below and find the actuator color, contact block, and wiring symbol. Read across the top to find the cam and knob position. Where these two columns intersect will be the contact target.

| ACTUATOR COLOR | Contact Block 800T- | Single Circuit Or Optional | Normal Circuit Operation | Wiring Symbol | CAM CODE AND KNOB POSITIONS [1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maintained | | | | | | Spring Return From Left | | Spring Return From Right | |
| | | | | | B6 | | E8 | | L8 | | L8 | | L8 | |
| | | | | | ↖ | ↗ | ↖ | ↗ | ↖ | ↗ | ↖ | ↗ | ↖ | ↗ |
| WHITE | XA, XAR, XAP | XD2 or XD6 XD2R, XD2P | NC | B | X | O | O | X | O | X | O | X | X | O |
| | | XD1 or XD5 XD1R, XD1P | NO | A | O | X | X | O | X | O | X | O | O | X |
| | XA1 | XD4 | NCLB | BZ1 | X | O | O | X | O | X | O | X | X | O |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | O | X | X | O | X | O | X | O | O | X |
| | [3] XA2, XA2R | XD1 or XD5 XD1R, XD1P | NO | A1 | O | X | X | O | X | O | X | O | O | X |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | O | X | X | O | X | O | X | O | O | X |
| | XA4, XA4R | XD2 or XD6 XD2R, XD2P | NC | B1 | X | O | O | X | O | X | O | X | X | O |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | X | O | O | X | O | X | O | X | X | O |
| | XA7 | XD4 | NCLB | BZ1 | X | O | O | X | O | X | O | X | X | O |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | X | O | O | X | O | X | O | X | X | O |
| | XD3 | — | NOEM | AZ | O | X | X | O | X | O | X | O | O | X |
| | XD4 | — | NCLB | BZ | X | O | O | X | O | X | O | X | X | O |
| BLACK | XA, XAR, XAP | XD2 or XD6 XD2R, XD2P | NC | B | X | O | X | O | O | X | O | X | X | O |
| | | XD1 or XD5 XD1R, XD1P | NO | A | O | X | O | X | X | O | X | O | O | X |
| | XA1 | XD4 | NCLB | BZ1 | X | O | X | O | O | X | O | X | X | O |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | O | X | O | X | X | O | X | O | O | X |
| | [3] XA2, XA2R | XD1 or XD5 XD1R, XD1P | NO | A1 | O | X | O | X | X | O | X | O | O | X |
| | | XD1 or XD5 XD1R, XD1P | NO | A2 | O | X | O | X | X | O | X | O | O | X |
| | XA4, XA4R | XD2 or XD6 XD2R, XD2P | NC | B1 | X | O | X | O | O | X | O | X | X | O |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | X | O | X | O | O | X | O | X | X | O |
| | XA7 | XD4 | NCLB | BZ1 | X | O | X | O | O | X | O | X | X | O |
| | | XD2 or XD6 XD2R, XD2P | NC | B2 | X | O | X | O | O | X | O | X | X | O |
| | XD3 | — | NOEM | AZ | O | X | O | X | X | O | X | O | O | X |
| | XD4 | — | NCLB | BZ | X | O | X | O | O | X | O | X | X | O |

[1] The slanted lines represent the knob positions.

**Abbreviation and Symbols**

NO = Normally Open — X = Closed
NC = Normally Closed — O = Open
LB = Late Break
EM = Early Make

[3] XA2 contact blocks must be used only on the 2 ND level if stacked.

40060-259-02 (E)
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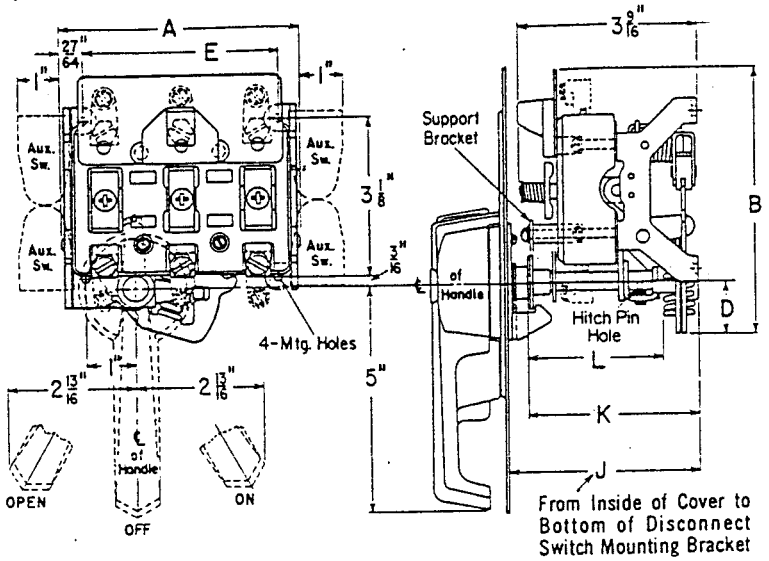
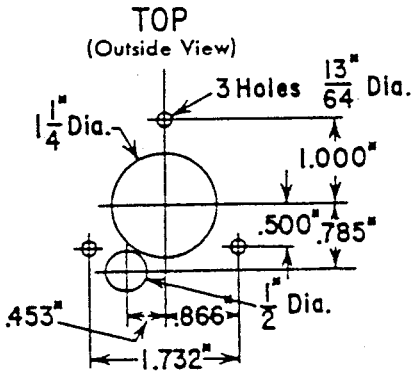
# ROD OPERATED DISCONNECT SWITCH

**30 Ampere Size—Catalog Number 1494R-N30**
**60 Ampere Size—Catalog Number 1494R-N60**

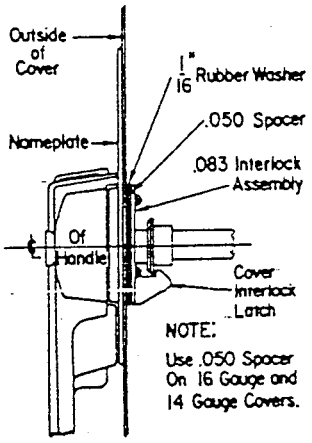
See Reverse Side for 100 and 200 Ampere Size




**Cover Drilling Dimensions**

Cabinet cover thickness
#16 Ga. Min. to #10 Ga. Max.




| NEMA Designation | Dimensions in Inches | | | | | | | | | Approximate Shipping Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| | A Wide | B High | D | E | J | | | K | L | |
| 30 Amperes | 3 31/32 | 4 13/16 | 1 1/8 | 3 1/8 | Standard Shaft | 4 3/8 Min. | 10 7/8 Max. | 1 | 2 | 4 Lbs. |
| | | | | | Long Shaft | 4 3/8 Min. | 19 3/8 Max. | | | |
| 60 Amperes | 4 21/32 | 5 1/4 | 1 1/16 | 3 13/16 | Standard Shaft | 4 1/2 Min. | 10 7/8 Max. | 1 | 2 | 4 1/2 Lbs. |
| | | | | | Long Shaft | 4 1/2 Min. | 19 3/8 Max. | | | |

1 The Adjusted Coupling Position is determined by measuring the cabinet depth and subtracting 9/16" ±1/16".

2 The Shaft Length is determined by measuring the cabinet depth and subtracting 1 3/8".

## MOUNTING THE DISCONNECT SWITCH

1. Measure the cabinet depth (Dimension "J"), to insure that your cabinet is within the maximum and minimum size range.
2. Select desired location on enclosure surface for mounting the disconnect switch.
3. From the line drawing and dimension table above, locate the mounting holes of the switch.
4. Mount the disconnect switch on the enclosure mounting surface. Use 3/16" or #10 screw.

## MOUNTING THE ACTIVATING ROD

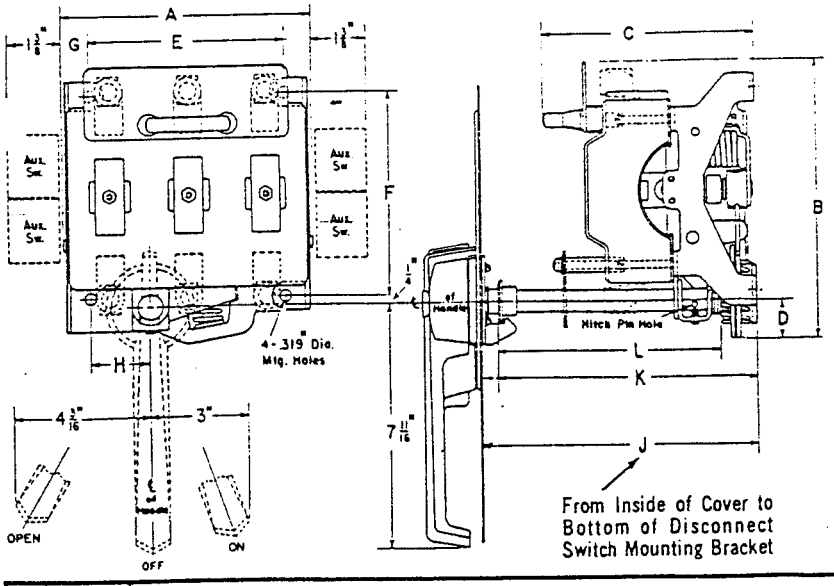
1. Determine shaft length (Dimension "L") from table and cut uninsulated end of shaft to size.
2. Insert the insulated end of shaft through the hole in the support bracket and into the two square holes in the switch lever. Tighten set screw to secure shaft to switch lever. Insert hitch pin furnished into hole in shaft (see side view above).
3. Determine the adjusted coupling position (Dimension "K") and attach the coupling to the shaft with set screws. The "D" molded on the face of the coupling must be at the bottom and the "C" at the top, with the switch in "Off" position.

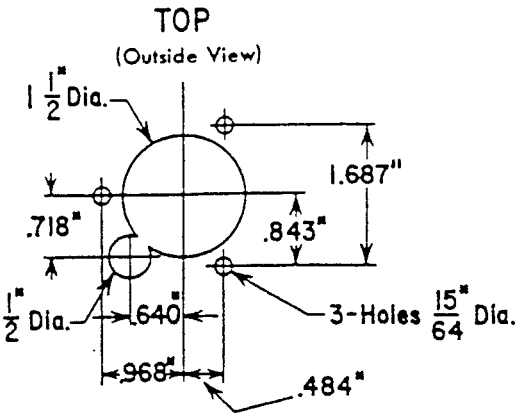
## MOUNTING THE HANDLE ASSEMBLY

1. Using the template and dimension table as a guide, determine the point on the cover, within 1/8", at which the center of the rod and the center of the handle assembly should meet.
2. With the template located, center-punch the location of the five mounting holes. Drill the 13/64" diameter holes. Drill pilot holes for Greenlee cutters for the 1/2" and 1 1/4" diameter holes. Cut the 1/2" diameter hole with Greenlee cutter first, then the 1 1/4" diameter hole.
3. Close the cover and check the coupling spear-point for alignment with the center of the large diameter hole. Adjust the support bracket, if necessary, to center the spear-point within 1/16".
4. On the outside surface of the cover, mount the nameplate and handle so that the handle passes through the nameplate and enclosure cover. Use trichlorethylene or lacquer thinner to activate the adhesive on the back of the nameplate. On the inside surface of the cover the rubber washer, the spacer (used only on 14 and 16 gauge covers) and the interlock are assembled, in that order, around the protruding shoulder of the handle assembly. Tighten the three mounting screws securely.
5. CAUTION: MAKE SURE THE COVER INTERLOCK LATCH SWINGS FREELY.
6. With the handle in the "Open" position, the cover should open freely. With the handle in either the "On", "Off" or "Lock" position, the cover interlock MUST prevent opening the cover unless the defeater is used.

Publication 1494R-5.0—November, 1974
Supersedes 1494R-800

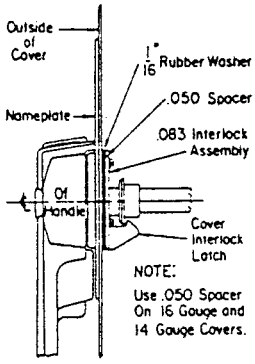
## 100 Ampere Size — Catalog Number 1494R-N100 • 200 Ampere Size — Catalog Number 1494R-N200




**Cover Drilling Dimensions**

Cabinet cover thickness
#16 Ga. Min. to #10 Ga. Max.




| NEMA Designation | Dimensions in Inches | | | | | | | | | | | | Approximate Shipping Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A Wide | B High | C Deep | D | E | F | G | H | J | | | K | L | |
| 100 Amperes | 6 7/16 | 7 3/16 | 5 7/16 | 15/16 | 5 | 5 1/4 | 23/32 | 1 1/2 | Standard Shaft | 6 1/4 Min. | 12 3/8 Max. | 1 | 2 | 9 Lbs. |
| | | | | | | | | | Long Shaft | 6 1/4 Min. | 25 3/8 Max. | | | |
| 200 Amperes | 7 1/4 | 9 1/2 | 6 1/2 | 1 7/16 | 5 3/4 | 6 1/2 | 3/4 | 1 23/32 | Standard Shaft | 7 7/16 Min. | 12 3/8 Max. | 1 | 2 | 15 Lbs. |
| | | | | | | | | | Long Shaft | 7 7/16 Min. | 25 3/8 Max. | | | |

1 The Adjusted Coupling Position is determined by measuring the cabinet depth and subtracting 15/16" ± 1/16".

2 The Shaft Length is determined by measuring the cabinet depth and subtracting 1 7/8".

### MOUNTING THE DISCONNECT SWITCH

Measure the cabinet depth (Dimension "J") to insure that your cabinet is within the maximum and minimum size range.

2. Select desired location on enclosure surface for mounting the disconnect switch.
3. From the line drawing and dimension table above, locate the mounting holes of the switch.
4. Mount the disconnect switch on the enclosure mounting surface. Use 1/4" or 5/16" screws.

### MOUNTING THE ACTIVATING ROD

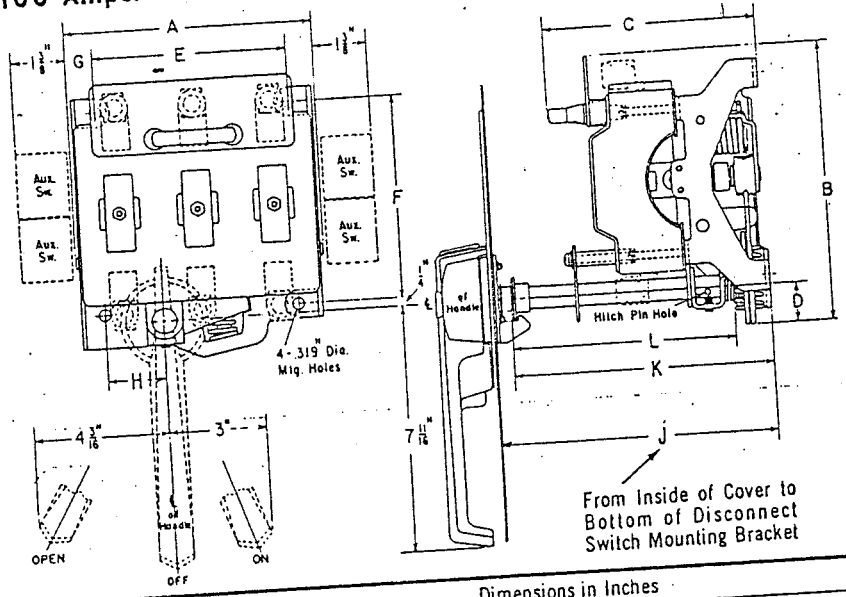
1. Determine shaft length (Dimension "L") from table and cut uninsulated end of shaft to size.
2. Insert the insulated end of the shaft through the hole in the support bracket and into the two square holes in the switch lever. Tighten set screw (or screws) to secure shaft to switch lever. Insert hitch pin furnished into hole in shaft (see side view above).
3. Determine the adjusted coupling position (Dimension "K") and attach the coupling to the shaft with set screws. The word "On" and the arrow molded on the face of the coupling must be at the bottom with the switch in the "Open" position.

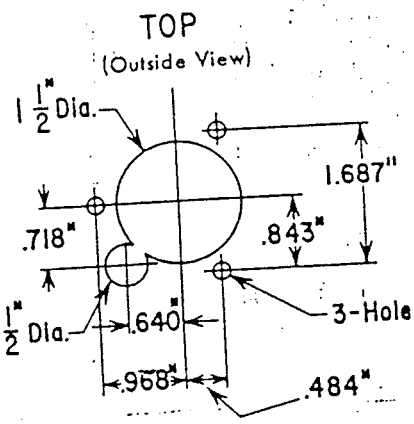
### MOUNTING THE HANDLE ASSEMBLY

1. Using the template and dimension table as a guide, determine the point on the cover, within 1/8", at which the center of the rod and the center of the handle assembly should meet.
2. With the template located, center-punch the location of the five mounting holes. Drill the 15/64" diameter holes. Drill pilot holes for Greenlee cutters for the 1/2" and 1 1/2" diameter holes. Cut the 1/2" diameter hole with Greenlee cutter first, then the 1 1/2" diameter hole, overlapping the 1/2" diameter hole.
3. Close the cover and check the coupling spear-point for alignment with the center of the large diameter hole. Adjust the support bracket, if necessary, to center the spear-point within 1/16".
4. On the outside surface of the cover, mount the nameplate and handle so that the handle passes through the nameplate and enclosure cover. Use trichlorethylene or lacquer thinner to activate the adhesive on the back of the nameplate. On the inside surface of the cover the rubber washer, the spacer (used only on 14 and 16 gauge covers) and the interlock are assembled, in that order, around the protruding shoulder of the handle assembly. Tighten the three mounting screws securely.
5. CAUTION: MAKE SURE THE COVER INTERLOCK LATCH SWINGS FREELY.
6. With the handle in the "Open" position, the cover should open freely. With the handle in either the "On", "Off", or "Lock" position, the cover interlock MUST prevent opening the cover unless the defeater is used.


ALLEN-BRADLEY
Industrial Control Division
Milwaukee, Wisconsin 53204

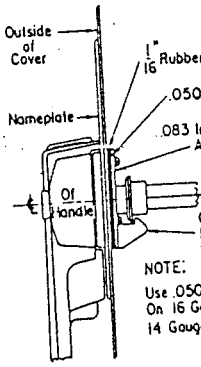
# 100 Ampere Size — Catalog Number 1494R-N100 • 200 Ampere Size — Catalog Number 1494R-N200




**Cover Drilling Dimensions**

Cabinet cover thickness
#16 Ga. Min. to #10 Ga. Max.




| NEMA Designation | Dimensions in Inches | | | | | | | | | | | | | Approximate Shipping Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A Wide | B High | C Deep | D | E | F | G | H | J | | | K | L | |
| 100 Amperes | 6 7/16 | 7 3/16 | 5 7/16 | 15/16 | 5 | 5 1/4 | 23/32 | 1 1/2 | Standard Shaft | 6 1/4 Min. | 12 1/8 Max. | 1 | 2 | 9 Lbs. |
| | | | | | | | | | Long Shaft | 6 1/4 Min. | 25 1/8 Max. | | | |
| 200 Amperes | 7 1/4 | 9 1/2 | 6 1/2 | 1 7/16 | 5 1/4 | 6 1/2 | 3/4 | 1 23/32 | Standard Shaft | 7 1/16 Min. | 12 1/8 Max. | 1 | 2 | 15 Lbs. |
| | | | | | | | | | Long Shaft | 7 1/16 Min. | 25 1/8 Max. | | | |

1 The Adjusted Coupling Position is determined by measuring the cabinet depth and subtracting 1 5/16" ± 1/16".

2 The Shaft Length is determined by measuring the cabinet depth and subtracting 1 7/8".

## MOUNTING THE DISCONNECT SWITCH

1. Measure the cabinet depth (Dimension "J") to insure that your cabinet is within the maximum and minimum size range.
2. Select desired location on enclosure surface for mounting the disconnect switch.
3. From the line drawing and dimension table above, locate the mounting holes of the switch.
4. Mount the disconnect switch on the enclosure mounting surface. Use 1/4" or 5/16" screws.

## MOUNTING THE ACTIVATING ROD

1. Determine shaft length (Dimension "L") from table and cut uninsulated end of shaft to size.
2. Insert the insulated end of the shaft through the hole in the support bracket and into the two square holes in the switch lever. Tighten set screw (or screws) to secure shaft to switch lever. Insert hitch pin furnished into hole in shaft (see side view above).
3. Determine the adjusted coupling position (Dimension "K") and attach the coupling to the shaft with set screws. The word "On" and the arrow molded on the face of the coupling must be at the bottom with the switch in the "Open" position.

## MOUNTING THE HANDLE ASSEMBLY

1. Using the template and dimension table as a guide, determine the point on the cover, within 1/8", at which the center of the rod and the center of the ha assembly should meet.
2. With the template located, center-punch the loc of the five mounting holes. Drill the 15/64" diar holes. Drill pilot holes for Greenlee cutters for th and 1 1/2" diameter holes. Cut the 1/2" diameter with Greenlee cutter first, then the 1 1/2" diar hole, overlapping the 1/2" diameter hole.
3. Close the cover and check the coupling spear for alignment with the center of the large dia hole. Adjust the support bracket, if necessar center the spear-point within 1/16".
4. On the outside surface of the cover, mount the plate and handle so that the handle passes th the nameplate and enclosure cover. Use trichloret or lacquer thinner to activate the adhesive on th of the nameplate. On the inside surface of the the rubber washer, the spacer (used only on 1 16 gauge covers) and the interlock are assemb that order, around the protruding shoulder handle assembly. Tighten the three mounting securely.
5. CAUTION: MAKE SURE THE COVER INTE LATCH SWINGS FREELY.
6. With the handle in the "Open" position, th should open freely. With the handle in either th "Off", or "Lock" position, the cover interloc prevent opening the cover unless the defeater

ALLEN-BRADLEY
Industrial Control Division
Milwaukee, Wisconsin 53204

# Ball Bearing Units

## MOUNTING AND LUBRICATION INSTRUCTIONS

Hub City Bearing Unit performance is dependent on proper installation and lubrication where required. Failure to follow instructions may result in poor performance and short bearing life.

### MOUNTING INSTRUCTIONS

1. For best results use turned and ground shafting, free of rough spots and burrs. If old shafting is used, locate bearing on a smooth unworn section.
2. Clean shaft and bearing bore. Coat shaft with a small amount of oil.
3. Check bearing for freedom of alignment, before mounting bearing unit on shaft.

### A — Eccentric Collar Bearings

4a. Slide bearing unit and collar on the shaft. (If projecting side of bearing is to be mounted toward the machine, put the locking collar on first). Collar should be opposing thrust load. DO NOT HAMMER THE ENDS OF THE INNER RACE. If it is necessary to apply force in mounting, use a soft metal bar or pipe against the inner race only. Tap the bearing unit into place.

5a. Fit the eccentric locking collar on the projecting inner race. TURN IT IN THE DIRECTION OF SHAFT ROTATION. Tighten the collar securely, using a spanner or setscrew wrench. Tighten the setscrew against shaft.

### B — Setscrew Lock Bearings

4b. Slide the bearing unit on the shaft. DO NOT HAMMER THE ENDS OF THE INNER RACE. If it is necessary to apply some force in mounting, use a soft metal bar or pipe against the inner race only. Tap the bearing unit into place. Tighten the two setscrews securely to lock bearing to shaft.

### LUBRICATION INSTRUCTIONS

All Hub City bearing units are factory lubricated and ready for use (except for unusually severe applications). Lubricated-For-Life bearings have no grease fitting and require no additional lubrication while in use. Re-lube bearing housings have a lubrication fitting mounted on the housing and should be lubricated when used in wet or dirty applications. For normal operation there is no need to relubricate bearings at all. The following table is a general guide for relubrication. Experience will determine the best interval for each specific application.

### LUBRICATION GUIDE

| Operating Conditions | Bearing Temperatures | Grease Interval | Recommended Grease or Equivalent |
|---|---|---|---|
| Clean | 32° F to 120° F<br>120° F to 150° F<br>150° F to 200° F | 6 to 12 months<br>1 to 3 months<br>1 to 4 weeks | Shell Alvania #2<br>Texaco Multifak #2 |
| Dirty | 32° F to 150° F<br>150° F to 200° F | 1 to 4 weeks<br>Daily — 1 Week | Sun Prestige #41<br>Humble L 100K #2 |
| Moisture | 32° F to 200° F | Daily — 1 Week | Sinclair Litholine Multi-Purpose |

When lubricating bearings add grease slowly while shaft is rotating. When grease begins to come out the seals, the bearing will contain the correct amount of lubricant.

Bearings should not run in steady operation over 200° F and should not exceed 225° F for intermittent operation.

For unusual or severe applications, contact Hub City Customer Service Department.

### REPLACEMENT OF ADAPTOR BEARINGS IN BEARING UNITS

All Hub City bearing units are fitted with self-aligning adaptor bearings which can be replaced in case of wear or damage to the original adaptor bearing. To replace bearing:

1. Loosen setscrew in locking collar or bearing.
2. Loosen locking collar, if any, from shaft by turning in direction opposite to shaft rotation.
3. Remove unit from shaft.
4. Remove collar, if any, from inner race of bearing unit.
5. Rotate bearing 90° in the housing.
6. Withdraw along the slots in the sides of the housing.
7. Inspect housing for wear or damage and replace if necessary.
8. Clean inside of housing with solvent and dry with lint-free cloth or paper towel.
9. Insert bearing in the slots.
10. Rotate bearing 90° in the housing to operating position. If the fit between the housing and bearing is loose, the housing should be replaced.
11. Replace collar, if any.
12. Remount unit on shaft following the procedure outline above.

2914 Industrial Dr., P. O. Box 1089, Aberdeen, SD 57402-1089, U.S.A.
Phone (605) 225-0360 • Telex 29-2236 • FAX 605-225-0567

*LEROY-SOMER, INC.*
560 S. HICKS RD.
PALATINE, IL 60067
PH. 312/359-2440
TLX 210231

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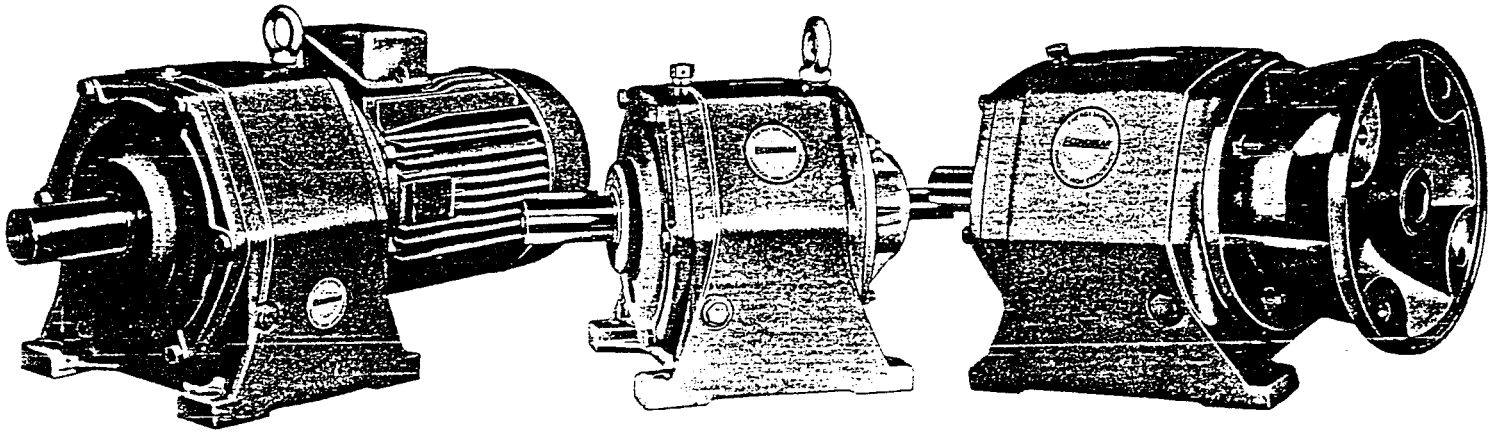
# MAINTENANCE



## Installation

All speed reducers should be mounted on a solid foundation to support it and to isolate it from vibrations.

Remove protective coating on output shaft.

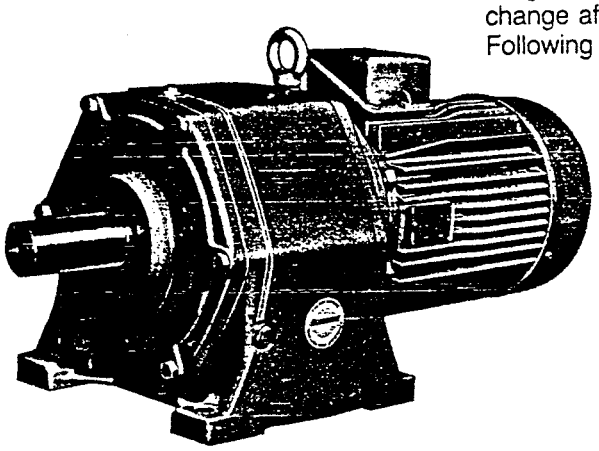
When chain drives, belt drives or open gearing are used on the output shaft of the speed reducer, great care should be taken in installation to minimize abnormal loading. Avoid hammering. Prefer preheating the parts to be mounted on the shaft. Sheave or sprocket should be mounted as close as possible to the housing to reduce overhung load. Do not over-tension the chain or the belt. Refer to manufacturer's recommendation.

Check for proper shaft parallelism.

## Lubrication

Before starting up, fill the gearbox with oil until level reaches level plug. Econogear® reducers can be used in any position. Check with following table the location of level (L), filling (F) and draining (D) plugs according to mounting position. Fit the breather supplied with the box in place of filling plug.

Oil grade: EP gear oil, viscosity 150 VG 150. AGMA #4EP. First oil change after a running period comprised between 1000 and 1500 hours. Following oil changes every 5000 hours.

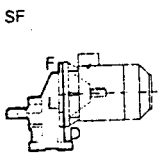
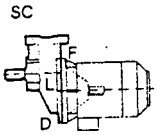
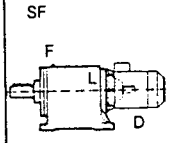
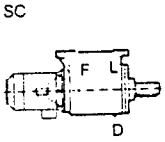
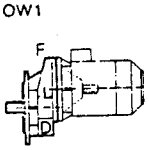
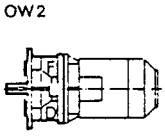
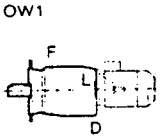
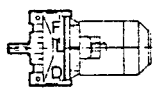
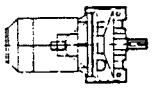
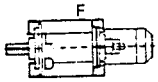
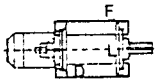
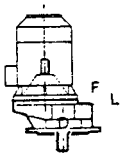
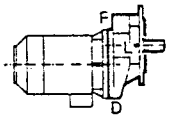
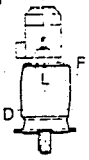
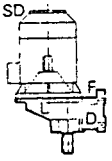
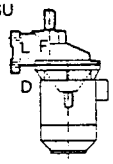
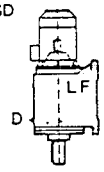
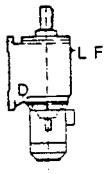
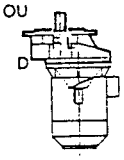
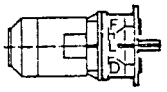
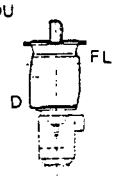


LEROY SOMER

CORRESPONDANCE TABLE OF THE LUBRICANTS FOUND ON THE HOME MARKET

| Make | Running conditions between 15 °F and 60 °F | | Running conditions between 60 °F and 165 °F | |
|---|---|---|---|---|
| | without backstop | with backstop | without backstop | with backstop |
| AGMA lubricant | # 2 EP | # 2 | # 4 EP | # 4 |
| Cities Service Co | CITGO EP Comp. # 68 | Pacemaker # 68 | Citgo EP Compo # 150 | Pacemaker # 150 |
| Fiske Bros. Refinning | Lubriplate APG 80 | Lubriplate Non. Det # 2 | Lubriplate APG 90 | Lubriplate STM 90 |
| Gulf Oil Corp. | EP Lubricant HD 68 | Harmony 68 | EP Lubricant HD 150 | Harmony 150 D |
| Keystone Div. | KLC - 543 | KLC 543 | KLC 432 | KLC 432 |
| Mobil Oil Corp. | Mobil Gear 626 | Mobil DTE heavy med. | Mobil Gear 629 | Mobil DTE extra heavy |
| Shell Oil Corp. | Omala 68 | Turbo 68 | Omala 150 | Turbo 150 |
| Sun Oil Corp. | Sunep 1050 | Sunvis 931 | Sunep 1060 | Sunvis 975 |
| Texaco, Inc. | Meropa # 1 | Regal Oil PCR & O | Meropa # 2 | Regal Oil GR & O |

# Mounting Positions

| Foot mounting single reduction | | Foot mounting double and tripie reduction | | Flange mounting single reduction | | Flange mounting double and triple reduction |
|---|---|---|---|---|---|---|
| SF  | SC  | SF  | SC  | OW1  | OW2  | OW1  |
| SW1  | SW2  | SW1  | SW2  | OD  | OW3  | OD  |
| SD  | SU  | SD  | SU  | OU  | OW4  | OU  |

plug locations - F: filling L: level D: draining

**Reducer oil capacity** (us quarts)

| Reducer size | Mounting position | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SF | SW1/SW2 | SC | SD | SU | OW1/OW3 | OD | OU | OW2/OW4 |
| B1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| C1 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| D1 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| E1 | 1.5 | 1.9 | 3 | 1.2 | 1.8 | 1 | 1.9 | 1.8 | 1.9 |
| F1 | 2.7 | 3.6 | 5 | 3.7 | 5.1 | 2.7 | 3.7 | 5.1 | 3.7 |
| B2/B3 | 0.5 | 1.4 | 1.4 | 1.7 | 1.7 | 0.5 | 1.9 | 1.9 | |
| C2/C3 | 1.1 | 2.1 | 2.1 | 3.1 | 3.1 | 1.1 | 3.1 | 3.1 | |
| D2/D3 | 1.6 | 3.7 | 3.7 | 5.4 | 5.4 | 1.6 | 5.4 | 5.4 | |
| E2/E3 | 2.3 | 4.7 | 6.9 | 7.9 | 7.9 | 2.4 | 7.9 | 7.9 | |
| F2/F3 | 4.4 | 9.3 | 13.8 | 16.3 | 15.8 | 4.4 | 16.3 | 15.9 | |
| R2/R3 | 9.5 | 23 | 23 | 38 | 38 | 9.5 | 38 | 38 | |
| G2/G3 | 11.6 | 29 | 29 | 48 | 48 | 11.6 | 48 | 48 | |
| H2/H3 | 24 | 58 | 58 | 100 | 100 | 24 | 100 | 100 | |

**Data to be supplied when ordering spare parts.**

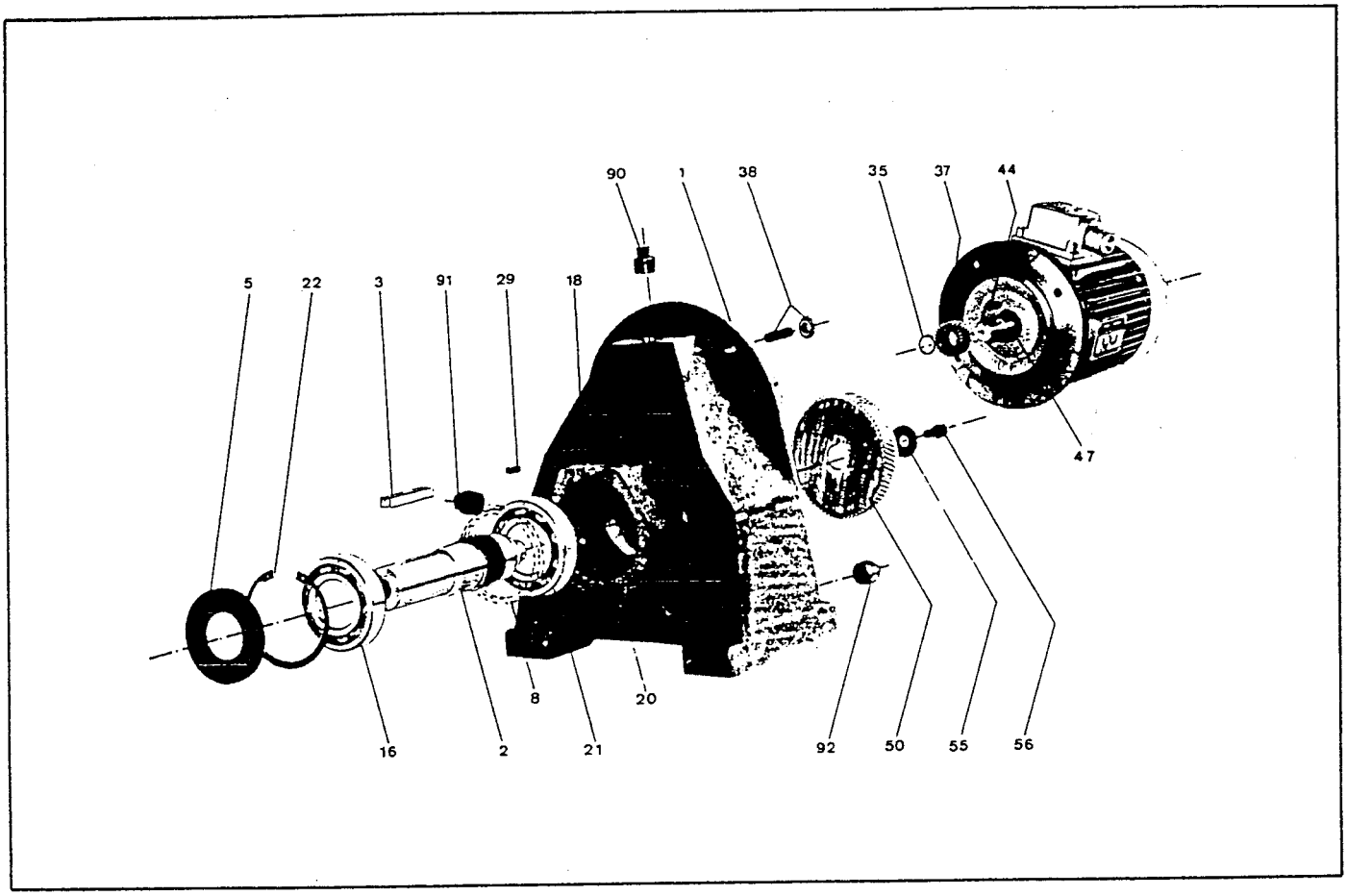
Always refer to the nameplate of the reducer, even if the unit is a gearmotor.
Give the serial number indicated on the nameplate.

Locate on the exploded view of the unit, the part needed and give the reference number of the part.

For example:
Econogear S/N #A20212
Part no. 19

ECONOGEAR®
*Designed for*
*Outstanding Performance And Long Life*

# Nomenclature B1-C1-D1-E1-F1




| Ref. No. | Qty. | Item |
|---|---|---|
| 1 | 1 | Housing |
| 2 | 1 | Output shaft |
| 3 | 1 | Output shaft key |
| 5 | 1 | Oil seal |
| *8 | 1 | Adjustment gage |
| 16 | 1 | Bearing |
| *18 | 1 | Lock washer |

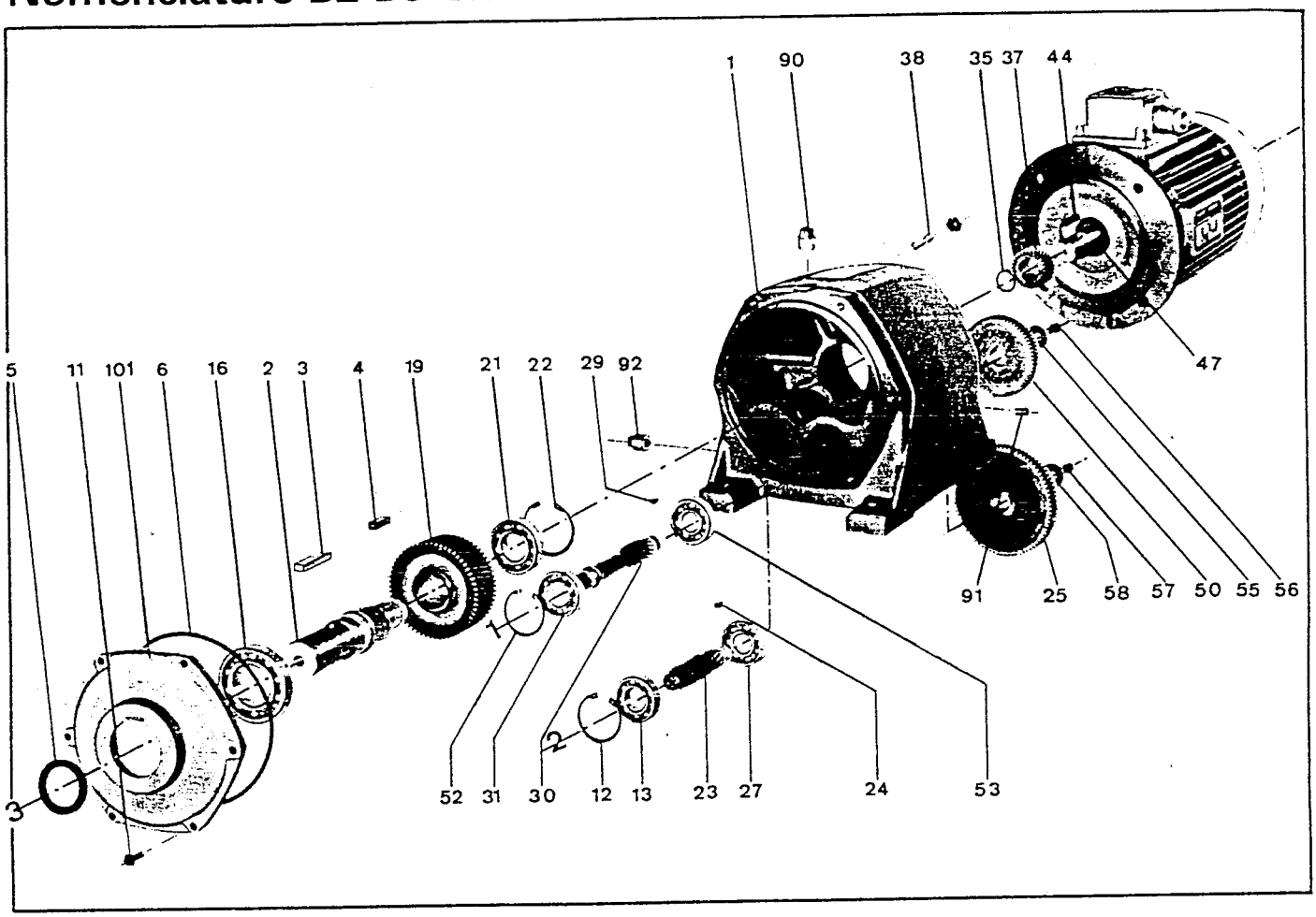
| Ref. No. | Qty. | Item |
|---|---|---|
| *20 | 1 | Castle nut |
| 21 | 1 | Bearing |
| 22 | 1 | Snap ring |
| 29 | 1 | Gear key |
| 35 | 1 | Snap ring |
| 37 | 1 | Input pinion |
| 38 | 4 | Fixing threads |

| Ref. No. | Qty. | Item |
|---|---|---|
| 44 | 1 | Motor Key |
| 44 bis | 1 | Pin (shank pinion) |
| 47 | 1 | Oil deflector |
| 50 | 1 | Gear |
| 55 | 2 | Gear washer |
| 56 | 1 | Fixing screw |
| 90 | 1 | Breather |
| 91 | 1 | Plug |
| 92 | 1 | Plug |

*For D1, E1 and F1 only

| TYPES | Principal maintenance parts ☐ | | | |
|---|---|---|---|---|
| | 5 | 8 | 16 | 21 |
| B1 | 25 x 52 x 7 | – | 6 205 | 6 203 |
| C1 | 30 x 62 x 7 | – | 6 206 | 6 205 |
| D1 | 40 x 80 x 10 | 63 x 80 x 3 + 63 x 80 x gages | 30 208 | 32 006 |
| E1 | 52 x 85 x 10 | 63 x 80 x 3 | 30 209 | 30 208 |
| F1 | 60 x 90 x 10 | 65 x 85 x 3,5 | 30 210 | 30 209 |

# Nomenclature B2-B3-C2-C3-D2-D3

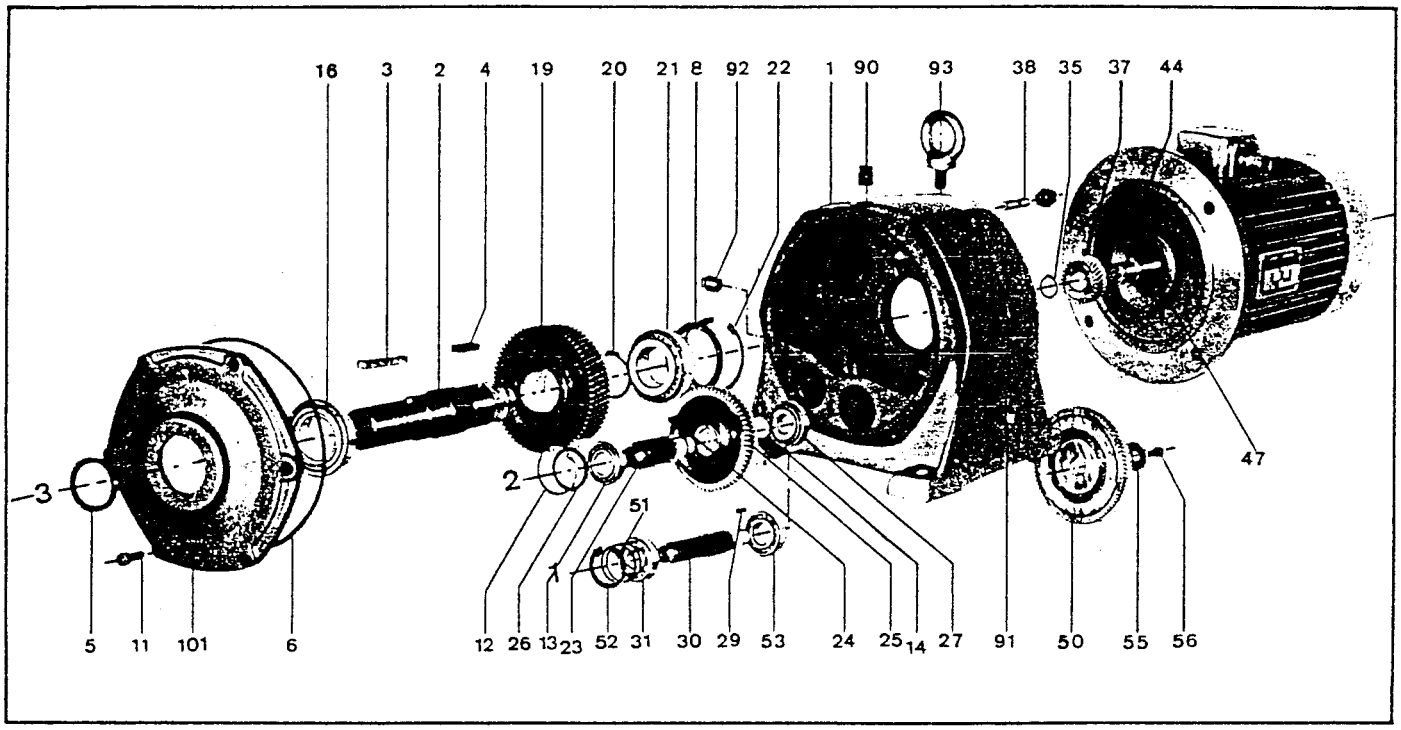



Nomenclature B3-C3-D3 (For B2-C2-D2 take off ref. no. of axis 2:12-13-23-24-25-27-57-58)

| Ref No. | Qty. | Item | Ref No. | Qty. | Item | Ref No. | Qty. | Item |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Housing | 22 | 1 | Snap ring axis 3 | 47 | 1 | Oil deflector |
| 101 | 1 | End bell | 23 | 1 | Pinion axis 2 | 50 | 1 | Gear axis 1 |
| 2 | 1 | Output shaft | 24 | 1 | Key axis 2 | 52 | 1 | Snap ring axis 1 |
| 3 | 1 | Output shaft key | 25 | 1 | Gear axis 2 | 53 | 1 | Bearing axis 1 |
| 4 | 1 | Gear key | 27 | 1 | Bearing axis 2 | 55 | 1 | Washer axis 1 |
| 5 | 1 | Oil seal | 29 | 1 | Key axis 1 | 56 | 1 | Screw axis 1 |
| 6 | 1 | "O" ring | 30 | 1 | Pinion axis 1 | 57 | 1 | Screw axis 2 |
| 11 | 6 | Fixing screw | 31 | 1 | Bearing axis 1 | 58 | 1 | Washer axis 2 |
| 12 | 1 | Snap ring (D3 type) | 35 | 1 | Snap ring | 90 | 1 | Breather |
| 13 | 1 | Bearing axis 2 | 37 | 1 | Pinion | 91 | 1 | Plug |
| 16 | 1 | Bearing axis 3 | 38 | 4 | Fixing threads | 92 | 1 | Plug |
| 19 | 1 | Gear axis 3 | 44 | 1 | Motor key | | | |
| 21 | 1 | Bearing axis 3 | 44bis | 1 | Pin (shank pinion) | | | |

| | Principal maintenance parts | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | 5 | 6 | 16 | 21 | 31 | 53 | TYPE | 5 | 6 | 13 | 16 | 21 | 27 | 31 | 53 |
| B2 | 30x42x8 | 126,72x1,78 | 6206 RS | 6203 | 6302 | 6202 | B3 | 30x42x8 | 126,72x1,78 | 6203 | 6206 RS | 6203 | 6202 | 6302 | 6202 |
| C2 | 35x52x10 | 133,07 x1,78 | 6207 RS | 6204 | 6204 | 6204 | C3 | 35x52x10 | 133,07x1,78 | 6204 | 6207 RS | 6204 | 6204 | 6204 | 6204 |
| D2 | 45x62x8 | 172x3 | 6209 RS | 6206 | 6304 | 6205 | D3 | 45x62x8 | 172x3 | 6304 | 6209 RS | 6206 | 6205 | 6304 | 6205 |

# Nomenclature E2-E3-F2-F3-R2-R3-G2-G3-H2-H3




Nomenclature E3-F3-R3-G3-H3 (for E2-F2-R2-G2-H2 take off ref. number of axis 2: 12-13-14-23-24-25-27)

| Ref No. | Qty. | Item | Ref No. | Qty. | Item | Ref No | Qty. | Item |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Housing | 23 | 1 | Pinion axis 2 | 50 | 1 | Gear axis 1 |
| 101 | 1 | End Bell | 24 | 1 | Key axis 2 | 51 | 1 + x | Gages + axis 1 adjustment |
| 2 | 1 | Output shaft | 25 | 1 | Gear axis 2 | | | |
| 3 | 1 | Output shaft key | 26* | 1 + x | Gages + axis 2 adjustment | 52 | 1 | Snap ring axis 1 |
| 4 | 1 | Gear key | 27 | 1 | Bearing axis 2 | 53 | 1 | Bearing axis 1 |
| 5 | 1 | Oil seal | 29 | 1 | Key axis 1 | 55 | 2 | Washer axis 1 |
| 6 | 1 | "O" ring | 30 | 1 | Pinion axis 1 | 56* | 1 | Screw axis 1 |
| 8 | 1 + x | Gages + axis 3 adjustment | 31 | 1 | Bearing axis 1 | 90 | 1 | Breather |
| 11 | 6 | End Bell fixing screw | 35 | 1 | Snap ring | 91 | 1 | Plug |
| 12 | 1 | Snap ring axis 2 | 37 | 1 | Pinion | 92 | 1 | Plug |
| 13 | 1 | Bearing 2 | 38 | 4 | Fixing thread + nut | | | |
| 14 | 1 | Snap ring axis 2 (E.F.) | | | | 93 | 1 | Lifting eye bolt |
| 16 | 1 | Bearing axis 3 | 44 | 1 | Motor key | | | |
| 19 | 1 | Gear axis 3 | 44bis | 1 | Pin (shank pinion) | | | |
| 20 | 1 | Snap ring 3 (E.F) | 47 | 1 | Oil deflector | | | |
| 21 | 1 | Bearing axis 3 | 48 | | | | | |
| 22 | 1 | Snap ring axis 3 | | | | | | |

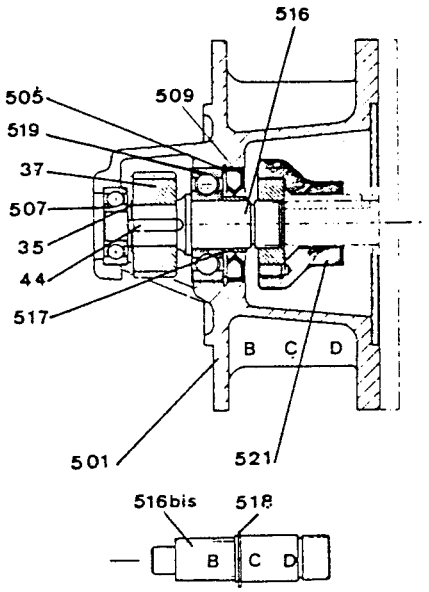
*gages in front on E and gages at rear on G and H. *2 screws on H

**Principal maintenance parts**

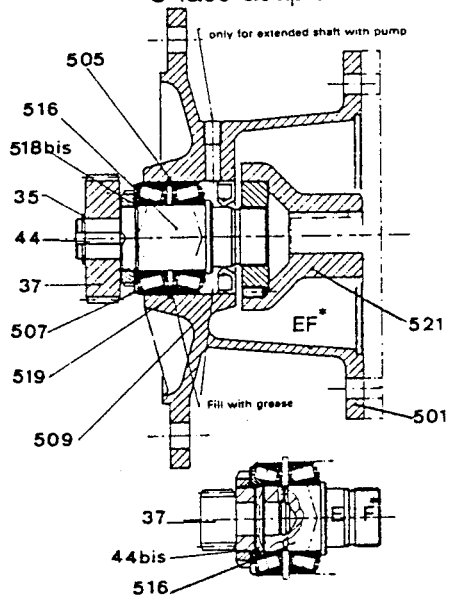
| TYPE | 5 | 6 | 16 | 21 | 31 | 53 | TYPE | 5 | 6 | 13 | 16 | 21 | 27 | 31 | 53 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E2 | 50x65x8/10 | 224.5x3 | 30210 + deflector | 32209 | 30205 | 30205 | E3 | 50x65x8/10 | 224.5x3 | 30205 | 30210 + deflector | 32209 | 30304 | 6304 | 6205 |
| F2 | 65x90x10/12 | 280x3 | 30213 + deflector | 33012 | 32207 | 32207 | F3 | 65x90x10/12 | 280x3 | 32007 | 30213 + deflector | 33012 | 32206 | 6306 | 6207 |
| R2 | 70x90x10 | 330x4 | 22214 + deflector | 22211 | 32307 | 32208 | R3 | 70x90x10 | 330x4 | 32307 | 22214 + deflector | 22211 | 32208 | 30207 | 30207 |
| G2 | 80x100x10 | 380x4 | 30216 + deflector | 32211 | 32308 | 32210 | G3 | 80x100x10 | 380x4 | 32308 | 30216 + deflector | 32211 | 32210 | 30306 | 32207 |
| H2 | 90x110x14 | 470x4 | 32218 + deflector | 33212 | 32310 | 32212 | H3 | 90x110x14 | 470x4 | 32310 | 32216 + deflector | 33212 | 32212 | 30309 | 30309 |

# Nomenclature B-C-D-E-F

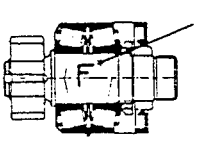
C face adaptor B-C-D




C face adaptor E-F

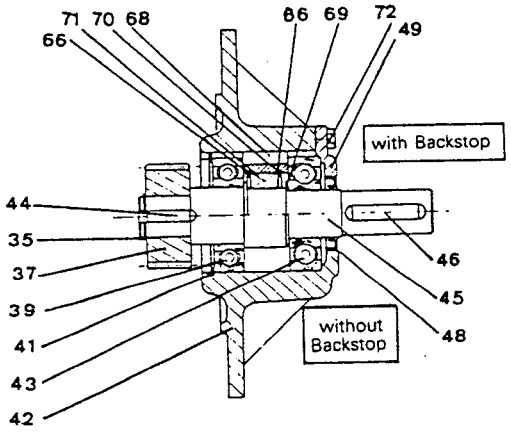


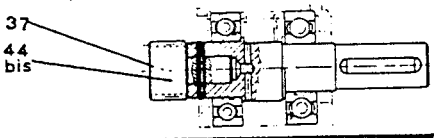

| Ref. No. | Qty. | Item |
|---|---|---|
| 501 | 1 | Housing |
| 505 | 1 | Snap ring |
| 507 | 1 | Bearing |
| 509 | 1 | Oil seal |
| 35 | 1 | Snap ring |
| 37 | 1 | Pinion |
| 516 | 1 | Shaft for pinion |
| 516 bis | 1 | Cut on the shaft pinion |
| 44 | 1 | Pinion key |
| 44 bis | 1 | Pin (shank pinion E-F) |
| 517 | 1 | Ring (D) |
| 518 | 1 | Snap ring (B and C) |
| 518 bis | 1 | Nut and lock washer (E and F) |
| 519 | 1 | Bearing |
| 521 | 1 | Coupling |




For F locking nut at rear

## Input shaft assembly (with or without Backstop)




| Ref No. | Qty. | Item |
|---|---|---|
| 35 | 1 | Snap ring |
| 37 | 1 | Pinion |
| 39 | 1 | Bearing |
| 41 | 1 | Snap ring |
| 42 | 1 | Housing |
| 43 | 1 | Bearing |
| 44 | 1 | Pinion key |
| 44 bis | 1 | Pin (shank pinion) |
| 45 | 1 | Shaft |
| 46 | 1 | Key |
| 48 | 1 | Oil seal |

For modification into Backstop, order special parts 42 and 45, first maintenance parts and Backstop kit below

**BACKSTOP KIT**

| Ref No. | Qty. | Item |
|---|---|---|
| 49 | 1 | Back stop cap |
| 66 | 2 | snap ring (B, C and D) |
| | 4 | Snap ring (E and F) |
| 68 | 1 | Key |
| 69 | 1 | Washer |
| 70 | 1 | Free wheel ring |
| 71 | 1 | Free wheel |
| 72 | 4 | Cap screw |

Principal maintenance parts

| Reducer Type | Code ratio | C FACE ADAPTOR 507 | 509 | 519 | INPUT SHAFT ASSEMBLY 39 | 43 | 48 | INPUT SHAFT ASSEMBLY WITH BACKSTOP 39 | 43 | 48 | 70 | 71 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 B2 B3 | 1.2 / 3.4.5.6 / 7.8 | HK1312 IR10x13x12.5 | 20x47x7 | 6204 / 6303 | 6304 / 6205 | 6204 | 17x30x8 | 6304 / 6205 | 6304 | 17x30x8 | 281543 | BF52Z |
| C1 C2 C3 | 1.2.3 / 4.5.6.7 | HK1312 IR10x13x12.5 | 20x47x7 | 6204 | 6304 / 6205 | 6204 | 20x30x7 | 6304 / 6205 | 6304 | 20x30x7 | 281543 | BF52Z |
| D1 D2 D3 | All | 6302 | 30x62x10 | 6305 | 6206 | 6305 | 25x40x8 | 6206 | 6305 | 25x40x8 | 261257 | BF72Z |
| E1 E2 E3 | All | 32007x | 32x62x10 | 32007x | 6307 | 6307 | 35x52x10 | 6307 | 6307 | 35x52x10 | 261258 | BF91Z |
| F1 F2 F3 | 0.1.2.3 / 4.5 / 6.7 | 30307 / 30208 | 32x80x10 | 30307 / 30208 | 6309 | 6309 | 45x62x8 | 6309 | 6309 | 45x62x8 | 261729 | BF121Z |

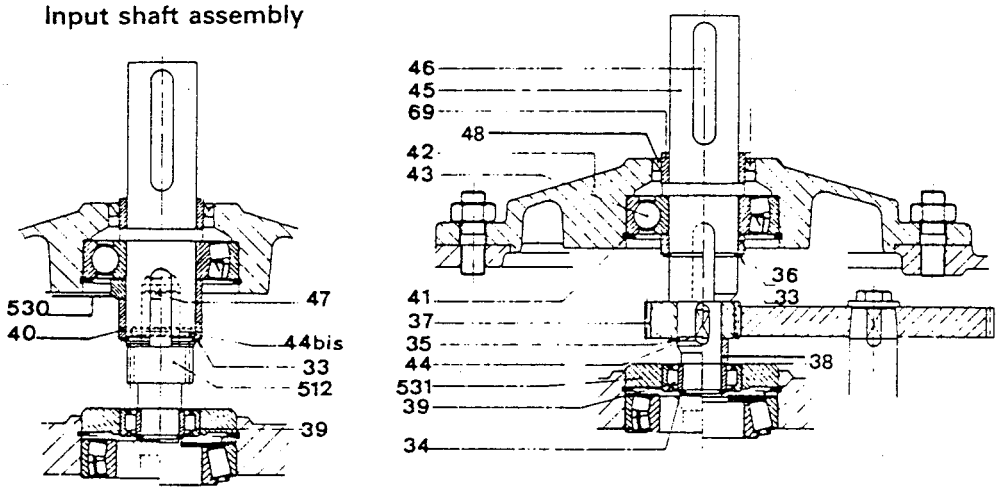
Never put extreme pressure oil with backstop

**Note:** some details in mounting can vary depending on types and ratios

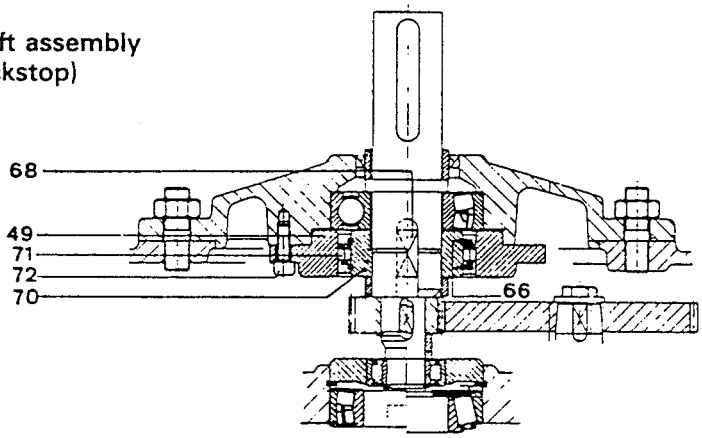
# ECONOGEAR®

## Nomenclature R2-R3-G2-G3-H2-H3

Input shaft assembly




Input shaft assembly (with Backstop)




| Ref. No. | Qty. | Item |
|---|---|---|
| 33 | 1 | Snap ring (R.G.) |
| 34 | 1 | Snap ring |
| 35 | 1 | Snap ring (R3-G3-H3) |
| 36 | 1 | Spacer |
| 37 | 1 | Pinion |
| 512 | 1 | Shank pinion |
| 38 | 1 | Spacer |
| 39 | 1 | Bearing |
| 40 | 1 | Spacer |
| 41 | 1 | Snap ring |
| 42 | 1 | Housing |
| 43 | 1 | Bearing |
| 44 | 1 | Pinion key |
| 44bis | 1 | Pin (shank pinion) |
| 45 | 1 | Shaft |
| 46 | 1 | Key |
| 47 | 1 | Key |
| 48 | 1 | Oil seal |
| 69 | 1 | Ring |
| 530 | 1 | Oil deflector |
| 531 | 1 | Bearing cap |
| BACK STOP KIT | | |
| 49 | 1 | Cap 0748297101 |
| 66 | 2 | Snap ring |
| 68 | 1 | Key |
| 70 | 1 | Ring 0748297001 |
| 71 | 1 | Free wheel |
| 72 | 6 | Fixing screws |

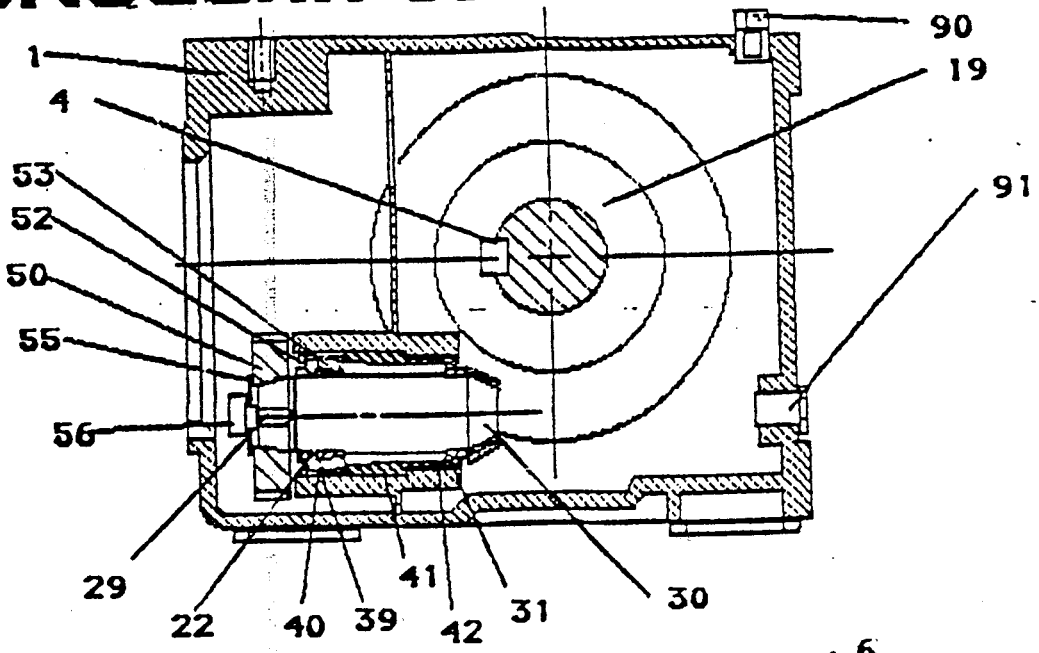
**Principal maintenance parts** ☐

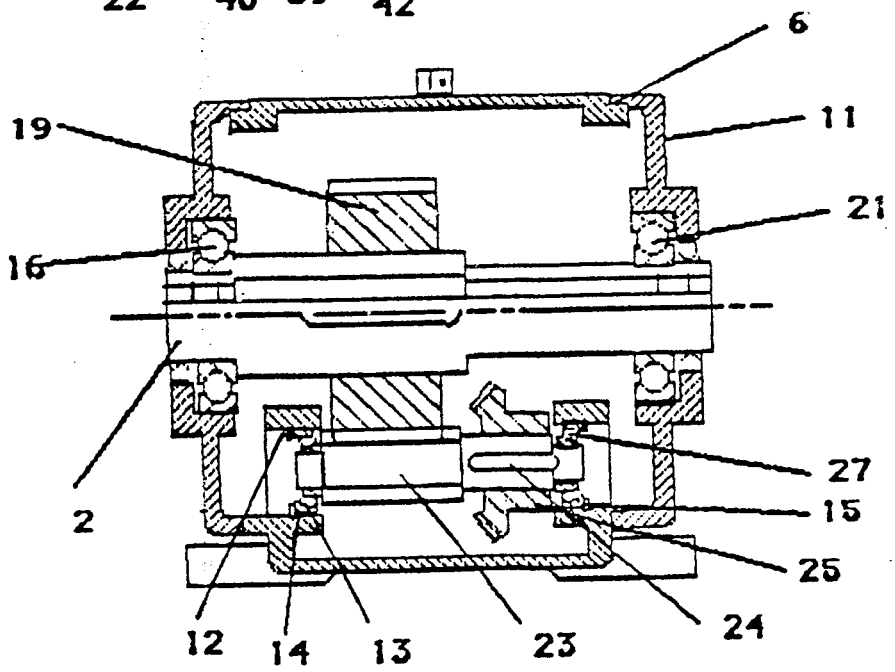
| Ref. No. / Type | Input shaft assembly | | | Input shaft assembly with back stop | | | |
|---|---|---|---|---|---|---|---|
| | 39 | 43* | 48 | 39 | 43* | 48 | 71 |
| R2/G2 | NU 2206 E | $6309/_{21309}$ | 55 x 68 x 8 | NU 2206 | $6309/_{21309}$ | 55 x 68 x 8 | U 74 7580 243 (BW 13 243) |
| R3/G3 | NU 2205 E | $6309/_{21309}$ | 55 x 68 x 8 | NU 2205 E | $6309/_{21309}$ | 55 x 68 x 8 | U 74 7580 243 (BW 13 243) |
| H2 | NU 2207 E | $6311/_{21311}$ | 60 x 80 x 8 | NU 2207 E | $6311/_{21311}$ | 60 x 80 x 8 | U 74 7580 243 (BW 13 243) |
| H3 | NU 2206 E | $6311/_{21311}$ | 60 x 80 x 8 | NU 2206 E | $6311/_{21311}$ | 60 x 80 x 8 | U74 7580 243 (BW 13 243) |

*depending on load on input shaft


LEROY-SOMER, INC.
560 S. HICKS RD.
PALATINE, IL 60067
PH. 312/359-2440
TLX 210231

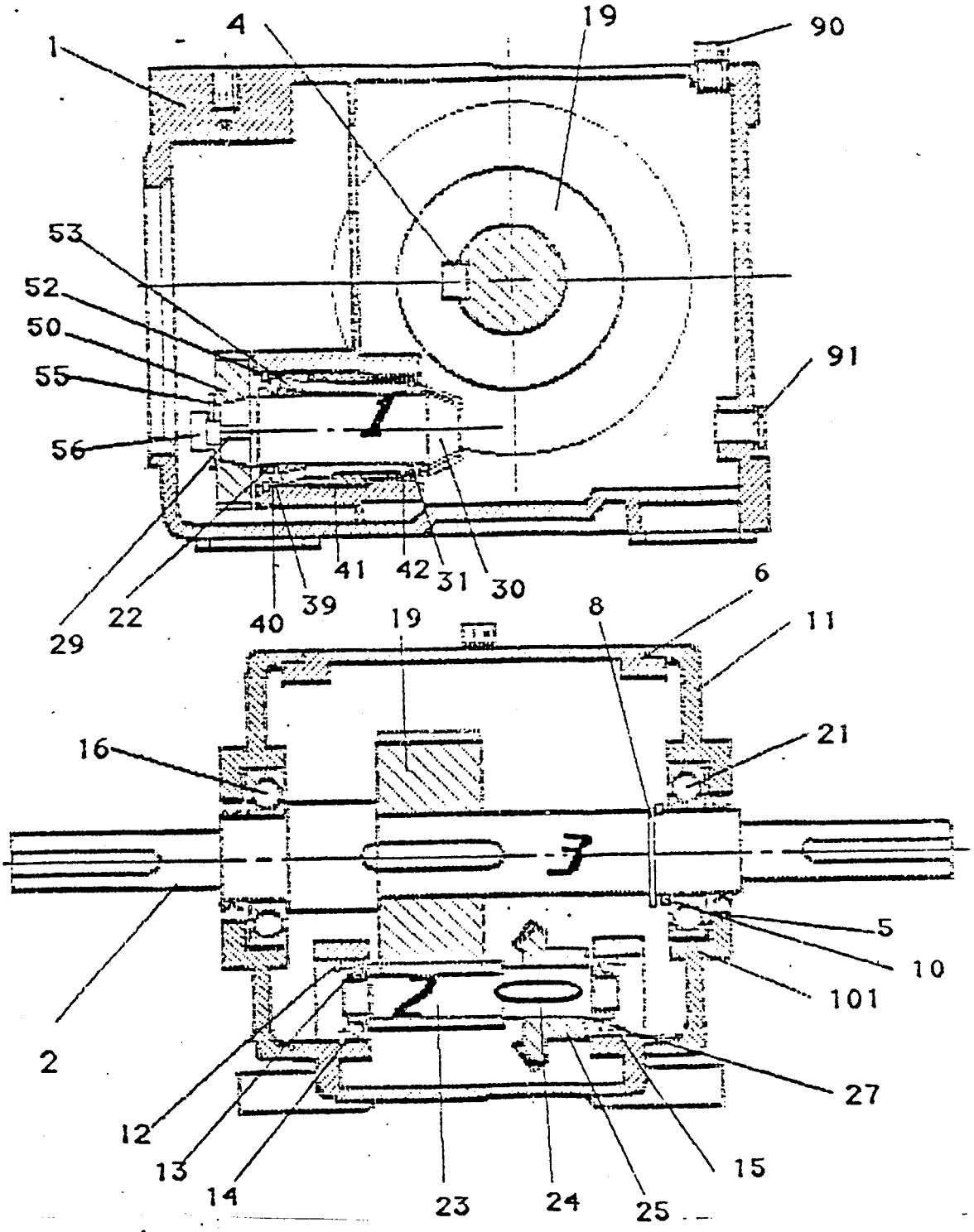
# ECONOGEAR 90 HOLLOW SHAFT




| REF. | QTY. | DESCRIPTION | REF. | QTY. | DESCRIPTION | REF. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | HOUSING | 15 | | GAUGES | 40 | | GUAGES |
| 101 | 2 | FLANGE | 16 | 1 | BEARING AXIS 1 | 41 | 1 | SLEEVES |
| 2 | 1 | OUTPUT SHAFT | 19 | 1 | OUTPUT GEAR | 42 | | GUAGES |
| 4 | 1 | OUTPUT KEY | 21 | 1 | BEARING | 50 | 1 | GEAR AXIS 1 |
| 5 | 2 | OUTPUT SEALS | 22 | 1 | SKF NUT & WASHER | 52 | 1 | SNAP RING AXIS 1 |
| 6 | 2 | "O" RINGS | 23 | 1 | PINION AXIS 2 | 53 | 1 | BEARING AXIS 1 |
| 9 | 1 | SNAP RING AXIS 1 | 24 | 1 | KEY AXIS 2 | 55 | 1 | WASHER |
| | 1 | SPACER | 25 | 1 | SPIRAL GEAR AXIS 2 | 56 | 1 | BOLT AXIS 1 |
| 11 | 12 | BOLTS | 27 | 1 | BEARING AXIS 2 | 90 | 1 | BREATHER |
| 12 | 2 | SNAP RING AXIS 2 | 29 | 1 | KEY AXIS 1 | 91 | 5 | PLUG |
| 13 | 1 | BEARING AXIS 2 | 30 | 1 | SPIRAL PINION AXIS 1 | | | |
| 14 | 2 | SPACER | 31 | 1 | BEARING AXIS 1 | | | |
| | | | 39 | 1 | SPACER | | | |

# Econogear 90 Parts List




Leroy-Somer, Inc.

560 South Hicks Road • Palatine, IL 60067

312/359-2440 • Telex 210 231

ECONOGEAR 90

SPARE PARTS PRICE LIST

WITH RECOMMENDED SPARE PARTS

| REFERENCE | QTY | DESCRIPTION |
|---|---|---|
| 1 | 1 | Housing |
| 101 | 2 | Flange |
| 2 | 1 | Output Shaft |
| 4 | 1 | Output key |
| 5 | 2 | Output seals |
| 6 | 2 | "O" ring |
| 8 | 1 | Snap ring gear axis 3 |
| 10 | 1 | Spacer |
| 11 | 12 | Bolts |
| 13 | 1 | Bearing axis 2 |
| 14 | 2 | Spacer |
| 15 | | Gauges |
| 16 | 1 | Bearing axis 3 |
| 19 | 1 | Output gear |
| 21 | 1 | Bearing axis 3 |

| REFERENCE | QTY | DESCRIPTION |
|---|---|---|
| 22 | 1 | SKF nut & washer |
| 23 | 1 | Pinion axis 2 |
| 24 | 1 | Key axis 2 |
| 25 | 1 | Spiral gear axis 2 |
| 27 | 1 | Bearing axis 2 |
| 29 | 1 | Key axis 1 |
| 30 | 1 | Spiral pinion axis 1 |
| 31 | 1 | Bearing axis 1 |
| 39 | 1 | Spacer |
| 40 | | Gauges |
| 41 | 1 | Sleeve |
| 42 | | Gauges |
| 50 | 1 | Gear axis 1 |
| 52 | 1 | Snap ring axis 1 |
| 53 | 1 | Bearing axis 1 |
| 55 | 1 | Washer |
| 56 | 1 | Bolt axis 1 |
| 90 | 1 | Breather |
| 91 | 5 | Plug |

Leroy-Somer, Inc.

560 South Hicks Road • Palatine, IL 60067

312/359-2440 • Telex 210 231



ECONOGEAR 90

SPARE PARTS PRICE LIST

WITH RECOMMENDED SPARE PARTS

# Ball Bearing Units

## MOUNTING AND LUBRICATION INSTRUCTIONS

Hub City Bearing Unit performance is dependent on proper installation and lubrication where required. Failure to follow instructions may result in poor performance and short bearing life.

### MOUNTING INSTRUCTIONS

1. For best results use turned and ground shafting, free of rough spots and burrs. If old shafting is used, locate bearing on a smooth unworn section.
2. Clean shaft and bearing bore. Coat shaft with a small amount of oil.
3. Check bearing for freedom of alignment, before mounting bearing unit on shaft.

### A — Eccentric Collar Bearings

4a. Slide bearing unit and collar on the shaft. (If projecting side of bearing is to be mounted toward the machine, put the locking collar on first). Collar should be opposing thrust load. DO NOT HAMMER THE ENDS OF THE INNER RACE. If it is necessary to apply force in mounting, use a soft metal bar or pipe against the inner race only. Tap the bearing unit into place.

5a. Fit the eccentric locking collar on the projecting inner race. TURN IT IN THE DIRECTION OF SHAFT ROTATION. Tighten the collar securely, using a spanner or setscrew wrench. Tighten the setscrew against shaft.

### B — Setscrew Lock Bearings

4b. Slide the bearing unit on the shaft. DO NOT HAMMER THE ENDS OF THE INNER RACE. If it is necessary to apply some force in mounting, use a soft metal bar or pipe against the inner race only. Tap the bearing unit into place. Tighten the two setscrews securely to lock bearing to shaft.

### LUBRICATION INSTRUCTIONS

All Hub City bearing units are factory lubricated and ready for use (except for unusually severe applications). Lubricated-For-Life bearings have no grease fitting and require no additional lubrication while in use. Re-lube bearing housings have a lubrication fitting mounted on the housing and should be lubricated when used in wet or dirty applications. For normal operation there is no need to relubricate bearings at all. The following table is a general guide for relubrication. Experience will determine the best interval for each specific application.

### LUBRICATION GUIDE

| Operating Conditions | Bearing Temperatures | Grease Interval | Recommended Grease or Equivalent |
|---|---|---|---|
| Clean | 32° F to 120° F<br>120° F to 150° F<br>150° F to 200° F | 6 to 12 months<br>1 to 3 months<br>1 to 4 weeks | Shell Alvania #2<br>Texaco Multifak #2 |
| Dirty | 32° F to 150° F<br>150° F to 200° F | 1 to 4 weeks<br>Daily — 1 Week | Sun Prestige #41<br>Humble L 100K #2 |
| Moisture | 32° F to 200° F | Daily — 1 Week | Sinclair Litholine Multi-Purpose |

When lubricating bearings add grease slowly while shaft is rotating. When grease begins to come out the seals, the bearing will contain the correct amount of lubricant.

Bearings should not run in steady operation over 200° F and should not exceed 225° F for intermittent operation.

For unusual or severe applications, contact Hub City Customer Service Department.

### REPLACEMENT OF ADAPTOR BEARINGS IN BEARING UNITS

All Hub City bearing units are fitted with self-aligning adaptor bearings which can be replaced in case of wear or damage to the original adaptor bearing. To replace bearing:

1. Loosen setscrew in locking collar or bearing.
2. Loosen locking collar, if any, from shaft by turning in direction opposite to shaft rotation.
3. Remove unit from shaft.
4. Remove collar, if any, from inner race of bearing unit.
5. Rotate bearing 90° in the housing.
6. Withdraw along the slots in the sides of the housing.
7. Inspect housing for wear or damage and replace if necessary.
8. Clean inside of housing with solvent and dry with lint-free cloth or paper towel.
9. Insert bearing in the slots.
10. Rotate bearing 90° in the housing to operating position. If the fit between the housing and bearing is loose, the housing should be replaced.
11. Replace collar, if any.
12. Remount unit on shaft following the procedure outline above.

2914 Industrial Dr., P. O. Box 1089, Aberdeen, SD 57402-1089, U.S.A.
Phone (605) 225-0360 • Telex 29-2236 • FAX 605-225-0567

BALDOR

# DC MOTOR
## INSTALLATION - MAINTENANCE INSTRUCTIONS

The safety of personnel depends upon following these instructions.

### RECEIVING:

Inspect machine before accepting shipment for any damage in transit. Shaft should turn freely with only brush and bearing friction. Any damage from transit should be reported to the carrier immediately.

### INSTALLATION

Qualified or trained personnel should install the machine. Electrical rotating equipment can result in property damage, serious injury, or death, when improperly installed. Equipment should be installed in accordance with the National Electrical Code, local codes and with NEMA MG2, Safety Standards for Construction and Guide for Selection, Installation and Use of Electrical Motors and Generators.

**WARNING: Observe the following for safety:**

1. When eyebolts are provided, they are intended only for lifting the motor and its included motor accessories. Eyebolt must be fully tightened.
2. The machine must be grounded in accordance with the National Electrical Code and any local code.
3. Permanently guard machine against accidental contact of body parts or clothing with moving parts.
4. Shaft key must be secured before starting motor.
5. The machine should match the voltage and the load (HP and RPM) for the application.
6. Applications for motor-mounted brake should have proper safeguards provided for personnel in case of possible brake failure.
7. Remove all power services and allow machine to reach standstill prior to servicing.
8. Do not by-pass or render inoperative safeguard or protective devices.

### MOTOR ENCLOSURE

Open drip proof motors are intended for use in clean, dry locations with access to an adequate supply of cooling air. In addition, there should be protection from or avoidance of flammable or combustible materials in the area of open-type motors as they can eject flame and / or molten metal in the event of an insulation failure. Totally enclosed motors are intended for use where moisture, dirt, and / or certain corrosive materials are present in indoor or outdoor locations. Explosion-proof motors, as indicated by the Underwriters Laboratories, Inc. label, are required for hazardous locations in accordance with the National Electrical Code.

### MOUNTING

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be required if foundation is uneven.

Flange mounted machines should be properly seated and aligned. NOTE: If improper direction of rotation is detrimental to the load, check rotation prior to connecting the motor to the load.

For V-belt drive, mount the sheave (pulley) close to the motor housing, however, allow clearance for end to end movement of shaft. Do not overtighten belts as this may cause premature bearing failure and / or shaft breakage.

Direct coupled machines should be carefully aligned and shaft should turn freely without any binding.

### WIRING

If the motor is part of an SCR drive system, refer to the control manufacturer's diagrams and installation data. If the motor is shunt wound and not part of an SCR control system, a proper resistance starter should be used. For protection, use a fuse or circuit breaker rated at 125% of full load amperage on the nameplate. If the motor is a series or compound wound motor, refer to the connection data tag attached to the motor. If the motor is a component part of a piece of equipment, be sure to refer to the Original Equipment Manufacturer's electrical circuit information for proper connection.

The wiring, fusing, and grounding must be in accordance with the National Electrical Code and any local codes.

When the machine is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If this is not the case, immediately shut motor off, investigate the cause. The cause could be; low-voltage, the motor is misconnected, or the load is too great, etc.

It is recommended that the motor current be checked after it has been operating a short time and compared against nameplate current.

### BRUSHES

Periodically, the brushes should be inspected and the brush dust blown out of the motor. If the length has been worn down 1/2" from the original length shown in renewal parts data, the brushes should be replaced. If at this time the commutator is worn or rough, the armature should be removed. The commutator should be turned in a lathe, the mica recut, and commutator polished. Reassemble, and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

### LUBRICATION

This is a double sealed ball bearing motor. The bearings have been given lubrication at the factory. No lubricant need be added.

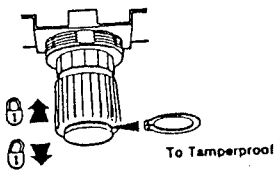
### LUBRICANT

Baldor motors are pre-greased normally with Shell Oil Company's "Dolium R". Several equivalent greases which are compatible with the Baldor furnished grease are Chevron Oil's "SRI No. 2" and Texaco Inc. "Premium RB".

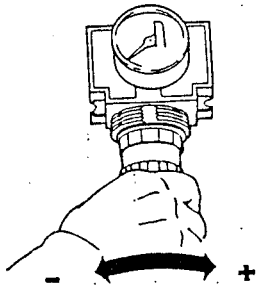
Additional copies may be obtained at no charge by writing:
BALDOR ELECTRIC COMPANY • P. O. BOX 2400 • FORT SMITH, ARKANSAS 72902

LB5015-

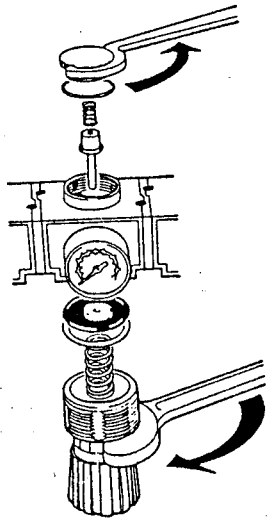
## ADJUSTMENT LOCK



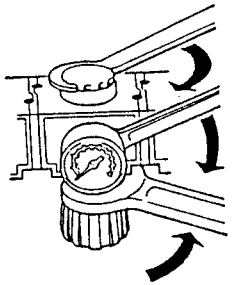

## PRESSURE ADJUSTMENT




## DISASSEMBLY

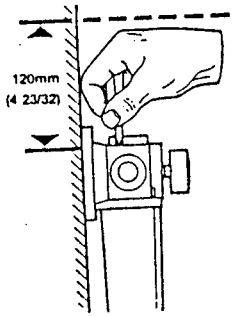


## REASSEMBLY



Torque Bonnet to 40-45 FT/LBS

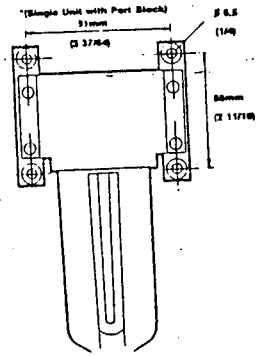
## MOUNTING DIMENSIONS




* NOTE: For each additional unit mounting, hole centers increase by 86mm (3 3/8).

For 2 units, hole cts. are 177mm ( 6 31/32).

For 3 units, hole cts. are 263mm (10 11/32).



Schrader Bellows Division

Scovill

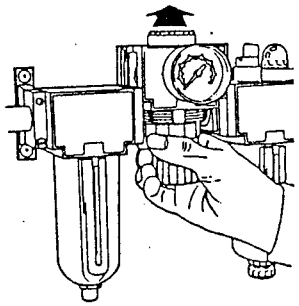
# schrader bellows

Scovill

# PREP-AIR MODULAR

**Regulator Part Nos.**

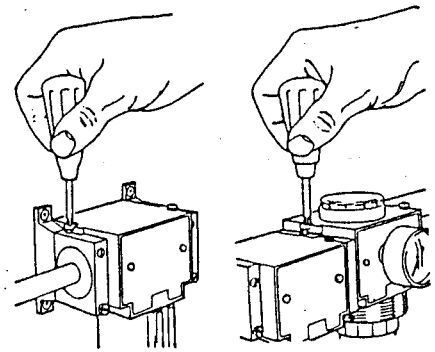
| | NON-RELEIVING | | RELEIVING | |
|---|---|---|---|---|
| | WITHOUT GAUGE | WITH GAUGE | WITHOUT GAUGE | WITH GAUGE |
| Less Port Connectors | 4569-2010 | 4569-2210 | 4569-2000 | 4569-2200 |
| 1/4" NPTF + Port Connectors<br>3/8" NPTF + Port Connectors<br>1/2" NPTF + Port Connectors<br>3/4" NPTF + Port Connectors | 4562-2010<br>4563-2010<br>4564-2010<br>4566-2010 | 4562-2210<br>4563-2210<br>4564-2210<br>4566-2210 | 4562-2000<br>4563-2000<br>4564-2000<br>4566-2000 | 4562-2200<br>4563-2200<br>4564-2200<br>4566-2200 |
| ANSI Symbol |  |  |  |  |



**IMPORTANT**

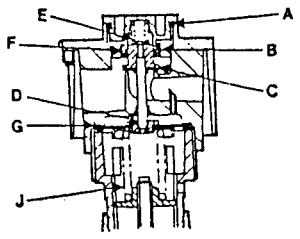
Grease 'O' ring in port connector and body connector grooves prior to assembly.

All units are fitted or removed from each other and from port blocks by releasing fastening screws and sliding upwards.



| Port Connector Kit | Wall Mounting Kit |
|---|---|
| 1/4" NPTF = 9452-4000<br>3/8" NPTF = 9453-4000<br>1/2" NPTF = 9454-4000<br>3/4" NPTF = 9456-4000 | 9450-1000 |
| Comprises:<br>2 Port Connectors + Seals | Comprises:<br>2 Brackets + Unit Fixing Screws |

| J Spring 5-60 psig | J Spring 5-125 psig | J Spring 5-250 psig |
|---|---|---|
| 4569-7035 | 4569-7036 | 4569-7037 |

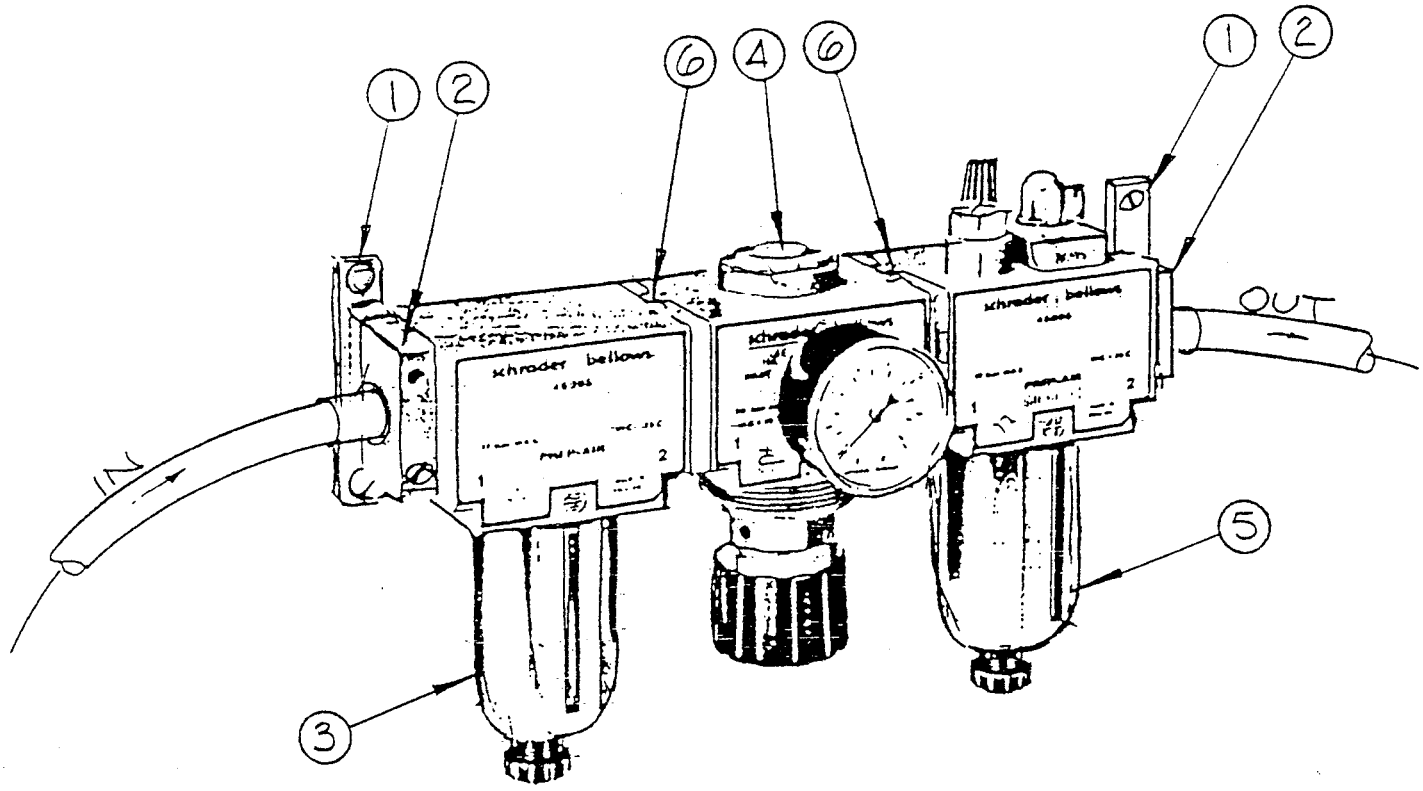



| A O-Ring | B O-Ring | C Valve Assy. | D * O-Ring | E Spring | F O-Ring Retainer | G Diaphragm Assy. | H Connector O-Rings (Not Shown) |
|---|---|---|---|---|---|---|---|
| Service Kit 4569-8000 (Relieving) and 4569-8001 (Non-Relieving) | | | | | | | |

* Not contained in Service Kit 4569-8001 (Non-Relieving)

**TECHNICAL INFORMATION:**

| | |
|---|---|
| Inlet Pressure: | 30 psig, 200 kPa |
| Temperature: | 15°F to 165°F<br>-10°C + 75°C Max. |
| Outlet Pressure Ranges: | |




## for MECHANICAL LOCK ONLY!

| ITEM | QTY. | PART NO. | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 9450-1000 | WALL MTG. KIT |
| 2 | 2 | 9452-4000 | 1/4 NPT PORT KIT |
| 3 | 1 | 4539-2000 | FILTER |
| 4 | 1 | 4569-2200 | REGULATOR |
| 5 | 1 | 4589-2000 | LUBRICATOR |
| 6 | — | OPTIONAL | BODY CONNECTOR |
| | 2 | 9450-5000 | W/O PORT |
| | — | 9450-6000 | W/ PORT |
| | | | |
| | | | |
| | | | |

ADCO MANUFACTURING, INC.

DK

8-23-89

SCHRADER BELLOWS

A15AT616