GT®

RAB
RECIRCULATING
AUTOMATIC BATCH
GRAIN DRYER
OPERATOR'S MANUAL
& PARTS BOOK

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Printed in U.S.A.

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GT Mfg., Inc.

MANUFACTURERS OF FARM AND INDUSTRIAL EQUIPMENT

RAB
OPERATORS MANUAL & PARTS CATALOG

Your GT Grain Dryer is one of the finest grain dryers ever built; designed to give you excellent service for many years. The information and suggestions found in this owners manual will help you achieve this.

Your GT Grain Dryer dealer is well trained and equipped to give you complete service when and if the need should arise.

We would also like to take this opportunity to thank you for choosing GT and assure you of our continuing interest in your complete satisfaction.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

SAFETY

⚠ DO NOT OPERATE OR ALLOW ANYONE TO OPERATE THIS EQUIPMENT WHO HAS NOT BEEN PROPERLY TRAINED IN ITS SAFE OPERATION.

Throughout your operator's manual and at various locations on your machine you will see the Safety-Alert synbol shown below. This emblem has been adopted by the agricultural equipment industry to provide a universal symbol which means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

This symbol is our way of telling you to pay special attention to the instructions or warnings which follow because your safety is involved.
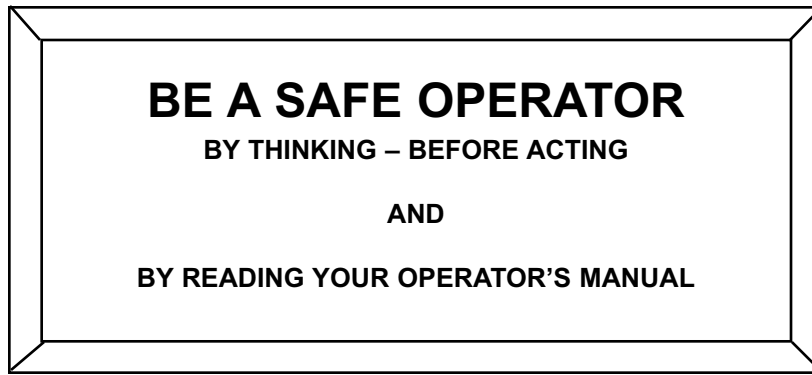

SAFETY-ALERT SYMBOL
FOR AGRICULTURAL EQUIPMENT

The following labels found on your machine provide important safety messages and instruction for safe operation.

⚠ As these labels become worn, damaged, or illegible replace them immediately. These labels are available at your authorized dealer.

```
┌─────────────────────────────────────────┐
│                                         │
│        BE A SAFE OPERATOR               │
│      BY THINKING – BEFORE ACTING        │
│                                         │
│                  AND                    │
│                                         │
│     BY READING YOUR OPERATOR'S MANUAL   │
│                                         │
└─────────────────────────────────────────┘
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AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home, or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.

THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. THAT RULE IS:

STOP MACHINE TO ADJUST, LUBRICATE, SERVICE, CLEAN OR MOVE.

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┌─────────────────────────────────────────┐
│                                         │
│      ⚠ CAUTION                          │
│                                         │
│   1.  Read and understand the Operator's │
│       Manual before operating the unit.  │
│   2.  Keep children, visitors and all untrained person- │
│       nel away from the machine while in operation. │
│   3.  Keep all shields and safety devices in place. │
│   4.  Stop machine to adjust, lubricate, service, clean │
│       or move. │
│   5.  Keep hands, feet and clothing away from moving │
│       parts. │
│   6.  Disconnect electrical power before servicing. │
│   7.  Keep unit level when operating. │
│   8.  Maintain proper tire pressure when transporting │
│       machine. (Refer to Manufacturer's Recommen- │
│       dations.) │
│                                         │
└─────────────────────────────────────────┘
```

⚠ DANGER

For maximum safety and smoothest operation keep p.t.o. shaft in closed position while under load. Keep u-joint angles equal. Do not remove safety shields. Do not exceed 540 r.p.m.

64 MAX.

$16\frac{9}{16}$ MAX.

15° MAX.

15° MAX.
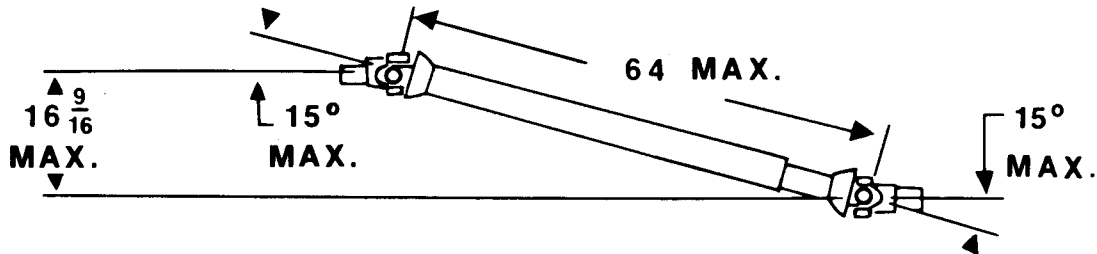
FAILURE TO HEED WILL CAUSE P TO SHAFT FAILURE OR SEPARATION & RESULT IN SERIOUS INJURY OR DEATH.

⚠ DANGER

ROTATING DRIVELINE
CONTACT CAN CAUSE DEATH
KEEP AWAY!

DO NOT OPERATE WITHOUT —
- ALL DRIVELINE, TRACTOR AND EQUIPMENT SHIELDS IN PLACE
- DRIVELINES SECURELY ATTACHED AT BOTH ENDS
- DRIVELINE SHIELDS THAT TURN FREELY ON DRIVELINE

L1   279561

5

⚠ DANGER
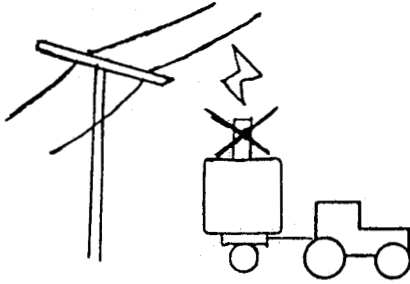
ELECTROCUTION HAZARD

To prevent serious injury or death from electrocution:

- Remove unloading head when transporting.
- Stay away from overhead power lines when transporting.
- This machine is not grounded.
- Electrocution can occur without direct contact.

⚠ DANGER
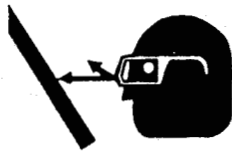
CONNECT TO LIQUID PROPANE ONLY.

Wear Rubber Gloves and Eye Protection.

Avoid Contact with Propane.

FLAMMABLE **Check for Leaks with Soap and Water.** **NEVER USE FLAME.**

⚠ DANGER

KEEP HANDS AND FEET AWAY

SW803

6

⚠ DANGER

DO NOT ENTER DOOR WHEN MACHINE IS RUNNING

TORQUE WHEEL BOLTS TO 70 LB. – FT.

(94.85 N – M). CHECK TORQUE

BEFORE TOWING AND PERIODICALLY

UNTIL TORQUE IS HELD.

74535

⚠ DANGER

FRAME PINCH POINT HAZARD
KEEP AWAY

TO PREVENT DEATH OR SERIOUS INJURY:

DO NOT OPERATE MACHINE WITHOUT GUARD IN PLACE.
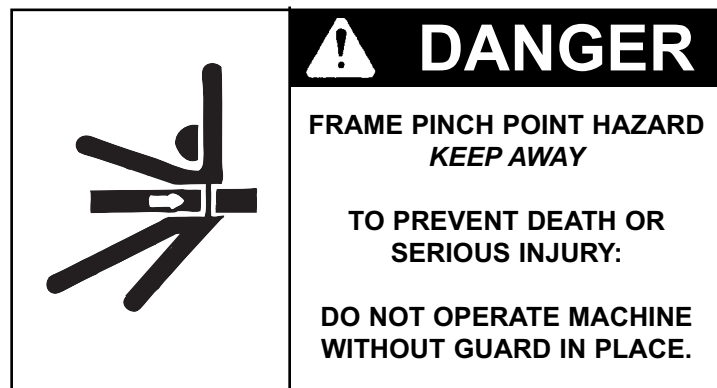
FOR YOUR SAFETY. . . . .

1. Keep all guards and shield in place.

2. Inspect your drive before adding power and know how to shut down in an emergency.

3. Stop all moving parts before allowing anyone to approach the equipment for cleaning, unplugging, adjusting, performing maintenance or any other duty.

4. Replace all safety shields/guards before restarting.

5. Replace all safety shields/guards as they become worn, damaged, unusable, missing or lost.

GENERAL INFORMATION

Mechanical drying of grain is a relatively new process; therefore, emphasis must be placed on proper operation of grain drying equipment. Your GTY Dryer was designed and engineered to retain grain quality, and to dry grain as rapidly as possible at the lowest cost consistent with retention of quality grain. study and follow this manual so you too may enjoy the additional profis derived from drying.

THEORY OF DRYING

The theory of drying has two basic stages: (1) diffusing of internal moisture to the surface of the kernel, and (2) removal of external moisture by air flowing around the kernel. Vapor pressure is increased inside the kernel which causes moisture to diffuse through the micropores of the seed coat. The grain temperature largely establishes this rate of diffusion and hence must be controlled to not exceed a maximum rate which would result in a ruptured kernel.

Removal of the exterior moisture for a given air flow is dependent upon the air temperature. these two stages must be balanced to produce quality dried grain.

This balance is accomplised quite simply in the GT Grain Dryer with its uniform circulation, regulated heat, and controlled air flow.

RATE OF DRYING

In addition to the kind and variety of grain, the drying rate is controlled by atmospheric conditions. Hard and fast rules cannot be set forth because of these variables. It will be necessary to dry several batches to determine the exact dryer settings in a specific area. A chart for recording necessary information for later use is included in the back of this manual.

WHEN GRAIN IS MATURE

Most grain is mature at 30% to 35% moisture. While some grain may be harvested easily at 30%, others do not harvest well above 20%. Therefore, grain should be harvested as soon as possible after maturity, as long as grain damage is at a minimum and gleaning thorough.

STORAGE MOISTURE LEVELS

To properly store grain, the grain moisture content must be compatible with the length of time the grain will be in storage, and with the grain's intended use. This moisture content will vary due to locale.

GRAIN	1 YEAR STORAGE (% Moisture)
Corn	13%
Wheat	13-14%
Barley	13%
Rice	12%
Oats	13%
Rape Seed	10.5%
Grain Sorghum	12%
Flax	9%
Soybeans	11%
Edible Beans	14-16%
Sunflower Seed (Oil Type)	10%
Sunflower Seed (Bird Seed Type)	12%

Corn may be stored at 15% moisture if moved before warm spring weather. For long time storage – up to 5 years, or for grain stored as seed stock, moisture level should be 2% lower than shown above.

MOISTURE TESTING

Since grain must go into storage at not more than specified moisture content, it is necessary to use a reliable tester to determine moisture content. When marketing grain from the dryer, it should be only dry enough to eliminate moisture discounts. The moisture tester may also be profitably used to determine when to harvest.

COOLING OF GRAIN

It is very important to cool grain. Grain being put in storage should be cooled after drying to within 20 degrees F of atmospheric temperature or, 10 degrees F of grain already in the storage bin. Moisture migration from the air to grain will occur if the grain is not colled to these limits.

GRAIN SHRINK

Grain "shrink" is the weight loss which occurs when grain is dried. The dry matter of grain does not change, consequently when a percentage of water is removed the "shrink" percentage is greater than the percentage of water removed. For example, if you dried a bushel of corn from 27% down to 15%, the corn loses 14.2% of its weight and the moisture content was dropped 12% (27% –15%). To find this weight loss from the chart below, follow the horizontal line (27% moisture at start) across until it intersects the 15% inclined line (moisture at completion of drying).

The final weight of any amount of grain can be figured from this formula:

Original Weight X $\dfrac{100 - \text{Moisture content of Wet Grain}}{100 - \text{Moisture content of Drying Grain}}$ = Final Weight

Example: 100 bushel of corn weighing 6200 pounds at 25% moisture content dried to 15%.

6200 pounds X $\dfrac{100 - 25\%}{100 - 15\%}$ = 5471 pounds

PERCENTAGE OF MOISTURE AT START

Inclined lines represent moisture at completion of drying

PERCENTAGE OF ORIGINAL QUANTITY
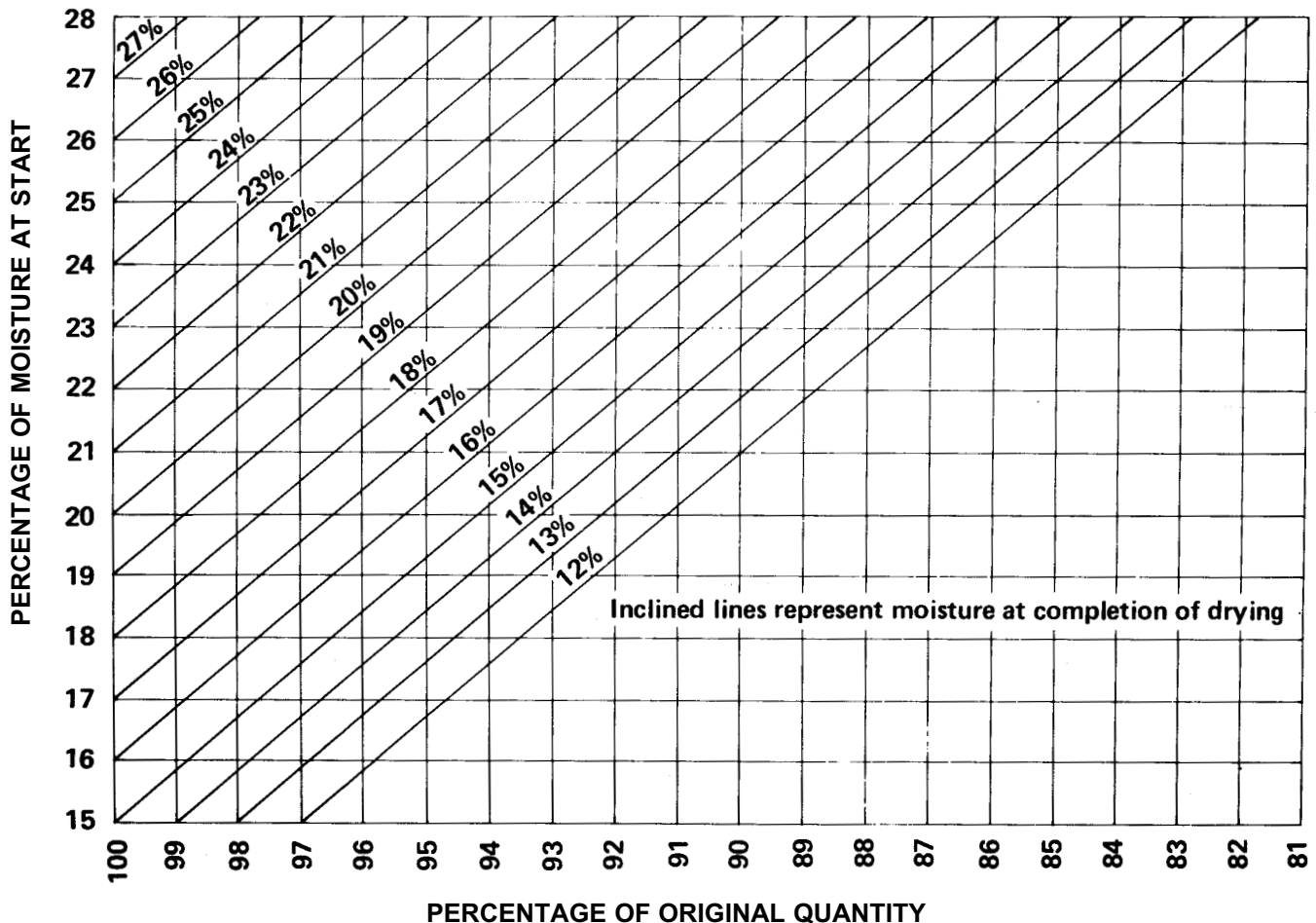
INSTALLATION AND SET-UP

1.   INSTALLATION OF EQUIPMENT

The equipment shall be installed in accordance with the installation code for gas burning appliances and equipment, CAN 1-B149 or applicable code or Provincial Regulation for the class. Installation shall also comply with National Electric Code, Canadian Electric Code, and all governing regulations regarding electrical equipment installation.

2.   PLACING MACHINE FOR OPERATION

Select a site as level as possible, 50 ft. (15 meters) from any inhabited building. Set machine, if possible, with fan into prevailing winds. Lower the supporting legs and insert pins. If machine is being set on a level concrete slab, no additional blocking will be necessary. However if being set on dirt, at least a 2" x 8" x 12" board or equivalent should be placed under each leg for additional flotation. Add any additional blocking material necessary to bring machine level. Use a level on the main frame to determine this.

3.   INSTALLING TOP SECTION OF AUGER AND ADJUST FOR UNLOADING

When installing the top section of auger, it may be necessary to jack the lower flight up to allow the bolt holes in the connecting shaft to align. The weight of the complete auger should be supported by the top auger bearing when in proper adjustment.

If the dryer is equipped with the standard horizontal head, removing the bolts through the mounting flanges which hold the upper and lower tubes together will allow the upper tube to be rotated to provide unloading at several points.

When using the horizontal unloading head, it is not advisable to leave grain set in the dryer for any length of time (such as overnight) without the vertical auger operating. If grain must be left in the dryer, it should be lowered to a level below the top of the unload auger head to prevent grain from running back down the vertical auger.

4.   LOCATING PROPANE GAS SUPPLY TANK

Location of the Propane Gas Supply Tank must be in accordance with local, state or provincial regulation. It should also be approved by the insurance company. A minimum distance of twenty-five (25 ft.) (7.5 meters) is recommended for safety and will allow room for maneuvering grain hauling equipment.

GT Propane Gas fired dryers are equipped with Vaporizers and must be connected to the supply tank for LIQUID withdrawal. It is recommended that rubber hose specifically made for Propane gas be used as a supply line connecting tank to dryer. Specifications for the line are: (1) minimum working pressure 350 psi, (2) minimum bursting strength 1,750 psi, and (3) 1/2" minimum inside diameter. Tank pressure is used at the dryer; therefore, it is not necessary to install a pressure regulator at the tank.

⚠ **DANGER**

All lines and fittings should be checked periodically for leaks before and during operation. Check for leaks with liquid detergent suds or comparable substance, but NEVER with flame. Failure to do so may result in serious injury or death.

⚠ **CAUTION**

Do not use storage tanks that have been used to store Anhydous Ammonia. This causes corrosion to the gas line controls.

Always protect gas supply line against vehicle or animal damage.

5.   NATURAL GAS

Specifications for Natural Gas connections are available from the gas supplier and must be adhered to. The RAB dryer will require up to 20 psi, depending on locality. Pressure shown is at the dryer. Maximum Natural Gas volume on the RAB is up to 50 cubic feet per minute.

6.   ELECTRICAL CONNECTIONS

Standard equipment for 3 phase operates on 240 volt electric power and requires 125 ampere service. All wiring suppling the electrical control panel shall be done in compliance with national,l and local wiring codes by a qualified electrician.

7.   MICROPROCESSOR INSTALLATION

1. Connect cable (6) to rear of the microprocessor box (1). A polarized screw connector locks the cable into place.

2. Mount the microprocessor box (1) to the right front power frame unit by threading the plastic adjusting knobs (3) through mounting brackets (2) and (13) and into the microprocessor box.

3. Adjust the microprocessor box to a convenient angle to reduce glare and improve readability. Tighten adjusting knobs.
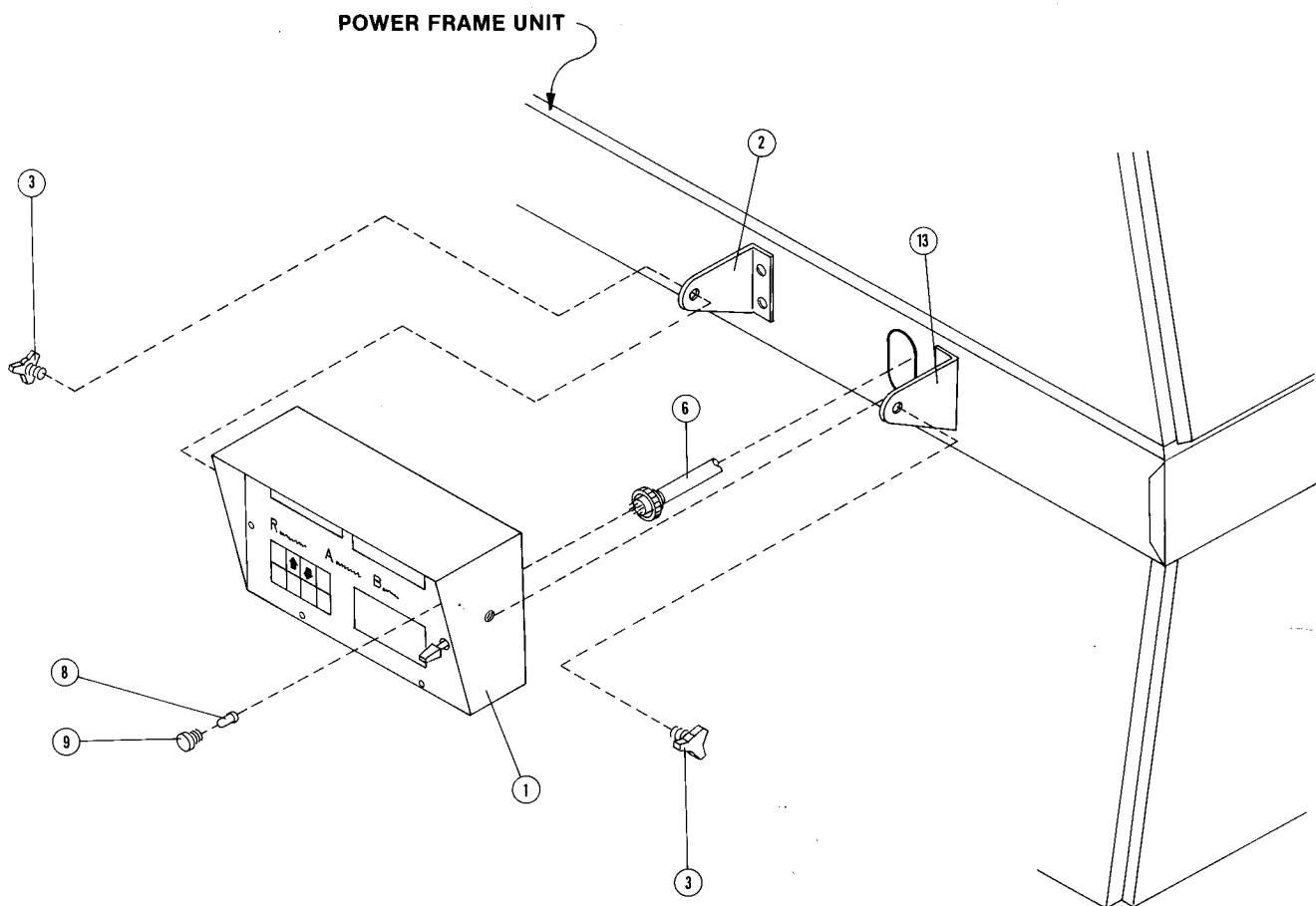
8.   LUBRICATION

        Use a high-low temperature grease or equivalent made especially for ball and roller bearings in extreme temperature.

        Refer to the following chart for location of lubrication points and frequency of lubrication. A small amount of grease at the specified intervals is recommended over a large amount at less frequent intervals.
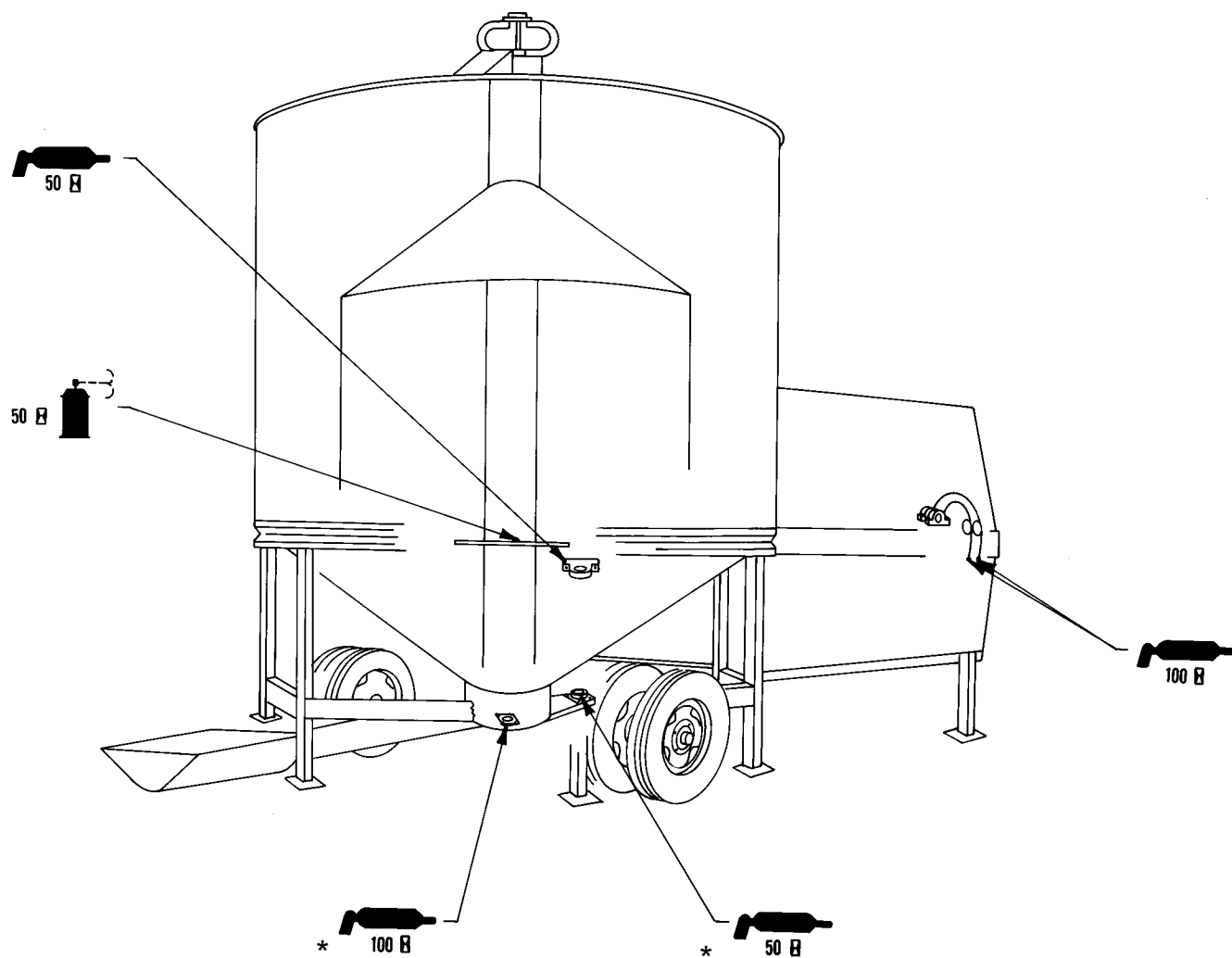
Symbol descriptions: * These points are located at centralized panel.

━◀█   Grease Point

× █   Lubrication Frequency (Hours of Operation)   Dry Film Spray Lubricant

When performing the 100 hour lubrication, check to see that the set screws in bearing and tumblers are tight.

IMPORTANT: In extremely cold weather, it may be necessary to operate the dryer empty for a short period of time to allow the grease in the bearings to warm up.

9.   SERVICING AND CARE OF AGITATOR

It is important that the agitator be inspected before and after the first load. Then after each 100 hours of operation.

A.   The tapered agitator rollers must support the plate sprocket so there is no horizontal movement of sprocket.

The RAB has four rollers mounted on the agitator sprocket so each roller supports an equal load. These rollers are tapered so all horizontal and vertical slack may be taken up.

B.   Adjusting Rollers

1. Secure the cam nut and loosen the bolt

2. Rotate the cam nut counter-clockwise (when looking down into the cam nut) while holding the bolt stationary.

3. Secure the cam nut and tighten the bolt.

4. All cam nuts must be rotated an equal amount so the agitator sprocket remains true.

5. Rotate agitator arms by hand and check clearance.

NOTE: Agitator drive chain is provided with a spring loaded idler, however, it is necessary to periodically check the slack.

⚠ **DANGER**

Do not open inspection door or enter machine while in operation. Failure to do so may result in serious injury or death.

10.   BELT TENSION

With machine running at normal speed, belts should be tight enough to keep out the slack. Keep belts tight to prolong life.

11.   VAPORIZER (Propane Only)

The vaporizer is designed for year round operation. The vapor plumbing under normal conditions should be operating at a temperature of approximately 120F to 140F. The temperature may be checked by placing your bare hand on the plumbing and will range from warm to hot.

Check propane tank for liquid withdrawal. Vapor withdrawal will cause overheating of the vaporizer and possible damage to the controls. If the vaporizer has been overheated, causing possible rupture, you will be unable to control the plenum temperature.

⚠ **WARNING**

The vaporizer pipe should be inspected every season for pitting and heat damage. Replace IMMEDIATELY if any damage is found.

12.   CHECK OUT — BEFORE LOADING

All piping and burners have been checked and test fired at the factory. It is possible, however, that some of the connections may have been loosened or damaged during shipment. After connecting supply tank to dryer all connections should be tested under pressure with gas pressure on. Tractor can then be started and dryer test run before loading with grain.

DANGER

Check with liquid soap solution, never with flame. Failure to do so may result in serious injury or death.

CONTROLS IDENTIFICATION

⚠️ Do not operate this machine until you have read and fully understand its safe operation.

1.   CONTROLS

This picture shows all components of the control system of the GT Dryer. All parts are numbered and identified by description. The following pages of the Operation, Maintenace and Service sections refer to the following information contained herein.

STUDY THIS INFORMATION. IT WILL GREATLY ASSIST YOU IN THE OPERATION OF YOUR DRYER.
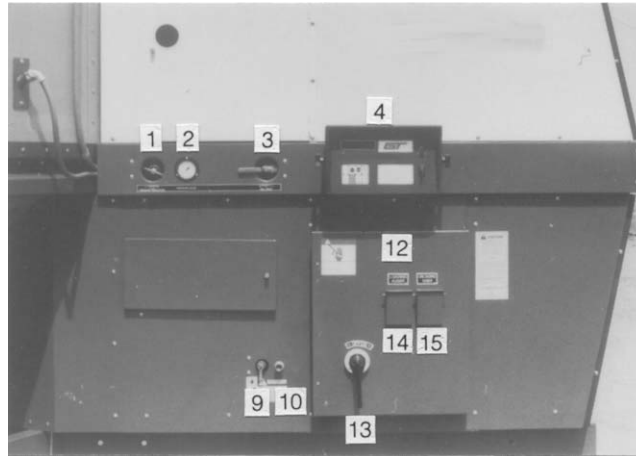
Dryer Controls
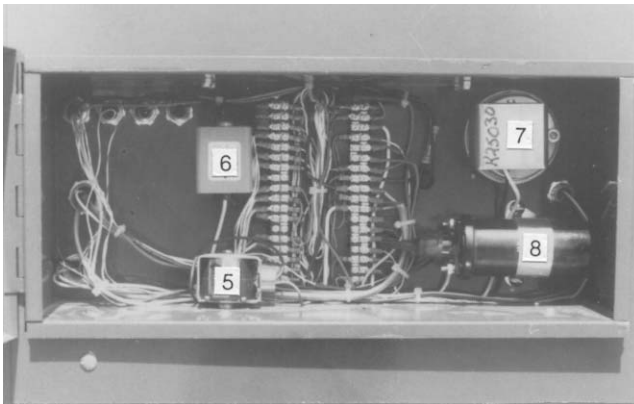
Junction Box
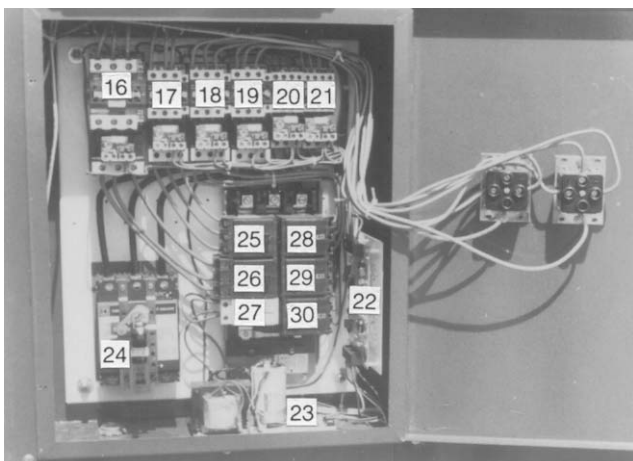
Electrical Control Box

1.   Pressure Regulator
2.   Pressure Gauge
3.   Ball Valve
4.   Microprocessor
5.   Solenoid Valve Coil
6.   Flame Detector
7.   Air Switch
8.   12V Ignition Coil
9.   Quick Acting Valve
10.   Propane Inlet
12.   Electric Control Box
13.   Main Power Disconnect
14.   Aux. Loading Outlet
15.   Aux. Unloading Outlet
16.   Contactor, Fan Motor
17.   Contactor, Vertical Auger
18.   Contactor, Aux. Loading
19.   Contactor, Aux. Unloading
20.   Contactor, Loading
21.   Contactor, Unloading
22.   AC-DC Relay
23.   DC Power Supply
24.   Circuit Breaker, Main
25.   Breaker, Auger
26.   Breaker, Fan Motor
27.   Breaker, DC Power
28.   Breaker, Aux.
29.   Breaker, Loading Mtr.
30.   Breaker, Unloading Mtr.

2.   PLENUM HIGH LIMIT CONTROL

The high limit control safeguards against excessive plenum temperatures. The maximum temperature is factory set and microprocessor controlled. An additional high limit thermostat is placed in the plenum and acts in conjunction with the microprocessor. During the initial start-up of the dryer the microprocessor checks the high limit thermostat to make certain the plenum temperature falls within the operating range. If so, operation continues and the dryer begins the cycle. Should the thermostat open at any time during operation, power to the controller will be interrupted, halting operation of the entire unit.

3.   LOADING THE BIN

⚠ **DANGER**

The loading auger operates automatically and may start without notice. Make certain that the auger is free of debris and that everyone stays clear of the intake. Failure to do so may result in serious injury or death.

The standard loading hopper may be used in conjunction with bin unloading equipment or it may be extended to reach under a hopper bottom bin. An auxiliary outlet is also provided which becomes energized as the dryer begins to load. This outlet can be used to operate an auxiliary electric auger, such as a bin unloader or transport auger, to fill the dryer. The grain can also be loaded directly into the top of the dryer.

When the loading hopper attachment is used for filling the dryer, follow these steps to prevent the grain from being fed into the dryer faster than the vertical auger can recirculate it. When this happens the grai.n can build up in the bottom of the dryer until it gets into the agitator assembly and causes damage to the agitator.

A.   Make sure that the vertical auger drive belt is kept tight and is not slipping.

B.   Make sure the discharge holes at the top of the vertical auger housing are completely open with the swivel head in the recirculation position.

C.   Make sure that the bottom auger well is kept clean of trash or fine material build up which restricts the flow of grain into the intake of the vertical auger.

D.   The vertical auger flighting cannot be worn down at the intake end.

E.   When using the folding hopper, set the grain flow regulator in the loading hopper down 1½" as shown in the drawing. See Figure A.
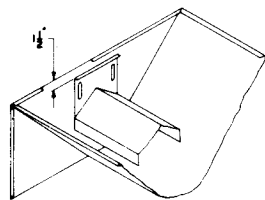

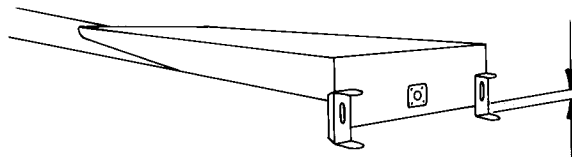Figure A   Figure B

F.   Adjust the loading hopper feet so they touch the ground as the loading auger becomes fully engaged with the drive portion of the auger. See Figure B.

⚠ **DANGER**

The loading auger operates automatically and may start without notice. Make certain that the auger is free of debris and that everyone stays clear of the intake. Failure to do so may result in serious injury or death.

G. The grain bin will fill until the grain is approximately 10 inches below the top ring. Wet grain expands as it is heated. Leaving a couple of inches at the top provides the additional room needed and prevents the dryer from spilling over.

DO NOT LEAVE GRAIN IN DRYER OVERNIGHT. Grain that remains in the dryer overnight will absorb moisture and swell. This swelling can cause the vertical auger to cease.

When the loading attachment is not used, overhead bins or a conventional farm type elevator or auger may be used. In using any method of filling from top, make delivery of grain into dryer as near to center as possible. Start machine, without burner, at the same time loading begins. this helps keep bin loaded evenly. Bin will fill to rim and pyramid evenly to auger outlet.

OPERATING INSTRUCTIONS

Turning the controller on and off is accomplished using the keypad, thus eliminating the protruding toggle switch used on prior models.

Basic Controller Operation - The controller operates from a source of nominally 12 Volts DC. This Voltage will be provided by a supply internal to the dryer. That supply derives its power from the same AC source which is used to run the dryer's motors.

As soon as DC power is available, a portion of the controller becomes active, even though the unit appears to be completely off. The current drawn while the controller is in this mode is only a few milliamps. The controller may be allowed to remain in this state indefinitely as the power consumed is insignificant.

The keypad area on the controller, which is shown in Figure 2B, is where the operator provides the information needed to control dryer operation. Options may be quickly accessed in an intuitively-simple sequence.
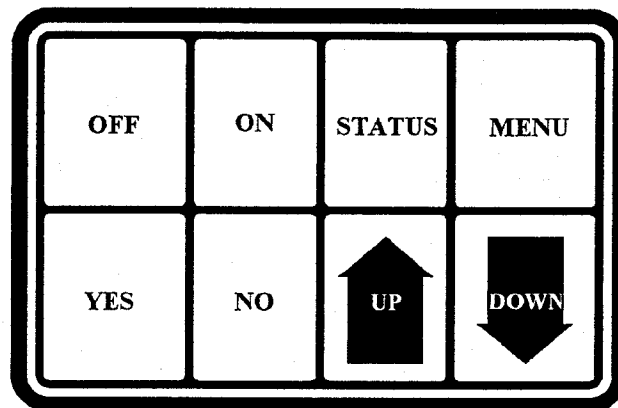
Figure 2B - Keypad area of the controller

The **ON** and **OFF** keys have only one function, to apply or remove electrical power to the controller and the dryer's DC circuitry. The remaining keys are used to select options while the dryer is in operation.

Controller States - While running, the controller can be in only one of eight possible states.   These have been assigned descriptive names which will appear in the display when the controller is in the Status mode. Table 2A list these states.

The flow chart in Figure 2C describes how the controller moves from state to state. When the unit is first set to on, the *Idle* state will be active.

State Numb	State Name	Description
0	*Idle*	Idle state - no automatic operations are under way
1	*Fill*	Grain bin is being filled
2	*Purge*	Plenum is purged of possibly explosive gases
3	*Ignite*	Ignition of burner
4	*Heat*	Fuel heater is being warmed
5	*Dry*	Grain is dried
6	*Cool*	Cooling grain
7	*Unload*	Unload grain in bin

Table 2A - The controller, once it is set to on, can only be in one of the 8 possible states listed above. When the controller is set to the status mode, the state name will be shown in the LCD window. If the unit has been off and the **ON** key is pressed, the *Idle* state will be active.
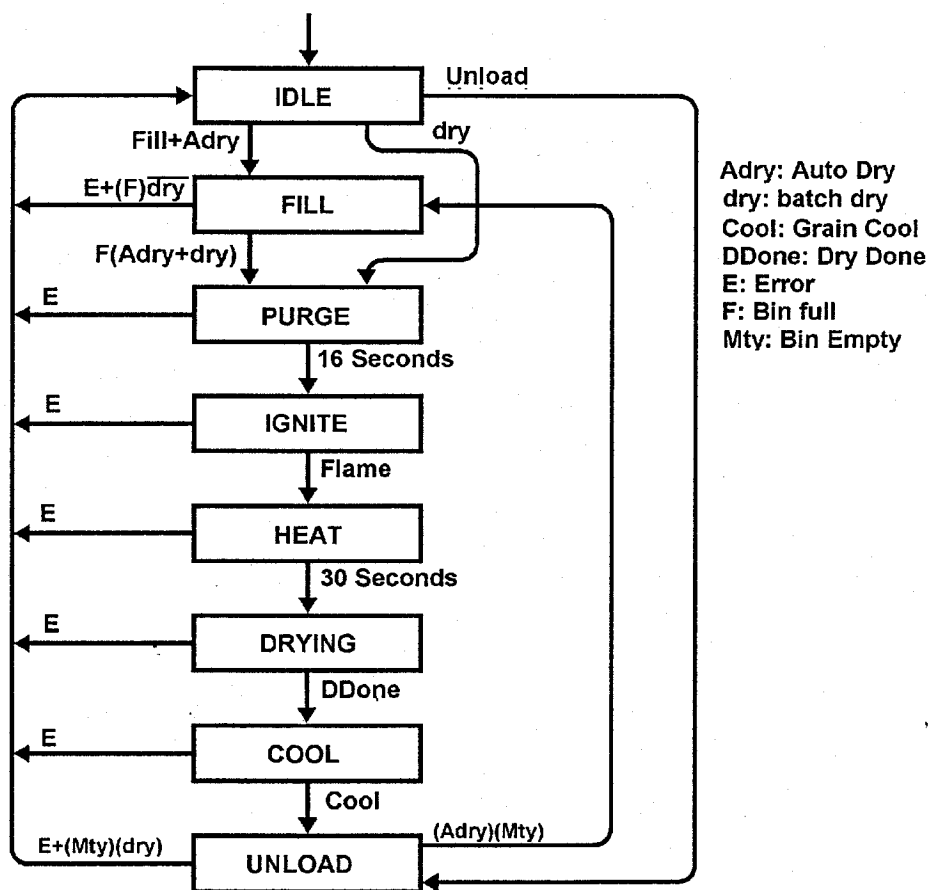
Figure 2C - Controller state flow diagram. The rectangles represent the allowed states while the labels next to the lines are the logical conditions required to cause the transition indicated. The "+" is a logical "OR" and multiplication is logical "AND".

Dryer Operating Modes - There are two drying options, a filling option, an unloading option and a mode where the dryer motors may be operated manually. While the latter is available primarily for troubleshooting, the other four will routinely be used in the course of drying and handling the grain.

The filling and unloading options are available to allow the operator to load or unload grain from the dryer bin.

The two drying options are Automatic Dry and Batch Dry. The latter operates just as a single-batch dryer would, allowing the drying of whatever grain is in the dryer at the time, and stopping after the grain has been dried and unloaded. The Automatic Dry option will first attempt to fill the grain bin if it is not currently full. Once filled, the controller will move the dryer through the same states as if Batch Dry was in effect until the grain is unloaded. At that point, rather than the controller returning to the *Idle* state, it will return to *Fill*. In this mode, the RAB dryer can dry batch after batch without operator intervention.

A combination of the two modes is also possible. If the dryer is started in the Batch Dry mode and then, after burner operation commences, it is shifted to Automatic Dry mode, it will complete the drying of an initial batch without first going through a fill. Continuous batch operation will then occur after the initial batch has been finished.

Errors - The controller returns immediately back to the *Idle* state should an error condition be detected. For example: in the *Purge* state, the flame detector is checked. Since the fuel valves are closed at this time, no burner operation is possible. So, if the flame detector module in the dryer indicates that a flame is present - probably due to a failed flame detector unit - something is wrong. At that point the controller will return to the *Idle* state with the LCD display showing the message *Flame On*. The **INDICATOR LIGHT** will also be lit.

Even certain "normal" or expected conditions may produce such an outcome. In Automatic Dry operation, the grain supply may eventually be exhausted. After a period passes and the dryer determines that it is unable to refill the bin, dryer operation will stop, although due to no fault of its own. The message *No Fill* will be displayed and the **INDICATOR LIGHT** will be lit.

Basic Drying Cycle - The controller will remain in its inactive state until the **ON** key on the controller keypad area is depressed.

Depressing the **ON** key will cause normal operation to commence. The display will show a message of the form

<p style="text-align: center;">***Hours   xxxxx***</p>

where ***xxxxx*** is the total number of elapsed hours the controller has been in operation since manufacture.

NOTE: This time is NOT the period that DC power has been applied to the controller's electrical terminals, but the time that the controller is actually active.

The diagram in Figure 2D illustrates the primary menu options presented to the operator and under what conditions they are presented. It is important to note that this diagram is quite different from the machine state diagram of Figure 2C. The state diagram shown previously indicates how the controller and dryer complete the instructions presented by the operator. The menu option diagram below shows what the controller displays to the operator and how the controller will respond to the choices made.

Sub-menus are not shown in Figure 2D (page 19). For example: the box titled SELECT GRAIN ITEMS includes steps to select the grain type, plenum set point, grain set point, whether temperatures should be displayed in degrees F or C, etc. These details are not shown, However, there is only one way into and one way out of these sub-menus. That is what is depicted in the diagram.
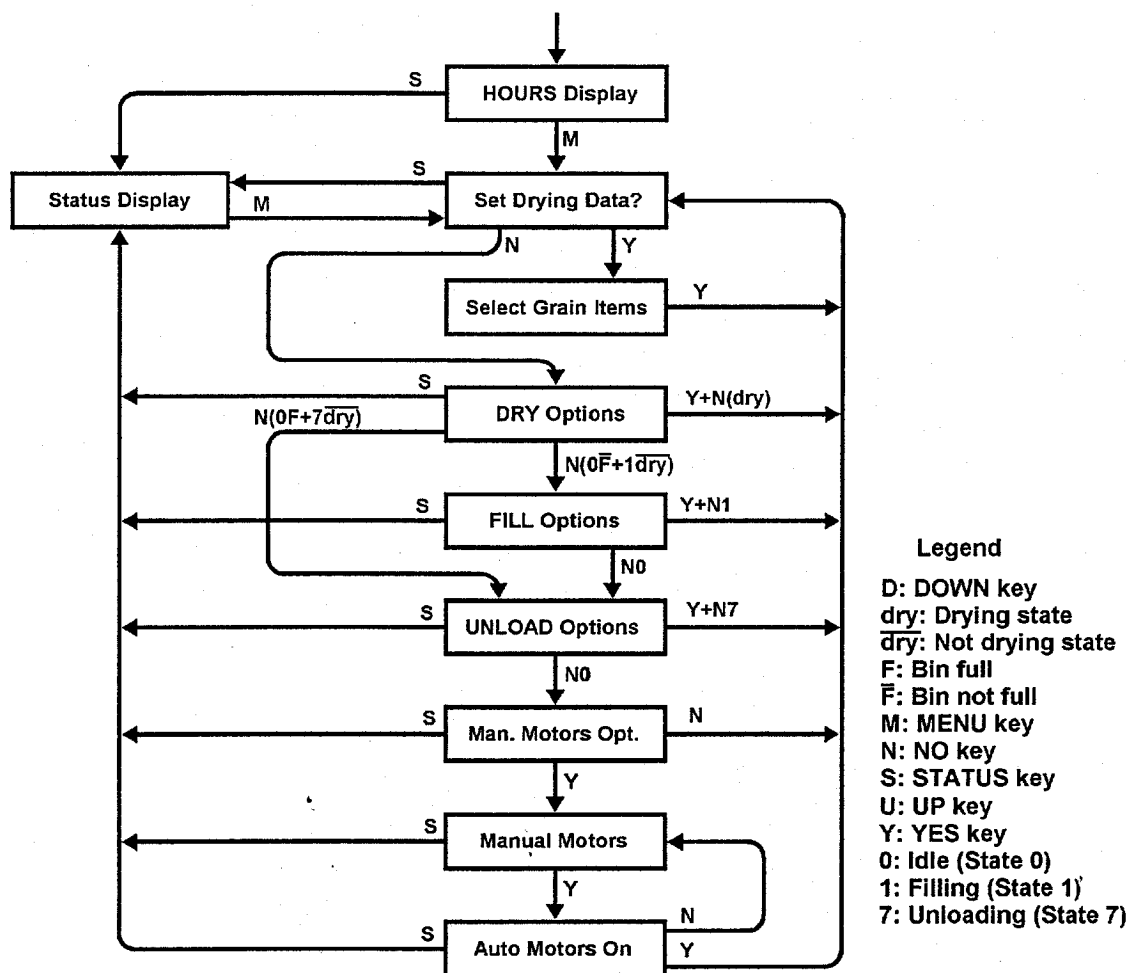
Figure 2D - Menu options provided the operator by the controller. The boxes represent message states. The items next to the lines are the conditions required to make the indiated transition. some boxes contain additional sub-displays not shown here which require operator inputs, but they do not alter the overall flow as shown here. The "+" symbol represents a logical "OR" and multiplication represents logical "AND".

Legend

D: DOWN key
dry: Drying state
d̄r̄ȳ: Not drying state
F: Bin full
F̄: Bin not full
M: MENU key
N: NO key
S: STATUS key
U: UP key
Y: YES key
0: Idle (State 0)
1: Filling (State 1)
7: Unloading (State 7)

IDLE Options - Once the controller has been set to on and the hours message is displayed, only the **OFF, STATUS** and **MENU** keys have any effect.

OFF Key - The **OFF** key will turn the controller off and remove DC power from all parts of the dryer which it controls.

STATUS Key - When the **STATUS** key is pressed, if no error conditions are present, the display will cycle between two messages. One of these will be *Idle*, indicating the current state of the controller. The second display will be the current grain temperature. No drying functions are being performed, other than monitoring certain dryer conditions, such as its DC Voltage supply level.

The status display does not expect any operator inputs and will respond only to the **MENU** or **OFF** keys. The status display's purpose is to provide information on the dryer's current operating condition. Except when actual control functions are being performed, the status display should be activated so the controller can provide information on current dryer conditions.

MENU Key - Pressing the **MENU** key, either when the hours display is present or when either status message is present, will activate the controller's menu routine. It is used to set dryer operating parameters, start and stop drying, as well as manually controlling motors.

Grain Parameter Setting - The first option provided to the operator after the **MENU** key is depressed will allow him to select the grain to be dried, desired temperatures and whether the temperatures are displayed in degrees C or F.

The values previously set for the last load of grain dried are the first presented . This allows a **YES** response at each option to preserve the previous value.

The ↑ **(UP)** and ↓ **(DOWN)** keys may be used to modify numeric values as well as select different grains. Switching between degrees F and degrees C never alters dryer operation and may be done at any time.

With the exception of choosing the grain, all grain-related options are also available when drying is in progress.

The grain parameter setting process may be skipped by responding with **NO** whenever the option message *Set Drying Data?* is present in the display.

Drying Options - After passing the grain drying parameter setting routine by answering **NO** as indicated above, the operator will be asked to make a selection which will start or stop the basic drying process. If the dryer is in the *Idle* state, the options to commence drying will be provided. If drying has already been initiated, the option to stop drying or to switch to the other drying mode will be provided.

Additional Non-drying Options - If the dryer is in the non-drying *Idle state*, two or three additional options are available in the menu area. These are accessed if the drying options were answered with a **NO** response. If the dryer grain bin is not full, the *Fill On?* option will be presented. A **YES** response will cause the dryer to attempt to fill the bin with grain. If this option is chosen, a sensor will terminate the filling process when the bin becomes full. If the dryer is unable to fill the bin due to a lack of grain after adequate time to do so has passed, it will also stop with the error message *No Fill*. If the bin is already full, this option will not be presented.

If the option to initiate filling of the bin was absent, due to the bin already being full, or if it was bypassed by answering **NO**, the *Unload On?* option will then be presented. Unlike the filling option, even if the grain bin is empty, unload is available to provide a means of cleaning small grain residues from the bottom of the unit. It will run a short time after the empty sensor detects the bin is empty and then stop unloading.

The final option is *Manual Motors On?* A **YES** response will open a sub-menu which will allow the operator to individually control every motor available on the dryer which the controller can activate or deactivate. In manual mode, the dryer's sensors are not monitored. For example: the fill motor can be set to run even if the bin is full. Without operator intervention, it will continue running.

The manual motor routine is useful when troubleshooting dryer operation.

The last option in the manual motor area is *Auto Motors On?* A **YES** returns the controller to the grain setting point and a **NO** takes the operator back to the start of the manual motor area.

If the *Fill?* or *Unload?* options or either dry option was activated, the dryer will no longer be in the *Idle* state. In this event, the *Manual Motors On?* options will not be available.

Leaving the MENU Routine - It is not possible to return to the status routine until any active sub-menus have been completed. These two are the grain parameter setting and manual motor control segments. With this exception, pressing the **STATUS** key will restore the status display.

Loading and Unloading - The dryer may be loaded or unloaded without the activation of a drying cycle. Once filling or unloading has begun, the **STATUS** key will return the unit to the status display mode, which is similar to the *Idle* display, except the word *Idle* is replaced by either *Fill* or *Unload,* depending on the choice previously made.

In the *Fill* state, the menu option will allow setting the automatic drying mode by responding with a **YES** to *Auto Dry On?*. This will cause the dryer to continue filling, but then move on to automatic drying when the bin is full.

Drying - There are two types of drying cycles: batch and automatic. Presuming there are no failures such as loss of electrical power, exhaustion of burner fuel or mechanical problems in the dryer, the batch mode dries the current load of grain, cools the grain if desired, and then unload the bin, stopping in the *Idle* state. When it stops, the message *Grain Done* is present. In the automatic mode, the grain bin is first loaded and then the grain is dried. A cool-down state may or may not occur next, depending on cool-down temperature settings. The bin is then unloaded, followed by the dryer returning to the *Fill* state to start a new cycle. This will continue until terminated by the operator or some problem occurs, including a lack of enough grain to fill the bin. In the case of this latter event, the dryer will return to the *Idle* state with an appropriate message on the LCD display.

If the display is set to the status mode, the progression through the various states may be observed by watching the messages on the LCD display.

The drying portion of the cycle progresses as follows: a 16-second *Purge* state is entered first during which any unburned gas in the plenum is expelled by the dryer fan. It at the start of this period that the fan will be activated.

After the purging time has passed, the controller will move to the *Ignite* state. The electric ignitor will generate a spark and the low-flow fuel path will be opened so that fuel is supplied to the burner. This period will continue for up to 90 seconds, if needed, during which time the burner should light.

Once ignition occurs, the controller will move to the *Heat* state. This is a 30 second period during which the high-flow fuel path remains blocked. This will assure that dryers that need to heat the fuel for efficient burner operation will have time to raise the temperature of the fuel heater.

In the previous three cases, the status display shows only the state of the controller, or *Purge*, *Ignite* and *Heat*, respectively. But once the dryer reaches the drying state, the status display will alternate between the state - *Dry* - and temperature information for the plenum and the grain.

When the grain reaches the preset grain temperature for dryness, the unit will move on to the *Cool* state where the burner is now extinguished and the grain is cooled by ambient air supplied by the fan. The displayed messages are similar to those in the *Dry* state, but the plenum temperature is omitted as the burner is extinguished. When the cool setpoint is reached, unloading commences. If the cool setpoint and grain setpoint are equal, the *Cool* state is terminated immediately after being entered and the dryer moves directly to unload.

Manual unloading can also be initiated if the operator wishes to unload in the bin without completing the drying process. The dryer must be removed from the drying mode to do this.

Safety and Control Monitoring - A variety of sensors provide information to the controller about the dryer's condition. These check for excessive plenum temperatures, burner flame presence or absence, air flow through the burner, grain and plenum temperatures, the magnitude of the 12 Volt DC internal supply, grain bin being full or empty. Some conditions are monitored continuously, while others are only checked when to do so is vital for safe dryer operation.

Whenever an unsafe condition is detected, the controller will stop all dryer operation over which it has control, thus returning the dryer to the *Idle* state. A message indicating the problem which produced the halt is presented. Since some of these conditions may be transient, the problem may vanish by the time the operator returns. To avoid losing the cause, the detected condition is latched on the display. The operator can clear it by pressing any key.

Some "normal" conditions will stop the dryer as if they were failures. For example: if the controller had been set to fill the bin, but the automatic batch mode had not been set, when the bin becomes full, the dryer will return to the *Idle* state and display the message *Fill Done*, as well as turning the **INDICATOR LIGHT** on.

The **OFF** button may always be used to instantly remove power from all of the 12 Volt DC devices controlled by the unit, including the burner fuel solenoids and motor contactors. The internal switching device is a relay, thereby assuring that there are no residual currents flowing in any of the controlled elements.

Detailed Controller Operation

Assumptions - In this section it is assumed that the controller and the associated dryer are in good working condition. The exception will be certain "error" conditions that may reasonably be expected to occur, such as failure to fill because the grain source has been exhausted. See Section 6 for a discussion of controller operation when failures occur.

Controller Options - The controller options which are available to the operator are shown in Figure 4A.
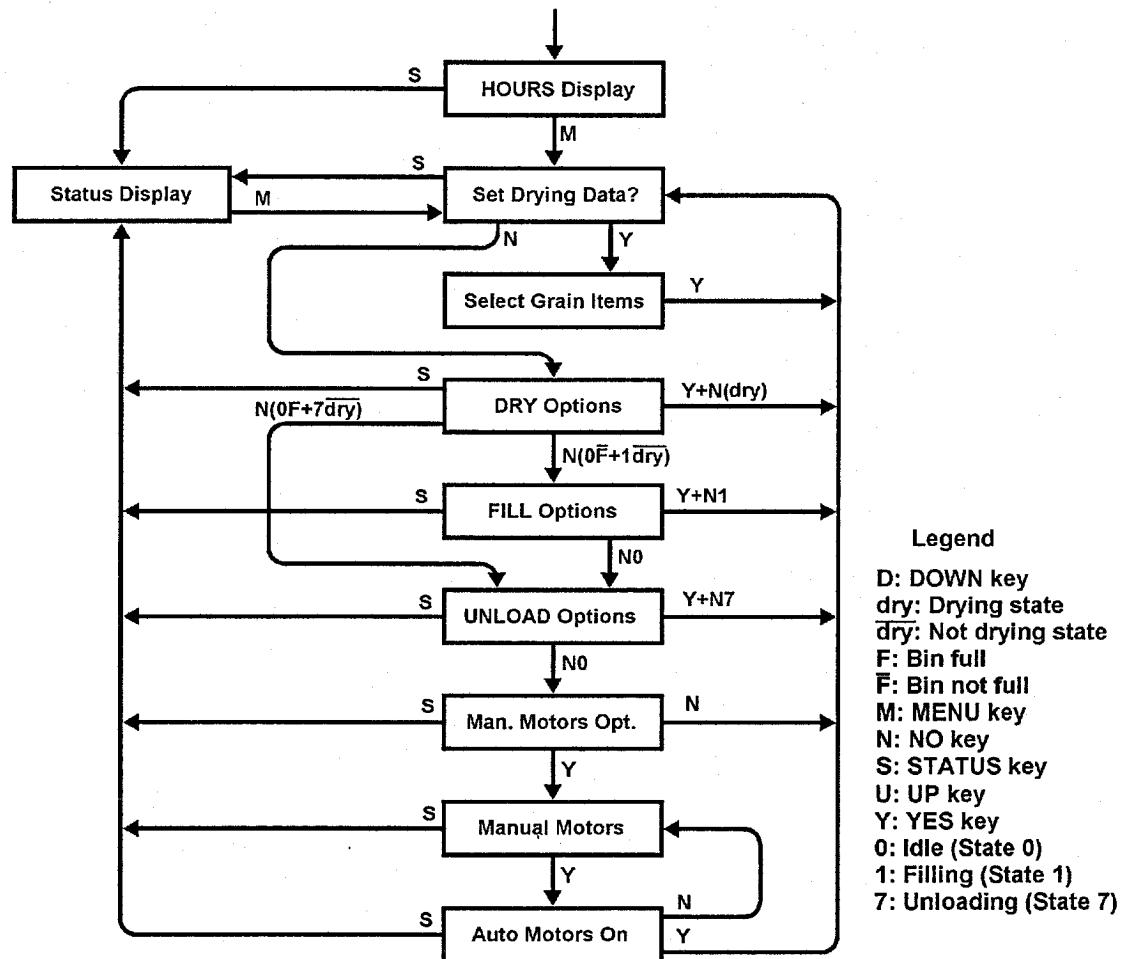
Figure 4A - RAB Keypad input options and their effects.

Drying Operation - While filling the grain bin may be commenced by the operator before drying parameters are set, some of the options available to the operator when the unit is in the **Idle** state are not available once the **Fill** state has been activated. The following discussion assumes all options are to be maintained, so filling will not be commenced until other drying conditions have been established.

Initial Dryer Setup - The following steps will begin grain drying.

Turn the Unit On - After the dryer has been completely setup mechanically and electrically, including providing a supply of wet grain and fuel, depress and release the **ON** key. The display will change from being blank to

<div align="center">

Hours xxxxx

</div>

where ***xxxxx*** will be a number between 000 and 25599. The number displayed will be the number of hours that the controller has been in the operating state.

Controller STATUS display - Press the **STATUS** key. The path to reach the **Status** display is shown in Figure 4B.
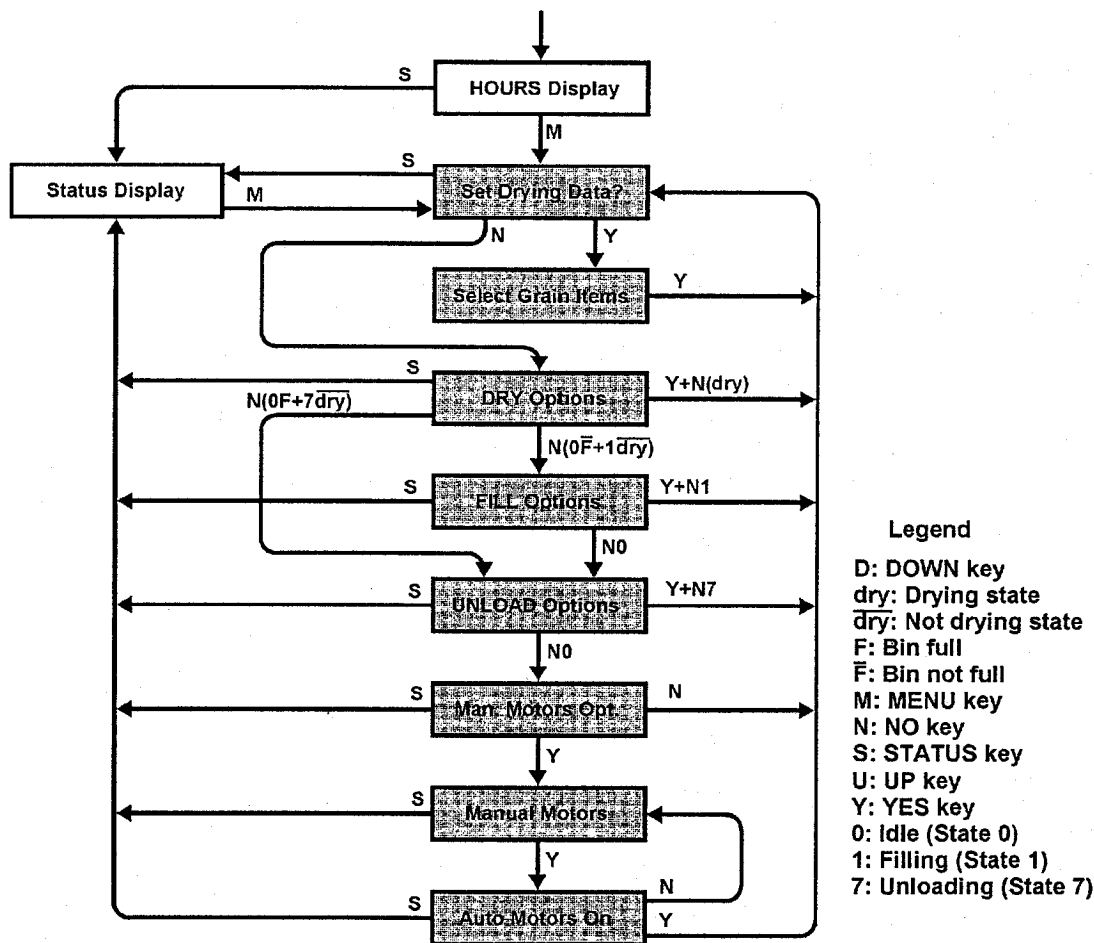
Figure 4AB - Path from Hours display to Status display

Providing that no error conditions exist, the display will switch to one of the two messages shown below.

>   *Idle*
>   or   *Grain   ttt   sdddS*

That message will remain for 2 seconds and then change to the other, which will then be present for an equal period of time. When both message have been shown once, the display will cycle back to the first message and repeat.

Idle informs the operator of the state of the controller and dryer i.e. no action in regard to drying is under way.

The *Grain* portion of the second message informs the user that the numbers to the right are related to the temperature of the grain in the dryer bin. *ttt* is the temperature of the grain. *sddd* is the temperature difference between the grain setpoint and the current grain temperature. s is the sign of the difference and will be + to indicate that the grain in the bin is above the setpoint and - to indicate that it is below. *S* is the temperature system and will be *F* for Fahrenheit and *C* for Celsius.
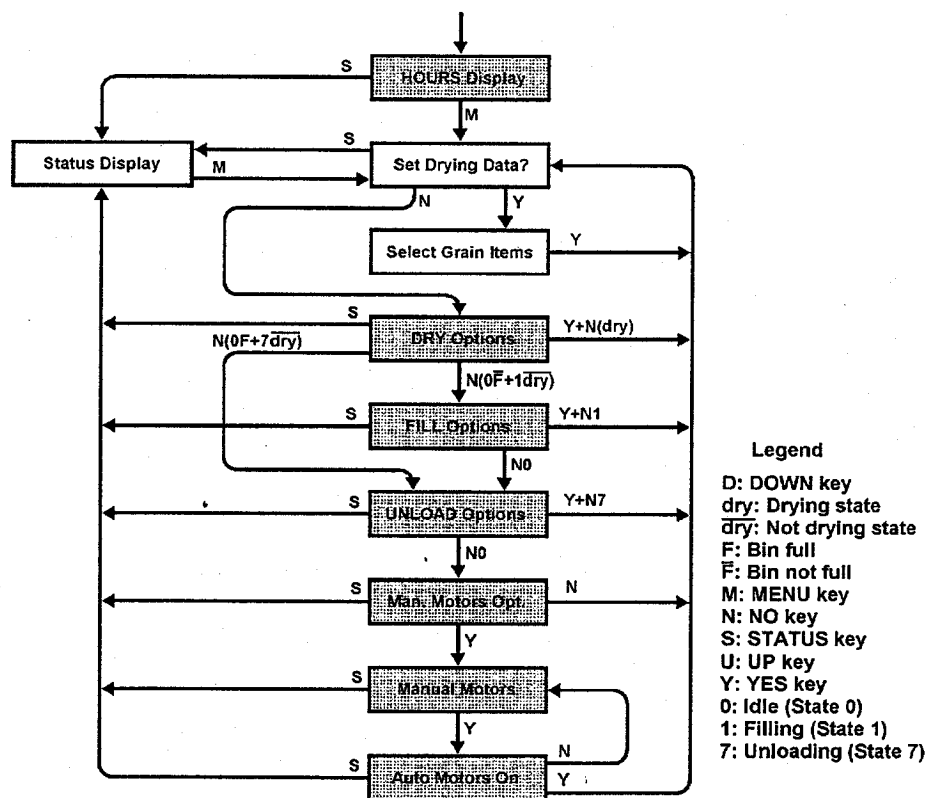
Figure 4AC - The MENU key will activate the drying conditions option.

Establishing Drying Conditions - Press and release the MENU key. The path taken by the controller to reach the grain parameter setting display is shown in Figure 4C.

Providing that no error conditions exist, the display will switch to the messages shown below.

Set Drying Data?

When the dryer is in the *Idle* state, the Menu routine has five areas. These are:

1. Grain parameter setting
2. Activating/deactivating drying
3. Filling the grain bin
4. Emptying the grain bin
5. Motor control

The *Set Drying Data?* message is asking the operator if he would like to enter the grain parameter setting sub-menu. If it is desired to set or adjust the grain parameters, press **YES.** If the current settings are known to be acceptable, press **NO**. If the latter choice is made, the controller will move to the drying options.

Select Grain - Press and release the **YES** key. The display will now change to:

Gggggggg?

where *Gggggggg?* represents one of the grains in the controller's library. The selected grain from the library will always be the one selected when the dryer was last used. So, if the grain selected for drying during the previous use was corn, the controller will initially display *Corn?* This recall of the previously set parameters is true for all of the settings in this sub-menu. This allows the operator to turn the unit off and return later to dry another batch without having to remember the previous settings.

The appearance of a *?* in any controller message is a prompt for the user, reminding him that he is expected to make a selection.

If the grain displayed is not the one desired, use the ↑ **(UP)** and ↓ **(DOWN)** keys to step through the alphabetized table until the desired grain is reached. NOTE: once either of these keys is used, even if the same grain as dried last time is eventually selected, all previously set grain parameters will be replaced by those values stored in the controller's library. In other words, those previously set will be lost.

A change in the selected grain can only be made when the unit is in the *Idle* state.

The only way the controller can exit the grain selection sub-menu is to press **YES**.

Select Temperature System - Once the desired grain is displayed, press **YES**. The display will change to:

<div align="center">

Degrees S?

</div>

S will either be **C** or **F**, indicating that the current temperature displaying system is Celsius *(C)* or Fahrenheit *(F)*. A **NO** response will switch the display to the other system while another **NO** will return it to the original. This sub-menu may only be left by answering with a **YES** key depression and the last displayed system will be the one set.

Set the Plenum Temperature - Depressing and releasing the **YES** key will cause the display to change to:

<div align="center">

Plenum?   ttt   sdddS

</div>

The *Plenum* portion of the message indicates that the current plenum temperature setpoint conditions are being displayed. The ?, as with all controller displays, shows that the value may be adjusted. The *ttt sdddS* format is very similar to the one previously introduced. *ttt* is the desired or setpoint plenum temperature during drying, rather than the actual temperature. *sddd* is the sign and difference, but in this case, the difference is between *ttt* and the suggested value found in the controller's library. This allows the operator to see how far the suggested set point has been changed from the library value. **S**, as before, is the temperature system. It will be *F* for Fahrenheit and *C* for Celsius.

If the plenum set point displayed is not the one desired, the ↑ **(UP)** and ↓ **(DOWN)** keys may be used to step the values until the desired point is reached. One depression will raise or lower - depending on which key is used - the set point one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released or a limiting value is reached.

The library contains limiting values, above which the plenum may not be set. Attempting to lower the plenum temperature below the grain setpoint is not allowed either.

If the grain type was unchanged, then the initial plenum setpoint will be whatever it was set to previously. If the grain selection was changed, the initial value will be the one stored in the library.

Changing the plenum setpoint has no effect on any other setting. It may be changed before drying commences or after it has begun.

This sub-menu may only be left by answering with a **YES** response, establishing the last displayed value as the setpoint.

Select the Grain Temperature - Pressing the **YES** key will cause the display to change to:

<div align="center">

Grain? ttt   sdddS

</div>

The **Grain** portion of the message indicates that the current grain temperature setpoint conditions are being displayed. The *?* shows that the value may be adjusted. The *ttt sdddS* format is very similar to the one described for the plenum. *ttt* is the desired (maximum) grain temperature during drying, rather than the actual temperature. *sddd* is the sign and the difference between *ttt* and the suggested value in the controller's library for the selected grain. This latter value allows the operator to see how far the set point has been changed from the suggested setting in the library. **S** is the temperature system and will be an *F* for Fahrenheit or a *C* for Celsius.

If the grain setpoint displayed is not the one desired, use the ↑ **(UP)** and ↓ **(DOWN)** keys until the

desired value is reached. One depression will raise or lower - depending on which key is used - the setpoint one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released or a limiting value is reached.

The library also contains values above which the grain may not be set. Attempting to raise the grain temperature above the plenum setpoint is also not allowed. The grain temperature may not be set to freezing or below.

If the grain type was unchanged, then the initial grain setpoint will be whatever it was set to previously. If the grain selection was changed, the initial value will be the one stored in the library.

Changing the grain setpoint has no effect on any other setting. It may be changed before drying commences or after it has begun.

This sub-menu may only be left by answering with a **YES** response, establishing the last displayed value as the setpoint.

Select the Cool-Down Temperature - Pressing the **YES** key will cause the display to change to:
Cool?   ttt   sdddS

The *Cool?* portion of the message indicates that the user can adjust the temperature the grain must reach before unloading will commence. The **ttt sdddS** format is similar to the two previously introduced. *ttt* is the grain temperature which will initiate an unload. *sddd* is the sign and the difference between *ttt* and the grain setpoint temperature. **S** is the temperature system and will be an *F* for Fahrenheit and a *C* for Celsius.

NOTE: *Care must be exercised in setting the cool temperature. If it is set above the grain temperature setpoint, unloading will never occur. This will also happen if the cool down temperature is set below the ambient temperature.*

If the grain setpoint displayed is not the one desired, use the ↑ **(UP)** and ↓ **(DOWN** keys until the desired value is reached. One depression will raise or lower - depending on which key is used - the setpoint one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released.

If the grain type was unchanged, then the initial cool setpoint will be whatever it was set to previously. If the grain selection was changed, the initial value will be the one stored in the library.

Changing the cool setpoint has no effect on any other setting. It may be changed before drying commences or after it has begun.

After the cool temperature has been set, the **YES** key must be depressed and released. This will cause the controller to return to the state it was in before the grain drying parameter subprogram was entered at the beginning. The display will once again shows *Set Drying Data?.* Depress and release the **NO** key to move to the drying mode options. If it is desired to return to the grain parameter setting sub-menu, perhaps to change a previously accepted value, press the **YES** key.

Drying Mode Options - Once the grain drying parameters are set, the operator is provided with several options to initiate the drying process. Figure 4D (page 27) shows the options which are available.

Four Initial Choices - Although Figure 4D shows three apparent options, the first contains two closely associated choices, making a total of four. These appear in the following order: automatic continuous batch drying, single batch drying, grain bin fill and grain bin unload.
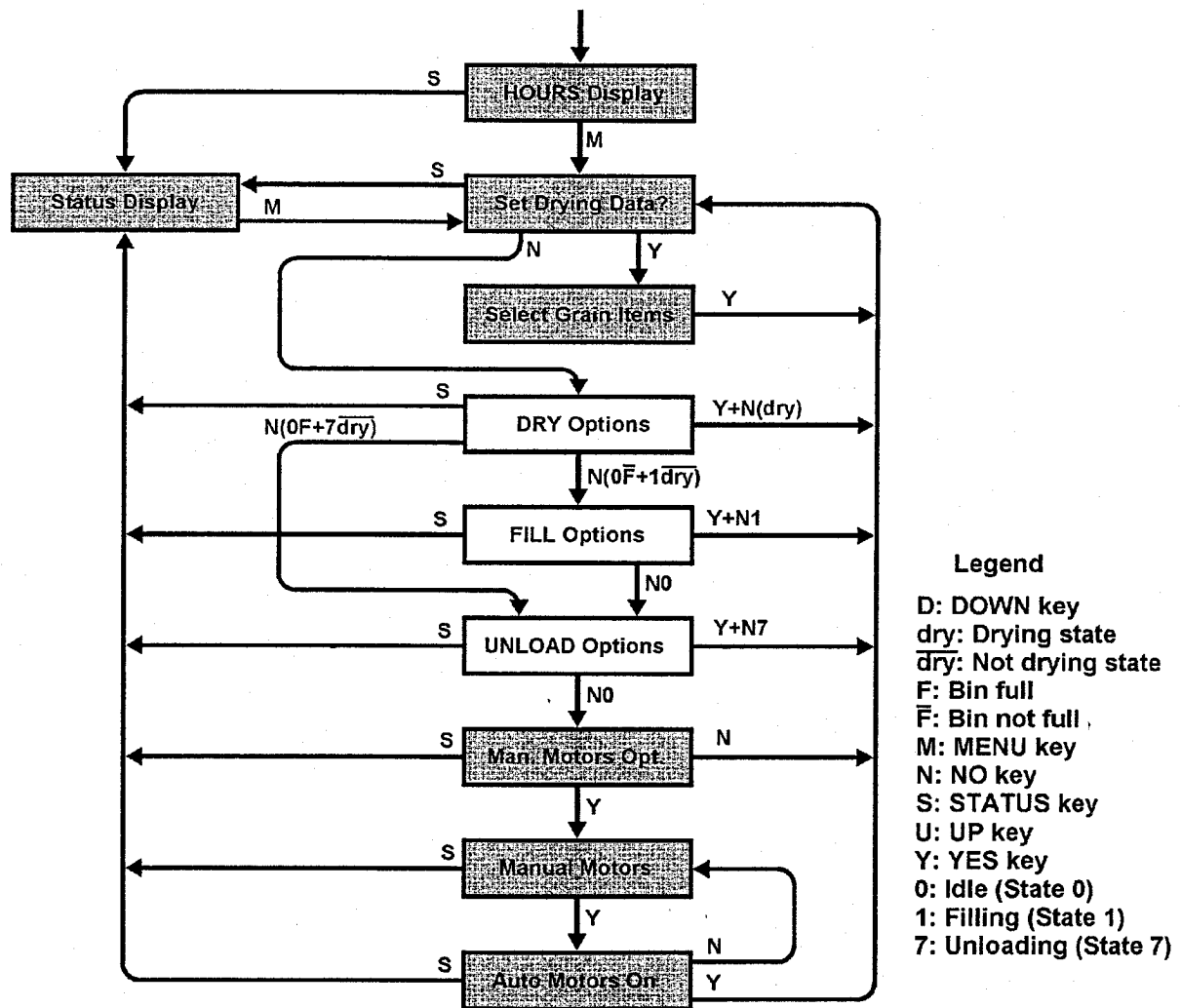
Figure 4D - A **NO** response to *Set Drying Data?* will provide the unshaded options.

Automatic Continuous Batch and Single Batch Drying - When the dry option mode is entered by answering **NO** to *Set Drying Data?* Presuming the dryer has not been previously set to initiate drying, the display will present the message:

Auto Dry On?

This will be the option most frequently chosen. A depression of the **YES** key will start the sequence of events which will lead to continuous drying of batches of grain. The basic steps will be to fill the bin, purge the heating chamber, ignite the flame, warm the fuel preheater, dry the grain, cool the grain, unload the dry grain and then repeat. If the grain bin is already full, it will skip the first step on the first pass through the cycle. It will continue in this fashion until the grain bin cannot be filled, a failure occurs, or the operator intervenes to stop the dryer.

A **NO** response to the *Auto Dry On?* message will produce the following display:

Batch Dry On?

This option will allow the drying of a single batch of grain. It does not fill the grain chamber at the start and stops after any grain in the bin has been unloaded. In all other regards, it operates like the automatic continuous batch mode.

Fill and Unload Options - If both drying options are rejected by a **NO** response, then one of the following two messages will be displayed:

Fill On?
Unload On?

If the bin is not currently full, then *Fill On?* will be shown. If the bin is full, then the filling option will be bypassed and the unloading option presented immediately.

If the *Fill* option is displayed, a **YES** response will initiate the filling of the drying chamber with grain. A **NO** response will cause the controller to present the unloading option. A **YES** to the *Unload On?* message will initiate immediate unloading of the grain bin.

While a **YES** response to either option will immediately return the display to the *Set Drying Data?* message, the selected action will continue until completed or stopped.

Both filling and unloading have a time-out mechanism, stopping the dryer motors if the requested process does not complete in the time allotted. The time out limit is 40 minutes.

In the unloading mode, operation continues for 1 minute after the internal bin sensors indicate that the bin is empty. This is done to empty the grain from the grain handling system.

Options when not in *Idle* - If the dryer is not in the *Idle* state, the options shown in Figure 4D are changed.

Batch or Automatic Dry in effect - If either continuous or single batch drying was previously initiated, the first option provided will be *Dry Off?* As might be expected, a **YES** will terminate the drying process. A **NO** will bring up the next option.

If the response was a **NO**, the drying option not in effect will be offered i.e. batch dry will be suggested if automatic dry is in effect; automatic will be suggested if batch is operational. A **YES** will change the drying mode to the newly-suggested one while a **NO** will return the user to the grain-setting question.

NOTE: if either drying mode is cancelled while the bin is being filled or unloaded, the controller will revert to *Fill* and *Unload* respectively.

Filling or Unloading Active - If filling has begun, the option to stop filling will be provided, but the option to unload will not. If unloading has begun, the option to stop is provided, but the option to fill is not. In both cases, the option to commence an automatic batch drying cycles will be provided. This would allow the operator to begin or continue filling or unloading the bin and automatically initiate the drying cycle later. During filling, the batch dry mode will also be available.

Additional Choices - If the dryer is in the Idle state and NO is the response to *Unload On?*, the display will change to:

Manual Motor On?

This is an option provided for manually operating the dryer's motors and most likely would be used for troubleshooting purposes. The normal response is **NO**, returning the user to the grain data setting mode.

Running Operation - As Figures 4C and 4D indicate, in almost every state, the **STATUS** key may be depressed to return the controller to the status displaying mode. Any options which were being presented when **STATUS** was pressed are cancelled. It will be necessary to select **MENU** to once again access the operation setting modes of the controller. Pressing the **STATUS** key never alters what the dryer is doing, but only changes what the controller displays.

Fill Status Display - Providing that no error conditions exist, when the dryer is in the filling state, the display will cycle between the two messages shown below. Each will remain for 2 seconds and then switch to the other for an equal period of time. When both message have been shown once, the displays will repeat.

Fill
or   *Grain   ttt   sdddS*

Fill shows the state of the controller and dryer i.e. the controller is attempting to fill the dryer's bin with grain. The grain message is the same one as shown in the ***Idle*** state, with ***ttt*** being the actual grain temperature and ***sddd*** being the sign and the difference between the grain temperature and the grain setpoint temperature. **S** is the temperature system; ***F*** for Fahrenheit and ***C*** for Celsius. A + sign means the grain is above the setpoint and A - means it is below.

Purge **Status Display** - Providing that no error conditions exist, the display will be as shown below:
<div align="center">

Purge
</div>

Purge is the state of the controller and dryer i.e. the burner chamber is being flushed of possibly explosive gasses. This stage lasts for 16 seconds before the dryer moves on to ***Ignite***. The grain stirring mechanism and the fan are all operating by the end of this state.

Ignite **Status Display** - Providing that no error conditions exist, the display will be as shown below:
<div align="center">

Ignite
</div>

Ignite is the state of the controller and dryer i.e. the controller is attempting to ignite the burner flame. This lasts a maximum of 90 seconds, but will normally be terminated earlier when the burner ignites and the flame detector determines that the burner is operating.

Heat **Status Display** - Providing that no error conditions exist, the display will be as shown below:
<div align="center">

Heat
</div>

Heat is the state of the controller and dryer i.e. the burner is operating in the low-output mode to heat the fuel preheater. This lasts for 30 seconds. The drying state will follow.

Dry **Status Display** - Providing that no error conditions exist, the display will cycle between the messages shown below. Each will remain for 2 seconds and then switch to the next for an equal period of time. When all message have been shown once, the cycle of displays will repeat.

<div align="center">

Dry
or   ***Plenum ttt   sdddS***
or   ***Grain   ttt   sdddS***
</div>

Dry is the state of the controller and dryer i.e. the dryer is drying the bin grain.

The ***Plenum*** message indicates that the data to the right is the temperature information about the hot air chamber. ***ttt*** is the temperature of the plenum air. ***sddd*** is the sign and temperature difference between the current plenum temperature and the plenum set point temperature. ***s*** will be + to indicate the plenum is above the setpoint and - to indicate that it is below. **S** is the temperature system and will be ***F*** for Fahrenheit and ***C*** for Celsius.

The ***Grain*** message indicates that the data to the right is the temperature information for the bin grain. ***ttt*** is the temperature of the grain. ***sddd*** is the sign and temperature difference between the temperature and the grain setpoint temperature. s will be + to indicate that the grain in the bin is above the setpoint and - to indicate that it is below. **S** is the temperature system and will be ***F*** for Fahrenheit and ***C*** for Celsius.

Cool **Status Display** - Providing that no error conditions exist, the display will cycle between the two messages shown below. Each will remain for 2 seconds and then switch to the other for an equal period of time. When both message have been shown once, the display will repeat.

<div align="center">

Cool
or   ***Grain   ttt   sdddS***
</div>

Cool is the state of the controller and dryer i.e. the dryer is cooling the now-dry grain in the bin.

The ***Grain*** message indicates that the data to the right is temperature information about the bin grain. ***ttt*** is the temperature of the grain. ***sddd*** is the sign and temperature difference between the grain temperature

and the grain cool-down setpoint. s will be + to indicate that the grain in the bin is above the setpoint and - to indicate that it is below. **S** is the temperature system and will be *F* for Fahrenheit and *C* for Celsius.

Unload **Status Display** - Providing that no error conditions exist, the display will cycle between the two messages shown below. Each will remain for 2 seconds and then switch to the other for an equal period of time. When both message have been shown once, the display will repeat.

<div align="center">

Unload

or   *Grain   ttt   sdddS*

</div>

Unload is the state of the controller and dryer i.e. the dry grain is being unloaded from the dryer.

The *Grain* message indicates that the data to the right is temperatures information about the bin grain. *ttt* is the temperature of the grain. *sddd* is the sign and temperature difference between the grain dry setpoint and the current grain temperature. s will be + to indicate that the grain in the bin is above the setpoint and - to indicate that it is below. **S** is the temperature system and will be *F* for Fahrenheit and **C** for Celsius.

End of Drying - Dryer operation is halted in one of three ways:

1. A problem is detected.
2. The batch mode was set and the grain has been unloaded.
3. Manually by the operator.

In all three cases, the gas valves are closed, the ignition is, and the motors are halted. The dryer is in the *Idle* state. In the event of either of the first two, the display will have a message indicating what condition stopped dryer operation. *Unload Done* is the display for the normal completion of drying in batch mode. All others are considered abnormal conclusions to the drying process.

With one exception, the indicator lamp on the front panel will be lit whenever a stop occurs by any means other than operator intervention. That one condition is over-Voltage, as the high Voltage could burn out the lamp.

In the event of either a case 1 or 2 stop, the indicator lamp may be extinguished and the normal Idle status display restored by pressing any front panel key except **OFF**, which would turn the controller off.

Manual shut down should normally be implemented by using the **MENU** key to reach the operator-adjustable options. The grain setting option is first rejected. If either of the drying modes was in effect, the display will present *Dry Off?* The proper answer is **YES.** If the dryer was filling or unloading, rejecting the drying options will present the option to stop the fill or unload activity. Again, a **YES** will halt the machine, restoring the *Idle* state.

Emergency Shutdown - The **OFF** key may be used to instantly halt all controller activity. However, this should not be routinely used to terminate dryer operation as it increases the wear on the controller's internal relay.

Manual Motor Operation - There are times when it may be useful to operate the dryer motors manually. This option is provided only when the dryer is in the *Idle* state. The state of the dryer can be determined from the Status display. Once in *Idle,* the manual motor routines may be accessed.

NOTE: No error conditions are checked while in the manual motor routine. The operator is required to monitor all operations.

Reaching the Manual Motor Routines - Figure 4E indicates how the Manual Motor routine may be reached. This path may be followed only if the controller is first placed in the Idle state.

1. Whether the controller is in the elapsed hours or status mode, the **MENU** key should be pressed.

2. To the message **Set Drying Data?**, press **NO.**

3. To both the **Auto Dry On?** and **Batch Dry On?** messages, press **NO.**

4. If the *Fill?* message is presented, press **NO**.

5. To the *Unload?* Message, press **NO.**

6. To the *Manual Motors On?* message, press **YES.**


```
                              ┌─────────────────┐
                         S    │  HOURS Display  │
              ┌──────────────▶└─────────────────┘
              │                        │ M
              │                  S      ▼
 ┌─────────────────┐  ◀───  ┌─────────────────┐
 │ Status Display  │   M    │ Set Drying Data?│  ◀───
 └─────────────────┘ ──────▶└─────────────────┘
              │              N │        │ Y
              │                ▼        ▼
              │          ┌─────────────────┐    Y
              │          │ Select Grain Items ├────────▶
              │          └─────────────────┘
              │        S          │
              │ ◀──────────┌─────────────────┐  Y+N(dry)
              │ N(0F+7dry) │   DRY Options   ├────────▶
              │            └─────────────────┘
              │              N(0F+1dry) │
              │        S          ▼
              │ ◀──────────┌─────────────────┐   Y+N1
              │            │   FILL Options  ├────────▶
              │            └─────────────────┘
              │               N0  │
              │        S          ▼
              │ ◀──────────┌─────────────────┐   Y+N7
              │            │ UNLOAD Options  ├────────▶
              │            └─────────────────┘
              │               N0  │
              │        S          ▼
              │ ◀──────────┌─────────────────┐    N
              │            │ Man. Motors Opt.├────────▶
              │            └─────────────────┘
              │                   │ Y
              │        S          ▼
              │ ◀──────────┌─────────────────┐
              │            │  Manual Motors  │ ◀───
              │            └─────────────────┘
              │                   │ Y
              │        S          ▼          N
              └────────────┌─────────────────┐────▶
                           │  Auto Motors On │  Y
                           └─────────────────┘
```

Legend

D: DOWN key
dry: Drying state
$\overline{dry}$: Not drying state
F: Bin full
$\overline{F}$: Bin not full
M: MENU key
N: NO key
S: STATUS key
U: UP key
Y: YES key
0: Idle (State 0)
1: Filling (State 1)
7: Unloading (State 7)

Figure 4E - Path for activating manual motor control.

   Manual Motor Control - All manual motor options operate in the same fashion. First a message is presented. If it is accepted by answering **YES**, the current state of the motor will be unchanged i.e. if it was stopped, it will remain stopped; if it was running, it will remain running. For example:

Fill Off?

   This is the first option presented when the manual motor mode is first reached. Responding with a **YES** will leave the motor in the off state and the controller will go to the next motor with a similar question. If the response is a **NO**, the display will change to:

Fill On?

   Responding with a **YES** would now turn the motor on while a **NO** will return to the previous *Fill Off?* option.

   When the presented state is the desired one, press **YES**. If the opposite state is the desired one, the proper response is **NO**. A **NO** response always causes the controller to provide the opposite option.

Regardless of the state of the motor, running or stopped, the options for each motor can only be left with a **YES** response - affirming the motor's current operating state.

Options are provided for the motors in the following order:

1. Fill
2. Unload
3. Fan
4. Circulate

Leaving Manual Motor Control - After leaving the circulate motor option, the following message will appear:

Auto Motors On?

A **NO** response will return the user to the start of the manual motor control option list at the fill motor option. A **YES** key depression will return the dryer to the *Set Drying Data?*.

When the manual motor routine is exited, all motors are set to the stopped state.

NOTE: The large motors used in the dryer draw high currents during starting. To prevent damage to the motors or excessive tripping of their protective circuit breakers, they should not be started more than once every ten minutes.

Controller Initialization & Error Codes - Before a controller can be used on a dryer, it is necessary to set the controller type to RAB. Since it is reasonable to set the elapsed time at this same time, access to the clock initialization routine is also provided.

Whenever the dryer controller stops because of an error, the conditions present when the stop took place are saved in the controller's EEPROM. These may prove to be helpful when troubleshooting an elusive problem. How to access to the EEPROM codes is provided here as well.

Activating Initialization Routine - Figure 5A (page 33) indicates the path the controller will follow to reach the first initialization subroutine.

Power Up - The controller must be connected to an appropriate power source. This may be the dryer power supply or any source of 12 VDC capable of delivering 100 mA or more.

Press the **ON** key. The display will indicate:

Hours xxxxx

Where *xxxxx* will usually be a number between 000 and 25599. In rare instances, if the controller has never been initialized before, unusual characters may be displayed in the *xxxxx* area.

NOTE: if the **MENU** or **STATUS** keys are pressed before the following procedure is completed, the unit cannot be initialized except by turning the power off and then starting again. That procedure will return the user to the point where the initialization routine may once again be activated.

Entering the Initialization Routine - Press the **YES, NO, ↑ (UP)** and **↓(DOWN)** keys all at the same time. (These four keys do not have to be pressed at the same instant, but must at some point all be depressed simultaneously.)

Setting the Controller Type - The display will change to one of the following three messages:

Single Batch
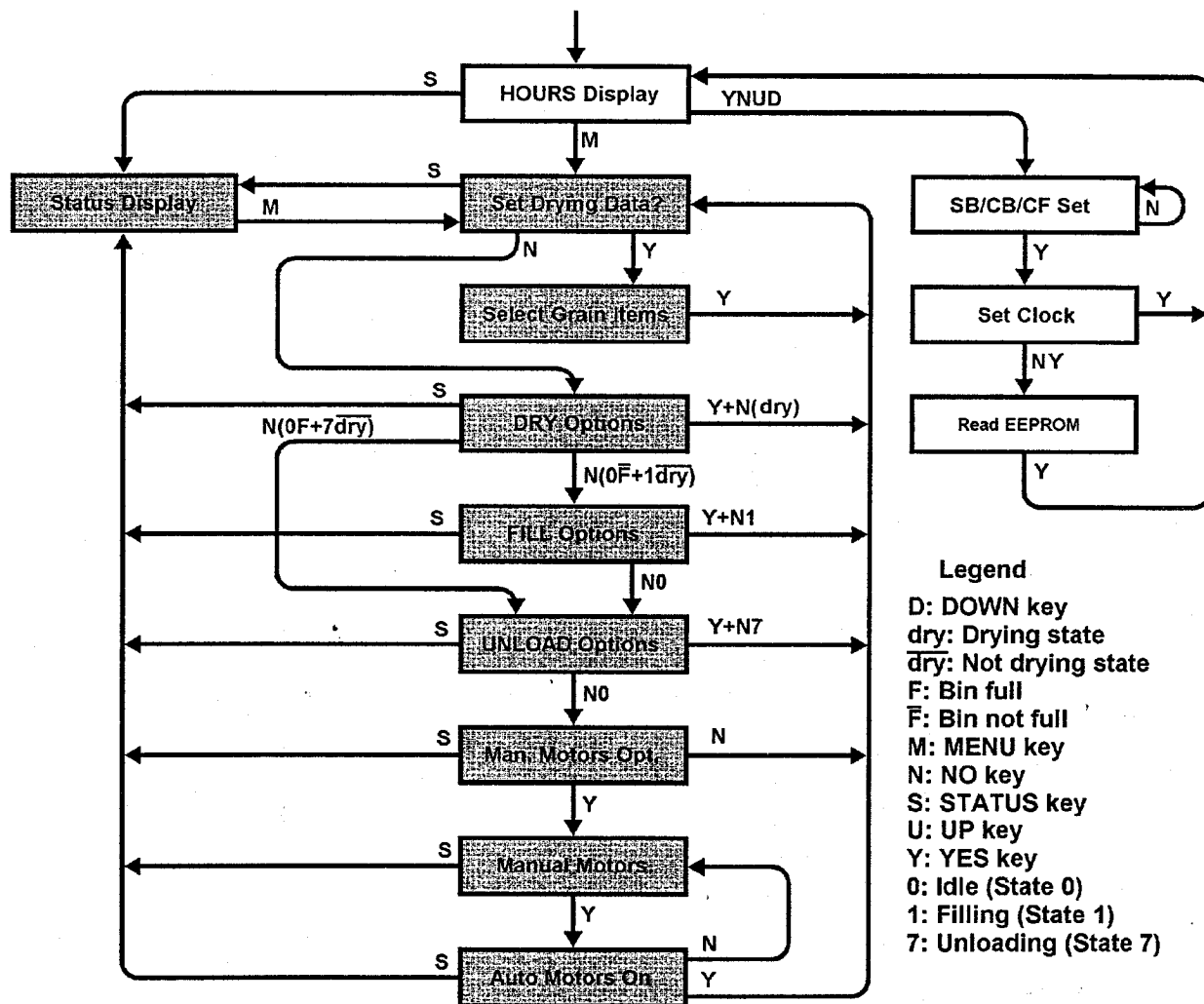or   *Cont. Batch*
or   *Cont. Flow*

Figure 5A - Path to the initialization routines.

Pressing the **NO** key repeatedly will cause the message to change to the next option below, or, in the case of the last one, back to the top option. Press NO if needed to bring up the message *Cont. Batch*. When that message is displayed, press **YES.**

Setting the Elapsed Hours - This subprogram will allow the displayed elapsed time of operation to be manually set. Figure 5B (page 34) shows the path followed by the controller to reach the hour setting location.

The display will become:

<div align="center">

Hours xdhtu

</div>

where ***xdhtu*** is the current elapsed time. ***u, t, h, d,*** and ***x*** are the units, tens, hundreds, thousands and ten-thousands digits, respectively.

Units and Tens Setting - When the routine is entered, the ↑ **(UP)** and ↓ **(DOWN)** keys may be used to set the ***t*** and ***u*** digits in the display. Both digits, taken together, may be changed one unit at a time between 00 and 99.

While both the tens and units may be adjusted in this way, a **YES** response after ***u*** has been set to the desired value will cause further inputs to only change the ***t*** digit. Consequently, the smallest amount of time required to set the clock is to use the ↑ **(UP)** and ↓ **(DOWN)** keys to set the ***u*** or units digit, and then press **YES** and use the same keys to set the ***t*** or tens digit. Whichever method is used, two **YES** entries will be required to reach the ***h*** setting point.
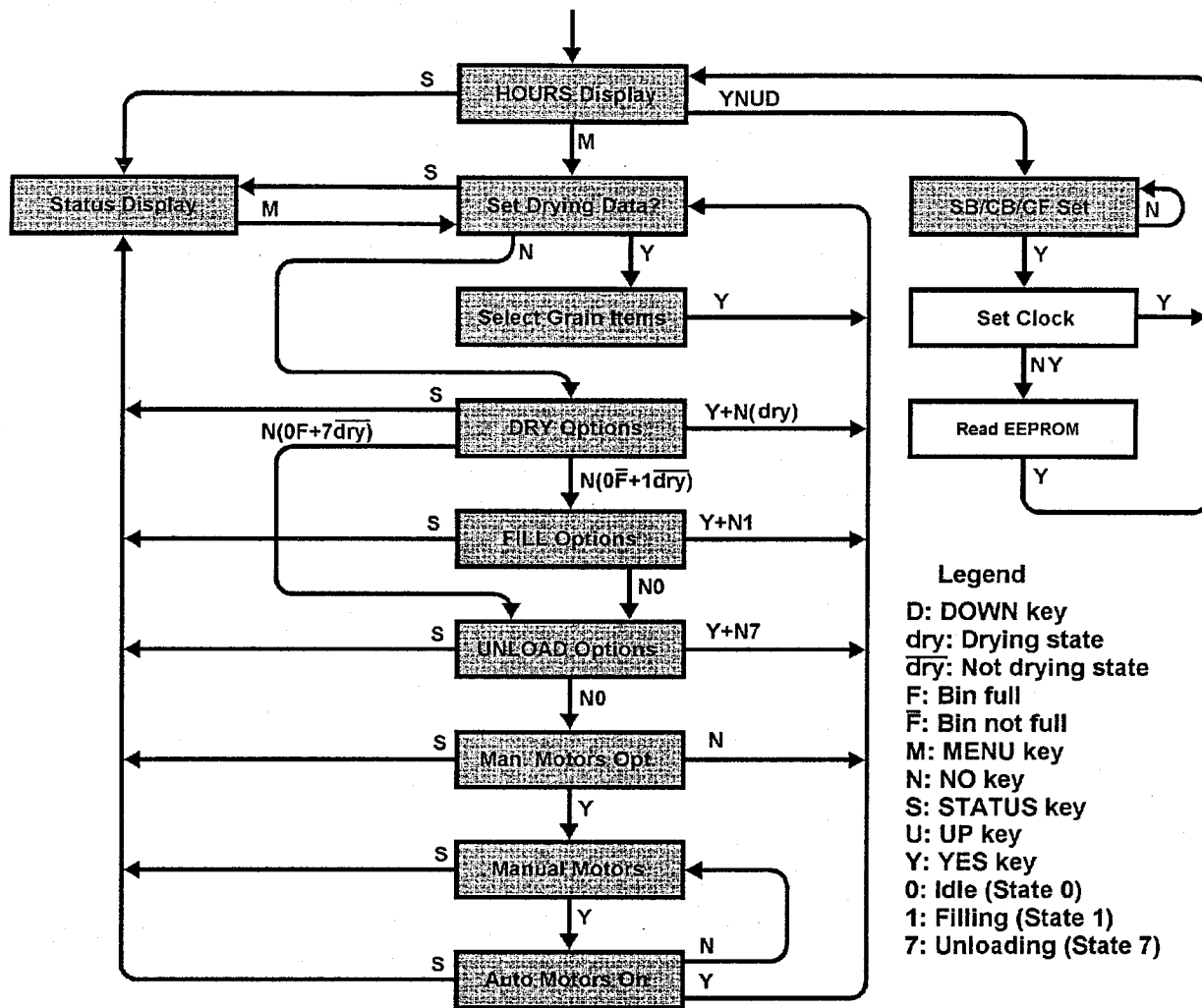
Figure 5B - Entry path to Clock setting and EEPROM reading routines.

If any displayed character is not one of the common numerals 0 - 9, use either the ↑ **(UP)** and ↓ **(DOWN)** key repeatedly until both digits are in the 0-9 span. The digits may then be set in the usual way.

Setting *xdh* Digits - A similar procedure will allow the *xdh* digits to be set. However, the *x* digit may never be selected by itself, but must be set with the *d* digit.

The time display has partial leading-zero blanking, so when the value is less than 10000, there will only be four digits shown. Numbers less than 1000 contain only three digits.

Since the display cannot be set higher than 25599, any attempt to surpass 255 for the top three characters will cause the display to roll over to 0.

Completing Hours setting and EEPROM Code Reading - Figure 5B indicates two ways that the clock initialization routine may be exited. If, after setting the clocks thousands and ten thousands digits, the YES key is pressed once again, the initialization routine is terminated immediately.

But if the **NO** key is first depressed and held, followed by the **YES** key while still holding the **NO** key down, when the **YES** key is then released, the EEPROM codes may be read as. The **NO** key may then be released.

EEPROM Codes - The EEPROM codes may be reached as described above in the clock set routine or by a more direct route if the clock and controller type is not to be changed. In the latter instance, after turning the controller off and then turning it on by pressing and releasing the **ON** key, press the **YES, NO**, ↑ **(UP)** and ↓

34

(DOWN) keys all at the same time. (These four keys do not have to be pressed at the same instant, but must at some point all be depressed simultaneously.)

Once the initialization routine has been activated, press and release the **YES** key four times. Then depress and hold the **NO** key. While still holding the NO key down, press and release the **YES** key. The **NO** key can then be released.

Data Display Format - The display will look like the one shown below:

$$nn \qquad dd$$

where **nn** is a two digit hexadecimal number and corresponds to the location of the data being displayed. **dd** is the hexadecimal data stored in that location.

Moving through the Data - Every time the **YES** key is pressed and then released, the location nn is incremented. The data is not stored in contiguous locations. Location 08 is followed by location 50; after location 5F will come location C0. CF is the last location.

The next **YES** depression will return the controller to the **Hours xxxxx** display.

Failures and Exceptional Condition Processing

Failsafe Operation - The circuitry of the controller and the associated dryer have been designed so single failures will not cause unsafe conditions to develop. For example: should the controller fail with the fuel valves open and the burner operating, the plenum temperature would eventually reach the point where the plenum temperature limit switch would open. This would open the fuel valve electrical supply, shutting off the fuel supply to the burner.

This is not to say that problems cannot occur which might result in loss. If, for example, the operator attempts to dry a load to a very low moisture content or to dry the grain very quickly, a fire can be started in the grain bin. Unless the operator takes appropriate steps to extinguish the fire, grain destruction and damage to the dryer could occur.

Monitored Variables - Table 6A lists the various items monitored by the controller.

<u>**Item**</u>

DC Supply Voltage level
Grain Bin Full
Grain Bin Empty
Agitator Rotation
Auger Rotation
Plenum Over-Temp Switch
Plenum Temperature
Air Flow
Flame Detector
Grain Temperature

Table 6A Sensor inputs utilized by the controller.

What Constitutes a Failures and the Controller's Response - Page 22 describes how to operate the controller, assuming that the dryer-controller combination functions in the intended manner. But if the controller detects some undesired or exceptional condition, it will generally take four actions. These are:

1. **Lit Indicator Lamp** - The front-panel **INDICATOR LIGHT** will be lit.

2. **Return to Idle** - The controller returns to the *Idle* state if it is not in that state. This will involve halting all dryer motors, closing all fuel valves and stopping the ignitor.

3. **Failure Message** - The Display will provide information that will allow the operator to determine the failure or condition which caused the dryer to halt.

   Error Code Recording - The controller contains a memory device whose contents are preserved even when the power is removed. Whenever a special condition is detected, the controller records all of the machine data available in this memory device.

When a failure occurs, the general goal is to return the unit to a safe condition so that no destruction may result from the failure and to draw the operator's attention to the failure. But some expected conditions have the same goal. When a single batch of grain is finished drying, it would be appropriate to halt all dryer operations and alert the operator. Due to the similarity in actions required of the controller in cases such as these, the controller treats both of these situations the same i.e. as if they were failures.

Table 6B lists all possible error messages and their meanings.

Message	Priority	Meaning
Voltage Low	7	The 12 Volt DC supply is lower than about 9.5 Volts
Voltage High	7	The 12 Volt DC supply is higher than about 17 Volts
Plenum Hot	6	Plenum switch or sensor found a high plenum temperature
Air Low	6	Air flow switch is open, indicating inadequate air flow
No Flame	5	Flame is absent when it should be present
Flame On	5	Flame switch is closed when it should be open
No Fill	4	Grain bin did not fill within allotted 30 minutes
Fill Done	4	Requested bin fill was completed normally
No Unload	3	Grain bin did not empty within allotted 30 minutes
Unload Done	3	Requested bin unload was completed normally
Agitator Slow	2	Agitator rotational rate is too low
Auger Slow	2	Auger stopped
Grain Done	1	Grain drying completed

Table 6B Error messages the controller can deliver and their meaning.

   In some cases it might be possible for two or more failures to occur at the same time. For example: if the motor which drives the auger and agitator would fail to start, both auger and agitator failures would occur. In the event of simultaneous failure conditions, only one is displayed and that will be the one with the higher priority as indicated in Table 6B.

4. RECOMMENDED PLENUM TEMPERATURE FOR DRYING

The following chart lists the recommended plenum operating temperatures and preset values for each grain stored in the microprocessor library.

PLENUM TEMPERATURE RANGES FOR DRYING

GRAIN*	PLENUM TEMPERATURE OPERATING RANGE (degrees F)	PRESET PLENUM TEMPERATURE (degrees F)
Barley	180 — 200	190
Barley Seed	120 — 170	160
Corn	200 — 230	220
Corn Seed	140 — 180	160
Flax	140 — 160	150
Flax Seed	90 — 120	120
Grain Sorghum	230 — 250	230
Grain Sorghum Seed	140 — 180	160
Oats	200 — 230	220
Oats Seed	140 — 180	160
Rape	140 — 160	150
Rape Seed	90 — 120	120
Rough Rice	140 — 160	150
Rough Rice Seed	90 — 120	120
Soybeans	180 — 200	190
Soybeans Seed	120 — 170	150
Sunflower — Bird	110 — 150	140
Sunflower — Oil	110 — 150	150
Wheat	150 — 180	170
Wheat Seed	100 — 150	130

*NOTE: Grains which are not indicated as "Seed" are intended for commercial use or animal feed.

5. RECOMMENDED GRAIN TEMPERATURES FOR DRYING

The following chart lists the maximum recommended grain temperatures and the preset values for each grain stored in the microprocessor library.

MAXIMUM GRAIN TEMPERATURE FOR INDICATED USE

GRAIN	PRESET GRAIN TEMP. (degrees F)		MAXIMUM GRAIN TEMP. (degrees F)		
	SEED	COMM. USE/ FEED	SEED	COMM. USE	FEED
Barley	105	120	105	120	140
Corn	110	130	110	130	140
Flax	105	120	110	120	
Grain Sorghum	110	130	110	140	140
Oats	105	130	105	140	140
Rape	110	120	110	120	
Rough Rice	110	110	110	110	110
Soybeans	105	120	105	120	140
Sunflower — Bird		90		90	
Sunflower — Oil		100		100	
Wheat	105	120	105	120	140

6.   ADJUSTING GRAIN TEMPERATURE SETTING

The grain temperature setting serves to prevent over-heating of the grain. When the temperature gets to the preset grain temperature the burner will shut off and the Indicator Light will light. Refer to the above chart for maximum grain temperature settings.

To initialy set the grain temperature begin with the preset grain temperature setting stored in the microprocessor. NOTE: When drying grain for seed purposes, use the grain setting indicated as "Seed". As the batch is drying, periodically take grain samples from the sampler tube and check the moisture content on an accurate moisture tester. When the grain gets within 1 - 2 percentage points of the desired final moisture content adjust the grain temperature setting down until the gas shuts off thus extinguishing the burner. Let the grain cool to the desired temperature. The grain will continue to dry during the cooling process and should be near the desired dryness after cooling. If the grain is still a little too wet, raise the temperature setting one or two degrees on the next batch. If the grain was a little too dry, lower the temperature setting one or two degrees on the next batch.

When drying grain for seed purposes set the grain setting on "Seed", and begin with the preset value. When the grain in the dryer reaches the preset temperature the burner will be extinguished. Check the moisture content after cool down. If this batch is too wet, LOWER the plenum temperature slightly for the next batch. Lowering the plenum temperature will increase the drying time and therefore decrease the grain moisture. Conversely, if the batch is too dry, RAISING the plenum temperature slightly for the next batch will decrease the drying time and therefore increase the grain moisture. Do not exceed maximum plenum or grain temperatures shown in the following charts.

The grain temperature control serves as an indicator to the degree of dryness, but settings must be ascertained at user level. For recording temperatures used, a sheet is provided in the back of this manual. Each batch should be tested to be sure the proper moisture level is reached. Different varieties of the same grain may require different temperature settings to achieve the same degree of dryness.

7.   ADJUSTMENT OF FUEL - AIR MIXURE

Your burner is factory set for correct air input for various pressures. Burner will not operate properly unless fan is at the approximate recommended operating speed.

PROPANE GAS FLOW CHART

VAPORIZER

BURNER

LIQUID

ORIFICE

AIR TUBES

VAPOR

PRESSURE REGULATOR

HIGH-BURN VALVE

LOW-BURN VALVE

BALL VALVE

BLOCK VALVE

RELIEF VALVE
(CSA ONLY)

VAPOR PRESSURE

OIL TRAP

SOLENOID VALVE
(CSA ONLY)

LIQUID

SOLENOID VALVE

STRAINER

QUICK - ACTING
HAND VALVE

SENSOR LOCATIONS

GRAIN FULL SENSOR SWITCH

PLENUM TEMP. SENSOR

TEMP. HIGH LIMIT CONTROL

GRAIN TEMP. SENSOR

AGITATOR SENSOR

VERTICAL AUGER SENSOR

GRAIN EMPTY SENSOR SWITCH

JUNCTION BOX
WIRING DIAGRAM - RAB
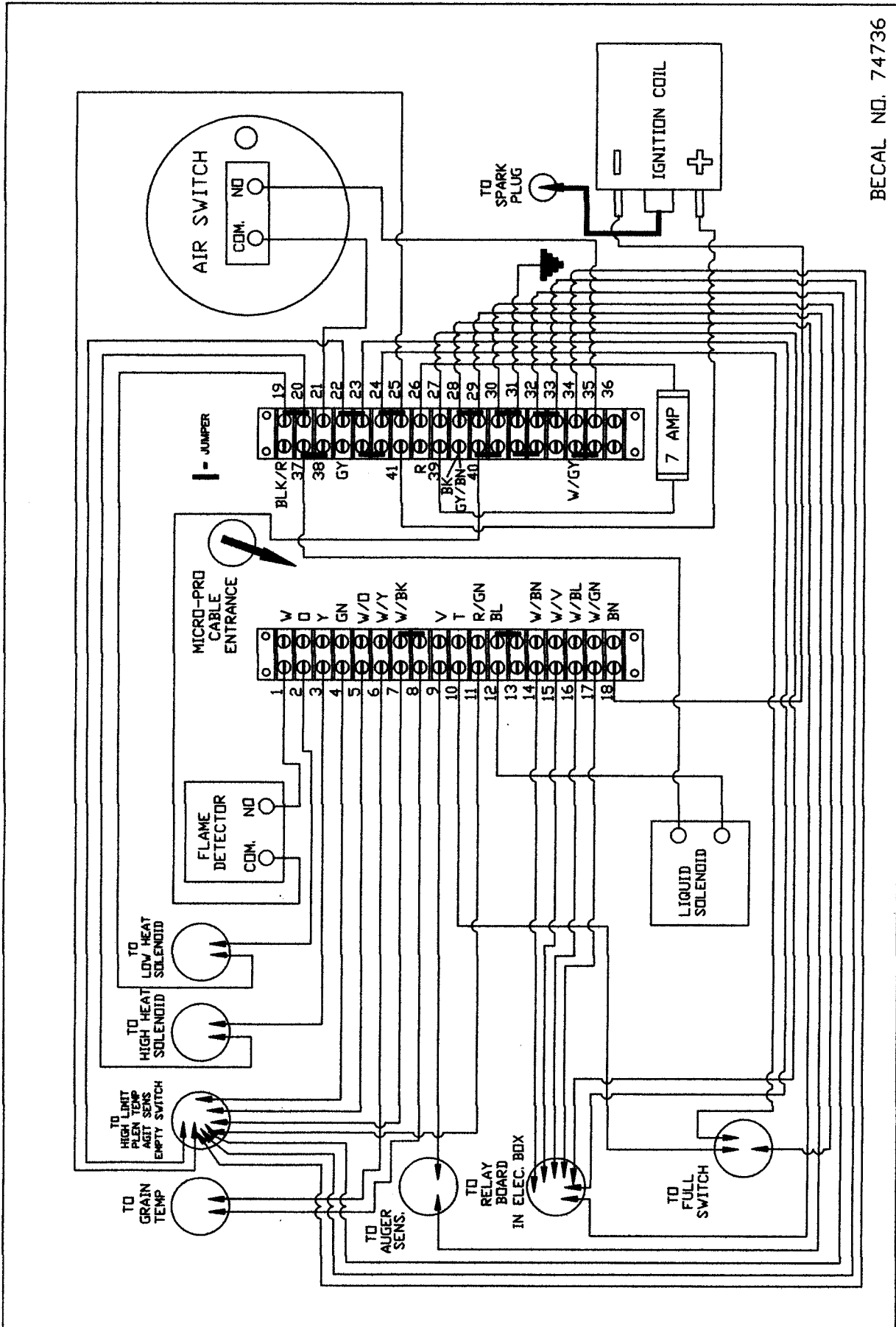
BECAL NO. 74736

TERMINAL BLOCK KEY
RAB

1. Flame Detector (N.O.) - Black
2. Low Heat Solenoid - Black
3. High Heat Solenoid - Black
4. Agitator Sensor - White/Blue
5. Plenum Tem. Sensor - White/Orange
6. Grain Temp. Sensor - White/Orange
7. Plenum Temp. Sensor - White/Black
8. Grain Temp. sensor - White/Black
9. Auger Sensor - Brown
10. Full Sensor - Black
11. Empty Sensor - Black
12. Liquid Solenoid - Black
13. Liquid Solenoid - Black
14. Relay Panel #6 - Red (Auger Control)
15. Relay Panel #5 - White (Fan Control)
16. Relay Panel #4 - Brown (Load Control)
17. Relay Panel #3 - Yellow (Unload Control)
18. Ignition Coil (Neg.) - White
19. Low Heat Solenoid - Blue
20. High Heat Solenoid - Blue
21. Air Switch (Common) - White
22. High Limit Switch - White/Black
23. Relay Panel #1 - Green
24. Full Switch - Brown
25. Empty Switch - Brown
26. Fuse - 7 AMP
27. 12 VDC Positive - Yellow
28. 12 VDC Negative - Brown
29. Auger Sensor - Yellow
30. Full Sensor - Blue
31. Earth Ground - Green
32. Empty Sensor - Blue
33. Agitator Sensor - White/Black
34. High Limit Switch - Orange
35. Air Switch (N.O.) - Black
36. Open Terminal
37. Liquid Solenoid - Blue
38. Liquid Solenoid - Blue
39. Fuse - 7 AMP
40. Flame Detector (Common) - White
41. Ignition Coil (Pos.) - Black

MICROPROCESSOR CABLE

BK - Black (Ground)
BL - Blue (Liq. Sol.)
BN - Brown (Ignition)
GN - Green (Agitator)
GY - Gray (Common)
GY/BN - Gray/Brown (Common)
O - Orange (Low Sol.)
R - Red (12 VDC Power)
BLK/R - Black/Red (Sol. Com.)
R/GN - Red/Green (Empty)
R/Y - Red/Yellow (Air/High Lim.)
T - Tan (Full)
V - Violet (Auger)

W - White (Flame)
W/BK - white/Black (Plenum)
W/BL - White/Blue (Load Motor)
W/BN - White/Brown (Auger Motor)
W/GN - White/Green (Unload Mtr.)
W/O - White/Orange (Plenum)
W/GY - White/Gray (Com.)
W/V - White/Violet (Fan Motor)
W/Y - White/Yellow (Grain Temp.)
Y - Yellow (High Heat Sol.)

ELECTRICAL CONTROL BOX
WIRING DIAGRAM
RAB 3 PHASE
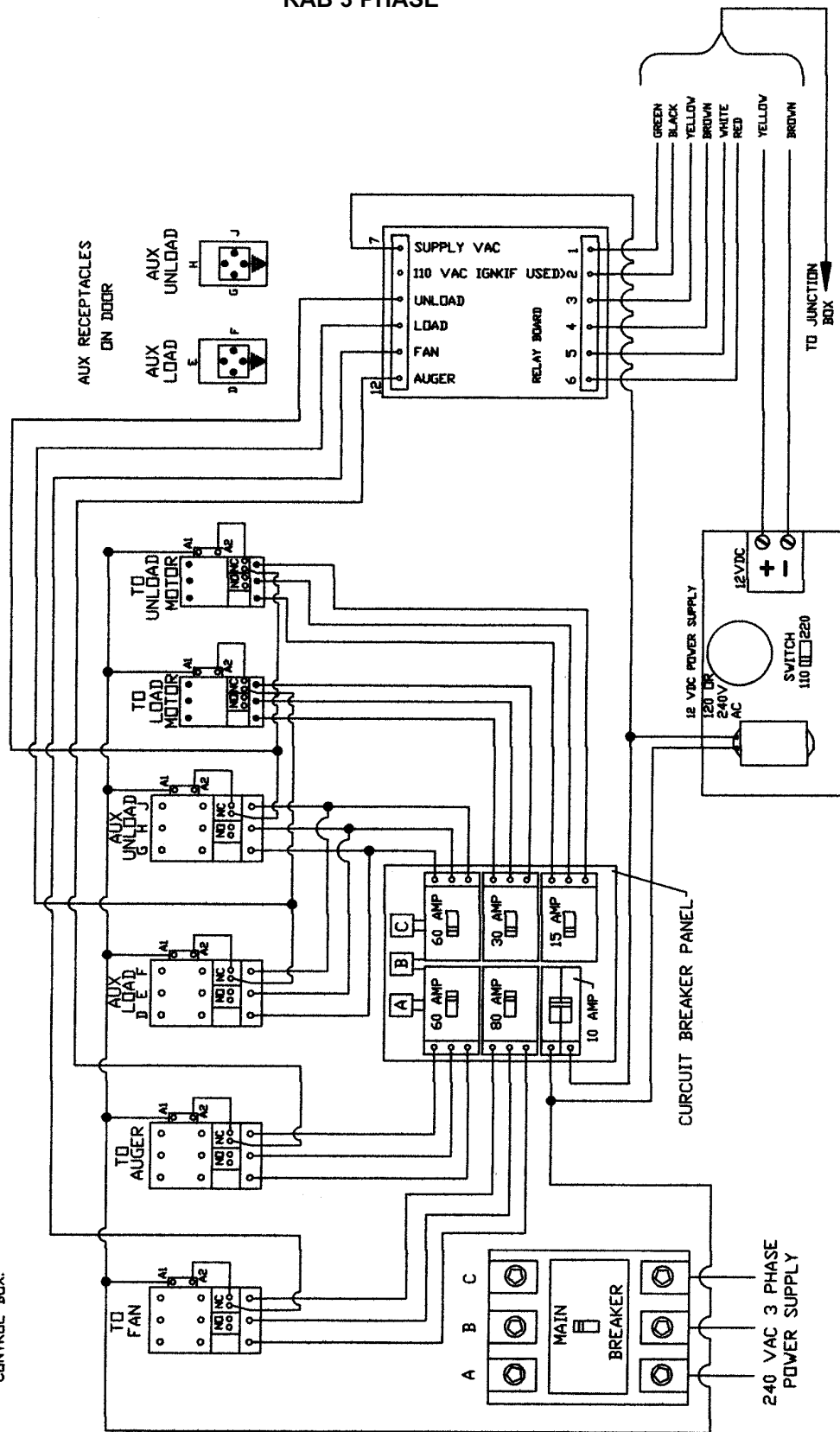
GENERAL OPERATING MAINTENANCE

1. Keep the area clean of shucks, chaff and other combustible foreign material.

2. Keep the fan screen clean.

3. Periodically check the ignition system, all controls and safety shut-off valves for proper operation and gas tightness.

4. Periodically clean the screen in the fuel line strainer.

5. Drain propylene out of oil trap pipe in plumbing weekly.

6. Check all belts for proper tension.

7. Lubricate the machine as outlined on page 12.

8. Make certain dryer weight is evenly supported by jacks.

9. Depending on operating and fuel conditions the burner ports may need to be cleaned periodically. Working from the inside the plenum chamber and using a 5/64" diameter drill bit or torch tip cleaner open up the burner ports.

10. ⚠ Keep all safety labels and operating instructions clean and legible. If any label becomes worn, damaged, or illegible, replace it immediately.

11. ⚠ Replace all shields/guards removed for service before operating the machine.

REMEMBER: An ounce of prevention is worth a pound of cure!

MICROPROCESSOR AND SENSOR MAINTENANCE

WARNING: DO NOT OPEN THE MICROPROCESSOR ENCLOSURE! There are no owner serviceable components. Service is to be done by authorized personnel only. See your authorized GT dealer.

1. Disconnect the microprocessor unit (See page 11) BEFORE servicing any motion or temperature sensor. Failure to do so may result in permanent damage to the microprocessor.

2. When the dryer is not in use store the microprocessor unit in a cool, dry place free of dust. This will help to insure long, trouble free service from your microprocessor.

3. The correct spacing between the motion sensors and magnets is 0.125 inch. The unit will function properly if the clearance is less than this but should they come into contact the sensors would be destroyed.

4. The temperature sensors are polarized and must be installed properly. See the wiring diagram, page 41, for proper wire locations. Should the wires become reversed, the dryer will not ignite. The sensors are seen as "HOT" and ignition is prevented.

5. It is important to keep your electrical supply to the dryer in peak operating condition.

6. The spark plug wire is a carbon filled cable. If the spark plug wire is ever replaced on the machine it must be of this type. The metal conductor in other types of spark plug wires causes excessive electrical "Noise" which inhibits the operation of the processor.

7. Overheating of the plenum is protected against by two systems, the microprocessor and a thermostat located inside the plenum. Should the thermostat be activated, the switch will open and operation will cease. The thermostat must cool before the operation can resume.

PREPARING DRYER FOR STORAGE

1. If dryer remains connected to the fuel supply, close the shut-off valve at the tank and the ball valve and quick acting valve at the dryer.

2. Remove the microprocessor. Store in a cool, dry place free of dust.

3. With masking tape or equivalent, seal holes in air switch tube, any openings in the fuel system, and the microprocessor cable end just removed.

4. Open clean out door in bottom well, clean out all grain, leave door open.

5. Remove belts. Store in a cool, dry place.

6. Brush protective coating of oil on chains and belt surfaces of pulleys.

7. Lubricate all bearings. See chart on page 12.

8. Inspect for worn or damaged parts which should be replaced before being used again.

⚠ Replace any safety or operating label that has become worn, damaged or illegible.

9. Set jacks to support dryer weight.

10. Lock electrical disconnect in the "OFF" position.

PREPARING DRYER FOR USE - OUT OF STORAGE

1. Remove masking tape covering openings.

2. Connect microprocessor control cable and mount microprocessor to the dryer.

3. Replace and tighten belts.

4. Make certain bottom well is clean and close clean out door just prior to using.

5. Lubricate all bearings. See chart on page 12.

6. Close access door.

7. Check burner ports and clean if necessary. See General Operating Maintenance.

8. Test fire the burner and check out all controls to make sure they are working properly before grain is added to the dryer.

9. Level dryer and make certain the weight is equally distributed on the jacks.

TRANSPORTING THE DRYER

⚠ DANGER

Be alert to overhead obstructions and wires. Failure to do so may result in serious injury, electrocution or death. Removal of top auger section is recommended before towing.

⚠ CAUTION

OBSERVE THE FOLLOWING RULES WHEN TRANSPORTING THE DRYER.

1. Make certain the hitch pin is securely attached and an alternate hitch safety chain is secured to the dryer and towing vehicle.

2. Do not transport the dryer at speeds in excess of 20 MPH (32 KPH) and comply with any local regulations governing marking, towing and maximum width.

3. Do not transport the dryer after dark or during periods of poor visibility.

4. Maintain proper tire pressure. (Refer to tire manufacturer's recommendations on the sidewall.)

5. Make certain the microprocessor is securely fastened to the dryer. If the dryer is to be towed any distance the microprocessor should be removed from the dryer and safely stored.

TROUBLE SHOOTING

WARNING: CAUTION SHOULD BE EXERCISED WHEN CHECKING CONTROL PANEL. USE VOLT METEF TEST LIGHT.

WARNING: DISCONNECT THE MICROPROCESSOR BEFORE SERVICING THE ELECTRICAL OR SENSOR SYSTEMS. FAILURE TO DO SO MAY RESULT IN PERMANENT DAMAGE TO THE UNIT.

Reconnect the microprocessor cable and make certain that it is tight before attempting to restart the drye

Problem A.   BURNER WILL NOT LIGHT.

Probable Cause

1.   Check the microprocessor display for error message. If given, correct and proceed.
2.   Are both tank and dryer fuel valves open?
3.   Check that the in-line fuse has not blown.
4.   Is the grain temperature above the grain temperature setting?
5.   Check to see that the solenoid valves are opening. When "FLAME" appears on the display th solenoid vales should open. If the valves open there should be a pressure reading on the pressure gauge.
6.   Display returns to "IDLE" just as "FLAME" appears on display. Attempt to restart the dryer carefully watching the display. If insufficient voltage is being applied to the dryer, the error message "VOLTS LOW" will very briefly flash on the display and then "IDLE" will appear.
7.   Air switch not closing ("AIR" displayed on screen). Remove and clean or replace air switch t
8.   Check for plugged oriface.
9.   Possible loose wire connection.
10.   Gas pressure too low. Up to 5 PSI for ignition may be required for propane.
11.   Gas pressure too high. 30 PSI is near maximum for ignition with propane burner.
12.   System improperly grounded Check lead wire connections at terminal block.
13.   Check plug for spark. If no spark check the following after disconnecting power to the systerr
    a. Check spark gap. Gap should be 3/32" + or — 1/32". If plug is carboned at the points, cl replace after checking gap.
    b. Check high voltage lead wire for cracks or breaks, and replace if necessary.
    c. Check that the high voltage lead wire is not too close to a metal surface to insure that arc will not occur at any point other than across the high voltage electrode at the ignitor.
14.   Check the fuel strainer.
15.   If flame sensor is shorted or closed circuit, burner will not light.

Problem B.   BURNER LIGHTS BUT PRESSURE WILL NOT EXCEED 5 TO 6 PSI AND/OR HAS EXCESSIVE FLUTTERING.

Probable Cause
1.   Vapor solenoid malfunctioning.
     Solution:
     Disassemble solenoid body and remove diaphram. If diaphram is oily or dirty, wipe clean and replace. If diaphram is ruptured replace with new diaphram.
2.   Pressure regulator malfunctioning.
3.   High Heat solenoid is not opening. Check wire connections. If still does not open, disassemble and clean solenoid valve.

Problem C.   BURNER IGNITES BUT GOES OUT DURING OPERATION

Probable Cause
1.   Electrical connection may be loose.
2.   Worn insulation or wet wires may be grounding.
3.   Excessive flow valve at tank may be closing.
4.   Check for stoppage in air switch tube. ("AIR" indicated on display.) Remove tube from switch and clean or replace.
5.   The flame detector bulb is not sensing flame at the burner. The flame detector must sense enough heat from the flame to close its contacts before the 90 second ignition period has elapsed. If the flame detector is not closing it will be necessary to adjust the sensor bulb mounted to the burner so that it picks up more heat from the flame. To do this adjust the bulb so that it protrudes into the burner 3/8'' to 1/2''. Do not over-tighten the locking nut on the flame detecting bulb.
6.   Inaccurate plenum temperature sensor. "PLENUM" appears on the display.

Problem D.   UNCONTROLLABLE HEAT.

Probable Cause
1.   Cracked Vaporizer.
2.   Ruptured gas line.

Problem E.   TRASH OR GRAIN FIRE.

Probable Cause
1.   Excessive plenum temperature.
2.   Trash build-up in plenum.
3.   Poor circulation due to agitator being out of operation or adjustment.
4.   Ruptured gas line or vaporizer.
5.   Improper burner and baffle adjustment. Shut off gas supply.

Problem F.   GAS WILL NOT SHUT OFF IMMEDIATELY WHEN POWER IS SHUT OFF.

Probable Cause
1.   Perforated diaphragm in vapor solenoid valve.
2.   Plunger upside down on vapor solenoid valve.
3.   Lack of diaphragm in vapor solenoid valve.

Problem G. AGITATOR DRIVE CHAIN OFF

⚠ **DANGER**

Do not open inspection door or enter machine while in operation.

Probable Cause
   1. Roller stuck — seized bearing — may be flat on one side.
   2. Too much horizontal play between agitator race and rollers.
   3. Agitator drive sprocket out of line.
   4. Too slack a chain.
   5. Excess feeding of loading auger causing grain level to rise above agitator. (Close grain flow regulator slightly to reduce feed rate.)

Problem H. AUGER STOPPAGE

Probable Cause
   1. Slack belt.
   2. Block of wood or rock lodged between auger flight and housing.
   3. Extremely wet grain standing over night.
   4. Bottom auger bearing frozen.

Problem I. EXCESSIVE DRYING TIME

Probable Cause
   1. Plenum temperature too low for conditions.
   2. Inaccurate plenum temperature sensor.
   3. Poor circulation of grain.
   4. Dirty or trashy grain.
   5. Hard to dry variety. (Thick seed coat.)
   6. Incorrect fan speed.
   7. Adverse weather conditions.
   8. Recirculation of exhaust air from dryer back into plenum.

Problem J. POOR GRAIN CIRCULATION

Probable Cause
   1. Fan speed above that recommended.
   2. Build up of foreign material, especially in bottom section of dryer.
   3. Agitator not operating. ("AGITATOR" indicated on the display.)

MICROPROCESSOR CONTROL SYSTEM

See page 36 for a complete listing of the error messages given by the microprocessor.

WARNING: DISCONNECT THE MICROPROCESSOR BEFORE SERVICING THE ELECTRICAL OR SENSOR SYSTEMS. FAILURE TO DO SO MAY RESULT IN PERMANENT DAMAGE TO THE UNIT.

Reconnect the microprocessor cable and make certain that it is tight before attempting to restart the dryer.

1. Low Voltage: The microprocessor requires 12 volts DC to operate properly. If this is not available, operation will cease at that point and "VOLTS LOW" will flash on the display.

   Probable Cause:
   A. A loose or poor connection
   B. Power supply not functioning properly. Check, repair or replace.

2. Rotational Sensor Failure: The microprocessor may indicate an error even though the component (Auger, Agitator) seems to be functioning properly.

   DISCONNECT THE MICROPROCESSOR BEFORE SERVICING MOTION SENSORS!

   Probable Cause:
   A. Sensor failure. To check the switch, line up the sensor and the magnet then using a volt meter or continuity tester, see if there is continuity across the corresponding lugs on the terminal block. There should be a signal. Now rotate the magnet a quarter turn past the sensor and check the continuity again. If everything is working properly there should be no continuity.
   B. Sensor out of adjustment. There should only be 0.125 inch between the magnet and the rotational sensor. Distances greater than this will give a weak signal and may not activate the sensor.
   C. Loose or poor connections at either the terminal block or the sensor connection.

3. Spark Plug Wire: Should the spark plug wire become damaged and need to be replaced it is important that a carbon filled cable and not a solid wire conductor be used. A wire conductor will cause excessive electrical "Noise" inhibiting the operation of the machine.

4. Inaccurate Temperature Readings:

   Probable Cause:
   A. Loose or poor connection.
   B. Wires hook up backwards. The temperature sensor wires are polarized and must be hooked up correctly. See wiring diagram on page 43.
   C. Temperature sensor failure:
      1. If the sensor shorts out, the microprocessor will see this as an extremely cold condition and will try to bring the temperature up. "PLENUM LOW" will appear on the display if the plenum sensor fails.

      2. If the sensor opens, the microprocessor will see this as an extremely hot condition and shut the dryer down. If the plenum sensor fails "PLENUM" will appear on the display. "GRAIN" will appear if the grain sensor fails.

      3. If the sensor falls out of calibration a faulty temperature will be given. This should be detectable by observation. If the plenum can not achieve the preset value, check the plenum temperature sensor. If the microprocessor says the grain is dry and the grain is still cold check the grain temperature sensor.

      4. If the high limit switch opens, the display will show "PLENUM" and operation will stop.

GRAIN	USED FOR	PLENUM TEMP.	GRAIN TEMP.	DRYING TIME	COOLING TIME

POWER FRAME ASSEMBLY
THREE PHASE
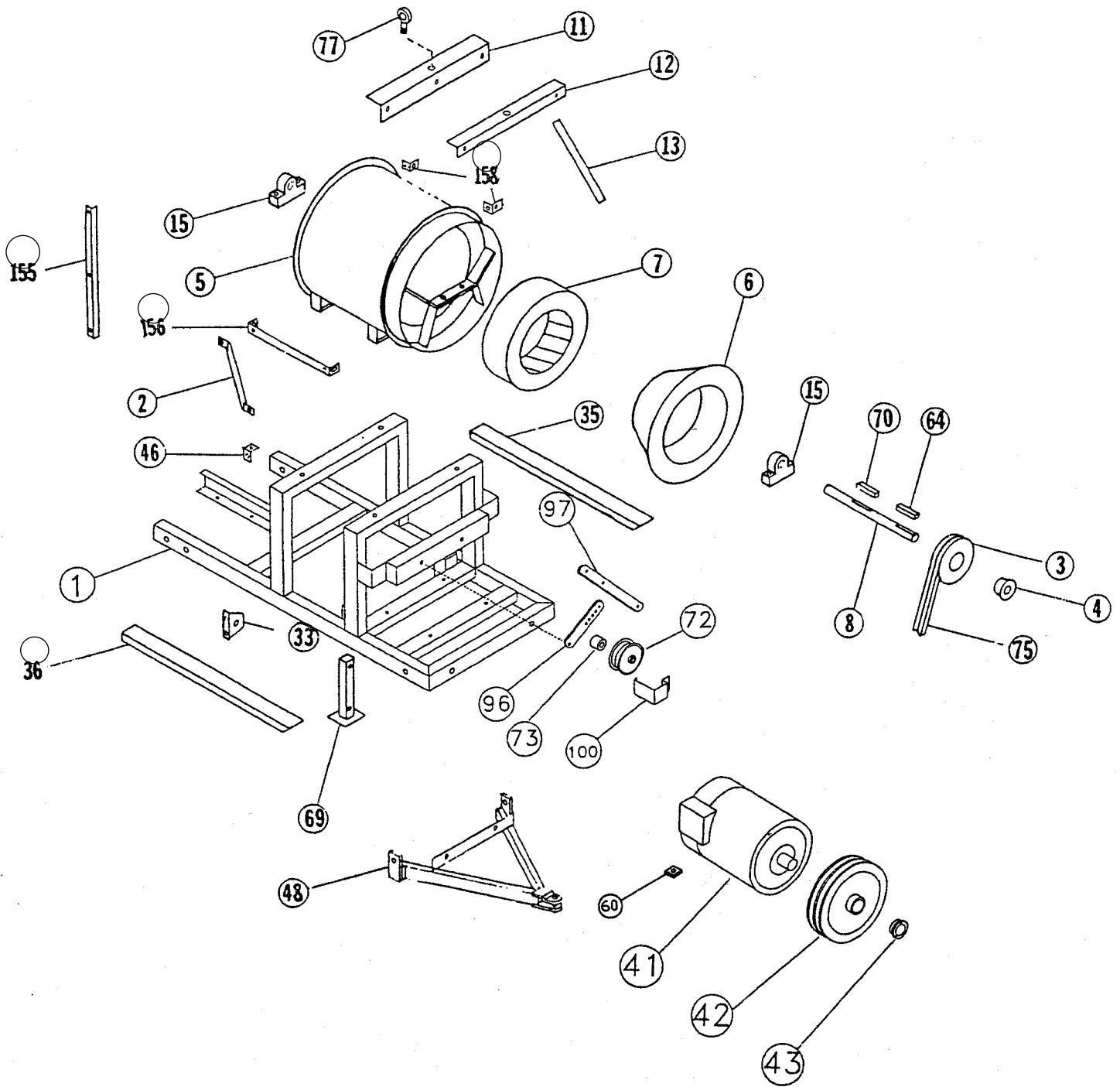
REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D50476	1	Frame, Power
2	D52022	2	Brace, Power Frame
3	76052 (US)	1	Sheave, 2B 9.4 PD
3	76046 (UK)	1	Sheave, 2B 8.0 PD
3	76070 (UK)	1	Sheave, 2B 8.6 PD Lg. Plenum
4	76002	1	Hub, 2.0" SK
5	76156	1	Housing, In Line Fan
6	D57300	1	Venturi, In Line Fan
7	D52072	1	Fan
8	D52082	1	Shaft, 1L 2"
11	D57100	1	Support, Large Top Panel
12	D57105	1	Support, Small Top Panel
13	D57200	4	Brace, Top Panel
15	85019	2	Bearing, 2" Pillow Block
33	D57225	4	Support, Wrapper
35	D57120	1	Support, Lwr. Panel Left
36	D57111	1	Support, Lwr. Panel Right
41	52-10080	1	Motor, 15 H.P. 220/440 3o TEFC
42	76052	1	Sheave, 2B 0.4 PD
42	76052 (UK)	1	Sheave, 2B 11 PD Lg Plenum
43	76055	1	Hub, 1.625 SK
	76034 (UK)	1	Hub, 42 mm SK
46	D57315	1	Brace, Junction Box
48	D52463	1	Hitch
	D52464 (UK)	1	Hitch
60	D50795	8	Spacer, 2 x 2 x 3/8
64	73424	1	Key, ½ x½ x 3-7/8
69	D50570	2	Jacks
	D21022	2	Adjustable Jacks (optional)
70	73419	1	Key, ½ x ½ x 2¼
72	42-16336	1	Pulley, Idler
73	D32220	1	Spacer
75	D32272	1	Belt, 2RB 133
75	D32273	1	Belt, 2RB 136
77	71941	2	Eyebolt, ½ x ½
96	D50720	1	Link, Idler
97	D50715	1	Arm, Idler
100	D32260	1	Guide, Belt
155	D37075	2	Brace, Panel
156	D57285	1	Bracket, Rt. Fan Guard
158	D37285	2	Bracket, LH Fan Guard

POWER FRAME ASSEMBLY
THREE PHASE

DRAWING NO.
M5004
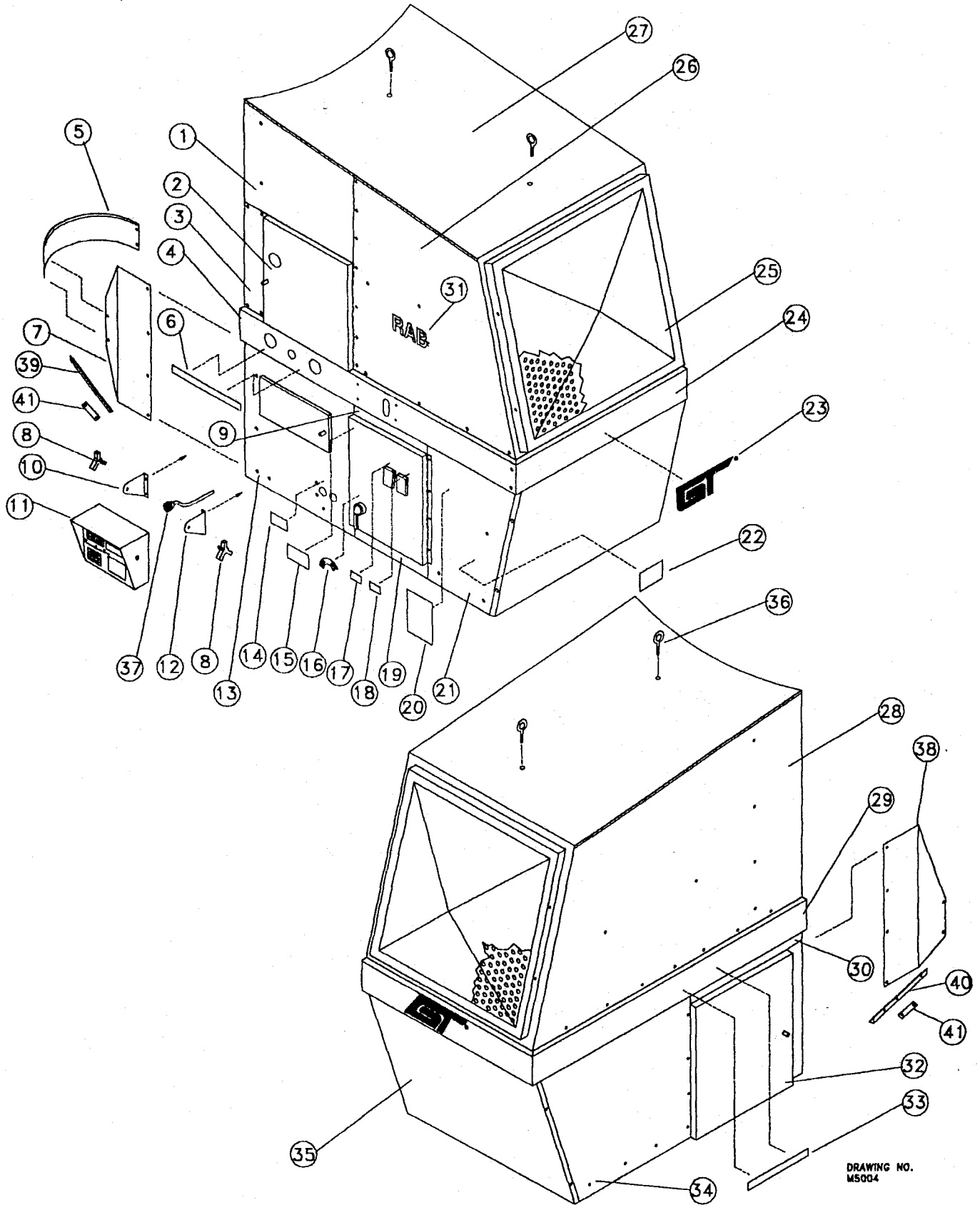
REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D57435	1	Panel, Upper Rear Rt.
2	D37261	1	Door, Rt Upper
3	D57340	1	Panel, Lower Rear Rt.
4	D52892	1	Wrapper, Rt. Power Frame LP
4	D52897	1	Wrapper, Rt. Power Frame NG
5	D50750	1	Guard, Auger Mtr. Belt
6	74620	1	Decal, Valve
7	D50166	1	Shield, Jack shaft Rt.
8	77235	2	Knob, Mounting
9	D50755	1	Filler, Top Electric Box
10	D25845	1	Mount, Rear Box
11	DA25004	1	**Grain Guard Dryer Controller**
12	D25840	1	Mount, Front Box
13	D50211	1	Panel, Rt. Lwr. Rear
14	73661	1	Decal, Danger LP Gas Supply
15	74676	1	Decal, Danger Electrocution
16	74673	1	Decal, On-Off
17	74670	1	Decal, Load
18	74671	1	Decal, Unload
19	D50760	1	Filler, Bottom Elec. Box
20	73682	1	Decal, Be a Safe Operator
21	D50181	1	Panel, Lwr. Rt. Front
22	73981	1	Decal, Electrocution
23	73949	1	Decal, GT Logo
24	D52901	1	Wrapper, Front
25	D57195	1	Grill, Front Fan
26	D57350	1	Panel, Rt. Fan Guard
27	D57170	1	Panel, Top Fan Guard
28	D57180	1	Panel, Left Fan Guard
29	D52131	1	Wrapper, Left Power Frame
30	D57265	1	Filler, Door
31	74683	2	**Decal, RAB**
32	D57260	1	Door, Left
33	74705	1	Decal, Grease Line
34	D57160	1	Panel, Left Lwr. Frnt.
35	D50765	1	Panel, Lower Front
36	71941	2	Eyebolt, ½ x 1 ½
37	77579	1	Cable, Micro Pro
38	D50161	1	Shield, Jackshaft Left
39	D50346	1	Angle, RT. Jackshaft
40	D50341	1	Angle, LT. Jackshaft
41	D50560	2	Strap, Jackshaft Angle Mount

BURNER ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D57210	1	Tube, Burner (Propane)
2	D52303	1	Burner, Ring (Propane)
3	D52520*	1	Ring, Flame Deflector
4	D22320	1	Spark Plug
5	57001279*	1	Vaproizer, Ring
6	57001242	2	Bracket, Vaporizer
7	71959	3	Bolt, Burner Mt.
8	D22462	1	Window, Plexiglass
9	D57545	1	Tube, Outside Liquid to Vapor
10	D57235	1	Tube, Outside Vapor to Plumb.
11	57001268*	1	Tube, Inside Vapor
12	57001267*	1	Tube, Inside Liquid
13	D52374*	1	Tube, Inside Vapor to Burner
15	D52404	1	Orifice - LP
16	D32301*	1	Holder, Orifice
18	73086*	7	Adapter, ½" P. to ½" T. Union
19	71028*	4	Capscrew, 5/16" x 1¼" Hex
21	D37330	3	Coupler, Union Brkt.
22	71942*	4	Screw, No. 14 x ¾" Metal
23	73270	2	Grommet, 3/8" I.D. Rubber
24	74155	1	Adapter, Fan
25	72035	2	Screw, No. 8 x ¼" Metal
27	77100*	1	Nut, Conduit
28	D37231	1	Tube, Outside, Vapor to Burner
30	72947	1	Tee, ½" x ½" x ½" N.P.T.
31	72928*	1	Nipple, ½" x 13"
32	72949	1	Reducer, ½" x ¼"
33	72633*	1	Plug, ¼" N.P.T.
34	57001241	1	Mount, Spark Plug
35	D32130	1	Bracket, Flame Detector Bulb Mount
36	72797*	1	Nipple, ½" x 4½" XH
38	72946	2	Elbow, ½" x 90° St.
51	D32370	1	Shield, Burner (Propane)
52	D37206	1	Cover, Hole
53	73101	1	Adapter, 90°

NOTE: *Propane Burners Only

PROPANE CONTROL CABINET ASSEMBLY
THREE PHASE
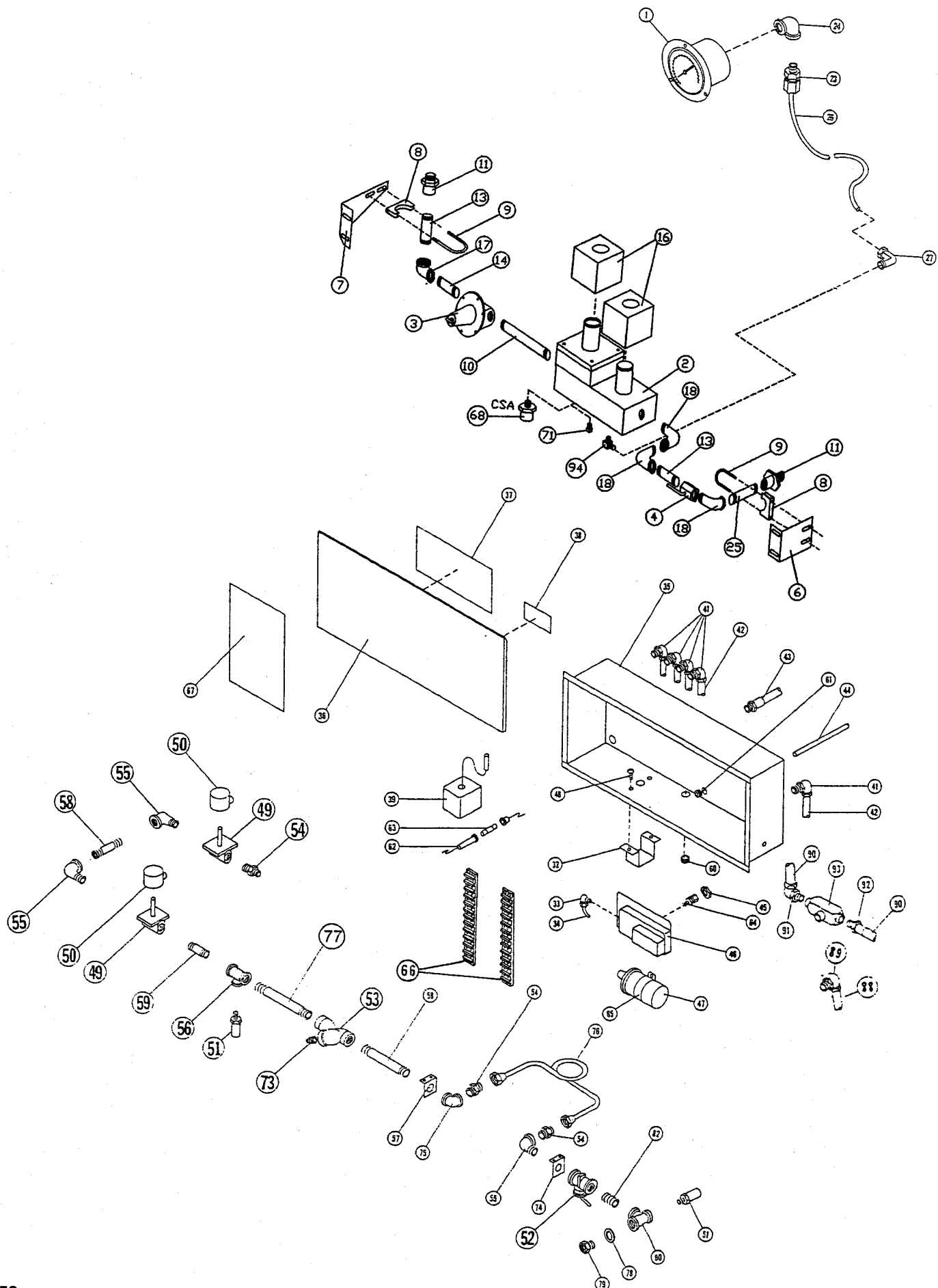
REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D25102	1	Gauge, Pressure
2	77587	1	Valve, Solenoid Valve
	77576	1	Kit, Diaphram Valve
	77578	1	Kit, Direct Valve 3/16 Seat
3	D25191	1	Regulator, ½ Pressure
4	57001285	1	Valve, Ball
6	D25620	1	Bracket, Front plumbing
7	D25632	1	Bracket, Rear plumbing
8	D25610	2	Clamp, ½" Saddle
9	71987	2	V-Bolt
10	72799	1	Nipple, ½ x 6 Sch 80
11	73071	2	Connector, ½ T to ½ Pipe
12	D22416	1	Orifice, .125
13	72792	2	Nipple, ½" x 2"
14	72791	1	Nipple, ½" x 1.5"
16	D77575	2	Coil, Solenoid
17	72945	1	Elbow, ½ Sch 80
18	72858	3	Elbow, ½ Street
23	73110	1	Connector, ¼ Tee to ¼ Pipe
24	72841	1	Elbow, ¼ x 90 Deg.
25	72793	1	Nipple, ½ x 2.5"
26	D55310	1	Line, Pressure Gauge
27	73128	1	Elbow, 90 deg. Brass
32	D25251	1	Bracket, Plumging
33	73125	1	Elbow, 3/16 T to 1/8 Pipe 90 Deg.
34	D22250	1	Line, Air Switch
35	D50411	1	Box, 3ø Junction
36	D25512	1	Door, Junction Box
37	74736	1	Decal, J Box Wiring Diagram
38	74695	1	Decal, Terminal Block
39	D25161	1	Detector, Flame
41	73159	5	Connector, 3/8" x 90 Deg.
42	73166	Per ft.	Conduit, 3/8" Liquidtite
43	73157	1	Connector, 3/8" Straight
44	D32020	1	Tube, Air Switch
45	72279	1	Nut, 1" NF Hex
46	K25030	1	Air Switch
47	77228	1	Coil
48	71683	2	Screw, 10-24 x ½" Machine
49	77192	2	Body, 3/8 NPT Solenoid Valve
50	D25522	2	Coil, Solenoid Valve 12 VDC

PROPANE CONTROL CABINET ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
51	D25240	2	Valve, 1/4" NPT relief
52	D25120	1	Valve, 3/8" NPT Quick Acting
53	D25280	1	Strainer, 3/8" NPT
54	73085	3	Connector, ½ tube to 3/8 MNPT
55	72944	3	Elbow, 3/8 NPT Street
56	72956	1	Tee, 3/8 NPT
57	D25271	1	Bracket , plumbing
58	72784	2	Nipple, 3/8 NPT x 3 XH
59	72781	1	Nipple, 38 NPT x 1.5 XH
60	73278	2	Grommet
61	73270	2	Grommet
62	77188	1	Holder, in-line fuse
63	77268	1	Fuse, 7 AMP
64	73110	1	Fitting, 1/4 T to 1/4 pipe
65	77229	1	Bracket, Coil
66	77309	2	Block, Terminal
67	74724	1	Decal
68	74164	1	Pop-Off, 45 PSI
	72918	1	Bushing, ½ to 1/4
69	72796	1	Nipple, ½ x 4
70	72909	1	Tee, ½ x 1/4 x ½
71	73146	1	Plug, 1/4 NPT Brass
73	72653	1	Plug, 3/8 NPT
74	D25275	1	Bracket
75	72948	1	Elbow, 3/8 NPT
76	D57242	1	Tube, Liquid Copper
77	72787	1	Nipple, 3/8
78	72595	1	Washer
79	90037	1	Connector, ½ hose to 3/8 NPT
80	72956	1	Tee, 3/8x1/4x3/8 NPT
	72890	2	Bushing, 3/8 x 1/4 Reducer
82	72780	1	Nipple, 3/8 close
88	73164	1	Connector, 3/4 x 90 deg.
89	73733	Per ft.	Conduit, liquidtite 3/4
90	73735	Per ft.	Conduit, liquidtite ½
91	73165	1	Connector, ½ x 90 deg.
92	73163	1	Connector, ½ straight
93	77106	1	Tee, conduit ½
77540 {	77245	Per ft.	Wire, Spark Plug
	73268	1	Terminal, Spark plug
	77249	1	Terminal, Striaght
	77250	1	Boot

POWER UNIT
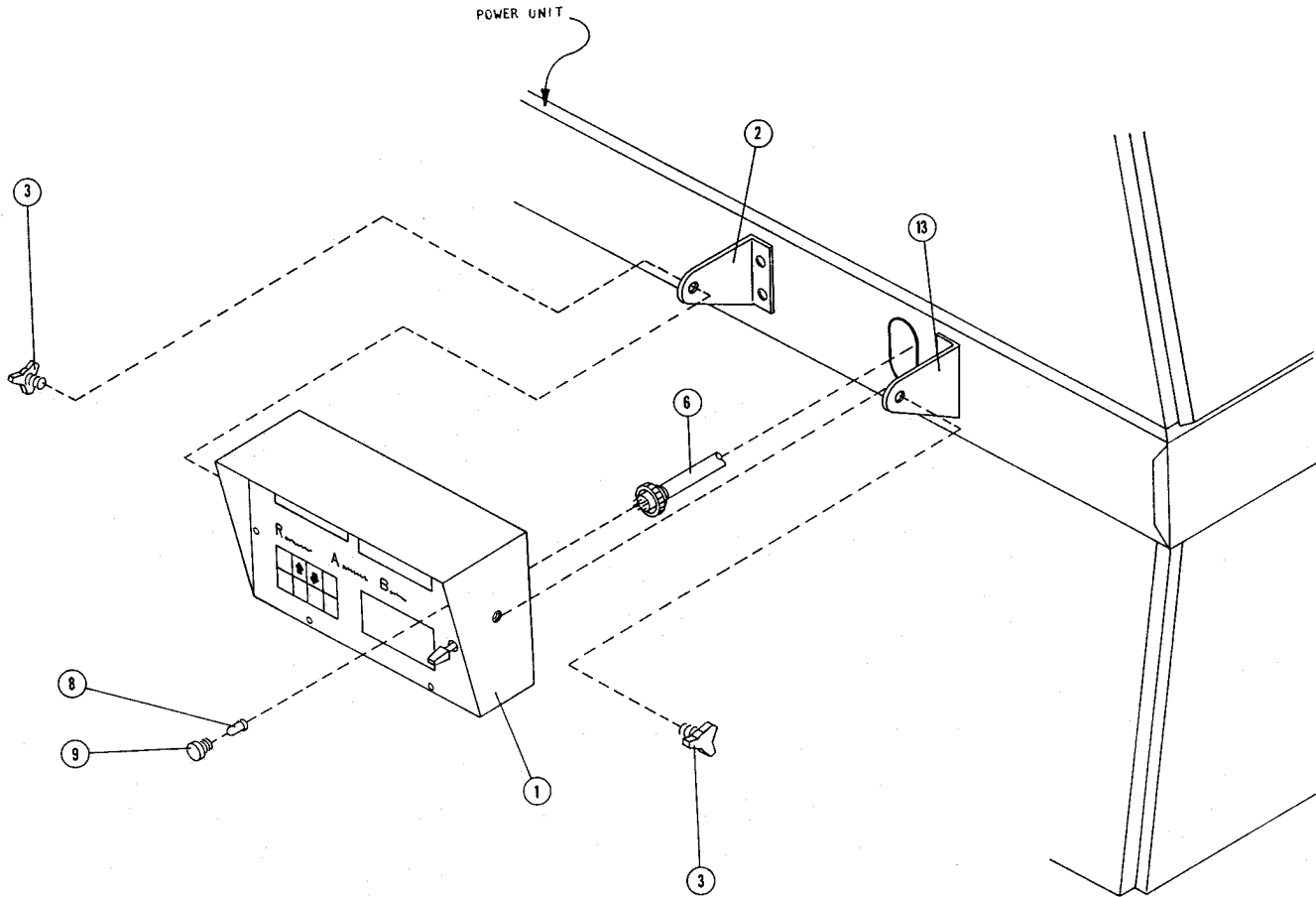
REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	DA25004	1	Grain Guard
2	D25845	1	Mount, Rear Box
3	77235	2	Knob, Adjusting
6	77579	1	Cable
8	77239	1	Lamp
9	77238	1	Lens
13	D25840	1	Mount, Front Box

SOLENOID VALVE ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION
60	77507	Kit, 3/8" Solenoid Valve Diaphram Repair
60	77506	Kit, ½" Solenoid Valve Diaphram Repair
60	77506	Kit, 1" Solenoid Valve Diaphram Repair (Natural Gas)
62	D25542	Coil, 12 Volt Solenoid Valve, 27" Leads w/Forks
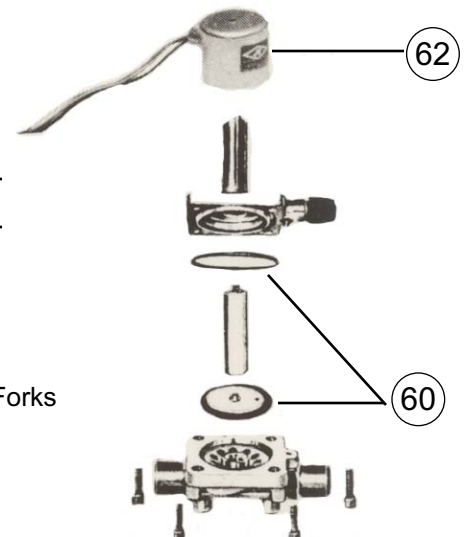
FRAME ASSEMBLY
THREE PHASE
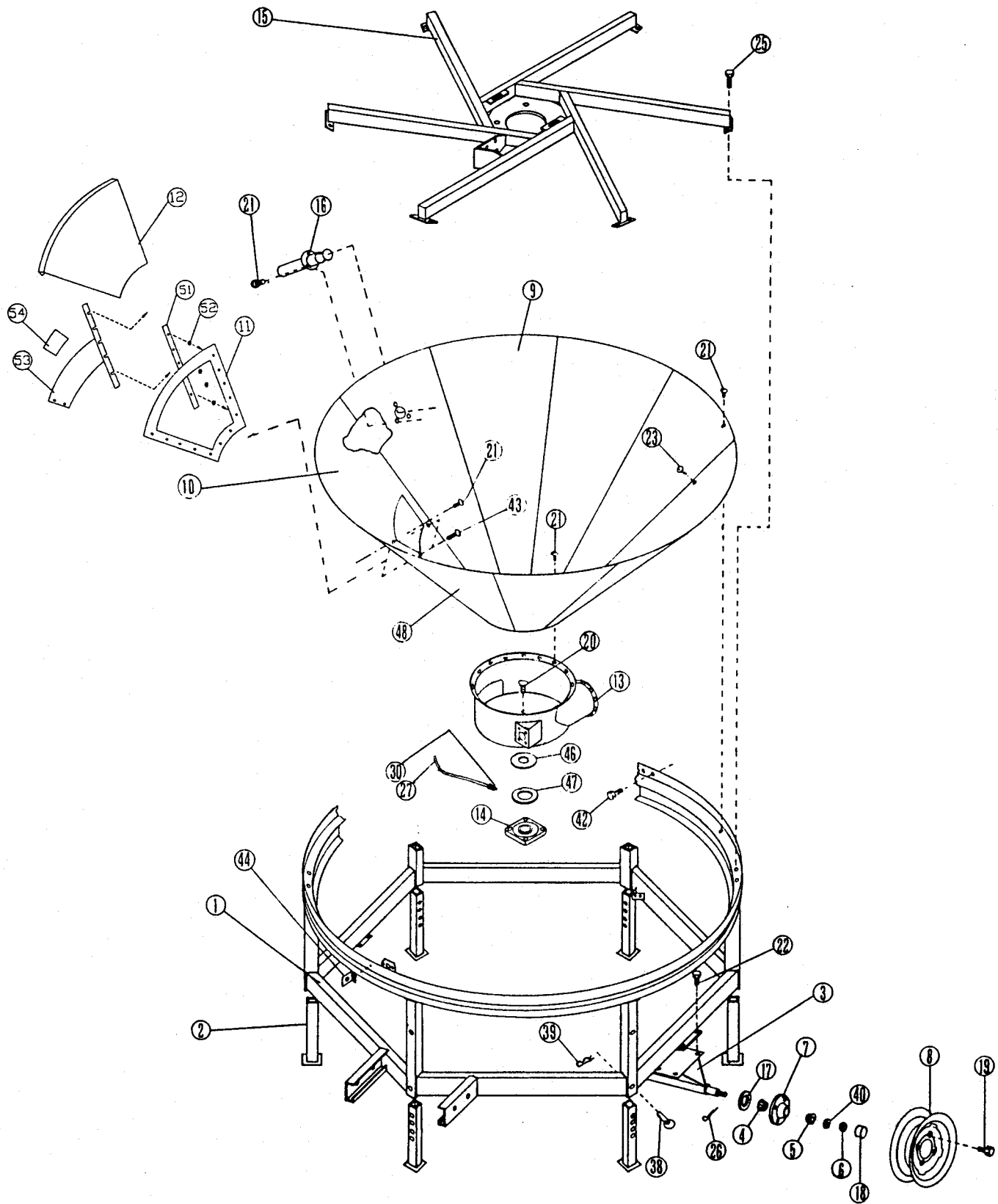
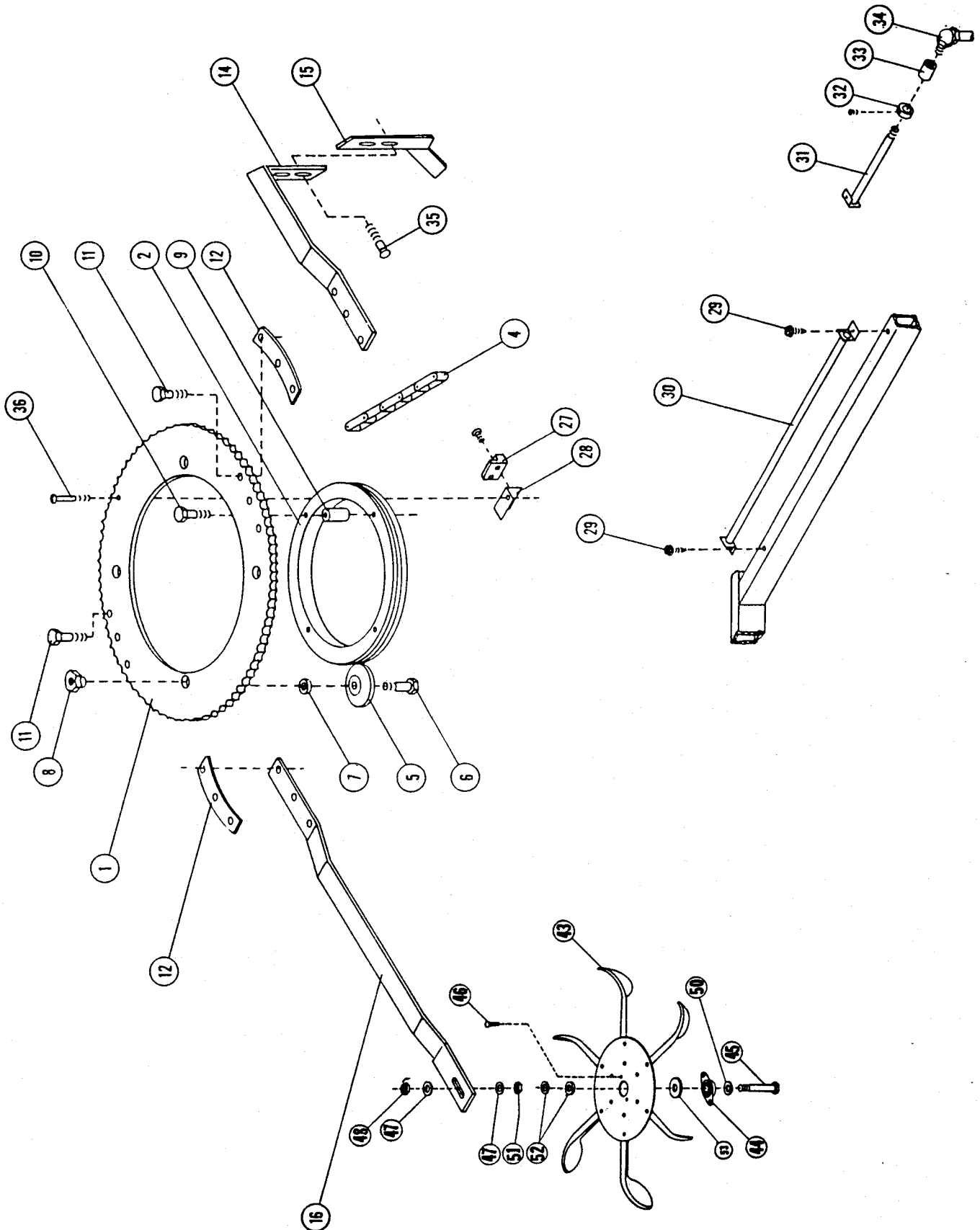| REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D50480	1	Main Welded Frame Less Hitch
2	D21021	6	Jack
	D21022	6	Adjustable Jack (Optional
3	D51032	2	Axle Assembly
4	42-220149	4	Inner Bearing
5	D21050	4	Outer Bearing
6	D21060	4	Nut
7	D21075	4	Hub with Bearing Cups
8	D21080	4	Wheel Rim 15"
	D21085	4	Tire, Tube & Rim (Mounted)
9	D51450	8	Bin Bottom Sheet (Perf, Coated
10	D51460	1	Bin Bottom Sheet w/Access Hole (Perf, Coated)
11	D21123	1	Access Door Frame
12	D21133	1	Access Door
13	D51144	1	Bin Bottom Well w/Boot
14	D21161	1	Bottom Auger Bearing
15	D50485	1	Spider, RAB
15	D50640	1	Spider, RAB KD
15	D50641	1	Spider, RAB Lg. Plenum KD
16	D21182	1	Grain Sampler
17	D21190	4	Seal
18	D21200	4	Cap
19	42-16053	16	Lug Bolt
20	71329	4	Carriage Bolt, ½" x 1½"
21	71823	129	¼" - 20 x ½" Slotted HD Machine Screw
22	71103	8	½" x 1¼" Capscrew
23	71822	150	¼" - 20 x 3/8" Slotted HD Machine Screw
25	71053	20	3/8" x 1¼" Capscrew
26	73527	4	5/32" x 1¼" Cotter Pin
27	73150	Per ft.	Grease Line
28	D21220	1	Grease Line Bracket
29	72840	1	1/8" x 90° Elbow
30	73109	2	1/8" Compression Fittings
31	42-16127	1	1/8" Grease Zerk
38	73586	6	Pin
39	73587	6	Clip
40	72474	4	¾" Washer
42	71054	2	3/8" x 1½" Capscrew
43	71825	2	¼" 0 20 x ¾" Slotted Head Machine Screw
44	D22491	1	Bracket, Conduit
46	73289	1	Seal, 2" I.D. Neoprene Shaft
47	73290	1	Seal, 2.72" I.D. Neoprene Bearing
48	D51400	1	Bin Bottom Sheet (Solid)
51	D21500	1	Track
52	72488	6	Washer, High Lock
53	D21136	1	Bar, Safety
54	74716	1	Decal

AGITATOR ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D28033	1	Sprocket, No. 60, 112 Teeth
2	D28260	1	Race, Agitator
4	D28140	1	Chain, Roller No. 60
5	D28161	4	Roller, Agitator w/ Bearings
	A28000	4	Bearing, Agitator Roller
6	73521	4	Capscrew, 3/4 x 3 3/4 HT
7	72522	4	Washer
8	D28204	4	Nut, Cam
9	D28270	4	Spacer
10	73519	4	Capscrew,7/16x5 HT
11	73504	6	Capscrew, 7/16x2 ½ HT
12	D28082	4	Spacer
14	D50320	1	Arm, Horz. Sect. Vert. Agit.
15	D50290	1	Paddle
16	D50325	1	Arm, Horz. Agit.
27	77247	1	Magnet
28	D25900	1	Angle, Agit. Seneor Mtg.
29	72095	3	Screw, #10 x ½
30	D24250	1	Pipe, Agit. Sensor spider
31	D24260	1	Pipe, Agit. Sensor grain wall
32	D22130	1	Coller, Set
33	72836	1	Coupler, ½
34	73159	1	Elbow, 3/8 Conduit
35	71331	2	Bolt, ½ x 2 Carriage
36	71688	1	Screw, #10 x 3/4
43	D58080	1	Wheel, Rotary agit.
	D58160	1	Disk (for above)
	D58170	6	Paddle (for above)
44	D58293	1	Bearing, Paddle Wheel
	85025	1	Bronze Busing, ¾"
45	75342	1	Capscrew, 3/4 x 4
46	72177	2	Carriage bolt, 3/8 x 3/4
47	72591	2	Washer, 3/4 wide rim
48	72375	1	nut, 3/4 NR Machine
50	72595	1	Bushing, 3/4 NR Machine
51	72256	1	Nut, Jam
52	D28370	1	Bushing, 3/4 Machine Thick
53	72415	1	Washer, 7/8"

AGITATOR DRIVE ASSEMBLY
THREE PHASE
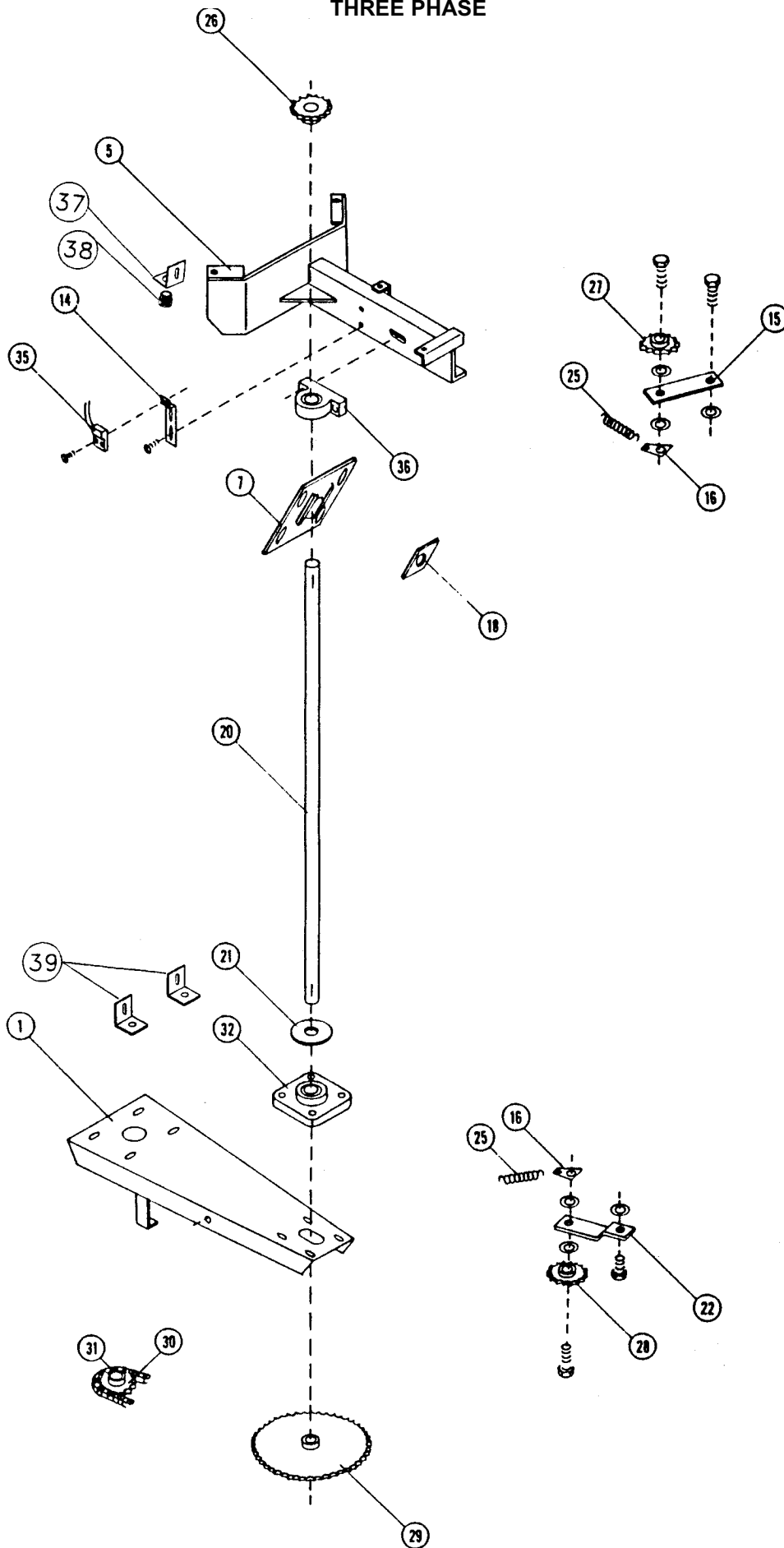
AGITATOR DRIVE ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D50335	1	Support, Lower Agitator Brg.
5	D50315	1	Support, Upper Agitator Brg.
7	D50295	1	Flange, Bin
14	D50470	1	Bracket, Agit. Sensor
15	D28181	1	Arm, Idler
16	D28280	2	Tab, Spring
18	D50300	1	Seal, Nylon
20	D50330	1	Shaft, Agitator
21	73277	1	Washer, Rubber
22	D50565	1	Arm, Idler Sprocket
25	D28190	2	Spring
26	42-68011	1	Sprocket, 60B x 13
27	D28172	1	Sprocket, Idler
28	80034	1	Sprocket, # 50 Idler
29	80032	1	Sprocket, 50B 60T x 1.25
30	80033	1	Sprocket, 50B 11T x 1
31	80035	1	Chain, #50 x 100P
32	42-58052	1	Bearing, 1 1/4 " (4 Hole)
35	77248	1	Sensor, Pick-up
36	D28041	1	Bearing, 1 1/4"
37	D50685	1	Bracket, Conduit Fitting
38	73157	1	Connector, 3/8 Conduit
39	D50710	2	Brace, Bin Well

PLENUM ASSEMBLY
THREE PHASE
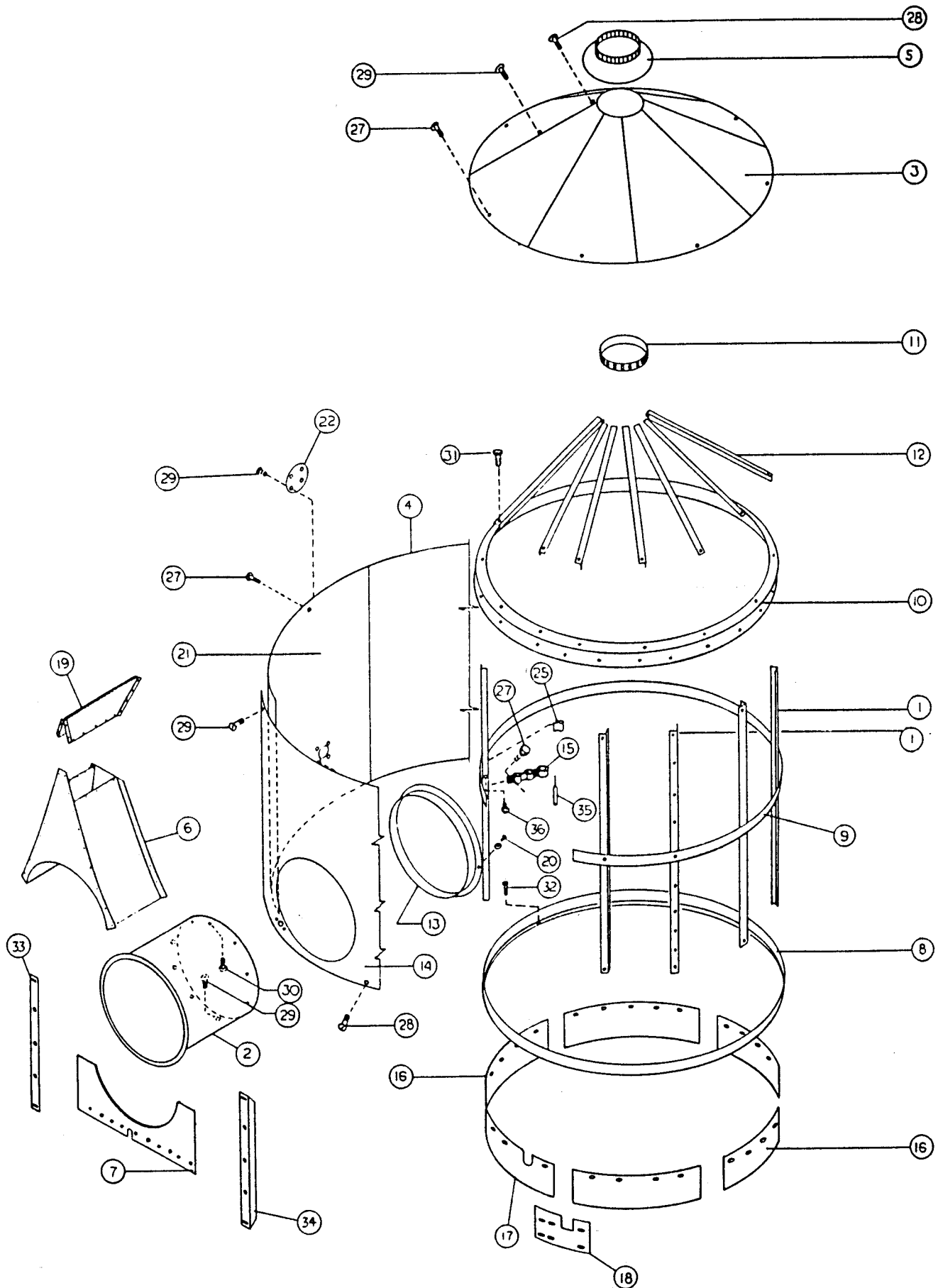
PLENUM ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D33010	31	Plenum Frame Angle
1	D33011	31	Plenum Frame Angle Lg. Plenum
2	D53020	1	Connecting Tube
3	D53342	7	Lid Sheet
4	D53040	4	Side Sheet, Plenum
4	D53041	4	Side Sheet, Plenum Lg. Plenum
5	D23051	1	Cone Cap
5	D23050	1	Cone Cap, Lg. Plenum
6	D53061	1	Saddle
7	D53070	1	Front Enclosure
8	D53080	1	Lower Frame Band
9	D53091	1	Center Band, 1/8" thick
10	D53100	1	Transition Band
11	D53110	1	Top Ring
12	D53120	35	Lid, Frame Angle
12	D63120	35	Lid, Frame Angel Lg. Plenum
13	D53130	1	Connecting Tube Trim Ring
14	D53360	1	Side Sheet w/Connecting Tube Hole
14	D53361	1	Side Sheet w/Connecting Tube Hole Lg. Plenum
	D53150	1	Side Sheet (Narrow Strip)
	D53151	1	Side Sheet (Narrow Strip) Lg. Plenum
15	D23161	2	Thermometer Support Bracket
16	D53172	5	Skirt
17	D53182	1	Skirt with Slot
18	D53192	6	Splices, Plenum Skirt
19	D53160	1	Extension, Saddle
19	D53161	1	Extension, Saddle Lg. Plenum
20	71942	11	No. 14 x ¾" Self Tapping Screw
21	D53210	1	Side Sheet w/Cleaner Hole
21	D53211	1	Side Sheet w/Cleaner Hole Lg. Plenum
22	D24210	1	Plate, Cover
25	D23210	2	Push on Clip
27	71823	85	¼" - 20 x ½" Slotted Head Machine Screw
28	71825	108	¼" - 20 x ¾" Slotted Head Machine Screw
29	71822	104	¼" - 20 x 3/8" Slotted Head Machine Screw
31	71001	35	¼" x¾" Capscrew
32	72155	6	5/16" x ¾" Self-tapping Hex Head Screw
33	D54320	1	Stiffener, Front Sheet, Right
34	D54330	1	Stiffener, Front Sheet, Left
35	77271	1	Sensor, Temperatur Plenum
36	77586	1	Sensor, Hight Limit Switch Kit
(includes)	77635	1	Switch
	D23230	1	Bracket
	77522	1	¾" x ¾" Washer
	72204	1	Nut, Hex #10
	72958	1	Nut, 3/8" NPT Brass Lock
	71683	1	Screw, 10-24 x ½"
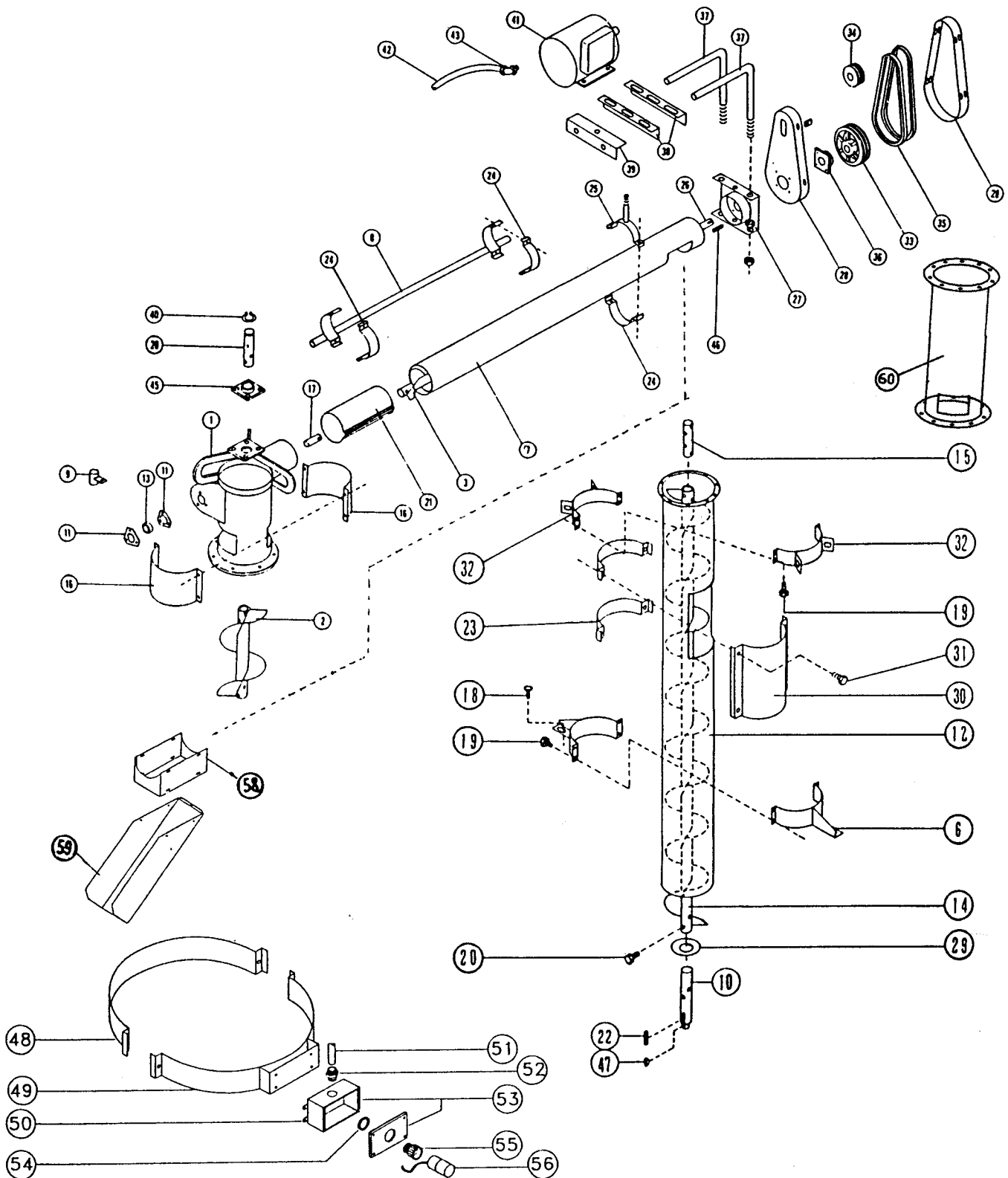
REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D26282	1	Head, Horz. Unloading
2	D26311	1	Flight, Vert. Horz. Head
2	D26313	1	Flight, Vert. Horz. Head Lg. Plenum
3	D56291	1	Flight, Horz. Head Ext.
6	D26065	2	Clamp, Support (at Spider)
7	D56300	1	Tube, Horz. Unload Ext.
8	D26540	1	Guide, Conduit
9	D26550	1	Support, Horz. Unload Conduit
10	D56101	1	Lower Stub Shaft
11	42-54054	Pair	Retainer Bearing
12	D56120	1	Auger Tube (Bottom)
12	D56121	1	Auger Tube (Bottom) Lg. Plenum
13	85000	1	1" Bearing
14	D36142	1	Flight (Bottom)
14	D36142	1	Flight (Bottom) Lg. Plenum
15	D26150	1	Stub Connecting Shaft
16	D26162	2	Inspection Hole Cover (4 on Lg. Plenum)
17	42-56211	1	Stub, Tail
18	71329	6	½" x 1½" Carriage Bolt
19	71056	10	3/8" x 2" Capscrew
20	D26021	1	Stub, Upper
22	73417	1	Key, ½" x ½" x 1½"
23	D41030	2	Cleaning Attachment Band
24	41-10042	3	Half Band 8"
25	42-58082	1	Band, Rear Motor Support
26	42-58037	1	Stub, Head
27	42-58049	1	Plate, Head
28	42-58081	1	Guard, Belt
29	72424	1	2" Washer
30	D26220	1	Grain Cleaner Hole Cover
31	71054	4	3/8" x 1½" Capscrew
	DA26000		Head Baffle Assy. (Includes Items 1, 9, 25, 26 & 27)
32	D26057	2	Clamp, Brace
33	76052	1	Sheave, 2B 9.4
	76069	1	Hub, 1¼" SK
34	75045	1	Pulley, 2B 3 x 7/8"
	75044	1	Pulley, 2B 3 x 24mm (UK)
35	D29321	2	Belt, B40
37	42-58046	1	Rod, Motor Mounting
38	42-58048	1	Strap, Motor Mount w/Nuts
38	42-58091	1	Strap, Motor Mount
39	42-58083	1	Angle, Rear Motor Support
40	69503	2	Snap Ring
41	52-10077	1	Motor, 2 H.P.
42	73166	Per ft.	Conduit, 3/8" x 13'4"
43	73159	1	Connector, 3/8" Elbow
45	D21161	1	Bearing, 2" Flanged
46	42-58050	1	Key
47	42-18282	1	Key, Woodruff
48	D41030	1	Half Band Clamp
49	D50705	1	Half Band Clamp w/Mounting
51	73166	Per Ft.	Conduit, 3/8
52	73157	1	Connector, 3/8"
53	77289	1	Enclosure w/Lid
54	77392	1	Nut, 1¼ /cibdyut'
55	77394	1	Adapter, 1¼ PVC
56	77391	1	Sensor, Adjustable Wet Grain (Includes 54 & 55)
57	D26441	2	Spreader, Grain
58	D26265	1	Adapter, Spout
59	D26326	1	Spout, Top Unloaded Head
60	D26581	1	Housing, Vert. Lg. Plenum

VERTICAL AUGER DRIVE ASSEMBLY
THREE PHASE

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D50455	1	Bracket, Jackshaft Mtg
2	D50430	1	Angle, Top Vert. Motor
6	D50435	1	Angle, Bottom Vert. Motor
7	D50445	1	Support, Right Vert. Motor
8	D50450	1	Support, Left Vert. Motor
9	D50550	2	Plate, Mounting
11	D50440	2	Brace, Motor Mount
12	76044	1	Sheave, 2B x 20.0
14	76048	1	Sheave, 2B x 15.4
14	76075	1	Sheave, 2B x 13.6 Lg. Plenum
15	D50425	1	Shaft
18	76047	1	Sheave, 2B x 6.0
20	52-10079	1	Motor, 10HP 3 PH
20	52-10080	1	Motor, 15HP 3PH Lg. Plenum
21	71103	2	Capscrew, ½" x1¼"
22	71142	2	Capscrew, 5/8" x 9½"
23	71142	2	Capscrew, 5/8" x 9½"
24	76043	1	Hub, 1-3/8 SDS
24	76074	1	Hub, 42mm SDS (UK)
25	76011	1	Hub, 1½" SK
26	76011	1	Hub, 1½" SK
28	76046	1	Sheave, 2B 8.0
28	76052	1	Sheave, 2B 9.4 (UK)
28	76062	1	Sheave, 2B 11.0 (UK) Lg Plenum
30	D50545	1	Belts, B66 (Set of 2)
30	D50546	1	Belts, B64 (Set of 2) Lg. Plenum
31	D22097	2	1½" Bearing
32	73166	Per Ft.	Conduit, 3/8"
33	73157	1	Connector, 3/8"
34	D50700	1	Bracket, Sensor
35	77248	1	Sensor, Pickup
36	77247	1	Magnet, Sensor
37	D25900	1	Bracket, Sensor
38	79065	1	Clamp, Band
39	D50748	1	Shield, Left Lwr. Auger
40	D50741	1	Shield, Center Auger Sheave
41	D50738	1	Shield, Right Lwr. Auger
42	D50732	1	Shield, Center Auger Drive
43	D50800	2	Hinge, Shield
44	D50810	2	Bracket, Shield Mt. Long
45	D50815	2	Bracket, Shield Mt. Short
46	D50805	1	Cover, Auger Belt

OUTSIDE SKIN ASSEMBLY
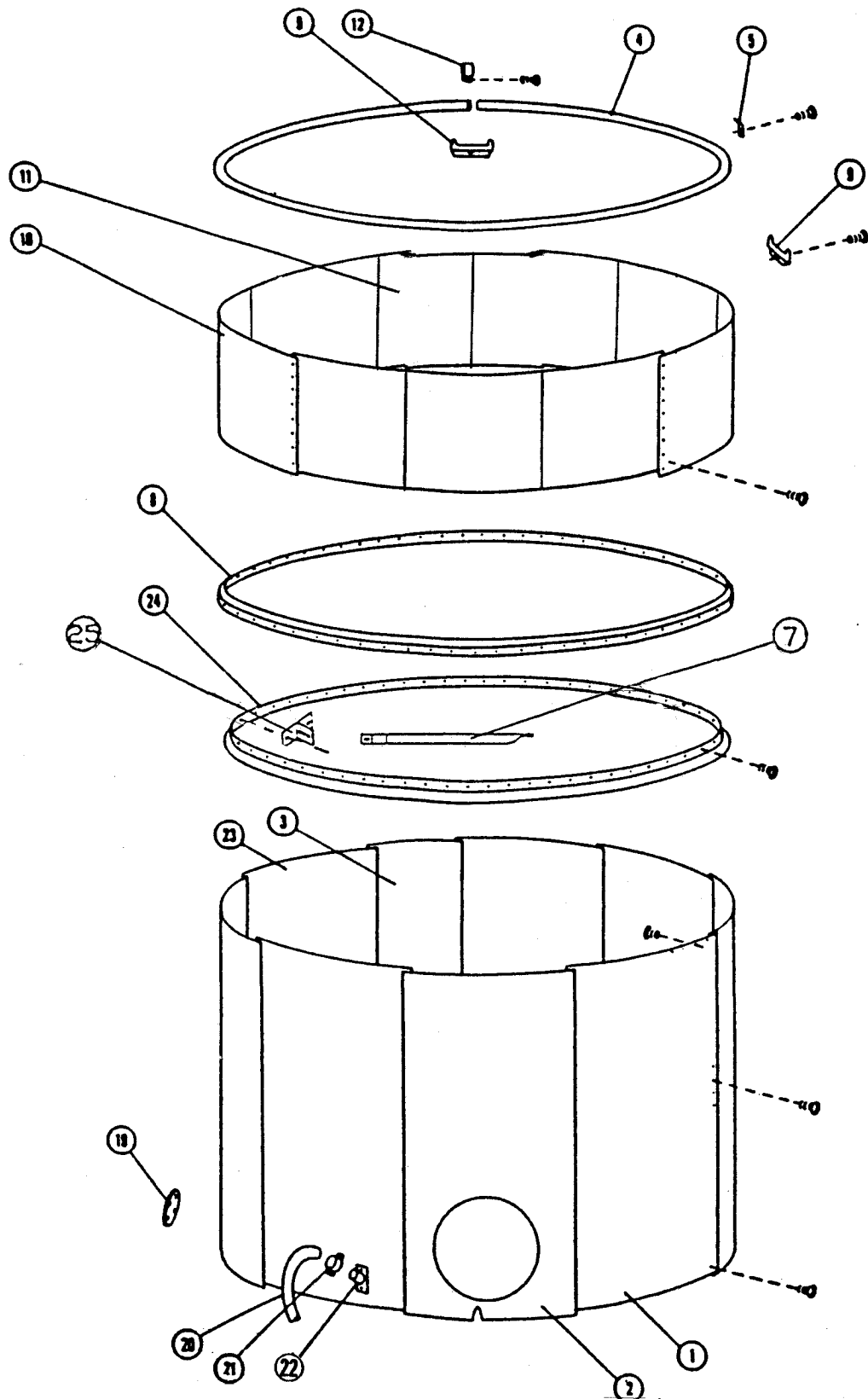## THREE PHASE
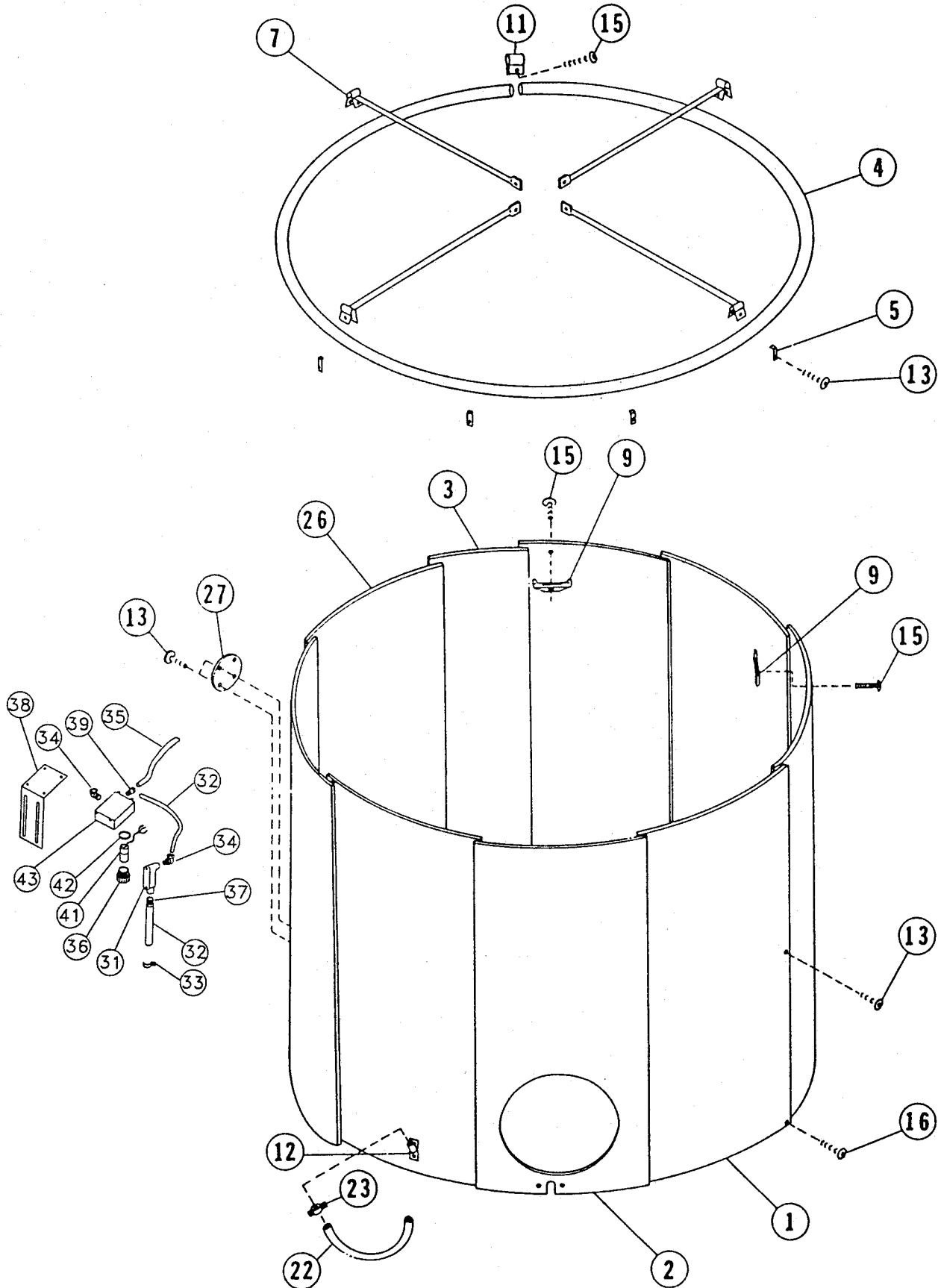
OUTSIDE SKIN ASSEMBLY - THREE PHASE

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	D54260	6	Outside Sheet Fine Perforated
1	D54300	6	Outside Sheet Std. Perforated
2	D54240	1	Outside Sheet with Hole Fine Perforated
2	D54280	1	Outside Sheet with Hole Std. Perforated
3	D54270	1	Outside Sheet 34" Wide Fine Perforated
3	D54310	1	Outside Sheet 34" wide Std. Perforated
4	D54040	1	Cap Ring
5	D24050	8	Ring Holder
7	D54072	4	Auger Brace
8	D24080	1	Spout Control Catch
9	D24091	2	Spout Support
11	D24110	1	Rim Connector
12	D24240	1	Grain Temperature Capillary Support Bracket
13	71822	220	¼" - 20 x 3/8" Slotted Hd Machine Screw
15	71825	12	¼" - 20 x ¾" Slotted Hd Machine Screw
16	71823	105	¼" - 20 x ½" Slotted Hd Machine Screw
22	D25262	1	Liquitite Conduite
23	73263	1	¾" Two Screw Connector
26	D54250	1	Outside Sheet w/Hole for Grain Cleaner-Fine Perf.
26	D54290	1	Outside Sheet with Hole Grain Cleaner - Std. Perforated
27	D24210	1	Cover Plate
	73966	1	(GT Logo)
31	77097	1	Junction Box 90 Deg.
32	73735	Per ft.	Conduit, ½
33	73225	3	Conduit Clamp
34	73165	2	Connector, 90 Deg.
35	73735	Per. Ft.	Conduit, 3/8"
36	77394	1	Adapter, 1 1/4 PVC
37	73163	1	Connector, ½ Conduit
38	D50695	1	Bracket, Top Sensor Box
39	73157	1	Connector, 3/8 Conduit
41	77391	1	Sensor, Adjustable Wet Grain
42	77392	1	Nut, 1 1/4 Conduit
43	77289	1	Enclosure, Plastic /w Lid

GRAIN CAPILIARY ASSEMBLY

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
12	D24240	1	Bracket, Grain Temp Sensor
14	77271	1	Sensor, Grain Temperature
29	D24270	1	Strip, Clamping
30	73486	1	Clip, Jiffy
31	71685	1	Screw, #10 - 24 x ¾
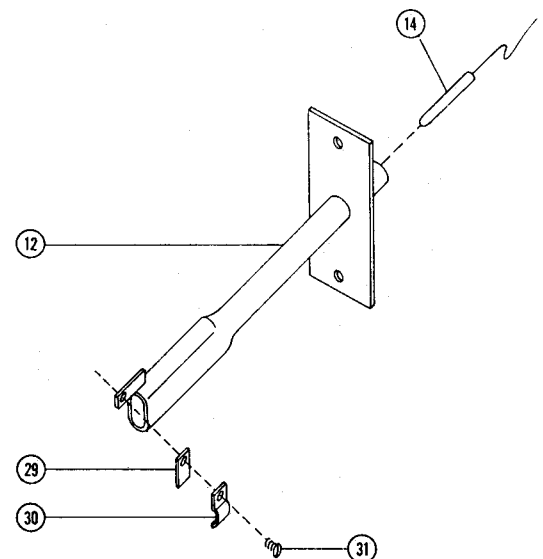
LARGE PLENUM
OUTSIDE SKIN AND EXTENSION ASSEMBLY

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	D74260	6	Outside Sheet Fine Perf. Coated
1	D74500	6	Outside Sheet Std. Perf. Coated
1	57001339	6	Outside Sheet Fine Perf.
1	57001305	6	Outside Sheet St. Perf.
2	D74240	1	Outside Sheet w/hole, Fine Perf. Coated
2	D74480	1	Outside Sheet w/hole, Std. Perf. Coated
2	D73390	1	Outside Sheet w/Burner H. Fine Perf.
2	D74020	1	Outside Sheet w/Burner H. Std. Perf.
3	D74270	1	Outside Sheet 34" Wide, Fine Perf. Coated
3	D74510	1	Outside Sheet 34" Wide, Std. Perf. Coated
3	57001340	1	Outside Sheet 34" Wide, Fine Perf.
3	57001320	1	Outside Sheet, 34" Wide Std. Perf.
4	D54040	1	Cap Ring
5	D24050	8	Ring Holder
7	D54076	4	Brace, Middle Auger
8	57001328	2	Band, Dryer Top
9	D24091	2	Spout Support, Extended
10	D74522	8	Sheet, Extension Std. Coated
10	D74232	8	Sheet, Extension Fine Perf. Coated
10	D74462	8	Sheet, Extension Std. Perf.
10	D74132	8	Sheet, Extension Fine Perf.
11	D74560	1	Sheet, Extension Std. Perf. Coated 34"
11	D74570	1	Sheet, 34" Extension Fine Perf. Coated
11	D74540	1	Sheet, 34" Wide Extension Std. Perf.
11	D74550	1	Sheet, 34" Wide Extension Fine Perf.
12	D24110	1	Rim Connector
19	D24210	1	Cover Plate
20	D25262	1	Liquid Tight Conduit
21	73263	1	3/4" Two Screw Connector
22	D24240	1	Grain Temperature Capillary Support Bracket - Micro
22	D24131	1	Grain Temperature Capillary Support Bracket - Non Micro
23	D74250	1	Outside Sheet w/Grain Cleaner Hole Fine Perf. Coated
23	D74490	1	Outside Sheet w/Grain Cleaner Hole, Std. Perf. Coated
23	D74220	1	Outside Sheet w/Grain Cleaner Hole Fine Perf.
23	D74200	1	Outside Sheet w/Grain Cleaner Hole Std. Perf.
25	D54065	4	Base, Brace. Large Plenum
	A74000	1	Ladder (not shown)

LOADING HOPPER (STANDARD) THREE PHASE

LOADING HOPPER, OPTIONAL STYLE THREE PHASE

LOADING HOPPER (STANDARD) THREE PHASE

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
20	D29790	1	Hopper
21	42-58080	1	Band, Connecting
22	D50490	1	Flight, Front
23	D59550	1	Mount, Tube
24	41-10144	1	Band, 8" Half
25	D50495	1	Tube, Front
26	D29580	1	Flight
27	42-66022	1	Bearing
57	73899	1	Decal, Slow Moving Vehicle
59	D50555	1	Mount, S.M.V.

LOADING HOPPER, OPTIONAL STYLE THREE PHASE

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	D29013	1	Hopper, Extended
2	D29500	1	Catch, Hopper
3	41-10143	1	Band, Half
4	D29521	1	Latch, Hopper
5	D29540	1	Pin, Latch
6	D59141	1	Mount, Tube
7	D59031	1	Tube, Front Auger
8	D59053	1	Flight, Front Auger
9	D59391	1	Flight, Short Sec. Rear Auger
10	D29042	1	Flight, Long Sect. Rear Auger
11	42-98080	1	Bearing & Casting
	71127	1	Capscrew, 5/8 x 1
	D29510	1	Bolt w/Zerk
	42-18133	1	Bronze Bearing
12	42-66022	2	Bearing
13	D59150	1	Regulator, Grain Flow
14	D29470	1	Grill, Hopper
	D29471 (U.K.)	1	Grill, Hopper U.K.
15	D29560	4	Clip, Grill
16	D29161	2	Stand, Hopper
17	D29531	1	Latch Handle
32	42-18282	2	Key, No. 808 Woodruff
33	73317	2	Spring, Lift
	D29480	2	Spring, Lift w/Plug Nut
34	73534	2	Pin, Cotter, 1/8" x 1¼"
35	73316	1	Spring, Pin
37	71104	2	Capscrew, ½" x 1½"
38	71027	8	Capscrew, 5/16" x 1"
40	71251	8	Bolt, Carriage 5/16" x ¾"
41	71026	2	Capscrew, 5/16" x ¾"
42	71825	4	Screw, 5/16" x ¾" SL HD Machine
43	71054	8	Capscrew, 3/8" x 1½"
48	71988	2	Capscrew, ½" x 6" Full Thd.
49	73504	2	Capscrew, 7/16" x 2½"
50	71104	2	Capscrew, ½" x 1½"
51	D29020	2	Spacer, ½" ID x 1" OD x 5/16"
52	71303	1	Bolt, Carriage, 7/16" x 1¼"
53	D59172	2	Rod, Spring Connecting
55	71051	2	Capscrew, 3/8" x ¾"
56	D29550	As Req'd.	Spacer, Hopper Latch
57	73899	1	Decal, Slow Moving Vehicle
58	71053	8	Capscrew, 3/8" x 1¼"

9' HOPPER PARTS

15

1/8 x 1 3/4 COTTER PIN

12

TUBE MOUNT

11

1/2 x 1 1/2 CAPSCREW.

10

8

HOPPER LATCH

2

9

3

1

4

3

5

9' HOPPER

6

7

13

14
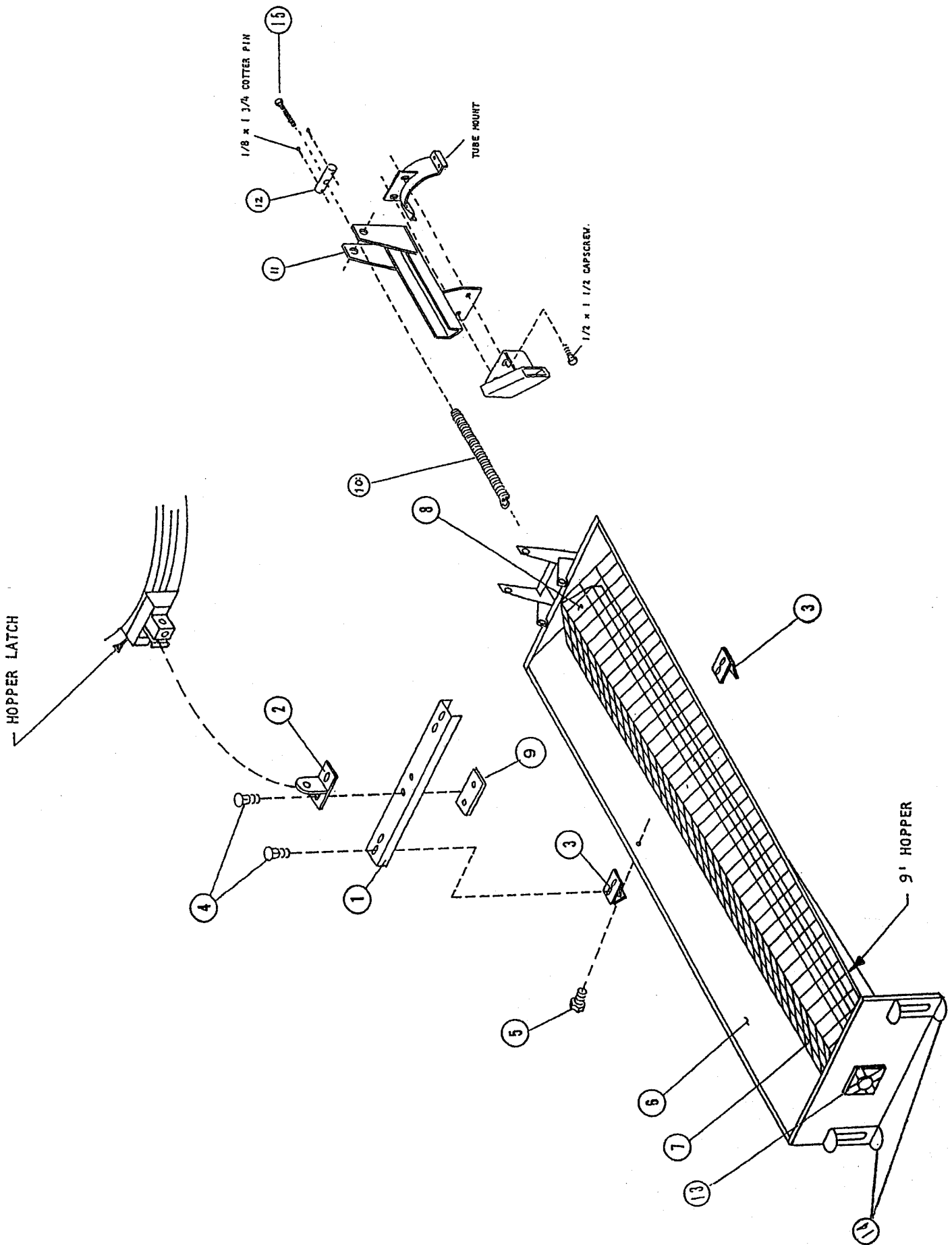
9' HOPPER PARTS LIST

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	D29750	1	Channel
2	D29740	1	Catch
3	D29730	2	Hook
4	71252	6	Bolt, 5/16 x 1 Carriage
5	71027	2	Capscrew, 5/16 x 1
6	D29710	1	Hopper, 9'
7	D29476	1	Grill, Hopper
8	D29720	1	Regulator, Grain
9	D29755	1	Plate, Channel
10	D29480	1	Spring w/Nut
11	D59860	1	Channel, Mtg.
12	D29870	1	Pivot, Hopper Spring
13	42-66022	1	Bearing
14	D29161	2	Stand, Hopper
15	71992	1	Capscrew, ½" x 7" Full Thread

PLENUM SKIN

OUTSIDE SKIN
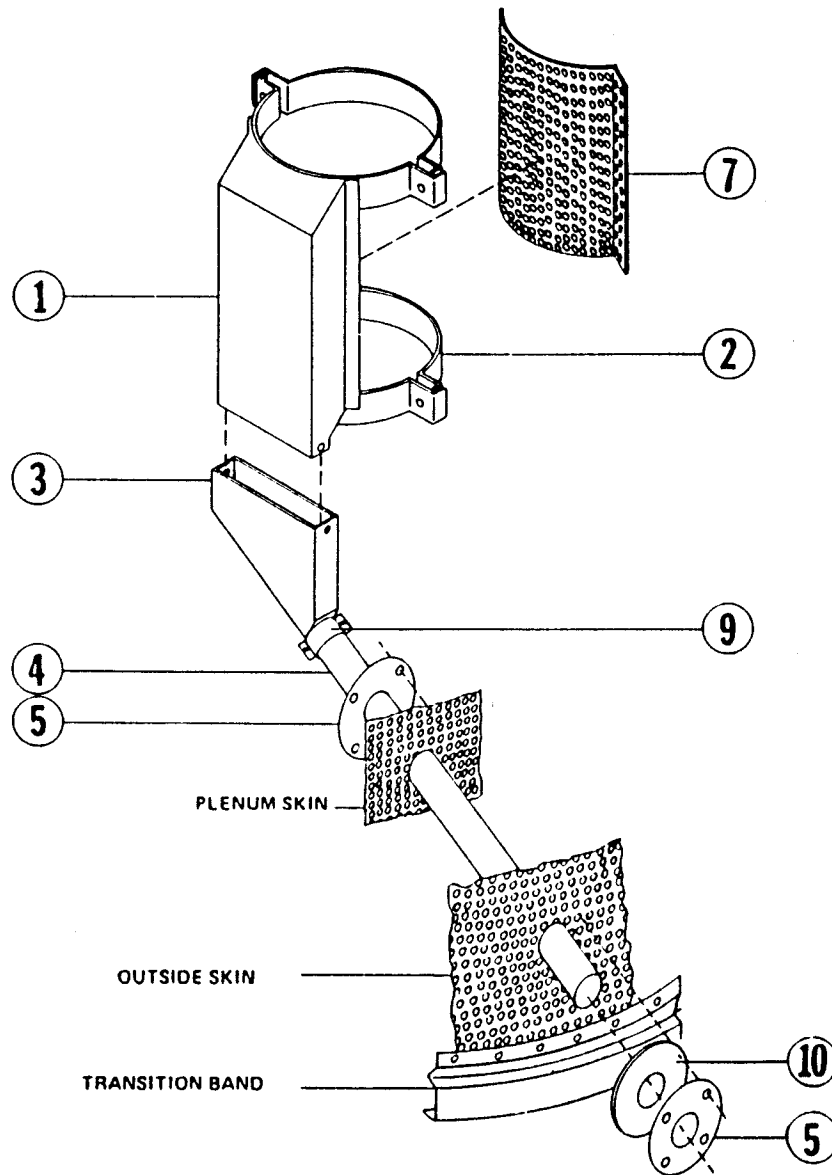
TRANSITION BAND

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
	A41011	1	Grain Cleaning Attachment
1	D41020	1	Cleaning Attachment Body
2	D41030	2	Cleaning Attachment Bands
3	D41082	1	Cleaning Attachment Transition
4	D41090	1	Cleaning Attachment Top Tube
5	D41100	1	Flange, Cleaning Attachment Tube
7	A41100	1	Cleaning Attachment Screen (Corn, Sunflower) 7/32" Holes
7	A41110	1	Cleaning Attachment Screen (Wheat, Oats, Barley, Milo) 7/64" Holes
7	A41120	1	Cleaning Attachment Screen (Soybeans) 5/32" Holes
7	A41130	1	Cover Plate (To replace screen)
7	A41105	1	Cleaning Attachment Screen (Flax) 5/64" Holes
7	A41115	1	Cleaning Attachment Screen (Rape Seed) 1/16" Holes
9	D41081	1	Band, Transition ½
10	73289	1	Seal, Rubber

LOADING AUGER DRIVE ASSEMBLY
THREE PHASE
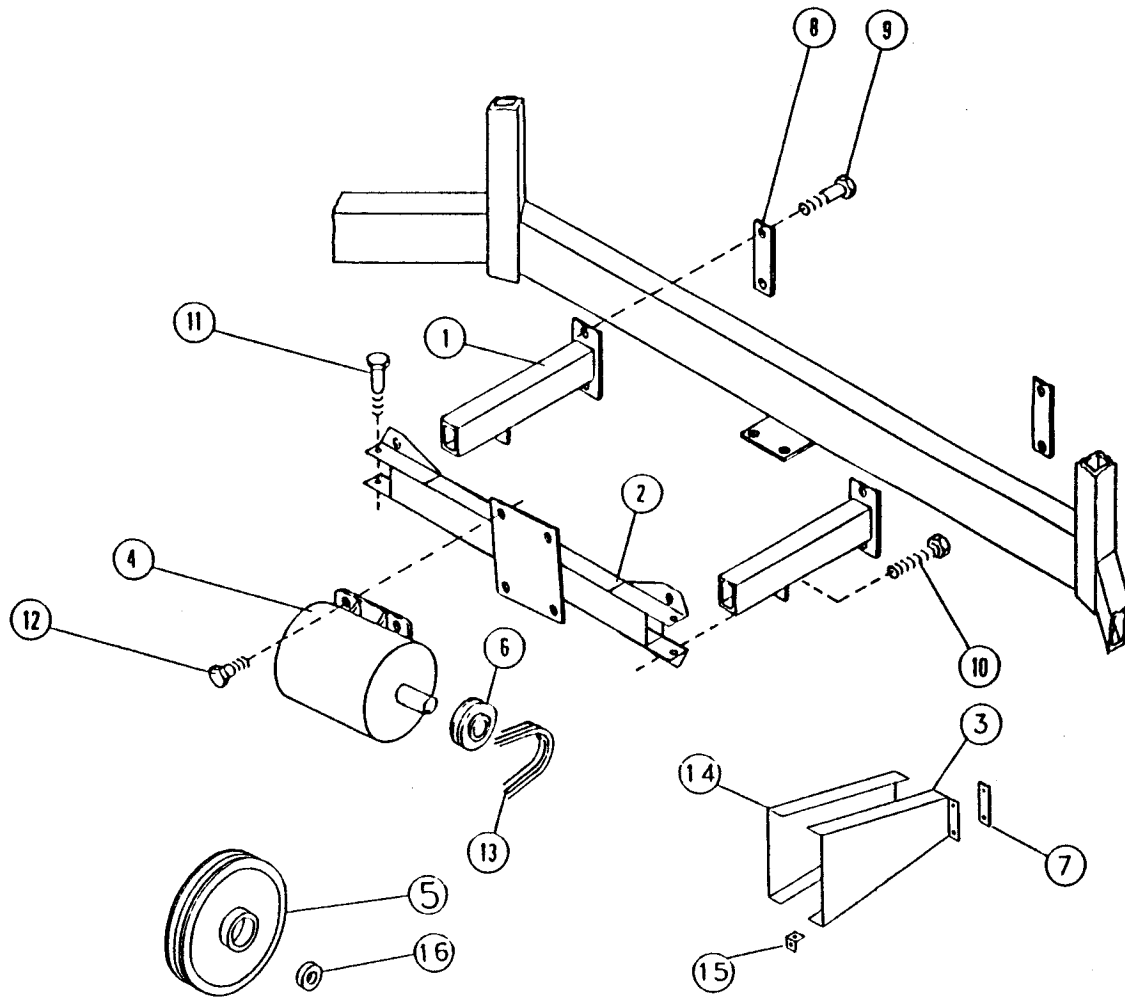
REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	D59590	2	Arm Support
2	D59580	1	Cross Member
3	D50351	1	Shield, Loading Motor
4	52-10078	1	Motor
5	76062	1	Sheave, 2B 11" x 1"
6	75047	1	Sheave, 2B 3" x 1-1/8"
	76061 (U.K.)	1	Sheave, 2B 3.4 PD L/Hub SH
	76058 (U.K.)	1	Hub, 28mm SH
7	D50591	1	Door, Electric Enclosure
	D50590 (U.K.)	1	Door, U.K. Electric Enclosure
8	D52720	2	Support, Arm Strap
9	71112	4	Capscrew, ½" x 4"
10	71957	2	Capscrew, ½" x 5" Full Thread
11	71087	2	Capscrew, 7/16" x 4"
12	71054	4	Capscrew, 3/8" x 1½"
13	K52701	2	Belt, B75
14	D50725	1	Shield, Loading Belt
15	D50770	1	Bracket, Lwr. Shield
16	76060	1	Hub, 1" SK

ELECTRICAL CONTROL BOX ASSEMBLY
THREE PHASE
USA ONLY

REF. NO.	PART NO.	NO. REQ'D.	DESCRIPTION
1	77327	1	Handle
2	74673 (UK)	1	Decal
3	D25980	2	Door, Outlet Cover
4	502131	2	Cover, Outlet
5	D25985	2	Hinge, Outlet Cover
6	72196	4	Cap, 3/16 Push-On
7	D50591	1	Door, Electric Enclosure
8	77554	2	Receptacle, 3 Phase
9	DA25010	1	Power Supply
10	77541	1	Breaker, QO210
11	77545	1	Breaker, QO315
12	77542	1 (2 on Lg. Plenum)	Breaker, QO380
13	77544	1	Breaker, QO330
14	77543	1	Breaker, QO360
15	77543	1 (1 on Lg. Plenum)	Breaker, QO360
16	77318	1	Panel, Circuit Breaker
17	77367 (UK)	1	Relay Panel AC/DC
18	D25925 (UK)	1	Mount, Relay
19	D50596	1	Panel, Electric Control
20	D32220 (UK)	4	Spacer
21	D25961	1	Box, Electrical Enclosure
22	73736	2	Connector, 3/4" Conduit
23	73733	Per Ft.	Conduit, 3/4"
24	73163	2	Connector, Conduit ½"
25	73735	Per Ft.	Conduit, ½"
26	77319	1	Ground Bar, SN20
27	73164	1	Elbow, 3/4" Conduit
28	77547	1	Contactor, 5 H.P.
29	77548	3 (2 on Lg. Plenum)	Contactor, 10 H.P.
30	77326	1	Breaker, Main Circuit
31	77549	1 (2 on Lg. Plenum)	Contactor, 15 H.P.
32	74671 (UK)	1	Decal, Unloading
33	74670 (UK)	1	Decal, Loading
34	74676 (UK)	1	Decal, Danger Electrocution
35	77328	1	Track, Mounting
36	77553	1 (2 on Lg. Plenum)	Thermal Overload, 15 H.P.
37	77552	3 (2 on Lg. Plenum)	Thermal Overload, 10 H.P.
38	77551	1	Thermal Overload, 5 H.P.
39	77550	1	Thermal Overload, 2 H.P.
40	77546	1	Contactor, 2 H.P.
	74693	1	Decal, Control Box Wiring Diagram

INSIDE BURNER TUBE

RING BURNER P/N D52305

TO BURNER

A

40	72845	1 x 90 EL
41	72700	1 CLOSE NIPPLE
42	72904	3/4 x 1 BELL REDUCER
43	D25895	NIPPLE, ORIFICE
44	D52441	1 x 32 HOSE
45	D52413	ORIFICE 3/8 NG .5 NPT

NATURAL GAS CONTROL CABINET ASSEMBLY

REF. NO.	PART NO.	NO. REQ'D	DESCRIPTION
1	D55650	1	Valve, 1" Ball
2	73185	1	Valve, 1" Gate
3	D25305	1	Line, Pressure Gauge
4	72841	1	Elbow, ¼" NPT x 90^0
5	72705	1	Nipple, 1" x 3½"
6	72712	1	Nipple, 1" x 7"
7	D52950	1	Bracket, Lwr. Plumbing
8	D32940	1	Bracket, Long Lwr. Plumbing
9	72932	1	Nipple, 1" x 15"
10	728545	3	Elbow, 1" x 90^0
11	D52412	1	Orifice, NG Low Burn
12	D55895	1	Holder, Orifice
13	D25102	1	Gauge, Pressure
14	D52441	1	Hose, 1" x 32" NG
15	D52955	1	Clamp, Lwr. NG Plumbing Brkt.
16	D52941	2	Bracket, NG Plumbing
17	72860	3	Elbow, 1" x 90^0 Street
18	72716	2	Union, 1" Pipe
19	72700	10	Nipple, 1" Close
20	D25542	2	Coil, Solenoid Valve 12 VDC (27")
21	77191	2	Valve, 1" Solenoid
22	72916	4	Tee, 1" x 1" x 1"
23	72911	1	Reducer, 1" to ¼" Bell
24	73110	2	Fitting, ¼" NPT to ¼ comp.
25	72713	1	1" Pipe Plug

NUTS, WASHERS AND LOCKWASHERS

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
72208	¼" Nut	72438	¼" L-Washer
72209	5/16" Nut	72439	5/16" L-Washer
72210	3/8" Nut	72440	3/8" L-Washer
72211	7/16" Nut	72441	7/16" L-Washer
72212	½" Nut	72442	½" L-Washer
72213	5/8" Nut	72443	5/8" L-Washer
72380	¼" L-Nut	72408	¼" Washer
72379	½" L-Nut	72409	5/16" Washer
72375	¾" L-Nut	72410	3/8" Washer
72382	¼" Whiz Lock-Nut	72411	7/16" Washer
72334	¼" Tinnerman Nut	72412	½" Washer
72376	5/8" Lock Nut	72413	5/8" Washer
72195	#4 Nut	72486	#4 Nylon Washer
72204	#10 Nut	72434	#10 L-Washer

TORQUE ALL BOLTS PER TORQUE SPECIFICATION CHART

COARSE THREAD FASTENER	GRADE DESIGNATION	SCREW, STUD, OR BOLT SHANK SIZE OR DIAMETER							
		1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"
CAP SCREW	S.A.E. 2 STEEL	5	11	20	30	50	70	100	170
CAP SCREW	S.A.E. 5 STEEL	8	17	30	50	75	110	150	270
CAP SCREW	S.A.E. 8 STEEL	12	24	45	70	105	155	210	375

Torques are in ft - lbs.
Torques shown are for National Coarse Thread Plain or Zinc plated fasteners carrying residual oil of Manufacture.