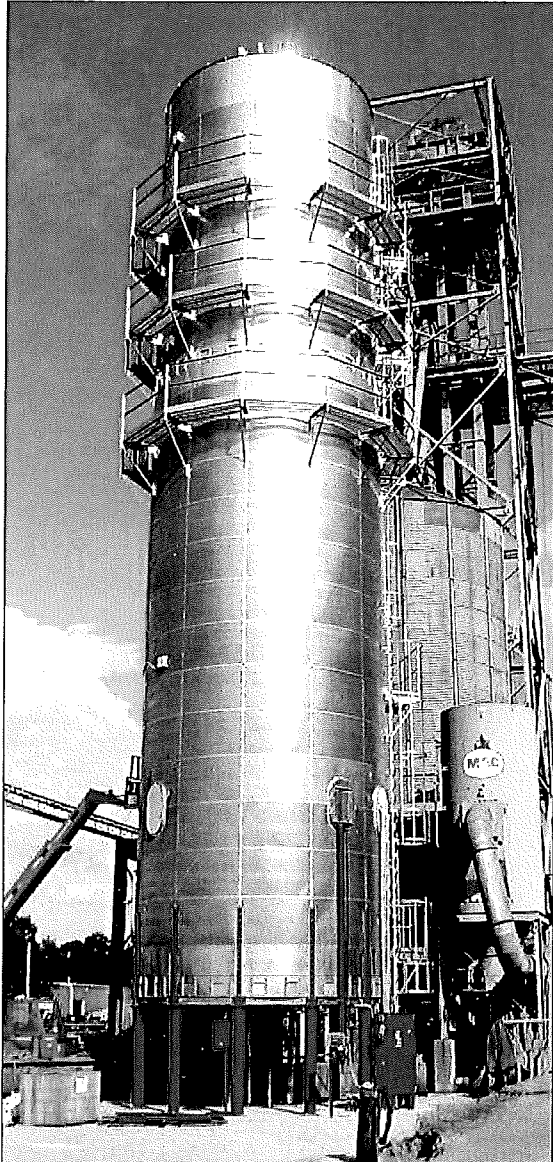




TOWER DRYER



OPERATOR'S MANUAL

Models: 2000, 2400,
3000, 3500 & 4000

Effective: January 1st, 2008

Mathews Company

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Section 1
Equipment Overview

INTRODUCTION

To the Owner-Operator

This manual was prepared to provide owners and operators of the M-C models 2000, 2400, 3000, 3500 and 4000 grain dryers starting with serial number 59112 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 startup 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 is suggested that it be cleaned and lubricated, the belt tension adjusted and the ignition system, fill system, and unloading system be tested each year prior to the drying season. Refer to the "preseason check" in the maintenance section. The preseason 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 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 shown in Figure A. For future reference, record the model and serial number in the blank spaces of the plate shown in Figure A.

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 SETTING FOR LARGEST MOTOF 76 Amps			
MATHEWS COMPANY 500 INDUSTRIAL AVE. CRYSTAL LAKE, IL., U.S.A. PRODUCTION DATE May-06			

Panel Listing

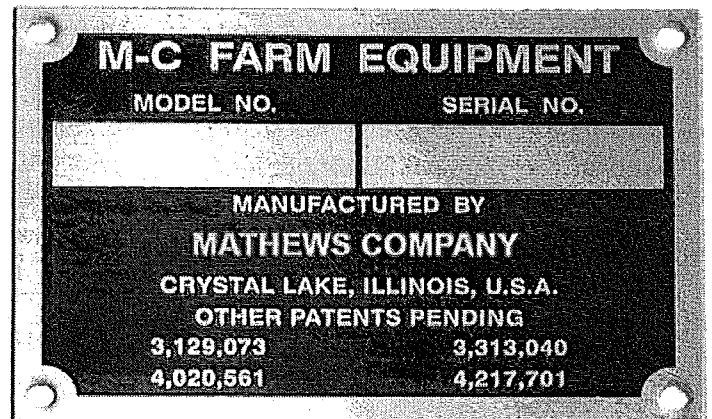
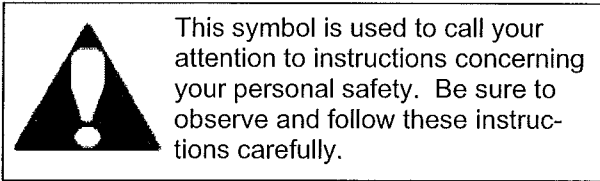


Figure A: Model and Serial Number

M-C GRAIN DRYER			
MODEL 2000	CONTROL VOLTAGE 110	SERIAL NUMBER	#58746
VOLTAGE 460	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 6 INCHES, W.C.			
MINIMUM CLEARANCE TO COMBUSTIBLE CONSTRUCTION - 4 FEET			
WARNING - FOR OUTDOOR INSTALLATION ONLY			
MATHEWS COMPANY 500 INDUSTRIAL AVE. CRYSTAL LAKE, IL., U.S.A. PRODUCTION DATE May-06			

High Voltage Cabinet Decal

SAFETY PRECAUTIONS



1. Read and understand the operation manual before attempting to operate the unit.
2. Keep ALL guards, access doors, covers, safety decals and safety devices in place and securely fastened. NEVER operate the system while guards are removed.

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

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.

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. Each worker has 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 is 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 s/he 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 crafts.

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.

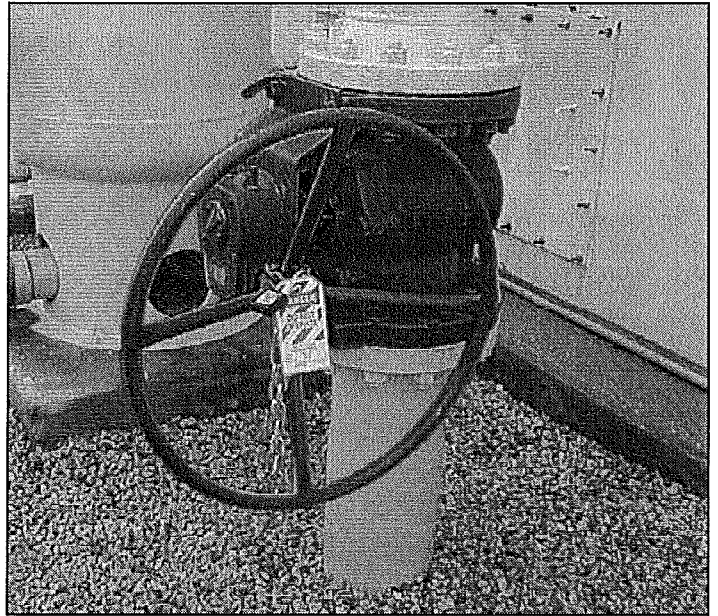
Tagout devices shall be capable of enduring at least 50 pounds of pull, and a non-reusable type.

Blocks

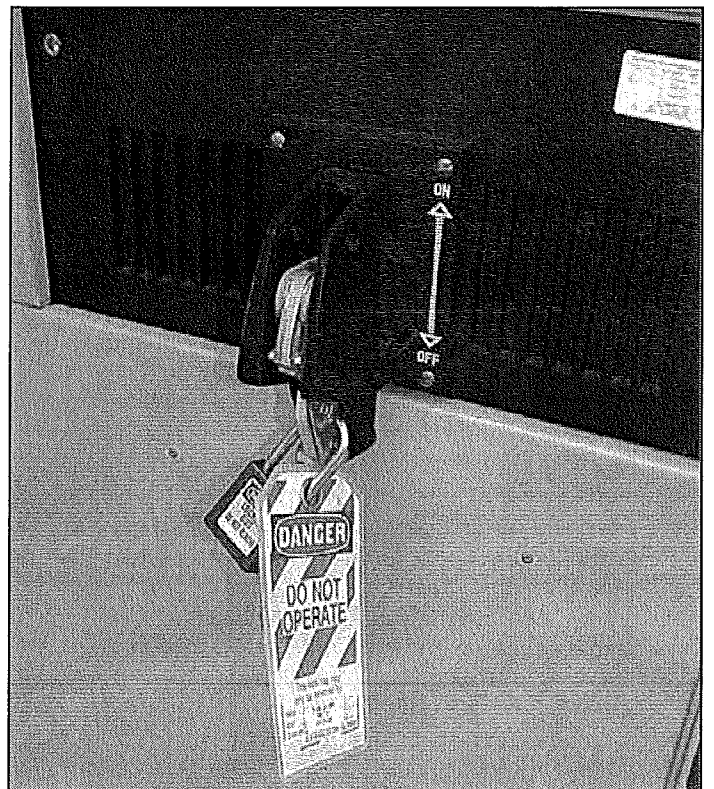
Suitable blocks are another important safety device for making a piece of equipment safe to be repaired or serviced. Blocks must be placed under raised dies, lifts, or any equipment that might inadvertently move by sliding, falling or rolling.

Blocks, special brackets, or special stands such as those commonly used under raised vehicles, must be available and always used. 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.

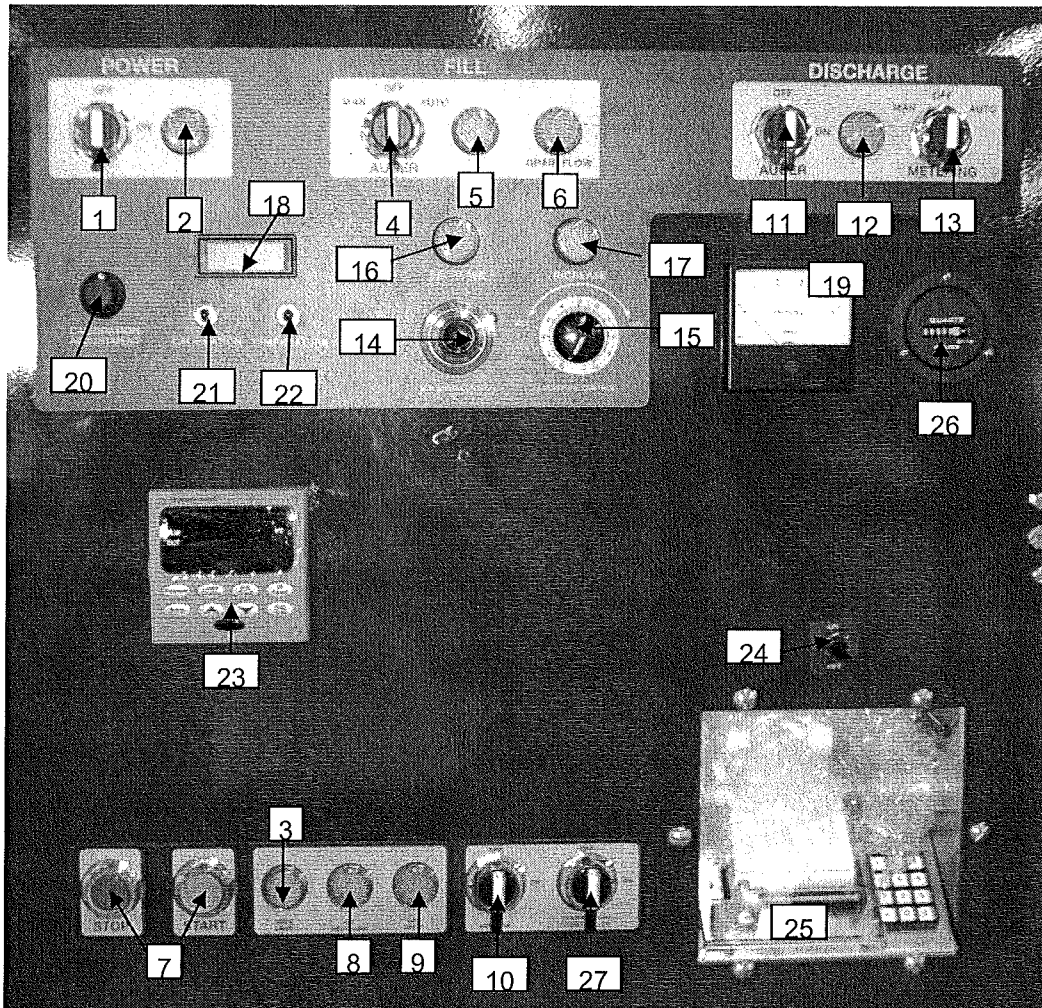


Gas Lockout & Tagout



Electrical Lockout & Tagout

**REMOTE CABINET
BUTTONS, DIALS, LIGHTS, METERS, & SWITCHES**



Ref. 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 the power-on switch to the ON position again.

Ref. 2 - Power-On Light:

Indicates that the power-on switch has been turned on, discharge overload door and starter overloads are closed, and dryer relay is activated.

Ref 3. - High-Limit Light:

Indicates that the power switch has been turned on and the high limit switch is closed.

Ref. 4 - Wet Grain Fill Switch:

When the 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 the fill equipment when the hopper is full.

Ref. 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.

Ref. 6 - Grain Flow Light:

Indicates low grain level in the wet hopper. The light comes on when the grain flow timer reaches zero and the dryer is shut down.

Ref 7. - Fan Start/Stop Buttons:

Green button starts and red button stops the fan.

Ref. 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.

Ref. 9 - Gas Valve Light:

Indicates ignition board terminal V1 is powered to open solenoid valves for burner ignition. The light will remain lit as long as the flame sense probe continues sensing burner flame and terminal V1 is powered on. If sensing is lost, the board will lock out and shut down solenoid valves and the gas valve light.

Ref. 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 within 10 seconds, the ignition board will lock out, de-energizing the gas solenoid valves and the gas valve light. The switch will have to be turned to OFF then back to ON for another try at burner ignition.

Ref. 11 - Discharge (Unload) Auger Switch:

Turn this spring-loaded switch to the ON position to start the discharge auger. If there is a momentary loss of electricity, the dryer will shut down and will have to be re-started.

Ref. 12 - Discharge Auger Light:

Indicates that the customer takeaway system is operating.

Ref. 13 - Discharge Metering Switch:

When the switch is turned to the MANUAL position, the AC drive motor will run constantly and the speed of the sweep will be controlled by the Manual Drive Speed Control dial.

When the switch is in the AUTOMATIC position, the moisture control board will speed up or slow down the AC motor automatically.

Ref. 14 - Manual AC Drive Speed Control:

This manual speed control is used to adjust the speed of the AC motor that drives the grain sweep arm and changes the discharge speed when the discharge metering switch (Ref. 13) is in the MANUAL position only. Be sure to disengage the lock before turning the dial.

Ref. 15 - Moisture Control Balance Dial:

This balance dial is used to equalize the moisture control decrease and increase indicator lights before turning the discharge metering switch to AUTOMATIC.

Ref. 16 - Moisture Control Decrease Light:

Indicates that the discharge rate is decreasing if the moisture control is in AUTOMATIC.

Ref. 17 - Moisture Control Increase Light:

Indicates that the discharge rate is increasing if moisture control is in AUTOMATIC.

Ref. 18 - Digital Display Meter:

Displays the discharge grain moisture constantly, grain temperature and calibration setting when the respective display button is pushed.

Ref. 19 - Discharge Meter:

Indicates the rate of discharge when the discharge metering switch is in MANUAL or AUTOMATIC.

Ref. 20 - Calibration Adjustment Dial:

Turn dial to change calibration.

Ref. 21 - Calibration Display Button:

Push button to display the amount added to or subtracted from (-9.9 to + 9.9) the discharge grain moisture shown on the digital display meter.

Ref. 22 - Temperature Display Button:

Push button to display temperature of grain moving over discharge moisture sensor.

Ref. 23 - Temperature Controller:

Controls the modulating valve that regulates the amount of gas supplied to the burner. Digital display shows temperature and percent that modulating valve is open. Contains both plenum high and low shutdown +/- 40° from the set point.

Ref. 24 - Printer ON/OFF Switch:

Turns printer on or off.

Ref. 25 - Printer

Provides printed record of time, day, discharge grain moisture, temperature, and average moisture content.

Ref. 26 - Hour Meter:

Records hours of dryer operation.

Ref. 27 - Plenum Control On/OFF switch:

Powers the temperature controller on and off.

Honeywell Operator Interface and Key Functions

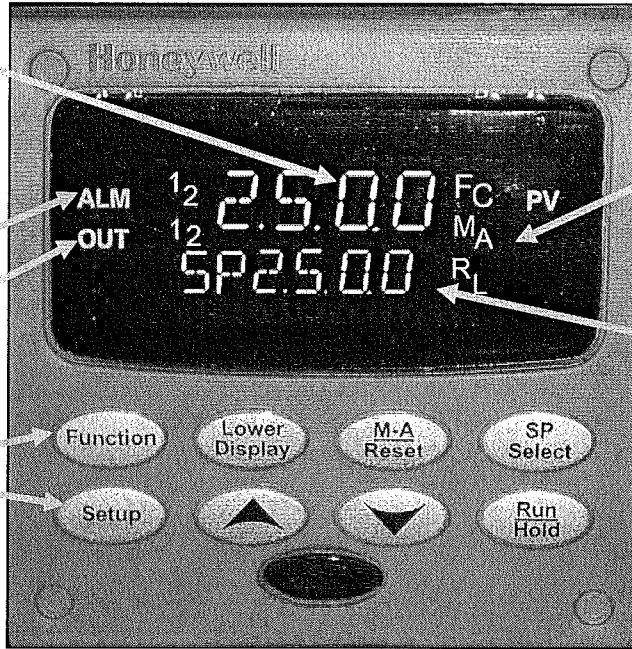
Upper Display—Four Digits

- Normal Operation - Process Variable
- Configuration Mode - displays parameter value of selection
- TUNE - Accutune in progress

ALM - Alarm Conditions

OUT - Control Relay 1 or 2 ON.

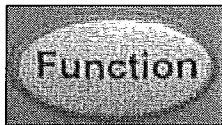
KEYS



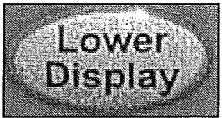
- F - Fahrenheit being used
- C - Centigrade being used
- M or A - Manual/Auto display
- R - Remote or local SP2 set point active
- L - Local Set point Active

Lower display - six alphanumeric characters.

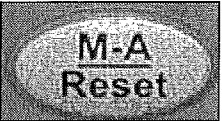
- Normal Operation - display is blank unless configured for default prompt of PV or set point
- Configuration mode - displays functions and parameters



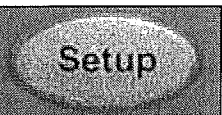
Used with Setup key to elect individual functions of selected Setup group.



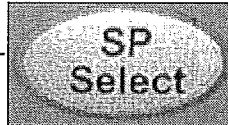
Returns controller to normal display from Setup mode. Toggles various operating parameters for display.



Selects Manual or Auto mode. Resets the limit controller relay.



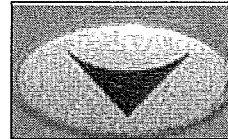
Places controller in the configuration setup group select mode. Scrolls through the configuration setup groups.



Hold key to cycle through configured setpoints.



Increases setpoint or output values. Increases configuration values or changes functions in configuration mode groups



Decreases setpoint or output values. Decreases configuration values or changes functions in configuration mode groups.



Enables Run/Hold of the SP ramp or program. Acknowledges a latched alarm or diagnostic message.

Key Error Message

When a key is pressed and the prompt KEYERR appears in the lower display, it will be for one of the following reasons:

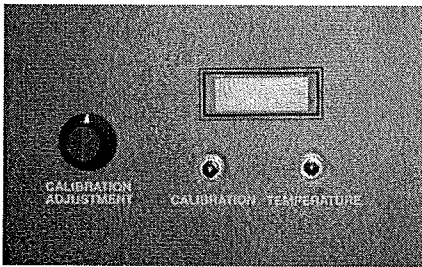
- Parameter is not available ,
- Not in Set up mode, press Setup key first,
- Key malfunction.

Moisture Monitor and Printer

As soon as electric power is supplied to the dryer, the moisture monitor and printer will be activated. The printer is equipped with an ON / OFF switch to control its operation.

Moisture Monitor Instructions

- A. The digital display meter shows grain moisture constantly and should read approximately 6% when the sensor is in open air (no grain passing over the sensor).
- B. Push the grain temperature button and the display meter will show the temperature of the grain on the sensor.
- C. Push the calibration button and the display meter will show the amount added to or subtracted from the displayed moisture.



Moisture Monitor

- D. The moisture monitor may need to be calibrated to compensate for different grains and sensor configurations. Make sure that the calibration is set at zero before comparing the displayed moisture values with the samples tested with a reliable moisture tester. See the Moisture Monitor sampling chart opposite.
 1. If the displayed moisture value is less than that from a moisture tester, push the "Display Calibration" and turn the calibration knob to display the actual difference (+ Value)
 2. If the displayed moisture value is more than from the moisture tester value, push the "Display Calibration" and turn the calibration knob to display the actual difference with a minus sign (- value).



CAUTION: Use a safe sampling procedure. Do not sample from a hopper with an unguarded auger. Keep hands, feet and clothing away from rotating parts.

The following sampling guidelines are recommended:

- Take samples when the displayed moisture values are not changing rapidly.
- Observe the moisture display when the sample is taken. Record both the displayed values and tested values for at least six (6) samples and take the average of each.
- Take the samples from the grain sampler located on the left side of the unload (discharge) auger box.

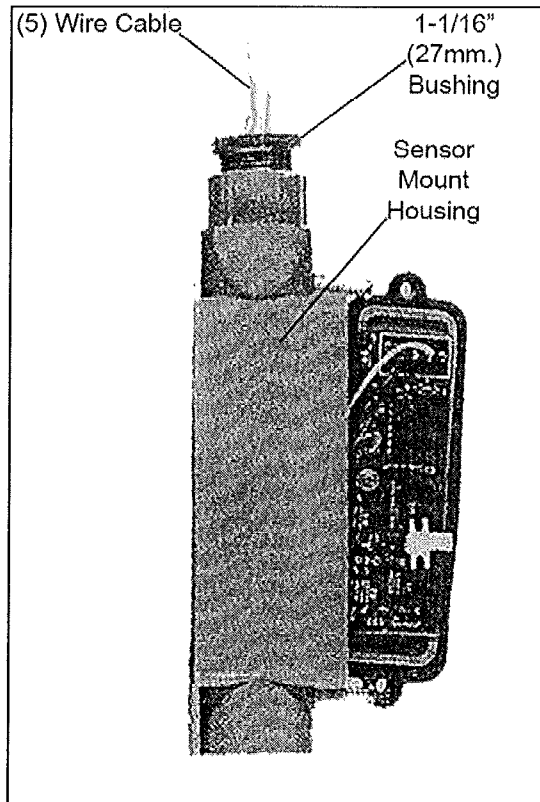
It is recommended that the moisture offset be set at +0.3, which would match the point of sale's moisture reading.

Moisture Monitor Sampling					
The chart shows grain moisture readings (from a real situation) as they should be taken to obtain a realistic moisture value.					
Time	M-C Monitor		Dole		Elevator
	Temp	Moisture	Temp	Corrected Moisture	Moisture
9:33AM	112	14.4%	109	14.7%	
9:36AM	112	14.4%	111	14.4%	
9:38AM	108	16.0%	107	17.5%	
9:40AM	110	14.6%	109	14.7%	
9:43AM	108	15.9%	104	17.3%	
9:50AM	111	14.5%	107	15.0%	
Total		89.8%		93.6%	
Average		15.0%		15.6%	15.3%

Printer

The printer provides a printed record of:

1. Time
2. Mode
3. Grain discharge moisture
4. Grain discharge temperature
5. Ambient temperature from weather station
6. Average discharge moisture
7. Relative humidity from weather station
8. Calibration (moisture offset)
9. Bin # that is being filled with dry grain.



Weather Sensor

A weather sensor is supplied with the printer, but must be installed by the customer when dryer installation is completed.

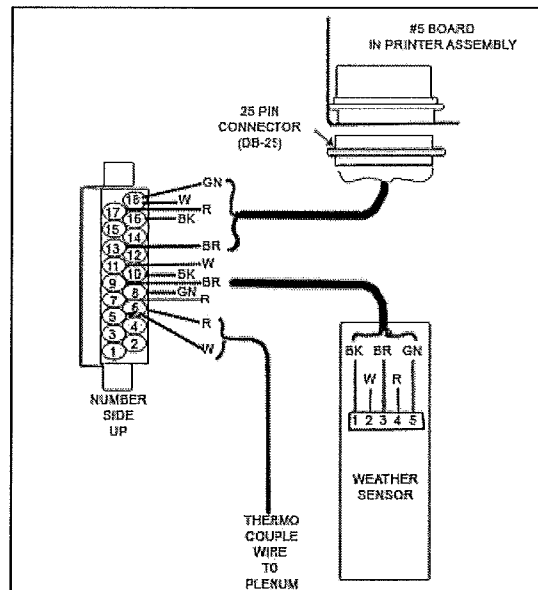
The weather sensor is not required for the proper operation of the monitor and printer.

It is recommended that the sensor be located about 20 ft. (6.1 m.) from the heat and humidity of the dryer.

There are five (5) colored wires connected to the weather sensor circuit board that will have to be connected to the (36) pin black connector (number side) that is attached to the top of the monitor and printer interface board holder in the control cabinet. The (5) wires are:

- White to terminal 11
- Black to terminal 10
- Brown to terminal 9
- Green to terminal 8
- Red to terminal 7

If the remote cabinet is a sufficient distance from the heat and humidity produced by the dryer, the weather sensor can be mounted to the outside bottom of the remote cabinet.



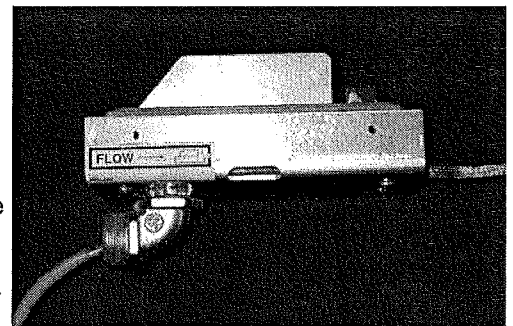
A 1-3/32" (27.8mm.) diameter hole must be drilled in the bottom of the remote cabinet. The special 1-1/16" (27 mm.) threaded bushing is then placed into the hole with the thread end to the bottom.

The 5-wire cable from the sensor board is pulled through the bushing and the mount housing is secured to the bottom of the cabinet by turning the bushing into the mount housing until tight. Place the 5 wires listed above into their correct terminals and tighten. See the wiring diagram above.

If the remote cabinet is located too close to the dryer, it should be relocated (20ft./6.1 m. from the dryer is recommended) if possible. Once a suitable location has been selected, secure the weather sensor mount housing.

A length of (5) wire cable may have to be spliced and soldered to the 8 ft. (2.44 m.) cable supplied with the weather sensor to reach the appropriate distance from the dryer. Be sure to allow 36" (92 cm.) from the bottom of the remote cabinet to the 36-pin black connector at the top inside of the cabinet.

The 5-wire cable should be placed into a separate 3/8" (9.5 mm.) flexible liquidtite conduit or a 1/2" (12.7 mm.) metal conduit from the sensor mount housing to the bottom of the control cabinet. No high voltage (115V) wires are to be placed in the same conduit as the 5 low voltage sensor wires.



Moisture Sensor

Printer Definitions

Printer Module and Printout

A "cold start" occurs when batteries are not installed or are weak and need replacing (approximately every 2 years).

This data needs to be entered for operation. If entry is not accepted, the question is repeated.

Acceptable number inputs are:

MM = Month	01 through 12
DD = Day	01 through 31
YY = Year	01 through 99
HH = Hour	01 through 12
MM = Minute	01 through 60

Prints out your entered information..

Automatically set at five minutes. Can be set from two minutes through 30 minutes.

Automatically set at "1."
Can be numbered up to "999."

Menu is printed when any key is pushed.
Data entered at cold start.
Battery backup, even with power loss.

Enter if other grain is run

1	—	Corn
2	—	Milo
3	—	Rice
4	—	Wheat
5	—	Soybeans
6	—	Sunflower
7	—	Other

Weather station input at time of printing. Reads "0" when not hooked up.

Header always printed after two hours of running time, moisture limit change, and moisture offset change.

Anytime you want to go to the menu, hit any key on the keyboard. This will interrupt the printing and print the menu.

NOTE: After you are finished using the menu, press "1" to again begin the readout. This will not affect the averaging, unless you had already reset the averaging.

```

COLD START - CHECK BATTERIES
ENTER THE DATE      MMDDYY
DAY? - SUN=1 M=2 T=3 W=4 T=5 F=6 SAT=7
ENTER THE TIME      HHMM (12 HR FORMAT)
ENTER 0 FOR AM OR 1 FOR PM
DATE THURSDAY 08-17-89 TIME 08:36A
ENTER 0 TO CHANGE OR # TO ACCEPT
CURRENT INTERVAL IS 5 MINUTES
ENTER 2-DIGITS OR # TO ACCEPT
CURRENT BIN IS #    1
ENTER 3 DIGIT NUMBER OR # TO ACCEPT
    
```

```

GRAIN TYPE? - CORN=1 MILO=2 RICE=3
WHEAT=4 SOYBEAN=5 SUNFLOWER=6 OTHER=7
-----
DATE THURSDAY 08-17-89 TIME 08:54A
1 TO BEGIN PERIODIC READOUT
2 TO CHANGE PRINT INTERVAL--NOW 5 MIN.
3 TO AVERAGE---BEGAN 08-17-89 AT 08:36A
4 TO CHANGE BIN NUMBER--NOW 1
5 TO CORRECT DATE/TIME
6 TO CHANGE GRAIN TYPE--NOW CORN
    
```

```

R.H. 67% CALIBRATION 0.0 PLENUM 00
HIT ANY KEY FOR MENU CORN
-----
TIME  MODE  GRAIN  GRAIN  AMB  AVE
          MOIST  TEMP  TEMP  MOIST
-----
09:09A  MON  15.0   77   76  14.8
09:10A  MON  15.2   77   76  14.8
09:10A  MON  14.6   77   76  14.8
    
```

Sample Printer Readout

Time:
Set at cold start.
Reset by menu input.

Mode:
MON=Monitor

```

03-11-98      SETPOINT 0.0      BIN #6
R.H.  67% CALIBRATION  0.0      PLENUM 00
HIT ANY KEY FOR MENU      CORN

MACH  GRAIN  GRAIN  AMB  AVE
TIME  MODE  MOIST  TEMP  TEMP  MOIST
-----
09:09A  MON  15.0    77   76   14.8
09:10A  MON  15.2    77   76   14.8
09:10A  MON  14.6    77   76   14.8
    
```

Not used

Moisture Offset:
Direct reading from the control panel calibration.

Not used

Ambient Temperature:
From weather station input at time of reading

Average Moisture:
Gives a running average of all readings since start of averaging time. Starts when unit is started after cold start or when reset from menu.

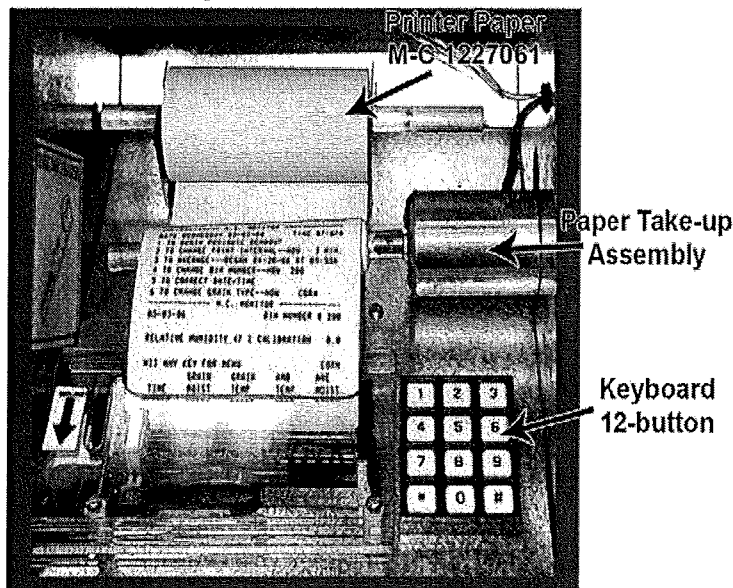
Grain Moisture:
Actual grain moisture at the sensor—temperature compensated.

Grain Temperature:
Actual grain temperature at the sensor.

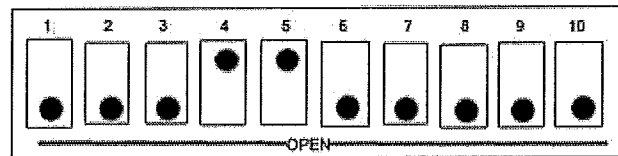
NOTE: To find when last average began, push any key from Line 3 of menu. Push "1" to restart printing.

NOTE: Replace batteries every year. Use two "AA" alkaline batteries. Turn off power to unit, replace the batteries, then turn on power and reprogram if "Cold start" notation is printed.

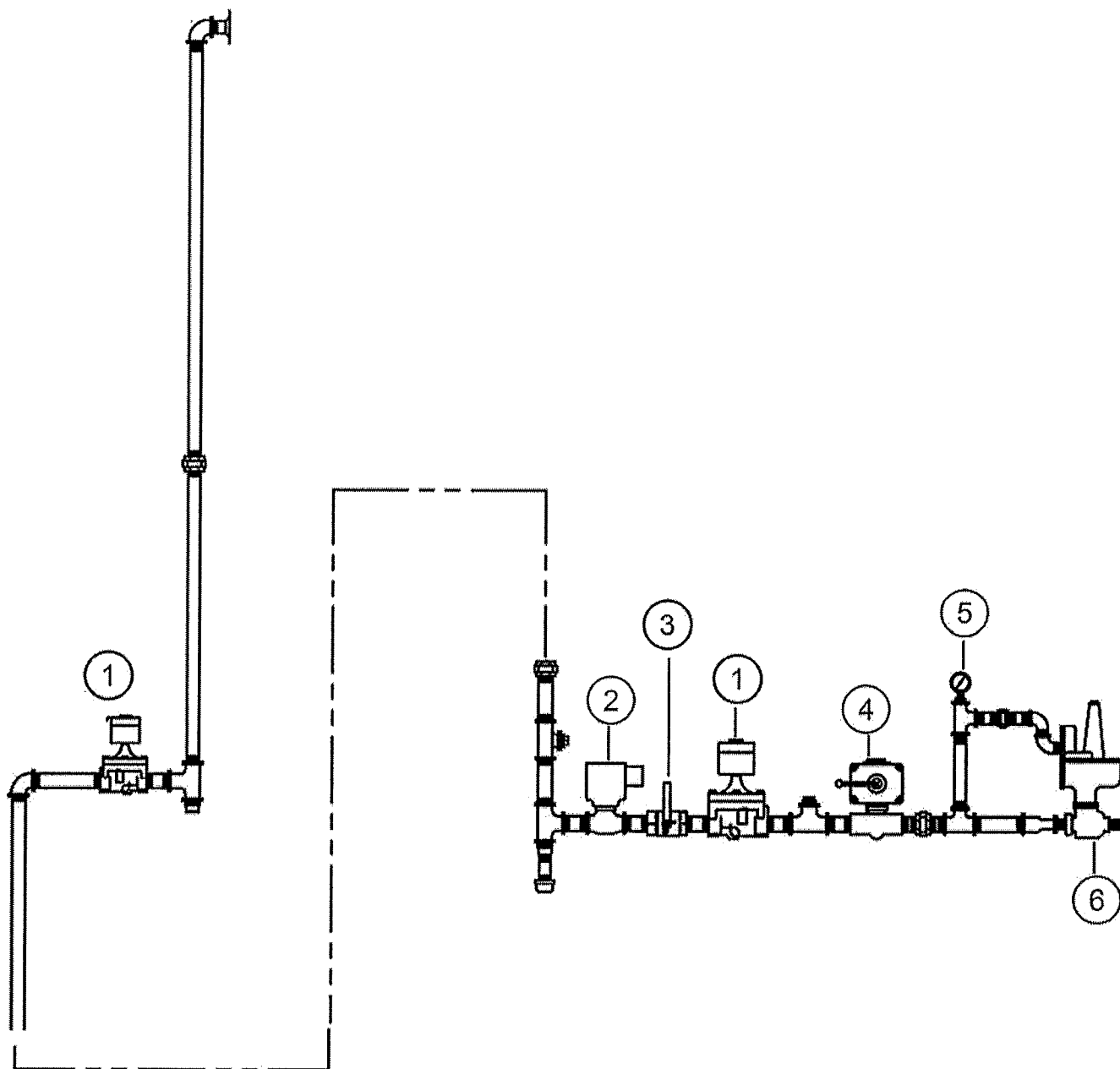
Printer Assembly



DIP SWITCH SETTING ON MONITOR BOARD

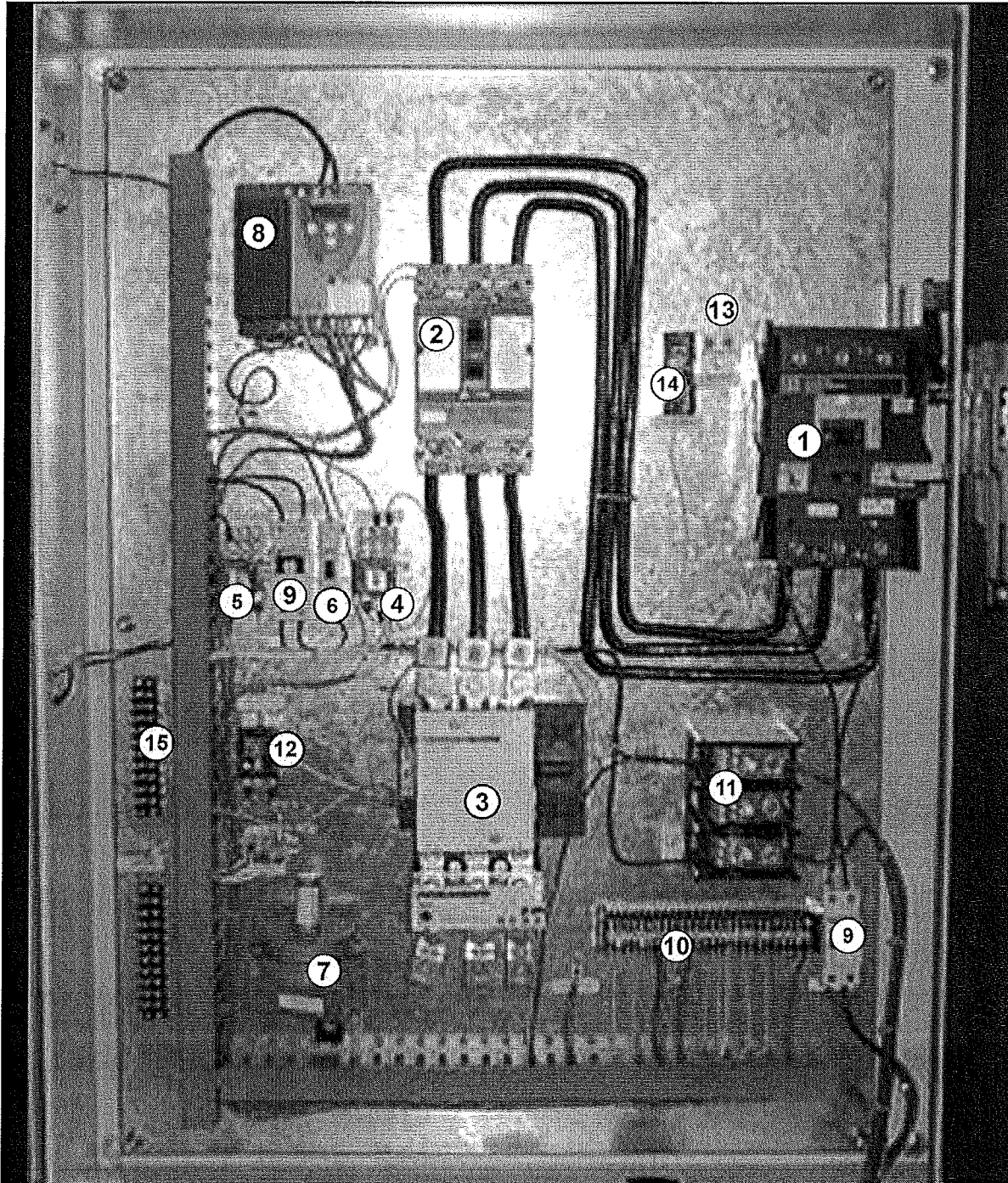


Gas Train Assembly



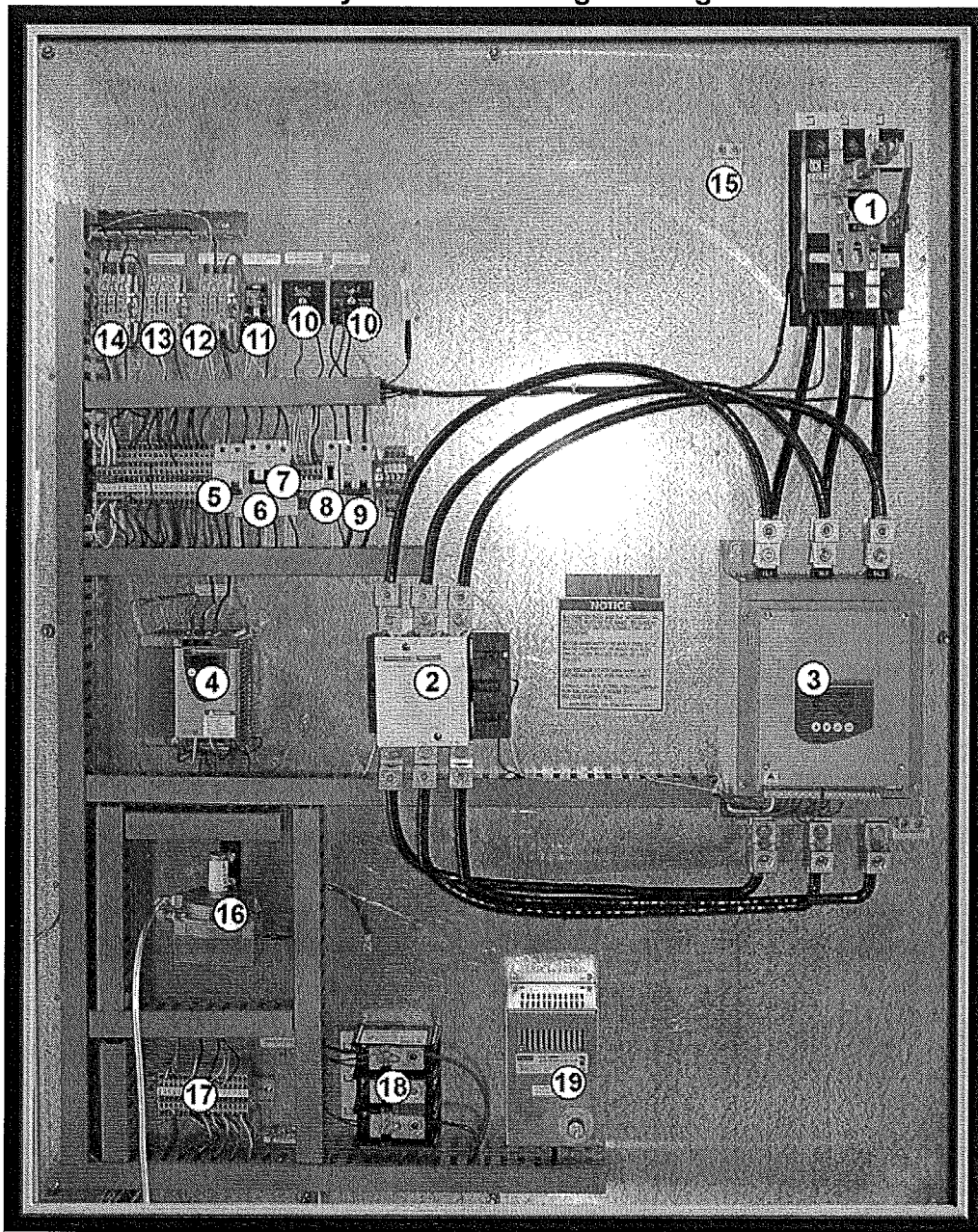
Ref.	<u>Description</u>
1.	Solenoid Valve
2.	Proportional Valve and Actuator
3.	Shutoff Valve
4.	Manual Reset
5.	Pressure Gauge 0-3 psig (0-20 kpa)
6.	Pressure Regulator

12' Tower Dryer Direct Start High Voltage Cabinet



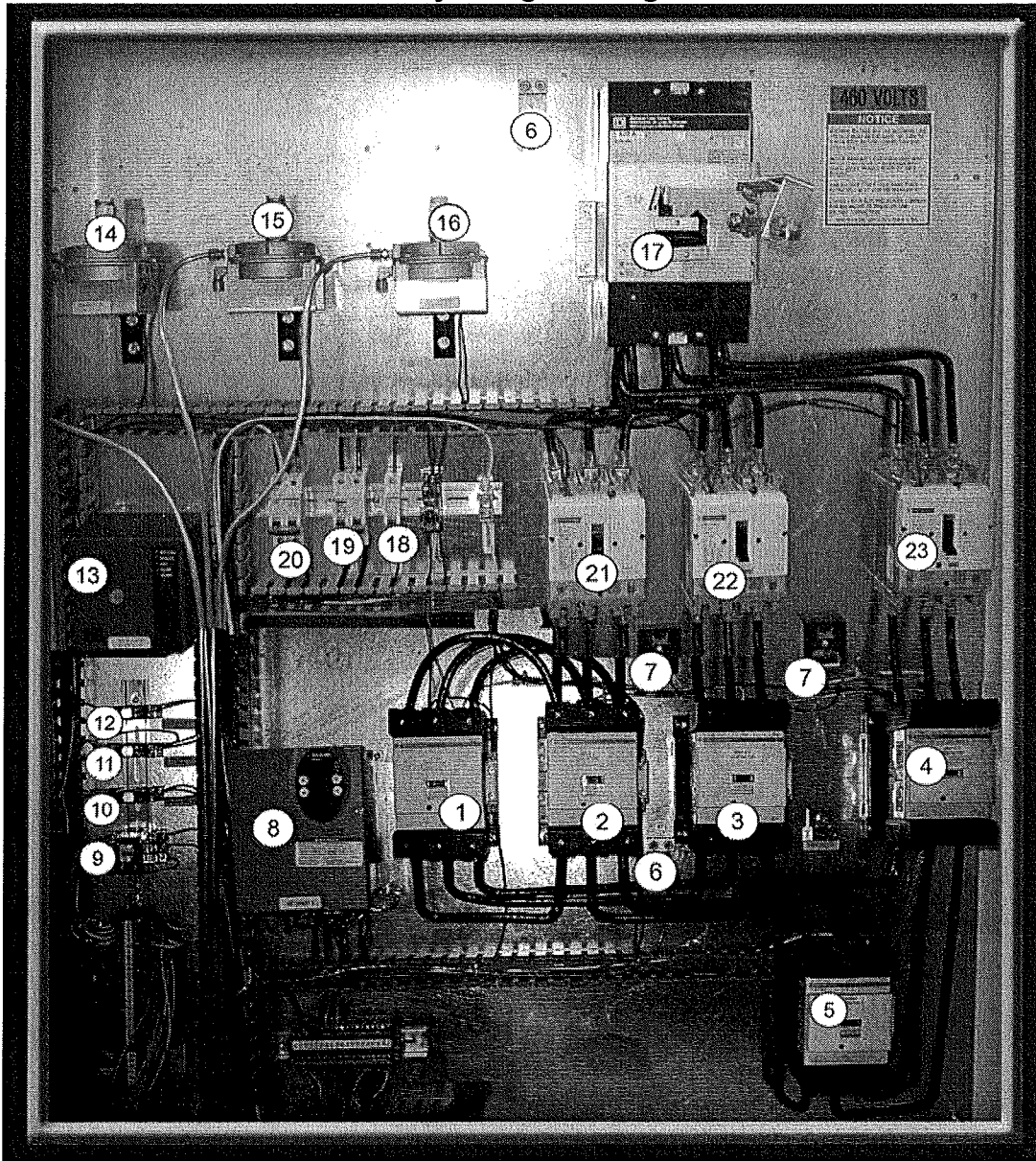
1 Disconnect Switch	9 Double Pole AC Drive Circuit Breaker
2 Manual Motor Protector	10 24 & 120 Volt Terminal Block
3 Motor Contactor	11 Distribution Block
4 Discharge Relay	12 Fill Relay
5 Alarm Relay	13 Ground Lug
6 Circuit Breaker 7 Amps-120 Volt	14 Isolated Neutral Block
7 Air Pressure Switch	15 Signal Wire Terminal Blocks
8 AC Drive Unit (VFD)	

12' Tower Dryer Soft Start High Voltage Cabinet



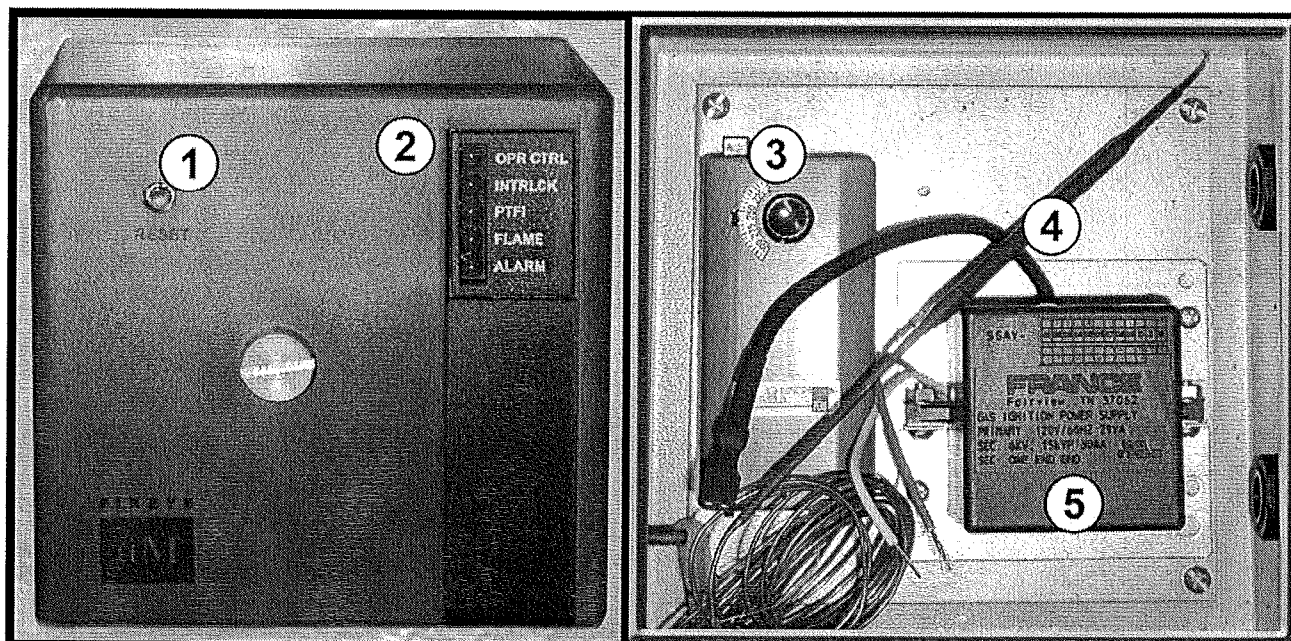
1	Disconnect Switch	11	Fill Relay
2	Motor Contactor	12	Fan Control Relay
3	Soft Starter	13	Alarm Relay
4	AC Drive Unit (VFD)	14	Discharge Relay
5	Double Pole 460V Transformer Circuit Breaker—25 Amps	15	Ground Lug
6	Double Pole Cabinet Heater Circuit Breaker—4 Amps	16	Air Pressure Switch
7	Single Pole Soft Starter Circuit Breaker—1/2 Amp	17	24 & 120 Volt Terminal Block
8	Circuit Breaker 7 Amps - 120 Volt	18	Distribution Block
9	Double Pole AC Drive Circuit Breaker—30 Amp	19	Cabinet Heater
10	Time Delay		

18' Tower Dryer High Voltage Cabinet



1 Start Contactor	13 Ignition Module
2 Fan #1 Contactor	14 Air Pressure Switch #1
3 Fan #2 Contactor	15 Air Pressure Switch #2
4 Fan #3 Contactor	16 Air Pressure Switch #3
5 Start Contactor B	17 Disconnect Switch
6 Ground Lug	18 8 Amp Circuit Breaker
7 Time Delay	19 2 Pole 25A, 277 VAC Circuit Breaker
8 3 HP AC Drive Unit	20 2 Pole 30A 277 VAC Circuit Breaker
9 Discharge Relay	21 Fan #1 Protector
10 Alarm Relay	22 Fan #2 Protector
11 Fan Control Relay	23 Fan #3 Protector
12 Fill Relay	

Ignition for 12' and 18' Tower Dryers



1	Reset Button
2	LED Indicator Lights
3	High Limit
4	High Limit Bulb
5	Ignition Transformer

LED Indicator Lights

OPR CTRL (Operating Control)

LED is energized whenever the burner control switch and all other various limit switches are closed and power is applied to Terminal #7.

INTRLCK (Interlock):

LED is illuminated whenever power is detected on Terminal #6, indicating that the air flow switch or other running interlock is closed. If the operating control is closed and the running interlock switch remains open, this LED will flash at a 1-second rate indefinitely for the MEP100 and MEP200 family. Lockout will occur if the switch remains open for 10 minutes in the MEP500 family. This LED will blink when configured as a flame switch and flame is detected.

PTFI: LED is illuminated only during the pilot trial for ignition period and the stabilization period when so equipped.

Flame: LED is on whenever a flame signal is detected, and the control is not in a locked-out state.

Alarm: LED flashes when an alarm condition is detected and is used as an address indicator. During an alarm condition, the Alarm LED is made to flash at approximately a 1-second rate. The remaining four LEDs are illuminated as a coded sequence identifying the reason for the lockout. For instance, for a LOCK OUT - FLAME FAIL - PTFI, the INTER-LOCK, PTFI and FLAME LEDs will all be lit steady, with the Alarm LED flashing. This remains true if power is removed and then restored in a locked-out condition.

While in the Idle or Off state, the LEDs are made to flash sequentially to show the operational status of the control every minute. The LEDs can be tested by pressing and releasing the reset push button, while in the Idle or Off state.

Section 2

Operation

START-UP PROCEDURE

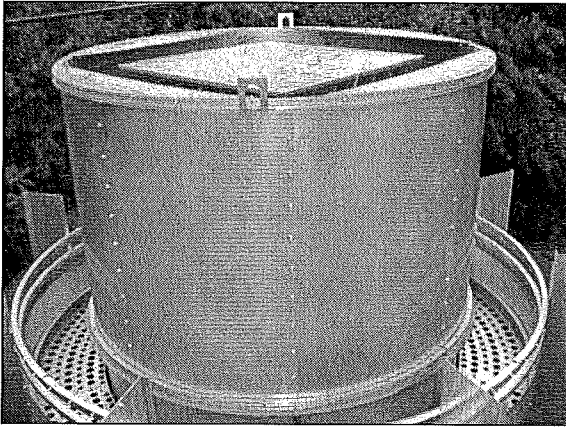
General

IMPORTANT: 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.



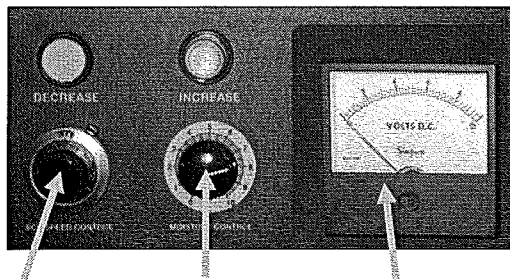
CAUTION: Lock out and tag out high voltage disconnect when working inside any control cabinet or inside the dryer.

BE SURE TO REMOVE THE BURNER COVER!



1. Adjust the high limit and cold limit thermostats inside the cooling section of the dryer. Items are located inside the 12" x 12" cabinet. Set the high limit at 30 to 50 degrees above the drying temperature. Set the cold limit at 120° or below. 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 the pipe cap from the vapor line to the burner and open the hand valve to allow any built-up water to drain from the gas lines. Once the 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.
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. Turn all rotary switches in the remote cabinet to the OFF position. Turn the low temperature shutdown switch to the START position.
6. Make preliminary adjustments to timers located in the remote cabinet. Adjust the fill timer to 60 seconds and the grain flow timer to five minutes. Make sure that the arrows on the grain flow timer are set at 10x and M (minutes). This can easily be adjusted with a small flathead screwdriver.
7. Turn the disconnect on the high voltage cabinet to the ON position.
8. Turn the power switch to the start position. The ON light should energize.
9. 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.
10. Turn the fill switch to the MANUAL position and allow the dryer to completely fill. Once the dryer is filled, turn the fill switch to the automatic position.
11. Adjust the air pressure switch (located inside the high voltage cabinet) so that 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 the grain columns start to empty, the air pressure light should de-energize. To adjust the air pressure switch, perform this operation when the fan is running and the grain columns are full. Turn the adjustment screw clockwise until the air pressure light goes out, then slowly turn it counterclockwise until the light comes back on. Then add 1/2 turn counterclockwise.
12. Open the hand lever on the Maxon valve to the OPEN position. The valve is located on the gas train alongside the dryer base. The valve has a sight gas to indicate the status of the valve (OPEN or SHUT).
13. Open the hand valve on the gas train, which is located downstream of the optional Maxon valve. Gas pressure should be indicated on the gauge located on the gas train.
14. Turn the ignition switch to the ON position. 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).
15. The Honeywell gas controller should display M for manual and 30% for the percentage the valve is open. If the burner does not light on the second trial for ignition, adjust the manual percentage plus or minus up to 10% change of opening. This is a trial-by-error process to achieve the right air to gas ratio for the installation.
16. Once the burner is lit and the gas valve light is energized for longer than 10 seconds, press the Auto/Man key on the Honeywell controller. The "M" will change to "A" for automatic control. Then, using the arrow keys, scroll number up to desired plenum temperature. Once in the automatic position, the controller will display two numbers. The upper number is the actual plenum temperature in Fahrenheit. The bottom number—SP—is adjustable with the arrow keys.

17. The plenum temperature may take up to 30 minutes to stabilize. The controller is programmed to slow down the rate at which the 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.
18. Once the plenum has reached the desired temperature, turn the low temperature shutdown switch to the RUN position. If the burner flame is extinguished for any reason, the plenum will lose temperature and the dryer will shut down. The Honeywell will automatically shut down the dryer if there is a fluctuation in temperature that exceeds 40 degrees from the set point.



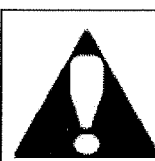
SCR Speed Control Dial Moisture Control Discharge Meter

19. Test moisture content of the grain being discharged every (15) minutes until it stabilizes.
20. If the moisture content is too high after it stabilizes, turn the manual speed control dial down to a lower number to decrease the unloading speed. If it is too low, turn the speed control up to a higher number to increase the unloading speed.

NOTE: After any adjustment of the discharge speed, wait 1 1/2 to 2 hours to make further speed 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.

FILLING THE DRYER

NOTE: Always have the fan running before filling 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.

19. Once you are satisfied with grain discharge moisture content, it is time to balance discharge (+, -) lights. First, turn the moisture control knob until both discharge lights go out simultaneously. This is the dryer discharge set point. It is now time to turn the Manual/Auto switch from the Manual to the Automatic position. The discharge speed meter should not change speed while changing from the manual to the automatic position on the switch.
20. Once you have the dryer discharge in automatic mode, the discharge speed will change to maintain the desired grain moisture content. When the minus light (-) is on, the system is decreasing speed to maintain moisture content. When the plus (+) light is on, the system is increasing speed to maintain moisture content. Once in automatic mode, the manual speed control dial is no longer functional.
21. To change moisture content while remaining in automatic, use the moisture control knob. The knob is graduated 0 to 10, with 0 being the wetter value and 10 being the drier value. To change the discharge moisture content, simply turn the moisture control dial up to a higher number for drier grain and the minus (-) light will come on. Turning the moisture control dial down to a lower number for wetter grain will cause the (+) light to come on.

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.

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.

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 empty lamp will light.

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

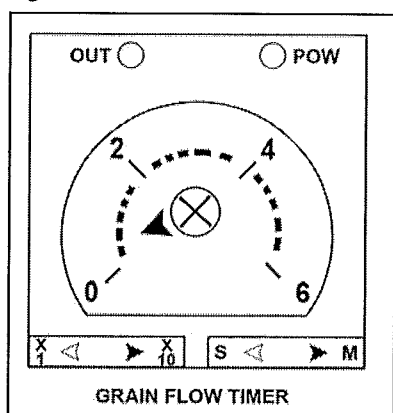
1. Set the adjustable 0 to 3 minute fill switch delay to the time desired.
2. Flip the wet grain toggle switch or turn the fill dial switch (remote cabinet) to the MANUAL position (bypassing the 0 to 60 minute low grain timer). The filling (fill) light will now be ON.
3. After the desired time (0 to 3 minutes) is reached on the rotary fill switch delay, the fill system will start to fill the dryer with wet grain until it reaches the rotary fill switch in the hopper. When the rotary switch opens from the pressure of the wet grain, the fill system stops and the filling (fill) light goes out.

Setting the Grain Flow Timer

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

Conveyor Fill System (Slave System)

1. Set the adjustable wet fill delay for the desired time (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

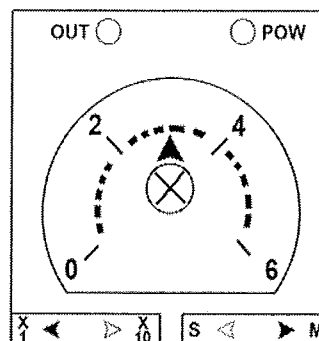
3. Check the refill time a minimum of 6 times. The filling (fill) light will come on when the rotary fill switch in the hopper signals for grain and will go out when the hopper is full. The length of time that the filling (fill) light is on is the refill time (including the 0- to 3-minute delay).
4. Average 6 refill times and reset the grain flow timer to run 5 minutes longer. For example, if it takes the fill system an average of 5 minutes to refill the dryer, set the grain flow timer to run 10 minutes.

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

Gravity Feed Tube System (Choke Fill System)

1. Set the timer for the desired refill time 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 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 5 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 5 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.

5. Turn Power On switch to the OFF position, then back to the ON position to reset the grain flow timer.
6. 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 Fan & 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 Control switch to ON and allow time to power up the Honeywell unit. The proportional valve will open and hold lighting position or manual percentage open.
4. Once the burner is operating, depress the M-A Reset on the temperature controller and change to Automatic mode. The controller will drive the plenum temperature to the set point.

NOTE: The 12-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 fire eye 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. After the flame is established, **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. If the LP gas line freezes, close the gas vapor hand valve and flip or turn (remote) the burner switch to OFF. After the gas line thaws out, repeat steps 3 and 4 but open the gas vapor hand valve **slower**.
7. Turn the burner switch OFF then ON again; a new trial for ignition will take place.

NOTE: If the burner fails to light, turn OFF and LOCK electric power to dryer. Close liquid LP intake valve and gas vapor valve. Now check wires to electrodes and ignition boards looking for loose, burned or broken wires or poor connections. Also check ignition switch with a continuity tester.

8. If the High Limit light will not come on, push the reset button on the high limit switch, located in the burner housing with ignition transfer.

NOTE: When the high limit switch trips out, the dryer will shut down. The high limit light will not energize and the fan and burners will have to be restarted.

9. Push the control circuit switch up to START or turn the Power On switch to the ON position and release.
10. Start the fan by pressing the FAN START BUTTON. Check to make sure that the indicator light for the air pressure switch is on.
11. Open the gas vapor hand valve halfway.
12. Turn the burner switch to the ON position. The gas valve light will light and the burners will ignite.
13. The gas pressure reading on the low pressure gauge should indicate from 0.75 to 3.0 (10 to 20.7 kPa.) to maintain the drying temperature during variations in the outside temperature (especially when drying at night).

Setting the 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 Honeywell.
2. Press Arrow ▲ or ▼ to desired percentage open in manual. Press “Lower Display” until SP_____ is displayed. Press Δ or ∇ until desired temperature is displayed. The lower display key will cycle display information.

NOTE: After the dryer has been operating for one half (1/2) hour, check the Honeywell. 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.

Drying Temperatures			
Model	Corn	Sorghum & Wheat	Sunflowers, Oats, Barley, Soybeans
	Dry & Cool	Dry & Cool	Dry & Cool
2000	210	160	130
2400	210	160	130
3000	210	160	130
3500	210	160	130
4000	210	160	130

Manual Discharge Mode

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

The momentary position energizes the relay coil to hold the circuit through one pole of the relay. The other pole closes a path between the C3 & C4 terminals to control the external takeaway system.

The right side discharge switch is labeled "metering" and is a three-position maintained switch (MANUAL, OFF, AUTO) that controls the discharge relay. The motor speed reference is either manual (potentiometer) or auto (moisture 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 placing the Moisture-matic or Metering Switch (remote) into AUTOMATIC, the dryer should be operated in the MANUAL position to establish a setting on the Manual Speed Control Dial 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 Set Point dial or Moisture Control dial is set at 0.
2. While the Moisture-matic or metering switch (remote) is in MANUAL, turn the Auto Set Point Dial or Moisture Control Dial (remote) clockwise to balance the moisture control system to the point at which both the (-) Decrease and (+) Increase lights are off. At this point, the Moisture Control System is calibrated to the moisture content established in the MANUAL position.
3. Turn the metering switch to AUTOMATIC on the remote panel.

Now the manual speed control is OFF and the discharge rate is being controlled by the moisture control board, thermistors and the setting on the auto set point dial or the moisture control balance dial on the remote panel.

The unloading speed on the discharge meter should be the same as when the switch was in MANUAL, but the meter 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 (-) decrease light will come on and the discharge meter indicator will drop until the unload speed is automatically adjusted. When the adjustment is completed, the (-) decrease light will go out and the discharge meter indicator and the unload speed will remain constant until after another change is required.

If the discharge speed increases because the incoming grain is drier, the (+) Increase Light will come on and the discharge meter indicator will move up until the unload speed is automatically adjusted. When the adjustment is complete, the (+) Increase Light will go out and the discharge meter indicator and the unload speed will remain constant until another change is required.

The system will automatically change speed (+) increase or (-) decrease to keep the discharge grain at the moisture content that was selected when the moisture control system was in the MANUAL position.

If the discharge speed increases because the incoming grain is drier, the (+) increase light will come on and the discharge meter indicator will move up until the unload speed is automatically adjusted. When the adjustment is completed, the (+) increase light will go out and the discharge meter indicator and the unload speed will remain constant until another change is required.

The system will automatically change speed (+) increase or (-) decrease to keep the discharge grain at the moisture content that was selected when the moisture control system was in the MANUAL position.

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 decreased. The automatic moisture 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 six 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 3HP variable speed 3 phase 230V AC motor and reduction gearbox drive.

1. The discharge system is started by placing 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 MANUAL 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 manual speed control dial and appears on the discharge speed meter. The speed control dial is graduated from 0 (slow) to 10 (fast).
3. When the metering switch is in the AUTOMATIC position, the speed of the discharge system drive motor is determined by the moisture control board, thermistors, and setting of the Auto Set Point Dial.

When the moisture content of the incoming grain increases, the thermistors sense the change in grain temperature (cooler) and signal the automatic moisture control board to slow down or stop the discharge system motor to prevent the discharge of wet grain from the dryer when moisture is above the setting of the auto set point dial.

When the moisture content of the incoming grain decreases, the thermistors sense the change in grain temperature (warmer) and signal the automatic moisture control board to increase the speed of the discharge motor to prevent over drying of the grain.

Moisture Control Settings and Adjustments When in Automatic

The discharge rate will change to keep moisture content the same as when in manual. However, if you want to change the discharge moisture content when operating in automatic, simply turn the Moisture Control Dial **UP** to a higher number for **drier** grain and **DOWN** to a lower number for **wetter** grain. When you turn the dial, either the (+) increase light or the (-) decrease light will come on and you will see the discharge meter indicator change to reflect the change in speed.

Approximate Discharge Speed Dial Settings			
Model	Crop and Drying Mode	Moisture Removal	
		20%-15%	25%-15%
2000	Corn—Dry & Cool	6.0	3.0
2400	Corn—Dry & Cool	7.0	3.5
3000	Corn—Dry & Cool	5.5	2.7
3500	Corn—Dry & Cool	6.5	3.5
4000	Corn—Dry & Cool	7.5	4.1

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 the gas vapor hand valve and liquid line intake valve on dryers equipped with liquid propane (LP) burners.
3. Operate the fan for about 15 to 20 minutes to cool the grain in the dryer, then turn off the fan and flip the Power On switch to OFF.
4. Turn off and lock the electric power supply to the dryer.

Next Day Start Up

1. Turn on electrical power to the dryer. Turn the Power On switch to ON, place the wet grain switch or fill switch into AUTOMATIC, place the low temperature shutdown switch into START, and push the green button to start the fan.
2. Open the liquid propane (LP) gas supply valve at the tank or the natural gas (NG) supply valve and liquid line intake valve on dryers equipped with liquid propane burners. Now open the vapor hand valve.
3. Start the burners. Allow the thermometer to reach drying temperature before turning the discharge auger switch to ON and releasing. Now turn the metering switch to MANUAL.
4. After the dryer has been unloading grain for at least 15 minutes, the metering switch can be placed into AUTOMATIC.

DO NOT ATTEMPT TO RE-BALANCE THE MOISTURE CONTROL SYSTEM.

Going Back to Manual

You can switch back to MANUAL at any time. Just turn the metering switch (remote) to the MANUAL position. At this time, the moisture control system will be off and the discharge system speed will be controlled by the manual speed-control dial. The discharge meter will indicate the manual speed setting. If you want to unload at the same speed in manual as automatic, adjust the manual speed control dial until the discharge meter needle is at the same reading as in automatic.

When operating in MANUAL, the (+) increase and (-) decrease lights may be lit. However, they are only indicating what would happen if you were in AUTOMATIC based on the set point of the moisture control knob. When in MANUAL you can balance the (+) increase and (-) decrease lights, but unless you go to the AUTOMATIC position, nothing will change. In the MANUAL position, the discharge rate can only be changed by adjusting the manual speed control dial.



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 Shut Down

When the last grain to be dried has been put into the dryer, switch the discharge auger switch (remote) 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 the 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 the gas vapor hand valve (handle 90° to the piping). For LP gas, close the liquid intake valve. Run the fan approximately 20 minutes to cool the grain in the dryer.

After cooling, shut off the fan and empty the dryer by placing the discharge auger switch in the ON position. Wait until the last of the grain has been removed from the dryer discharge auger by the customer's dry grain takeaway equipment. place the discharge auger switch into the OFF position to stop the discharge motor.

Grain Storage

Tower dryers are not designed to be a grain storage device! Once the grain has been 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 of internal problems increases.

The recommended tool for cleanout is air—preferably from a vacuum; however, using a non-metallic brush or broom is also recommended. 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 as possible. The grain flow timer needs to have the time frame decreased. The time frame should be near 5 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 buildup 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 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 common, but if the dryer is empty, water may get inside the plenum chamber, which can result in additional inside maintenance. When the outside screens become fully plugged, the inside screens should also be checked. When air is not passing through the grain column, the inside screen will not self clean. If inside screens plug, they will create a debris buildup on the outside. The two surfaces are dependent on each other to be free of 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 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 loose bolts or screws. Tighten as needed.
5. With a non-metallic brush or broom, sweep the 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 clear 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 dryer capacity.
10. Wipe down and calibrate moisture sensors.
 - If sensors are reading high, extra fuel is being used to dry the grain.
 - If sensors are reading lower than actual grain moisture, the risk of spoilage and reduced quality can occur.
11. Inspect any loose bolts or screws. Tighten as needed.
12. Re-engage both electrical power and gas fuel supply.
13. Once the dryer is back to normal operation, inspect the columns for grain movement. The grain should be moving down the grain column and if it is not freely moving, the grain dryer should be manually shut down. Empty the dryer to detect whether all the columns are moving when the discharge is running. This will tell you whether or not there is a problem. If all the columns are properly moving, fill the dryer and restart the drying process. If the grain is not moving, a cause must be determined. Buildup of debris near the metering system can keep the grain from exiting the dryer. This must be cleared manually before starting to dry grain through the dryer.

Preseason check

1. Clean out heating and cooling chambers.
2. Remove the weather cover from the burner. Also at this time, check the spark plugs and wires for cracks, heat damage and loose connections.
3. Check wires in the Ignition Board Box(es) located in the upper cooling section, for cracks and loose connections.
4. Grease the fan motor bearings. Apply grease until it comes out the relief port. Use Chevron SRI-2 grease or equivalent.
5. Check oil in the 50:1 gearbox and grease top bearing. The oil must be at least 1/4" over the gears.
6. Grease the U-Joint on the 50:1 gearbox drive shaft.
7. Grease the belt tightener pivot.
8. Replace the spring tension on the belt tightener.
9. Grease the 1" discharge system Jackshaft bearings.
10. Liquid Propane - Remove the plug at the end of the gas strainer, remove screen and clean it. Replace screen and plug.



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.

11. Unlock the control cabinet door. **Make sure power is still OFF!** Check all wires for cracks, nicks and loose connections, especially on High Voltage wires. Also, be sure to check the connections on the earth ground wire lug in the control cabinet and at the copper ground rod next to the dryer.

Post-Season Dryer Maintenance

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 the supplied weather cover over the burner.
3. Using a non-metallic brush or broom, sweep the inner screen clean going from the top down to the bottom.
4. Sweep out the heat floor to remove any debris from it.
5. Open the cooling floor access door and sweep out all the 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 that one of them needs to be replaced. Make a note to replace any that are suspicious. Inspect any drive belts and chains to note if any need replacing. Lubricate the chains for the winter.

8. Use a power washer on the outer screens if dirt has filled the perforations.
9. Remove the 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 the fan bearings with Chevron SR1-2 or equivalent.
12. Use a vacuum cleaner to remove any dirt from the control cabinet.
13. Place the supplied weather cover over the burner.

End of Season dryer Shutdown

Once the dryer has completed drying for the season, it must be emptied and cleaned out. The use of a 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 to the dryer. 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. Cleanout of the machine is crucial for the preservation of grain and mandatory for safe operating conditions.

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 put out 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 already 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.

Changing Settings on AC Drive

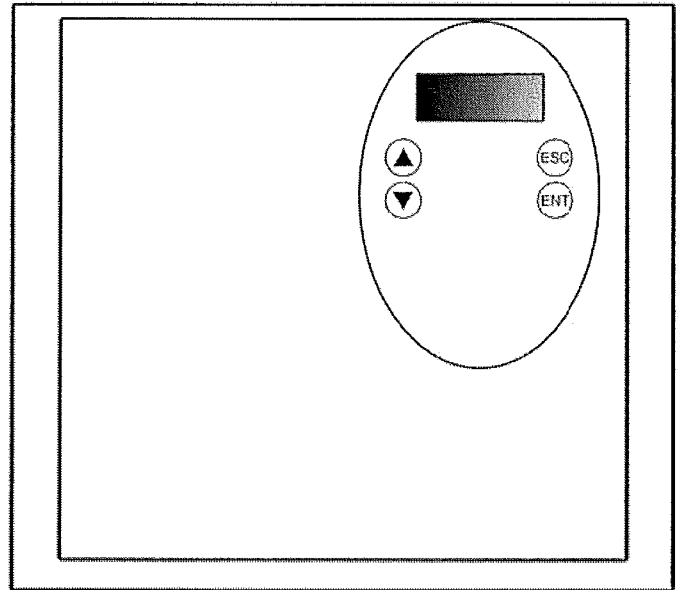
The AC drive arrives from the factory programmed with the correct default settings. It is unlikely that you will ever have to change the settings on the AC drive, but if you do, the chart on the following page lists all the menus and parameters.

The AC drive has various menus (SEt, drC, I-O, FUn and SUP), which are subdivided into various parameters to which users can navigate using the arrow keys.

Most parameters will never need adjustment, with the exception of the High Speed parameter, the default setting of which is its highest setting. If your takeaway system cannot accommodate that level of output, you may need to set it at a lower speed. You can reset it later if you upgrade your system.

To Change a Setting:

1. Press "ENT" then the down arrow until the desired menu is displayed ("SEt" for example).
2. Press "ENT" to Enter the SEt menu.
3. Arrow down to the desired parameter within that menu.
4. When you have reached the desired parameter, press "ENT" to view its current setting.
5. Press the arrow keys to adjust that setting, "ESC" to cancel a change or "ENT" to save a change.



AC Drive

DANGER: HAZARDOUS VOLTAGE



The AC Drive Capacitor can continue to discharge voltage for up to 20 minutes after the 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.

DISCHARGE AC DRIVE SPEED CONTROL

Keypad Instructions:

Keys are:

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

AC Drive Parameters

MENU	Parameter	Description	Value 5HP/2HP
SEt	ACC	Acceleration Time	5sec
	dEC	Deceleration Time	5sec
	LSP	Low Speed	5.0
	HSP	High Speed	60hz
	lth	Motor Thermal Current	12.2/6.3
	UFR	IR Compensation	25
	FLG	Frequency Loop Gain	20
	StA	Frequency Loop Stability	20
	SLP	Slip Compensation	100
	tdC1	Auto DC Injection Time	0.5 s
	SdC1	Auto DC Injection Current	7.7
	tdC2	2nd level DC injection time	0 s
	SdC2	2nd level DC Inject Current	
	JPF	Skip frequency	0 Hz
	JF2	2nd skip frequency	0 Hz
	SP2	Speed preset 2	10 Hz
	SP3	Speed preset 3	15 Hz
	SP4	Speed preset 4	20 Hz
	CLI	Limiting Current	15.0/8.5
	tLS	Low Speed Operating Time	0 (disable)
	Ftd	Motor Frequency Threshold	
	ttd	Motor Thermal Threshold	
	Ctd	Motor Current Threshold	
	SdS	Scale Factor for SPd 1/2/3	
	SFr	Switching Frequency	4 kHz

MENU	Parameter	Description	Value 5HP/2HP
drC	bFr	Motor Frequency	60 Hz
	UnS	Nominal Motor Voltage	230
	FrS	Nominal Motor Frequency	60
	nCr	Nominal Motor Current	12.2/6.8
	nSP	Nominal Motor Speed	1725
	COS	Motor Power Factor	0.88
	rSC	Cold State Stator Resist	nO
	tUn	Auto Tuning	nO
	tUS	Auto Tune Status	tAb
	UFt	Voltage/Freq ratio	n
	nrd	Random switching freq	yES
	SFr	Switching frequency	4kHz
	tFr	Max Output Frequency	60Hz
	SSL	Suppress Speed Loop	nO
	SCS	Save Parameter Config	nO
	FCS	Restore Factory Settings	nO
	I-O	tCC	Type of Control
tCt		Type of 2 wire Control	trn
rrS		Reverse	nO
CrL3		Current Input Low	n/a
CrH3		Current Input High	n/a
AOlt		Analog Output Config	IOU
dO		Analog/Logic Output	OFR
r1		Relay R1	FLt
r2		Relay R2	nO
SCS		Configuration Backup	nO
FCS	Reset the Configuration	nO	
FUn	stC-	Stop Control	
	Stt	Normal Stop Type	nSt
SUP		Monitoring Parameter	FrH or LCr Freq. or Current

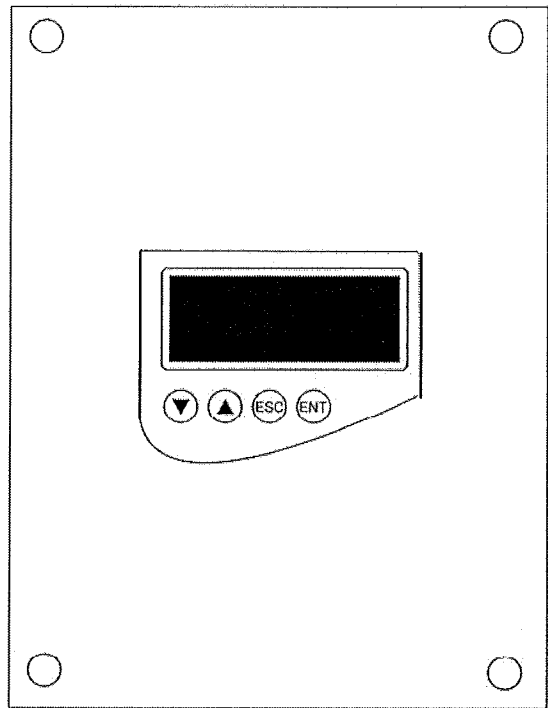
NOTE: The same AC Drive is used to run a 5HP motor for 12' Towers and a 2HP motor for 18' towers.

Changing Soft Starter Parameters

The soft starter has a Menu/Parameter organizational structure similar to that of the AC Drive. A list of soft starter parameters appears on the following page.

There is a basic procedure for changing parameters:

1. Press the down arrow key until the desired menu is displayed.
2. Press "ENT" to enter that menu level and display the parameters.
3. Use the arrow keys to navigate to the desired parameter and press "ENT" to see the current value.
4. If necessary, adjust the value using the arrow keys.
5. Press "ENT" to save the adjustment. Press "ESC" to erase changes.



Example: Soft Starter

SOFT STARTER PARAMETERS

NOTE: The soft starter is rated to start the blower once every 10 minutes. If longer than 10 minutes, it will overheat and fault out.

MENU	Parameter	Description	Value	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	Decel Ramp Time	n/a	n/a	
	brC/EbA	Brake Torque	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 Thresh.	n/a	n/a	
	PHr	Phase Protection	nO	nO	
	tbS	Time Before Start	2	2	
	PHL	Phase Loss Threshold	10	10	
	PtC	Monitoring Probes	OFF	OFF	
	ArS	Automatic Restart	OFF	OFF	
	rH	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	AUt	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	

Motor HP	Voltage	Reference Current from Motor Nameplate REF	Thermal Class 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

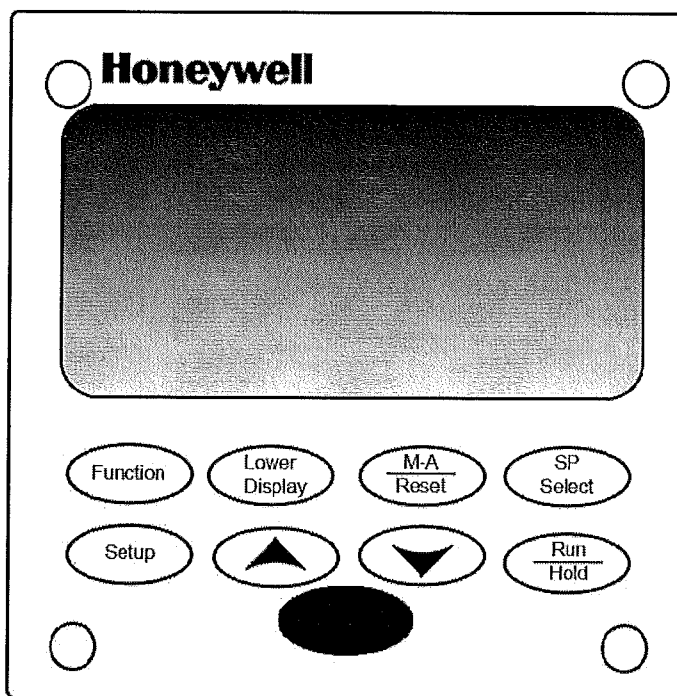
Menus below are not typically adjusted (use defaults)

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 limit2	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

Activates Shunt Trip

Note: Only the 6 parameters in **BOLD** are changed from default values. See chart on the right for motor specific values.

HONEYWELL CONTROLLER PARAMETERS



Operation	Key	Result
Enter Setup Mode	Setup	Lower Display = LOCK (This is the first Setup Group Title)
Select any setup group	Setup	Displays the other setup group titles in sequence. The arrow keys can also be used to scan the Setup groups in both directions. Stop at the setup group title that describes the group of parameters you want to configure.
Select a function parameter	Function	Displays the other function prompts of the setup group in sequence.
Change the value or selection	Up or Down Arrow keys	Increments or decrements of value or selection that appear for the selected function prompt. If you change the value or selection of a parameter while in Setup mode and then decide not to enter it, press M-A/RESET once—the original value or selection is recalled.
Enter the value or selection	Function	Enters value or selection made into memory after another key is pressed.
Exit Configuration	Lower Display	Exits configuration mode and returns indicator to the same state it was in immediately preceding entry into the setup mode. It stores any changes you have made. If you do not press any keys for 30 seconds, the indicator times out and reverts to the mode and display used prior to entry into setup mode.

HONEYWELL CONFIGURATION

Setup Group	Function Prompt	Value or Selection	Factory Setting
TUNING	PB	28.7	1.000
	RATE T	0.21	0.00
	I MIN	0.83	1.00
	MAN RST	0	0
	SECUR	0	0
	LOCK	NONE	DIS
	AUTOMA	ENAB	ENAB
	RN HOLD	DIS	ENAB
	SP SEL	DIS	ENAB
SP RAMP	SP RAMP	DIS	DIS
	SPRATE	DIS	DIS
ATUNE	FUZZY	DIS	DIS
	TUNE	TUNE	TUNE
	AT ERROR		---
ALGOR	CTRALG	PID A	PID A
	TIMER	DIS	DIS
OUTALG	OUTALG	CUR	
	CRANGE	0-20	
INPUT 1	IN1TYP	100L	K H
	IN1 HI		300
	IN1 LO		-300
	RATIO1		1.000
	BIAS 1		0.0
	FILTR1		1.000
	BRNOUT		UP
INPUT 2	IN2TYP	DIS	
CONTROL	PIDSET	ONE	ONE
	LSP'S	ONE	ONE
	SP TRK		NONE
	PWR UP	MAN	ALSP
	PWROUT		LAST
	SP Hi	260	
	SP Lo	0	0
	ACTION	REV	REV
	OUT Hi	100	100
	OUT Lo	5	0
	HYST		0.5
	FAIL SF	25.0	0.0
	FS MODE		NO_L
	PBorGN	PB	GAIN
	MINRPM		MIN

Setup Group	Function Prompt	Value or Selection	Factory Setting
COM	ComADD		3
	COMSTA		DIS
	BAUD		2400
	TX_DLY		1
	IRENAB		ENAB
	ALARMS	A1S1TY	DE
A1S1VA		40.0	90
A1S1HL		HIGH	HIGH
A1S2TY		NONE	NONE
A2S1TY		DE	NONE
A2S1VA		40.0	
A2S1HL		LOW	
ALMHYST		0.5	0
ALARM1		LACH	NO L
BLOCK	AL2	DIS	
DISPLAY	DECMAL		8888
	UNITS		F
	FREQ		60
	HOLDSP		DIS
	DISPLY		PRN
	LNGUAG		ENGL

Values from Field Tune with Belimo

Changing the Honeywell Controller Parameters

Setup Group:

To go through the setup groups, press the **SETUP** button until desired setup group is reached.

Function Prompts:

1. After reaching the desired setup group, press the **FUNCTION** key to go through the function prompts.
2. After reaching the desired function prompt, press the up or down arrows to adjust to the desired value.
3. Once a value is selected, press the **LOWER DISPLAY** button to save and exit Setup.

Manual-Auto Reset Button:

1. The upper right hand corner of screen will display **MAN** (Manual) or **A** (Auto). Press the M-A Reset button until **A** is displayed.
2. Press the **LOWER DISPLAY** button until the **SP** is visible at the bottom middle portion of the screen. Press the up or down arrow until the value to the right of **SP** is your desired plenum temperature in degrees Fahrenheit.
3. Press the **LOWER DISPLAY** button until the words "**NO TUNE**" are displayed at the bottom middle of the screen. Press the up arrow until the words **DO SLOW** are displayed. If "NO TUNE" is not available, then:
 - Press the **SETUP** button until **ACCUTUNE** is displayed in the middle of the screen.
 - Press the **FUNCTION** button until **ACCUTUNE** is displayed in the middle of the screen.
 - Press the up or down arrow until **TUNE** is displayed below **ACCUTUNE**

LOWER DISPLAY will take you out of navigation or parameter change mode and bring you back to the normal display.

Key Error Message

If a key is pressed and the prompt KEYERR appears in the lower display, it will be for one of the following reasons:

- Parameter is not available.
- Not in Setup mode, press **SETUP** key first.
- Key malfunction.

To Adjust Startup (Lighting) Output:

1. Press the **SETUP** button until **CONTROL** is displayed on the screen.
2. Press the **FUNCTION** button until **FAIL SF** is displayed.
3. Use the arrow keys to select the desired value.
4. Press **FUNCTION** to advance to the next setting.
5. Press **LOWER DISPLAY** to exit startup.

To Accutune:

1. The burner must be lit and temperature must be close to setpoint.
2. Press the **LOWER DISPLAY** button until **NO TUNE** is displayed on the screen (must be in AUTO).
3. Press the up arrow until **DO SLOW** is displayed.
4. The Honeywell controller will now begin tuning in the Autotune mode.
5. Display will show the current temperature and "**TUNE**" alternately.
6. When tuning is complete, the lower display will show "**NO TUNE.**"

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 grease 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.
683:1 Sweep Gearbox	Oil for gearbox SHC-634 Plantatary gears Shell Alvania #2 grease	Every 500 hours if operated 10-24 hours/day. Otherwise, every 3-6 months.

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

Lubrication Schedule for Ball Bearing Pillow Blocks:

- For 2000 Dryers:
Every two months, use 2.0 oz. grease to spherical roller bearing (split) pillow blocks.
- For 2400 Dryers:
Every month, use 2.0 oz. grease to spherical roller bearing (split) pillow blocks.
- For all 18' Dryers:
Every two months, use 0.75 oz. grease to spherical roller bearing (split) pillow blocks.

NOTE: Lubrication to be used is a grease NLGI grade 2

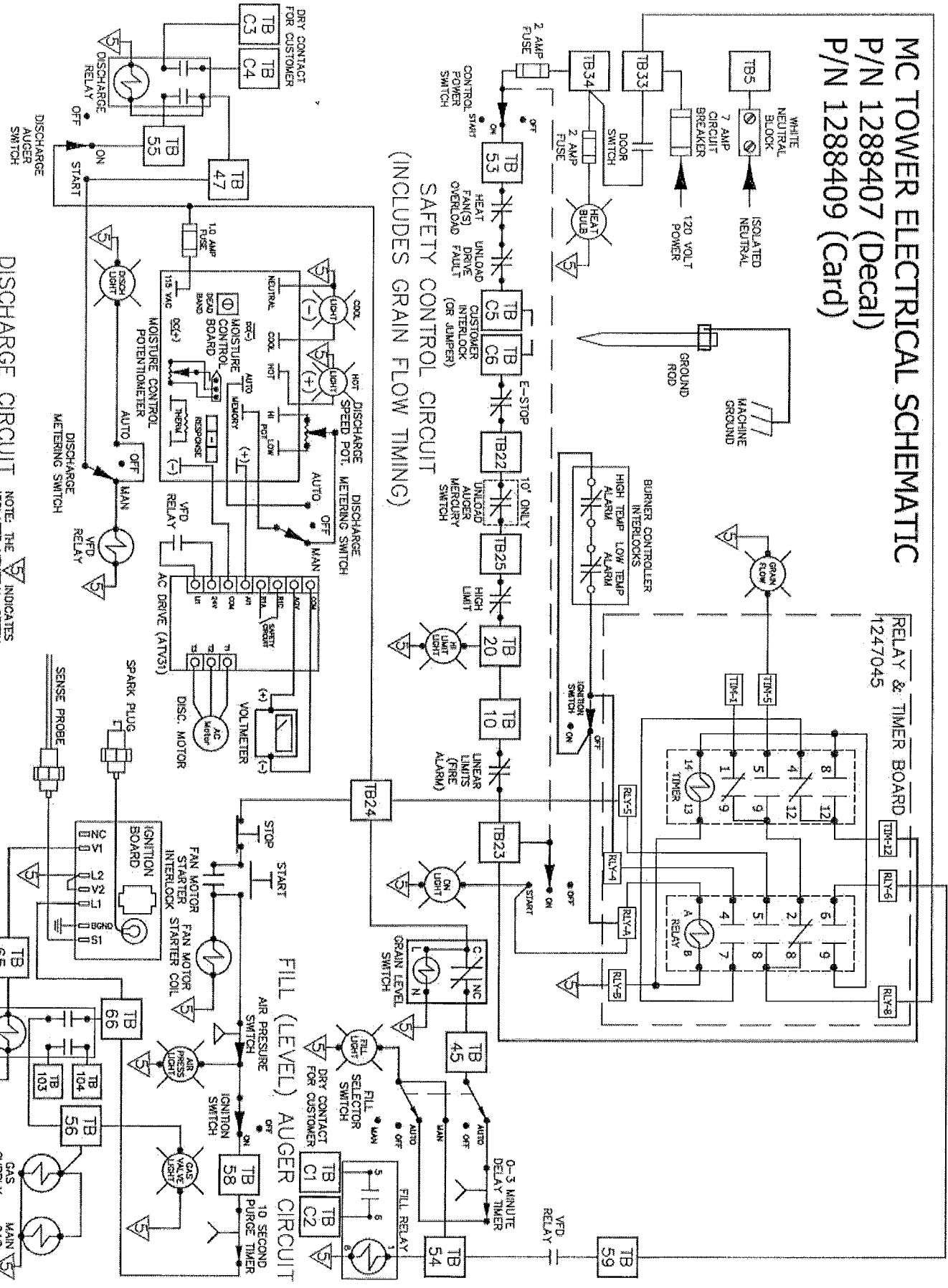
NOTES

Section 4

Troubleshooting

Troubleshooting the Safety Circuit

MC TOWER ELECTRICAL SCHEMATIC
P/N 1288407 (Decal)
P/N 1288409 (Card)



SAFETY CONTROL CIRCUIT
 (INCLUDES GRAIN FLOW TIMING)

DISCHARGE CIRCUIT

FAN AND BURNER CIRCUIT

REvised
 1/11/2008

NOTE THE INDICATES ISOLATED NEUTRAL. OFTEN COMPONENTS STARTING AT TERMINAL 5.

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 6 amp mini-breaker. This breaker should be turned off and voltage should be checked before turning the mini-breaker on. If the voltage reads anything outside of 110 to 120 volts, the supply voltage needs to be checked before powering on the mini-breaker.

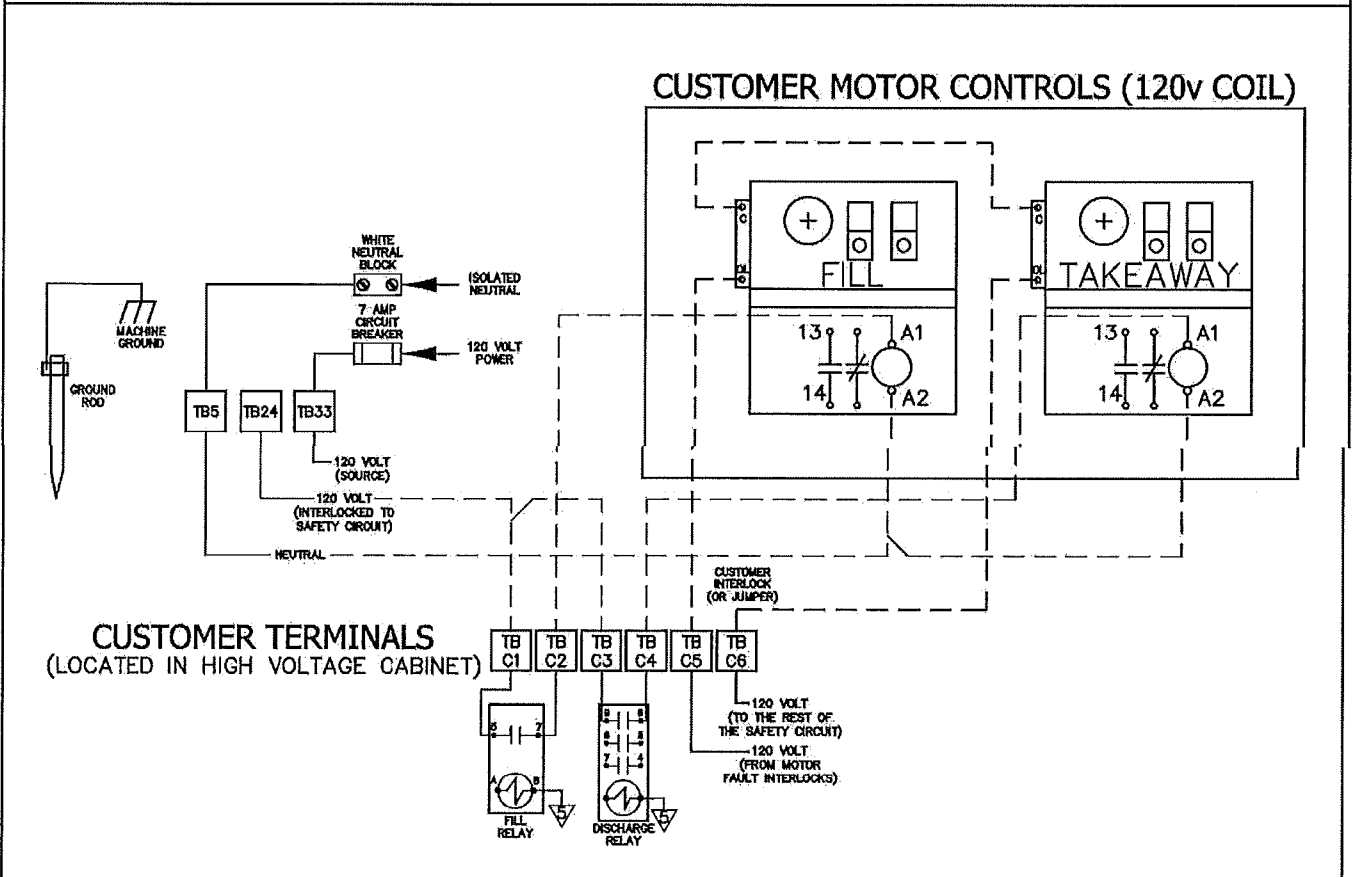
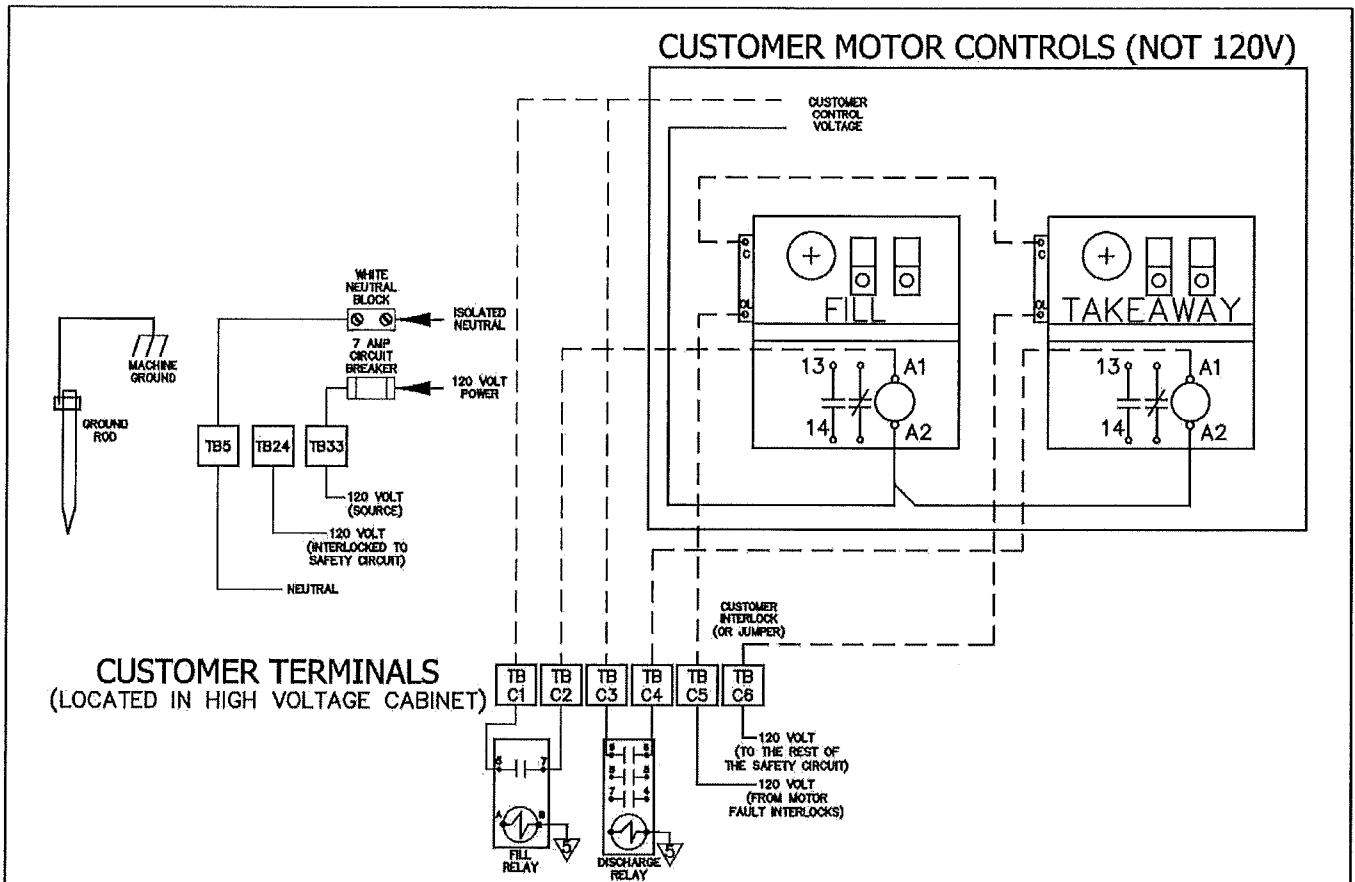
Next to the mini-breaker is a neutral block, which feeds all neutrals throughout the entire dryer. The electrician needs to supply a neutral feed line to the neutral block.

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 the meter to AC voltage (wave sign or "V")

- Place the second lead on TB33, if 110 to 120 volts show on the meter, then the mini-breaker is good. If no volt appears on the meter, then the mini-breaker is tripped.
- Place the second lead on TB53. Turn the power switch to the ON position. If 120-voltage is good, move to the next step. If no volt is read on the meter, there is a problem with the Power On switch.
- Place the 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 or the AC drive unit may have faulted out. To reset the AC Drive, turn the mini-breaker 30 amp for drive off. Wait until the AC drive unit screen goes dead. Then, re-store the mini-breaker to the ON position and the drive will automatically reset.
- Place the 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 takeaway and fill equipment into the safety circuit, check to see if the customer's remote starter equipment needs to be reset.
- Place the second lead on TB22, if 120-voltage is good, move to the next step. If there is no voltage on the meter, the E-stop switch is not functioning properly.
- Place the second lead on TB25. If 120-voltage is good, move to the next step. If there is no voltage on the meter, the mercury switch on the discharge system has tripped and the door is raised or the mercury switch is faulty.
- Place the second lead on TB20. If 120-voltage is good, move on to the 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 the second lead on TB10. If 120-voltage is good, move on to the next step. If there is no voltage on the meter, the Honeywell Controller could have an alarm fault on the screen. This must be reset by powering down the Honeywell Controller and then powering it back up. The alarm message should be cleared from the screen. The Honeywell Control contacts power up a safety relay and the relay could be non-functional and need replacement.
- Place the 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°. 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 the 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, the 0-60 minute timer or the 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 be 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:

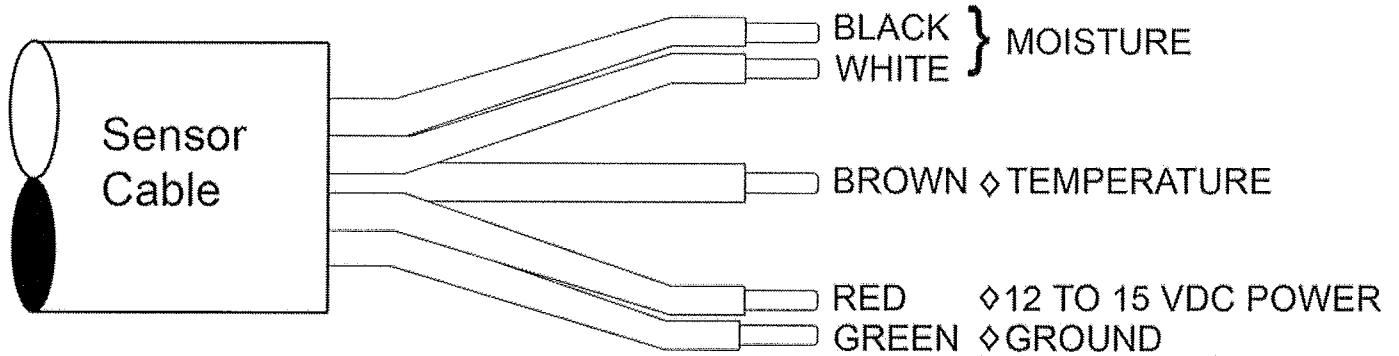
- C1 - C2—Remote fill equipment
- C3 - C4—Remote discharge equipment
- C5 - C6—Dryer safety circuit for remote starters.

C1 — C2 are a dry set of contacts and are for the customer to supply power to C1 and C2, which would run back to the 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 and are for the customer to supply power to C3 and C4, which 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 and C6 to allow complete testing of the safety circuit. The jumper can be removed and two wires run from C5 and C6 to any motor starter overloads that will be engaged when the dryer is running. This will attach through a normal closed path of contacts that will open when the motor starters trip or thermal conditions are exceeded. This will drop out the entire dryer when the pathway opens. Remember that the dryer is providing power from C5 to C6 and must be tied to a dry set of contacts in the customer's equipment. **This is to be done ONLY by a trained electrician.**

Moisture Monitor Troubleshooting Guide



If the moisture monitor temperature is reading incorrectly:

1). Check Sensor:

- Remove the monitor board and then re-insert it to reset it.
- Disconnect the five wires from the sensor.
- If the sensor is disconnected and the display reads -110° Fahrenheit and 33% moisture, then the monitor board connections are good. The sensor needs to be looked at.
- Connect the 5 wire leads to the sensor. The display should read approximately the ambient air temperature and 5% to 7% moisture. This reading should be taken with the sensor in a free air condition, having no contact with the grain.
- Make sure that the sensor is clean and the ground strap is connected. If everything else is intact, the sensor may need to be replaced.

2). Check Display:

- Check DC voltage across black and green wire. It should be the same as the display with the decimal place moved one place to the left.

(Example: 15.5% display will read 1.55 dcv.)

3). Check Monitor:

- Check the voltage to the power supply and the output of the power supply. The output should be 12.3 to 12.7 volts DC between red and green and between blue and green wires.
- Check dipswitches on the monitor board. All switches should be "open" except for #4 and #5.

4). Check Printer:

- Check voltage to the printer, via the red and green wires to the printer unit. Should be from 5 to 5.2 dcv. If not, adjust pot on the power supply unit until the voltage is correct.
- Check the printer fuse to make sure it is AGC 1-amp and **not** MDL 1-amp. Slow blow fuse (MDL) will not let the printer function properly.
- If the time is incorrect, replace the batteries on the printer board.
- If the voltage is correct, remove the 26-pin connector from the side of the printer unit. Jumper from #2 to #3 and press any key 40 times. If the printer is not operating correctly, it will print out 40 digits and fill one entire line.
- If the printer does anything else or nothing at all, the printer unit is bad.
- If the printer functions properly, check the connection or replace the printer board.

Moisture Monitor Troubleshooting Guide

PROBLEM	PROBABLE CAUSE	SOLUTION
Monitor reads approximately -110° and 33% moisture.	<ul style="list-style-type: none"> • Sensor is dirty • Ground strap is not hooked up 	<ul style="list-style-type: none"> • Verify that the sensor is clean • Check that the ground strap is hooked up • Replace the sensor
Moisture readings to change, temperature readings are high negative.	<ul style="list-style-type: none"> • Sensor leads are broken or not hooked onto the terminal 	<ul style="list-style-type: none"> • Tighten terminal screws • Replace sensor
Moisture readings are intermittently high then low.	<ul style="list-style-type: none"> • Sensor ground strap is not hooked up • Sensor cable leads are broken. • Terminal leads where sensor is hooked are loose. 	<ul style="list-style-type: none"> • Hook up strap • Replace sensor • Tighten screws
Moisture readings are consistently high or low	<ul style="list-style-type: none"> • Calibration needs adjustment 	<ul style="list-style-type: none"> • Adjust to correct calibration.
Blowing control fuses	<ul style="list-style-type: none"> • Check the surge absorber for signs of smoke. • Leads may be shorted or loose. • Check for any bad component. 	<ul style="list-style-type: none"> • Replace the surge absorber if damaged. • Isolate and correct any shorted or loose leads. • Isolate and replace any bad components.

Printer Troubleshooting Guide

PROBLEM	PROBABL CAUSE	SOLUTION
Blowing control fuses.	<ul style="list-style-type: none"> • Check for loose or shorted leads. • Any component that is bad can cause this - check by isolating one component at a time 	<ul style="list-style-type: none"> • Isolate and correct • Replace bad component
Printer spaces several lines but nothing is printed	<ul style="list-style-type: none"> • Paper installed with the wrong side up • Wrong type of paper is being used. • Print head is unplugged or bad 	<ul style="list-style-type: none"> • Turn over paper • Install correct type of paper
Printer spaces one line, nothing more.	<ul style="list-style-type: none"> • Paper installed with the wrong side up • Wrong type of paper is being used • Print head is unplugged or bad 	<ul style="list-style-type: none"> • Insert the computer card or replace the card. • Refer to decal for correct wiring at the computer jack. Insert the 25 pin jack at the printer.
Printer does not space, no night light and the paper take-up motor is not working.	<ul style="list-style-type: none"> • No DC power or no AC power or not hooked up. 	<ul style="list-style-type: none"> • If 5V DC is missing, replace the power supply or repair loose or broken power leads (red and green) or (white and violet).
Printer does space but has night light	<ul style="list-style-type: none"> • Printer motor not plugged in 	<ul style="list-style-type: none"> • Plug in the flat, grey cable on the printer and check to see if it is broken.
Prints characters that are unintelligible	<ul style="list-style-type: none"> • Computer is not working 	<ul style="list-style-type: none"> • Power down and retry
Top part of characters are missing	<ul style="list-style-type: none"> • Plastic guard is too close 	<ul style="list-style-type: none"> • Raise the plastic shield.
Part of each character is missing	<ul style="list-style-type: none"> • Loose head cable or bad print head 	<ul style="list-style-type: none"> • Reset the flat brown cable or replace the printer.
Paper take-up not rolling up the paper	<ul style="list-style-type: none"> • Loss of power or bad motor on aluminum shaft is binding against the motor 	<ul style="list-style-type: none"> • The orange and the orange/white wires are loose or broken. Tighten or replace the motor assembly or adjust the aluminum shaft by loosening the Allen screw.

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

	Procedure	Troubleshooting
1.	Set HIGH LIMIT	
2.	Start of operation of dryer: 115 volt light should be ON	If not, check: <ul style="list-style-type: none"> • Main disconnect • Fuse is not functional or 7A circuit breaker is tripped
3.	Switch the control switch to the ON position. The HIGH LIMIT light should be ON	If not, check: <ul style="list-style-type: none"> • RUN-START in START position • Overload circuit through starters • AC drive and fuses or circuit breaker • Back door mercury switch • High limit reset • Soft starter • Burner resets • CAL or Honeywell controller
4.	Switch the control switch to the START position, POWER ON and FILL lights ON	If not, check: <ul style="list-style-type: none"> • The FILL light will only come on when the FILL switch is in the MANUAL or AUTO position and calling for grain. • Main relay • Rotary fill switch is not calling for grain • Grain flow timer elapsing (EMPTY light)
PRIMARY CIRCUIT IS NOW COMPLETE (SAFETY CIRCUIT) TB24 IS ENERGIZED		
5.	Push fan start button. Fan should start and run.	If not, check: <ul style="list-style-type: none"> • Main power voltage through disconnect and breaker to starter. • Starter, OR • Soft starter See soft starter parameters on p. 34
6.	Switch fill relay from ON to MANUAL Fill relay closes to provide 110 volts to customer-supplied fill equipment.	
7.	Adjust 0.2 to 3 minute delay fill timer to the desired setting.	
8.	After the dryer has filled with grain, switch the fill switch to the AUTO position	
9.	Grain flow timer is only in the circuit in the AUTO position	
10.	Set the 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: <ul style="list-style-type: none"> • Dryer not full of grain • Air pressure switch not adjusted • Filter is dirty
12.	Turn temperature control power switch to ON	If not, check: <ul style="list-style-type: none"> • Honeywell temperature controller powers up and opens proportional level to enable the burner to light once the ignition is turned ON.

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

13.	Switch ignition to the ON position. After the 12-second purge timer times out, the #1 ignition light comes on. This will ignite both (or all three) burners.	<p>If not, check:</p> <ul style="list-style-type: none"> • Purge timer (internal) • Check for air pressure • Trial for ignition • Flame sensing present <p>*Above is the LED sequence on the Fire Eye unit.</p>
14.	Switch Honeywell controller from manual to automatic after 30 seconds of having the burner lit along with setting the plenum temperature. The controller will bring the plenum temperature up to the selected set point and stabilize.	<p>If not, check:</p> <ul style="list-style-type: none"> • Controller • Controller parameter settings • Has the controller been AUTO TUNED?
15.	Switch discharge system switch to the START position. The sweep arms should start	<p>If not, check</p> <ul style="list-style-type: none"> • AC drive fault settings • AC drive parameter settings • AC drive fuses or circuit breaker • Voltage output to motor. Should be 230 volt, 3 phase. • 3HP motor • Drive belts.
16.	Grain flow timer has a 1-60 minute range. Set the M-C Control board response switch to 2. Set the grain flow timer according to the manual.	
17.	Use the potentiometer to adjust the sweep speed. Adjust the speed until the moisture content of the grain is the desired percentage. After running the dryer long enough to stabilize the moisture output, the dryer is ready for automatic mode.	
18.	Use the moisture control potentiometer to balance the lights so that both are OFF. Before switching to Automatic mode, set the response selector. Responses 1, 2, 3: 1 being fastest response, 3 being slowest response from thermostats to change the speed in the sweep system.	
19.	Switch discharge system into automatic.	<p>If it doesn't switch:</p> <ul style="list-style-type: none"> • Auto/manual switch for wiring problem. • 1.0 Amp fuse • AC drive and motor

Dryer Troubleshooting Guide

PROBLEM	PROBABLE CAUSE
Main gas valve is opened but 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 it doesn'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 the feedback line to the main gas regulator. It should be partially open.
Dryer will not reach operating temperature, or reaches it slowly.	<ol style="list-style-type: none"> 1. Low gas pressure. Increase gas pressure on main gas regulator. 2. Check for water in gas train by opening 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 them 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 the 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 the 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 a possible excessive voltage drop in power supply wiring.
Burner will not fire.	<ol style="list-style-type: none"> 1. Check the gas supply for possible obstruction of closed valves. Refill the tank. Replace or repair parts as required. 2. Inspect the gas solenoid valves for defective coils or improper wiring. Replace the valve or coil if the valve will not open with the proper voltage applied (115 volts). 3. Temperature controller is not powered on or proportional valve is not opening up. 4. Gas pressure is too high. The range is 0.5-2.0 psig. Reduce pressure at regulator.
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.

Dryer Troubleshooting Guide (Continued)

PROBLEM	PROBABLE CAUSE
Uneven drying—Some kernels appear brown while others are under dried. Uneven heat exiting from dryer columns.	—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. Keep the dryer clean! Do not allow fine material to gather in the plenum chamber.
Soft Starter (if equipped) faults out and shuts down dryer.	<ol style="list-style-type: none"> 1. Rated to start blower every 10 minutes. It may be overheated. Allow to cool. 2. Lugs and connections will overheat if loose. Tighten hardware. 3. Check parameters. See p. 33
AC Drive faults out and shuts down dryer.	<ol style="list-style-type: none"> 1. Sweep will not turn, mechanized blockage in columns. Pull the grain back from the sweep arms and back the sweep arms up slightly, engage at 100% discharge speed. Change parameters temporarily to help break the sweep arm free. Consult the factory. 2. Motor is wired incorrectly. Unit is 230, 3-phase output regardless of dryer voltage. Check motor for low voltage wiring. 3. Check parameters. See p. 32
Proportional Valve is not responding to the Honeywell Controller.	<ol style="list-style-type: none"> 1. Inlet gas pressure is too high. Reduce pressure. 2. Belimo actuator is not exactly 90° from the butterfly shaft. Adjust position so that the actuator is exactly 90° from the shaft. The slot on top of the shaft should show the butterfly gate position. Depress the push button and hold, turn the shaft using a screwdriver until it rotates freely. 3. The Actuator is a motor-driven device using 24 dcv power. Inspect the power to the unit using a dc volt meter. When closed, it should be 2dcv, when full open, it should be 10 dcv. <p>Honeywell: Manual operation of the temperature controller displays the percentage the valve is open. Use the arrow keys on the Honeywell controller to adjust the valve open or closed.</p>



Proportional Valve

Fire Eye Ignition Troubleshooting Guide 12' Tower Dryer

PROBLEM	POSSIBLE CAUSE AND SOLUTION
Difficulty lighting the burner	<ul style="list-style-type: none"> • Ensure that gas supply to the dryer is on, hand valves are open. • Fan must be on to achieve air pressure light. • Gas pressure is too high. It should be within the 0.5-2.0 psig range. • Check to see if temperature controller is powered up. • Check 120 to ignition transformer and 120 to solenoid valves. • Check gas solenoid operation by listening for click/snap or feeling the vibration as they open. If solenoid doesn't open, check the wiring and coil for damage, bad connections, etc. • Check the spark plug (igniter) for spark. Check the high voltage wire for damage, good connections.
Burner lights but doesn't stay lit. NOTE: This is most likely due to flame sensing.	<ul style="list-style-type: none"> • Ensure flame sense probe is located in the flame. • Inspect the sense wire for damage, loose or wet connections, sense wire connected to S2 at FE. • Sense wire must be routed separately from the high voltage ignition wire. • Check to see that the dryer is properly grounded with earth ground to chassis. • Clean sense probe with fine steel wool. • Burner may have to be grounded at the burner body to the burner housing.

Proportional Valve Troubleshooting guide

PROBLEM	POSSIBLE CAUSE & SOLUTION
Proportional valve will not rotate.	<ul style="list-style-type: none"> • Depress and hold down the actuator push button on the orange Belimo valve. Turn the shaft with a screwdriver. • With the temperature controller powered on, use the manual mode to rotate the valve. Measure voltage at the actuator. 2 volts closed—10 volts open.

12' Tower Dryer Specifications			
MATHEWS COMPANY	Units	MC	MC
Model Number of Dryer		2000	2400
Drying CFM	CFM	90,000	109,000
Cooling CFM	CFM	45,000	54,500
Fan HP	HP	100	100
Fan RPM	RPM	900	822
Maximum Burner Capacity (MBTU)	MBTU	21.78	26.38
Typical Heat Use @ 60° F. (MBTU)	MBTU	11.88	14.39
Typical gas pressure usage at manifold	psig	0.5 to 1.25 psi	0.5 to 1.25 psi
Maximum natural gas supply	psig	60 psi	60 psi
Maximum LP gas supply	psig	250 psi	250psi
Tower Diameter	Ft. & In.	11'8"	11'8"
With Walkways	Ft. & In.	17' 9"	17' 9"
Overall Height	Ft. & In.	75' 4"	87' 4"
Grain Column Width	Inches	12"	12"
Grainwall Height	Feet	63'	75'
Heat Holding (bu)	Bushels	1211	1453
Cool Holding (bu)	Bushels	485	566
Total Column Holding (bu)	Bushels	1696	2019
Peak Holding (bu)	Bushels	249	249
Total Dryer Holding (bu)	Bushels	1945	2268
Unload Capacity	Bu/Hr	3200	3200
Electrical Load			
230 Volts	Amps	320	320
460 Volts	Amps	167	167
Discharge Drive	HP AC	3	3
Sweep	Arms	4	4
BPH Capacity (20%-15%)	Bu/Hr	2000	2250
BPH Capacity (25%-15%)	Bu/Hr	1175	1322

12' Tower Discharge Data

POT SETTING	MOTOR FREQ.	MOTOR RPM	5 to 1 Gearbox Output RPM	SWEEP RPM	Calculated BU/HR
10	60	1725.0	345.0	6.9	3105
9.5	57.25	1645.9	329.2	6.6	2963
9	54.5	1566.9	313.4	6.3	2820
8.5	51.75	1487.8	297.6	6.0	2678
8	49	1408.8	281.8	5.6	2536
7.5	46.25	1329.7	265.9	5.3	2393
7	43.5	1250.6	250.1	5.0	2251
6.5	40.75	1171.6	234.3	4.7	2109
6	38	1092.5	218.5	4.4	1967
5.5	35.25	1013.4	202.7	4.1	1824
5	32.5	934.4	186.9	3.7	1682
4.5	29.75	855.3	171.1	3.4	1540
4	27	776.3	155.3	3.1	1397
3.5	24.25	697.2	139.4	2.8	1255
3	21.5	618.1	123.6	2.5	1113
2.5	18.75	539.1	107.8	2.2	970
2	16	460.0	92.0	1.8	828
1.5	13.25	380.9	76.2	1.5	686
1	10.5	301.9	60.4	1.2	543
0.5	7.75	222.8	44.6	0.9	401
0	5	143.8	28.8	0.6	259

Dryer capacity output is all calculated numbers. This does not take into account any changes made to finger adjustment on sweep arms.

18' Tower Dryer Specifications				
MATHEWS COMPANY	Units	MC	MC	
Model Number of Dryer	Inches	3000	3500	4000
Drying CFM	CFM	153,000	165,000	193,000
Cooling CFM	CFM	73,440	79,200	92,640
Fan HP	HP	(3) 50hp	(3) 60hp	(3) 75hp
Fan RPM	RPM	1040	1090	1209
Maximum Burner Capacity (MBTU)	MBTU	33.66	36.30	42.46
Typical Heat Use @ 60° F. (MBTU)	MBTU	20.20	21.78	25.48
Tower Diameter	Ft. & In.	17'6"	17'6"	17'6"
With Walkways	Ft. & In.	23'2"	23'2"	23'2"
Overall Height	Ft. & In.	82' 11"	88' 11"	97' 11"
Grain Column Width	Inches	12"	12"	12"
Grainwall Height	Feet	70' 5"	76' 5"	85' 5"
Heat Holding (bu)	Bushels	1996	2246	2497
Cool Holding (bu)	Bushels	790	790	916
Total Column Holding (bu)	Bushels	2786	3036	3413
Peak Holding (bu)	Bushels	808	808	808
Total Dryer Holding (bu)	Bushels	3594	3844	4221
Unload Capacity	Bu/Hr	6000	6000	6000
Electrical Load				
230 Volts	Amps	460	499	574
460 Volts	Amps	224	256	293
Discharge Drive	HP AC	3hp	3hp	3hp
Sweep	Arms	6	6	6
BPH Capacity (20%-15%)	Bu/Hr	3000	3500	4000
BPH Capacity (25%-15%)	Bu/Hr	1800	2100	2400
CFM/bu of Heated Grain		77	73	77

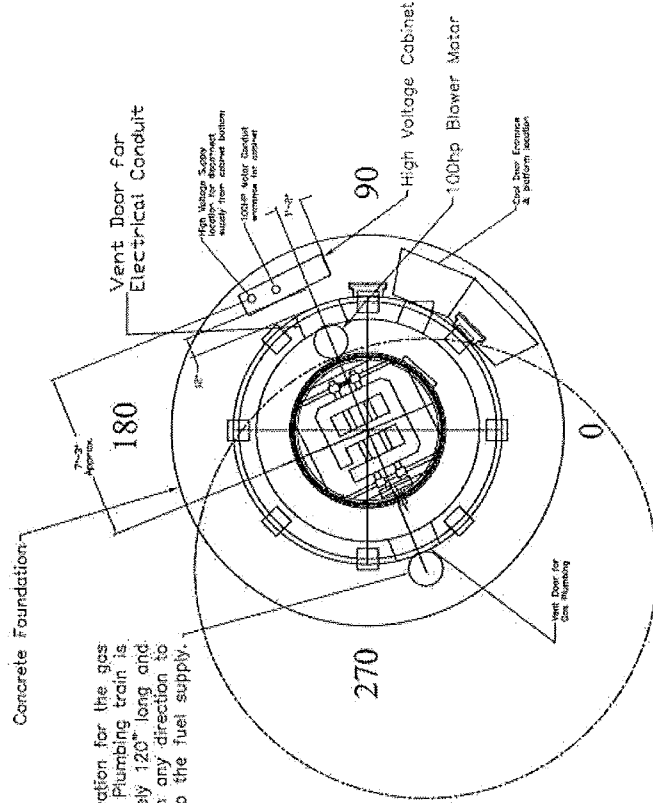
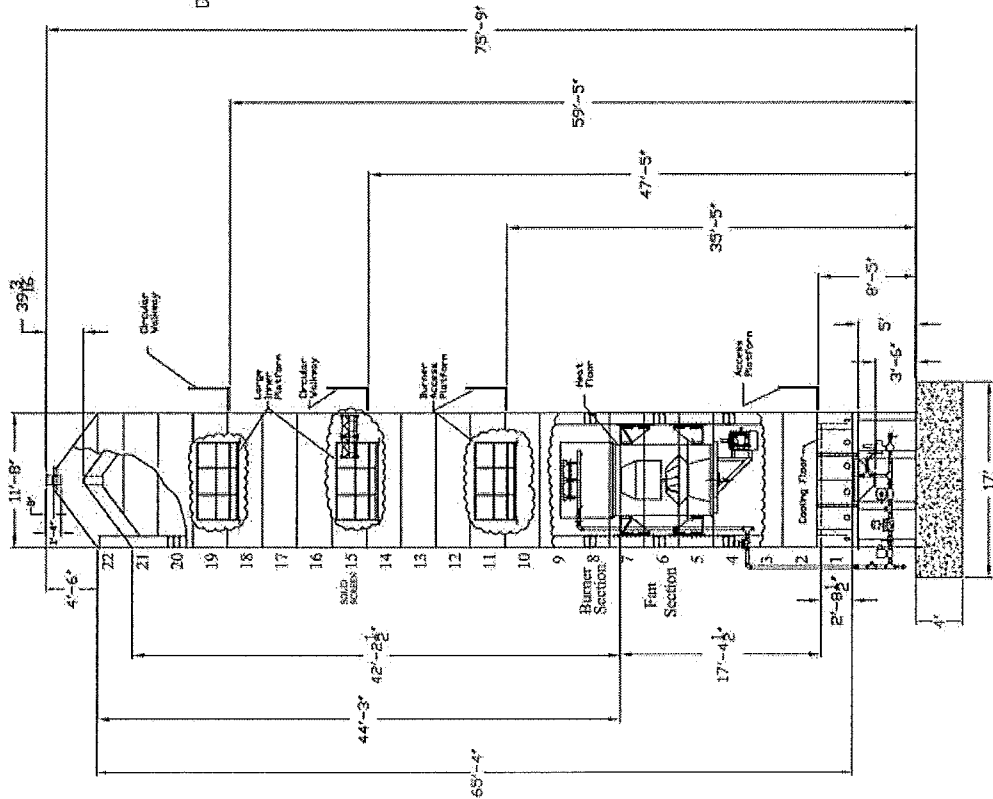
18' Tower Discharge Data

POT SETTING	MOTOR FREQ.	MOTOR RPM	SWEEP RPM	LINER OUTPUT BU/HR
10	60	1725	2.3	5175
9	54.5	1566.88	2.1	4701
8	49	1408.75	1.8	4226
7	43.5	1250.63	1.6	3752
6	38	1092.5	1.4	3278
5	32.5	934.38	1.2	2803
4	27	776.25	1	2329
3	21.5	618.13	0.8	1854
2	16	460	0.6	1380
1	10.5	301.88	0.4	906
0	5	143.75	0.2	431

Electric and Gas Configuration 12 Foot Tower

2000 TOWER

REVISED 05/15/06

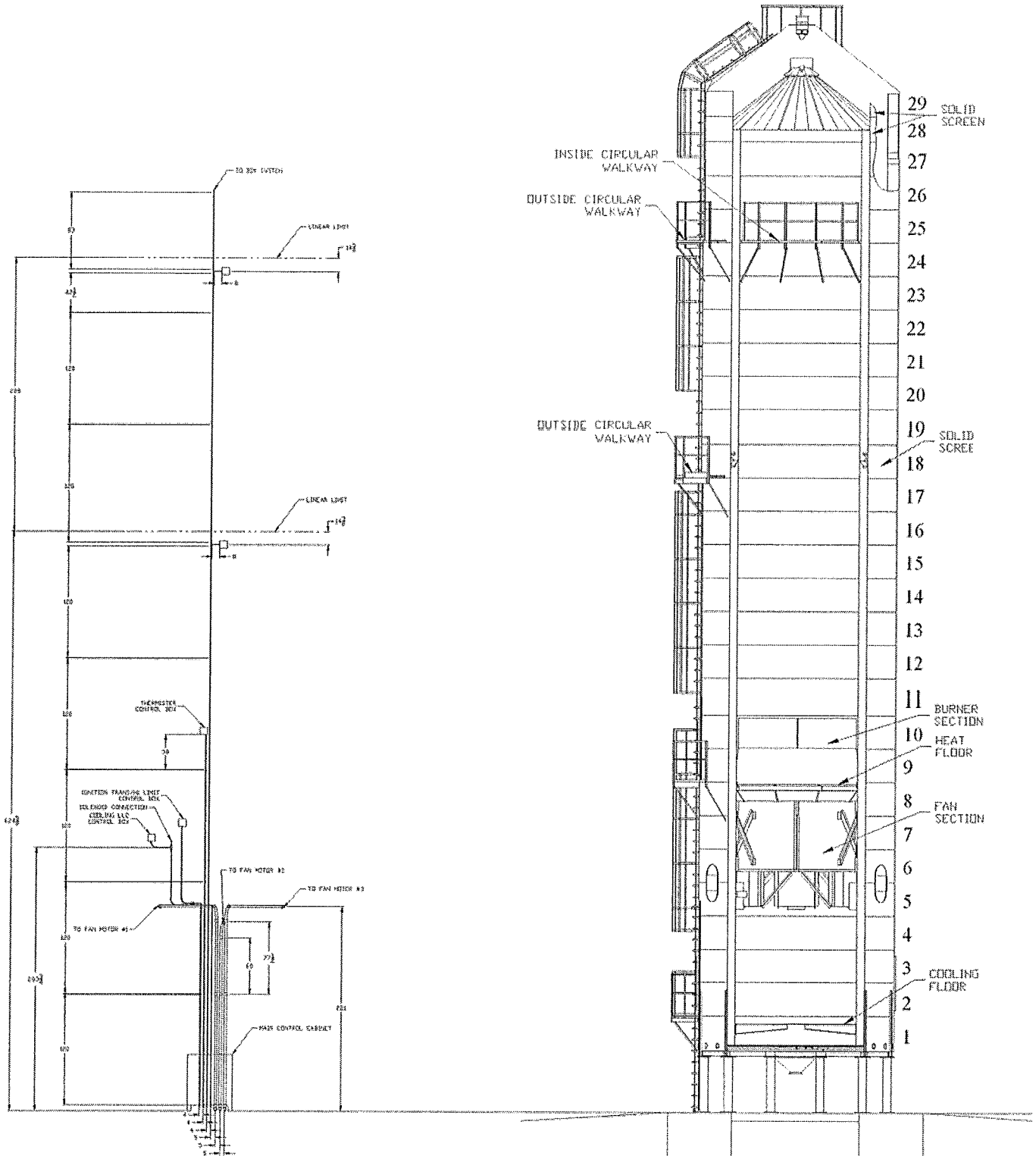


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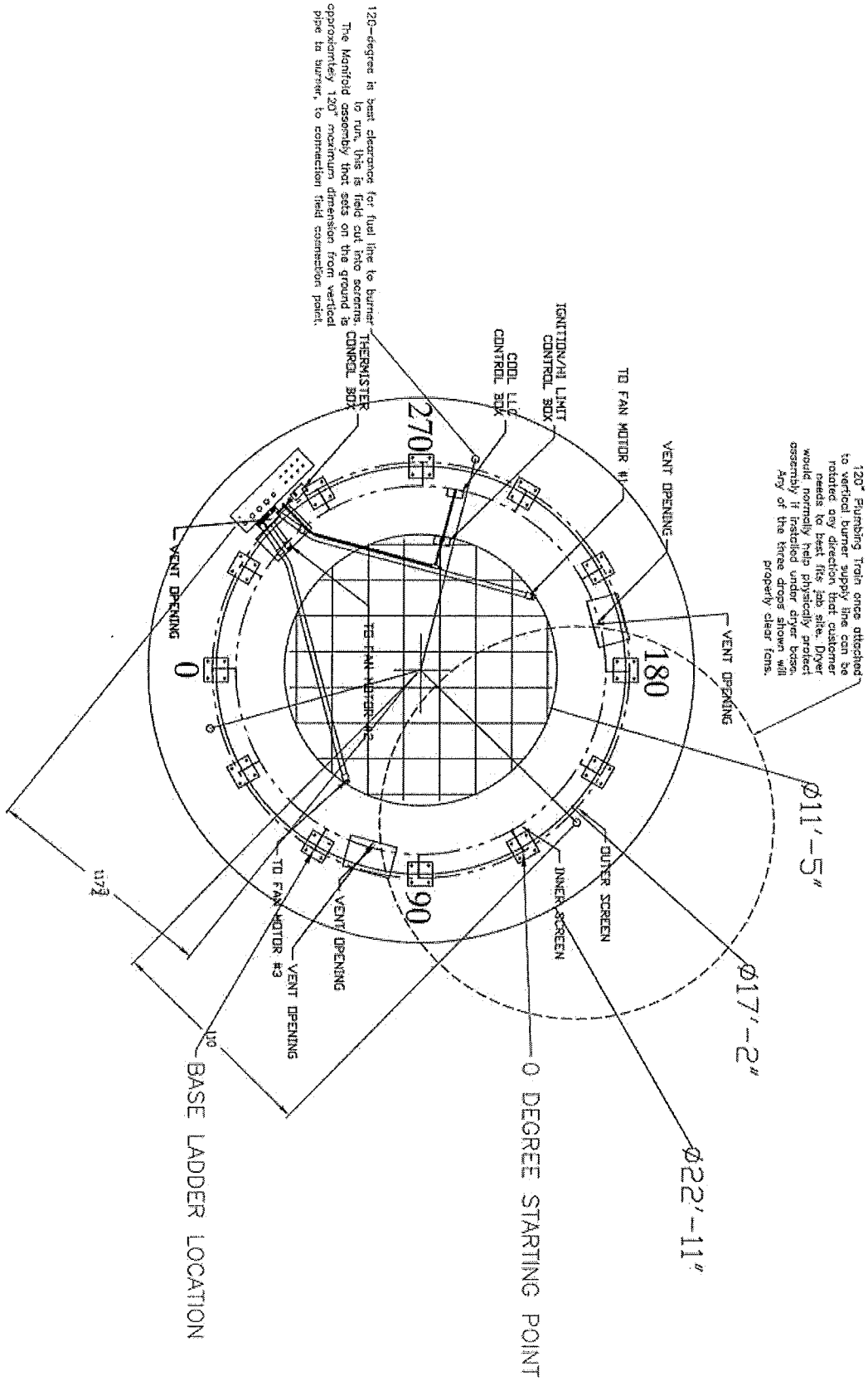
Electric and Gas Configuration 18 Foot Tower

Electrical and fuel supply location

4000 TOWER

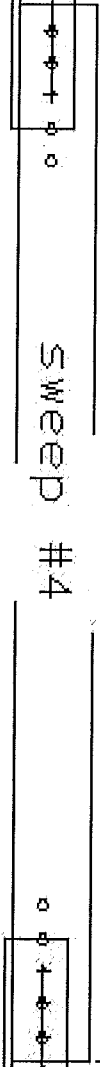
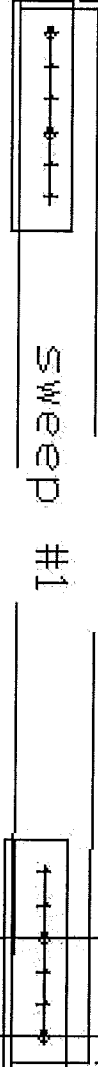
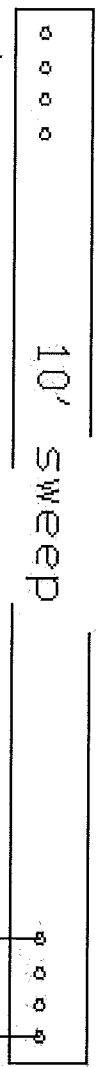
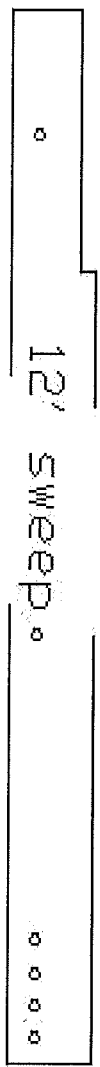


18 Foot Tower Electric and Gas Configuration Continued



A)

PART NO.
RD-2133



SWEEP #3 USE DN 10520 THRU 10730 TOWERS
 SWEEP #4 USE DN 10840 & 101275 TOWERS
 SWEEP #3 USE DN 2000 & 2400 TOWERS

QTY MODEL

MC

MANUFACTURED BY
MATHEWS COMPANY
 AN IRIDIUM COMPANY
 10000 WILSON ROAD
 GREENSBORO, NC 27409

DATE
 8-6-03

TITLE
 SWEEP ARM MANUFACTURED

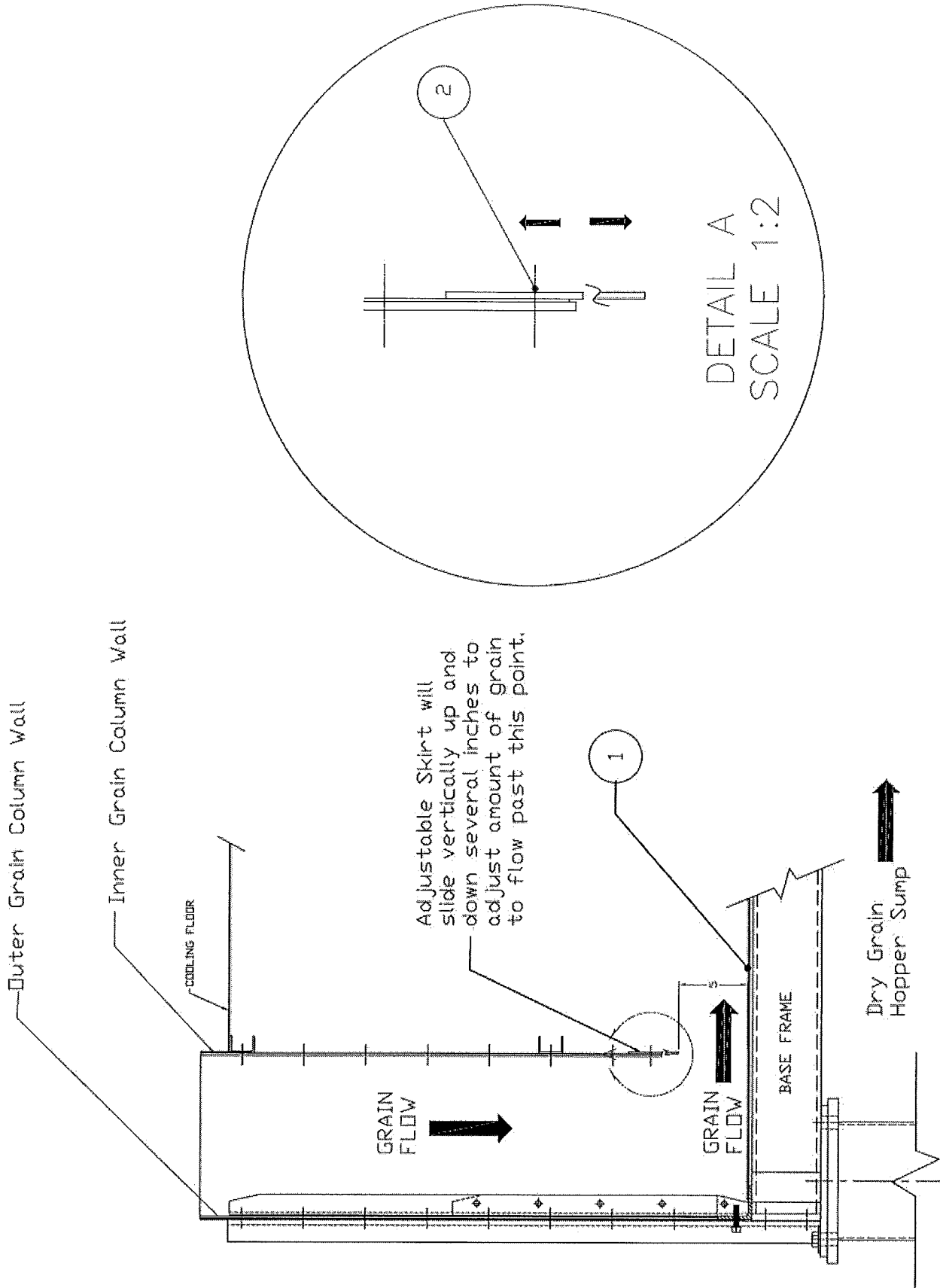
SCALE
 1/4" = 1'

DATE
 7GA. X 2-1/2" X 62" HR.

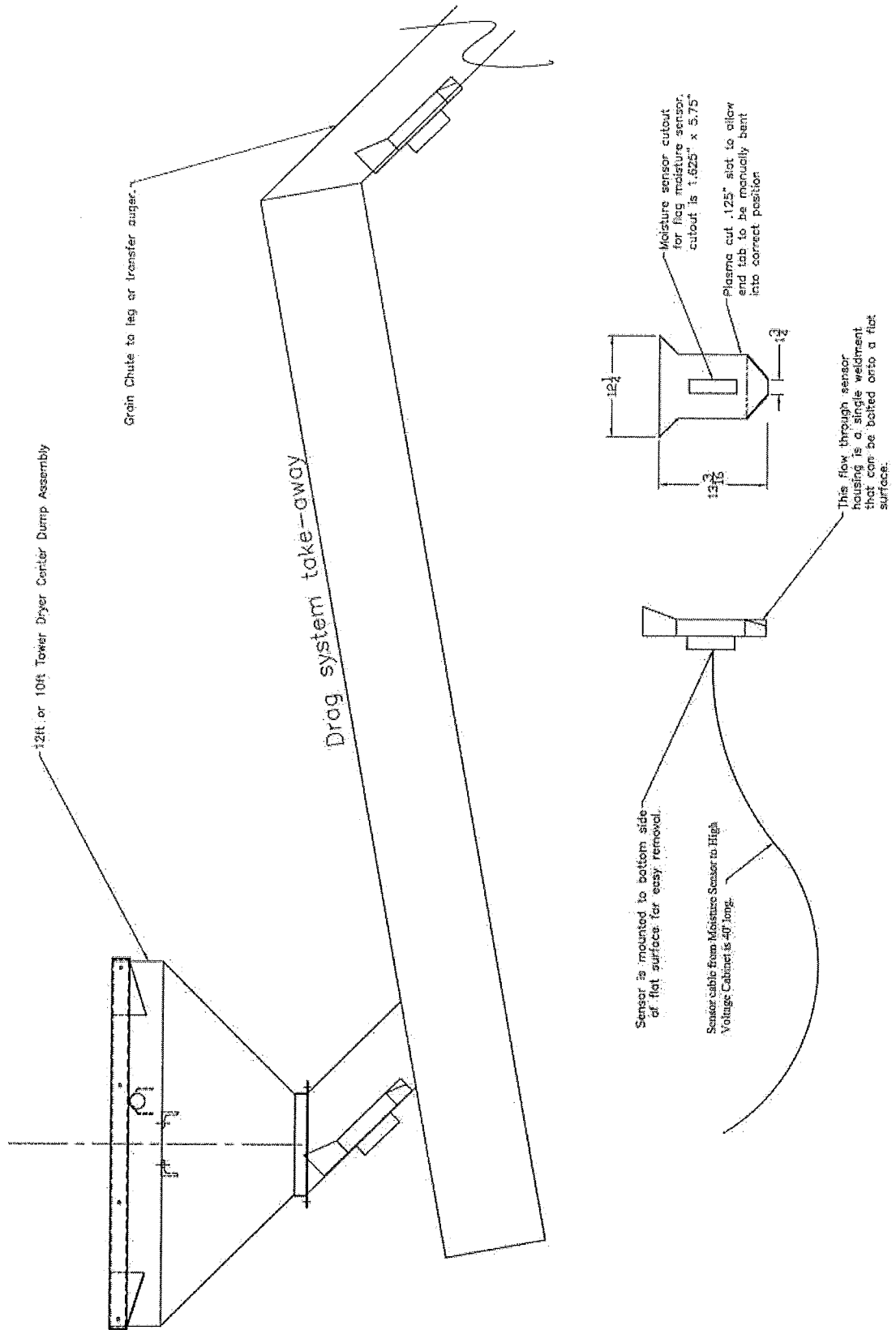
PART NO.
 RD-2133

CHECKED BY

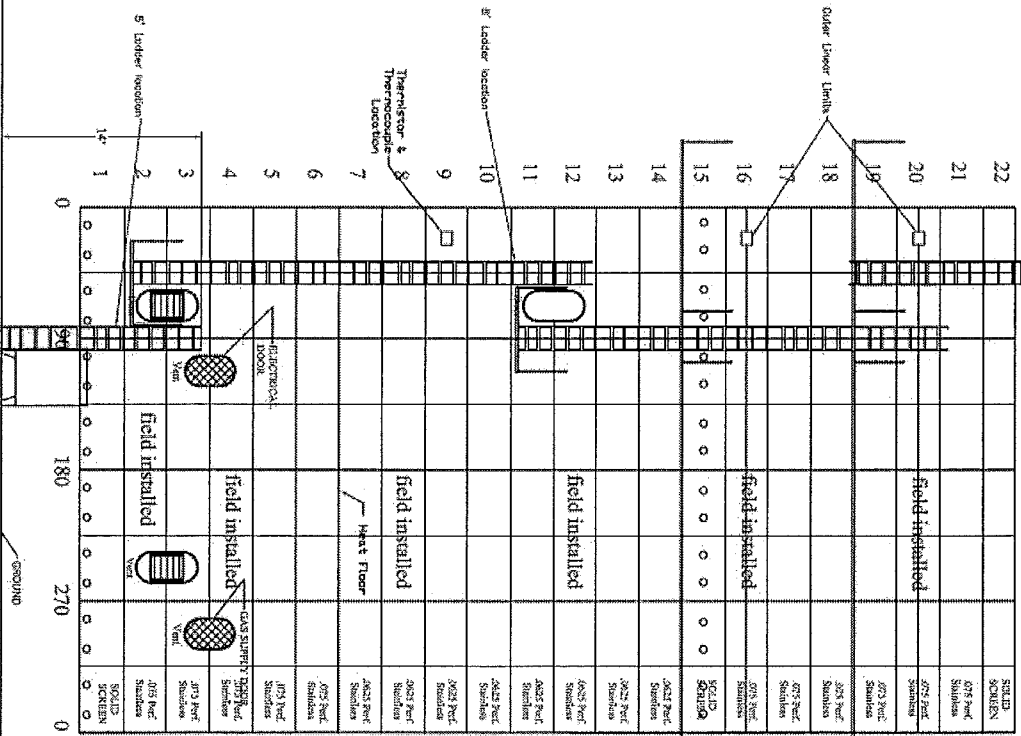
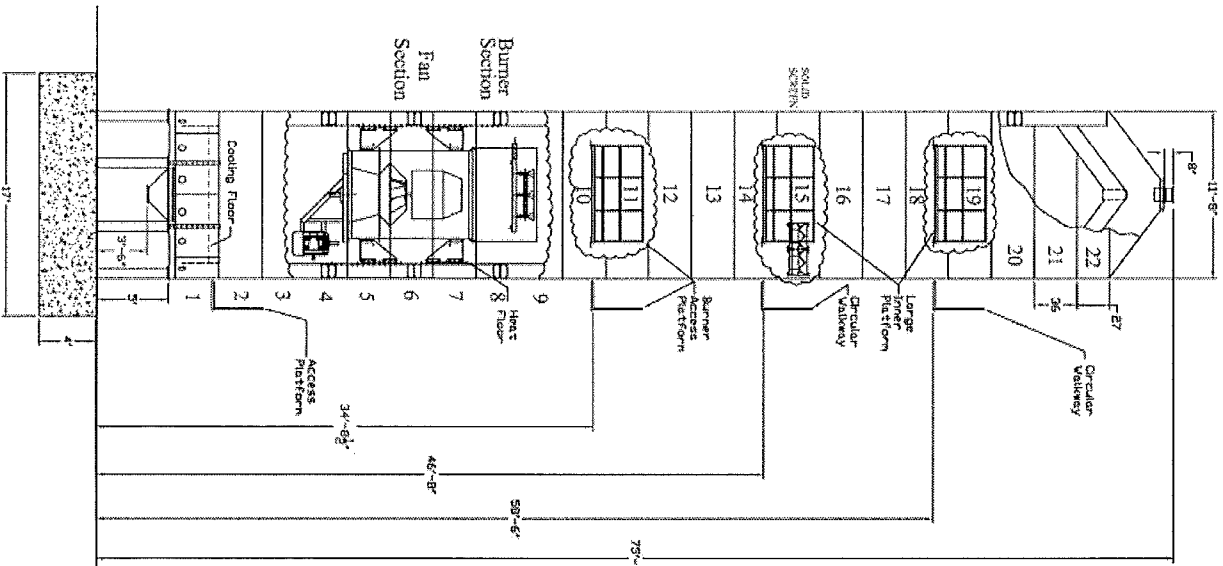
Grain Flow



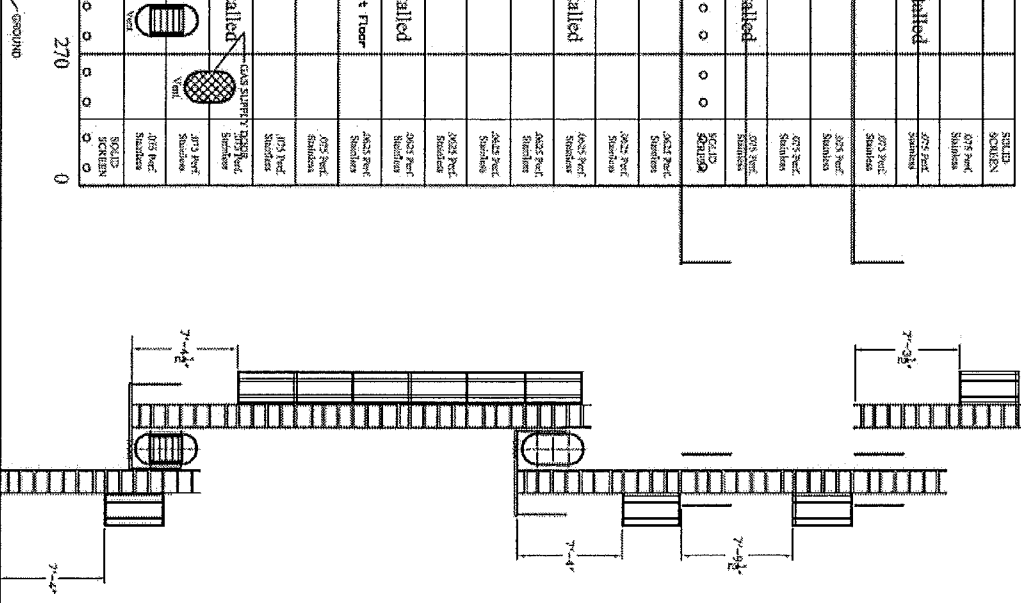
MOISTURE SENSOR FUNNEL



2000 TOWER

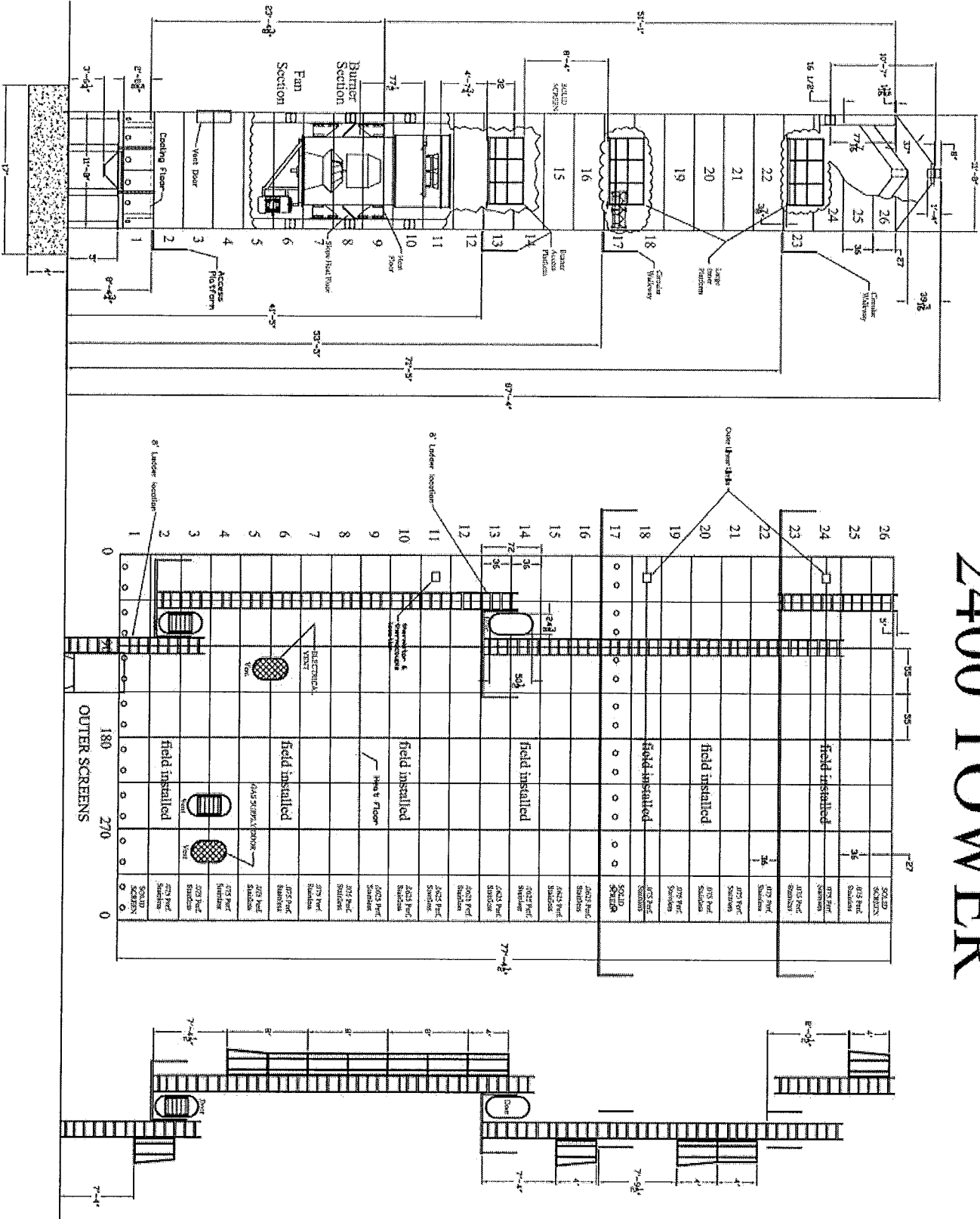


OUTER SCREENS

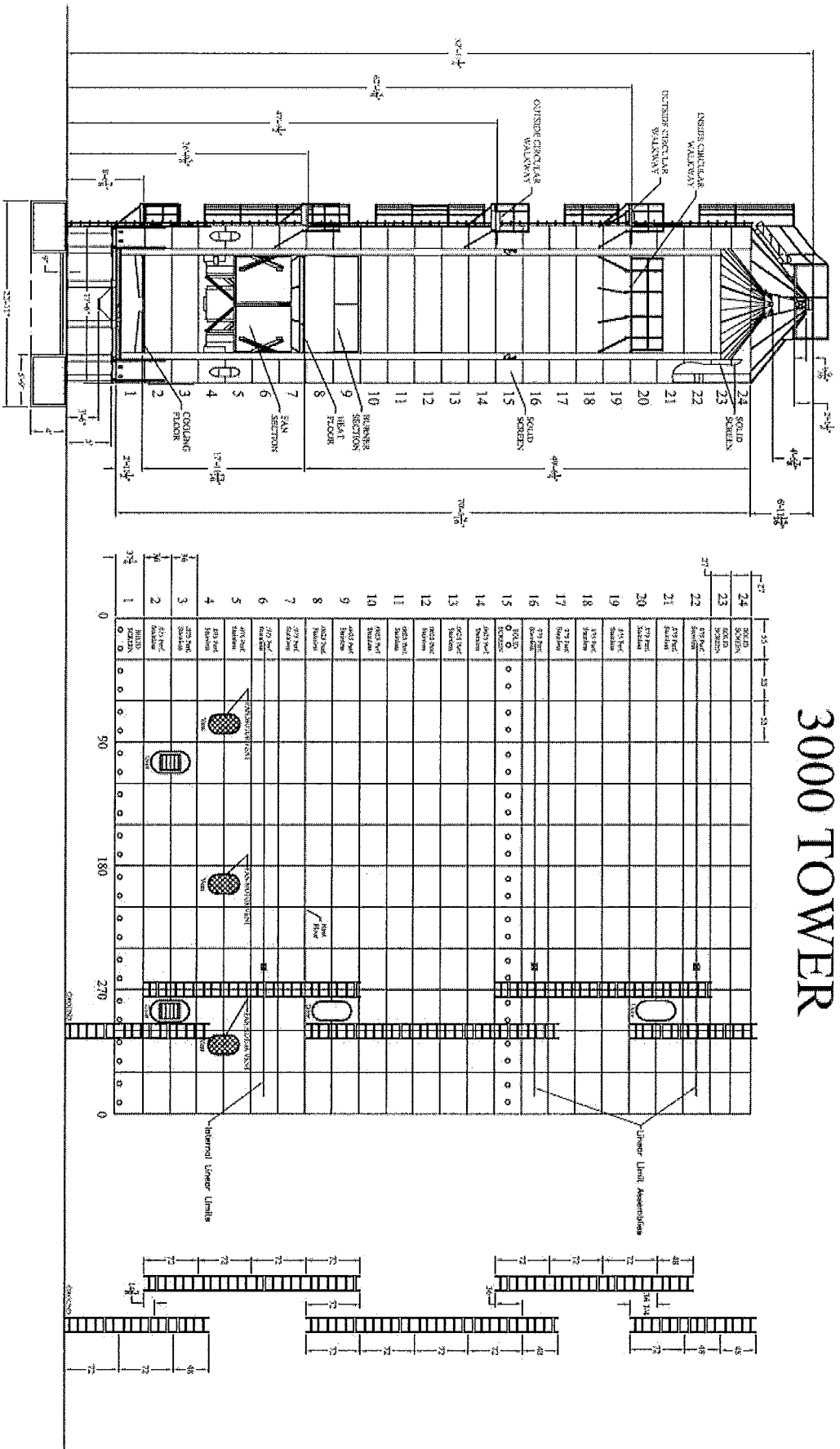


2400 LADDER DIAGRAM

2400 TOWER

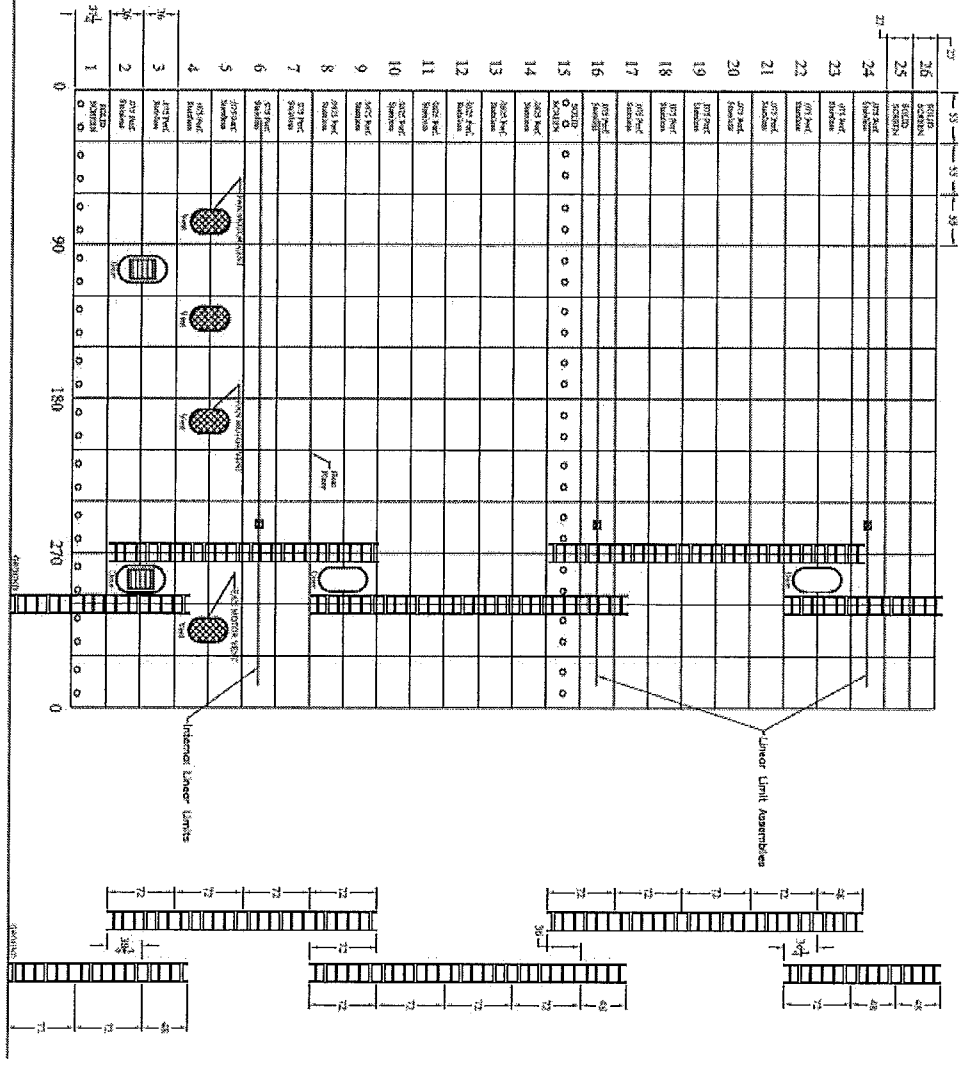
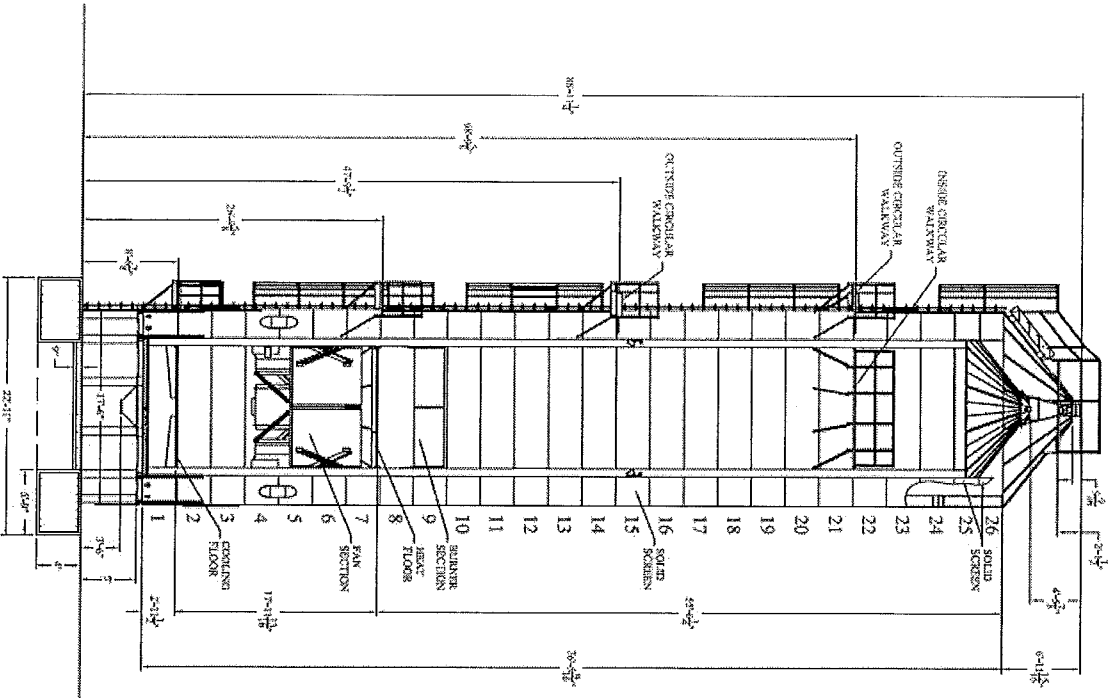


3000 LADDER LAYOUT



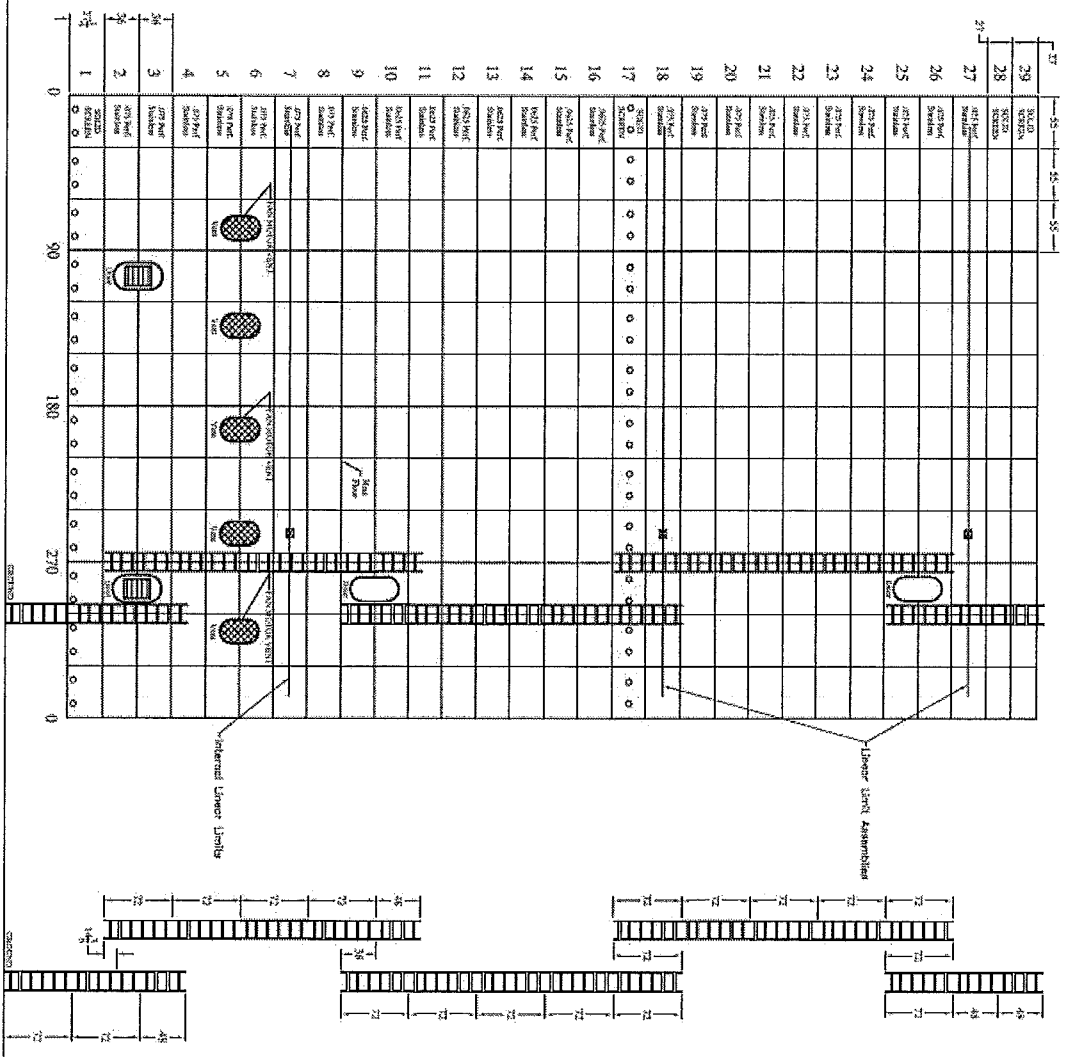
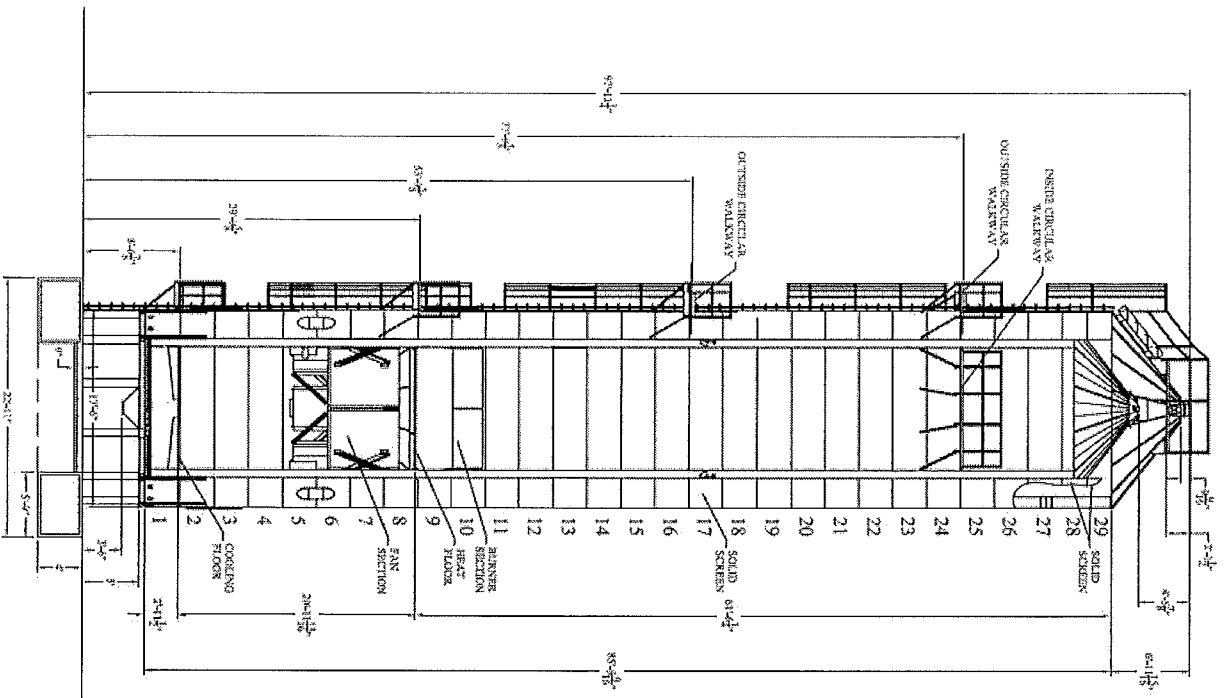
3500 LADDER LAYOUT

3500 TOWER



4000 LADDER LAYOUT

4000 TOWER



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 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 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, which the dryer will maintain for consistent plenum temperature. This temperature can be changed to an appropriate drying temperature for the product being processed. This method controls 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 metering 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 metering 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 plenum temperature stable. The method of opening and closing to control gas flow is normally 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 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 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% above the 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 coil to either 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 the solenoids to open and maintain fuel supply to the burner. The timing sequence for the ignition board is 0 time for pre-purge and a 10 second trial for ignition. The ignition board contains an automatic reset, which always resets on the board re-energizing 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 normal 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.
- **Thermistor:** Used on the side of the dryer to detect the level of temperature present in the grain. It is used to drive the moisture 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 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 the 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.
- **Mercury Switch:** The mercury switch is an enclosed cylindrical tube that contains a liquid, which will readily conduct electrical current. At one end of the cylinder is a set of contacts that will pass power from one contact to the other only when the liquid is present. The cylinder can be mounted in such a manner so that the tube is rotated and the liquid runs away from the contacts and opens the contacts so that they are not capable of passing current. This device is located on the back door of the unloading auger.
- **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.
- **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.
- **Moisture Control Board:** This printed circuit board controls AC Drive Unit signal to increase or decrease sweep and unload auger speed. These printed circuit board controls are in manual and automatic. In manual, the operator dials in a setting using the potentiometer. The automatic control is dialing in a set point and thermistor control printed circuit board to increase or decrease speed as needed.
- **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 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.
- **Discharge Speed Meter:** Displays the DC output signal at which the sweep and auger system is running. It is used as a point of reference to the speed of the discharge system.
- **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 Door 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.

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:** The 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.

2000 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models 2000			Dry & Cool @ 170 Degrees		
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	584	1.1	11	151.1	60.5	10.8
29-15	635	1.3	13	137.0	54.9	10.7
28-15	693	1.5	15	123.8	49.6	10.5
27-15	759	1.8	18	111.5	44.6	10.4
26-15	833	2	20	100.2	40.1	10.2
25-15	917	2.3	23	89.8	36.0	10.1
24-15	1012	2.6	26	80.3	32.2	9.9
23-15	1120	3	30	71.6	28.7	9.7
22-15	1245	3.5	35	63.6	25.5	9.6
21-15	1396	4	40	56.0	22.4	9.4
20-15	1585	4.7	47	48.7	19.5	9.3
19-15	1843	5.6	56	41.4	16.6	9.1
18-15	2233	6.9	69	33.7	13.5	9.0
17-15	2927	9.4	94	25.4	10.2	8.9

Moisture Removal Corn	Dryer Models 2000			Dry & Cool @ 200 Degrees Fahrenheit		
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	778	1.8	18	113.3	45.4	14.06
29-15	847	2.1	21	102.8	41.2	13.87
28-15	924	2.3	23	92.8	37.2	13.59
27-15	1012	2.6	26	83.6	33.5	13.4
26-15	1111	3	30	75.1	30.1	13.11
25-15	1200	3.3	33	68.6	27.5	12.6
24-15	1349	3.8	38	60.2	24.1	12.54
23-15	1493	4.3	43	53.7	21.5	12.35
22-15	1660	4.9	49	47.7	19.1	12.06
21-15	1861	5.6	56	42	16.8	11.78
20-15	2000	6.1	61	38.5	15.4	11.1
19-15	2457	7.7	77	31	12.4	11.4
18-15	2977	9.6	96	25.3	10.1	11.31
17-15						

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.

2400 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		2400 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	688	1.5	15	153.9	60.0	12.5
29-15	748	1.7	17	139.6	54.4	12.3
28-15	816	2	20	126.1	49.1	12.2
27-15	894	2.2	22	113.6	44.2	12.0
26-15	981	2.5	25	102.0	39.7	11.8
25-15	1080	2.9	29	91.5	35.6	11.7
24-15	1192	3.3	33	81.8	31.9	11.5
23-15	1319	3.7	37	73.0	28.4	11.3
22-15	1467	4.2	42	64.8	25.2	11.1
21-15	1644	4.9	49	57.1	22.2	10.9
20-15	1867	5.7	57	49.6	19.3	10.7
19-15	2170	6.7	67	42.2	16.4	10.5
18-15	2630	8.3	83	34.4	13.4	10.4
17-15						

Moisture Removal Corn	Dryer Models		2400 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	860	2.1	21	123.1	48.0	15.3
29-15	935	2.4	24	111.6	43.5	15.1
28-15	1020	2.7	27	100.9	39.3	14.8
27-15	1117	3	30	90.8	35.4	14.6
26-15	1227	3.4	34	81.6	31.8	14.3
25-15	1395	4	40	70.8	27.6	14.4
24-15	1490	4.3	43	65.4	25.5	13.8
23-15	1649	4.9	49	58.4	22.7	13.5
22-15	1833	5.5	55	51.8	20.2	13.2
21-15	2055	6.3	63	45.7	17.8	13.0
20-15	2334	7.3	73	39.7	15.5	12.7
19-15	2713	8.6	86	33.7	13.1	12.5
18-15						
17-15						

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.

3000 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		3000 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	994	1	10	151.2	63.9	18.3
29-15	1080	1.1	11	137.1	57.9	18.1
28-15	1179	1.3	13	123.9	52.3	17.9
27-15	1291	1.5	15	111.6	47.1	17.7
26-15	1418	1.8	18	100.2	42.3	17.4
25-15	1561	2	20	89.8	38.0	17.1
24-15	1722	2.3	23	80.4	33.9	16.9
23-15	1906	2.7	27	71.7	30.3	16.6
22-15	2119	3.1	31	63.6	26.9	16.3
21-15	2375	3.6	36	56.1	23.7	16.0
20-15	2697	4.2	42	48.7	20.6	15.7
19-15	3136	5	50	41.4	17.5	15.4
18-15	3799	6.3	63	33.8	14.3	15.2
17-15	4980	8.5	85	25.4	10.7	15.0

Moisture Removal Corn	Dryer Models		3000 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	1200	1.4	14	125.1	52.9	21.8
29-15	1305	1.6	16	113.5	47.9	21.5
28-15	1425	1.8	18	102.5	43.3	21.2
27-15	1560	2	20	92.3	39.0	20.9
26-15	1713	2.3	23	82.9	35.0	20.5
25-15	1886	2.6	26	74.4	31.4	20.1
24-15	2081	3	30	66.5	28.1	19.7
23-15	2303	3.4	34	59.3	25.1	19.3
22-15	2560	3.9	39	52.7	22.2	18.8
21-15	2869	4.5	45	46.7	19.6	18.5
20-15	3259	5.2	52	40.3	17.0	18.2
19-15	3789	6.2	62	34.3	14.5	17.8
18-15	4591	7.8	78	27.9	11.8	17.6
17-15						

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.

3500 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		3500 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	1093	1.2	12	154.1	58.1	19.8
29-15	1188	1.3	13	139.8	52.6	19.6
28-15	1297	1.5	15	126.3	47.6	19.3
27-15	1420	1.8	18	113.7	42.8	19.1
26-15	1560	2	20	102.2	38.5	18.8
25-15	1716	2.3	23	91.6	34.5	18.5
24-15	1894	2.7	27	81.9	30.9	18.2
23-15	2096	3	30	73.1	27.5	17.9
22-15	2331	3.5	35	64.9	24.4	17.6
21-15	2612	4	40	57.1	21.5	17.3
20-15	2966	4.7	47	49.7	18.7	17.0
19-15	3449	5.6	56	42.2	15.9	16.7
18-15	4179	7	70	34.4	13.0	16.5
17-15	5478	9.4	94	25.9	9.8	16.4

Moisture Removal Corn	Dryer Models		3500 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	1320	1.6	16	127.6	48.1	23.5
29-15	1436	1.8	18	115.7	43.6	23.2
28-15	1567	2	20	104.5	39.4	22.9
27-15	1716	2.3	23	94.1	35.5	22.5
26-15	1884	2.6	26	84.6	31.9	22.1
25-15	2074	3	30	75.8	28.6	21.7
24-15	2288	3.4	34	67.8	25.5	21.3
23-15	2533	3.9	39	60.5	22.8	20.9
22-15	2816	4.4	44	53.7	20.2	20.4
21-15	3156	5	50	47.3	17.8	20.1
20-15	3585	5.9	59	41.1	15.5	19.7
19-15	4167	7	70	34.9	13.2	19.4
18-15	5049	8.6	86	28.5	10.7	19.3
17-15						

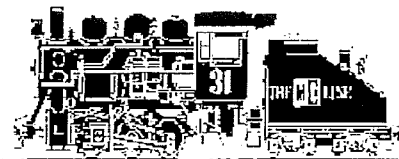
This information is generated through grain dryer simulation programs and figures are approximated based on principles of drying, field experience and calculated computer simulation. There may be variations in calculated numbers due to grain physiological factors, external grain and weather conditions,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

4000 Tower Dryer Capacity Charts

Moisture Removal Corn	Dryer Models		4000 Dry & Cool @ 170 Degrees			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	1244	1.4	14	150.1	58.4	23.1
29-15	1352	1.6	16	136.1	52.9	22.9
28-15	1476	1.9	19	122.9	47.8	22.6
27-15	1616	2.1	21	110.7	43.0	22.3
26-15	1775	2.4	24	99.5	38.7	22.0
25-15	1953	2.8	28	89.2	34.7	21.6
24-15	2155	3.2	32	79.8	31.0	21.3
23-15	2385	3.6	36	71.1	27.7	20.9
22-15	2652	4.1	41	63.2	24.6	20.6
21-15	2972	4.7	47	55.6	21.6	20.2
20-15	3376	5.5	55	48.4	18.8	19.9
19-15	3925	6.5	65	41.1	16.0	19.6
18-15	4755	8.1	81	33.5	13.0	19.3
17-15						

Moisture Removal Corn	Dryer Models		4000 Dry & Cool @ 200 Degrees Fahrenheit			
	Bu/hr Capacity	Pot Set Speed	Unload % Speed	Heat Time	Cool Time	Mbtu/hr Energy
30-15	1503	1.9	19	124.2	48.3	27.5
29-15	1634	2.2	22	112.6	43.8	27.1
28-15	1784	2.5	25	101.7	39.6	26.7
27-15	1953	2.8	28	91.6	35.6	26.3
26-15	2144	3.1	31	82.3	32.0	25.9
25-15	2360	3.5	35	73.8	28.7	25.4
24-15	2604	4	40	66.0	25.7	24.9
23-15	2882	4.5	45	58.9	22.9	24.4
22-15	3205	5.1	51	52.3	20.3	23.9
21-15	3591	5.9	59	46.1	17.9	23.5
20-15	4079	6.8	68	40.0	15.6	23.1
19-15	4742	8	80	34.0	13.2	22.7
18-15	5746	9.9	99	27.7	10.8	22.5
17-15						

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