



Tower Dryers

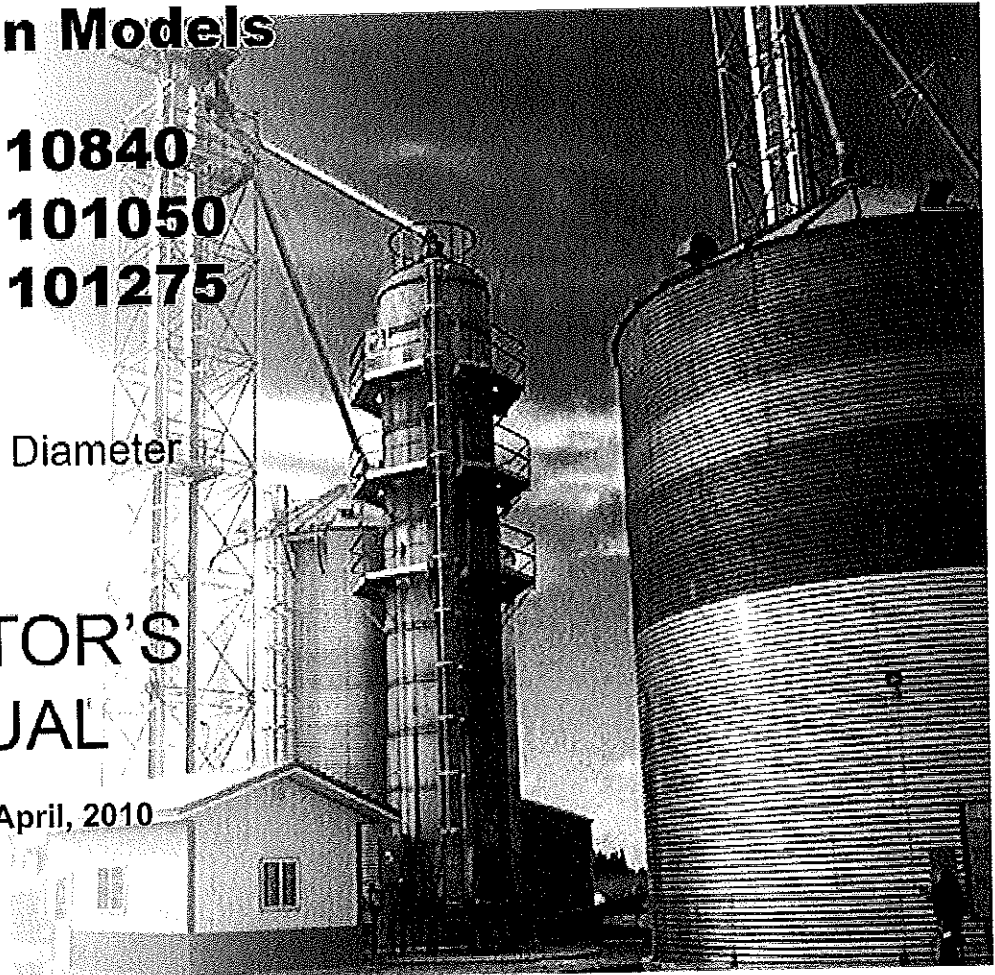
Single Fan Models

10520 10840
10630 101050
10730 101275

10 ft. (3m.) Diameter

**OPERATOR'S
MANUAL**

Effective Date: April, 2010



Mathews Company

500 Industrial Avenue
P.O. Box 70, Crystal Lake IL 60039-0070
Phone: 815.459.2210 Fax: 815.459.5889
www.mathewscompany.com

EQUIPMENT OVERVIEW	5
To the Owner-Operator	5
Warranty Registration	5
Model and Serial Number Location.....	6
Safety Precautions	6-7
Lock out / Tag out Procedure Requirements	7
End of Season Dryer Shutdown.....	8-9
Remote Cabinet Buttons, Lights, Switches and Controls	10
Cal Controller Features	11-14
Pinnacle Lite Moisture and Temperature Monitor	15
Gas Supply and Connections: Liquid Propane	16
Gas Supply and Connections: Natural Gas	17
10' Tower Dryer Direct Start High Voltage Cabinet	18
10' Tower Dryer Soft Start High Voltage Cabinet	19
10' Tower VFD Enclosure	20
Tower Dryer Ignition System.....	
OPERATION	22-23
Start Up Procedure	23
Filling the Dryer	24
Setting Grain Flow Timer	24
Grain Flow Timer Operation.....	25
Starting the Burner	25
Setting Drying Temperature.....	25
Cal Controller Wiring	26
Drying Temperatures	26
Manual Discharge Mode	26
Switching from Manual to Automatic.....	26
Automatic Moisture Control System.....	27
Operation of the Discharge System with the Automatic Moisture Control System.....	27
Moisture Control Setting and Adjustments when in Automatic.....	27
Approximate Discharge Speed Dial Settings	27
End-of-Day Shutdown.....	28
Next Day Startup.....	28
Final Shutdown	28
MAINTENANCE	30
Cleanout Recommendations.....	30
Cleaning the Outside of the Dryer.....	30
Seasonal Daily Cleanout and Maintenance Guidelines.....	31
Preseason Check.....	31
Post-Season Dryer Maintenance	31
In Case of Fire.....	32
AC Discharge Drive Speed Control	33
Changing Settings on AC Drive	34
VFD and AC Motor Fault Menu.....	35
Cal Controller Instrument Panel Features.....	36
Operating Instructions for the Cal Controller.....	37
Cal Controller Settings	38
Soft Starter Parameters	39
Changing Soft Starter Parameters	40
Lubrication.....	

TROUBLESHOOTING

Safety Circuit.....	42-43
Safety Circuit—Customer Connections	44-45
Pinnacle Lite Troubleshooting Guide.....	46
Moisture Sensor Troubleshooting Guide	47-48
Cal Controller Troubleshooting Guide.....	49
Single Fan Tower General Troubleshooting Startup and Running of Dryer	50-51
Dryer Troubleshooting Guide.....	52
Ignition Board Troubleshooting Guide	53

DRYER INFORMATION

10' Tower Dryer Specifications	55
10' Tower Dryer Discharge Data.....	56

DIAGRAMS

Sweep Arm System.....	57
Tower Dryer Dimensions 10520	58
Tower Dryer Dimensions 10630	59
Tower Dryer Dimensions 10730	60
Tower Dryer Dimensions 10840	61
Tower Dryer Dimensions 101050	62
Tower Dryer Dimensions 101275	63

TOWER DRYERS: THEORY, COMPONENT FUNCTION & CAPACITY CHARTS

Grain Drying Theory for Tower Dryers.....	64
Grain Dryer Component Functions	65-66
Capacity Charts 10520.....	67
Capacity Charts 10630.....	68
Capacity Charts 10730.....	69
Capacity Charts 10840.....	70
Capacity Charts 101050.....	71
Capacity Charts 101275.....	72

Section 1

Equipment Overview

INTRODUCTION

To the Owner-Operator

This manual was prepared to provide owners and operators of the M-C Model 10520, 10630, 10730, 10840, 101050 and 101275 Grain Dryers with operating instructions and maintenance information that will enable them to keep their M-C Grain Dryers operating at peak efficiency.

Before operating your grain dryer, read the Start-up and Operating Instructions. Check each item referred to and become familiar with the controls, adjustments and settings required to obtain efficient operation.

To keep the dryer operating at peak efficiency, it should be cleaned, lubricated, its belt tension adjusted and the ignition system, fill system and unloading system tested each year prior to the drying season. Refer to "Pre-Season Check" in the Maintenance section. The Pre-season check can be made when the dryer is empty. Any necessary repairs or adjustments can be made so that the dryer will be ready to operate before the drying season.

Warranty Registration

It is important to send in your warranty registration card as soon as your new grain dryer is delivered. Not only does the card validate your grain dryer's warranty, but it is also our way of knowing who has purchased M-C equipment so that we can keep in touch with you.

Model and Serial Number Location

The model, serial number and specifications of your Mathews Company continuous flow grain dryer are stamped on plates located on the base of the dryer. For future reference, record the model and serial number in the blank spaces of the plate shown at right, center.

Disclaimer: "The equipment shall be installed in accordance with the current INSTALLATION CODES FOR GAS BURNING APPLIANCES AND EQUIPMENT, CAN1-B149.1 and B149.2, or applicable Provincial Regulations, which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made."

PANEL LISTING SPECIFICATIONS			
MODEL	2000	CONTROL VOLTAGE	110 SERIAL NUMBER #58746
MAXIMUM CONTROL CABINET OPERATING AMPS		7	
LARGEST BLOWER MOTOR HP	100	RPM	1750
SHORT CIRCUIT CURRENT RATING IN AMPS			10KA
THERMAL TRIP SETTINGS FOR LARGEST MOTOR			76 Amps
MATHEWS COMPANY 500 INDUSTRIAL DR. CRYSTAL LAKE, IL., U.S.A. PRODUCTION DATE Jun-08			

Example: Panel Listing



Model and Serial Number

M-C GRAIN DRYER			
MODEL	2000	CONTROL VOLTAGE	110 SERIAL NUMBER #58746
VOLTAGE	480 PHASE	3	HZ 60 MAX. OPER AMPS 180.0
FAN BLOWER MOTOR HP		100 AC	RPM 1750
AC DISCHARGE MOTOR HP		3 AC	RPM VARIABLE
FUEL	NATURAL GAS YES		LIQUID PROPANE
MAXIMUM ALLOWABLE SUPPLY PRESSURE			60 PSIG
MAXIMUM INPUT BTU			21780000 BTU
NORMAL INPUT BTU			12,870,000 BTU
MANIFOLD PRESSURE AT MAXIMUM INPUT			1.25 PSIG
PLENUM STATIC PRESSURE FROM 1/2 TO 8 INCHES, W.C.			
MINIMUM CLEARANCE TO COMBUSTIBLE CONSTRUCTION - 4 FEET			
WARNING - FOR OUTDOOR INSTALLATION ONLY			
MATHEWS COMPANY 500 INDUSTRIAL DR. CRYSTAL LAKE, IL., U.S.A. PRODUCTION DATE JUN-08			

Example: High Voltage Cabinet Decal

SAFETY PRECAUTIONS



This symbol is used to call your attention to instructions concerning your personal safety. It is important to observe and follow these instructions.

1. Read and understand the operation manual before attempting to operate the dryer.
2. Keep ALL guards, access doors, covers, safety decals and safety devices in place and securely fastened. NEVER operate the dryer while guards are removed.
3. Keep all untrained personnel away from system components and control panel at all times.
4. NEVER attempt to operate the unit by jumping or otherwise bypassing any safety devices.
5. Always open the main power supply disconnect switch and lock it in the open position with a padlock when performing any service or maintenance work on the fan or heater unit.
6. Lock out power before removing guards, access doors, and covers.
7. Keep hands, feet and clothing away from all rotating parts.
8. Electrical repairs should be performed by trained, qualified personnel only. Failure to follow safe electrical procedures can result in serious injury.
9. If it should become necessary to perform checks on system components or high voltage tests with "live" circuits, be extremely careful and follow all established safety practices.
10. Routinely check for any developing gas plumbing leaks.
11. Do not allow children or bystanders to be near the grain dryer or grain handling machinery while it is operating.
12. Do not operate the grain dryer without all safety shields in place and secure.

NOTE: To provide clear illustrations in this manual, some of the covers, guards and shields have been removed.

DANGER: HAZARDOUS VOLTAGE



The AC Drive Capacitor can continue to discharge voltage for up to 20 minutes after disconnect has been turned off.

Before servicing, disconnect all power, wait 15 minutes, then verify that no voltage is present.

Failure to follow these instructions will result in death or serious injury.

Lock out / Tag out Procedure Requirements

The purpose of a lock and tag out procedure is to prevent injury and/or death to personnel by requiring that certain precautions be taken before servicing or repairing equipment. This includes shutting off and locking out the electrical power source of the equipment.

1. All maintenance personnel are issued a suitable lock (or locks). The lock has the individual worker's name and other identification on it. That worker will have the only key to the lock.
2. Check to be sure that no one is operating the machinery BEFORE turning off the power. The machine operator must be informed before the power is turned off. Sudden loss of power could cause an accident.
3. Steam, air, and hydraulic lines should be bled, drained, and cleaned out. There should be no pressure in these lines or in reservoir tanks.
4. Any mechanism under load or pressure, such as springs, should be released and blocked.
5. Each person who will be working on the machinery should put a lock on the machine's lockout device(s). Each lock must remain on the machine until the work is completed. Only the worker who placed the lock should remove his/her lock.
6. All energy sources that could activate the machine must be locked out.
7. The main valve or main electrical disconnect must be tested to be sure that the power to the machine is off.
8. Electrical circuits must be checked by qualified persons with proper and calibrated electrical testing equipment. An electrical failure could energize the equipment, even if the switch is in the OFF position. Stored energy in electrical capacitors should be safely discharged.
9. CAUTION: Return disconnects and operating controls to the OFF position after each test.
10. Attach accident-prevention tags, which give the reason for placing the tag, the name of the person placing the tag, how he/she may be contacted and the date and time the tag was placed. No one removes the lock without proper authority.

Locks

Each worker must have his/her own lock and the only key to that lock.

The lock should be substantial and durable, and should have the name of the employee on it. In addition, locks can be color coded to indicate different shifts or types of service.

When more than one worker is servicing a piece of equipment that must be locked out, a lockout adaptor can be used, which allows all the workers to place their locks on the disconnecting means. After the work is completed, each worker removes his/her lock and the machine is then returned to service.

Tags

DO NOT USE TAGS ALONE. Use tags or signs in addition to locks.

Tags must state the:

- reason for the lockout.
- name of the employee who is working on the equipment and how that person may be reached.
- date and time the tag was put in place.

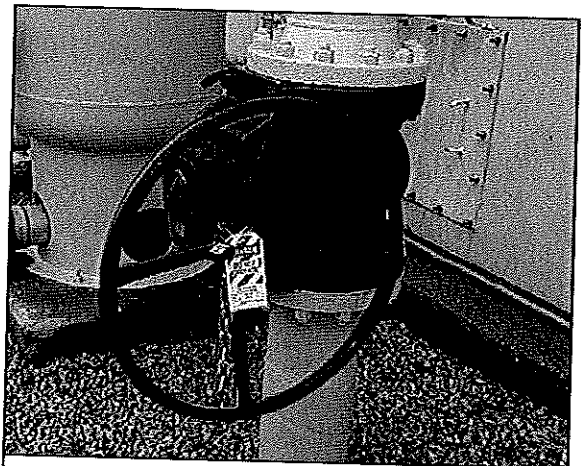
Tagout devices should be capable of enduring at least 50 pounds of pull, and of a non-reusable type.

Blocks

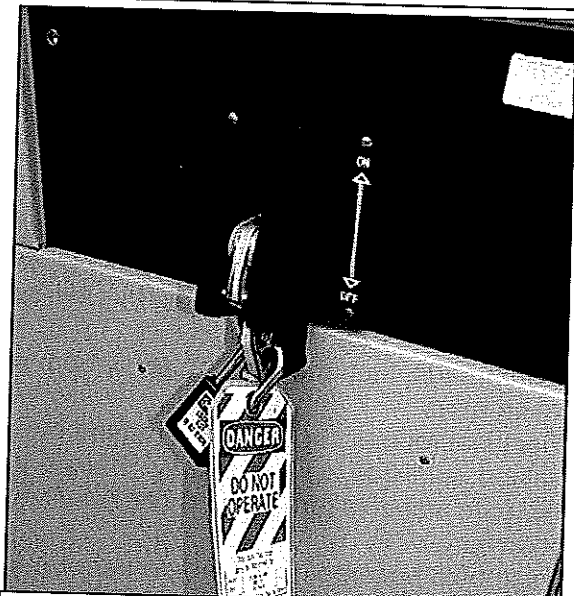
Suitable blocks are another important safety device for making a piece of equipment safe to be repaired or serviced. Blocks must be placed under raised dies, lifts, or any equipment that might inadvertently move by sliding, falling or rolling.

Blocks, special brackets, or special stands such as those commonly used under raised vehicles, must be available at all times. Another form of blocking is the placement of a blind. A blind is a disk of metal placed in a pipe to ensure that no air, steam, or other substance will pass through that point if the system is accidentally activated.

Before installing blinds or blocks, bleed down steam, air or hydraulic lines to get rid of any pressure. Coiled springs, spring-loaded devices or suspended loads must also be released so that their stored energy will not result in inadvertent movement.



Gas Lockout & Tagout



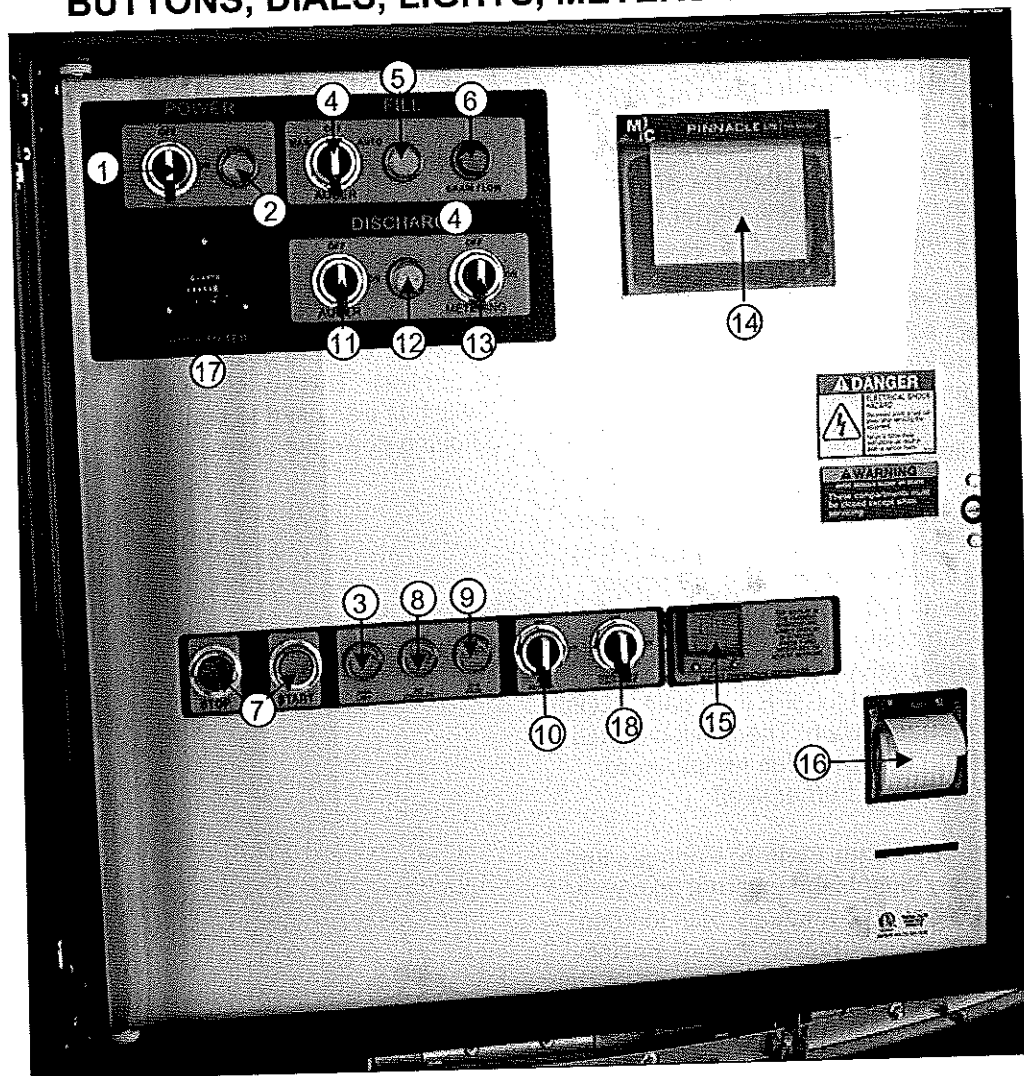
Electrical Power Lockout & Tagout

End of season dryer shutdown.

Once the dryer has completed drying for the season, it must be emptied and cleaned out. The use of the grain dryer as a grain storage unit will void the warranty. **The grain dryer was not designed as a storage unit for wet or dry grain.** The screen perforation allows the grain to rehydrate and swell in size if left in the machine too long, resulting in permanent structural damage. The stored grain can also bond together to form a solid piece, which can make discharging grain very difficult and may require manual separation of grain columns.

Grain left in the dryer for an extended period of time can be exposed to freezing, thawing and rain. This type of exposure can lead to rehydration and expansion of the kernels. Not only is this process harmful to the machine, it can damage grain as well. Clean-out of the machine is crucial for preservation of grain and mandatory for safe operating conditions.

REMOTE CABINET BUTTONS, DIALS, LIGHTS, METERS & SWITCHES



1. — Power On Switch: When this spring-loaded switch is turned to the ON position, the power-on light will be on if the rear discharge overload door is closed, all magnetic starter overload relay blocks are closed, and the relay is activated. High-limit lights will also be on. If not, push the reset button on the high-limit switch.

NOTE: If there is a momentary loss of electricity, the dryer will shut down and will have to be restarted by turning power-on switch to the ON position again.

2. — Power On Light: Indicates power-on switch has been turned on, discharge overload door and starter overloads are closed, and dryer relay is activated.

3. — High Limit Light: Indicates power switch has been turned on and high-limit switch is closed.

4. — Wet Grain Fill Switch: When switch is in the MANUAL position, the wet hopper fill equipment will start immediately when the rotary FILL switch in the hopper signals for grain and stops when the hopper is full.

When the switch is in the AUTOMATIC position, the rotary FILL switch will start the fill equipment automatically after the preset time on the delay and stop fill equipment when hopper is full. Filling time is monitored with the grain flow timer.

5. — Fill Light: Indicates that the grain level in the hopper is low and the rotary FILL switch in the hopper has closed, activating the customer-supplied fill equipment.

6. — Grain Flow Light: Indicates low grain level in wet hopper. The light comes on when the Grain Flow Timer reaches zero and dryer is shut down. Grain flow shut-down occurs when the fill has run continuously for the timer setting without reaching the level switch to indicate full.

REMOTE CABINET

BUTTONS, DIALS, LIGHTS, METERS & SWITCHES CONTINUED

See Diagram on Page 8

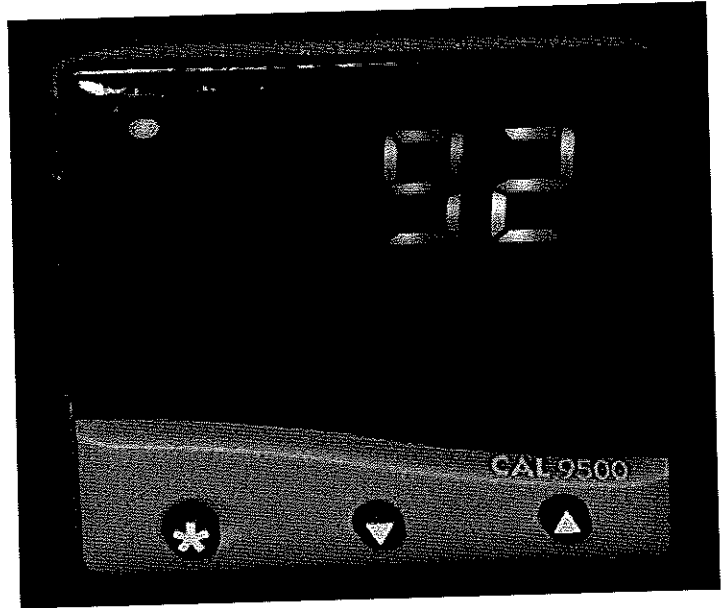
7. — **Fan Start-Stop Buttons:** Green button starts and red button stops the fan.
8. — **Air Pressure Switch:** Indicates that the air pressure switch is closed, the fan motor magnetic starter is engaged, and the dryer is full of grain.
9. — **Gas Valve Light:** Indicates ignition board terminal V1 are powered to open solenoid valves for burner ignition. Light remains lit as long as flame sense probe continues sensing burner flame and terminal V1 is powered. If sensing is lost, board will lock out and shut down solenoid valves and gas valve light.
10. — **Burner Ignition Switch OFF/ON:** After a 10 second delay, the Ignition Board terminal V1 is energized to open gas solenoids for burner ignition. The gas valve light will also be energized. If the burner does not ignite in 10 seconds, the ignition board will lock out, de-energizing the gas solenoid valves and gas valve light. The switch will have to be turned to OFF then back to ON for another attempt at burner ignition. The ignition switch has a second contact (NC) to bypass the temperature controller alarm relays when the burner is off.
11. — **Discharge (Unload) Auger Switch:** Engages the discharge relay. The relay signals the external takeaway equipment to run and holds the momentary path to keep the relay coil on. If there is a momentary loss of electricity, the dryer will shut down and the discharge will have to be restarted.
12. — **Discharge Auger Light:** Indicates that the discharge auger is running.
13. — **Discharge Metering Switch:** When the switch is turned to the ON position, the AC drive motor will run constantly and the speed of the sweep will be controlled by the speed control on the TruTemp HMI.
14. — **Pinnacle Lite Touch Screen HMI:** Use the touch screen controls displayed on the screen to control the discharge speed and monitor the discharge moisture of the grain if equipped with the optional moisture sensor.
15. — **CAL Controller:** Controls the proportional valve that regulates the amount of gas supplied to the burner. Digital display shows temperatures. Contains both plenum high and low shutdown +/- 40° from actual and set point.
16. — **Printer:** Provides printed records of time, day, discharge grain moisture, temperature, and average moisture content for dryers equipped with the optional moisture sensor.
17. — **Hour Meter:** Records hours of dryer operation.
18. — **Temperature Control ON/OFF Switch:** Supplies power to temperature controller of plenum chamber (Cal controller). This switch must be ON to light the burner. Switch is also used to reset temperature controller without shutting down the dryer.

CAL CONTROLLER FEATURES

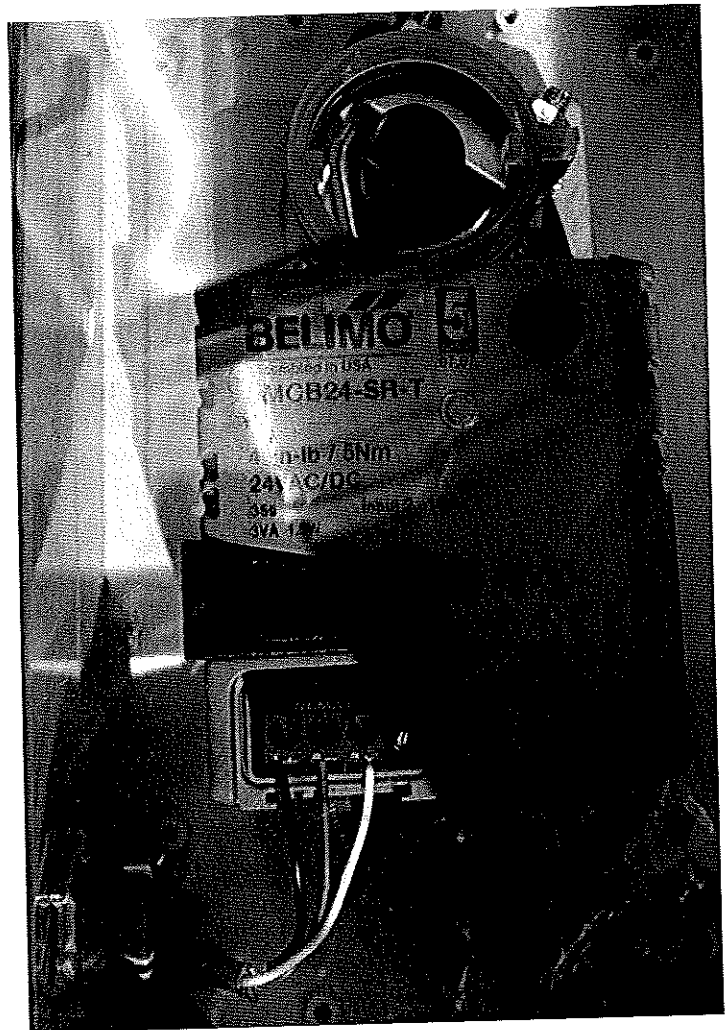
- Displays set point and actual plenum temperature simultaneously.
- Reads plenum temperature with an RTD (Resistance Temperature Device).
- Uses a PID loop control to keep temperature within +/- 2° in plenum chamber.
- Has an auto-tuning feature to automatically set PID values. This allows the controller to maintain temperature tolerances as ambient conditions and gas pressure are changed.
- Gas flow is controlled with a proportional actuator on a butterfly valve that takes 30 seconds to rotate 90°
- The proportional valve opens and closes from 0 to 100% to change gas flow and fluctuate the plenum temperature.
- When the actual temperature is more than 37.5° below the set point, the control signal will be at full output to open the valve.
- Once the actual temperature in plenum chamber nears the set-point temperature, the proportional valve starts to close to drive the temperature to the set point.
- The bottom end of the proportional valve can be adjusted to leave a percentage always open, which may be necessary to keep the burner lit.
- The travel of the proportional valve can be adjusted to either increase or decrease total amount open.
- The safety circuit for dryer is wired through the controller, by means of a relay.
- The high temperature limit shutdown is 40° over set point. This alarm latches on, power to clear.
- The low temperature limit shutdown is 40° below set point.

NOTE: When first starting the dryer, the low temperature shutdown is inhibited and does not become active until it reaches a temperature within 40° of set point. If the dryer loses the flame of the burner and temperature drops more than 40°, the dryer will shut down.

- Diagnostics will display alarm after shutting down dryer.
- Red LEDs to the left of the SP display (bottom) indicate alarm (Upper LED is for high temperature, lower LED is for low temperature).
- The green LED (upper left corner) flashes as the control output is calculated and changed.



CAL Controller

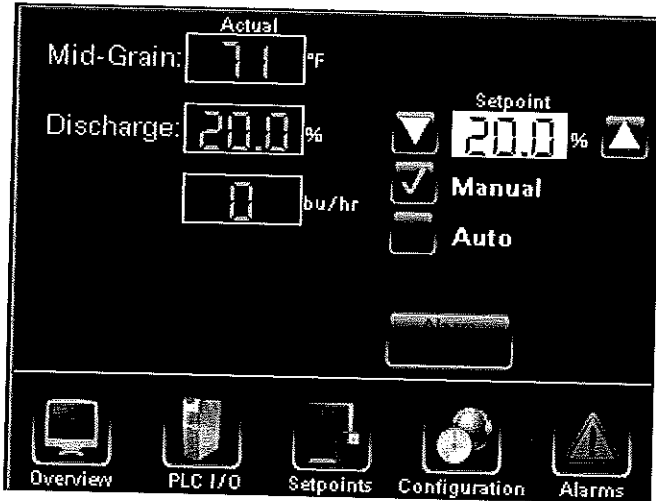


Proportional Valve

Pinnacle Lite Moisture and Temperature Monitor

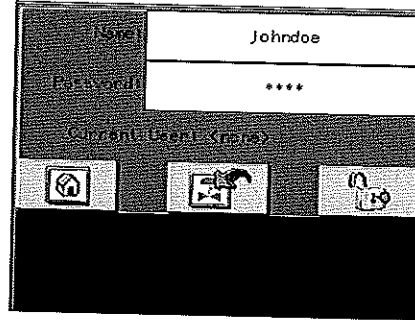
Overview Screen

Upon startup, the initial display is the overview screen showing the mid-grain temperature, discharge speed, and bushels per hour of discharge. From here, the operator can change the setpoint and choose between manual and automatic modes.

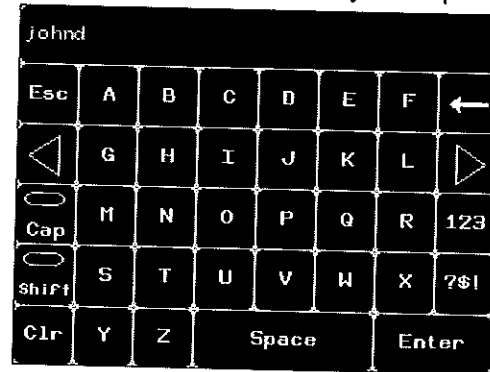


Some Pinnacle Lite functions require a username and password. An attempt to perform such functions will generate the popup seen at right.

Clicking in the white field to enter username and password will cause the password keypad to appear.



Pressing the white field for the username will bring up the alphabet keypad with a number or symbol option.



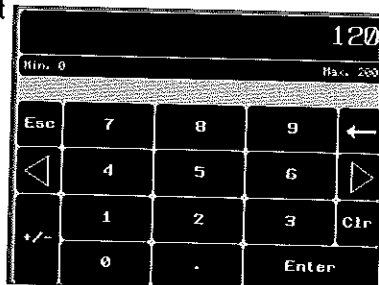
- The mid-grain temperature is an average of the four separate readings from the mid-grain sense probes. The temperature reading may be displayed in either Fahrenheit or Celsius.
- Discharge speed, which is measured in percentage of motor capacity utilized, can be adjusted in manual mode.
- The other measure of discharge output is bushels per hour.
- Switch from Manual to Automatic mode from the main screen by pressing the box next to the desired mode. A checkmark will appear by the current selection.
- Use the navigation bar across the bottom to switch to a different screen.

Navigation

To change the numerical values in the setpoint fields, use arrows when available or touch the field to generate a pop-up number keypad


Enter the desired value and press **Enter** to return to the main screen. If you do not wish to change the value, press **Esc** to return to the main screen without making a change.

The **[←]** button will delete one digit and **[Clr]** will delete the whole number.



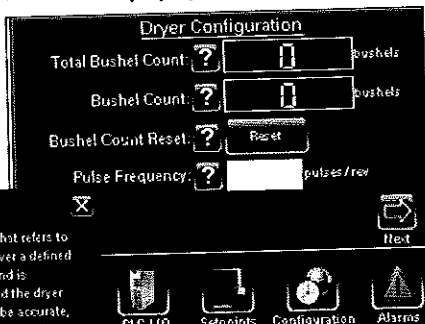
- Switches the keypad to numbers
- Switches the keypad to symbols
- Changes capital letters to lower case and vice versa.
- Press to return to the "Overview" screen
- Press to return to the previous screen before the password prompt was activated.
- Press to indicate completion of username and password entry

While navigating through the system, remember that fields with a gray background cannot be modified. Fields with a white background can be modified using the keypad.

Press the  icon to activate the popup help screens. Each one provides additional information about the adjacent field or button.

Bushel Count

The bushel count is a resettable counter that refers to the amount of grain that has been dried over a defined length of time. The units are in bushels and is calculated based on the discharge rate and the dryer running time. In order for this counter to be accurate, the discharge capacity must be consistent with the grain type and the dryer configuration.

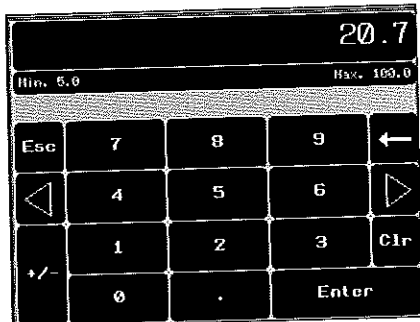


Changing the Discharge Setpoint

The discharge setpoint can only be changed in manual mode. To make a small adjustment, simply use the arrows up or down on either side of the display.



To make a more substantial adjustment, it is faster to input the numbers directly. Touch the display field to activate a number keypad with which to enter the desired discharge moisture setpoint.



Changing the Mid-Grain Temperature:

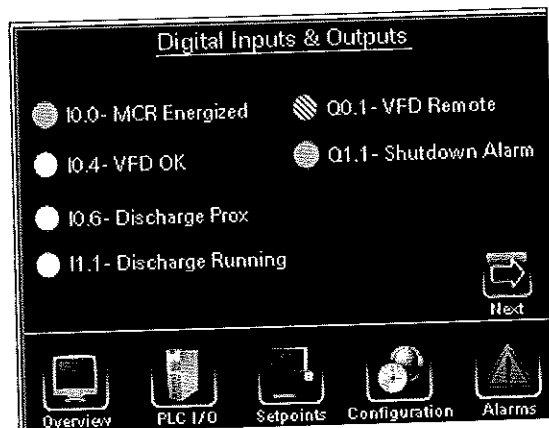
To change the temperature, the dryer must be running in automatic mode. Touch the box next to "Automatic" to check the box and select automatic mode.

The display shows the actual temperature. After the temperature setpoint is changed, the discharge moisture rate will increase or decrease until the actual temperature matches the temperature setpoint. The temperature setpoint does not have arrows to key up the temperature, but it does have the pop-up number keypad, similar to the one shown above for changing the discharge moisture setpoint.

Alarm Reset Button:

The alarm reset button is located on the Overview screen. When an alarm occurs, a warning or alarm screen pops up requiring the operator to acknowledge the event. Alarms that have not been cleared can be reset using the Alarm Reset button. The text will turn white if all the alarms have been successfully cleared. If an alarm condition still exists, the text of the button will remain red.

Input/Output Data:



Touch the PLC I/O icon on the bottom menu bar to navigate to the Digital Inputs & Outputs screen. These screens allow the user to monitor the operation of the PLC in real time.

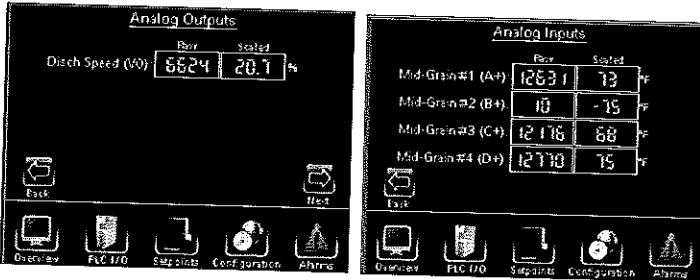
On the digital Inputs & Outputs screen, a green circle will indicate that a function is occurring and a white circle will appear when it is dormant.

- **10.0- MCR Energized**- If green, the control power is on and the safety circuit is functioning properly.
- **10.4- VFD Ok**- If green, the VFD is not exhibiting a fault. If a fault is generated, the bubble will turn white. This could indicate a discharge VFD alarm if the discharge and metering rolls are running when the fault occurs.
- **10.6- Discharge Prox**- Turns green at intervals in conjunction with the speed of the RPM proximity sensor. When the discharge is running, the RPM proximity sensor will change rate based on the rate of discharge. If the proximity sensor does not change state within a predetermined amount of time, an alarm indicating a discharge fault will be generated.
- **11.1 - Discharge Running**- When the discharge is running, this circle will be green.
- **Q0.1- VFD Remote**- A green light indicates communication between the VFD and the PLC. If the PLC fails or is turned off, this output is no longer presented to the VFD and manual adjustment of the VFD by a service professional may be necessary.
- **Q1.1-Shutdown Alarm**-Indicates the occurrence of a shutdown alarm.

Press the "Next" arrow in the bottom right corner of the display to advance to the Analog Outputs screen.

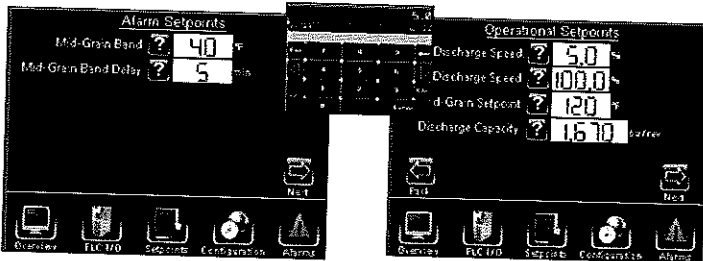
The analog screens display the raw communication from the PLC as well as the scaled value, which displays as a percentage of the motor speed capacity, similar to the display on the overview screen.

The outputs screen shows the discharge data. The inputs screen shows the separate readings from each of the four mid-grain temperature probes that get averaged together to comprise the mid-grain temperature displayed on the overview screen.



Changing Setpoints:

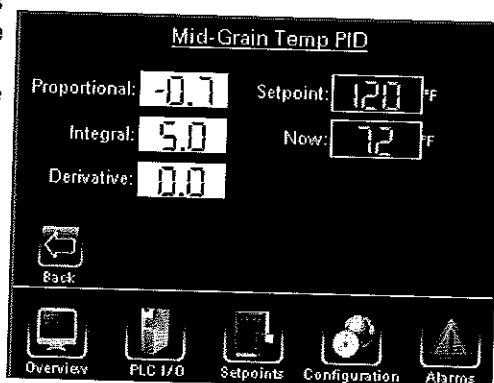
The Alarm Setpoints and Operational Setpoints screens allow the operator to change any of the parameters listed. To change a parameter, simply touch that field and a separate number pad will pop up. The current value appears in the field at the top of the number pad.



Choose the desired value and press "Enter" to confirm it. To go back to the Setup screen, press the "ESC" key. Press the question mark icons for help screens.

Click "Next" in the bottom right hand corner to go to the Mid-Grain Temp PID setpoint screen.

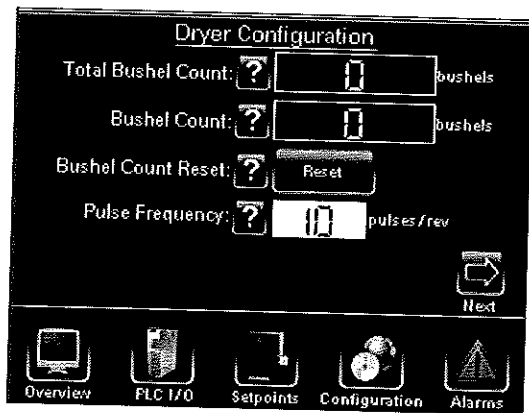
The Mid-Grain Temp PID screen shows the settings of the Proportional-Integral-Derivative (PID) controller. Each of these three fields provides a separate value in the control loop feedback. The PID loop is used to automatically regulate the discharge speed, based on the mid grain temperature.



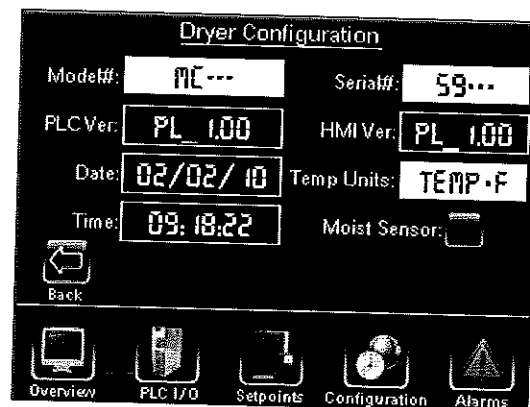
Dryer Configuration:

Dryer Configuration is handled from two screens. Many of these settings are programmed in the factory before the dryer is shipped and there should be no need to change them. Fields with a gray background are not modifiable. Those with a white background may be changed, but a user name and password are required to change factory settings.

The first screen has two bushel counters. The Total Bushel Count figure reflects the bushel count for the entire operating life of the machine and cannot be changed. The Bushel Count in the second field can record the bushels processed over a set period of time. This can be reset by pressing the "Reset" button directly below it. The Pulse Frequency figure represents the number of pulses sensed by the proximity sensor in relation to the discharge speed of the dryer.



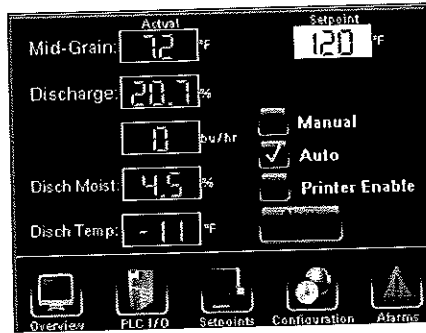
The second dryer configuration screen shows the dryer's model and serial number as well as the current PLC and HMI versions, the running date and time and the temperature units; Fahrenheit or Celsius. If the machine has a moisture sensor, there will be a green check mark in the moisture sensor box.



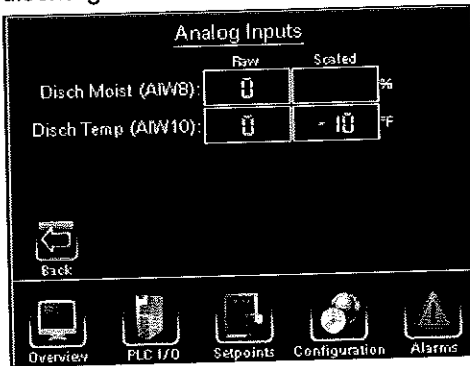
Optional Moisture Sensor:

If the machine is equipped with a moisture sensor, the Overview screen will include discharge moisture and temperature reading that are not available without this feature.

Because the printer is included with the moisture sensor, the option to enable the printer will also appear on the Overview screen.



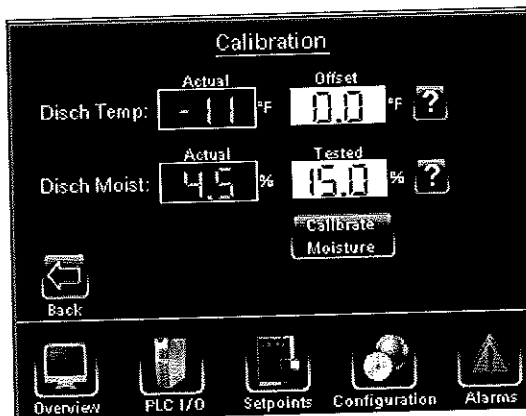
If the moisture sensor option is included, there will be an additional screen in the PLC Inputs/Outputs section showing the discharge moisture and temperature readings.



In addition to the two screens detailed above, there is a Calibration screen at the end of the Setpoints sequence.

The discharge temperature reading can be modified by changing the value in the Offset field. For example, if the moisture sensor is reading 75 °F and the actual temperature is 80 °F, the user must enter an offset value of 5 °F to compensate.

The tested moisture is a user-defined value based on a tested grain sample. To calibrate the moisture sensor, enter the tested grain moisture and press Calibrate Moisture.



Printer Reading:

Machines equipped with an option moisture monitor will also have a printer. The printer output on the interval basis is formatted as follows: time (24hr format), current moisture (interval average), current temperature and running average moisture. The printed header consists of the date (MM-DD), and dryer model and serial number.

Sample Printout

```

TIME  MOIST  TEMP  RUNAVG
02-02-2010  MOISTURE
MODEL MC--- S/N 59nnn
15:28 15.0% 070F 13.6%AV
15:27 15.0% 070F 13.5%AV
15:26 15.0% 070F 13.5%AV
15:25 15.0% 070F 13.5%AV
15:24 15.0% 070F 13.4%AV
15:23 15.0% 070F 13.4%AV
15:22 15.0% 070F 13.4%AV
15:21 15.0% 070F 13.3%AV
15:20 15.0% 070F 13.3%AV
15:19 15.0% 070F 13.2%AV
TIME  MOIST  TEMP  RUNAVG
02-02-2010  MOISTURE
MODEL MC--- S/N 59nnn
15:18 15.0% 070F 13.2%AV
15:17 15.0% 070F 13.1%AV
    
```

Alarms:

Alarms are indicated in two ways. When an alarm is generated, a popup will appear on the screen detailing the reason for the alarm and what type of alarm it is. Press the Accept button to acknowledge the alarm and return to the previous screen.

A yellow popup box indicates a Warning. It should be acknowledged but is not crucial. A red popup box indicates a potential shutdown and must be acknowledged right away.

To navigate to the alarm list press the Alarms icon on the bottom navigation bar. The alarm list shows a brief description of the alarm as well as the date it was recorded.

Alarms that have been acknowledged are shown in yellow. Alarms that have been rectified appear in green.

Scroll to the right using the scroll bar or arrows to show the date of the alarm and the date that it was accepted from the initial popup.

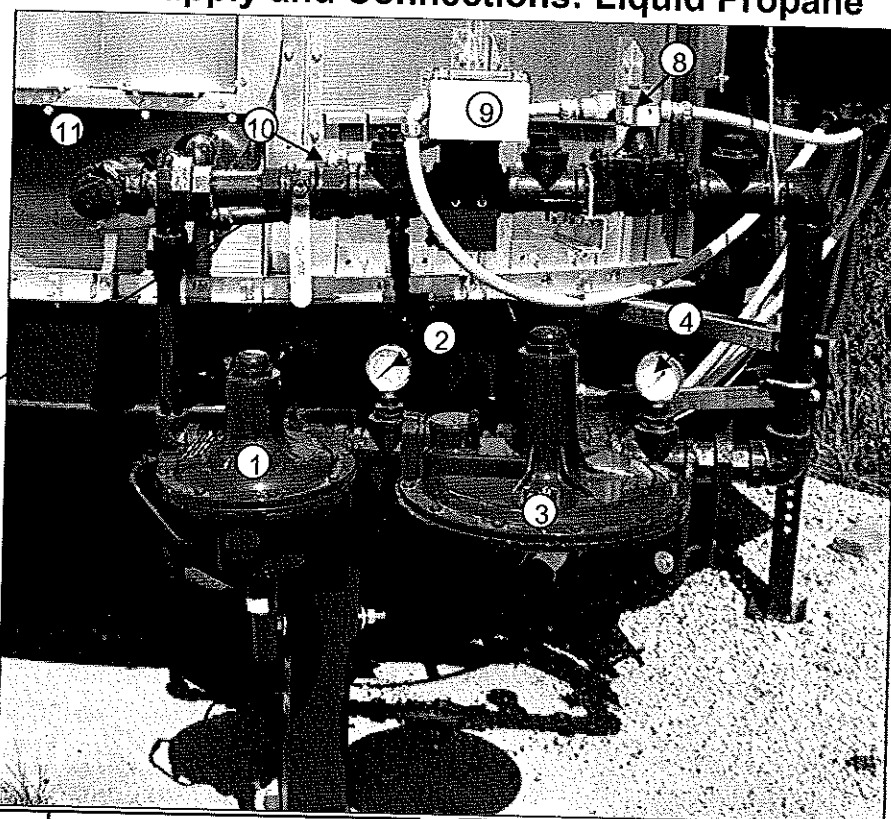
Name	Time
Discharge VFD	14:11:28
Discharge VFD	14:11:27
Discharge Failure	14:11:43
Mid-Grain Temp Probe #4 Failure	14:16:23
Mid-Grain Temp Probe #4 Failure	14:16:42
Discharge VFD	14:33:52
Discharge Failure	14:34:03
Discharge Moisture Low Limit	14:38:48

Navigation icons at the bottom: Overview, PLC I/O, Setpoints, Configuration, Alarms.

Gas Supply and Connections: Liquid Propane



Side View



1	High Pressure Regulator
2	High Pressure Gauge
3	Low Pressure Regulator
4	Low Pressure Gauge
5	Strainer
6.	Liquid Hand Valve

7	Liquid Solenoid Valve
8	Main Solenoid
9	Proportional Valve
10	Hand Vapor Valve
11	Vapor Line to Burner



CAUTION: Before starting the dryer, test for any gas leaks. Turn the gas supply on and apply soapy water to ALL pipe joints and unions, including pipes assembled on the site and those assembled at the factory.

IMPORTANT: Use type of supply line specified by local codes.

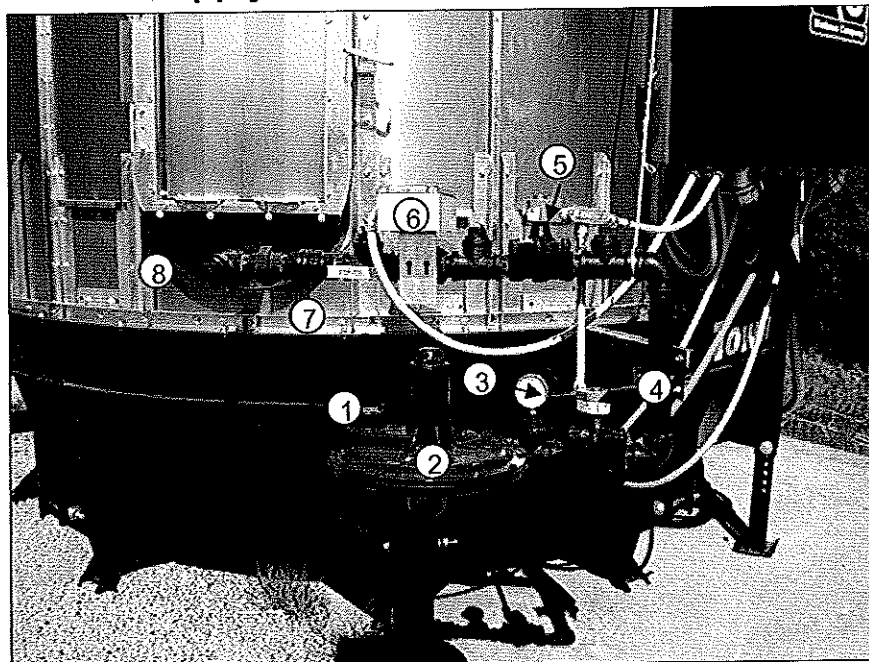
1. Advise your LP gas supplier that the burner requires liquid propane from the LP tank (not vapor).
2. The burner requires 1.5 to 3 psig. (10.6 to 21 kPa) of gas pressure on the Low Pressure Gauge.
3. Consult the LP gas supplier for gas line size required from the supply tank to the dryer gas manifold that will provide the amount of fuel to meet dryer BTU/Hr. requirements at the recommended operating pressure. See *Gas Consumption BTU/Hr. Chart*.
4. Connect the LP gas supply line from the tank valve to the 3/4" (19mm.) extra heavy duty intake pipe below the left side of the control cabinet (if you are facing the cabinet)

Gas Consumption (BTU/Hr.)*

Model	Normal Operating	Maximum
10520	2,904,000	5,280,000
10630	3,630,000	6,600,000
10730	4,114,000	7,480,000
10840	5,082,000	9,240,000
101050	6,171,000	11,220,000
101275	7,502,000	13,640,000

* Based on 200°F (93.3°C) drying temperature and 50°F (10°C) outside air temperature.

Gas Supply and Connections: Natural Gas



1	Natural Gas Entry
2	Low Pressure Regulator
3	Low Pressure Gauge
4	Gas Solenoid #1

5	Gas Solenoid #2
6	Proportional Valve
7	Main Vapor Hand Valve
8	Vapor Line to Burner



CAUTION: Before starting the dryer, test for any gas leaks. Turn the gas supply on and apply soapy water to ALL pipe joints and unions, including pipes assembled on the site and those assembled at the factory.

IMPORTANT: Use type of supply line specified by local codes.

1. Consult the natural gas company to obtain the size of the supply line to the dryer gas manifold. This supply line must be large enough to provide the volume of gas required for the burner at an operating pressure of 1.5 to 3 psig. (10.6 to 21kPa) on the Low Pressure Gauge. See Gas Consumption BTU/Hr. Chart

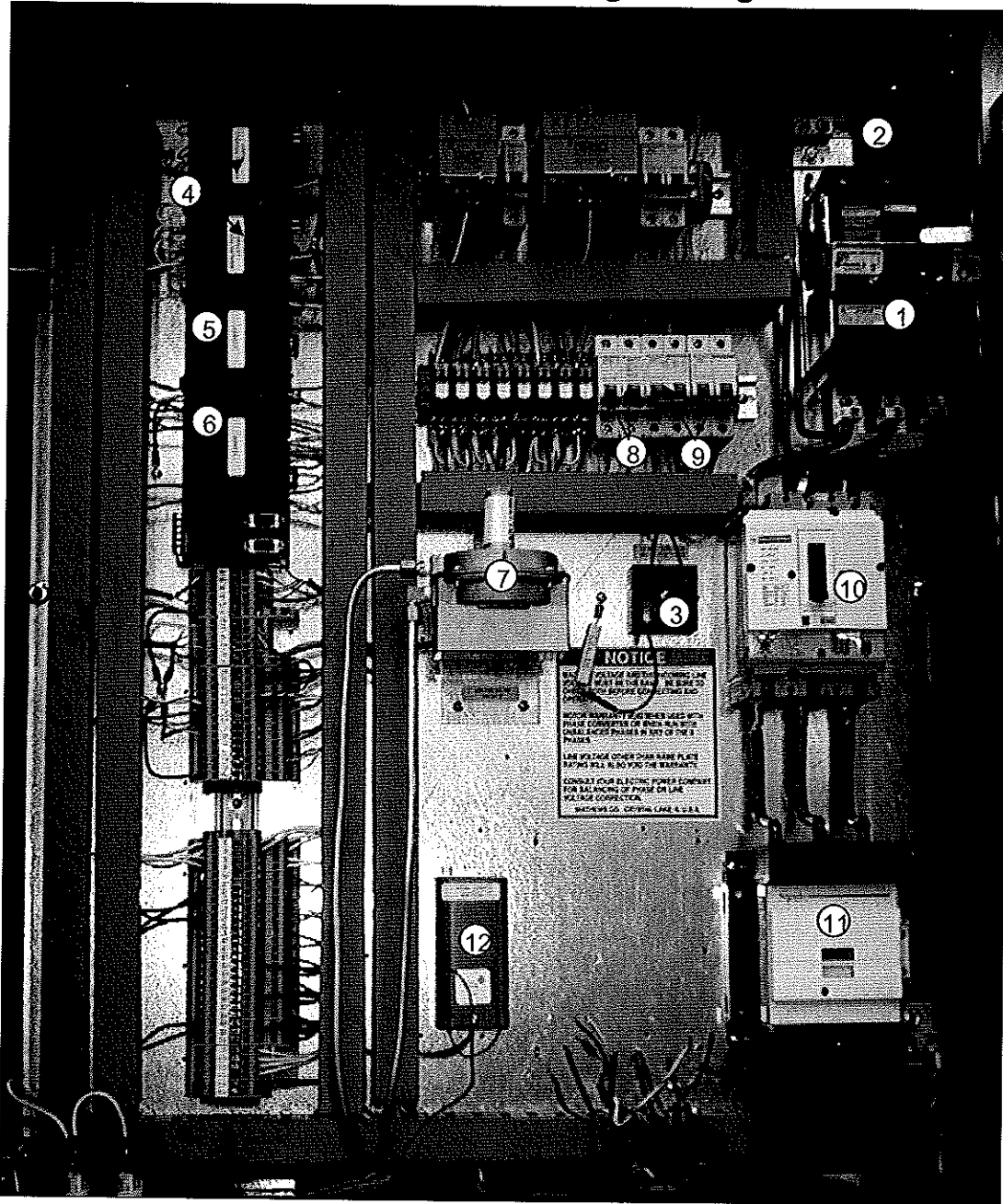
2. Connect the natural gas supply line to the 1 1/2" (50mm.) 10520-10730 or 2" (50mm.) 101050-101275 intake pipe.

Gas Consumption (BTU/Hr.)*

* Based on 200°F (93.3°C) drying temperature and 50°F (10°C) outside air temperature.

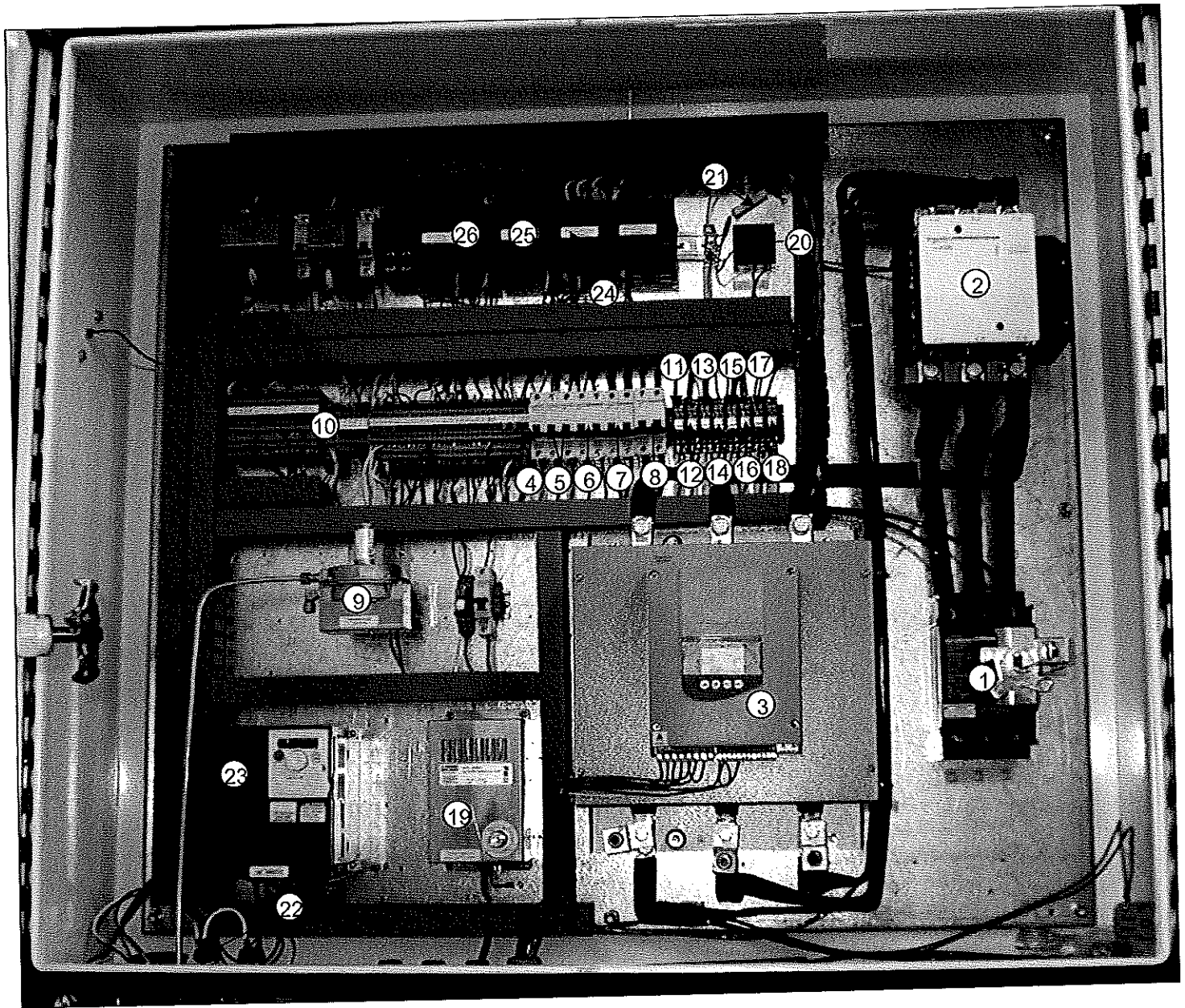
Model	Normal Operating	Maximum
10520	2,904,000	5,280,000
10630	3,630,000	6,600,000
10730	4,114,000	7,480,000
10840	5,082,000	9,240,000
101050	6,171,000	11,220,000
101275	7,502,000	13,640,000

10' Tower Dryer Direct Start High Voltage Cabinet



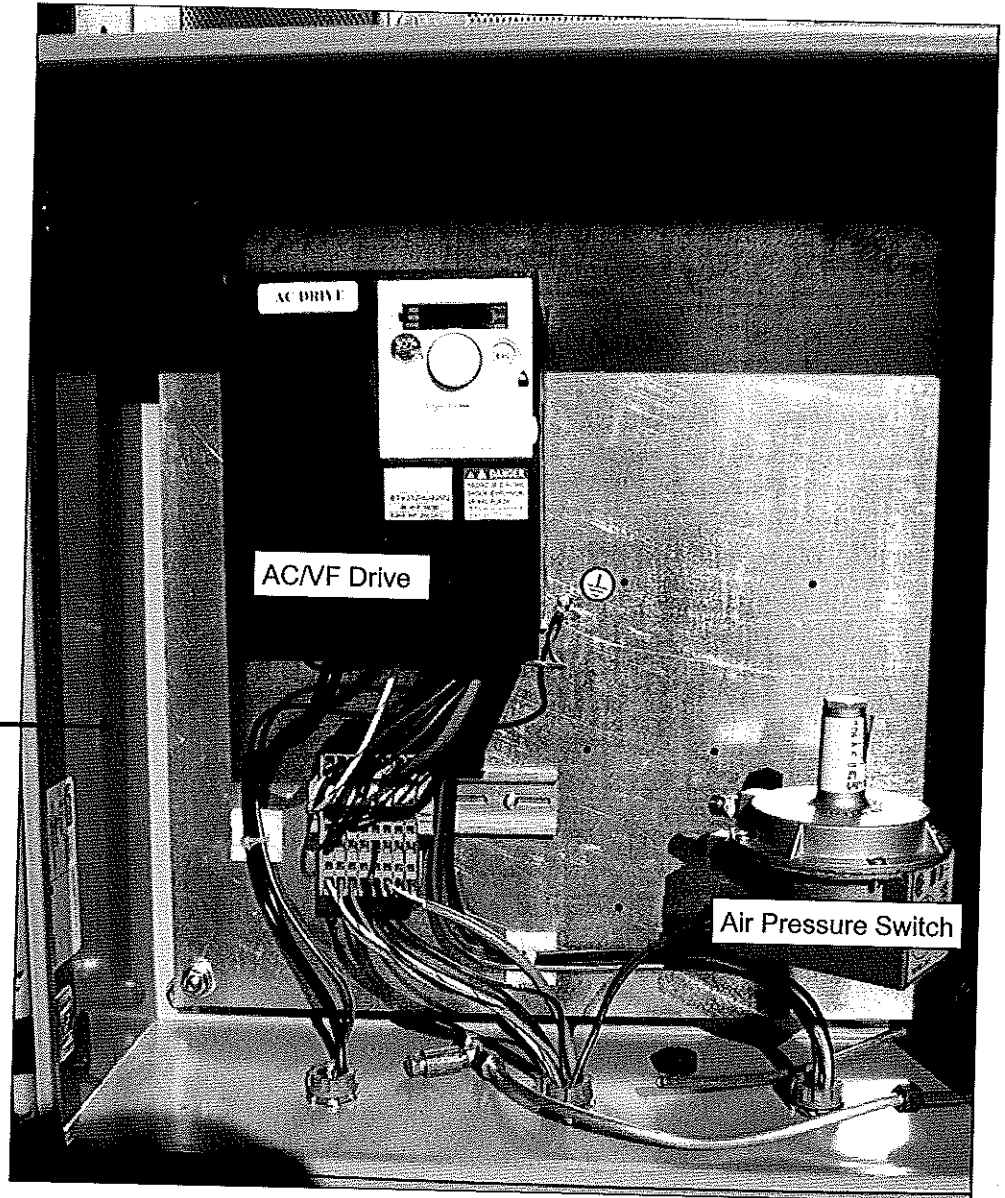
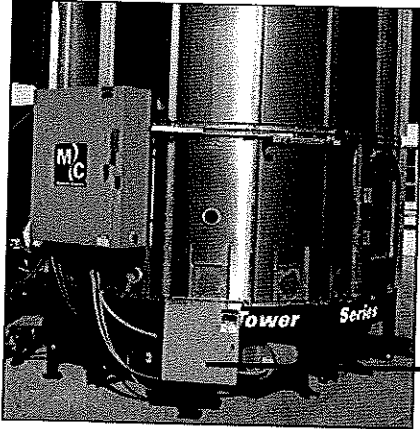
- | | |
|------------------------------|--|
| 1. Disconnect Switch | 8. Circuit Breaker 8 Amp (1) Pole |
| 2. Ground Lug | 9. Circuit Breaker 8 Amp (1) Pole |
| 3. Purge Timer | 10. Motor Protector |
| 4. Analog Input Card for PLC | 11. Motor Contactor |
| 5. PLC Module | 12. High Limit Switch (10520-10730 only. Located in the ignition box on larger models) |
| 6. PLC CPU | |
| 7. Air Pressure Switch | |

10' Tower Dryer Soft Start High Voltage Cabinet



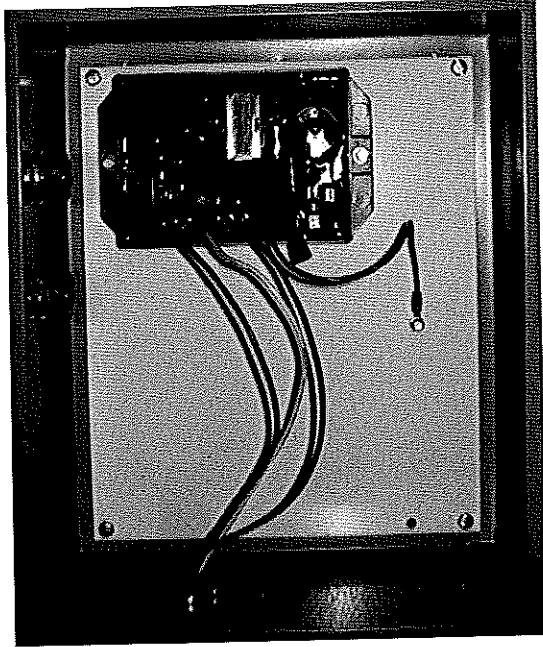
- | | |
|---|---------------------------------|
| 1. Disconnect Switch | 14. Ignition Relay |
| 2. Motor Contactor | 15. Discharge Relay |
| 3. Soft Starter | 16. Fill Equipment Relay |
| 4. Single Pole Soft Starter Circuit Breaker—1/2 Amp | 17. VFD Fault Relay |
| 5. Circuit Breaker 7 Amps - 120 volt | 18. Alarm (LLC) Relay |
| 6. Double Pole Cabinet Heater Circuit Breaker—4 Amps | 19. Cabinet Heater |
| 7. Double Pole AC Drive Circuit Breaker—30Amp | 20. Ignition Purge Timer |
| 8. Double Pole 460v Transformer Circuit Breaker-35 Amps | 21. Ceramic Resistor 10W-3K OHM |
| 9. Air Pressure Switch | 22. Linear Limit Lights |
| 10. Terminal Block | 23. VFD |
| 11. MCR Relay | 24. Analog Input Card for PLC |
| 12. VFD Relay | 25. PLC module |
| 13. Monitor Limit Relay | 26. PLC CPU |

10' Tower Dryer VFD Enclosure



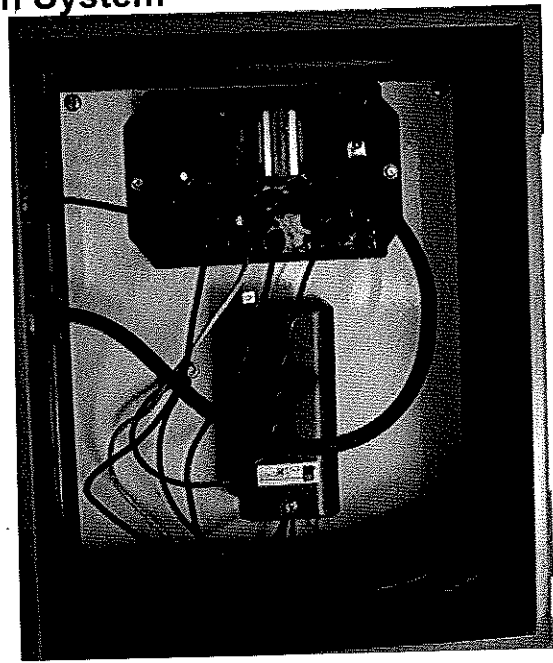
The 10' tower VFD is now housed in a separate enclosure, which is mounted at the base of the dryer and contains the Variable Frequency AC Drive and the air pressure switch.

Tower Dryer Ignition System



Tower Dryer Ignition Module for Models 10520-10730
(High Limit switch located in high voltage cabinet)

1. Power is supplied to the air pressure switch through a fan-motor interlock. Once the fan is running, the air pressure switch is powered up.
2. The air pressure light comes on, proving air flow. This then provides power to the ignition switch.
3. Once the ignition switch is turned to the ON position, power up the input side of the external 10-second timer. The load side of the timer has both a resistor-to-ground (eliminating excess voltage during timing cycle) and a hot lead to ignition board.
4. When the ignition board is powered up at L1 and neutral is L2, the board starts through lighting procedure.
5. The Red LED light on the ignition board will flash once when it first receives power. This is to reset the internal board protection and clear memory. This is a 1-second delay before the board starts the first trial for ignition.
6. Once the board is reset and memory is cleared, the board will send high voltage out of E1 (coil) to the spark plug in order to light the burner and 120 volts output from V1 to open up solenoid valves & light up the gas valve light. This trial for ignition will last for 10 seconds. The trial for ignition ends after 10 seconds as does the high voltage arc and 120 volts out to solenoids from V1.



Tower Dryer Ignition Module for Models 10840-101275

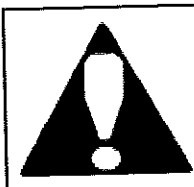
7. If the burner is successfully lit, the board will output between 40 and 60 volts to the flame sense probe at the burner. The flame sense probe will try to push voltage through the flame and to chassis ground. Once the circuit from the flame sense probe to chassis ground is complete and the signal is strong, the board will keep power at V1 and the solenoids remain open.
8. If the signal drops down or is interrupted, the board will drop power to V1 and the solenoid will close, causing the flame to go out.
9. The ignition board has a second trial for ignition, which will occur immediately after dropping out the burner. This will occur so quickly that the gas valve light will not even flash off between loss of signal and re-trial for ignition. The second trial for ignition will not occur if a flame is never established.
10. When the flame is lost, the board will show three flashes on the red LED light on the ignition board, indicating lock out condition.
11. If burner does not light, turn the ignition switch to the OFF position and back to the ON position. The sequence will begin again.

Section 2
Operation

Start-Up Procedure

General

WARNING: Inspect for and remove any foreign material (nuts, bolts, tools, parts, etc.) from the grain columns, discharge auger and heat chamber before filling the dryer with grain.



CAUTION: Lock out and tag out high voltage disconnect when working inside any control cabinet or inside dryer.

BE SURE TO REMOVE BURNER COVER!

1. Adjust high limit, located inside the high voltage cabinet on models 10520-10730, and inside the ignition box on models 10840 and 101275 (high limit is located in the high voltage cabinet for dryers smaller than 10 sections). Set high limit at 30 to 50 degrees above drying temperature. Recommended settings are to avoid nuisance shutdown.
2. Make sure that all gas supply is turned off and locked out.
 - A. Liquid Propane (LP) Fuel:
 - Turn the LP liquid line hand valve 90° to the piping to shut off the LP at the dryer.
 - Turn the vapor hand valve 90° to the piping to shut off the gas to the burner.
 - Open the LP valve at the source.
 - B. Natural Gas (NG) Fuel:
 - Turn the NG hand valve 90° to the piping to shut off the NG at the dryer.
 - Open the NG valve at the source.
3. Remove pipe cap from vapor line to burner and open hand valve to allow any built-up water to drain from gas lines. Once water has completely drained, recap the end of the vapor line using Teflon tape and non-hardening pipe dope to reseal and close. Gas supply can now be restored. **See diagram on page 15.**
4. The burner cover must now be removed from the burner. This is located directly on top of the burner in the heat chamber.
5. Make preliminary adjustment to timers located in the remote cabinet. Adjust fill timer to 60 seconds and grain flow timer to 5 minutes. Make sure that arrows on grain flow timer are set at 1x and M & 5 (for five minutes). This can be easily adjusted with a small flathead screwdriver. See page 23.
6. Turn the disconnect in the high voltage cabinet to the ON position.
7. Turn the Power switch to start position. The ON light should energize.
8. Depress the fan start button and the fan should come on. Once the fan is running at full speed, the dryer is ready to be filled.
9. Switch the fill switch on the remote panel to Manual to allow the dryer to fill completely.
10. Adjust the air pressure switch (located inside high voltage cabinet or VFD enclosure, depending on vintage) so the air pressure light energizes when the dryer is full of grain and the fan is running. **NOTE:** If the fan stops for any reason or grain columns start to empty, the air pressure light should de-energize. The air pressure switch should be adjusted when the fan is running and grain columns are full. Turn adjustment screw clockwise until Air Pressure light goes out, then slowly turn counterclockwise until the light comes back on. Add one half turn Counterclockwise.
11. Open the hand valve on gas train, located downstream of the optional Maxon valve. Gas pressure should be indicated on the gauge located on the gas train.
12. Turn the temperature control switch ON, then turn the ignition switch to ON. This will energize the ignition board and go through a 10-second purge time. Then the ignition board will attempt to light the burner for 10 seconds (trial for ignition). The gas valve light should be energized while the burner is trying to light (10 seconds).

NOTE: If the burner will not attempt to light while the temperature control is in the OFF position, set the temperature control switch to the ON position and allow the controller to run through test mode and display plenum chamber.
13. Once burner is lit, press * and ▲ on the Cal Controller to scroll the number up to the desired plenum temperature. The controller will display two numbers. The upper number is the actual plenum temperature in Fahrenheit or Celsius. The lower number is the set point (SP) or desired plenum temperature in Fahrenheit or Celsius. Bottom number SP is the only number you can adjust with arrow keys. The plenum temperature may take several minutes to stabilize. The controller is programmed to slow down the rate that temperature is increasing, the closer the plenum gets to the set point. This is to avoid tripping the high-limit device and overshooting the temperature. The Cal Controller automatically shuts down the dryer if there is a loss or gain in the temperature of more than 40 degrees from the set point.
14. After allowing the dryer to warm up, start the discharge system by turning the Auger switch to On and start the Auger itself with a further turn to the right. Turn the Discharge Switch to ON and the Discharge light will illuminate. Note that the take away equipment must be running for this to operate.

FILLING THE DRYER

NOTE: Always have the fan running before filling the dryer. Either start with dry grain in the cool section or be prepared to catch wet grain and recycle it back into the dryer.

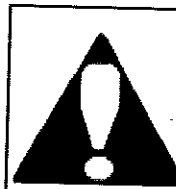
There is an adjustable 0- to 3-minute delay in the dryer wet-fill circuit. The delay is activated when the wet grain filling switch is in the AUTOMATIC position and the filling (fill) light is signaling for grain.

This delay prevents nuisance starting and stopping of the fill system. If the wet grain filling switch is placed in the OFF and back to the AUTOMATIC position, the delay will recycle.

When the dryer fills with grain up to the level of the rotary bin switch, the dryer has reached its capacity and automatically stops filling.

The grain flow timer will shut down the dryer if there is an insufficient amount of wet grain to fill the hopper. When the fill system starts, the grain flow timer will be activated. When the timer counts down to zero, the dryer will shut down and the grain flow light will be illuminated. Grain flow is only a part of the circuit when the discharge is operating.

NOTE: Either start with dry grain in the cool section or be prepared to catch wet grain and recycle it back into the dryer.



CAUTION: Do not allow anyone to be in the dryer when filling it with grain. Always turn off and lock the electric power supply to the control cabinet before allowing anyone to work in the dryer.

15. Use the HMI touch screen to adjust the discharge speed. To perform this function, the dryer must be running in manual mode. Increasing the discharge speed will cause the grain to pass through the dryer more quickly, causing the mid-grain temperature indicated on the HMI to decrease and the discharge moisture to increase. Decreasing the discharge speed causes the grain to pass through the dryer more slowly removing more moisture, which causes the mid-grain temperature to rise and the discharge moisture to decrease. By carefully adjusting the discharge speed, the resulting discharge moisture can be adjusted to the desired moisture percentage. Once the drying process has stabilized and the desired discharge moisture has been achieved, you can switch from manual to automatic mode by selecting the "Automatic" button on the HMI. Make sure that the set point for the mid-grain temperature matches the actual reading.
 16. In automatic mode, the discharge speed will change to maintain the desired grain moisture content. As the mid-grain temperature increases, the discharge speed will be increased so as to reduce the drying time and cause the mid-grain temperature to decrease and maintain moisture content. Once in automatic mode, the manual speed control is no longer available.
 17. Running on continuous heat, it will take approximately 6 minutes per point of moisture being removed to dry the first load.
- NOTE:** Because the dryer is operated "Dry and Cool," it will be necessary to recycle the wet grain in the cooling section back through the heat section after drying the first load or start with dry grain in the cooling section.
18. Test moisture content of the grain being discharged every 15 minutes until it stabilizes.
 19. If the moisture content is too high after it stabilizes, adjust the mid-grain temperature setpoint to a higher temperature, which will cause the unloading speed to decrease. If the discharge moisture is too low, key the mid-grain temperature setpoint down to a lower temperature, which will increase the unloading speed.

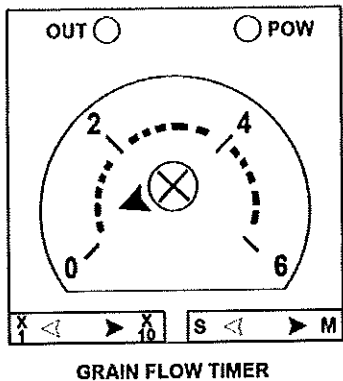
NOTE: After any adjustment of the mid-grain temperature, wait 1 1/2 to 2 hours to make further temperature adjustments since it takes that long for grain to pass through the dryer and for the full effect of the speed adjustment to be realized.

Setting the Grain Flow Timer

IMPORTANT: If the timer has not been set, the dryer will shut down when the fill dial switch is turned from MANUAL to AUTOMATIC.

Conveyor Fill System (Slave System)

1. Set the adjustable wet fill delay for time desired (0 to 3 minutes) if not already set.
2. Set the Grain Flow Timer arrows at the bottom of the timer face to X10 (times ten) and to M (minutes). It may be necessary to remove the timer from its socket to make this adjustment. Now turn the timer control knob to 1 (3x10) or 10 minutes and flip the wet grain switch to AUTOMATIC. The fill system will start after the 0- to 3-minute delay if the filling (fill) light is on, signaling for grain.



Example: Timer setting for conveyor fill system

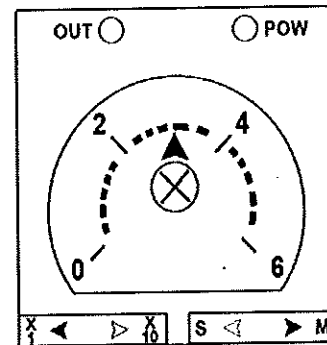
3. Check the refill time a minimum of six times. The filling (fill) light will come on when the rotary fill switch in the hopper signals for grain and will go out when the hopper is full. The length of time that the filling (fill) light is on is the refill time (including the 0- to 3-minute delay)
4. Average the 6 refill times and reset the grain flow timer to run five minutes longer. For example, if it takes the fill system an average of five minutes to refill the dryer, set the grain flow timer to run 10 minutes.

NOTE: The timer does not operate when the fill switch is in the MANUAL or OFF position.

Gravity Feed Tube System (Choke Fill System)

1. Set the timer for refill time desired 2 to 180 at 10 seconds if not already set.
2. Set the grain flow timer arrows at the bottom of the timer to X1 (times one) and to M (minutes).
3. Grain flow should be set from 2 to 4 minutes.

NOTE: This will not cycle the fill system. The rotary fill switch is used to shut down the dryer on loss of wet grain only.



Example: Timer setting for gravity feed tube system

Grain Flow Timer Operation

With the grain flow timer set to run five minutes longer than the fill system refilling time, the timer will work as follows:

1. The timer will start when the fill system starts. The red light on the face of the timer will be on and the timer will start to count down to zero.
2. After the fill system refills the dryer and shuts off, the filling (fill) light will go out and the timer will automatically reset. The red light on the face of the timer will be out.
3. If there is an insufficient grain supply, the fill system will continue to run beyond the five minute refilling period. When the fill system has run the length of time that was set on the grain flow timer, the dryer will shut down.
4. The Remote Cabinet panel will have the grain flow light on. The 2 red lights at the top of the grain flow timer inside the remote cabinet will be on. Flip the wet grain switch or turn the fill switch remote to OFF
5. Discharge must be in operation for grain flow timer to function.

NOTE: The grain flow timer shuts the dryer down when it has run out of wet grain.

If equipped—the main gas supply safety shutoff valve must be opened manually before the burners can be started.

6. Turn Power -On switch to the OFF position then to the ON position to reset the grain flow timer.
7. Turn the fill switch to MANUAL. Restart the fan, burner, and discharge system. Turn the fill switch to the AUTOMATIC position. The fill system 0- to 3-minute delay will be activated if the filling (fill) light is signaling for wet grain.

Starting the Burner

1. Start fan by pressing the Fan Start button (green). Check to make sure that the air switch indicator light is ON.
2. Open the gas vapor hand valve.
3. Turn the temperature controller switch to ON. This switch turns on the plenum burner temperature controller.
4. Turn the ignition switch to the ON position. After a 10 second purge delay, the ignition indicator light will be ON and the burner will light.

NOTE: The 10 second purge is a safety feature that allows the fan to purge the heat chamber of any unburned gases that may remain after a burner has been shut down for any reason.

The ignition board is electronically timed so that the ignition system will spark and hold the solenoid gas valves open for a "trial ignition" period of 10 seconds. If the burner does not light, the system will "lock out," closing the gas solenoid valves.

5. If the LP gas line freezes, close the gas vapor hand valve and turn the burner switch to OFF. After the gas line thaws out, **slowly** open the gas vapor hand valve all the way (handle parallel to the piping).

NOTE: Opening the gas vapor hand valve slowly will prevent possible freezing of the LP gas line and also prevent the temperature from rising too fast. If the temperature rises too fast, the high limit switch will trip out and the dryer will shut down.

6. Push the reset button on the high limit switch, located in the center of the standard control cabinet, in the lower right-hand corner of the Motor Control Cabinet on models 10520 to 10840, equipped with the optional remote cabinet controls, and in a special 12"x10"x5" junction box located in Section 2 of the 101050 dryers.

NOTE: When the high limit switch trips out, the dryer will shut down. The fan and burners will have to be restarted.

7. Turn Power On switch to the ON position and release.
8. Start the fan by pressing the green FAN START BUTTON. Check to make sure that the indicator light for the air pressure switch is on.
9. Open the gas vapor hand valve halfway.

10. Turn the burner switch to the ON position. The gas valve light will light and the burners will ignite.
11. The gas pressure reading on the pressure gauge should indicate from .75 to 3.0 p.s.i. (10 to 20.7 kPa.) to maintain the drying temperature during variations in the outside temperature (especially when drying at night).

Setting Drying Temperature

NOTE: Temperatures shown are initial settings and may have to be adjusted for local crop and weather conditions.

1. With the burner operating, set the drying temperature by adjusting the cal controller.
2. Press the * key with the up and down arrow to change the desired set point (drying temperature).

NOTE: After the dryer has been operating for one half hour, check the Cal Controller. The display, in operating mode, shows 2 numbers. The top number is the actual temperature detected by the sensor, and the bottom number is the current set point temperature. The controller is used to show drying temperatures.

Cal Controller Wiring

The proportional valve (Belimo actuator) is powered from 24VDC and opens according to a 0-10 VDC signal. This signal comes from the temperature controller (Cal Controller). The controller will output 10v whenever the current temperature is significantly lower than the set-point temperature. To avoid overshoot upon initial lighting of the burner, this signal output is wired through one pole of the ignition relay.

The Cal controller has a high limit of 40° above the set point and a low limit of 40° below the set point. Upon initial power-up, the low limit is bypassed (inhibited) until the current temperature is within 40 degrees of the setpoint. Both the high and low alarms are bypassed when the ignition switch is off.

With the ignition off, the controller can be powered off and then turned back on to reset the low temperature inhibit or clear a high temperature alarm latch. After the controller powers up and is not in alarm, ignition can be attempted.

If holding a steady plenum temperature is a problem, check the proportional valve to make sure it rotates freely and turn down the pressure as low as possible while still maintaining temperature.

Drying Temperatures			
Model	Corn	Sorghum & Wheat	Sunflowers, Oats, Barley, Soybeans
	Dry & Cool	Dry & Cool	Dry & Cool
10520	210°F	160°F	130°F
10630	210°F	160°F	130°F
10730	210°F	160°F	130°F
10840	210°F	160°F	130°F
101050	210°F	160°F	130°F
101275	210°F	160°F	130°F

Manual Discharge Mode

The discharge system has two selector switches and one pilot light. The discharge switch on the left (labeled AUGER) is a two-position switch (OFF and ON) that powers the customer relay.

The right side discharge switch is labeled "metering" and is a two-position maintained switch (OFF and ON) that controls the discharge relay. The motor speed reference is either manual (adjusted on the HMI) or auto (TruTemp control system) input to a variable frequency drive (VFD). The switch energizes the VFD relay to give a run signal and turn on the discharge system light. Power comes from the first switch so the dryer discharge won't engage unless the takeaway system has been turned on.

Switching from Manual to Automatic

1. Before switching to AUTOMATIC on the HMI, the dryer should be operated in the MANUAL mode (Manual box checked on HMI main screen) to establish a discharge speed setting on the HMI that will unload dry grain at the desired moisture content. When the moisture content of the discharged grain has been consistent for 2 or more hours, it is time to switch to AUTOMATIC. Be sure the mid-grain temperature set point is at the same temperature as that indicated on the HMI.
2. While the discharge metering is in MANUAL, (Manual box checked on the HMI main screen), switch the HMI to the Settings screen and set the mid-grain temperature set point to the same value as the indicated mid-grain temperature.
3. Switch to Automatic by checking the box on the HMI main page. Now, the manual speed control is off and the discharge rate is being controlled by the TruTemp automatic system, and the mid-grain temperature RTDs. The unloading speed on the HMI should be the same as when the system was in manual mode, but the indicated discharge speed will begin to change automatically.

When the moisture content of the incoming grain changes (wetter or drier); the discharge rate will change automatically. If the speed slows down because the incoming grain is wetter, the discharge indicated speed will drop as the unload speed is automatically adjusted. When the adjustment is completed, the discharge speed should remain steady and the unload speed will remain constant until another change is required.

If the discharge speed increases because the incoming grain is drier, the discharge indicated speed will increase until the unload speed is automatically adjusted. After adjustment, the unload speed will remain constant until another change is required.

The system will automatically change speed, increasing or decreasing to keep the discharge grain at the moisture content that was established when the TruTemp Control System was in the manual mode.

Automatic Moisture Control System

There is a direct relationship between grain temperature and grain moisture. Any change in grain temperature will mean a change in grain moisture. If the temperature of the grain goes down, the moisture content will have increased. If the temperature of the grain goes up, the moisture content will have gone down.

The TruTemp control on M-C dryers maintains uniform moisture content of the grain being discharged from the dryer by changing the unloading speed of the dryer.

The moisture control is sensing grain temperature and reacting to it by slowing down or speeding up the unload rate of the metering rolls.

NOTE: As the dryer is operated "Dry and Cool," it will be necessary to recycle the wet grain in the cooling section back through the heat section after drying the first load or start with dry grain in the cooling section.

Running on continuous heat, it will take approximately 6 minutes per point of moisture being removed to dry the first load.

When the first load is dry, turn the spring loaded dial auger switch to ON and release. The discharge light will be ON.

Operation of the Discharge System with the Automatic Moisture Control System

The dryer sweep system is driven by a 5HP AC variable speed 3 phase 230V AC motor and reduction gearbox drive.

1. The discharge system is started by turning the spring-loaded auger switch, located inside the remote cabinet, clockwise all the way and releasing it. At this time, the customer takeaway system will be engaged.
2. When the metering switch is in the ON position, power flows directly to the AC discharge system drive motor. The speed of the discharge system drive motor is controlled by the setting on the TruTemp Control System HMI. The speed control is adjustable in 0.1% increments.
3. When the discharge is in the AUTOMATIC mode, the speed of the discharge system drive motor is determined by the TruTemp Control System, RTDs, and setting of the Mid Grain Temperature set point.

When the moisture content of the incoming grain increases, the RTDs sense the change in grain temperature (cooler) and signal the TruTemp Control System to slow down or stop the discharge system motor to prevent the discharge of wet grain from the dryer when moisture is outside of the pre-set limits or the Mid Grain Temperature is outside of the preset temperature band.

When the moisture content of the incoming grain decreases, the RTDs sense the change in grain temperature (warmer) and signal the TruTemp Control System to increase the speed of the discharge motor to prevent the over drying of the grain.

Moisture Control Setting and Adjustments When in Automatic

The discharge rate will change to keep moisture content the same as when it was established in manual mode. However, if you want to change the discharge moisture content when operating in automatic, simply increase the Mid Grain Temperature set point **up** to a higher temperature for **drier** grain or **down** to a lower temperature for **wetter** grain. When you adjust the Mid Grain Temperature you will see the discharge speed and discharge rate change to reflect the change in speed.

Going Back to Manual

You can switch back to MANUAL mode at any time. Just select the Manual button on the HMI. At this time, the TruTemp Control system will be off and the discharge system speed will be controlled by the manual discharge speed control value. The indicated discharge speed will show the manual speed setting. If you want to unload at the same speed in manual as automatic, adjust the manual speed control value until the discharge rate is at the same reading as in automatic.

In Manual mode, the discharge rate can only be changed by adjusting the manual discharge speed value.

End of Day Shutdown

1. To shut off the dryer, close the liquid propane (LP) gas supply valve at the tank or close the natural gas supply valve. Operate burners until the flame goes out, then turn off the ignition switch.
2. Close gas vapor hand valve and liquid line intake valve on dryers equipped with liquid propane (LP) burners.
3. Operate fan about (15) to (20) minutes to cool grain in dryer, then turn off fan and flip the Power On switch to OFF.
4. Turn off and lock the electric power supply to the dryer.

Next Day Startup

1. Turn on electrical power to dryer. Turn Power On switch to ON, place the wet grain switch or fill switch into AUTOMATIC and push the green button to start the fan.
2. Open the liquid propane (LP) gas supply valve at the tank or natural gas (NG) supply valve and liquid line intake valve. Now open the vapor hand valve.
3. Turn on the temperature controller. Allow the temperature controller to stabilize and turn the Ignition to ON to start the burners. Allow the mid-grain temperature to reach drying temperature before turning the discharge auger switch to ON and releasing. Now, turn the metering switch to ON and select Manual mode on the HMI. The discharge speed should be at the same value as when the dryer was last discharging in Automatic mode.
4. After the dryer has been unloading grain for at least 15 minutes, the discharge system may be placed in the Automatic mode by checking the Automatic box on the HMI main screen.



WARNING: Check and clean the inside of the dryer heating and cooling chambers daily, or more often if needed. Most dryer fires are caused by poor housekeeping.

Final Shutdown

When the last grain to be dried has been put into the dryer, place the discharge auger switch into the OFF position to stop the discharge system motor before the grain has dropped below the perforated area in the wet grain holding area of the roof section.

Dry this remaining grain for approximately 6 minutes per point of moisture to be removed. When grain is dry, close the LP gas supply valve at the tank or close the natural gas supply valve.

Operate the burner until the flame goes out, then place the burner switch into the OFF position. Close gas vapor hand valve (handle 90° to the piping). LP gas—close the liquid intake valve, run the fan approximately 20 minutes to cool grain in the dryer.

After cooling, shut off fan and empty dryer by placing the discharge auger switch in the ON position and the HMI in Manual mode. Wait until the last of the grain has been removed from the discharge auger by the dry grain take-away equipment. Place the discharge auger switch into the OFF position to stop the discharge motor.

Grain tower dryers are not designed to be grain storage devices. Once grain is dried, it needs to be emptied from the dryer and stored in an appropriate facility. Grain stored in a dryer for more than one week may cause damage to the machine.

Section 3
Maintenance

Cleanout Recommendations

Proper cleaning maintenance of a grain dryer allows the dryer to perform more efficiently. When the screens of a dryer are clean, the air flow moves more easily through the grain wall. As debris builds up inside the dryer, the likelihood for internal problems increases.

The recommended tool for cleanout is air—preferably from a vacuum; however, using a non-metallic brush or broom also works. Should water be used for cleanout, be aware that some residue can form a paste inside the dryer, sticking to internal surfaces and becoming difficult to fully remove.

Internal cleaning of the grain dryer should be performed on a daily basis to prevent screen perforations from becoming plugged. Dirty internal conditions can result in the combustion of debris.

Note: Setting the fill timers is very important in preventing internal debris buildup. The recycle fill timer (0-180) should be set for as short a time frame as possible. The grain flow timer needs to have time frame decreased to five minutes at maximum.

Cleaning the Outside of the Dryer

- The outside perforated screens of the dryer need to be kept as clean as possible for safety and performance reasons. The perforation of the screens allows heated air saturated with moisture from the grain to discharge from the machine. This process also creates a damp atmosphere on the outside of the screens and can allow the outer shell of the kernel to deposit or build up on the outer side of the screen. These deposits of debris can eventually build up to a point of fully plugging the path of air through the screen. This will result in loss of capacity and higher cost of drying. In addition, the chamber inside can show static air pressure present when the dryer is not full of grain. The burners should not be lit when the dryer is not full of grain. The hot air will follow the path of least resistance and rush out the top of the dryer where grain is not present. This will change the drying condition and characteristics of the drying process. This change can lead to overheating the top of the grain column, damaging grain and potentially grain combustion.

- The outside screens can be cleaned on an as-needed basis using brushes, compressed air or water. This process can be done during the drying process and can affect discharge rate. The proper way to clean is to brush down the screens while grain is in process, as this will help push material out of perforations. The discharge rate should increase as the dryer is cleaned because more surface area is now exposed to heated air passing through the grain columns.

- Cleaning with water is a common method but if the dryer is empty, water will be permitted inside the plenum chamber, which may result in additional inside maintenance. When the outside screens become fully plugged, the inside screens also need to be checked. When air is no longer passing through the grain column, the inside screen will not self clean. If the inside screens plug, they will always create a debris buildup on the outside. The two surfaces are dependent on each other to keep clean from debris. The accumulation of debris on the inside and outside of screens affects both safety and function.

Seasonal Daily Cleanout and Maintenance

Note: When cleaning inside the grain dryer, a protective breathing mask is recommended for personal safety.

1. Disconnect all electrical power and gas; this is a lock-out and tag-out procedure.
2. Do not let grain fines, bees' wings and dust accumulate inside the dryer.
3. Keep the surroundings clean at all times, to prevent breeding places for insects and other pests.
4. Inspect any loose bolts or screws. Tighten as needed.
5. Using a non-metallic brush or broom, sweep inner screens and channel rings going from top to bottom.
6. Sweep clean the heat floor to remove any debris.
7. Check the burner section to make sure the wires look good and the burner is clean of debris.
 - If burner ports are plugged, clear them with a piece of wire or a drill bit.
8. Open the cooling floor door and sweep any foreign material onto the grain deck floor or remove it from the dryer through air doors.
9. Clean outer screens and channel rings if necessary by sweeping them with a brush or power washing them with water to maintain current dryer capacity.
10. Wipe down and calibrate moisture sensors.
 - If sensors are reading high, extra fuel is being used to dry the grain.
 - If the sensors are reading lower than actual grain moisture, the risk of spoilage and reduced quality occurs.
11. Inspect any loose bolts or screws. Tighten as needed.
12. Re-engage both electrical power and gas fuel supply back on.
13. Once the dryer is back to normal operation, inspect the columns for grain movement. The grain should be moving down the grain column freely. If not, the dryer should be manually shut down. Empty the dryer to detect whether all columns are moving when discharge is running. This will determine whether there is a problem or not. If all columns are properly moving, fill the dryer and restart the drying process. If grain is not moving, a cause must be determined. Debris buildup near the metering system can keep grain from exiting the dryer. This must be cleared manually before starting to dry grain through the dryer.

Preseason Check



CAUTION: Before starting the following steps, turn off and lock the electric power supply to the dryer. Place circuit breaker in the control cabinet into the OFF position and lock the control cabinet doors.

1. Clean out heating and cooling chamber.
2. Remove weather cover from burner. At this time, also check spark plugs and wires for cracks, heat damage and loose connections.
3. Check wires in 17 x 14 x 18 1/2" ignition board box(es) located in upper cooling section, for cracks and loose connections.
4. Grease fan motor bearings. Apply grease until it comes out relief port. Use Chevron SRI-2 grease or equivalent.
5. Check oil in 50:1 gearbox and grease.
 - A. Oil must be at least 1/4" over gears
 - B. Grease top bearing
6. Grease U-joint on 50:1 gearbox drive shaft.
7. Grease belt tightener pivot.
8. Replace spring tension on belt tightener.
9. Grease 1" discharge system jackshaft bearings.
10. LP gas—remove plug at the end of the gas strainer, remove and clean screen. Replace screen and plug.
11. Unlock the control cabinet door (**be sure power is still OFF**) and check all wires for cracks, nicks and loose connections, especially on high voltage wires. Also be sure to check connections on the earth ground wire lug in the control cabinet and at the copper ground rod next to dryer.

Post-Season Dryer Maintenance



CAUTION: Before starting the following steps, turn off and lock the electric power supply to the dryer. Place the circuit breaker in the control cabinet into the OFF position and lock the control cabinet doors.

NOTE: During this procedure, wearing a dust mask is strongly recommended.

1. Disconnect all power and turn off the gas supply before proceeding with any post-season maintenance.
2. Place supplied weather cover over burner.
3. Using a non-metallic brush or broom, sweep the inner screen clean, going from top down to bottom.
4. Sweep out the Heat Floor to remove any debris from the floor
5. Open the cooling floor access door, sweep out all foreign material.
6. Clean off the grain floor along with the sweep arms.

NOTE: Be sure to remove grain debris that has built up in the corner edge of the grain floor and sweeps.

7. Visually inspect the bearings to see if there is any indication of one needing to be replaced and make a note to replace any that need it. Inspect any drive belts and chains to note if any need replacing. Lubricate chains for the winter.
8. Use a power washer on the outer screens if dirt has filled the perforations.
9. Remove cooling floor sections and remove grain from the bottom of the dryer.
10. Replace the cooling floor sections.
11. Grease the fan motor bearings and fan bearings with Chevron SR1-2 or equivalent.
12. Use a vacuum cleaner to remove any dirt from the control cabinet.
13. Place supplied weather cover over burner.

In Case of Fire

1. Call the Fire Department.
2. Shut off the electrical and fuel supply to the dryer.
3. Shut down the entire drying operation, including grain flow into and out of the dryer. The emergency controls may have already done this.
4. Do not try to cool a fire by running the fan(s).
5. Never run grain from the dryer into the elevator or storage if a fire is known or suspected.
6. Locate the area of the fire.
7. 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.
8. Emergency discharge slide gates at the bottom of each column as well as easy access gates located near the discharge area permit fast dumping of each individual grain column.
9. A fire extinguisher should be located at or near the dryer. If a fire seems to be getting out of control, call the fire department. Avoid chopping holes in the dryer if possible.

AC DISCHARGE DRIVE SPEED CONTROL

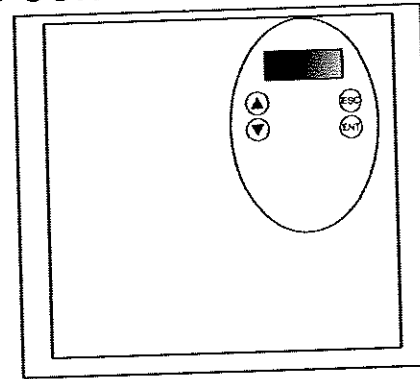
Keypad Instructions:

Keys are:

- **ESC** - Backs out of menus
- **ARROWS** - Scrolls up and down through menus
- **ENT** - Displays data numbers and saves data

Codes that Display Faults on Drive:

- OCF = Overcurrent
- SCF = Motor Short-circuit insulation fault
- InF = Internal Fault
- CFF = Configuration Fault
- SOF = Over Speed
- OHF = Drive Overload
- OLF = Motor Overload
- OSF = Over Voltage
- ObF = Over Voltage During Deceleration
- PHF = Line Phase Failure
- USF = Under Voltage
- CrF = Charging Circuit



Example: 5 HP AC Drive

Level	Code	Description	M-C Setting	Factory Default	
drC	bFr	Motor Frequency	60 Hz	50 Hz	
	UnS	Nominal Motor Voltage	230*	230	
	FrS	Nominal Motor Frequency	60	50 Hz	
	nCr	Nominal Motor Current	12.2	8.0	
	nSP	Nominal Motor Speed	1725	1715	
	COS	Motor Power Factor	0.88	0.88	
	rSC	Cold State Stator Resist	nO	nO	
	tUn	Auto Tuning		nO	
	tUS	Auto Tune Status	dOnE	tAb	
	UFt	Voltage/Freq ratio	n	n	
	nrd	Random switching freq	yES	yES	
	SFr	Switching frequency	4kHz	4kHz	
	10'/12'	tFr	Max Output Frequency	80Hz/72Hz	72Hz
		SSL	Suppress Speed Loop	nO	nO
I-O	SCS	Save Parameter Config	nO	nO	
	FCS	Restore Factory Settings	nO	nO	
	tCC	Type of Control	2C	2C	
	tCt	Type of 2 wire Control	trn	trn	
	rrS	Reverse	nO	LI2	
FUn	CrL3	Current Input Low	4 ma	4 ma	
	CrH3	Current Input High	20 ma	20 ma	
	AOIt	Analog Output Config	IOU	OA	
	dO	Analog/Logic Output	OFR	nO	
	r1	Relay R1	FLt	FLt	
	r2	Relay R2	nO	nO	
	SCS	Configuration Backup	nO	nO	
	FCS	Reset the Configuration	nO	nO	
	stC-	Stop Control			
	Stt	Normal Stop Type	nSt	rMP	
SUP	Monitoring Parameter		FrH or LCr	FrH	
			Freq. or Current		

*UnS can be set to 208v for dryers of that supply voltage.

AC Drive Parameters

Level	Code	Description	M-C Setting	Factory Default
SEt	ACC	Acceleration Time	5sec	3.0
	dEC	Deceleration Time	5sec	3.0
	LSP	Low Speed	5.0hz	0.0
10'/12'	HSP	High Speed	72hz/60hz	60.0
	lTh	Motor Thermal Current	12.2	11.0
	UFR	IR Compensation	25	20
	FLG	Frequency Loop Gain	20	20
	StA	Frequency Loop Stability	20	20
	SLP	Slip Compensation	100	100
	tdC1	Auto DC Injection Time	0.5 s	0.5 s
	SdC1	Auto DC Injection Current	7.7	7.7
	tdC2	2nd level DC injection time	0 s	0 s
	SdC2	2nd level DC Inject Current	5.5	6.1
	JPF	Skip frequency	0 Hz	0 Hz
	JF2	2nd skip frequency	0 Hz	0 Hz
	SP2	Speed preset 2	10 Hz	10 Hz
	SP3	Speed preset 3	15 Hz	15 Hz
	SP4	Speed preset 4	20 Hz	20 Hz
	CLi	Limiting Current	15.0	16.5
	tLS	Low Speed Operating Time	0(disable)	0 (disable)
	Ftd	Motor Frequency Threshold	60	60
	ttd	Motor Thermal Threshold	100	100
	Ctd	Motor Current Threshold	12.2	11.0
	SdS	Scale Factor for SPd 1/2/3	30	30
SFr	Switching Frequency	4 kHz	4kHz	

Changing Settings on AC Drive

How to Increase or Decrease Minimum Discharge Rate:

1. Press "ENT" key until "SET" appears on display.
2. Press "ENT" again to select the next screen.
3. Arrow down until unit displays "LSP."
4. Press "ENT" to display data.
5. The data displayed is in units of hertz, The range is 0 to 60 Hz.
6. Arrow up or down to change the number. The higher the number, the faster the discharge. Factory setting should be at 5.0 Hz.
7. Press "ENT" twice to save the value, once the desired setting has been reached.
8. Press "ESC" until a flashing "USF" appears on the screen.
9. Press "ESC" to return to "SET" display.

How to Increase or Decrease Maximum Discharge Rate:

1. Press "ENT" key until "SET" appears on display.
2. Press "ENT" again to select next screen.
3. Arrow down until the unit displays "HSP."
4. Press "ENT" to display data.
5. The data displayed is in units of hertz. The range is 0 to 60.
6. Arrow up or down to change the number. The higher the number, the faster the discharge. Factory setting should be at 60.0 Hz.
7. Press "ENT" twice to save the value, once the desired setting is reached.
8. Press "ESC" until a flashing "USF" appears on the screen.
9. Press "ENT" to return to "SET" display

How to Increase or Decrease Current Limit of Discharge Rate:

1. Press the "ENT" key until "SET" appears on the display.
2. Arrow down until unit displays "drC-."
3. Press "ENT" to display data (Motor Control Data)
4. Arrow down the menu until "nCr" appears.
5. The data displayed is in units of AC amps.
6. Press "ENT" to display the next screen.
7. Arrow up or down to change the number. This will increase the amount of amps the motor can draw to drive the discharge system. The higher the number, the more torque the motor has. (Factory setting is 10 amps, but could be increased to 12 amps if discharge will not start up.)
8. Press "ENT" twice to save value, once the desired setting has been reached.
9. Press "ESC" until a flashing "USF" appears on the screen.
10. Press "ESC" to return to "SET" display.

How to Increase or Decrease Acceleration for Discharge:

1. Press the "ENT" key until "SET" appears on the display.
2. Press "ENT" again to select the next screen.
3. Arrow down until unit displays "ACC."
4. Press "ENT" to display data.
5. Data displayed is in units of seconds.
6. Arrow up or down to change the number. The higher the number, the faster the speed of discharge. Factory setting should be at 5 seconds.
7. Press "ENT" twice to save the value once desired setting has been reached.
8. Press "ESC" until a flashing "USF" appears on the screen.
9. Press "ESC" to return to "SET" display.

How to Increase or Decrease Deceleration for Discharge:

1. Press the "ENT" key until "SET" appears on display.
2. Press "ENT" again to select the next screen.
3. Arrow down until the unit displays "dEC."
4. Press "ENT" to display data.
5. Data displayed is in units of seconds.
6. Arrow up or down to change the number. The higher the number, the faster the speed of discharge. Factory setting should be at 5 seconds.'
7. Press "ENT" twice to save value, once desired setting has been reached.
8. Press "ESC" until a flashing "USF" appears on the screen.
9. Press "ESC" to return to "SET" display.

DANGER: HAZARDOUS VOLTAGE



The AC Drive Capacitor can continue to discharge voltage for up to 20 minutes after disconnect has been turned off. Before servicing, disconnect all power, wait 15 minutes, then verify that no voltage is present.

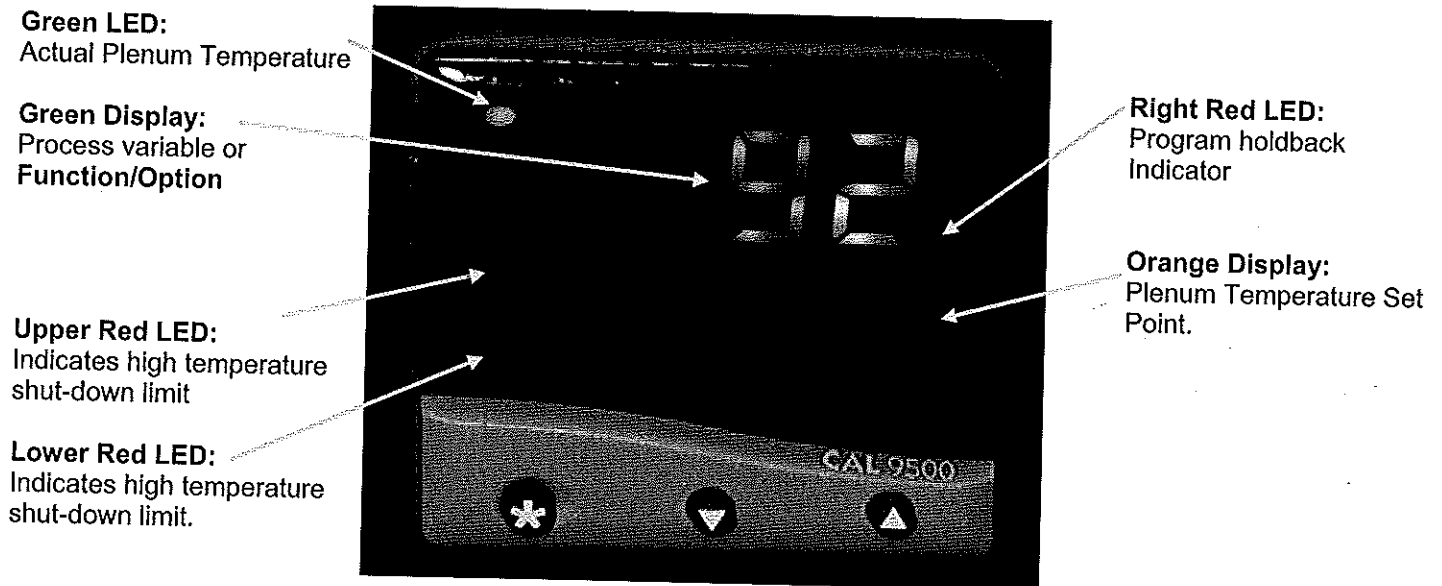
Failure to follow these instructions can result in death or serious injury.

VFD and AC Motor Fault Menu

VFD for Unload System		
Fault Code	Description of Fault	Action to resolve
CrF	Precharge circuit damage	Reset drive - power down
InF	Internal Fault	Replace drive unit
OCF	Overcurrent fault	Drive is undersized for load, check Set & drC
SCF	Motor short circuit	Wiring shorted to ground, check continuity
SOF	Overspeed fault	Instability
tnF	Auto-tuning fault	N/A
COF	N/A	N/A
EPF	External Fault	Fault outside drive
LFF	Loss of reference signal	Check wiring connection, check signal source
ObF	Overvoltage during deceleration	Overhauling load or stopping too quickly
OHF	Drive overload	Ambient temperature is too high, check motor amps
OLF	Motor overload	Thermal protection trip, let motor cool, check lth
OPF	Motor phase fault	Loss of phase to motor, check connections
OSF	Overvoltage during steady state	Line voltage too high
PHF	Input phase failure	Motor leads not wired in proper order for rotation
SLF	Serial link failure Modbus	N/A
CFF	Configuration fault	Reload parameters
CFI	Configuration fault with serial port	N/A
USF	Undervoltage	Lost input power to drive

Soft Starter for Blower Motor		
Fault Code	Description of Fault	Action to resolve
InF	Internal Fault	Disconnect and reset power, replace drive unit
OCF	Overcurrent fault	Drive is undersized for load, check Set & drC
PIF	Phase Inversion	Motor leads not wired in proper order for rotation
PHF	Input phase failure	Loss of phase to drive or motor
EEF	Internal memory fault	Disconnect and reset power, replace drive unit
CFF	Configuration fault	Reload parameters
CFI	Configuration fault with serial port	N/A
FrF	Line frequency is out of tolerance	Fault outside drive
USF	Undervoltage	Lost input power to drive
CLF	Control line failure	Lost power to CL1/CL2, check mini-breaker
EIF	External Fault	Fault outside drive
OLC	Current overload	Check amp draw values & blower for easy rotation
OLF	Motor overload	Thermal protection trip, let motor cool, check lth
ULF	Motor underload	Not enough load for motor size
LrF	Locked rotor fault	Blower rotor is not rotating, locked in position

Cal Controller Instrument Panel Features



Adjustments

To enter or exit program mode:	Hold down ▼▲ together for 3 seconds
To scroll through functions:	Press ▼ or ▲
To change levels or options:	Press *
To view set-point units:	Press *
To increase temperature set point:	Press * ▲ together
To decrease temperature set point:	Press * ▼ together
To reset latched alarm or tune fail:	Press ▼▲ together briefly

NOTES: If in danger of becoming "lost in program mode," press the ▼ and ▲ together for three seconds to return to display mode, check the INSTRUMENT ADJUSTMENTS above and try again.

When in program mode, after 60 seconds of key inactivity, the display will revert to either **inPt : nonE** or, if the initial configuration has been completed, the measured value. Any settings already completed will be retained. During program configuration, it is recommended that this feature be inhibited. Select **ProG StAY** in level 4.

DIAGNOSTICS:

(-AL-) indicates both high and low plenum temperature conditions that shut down the dryer. Reset dryer safety circuit.

(INPT—FAIL) These two words will flash back and forth. This condition is an invalid plenum chamber temperature signal back to the Cal controller. Check the temperature input device wires to Cal controller.

(dAtA—Fail) These two words will flash back and forth. This condition is a failure of an internal component on the controller. Controller needs to be replaced.

(tunE— Fail) These two words will flash back and forth. The Cal controller could not complete the auto-tune process. This will only occur when trying to auto tune. Something happened in the process to make the auto-tuning process become corrupted. Restart auto-tuning process again to establish good PID numbers to control temperature.

Operating Instructions for the Cal Controller

All parameters for the Cal controller can be changed with power on to dryer. The disconnect must be powered on, so that the digital display on the unit is powered up. The display, in operating mode, shows two numbers. The top number is the actual temperature detected by the dryer sensor. The bottom number shows the current set point temperature. The controller will adjust the proportional valve output to drive the temperature to the set point. The controller has an auto-tune function to optimize how it adjusts to get to the temperature.

1.0 How to Increase or Decrease Temperature Set Point

- 1.1 Wait for the unit to power up.
- 1.2 Press * and ▼ or ▲ to change the desired set point.

2.0 How to Initiate Auto-tune Function

- 2.1 Start dryer. With fan on and dryer full, ignite burner. When temperature is near set point, start tuning.
- 2.2 Hold down ▲▼ together for 3 seconds. **TUNE** should be displayed.
- 2.3 Press ▲ or ▼ until the word **BAND** is displayed.
- 2.4 Press the * and ▼ to reduce **BAND** to 20.
- 2.5 Press ▲ or ▼ to return to **BAND**.
- 2.6 Press the * and ▲ or ▼ until **At.SP** is displayed.
- 2.7 Hold down ▲▼ together for 3 seconds.
- 2.8 You are now auto-tuning. Once **TUNE** disappears, auto tuning is complete.
- 2.9 To abort auto tune, press ▲▼ together for 3 seconds.
- 2.10 Press ▲ or ▼ until the word **TUNE** is displayed.
- 2.11 Press the * and ▲ or ▼ until **oFF** is displayed.
- 2.12 Hold down ▲▼ together for 3 seconds.
- 2.13 Auto-tuning is now disabled.

3.0 How to Change a Level

- 3.1 Hold down ▲▼ together for 3 seconds.
- 3.2 Press ▲ or ▼ separately to page through parameters.
- 3.3 When **LEVL** is displayed, press the * key with ▲ or ▼ to change level.
- 3.4 Press ▲ or ▼ separately to page through the parameters for that level.

4.0 How to Change Parameter Values

- 4.1 Hold down ▲▼ together for 3 seconds.
- 4.2 Press ▲ or ▼ separately to page through parameters
- 4.3 Press the * key with ▲ or ▼ to change a parameter value.
- 4.4 Press ▲ or ▼ separately to go on to the next parameter.
- 4.5 Hold down ▲▼ together for three seconds when finished.

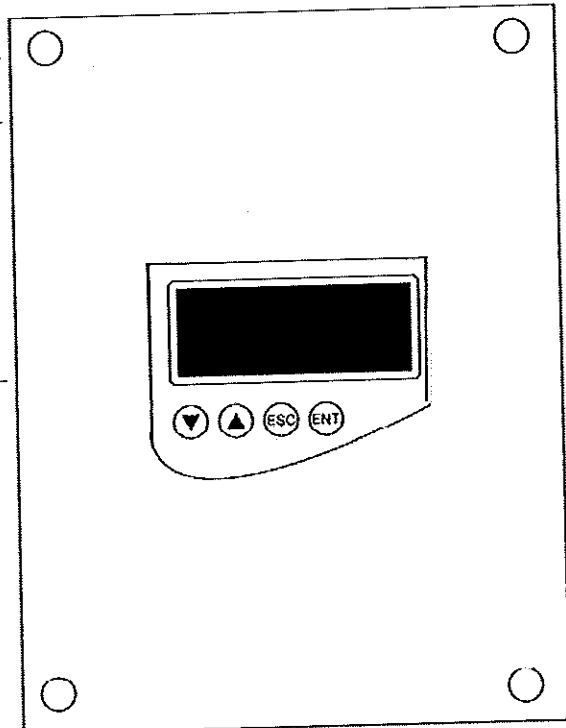
PID Values (Standard)

- For Cal Controller with Belimo Valve: **BAND: 119, int.t: 0.7, der.T: OFF**
- For Cal Controller with Asco Valve: **BAND: 75, int.t: 2.4, der.T: 11**

Cal Controller Settings							
Function Level	Function Description	Function Name	Setting Default	Setting Tower	Function Level	Function Name	Setting Default
LEVEL 5 (On First Power-up)	Temp Input Device	inPt	nonE	rtd	LEVEL 4	dEr.S	0.5
	Scale Units	unit	nonE	F		di.SS	6
	Output 1 Type	SP1.d	nonE	AnLG		no.AL	oFF
LEVEL 2	Output 1 Level	SP1.P	100	100		ProG	Auto
	Manual Mode	hAnd	oFF	oFF		LoCk	nonE
	Max Output (heat)	PL.1	100	100		SEt.L	oFF
	Max Output (cool)	PL.2	100	100	LEVEL 3	SP1.d	AnLG
	Output 2 Mode	SP2.A	nonE	dV.hi		SP2.d	rLY
	Output 2 Options	SP2.b	nonE	LtCh		burn	up.SC
	Display Resolution	diSP	1	1		rEv.d	1r.2d
	High Scale Limit	hi.SC	varies	220		rEv.L	1n.2n
	Low Scale Limit	Lo.SC	32	0		SPAn	0.0
	Temp Input Device	inPt	nonE	rtd		Zero	0.0
	Scale Units	unit	nonE	F		ChEk	oFF
LEVEL 1	Auto Tune Select	tunE	Off	Off		rEAD	*
	Proportional Band	bAnd	18	119		tECh	*
	Integral Time (Min)	int.t	5.0	0.7		Ver	953.1
	Derivative Time (Sec)	der.T	25	oFF		rSEt	nonE
	Derv Approach Control	dAC	1.5	1.5	LEVEL P	ProG	1
	Cycle Time	CYC.t	20	0.1		run	oFF
	Offset/Man reset	oFSt	0	0		FAiL	rSEt
	Setpoint Lock	SP.LK	oFF	oFF		St.u	PV
	Setting for Output2	SEt.2	0	40		Spru	hour
	Band for Output 2	bnd.2	3.9	5		SEG	1
	Cycle Time 2	CYC.2	on.of	on.of		tYPE	SPr
LEVEL A (Analog)	Lin Input Scale Max	An.hi	1000	1000		Sint	cont
	Lin Input Scale Min	An.Lo	0	0		PCYC	cont
	Lin Input Max	hi.in	50.0	50.0		Sub.P	nonE
	Lin Input Min	Lo.in	10.0	10.0		SPrr	100
	Lin Input Resolution	dECP	0000	0000		t.SP	*
	Output 3 Mode	SP3.A	nonE	dV.Lo	LEVEL C	Addr	1
	Output 3 Options	SP3.b	nonE	hoLd	Comms	bAud	9600
	Setting for Output3	SEt.3	0	-40	Option	dAtA	18n1
	SP3 Hysteresis	hYS.3	3.6	3.6	Not Used	dbuC	oFF
	Sensor Burn-out	brn.3	uPSC	uPSC			
	Output 3 Operation	rEU.3	3d	3d			

SOFT STARTER PARAMETERS

MENU	Parameter	Description	MC Setting	Default
SEt	In	Nominal Motor Current	REF	Varies
	ILt	Current Limit	400	400
	ACC	Acceleration Ramp Time	15	15
	t90	Starting Torque	50%	20%
	StY	Stop Type	-F-	-F-
	dEC/EdC brC/EbA	Deceleration Ramp Time Brake Torque	n/a n/a	n/a n/a
PRO	tHP	Thermal protection	CL	10
	ULL	Motor underload	OFF	OFF
	LUL/tUL	Motor underload threshold	n/a	n/a
	tLS	Excessive start time	OFF	OFF
	OIL	Current overload active	OFF	OFF
	LOC/tOL	Current overload threshold	n/a	n/a
	PHr	Phase protection	123	nO
	tbS	Time before start	300	2
	PHL	Phase loss threshold	5	10
	PIC	Monitoring probes	OFF	OFF
	ArS	Automatic restart	OFF	OFF
	rtH	Reset motor thermals	nO	nO
drC	tLI	Torque limit	OFF	OFF
	bSt	Voltage boost	50%	OFF
	SSt	Small motor test	OFF	OFF
	CLP	Torque control	On	On
	LSC	Stator loss compensation	50	50
	tIG	Decel gain	40	40
	CSC	Cascade activation	OFF	OFF
	ULn	Line voltage	Per Dryer	460
	FrC	Line Frequency	60	AUt
	rPr	Reset operating time	nO	nO
FCS	Factory control settings	nO	nO	
IO	L13	Logic input	LIA	LIA
	L14	Logic input	LIL	LIL
	IPr/tPr	Preheating level / time	n/a	n/a
	L01	Logic output 1	tAI	tAI
	L02	Logic output 2	rnI	rnI
	r1	Relay 1 assignment	r1F	r1F
	r3	Relay 3 assignment	tAI	rnI
	AO	Analog output	OCr	OCr
	O 4	Output configuration	020	020
	ASC	Analog scaling	200	200



Example: Soft Starter

MENU	Parameter	Description	Default
St2	In2	Nominal Motor Current2	Varies
	IL2	Current Limit2	400
	AC2	Acceleration ramp time2	15
	t92	Starting torque2	20
	dE2/Ed2	Decel ramp time2	n/a
	tL2	Max torque limit 2	OFF
	tI2	Decel gain 2	n/a
COP	Add	Address (RS232)	0
	tbr	Comm Speed (kbps)	19.2
	FOr	Comm Format	8n1
	tLP	Serial Link timeout	5
	Pct	Remote keypad link	OFF
SUP	n/a	Support Display selection	LCr
*Menus above are not typically adjusted (use defaults)			
Motor	Voltage	REF (Reference Current)	CL
50	460	60	15
75	460	82.4	15
100	460	113	20
50	230	120	15
75	230	165	15
100	230	226	20
50	208	128	15
75	208	182	15
100	208	250	20
40	230	95.2	15

CHANGING SOFT STARTER PARAMETERS

Parameters for the soft starter unit can be changed with power on to the dryer. The disconnect must be powered on, so that the digital display on the unit is powered up.

How to set Motor Current

1. Press the "ESC" key until "SEt" appears on display
2. Arrow down until unit displays "In."
3. Press "ENT" to display data
4. The data displayed is in units of AC amps
5. Arrow up or down to change the number. Set number to match motor name plate AC amps. Factory setting should match motor name plate.
6. Press "ENT" twice to save the value, once it is at desired setting.
7. Press "ESC" to get back to the "SEt" display.

How to Set Current Limit:

1. Press the "ESC" key until "SEt" appears on display.
2. Arrow down until unit displays "ILt."
3. Press "ENT" to display data.
4. The data displayed is in units of percentage of motor amps.
5. Arrow up or down to change the number. The number should be 450% of motor full-load amps. Factory setting should be 450%.
6. Press "ENT" twice to save the value, once it is at desired setting.
7. Press "ESC" to get back to the "SEt" display.

How to Set Acceleration Time for Bypass Contactor Takeover:

1. Press the "ESC" key until "SEt" appears on display.
2. Arrow down until unit displays "ACC."
3. Press "ENT" to display data.
4. The data displayed is in units of time (seconds).
5. Arrow up or down to change the number. The number represents the time from when the soft starter begins fan rotation until the bypass contactor takes over. Factory setting is 15 seconds.
6. Press "ENT" twice to save the value once it is at desired setting.
7. Press "ESC" to get back to the "SEt" display.

How to Set Starting Torque:

1. Press the "ESC" key until "SEt" appears on display.
2. Arrow down until unit displays "T90."
3. Press "ENT" to display data.
4. The data displayed is in units of percentage.
5. Arrow up or down to change the number. The number represents the starting applied motor torque in percentage. Factory setting should be 50%.

How to Set Thermal Protection:

1. Press the "ESC" key until "SEt" appears on display.
2. Arrow down until unit displays "PRO."
3. Press "ENT" to display data.
4. Arrow down until unit displays "tHP."
5. The data displayed is in units of classification.
6. Arrow up or down to change the number. The number that appears is the rated classification of the soft starter unit. Factory setting should be 20.
7. Press "ENT" twice to save the value once it has reached the desired setting.
8. Press "ESC" to get back to the "SEt" display.

How to Voltage Boost:

1. Press the "ESC" key until "SEt" appears on display.
2. Arrow down until unit displays "drC."
3. Press "ENT" to display data.
4. Arrow down until unit displays "bSt."
5. The data displayed is in units of AC voltage by percentage.
6. Arrow up or down to change the number. The number represents the percentage of motor voltage available for motor and fan startup. Factory setting should be 50%.
7. Press "ENT" twice to save the value, once it is at desired setting.
8. Press "ESC" to get back to the "SEt" display.

Lubrication

Lubrication is applied to all required areas before leaving the factory; however, a lubrication schedule should be maintained as described below.

Avoid mixing greases. Bearings are filled with lithium-based grease before leaving the factory.

Item	Lubrication Required	Interval
50:1 Gearbox Oil Level	Fill 1/4" over gear with SAE 90 gear lubricant.	Maintain proper level. Check every 100 hours.
50:1 Gearbox Grease Fitting	Use (5) strokes of gun grease.	At beginning and end of season.
SCR Gearbox	Mobil SHC-634 or equivalent.	Maintain proper level. Check every 100 hours.
U-Joints	Use (1) stroke of gun grease.	Every 50 hours of operation
Fan Motor(s) & Discharge System 5HP (DC) Motor	Lubricate with SRI-2 (Chevron) grease or equivalent. (Equivalentents below)	Prior to operation and at end of season
Motor Bearings	Use Exxon Corp-Plyrex-em product or Chevron, Inc.-SRI #2. Grease should be lithium based	At beginning and end of season.
Cent Fan Bearings	Use only # 2 consistency lithium-based grease with high-quality mineral oil with rust and oxidation inhibitor. Use Shell Alvania #2, Mobil Mobilux #2 or Texaco Multifak #2.	At beginning of season and every 100 hours until end of season.
Axial Fans	Exxon Polygrease	At beginning of season and between 4,000 and 5,000 hours of operation until end of season.
Unload Auger Bearings	Use Shell Alvania #2, Mobil Mobilux #2 or Texaco Multifak #2.	Grease every 100 hours. NOTE: In extremely dirty conditions once daily to weekly.
Metering Roll Bearings	Use grade #2 mineral oil lithium or lithium complex base grease.	Front bearings greasing is at beginning and end of season. Internal bearings are brass and do not need lubrication.
Unload Auger Gearbox Oil:	Mobil SHC-634 or equivalent	
Tower Sweep Gearbox Oil	Mobil SHC-634	At beginning of season and every 100 hours until end of season. Only fill box 1/4" over gears. NOTE: In extremely dirty conditions, it is recommended to grease sooner than every 100 hours.

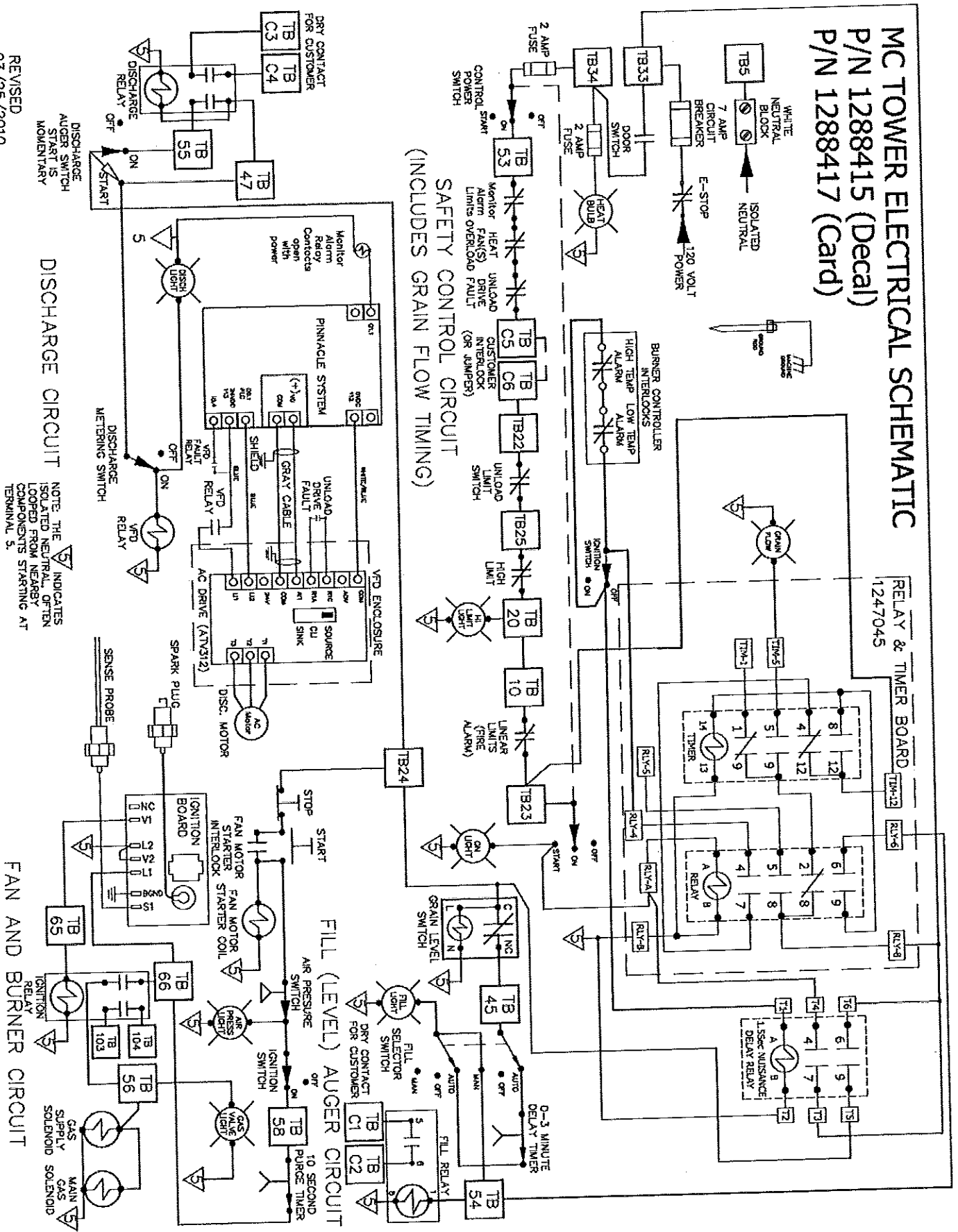
Fan and Discharge Motor Greases	Fan Motor Bearings Greases
Chevron SRI-2 Standard Oil of California Aeroshell #16 Shell Oil Company Hi Temp Texaco, Inc. Andok 260 Humble Oil Rykon #2 American Oil	Shell—Alvania No. 2 Texaco —Premium RB2 Mobil—Mobilith SHC 100 Amoco—Rykon Premium 2

Section 4
Troubleshooting

Troubleshooting the Safety Circuit

MC TOWER ELECTRICAL SCHEMATIC
P/N 1288415 (Decal)
P/N 1288417 (Card)

RELAY & TIMER BOARD
 1247045



REVISED
 03/25/2010

DISCHARGE CIRCUIT

NOTE: THE INDICATES ISOLATED NEUTRAL, OFTEN LOOPED FROM NEARBY COMPONENTS STARTING AT TERMINAL 5.

FAN AND BURNER CIRCUIT

FILL (LEVEL) AUGER CIRCUIT

Troubleshooting the Safety Circuit

The contacts for incoming hot and neutral are found in the High Voltage cabinet.

The 120-volt input power to the dryer circuit for dryer controls comes from either the bottom side of the disconnect or the transformer (depending on voltage) and runs to the 7- or 8-amp mini-breaker. This breaker should be turned off and voltage should be checked before turning the mini-breaker on. If voltage reads anything outside of 110 to 120 volts, the supply voltage needs to be checked before powering on mini-breaker.

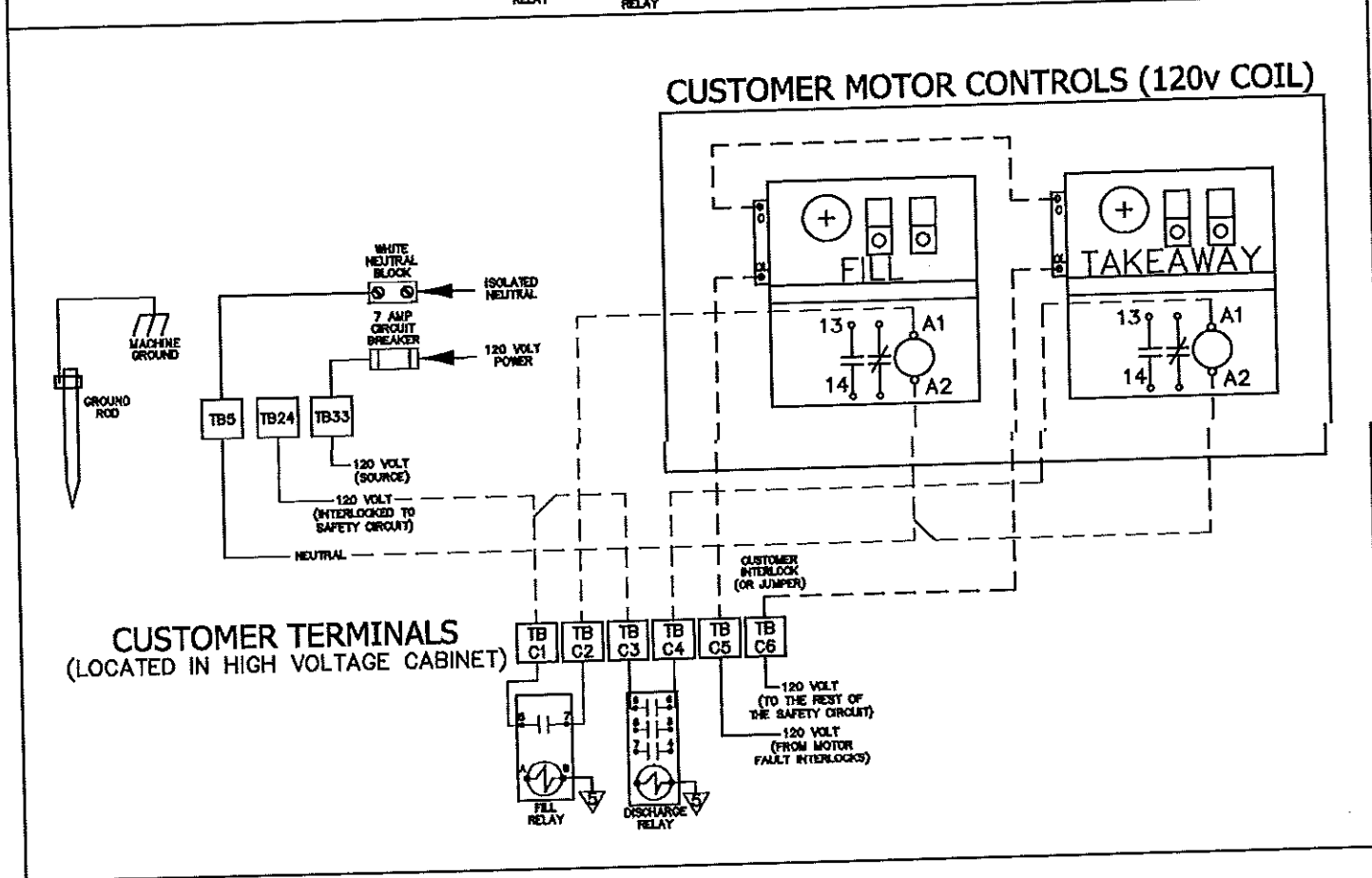
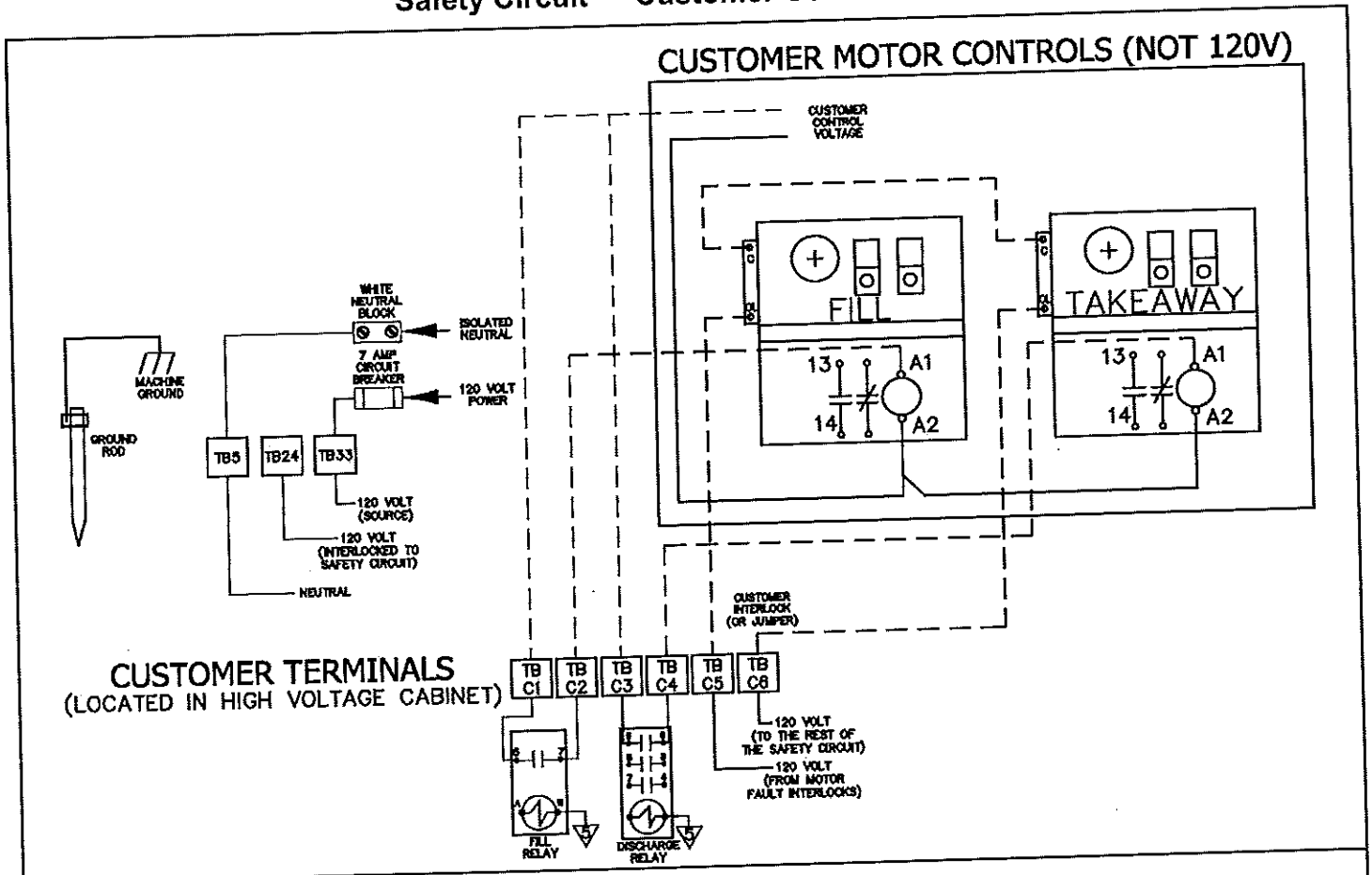
Next to the mini-breaker is a neutral block, which feeds all neutrals throughout the entire dryer. This neutral is connected to the neutral from the secondary side of the transformer that is standard equipment on all 2010 dryers and later.

The incoming neutral line is connected to TB5 (white wire) and the hot line is on TB33 (after circuit breaker). The incoming 120-volt supply is a 7amp mini-breaker.

Using a volt meter, hook one lead to TB5 and set meter to AC voltage (wave sign or "V").

- Place second lead on TB33. If 110 to 120 volts show on the meter, then the mini-breaker is good. If no voltage appears on the meter, the mini-breaker is tripped.
- Place second lead on TB53. Turn the power switch to ON. If 120 voltage is good, move to the next step. If no voltage is read on the meter, there is a problem with the power-on switch circuit.
- Place second lead on TB-C5, if 120 voltage is good, move to the next step. If there is no voltage on the meter, reset all manual motor protectors as the AC drive unit may have faulted out. To reset the AC drive, turn off the mini-breaker 30amp for drive. Wait until the AC drive unit screen goes dead, then restore the mini-breaker to the ON position and the drive will automatically reset.
- Place second lead on TB-C6. If 120-voltage is good, move to the next step. If there is no voltage on the meter, reset all manual motor protectors or the AC drive unit might have faulted out. To reset the AC drive, turn the mini-breaker 30amp for drive off. Wait until the AC drive unit screen goes dead, then restore the mini-breaker to the ON position and drive will automatically reset.
- Place second lead on TB-C6. If 120-voltage is good, move on to the next step. If there is no voltage on the meter, then the jumper from C5 to C6 has become disconnected. If the customer has pulled the jumper and installed take-away and fill equipment into safety circuit, check to see if customer's remote-starter equipment needs to be reset.
- Place second lead on TB22. If 120 voltage is good, move to next step. If there is no voltage on the meter, the E-stop switch is not functioning properly.
- Place second lead on TB25. If 120-voltage is good, move to next step. If there is no voltage on the meter, the limit switch on discharge system has tripped and door is raised or the switch is faulty.
- Place second lead on TB20. If 120-voltage is good, move to next step. If there is no voltage on the meter, the high limit has tripped and must be manually reset on the front of the switch.
- Place second lead on TB10. If 120 voltage is good, move to the next step. If there is no voltage on the meter, the Cal controller could have an alarm fault on the screen. This must be reset by powering down the Cal controller and then powering it back up. The alarm message should be cleared from screen. The Cal controller control contacts power up a safety relay and that relay may need to be replaced.
- Place second lead on TB23. If 120 voltage is good, move to the next step. If there is no voltage on the meter, the linear limits have overheated and must be checked. When linear limits overheat (218°F), they will automatically reset when the temperature drops below 218°F. If they do not reset, they will need to be replaced. These can be checked with power off and run continuity test through each linear limit module.
- Place second lead on TB24. If 120-voltage is good, then the safety circuit is completed. If there is no voltage on the meter, there is a problem with either the main relay, 0-60 minute timer, or relay/timer board. There is a 180-volt varistor on the side of the board. If this goes bad, the board has seen a spike in voltage and needs to have the board replaced. If the board is good, replace either the timer or the main relay.
- TB24 is the main supply distribution point that will feed voltage to the fill circuit, fan/burner circuit and discharge circuit. These three circuits are all independently powered up.

Safety Circuit — Customer Connections



Safety Circuit — Customer Connections

Customer connections for remote equipment are the customer connection terminal blocks located in the remote cabinet. They are labeled:

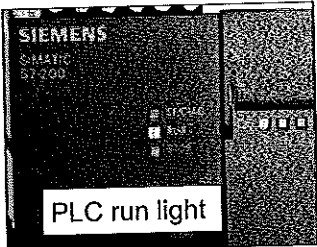
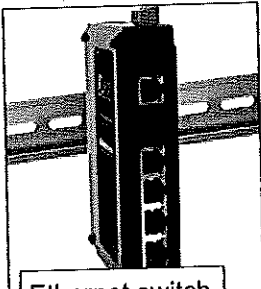
- C1 - C2 which are remote fill equipment
- C3 - C4 which are remote discharge equipment
- C5 - C6 which are dryer safety circuits for remote starters

C1 - C2 are a dry set of contacts that are for customer to supply power to C1 and C2 and would run back to customer's fill starter and pull in starter. C1 and C2 contacts close when the dryer fill cycle begins. When this closes, the dryer will start the customer's equipment running, provided that remote fill equipment has a good power source.

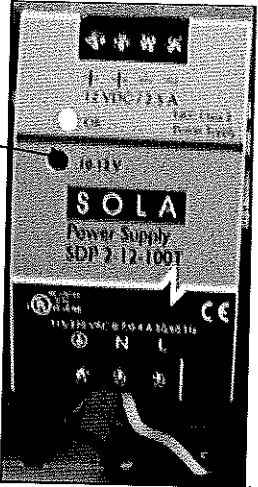
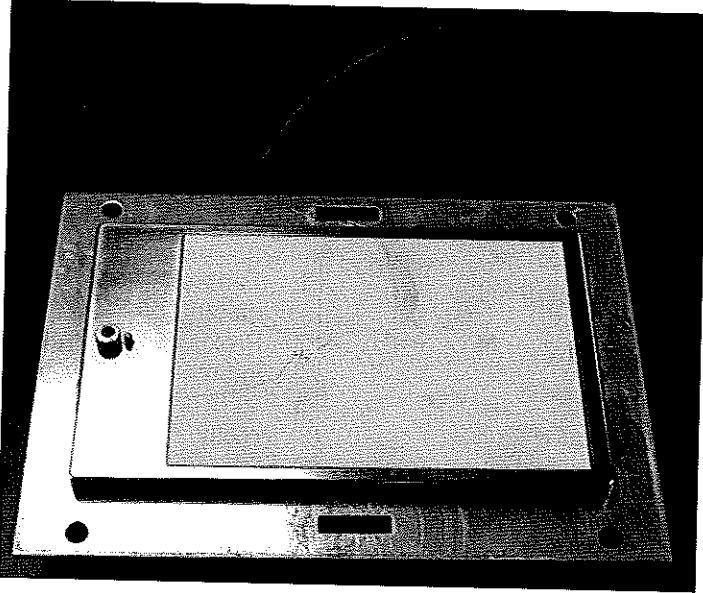
C3 - C4 are a dry set of contacts for customers to supply power to C3 and C4 and would run back to the customer's discharge starter and pull in starter. C3 and C4 contacts close when the dryer discharge system begins. When this closes, the dryer will start the customer's equipment running, provided that remote discharge equipment has a good power source.

C5 - C6 are part of the dryer safety circuit and carry 120 volts as long as the dryer power switch is in the ON position. The dryer originally is delivered to the customer with a jumper across C5 - C6 to allow complete testing of safety circuit. The jumper can be removed and two wires run from C5 & C6 to any motor starter overloads that will be engaged when the dryer is running. This will attach through a normally closed path of contacts that will open when the motor starters trip if thermal conditions are exceeded. Opening of this pathway will drop out the entire dryer. Remember that the dryer is providing power from C5 to C6 and must be tied to a dry set of contacts on customer's equipment. **This is to be done ONLY by a trained Electrician.**

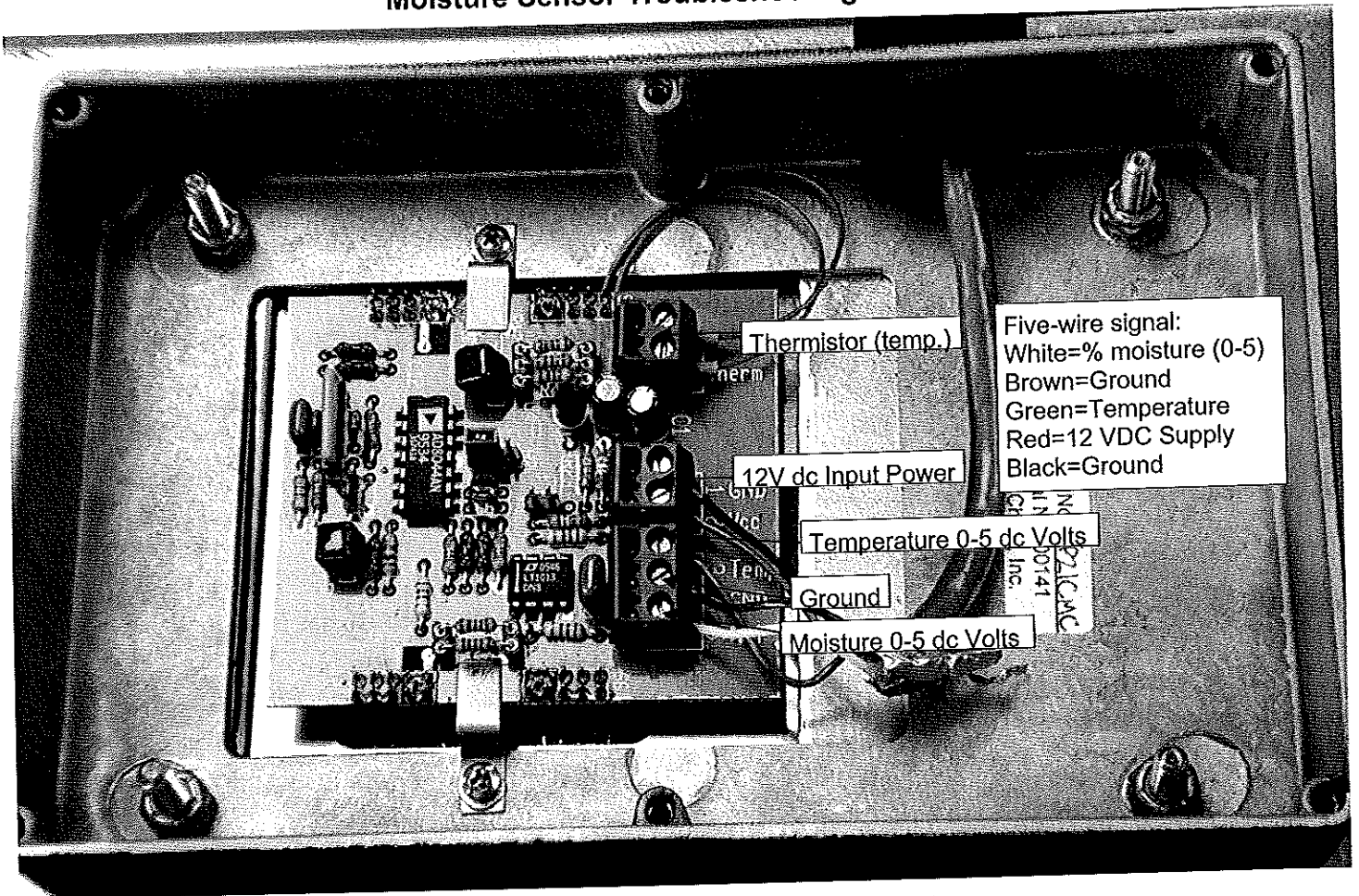
Pinnacle Lite Troubleshooting Guide

Issue	Possible Cause(s)	Solution
MCR is de-energized	Lost power or tripped safety circuit	Perform a step-by-step check of each unit on the safety circuit until you find the problem.
HMI screen is blank	<ol style="list-style-type: none"> 1. Main disconnect is off 2. LED in left-hand corner is not functioning 	<ul style="list-style-type: none"> -Make sure power is on. -Check to see that the 24 VDC power supply is on -Check LED on power supply in the high voltage cabinet -Confirm that the 24 VDC breakers are on.
Screen shows yellow triangles by one or more data values	<ol style="list-style-type: none"> 1. Communication with the PLC has failed. 2. PLC is not on 3. Main disconnect is not on 4. LED in the left-hand corner of the HMI is not on 5. The PLC is not on 	<ul style="list-style-type: none"> -Check that the ethernet cable to the high voltage cabinet is connected. -Check inside the remote cabinet and verify the ethernet switch is on. This will be indicated with a red LED power light. -Check that the PLC in the high voltage cabinet is on. <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
Discharge jam fault	<ol style="list-style-type: none"> 1. Too much wet material in the metering rolls. 2. Proximity switch is not detecting movement. 3. VFD is not programmed correctly. 	<ul style="list-style-type: none"> -Clear out wet grain. -Check the I/O screen when the metering rolls start to see if the LED turns on and off. This can also be monitored by observing the proximity switch. -Make sure VFD parameters are programmed correctly. Contact dealer or factory for assistance.

Moisture Sensor Troubleshooting Guide

PROBLEM	SOLUTION
<p>Power source is not within the 8-12.4Vdc operating range</p>	<p>Manually adjust the potentiometer</p> <div style="text-align: right; margin-right: 50px;"> <p>Adjustment Screw</p>  </div>
<p>Sensor signal fluctuates or values are abnormally high</p>	<ol style="list-style-type: none"> 1. Clean off the ceramic face of the moisture sensor. <div style="text-align: center; margin: 10px 0;">  </div> <ol style="list-style-type: none"> 2. Verify that the sensor shielded wire is properly grounded (see next page for more detail).

Moisture Sensor Troubleshooting Guide



The two red wires connected to the thermistor are thermistor probe sensors to the circuit board.

If sensor outputs are abnormal:

1. Check the middle power supply (with red and black wires). It should be 12 VDC.
2. Set the volt meter to ohms of resistance.
3. Snap the thermistor connector off of the circuit board and measure the resistance across the two thermistor wires.
4. Thermistor resistance will vary based on temperature. Consult the chart at right for proper reading.

***Note:** When removing the moisture sensor cover, there is a small O-ring on each screw. Be careful not to drop these.

Moisture Sensor Resistance of Thermistor	
Degrees Fahrenheit	Ohms of Resistance
32	29,500
40	23,000
50	18,800
60	14,700
70	11,500
80	9,300
90	7,400
100	6,000
110	4,900
120	4,000
130	3,300
140	2,760
150	2,300
160	1,900
170	1,600
180	1,350
190	1,150

Cal Controller Troubleshooting Guide

Always Overshoots Set Point Temperature:

If the set point is consistently overshooting and tripping the alarm on the Cal controller, the first-time start procedure needs to be changed.

1. Start the fan and establish air pressure. Make sure the air pressure light is on continuously and does not flutter.
2. The set point always overshoots. If pressure is too high, that means there is low pressure at the regulator.
3. If the butterfly valve does not rotate freely, rotate it manually to free the valve.

If the set point is not reached without tripping the high limit on the Cal controller, auto-tune from the start-up position.

1. Once flame is established, press and hold down both arrow buttons simultaneously on the Cal controller for 3 seconds.
2. Cal controller displays **tune off**.
3. Press * and ▲.
4. Display will read **tune on**.
5. Press both arrows for 3 seconds to begin tuning function.
6. As the plenum temperature rises, the display will flash "tune" and the actual temperature during the tuning process.

Unable to Reach Set Point Temperature:

If the set point cannot be achieved, even when the valve is 100% open, there is not enough gas pressure to obtain the selected plenum temperature.

Adjust the pressure to obtain proper temperature. The Cal controller will start to control the opening of the valve. The closer to the set point we get, the more the Cal controller will shut the valve until the desired temperature is reached.

Plenum Temperature will not hold Satisfactorily:

1. Turn down the gas pressure
2. Free the proportional valve by depressing the tab and rotating the shaft freely.
3. Attempt to auto-tune at the set point.

NOTE: Plenum temperature must be close to the set point to start this function

1. Press both arrow keys simultaneously and hold down for 3 seconds. Display will show **tune off**.
2. Press arrow up until display reads **bAnd—[number]** (the correct numerical value will appear instead of "number").
3. Press * and arrow until number is 20.
4. Press down arrow until display reads **tune off**. Press * and up arrow until display shows **tune—At.SP**.
5. Hold down both arrows for 3 seconds to begin auto-tuning function.

When the tuning function is complete, both actual and set-point values will be displayed on the Cal controller.

Once the Cal controller has tuned or auto-tuned for dryer conditions, PID numbers are automatically moved into the internal PID loop and saved for future use.

**Single Fan Tower
General Troubleshooting
Start-up and Running of Dryer**

	PROCEDURE	TROUBLESHOOTING
1.	Set HIGH LIMIT and LOW TEMP thermostats	
2.	Start of Operation of Dryer: 115 Volt light should be ON	If not, check: 1. Main disconnect 2. Fuse is not functional or 7A circuit breaker tripped. 3. TB33 for connection (110 Volts) 4. 115 Volt bulb and socket
3.	Switch control switch to ON position. HIGH LIMIT light should be ON.	If not, check: 1. RUN-START in START position 2. Overload circuit through starters 3. AC drive and fuses or circuit breaker 4. Back door limit switch 5. High Limit reset 6. Soft starter 7. Burner resets 8. CAL or Honeywell controller
4.	Switch control switch to START position, POWER ON and FILL lights ON	If not, check: 1. Verify that the FILL switch is in MANUAL or AUTO position and calling for grain. 2. Main relay 3. Rotary fill switch is not calling for grain 4. Grain flow timer elapsing (EMPTY light)
PRIMARY CIRCUIT IS NOT COMPLETE (SAFETY CIRCUIT), TB24 IS ENERGIZED		
5.	Push fan start button. Fan should start and run.	If not, check: 1. Main power voltage through disconnect and breaker to starter 2. Starter 3. Soft starter
6.	Switch fill relay from ON to MANUAL Fill relay closes to provide 110 volts to customer-supplied fill equipment	
7.	Adjust .2 to 3-minute delay fill timer to desired setting.	
8.	After dryer has filled with grain, switch fill switch to AUTO position	
9.	Grain flow timer is only in the circuit in AUTO position	
10.	Set grain flow timer for 2 to 10 minutes	
DRYER IS NOW FILLED AND READY TO DRY GRAIN		
11.	Air switch light should light.	If not, check for: 1. Dryer not full of grain 2. Air pressure switch not adjusted 3. Filter is dirty

**Single Fan Tower
General Troubleshooting
Start-up and Running of Dryer**

	PROCEDURE	TROUBLESHOOTING
12.	Switch ignition to ON position. After the 10-second purge timer times out, the #1 ignition light comes ON. This will ignite both (or all three) burners.	If fault, check: 1. Purge timer 2. Ignition board, as follows: • L1 is hot, L2 is neutral (110 volt power to unit) • V1 is hot, V2 is neutral (110 volt power to solenoids) • S1 is voltage to flame sense probe • BGRD is grounded to the chassis • E1 is HIGH VOLTAGE to electrode (DANGER! Never test with meter)
13.	Switch CAL controller from manual to automatic after 30 seconds of having burner lit along with setting plenum temperature. Controller will bring plenum temperature up to selected set point and stabilize.	If fault, check: 1. Controller 2. Controller parameter settings 3. Has controller been AUTO TUNED?
14.	Switch the discharge system switch to "ON" position. The customer takeaway system should start.	If not, check auxiliary motor controls (breaker)
15.	Switch the metering switch to manual. The sweep arm and auger should start up and run.	If fault, check: 1. AC drive fault settings 2. AC drive parameter settings 3. AC drive fuses or circuit breaker 4. Voltage output to motor should be 230 volt, 3 phase. 5. 5HP motor 6. Drive belts
16.	Grain flow timer has a 1 to 60 minute range. Set grain flow timer according to p. 24.	
17.	Use potentiometer to adjust sweep speed. Adjust speed until the moisture content of the grain is the desired percentage. After running the dryer long enough to stabilize moisture output, it is ready for automatic mode.	
18.	Switch metering system into automatic at this point	If fault, check: 1. Auto/manual switch for wiring problem. 2. 1.0 amp fuse 3. AC drive and motor

Dryer Troubleshooting Guide

PROBLEM	PROBABLE CAUSE
Main gas valve is opened. Main burner will not come on.	<ol style="list-style-type: none"> 1. The handle on the Maxon main gas shutoff valves should offer some resistance when they are opened. If they don't, check the latching solenoid inside the valve by removing the cover from the side of the valve opposite the handle. The solenoid should energize when a pilot is established. If it does not, check for faulty electrical connections or a faulty solenoid. 2. Check for water in the gas line by opening the drain valve. 3. Check the hand valve in feedback line to the main gas regulator. It should be partially open.
Dryer will not reach operating temperature, or it reaches it slowly.	<ol style="list-style-type: none"> 1. Low gas pressure. Increase gas pressure on the main gas regulator. 2. Check for water in the gas train by opening the drain valve. 3. Make sure the dryer is completely full of grain by entering the heat plenum and looking for daylight in one of the grain columns. 4. Gas parts in the burner need to be cleaned. Clean by drilling with a #47 drill bit. 5. Make sure that the gas butterfly valve is being driven wide open by the modulating motor. If not, check the motor or motor linkage.
Blower motor(s) will not start.	<ol style="list-style-type: none"> 1. Check that the fan circuit breaker and the fan switch are on. Also, check for a defective switch or bad wiring connections. 2. If a lighted switch does not light, an air switch needs adjustment, or the bulb may be burned out. 3. Verify closing of the fan motor contactor. Check voltage on the load side of the contactor. 4. Inspect the contactor for defective points or a burned out coil. 5. Inspect connections, and check voltage applied to the motor leads to determine if the motor is defective. 6. If the motor starts slowly, check for low voltage during starting due to excessive voltage drop in power supply wiring.
Burner will not fire.	<ol style="list-style-type: none"> 1. Check gas supply for possible obstruction or closed valves. Refill tank; replace or repair parts as required. 2. Inspect gas solenoid valves for defective coils or improper wiring. Replace the valve or coil if the valve will not open with proper voltage applied (115 volts).
Burner will not fire, but gauge shows gas pressure.	<ol style="list-style-type: none"> 1. Check that the igniter is properly gapped and has a strong spark. 2. Inspect the porcelain and electrodes for damage or cracking. Replace or clean if necessary. 3. Machine does not have chassis ground.
Uneven drying—some kernels appear brown while others are under-dried. Uneven heat exiting from dryer columns.	<ol style="list-style-type: none"> 1. Check plenum thermostat temperature setting. Some varieties of grain are more sensitive to higher operating temperatures. It may be necessary to lower the plenum operating temperature to accommodate this.
Grain is not moving through columns.	<ol style="list-style-type: none"> 1. Check the dryer for fine material buildup inside the columns. 2. Avoid leaving the dryer columns full for long periods at a time (2-3 days) while not operating the dryer, or during rainy weather. 3. Empty the dryer and clean regularly. Do not allow fine material to gather in the plenum chamber.

Ignition Board Troubleshooting Guide 10' Tower

Problem	Possible Cause and Solution
<p>Difficulty lighting the burner</p>	<ol style="list-style-type: none"> 1. Ensure gas supply to the dryer is on and hand valves are open. 2. Fan must be on to achieve air pressure light. 3. Ignition switch set to ON, applies 120 VAC at L1 (0 volts at L2-Neutral) of the Ignition board. 4. In some cases (towers), ignition switch powers on external pre-purge timer (10 seconds). Check for power to and from timer. 5. After pre-purge time, the ignition board should power out 120 VAC at V1 (V2 neutral) for a <i>trial for ignition</i> period to open the solenoid(s) and gas valve light. The normal trial time is 10 seconds. If the trial is not successful, voltage output stops. 6. Check gas solenoid operation by listening for a click/snap or feeling the vibration as they open. If the solenoid doesn't open, check the wiring and coil for damage, bad connections, etc. 7. Check the spark plug (igniter) for spark. Check the high voltage wire for damage, good connections. 8. Replace the ignition board.
<p>Burner lights but doesn't stay lit</p> <p>NOTE: This is most likely due to flame sensing</p>	<ol style="list-style-type: none"> 1. Ensure flame sense probe is located in the flame. 2. Inspect the sense wire for damage, loose or wet connections. 3. Sense wire must be routed separately from the high voltage ignition wire. 4. Check that the ignition board (B.GND) is grounded separately from all other connections. Sharing a ground connection can cause problems. 5. Clean sense probe with fine steel wool. 6. Burner may have to be grounded at the burner body to the burner housing.

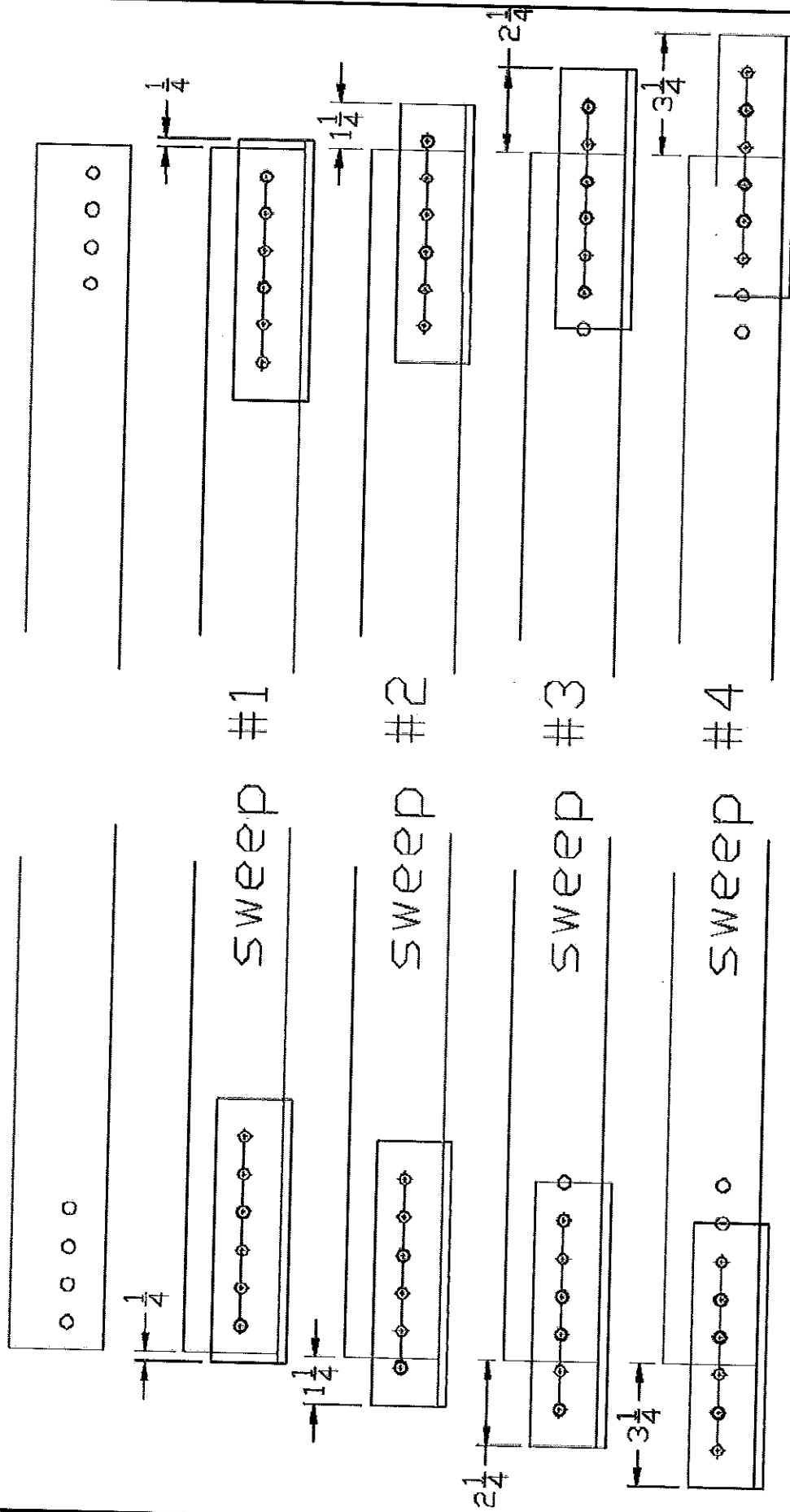
Section 5
Dryer Information

10' Tower Dryer Specifications						
Model	10520	10630	10730	10840	101050	101275
Diameter	10'	10'	10'	10'	10'	10'
Height	31'-7"	35'-8"	39'-8"	43'-8"	51'-10"	59'-11"
Motor Sizes						
Fans	20HP	30HP	30HP	40HP	50HP	75HP
Metering	5HP	5HP	5HP	5HP	5HP	5HP
Total Running Amps						
230V-3ph	99.5 Amps	123 Amps	123 Amps	156.1 Amps	189.5 Amps	243.3 Amps
460V-3ph	56.3 Amps	68 Amps	68 Amps	84.5 Amps	101.3 Amps	128 Amps
575V-3ph	44.4 Amps	54.4 Amps	54.4 Amps	67.6 Amps	77.8 Amps	102.4 Amps
Weight, Empty (Approx.)	9,775 lbs.	10,715 lbs.	12,155 lbs.	13,112 lbs.	15,055 lbs.	16,793 lbs.
Column Thickness	12 in.	12 in.	12 in.	12 in.	12 in.	12 in.
BTU Outputs						
Normal Operating	2,904,000	3,630,000	4,114,000	5,082,000	6,171,000	7,502,000
Maximum	5,280,000	6,600,000	7,480,000	9,240,000	11,220,000	13,640,000
Drying Rates						
10 pt. Removal 25%-15%	320 bu./hr.	400 bu./hr.	460 bu./hr.	555 bu./hr.	680 bu./hr.	820 bu./hr.
7 pt. Removal 22%-15%	440 bu./hr.	550 bu./hr.	630 bu./hr.	755 bu./hr.	920 bu./hr.	1115 bu./hr.
5 pt. Removal 20%-15%	560 bu./hr.	700 bu./hr.	800 bu./hr.	960 bu./hr.	1175 bu./hr.	1415 bu./hr.
Heated Holding Capacity	327.5 bu.	416.5 bu.	496.5 bu.	579.5 bu.	717.5 bu.	867.5 bu.
Cooling Holding Capacity	122 bu.	122 bu.	137 bu.	137 bu.	175 bu.	201 bu.
Total Holding Capacity (Approx.)	639 bu.	728 bu.	823 bu.	906 bu.	1082 bu.	1258 bu.

10' Tower Dryer Discharge Data

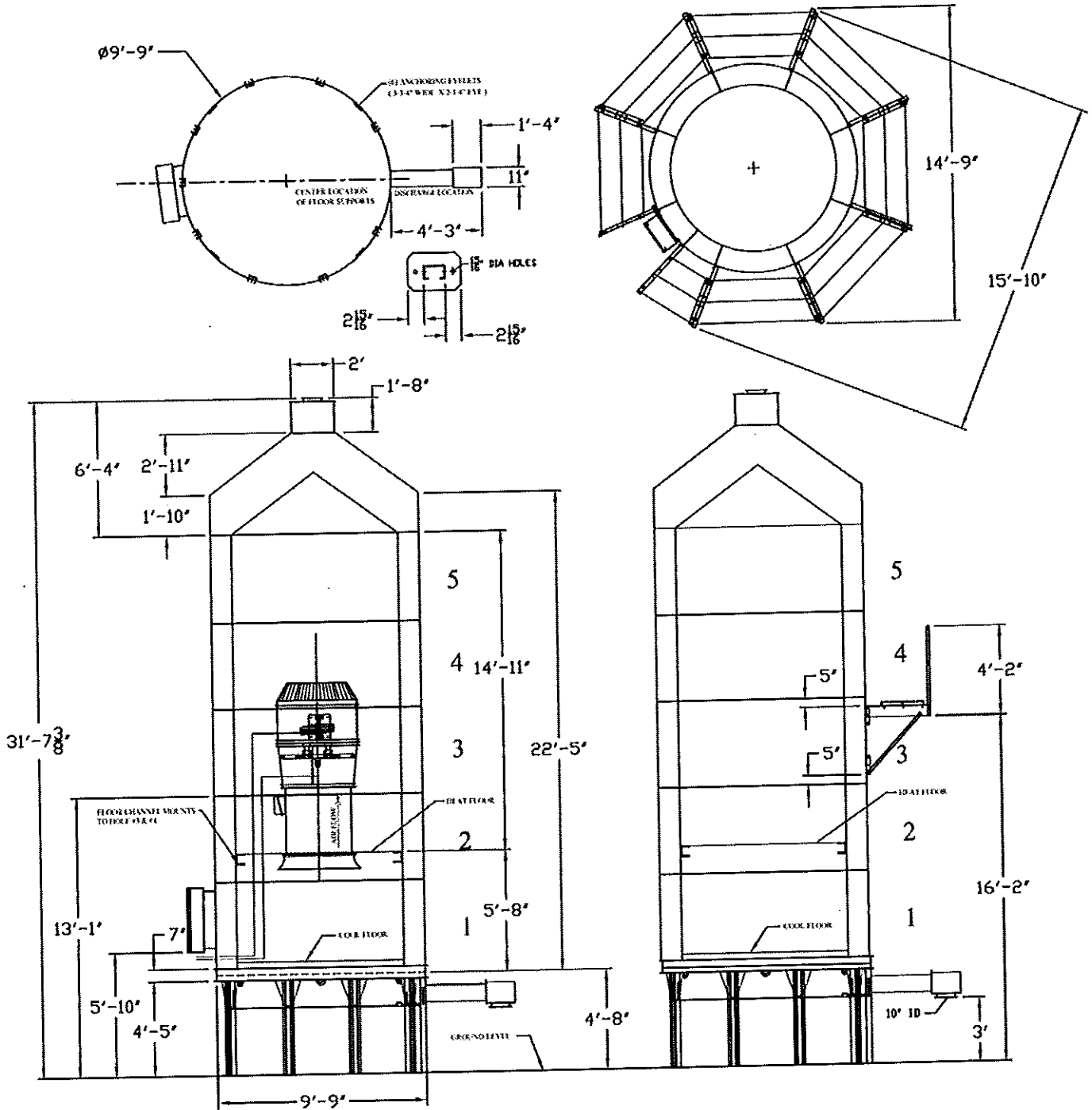
NOTE: Dryer capacity output is all calculated numbers, this does not take into account any changes made on finger adjustment on sweep arms.

10' DRYER 5 HP MOTOR A/C DRIVE Smaller scale Pot Settings									
Discharge Speed Setting	Overspeed MOTOR FREQ	MOTOR RPM	SWEEP RPM	Sweep #4 OUTPUT BU/HR	Sweep #3 OUTPUT BU/HR	Sweep #2 OUTPUT BU/HR	Sweep #1 OUTPUT BU/HR	5.208 AUGER RPM	4.91 AUGER MAX@RPM
100%	72	2070.0	8.4	1613	1371	1129	807	397.5	1951.6
95%	68.65	1973.7	8.0	1538	1308	1077	769	379.0	1860.8
90%	65.3	1877.4	7.7	1463	1244	1024	732	360.5	1770.0
85%	61.95	1781.1	7.3	1388	1180	972	694	342.0	1679.1
80%	58.6	1684.8	6.9	1313	1116	919	657	323.5	1588.3
75%	55.25	1588.4	6.5	1238	1052	867	619	305.0	1497.6
70%	51.9	1492.1	6.1	1163	989	814	582	286.5	1406.8
65%	48.55	1395.8	5.7	1088	925	762	544	268.0	1315.9
60%	45.2	1299.5	5.3	1013	861	709	506	249.5	1225.1
55%	41.85	1203.2	4.9	938	797	656	469	231.0	1134.3
50%	38.5	1106.9	4.5	863	733	604	431	212.5	1043.5
45%	35.15	1010.6	4.1	788	669	551	394	194.0	952.7
40%	31.8	914.3	3.7	713	606	499	356	175.5	861.9
35%	28.45	817.9	3.3	638	542	446	319	157.1	771.1
30%	25.1	721.6	2.9	562	478	394	281	138.6	680.3
25%	21.75	625.3	2.5	487	414	341	244	120.1	589.5
20%	18.4	529.0	2.2	412	350	289	206	101.6	498.7
15%	15.05	432.7	1.8	337	287	236	169	83.1	407.9
10%	11.7	336.4	1.4	262	223	184	131	64.6	317.1
5%	8.35	240.1	1.0	187	159	131	94	46.1	226.3
0%	5	143.8	0.6	112	95	78	56	27.6	135.5

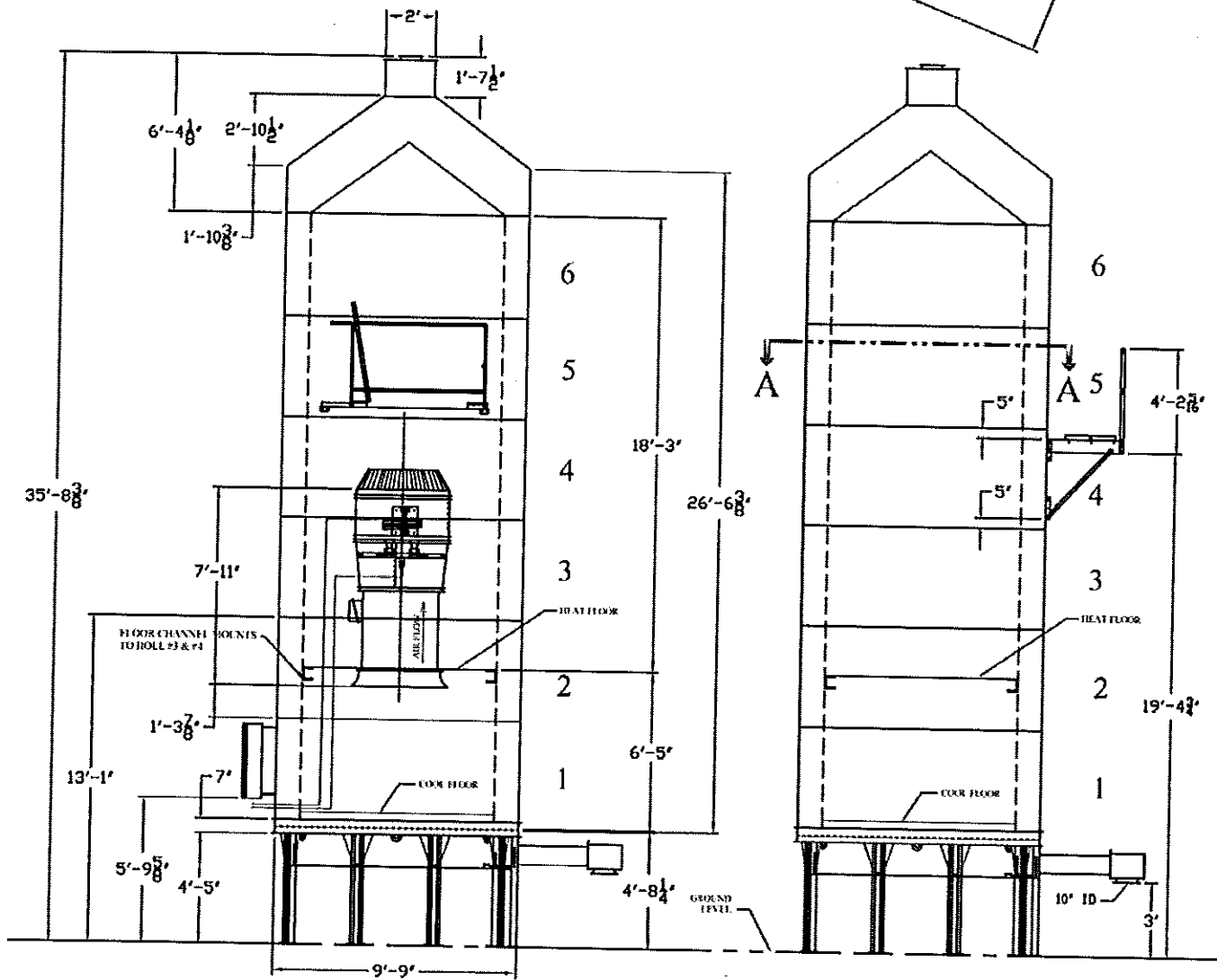
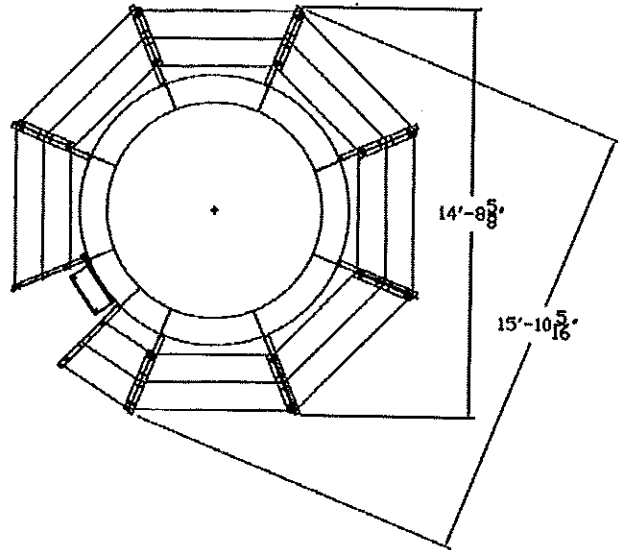
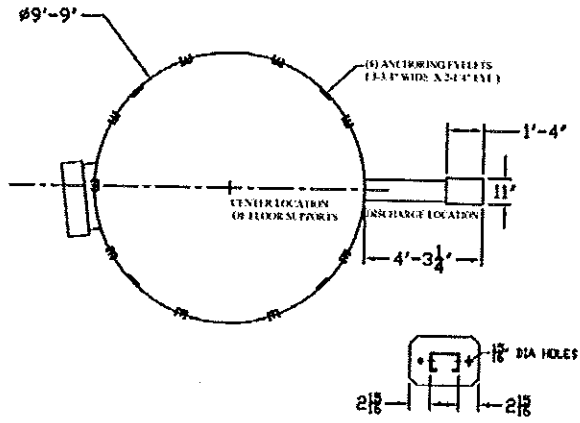


SWEEP #3 USE ON 10520 THRU 10730 TOWERS
 SWEEP #4 USE ON 10840 & 101275 TOWERS

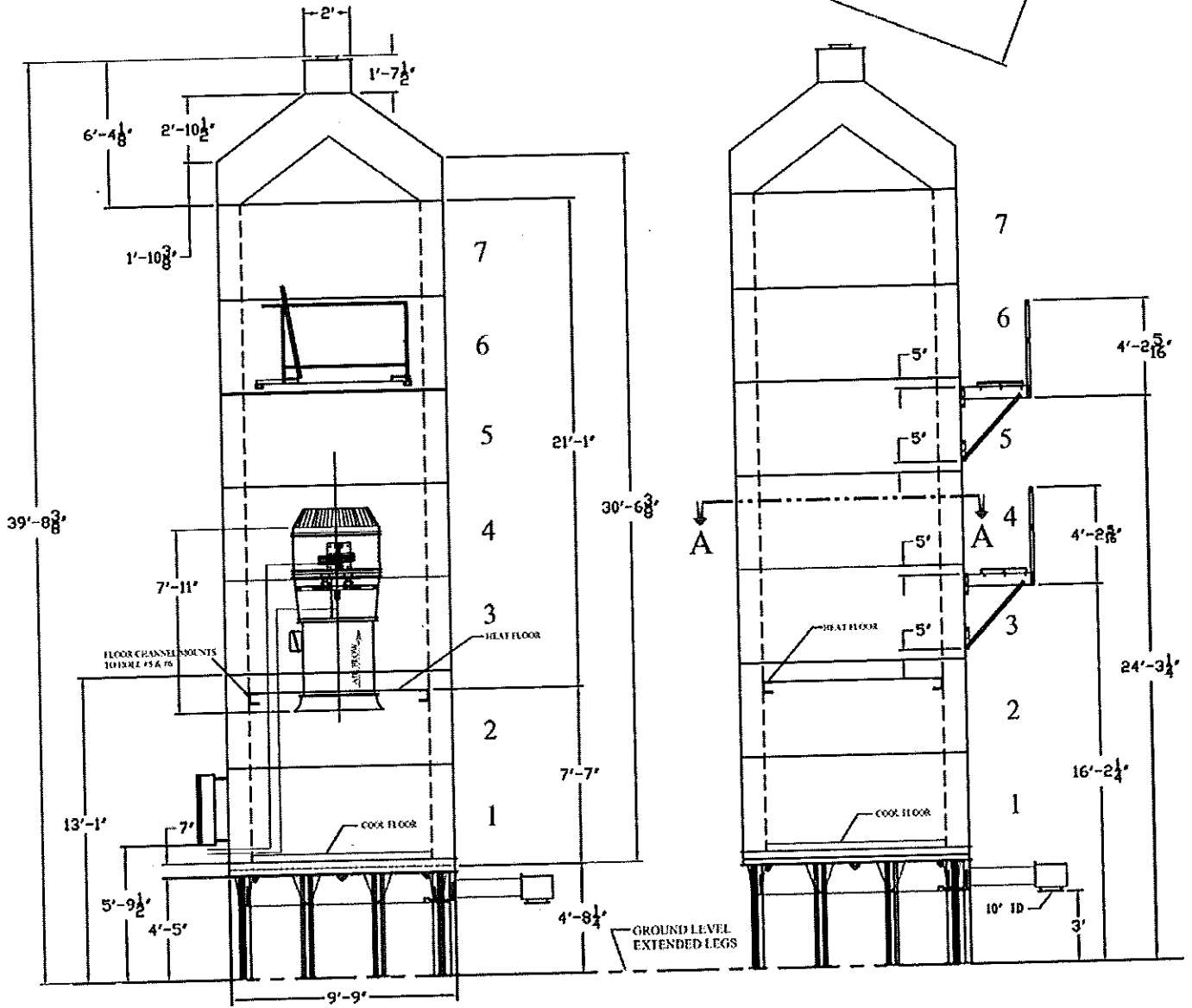
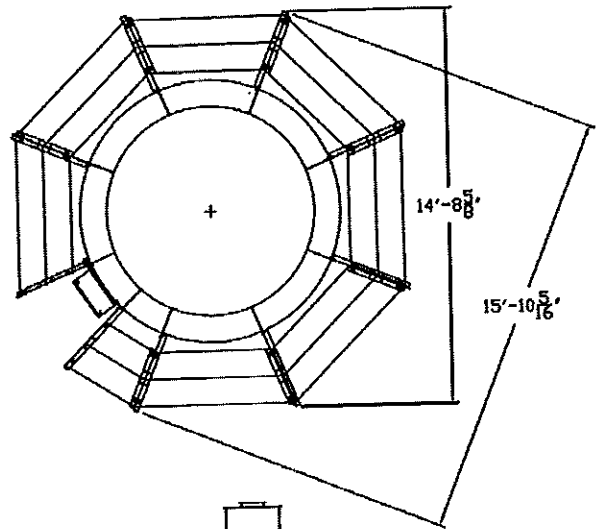
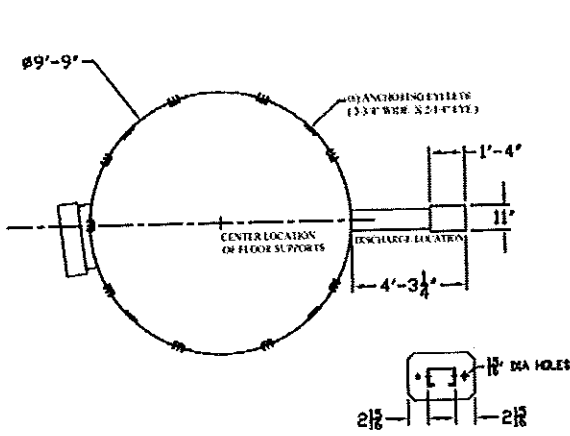
10520 Dimensions



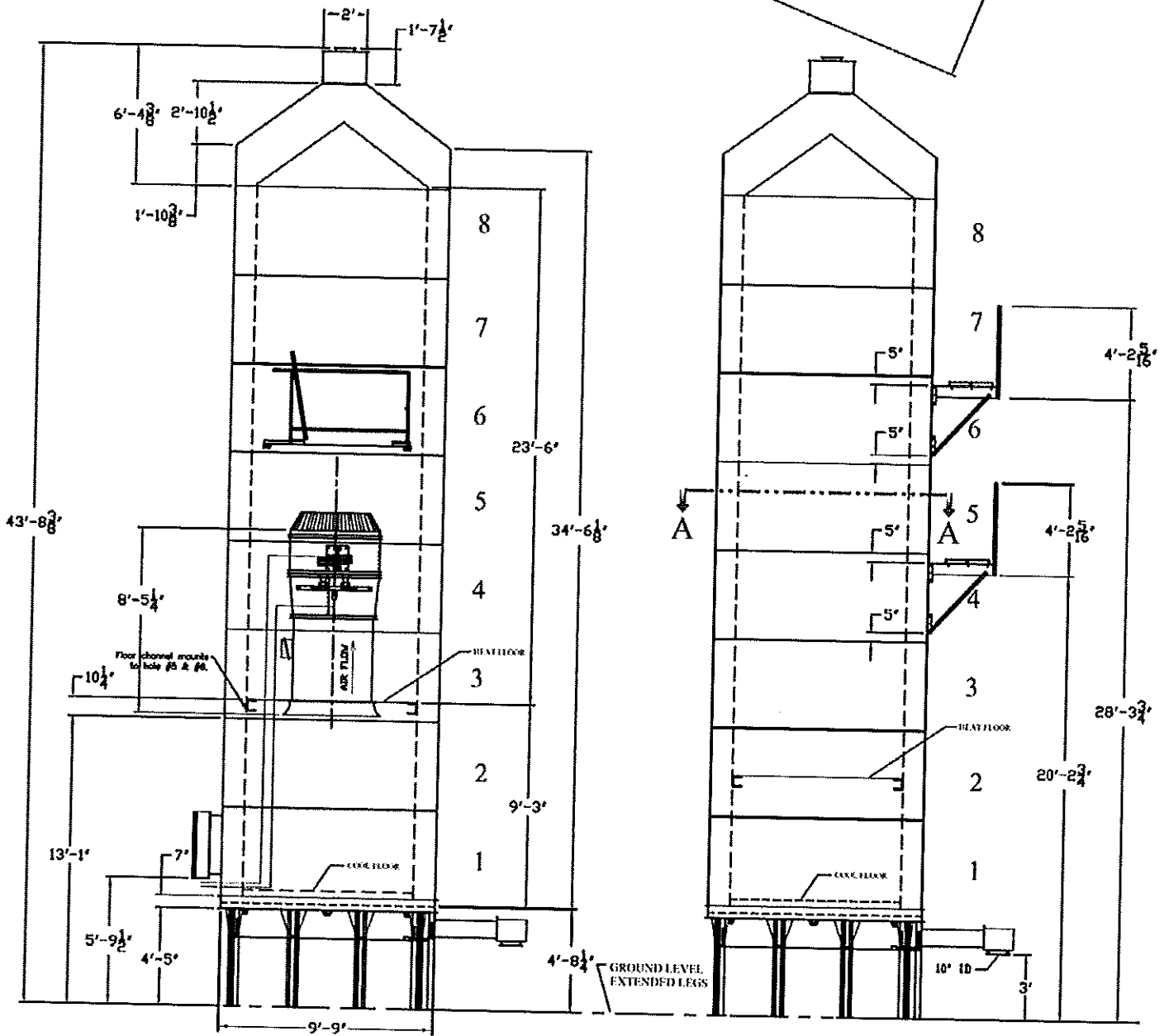
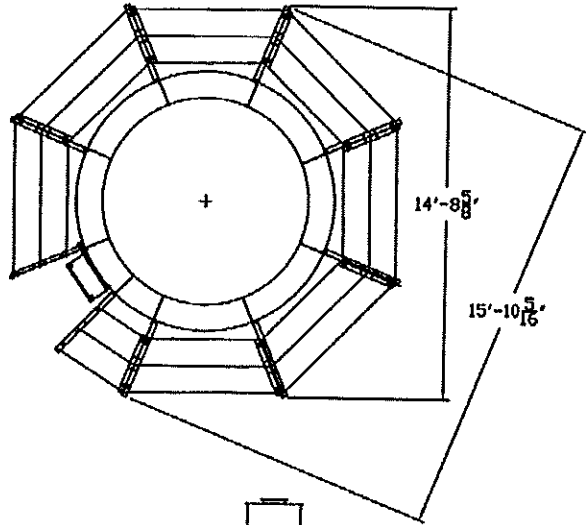
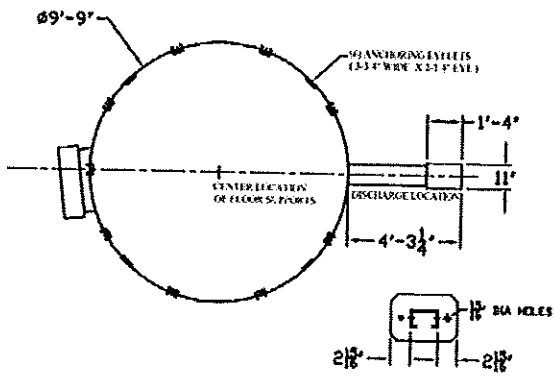
10630 Dimensions



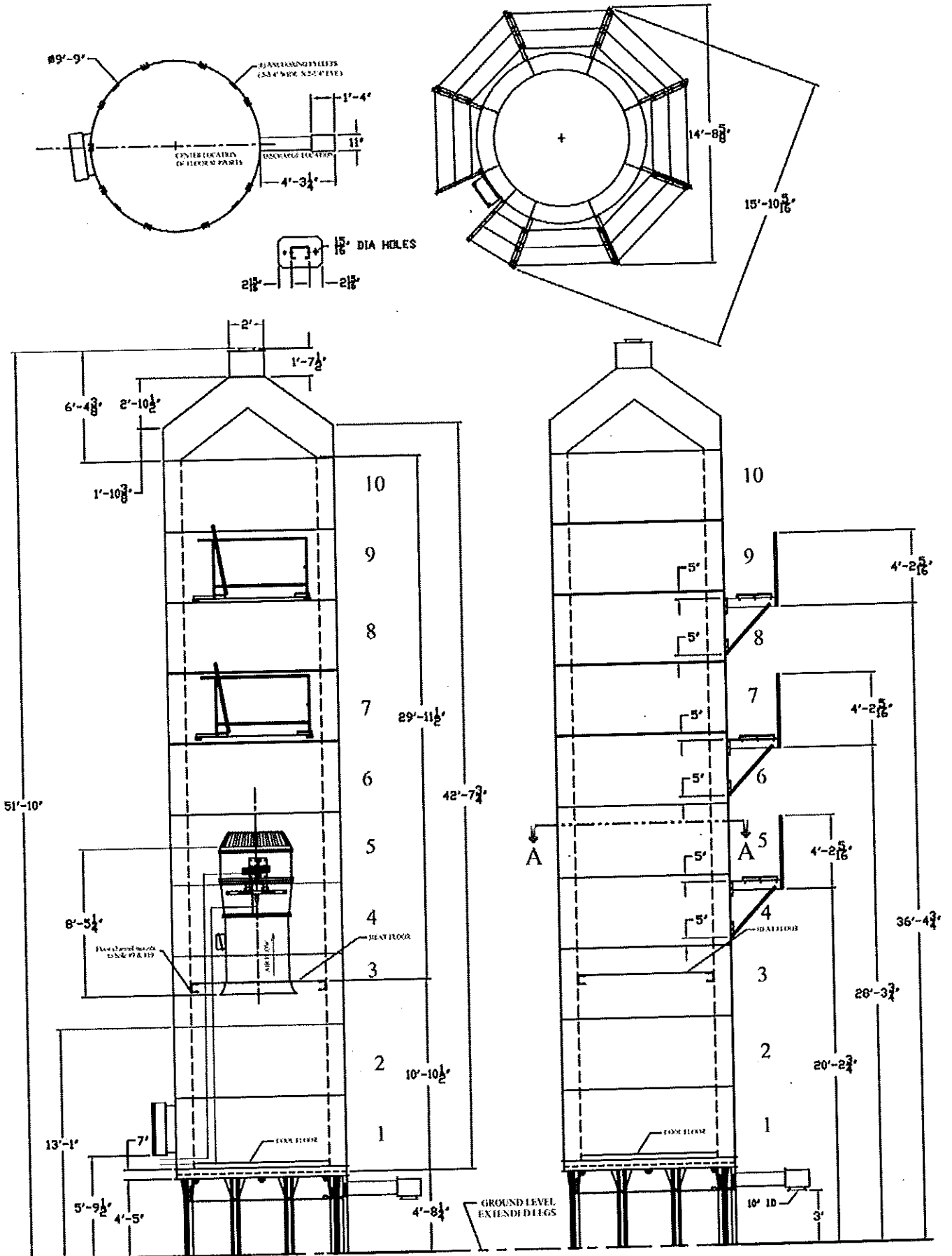
10730 Dimensions



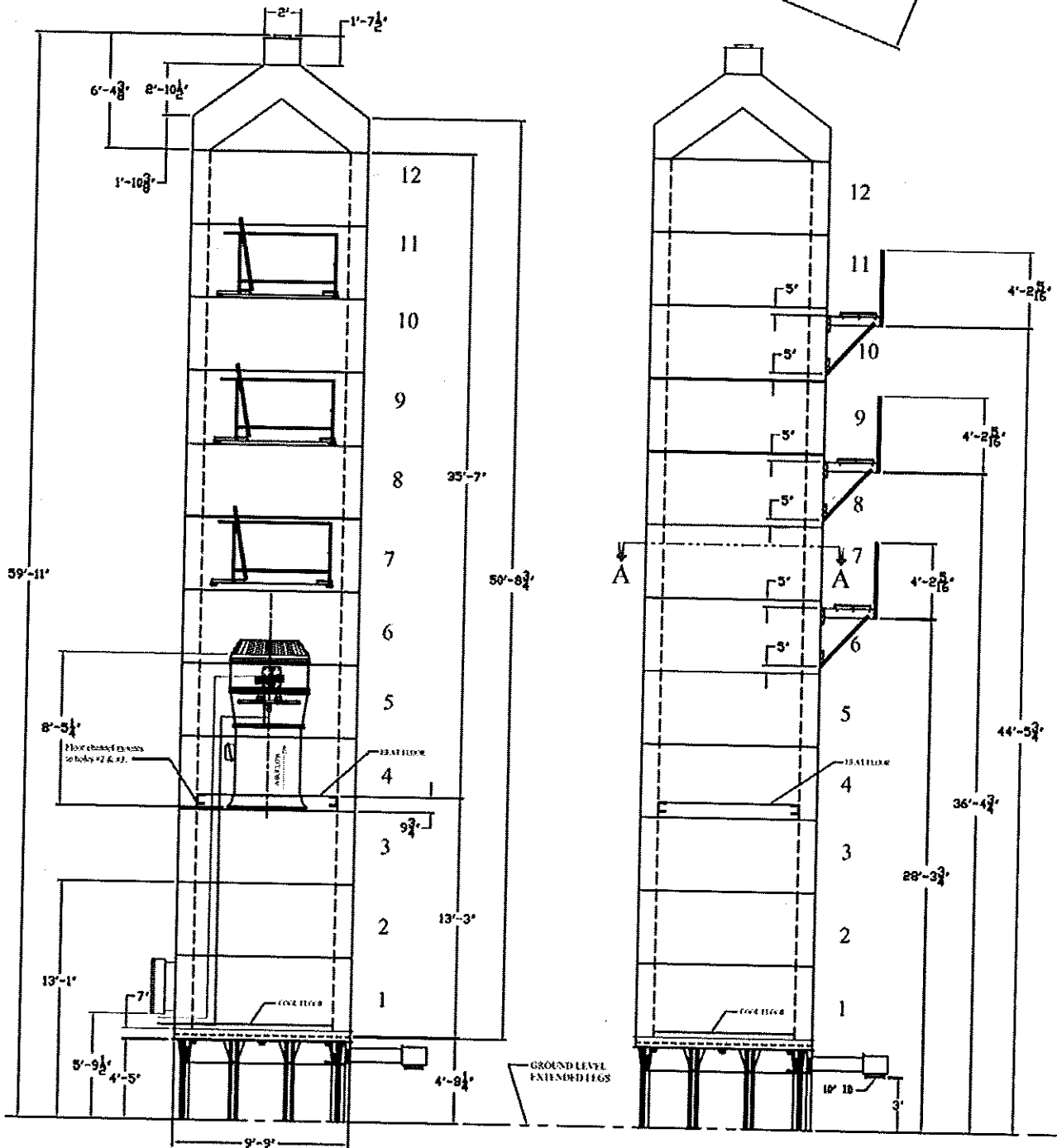
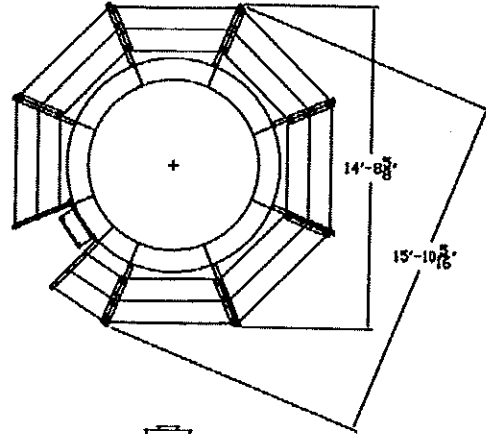
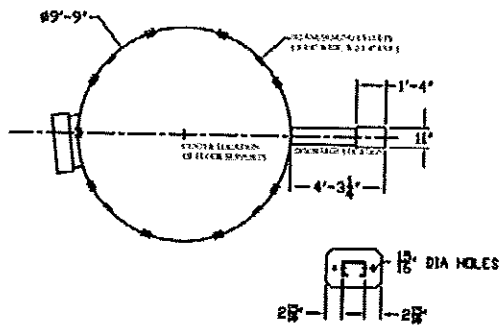
10840 Dimensions



101050 Dimensions



101275 Dimensions



Grain Drying Theory for Tower Dryers

The process of drying grain in a Mathews Company tower grain dryer requires 3 main components:

1. **Air:** The air volume is supplied by a blower that is vertically mounted inside the tower dryer. The function of the air is two-fold. It is a heat transfer mechanism and also provides a mode of transportation for grain moisture. The air transfers the heat from the burner or energy source to the grain. The air assists the heat in grain-shell penetration to dry the grain. The second function of the air is as a mode of transportation for moisture. The air absorbs the moisture from the grain and carries that moisture outside the dryer.
2. **Heat/Energy:** The burner that sits directly above the blower heats the air that fills the plenum chamber and transfers this heat from its origin to every kernel of grain. The heat is what dries the grain or releases the moisture from the kernel or seed. The accurate control of this heat or energy is what makes the equipment energy-efficient. The most effective way to regulate control of this energy is through modulating- or proportional-valve gas controls.
3. **Time:** Time, in this case, refers to the retention time of grain inside the dryer columns. The time that the grain is exposed to both air and heat determines how much moisture is driven out of the grain. The longer the exposure, the more moisture removal occurs. Thus, the best method for controlling the amount of moisture removal in grain is to increase and decrease the grain metering system of the dryer. The slower the metering systems run, the longer the grain is exposed to air and heat and the moisture removal is increased. The faster the metering system operates, the shorter the grain retention time and the moisture removal of grain is reduced. The easiest way to keep good grain quality and accurate control is to keep heat and air consistent while varying only grain retention time. This seems to be the most common and efficient way of drying grain.

Functions of air, heat and time in the drying process:

The bottom third of the dryer is suction-cooled, pulls heat off of the grain and returns it to the burner to lower energy consumption. This is the method of heat reclamation that creates the most efficient use of energy in the dryer. The top two thirds of the dryer are pressure heated to dry grain. The air is pulled into the dryer through free air doors or dry grain in the dryer columns. The amount of air volume the blower can move is dependent on the static air pressure in the chambers. The higher the static air pressure, the less air volume the blower moves. The free air doors have adjustable opening louvers. Increasing the amount of opening of the free-air doors increases the air volume of the blower. The increased air volume will correlate to increased drying capacity. The free-air door adjustment is also a means of controlling the discharge grain temperature. When the doors are closed, the discharge grain temperature is closer to the ambient temperature. The further open the doors are, the higher the discharge temperature will rise.

The dryer plenum temperature control system provides a method of entering one given temperature that the dryer will maintain for consistent plenum temperature. This temperature can be changed to an appropriate drying temperature for the product being processed. This is the method to control fuel efficiency.

The blower pushes the air volume through the burner and the air transfers this heat to fill the plenum chamber and heat the grain. The grain will absorb the heat and drive moisture out of the kernel or seed. The grain moisture emitted will saturate the air, and the air will carry the moisture out of the dryer and leave the kernel or seed dry and hot. This heat will be reclaimed when it moves down the dryer column and is exposed to the suction cooling process. The sweep system at the base of the dryer is continuously running, providing a continuous flow-drying method. The moisture control system is meant to control the sweep system or grain-flow rate. The rate is to change as grain moisture changes to maintain consistent discharging grain-moisture levels. The grain passes once through the dryer and is completely dry and ready for storage.

The dryer control system function is to provide safe operation and accurate control over the system.

Grain Dryer Component Function

Plumbing components:

- **Strainer:** This item contains a wire filter and will collect any foreign material that is in the fuel supply line.
- **Solenoid:** The solenoid is controlled by the Ignition Board. 120-volt power will energize the solenoid coil and open the gas line to allow fuel supply to flow to the burner. The de-energizing of power will allow the solenoid to close within one second. This stops gas flow and extinguishes the burner flame.
- **Main Shutdown Valve:** This is a manual-ON gas supply switch that needs to be energized by the safety circuit in order to allow the gas line to be opened. If the safety circuit drops out for any reason, this device will automatically drop out and shut off the gas supply. This device is a gas-supply safety valve.
- **Modulating or Proportional Valve:** This valve opens and closes to allow fuel supply to change and to keep the plenum temperature stable. The usual method of opening and closing to control gas flow is via a butterfly gas valve. The proportional valve uses a controlling device to dictate to the valve the direction in which it should open or close to maintain temperature in the chamber. This device will normally display and regulate temperature using the proportional valve as a slave to control signal. The modulating valve is not attached to any electrical device for control functions. The modulating valve contains a power element, which is inserted into the heated chamber. As temperature inside the chamber rises, the power element capillary bulb heats up and internal gas expands. This expansion causes the valve body to close the gas orifice down and decrease flow. This constant adjustment is how the valve maintains the set-point temperature.
- **Hand Valve:** Mechanically operated ball valve to manually open and close fuel supply to the burner.
- **High Pressure Relief Valve:** When line pressure becomes too great, the valve automatically opens and relieves excess pressure until the pressure drops. Once pressure drops, the valve will close and seal for proper function.
- **Low Pressure Switch:** The low pressure switch is an adjustable-pressure switch that will shut down the burner if pressure drops below the set point on the switch. The switch is adjustable and can be set for any pressure from 0 to 9 psig. The normal low-pressure setting is 50% of the low-end range of manifold pressure. This switch is normally used on CGA and CE Dryers.
- **High Pressure Switch:** The high pressure switch is an adjustable-pressure switch that will shut down the grain dryer if the pressure rises above the set point on the switch. The switch is adjustable and can be set for any pressure from 0 to 20 psig. The normal high-pressure setting is 50% of above high end range of manifold pressure. This switch is normally used on CGA and CE dryers.

- **Pressure Regulator:** This device reduces the pressure input to a controlled and adjustable output. These devices have different configurations and sizes, but functionally perform two tasks: pressure reduction and stabilization of output within reasonable ranges.

Field device components:

- **Ignition Board:** 120-volt power supply to function Ignition Board. The board function is to supply high voltage from the coil to either the spark plug or igniter to direct spark the burner. The board provides the flame sense probe with 60 volts. The voltage must transmit current from the flame sense probe, through the flame to burner ground. The completion of the circuit allows the ignition board to monitor and detect the presence of flame. The ignition board provides 120 volts to solenoids to open and maintain fuel supply to the burner. The timing sequence for the ignition board is 0 time for pre-purge and 10 second trial for ignition. The ignition board contains an automatic reset, which always resets on the board re-energizing of 120-volts.
- **Rotary Fill Switch:** The rotary fill switch is located in the receiving tube at the top of the dryer. This is powered by 120 volts and contains normally open and closed contacts. The switch is motorized and will rotate a slicer blade or paddle until wet grain contacts the switch. The grain stops the rotation and proves the presence of grain. This switch is normally closed and allows the dryer to continue to fill as long as the switch rotates. When grain stops the device from rotating, the contact status changes to normally open and shuts off the fill system.
- **High Limit Switch:** The high limit switch is located in a cabinet with a capillary bulb in the plenum chamber. This device is adjustable to be set 40 degrees higher than the plenum temperature set point. Once the plenum temperature reaches the high-limit set point, the device will shut down the dryer. It is a heat-over-temperature device for equipment and grain safety. The high-limit switch is a normally closed contact until the temperature reaches the set point and then contacts open, shutting down the dryer.
- **Air Pressure Switch:** The air pressure switch is an air-proving device. The switch is fully adjustable, allowing the operator to set the air pressure switch to detect when the fan or blower is operating. The air pressure switch is normally open and will not close until air flow is detected. Once air flow is detected, the switch closes and provides 120 volts to the ignition switch, allowing the operator to light the burner.
- **RTDs:** Used on the side of the dryer to detect the level of temperature present in the grain. They are used to drive the TruTemp Control System.
- **RTD or Thermocouple :** Temperature sensing device to transmit signal to temperature controller. Located in the plenum chamber to monitor precise internal dryer temperature of static air.

- **Moisture Sensor:** The moisture sensor monitors moisture and temperature of discharge grain using DC power and micro-processing technology to change the DC signal to moisture and temperature of discharging grain. Moisture is measured using capacitance to the ground. Temperature of grain is measured by a thermocouple device on a moisture sensor.
- **Linear Limit:** Located outside the grain column wrapped around the top screen section of dryer. The linear limit is an over-temperature-detection device. Once the exhaust air emitting from dryer reaches 218° F, contacts that are normally closed will open and shut down the dryer. The opening of linear limit contacts also sounds an audio alarm that can only be shut off by powering down the dryer. The linear limits will close the contacts once the temperature drops below 208° F.
- **Whisker Actuator Limit Switch:** Spring loaded lever that maintains a normally closed contact. It is adjusted so that if the rear discharge overload door is opened, the switch is opened and the current is broken. This switch appears on auger systems only, does not apply to dryers with center dumps.
- **Flame Sense Probe:** The flame sense probe is mounted to the burner assembly. This probe has 60 volts of power flowing through to the flame of the burner. The flame will allow current to connect a circuit to chassis ground. It is attached to the ignition board on terminal S1.
- **Spark Plug:** The spark plug receives high voltage current from the ignition board and arcs at the spark plug gap to provide direct spark ignition for burner. Used on low pressure burners only.
- **Low Pressure Burner:** The low pressure burner is located directly over the blower and is used to heat the air flowing into the plenum chamber to dry grain.

Electrical components inside cabinets

- **IEC Manual Motor Protectors:** Manual motor protectors are for operation of any motors. The protectors have both magnetic and thermal protection for the motor. They contain auxiliary contacts and fault contacts. The fault contacts trip or open whenever the magnetic or thermal protection is compromised. This, in turn, shuts down the dryer.
- **Soft Starter:** Soft starter is used to start up and monitor large blower motors. These are programmable devices that have built-in motor protection and adjustable features. The normal use of the soft starter is to lower start-up motor amp draw and protect motor life. Once the motor is running and amp draw is normal, the shorting contactor pulls in and carries the motor amp load and the soft starter monitors high voltage lines for irregularities to protect motor life.

- **AC Drive Unit:** The AC drive unit is a single-phase input and three-phase output to run and protect the unload motor. This device is controlled by means of a micro-processing board.
- **Cal Controller:** This device displays measured plenum temperature and controls the proportional valve. The valve will open and close butterfly to adjust gas flow and continually adjust to maintain stable plenum temperature. This device can also function to shut down the machine if the actual plenum temperature rises or falls more than 40° F.
- **Moisture Monitor:** The display unit is used to show both grain moisture and temperature that the moisture sensor is contacting as dry grain discharges.
- **Printer:** Printer will periodically print out discharge grain temperature and moisture for the operator's information.
- **Relay:** The relay is a 120-volt coil that energizes relay contacts to close and pass power through to the proper device.
- **Push button:** These push buttons are used for starting and stopping the blower. The push buttons control the manual motor protector that runs the blower.
- **LED lights:** All lights are 120-volt power LED lights for daylight viewable use.
- **Rotary Switches:** These come in a variety of combinations and are typically used to actuate items on and off or switch modes ON-OFF-ON.
- **Potentiometers:** Potentiometers are used to vary resistance in a circuit.
- **HMI:** Acronym stands for Human Machine Interface. This is the touchscreen graphical display of the PLC unit.

10520 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		10520				Dry & Cool @ 170 Degrees		
	Bu/hr Capacity	Pot Set Speed	Unload %	Speed	Heat Time	Cool Time	Mbtu/hr	Energy	
30-15	157	0.5	5		152.1	56.7	2.9		
29-15	171	0.6	6		137.9	51.4	2.8		
28-15	186	0.7	7		124.6	46.4	2.8		
27-15	204	0.9	9		112.2	41.8	2.8		
26-15	224	1	10		100.8	37.6	2.7		
25-15	246	1.2	12		90.4	33.7	2.7		
24-15	272	1.4	14		80.9	30.1	2.6		
23-15	301	1.6	16		72.1	26.9	2.6		
22-15	335	1.9	19		64.0	23.8	2.6		
21-15	375	2.2	22		56.4	21.0	2.5		
20-15	426	2.6	26		49.0	18.3	2.5		
19-15	495	3.1	31		41.7	15.5	2.4		
18-15	600	4	40		34.0	12.7	2.4		
17-15	786	5.4	54		25.6	9.5	2.4		

Moisture Removal Corn	Dryer Models		10520				Dry & Cool @ 200 Degrees Fahrenheit		
	Bu/hr Capacity	Pot Set Speed	Unload %	Speed	Heat Time	Cool Time	Mbtu/hr	Energy	
30-15	200	0.8	8		119.3	44.5	3.6		
29-15	217	1	10		108.2	40.3	3.5		
28-15	237	1.1	11		97.7	36.4	3.5		
27-15	260	1.3	13		88.0	32.8	3.4		
26-15	286	1.5	15		79.1	29.5	3.4		
25-15	320	1.8	18		70.0	26.1	3.3		
24-15	347	2	20		63.4	23.6	3.2		
23-15	384	2.3	23		56.6	21.1	3.2		
22-15	440	2.7	27		49.6	18.5	3.1		
21-15	478	3	30		44.2	16.5	3.0		
20-15	560	3.6	36		38.0	14.1	3.0		
19-15	631	4.2	42		32.7	12.2	3.0		
18-15	765	5.2	52		26.6	9.9	2.9		
17-15	1002	7.1	71		20.1	7.5	3.0		

This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.

10630 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		10630 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	198	0.8	8	153.5	45.0	3.6
29-15	215	0.9	9	139.2	40.8	3.6
28-15	235	1.1	11	125.7	36.8	3.5
27-15	257	1.3	13	113.2	33.2	3.5
26-15	282	1.5	15	101.7	29.8	3.4
25-15	311	1.7	17	91.2	26.7	3.4
24-15	343	1.9	19	81.6	23.9	3.3
23-15	379	2.2	22	72.8	21.3	3.3
22-15	422	2.6	26	64.6	18.9	3.2
21-15	472	3	30	56.9	16.7	3.2
20-15	537	3.5	35	49.5	14.5	3.1
19-15	624	4.1	41	42.0	12.3	3.1
18-15	756	5.2	52	34.3	10.0	3.1
17-15	991	7	70	25.8	7.6	3.2

Moisture Removal Corn	Dryer Models		10630 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	255	1.3	13	118.8	34.8	4.5
29-15	278	1.4	14	107.7	31.6	4.5
28-15	303	1.6	16	97.3	28.5	4.4
27-15	332	1.9	19	87.7	25.7	4.3
26-15	364	2.1	21	78.8	23.1	4.3
25-15	400	2.4	24	70.6	20.7	4.2
24-15	443	2.7	27	63.2	18.5	4.1
23-15	490	3.1	31	56.3	16.5	4.0
22-15	550	3.6	36	15.0	14.6	4.0
21-15	610	4	40	44.1	12.9	3.9
20-15	700	4.7	47	38.3	11.2	3.9
19-15	806	5.6	56	32.5	9.5	3.9
18-15	976	6.9	69	26.5	7.8	3.9
17-15	1280	9.3	93	20.0	5.9	4.1

This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.

10730 Tower Dryer Capacity Charts

Moisture Removal	Dryer Models		10730				Dry & Cool @ 170 Degrees		
	Bu/hr Capacity	Pot Set Speed	Unload %	Speed	Heat Time	Cool Time	Mbtu/hr Energy		
Corn									
30-15	223	1	10		153.1	44.7	4.1		
29-15	243	1.2	12		138.8	40.5	4.0		
28-15	265	1.3	13		125.4	36.6	4.0		
27-15	290	1.5	15		112.9	33.0	3.9		
26-15	319	1.8	18		101.5	29.6	3.9		
25-15	351	2	20		91.0	26.5	3.8		
24-15	387	2.3	23		81.4	23.7	3.8		
23-15	429	2.6	26		72.6	21.2	3.7		
22-15	477	3	30		64.4	18.8	3.6		
21-15	534	3.4	34		56.8	16.6	3.6		
20-15	607	4	40		49.3	14.4	3.6		
19-15	705	4.8	48		41.9	12.2	3.5		
18-15	855	6	60		34.2	10.0	3.5		
17-15	1120	8	80		25.8	7.5	3.6		

Moisture Removal	Dryer Models		10730				Dry & Cool @ 200 Degrees Fahrenheit		
	Bu/hr Capacity	Pot Set Speed	Unload %	Speed	Heat Time	Cool Time	Mbtu/hr Energy		
Corn									
30-15	289	1.5	15		118.5	34.6	5.1		
29-15	314	1.7	17		107.4	31.4	5.1		
28-15	343	1.9	19		97.1	28.3	5.0		
27-15	375	2.2	22		87.4	25.5	4.9		
26-15	412	2.5	25		78.6	22.9	4.8		
25-15	460	2.9	29		69.5	20.3	4.8		
24-15	500	3.2	32		63.0	18.4	4.7		
23-15	554	3.6	36		56.2	16.4	4.6		
22-15	630	4.2	42		49.2	14.4	4.6		
21-15	690	4.7	47		43.9	12.8	4.5		
20-15	800	5.5	55		37.7	11.0	4.5		
19-15	911	6.4	64		32.5	9.5	4.4		
18-15	1104	7.9	79		26.5	7.7	4.5		

This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.

10840 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		10840 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	276	1.1	11	153.0	36.2	5.0
29-15	300	1.3	13	138.7	32.8	5.0
28-15	328	1.4	14	125.3	29.6	4.9
27-15	359	1.6	16	112.9	26.7	4.9
26-15	394	1.9	19	101.4	24.0	4.8
25-15	434	2.1	21	90.9	21.5	4.7
24-15	478	2.4	24	81.3	19.2	4.7
23-15	529	2.8	28	72.5	17.1	4.6
22-15	589	3.2	32	64.4	15.2	4.5
21-15	660	3.6	36	56.7	13.4	4.5
20-15	749	4.2	42	49.3	11.7	4.5
19-15	871	5.1	51	41.9	9.9	4.5
18-15	1055	6.3	63	34.1	8.1	4.5
17-15	1383	8.5	85	25.7	6.1	4.7

Moisture Removal Corn	Dryer Models		10840 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	352	1.6	16	120.0	28.4	6.3
29-15	383	1.8	18	108.8	25.7	6.2
28-15	418	2	20	98.3	23.1	6.1
27-15	457	2.3	23	88.5	20.9	6.0
26-15	502	2.6	26	79.5	18.8	5.9
25-15	555	3	30	71.3	16.9	5.8
24-15	610	3.3	33	63.8	15.1	5.8
23-15	675	3.7	37	56.9	13.4	5.7
22-15	755	4.3	43	50.5	11.9	5.6
21-15	841	4.9	49	44.5	10.5	5.6
20-15	960	5.6	56	38.9	9.2	5.6
19-15	1111	6.7	67	32.9	7.8	5.7
18-15	1346	8.2	82	26.8	6.3	5.8

This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.

101050 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		101050 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	338	1.5	15	154.5	37.7	6.1
29-15	368	1.7	17	140.0	34.2	6.1
28-15	402	1.9	19	126.5	30.9	6.0
27-15	440	2.2	22	114.0	27.8	5.9
26-15	483	2.5	25	102.4	25.0	5.8
25-15	532	2.8	28	91.8	22.4	5.7
24-15	587	3.2	32	82.1	20.0	5.7
23-15	649	3.6	36	73.2	17.9	5.6
22-15	722	4.1	41	65.0	15.9	5.5
21-15	809	4.6	46	57.3	14.0	5.5
20-15	919	5.4	54	49.8	12.2	5.4
19-15	1068	6.4	64	42.3	10.3	5.4
18-15	1294	7.9	79	34.5	8.4	5.5

Moisture Removal Corn	Dryer Models		101050 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	430	2.1	21	121.2	29.6	7.6
29-15	470	2.4	24	109.8	26.8	7.5
28-15	512	2.7	27	99.2	24.2	7.4
27-15	561	3	30	89.4	21.8	7.3
26-15	616	3.4	34	80.3	19.6	7.2
25-15	680	3.8	38	72.5	17.7	7.0
24-15	750	4.2	42	64.4	15.7	7.0
23-15	828	4.8	48	57.4	14.0	6.9
22-15	920	5.4	54	51.3	12.5	6.8
21-15	1031	6.1	61	44.9	11.0	6.7
20-15	1175	7.1	71	39.3	9.6	6.7
19-15	1362	8.3	83	33.2	8.1	6.8

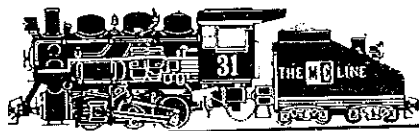
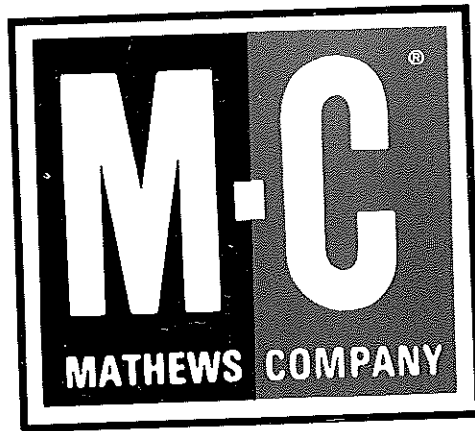
This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.

101275 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		101275 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	410	2	20	154.0	35.7	7.4
29-15	446	2.2	22	139.7	32.4	7.4
28-15	487	2.5	25	126.2	29.2	7.3
27-15	533	2.8	28	113.6	26.3	7.2
26-15	586	3.2	32	102.1	23.7	7.1
25-15	645	3.5	35	91.5	21.2	7.0
24-15	711	4	40	81.9	19.0	6.9
23-15	787	4.5	45	73.0	16.9	6.8
22-15	875	5.1	51	64.8	15.0	6.7
21-15	981	5.8	58	57.1	13.2	6.7
20-15	1114	6.7	67	49.7	11.5	6.6
19-15	1295	7.9	79	42.2	9.8	6.6
18-15	1569	9.7	97	34.4	8.0	6.7

Moisture Removal Corn	Dryer Models		101275 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload & Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	525	2.8	28	120.8	28.0	9.3
29-15	570	3.1	31	109.5	25.4	9.2
28-15	620	3.4	34	99.0	22.9	9.0
27-15	680	3.8	38	89.1	20.7	8.9
26-15	750	4.2	42	80.1	18.6	8.8
25-15	820	4.7	47	72.3	16.7	8.6
24-15	910	5.3	53	64.2	14.9	8.5
23-15	1005	5.9	59	57.3	13.3	8.4
22-15	1115	6.7	67	51.2	11.9	8.3
21-15	1250	7.6	76	44.8	10.4	8.3
20-15	1415	8.7	87	39.2	9.1	8.2

This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions, etc. The purpose of the capacity chart is to give operators a good reference point for grain drying process data.



Iron Horse Quality