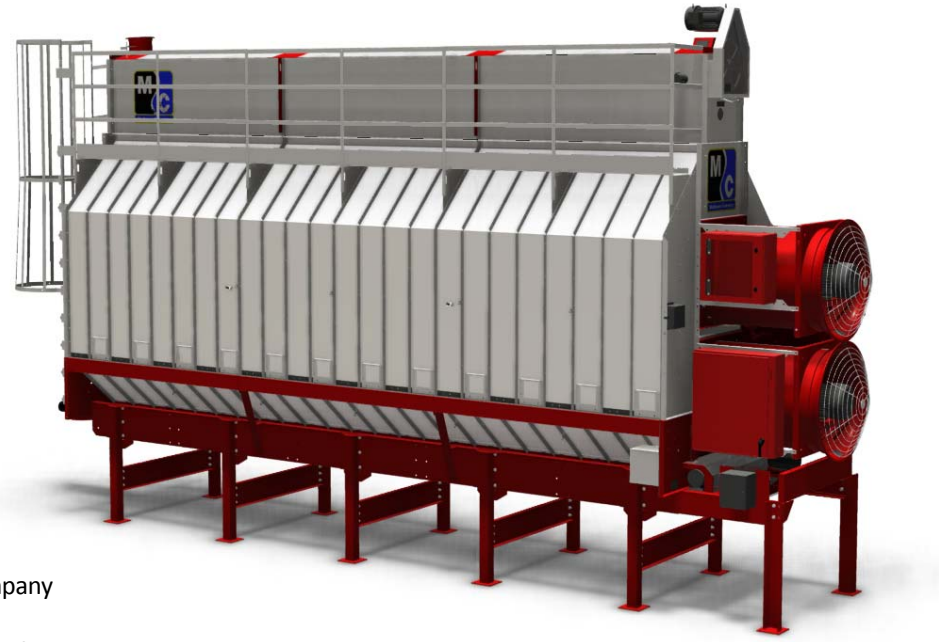
Volume 1

MATHEWS COMPANY

Infinity Series

CF320/CF420/CF520/CF620 /CF720/CF730/CF820

CF320C/CF420C/CF520C/CF620C/CF820C



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Operations Manual

DOC-I01-0811

OPERATIONS MANUAL – INFINITY SERIES
CF320 CF420 CF520 CF620 CF720 CF730 CF820
CF320C CF420C CF520C CF620C CF820C

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Section 1: Introduction

Grain Drying Theory for Profile Dryers

1. **Air**: Volume is supplied by a blower that is horizontally mounted on the exterior of the dryer. The function of the air is two-fold. The air acts as a heat transfer mechanism. The air assists the heat in penetrating the grain shell in order to dry the grain. The air absorbs the moisture from the grain and carries the moisture outside the dryer.

2. **Heat/Energy**: The burner that sits directly behind the blower heats the air filling the plenum chamber, and transfers the heat to the grain. The heat releases the moisture from the grain. The accurate control of this heat is what makes the equipment energy efficient. The most effective way to regulate the control of this energy is through a gas control valve that opens and closes to allow fuel supply to change to keep the plenum temperature stable.

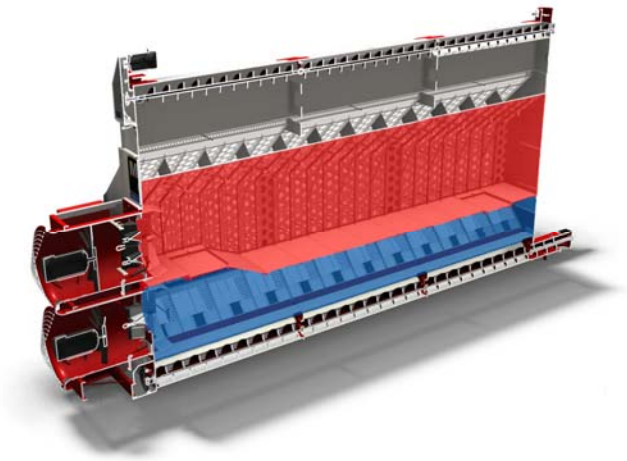


Figure 1: ***"Air Flow Infinity Series"***

3. **Time**: refers to the time the grain is spent inside the dryer. 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 the grain is to increase and decrease the grain metering system of the dryer. The slower the metering system operates, the longer the grain is exposed to air and heat and the moisture removal is increase. 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 has proven to be the most common and efficient way to dry grain.

Functions of Air, Heat, and Time

The air is pulled into the dryer through the blower of the dryer. The amount of air volume the blower can move depends on the dryer pressure drop. The higher the pressure drop, the less air volume the blower moves.

The dryer plenum temperature control system provides a means to maintain a consistent plenum temperature. The temperature can be changed to an appropriate drying temperature for the type of grain being dried, and is the method used for greatest fuel efficiency.

The blower pushes the air volume through the burner and the air transfers the heat to fill the plenum chamber and heats the grain. The grain will absorb the heat driving moisture out. The moisture emitted will saturate the air and the air will carry the moisture out of the dryer, leaves the grain hot. This heat will be reclaimed when it moves down the dryer column and is exposed to the suction cooling process resulting in fuel efficiency.

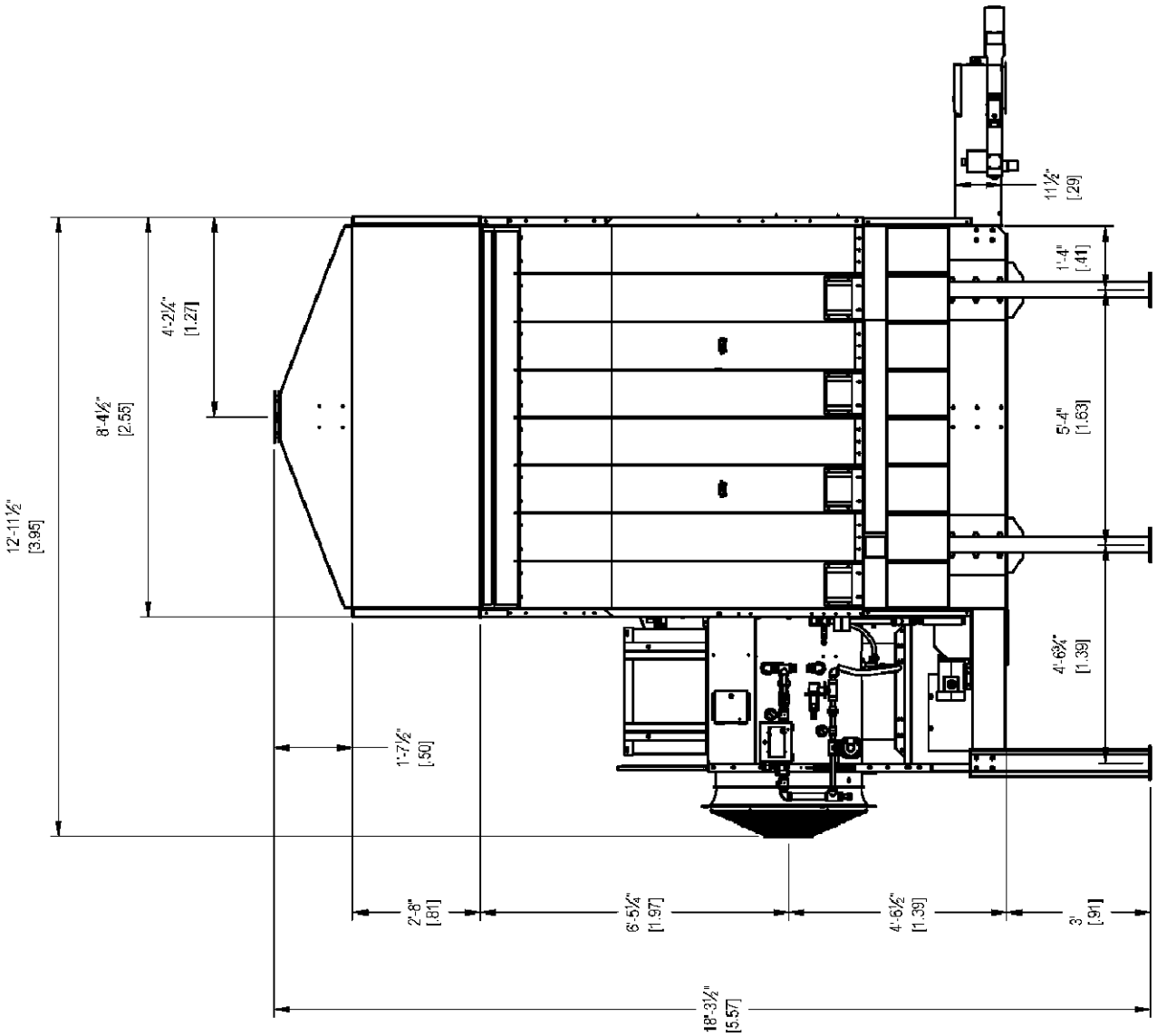
Section 2

Section 2: Dryer Specifications

Infinity Series Axial Dryer Specifications

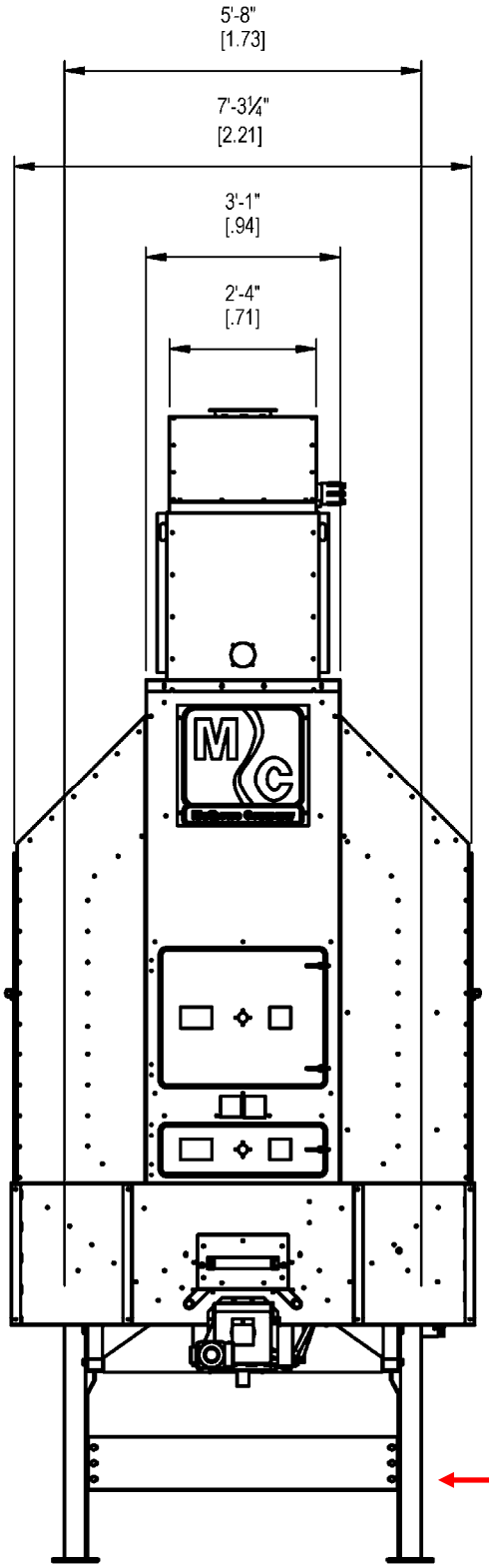
Model	CF 320	CF 420	CF 520	CF 620	CF 720	CF 730	CF 820
Holding Capacity	200 bu	281 bu	375 bu	375 bu	375 bu	470 bu	562 bu
Grain Column Thickness	12”	12”	12”	12”	12”	12”	12”
Grain Column Length	8’-0”	12’-0”	16’-0”	16’-0”	16’-0”	20’-0”	24’-0”
Burner Capacity (Heat+Cool)	2.00 MMBTU/hr	2.23 MMBTU/hr	2.58 MMBTU/hr	N/A	3.32 MMBTU/hr	3.81 MMBTU/hr	4.41 MMBTU/hr
Burner Capacity (All Heat)	2.99 MMBTU/hr	3.42 MMBTU/hr	3.97 MMBTU/hr	4.41 MMBTU/hr	5.67 MMBTU/hr	7.13 MMBTU/hr	7.73 MMBTU/hr
Fan(s) Configuration	(1) Axial	(1) Axial	(1) Axial	(1) Axial	(2) Axial	(2) Axial	(2) Axial
Fan Motor Size	10 HP	15 HP	20 HP	20 HP	10 HP 7.5 HP	15 HP 10 HP	20 HP 10 HP
Level Auger Motor Size	N/A	3 HP	3 HP	3 HP	3 HP	3 HP	3 HP
Unload Auger Motor Size	1.5 HP	1.5 HP	1.5 HP	1.5 HP	1.5 HP	1.5 HP	1.5 HP
Operating Height (On Skids)	15’-2”	14’-6”	14’-6”	14’-6”	14’-6”	14’-6”	14’-6”
Overall Length	16’-6”	20’-6”	24’-6”	24’-6”	24’-6”	28’-6”	32’-6”
Overall Width	7’-5”	7’-5”	7’-5”	7’-5”	7’-5”	7’-5”	7’-5”
Electrical Load (230V/1ph/60Hz)	92 Amps	136 Amps	152 Amps	152 Amps	142 Amps	176 Amps	192 Amps
Electrical Load (230V/3ph/60Hz)	68 Amps	93 Amps	108 Amps	108 Amps	96 Amps	118 Amps	133 Amps

CF 320 Side View Dimensions



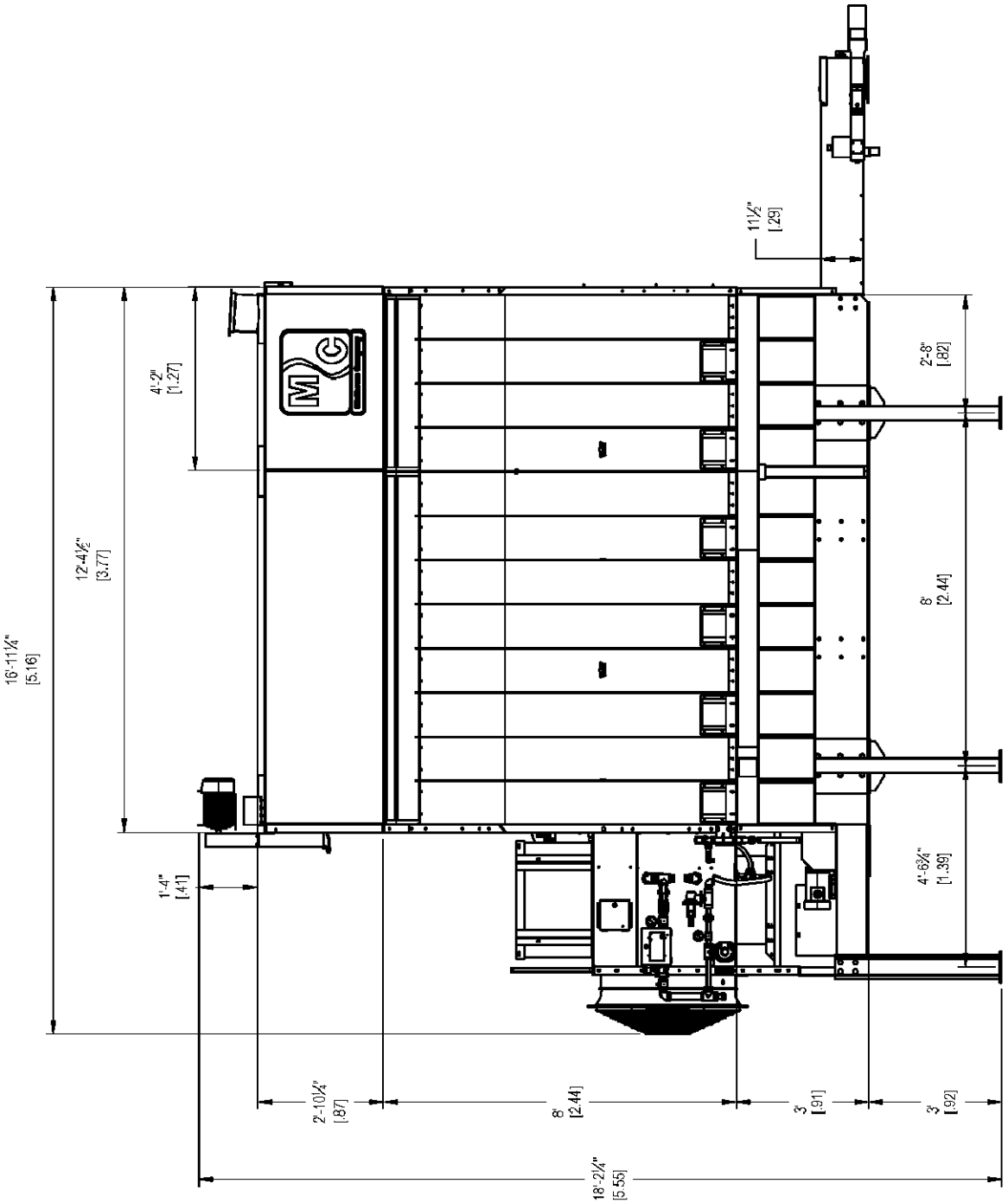
Side View

CF 320 Rear View Dimensions



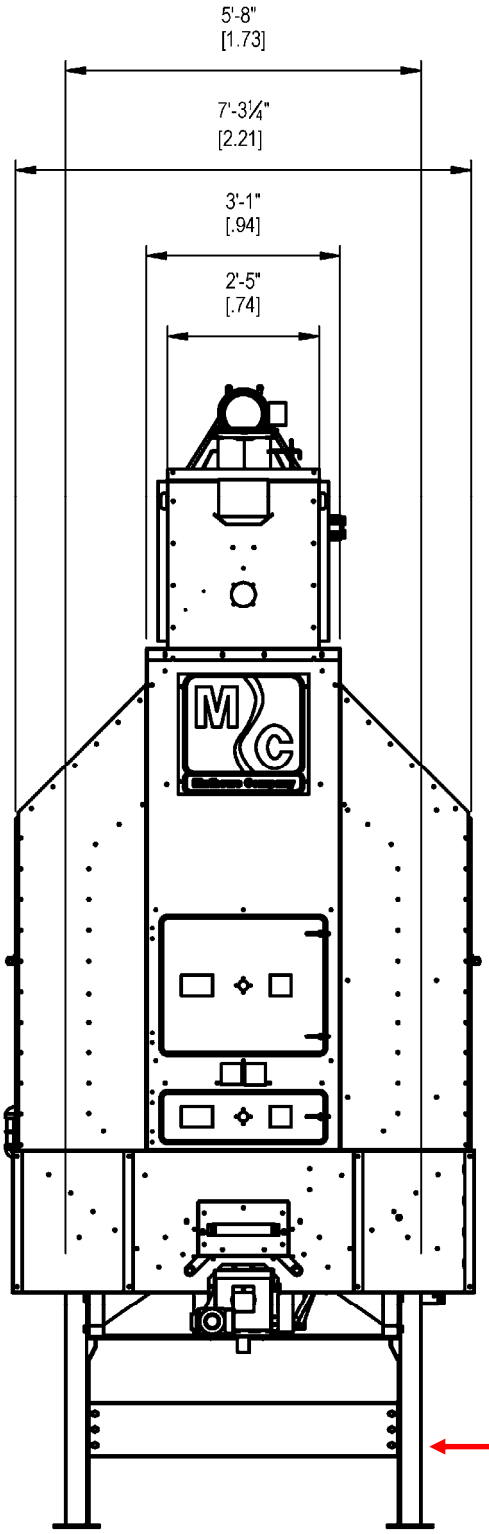
Rear View

CF 420 Side View Dimensions



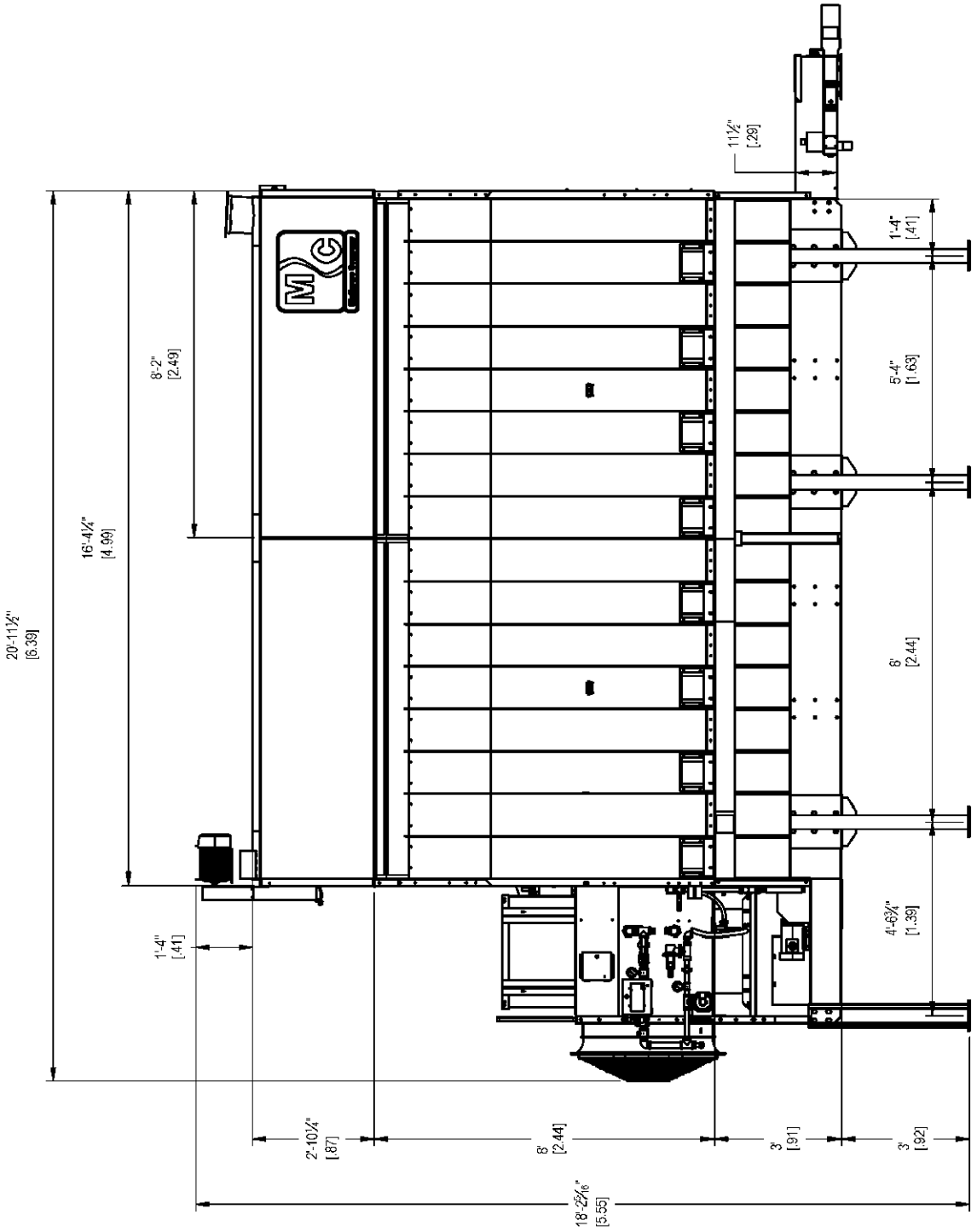
Side View

CF 420 Rear View Dimensions



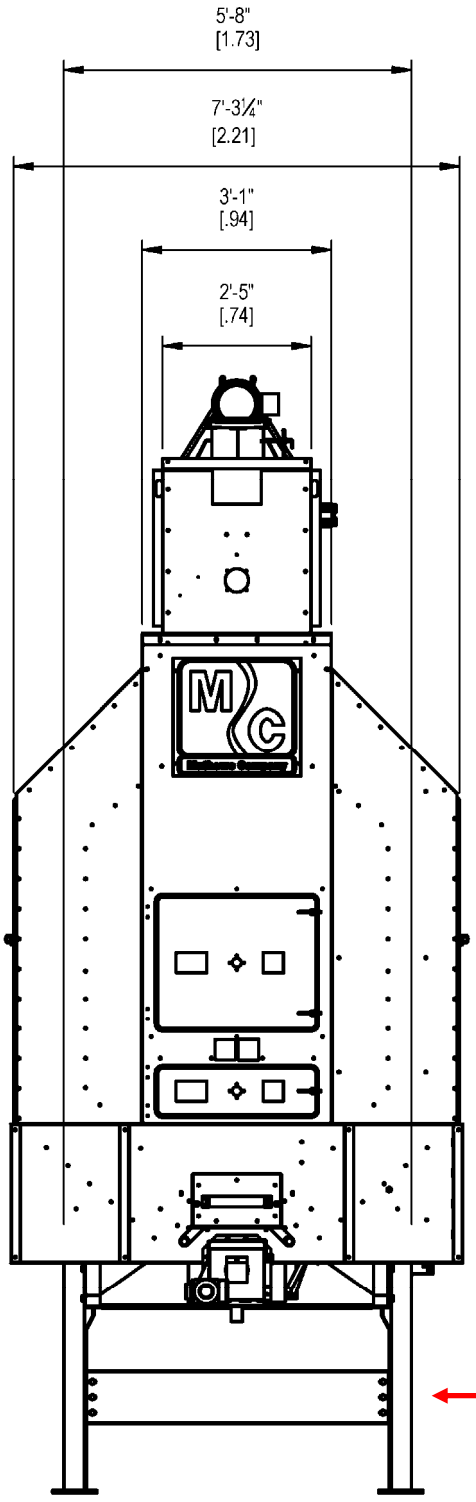
Rear View

CF 520 Side View Dimensions



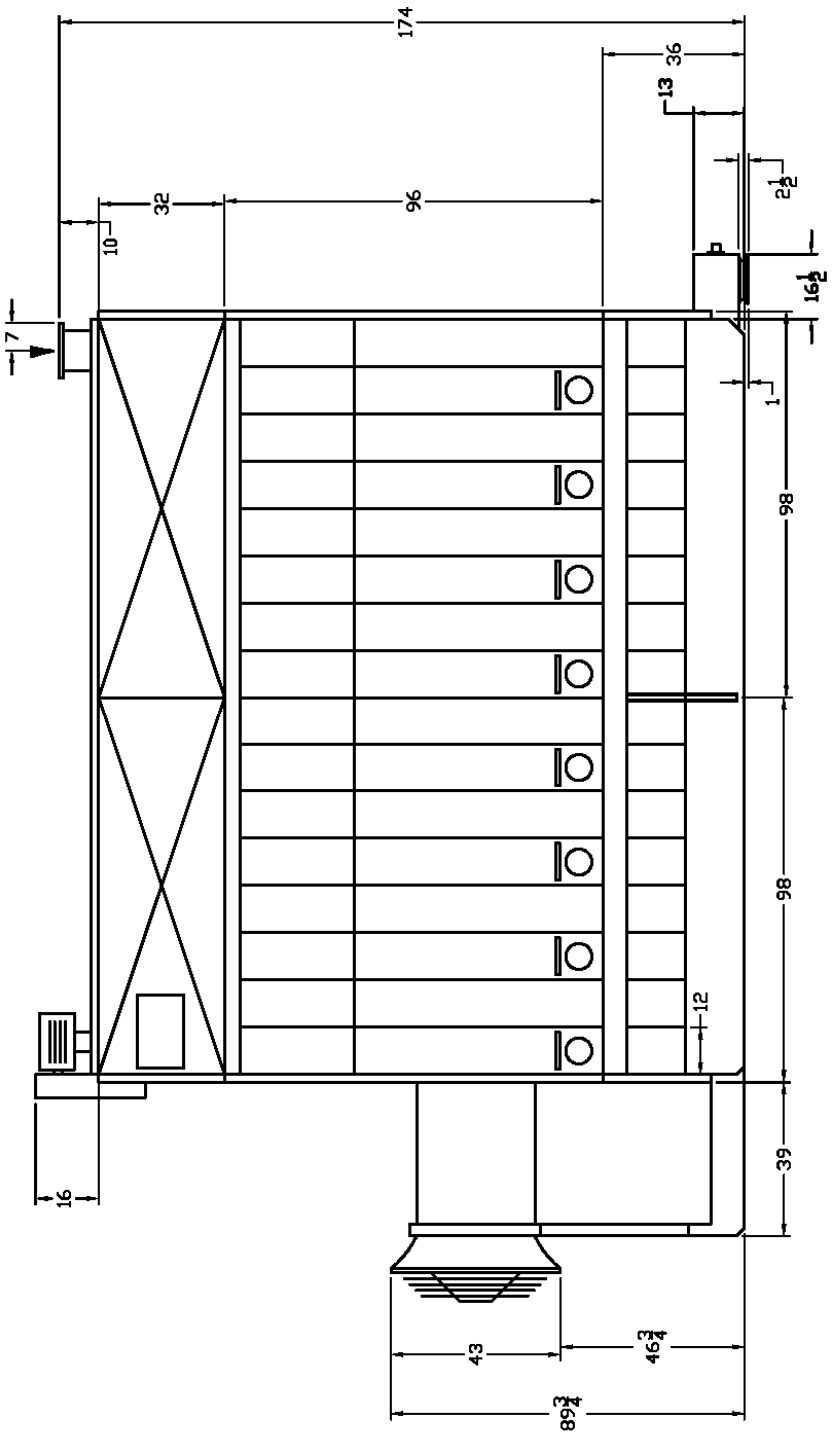
Side View

CF 520 Rear View Dimensions



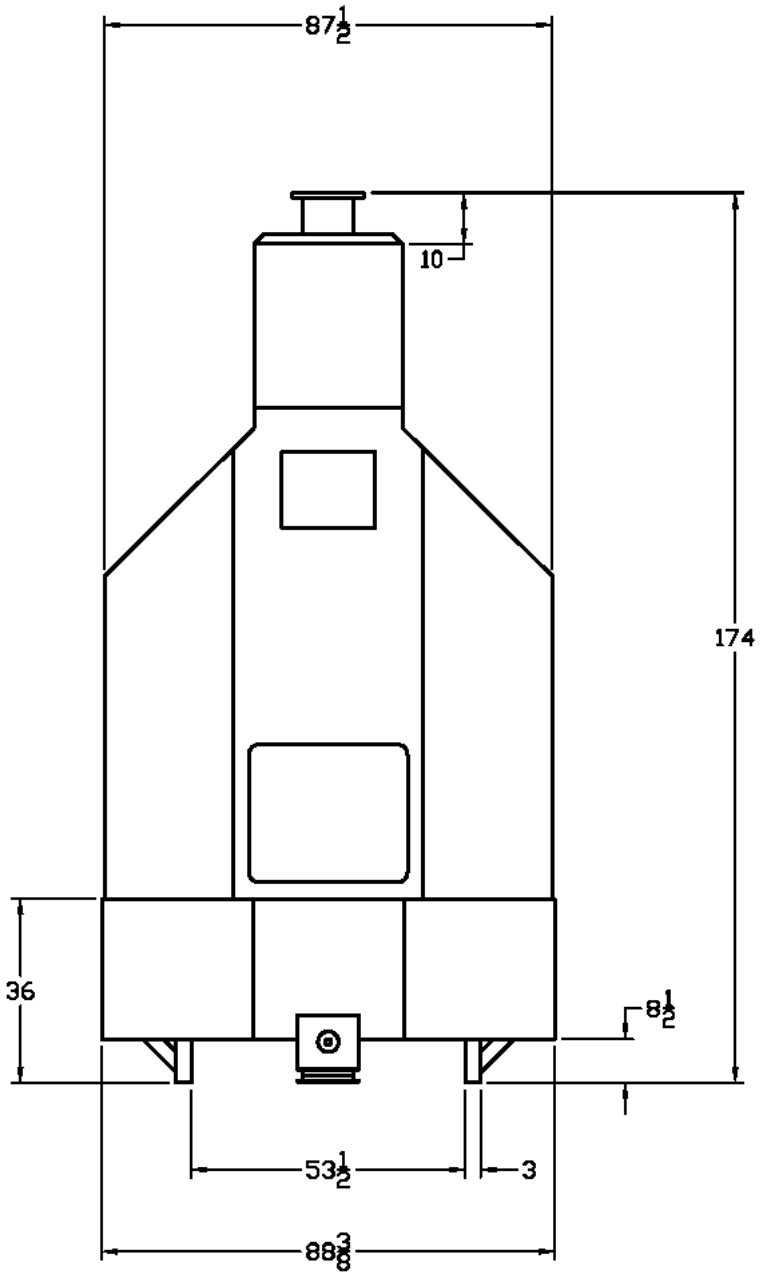
Rear View

CF 620 Side View Dimensions



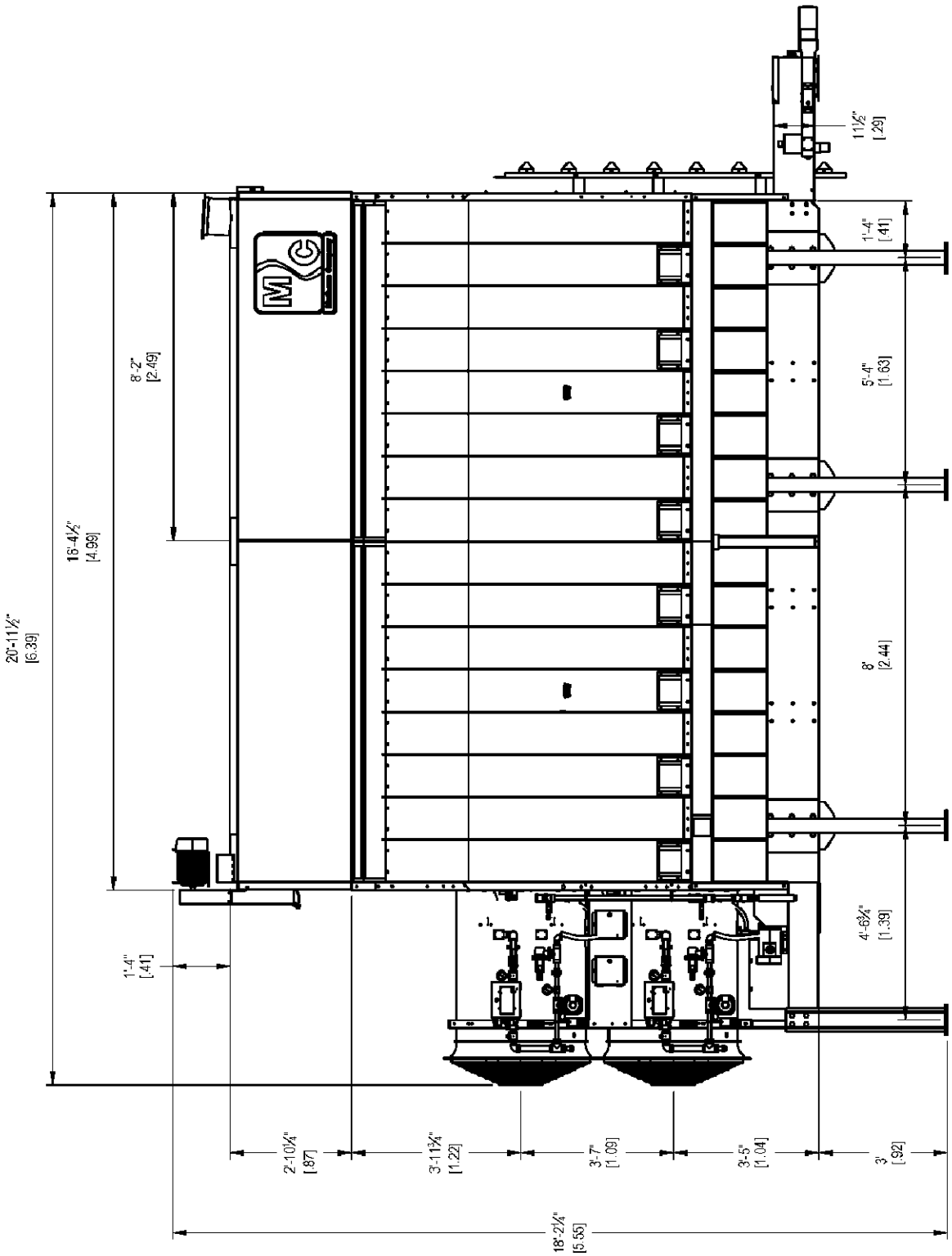
Side View

CF 620 Rear View Dimensions



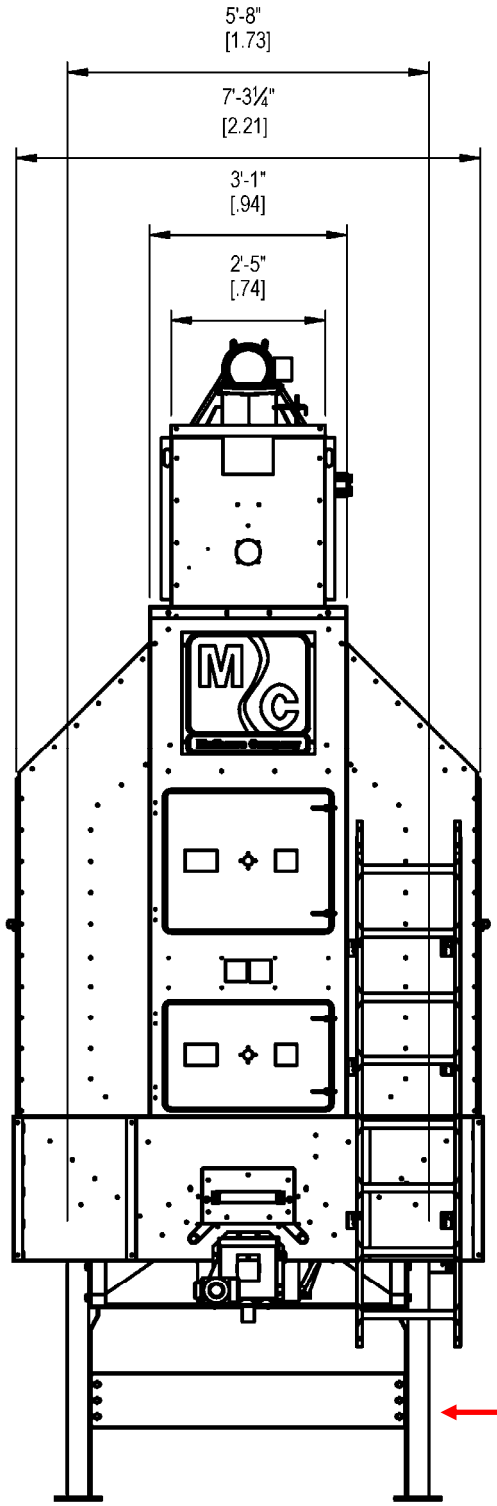
Rear View

CF 720 Side View Dimensions



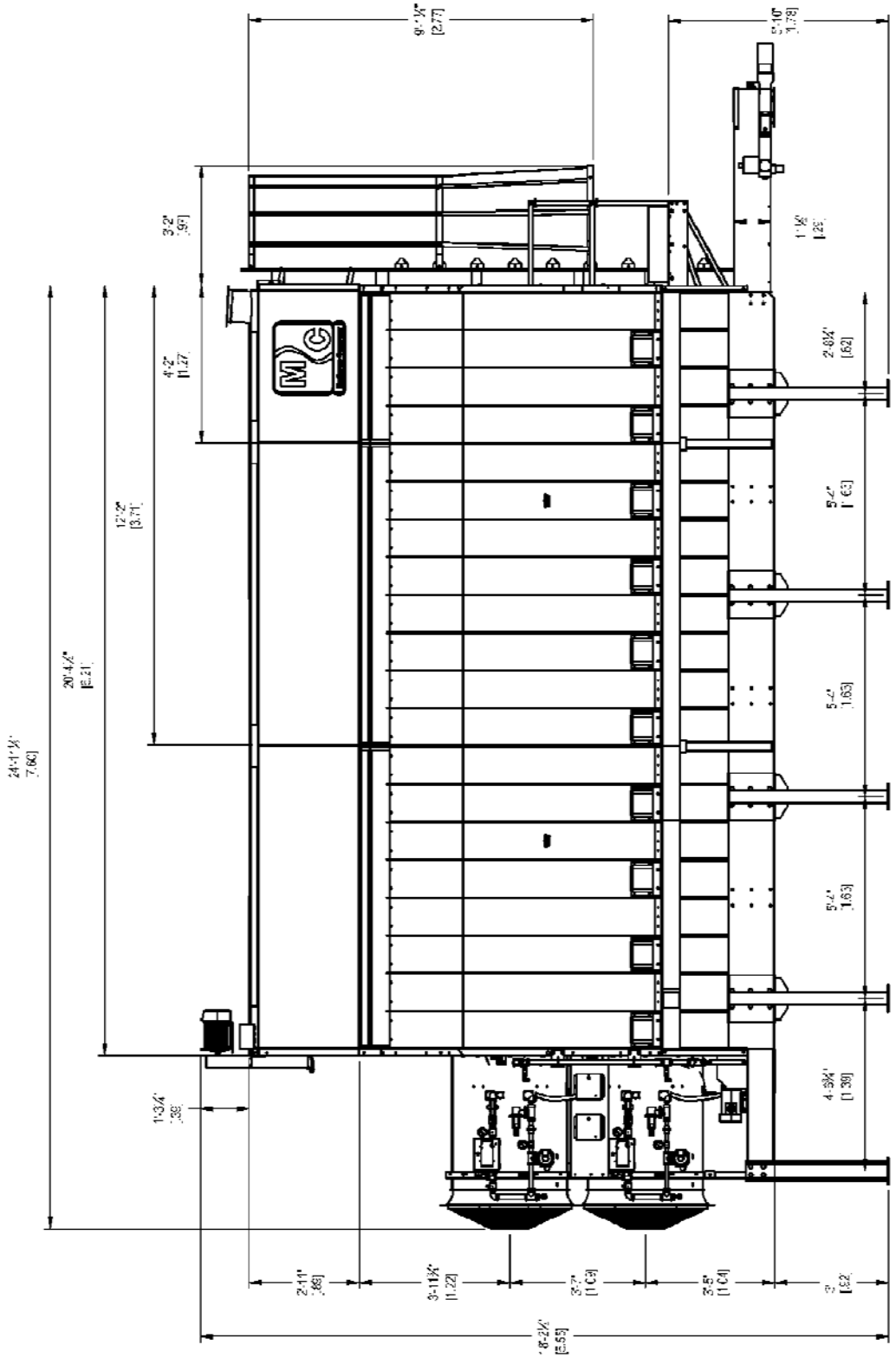
Side View

CF 720 Rear View Dimensions



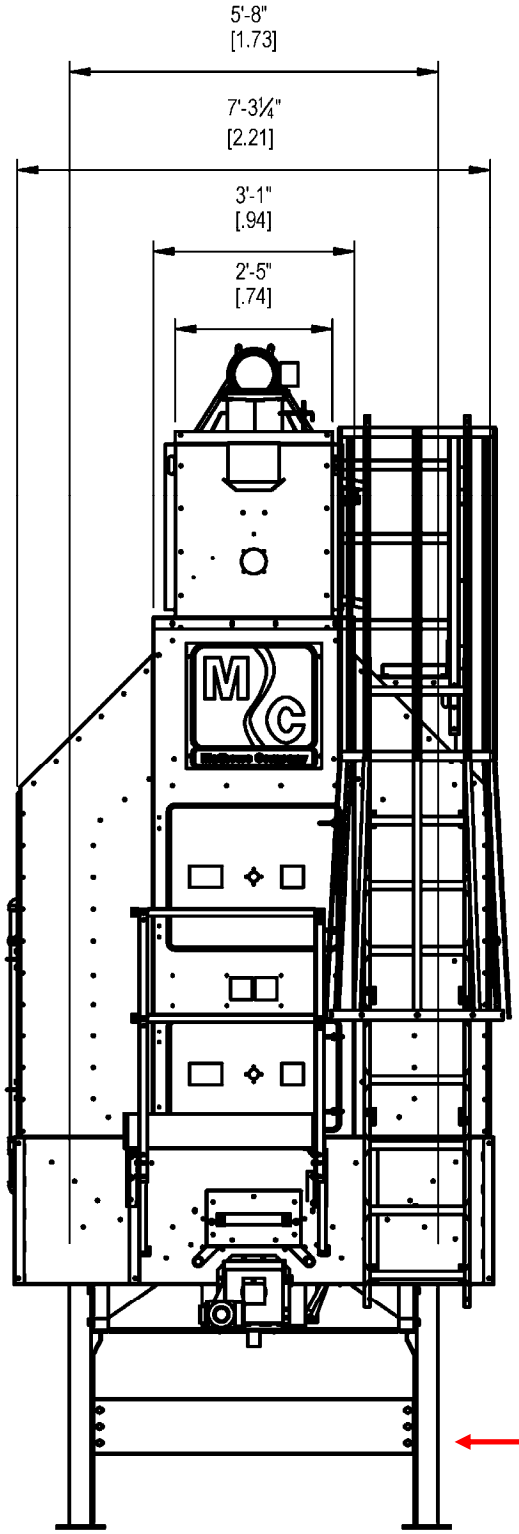
Rear View

CF 730 Side View Dimensions



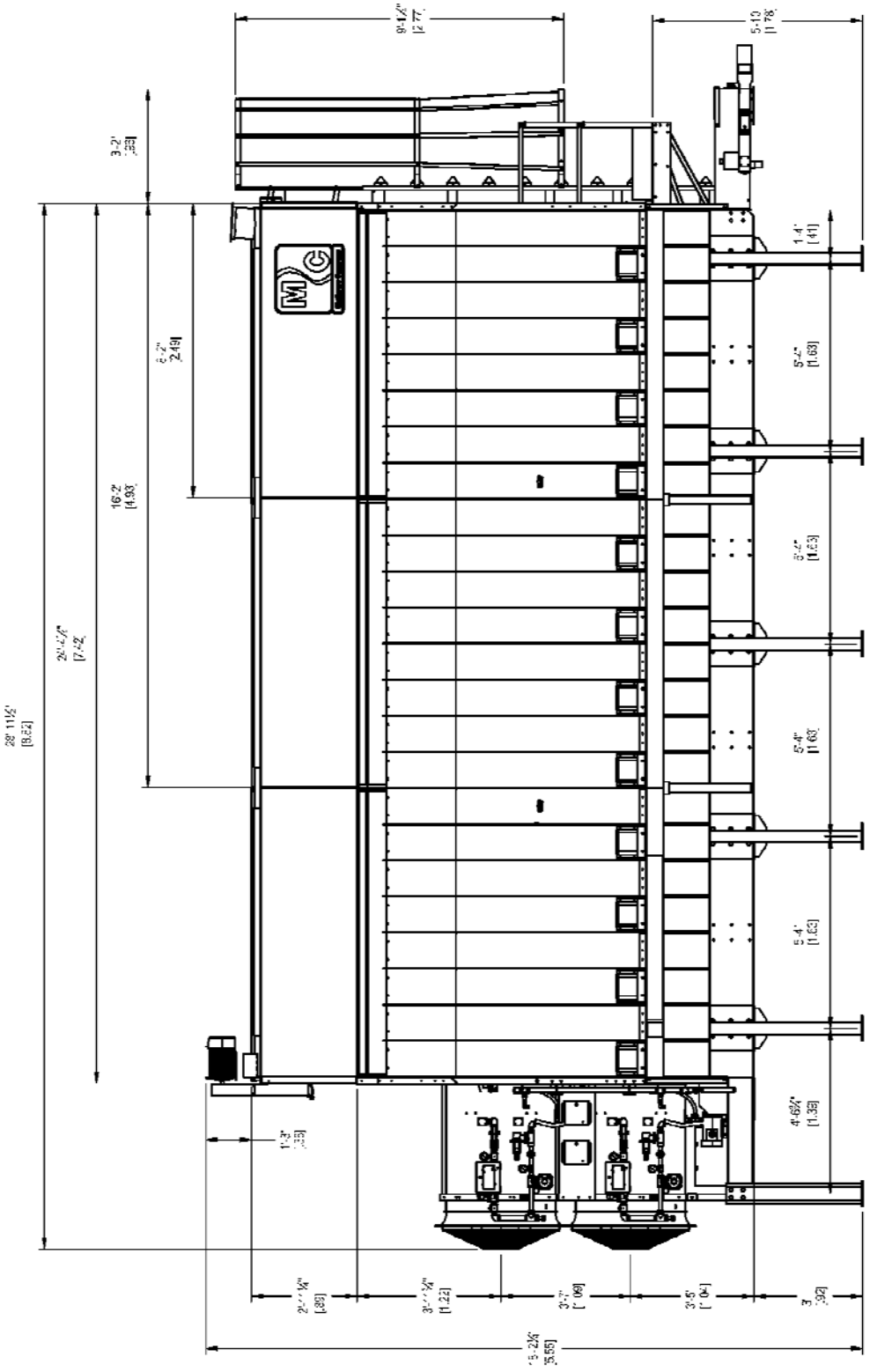
Side View

CF 730 Rear View Dimensions



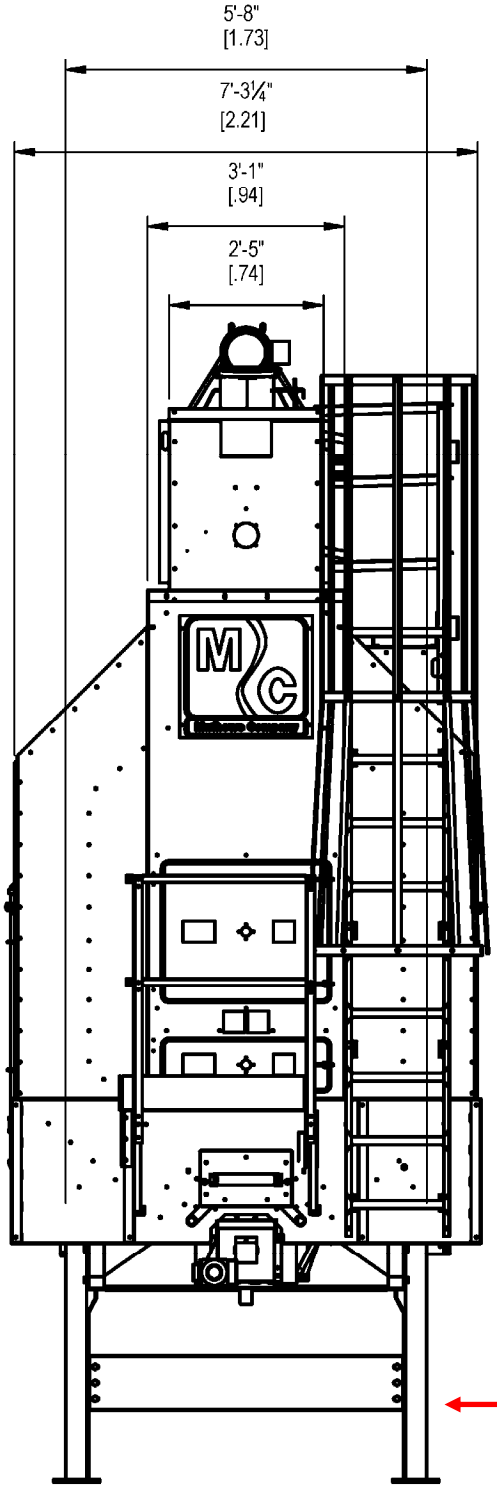
Rear View

CF 820 Side View Dimensions



Side View

CF 820 Rear View Dimensions

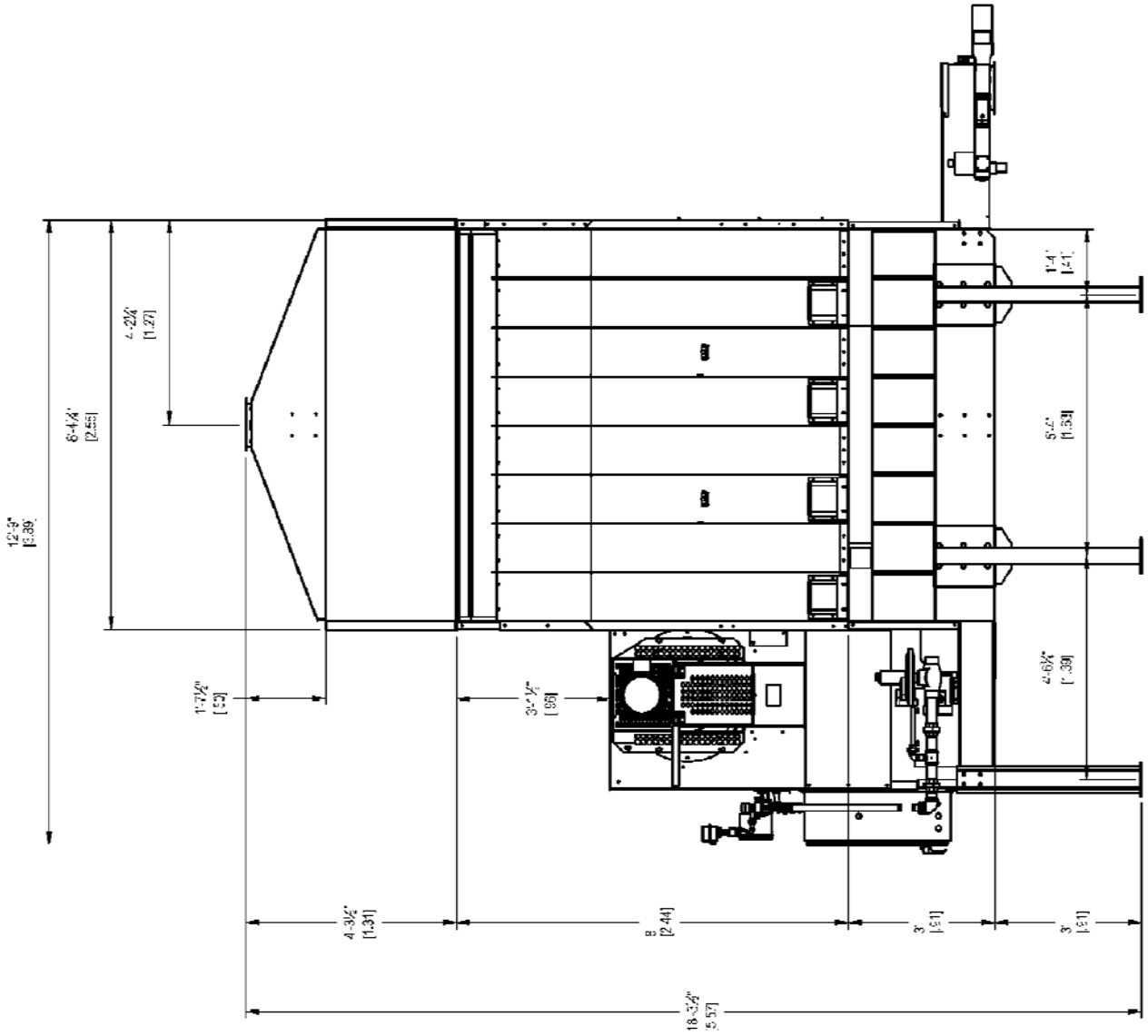


Rear View

Infinity Series Centrifugal Dryer Specifications

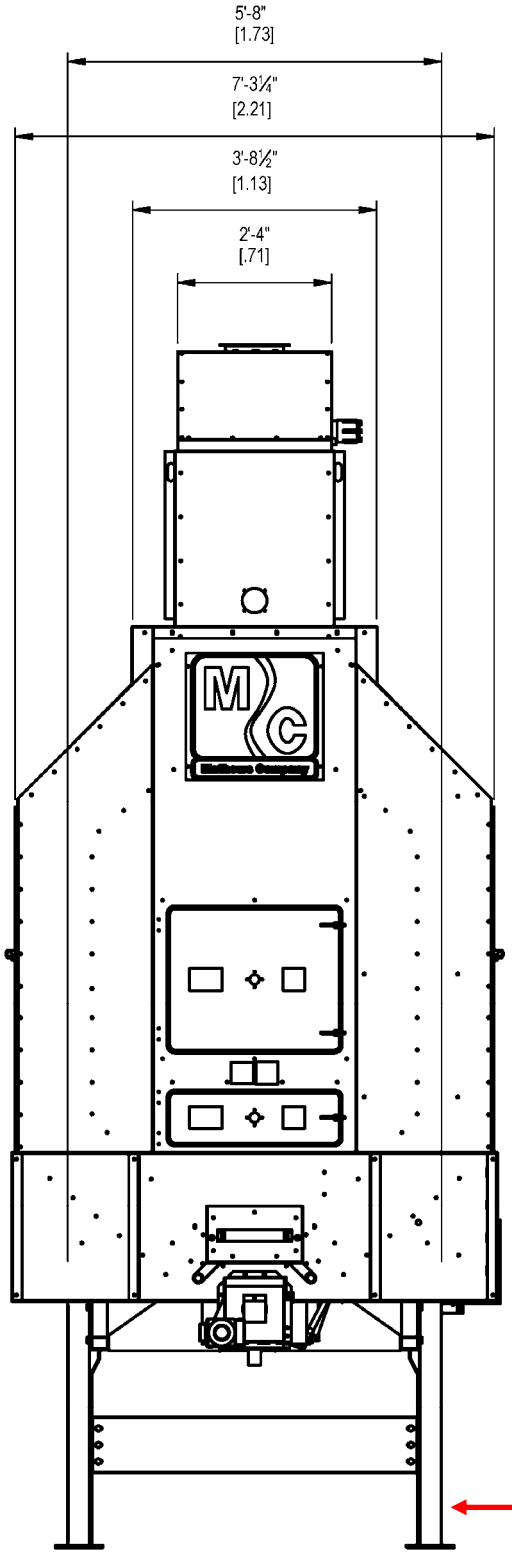
Model	CF 320C	CF 420C	CF 520C	CF 620C	CF 820C
Holding Capacity	200 bu	281 bu	375 bu	375 bu	562 bu
Grain Column Thickness	12"	12"	12"	12"	12''
Grain Column Length	8'-0"	12'-0"	16'-0"	16’-0”	24’-0”
Burner Capacity (Heat+Cool)	2.00 MMBTU/hr	2.23 MMBTU/hr	2.58 MMBTU/hr	N/A	N/A
Burner Capacity (All Heat)	2.99 MMBTU/hr	3.42 MMBTU/hr	3.97 MMBTU/hr	3.88 MMBTU/hr	4.77 MMBTU/hr
Fan(s) Configuration	(1) Centrifugal	(1) Centrifugal	(1) Centrifugal	(1) Centrifugal	(1) Centrifugal
Fan Motor Size	10 HP	15 HP	20 HP	20 HP	30 HP
Level Auger Motor Size	N/A	3 HP	3 HP	3 HP	3 HP
Unload Auger Motor Size	1.5 HP	1.5 HP	1.5 HP	1.5 HP	1.5 HP
Operating Height (On Skids)	15'-2"	14’-6”	14’-6”	14’-6”	14’-6”
Overall Length	16'-6"	20'-6"	24'-6"	24’-6”	32’-6”
Overall Width	7’-5”	7’-5”	7’-5”	7’-5”	7’-5”
Electrical Load (230V/1ph/60Hz)	92 Amps	136 Amps	152 Amps	152 Amps	N/A
Electrical Load (230V/3ph/60Hz)	68 Amps	93 Amps	108 Amps	108 Amps	136 Amps

CF 320C Side View Dimensions



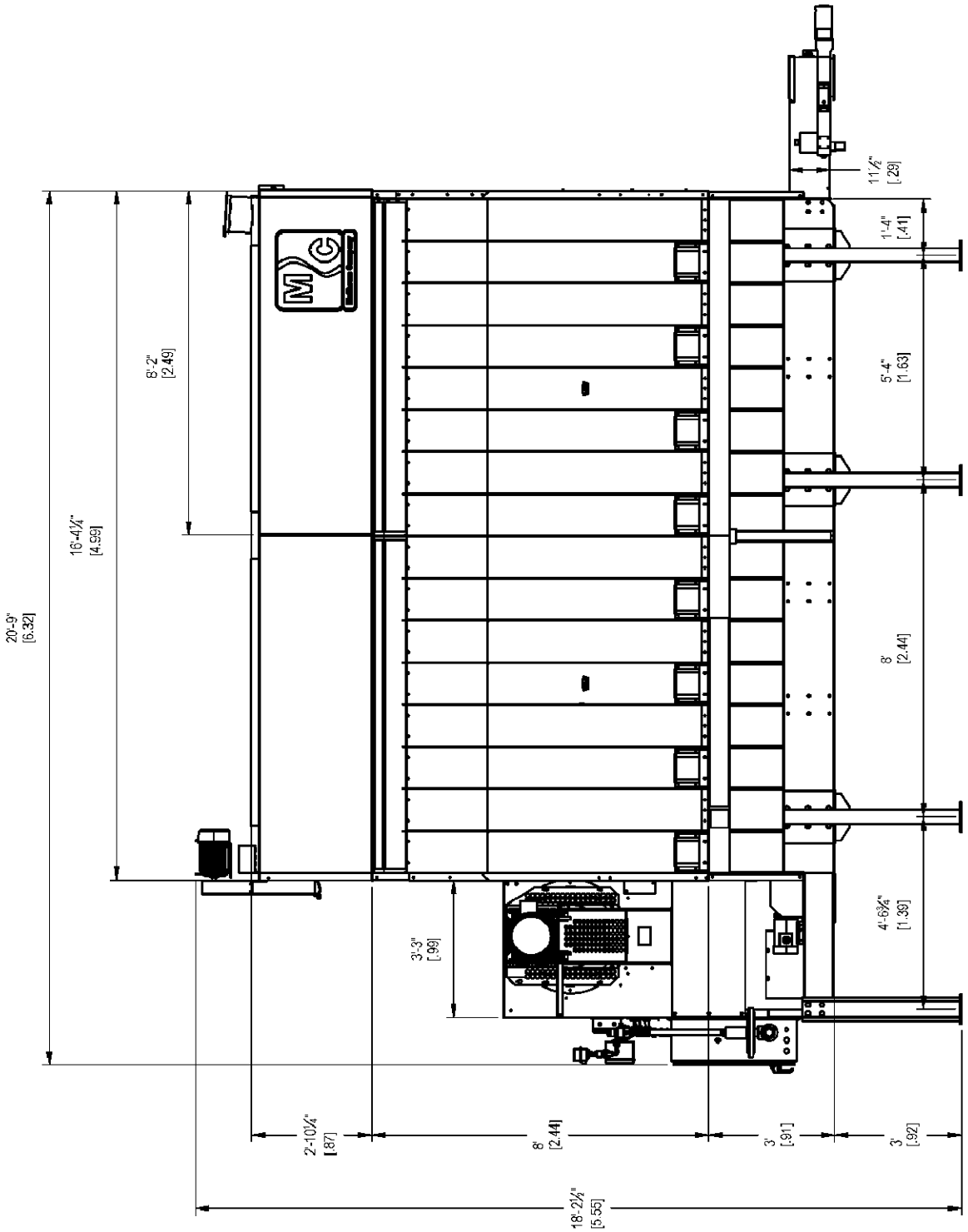
Side View

CF 320C Rear View Dimensions



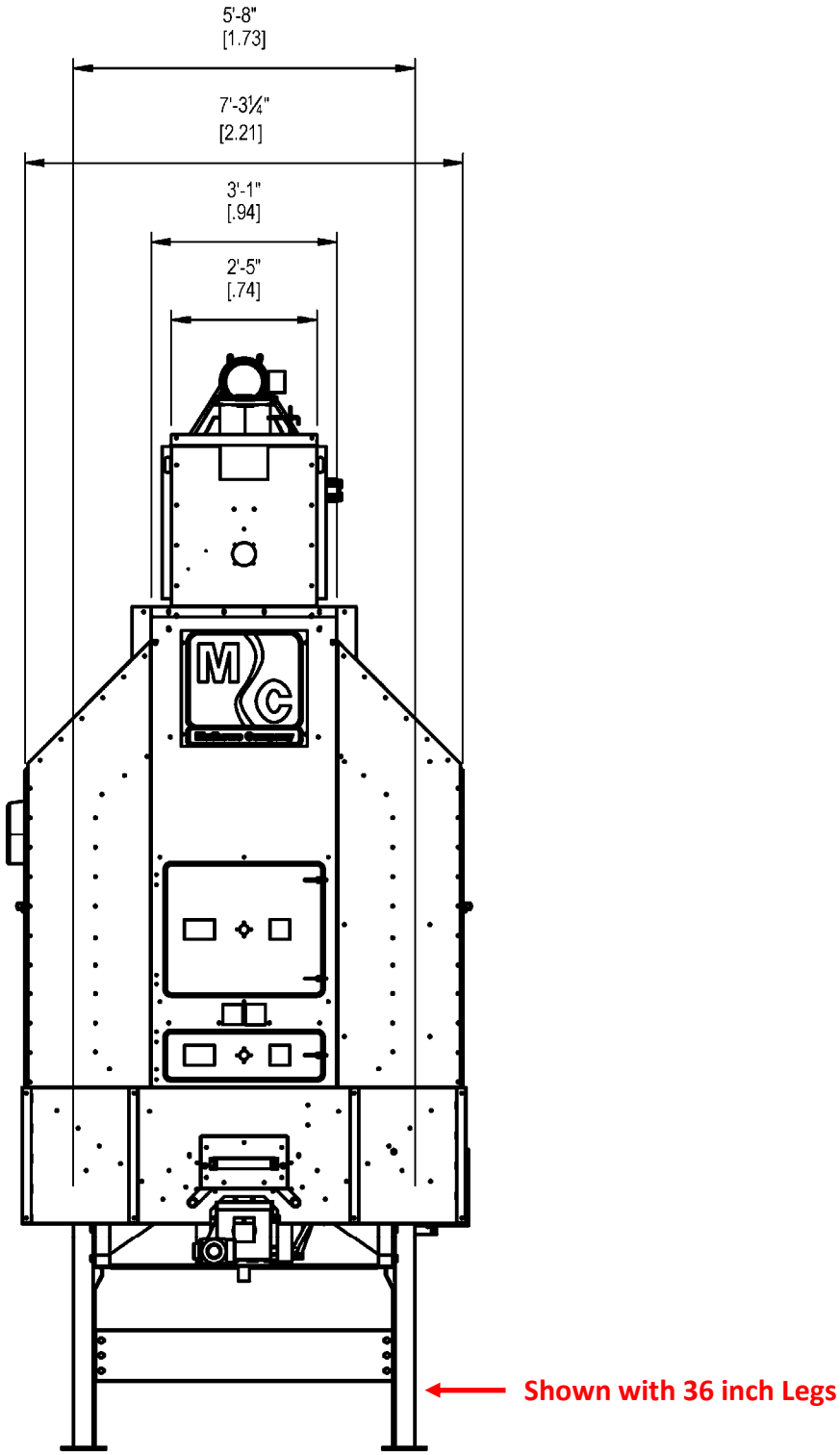
Rear View

CF 520C Side View Dimensions



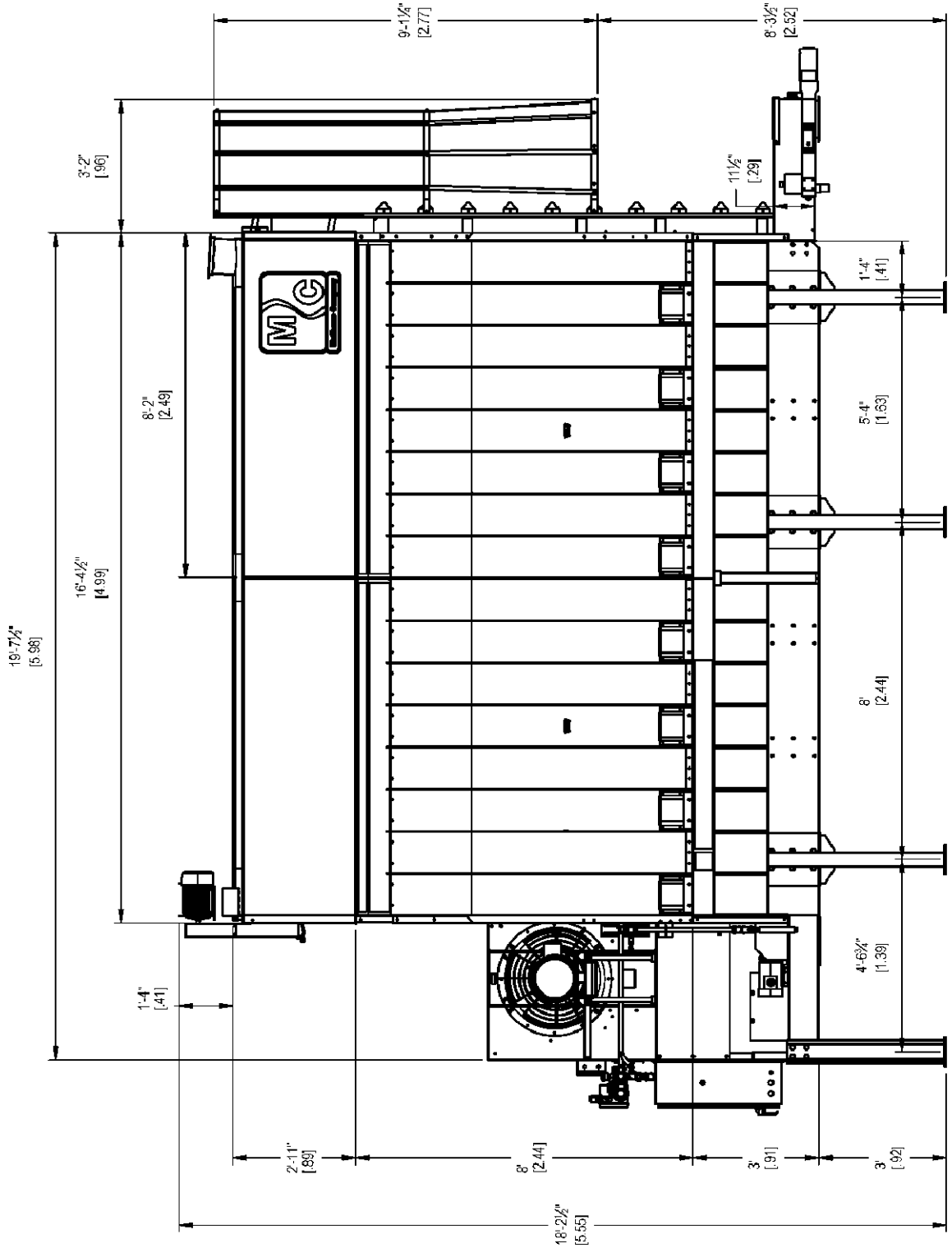
Side View

CF 520C Rear View Dimensions



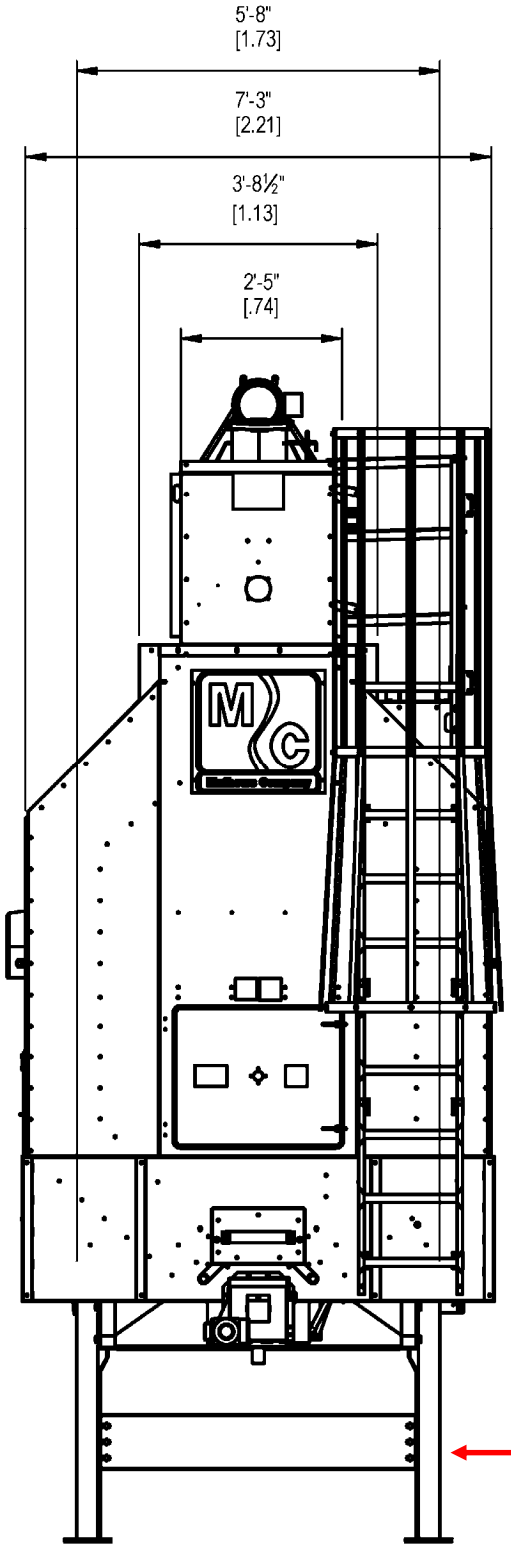
Rear View

CF 620C Side View Dimensions



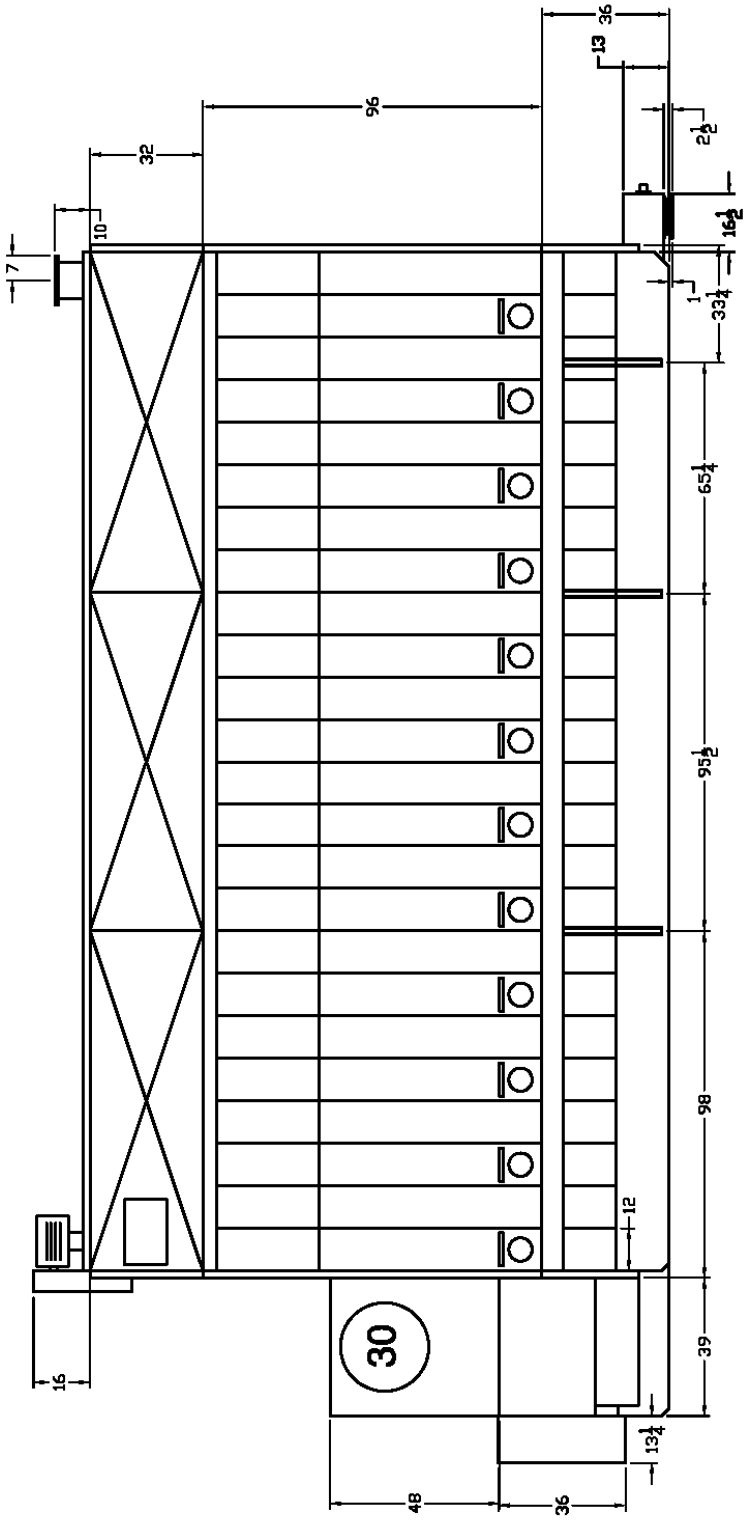
Side View

CF 620C Rear View Dimensions



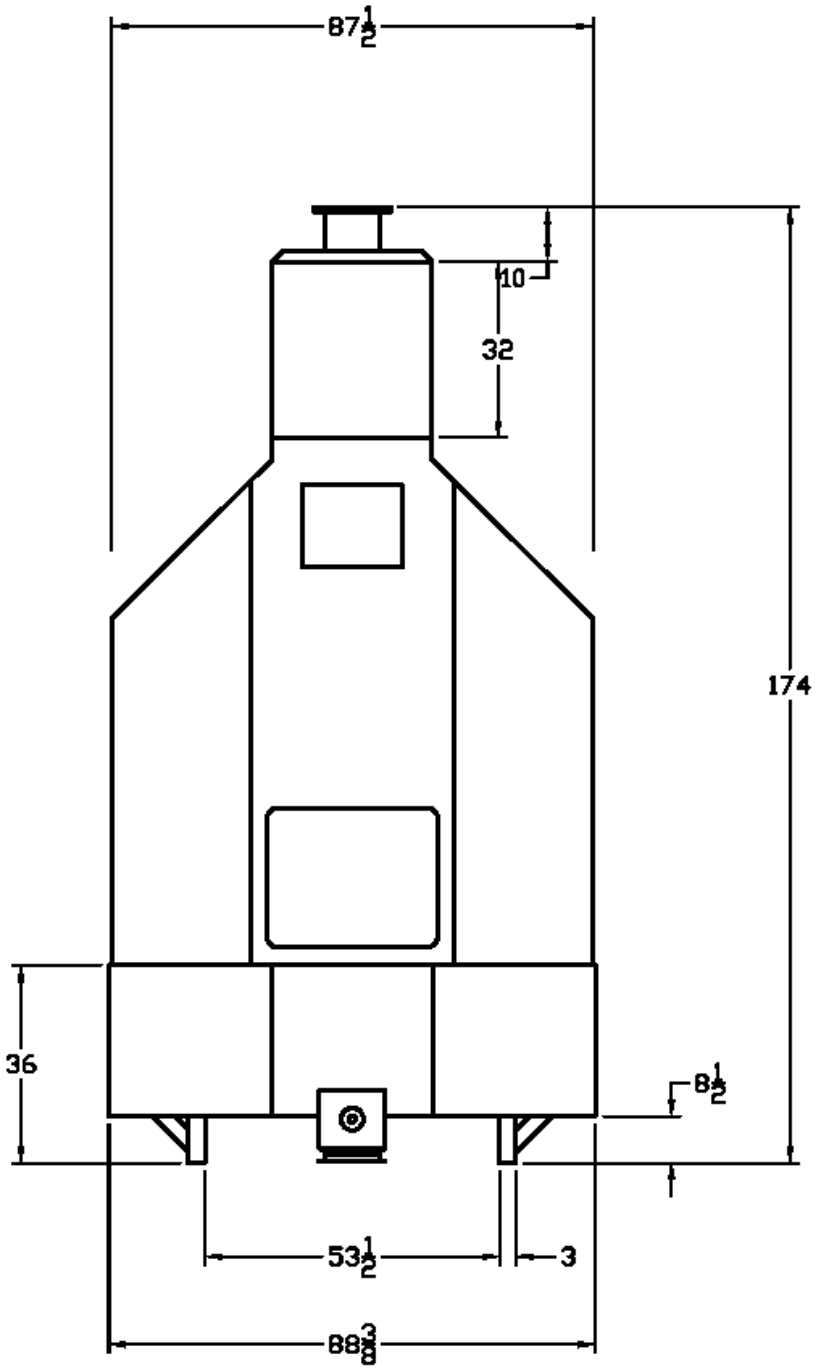
Rear View

CF 820C Side View Dimensions



Side View

CF 820C Rear View Dimensions



Rear View

Section 3

Section 3: Equipment Overview

Owner/ Operator Notes

This manual was prepared to provide owners and operators of the Mathews Company Infinity Series Grain Dryers with operating instructions and maintenance information that will enable them to keep their M-C Grain Dryers operating at peak efficiency.

Before operating your grain dryer, read the Start-Up and Operating Instructions. Become familiar with the controls, adjustments and settings required to obtain efficient operation.
To keep the dryer operating at peak efficiency, it should be: **CLEANED, LUBRICATED, BELT TENSION ADJUSTED, THE IGNITION SYSTEM CHECKED, AND THE FILL AND DISCHARGE SYSTEM TESTED.** This should be done annually prior to the drying season. Refer to "Pre-Season Check" in the Maintenance section. The Pre-Season check can be made when the dryer is empty. Any necessary repairs or adjustments should be completed so that the dryer will be ready to operate before the drying season.

Warranty Registration

It is important to send in your warranty registration card as soon as your new grain dryer is delivered. Not only does the card validate your grain dryer's warranty, but it assists M-C in disseminating information particular to your dryer model.

PANEL LISTING SPECIFICATIONS

MODEL	**CF 520**	CONTROL VOLTAGE	**110**	SERIAL NUMBER	**#60079**
MAXIMUM CONTROL CABINET OPERATING AMPS			**7**		
LARGEST BLOWER MOTOR HP		**20**	RPM	**1750**	
SHORT CIRCUIT CURRENT RATING IN AMPS			**10KA**		
THERMAL TRIP SETTING OF LARGEST MOTOR			**83 Amps**		

MATHEWS COMPANY
500 INDUSTRIAL AVE.
CRYSTAL LAKE, IL., U.S.A.
PRODUCTION DATE JUNE-2011

Figure 3: ***"Infinity Series Panel Listing Specifications"***

M-C GRAIN DRYER

MODEL	**CF 520**	CONTROL VOLTAGE	**110**		SERIAL NUMBER	**#60079**	
VOLTAGE	**230**	PHASE	**1**	HZ	**60**	MAX OPERATING AMPS	**152.4**
TOP BLOWER MOTOR HP			**20**		RPM	**1750**	
TOP AUGER MOTOR HP			**3**		RPM	**1760**	
LOWER AUGER MOTOR HP			**1.5**		RPM	**1725**	
FUEL	NATURAL GAS			LIQUID PROPANE		**YES**	
MAXIMUM ALLOWABLE SUPPLY PRESSURE					**20 PSI**		
MAXIMUM INPUT					**5,272,938 BTU**		

PLENUM STATIC PRESSURE FROM 1/2 TO 6 INCHES, W.C.
MINIMUM CLEARANCE TO COMBUSTIBLE CONSTRUCTION - 4 FEET

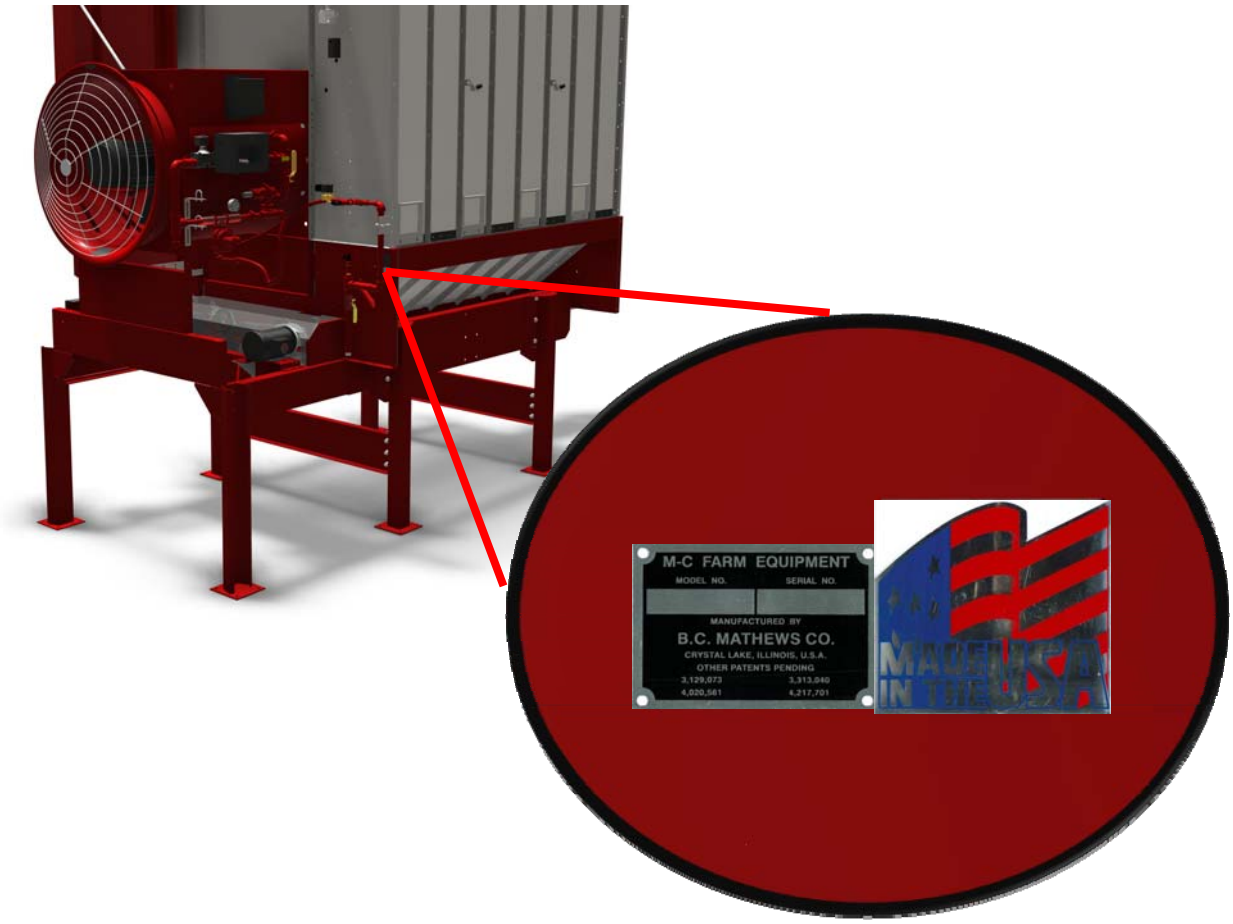
WARNING - FOR OUTDOOR INSTALLATION ONLY

MATHEWS COMPANY
500 INDUSTRIAL AVE.
CRYSTAL LAKE, IL., U.S.A.
PRODUCTION DATE **JUNE-2011**

Figure 2: ***"High Voltage Cabinet Information Decal"***

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



Safety Precautions

1. Read and understand the operations manual before attempting to operate the dryer.
2. Keep **ALL** guards, access doors, covers, safety decals, and safety devices in place and securely fastened**. NEVER** operate the dryer while guards are removed.
3. Keep all untrained personnel away from system components and control panels 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 an approved lockout device prior to performing any service or maintenance work on the fan or burner 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 test with "**engaged**" circuits, proceed with extreme caution and follow all established safety practices.
10. Routinely check for any gas 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 out/ tag out procedure is to prevent injury and/or death to personnel by requiring that certain precautions be taken before servicing or repairing equipment. This includes shutting off and locking out the electrical power source of the equipment.

1. All maintenance personnel are issued a suitable lock (or locks). The lock has the individual worker's name and other identification on it. That worker will have the only key to the lock.
2. 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 personnel who placed the lock should remove his/her lock.)
3. Check to be sure that no one is operating the machinery **BEFORE** turning off the power. The machine operator must be informed before the power is turned off. Sudden loss of power could cause an accident.
4. Any mechanism under load or pressure, such as springs, should be released and blocked.
5. All energy sources that could activate the machine must be locked out.
6. The main valve or main electrical disconnect must be tested to be sure that the power to the machine is **OFF**.

7. 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.
8. **CAUTION**: Return disconnects and operating controls to the **OFF** position after each test.
9. Attach accident-prevention tags, which give the reason for placing the tag, the name of the person placing the tag, how he/she many 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, durable, and should have the name of the employee or personnel on it. In addition, locks can be color coded to indicate different shifts or types of services.

Figure 5: - *"Lock Out Tag"*

Figure 4: - *"Lock Out Lock Assembly"*

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 or personnel who is working on the equipment and how that person may be reached.
- Date and time the tag was put in place.

Blocks

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

Blocks, special brackets, or special stands, such as those commonly used under raised vehicles, must be available at all times. Another form of blocking is the placement of a blind. A blind is a disk of metal placed in a pipe to ensure that no air 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.

Figure 6: - *"Lock Out Safety Sign"*

Grain Dryer Component Function

Field Device Components

Ignition Board
This board's function is to supply high voltage from the coil to the either the spark or the igniter to ignite the burner. For continuous operation successful flame proving is necessary.

Rotary (Bin) Fill Switch
The rotary fill switch is located in the wet hopper on the end opposite the fill tube. This is powered by 120 volts and contains normally open and closed contacts. The switch is motorized and will rotate a 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 on the outside of the dryer with a capillary bulb in the plenum chamber. This device is adjustable and should be set 40 degrees higher than the plenum temperature set point. If the plenum temperature reaches the high-limit set point, the device will actuate and shut down the dryer. The high-limit switch is normally closed until the temperature reaches the set point, upon reaching the set point the contacts will open and shut down the dryer.

Air Pressure Switch
The air pressure switch is an air flow proving device. The switch is fully adjustable, allowing the operator to set the air pressure switch to detect air when the machine is full of grain. The air pressure switch is normally open and will not close until sufficient air pressure is detected. Once sufficient air flow is detected, the switch closes and provides 120 volts to the ignition, allowing the operator to ignite the burner.

Temperature Controller
Temperature Controller displays the plenum temperature measured by the thermocouple and commands the gas control valve. The valve will open automatically adjusting the gas flow to continually adjust to maintain the plenum temperature automatically. This device can also shut down the machine if the actual plenum temperature rises or falls more than 40° F.

Belimo Valve Actuator
Is an electrical proportional valve that responds to signals from the cal controller output, the cal controller receives the signal from the plenum thermocouple and then sends the signal to the Belimo Valve Actuator. From there it modulates the gas flow to maintain the plenum temperature.

Mid-Grain RTDs

Mid-Grain RTDs (Resistance Temperature Device) located on the side of the dryer are used to detect the temperature of the grain. Four mid-grain RTDs are used to drive the TruDry Control System.

Thermocouple

The Plenum thermo couple is a temperature sensing device used to transmit a signal to the temperature controller. It is located in the plenum chamber to monitor plenum air temperature.

Discharge Moisture Sensor

The discharge moisture sensor monitors the moisture and temperature of the discharge grain using DC power and micro-processing technology. Moisture is measured using capacitance to the ground. The temperature of the grain is measured by a thermocouple device on a moisture sensor.

Linear Limit Devices (LLC)

Located outside the grain column wrapped around the top screen section of dryer. The linear limit is an over-temperature-detection device.

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 the burner.

Variable Frequency Drive (VFD)

The VFD unit is a single phase input and three phase output device to run and protect the discharge motor. This device is controlled by the PLC.

Whisker Actuator Limit Switch

Spring loaded lever that maintains a normally open contact that is held closed. It is designed to operate when the rear discharge overload door is opened. This switch appears on auger systems only, and does not apply to dryers with center dumps.

Axial Infinity Components Breakdown

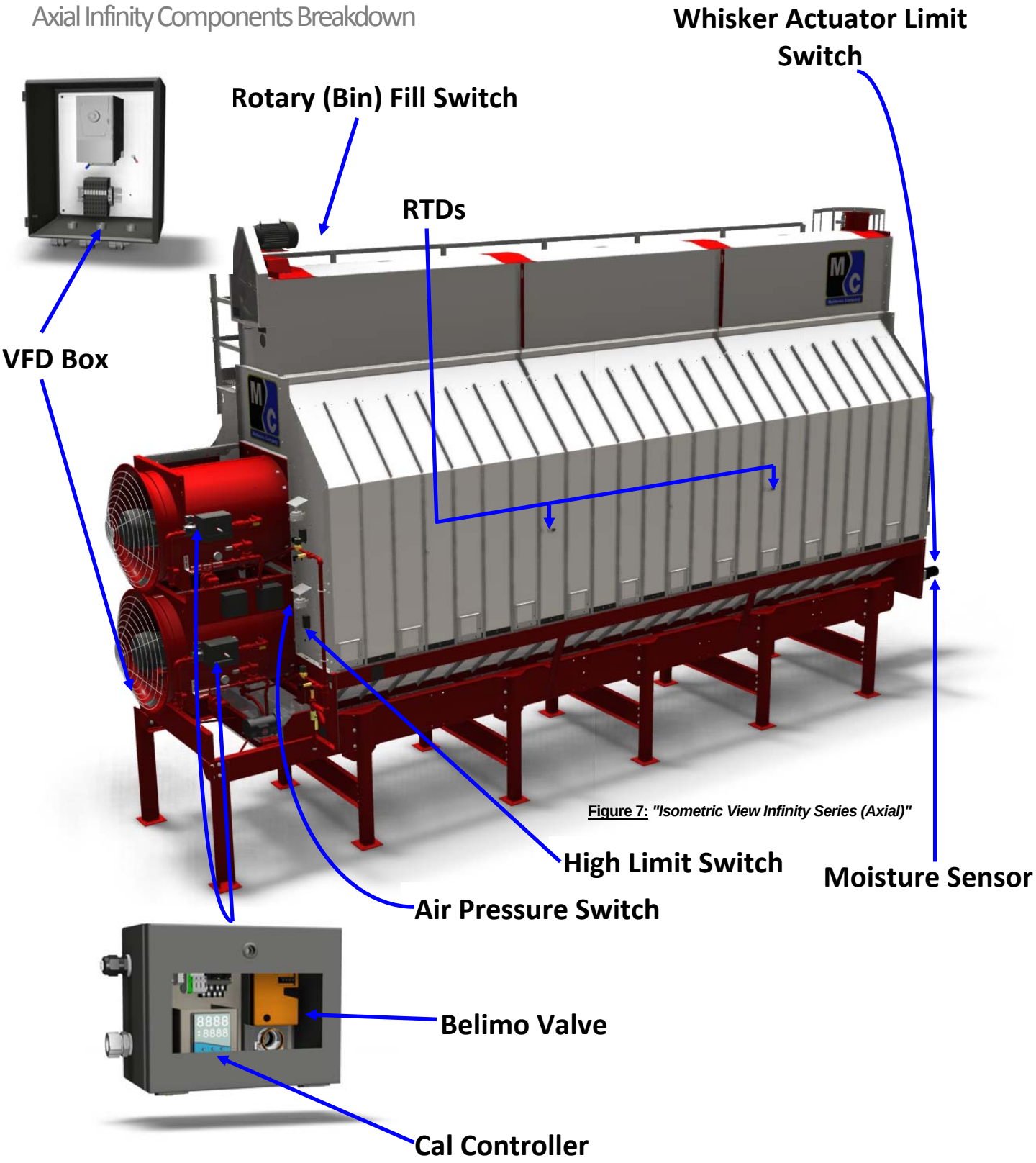


Figure 7: ***"Isometric View Infinity Series (Axial)"***

Centrifugal Infinity Components Breakdown

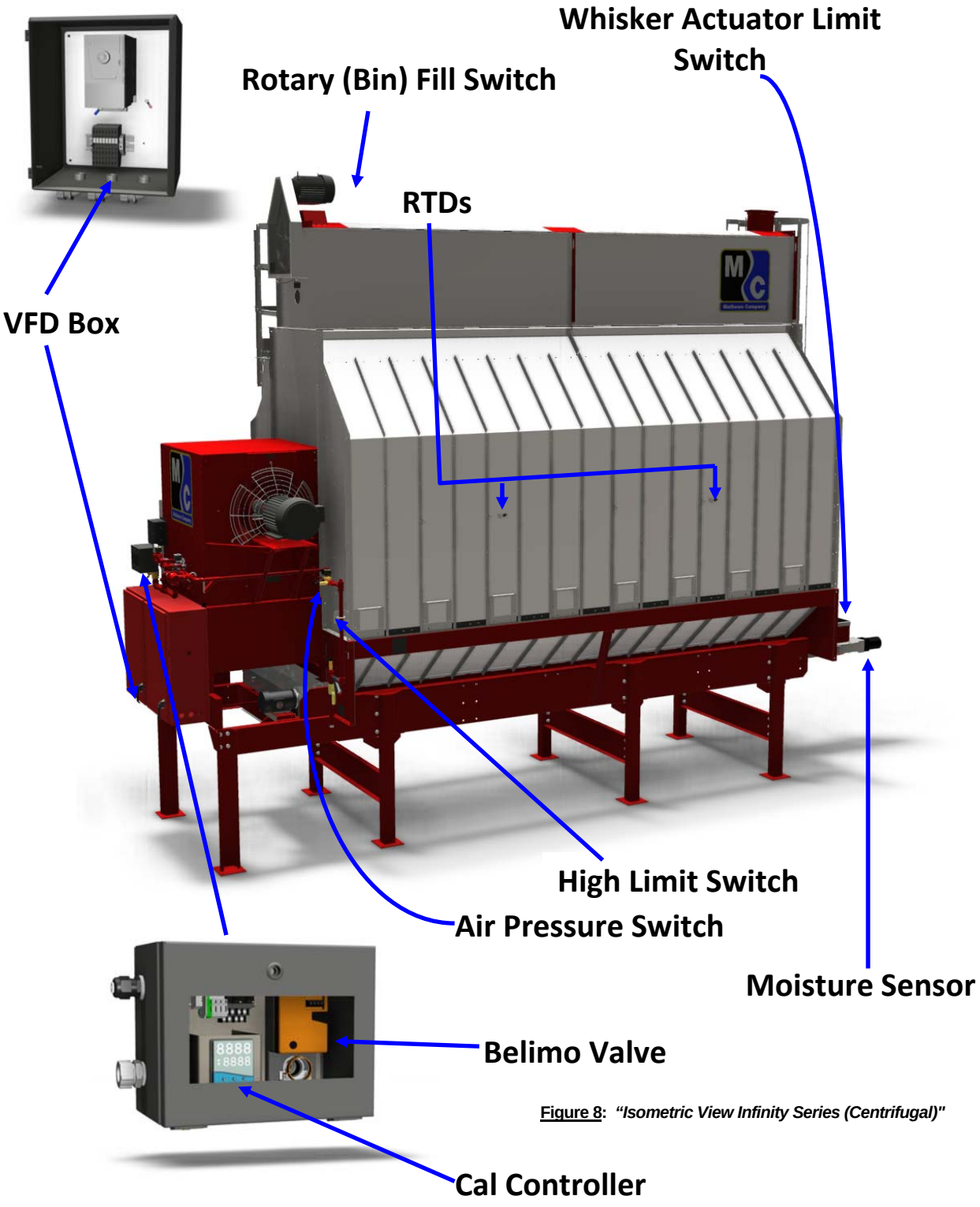


Figure 8: *"Isometric View Infinity Series (Centrifugal)"*

Remote Cabinet

Push Buttons
These push buttons are used for starting and stopping the blower.

LED Lights
All lights are 120-volt power LED's for daylight viewable use.

Rotary Switches
These come in a variety of combinations and are typically used to actuate items on and off or switch modes OFF-ON-START.

HMI
Acronym stands for Human Machine Interface. This is the touch screen that displays graphical information from the PLC.

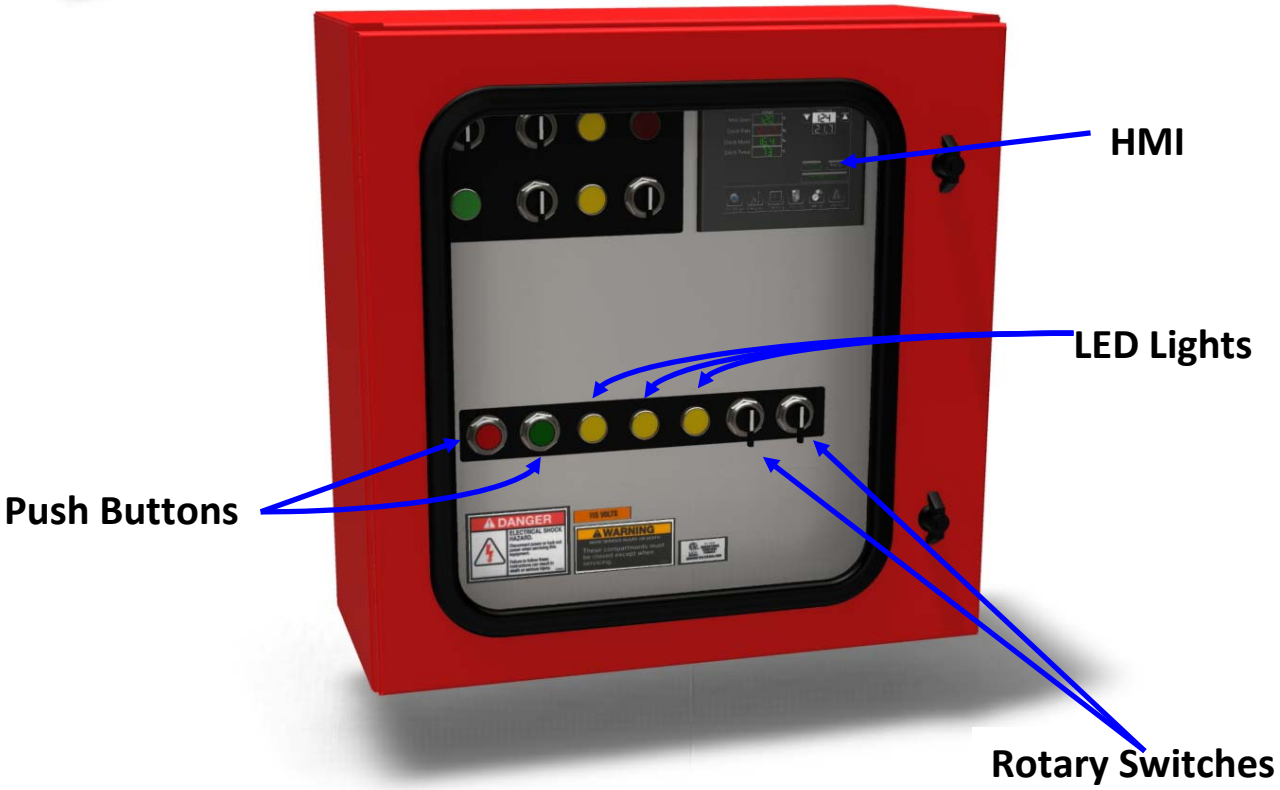


Figure 9: ***"Pinnacle Lite Remote Cabinet"***

Pinnacle

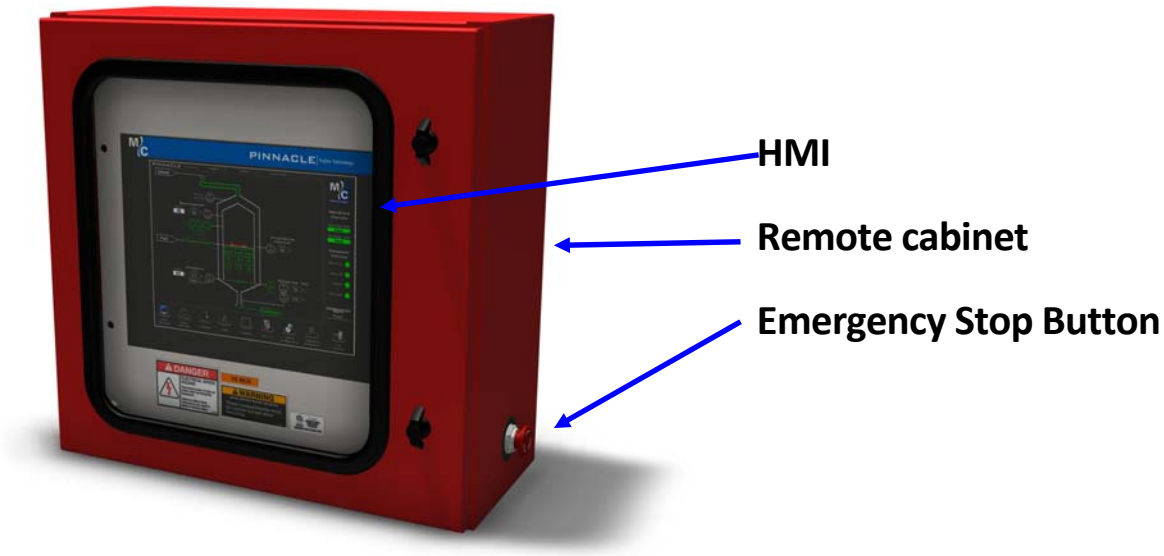


Figure 10: - *"Pinnacle Remote Cabinet"*

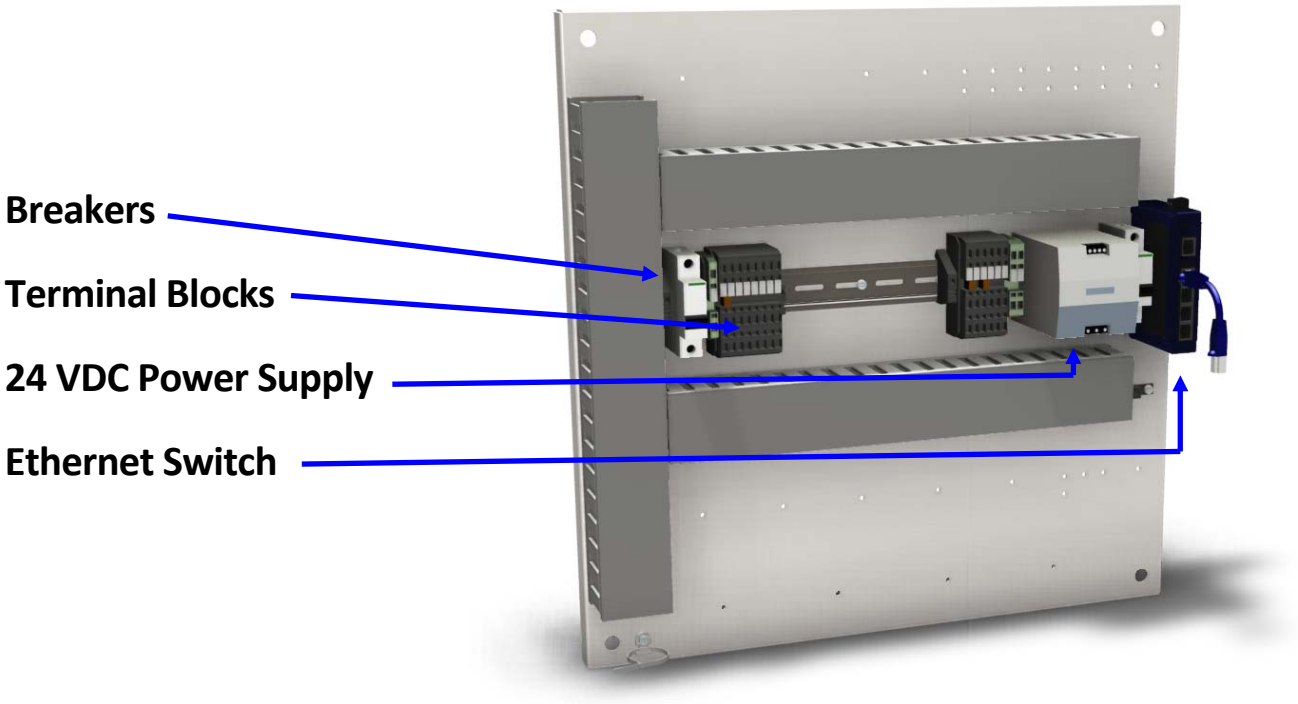


Figure 11: - *"Pinnacle Sub Panel Assembly"*

Pinnacle Lite

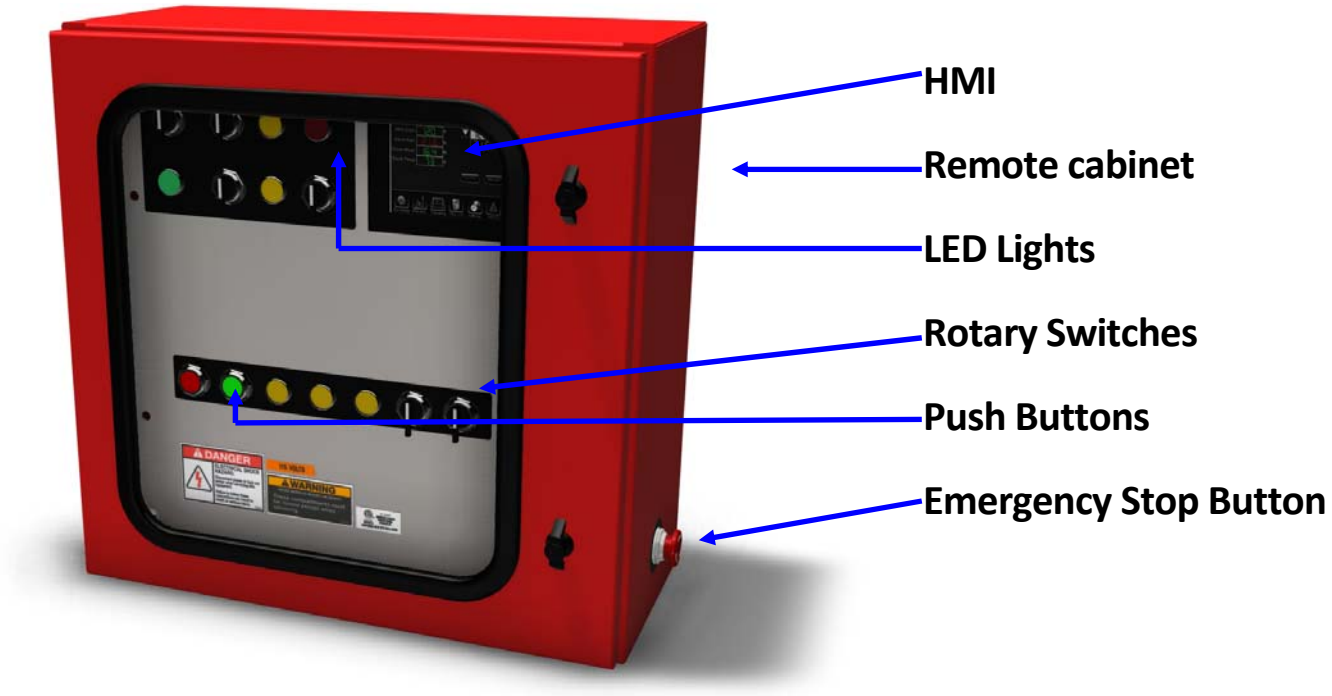


Figure 12: - *"Pinnacle Lite Remote Cabinet"*

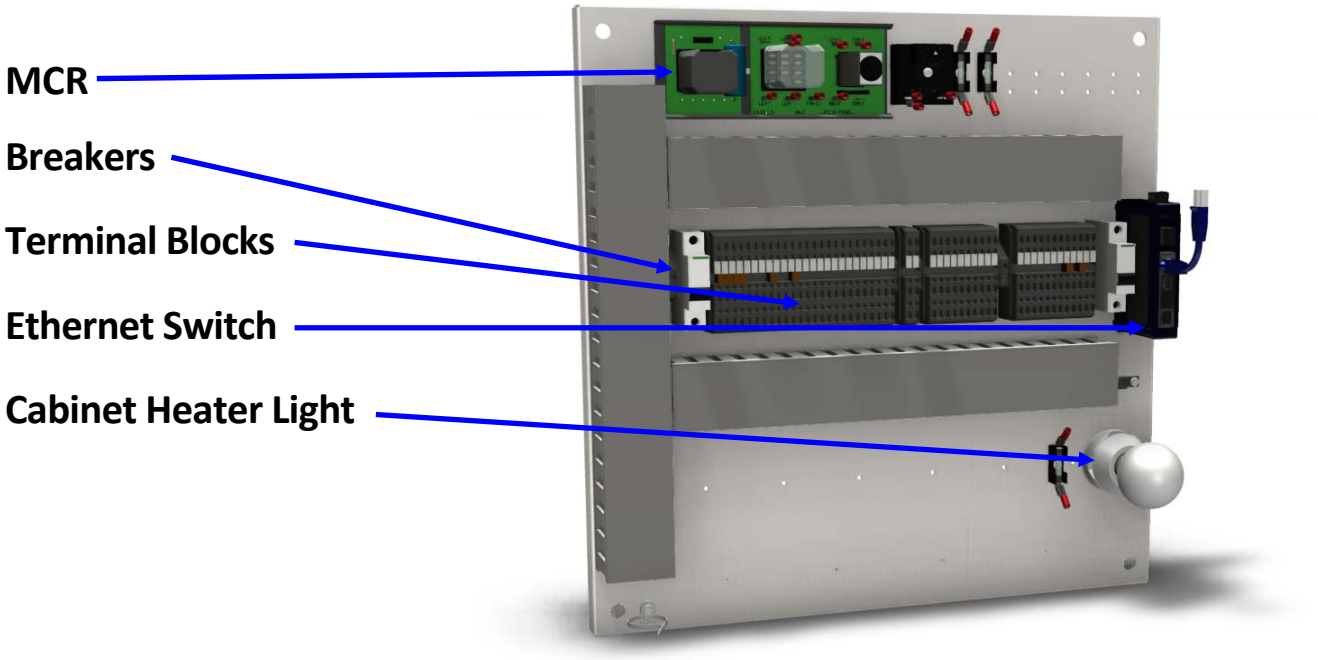


Figure 13: - *"Pinnacle Lite Sub Panel Assembly"*

Axial Infinity Dryer Direct Start High Voltage Cabinet

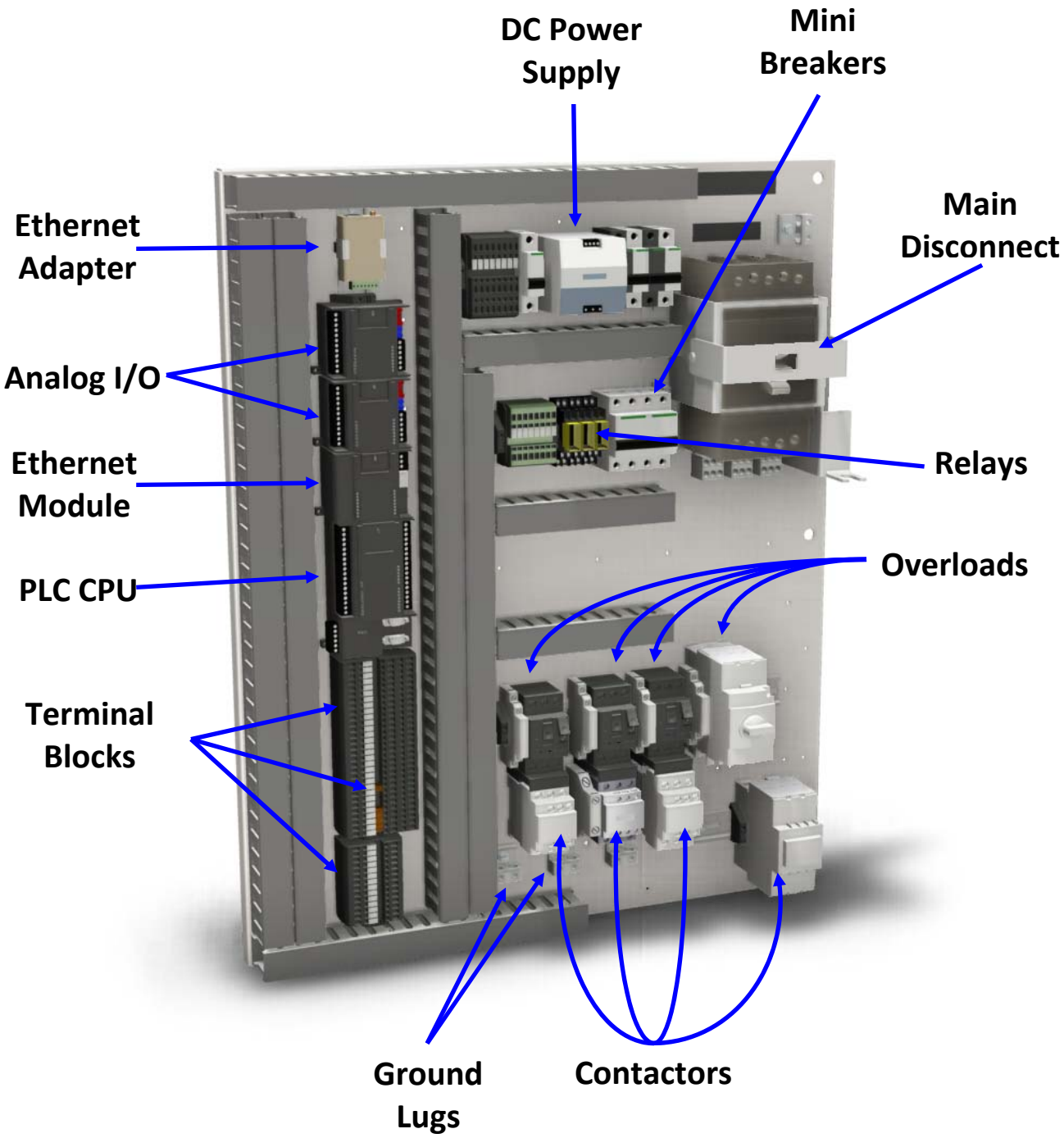


Figure 14: - *"Axial Infinity Direct Start Sub Panel"*

Centrifugal Infinity Dryer Direct Start High Voltage Cabinet

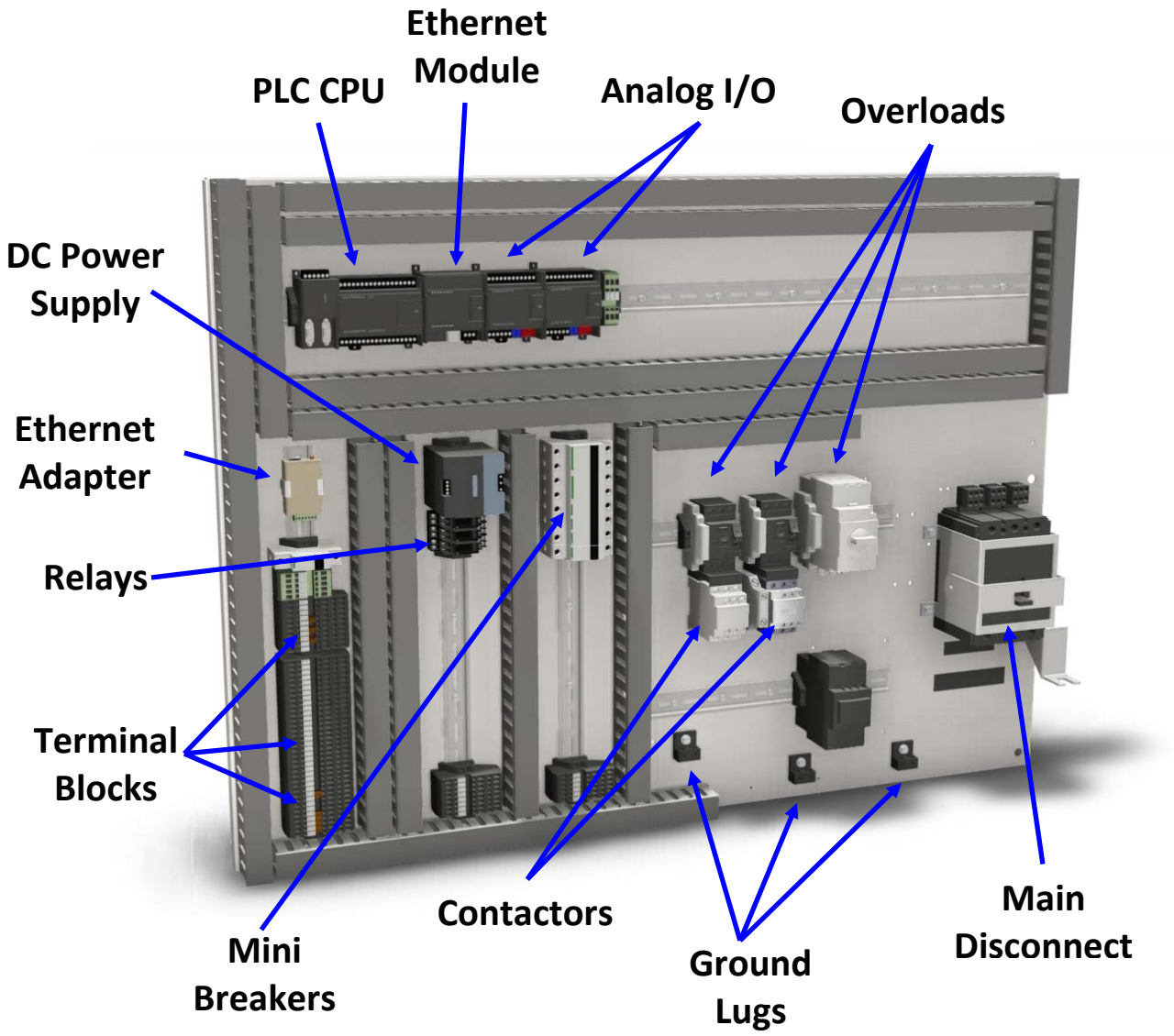


Figure 15: *"Centrifugal Infinity Direct Start Sub Panel"*

Gas Train Components

Strainer
This item contains a wire filter and will collect foreign material that may find its way into the fuel supply line.

Solenoid Valve
The solenoid valve is controlled by the ignition board. 120-volt power will energize the solenoid coil and open the valve to allow fuel to flow to the burner. De-energizing the solenoid coil will stop gas flow within one second and stops gas flow; extinguishing the burner flame.

Control Valve
This valve opens and closes to allow fuel supply to change and to keep the plenum temperature stable. This butterfly gas valve is directly controlled by the Belimo actuator which receives its signal from the cal controller in response to the plenum temperature.

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 Gas Pressure Switch (Optional CE/CGA Systems Only)
The low gas pressure switch is an adjustable pressure switch that will shut down the burner if pressure drops below the set point. The switch is adjustable, and can be set for any pressure from 0 to 9 psig. The normal low-pressure setting is 50% of the low-end range of manifold pressure.

High Gas Pressure Switch (Optional CE/CGA Systems Only)
The high gas 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 high-end range of manifold pressure.

Pressure Regulator
Reduces the pressure regulator 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.

Hand Valve
A Mechanically operated ball valve used to manually open and close fuel supply to the burner.

Infinity Series Manifold Overview

Figure 16: ***"Infinity Series LPG Manifold (Axial)"***

Figure 17: ***"Infinity Series NG Manifold (Axial)"***

Gas Supply & Connections

Axial Fan Liquefied Petroleum Gas (LPG)

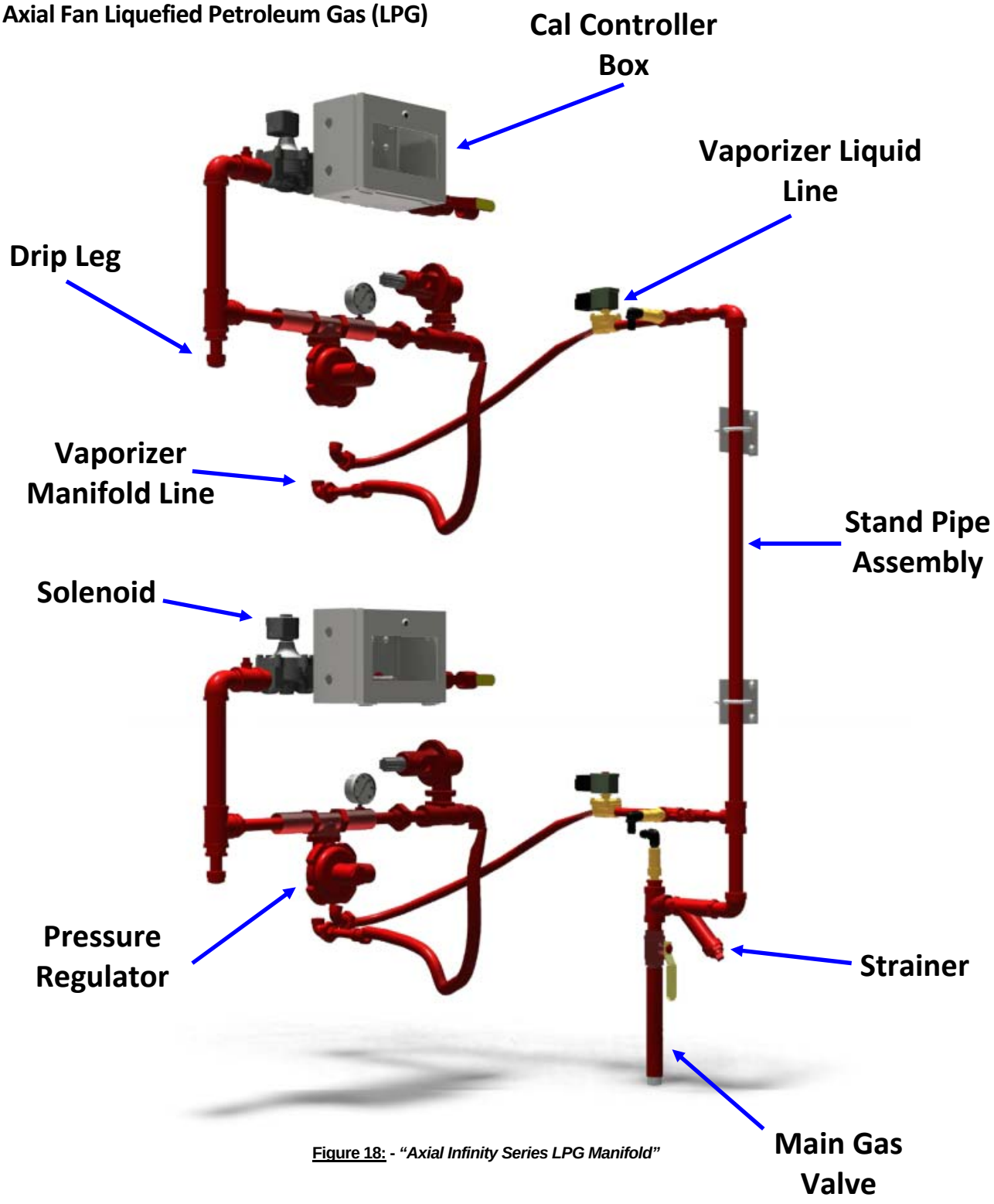


Figure 18: - *"Axial Infinity Series LPG Manifold"*

Centrifugal Fan Liquefied Petroleum Gas (LPG)

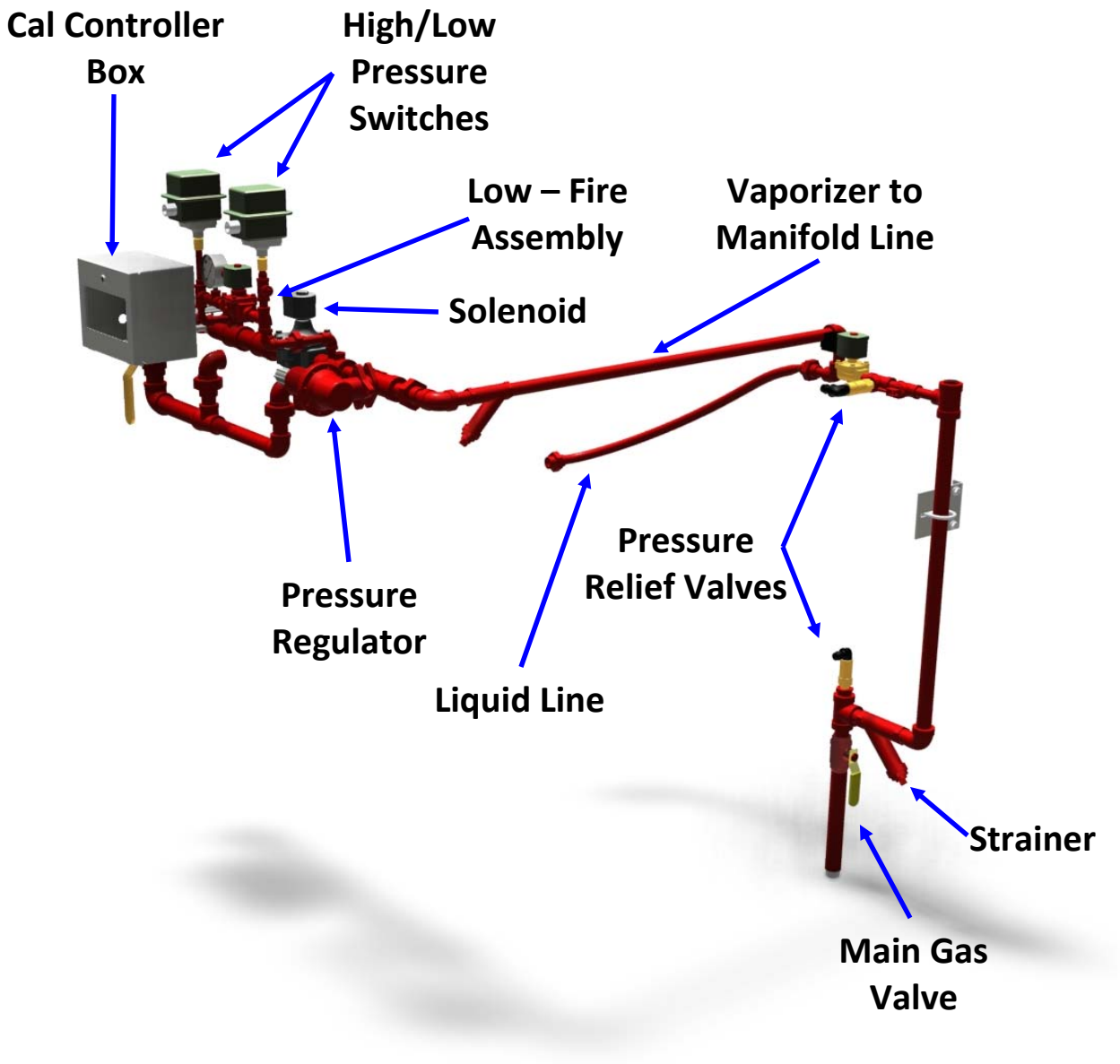


Figure 19: - *"Centrifugal Infinity Series LPG Manifold"*

Gas Supply & Connections

Axial Fan Natural Gas

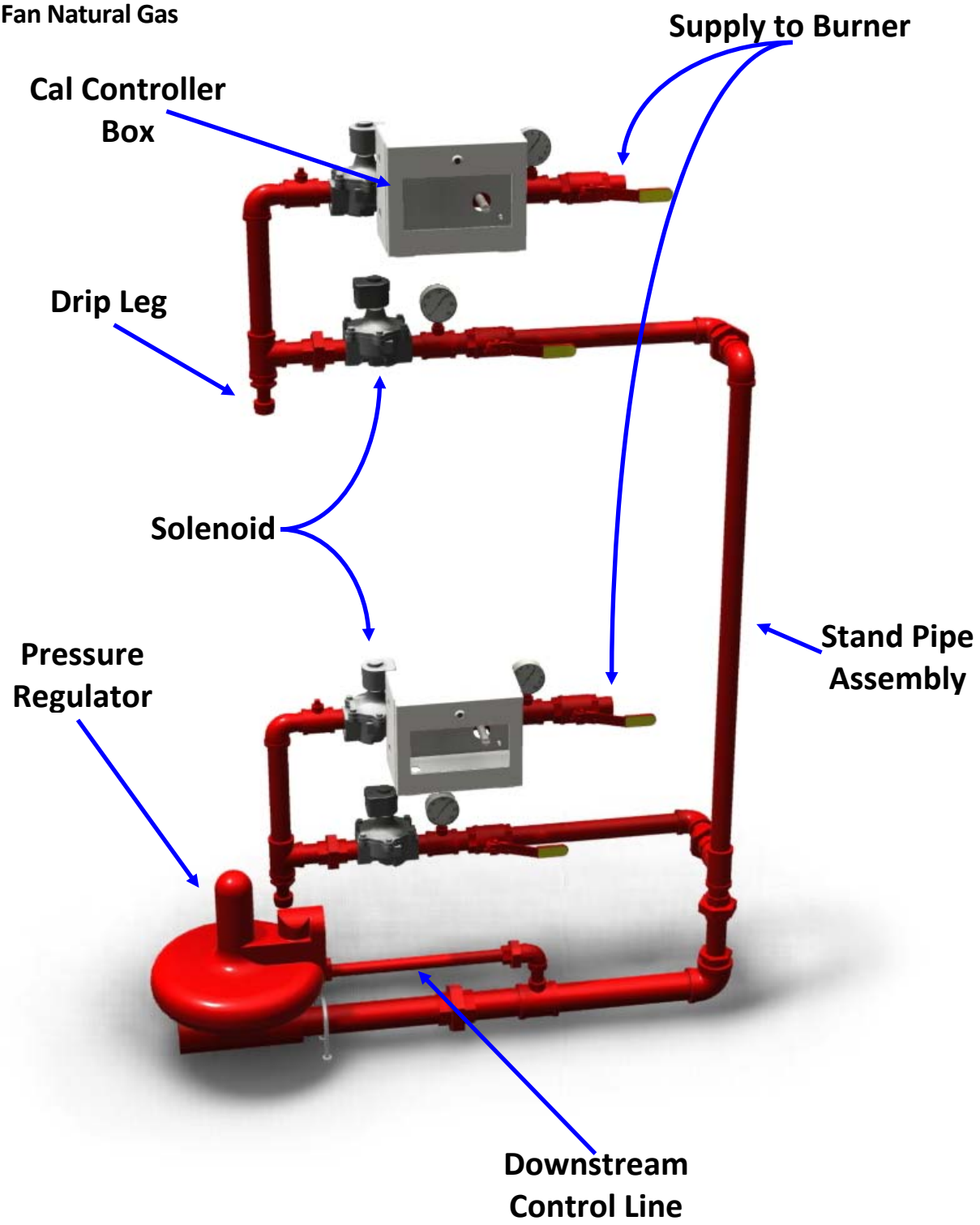


Figure 21: *"Axial Infinity Series NG Manifold"*

Centrifugal Fan Natural Gas

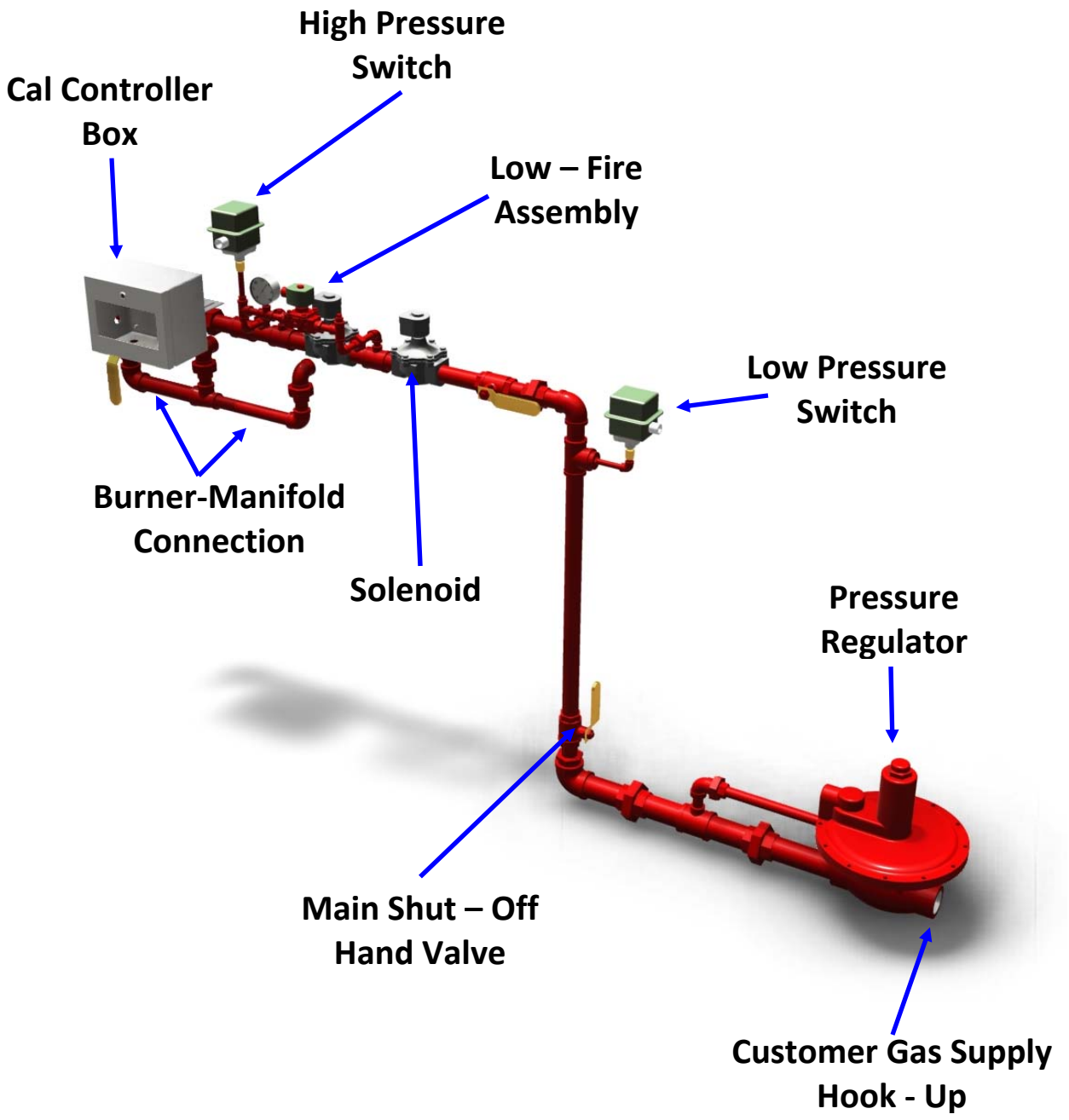


Figure 22: - *"Centrifugal Fan Natural Gas Manifold"*

Proportional Temperature Control

Cal Control Features

- Displays set point and actual plenum temperature simultaneously.
- Measures plenum temperature with an RTD (Resistance Temperature Device)
- Uses a PID loop to control plenum temperature.
- Has an auto tuning feature to automatically set PID values.
- Gas flow is controlled with a proportional actuator and a butterfly valve.
- The proportional valve (Belimo Actuator) opens and closes from 0 to 100% to modulate gas flow and control the plenum temperature.
- Once the temperature in plenum chamber nears the set point, the proportional valve starts to close to avoid overshoot and maintain the temperature at the set point.
- The safety circuit for dryer is wired through the high and low derivation contact of the controller. The high temperature limit shutdown is 40° over set point.
- The low temperature limit shutdown is 40° below set point.

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

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

Figure 24:-*"Temperature Controller (Cal)"*

Figure 23: -*"Belimo Actuator"*

Profile Dryer Ignition System

Figure 26: ***"Ignition Board"***

Figure 25:-***"Infinity Series Ignition Box"***

1. Power is supplied to the *Air Pressure Switch* through a fan motor interlock. Once the fan is running, the air pressure switch is energized.
2. The *Air Pressure Light* comes on, indicating air pressure, providing power to the ignition switch.
3. When the *Ignition Board* is powered up at **L1**, the board starts through the ignition process.
4. The red **LED** light on the *Ignition Board* will flash once when it first receives power, resetting the internal board protection and clearing the memory. There is a 15 second delay before the board starts the first trial for ignition.
5. After the 15 second purge time, the board will send high voltage out of **E1** (coil) to the spark plug to light the burner and 120 volts output from **V1** to open up solenoid valves & light up gas valve light. This trial for ignition will last for 7 seconds. The trial for ignition ends after 7seconds as does the high voltage arc and 120 volts out to solenoids from **V1**.
6. If the burner is successfully lit, the board will output between 40 and 60 volts to the *Flame Sense Probe* at the burner. The *Flame Sense Probe* will try to push current through the flame and to the chassis ground. Once the circuit from the *Flame Sense Probe* to chassis ground is complete and the signal is strong, the board will keep power at **V1** and the solenoids remain open.
7. If the signal drops down or is interrupted, the board will drop power to **V1** and the solenoid will close, causing the flame to go out.
8. The *Ignition Board* has a second trial for ignition, this trial will occur immediately after dropping out of the burner. This will occur so quickly that the gas valve light will not even flash off between loss of signal and re-trial for ignition. The second trial for ignition will not occur if we never established a flame. If the flame goes out, the board will show three flashes on the red **LED** light on the *Ignition Board*, indication lock out condition.
9. If the burner does not light, turn *Ignition Switch* to the **OFF** position and back to the **ON** position. The sequence will begin again

Section 4

Section 4: Operating Procedures

Start Up Procedure

General

WARNING: Inspect for and remove any foreign material (nuts, bolts, tools, parts, etc.) from the grain columns, metering rolls 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.

1. Adjust high limit, and set to 30 to 50 degrees above drying temperature.

2. Make sure that all gas supply is turned off and locked out.

    a. Liquid Propane (**LPG**) Fuel:
    - Turn the LPG liquid line hand valve 90° to the piping to shut off the LPG at the dryer.
    - Turn the vapor hand valve 90° to the piping to shut off the gas to the burner.
    - Open the LPG 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. Make preliminary adjustments to the timers located in the remote cabinet. Adjust the fill timer to 60 seconds and the grain flow timer to 5 minutes. Make sure that arrows on the grain flow timer are set at 1x and M & 5 (for five minutes). This can be easily adjusted with a small flathead screwdriver.
4. Turn the disconnect located in the high voltage cabinet to the **ON** position.
5. Turn the power switch to the **START** position. The green **ON** light should energize.
6. Press 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.
7. Turn the fill switch on the remote cabinet panel to the **MANUAL** position to allow the dryer to fill completely.
8. Adjust the air pressure switch so the air pressure light illuminates when the dryer is full of grain and the fan is running.

NOTE: If the fan stops for any reason or grain columns start to empty, the air pressure light should turn off. The air pressure switch should be adjusted when the fan is running and the grain columns are full. Turn adjustment screw clockwise until Air Pressure light goes out, then slowly turn counterclockwise until the light comes back on. Add one-half turn counterclockwise.

9. Open the hand valve on the gas train inlet. Gas pressure should be indicated on the gauge.
10. Turn the temperature control switch **ON**, then turn ignition switch **ON**. This will energize the ignition board and go through a 15 second purge timer. The ignition board will attempt to ignite the burner for 7 seconds (trial for ignition). The gas valve light should be illuminated while the burner is trying to ignite (7 seconds).
11. Once the burner is lit, press * and ▲ on the cal controller to scroll the number to the desired plenum temperature set point. This can also be accomplished on the HMI by pushing the Plenums button on the navigation bar. The controller will display two numbers. The upper number is the plenum temperature in degrees Fahrenheit or Celsius. The lower number is the set point (**SP**) or desired plenum temperature. The bottom set point number is the only number you can adjust with the arrow key. The plenum temperature may take several minutes to stabilize. The controller is programmed to slow down the temperature rise, the closer the plenum gets to the set point to avoid tripping the high limit device and overshooting the set point. The temperature controller automatically shuts down the dryer if there is an increase or decrease in the temperature of more than 40 degrees from the set point.

12. After allowing the dryer to warm up, start the metering system by turning the *takeaway* switch to the **ON** position. Then turn the *Metering* switch to the **ON** position. The discharge light will illuminate when the takeaway is energized. Note that the takeaway equipment must be running for this to operate.
13. Use the HMI touch screen to adjust the discharge speed. For this, the dryer must be running in manual mode. Increasing the discharge speed will cause the grain to pass through the dryer faster, causing the mid-grain temperature (indicated on the HMI) to decrease and the discharge moisture to increase. Decreasing the discharge speed causes the grain to pass through the dryer slower removing more moisture, causing the mid-grain temperature to rise and the discharge moisture to decrease. Once the drying process has stabilized and the desired discharge moisture has been achieved, you can switch from manual to TruDry mode by pressing the button on the HMI. Make sure that the set point for the mid-grain temperature matches the actual reading when doing this.
14. In TruDry mode the discharge speed will automatically adjust to maintain the desired average mid grain temperature. As the mid-grain temperature increases, the discharge speed will be increased. This will reduce the drying time and cause the mid-grain temperature to decrease and maintain the moisture content. Once in TruDry mode, manual discharge is no longer available.
15. Test the moisture content of the grain being discharged every 15 minutes until it stabilizes.
16. If the moisture content is too high after it stabilizes, adjust the mid-grain temperature set point to a higher temperature which will cause the discharge rate to decrease. If the discharge moisture is too low, adjust the mid-grain temperature set point down to a lower temperature which will increase the discharge rate.

***NOTE**: After any adjustments of the mid-grain temperature, wait 1 ½ to 2 hours to make further temperature adjustments since it takes that long for grain to pass through the dryer and for the full effect of the speed adjustment to be noticed.*

Fan Rotation

IMPORTANT: Before checking fan rotation, inspect for and remove foreign material (nuts, bolts, tools, parts, etc.) from the hopper, grain columns, metering rolls, unload auger and heat chambers.

1. Check the fan rotation from the front of the dryer. Centrifugal fans will not necessarily rotate in the same direction. Fan number one will turn opposite of fan number 2.

CAUTION: Do not turn the electrical power on until the fan guard has been installed.

2. Turn all switches on the control panel to the **OFF** position. Then turn on the electrical power supply to the dryer by pushing the dryer disconnect lever up to the **ON** position.

3. Turn the Power Switch to the **ON** position and the green LED light will light up. The High Limit LED indicator light will also light up. If the High Limit LED light does not light up push the reset button on the *High Limit* switch.

4. With everyone clear of the fan, push the fan **START** button. Immediately push the **STOP** button. Check the fan rotation and be sure that the fan is not rubbing within the fan housing.

5. If the fan rotation is not correct it can be changed by following the steps below:

    a. **Three phase motors**- Move the wire from terminal T1 to T3 and T3 to T1 on the fan motor contactor in the motor control cabinet.

    b. **Single phase motors**- Refer to the wiring information on the inside of the fan motor junction box cover

High Limit Switch

Adjust the *High Limit* switch(es) to 30° to 50° above operating temperature. This will avoid nuisance shutdowns during start up.

Air Pressure Switch

General

1. There is an air pressure switch for each heat chamber. The air pressure switch senses the static air pressure in the heat chamber when the dryer is full of grain and the fan is running. If the static air pressure drops because of fan failure, the air pressure switch opens, stopping current flow to the ignition switch. The gas solenoid valves will close and the burner will shut down.

2. The *Air Pressure* switch is designed to protect the dryer from fire that may result from fan (air flow) failure while the burner is ignited and flame is present.

CAUTION: This safety feature is for your protection and the protection of the dryer. The *Air Pressure* switches should be checked for correct operation at the start of the drying season and periodically throughout the season.

Checking

1. After the dryer has been filled and before any burners are started, the operation of each air pressure switch **MUST** be checked. Be sure the rear doors are closed.

2. Start the bottom fan. When it comes up to speed, start the next fan. Continue this procedure until all of the fans are running.

NOTE: The fan starter overloads are wired in series. If one fan magnetic starter overload relay trips, the dryer will shut down. When the motor overload relay is reset, the remote cabinet spring loaded Power ON Switch must be turned to the ON position. At this time the Power On and the High Limit lights will light up. Restart the fans.

3. The *Air Pressure* light on the remote cabinet inside the control door will light as each burner fan comes up to speed.

4. If the indicator light does not light or comes on before the fan reaches operating speed, the *Air Pressure* switch must be adjusted.

Adjusting

***NOTE*: All of the fans must be running (including the cooling fans) before the air pressure switches can be accurately adjusted.**

1. Remove the plastic cap on the *Air Pressure* switch. The slotted screw is the adjusting screw.
2. Turn the adjusting screw in the clockwise motion until the air pressure light goes out.
3. Turn the adjusting screw out (counter clockwise) until the air pressure light comes on. After the *Air Pressure* light comes on, turn the adjusting screw out an additional ¼ to ½ turn to allow for normal changes in static pressure.
4. Shut off the fan. The *Air Pressure* light will go out when the fan stop button is pushed. These dryers are wired so that the power flows from the fan start button to the air pressure switch.
5. If all *Air Pressure* switch adjustment is used and the *Air Pressure* light does not light up, the *Air Pressure* switch is defective and must be replaced. Check the operation of the new *Air Pressure* switch. Adjust if necessary.
6. If the *Air Pressure* light is blinking, turn the adjusting screw out a small amount.

Level and Discharge Auger Rotation

1. Level Auger
    a. Turn the *Power* switch to the **ON** position.
    b. With everyone clear of the fill auger and drive motor, turn the *Fill Auger* switch to the **MANUAL** position and check the pulley rotation to make sure that it is turning clockwise. Then turn the *Fill Auger* switch to the **OFF** position.
2. Discharge Auger

    With everyone clear of the discharge auger and drive motor, turn the *Discharge Auger* switch to the **ON** position. Check the discharge auger pulley rotation to make sure that it is turning counterclockwise. Then turn the *Discharge Auger* switch and *Power* switch to the **OFF** position.
3. If rotation of the level auger or discharge auger is not correct, it can be changed by following the steps below:
    a. **Three Phase Motors** – Move the wire from terminal T1 to T3 and T3 to T1 on the level or unload auger motor contactor in the control cabinet.
    b. **Single Phase Motors** – Refer to the wiring information on the inside of the level or unload auger motor junction box cover.
    c. **Check rotation as described above under Level Auger or Discharge Auger**.

Filling the Dryer

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

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

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

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

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.

Level Auger

Operation

There is an adjustable 0 to 3 minute delay in the level auger circuit. It is activated when the level auger switch is in the **AUTOMATIC** position and the level auger light is signaling for grain.

This delay prevents nuisance starting and stopping of the level auger. If the level auger switch is turned to **OFF** and back to the **AUTOMATIC** position, the delay will recycle.

The Grain Flow Timer will shut the dryer down if there is an insufficient grain supply to fill the hopper. When the level auger starts, the *Grain Flow* timer will be activated. When the timer counts down to zero, the dryer will shut down and the *Grain Flow* light will come on.

Setting the Grain Flow Timer

Conveyor Fill System (Slave System)

1. Set the adjustable wet fill delay for time desired (0 to 3 minutes) if not already set.

2. Set the *Grain Flow* timer arrows at the bottom of the timer face to X10 (times ten) and to M (minutes). It may be necessary to remove the timer from its socket to make this adjustment. Now turn the timer control knob to 1 (3x10) or 10 minutes and flip the wet grain switch to **AUTOMATIC**. The fill system will start after the 0 – to – 3 minutes delay if the filling (fill) light is on signaling for grain. Check the refill time a minimum of six times. The filling (**fill**) light will come on when the rotary fill switch in the hopper signals for grain and will go out when the hopper is full. The length of time that the filling (fill) light is on is the refill time (**including the 0 – to 3 – minutes delay**).

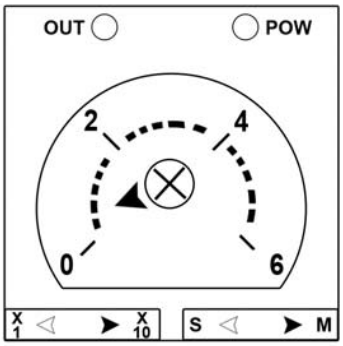


Figure 27: -*"Grain Flow Timer"*

3. Average the 6 refill times and reset the grain flow timer to run five minutes longer. For example, if it take the fill system an average of five minutes to refill the dryer. Set the grain flow timer to run 10 minutes.

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

Grain Flow Timer Operation

With the grain flow timer set to run five minutes longer than the fill system's 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 illuminated and the timer will start to count down to zero.

2. After the fill system refills the dryer and shuts off, the *Fill light* shuts off and the timer will automatically reset. The red light on the face of the timer will shut off.

3. If there is an insufficient grain supply, the fill system will continue to run beyond the five minute refilling period. When the fill system has run the length of time that was set on the *Grain Flow* timer, the dryer will shut down.

4. The *Grain Flow* light on the remote cabinet panel will be **ON**. The two 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 to **OFF**.

5. The discharge must be in operation for the grain flow timer to function.

NOTE: The grain flow timer shuts the dryer down when it has run out of wet grain .If equipped the main gas supply safety shutoff valve must be opened manually before the burners can be started.

6. Turn the *Power On* switch to the **OFF** position then back to the **ON** position to reset the grain flow timer.

7. Turn the *Fill* switch to **MANUAL**. Restart the fan, burner, and discharge system. Turn the fill switch to the **AUTOMATIC** position. The fill system 0 to 3 minute delay will be activated if the fill light is signaling for wet grain.

Maxon Burner (Axial Fan Only)

Overview

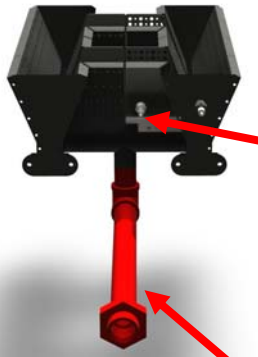


Figure 28: *"Front View Maxon Burner"*

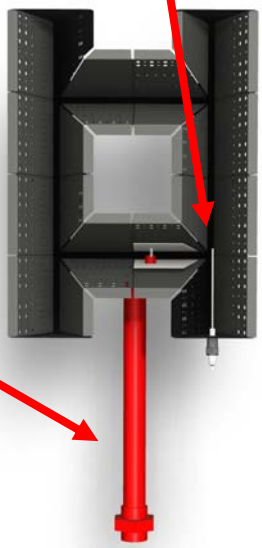


Figure 29: *"Top View Maxon Burner"*

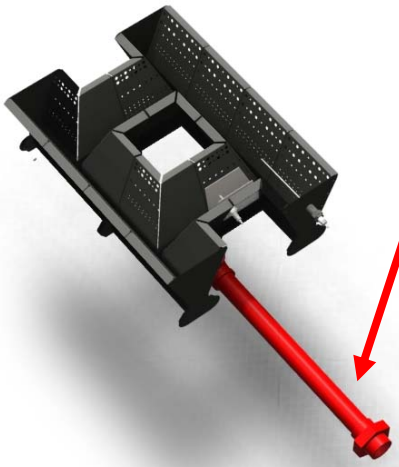


Figure 30: *"Isometric View Maxon Burner"*

Description

Maxon burners consist of a robust cast iron burner body, drilled to discharge the gaseous fuel between diverging stainless steel mixing plates. The burners are mounted directly in the air stream being heated. Gaseous fuel is injected into the process air stream. The unique design V-shaped burner mixing plates are intimately mixing both gas and process air together. All available heat from the gaseous fuel is released directly in the air stream. The required oxygen for the combustion is progressively drawn from the progress air stream. The carefully controlled aeration patterns provide progressive mixing, superior cross-ignition, flame retention and odor free combustion.

Venturi Burner (Centrifugal Fan Only)

Overview

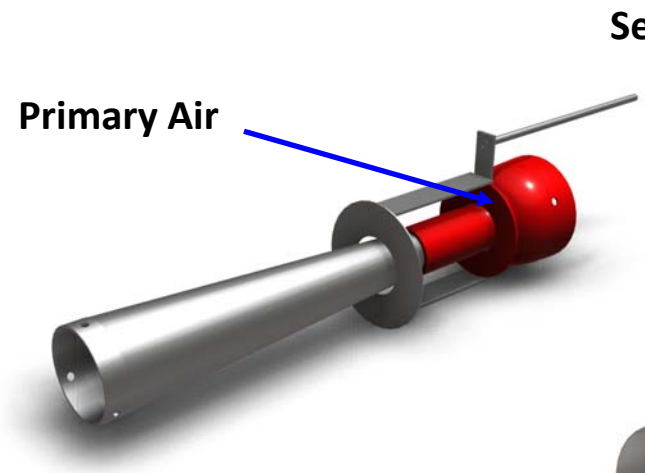


Figure 31: - *"Individual Venturi Burner"*

Figure 32: - *"Venturi LPG Isometric View"*

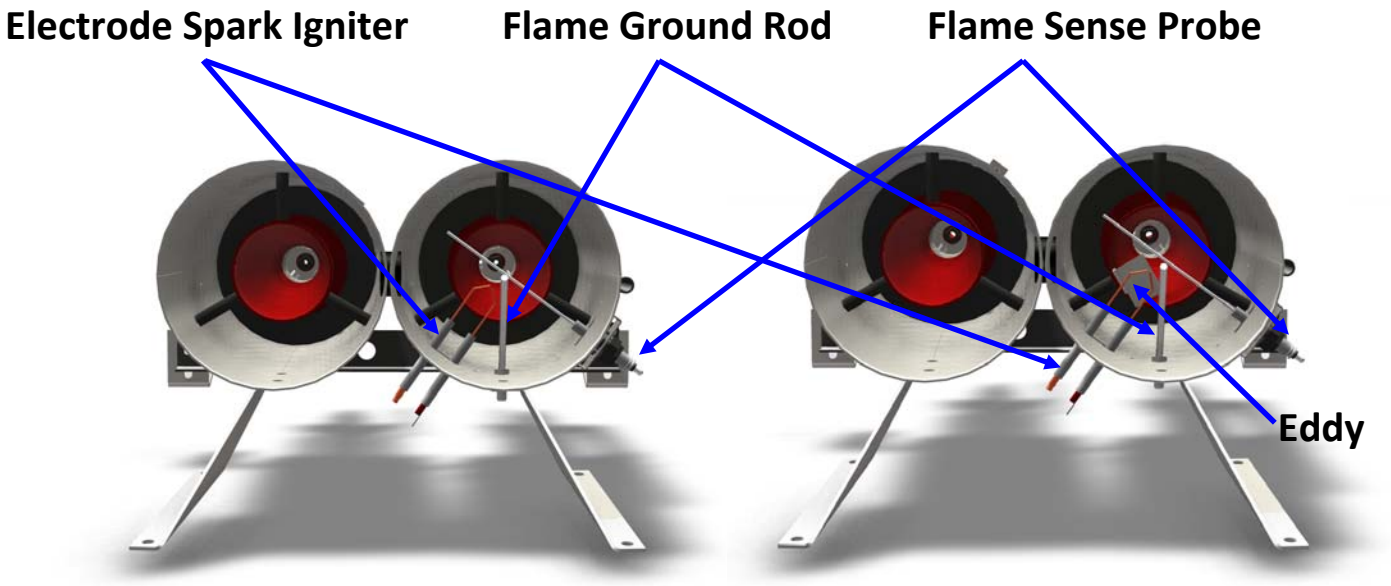


Figure 34: - *"LPG Venturi Burner Front View"*

Figure 33: - *"NG Venturi Burner Front View"*

Air Adjustment

The primary *Air Adjustment* controls the air fuel mixture to provide a good, clean, efficient flame. The adjustment is similar to the air adjustment on a burner in a gas furnace or stove.

The secondary *Air Adjustment* controls the flame pattern. Too much secondary air will keep the flame small and confined. It will also cause the flame to be blown off of the remote sensor, interrupting the flame sensing circuit resulting in gas solenoid valve chatter, or possibly it may keep the burner from lighting. When this occurs, the ignition system will operate for the "trial ignition period" then it will lock out. Correcting the secondary air adjustment will result in a bushy ball shaped flame that covers the remote sensor insuring a positive flame sensing circuit.

If the primary and secondary air adjustments have been misadjusted, time can be saved by shutting down the burner and starting over. Close the primary air adjustment all the way by loosening the locking bolt touching the center shaft. Next, turn the primary air adjuster pipe clockwise.

NOTE: If the primary air adjuster pipe turns hard, loosen the four bolts in the corners of the square plate and shift the plate until the air adjuster pipe turns freely. Once complete tighten the four bolts back into place.

Close the secondary air adjustment by loosening the locknuts on the secondary air adjustment rod. Push the secondary air adjustment rod in all the way and pulling it back approximately 3/8 inch (9.5mm).

Primary Air

If the flame appears very yellow or orange in color, open the primary air adjustment slightly to provide more air. If the flame is light blue in color with no yellow or orange at all, then close the primary air adjustment slightly until there is just a trace of yellow or orange at the tips of the flame.

NOTE: Allow 5 to 10 minutes for the LPG gas to properly vaporize before changing the adjustment.

To adjust, loosen locking bolt and turn the primary air adjuster pipe clockwise to decrease the amount of airflow and counterclockwise to increase the amount of airflow. The flame can be viewed through the window or through the view lens in the rear door as the adjustment is made. Next, re-tighten the locking bolt.

Secondary Air

If the flame is unstable and fluctuates greatly, open the secondary air adjustment slightly. This condition may cause the solenoid valves to chatter. If the flame is confined in a small area and is blowing past the remote sensor and electrode, close the secondary adjustment slightly.

To adjust, loosen the locknuts and push the secondary air adjustment rod in to decrease the amount of air. The flame can be viewed through the window as the adjustment is being made. Tighten the locknuts carefully so that the adjustment does not change.

IMPORTANT: Each Venturi burner must be adjusted the same distance or amount to provide even heat in the plenum chamber.

Igniting the Burner

1. Start fan by pressing the **green** *Fan Start* button. Check to make sure that the air pressure switch indicator light is **ON**.
2. Turn the *Temperature Controller* switch to **ON**. This switch sends power to the temperature controller.
3. Turn the *Ignition* switch to the **ON** position. After a 15 second purge delay, the gas valve light will be **ON** and the burner will attempt to ignite.

NOTE: The 15 second purge is a safety feature that allows the fan to purge the heat chamber of any unburned gases that may remain after the burner has been shut down for any reason.

The ignition board is electronically timed so that the ignition system will spark and hold the solenoid gas valves open for a "trail ignition" period of 7 seconds. If the burner does not light, the system will "lock out," closing the gas solenoid valves.

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

NOTE: Opening the gas vapor hand valve slowly will prevent possible freezing of the LPG gas line and also prevents 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.

2. Push the reset button on the high limit switch, located in the ignition box.

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

3. Turn the Power switch to the **ON** position and release.
4. Start the fan by pressing the green **FAN START BUTTON**. Check to make sure that the indicator light for the air pressure switch is on.
5. Turn the ignition switch to the **ON** position. The gas valve light will come on and the burners will ignite.
6. The gas pressure reading on the pressure gauge should indicate from .75 to 3.0 p.s.i (10 to 20.7 kPa) to maintain the drying temperature during variations in the outside temperature (especially when drying at night).

Setting Drying Temperature

1. With the burner operating, set the drying temperature by adjusting the set point on the HMI on the plenum screen or locally on the cal controller.

***NOTE*: After the dryer has been operating for one half hour, check the Cal Controller. The display, in operating mode, shows two 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 plenum temperatures.**

Cal Controller

Cal Controller Wiring

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

The Cal Controller has a high limit of 40° above the set point and a low limit of 40° below the set point. Upon initial power up, the low limit is bypassed (inhibited) until the current temperature is within 40° of the set point. Both the high and low alarms are bypassed when the *Ignition* switch is **OFF**.
With the *Ignition* **OFF**, the controller can be powered off and then turned back on to reset the low temperature inhibit or clear a high temperature alarm latch. After the controller powers up and does not indicate an alarm, ignition can be attempted.

If holding a steady plenum temperature is a problem, check the *Proportional Valve* (Belimo actuator) to make sure it rotates freely. Turn down the gas pressure as low as possible while still maintaining temperature.

Temperature Set Point

All parameters for the Cal Controller can be changed when power is on to the dryer. The disconnect must be powered on, so that the digital display on the unit is powered up. The display, in operating mode, shows two numbers. The top number is the actual temperature detected by the thermocouple. The bottom number shows the current set point temperature. The controller will adjust the proportional valve output to drive the temperature to the set point.

Temperature Set Point

1. Wait for the unit to power up.
2. Press * and ▼or ▲to change the desired set point.

Changing Levels

1. Hold down ▲▼ together for 3 seconds.
2. Press ▲ or ▼ separately to page through parameters.
3. When LEVL is displayed, press * key with ▲ or ▼ to change level.
4. Press ▲ or ▼ separately to page through the parameters for that level.

Parameters

1. Hold down ▲▼ together for 3 seconds.
2. Press ▲ or ▼ separately to page through parameters.
3. Press the * key with ▲ or ▼ to change a parameter value.
4. Press ▲ or ▼separately to go on to the next parameter.
5. Hold down ▲▼ together for 3 seconds when finished.

Domestic Settings

Function Level	Function Description	Function Name	Setting	
			Default	Profile
LEVEL 5 (On First Power-up)	Temp Input Device	inPt	*nonE*	*tc-K*
	Scale Units	unit	*nonE*	*F*
	Output 1 Type	SP1.d	*nonE*	*AnLG*
LEVEL 2	Output 1 Level_on	SP1.Pon	*100*	*100*
	Output 1 Level_Prop	SP1.dpr		
	Manual Mode	hAnd	*oFF*	*oFF*
	Max Output (Heat)	PL.1	*100*	*100*
	Max Output (Cool)	PL.2	*100*	*100*
	Output 2 Mode	SP2.A	*nonE*	*dV.hi*
	Output 2 Options	SP2.b	*nonE*	*LtCh*
	Display Resolution	diSP	*1*	*1*
	High Scale Limit	hi.SC	*varies*	*240*
	Low Scale Limit	Lo.SC	*32*	*0*
	Temp Input Device	inPt	*nonE*	*tc-K*
	Scale Units	unit	*nonE*	*F*
LEVEL 1	Auto Tune Select	tunE	*Off*	*Off*
	Proportional Band	bAnd	*18*	*75*
	Integral Time (min)	int.t	*5.0*	*1.5*
	Derivative Time (sec)	der.T	*25*	*oFF*
	Derv Approach Control	dAC	*1.5*	*1.5*
	Cycle Time	CYC.t	*20*	*0.1*
	Offset/Man Reset	oFSt	*0*	*0*
	Setpoint Lock	SP.LK	*oFF*	*oFF*
	Setting for Output2	SEt.2	*0*	*40*
	Band for Output 2	bnd.2	*3.9*	*5*
	Cycle Time 2	CYC.2	*on.of*	*on.of*
LEVEL A (Analogue)	Lin Input Scale Max	An.hi	*1000*	*1000*
	Lin Input Scale Min	An.Lo	*0*	*0*
	Lin Input Max	hi.in	*50.0*	*50.0*
	Lin Input Min	Lo.in	*10.0*	*10.0*
	Lin Input Resolution	dECP	*0000*	*0000*
	Output 3 Mode	SP3.A	*nonE*	*dV.Lo*
	Output 3 Options	SP3.b	*nonE*	*hold*
	Setting for Output3	SEt.3	*0*	*-40*
	SP3 Hysteresis	hYS.3	*3.6*	*3.6*
	Sensor Burn-out	brn.3	*uPSC*	*uPSC*
	Output 3 Operation	rEU.3	*3d*	*3d*

Function Level	Function Description	Function Name	Setting
LEVEL 4		dEr.S	*0.5*
		di.SS	*6*
		no.AL	*oFF*
		ProG	*Auto*
		LoCk	*nonE*
		SEt.L	*oFF*
LEVEL 3	Inverse of SP1.2	SP1.d	AnLG
		SP2.d	rLY
		burn	up.SC
		rEv.d	1r.2d
		rEv.L	1n.2n
		SPAn	*0.0*
		Zero	*0.0*
		ChEk	*oFF*
		rEAD	*
		tECh	*
		Ver	953.1
		rSET	*nonE*
LEVEL P		ProG	*1*
		run	*oFF*
		FAiL	*rSEt*
		St.u	*PV*
		Spru	*hour*
		SEG	*1*
		tYPE	*SPr*
		Sint	*cont*
		PCYC	*cont*
		Sub.P	*nonE*
		SPrr	*100*
		t.SP	*
LEVEL C Comms Option (2011)	Added to 2011 Pinnacle Lite production for remote temperature controllers	Addr	1
		bAud**	*19200*
		dAtA	*18n1*
		dbuC	*oFF*

****bAud Defaut Settings are 19200**
M-C Profile Settings 19.2

Export Settings

Function Level	Function Description	Function Name	Setting Default	Setting Profile
LEVEL 5 (On First Power-up)	Temp Input Device	inPt	*nonE*	*tc-K*
	Scale Units	unit	*nonE*	*C*
	Output 1 Type	SP1.d	*nonE*	*AnLG*
LEVEL 2	Output 1 Level	SP1.P	*100*	*100*
	Manual Mode	hAnd	*oFF*	*oFF*
	Max Output (Heat)	PL.1	*100*	*100*
	Max Output (Cool)	PL.2	*100*	*100*
	Output 2 Mode	SP2.A	*nonE*	*dV.hi*
	Output 2 Options	SP2.b	*nonE*	*LtCh*
	Display Resolution	diSP	*1*	*1*
	High Scale Limit	hi.SC	*varies*	*126*
	Low Scale Limit	Lo.SC	*32*	*0*
	Temp Input Device	inPt	*nonE*	*tc-K*
	Scale Units	unit	*nonE*	*C*
LEVEL 1	Auto Tune Select	tunE	*Off*	*Off*
	Proportional Band	bAnd	*18*	*24*
	Integral Time (min)	int.t	*5.0*	*1.5*
	Derivative Time (sec)	der.T	*25*	*oFF*
	Derv Approach Control	dAC	*1.5*	*1.5*
	Cycle Time	CYC.t	*20*	*0.1*
	Offset/Man Reset	oFSt	*0*	*0*
	Setpoint Lock	SP.LK	*oFF*	*oFF*
	Setting for Output2	SEt.2	*0*	*23*
	Band for Output 2	bnd.2	*3.9*	*2*
	Cycle Time 2	CYC.2	*on.of*	*on.of*
LEVEL A (Analogue)	Lin Input Scale Max	An.hi	*1000*	*1000*
	Lin Input Scale Min	An.Lo	*0*	*0*
	Lin Input Max	hi.in	*50.0*	*50.0*
	Lin Input Min	Lo.in	*10.0*	*10.0*
	Lin Input Resolution	dECP	*0000*	*0000*
	Output 3 Mode	SP3.A	*nonE*	*dV.Lo*
	Output 3 Options	SP3.b	*nonE*	*hoLd*
	Setting for Output3	SEt.3	*0*	*-23*
	SP3 Hysteresis	hYS.3	*3.6*	*3.6*
	Sensor Burn-out	brn.3	*uPSC*	*uPSC*
	Output 3 Operation	rEU.3	*3d*	*3d*

Function Level	Function Name	Setting Default
LEVEL 4	dEr.S	*0.5*
	di.SS	*6*
	no.AL	*oFF*
	ProG	*Auto*
	LoCk	*nonE*
	SEt.L	*oFF*
LEVEL 3	SP1.d	AnLG
	SP2.d	rLY
	burn	up.SC
	rEv.d	1r.2d
	rEv.L	1n.2n
	SPAn	*0.0*
	Zero	*0.0*
	ChEk	*oFF*
	rEAD	*
	tECh	*
	Ver	953.1
	rSET	*nonE*
LEVEL P	ProG	*1*
	run	*oFF*
	FAiL	*rSEt*
	St.u	*PV*
	Spru	*hour*
	SEG	*1*
	tYPE	*SPr*
	Sint	*cont*
	PCYC	*cont*
	Sub.P	*nonE*
	SPrr	*100*
	t.SP	*
LEVEL C Comms Option	Addr	1
	bAud**	*19200*
	dAtA	*18n1*
	dbuC	*oFF*

****bAud Defaut Settings are 19200 M-C Profile Settings 19.2**

Discharging the Dryer

Manual Discharge Mode

The discharge system has two selector switches and one pilot light. The discharge switch on the left (labeled **Takeaway**) is a three-position switch (**OFF**, **ON, START**) that powers the customers relay. The right side discharge switch is labeled **METERING** and is a two-position switch (**OFF** and **ON**) that controls the VFD relay. The motor speed reference is either manual (adjusted on the HMI) or auto input to the variable frequency drive (**VFD**). The switch energizes the VFD relay to give a run signal to the VFD. The 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 Discharge (TruDry)

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

   If the discharge speed increases because the incoming grain is drier, the discharge indicated speed will increase until the unload speed is automatically adjusted. After adjustment, the unload speed will remain constant until another change is required. The system will automatically change speed, increasing or decreasing to keep the discharge grain at the moisture content that was established when the TruDry control system was in manual mode.

Automatic Discharge Mode

There is a relationship between mid-grain temperature and incoming grain moisture. Any change in mid-grain temperature will mean a change has occurred in grain moisture. If the temperature of the grain decreases, the moisture content will increase. If the temperature of the grain increases, the moisture content will decrease.

The TruDry control on Mathews Company dryers attempts to maintain a uniform moisture content of the grain being discharged from the dryer by changing the discharge speed of the dryer.

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

Rear Discharge Overload Door

1. If the customer supplied grain take away system fails, the dryer will continue to discharge grain until the rear discharge overload door is raised by the grain.

2. When the overload door rises, the dryer will shut down and all of the lights except the 115V heat bulb will be out. The *Grain Flow* timer will automatically reset.

3. When the problem has been corrected and the rear discharge overload door closes, the high limit light will be on. Turn the *Power On* Switch to the **ON** position and release, then the *Power On* LED light will turn on.

4. The level auger delay will be activated if the level auger switch is in *AUTOMATIC* position and the level auger switch in the wet hopper is signaling for grain.

5. Turn the ignition switches to the **OFF** position and restart the fans, burners and discharge auger.

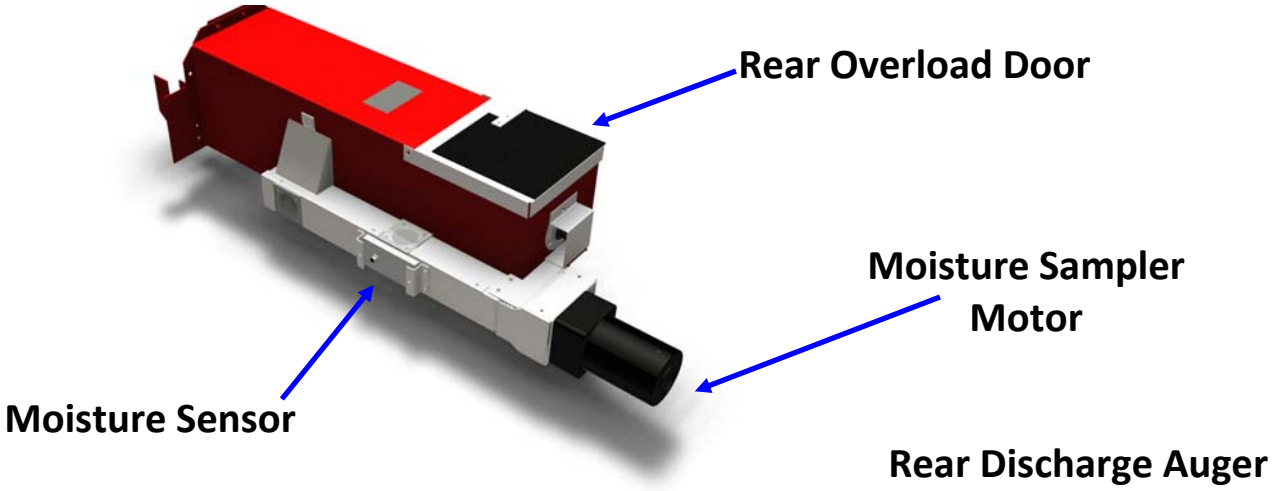


Figure 35: ***"Isometric View Rear Discharge Overload Door"***

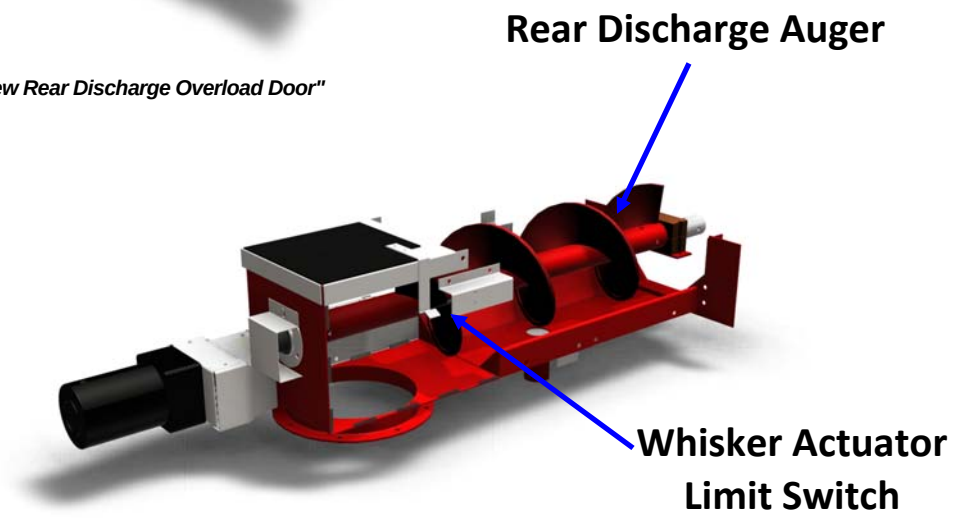


Figure 36: ***"Cut-Away View Rear Discharge Door"***

Moisture Control Setting and Adjustment

The dryer metering system is driven by a ¾ HP AC VFD controlled 3 phase 230V AC motor and reduction gear drive.

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

When the moisture content of the incoming grain increases, the RTDs sense the change in grain temperature and signals the TruDry control system to slow down the discharge system motor to prevent the discharge of wet grain from the dryer when the moisture is outside of the preset limits or the mid-grain temperature is outside the preset temperature band.

When the moisture content of the incoming grain decreases, the RTDs sense the change in grain temperature and signals to the TruDry control system to increase the speed of the discharge motor to prevent over drying the grain.

Moisture Control Setting and Adjustment

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

Switching From Automatic to Manual Discharge

You can switch back to **MANUAL** mode at anytime. Just press the **MANUAL** button on the HMI. The indicated discharge speed will show the manual speed setting. If you want to unload at the same speed in **MANUAL** as you did in TruDry, adjust the manual speed setting to reflect the discharge rate show previously in TruDry.

Shutdown Procedure

End of Day Shutdown

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

End of Day Shutdown

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

Next Day Startup

1. Turn on electrical power supply to the dryer. Then turn the power on switch to the **ON** position. Place the wet grain switch or fill switch into automatic mode and push the **green** button to start the blower.
2. Open the liquid propane (**LPG**) Gas Supply valve at the tank or Natural Gas (**NG**) Supply valve and liquid line Intake valve. Now open the vapor hand valve.
3. Turn **ON** the temperature controller. Allow the temperature controller to stabilize and turn the Ignition to **ON** to start the burners. Allow the mid-grain temperature to reach drying temperature before turning the takeaway switch to the **ON** position. Now, turn the metering switch to the **ON** position and select **MANUAL** mode on the HMI. The discharge speed should be at the same value as when the dryer was last discharging in TruDry.

After the dryer has been unloading grain for least one hour at the desired moisture level, the discharge system may be placed in the TruDry mode by press the TruDry button on the HMI screen.

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

Final Shutdown

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

Dry the remaining grain for approximately six minutes per point of moisture to be removed. When the remaining grain is dry, close the liquid propane (**LPG**) gas supply valve at the tank or close the natural gas (**NG**) supply valve.

Operate the burner until the flame goes out. Then place the burner switch to the **OFF** position. Close the gas vapor hand valve (handle 90° to the piping). For liquid propane (**LPG**), close the liquid intake valve and then run the fan for approximately 20 minutes to cool the grain in the dryer.

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

Grain dryers are not designed to be grain storage devices. Once all the grain has been dried, it needs to be emptied from the dryer and stored in an appropriate facility.

NOTE: Grain stored in a dryer for more than one week may cause damage to the machine.

Section 5

Section 5: Dryer Maintenance

Dryer Cleaning Recommendations

Proper cleaning and maintenance of a grain dryer allows the dryer to perform more efficiently. When the screens of a dryer are clean, the air flow moves freely through the grain walls. As debris builds up inside the dryer, internal problems may arise. The recommended method for cleaning the dryer is air, preferably from a vacuum; however, using a non-metallic brush or broom also works. Be aware that if using water to clean the dryer, the combination of water and residue can form a paste inside the dryer, making the internal surfaces sticky and more difficult to remove.

Internal cleaning of the grain dryer should be performed on a daily basis to prevent the screen perforated surface from becoming clogged. 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 should be set for a short time period.

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 creating a buildup of fines and dust reducing air flow resulting 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 flow 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. Also, this change can lead to overheating the top of the grain column, and cause damage to the grain and potentially grain combustion.
- The outside screens can be cleaned on a needed basis using brushes. Compressed air or water can be used. This process can be done during the drying process, but may affect the 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 the perforations in the screens. The discharge rate should increase as the dryer is cleaned because more surface area is now being exposed to the heated air passing through the grain columns.

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

Seasonal Cleanout and Maintenance

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

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

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

Pre-Season Dryer Check

Level Auger & Discharge System

1. Place all of the switches on the control panel to the **OFF** position. Flip all of the circuit breakers in the bottom cabinet to the **ON** position. Turn the electric power supply to the dryer to the **ON** position.
2. Turn the *Power On* Switch to the **ON** position and release. The *Power On* light will light up.
3. Check the level auger. Turn the *Level Auger* switch to the **MANUAL** position. The level auger will start immediately.
4. Push the spring loaded *Discharge Auger* switch to **ON** and release. The discharge auger will start.
5. Turn the *Discharge Metering Roll* switch to the **MANUAL** position. The metering roll motor will start.

Fans & Burners

1. Turn off the electric power supply to the dryer. Turn all switches on the control panel to the **OFF** position.
2. Close the burner gas manifold hand valve for each burner (handle 90° to the piping).
3. To test the burners without grain in the dryer, place a jumper wire with an alligator clip between terminal (4) of the fan motor **Start** button and the *Air Pressure* light terminal with the red wire of the burner being tested. Both the switch and light are located on the control cabinet inside door. The jumper wires will by-pass the *Air Pressure* switch.
4. LP Gas- Open the supply tank valve, the main shut off hand valve after the 1" (25.4mm.) inlet hose, and open (lift up) the ½" (12.7mm.) liquid line flip valve on each burner.

CAUTION: This is only a temporary procedure for checking the burner. When drying grain, **NEVER** operate the dryer with the air pressure switches disconnected or by-passed. This safety air pressure switch is for your protection and the protection of the dryer.

5. Turn on the electric power supply to the dryer and then turn the *Power On* switch to the **ON** position.

6. Start the bottom burner fan, the *Air Pressure* light will be **ON**. When the fan comes up to speed, open the burner gas manifold hand valve ¼ of the way. Be sure the **BURNER SWITCH** is in the low position. Turn the ignition switch **ON**. After a 15 second delay the gas valve light will be **ON** and the burner will light.

7. If the burner fails to light, turn off the fan, electric power supply to the dryer, the fan motor circuit breaker, and then close the burner gas manifold hand valve to the **OFF** position. Turn all the control panel switches to the **OFF** position. Check for a broken continuity or loose wires, corroded connections, and incorrect wire connections. Be sure to check continuity of the large high tension and small 18 gage ignition wires.

CAUTION: Before checking ignition wires, be sure to ground high tension coil (E1 terminal) on ignition board to eliminate any charge that may remain in the coil.

8. Next, check 115V power to *Ignition Board*. Connect a voltmeter between terminal L1 and L2 on ignition board. Turn on electric power supply to dryer. Be sure bottom fan #1 circuit breaker is still off and jumper wire is still in place between terminal #4 of the fan #1 *START* button and the terminal of the *Air Pressure* light with the red wire. Now turn the *Power on* switch to **ON** and release. Push the *Fan Start* button and *Air Pressure* light will light. Turn the *Ignition* switch **ON** and after the 15 second delay the voltmeter should read 115V. If not, place the *Ignition* switch in the **OFF** position and turn **OFF** the electric power to the dryer. Now check again for loose or broken wires from the *Ignition* switch to the *Ignition Board*.

   If there is 115V between terminal L1 and L2, check for 115V at terminal V1 on the *Ignition Board*. Turn **OFF** the electrical power to the dryer and turn the *Ignition* switch to the **OFF** position. Connect a voltmeter between terminal V1 and V2 on the ignition board. Turn **ON** the electrical power to the dryer and turn **ON** the *Power On* switch to the **ON** position. After 15 second delay, the voltmeter should read 115V. If not, the *Ignition Board* is defective and must be replaced.

NOTE: The voltmeter will show a reading during the "trial ignition" period for only 7 seconds. To check again, turn the ignitions switch to OFF and then back to the ON position. The 7 second "trial ignition" period starts after the 15 second delay.

9. If there is 115V at terminal V1, check to be sure that the solenoid valves are operating. Two people are required to make this test. One person to operate the *Ignition* switch and the other to be at the solenoid valves as there is only 7 seconds to check the solenoid valve.

10. Next, check the electrode for spark. Turn **OFF** the electrical power to the dryer. Be sure the burner gas manifold hand valve is still closed, and the fan #1 motor circuit breaker is in the **OFF** position. Now use a jumper wire between terminal #4 of fan #1. Push the *START* button and the terminal of the *Air Pressure* light with the red wire with the jumper connected, and the *Ignition* switch in the **OFF** position. Turn on the electrical power to the dryer. Turn the *Power On* switch to the **ON** position and then release. Push the lower fan #1 *START* button and the *Air Pressure* light will illuminate at this point. Turn the *Ignition* switch to the **ON** position, and then after a 15 second purge delay, observe electrode through the *View Lens* in the rear door of the heat chamber during the 7 second "trial ignition" period. In some cases the spark can also be heard.

    If there is no spark, turn the *Ignition* switch **OFF** then **ON** for another "trial ignition" period. If there is still no spark, the *Ignition Board* will have to be replaced. Turn the *Ignition* switch and the *Power on* switch to the **OFF** position. Then turn the **OFF** the electrical power to the dryer.

    NOTE: Once the Ignition Board has been replaced begin at step 1 within the Fans & Burner section to proceed with the pre-season check out.

11. After the bottom burner #1 ignites, allow the burner to operate for about 2 minutes, and then close the liquid line flip valve for LPG units. For NG proceed to close the burner manifold hand valve.

    CAUTION: Be sure to remove the jumper wire with the alligator clips between #4 terminal of the fan *START* button and the terminal of the *Air Pressure* light that has the red control wire.

12. Check the upper burners using the same procedure that was used for burner #1. After each burner has been tested, close the LPG supply tank valve if the burner is liquid propane or the natural gas supply valve if the natural gas.

Direct Spark Ignition System

The *Direct Spark Ignition* system consists of an electronic ignition board, ignition electrodes, and flame sensing probe. For ignition to occur, the dryer must be running and the *High Limit* and *Air Pressure* lights on the control panel must be on.

The dryer is wired so that the current flow from the control cabinet goes to the *High Limit* switch, *Fan Start and Stop* buttons, *Fan Overload Starter*, *Air Pressure* switch, *Ignition* switch, and the 15-second delay that is built into the *Ignition Board*. These safety features prevent ignition if the heat chamber temperature is too high or there is insufficient air flow and allows for a 15-second air purge of any unburned gas that may remain in the heat chamber after the burner shuts down.

When the ignition switch is turned to the ON position, the ignition board is energized (after the 15 second built in delay) and generates a high voltage spark between the tips of the electrodes and opens the gas solenoid valves at the same time. The gas valve light on the control panel will be on.

The electrodes provide the spark for ignition and the flame sensing probe senses the presence of the flame. A low-amperage current passes from the flame sensing probe to the flame which conducts the current, completing the electrical circuit. If the flame is not present, the circuit will be broken and the ignition system will be locked out.

The *Ignition Board* is electronically timed so that when the *Ignition* switch is turned ON, the spark plug will spark and the gas solenoid valves will be held open for a "trial ignition" period for 7 seconds after the initial 15 second purge delay.

When the ignition occurs and a flame is present, the ignition board flame monitoring system will continue to operate but the spark will shut off. If there is a flame failure, the ignition board will be locked out, closing the gas solenoid valves. The gas valve indicator light on the control panel will be out. Turn the *Ignition* switch to the OFF position, and then to the ON position for another "trail for ignition".

Belt Adjustment

After approximately 24 hours of operation, the belts will seat themselves in the pulley grooves and the tension may have to be readjusted. If the belts squeal when the motor starts, they are not tight enough.

Never apply belt dressing as this will damage the belt and cause early belt failure.

To adjust the belt tension on the *Discharge Auger*, loosen the unload auger motor mounting locknuts. Turn the locknut on the J bolt to adjust the tension.

Adjust the belt tension for the Level Auger by loosening the locknuts and raising the motor mount plate evenly with the four adjusting nuts, and then tighten the locknuts.

Post-Season Dryer Maintenance

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

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

1. Disconnect all power and turn **OFF** the gas supply before proceeding with any post-season maintenance.
2. Using a non-metallic brush or broom; sweep the inner screen clean, going from the top to bottom.
3. Sweep out the heat floor to remove all debris from the floor.
4. Visually inspect the bearings to see if there is indication of one needing to be replaced and make a note to replace any that need it. Inspect the drive belts and chains and note if any need replacing; lubricate chains for the winter.
5. Use a power washer on the outer screens if dirt has filled the perforations on the screens.
6. Grease the fan motor bearing and fan bearings with Chevron® SR1-2 or equivalent.
7. Use a vacuum cleaner to remove any dirt from the control cabinet.

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 by pressing the emergency stop button.
4. Do not try to cool the fire by running the fans.
5. Never run grain from the dryer into the elevator or storage if a fire is known or suspected.
6. Locate the area of the fire.
7. If the fire can be extinguished with a fire extinguisher, water hose, or by removing the burning material, this should be done right away. Watch the dryer closely for another fire after one has occurred.
8. Emergency discharge slide gates at the bottom of each column as well as easy access gates located near the discharge area permit fast dumping of each individual 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.

Lubrication Chart

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
2:1 Discharge Auger Gear Box	8 oz. Mobil SHC634 Oil	Oil change not required. Change only if servicing
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. (Equivalents 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 hig quality mineral oil with rust and oxidation inhibitor. Use Shell Alvania #2, Movil Mobilux #2 or Texaco Multfak # 2	At beginning of season and every 100 hours until end of season
Axial Fans	Exxon Polygrease	At beginning of season and between 4,000 and 5,000 hours of operation until end of season
Unload Auger Bearings	Use Shell Alvania #2, Mobil Mobilux #2 or Texaco Multifak #2	Grease Every 100 hours NOTE: In extremely dirty conditions once daily to weekly.
Metering Roll Bearings	Use grade #2 mineral oil lithium or lithium complex base grease.	Front bearings greasing is at beginning and end of season. Internal bearings are brass and do not need lubrication

Section 6

Section 6: Troubleshooting

Safety Circuit

Troubleshooting the Safety Circuit

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

The 120 volt input power to the dryer circuit for dryer controls comes from the bottom side of the transformer and runs to the top of the 8 amp mini-breaker. This breaker should be turned off and the voltage should be checked before turning the mini-breaker on. If the voltage reads anything outside of 125-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. This neutral is connected to the neutral from the secondary side of the transformer that is standard equipment on all 2010 dryers and later**.**

The incoming neutral line is connected to **TB5** (white wire) and the hot line is on **TB33** (after circuit breaker). The incoming 120-volt supply is an 8 amp mini-breaker.

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

- Place the second lead on **TB33**. If 110 or 120-volts show on the meter, then the mini-breaker is good if no voltage appears on the meter, then the mini breaker is tripped or off.
- Place the second lead on **TB53**. Turn the power switch to the **ON** position. If it shows 120-volts, then move to the next step. If no voltage is read on the meter, then there is a problem with the power on or the safety interlock switch on the remote cabinet door.
- Place second lead on **TB-C5**, if it shows 120-volts, move to the next step. If there is no voltage on the meter, reset all manual motor protectors as the AC drive unit may have went into fault. To reset the AC drive, turn off the mini breaker for the drive. Wait until the AC drive unit screen goes blank. Restore the mini-breaker to the **ON** position and the drive will restart automatically.

- Place the second lead on **TB-C6**, if it shows 120-volts then move onto the next step. If there is no voltage on the meter, then the jumper from **C5** to **C6** has become disconnected. If the end-user has pulled the jumper and installed take away 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 it shows 120-volts then move onto the next step. If there is no voltage on the meter, then check connection between **TB-C6** and **TB22**.

- Place the second lead on **TB25**, if it shows 120-volts, move onto the next step. If there is no voltage on the meter, then the whisker actuator switch on the discharge system has tripped. Check the customer's takeaway system.

- Place the second lead on **TB20**, if it shows 120-volts, move onto the next step. If there is no voltage on the meter, then the high limit has tripped it must be manually reset on the high limit itself.

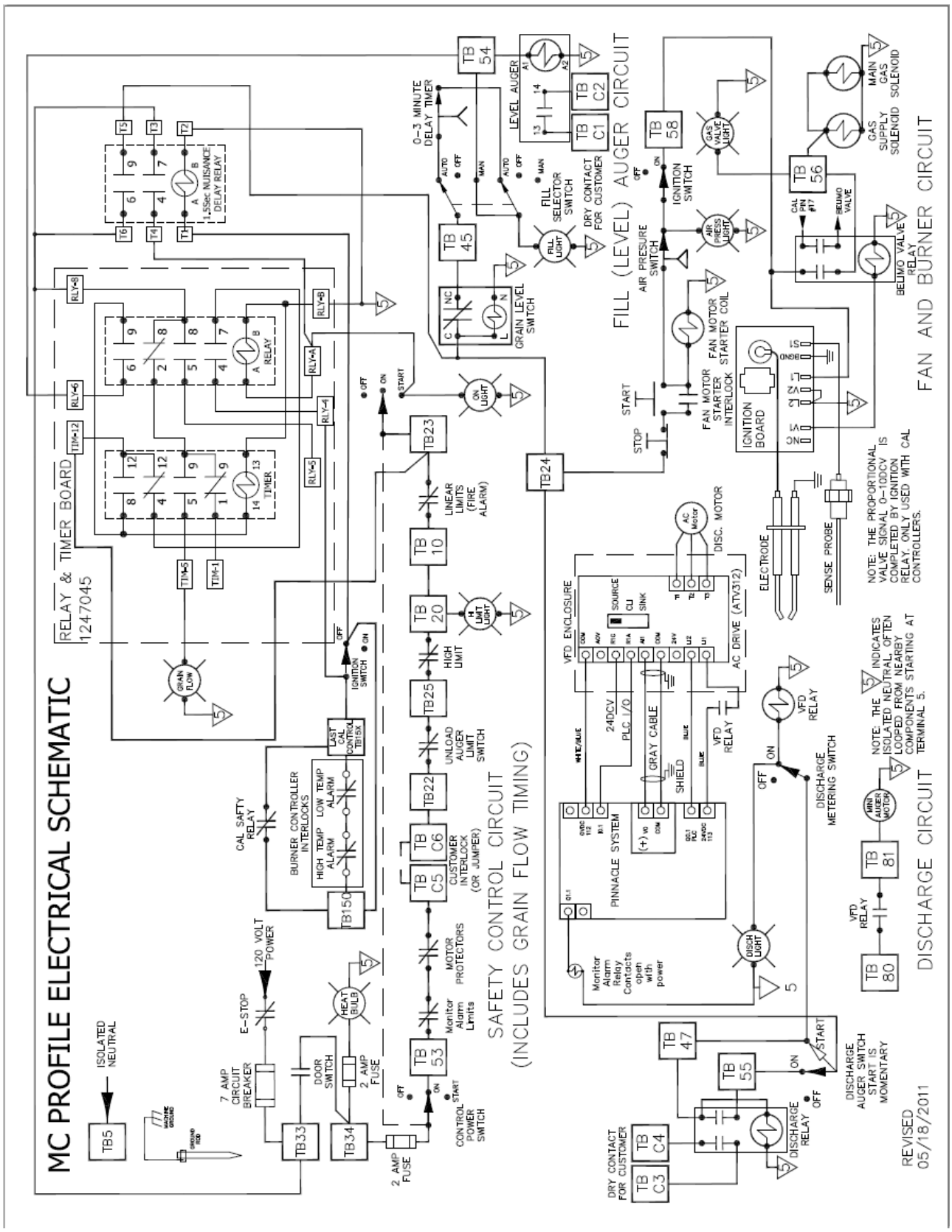
- Place the second lead on **TB10**, if it shows 120-volts, move onto the next step. If there is no voltage on the meter, check the connection between **TB20** and **TB10**.

- Place the second lead on **TB23**, if it shows 120-volts move onto the next step. If there is no voltage on the meter, then the linear limits if equipped have overheated and must be checked. When linear limits overheat (218°F), they will automatically reset when the temperature drops below 218°F. If they do not reset, they will need to be replaced. These can be checked by powering off and running continuity test through each linear limit module.

- Place the second lead on **TB24**; if it shows 120-volts, the safety circuit is completed. If there is no voltage on the meter, then there is a problem with the main relay, 0-60 minute timer, or the relay/timer board. There is a DC rectifier on the side of the board if this goes bad then the board has seen a spike in voltage and needs to be replaced.

- **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 Schematic



Customer Connections

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

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

C1-C2. **C1** and **C2** are a dry set of contacts that close when the dryer fill cycle begins. When this closes, the dryer will start the customer's equipment.

C3-C4 C3 and **C4** are a dry set of contacts that close when the dryer discharge system begins. When this closes, the dryer will start the customer's equipment.

C5-C6 is part of the dryer safety circuit and carries 120 volts as long as the dryer power switch is in the **ON** position. The dryer is delivered with a jumper across **C5** and **C6** to allow complete testing of the safety circuit. The jumper can be removed and the two wires that run from **C5 and C6** can be connected to external motor starter overloads that will be engaged when the dryer is running. Remember that the dryer is providing power from **C5** to **C6** and must be tied to a dry set of contacts on the customers equipment.

NOTE: This is to be done ONLY by a qualified electrician.

Temperature Controller (Cal)

Controller Issues

Always Overshoots the Set Point Temperature:

If the temperature is consistently overshooting the set point and tripping the alarm on the controller, adjustments to the controller are necessary.

- Press the up and down arrows 3 second till tune is displayed.
- Press the up arrow once till bAnd is displayed.
- Increasing the proportional band will help with overshoot.
- Hit the up arrow 3 more times until dAC is displayed. The derivative approach control works in conjunction with the proportional band to control overshoot.

NOTE: The three components for controlling overshoot are gas pressure, proportional band, and derivative approach control.

Unable to Reach Set Point Temperature:

If the set point cannot be achieved, even when the valve is 100% open, there is not enough gas pressure to obtain the selected plenum temperature. Adjust the pressure to obtain proper temperature. The controller will start to control the opening of the valve. The closer to the set point, the more the controller will shut the valve until the desired temperature is reached.

Plenum Temperature will not hold satisfactorily:

- Adjust the gas pressure adjustment.
- Free the proportional valve by depressing the black tab and rotating the shaft freely.
- Attempt to tune at the set point.

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

- Press both arrow keys simultaneously and hold down for 3 seconds. Display will show *tune off*.
- Press ▲ arrow up until display reads *bAnd-[number]*
- Press * and arrow until number is twenty (20).
- Press down arrow until display reads *tune off*. Press * and up arrow until display shows *tune –At.SP.*
- Hold down both arrows for three seconds for the auto tuning function.

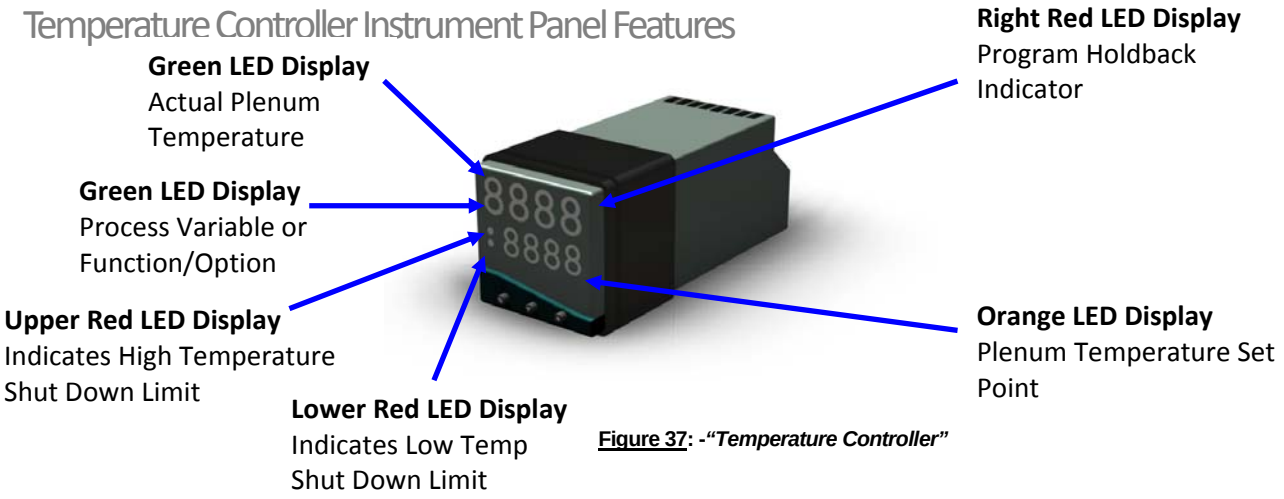


Figure 37: -*"Temperature Controller"*

Adjustments

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

If in danger of becoming "lost in program mode," press the ▼and▲ together for 3 seconds to return to display mode, check the adjustments above and try again.

When in program mode, after 60 seconds of key inactivity, the display will revert to either inPt: none or, if the initial configuration has been completed, the measured value. Any setting already completed will be retained. To inhibit automatic program exit select ProG StAY in level 4.

DIAGNOSTICS

(-AL-) indicates both high and low plenum temperature conditions that shut down the dryer. Reset dryer safety circuit, and reset the controller by the 2 outside buttons.

(iNPT- FAiL) These two words will flash back and forth. This condition is an invalid plenum chamber temperature signal back to the Cal Controller. Check the temperature input device wires to Cal Controller.

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

(tunE - FAiL) These two words will flash back and forth. The Cal Controller could not complete the auto tune process. This will occur when trying to auto tune. Something happened in the process to make the auto tuning process become corrupt. Restart the auto tuning process again to establish a good set of PID values to properly control temperature.

AC Discharge Speed Control

Keypad Instructions:

Keys are:

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

CODES that Display Faults on Drive:

- **OCF**=Over current
- **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

Figure 38: -*"AC Drive"*

AC Drive Parameters

Level	Code	Description	M-C setting	Factory Default
1st time power	**bfr**	Standard Motor Speed	60hz	50
	Fr1	(change to A1V1 for manual)	AI1	AI1
ref-	**LFr**	HMI frequency	0 to 500hz	0 to 500hz
	AIU1	Input	0 to 100%	0 to 100%
	FrH	Frequency	LSP to HSP	LSP to HSP
SEt	**ACC**	Acceleration Time	**5sec**	3.0
	dEC	Deceleration Time	**5sec**	3.0
	LSP	Low Speed	**5.0hz**	0.0
	HSP	High Speed	**60hz**	60.0
	ItH	Motor Thermal Current	**2.1**	11.0
	UFr	IR Compensation	**25**	20
	FLG	Frequency Loop Gain	20	20
	StA	Frequency Loop Stability	20	20
	SLP	Slip Compensation	100	100
	tdC1	Auto DC Injection Time	0.5 s	0.5 s
	SdC1	Auto DC Injection Current	7.7	7.7
	tdC2	2nd level DC Injection Time	0 s	0 s
	SdC2	2nd level DC Injection Current	5.5	6.1
	JPF	Skip Frequency	0 Hz	0 Hz
	JF2	2nd Skip Frequency	0 Hz	0 Hz
	SP2	Speed Preset 2	10 Hz	10 Hz
	SP3	Speed Preset 3	15 Hz	15 Hz
	SP4	Speed Preset 4	20 Hz	20 Hz
	CLI	Limiting Current	**2.6**	
	tLS	Low Speed Operating Time	0 (disable)	0 (disable)
	Ftd	Motor Frequency Threshold	60	60
	ttd	Motor Thermal Threshold	100	100
	Ctd	Motor Current Threshold	2.1	
	SdS	Scale Factor for SPd1/2/3	30	30
	SFr	Switching Frequency	4 kHz	4 kHz

drC	**bFr**	Motor Frequency	60 Hz	50 Hz
	UnS	Nominal Motor Voltage	230*	230
	FrS	Nominal Motor Frequency	60	50 Hz
	nCr	Nominal Motor Current	**2.6**	8.0
	nSP	Nominal Motor Speed	1725	1715
	COS	Motor Power Factor	0.88	0.88
	rSC	Cold State Stator Resist	nO	nO
	tUn	Auto Tuning		nO
	tUS	Auto Tune Status	dOnE	tAb
	UFt	Voltage/Freq Ratio	n	n
	nrd	Random Switching Freq	yES	yES
	SFr	Switching Frequency	4 kHz	4 kHz
	tFr	Max Output Frequency	**72 Hz**	72 Hz
	SSL	Suppress Speed Loop	nO	nO
	SCS	Save parameter config	nO	nO
	FCS	Restore Factory Settings	nO	nO
I-O	**tCC**	Type of Control	2C	2C
	tCt	Type of 2 Wire Control	trn	trn
	rrS	Reverse	**nO**	LI2
	CrL3	Current Input Low	4 ma	4 ma
	CrH3	Current Input High	20 ma	20 ma
	AOIt	Analog Output Config	**IOU**	OA
	dO	Analog/Logic Output	**OFr**	nO
	r1	Relay R1	FLt	FLt
	r2	Relay R2	nO	nO
	SCS	Configuration Backup	nO	nO
	FCS	Reset the Configuration	nO	nO
FUn	**StC-**	Stop Control		
	Stt	Normal Stop Type	**nSt**	rMP
SUP		Monitoring Parameter	FrH or LCr	FrH

General Parameters

Minimum Discharge Rate

1. Press the jog dial once and turn right one click until SEt is displayed.
2. Press the jog dial and turn right two clicks to display LSP.
3. Press the jog dial to display data. The data displayed is in units of hertz (Hz). The range is 0 to 60 Hz.
4. Rotate the dial to change the number. The higher the number the faster the discharge. Factory settings should be at 5 Hz.
5. Press and hold the jog dial till the value flashes to save.
6. Press "ESC" three times to return to rdY.

Maximum Discharge Rate

1. Press the jog dial once then turn to the right until SEt is displayed
2. Press the jog dial once, turn to the right three clicks to display HSP.
3. Press the jog dial once. The data displayed is in units of hertz (Hz). The range is 0 to 60 Hz.
4. Rotate the dial to change the number. The higher the number the faster the discharge. Factory settings should be at 60 Hz.
5. Press and hold the jog dial till the value flashes to save.
6. Press "ESC" three times to return to rdY.

Current Limit of Discharge Rate

1. Press the jog dial once then turn to the right until SEt is displayed
2. Press the jog dial once then turn to the right two click to display drC.
3. Press the jog dial once then turn to the right one click to display nCr. The data displayed is unit of AC amps.
4. Arrow down the menu until "**nCr**" appears. The data displayed is in units of AC amps.
5. Press and hold the jog dial till the value flashes to save.
6. Press "ESC" three times to return to rdY.

Acceleration for Discharge

1. Press the jog dial once and turn right one click until SEt is displayed.
2. Press the jog dial once till ACC is displayed.
3. Press the jog dial once to display data. The data that is displayed is in units of seconds.
4. Rotate the dial to change the number. The higher the number the faster the drive will accelerate to full speed. Factory settings should be at 5 sec.
5. Press and hold the jog dial till the value flashes to save.
6. Press “ESC” three times to return to rdY.

Deceleration of Discharge

1. Press the jog dial once and turn right one click until SEt is displayed.
2. Pres the jog dial once and turn right onc click unit dEC.
3. Press the jog dial once to display data. The data that is displayed is in units of seconds.
4. Rotate the dial to change the number. The higher the number the longer it will take to decelerate the drive. Factory settings should be at 5 sec.
5. Press and hold the jog dial till the value flashes to save.
6. Press “ESC” three times to return to rdY.

Variable Frequency Drive (VFD Fault Menu)

VFD for Unload System

Fault Code	Description of Fault	Action to resolve
CrF	Pre-Charge Circuit Damage	Reset drive (power down)
InF	Internal Fault	Replace drive unit
OCF	Over Current Fault	Drive is undersized for load, check set & drC
SCF	Motor Short Circuit	Wiring shorted to ground, check continuity
SOF	Over Speed Fault	Instability
tnF	Auto Tuning Fault	N/A
COF	N/A	N/A
EPF	External Fault	Fault outside drive
LFF	Loss of Reference Signal	Check wiring connection, check signal source
Obf	Overvoltage During Deceleration	Overhauling load or stopping to quickly
OHF	Drive Overload	Ambient temperature is too high, check motor amps
OLF	Motor Overload	Thermal Protection trip, let motor cool, check itH
OPF	Motor Phase Fault	Loss of phase to motor, check connections
OSF	Overvoltage During Steady State	Line voltage too high
PHF	Input Phase Failure	Motor leads not wired in proper order for ratation
SLF	Serial Link Failure Modbus	N/A
CFF	Configuration Fault	Reload parameters
CFI	Configuration Fault with Serial Port	N/A
USF	Under Voltage	Lost input power to drive

Ignition Board

Problem: Difficulty lighting burner.

Possible Cause/Solution:

1. Ensure gas supply to the dryer is **ON** and the hand valves are open.
2. Fan must be **ON** to achieve air pressure light.
3. Ignition switch set to the **ON** position. This applies 120 VAC at **L1** (0 volts at **L2** Neutral) of the ignition board.
4. After pre-purge time, the ignition board should power out 120 VAC at **V1** (**V2** neutral) for a trial ignition period to open the solenoids and gas valve light. The normal trial time is 7 seconds. If the trial is not successful, voltage outputs stops.
5. Check the gas solenoid operation by listening for a click/snap or feeling the vibration as they open. If the solenoid doesn't open, check the wiring and coil for damage, bad connections, etc.
6. Check the spark plug (igniter) for spark. Check the high voltage wire for damage, good connections.
7. Replace the ignition board.

Problem: Burner Lights but does not stay lit.

Possible Cause/Solution:

(NOTE: This is most likely due to the flame sensing)

1. Ensure flame sense probe is located in the flame.
2. Inspect the sense wire for damage and for loose or wet connections.
3. Check that sense wire is routed separately from the high voltage ignition wire.
4. Check the ignition board (B.GND) is grounded separately from all other connections. Sharing a ground connection can cause problems.
5. Clean sense probe with fine steel wool.

Burner may have to be grounded at the burner body directly to the burner housing

Common Start-Up Problems

Problem: Main gas valve is opened and main burner will not come on.

Possible Cause/Solution:

1. Check for water in the gas line by opening the drain valve.

Problem: Dryer will not reach operating temperature, or it reaches it slowly.

Possible Cause/Solution:

1. Low gas pressure. Increases gas pressure on the main gas regulatory.
2. Check for water in the gas train by opening the drain valve.
3. Make sure the dryer is completely full of grain by entering the heat plenum chamber and looking for daylight in one of the grain columns.
4. Gas parts in the burner need to be cleaned. Clean by drilling with a #47 drill bit.
5. Make sure that the gas butterfly valve is being driven wide open by the modulating motor. If not, check the motor or motor linkage.

Problem: Blower motor(s) will not start.

Possible Cause/Solution:

1. Check that the fan circuit breaker and the fan switch are on. Also, check for a defective switch or bad wire connections.
2. If the air pressure light does not come on, the air switch needs adjustment, or the bulb may be burned out.
3. Verify closing of the fan motor contactor. Check voltage on the load side of the contactor.
4. Inspect the contactor for defective contact or a burned out coil.
5. Inspect connections, and check voltage applied to the motor leads to determine if the motor is defective.

If the motor starts slowly, check for low voltage during starting due to excessive voltage drop in power supply wiring

Problem: Burner will not fire.

Possible Cause/Solution:

1. Check gas supply for possible obstruction or closed valves. Refill tank; replace or repair parts as required.
2. Inspect gas solenoid valves for defective coils or improper wiring. Replace the valve or coil if the valve will not open with proper voltage applied (115 volts).

Problem: Burner will not fire, but gauge shows gas pressure.

Possible Cause/Solution:

1. Check that the igniter is properly gapped and has a strong spark.
2. Inspect the porcelain and electrodes for damage or cracking. Clean or replace if necessary.
3. Machine does not have chassis ground.

Problem: Uneven drying, some kernels appear brown while others are under dried. Uneven heat exiting from dryer columns.

Possible Cause/Solution:

1. Check plenum 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.

Problem: Grain is not moving through columns.

Possible Cause/Solution:

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.

Empty the dryer and clean regularly. Do not allow fine material to gather in the plenum chamber.

Start Up and Dryer Operation Problems

Procedure

1. Set **HIGH LIMIT Switch.**

2. Start of Operation of Dryer: Light bulb in the remote cabinet will turn on.

   If not, check:
   - Main disconnect
   - Fuse is not functional or 7A circuit breaker tripped
   - TB33 for connection (110 Volts)
   - 115 Volt bulb and socket in the remote cabinet

3. Switch control switch to **ON** position. High Limit light should be **ON**.

   If not, check:
   - **RUN-START** in **START** position
   - Overload circuit through starters
   - AC drive and fuses or circuit breaker
   - Back door limit switch
   - High Limit reset
   - Cal Controller

4. Switch control switch to **START** position, **POWER ON**.

   If not, check:
   - Main relay
   - Refer to safety circuit troubleshooting

5. Push fan start button. Fan should start and run.
   If not, check:
   - Main power voltage through disconnect and breaker to starter.
   - Starter
6. Turn fill switch from **OFF** to **MANUAL**.

7. Adjust .2 to 3 minute delay fill timer to desired setting.

8. After dryer has filled with grain, switch fill switch to **AUTO** position.

9. Grain flow timer is only in the circuit in **AUTO** position.

10. Set grain flow timer for 2 to 10 minutes: ***NOTE:*** **DRYER IS NOW FILLED AND READY TO DRY GRAIN**

11. Air Switch light should light
    If not, check for:
    - Dyer not full of grain
    - Air pressure switch is not adjusted

12. Switch the Cal Controller on and allow time for the controller to reset and display values. The controller will display the plenum temperature and the selected set point.
    If not, check for:
    - Controller power **(TB141 or TB142)**

13. Switch ignition to **ON** position. After the 15 second purges timer times out, the gas valve light will turn **ON**. This will ignite the burner.
    If not, check:
    - Purge timer
    - Ignition board:
      1. L1 is hot, L2 is neutral (110 volt power to unit)
      2. V1 is hot, V2 is neutral (110 volt power to solenoids)
      3. S1 is voltage to flame sense probe
      4. **BGRD** is grounded to the chassis
      5. E1 is **HIGH VOLTAGE** to electrode **(DANGER! NEVER TEST WITH A METER)**

14. Switch the takeaway switch to the **ON** position. The customer takeaway system should start.
    If not, check:
    - Discharge auger starter

15. Switch the metering switch to **ON**. The metering rolls should start up and run.
    If not, check:
    - AC drive fault settings
    - AC drive parameter settings
    - AC drive fuses or circuit breaker
    - Check motor
    - Drive belts

16. Grain flow timer has a 1 to 60 minute range. If grain flow timer shuts down the dryer during normal operation, check settings and refer to "Fill System Adjustment" in the dryer manual.

Section 7

Section 7: Notes