

# ***OPERATORS MANUAL***



R3115B, R3118B,  
& R3120B Model  
Grain Dryers



---

## WARRANTY

ffi Corporation warrants its products to be free of defects in material and workmanship. The only obligation of the manufacturer is to repair or replace products which have been submitted and found to be defective within 12 months after installation. If so found defective, the products will be repaired or replaced without charge, this constituting and entirely fulfilling the warranty obligation. ffi assumes no liability for expenses incurred without written authorization; in no event shall its liability include special or consequential damages, or exceed the selling price of the product.

This warranty does not cover products or parts which have been damaged by negligent use, misuse, alteration or accident. Some components supplied by man-

ufacturers are warranted separately by those suppliers. This warranty is exclusive and in lieu of all other warranties, expressed or implied. ffi reserves the right to make design or specification changes at any time, without any contingent obligation to purchasers of products already sold.

All instructions, with the exception of those concerning safety, shall be construed as recommendations only; because of the many variable conditions in actual installation, ffi assumes no liability for results arising from the use of such recommendations.

---

READ THESE INSTRUCTIONS BEFORE  
INSTALLATION AND OPERATION.

SAVE FOR FUTURE REFERENCE.

This manual describes the installation and operation for all standard production type R-3100 Series dryers. These dryers are available for liquid propane or natural gas fuel supply, with either 230V or 460V three phase (60 Hz) electrical power.

USE CAUTION IN THE OPERATION OF THIS  
EQUIPMENT.

The design and manufacture of this dryer is directed toward operator safety. However, the very nature of a grain dryer having a gas burner, high voltage electrical equipment and high speed rotating parts does present a hazard to personnel which cannot be completely safeguarded against without interfering with efficient operation and reasonable access to components

Use extreme caution in working around high speed fans, gas-fired heaters, augers and auxiliary conveyors which may start without warning when the dryer is operating on automatic control.

Continued safe dependable operation of automatic equipment depends, to a great degree,

upon the owner and operator(s). For a safe and dependable drying system, follow recommendations within the manual and established safety practices. Also, make it a practice to regularly inspect the operation of the unit for any developing problems or unsafe conditions.

MAKE CERTAIN TO THOROUGHLY INSTRUCT  
ALL OPERATORS IN THE PROPER USE AND  
SERVICE OF THIS EQUIPMENT.

Take special note of the Operating Precautions listed on page ii before attempting to operate the dryer.

Keep the dryer clean. Do not allow fine material to accumulate in the plenum chamber.



.....A CAREFUL OPERATOR  
IS THE BEST INSURANCE AGAINST AN  
ACCIDENT.

---

# C O N T E N T S

Warranty .....	inside front cover	SECTION 4: TEST FIRING .....	19
Operating Precautions .....	2	SECTION 5: DRYER OPERATING .....	23
SECTION 1: SPECIFICATIONS .....	3	Important Service Tips for Dryer Operators .....	23
SECTION 2: INSTALLATION .....	7	Start-up Procedure .....	24
System Layout .....	7	Drying Recommendations .....	25
Site Selection .....	7	Drying Capacity .....	25
Foundation .....	7	Corn .....	25
Fuel Connection .....	7	Milo .....	25
Table 2-1: Fuel System Recommendations ...	9	Soybeans .....	26
Electric Power Supply .....	9	Drying Tables R-3180 .....	27
Auxiliary Load Conveyor Connection .....	9	Drying Tables R-3190 .....	28
Table 2-2: Electrical Load, Overload Relays, & Circuit Breakers .....	11	Drying Tables R-31100 .....	29
SECTION 3: OPERATING CONTROLS .....	13	SECTION 6: DRYER ILLUSTRATIONS .....	31
Miscellaneous Components .....	13	SECTION 7: SERVICE .....	39
Power Disconnect .....	13	Suggested Inspection and Service .....	39
Control Stop/Stat .....	13	Additional Inspection and Service .....	40
Fan Start/Stop .....	13	Lubrication Table .....	40
Burner On/Off .....	13	Propane Vaporizer Seasonal Inspection .....	42
Main/Safety Gas Shutoff Valve .....	13	End of Season Shutdown Procedure .....	42
Load Auger .....	14	Suggested Procedure to Follow in Case of Fire ..	42
Load (Top Auger) Timer .....	14	SECTION 8: WIRING DIAGRAMS .....	49
Unload Auger .....	14	SECTION 9: TROUBLESHOOTING .....	57
Plenum Temperature Control .....	15	General Troubleshooting .....	57
Metering Auger Controls .....	15	Plenum Temperature Control .....	60
Unloading Switch .....	15	Moisture Control (Manual Operation) .....	61
Manual Unloading Dial .....	15	Moisture Control (Automatic Operation) .....	62
Unload Rate Meter .....	15	Dryer Does Not Perform to Rated Capacity .....	62
Vari-Trol Moisture Control .....	15	APPENDIX A: PRE- AND POST-SEASON CHECKLIST .....	63
Dryer Operator Light .....	16		
Hour Meter .....	16		
Shutdown Indicators .....	16		
Restarting Dryer after a Shutdown .....	17		
Adjusting Dryer Airflow .....	17		

## OPERATING PRECAUTIONS

1. Read and understand the operation manual before attempting to operate the unit.
2. Keep ALL guards, safety decals, and safety devices in place. Never operate dryer while guards are removed.
3. Keep visitors, children, and untrained personnel away from dryer at all times.
4. Never attempt to operate the dryer by jumping or otherwise bypassing any safety devices on the unit.
5. Always set the main power supply disconnect switch to OFF and lock it in the OFF position using a padlock before performing any service or maintenance work on the dryer or the auxiliary conveyor equipment.
6. Keep the dryer and wet holding equipment CLEAN. Do not allow fine material to accumulate.
7. Set pressure regulator to avoid excessive gas pressure applied to a burner during ignition and when burner is in operation. See Table 2-1 for operating gas pressures. Do not exceed maximum recommended drying temperatures.
8. Do not operate the dryer if any gas leak is detected. Shut down and repair before further operation.
9. Clean grain is safer and easier to dry. Fine material can be highly combustible, and it also increases resistance to air flow and requires removal of extra moisture.
10. Use CAUTION in working around high speed fans, gas burners, augers, and auxiliary conveyors which start automatically.
11. Be certain that capacities of auxiliary conveyors are matched to dryer auger capacities.
12. Do not operate in an area where combustible material will be drawn into the fan.
13. The operating and safety recommendations in this manual pertain to the common cereal grains as indicated. When drying any other grain or products, consult the factory for additional recommendations.
14. Routinely check for any developing gas plumbing leaks. Check to ensure that vaporizer on LP models does not come into contact with burner vanes.

# SPECIFICATIONS

## SECTION 1

TABLE 1 - 1 GENERAL SPECIFICATIONS

	R3180	R3190	R31100
Diameter	11'-8"	11'-8"	11'-8"
Height	61'-9"	71'-9"	78'-5"
Fan	75 HP centrifugal	75 HP centrifugal	100 HP centrifugal
Electrical (dryer only)			
3 PH 230V	234 amps	234 amps	286 amps
3 PH 460V	118 amps	118 amps	144 amps
Metering Discharge System	3 HP VFD (2) 4" & (2) 5 sweep augers 2354 BPH	3 HP VFD (4) 5" sweep augers 3248 BPH	3 HP VFD (4) 5" sweep augers 3248 BPH
Heat Airflow	72,312 CFM	82,070 CFM	88,432 CFM
Cool Airflow	36,156 CFM	41,035 CFM	44,216 CFM
Total Holding Bushels	1573 bushels	1866 bushels	2040 bushels
Heat Bushels	947 bushels	1181 bushels	1309 bushels
Cool Bushels	327 bushels	386 bushels	432 bushels
W et Holding Bushels	228 bushels	228 bushels	228 bushels
Burner	16.7 M BTU max output 8.4 M BTU typical output	20.2 M BTU max output 9.6 M BTU typical	20.4 M BTU max output 10.3 M BTU typical
Capacity <sup>1</sup>			
20% to 15% dry & cool	1500 bushels/hour 900 bushels/hour	1800 bushels/hour 1080 bushels/hour	2000 bushels/hour 1200 bushels/hour
25% to 15% dry & cool	6'-0"	6'-0"	6'-0"
Standard Leg Height	1	2	2

1. Capacities listed are wet bushels at listed input moisture content and are estimates based on drying principles, field results, and computer simulation. Variances may occur due to the grain's physiological factors (kernel size, chemical composition, variety, maturity), excessive fines, adverse weather conditions, etc.

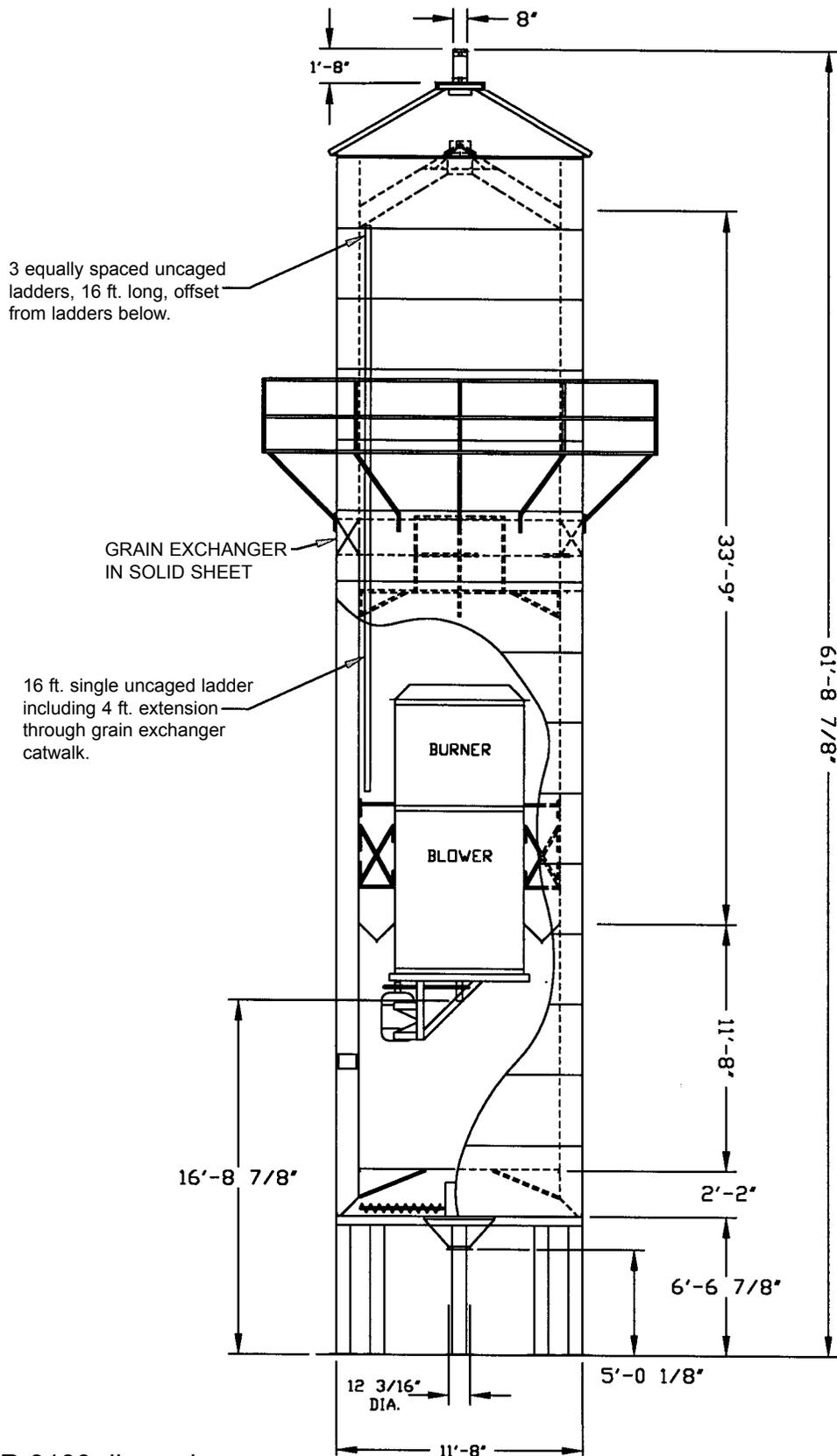


Fig. 1-1 R-3180 dimensions

3180dim.tif

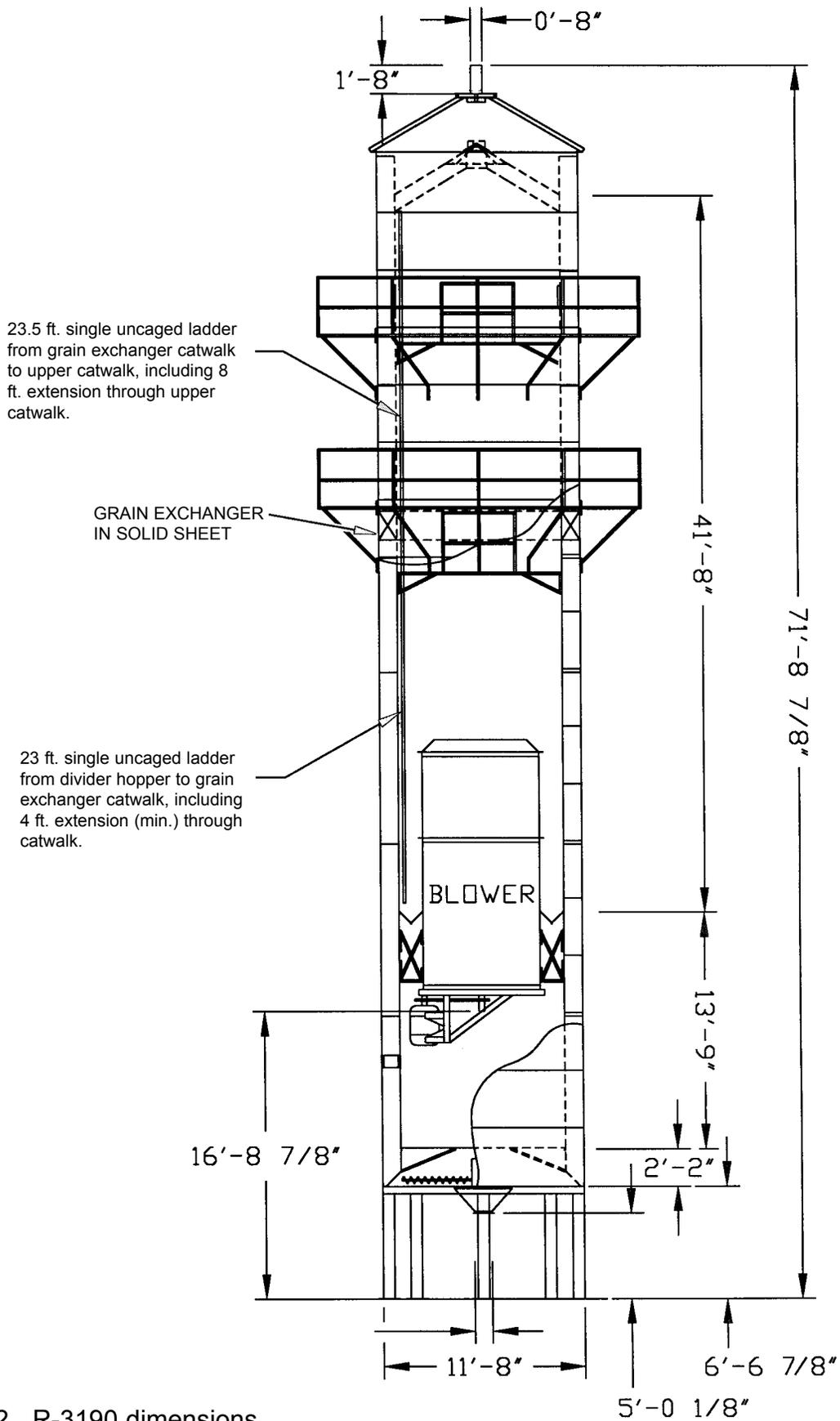


Fig. 1-2 R-3190 dimensions

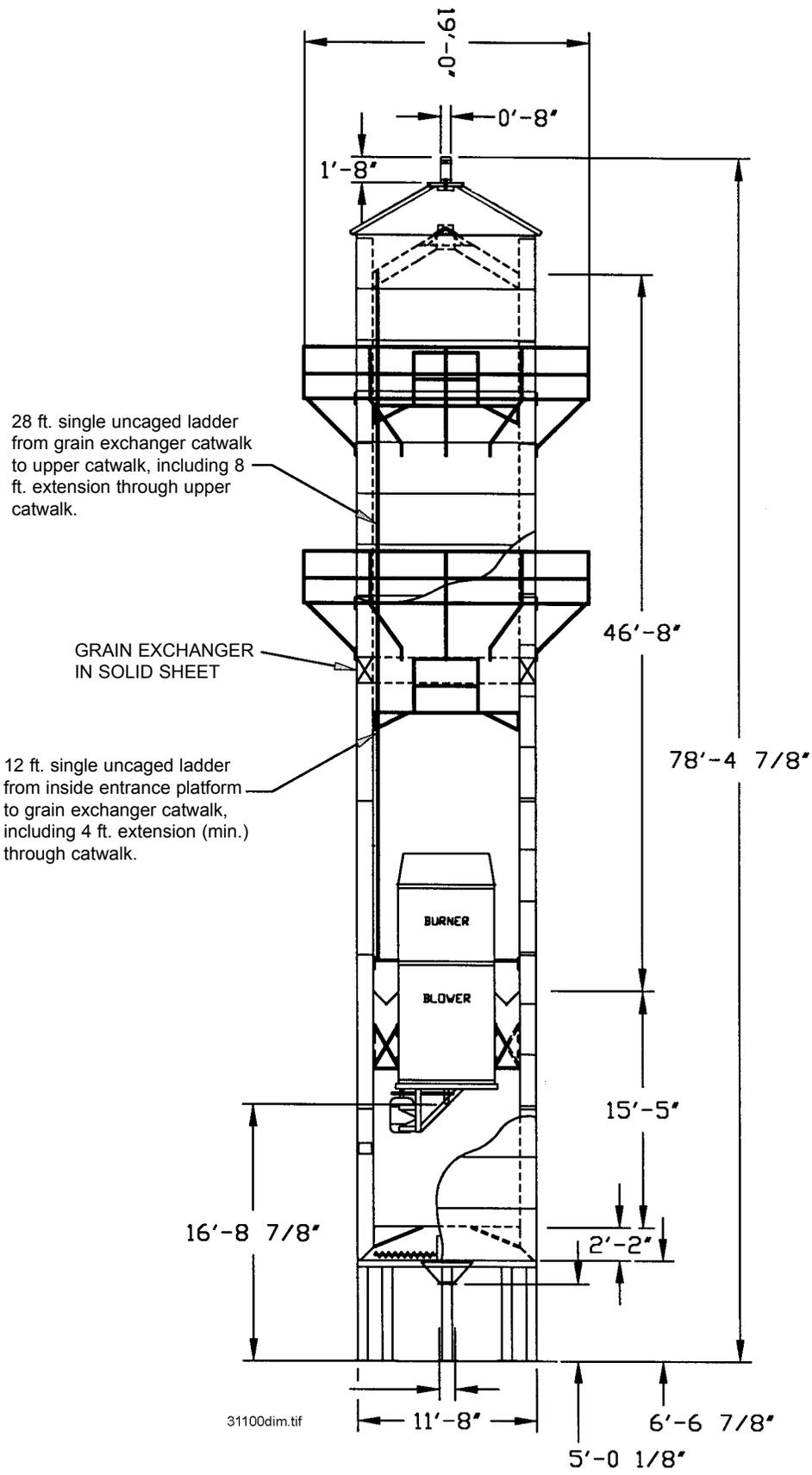


Fig. 1-3 R-31100 dimensions

## SYSTEM LAYOUT

Consider the grain handling system and location of storage bins and existing conveyors when selecting dryer site, to facilitate wet grain supply and dry grain discharge to conveyors. Other considerations are prevailing wind direction, fuel and power supply locations, noise, and convenience of control location.

## SITE SELECTION

The dryer should not be operated inside a building or in any area not permitted by electrical code, fuel installation regulations, or insurance requirements. Do not operate in an area where combustible material can be drawn into the fans. Maintain a minimum distance of three feet to other structures. Refer to dryer specifications and dimensions in Section 1.

## FOUNDATION

The dryer should be placed on a reinforced concrete slab located in a well-drained area. The slab should be large enough to provide working area around the dryer, with a surface elevation consistent with other parts of the grain handling and storage systems. See dryer specifications and dimensions and consult factory for foundation drawings.

---

## FUEL CONNECTION

### LIQUID PROPANE (LP) DRYERS WITH INTERNAL VAPORIZERS

**LIQUID DRAW** The dryer is designed to operate on liquid propane, with liquid draw from the supply tank. A piping system is provided on the dryer, including strainer, pressure relief valve, and manual shut-off valve. See Fig. 2-1.

**AMMONIA TANKS** Do not use propane supply tanks which have previously contained ammonia or fertilizer solutions. These substances are extremely corrosive and damaging to fuel supply and burner parts.

**OIL OR WATER IN TANKS** With liquid draw from the supply tank, any water present in the tank may freeze in the piping and controls in cold weather. To ensure that tanks are free of moisture, the usual precaution is to purge with methanol. Avoid tanks which may contain an accumulation of oil or heavy hydrocarbons from long use on a vapor withdrawal system.

### NATURAL GAS (NG)

**GAS VOLUME AND PRESSURE** The dryer is designed to operate on natural gas having a heat value of about 1,000 BTU per cubic foot. The dryer is equipped with a natural gas supply pipe system connected to the heater solenoid valves. A regulated pressure of 10 PSI must be provided at the connection to the dryer, with gas available in sufficient volume to maintain operating pressure. See Fig. 2-2.

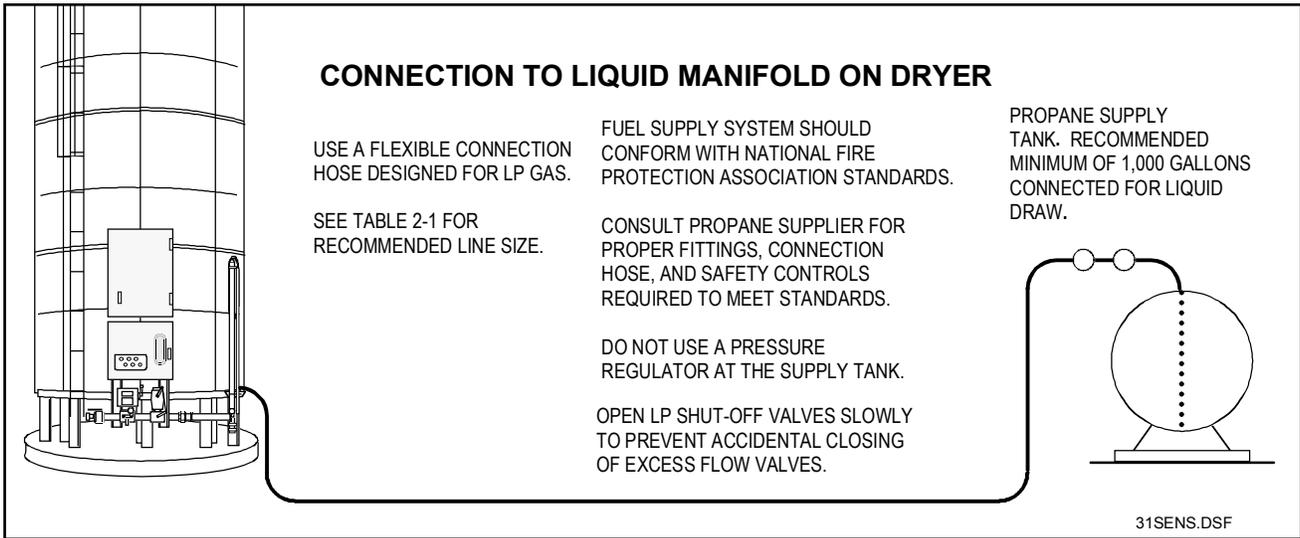


Fig. 2-1 Liquid propane (LP) fuel supply

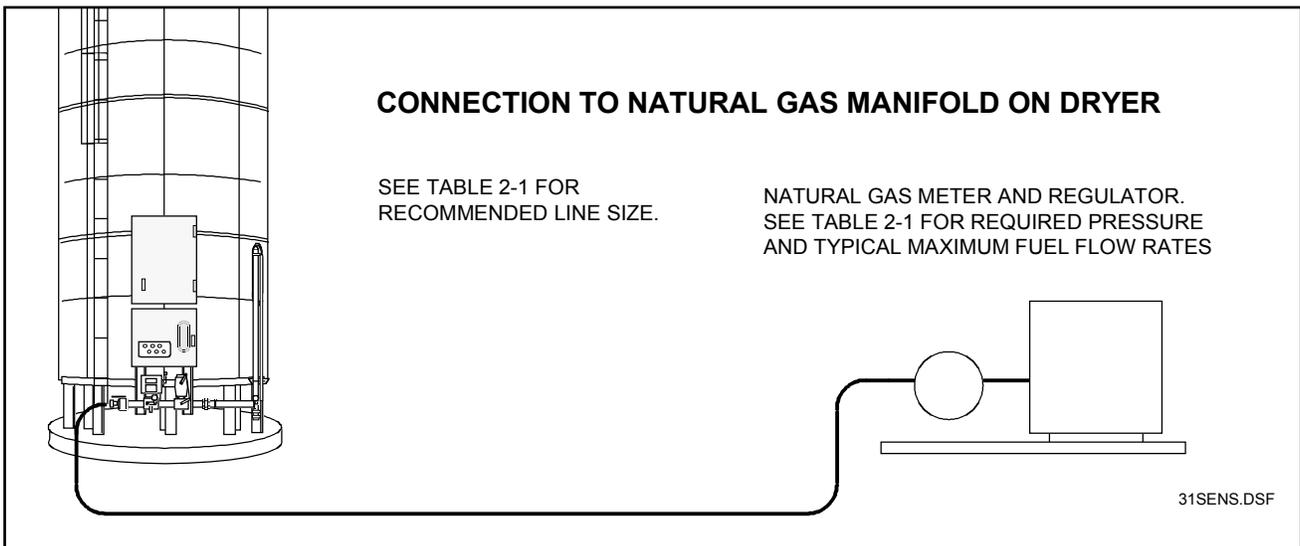


Fig. 2-2 Natural gas (N) fuel supply

**TABLE 2-1 FUEL SYSTEM RECOMMENDATIONS**

	<b>R-3180</b>	<b>R-3190</b>	<b>R-31100</b>
Maximum Heat Capacity (Million Btu/hr)	16.7	20.2	20.4
Liquid Propane (LP)	Total Max Fuel Flow - Gal./Hr. <sup>1</sup>	182	220
	Recommended Liquid Line Size	3/4	1
	Heater Orifice Drill Size	0.7187	0.781
	Max. Burner Pressure (PSI)	7.0	8.0
	Pressure Regulator Setting (PSI)	8	9
Natural Gas (N)	Total Max Fuel Flow <sup>1</sup> (1000 Cubic Ft./Hr)	16.7	20.2
	Recommended Minimum Line Size - 100' Distance	2	2.5
	Burner Orifice Size (dia.)	0.875	0.969
	Max. Burner Pressure (PSI)	9.0	9.0
	Regulated Supply Pressure to Dryer (PSI)	10	10

1. Maximum fuel flow rates listed assume full heat output for gas line sizing purposes. In normal operation the flow rates would be considerably lower than indicated, due to actual setting used and cycling of heater.

## ELECTRICAL POWER SUPPLY

POWER SUPPLY An adequate power supply and proper wiring are important factors for maximum performance and long life of the dryer. Electrical service must be of adequate size to prevent low voltage damage to motors and control circuits. All dryers should be field provided with a dependable equipment ground. Electrical power supply should conform to local, state, or provincial requirements.

NOTE: The dryer's power supply wiring should enter the PSC Box Assembly on the left-hand side of the box.

POWER SUPPLY DISCONNECT A power supply disconnect switch external to the Control Box is recommended for all dryer installation sites. This disconnect switch is to permit total power shutdown before opening ASC dead front, as required for inspection and service and should be located close to the dryer for quick shutdown.

TRANSFORMERS WIRING VOLTAGE DROP Contact the service representative of the power supplier, to advise of the additional load to be placed on the line. Check on KVA rating of trans-

formers, considering total horsepower load. The power supply wiring, main switch equipment, and transformers must be capable of providing adequate motor starting and operating voltage. Voltage drop during motor starting should not exceed 14% of normal voltage, and running voltage (after motor is at full speed) should be within 8% of normal voltage.

ELECTRICAL LOAD Table 2-2 indicates the electrical load in horsepower and full load current for motors on the dryer.

## AUXILIARY LOAD CONVEYOR CONNECTION

1. Motor must be powered from a source outside of the dryer and must use a separate contactor and overload protection device for each motor.
2. An auxiliary load contactor may be controlled by the dryer control panel or by an external source. If the contactor is to be controlled by the dryer control panel, the contactor must have a 110 volt coil and should not be connected to any other possible power source.

Aux Load Contactor control power from  
DRYER

Connect the contactor coil to terminal 48 in the ASC control panel and terminal 2, neutral. The neutral terminal of the contactor must be connected to the dryer control panel for proper operation.

Aux Load Contactor control power from  
EXTERNAL SOURCE

If a different control voltage is required, remove the gray terminal jumper connecting terminals 27 and 47 in the ASC control panel. This will remove the dryer's 110 volt control system from the terminals, providing a dry contact between terminals 47 & 48. This may be useful if the auxiliary equipment is controlled by 230 volts or by another system.

3. Auxiliary Unload equipment may be controlled by the dryer control panel or by an external source. The equipment may also be interlocked with the dryer so that the dryer unload system will not operate until the customer's unload system is operating.

Aux Unload Contactor control power from  
DRYER

Connect the contactor coil to terminal 51 in the ASC control panel and terminal 2, neutral. The neutral terminal of the contactor must be connected to the dryer control panel for proper operation.

Aux Unload Contactor control power from  
EXTERNAL SOURCE

If a different control voltage is required, remove the gray terminal jumper connecting terminals 27 and 50 in the ASC control panel. This will remove the dryer's 110 volt control system from the terminals, providing a dry contact between terminals 50 & 51. This may be useful if the auxiliary equipment is controlled by 230 volts or by another system.

Aux Unload interlock - Terminal 54-  
55

Provides proof that auxiliary equipment is operating. A contact pair associated with the auxiliary unload equipment may be wired into the dryer control panel. This contact must be closed when the auxiliary equipment is operating. If the dryer unload system is operating and the contact wired into terminals 54 & 55 opens, the dryer's unload system will stop operating. This may be used to interlock downstream equipment to the dryer.

NOTE: The contact pair from the auxiliary equipment must not be connected to ANY voltage sources.

#### 4. Dryer fill control - Bindicators

The standard R3180, 90, & 100 series dryers are designed for a choke fill type system. A low limit switch is included with the standard dryer to shut down the dryer if the grain level falls below the low limit switch for a period of time. If the dryer is being filled by a demand type system, an additional Bindicator switch is required. When the second switch is installed, it is necessary to change the position of terminal jumpers in the ASC control panel. For the standard single fill switch, a gray terminal jumper must be connected between terminals 27 and 46. For systems requiring two switches, remove the jumper connecting terminal 27 & 46 and install a jumper between terminals 41 & 46.

**TABLE 2-2 ELECTRICAL LOAD, OVERLOAD  
RELAYS, and CIRCUIT BREAKERS**

<b>R - 3 1 8 0</b>			
	Voltage	Fan	Aux. Unload Motor
Horsepower	3-PH - 230V	75	10
	3-PH - 460V	75	10
Full Load Current (amps)	3-PH - 230V	180	26
	3-PH - 460V	90	13
Max Running Load (dryer only, amps)	3-PH - 230V	196	
	3-PH - 460V	103.6	
Overload Setting	3-PH - 230V	90*	26
	3-PH - 460V	90	13
Circuit Breaker Rating - amps	3-PH - 230V	400	40
	3-PH - 460V	225	25
See Metering System, AC Transformer, and Notes below.			

<b>R - 3 1 9 0</b>			
	Voltage	Fan	Aux. Unload Motor
Horsepower	3-PH - 230V	75	10
	3-PH - 460V	75	10
Full Load Current (amps)	3-PH - 230V	180	26
	3-PH - 460V	90	13
Max Running Load (dryer only, amps)	3-PH - 230V	196	
	3-PH - 460V	103.6	
Overload Setting	3-PH - 230V	90*	26
	3-PH - 460V	90	13
Circuit Breaker Rating - amps	3-PH - 230V	400	40
	3-PH - 460V	225	25
See Metering System, AC Transformer, and Notes below.			

<b>R - 3 1 1 0 0</b>			
	Voltage	Fan	Aux. Unload Motor
Horsepower	3-PH - 230V	100	10
	3-PH - 460V	100	10
Full Load Current (amps)	3-PH - 230V	232	26
	3-PH - 460V	116	13
Max Running Load (dryer only, amps)	3-PH - 230V	247	
	3-PH - 460V	130	
Overload Setting	3-PH - 230V	116*	26
	3-PH - 460V	116	13
Circuit Breaker Rating - amps	3-PH - 230V	400	40
	3-PH - 460V	250	25
See Metering System, AC Transformer, and Notes below.			

---

**METERING SYSTEM**

---

3 HP AC variable frequency drive  
Drive FLA = 15.2 amps @230V

---



---

**AC DRIVE ISOLATION TRANSFORMER—6KVA**

---

230 Volt dryers:  
     Primary side (230V) C.B. ....32 amps  
     Secondary side (230V) C.B. ..25 amps  
 460 Volt dryers:  
     Primary side (230V) C.B. ....20 amps  
     Secondary side (230V) C.B. ..25 amps

---

**NOTES:**

For 230V systems, the fan is started with a part-wind contactor arrangement.  
 One auxiliary 10 HP unload motor contactor is supplied as a standard part of the dryer control panel.

---



## MISCELLANEOUS COMPONENTS

### POWER DISCONNECT

The dryer is equipped with a power disconnect lever on the front of the PSC control box. Note that a power supply disconnect external to the dryer is also recommended, as described under the Electrical Power Supply heading in Section 2.

### CONTROL START/STOP

With all dryer circuit breakers turned ON, the Main Control circuit can be energized by first rotating the red Stop switch clockwise until the button pops out to enable the control circuit, and then pushing the green START button. The green light on the START button indicates that the control circuit is ON and that all safety switches are reset.

Push the red STOP button to stop the dryer control circuit. Note that this button remains locked in the OFF position until rotated to enable the control circuit.

A warning HORN will sound when the STOP button is enabled (pulled out), until the START button is pushed and the safety circuit is energized to allow dryer operation.

### FAN START/STOP

**NOTE:** Be sure to remove cover from burner and ensure blower is not obstructed before starting.

The Fan can be started by pushing the green START FAN button. When the Fan is up to speed and air pressure is proven, the green light on the START button will glow.

Push the red STOP FAN button to stop Fan.

### BURNER ON/OFF

Turning the Burner On/Off switch ON merely enables burner ignition. Actual burner ignition requires proven airflow, a purge time, and the Main/Safety Shutoff Valve to be in the OPEN position. A purge time of approximately 30 seconds begins after the Burner switch is turned on and the fan air pressure is proven as indicated by the illumination of the Air Proven indicator.

With the BURNER switch ON and the purge cycle completed, the green BURNER ENABLED light will light for 15 seconds. During this time, the burner can be ignited by opening the Main/Safety Gas Shutoff Valve. Should the BURNER ENABLED light go off before ignition takes place, the burner will lock out as indicated by the flashing red Burner Lockout Indicator.

When ignition is completed, the green BURNER ENABLED light will remain ON as long as a fire is sensed. If the flame is lost, the red Burner Lockout Light will come on and the Burner control must be manually reset to reignite burner.

### RESETTING THE BURNER LOCKOUT

If the burner fails to light in the 15 second time period, the burner control will turn the gas off and go into a lock-out mode of operation as indicated by the flashing red Burner Lockout Indicator. The fan will continue to operate until timer 3IR (Lock-Out Shut Down Delay Timer) times out, at which time the dryer will shut down. This shutdown will be indicated by a constant illumination of the red Burner Lockout Indicator.

To reset the burner controller before the dryer shuts down, press the blue reset button located on the front of the Honeywell burner control located inside the ASC control box. The burner switch must be ON when the reset button is pressed.

If the dryer's unload system is operating when the burner switch is turned ON, the unload system will stop operating. The unload system will remain off until the Maxon gas valves are opened. This safety feature prevents the dryer from unloading wet grain in the event of a burner failure.

### MAIN/SAFETY GAS SHUTOFF VALVE

**VALVE OPERATION** This is an electrically energized, manual reset type valve. The valve is equipped with an electric solenoid which is energized only when the dryer Burner Switch is turned ON.

The valve has a "free handle" lever which will not open the valve to allow gas flow to the dryer until the Burner Switch is turned ON. Only then will the lever engage to allow the handle to be manually raised to the latched position, thereby opening the

valve. The valve will trip closed instantly when its solenoid is de-energized; gas flow will also stop when the lever is rotated to the closed position.

An "open" and "shut" indicator is provided on the side of the Main/Safety Shutoff valve. (An orange indicating bar aligns itself with the words "open" or "shut.")

NOTE: For the burner to fire, the Main/Safety Gas Shutoff Valve must be manually reset to OPEN and the fan must be ON. This valve should never be closed manually using the lever on the valve. To close the valve, turn the burner switch OFF. This will cause the valve's internal solenoid to de-energize, causing the valve to close.

## LOAD AUGER

The LOAD AUGER switch has three positions: ON, OFF, and AUTO.

The ON position is recommended when initially filling an empty dryer. With switch ON, the Load Timer is de-energized.

### Choke Fill (One Bindicator Switch)

With the load switch in the Auto position, the load auger relay, 2CR will energize when the grain level drops below the Bindicator switch. The relay will de-energize when the grain level is just above the Bindicator switch. In the choke fill mode of operation, the main use for the Bindicator switch is to stop the dryer when the wet grain supply is exhausted.

### Automatic Fill (Two Bindicator Switches)

With the load switch in the Auto position, the load auger relay, 2CR, will energize when the grain level drops below the lower Bindicator switch. The load auger relay will de-energize when the grain level reaches the upper Bindicator switch.

The AUTO switch position is the normal setting and is used to automatically stop the dryer when the wet grain supply is exhausted. With switch in the AUTO position, the Load Timer will be energized whenever the lower Bindicator is calling for grain. If the auxiliary load auger and timer operate continuously for a period longer than the timer setting, the timer will automatically shut down the dryer and the LOW GRAIN light will come on.

## LOAD (Top Auger) TIMER

FUNCTION The top auger loads the wet bin intermittently, depending on when the lower Bindicator paddle switch calls for more grain. The

Load Timer checks that the load auger does not run beyond the normal time to fill the wet grain holding bin. If, due to inadequate wet grain supply, the load auger runs longer than a normal refill time, the Load Timer causes a dryer shut-down.

The Load Timer, located within the ASC control box, is an automatic reset type timer. The amber LOW GRAIN shutdown indicator will light whenever a shutdown is caused by the Load Timer.

TIMER SETTING To set the Load Timer, observe the normal time required to fill the wet bin, then rotate the front dial to set timer to the average refill time plus several additional minutes.

NOTE: The Load Timer can be set to several time ranges of operation. The timer is factory set in the 60-minute range mode. With this arrangement, the no. 1 mark on the dial face equals 1/6 of the 60-minute range or 10 minutes.

## UNLOAD AUGER

The UNLOAD AUGER switch has two positions: OFF or ON.

With switch in the ON position, the auger runs continuously and the metering augers are controlled by the Unloading Switch position (Manual/Off/Auto).

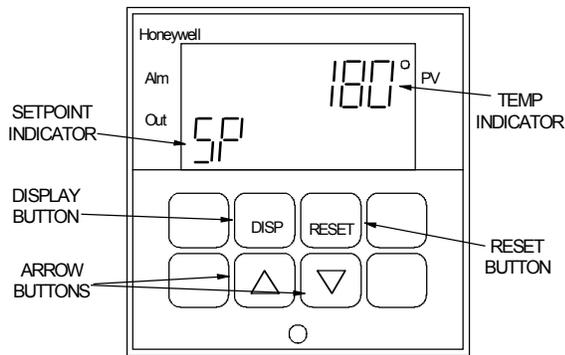
With switch in the OFF position, the metering augers are stopped.

NOTE: If the dryer's unload system is operating when the burner switch is turned ON, the unload system will stop operating. The unload system will remain off until the Maxon gas valves are opened. This safety feature prevents the dryer from unloading wet grain in the event of a burner failure.

## PLENUM TEMPERATURE CONTROL

Setting the Plenum Temperature:

- A. Push the DISP button once and SP (set point) will be displayed in the Lower LH corner.
- B. Raise or lower SET POINT to the DESIRED plenum temperature by pushing the triangle buttons to increase or decrease (set-point range is 0-250 F).
- C. Push RESET to return to plenum temp display. A set point should not be in the display. If display is inactive for 60 seconds, it automatically returns to a plenum temp display.



### Plenum Temp Control assembly

The PLENUM TEMP Controller will automatically begin opening the gas control valve when a flame is proven and will modulate the control valve to hold the Plenum set point entered.

### METERING AUGER CONTROLS

#### UNLOADING SWITCH

Switch has three positions: MANUAL, OFF, and AUTO. The UNLOAD AUGER switch must be ON in order for the Unloading Switch to operate metering augers. With Unloading Switch in the MANUAL position, metering auger speed is controlled by the MANUAL UNLOADING dial.

With switch in the AUTO position, metering augers are controlled automatically by the Moisture Control unit.

With the Unloading Switch set to Manual, the Moisture Control can only display grain temperature, but cannot control metering auger speed. With the Unloading Switch OFF, the Moisture Control display is also off.

#### MANUAL UNLOADING DIAL

The Manual Unloading dial sets metering auger speed to a constant unload rate. Set the desired % unload rate by watching the Unloading Rate volt meter as the Manual Unloading dial is adjusted. See Drying Time Tables in Section 5 for suggested start-up settings.

#### UNLOAD RATE METER

The UNLOADING RATE meter represents the % UNLOAD RATE of the dryer and should range from 7% to 100% as the unload speed is changed. Be sure to use the Unloading Rate meter as the primary indicator of the % unload rate, as the

Manual Unloading dial setting will be close to but not as accurate as the volt meter reading.

### VARI-TROL MOISTURE CONTROL

Vari-Trol Moisture Control works on the principle that grain moisture and grain temperature are closely related. Monitoring grain temperature, combined with manual testing of the grain's final moisture content, will allow the operator to determine the proper temperature/moisture relationship. Using the Moisture Control temperature display on the ASC panel, the operator can view the current grain temperature and set the desired grain temperature (set point), in the manner described as follows.

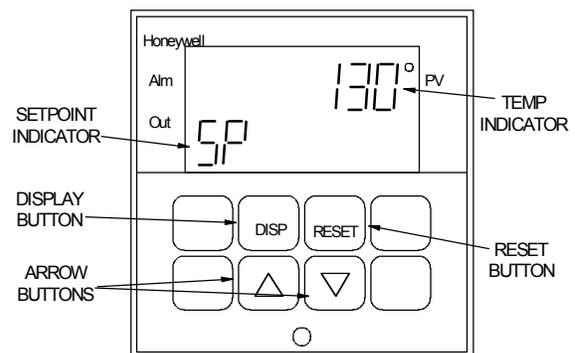
NOTE: As previously stated, with the Unloading Switch set to Manual, the Moisture Control can only display grain temperature, but cannot control metering auger speed. With Unloading Switch set to OFF, the Moisture Control display is also off.

#### SETTING TEMP

- A. Push DISP (display) button once and current set point will be displayed as indicated by the letters SP (set point) in the lower LH corner.
- B. Raise or lower set point to desired temperature by pushing the triangle buttons to increase or to decrease (set-point range is 0-200 F).
- C. Push RESET to return to measured temperature. SP will not be displayed. If display is inactive for 60 seconds, it will automatically return to measured temperature display. If moisture control is turned off while in the SP mode, the newly entered set point will be canceled.

#### OPERATING WITH AUTOMATIC MOISTURE CONTROL

1. After the discharge rate has been manually adjusted by the speed control in the manual



### Vari-Trol Moisture Control assembly

mode, and the grain being discharged from the dryer has been at the desired moisture content for an hour or so, the moisture control system may be placed in automatic mode of operation.

2. Move the Unloading Switch from MAN to OFF, then to AUTO, pausing 5 to 6 seconds in the OFF position. This pause is necessary for the Moisture Control to reinitialize. If the Moisture Control has been correctly reinitialized, first zero degrees and then the correct grain temperature will display after the switch is set to AUTO. Failure to wait for a complete reset can cause a lengthy delay in the time the Moisture Control needs to arrive at the correct meter roll speed. Also important: Do not change the manual unload rate dial while in the auto mode.
3. The Moisture Control unit will begin automatically controlling the metering auger speed to compensate for changes in the grain input moisture by maintaining the set point temperature entered.
4. If large changes in grain input moisture are encountered, repeat the setup procedure to establish a new set point temperature.
5. When restarting a loaded dryer following a shutdown period, the dryer should be operated in the MANUAL mode, until the newly dried grain has passed the RID grain sensor (2/3 of the grain pass time) and the grain temperature has stabilized, before switching to the AUTOMATIC mode. The Moisture Control set point should not require readjustment.

See Section 5, Dryer Operation, for moisture control operating procedure.

## DRYER OPERATOR LIGHT

**LIGHT OPERATION** The dryer operator light is designed to act as either a dryer monitor signal light, or a night convenience light.

**SWITCH POSITIONS** The three-position switch provides ON, OFF, or MONITOR operation. When the switch is set ON, the light will stay energized even when the dryer is shut down. When the switch is set to MONITOR, the light will be ON only when the dryer is operating.

**NOTE:** The light circuit is 115 volts and is intended for 100 watt bulb operation. Do not install an oversize light bulb!

## HOOR METER

The hour meter, located inside the ASC Control Box, is useful in keeping track of seasonal use of

the dryer and determining when service is required. The hour meter is non-resetting and accumulates hours only when the fan is powered.

## SHUTDOWN INDICATORS

The R-3100 series dryers are equipped with a safety circuit monitor which helps to locate the cause of a dryer shutdown by energizing an indicator light.

When a safety shutdown occurs, the control circuit will be disabled, the horn will sound, the Dryer Operator Light (if set to monitor position) will go off, and the appropriate shutdown indicator light will be energized. The indicator will stay energized until the control stop or start button is pushed. Be certain to check the indicator lights before stopping the dryer control. If the shutdown device requires manual resetting or has not yet automatically reset (due to cool down time required), the light will reappear when a control start is attempted.

**NOTE:** During periods of troubleshooting, the horn may become annoying. It can be temporarily disabled by pulling fuse #2 located in the ASC control box (see Fig. 6-1). The horn volume can be adjusted by turning the allen screw located on the horn's case. The horn is provided for the safety of the operator and to call attention to the dryer when a problem exists. Disabling the horn may result in injury to personnel or damage to equipment.

**NOTE:** NO indicator light will come ON if a motor overload relay trips open. The shutdown detector unit is designed so that if a malfunction occurs within the unit, such as a bad light or poor wiring connections, it will not prevent the dryer from operating, but will only cause abnormal action of the indicator lights

## RESTARTING DRYER AFTER A SHUTDOWN

1. Investigate the cause of shutdown and perform any necessary adjustments or corrections. For additional information, refer to "Control Circuit Not Energized" heading within Section 9 - TROUBLESHOOTING. As a future reference, it may be advisable to make a record of the cause, as indicated by the shutdown indicator.

**NOTE:** On rare occasions, several dryer safety devices may act to interrupt the safety control circuit simultaneously. If this occurs, the LOWEST NUMBER INDICATOR LIGHT on the detector will

always take priority, as the unit is constructed to indicate only one cause at a time.

2. Press the dryer START button. When the start button is pressed, the dryer control light should come ON, indicating that all safety devices have been reset and the dryer is operational.

If dryer will not restart and no indicator light is ON, the problem can be further identified as follows:

A. Depress the dryer start button and observe whether the dryer circuit becomes energized.

B. If the dryer will now start while the button is held depressed, the problem should be isolated to the Safety Shutdown Circuit. Verify that the safety shutdown unit is not operating properly. Refer to SECTION 9 - TROUBLESHOOTING and Section 8 Safety Shutdown Circuit schematic for additional information.

CAUTION: Do not attempt to place the dryer back into operation by fixing the start button in the depressed position, as this would bypass the safety devices and cause unsafe dryer operation!

Following is a list of shutdown indicators. For the most common shutdown causes, see Section 9, Troubleshooting.

#### ASC Panel Indicator Lights

Burner lockout    reset manually by pressing reset button on burner controller

Low Grain    auto resets

Plenum Hi-limit    auto resets after cooling

Top Overheat    auto resets after cooling

Middle overheat    auto resets after cooling

Bottom overheat    auto resets after cooling

Inside overheat    auto resets after cooling

AC Drive Fault    auto resets

#### Unmonitored Safety Shutdown Devices

Fan overload relay

Auxiliary unload overload relay

#### ADJUSTING DRYER AIRFLOW

The fresh air louvers can be adjusted to balance the amount of cooling air required. Opening the louvers wider will reduce the amount of vacuum cooling and increase the drying airflow rate. Closing the louvers will increase the cooling air-

flow rate while reducing the amount of air to the drying zone.

When drying crops wetter than 20% moisture, dryer capacity may be improved by fully opening the fresh air louver opening. Monitor dry grain temperature for adequate cooling when making final adjustments

The louvers can be adjusted by moving the HFWL 5/16-18 nuts located on the louver adjusting stud protruding through the lower door panel. Fine adjustments can be made by rotating the louver handle assembly.



Before the dryer is filled with grain and placed into actual drying operation, thoroughly inspect the unit and check out the operation as described in the following steps

1. Set controls and switches as follows:

<u>CONTROL</u>	<u>TEST FIRING SETTING</u>
Burner Switch	OFF
Load Auger Switch	OFF
Unload Auger Switch	OFF
Unloading Switch	OFF
Manual Unload Setting	Adjust to minimum
Loading Timer	30 minutes

2. Inspect metering augers and inside of dryer.

Check the inside of air plenum chambers and remove all foreign materials.

3. Check plumbing for leaks.

Open the main fuel supply valve to allow fuel flow to the electrically operated Main/Safety Gas Shutoff Valve.

On NG dryers, open the 2" hand valve and check for leaks in the fuel supply plumbing and the dryer fuel manifold up to the Main/Safety Shutoff Valve.

On LP dryers, open the 3/4" liquid valve and check for leaks in the fuel supply plumbing and vaporizer plumbing up to the liquid solenoid valve.

NOTE: Open the shutoff valve slowly to prevent accidental closing of the excess-flow valve within supply system.

Turn ON the Power Disconnect lever located on the PSC Power Box. Using a jumper wire, temporarily jump power from terminal #3 to terminal #37 on the ASC terminal strip to power the liquid solenoid valve open and pressurize the rest of the vaporizer plumbing. Turn the electrical disconnect OFF and check the vaporizer plumbing for leaks.

Proceed only after ALL fuel leaks have been corrected.

4. Turn ON the main power disconnect located on the PSC Power Box.
5. Start dryer control circuit.

Turn the Control Stop switch to ENABLE the controls and push the Control Start button. The green light on the Control Start button should immediately light, indicating the safety circuit and control circuit are energized to allow dryer operation.

6. Check conveyor motors rotation.

A. Any wet grain auxiliary supply conveyors connected to the control circuit should start and rotate in the proper direction when Load switch is turned to the ON or AUTO position.

B. Quickly bump (jog) the Unload Auger Switch to the ON position. Any dry grain auxiliary conveyors connected to the dryer power terminals should also start and rotate in the proper direction.

C. With the Unload Auger Switch ON, set the Unloading Switch to MANUAL position and check the direction of rotation. The metering auger gearbox shaft should rotate clockwise as viewed from the shaft end.

7. Check metering auger operation.

With Unloading Auger still operating, rotate the MANUAL UNLOADING control to increase metering auger speed and check the metering auger drive mechanism for proper operation. The UNLOAD RATE should range from approximately 7% to 100%. Make sure all drive chains are properly tensioned and that both metering augers rotate properly and smoothly.

NOTE: Do not test unload rates greater than 60% unless metering augers are removed from the gearbox shaft, or the dryer is filled with grain. Testing the metering auger without grain at high unload rates may result in damage to the augers.

8. Check fan motor rotation.

Jog the fan motor by pushing the FAN START switch and then immediately push the FAN OFF switch and observe the direction of the fan rotation. The fan should rotate counter clockwise as viewed looking into the fan inlet.

NOTE: If all dryer motors run backward, they can easily be reversed by changing the dryer's power supply connection. Auxiliary conveyors which have been field connected may have to be reversed individually.

9. Check fan motor starting.

Start the fan motor and observe the number of seconds required for the fan to reach FULL RPM. The fan should reach full speed within 10 seconds and the motor running current should be within acceptable limits to the full-load amperage listed in the electrical specifications of this manual.

10. Burner test firing.

NOTE: Pressure may not be adequate to activate the pressure switch when testing an empty dryer. Temporarily jump terminals 33 and 34 before proceeding with burner test firing.

A. Set the Plenum temperature control to 150 F. The plenum temperature should be reading approximately ambient temperature at this time.

B. Check to see that the fuel supply hand valves are on.

C. Preset Modulation Valve Linkage

Check to see that fuel modulating motor arm is starting from a position near 12 o'clock and that the butterfly valve linkage is in a nearly closed position (rotated to the stop counter-clockwise). See Fig. 6-1.

D. Check Burner Control Lockout

With the fan on, turn the Burner Switch to ON. The amber ENABLED light will come on when the purging cycle is complete (approximately 30 seconds after fan pressure has been proven). Do not operate the safety shutoff valve at this time. In 15 seconds, the burner LOCKOUT light will start flashing and the ENABLED light will go out. Press the Reset button on the Burner Control and turn off the Burner switch.

E. Ignite Burner

Turn the burner switch ON. When the amber ENABLED light is observed, open the Main/Safety Gas Shutoff valve. Ignition should occur, the fuel modulator motor will begin opening the butterfly valve, fuel pressure should be observed on the pressure gage downstream of the butterfly valve, and the plenum temperature should begin to rise.

F. Set Regulator

Observe the pressure on the gage mounted on the Main/Safety Gas Shutoff valve upstream of the butterfly valve. This pressure should be regulated to the pressures shown in the Fuel Specifications figure in Section 2. Set the regulator to the proper pressure.

NOTE: The regulator pressures specified in the charts are for maximum BTU rates required. Under drying conditions with moderate ambient temperatures or lower than normal drying temperatures, lower regulator settings may be used.

G. Adjust Low Fire

The plenum temperature controller should stabilize on the set point temperature after a short time of operation. Decrease the plenum set point to 100 F to cause the controller to go to minimum fire position. Adjust the linkage (rod length) on the butterfly valve to obtain a 1/2 to 1 PSI burner pressure and observe the fire through the side of the dryer. The fire should appear evenly spread within the burner baffles.

H. Check High Fire

Increase the plenum temperature controller to 150 F. The controller should stabilize on the set point after a short time. While the temperature is climbing, the modulation motor should drive the butterfly valve to an open position. At this time, the regulated pressure gage should be reading nearly the same pressure as the burner pressure gage. If the burner gage is considerably lower, the butterfly valve is not open enough and the effective arm length on the modulator motor should be increased. Make this adjustment when operating in low fire. Reset low fire adjustment as well.

I. Check Ignition

Turn the burner switch to OFF and allow the modulation motor to return to low fire. Turn the burner switch ON and open the Main/Safety Gas Shutoff valve. Verify that the low fire adjustment allows burner to ignite quickly and reliably. Slightly increase minimum gas pressure if ignition is slow.

J. Check Burner Control Circuit Shutdown

Turn the unload auger ON and set the Unloading Switch to Manual. With the burner still operating, turn fuel supply hand valve OFF. After the burner has burned down the fuel in the lines, the flame safeguard control should go into lockout. This should cause the unload auger OPERATING light to go off. Within three minutes, the dryer safety circuit should cause a complete dryer shutdown.

Be sure to reset the burner flame safeguard and open the fuel valves if dryer is to be refired.

#### 11. Check moisture control operation

A. Set all switches to the positions shown in step number 1.

B. Start the dryer control circuit, turn the unload auger to ON, and set the Unloading Switch to MAN position. Adjust the UNLOADING RATE to 30%.

C. The moisture controller should be reading approximately the same as ambient temperature unless there is still residual heat in the dryer from previous burner operation. Set the Moisture Controller to match the measured temperature displayed.

D. Set the Unloading Switch to AUTO, pausing a few seconds in the OFF position. The unloading rate should begin at the previously adjusted manual unloading rate.

E. Increase the moisture controller set point approximately 30 F above the current measured temperature. The unloading rate should drop to approximately 2/3 of the manual unload rate, or 20%. Additional temperature increase will not cause further unload rate reduction.

F. Decrease the moisture controller set point approximately 95 F below the measured temperature. The unloading rate will increase to approximately twice the manual unloading rate, or 60%.

#### 12. Check Bindicator operation (2-switch operation).

A. Adjust the Load Timer (inside the ASC box) to approximately 30 minutes.

B. Start the dryer control circuit and set the Load Auger switch to AUTO. The Load Auger Operating light should turn ON.

C. Simulate the filling and emptying of the dryer during normal operation by manually stopping and releasing the Bindicator paddles while someone observes the Load Auger Operating light at the control box.

Stop the lower Bindicator paddle (to simulate grain level rising). The Load Auger Operating light should remain ON.

Stop both the lower and upper Bindicator paddles (to simulate grain level reaching upper Bindicator). The Load Auger Operating light should turn OFF.

Next, release the upper Bindicator paddle (to simulate grain level decreasing). The light should remain OFF.

Finally, when the lower Bindicator paddle is released the Load Auger Operating light should turn ON again.

#### 13. Check safety shutdown devices.

A. Low grain monitor and fill switch

Adjust the Load Timer (inside the ASC box) to a short time period of approximately five minutes or less. Start the dryer control circuit and set the Load Auger Switch to OFF. The Load Timer should not be powered and no shut down should occur after a five-minute or longer filling time.

Position the Load Auger Switch to AUTO. The Load Timer should begin counting down and the dryer should shut down after five minutes of loading. The LOW GRAIN indicator light should be energized on the control panel. Be sure to reset the Load Timer to the appropriate time.

#### 14. Start the control circuit and then stop dryer operation.

Push the STOP button. The fan, burner, and augers should immediately stop operating as the button is depressed.

With the dryer properly functioning as described in the previous steps, the unit can be considered ready for drying operation. Refer to Section 5, Dryer Operation, for procedure and control settings.

Shut off the Power Disconnect lever on the PSC box and close fuel supply valves if you are not ready to begin the drying operation.



**CAUTION:** Extreme caution should be taken by anyone entering inside the dryer roof section to access the Bindicator paddles. It is advisable to wear a safety harness to protect against falls.



---

### IMPORTANT SERVICE TIPS FOR DRYER OPERATORS

1. Never fill the dryer unless either the burner is covered or the fan is on.
  2. During operation:
    - Keep divider hopper between heating and cooling sections clear and free of fines and foreign material.
    - Keep cooling chamber floor clean.
    - Keep inspection lid to metering section tightly sealed. Leaving it open is a fire hazard.
    - Check lube level in gear box reservoirs.
  3. An emergency discharge slide gate near the bottom of each column will permit dumping each individual grain column in case of an emergency (see Fig. 6-7).
  4. After drying season, remove all grain from dryer. Dryer is not intended to be a storage area for grain. If grain is left in dryer for an extended length of time it can become wet, freeze, expand, cake, and spoil. Expansion can put extreme pressure on grain column sheets and bridging can later be a major problem when trying to empty the dryer. Chunks of solid grain can prevent metering augers from turning and cause severe damage to the metering mechanism.
  5. After drying season, cover burner with a tarp or burner doors. Remove drain plug in main burner gas line. When dryer is empty, rain can blow into burner, drain into the gas pipe to gas control valves, and freeze during winter. This can damage or destroy the valves. If your dryer has no drain plug, open a union instead.
  6. See Service Section of this manual for further important service information.
-

## START-UP PROCEDURE

Ensure that the test-fire procedure as outlined in Section 4 has been recently performed. Test operate the dryer immediately prior to start-up to make certain that all motors and controls are functional before loading the dryer with wet grain.

### 1. Set controls as follows:

Burner Switch	OFF
Load Auger Switch	OFF
Unload Auger Switch	OFF
Unloading Switch	OFF
Loading Timer	10 Minutes
Plenum Temperature	See table for setting

Adjust the dryer airflow louvers as described under the Adjusting Dryer Airflow heading near the end of Section 3. Adjustments may require fine tuning after the dryer is operating.

- Turn ON the main disconnect on the PSC box. Unlock the control stop button to ENABLE dryer and press green START button. Green indicator light should come ON.
- Set Load Auger Switch to ON and allow dryer to fill. The load auger OPERATING indicator should be ON and will go OFF when dryer is filled. When dryer is filled, place the Load Auger switch into the AUTO position.
- Using the Reference Setting Tables found later in this section, determine the approximate drying time required for the type of grain and required moisture reduction.
- Start the fan by pushing the green fan START button. The green indicator light should come on and the fan should start.
- Turn the burner switch to ON. When the purging cycle is completed (30 seconds), the burner ENABLED light will come on. Open the Main/Safety Gas Shutoff valve while the ENABLED light is energized to ignite the burner.
- Operate the burner for a time equal to 2/3 of the estimated dry time before starting the unload auger.
- Start the grain discharge by setting the Unload Auger Switch to ON. Set the Unloading Switch to MAN and adjust the unload rate to the desired setting.

NOTE: During the initial start-up of a continuous-flow dryer, the discharged grain will not be of the desired moisture content until the dryer has been operated for at least the time required to make one grain pass.

$$\begin{array}{l} \text{Minutes} \\ \text{for one} \\ \text{grain pass} \end{array} = \frac{\text{Holding Capacity (bu.)} \times 60}{\text{Maximum Load Rate} \times \% \text{ Unload}}$$

Make provisions in your drying system to recirculate the first part of the initial batch back to the wet grain storage bin.

- Observe the typical operating time for the auxiliary load auger and set the Load Timer to a longer time to provide shutdown on wet grain outages. Set the Load Auger Switch to AUTO to energize this low-grain timer shutdown feature.
- After the dryer has been allowed to operate for one grain pass, check the discharged grain moisture for the desired drying results and make unload rate changes as required to obtain the proper discharge moistures. Allow another grain pass time and recheck grain moisture.
- Setting Moisture Control: Set the Unloading Switch to AUTO and set the Moisture Controller temperature referring to the procedure as follows.
  - Check for the desired final grain moisture. If adjustments are required, change the Manual unloading dial as required and allow dryer to operate for one grain pass before rechecking moisture. See formula listed in Step 8 above for calculating minutes for one grain pass.
  - After the grain has been readjusted and stabilized at desired moisture content, note the temperature on the moisture controller and adjust the set point to the temp noted.
  - Move the Unloading Switch from MAN to OFF, then to AUTO, pausing 8 to 10 Seconds in the OFF Position. DO NOT CHANGE THE MANUAL UNLOADING CONTROL WHILE IN THE AUTO MODE.
  - The Moisture Controller will begin automatically controlling the metering auger speed to compensate for changes in the grain input moisture by maintaining the set point temp. entered.
  - If large changes in grain input moisture are encountered, the setup procedure should be repeated to establish a new set point temperature.
  - When restarting a loaded dryer following a shutdown period, the dryer should be operated in

the MANUAL mode, until the newly dried grain has passed the RID sensor (2/3 of the grain pass time) and the grain temperature has stabilized, before switching to the AUTOMATIC mode. The Moisture Control setpoint should not require readjustment.

12. Make periodic checks of incoming grain moisture, discharged grain moisture, and plenum temperature to monitor dryer operation. Keep in mind that grain drying is a very slow process and that changes in the unload rate made either by the automatic moisture controller or manually will require 1/2 to 3 hours to be measured in the grain discharge moisture, depending on grain pass time. Do not over-react due to slow response to an unload speed change by making a second correction before the first has been analyzed.
13. If a dryer shutdown occurs, be sure to check for a shutdown indicator light before the dryer control STOP button is pushed. Check the listing of safety circuit monitors in Section 3 - Operating Controls for a more detailed explanation of the indicator lights

Foreign material in the grain reduces the drying rate. The higher the percent of foreign material, the greater the reduction.

NOTE: A dryer should be kept clean at all times, and in no case shall a dryer operate for more than 72 hours without a thorough cleaning. This means ~~to completely empty the dryer of all grain and then~~ thoroughly clean. Rule of thumb on milo: dryers should be cleaned every 24 hours minimum.

## CORN

Corn may be dried from almost any moisture content to a safe level for storage; however, it is recommended that the drying operation start when the moisture content is no greater than 30% for best results

Corn should be run through a cleaner ahead of the dryer. This will remove a high percentage of the chaff, stalks, etc., and result in faster, more even drying.

The plenum temperature should be set according to the end use of the corn. Normal temperatures used at most elevators are in the range of 180 - 210 F, with 140 for commercial milling.

Adequate cooling of the corn after it passes through the drying zone is imperative. Set the adjustable air louver to the point where just enough air goes to the cooling chamber to bring the discharge temperature of corn to approximately 10 to 15 F above the outside temperature.

Final moisture content is regulated by the speed the corn passes through the dryer.

## MILLO

Milo is often harvested with a moisture content of 16% to 25%. Milo or sorghum is an extremely dirty or trashy grain requiring more careful observation during the drying process. Cleaning grain sorghum before drying is very desirable. Trash increases the resistance to air flow, and when it accumulates in pockets and dries out, is easily ignited. It also tends to plug the perforations in the wall of the drying columns, as well as accumulate on the divider hopper of the drying chamber and floor of the cooling chamber. The plugging condition reduces the airflow and thus the drying efficiency. It is imperative that the inner wall of the drying column and the divider hopper be cleaned daily. Failure to do so will increase your drying

---

## DRYING RECOMMENDATIONS

### DRYING CAPACITY

Without question, the greatest factor affecting grain drying is the grain itself. Variety, fertilization program, rainfall, sunlight (degree days), planting date, disease and insect damage, and hail and storm damage all affect the physiological make-up and maturity of grain kernels and, consequently, the drying rate. A drying capacity change has been observed simply by changing the source of corn from one field to another of equal moisture content.

Drying grain to a moisture content lower than 15% reduces drying capacity. This results from the longer distance moisture has to travel to get from deep within the kernel to the surface where it is evaporated. As a rule of thumb, one point moisture removal below 15% is the equivalent of two points removal above 15%.

cost and increase the risk of fire in the dryer. Exercise more caution than usual when filling your dryer with milo. Also, an "OFF CENTER" fill tends to allow trash or fines to accumulate in two or three columns of the dryer. This causes a distinct change in the air flow pattern and can create an undesired moisture content spread in the discharged grain.

The drying air temperature should be in the 150 to 180 F temperature range, depending on the amount of trash in the sorghum. The danger of a greater fire hazard when drying sorghum at high temperatures and high trash content must be kept in mind and precautions taken at all times to operate the facility within its limitations.

## SOYBEANS

It may be advantageous to harvest soybeans at moisture levels above those for safe storage to reduce harvesting loss. Crop is usually dried down to 11-13% moisture content. This will vary with the objectives of the bean marketer or processor.

Like milo, soybeans are extremely trashy and the same precautions should be exercised as those shown above for drying milo.

For commercial soybeans, do not exceed 130 to 140 F plenum temperature. At high drying rates, the seed coat shrinks faster than the seed, causing cracks in the seed coat. If the amount of cracking due to drying is excessive, reduce drying temperature.

Soybean processing plants using high temperature drying (150 to 180 F) are limited to situations where seed-coat cracking and germination are not important. Bean temperatures should be limited to 150 F to avoid reduction in oil content. At these elevated temperatures, the danger of a fire hazard when drying soybeans should be recognized and precautions taken to keep inside plenum chambers clean and to make sure there is no build-up of trash or restriction to flow of grain through the columns. Trash that accumulates in pockets and dries out is easily ignited.

## REFERENCE SETTING TABLES — R-3115B

### CORN ...dry & cool

		170 °F		190 °F		210 °F		
MOISTURE in out								
	% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time		
17	15	98	25					
18	15	74	33	86	28			
19	15	60	40	70	34	80	30	
20	15	51	47	60	40	68	35	
21	15	45	54	52	47	59	41	
22	15	39	62	46	53	52	46	
23	15	35	69	41	60	46	52	
24	15	31	78	36	67	41	58	
25	15	28	87	32	75	37	65	
26	15	25	97	29	83	33	73	
27	15	22	108	26	93	30	81	
28	15	20	120	24	103	27	90	
29	15	18	133	21	114	24	100	
30	15	16	147	19	126	22	110	
32	15	14	176	16	151	18	132	
35	15	11	223	13	191	14	167	

### WHEAT, BARLEY, MILO ...dry & cool

		140 °F		155 °F		175 °F		
MOISTURE in out								
	% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time		
15	13	68	36	79	30			
16	13	51	47	60	40	68	35	
17	13	42	58	49	50	56	43	
18	13	36	68	41	58	47	51	
19	13	31	78	36	67	41	59	
20	13	27	89	32	76	36	67	
21	13	24	100	28	86	32	75	
23	13	19	125	22	107	26	94	
25	13	16	156	18	133	21	117	

### SOYBEANS ...dry & cool

		120 °F		130 °F		140 °F		
MOISTURE in out								
	% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time		
15	13	68	36	79	30			
16	13	51	47	60	40	68	35	
17	13	42	58	49	50	56	43	
18	13	36	68	41	58	47	51	
19	13	31	78	36	67	41	59	
20	13	27	89	32	76	36	67	
21	13	24	100	28	86	32	75	
23	13	19	125	22	107	26	94	
25	13	16	156	18	133	21	117	

3115blab.tif

The above reference settings are estimates based on drying principles, field results, and computer simulations. Variances may occur due to the grain's physiological factors (kernel size, chemical composition, variety, maturity), excessive fines, weather conditions, etc.

## REFERENCE SETTING TABLES — R-3118B

### CORN ...dry & cool

		170 °F		190 °F		210 °F	
MOISTURE	in out	% Unload	Dry	% Unload	Dry	% Unload	Dry
		Rate	Time	Rate	Time	Rate	Time
17	15	87	25				
18	15	66	33	77	28		
19	15	54	41	63	35	72	30
20	15	46	48	53	41	61	36
21	15	40	55	46	47	53	41
22	15	35	62	41	54	47	47
23	15	31	70	36	60	41	53
24	15	28	79	32	68	37	59
25	15	25	88	29	76	33	66
26	15	22	98	26	84	30	74
27	15	20	110	23	94	27	82
28	15	18	122	21	104	24	91
29	15	16	135	19	115	22	101
30	15	15	148	17	127	20	111
32	15	12	178	14	153	16	134
35	15	10	226	11	193	13	169

### WHEAT, BARLEY, MILO ...dry & cool

		140 °F		155 °F		175 °F	
MOISTURE	in out	% Unload	Dry	% Unload	Dry	% Unload	Dry
		Rate	Time	Rate	Time	Rate	Time
15	13	61	36	72	30		
16	13	46	47	54	40	62	35
17	13	38	58	44	50	50	43
18	13	32	68	37	58	43	51
19	13	28	78	33	67	37	59
20	13	25	89	29	76	33	67
21	13	22	100	25	86	29	75
23	13	17	125	20	107	23	94
25	13	14	156	16	133	19	117

### SOYBEANS ...dry & cool

		120 °F		130 °F		140 °F	
MOISTURE	in out	% Unload	Dry	% Unload	Dry	% Unload	Dry
		Rate	Time	Rate	Time	Rate	Time
15	13	61	36	72	30		
16	13	46	47	54	40	62	35
17	13	38	58	44	50	50	43
18	13	32	68	37	58	43	51
19	13	28	78	33	67	37	59
20	13	25	89	29	76	33	67
21	13	22	100	25	86	29	75
23	13	17	125	20	107	23	94
25	13	14	156	16	133	19	117

3118btab.tif

The above reference settings are estimates based on drying principles, field results, and computer simulations. Variances may occur due to the grain's physiological factors (kernel size, chemical composition, variety, maturity), excessive fines, weather conditions, etc.

## REFERENCE SETTING TABLES — R-3120B

### CORN ...dry & cool

MOISTURE		170 °F		190 °F		210 °F	
		% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time
17	15	93	26				
18	15	70	35	82	30		
19	15	57	42	67	36	76	32
20	15	49	50	57	43	65	37
21	15	42	57	49	49	56	43
22	15	37	65	43	56	50	49
23	15	33	73	38	63	44	55
24	15	29	82	34	70	39	62
25	15	26	92	31	79	35	69
26	15	24	102	28	88	31	77
27	15	21	114	25	98	28	86
28	15	19	127	22	109	25	95
29	15	17	140	20	120	23	105
30	15	16	155	18	133	21	116
32	15	13	186	15	159	17	139
35	15	10	235	12	201	14	176

### WHEAT, BARLEY, MILO ...dry & cool

MOISTURE		140 °F		155 °F		175 °F	
		% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time
15	13	68	36	79	30		
16	13	51	47	60	40	68	35
17	13	42	58	49	50	56	43
18	13	36	68	41	58	47	51
19	13	31	78	36	67	41	59
20	13	27	89	32	76	36	67
21	13	24	100	28	86	32	75
23	13	19	125	22	107	26	94
25	13	16	156	18	133	21	117

### SOYBEANS ...dry & cool

MOISTURE		120 °F		130 °F		140 °F	
		% Unload Rate	Dry Time	% Unload Rate	Dry Time	% Unload Rate	Dry Time
15	13	68	36	79	30		
16	13	51	47	60	40	68	35
17	13	42	58	49	50	56	43
18	13	36	68	41	58	47	51
19	13	31	78	36	67	41	59
20	13	27	89	32	76	36	67
21	13	24	100	28	86	32	75
23	13	19	125	22	107	26	94
25	13	16	156	18	133	21	117

3120btab.tif

The above reference settings are estimates based on drying principles, field results, and computer simulations. Variances may occur due to the grain's physiological factors (kernel size, chemical composition, variety, maturity), excessive fines, weather conditions, etc.



# DRYER ILLUSTRATIONS

## SECTION 6

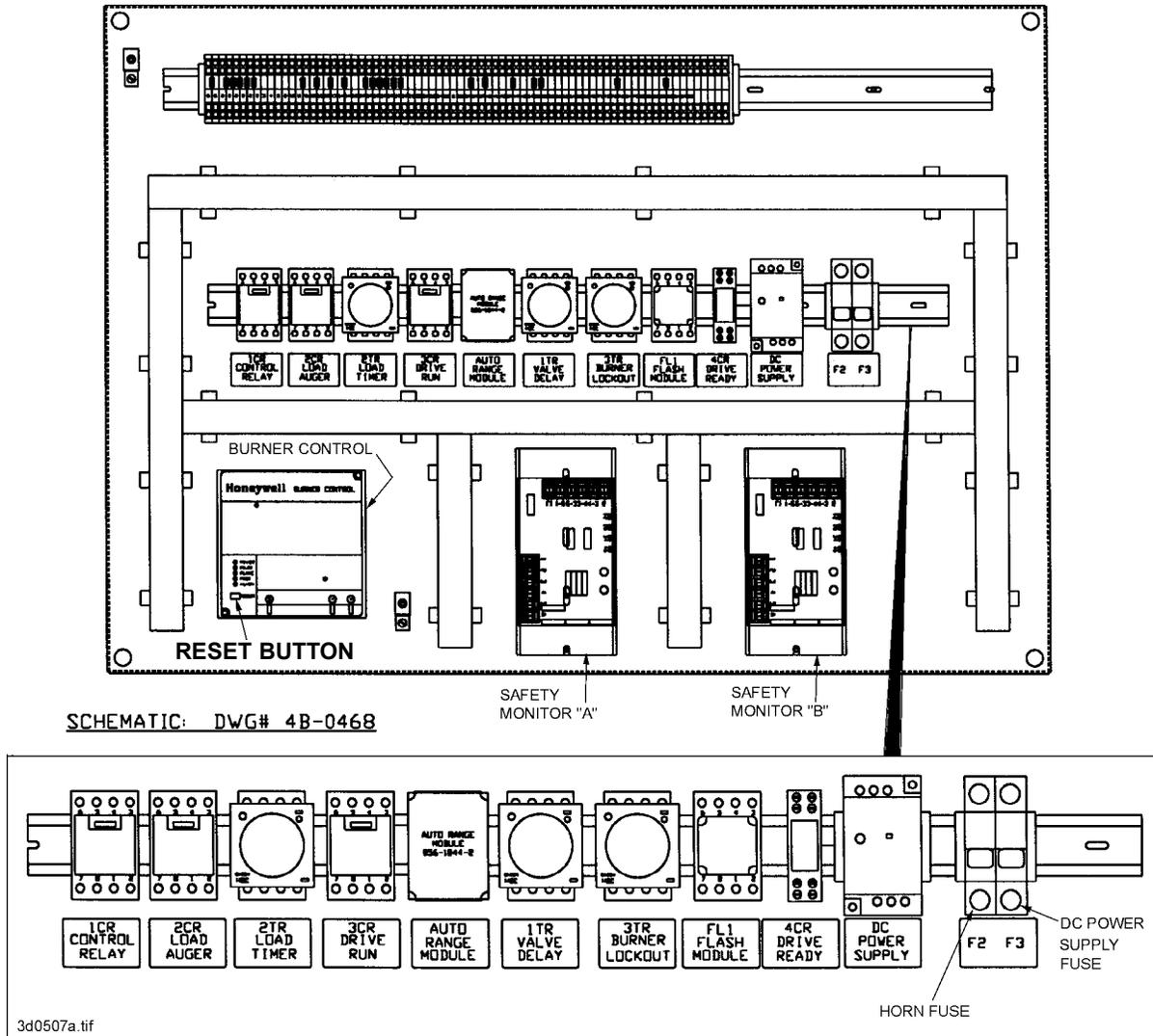
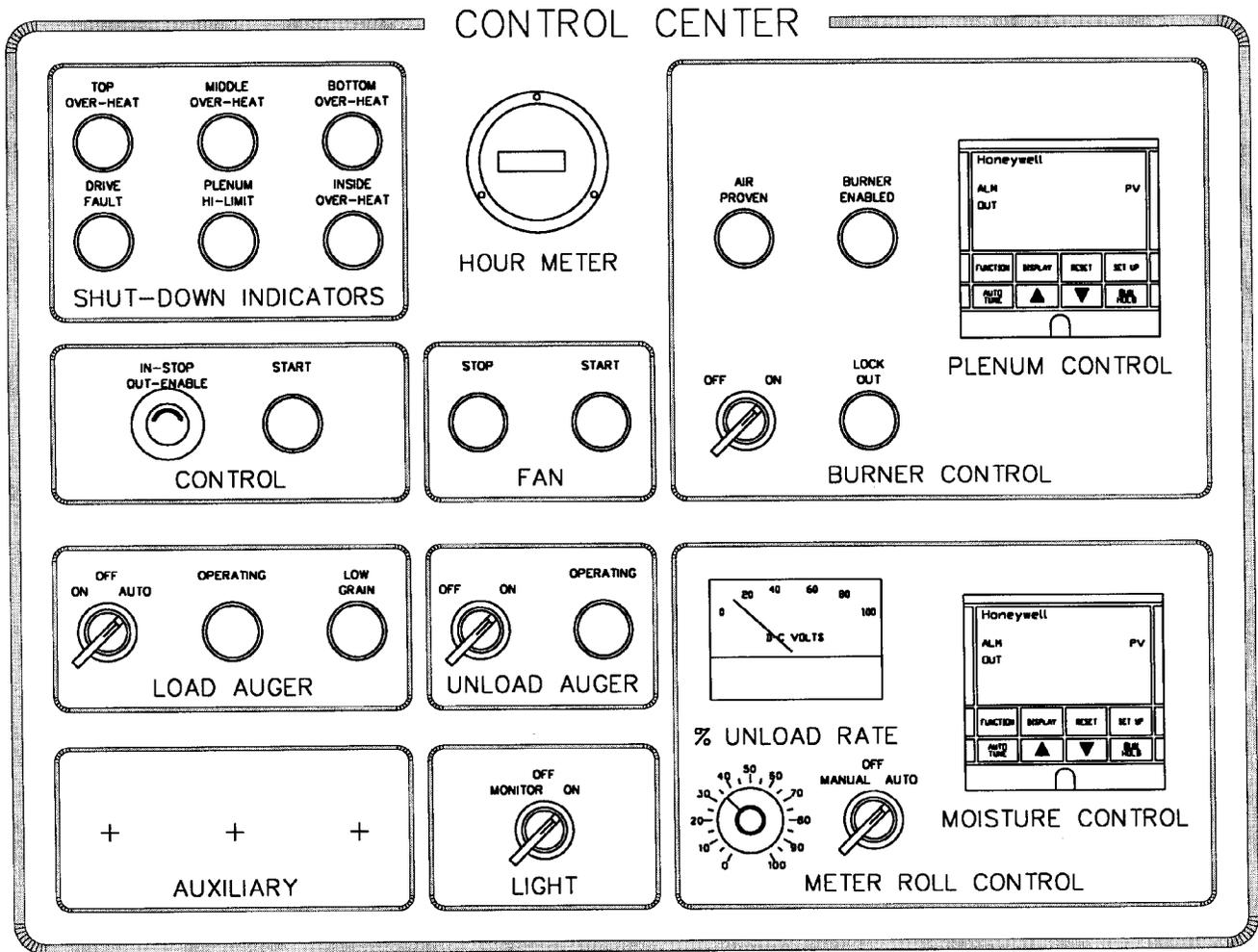


Fig. 6-1 ASC panel assembly, internal view

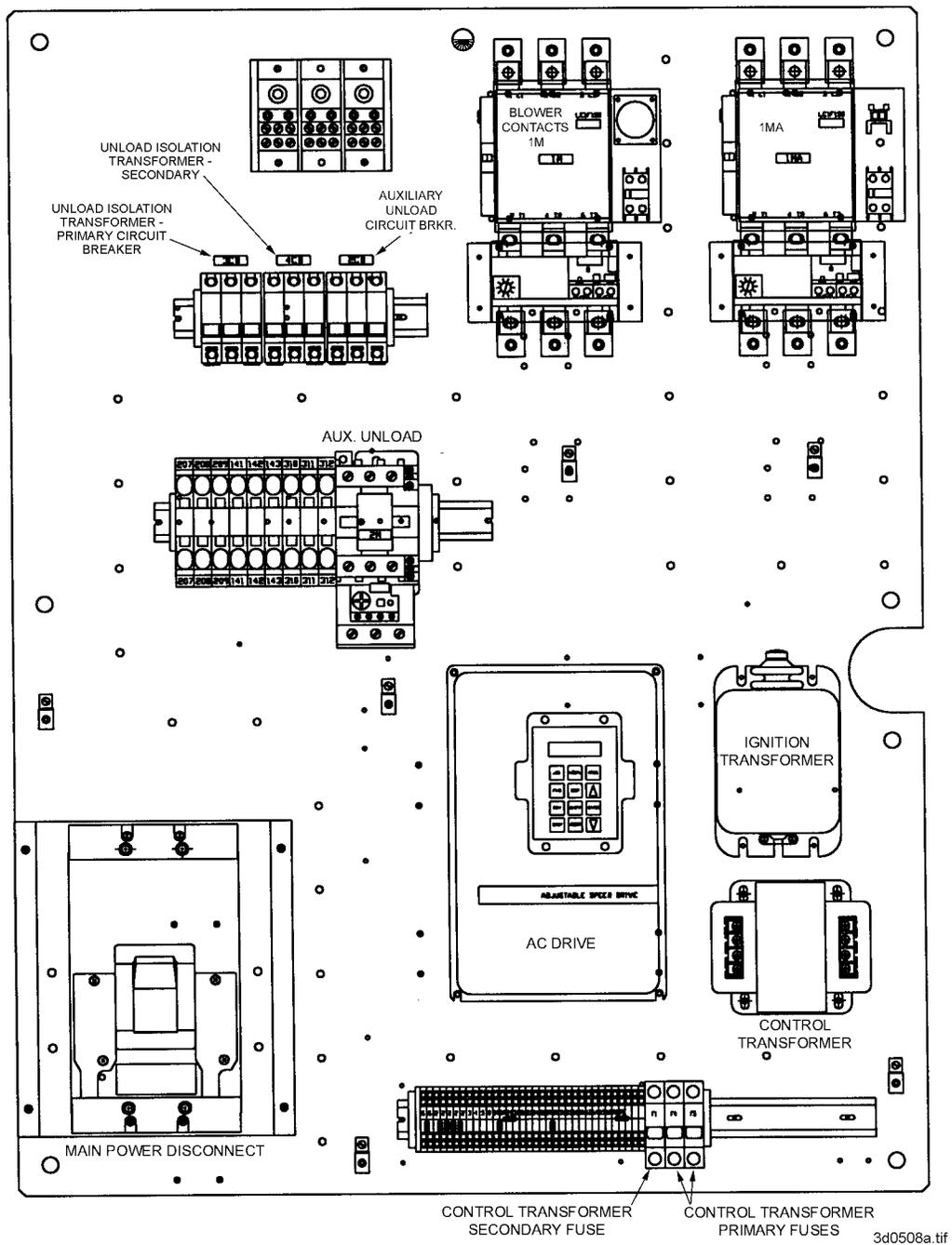


4d0207.tif

**3M** CORPORATION INDIANAPOLIS, INDIANA

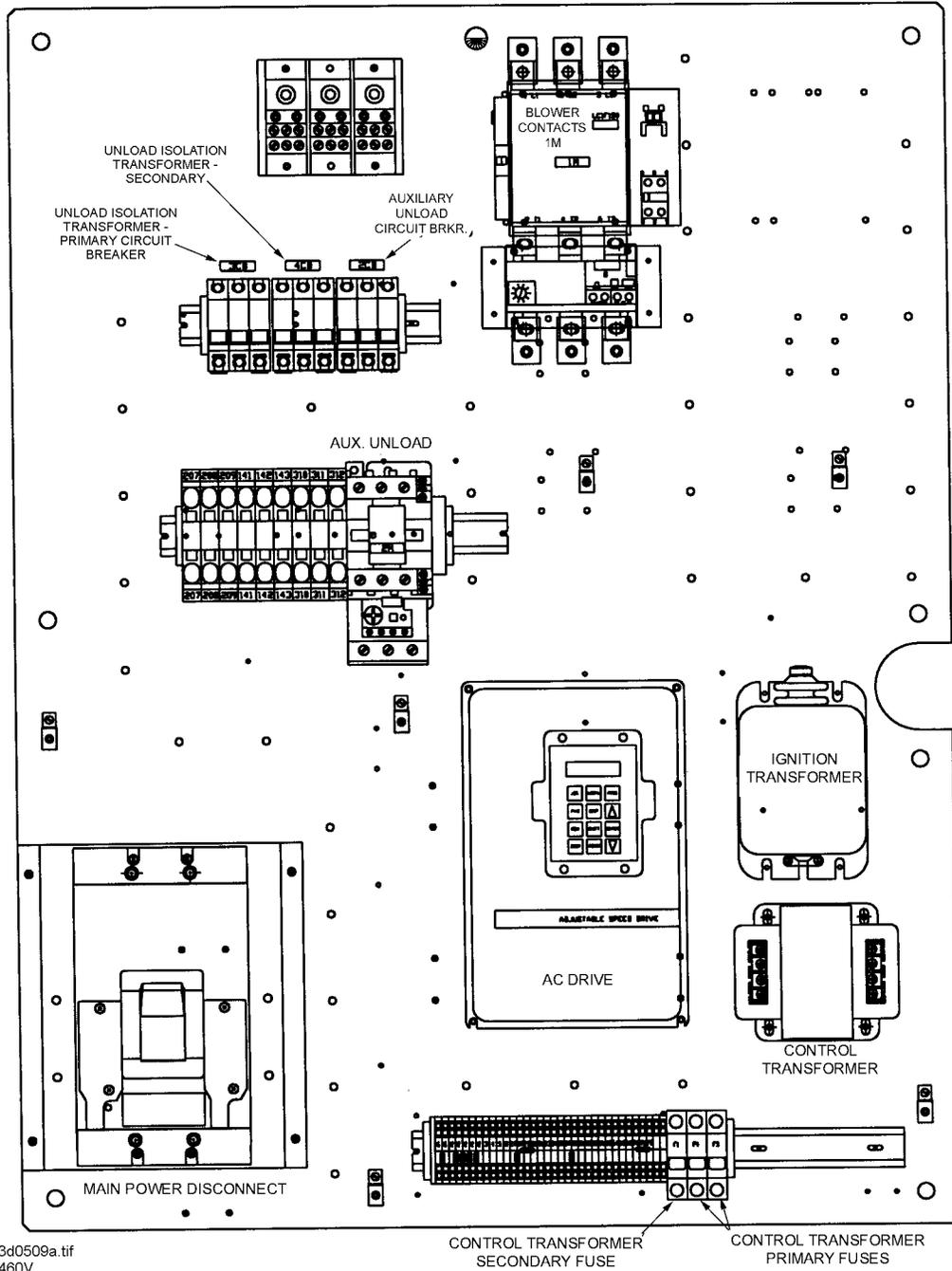
401-4874-2

Fig. 6-2 ASC panel assembly, external view



3d0508a.tif

Fig. 6-3 PSC power panel, 230V models



3d0509a.tif  
460V

Fig. 6-4 PSC power panel, 460V models

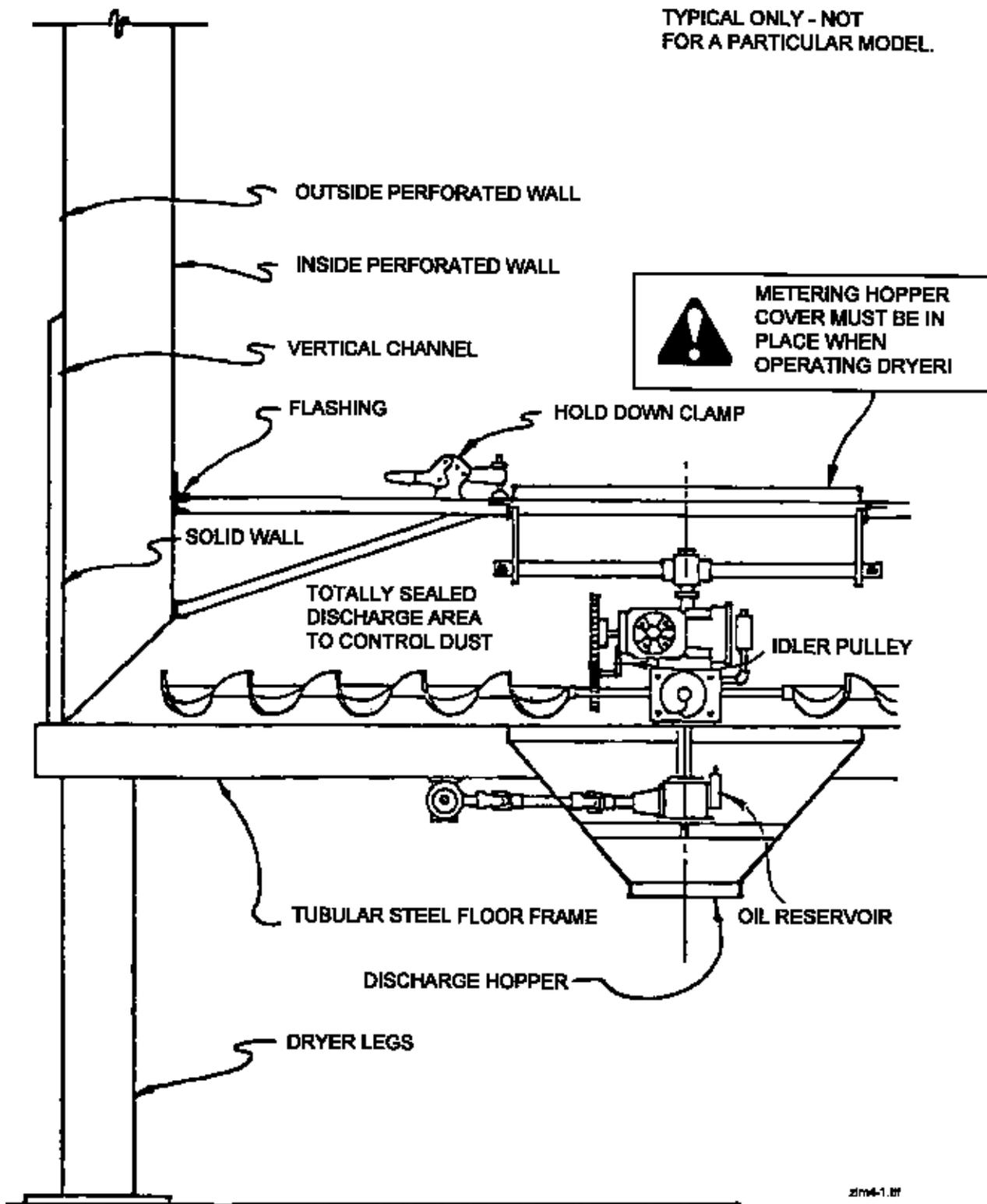
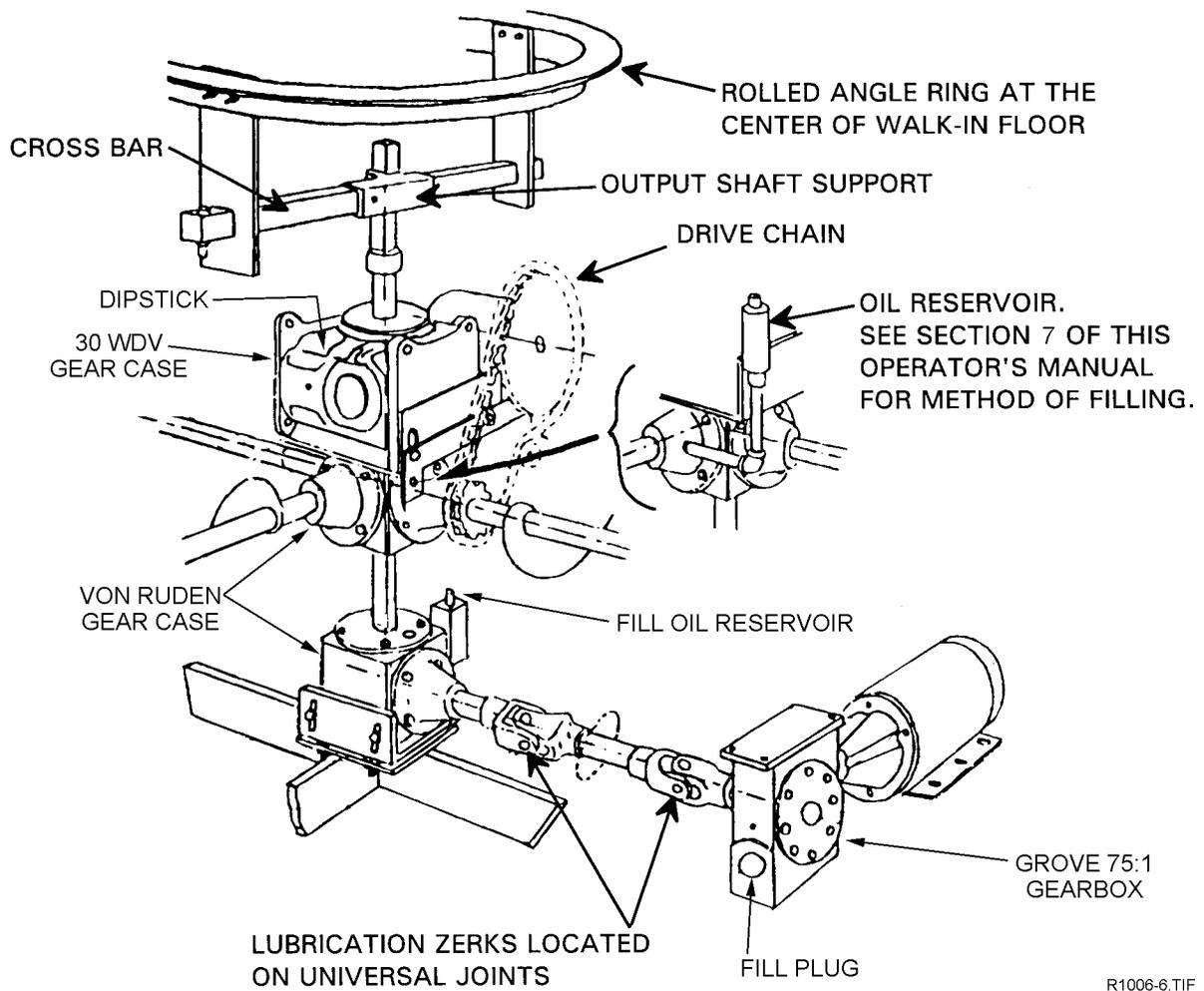
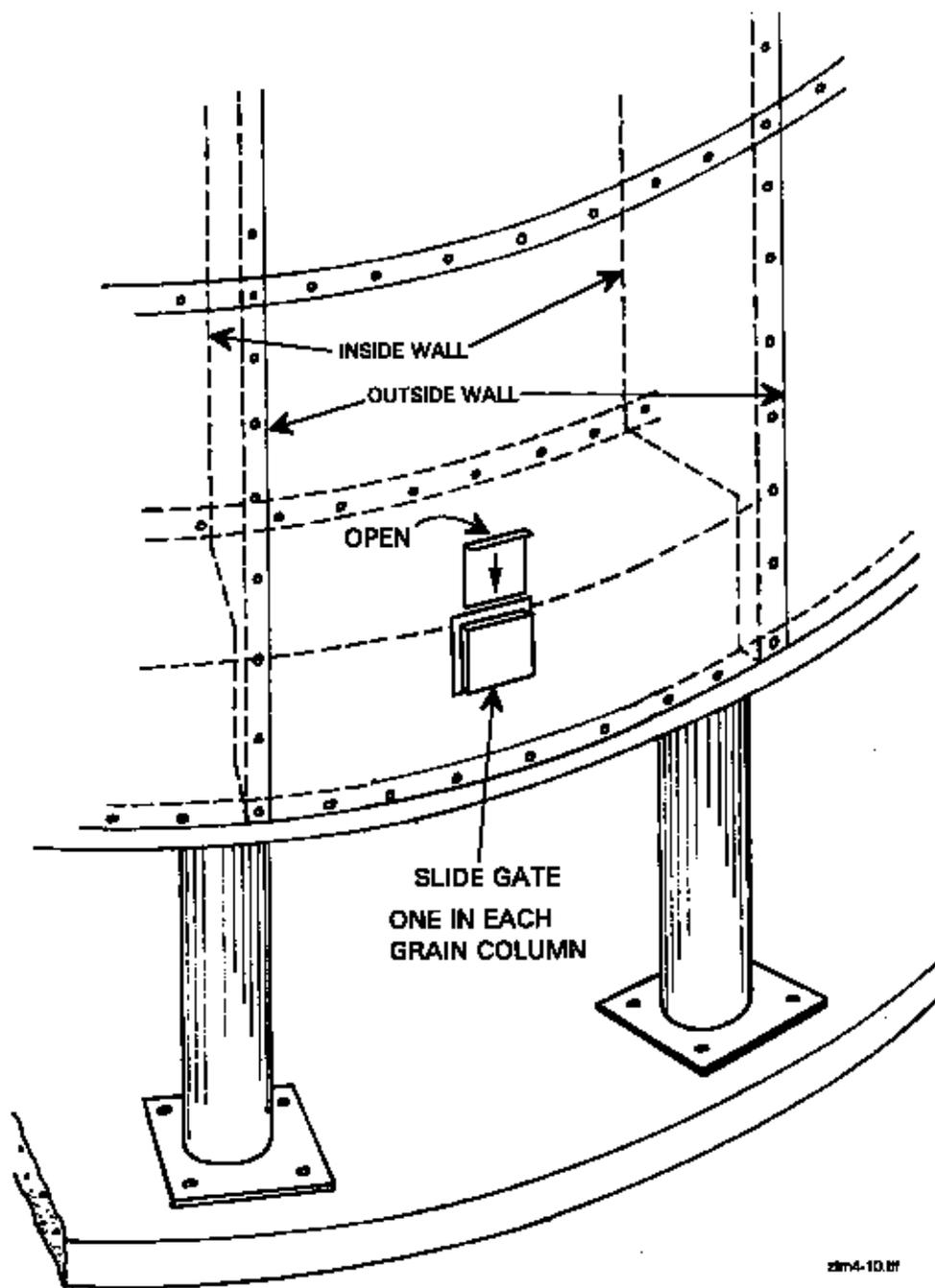


Fig. 6-5 Cross section of cooling and sealed discharge areas



R1006-6.TIF

Fig. 6-6 Typical metering mechanism



21m4-10.07

Fig. 6-7 Emergency grain discharge



## SUGGESTED INSPECTION & SERVICE

When first used each season: If not already done, complete pre-season service. Tighten all bolts and set-screws on grain metering mechanism. For the first three days, check gear lube level in metering system gear drives (two reservoirs), and fill as needed. Leak test the gas train and verify that all of the gas train safety devices are functioning properly.

Housekeeping is expected to be done as the need may arise: More often than the schedule below, if needed. Frequency will be more often when drying soybeans or milo than when drying corn. No fines or foreign matter should be allowed to accumulate at any location within the heating or cooling plenum sections of the dryer. This is to prevent the possibility of providing a location for or condition conducive to starting a fire. The dryer is designed to be partially self-cleaning in the heating section. The patented divider hopper between heating and cooling section allows most of the foreign matter from the heating section to pass through the divider hopper and come to rest on the cooling chamber floor. From this point it can be easily removed from the dryer or the cover from the discharge section of the dryer can be removed and the fines swept in.

**NOTE:** The cover for the discharge section must be in place at all times when dryer is in operation. If the cover is off, the blower will act as a giant vacuum cleaner, sucking foreign matter from the discharge section and passing it over the burner. If continued, a fire is likely where the fines accumulate.

Daily: Upon shutdown for the night or otherwise, inspect interior of the dryer.

Bi-weekly (more often if needed): Clean cooling chamber floor of fines or dust. Sweep down inside cooling sheets, if needed. Fines can be swept into discharge hopper. Make sure divider hopper at bottom of heat chamber is clean and open.

Weekly:

Check lube in metering system gear boxes and reducers (four units).

Inspect burner section of dryer:

Sweep dust that might collect on heat section lower angle rings or sheets into divider hopper and fall through to the cooling floor below. Remove or brush fines into grain discharge of the dryer. Make sure divider hopper is clean and open.

Check blower belts for proper tension and adjust if necessary.

Inspect grain unloading floor for build-up of fines, particularly at the bottom of grain columns. Loosen build-up if found.

Quarterly: Lubricate universal joints (metering screw dryers only, one inside and one outside unloading hopper).

Semi-annually: Lubricate blowers and blower motors. Dryers that dry in excess of two million bushels will require more frequent lubrication.

Only should need arise: If undried grain is left in dryer for a week or so during drying season, before restarting inspect plenum roof to make sure there is no wet corn or build-up sticking to it that will restrict grain flow. Look into grain discharge section to see that grain is flowing freely from each column and that there is no build-up at this point which would prevent free grain flow.

Grain column sheets are de-greased before installing. However, upon initial start-up, dust from dry grain may tend to stick to any grease remaining on inner sheets. Should this happen, dust must be brushed down a time or two until oil on the sheets has been absorbed.

In unusually high humidity conditions, when combined with drying very dirty corn, it is possible for screened column dryers to experience sludging on the outside sheets. This will start by sticking to the upper outside sheets and proceed down the dryer. The build-up can be removed when dry. One way to accomplish this is to shut off incoming grain supply, drop grain level to plugged area, lower plenum temperature to approximately 100 F, and run fan and burner until affected area is dry. Tapping outside sheets lightly will dislodge foreign matter. An alternate method would be to use high pressure water or high pressure air to remove the

accumulation. Cover burner with tarp if water is used.

NOTE: A dryer should be kept clean at all times, and in no case shall a dryer operate for more than 72 hours without a thorough cleaning. This means to completely empty the dryer of all grain and then thoroughly clean. Rule of thumb on milo: dryers should be cleaned at least every 24 hours.

**ADDITIONAL INSPECTION AND SERVICE**

We recommend the following additional items be checked before the unit is used each season. Replace any damaged or questionable parts. THESE CHECKS WILL HELP ELIMINATE POSSIBLE MINOR FAILURES AND ASSURE DEPENDABLE OPERATION OF THE EQUIPMENT WHEN IT IS NEEDED.

1. Shut off electrical power. Open main ASC control box and inspect for any moisture, rodent damage, or accumulated foreign material. Remove all foreign material present. INSPECT FOR AND TIGHTEN ANY LOOSE TERMINAL CONNECTIONS. Replace any damaged or deteriorated wiring.
2. Check blower for freedom of rotation. It should also be inspected for accumulated dirt and grain dust, ESPECIALLY BUILD-UP ON THE WHEEL, as any additional weight can seriously affect the balance and result in harmful vibrations and shortened bearing life. Keep inside of the housing free of dirt build-up for efficient fan performance.

**LUBRICATION**

All fan bearings are lubricated before leaving factory. Lubricate fan bearings after every 1 to 4 weeks of operation. Excessive lubricant damages the grease seals. Lubricant should be applied until it shows at the bearing seal. The excess should be removed. Use a good quality #2 consistency lithium base grease and apply with caution when using a high-pressure gun.

NOTE: Lube fitting to inner bearing extends to outer fan casing. See Bearing Lubrication Sheets for your make of fan bearings.

LUBRICATION OF MOTORS These motors are supplied with adequate grease to lubricate the bearings for a minimum of six months. Relubrication at intervals consistent with severity of service (see Lubrication Table) provide maximum bearing life.

3. MAKE SURE ALL MOTOR MOUNT BOLTS ARE TIGHT.

4. Auger motor bearings should be relubricated periodically, depending upon operating conditions. Under normal usage, it is desirable to have the motor cleaned and checked, and the bearings repacked by an authorized service station every two to three seasons. If the unit is operated continuously through most of the year, this service should be performed each year.

NOTE: If on-site bearing relubrication is to be performed, use CHEVRON SR1-2 high temperature grease or a compatible equivalent product.

**LUBRICATION TABLE \***

Location	Instructions	Type of Lubrication - Normal Operation	Type of Lubrication - Cold Weather Operation	Interval
Two bearings on blower shaft	Lubricate carefully until lubricant shows through seal. Wipe clean.	Good quality #2 consistency lithium base grease	Good quality #2 consistency lithium base grease	See Barry Blower lubrication chart
30 WDV gear case on metering mechanism	2.. qt. level indicated on dip stick	Multi-Grade 50-90 Mobil C-90 or equivalent	Valvoline SAE 75 W 90 gear oil	Beginning of season
** Von Ruden gear case - double	Fill oil reservoirs to top	Multi-Grade 50-90 Mobil C-90 or equivalent	Valvoline SAE 75 W 90 gear oil	Beginning of season
Grove 7%:1 right angle gear box	Fill to check plug	Mobil #SHC634 synthetic lube or equivalent	Valvoline SAE 75 W 90 gear oil	Beginning of season
U-joints	Lube with good bearing grease	Good bearing grease	Good bearing grease	Every 100 hours of operation

NOTES:

\* Zerk, dipstick, oil reservoir, and other lubrication components are identified in Fig. 6-6.

\*\* Von Ruden Double Gear Case is equipped with oil reservoirs. These two gear cases must fill completely to the top with lubricant to assure lubrication to the upper bearings when system is operating at low RPM.

## LUBRICATION EXAMPLES

Type of Service	Example	Lubrication Interval
Light	Intermittent duty, very clean atmosphere	8 years
Medium	Continuous duty, clean atmosphere	5 years
Heavy, dirty atmosphere	Continuous duty, frequent starting, severe vibration	2 years
Severe	Continuous duty, frequent starting, severe vibration, high ambient temp, very dirty atmosphere	6 months

Most fan motors are equipped with grease fittings to allow the fan motor bearings to be relubricated without disassembly. Lubricate the fan motor bearings once each year at the beginning of the drying season by applying 1/2 fl. oz. (approximately 8 strokes from standard hand gun) to the front and rear bearing using SHELL DOLIUM R or CHEVRON SRI-2 motor grease. DO NOT OVER-LUBRICATE!!

To keep motor bearings properly lubricated and dispel any accumulation of moisture within the windings, the fan and auger motors should be operated for 15 to 30 minutes minimum each month. The motor manufacturers' Authorized Service Station list is packed with all units and should be saved for reference and identification of service stations.

5. Fill four (4) gear cases in the metering mechanism with gear lubricant as outlined in lubrication table. Note: when filling the Von Ruden gear cases, make sure the reservoirs remain full after a period of time. This is necessary to make sure the gear case is filled completely, covering all gears in the casing.
6. When filling dryer with grain, adjust the moveable sleeve on the grain inlet spout so that grain level on the outside sheets is at or just below the eaves of the dryer on "choke-fill" installations. This may need to be adjusted as the moisture content of the wet grain changes significantly. Also adjust the grain deflector to guide the incoming grain to the side of the dryer directly opposite the Bindicators. This ensures that the Bindicator is indicating the lowest grain level location in the garner.
7. When burner is first ignited, linkages between the gas modulating valve and its drive motor must be adjusted so that butterfly valve is driven between minimum fire and full open positions. (See Section 4, step 10, Burner Test Firing, for adjustment procedure.)
8. Remove and clean the gas line strainers. Make certain gas valves are closed and that gas is

purged from system before attempting disassembly.

9. Inspect burner assembly for loose hardware and tighten as required.
10. Inspect ignitor plug and clean the electrodes, if required. Use an ignition point file to remove carbon and rust between the electrode surfaces. Spark gap should be about 3/32 inch.
11. Inspect flame rod for possible damage, accumulation of ash, or poor connections. The flame rod, ignitor plug, and burner ground wires must be in good condition.
12. Inspect all drive chains for proper adjustment and condition. Readjust tension as required.
13. Inspect entire dryer for loose, worn, or damaged pats. Include check of auger flighting and other internal pats. Check that temperature sensors within air plenum chamber are secured within the insulated clamps and do not chafe on other metal pats
14. Inspect that all dryer guards and warning decals are in place and securely installed. Make certain guards do not interfere with moving pats
15. Test fire the dryer several weeks ahead of the drying season. Include a check for possible gas leaks. At the beginning of each drying season, remove 2" pipe cap from water trap located at bottom of vertical fuel pipe to remove accumulation of condensation before firing burner.

NOTES: All auger bearings are lifetime lubricated and do not require service relubrication.

Do not allow high moisture material to collect within the auger trough area as it may adversely affect the metal pats

See Section 4 - TEST FIRING for suggested testing procedure.

### PROPANE VAPORIZER SEASONAL INSPECTION

LIQUID PROPANE MODELS ONLY Liquid propane fueled dryers are equipped with a vaporizer that operates at relatively high pressure. Since leakage can result in release of liquid propane, it is extremely important to maintain the condition of all components to provide safe operation. Vaporizers should be inspected and serviced prior to each season of operation, including the following:

1. Carefully inspect the surfaces and welds of the vaporizer coil and the liquid inlet and vapor outlet pipes for evidence of severe corrosion or abrasion of metal which could cause subsequent leakage of liquid propane, gross overheating, and fire hazard.
2. Inspect the fuel train components: Liquid solenoid valve, pressure relief valve, pressure regulator, Vapor Hi-limit Thermostat, and the fuel lines and fittings.

#### END OF SEASON SHUTDOWN PROCEDURE

1. Remove all grain from the dryer.

Dryer is not intended to be a storage area for grain. If grain is left in dryer for an extended length of time, it can become wet and cake and spoil. Chunks of solid grain can prevent metering augers from turning and cause severe damage to the metering mechanism.

- A. Start metering augers and empty columns.
- B. Clean out plenum roof grain cushion and remove any grain remaining on plenum roof. Make sure grain exchangers are clean.
- C. Clean divider hopper, between heating and cooling sections.
- D. Clean inside cooling chamber sheets
- E. Remove all grain from unloading floor section. The last remaining grain will have to be pulled into hopper with a rake or hoe.
- F. Sweep cooling chamber floor. Open or remove slide gates (4) in the grain floor. Leave hopper cover off until dryer is again filled.

2. Lubricate chain and sprockets on metering mechanism, using chain or gear lube. Start metering augers while doing this in order to saturate chain.
3. Shut off gas supply.

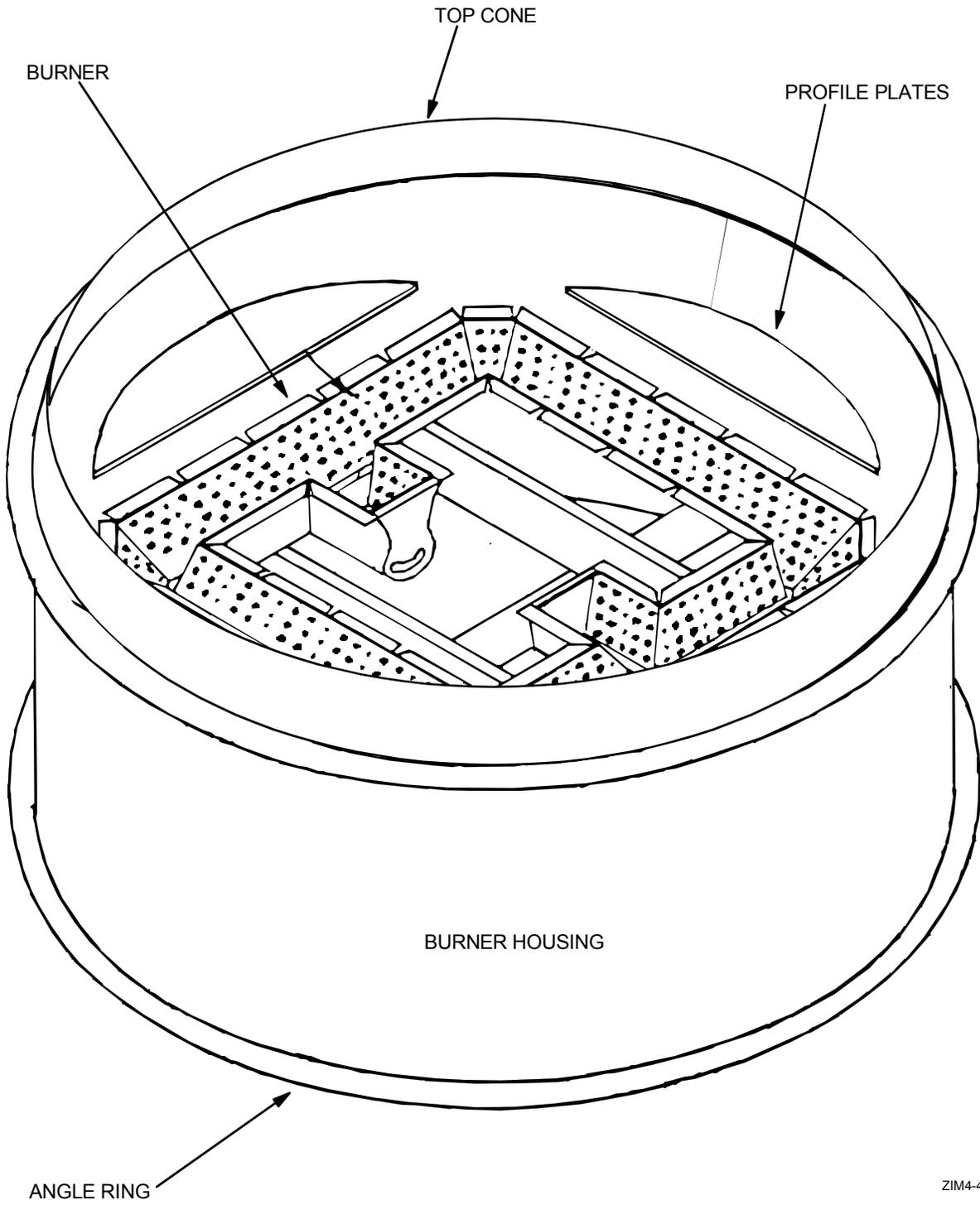
4. Remove drain plug located on main burner gas line (see Fig. 7-3 for water trap location).
5. Cover burner with a tarp or doors and tie securely.

#### SUGGESTED PROCEDURE TO FOLLOW IN CASE OF FIRE

1. When you first detect a fire, the entire drying operation should be shut down, including grain flow into and out of the dryer. The emergency controls may have already done this. Shut off the electrical and fuel supply to the dryer.
2. Do not try to cool a fire by running the fan(s). This provides oxygen to the fire and can make matters worse.
3. Never run grain from the dryer into the elevator or storage if a fire is known or suspected.
4. If a fire seems to be getting out of control, call the fire department.
5. Locate the area of the fire.
6. If the fire can be extinguished with a fire extinguisher, water hose, or by removing the burning material, this should be done right away. Watch the dryer closely for another fire after one has occurred.

NOTE: An emergency discharge slide gate near the bottom of each column will permit dumping each individual grain column (see Fig. 6-7).

Also, a fire extinguisher should be located at or near the dryer.



ZIM4-4.DSF

Fig. 7-1 Gas burner

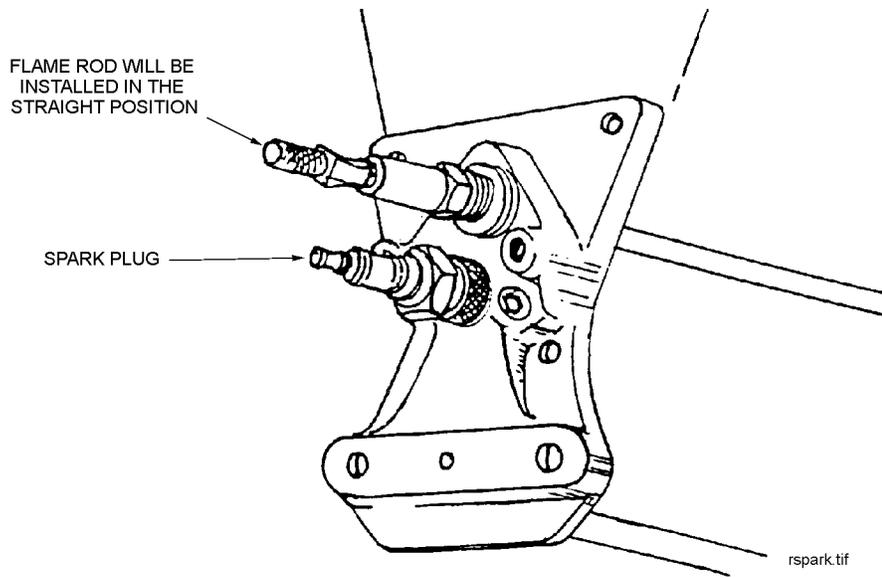


Fig. 7-2 Typical layout for spark-plug-ignited ignition

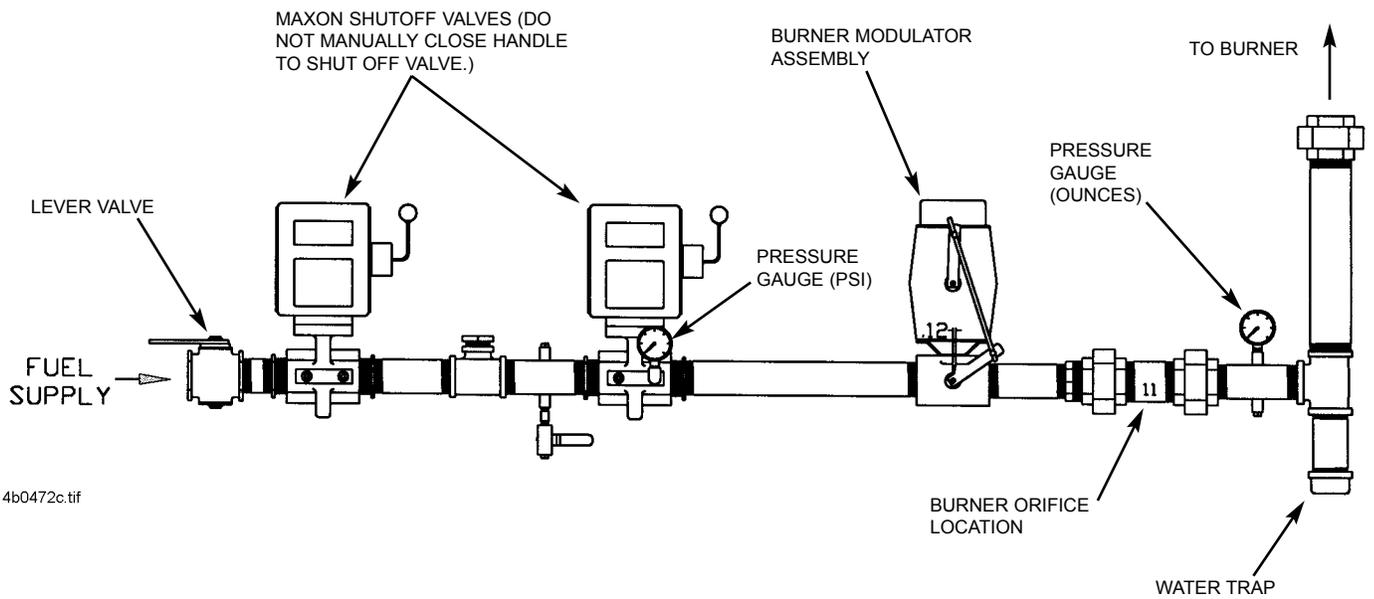
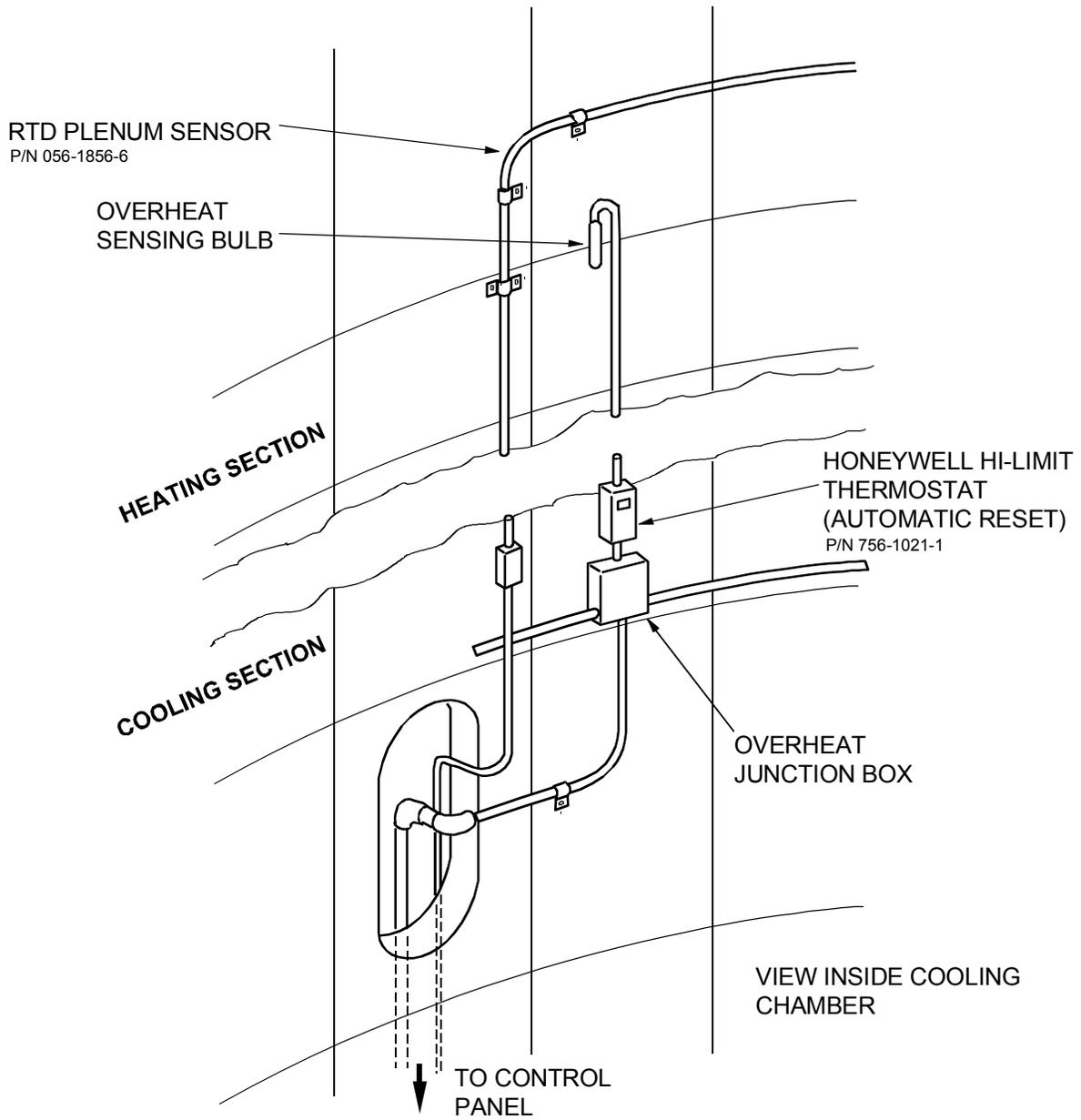
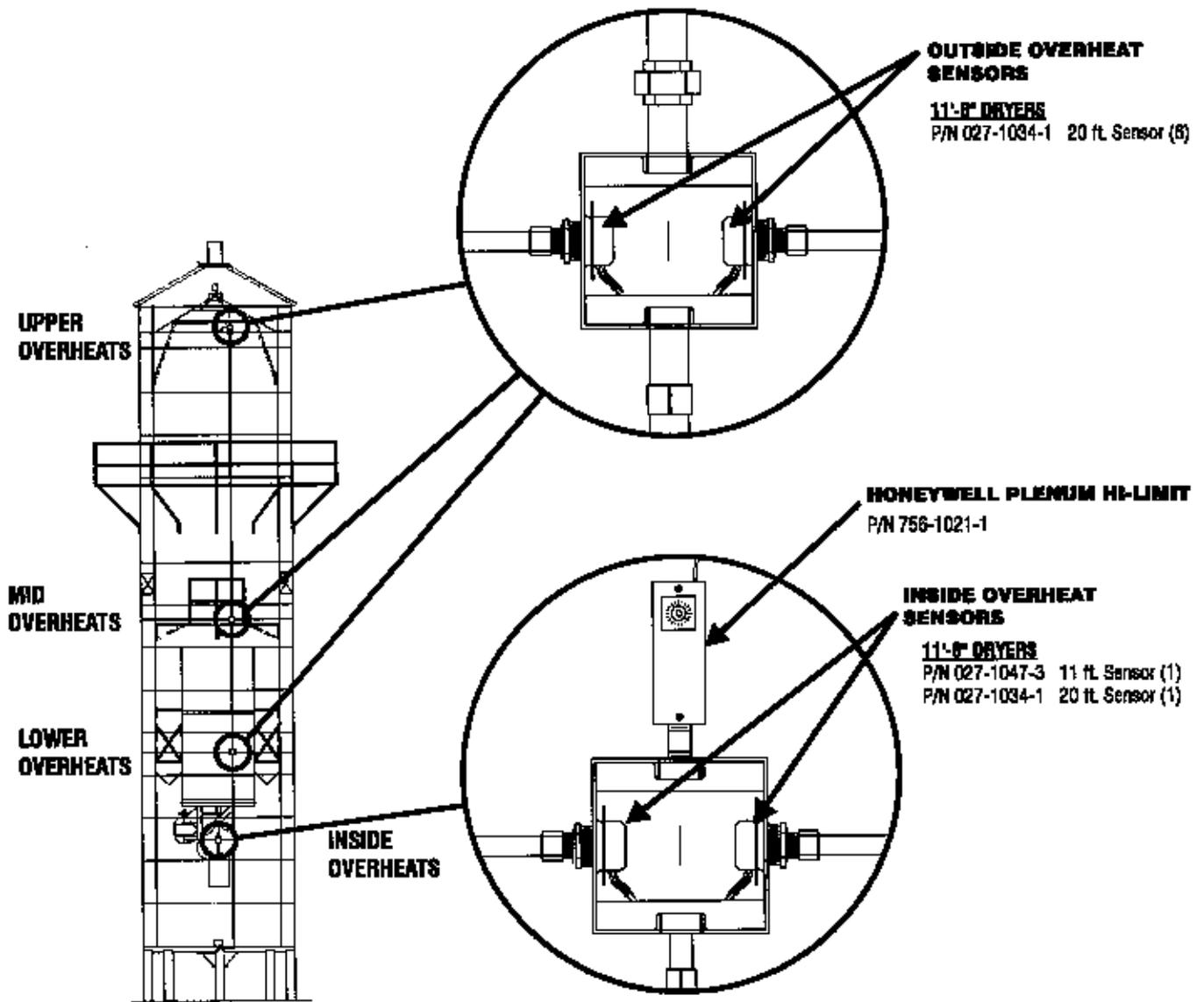


Fig. 7-3 Gas train components



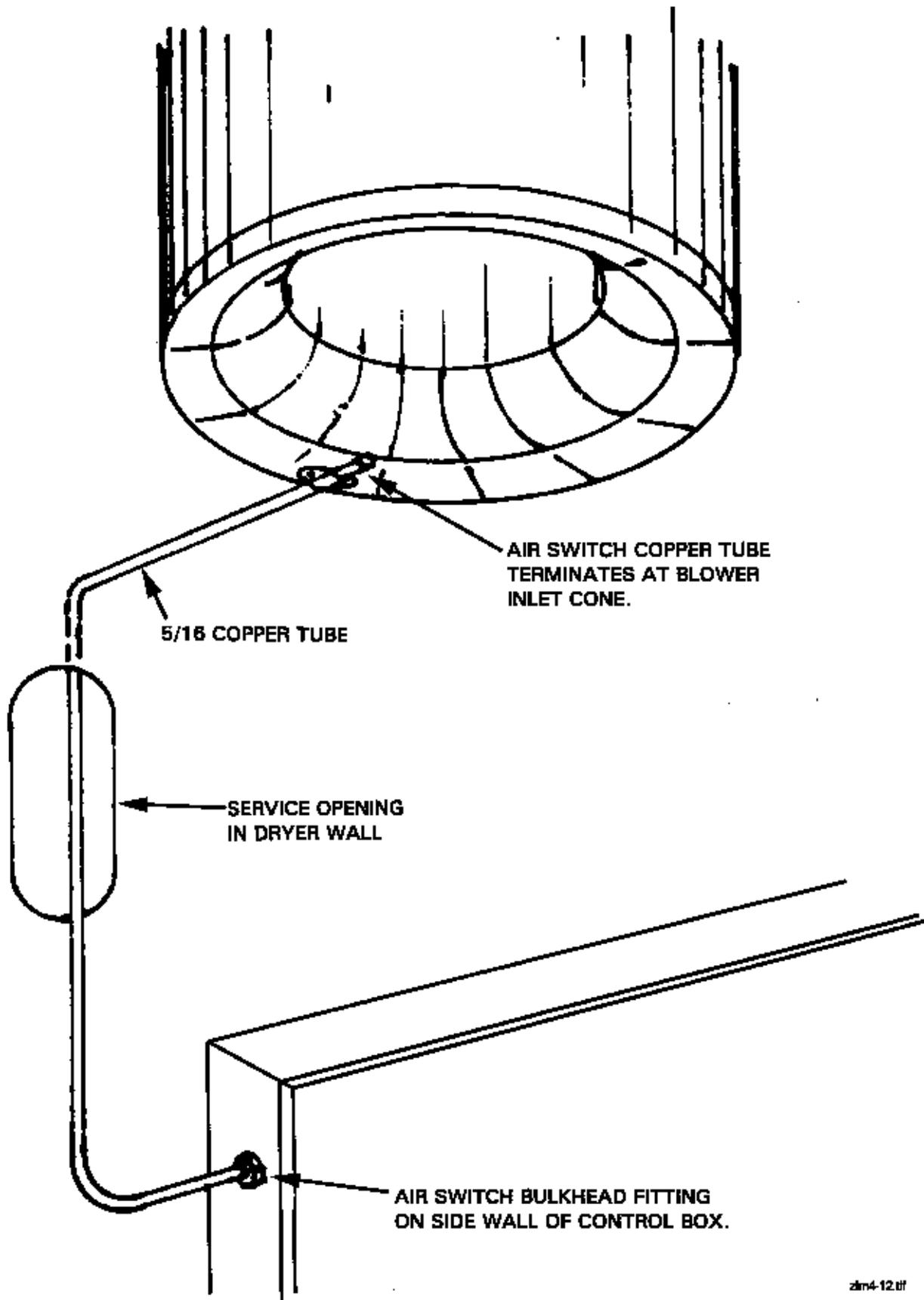
ZIM4-7.DSF

Fig. 7-4 Safety features



44-0148.W

Fig. 7-5 Overheat locations



zlm4-12.tif

Fig. 7-6 Air switch installation, single-blower model



# WIRING DIAGRAMS

## SECTION 8

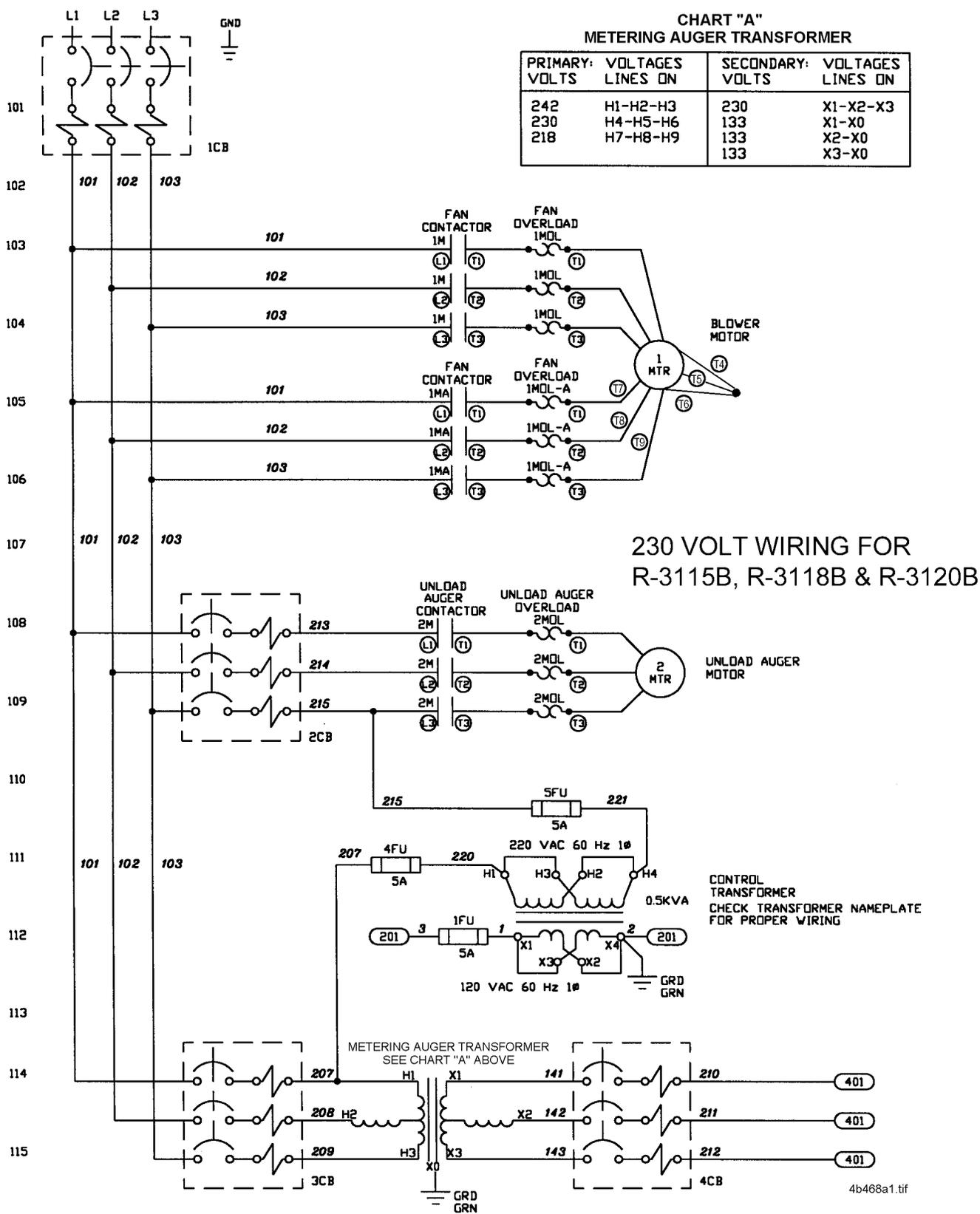


Fig. 8-1 Power circuit, 230V models

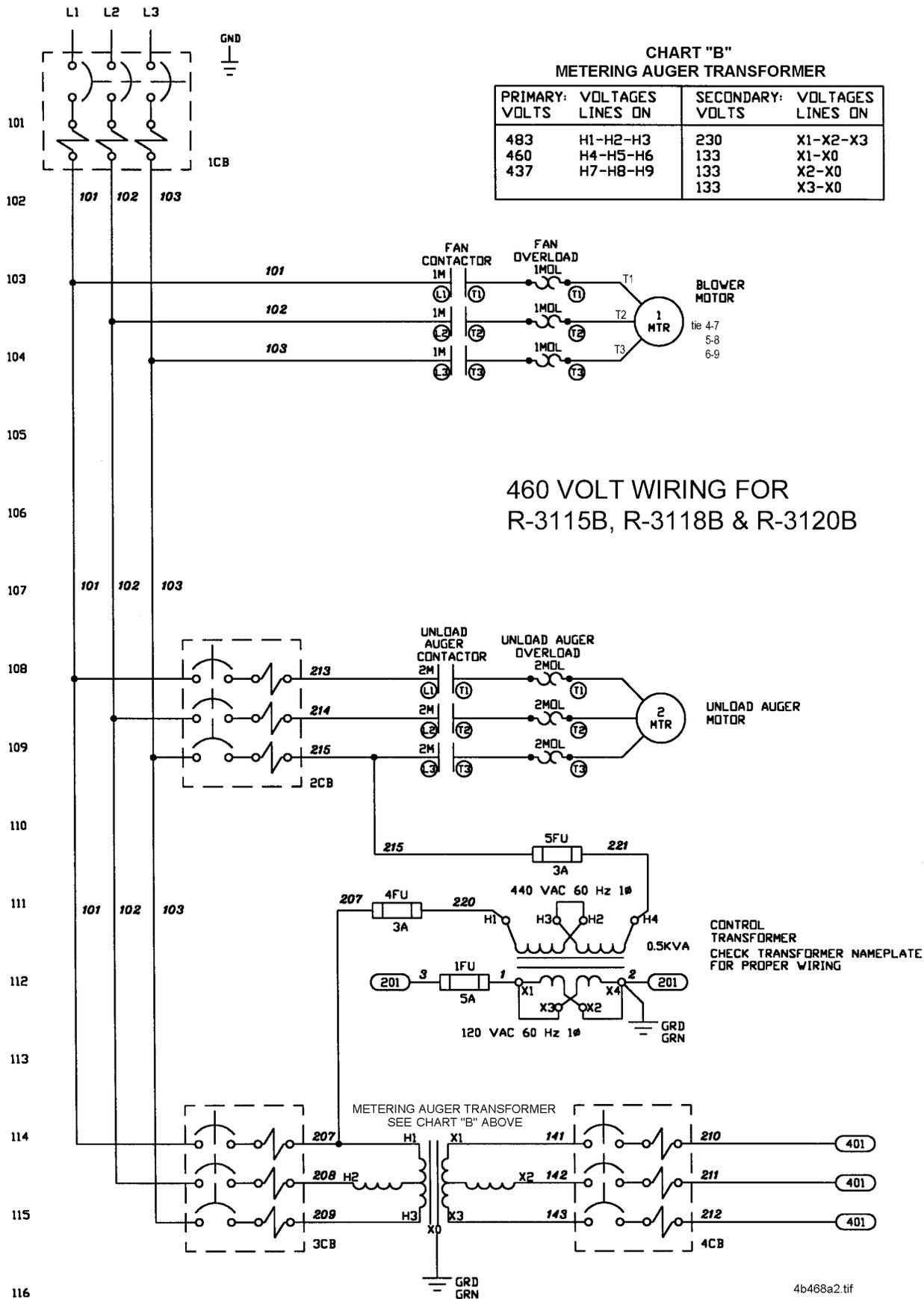
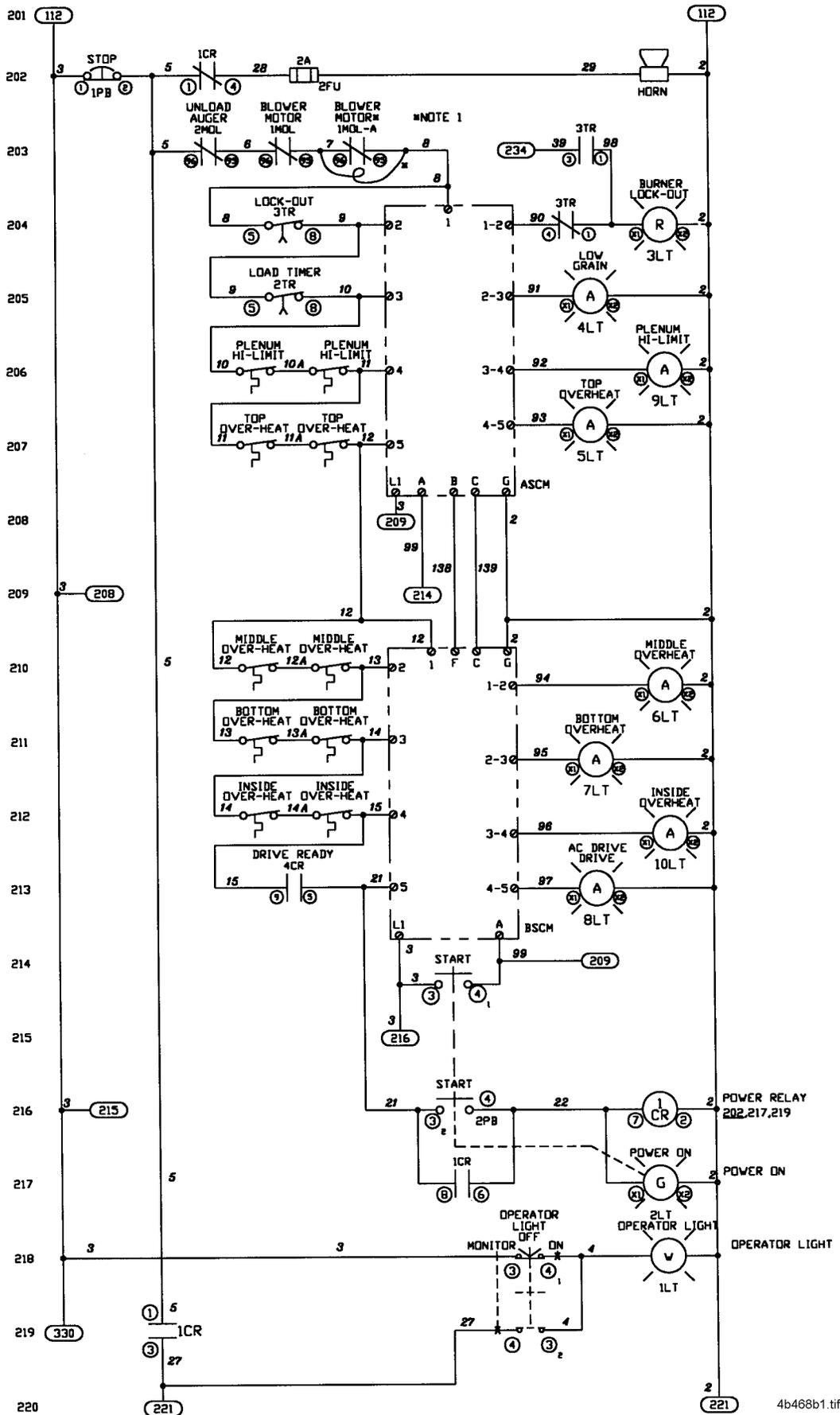
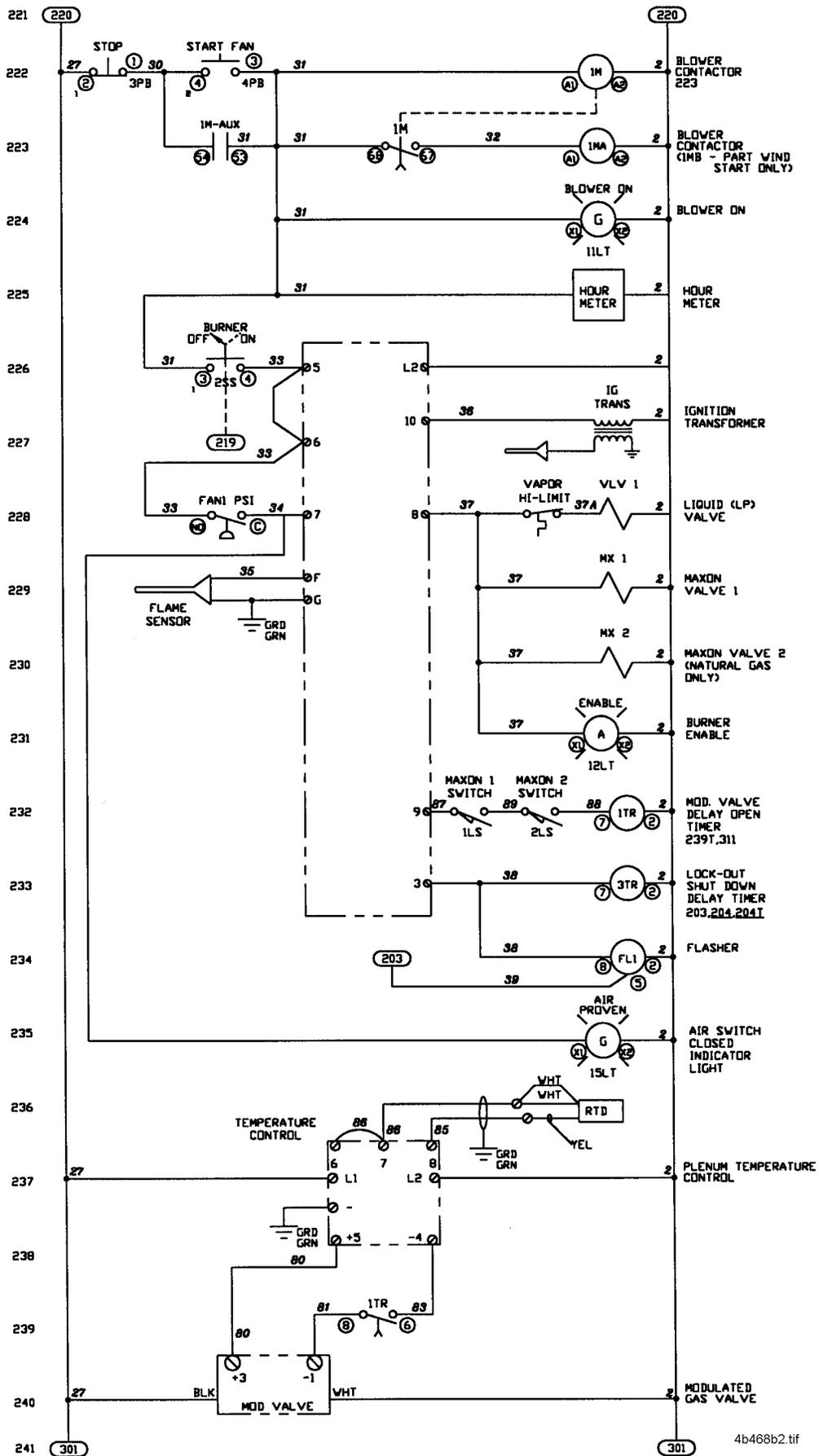


Fig. 8-2 Power circuit, 460V models



4b468b1.tif

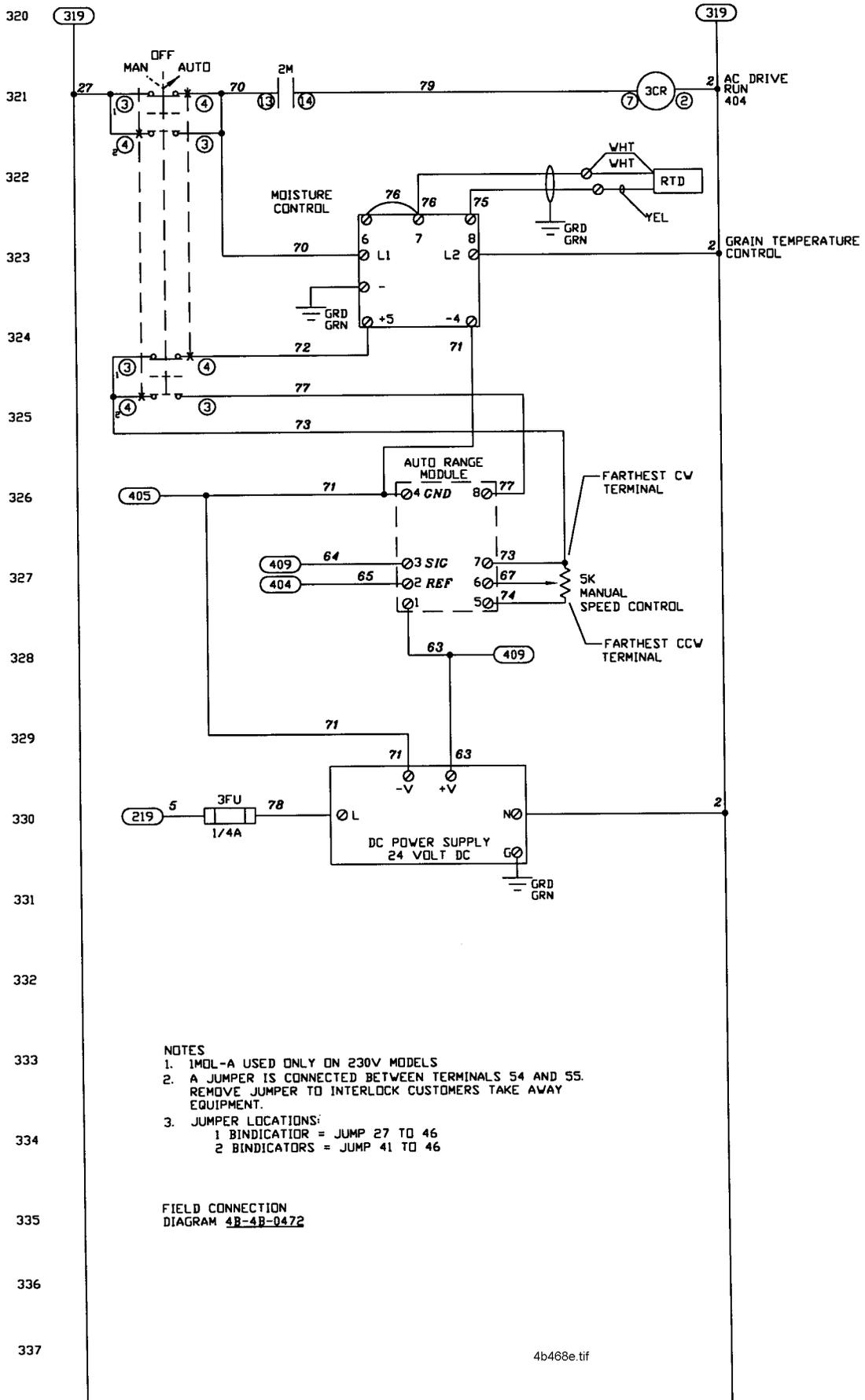
Fig. 8-3 Control circuit, p. 1 of 5



4b468b2.tif

Fig. 8-3 Control circuit, p. 2 of 5





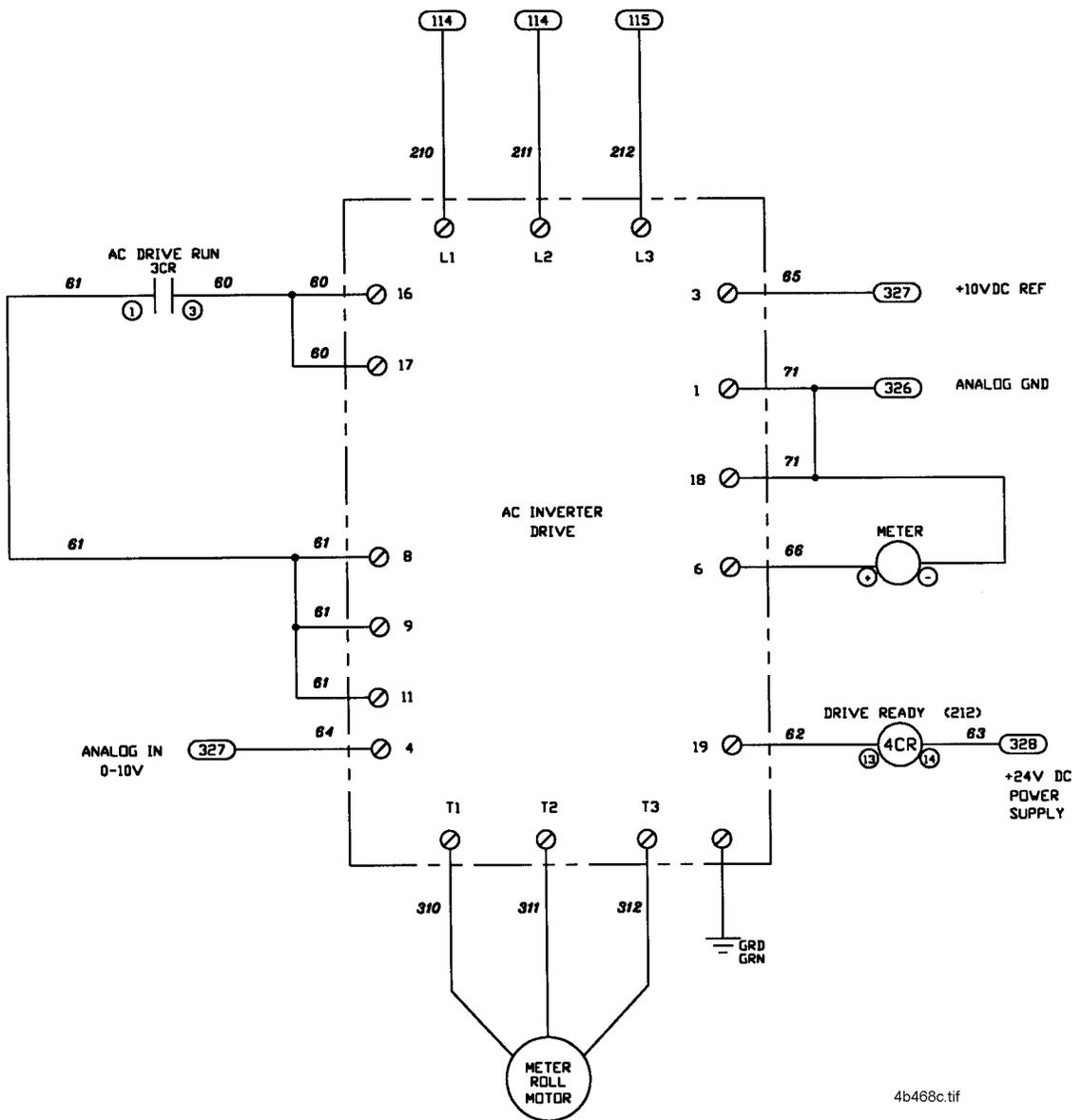
NOTES

1. IMOL-A USED ONLY ON 230V MODELS
2. A JUMPER IS CONNECTED BETWEEN TERMINALS 54 AND 55. REMOVE JUMPER TO INTERLOCK CUSTOMERS TAKE AWAY EQUIPMENT.
3. JUMPER LOCATIONS:  
 1 BINDICATOR = JUMP 27 TO 46  
 2 BINDICATORS = JUMP 41 TO 46

FIELD CONNECTION  
 DIAGRAM 4B-4B-0472

Fig. 8-3 Control circuit, p. 4 of 5

401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413



4b468c.tif

Fig. 8-3 Control circuit, p. 5 of 5



# TROUBLESHOOTING

## SECTION 9

A voltmeter is required for some of the following checkout procedures. Before performing any tests, make certain to determine if dryer power supply is 3 phase 230V or 3 phase 460V.

The general control circuit and safety circuits are 115 volt on all model dryers. When checking these circuits MEASURE VOLTAGE BETWEEN THE CIRCUIT TEST LOCATION AND GROUND.

REFER TO WIRING DIAGRAMS AND PARTS LIST FOR IDENTIFICATION OF PARTS AND ELECTRICAL TERMINALS.



CAUTION: When making high voltage tests with live circuits, be extremely careful to follow established safety practices. Turn power ON for testing only. DO NOT ATTEMPT TO MAKE THE DRYER OPERATE BY USING A JUMPER WIRE TO BYPASS A DEFECTIVE COMPONENT.

### TROUBLE

### CHECKOUT PROCEDURE & INFORMATION

Control Circuit Not Energized -  
Shutdown indicator lights OFF.

1. POWER SUPPLY - Check that MAIN POWER SUPPLY and CIRCUIT BREAKERS are turned ON. Also check for a tripped circuit breaker.
2. FUSES - Check for blown safety circuit fuse(s). See appropriate POWER CIRCUIT diagram for location and number used.
3. OVERLOAD RELAY - Check for tripped overload relay.
4. STOP OR START SWITCHES - Check for a defective STOP or START switch. Also check switch wiring connections.
5. LCR RELAY - Check for a defective LCR relay, relay base, or faulty wiring.

Control circuit not energized -  
Shutdown indicator light ON.

#### SHUTDOWN INDICATOR LIGHTS

On ASC panel door:

BURNER LOCKOUT (manual reset: press button on Burner Controller)

PLENUM HI-LIMIT (auto resets after cooling)

GRAIN HI-LIMIT (auto resets after cooling)

Burner lockout reset manually by pressing reset button on burner controller

Low Grain auto resets

Plenum Hi-limit auto resets after cooling

Top Overheat auto resets after cooling

Middle overheat auto resets after cooling

Bottom overheat auto resets after cooling

Inside overheat auto resets after cooling

AC Drive Fault auto resets

LOW GRAIN (auto resets immediately). Indicates Load Timer has been energized longer than set time for the following possible reasons:

A. Insufficient grain supply to fill dryer

B. Load timer set incorrectly:

load time set too low

timer set to incorrect range

timer memory set incorrectly to ON

C. Failed load drive

Plenum High Light (auto resets after cooling). Indicates Plenum Hi-limit switch has reached 300 F for the following possible reasons:

A. Plenum temperature set too high

B. Minimum gas pressure setting too high

C. Plenum controller failed

D. Plenum RTD failed

E. Plenum hi-limit switch failed

. . . cont.

Grain High Light (auto resets after cooling):

Grain column hi-limit switch has reached 210 F.

A. Grain has over dried due to:

- unload auger off
- metering augers speed set too low
- moisture control temperature set too high
- grain column plugged

B. Failed grain hi-limit switch

Burner Lockout (Manual reset)

Flame was not sensed for 15 sec.

A. Burner failed to ignite

- main shutoff valve was not opened in 15 sec. time allowed
- minimum fire set too low
- hand valves closed
- insufficient fuel supply
- failed or dirty spark plug
- failed or dirty flame rod
- failed liquid IP solenoid valve
- vapor hi-limit sensor reached 220 F and has not cooled down (LP only)
- failed ignition transformer

B. Burner flame has gone out

- minimum fire set too low
- insufficient fuel supply
- plenum pressure switch set has sensed low pressure
- failed, dirty or improperly positioned flame rod
- failed liquid IP solenoid valve
- vapor hi-limit sensor reached 220 F and has closed liquid solenoid (LP only)

NOTE: A flame failure will cause the Burner Lockout Indicator to FLASH while dryer is operating and stay ON while dryer has shut down.

Unmonitored safety shutdown devices:

- Unload auger overload relay
- Fan overload relay

Overload relay has opened (manual reset required)

A. Amperage draw too high on motor

- low voltage
- motor load too high
- loose overload heater elements screws
- loose power wires
- partially shorted motor wires
- failed motor

B. Overload relays not set properly

C. Relay has not been manually reset

D. Low voltage

Fan motor will not start

1. Check that fan circuit breaker and fan switch are ON; also for defective switch or bad wiring connections.
2. Verify closing of fan motor contactor; check for voltage on load side of contactor and for 120V to contactor coil. See POWER CIRCUIT and GENERAL CONTROL CIRCUIT wiring diagrams for fan circuit details. Inspect contactor for defective points or burned-out coil.
3. Inspect connections and check voltage applied to motor leads in motor junction box to determine if motor is defective.
4. If motor starts slowly, check for low voltage during starting, due to excessive voltage drop in power supply wiring.

Bottom auger will not start

1. Check that bottom auger circuit breaker is ON.
2. Check that UNLOAD switch is set to AUTO.
3. Verify closing of bottom auger contactor; check voltage on load side of contactor.
4. Burner control locked out. Check for Burner Lockout light. Push burner control reset button on the Burner Control in the ASC box.
5. If power was present in previous step, inspect connections and check voltage applied to motor leads in motor junction box to determine if motor is defective.

Metering augers will not operate

Check Honeywell Moisture Controller and Auto Range module.  
Check dry grain auger. Dry grain auger must be operating before the unload will run.

Turn up speed control.

The drive unit has an overload built into its circuitry. This overload will shut the metering motor off under an overload condition. If the motor stops during operation, wait a short period of time. Turn off the power to the inverter, and turn power back on to reset. Try to restart metering system.

Make sure the automatic moisture control switch is in the Manual position. If the unload does not run in the Manual position, momentarily switch to the Auto position. If the unload runs, check the manual speed pot for defects. Dry grain equipment is interlocked with dryer and if it is operating.

Check the message display on the unload AC inverter drive.

If the display is dead:

Check if circuit breakers 2CB and 3CB are tripped. Either of these being tripped is an indication of a SERIOUS fault in the inverter or the drive transformer. This is a rare case.

If the display reads "FORWARD/RUN," there is a problem with the analog (speed) signal being sent to the inverter.

Make sure that the automatic moisture control switch is in the MANUAL position. If the unload does not run in MANUAL, momentarily switch to the AUTO position. If the unload runs, the manual speed pot should be replaced.

Check the Honeywell Moisture Controller for faults (see MOISTURE CONTROL troubleshooting section).

Replace the auto-range module.

Turn the speed control pot up and down.

If the display reads a "FAULT":

Check the inverter drive manual for more detailed information on the "FAULT."

Generally, the fault will indicate an output overload condition. The inverter has an overload built into the unit. This overload will shut the metering motor off under an overload condition. If this occurs, shut the main disconnect off. Disconnect the metering motor from the drive shaft.

Turn the main disconnect on. Try to run the metering drive. If it still does not run, call your Farm Fans dealer to evaluate the inverter drive. If the motor does run, there is a lock-up problem with the metering transmission. Check all oil levels. Check for worn bearings.

NOTE: Any time a "FAULT" occurs in the inverter drive, it must be shut off and turned back on to reset the unit.

Metering system overloads, causing the overload in the drive to keep tripping.

Check for grain backing up in the dryer discharger hopper due to an obstruction or the failure of the dry grain conveyor to take grain away fast enough. Check oil levels in all the gear boxes.

The metering system can be rotated by placing a pipe wrench on the input shaft. If the shaft can only be turned with great difficulty, check the gear boxes for oil levels and for bad bearings.

Check gear boxes for oil levels and possible bad bearings.

Check for crusted grain on the bottom dryer floor.

The metering system rapidly speeds up and slows down.

Mechanism that rotates the metering screws in the dryer is not working, chain is off, sprocket is stripped, or teeth are stripped on gears in the reducer and grain is discharging from only two or four of the drying columns.

Grain discharging the dryer suddenly starts becoming wetter and wetter when everything else in the dryer appears to be operating properly.

Particulate matter has built up on one or more sides of the dryer. Clean outside sheets of the dryer either by brushing or by a stream of water or air.

Moisture tests of grain discharging the dryer vary widely although wet grain entering the dryer is of a fairly uniform moisture content.

#### 1. INLRNG Error Message

Temperature or Moisture Controller Error Messages (Honeywell UDC 2000)

SHORTED SENSOR CIRCUIT - Disconnect sensor leads from terminal strip. Using a VOM tester, test the sensor leads for approx. 100 ohm resistance (at 32 F). If test indicates a SHORTED condition, trace wires back to the sensor and repeat the test. Replace defective sensor or correct the wiring problem as required.

OPEN SENSOR - Disconnect sensor leads from terminal strip. Using a VOM tester, test the sensor leads for approx. 100 ohm resistance (at 32 F). If the circuit tests OPEN, replace defective sensor or correct wiring problem as required. Test each sensor lead for continuity to ground. If continuity is confirmed, replace sensor.

#### 2. FAILSF Error Message

This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if the controller fails to pass its memory test, configuration tests, or calibration test. Return controller to the factory for analysis.

#### 3. INLFAIL Error Message

Controller has detected two consecutive failures of the input signal. Check for shorted or open sensor condition as listed above.

#### 4. No temperature display

Check for 120vac power on controller terminals L1 and L2.

Check to see that Main shutoff valve is open and fire has ignited.  
Check that controller set point is higher than ambient temperature.

## PLENUM TEMPERATURE CONTROL

1. Modulating Valve does not open.

Check plenum controller for error messages displayed. See above section concerning messages.

Check for 4-20 ma signal between terminals 4 and 5 of plenum controller (you must remove wires from terminals to make measurement). If no signal, replace controller. If 4ma is measured and does not increase, check controller part number to be certain the correct controller has been installed. Make sure timer TTR is energized and has timed out. If it has not, refer to Control Circuit wiring diagram in Section 8 for proper connections.

Check inside Modulation Valve for 120VAC power to the black and white wire. Temporarily jumper terminals F and + or F and - and observe action. Motor should drive fully open. If no modulation action occurs, replace motor.

	<p>Check for 4-20 ma signal on wires 80 and 81 attached to terminals + and - of modulation valve (you must remove wires from terminals to make measurement). If no problems detected, replace Modulation Valve.</p> <p>Check that valve linkage works freely.</p> <p>Check that linkage has been adjusted properly. (See start-up and testing section.)</p>
2. Plenum temperature does not stabilize.	<p>Check for proper pressure regulator adjustment. See fuel specification Table 2-1. Reducing regulator pressure from settings listed in Fuel Specifications Charts when operating at lower than normal plenum temperatures, with reclaiming, or in warm ambient conditions will help reduce overshoots and improve modulation stability.</p> <p>Inadequate fuel supply or regulator operation will cause supply pressure (gage on shutoff valve) to drop as modulation valve opens causing unstable temperatures.</p> <p>It is normal to briefly overshoot temperature 10-20 F on start-up. Controller should settle in to temperature in a few minutes.</p> <p>Check that the pressure regulator pressures have been set properly.</p> <p><del>Reducing regulator pressure from settings listed in Fuel Specifications</del></p>
3. Plenum temperature severely overshoots set point temperature.	<p>Charts when operating at lower than normal plenum temperatures, or in warm ambient conditions will help reduce overshoots and improve modulation stability.</p> <p>If plenum temperature stabilizes at a point higher than the set point with the modulation valve closed, low fire setting may be too high. Adjust linkage for minimum fire as discussed in start-up and testing section.</p> <p>Check for too low of a regulator pressure setting and/or inadequate fuel supply.</p> <p>Check that the Modulating motor has stroked fully open (from 12:00, closed position to 3:00, open position)</p>
4. Plenum temperature does not reach set point temperature.	<p>Check that the modulation valve linkage has been properly adjusted per instructions in start-up and testing. When fully open, the gage pressure on the Shutoff valve and the gage upstream of butterfly valve should be nearly equal.</p> <p>Check for water in vertical manifold pipe.</p> <p>Check for obstruction at main burner orifice</p> <p>Check for plugged burner orifices (0.086 dia. holes)</p> <ol style="list-style-type: none"> <li>1. Grain moisture discharged too wet: Reduce % Unload Rate setting</li> <li>2. Grain moisture discharged too dry:</li> </ol>

### MOISTURE CONTROL (MANUAL OPERATION)

- Increase % Unload Rate setting
3. Grain moisture discharged inconsistent:
    - Check that plenum temperatures are being held consistent
    - Check for changes in incoming grain moisture. If changes are occurring, manual % Unload Rate setting must be adjusted accordingly. You may wish to change to Auto Moisture control mode.
    - Check for intermittently plugged grain columns.
    - Check fill auger for proper operation and that an adequate grain supply is available to maintain grain seal.
  1. Grain moisture discharged too wet:  
Increase moisture control temperature set point.
  2. Grain moisture discharged too dry:

---

## MOISTURE CONTROL (AUTOMATIC OPERATION)

---

Decrease moisture control temperature set point.

If discharge rate is running at or near 100%, it may be necessary to reduce plenum temperatures to allow moisture control more freedom to work.

3. Grain moisture discharged inconsistent:

Check that plenum temperatures are being held consistent.

Check for plugged grain columns (empty column to correct).

If large variations in incoming moisture are occurring, the control can only minimize changes in discharge moisture. Some variation must be accepted.

Check fill auger for proper operation and that an adequate grain supply is available to maintain grain seal.

4. Moisture controller temperature is not stable:

Be sure to allow 2/3 grain pass before starting into Auto control. See operation sections. Starting Auto Control when grain temperature and Set Point temperature are not nearly equal will greatly increase the time required to stabilize on set point.

Be sure to pause 5-6 seconds in the Off position when switching from Manual to Auto control to allow controller to reset properly.

Check that the Auto control Unload Rate starts at the same rate as was used in manual control when first switch to AUTO. If not, suspect problems with the Auto Range Module.

Be patient, grain drying is a slow process. 1-3 hours for a grain pass is not uncommon.

1. Check plenum temperature. Use thermometer inserted at heat section door. Plenum temperature should be near plenum controller set point. Be aware that when drying at temperatures below those listed in the drying tables, decreased drying capacity will be experienced.

2. Check plenum airflow rate:

---

## DRYER DOES NOT PERFORM TO RATED CAPACITY

---

Using a static pressure gage calibrated in (inches of water column), check static pressure in drying plenum. 1.1 INWC is a typical reading for shelled corn. Consult dealer for other grains or conditions.

Check that airflow lower is adjusted properly. See Operations section of manual.

Check that the dryer's perforated walls are clean inside and outside.

Check fill auger for proper operation and that an adequate grain supply is available to maintain grain seal.

3. Check discharge rate calibration:

Check for plugged or reduced flow in each column

Weigh a timed discharge from the dryer if discharge rate is still in question.

4. Calibrate Moisture tester:

Be sure moisture tester being used has been calibrated to a certified tester. Check tester with both wet and dry samples of grain for accuracy. Note that few testers are accurate with very high moisture grains or when testing warm grain. If required, allow warm grain to cool in an unventilated container before measuring for accurate measurements

---

# PRE- & POST-SEASON CHECKLIST

Appendix  
A

## PRE-SEASON SERVICE CHECKLIST

- \_\_\_\_\_ Lubricate fan motor bearings, if needed.
- \_\_\_\_\_ Lubricate blower bearings if necessary.
- \_\_\_\_\_ Clean burner ports; inspect ignitor and flame rod.
- \_\_\_\_\_ Check oil level, gear cases, and speed reducer.
- \_\_\_\_\_ Lube U-joints.
- \_\_\_\_\_ Lube chain on transmission.
- \_\_\_\_\_ Inspect divider hopper between heat and cooling sections. Make sure it is clean.
- \_\_\_\_\_ Inspect low grain Bindicator.
- \_\_\_\_\_ Inspect cooling floor seal to wall; seal if needed.
- \_\_\_\_\_ Inspect discharge hopper cover seal.
- \_\_\_\_\_ Lube hopper cover hold-down levers.
- \_\_\_\_\_ Check butterfly operation in modulating valve.
- \_\_\_\_\_ Check gas pressure gauges and vents on regulators.
- \_\_\_\_\_ Check interior of Maxon valve for corrosion; clean as needed.
- \_\_\_\_\_ Clean panels, tighten loose connections, and check for leaks where conduits enter cabinets.
- \_\_\_\_\_ Start up to check operating controls: electrical check.
- \_\_\_\_\_ Other: Itemize \_\_\_\_\_

## END OF SEASON SHUT-DOWN PROCEDURE

### REMOVE ALL GRAIN FROM DRYER:

1. Start metering augers and empty columns.
2. Clean out grain cushion (on plenum roof under fill spout). Also, remove any grain remaining on plenum roof.
3. Clean out divider hopper, between heating and cooling sections.
4. Clean inside cooling sheets.
5. Remove all grain from unloading floor section. The last remaining grain in this area will have to be pulled into hopper with a rake or hoe. (It is important that this area be cleaned, as grain left here will spoil.)
6. Sweep cooling chamber floor. Open or remove slide gates under each column. Leave hopper cover off until dryer is again filled.
7. Remove drain plug from gas line to burner.
8. Cover burner.



# **FARM FANS**

Division of ffi Corporation  
5900 Elmwood Ave. • Indianapolis, IN 46203  
© 1998 ffi Corporation Printed in USA