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### Icons Used In This Manual

This icon indicates information reader should note.

This icon indicates recommended tools and/or hardware.

# Introduction

Thank you for choosing a Grain Systems tower grain dryer. This manual describes how to install electrical wiring to tower dryers, all models. This dryer is one of the finest grain conditioning products ever built. It is designed to give excellent performance and service for many years.

### **GSI** Mission

"Provide our customers with awesome service and products in order to grow our company to be the world leader, using a best cost producer strategy, with empowered associates who enjoy their jobs."



Welcome to The GSI Group, Inc. in Assumption, Illinois.

### **Plan Ahead for Electrical Safety**

- Read this entire "Tower Grain Dryer Electrical Installation Manual" before beginning electrical installations.
- Plan ahead to assure safe and proper installation of all parts.
- Electrical safety starts with the design of your facility. Proper design provides the correct relationship of energy supplies, existing equipment, and structures.
- Use common sense when installing electrical connections.
- Obtain any permits and/or licenses required for work at the electrical installation location.
- Make sure power supply is turned off. Lock and tag the equipment on which you are working. Test to make sure it is *really* locked out.
- Check your work.

**Electrical wiring should be installed to tower dryers in accordance with national and local codes.** The United States National Electric Code (NEC) and/or the Canadian Standards Association (CSA) code provide basic standards for the design and installation of your electrical system.

- This product is intended for grain conditioning only. Any other application is a misuse of product. Misuse of product may cause injury. Misuse of product may void warranty.
- This product has sharp edges. These sharp edges may cause serious injury. To avoid injury use proper protective clothing and equipment at all times.
- In this manual guards are removed for illustration purposes only. All guards must be in place during operation.

• It is important to read and understand this manual. Know and use safe operating procedures. Know and prevent safety hazards.

Safety First

• It is the responsibility of the dryer owner and/or the dryer operator to read this manual and to know the equipment requirements and safety hazards. Inform all personnel who work with the equipment, or who are in the dryer area, about safety hazards to prevent injury or damage.

A careful operator reduces risk of personal injury and equipment damage.

**Electrical Power Supply:** Grain Systems recommends you contact your local power company and request that a representative inspect your dryer installation. Be sure your wiring is compatible with your power company's system and that you will have adequate power supplied to dryer.

Material Safety Data Sheets (MSDS): MSDS are available upon request.

#### Safety Icon:

This icon indicates safety and hazards to people and equipment. This icon is used to call your attention to instructions for your personal safety and/or safety of the equipment. Watch for this symbol. Use safety precautions to prevent injury to people and damage to equipment.

#### Safety Words:\*

- "DANGER" (red) this word means the hazard or unsafe practice will result in severe injury or death.
- "WARNING" (orange) this word means the hazard or unsafe practice could result in severe injury or death.

"CAUTION" (yellow) this word means the hazard or unsafe practice could result in minor injury or property damage.

<sup>\*</sup> These safety words conform to the American National Standards Institute draft standard ANSI Z535.4, "American National Standards for Product Safety Signs and Labels," 1989.

#### Safety Decals :

• Some of the required safety decals are placed on the dryer prior to shipping. The remainder are placed during dryer construction and electrical installation. The purpose of the safety decals on the dryer is to immediately alert all personnel to the hazards of an operating dryer. The safety decal does not replace the need for all personnel to know and understand safe dryer operations and requirements. Read the "Tower Dryer Operations and Service Manual".

Safety decals should be read and understood by all people in or around the dryer area.

• The following pages of "SAFETY DECALS" identify and give the location of all safety decals that should be on each tower dryer. Safety decals are listed in numerical order.

## Ç,

If the safety decals on the following pages are not on your dryer, or if they are damaged, immediately contact Grain Systems for replacement safety decals.

U.S. telephone: 217.226.4421 U.S. toll free fax: 1.800.800.5329 International fax: 217.226.3404 e-mail: gsisales@grainsystems.com internet: http://www.grainsystems.com



G 1004 East Illinois Street Post Office Box 20 Assumption, IL 62510-0020 United States of America

- **Location of Decals** (1)
- (English and Spanish) decals are placed on inside of hatch door prior to shipping.





Hatch door with decals in place.



Inside View - hatch door installed with decals in place.



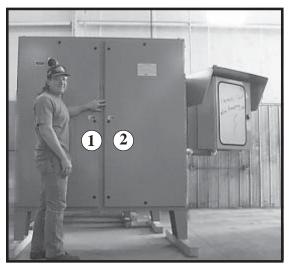
Outside View - hatch door installed with decals in place.



#### Location of Decal

- (1) on outside of main power box, on right door.
- (2) on outside of main power box, on left door.
- (3) inside main power box door, on same side as main electrical disconnect.





Example - Main Power Box with Electronic Monitoring Control System.

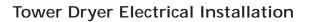




**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

	F	USE T	ABLE	E 1	
F#	TYPE	AMP	F#	TYPE	AMP
FU1 FU2 FU3 FU4 FU5 FU6 FU7			FU8 FU9 FU10 FU11 FU12 FU13 FU14		· · · · · · · · · · · · · · · · · · ·
					DC-985





## Safety Decals

#### Safety Decal # DC-987

**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Safety Decal**



Line side of disconnect is energized.

Hazardous voltage can shock, burn or cause death.

This unit may contain one or more voltages.





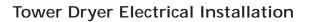
**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Safety Decal**

#### WARNING

To maintain overcurrent short circuit and ground fault protection, the manufacturer's instructions for selecting overload relays and setting the instantaneous trip circuit breaker must be followed.





## Safety Decals

#### Safety Decal # DC-989

**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Safety Decal**

#### WARNING

Insure that the incoming AC power and all separate power sources are turned off and locked before working on this equipment. Failure to observe this practice may result in severe injury, death, and/or equipment damage.





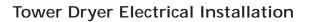
**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Safety Decal**

#### WARNING

All maintenance procedures must be performed by qualified personnel who are familiar with the operation of this equipment. Failure to observe this warning can result in serious or even fatal injury and/or equipment damage.







**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Safety Decal**

Be sure that charge light and all LED's are out before touching any components.

All test equipment should be connected and disconnected with power off.

Grounded test equipment, such as oscilloscopes, may damage the inverter.

Isolate all instruments from ground before using. The DC bus remains charged for several minutes after power is removed. DC-991



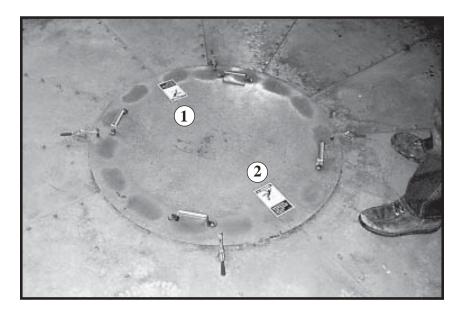


Location of Decal (1) on outside of metering drum access cover.(2) on outside of metering drum access cover.

#### **Safety Decal**



Rotating drum below. Will cause serious injury or death. Lockout power before entering or servicing.



**Location of Decal** (1) on outside of heat section door.

Safety Decal



beyond door. May cause serious injury. Do not enter when dryer is running.

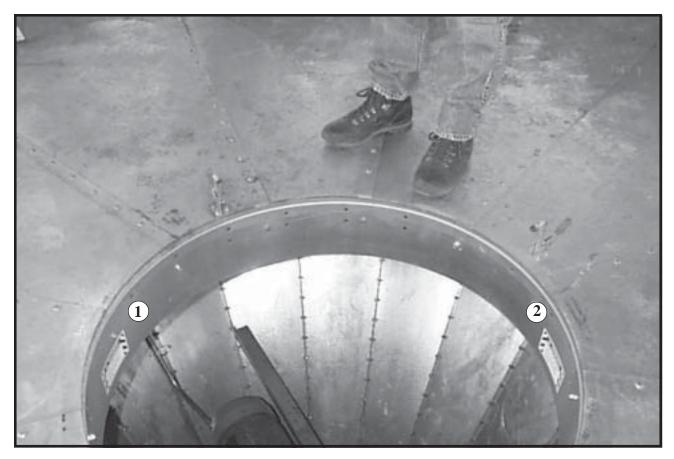


- **Location of Decal** (1) on upper ring around metering drum access opening.
  - (2) on upper ring around metering drum access opening.





Close-up of safety decal #DC-1062.



## Safety Decals

#### Safety Decal # DC-1063

**Location of Decal** (1) on outside of louvered access door to cooling section.

Safety Decal



Airborne particles during operation. May impair vision and breathing. Do not enter when dryer is running.





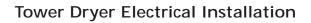
**Location of Decal** (1) on outside of louvered access door to cooling section.

Safety Decal



Aligh speed belt drive operating overhead. Can cause serious injury. Keep head and hands clear. Do not enter when dryer is running.

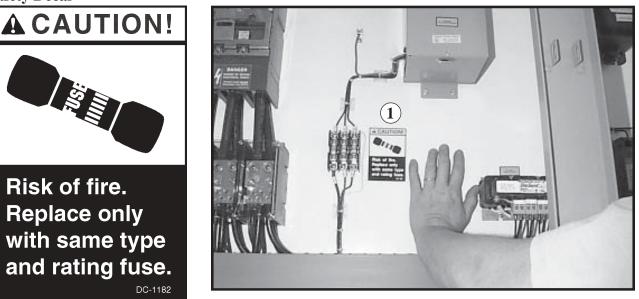




## Safety Decals

#### Safety Decal # DC-1182

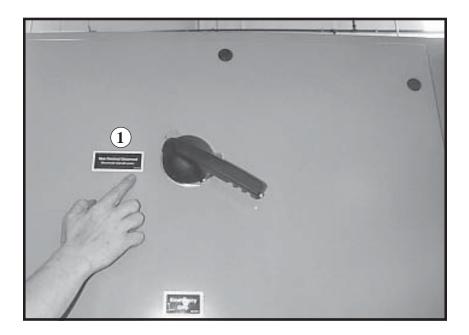
Location of Decal (1) inside main power box, on power panel next to fuse block.

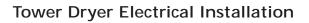




**Location of Decal** (1) on outside of main power box door, to left of main electrical disconnect.



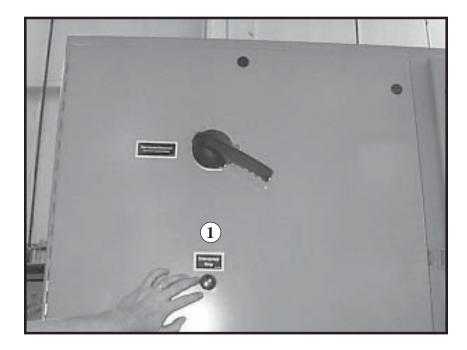






**Location of Decal** (1) on outside of main power box door, above emergency stop disconnect.





#### Name Plate for Main Power Box

**Location of Decal** (1) inside main power box door, on same side as main electrical disconnect.

#### **Information Decal**

GSI	GSI Assumption,	IL 62510	
Model	4000TIS4N8	ISD	]
Serial No.	03981032		]
Poel	NATURAL	1AS	]
Nex. Telai H.P.	230		]
Mas. Amperage	276		]
Bupply Voltage	3 Phose	460 Volta	60 ×
	Fan #4	H.P.	Amp
T	Fan #3	75	85
0	Pan #2	75	89
W	Fail #1	75	89
E	Metering	5	9
R	Lord		
	Unload	0.00	
D	Auxiliary 1		
R	Auxiliary 2		
Ŷ	Auxiliary 3		
	Accillary 4		and a



#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.



See Appendices for wiring notes and electrical drawings, etc.

# 1. Overview and Planning

#### **1.1. Installation Summary\***

- This summary is for GSI Tower Grain Dryers of any diameter, voltage or number of fans.
- The dryer has an **Electrical Control System** that consists of a main **Power Box** and a **Control Box**.

The **Power Box** contains all of the power components necessary to operate the dryer. This Power Box is a free standing NEMA 4 enclosure of varying sizes depending on the size of the dryer. The Power Box is generally anchored on the outer edge of the dryer foundation beneath one of the windows on the dryer. All of conduit runs will come out of the lower back of the Power Box. Then the conduits either run up the exterior of the dryer, into the dryer, or run to the Fuel Train.

The **Control Box** contains the computerized controller (**Electronic Monitoring Control System**), operator's controls, switches, etc. The Control Box is usually attached and wired to the **Power Box** at the factory.

The Fuel Train (with Maxon Gas Valves, Modutrol Motor, Pilot Fuel Train, and Pilot Solenoid) is anchored to the foundation beneath the dryer or secured to dryer legs.

Other installations are made during dryer construction as noted.

\* See all "Electrical Installations" sections of this manual for additional installation instructions.

After the tower grain dryer is erected, wire the dryer electrical components to the **Power Box** as follows.

**Fan Motors** (Use 1, 3, or 4 runs of conduit. Size of conduit depends on dryer size and voltage.) See Appendix B, "Fan Motor Wiring Guide".

During dryer construction, the Fan Motors are hung in the walk-in cooling section of the dryer.

Run a conduit for each Fan Motor from back of Power Box, up side of dryer (parallel with other conduits) to the Motor Window. Turn each conduit into the dryer (parallel with other conduits) and run to its Fan Motor. (Use flexible conduit at the Fan Motors so the motor mount can be moved back and forth when tightening the fan belts.)

Wire each Fan Motor from its fan (blower) motor starter in the Power Box.

#### Air Switch Tubing (one for each fan)

(Use 3/8" copper tubing - same tubing used for Pilot Fuel Line)

At the factory, Air Switches are installed in the Power Box.

At the factory, brass connectors for the air switch tubing are installed on the side of the Power Box. (The brass connections are installed on the side opposite the Control Box.)

Run Air Switch Tubing for each Fan from its brass connector on the outside of the Power Box to the Fan. Wire tie the Air Switch Tubing to the Fan Motor conduit as it runs up through Motor Window to the Fan. Extend the Air Switch Tubing up inside Fan no more than 1" to 2" past top of Venturi.

#### Metering Drum Motor. (Use 1/2" conduit)

During dryer construction, Metering Drum Motor is installed below walk-in cooling section of dryer, beneath access cover to discharge hopper.

Run conduit from back of Power Box, up side of dryer (parallel with other conduits) to dryer window. Turn conduit into dryer Motor Window, run down through walk-in cooling section floor. (Keep conduit as close to side of dryer as possible.) Clamp conduit along Inner Hopper, and run to Metering Drum Motor.

Wire Metering Drum Motor wires to Inverter Drive in Power Box at U, V & W terminal points.

#### Interior Hi-Limits (overheat) (with copper capillaries) Adjustable Plenum Hi-Limit Thermostat (overheat) Plenum Temperature Sensor (RTD)\* (Wire all three in one 1/2" conduit.)

Run conduit from back of Power Box, up side of dryer (parallel with other conduits) to dryer window (usually the motor window). Turn conduit into dryer, run up above motor window. Install Interior Hi-Limits, and Adjustable Plenum Hi-Limit Thermostat just above motor window (inside walk-in cooling section of dryer.)

Extend same conduit (from the Adjustable Plenum Hi-Limit Thermostat) up through Divider Hopper to approximately 3' above heating section walkway. Install Tee to conduit. Install Liquid Tite Cable Connector (Heyo, Appleton) to Tee. Pull copper capillaries from Adjustable Plenum Hi-Limit Thermostat (in walk-in cooling section below), turn copper capillaries at Tee, and install copper capillaries on dryer wall (parallel to heating section walkway). Extend conduit from tee up another approximate 3', and install Plenum Temperature Sensor approximately 6' above heating section walkway.

Wire from Terminal Strip in Power Box to each electrical component in walk-in heating or cooling sections of dryer. (Connect the Plenum Temperature Sensor in the Power Box to terminals RTD-C and RTD-D.)

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

**Exterior Hi-Limits** (overheats) (Wire all three Hi-Limits in one 1/2" conduit.)

During dryer construction, Upper Hi-Limit, Middle Hi-Limit, Lower Hi-Limit, and their respective copper capillaries are installed on the exterior of the dryer.

During dryer construction, one conduit for all three Exterior Hi-Limits is installed behind ladder, and down to approximately 10' above foundation.

Run conduit from back of Power Box (up parallel with other conduits), around dryer to ladder, and then up side of dryer to connect with existing conduit.

Wire from Terminal Strip in Power Box to each Exterior Hi-Limit.

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

<sup>\*</sup> Resistance Temperature Device

### 1 Overview

#### **Bindicator**(s)

(Use one 1/2" conduit - also contains Grain Temperature Sensors wiring.) (Even if the dryer only requires one Bindicator, pull wires for two Bindicators. This allows addition of second Bindicator if required.)

During dryer construction, Bindicator(s) are installed on the exterior of the dryer, within reach of the ladder. The standard Bindicator is installed on side of dryer (within reach of ladder), approximately 21" below the dryer roof eave. The optional Bindicator is installed on dryer roof, one sheet to left of hatch, approximately 45" above roof eave.

During dryer construction, one conduit for the Bindicator(s) (and Grain Temperature Sensor) is installed down to approximately 10' above foundation.

Run conduit from back of Power Box (up parallel with other conduits), around dryer to ladder, and then up side of dryer to connect with existing conduit. Install tee to conduit for Grain Temperature Sensors approximately 12" below bottom Grain Temperature Sensors.

Pull Bindicator wires (at the same time as Grain Temperature shielded cables) from Terminal Strip in Power Box to Bindicator(s).

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

#### Grain Temperature Sensors (RTDs)

(Use one 1/2" conduit - also contains wiring for Bindicators.)

During construction, two pairs of Grain Temperature Sensors (a total of four sensors on two 10' conduits) are installed on the exterior of the dryer, within reach of the ladder.

Run conduit from back of Power Box (up parallel with other conduits), around dryer to ladder, and then up side of dryer to connect with existing 1/2" Bindicator conduit.

Pull shielded cable (when Bindicator wires are pulled), from terminal points RTD-A (black) and RTD-B (white) on Terminal Strip in Power Box to Grain Temperature Sensors.

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

#### Ignitor (Ignition, Spark Plug)

(Use 1/2" conduit - MUST RUN SEPARATE FROM, AND PARALLEL TO FLAME SENSOR CONDUIT) (Ignitor and Flame Sensor conduits run parallel from Power Box to Burner.)

During dryer construction, the Burner (with installation point for the Ignitor) is installed in the walk-in heating section.

Run conduit (parallel with Flame Sensor conduit and other conduits) up side of dryer to dryer window. Turn up and run through Divider Hopper.Turn and run through Burner Housing, then extend conduit approximately 4" beyond Burner Housing. (Note: conduit must run within 16" of Ignitor to protect ignition cable.) Install 1/2" Liquid Tite Cable Connector to conduit. Install Ignitor to Burner.

Pull ignition cable from Ignition Transformer in Power Box to Ignitor in Burner.

**Flame Sensor** (Flame Probe, Flame Rod) (Use 1/2" conduit - MUST RUN SEPARATE FROM, AND PARALLEL TO IGNITOR CONDUIT) (Flame Sensor and Ignitor conduits run parallel from Power Box to Burner.)

During dryer construction, the Burner (with installation point for the Flame Sensor) is installed in the walk-in heating section.

Run conduit (parallel with Ignitor conduit and other conduits) up side of dryer to dryer window. Turn conduit up and run through Divider Hopper. Turn and run through Burner Housing, then extend conduit approximately 4" beyond Burner Housing. Install 1/2" Liquid Tite Cable Connector to conduit. Install Flame Sensor to Burner.

Pull wires (14 gauge) from Protectofier (terminal E) in Power Box to Flame Sensor in Burner.

#### FUEL TRAIN

Pilot Fuel Line(Use 3/8" copper tubing - same tubing used for Air Switches)Fuel Train Wiring(Use one 1/2" conduit to wire Pilot Solenoid, Maxon Gas Valves, and Modutrol Motor.)

During dryer construction, the Fuel Train is anchored to the foundation under the dryer or secured to the dryer legs (includes Pilot Fuel Train Assembly, Pilot Solenoid, Maxon Gas Valves, and Modutrol Motor).

Pilot Fuel Line Connect 3/8" Copper Pilot Fuel Line from Pilot Fuel Train Assembly on Fuel Train to connecting point on Burner. Wire tie 3/8" Copper Pilot Fuel Line to Fuel Piping. (Fuel Piping runs from Fuel Train up exterior of dryer, through motor window into walk-in cooling section, and up along fuel line to Burner.)

Fuel Train Wiring Run conduit up dryer leg closest to Power Box, around dryer (parallel with other conduits), down dryer leg closest to Fuel Train, and (using flexible conduit) over to Fuel Train.

Wire from respective points on Terminal Strip in Power Box to Pilot Solenoid, Maxon Gas Valves, and Modutrol Motor on Fuel Train.

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

#### Work Light and Safety Package (Use one 1/2" conduit.)

Locate and install according to dryer owner preference.

Often the Work Light and Safety Package are installed on dryer, just above Power Box.

See Appendix C "Field Notes" and "Wiring Diagrams Manual".

#### 1.2. Planning Electrical Control System EXAMPLES

The **Electrical Control System** consists of **Power Box** in NEMA 4 cabinet and **Control Box** with **Electronic Monitoring Control System**. (Photo 1-1)



**Power Box** is shipped pre-assembled. (Photo 1-2)

Control Box with Electronic Monitoring Control System is shipped pre-assembled and wired to Power Box. (Photo 1-3)

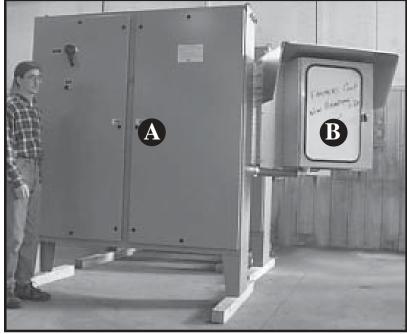


Photo 1-1 (A) Power Box as shipped.
(B) Control Box with Electronic Monitoring Control System as shipped.

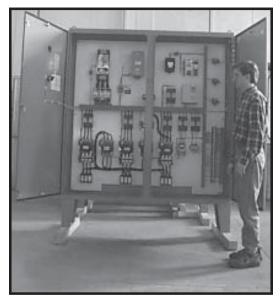


Photo 1-2 Interior of Power Box.



Photo 1-3 Interior of Control Box with Electronic Monitoring Control System.

### 1 Overview

#### 1.2. Electrical Control System continued



Photo 1-4 Close Up - Air Switches (for 4 fan dryer) as shipped.

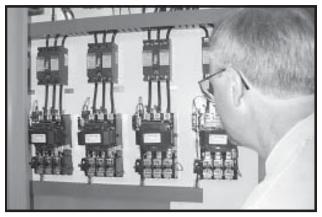


Photo 1-5 Close Up - Blower Motor Starters (for 4 fan dryer) as shipped.

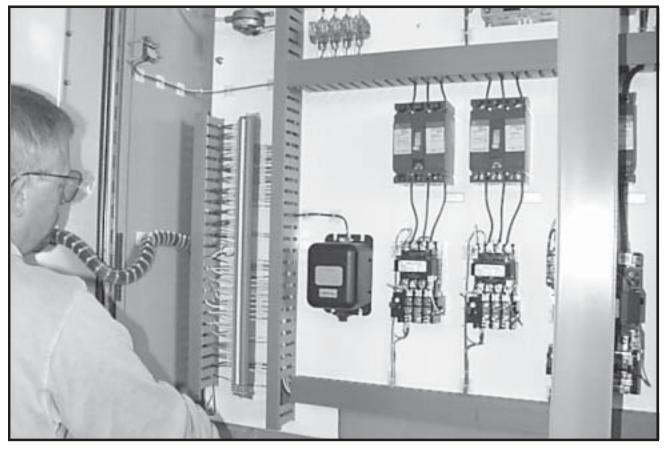


Photo 1-6 Close Up - Terminal strip, etc as shipped.

#### **1.2. Electrical Control System continued**

The location of the Electrical Control System is determined by tower dryer owner, or designee of tower dryer owner, for example, by the Elevator Manager.

#### **Tools and Materials**

(4) 1/2"x5-1/2" heavy duty expanding anchor bolts with (4) washers and (4) nuts

drill and 1/2" masonry bit 3/4" wrench

Use a forklift or tractor to place the Power Box under a dryer window.

Lift Power Box using eyelets on top of box - box may tip if lifted from below.

#### **Steps to Anchor Power Box on Foundation**

- **1.2.1.** Determine location for Electrical Control System.
- **1.2.2.** Center Power Box under dryer window.
- **1.2.3.** Measure, mark and drill four holes in concrete of tower dryer foundation.
- **1.2.4.** Bolt Power Box legs into concrete with heavy duty expanding anchor bolts.



Electronic Monitoring Control System is pre-installed to Power Box and inter-connect wired.

Elevator electrician will wire electrical supply feed.



Photo 1-7 (4) heavy duty expanding anchor bolts

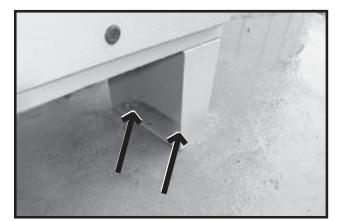


Photo 1-8 Heavy duty expanding anchor bolts (Redheads) anchor Power Box to dryer foundation.

#### Overview 1

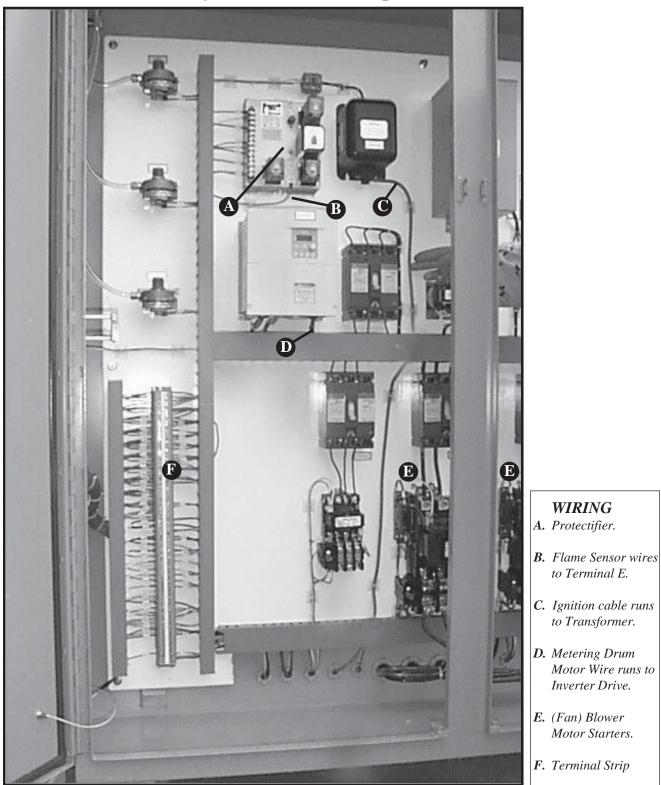


1.2. Electrical Control System continued

Photo 1-9 Control Box (with Electronic Monitoring Control System) installed.



Power Box installed (3 fan dryer). Photo 1-10



#### **1.2. Electrical Control System continued Example Power Box Wired.**

Photo 1-11 Interior of Power Box wired.

# **1.2. Electrical Control System continued Example Power Box Wired.**

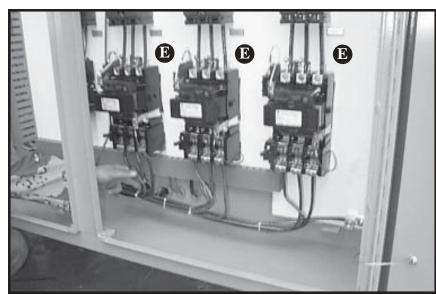


Photo 1-12 Close Up - Power Box Wired

WIRING E. (Fan) Blower Motor Starters

#### **1.3. Planning Conduit EXAMPLES**

(10' lengths, diameter 1/2", 1", 2-1/2")

Guidelines.

- If Power Box is to be located under dryer, place it so that there is enough room for all conduits to exit back of Power Box and run directly up to dryer window. (Usually the motor window.)
- Fan motor conduits are usually run through the center of the motor window, with all 1/2" conduits placed to either side as space permits. There are seven 1/2" conduits on all dryers. (See list on next page.)
- Run conduit parallel or perpendicular to other conduits.
- Vertical conduit runs should be plumb, neat, and orderly.
- Note orientation of electrical components (inside dryer and outside dryer) with respect to direction of conduit leaving Power Box.
- Support conduit systems with superstrut channels. Install superstrut where conduits enter motor window and behind parallel conduits to keep them in line.
- Electrical boxes should be readily accessible.
- Conduit fittings must be dust-tight, rain-tight, and satisfy any hazard requirements for the site.
- Use heavy duty thread sealing compound on conduit connections to tighten seals and prevent leaks.



Photo 1-13 Flexible Conduit.



Photo 1-14 IMC rigid, threaded conduit.

#### 1.3. Planning Conduit continued



Photo 1-15

#### THERE ARE SEVEN 1/2" CONDUITS ON ALL DRYERS

Exterior Conduits to Top of Dryer

- 1. one Exterior Hi-Limits conduit
- 2. one Bindicator conduit (also Grain Temperature Sensor)

Interior Conduits

- 3. one Ignitor conduit
- 4. one Flame Sensor conduit
- 5. one inside sensors conduit (for Interior Hi-Limits, Adjustable Plenum Hi-Limit Thermostat, and Plenum Temperature Sensor)
- 6. one Metering Drum Motor conduit
- 7. One Conduit to Fuel Train electrical components

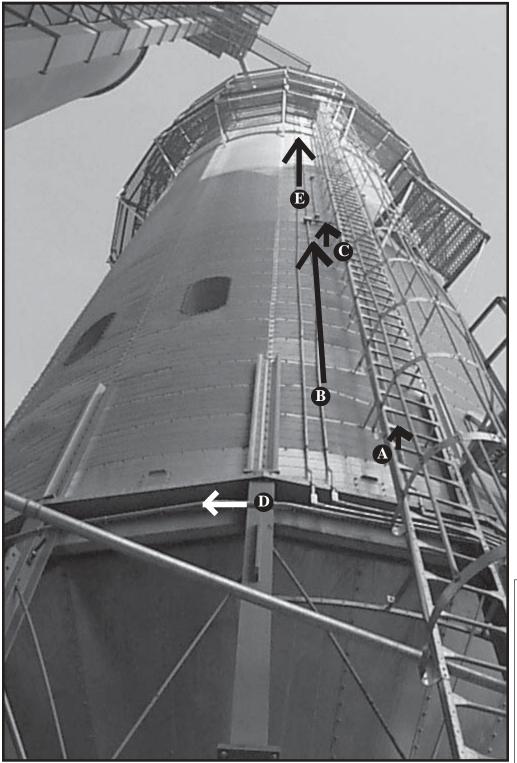


Front View - Conduit installed on 4 fan dryer. Photo 1-16 Rear View - Conduit installed on 3 fan dryer.



Rear View - Lights and horn installed Photo 1-17 on 3 fan dryer.

## **1.3. Planning Conduit continued**



#### **CONDUIT RUNS**

- A. Exterior Hi-Limits
- **B.** Bindicator(s)
- C. Grain Temperature Sensors
- **D.** Pilot Fuel Train
- E. Customer Installed Dryer Master

*Photo 1-18 Side View - Conduit installed on 4 fan dryer.* 

# 1 Overview

## 1.4. Planning Knockouts EXAMPLES

Guidelines.

- All of the dryer's electrical wiring exits the lower back of the Power Box through knockouts.
- Plan ahead for correct number, size, and spacing of knockouts.
- Space knockouts as closely together as is necessary to run conduits straight up dryer (Avoid bending conduits wherever possible.)
- Carefully mark and drill knockouts.
- In Power Box, install weathertite Myers Hub to each conduit hole to protect wires.

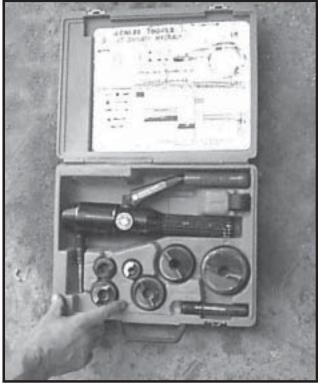


Photo 1-19 Hydraulic punch driver set with 1/2" to 2" knockout punches.

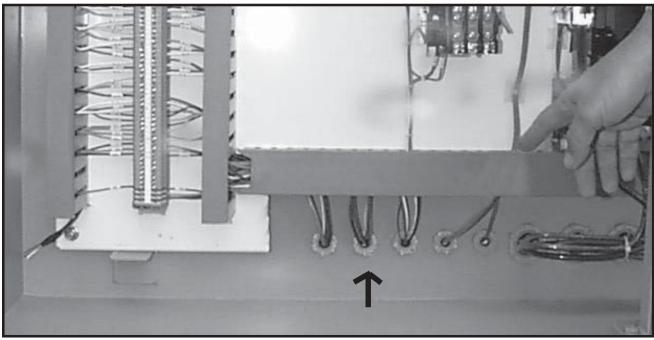


Photo 1-20 Interior view of Power Box - with Myers Hubs installed to knockouts.

# 1.4. Planning Knockouts continued



Photo 1-21



Photo 1-22

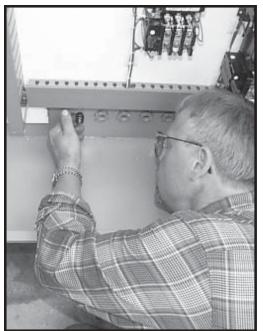


Photo 1-23



Photo 1-24

# 1 Overview

## 1.4. Planning Knockouts continued



Photo 1-25

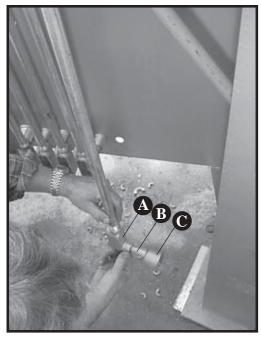


Photo 1-26 (A) LB-Body, (B) nipple, (C) exterior half of Myers Hub.

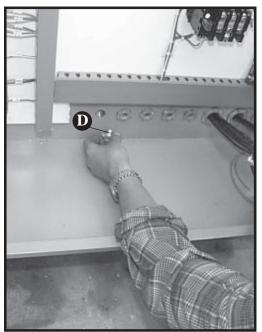


Photo 1-27 (D) Interior half of Myers Hub.

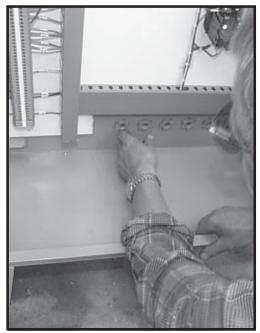


Photo 1-28

#### **1.5. Planning Wiring EXAMPLES**

Guidelines.

- Inside Power Box, run wires within wireways.
- Wires that cross wireways should run underneath raceways, especially high-voltage such as ignition cable.



No wires should run over the top of any wireway.

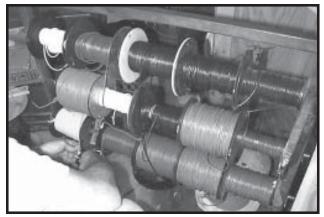


Photo 1-30 Wire Rack.

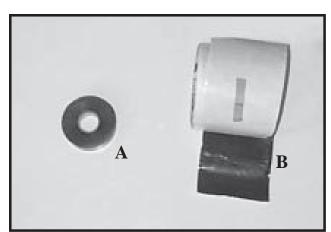


Photo 1-29

- **A.** #33 electrical tape
- **B.** #2210 mastic roll tape



Photo 1-31 Wire #1 THW Black.

## 1.5. Wiring continued

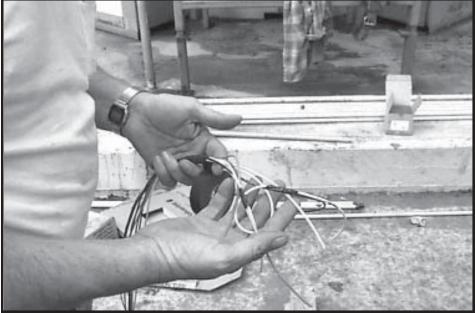


Photo 1-32 Pairing off wires for Pilot Fuel Train.

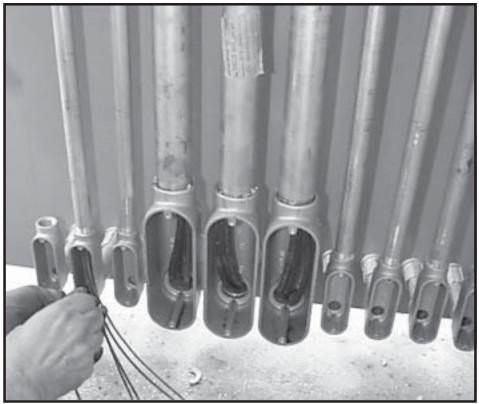


Photo 1-33 Close Up - Pulling wires from rear of Power Box.

## 1.5. Wiring continued



Photo 1-34 Tying wire to Fish Tape prior to pulling it through conduit.



Photo 1-35 Pulling wires to Exterior Hi-Limits.

#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics, etc.

# 2. Fan Motors wiring and installing Air Switch Tubing

1, 3 or 4 Fan Motors are installed during construction as required by dryer size.



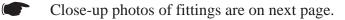
Photo 2-1 Example: 100 hp, 230/460vFan Motor.



*Photo 2-2 Example: Wiring for (3) Fan Motors installed. Note 3/8" copper tubing for each air switch is wire tied to fan motor conduit. Note: fan cover is not yet installed.* 

# 2.1. Wire (1, 3 or 4) Fan Motor(s) as required by dryer size.

- **2.1.1.** Determine where conduit for each Fan Motor(s) will exit Power Box, and knock out hole(s) in Power Box for conduit (size 1" to 2 1/2" depending on motor size). Install Myers Hubs. For 3 or 4 fan dryers position conduits as close together as Korn Clamps will allow. This will leave room for other 1/2" conduits that will exit Power Box in later steps.
- Conduit and fittings for Fan Motor(s) are shown in Photo 2-3.



- 2.1.2. Install LB Bodies at back of Power Box, and run conduit up dryer.
- **2.1.3.** Turn conduit into motor window and run conduit or sealtite into dryer. Install sealtite from fan motor conduit to fan motor. This allows motor mount to be adjusted.
- **2.1.4.** Pull wires and terminate. (Wrap split bolt connections in electrical tape, then mastic tape.) Follow manufacturer's instruction manual and terminal wiring diagram on motor name plate.

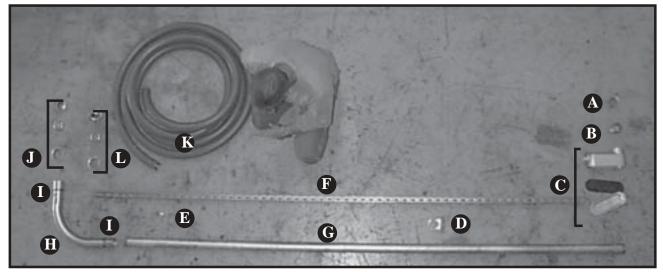


Photo 2-3 Fan Motor electrical fittings. See Close Ups on next page.

- A. 1-1/2" Scru-tite Hub (Myers)
- **B.** 1-1/2" Close Nipple Conduit
- C. 1 1/2" LB Body with gasket and cover
- **D.** 1-1/2" Korn Clamps, RA
- **E.** 1-1/2" Strut Clamp
- **F.** 1-5/8" channel strut (perforated) (cut to required length)

- **G.** 1-1/2" IMC Threaded Conduit (cut to required length)
- **H.** 1-1/2" Elbow Conduit, 90 degree
- **I.** 1-1/2" Conduit Couplings
- J. 1-1/2" Straight Connector
- **K.** Sealtite Flexible Conduit (cut to required length)
- L. 1-1/2" 45 Degree Connector, Liquid Tite Conduit

# **Fittings for Fan Motor Electrical Installation.**

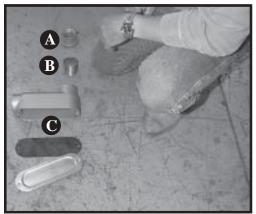
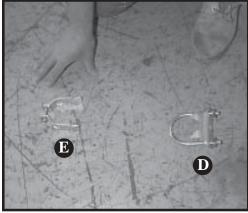


Photo 2-4 A. 1-1/2" Scru-tite Hub.
B. Close Nipple.
C. 1-1/2" LB Body with Gasket and Cover.



Photo 2-5 Split Bolt Connectors (6 per fan motor).



*Photo 2-6* **D.** *1-1/2" Korn Clamp.* **E.** *1-1/2" Strut Clamp.* 

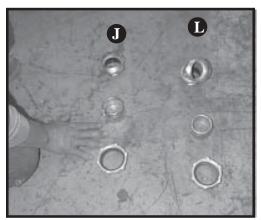


Photo 2-7 J. 1-1/2" Straight Connector. L. 1-1/2" 45 Degree Sealtite Connector.

# **EXAMPLE** - Pulling Fan Motor Wires.



Photo 2-8



Photo 2-10



Photo 2-9



Photo 2-11 Drill hole in angle iron for mini clamp.

# **EXAMPLE** - Making Up Motor Connections.

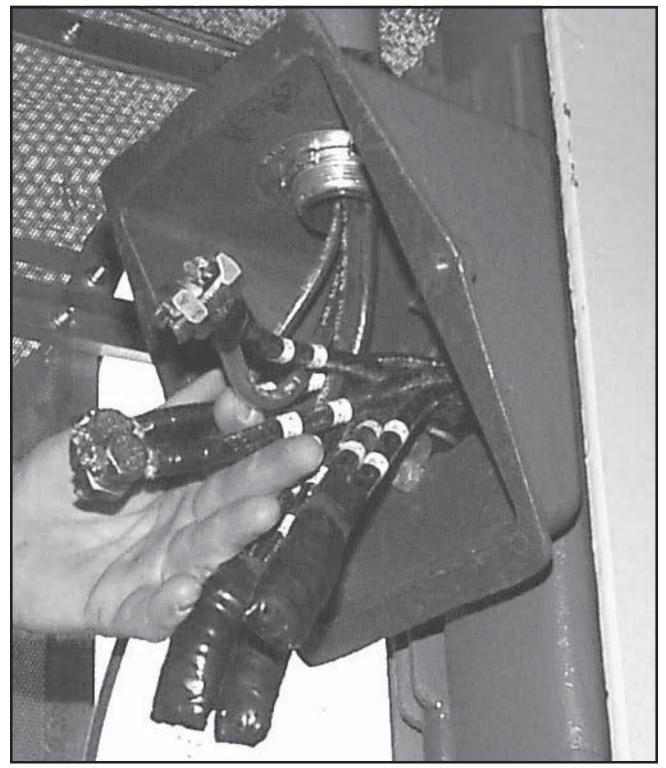


Photo 2-12 Connections (split bolt connectors) wrapped in electrical tape, then in mastic tape.

# **EXAMPLE** - Fan Motors wired in Power Box.

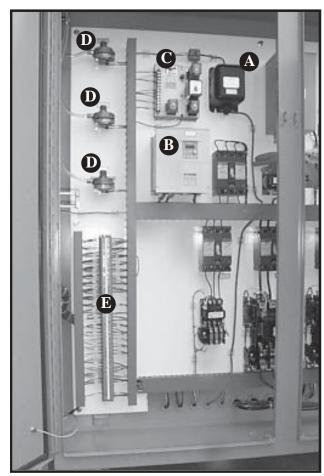


Photo 2-13 Interior view of Power Box - LH side.

- A. Ignition Transformer.
- **B.** Inverter.
- C. Protectofier
- D. 1, 3, or 4 Air Switches
- E. Terminal Strip

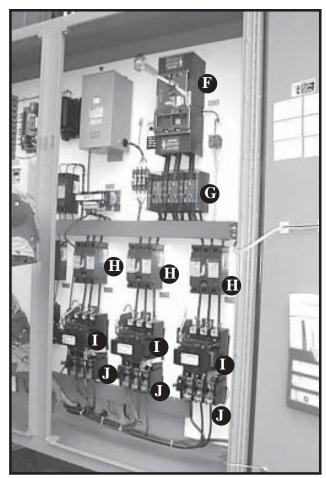


Photo 2-14 Interior view of Power Box - RH side.

- F. Main Breaker.
- G. Distribution Block.
- H. Branch Circuit Breakers.
- I. (Fan) Blower Motor Starters.
- J. Overload Assembly.

# 2.2. Install 3/8" Copper Tubing for Air Switches.

(Note: 3/8" copper tubing is same tubing used for Pilot Fuel Train.)

- 2.2.1. Run 3/8" copper tubing in motor window one for each fan.
- **2.2.2.** Extend 3/8" copper tubing into fan no more than 1" to 2" past top edge of Fan Inlet Venturi (curved interior of fan).
- **2.2.3.** Clamp 3/8" copper tubing inside each fan at midpoint and at bottom edge of Venturi.
- **2.2.4.** Run 3/8" copper tubing from each fan to Power Box along respective fan motor conduit. Secure with wire ties.
- **2.2.5.** With brass compression fittings, screw 3/8" copper tubing to brass fittings on side of Power Box.

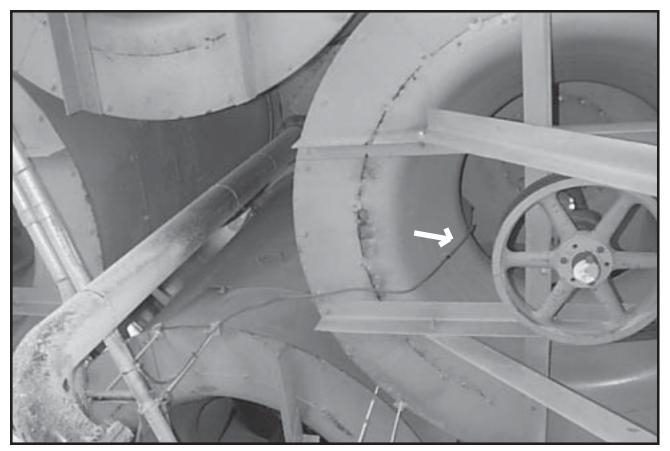


Photo 2-15 Air Switch Tubing runs to no more than 1" to 2" above top of Venturi.

# **EXAMPLE** - Fan Motors wired and Air Switch Tubing installed in dryer.

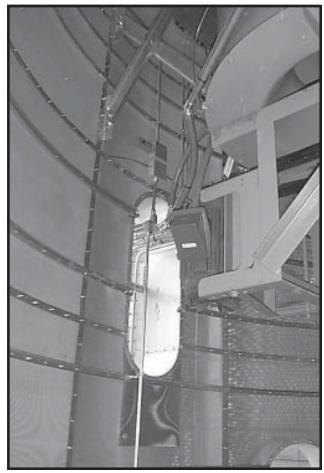
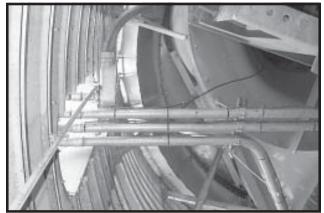


Photo 2-16 LH view - Fan Motors wired and Air Switch Tubing installed.

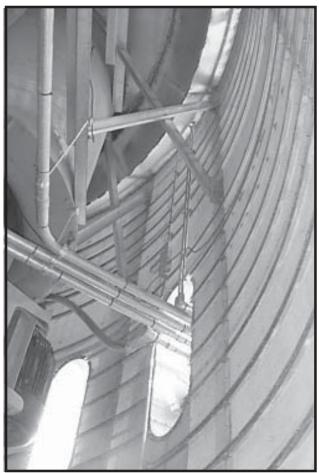


Photo 2-17 RH view - Fan Motors wired and Air Switch Tubing installed.

# **EXAMPLE** - Fan Motors wired and Air Switch Tubing continued.



*Photo 2-18 LH view - Fan Motors wired and Air Switch Tubing installed.* 



*Photo 2-19 RH view - Fan Motors wired and Air Switch Tubing installed.* 

# **EXAMPLE** - Running Air Switch Tubing.

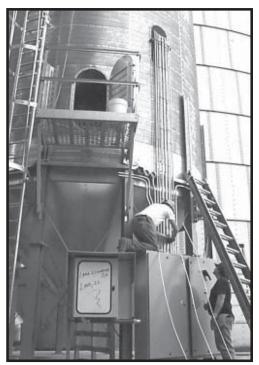


Photo 2-20



Photo 2-22



Photo 2-21

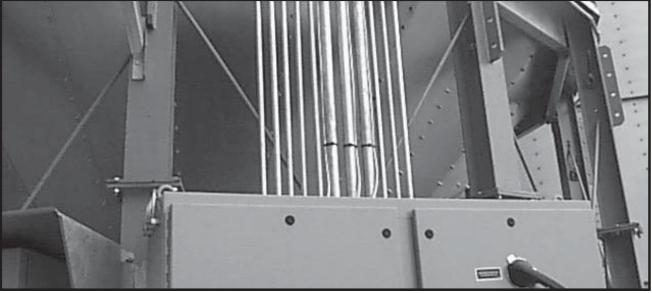


Photo 2-23

# **EXAMPLE** - Running Air Switch Tubing continued.



Photo 2-24 Brass connectors connect 3/8" copper tubing to Air Switches.



*Photo 2-25 Air Switch Tubing installed.* 

#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics, etc.

# **3. Metering Drum Motor**

During dryer construction, Metering Drum Motor is installed to gearbox on metering drum. Specifications: Toshiba, 5 hp, inverter-duty, 3 phase, AC. (Photo 3-1)



Photo 3-1 Toshiba motor as shipped.

- **3-1.** Determine where conduit for Metering Drum Motor exits back of Power Box. and knockout hole for 1/2" conduit. Install Myers Hub.
- **3.2.** Install LB Body at back of Power Box, and run conduit up dryer.
- **3.3.** With 90 degree bend (parallel to other conduits) turn conduit into Motor Window.
- **3.4.** Install LB Body and run conduit down inside dryer. (Keep conduit as close to inside wall of dryer as possible.)
- **3.5.** Use knockout set to punch 1/2" hole in bottom of walk-in cooling section floor and run conduit through floor.
- **3.6.** With 45 degree bend turn and run conduit to approximately 4' from Metering Drum. Clamp conduit to inner wall of Hopper.
- **3.7.** Connect to Metering Drum Motor with flexible conduit.
- **3.8.** Pull wires and terminate. Follow terminal wiring diagram on motor name plate.

Wire size varies with application.

**F** Refer to Appendix C, "Power Box Wiring - Field Notes" for wires, colors, and connections.

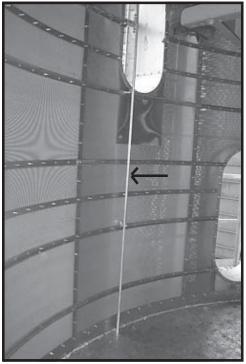


Photo 3-2 Conduit for Metering Drum Motor installed through motor window.



Photo 3-3 Broken arrow marks Metering Drum conduit installation under floor of walk-in cooling section and along inner wall of Hopper.

# Example 1 - Metering Drum Motor Components.

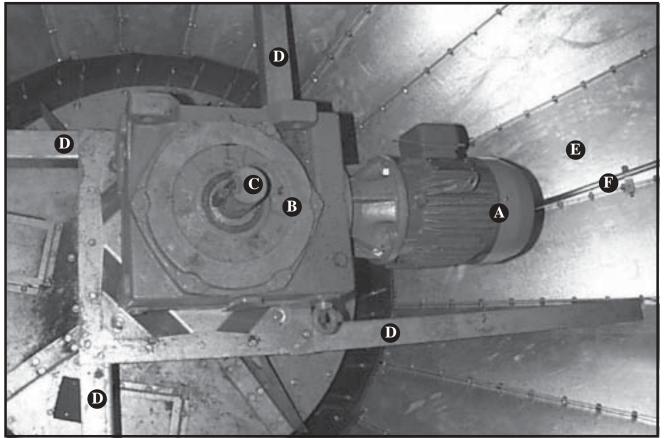


Photo 3-4 Metering Drum Motor installed.

- A. inverter driven, variable speed metering drum motor
- **B.** metering drum gearbox
- **C.** metering drum drive shaft
- **D.** (4) torque arms
- **E.** hopper inner wall
- **F.** Metering Drum Motor conduit

Example 2 - Metering Drum Motor wiring. (Dryer shown after operation.)

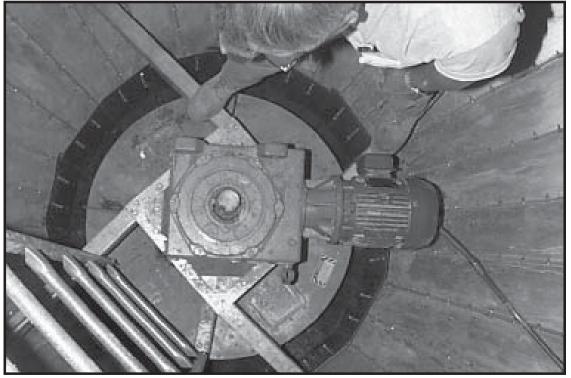


Photo 3-5

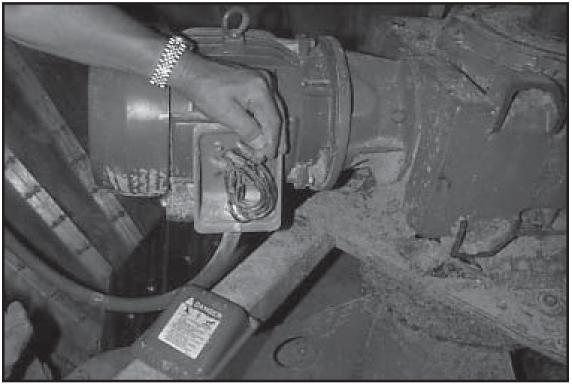
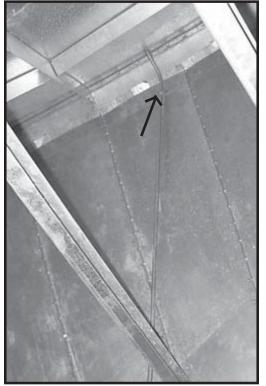


Photo 3-6

# Photo 3-7 Access hole to Hopper Section

Photo 3-7 Access hole to Hopper Section (in floor of walk-in cooling section.)



*Photo 3-9 View - Conduit inside Hopper Section, just below walk-in cooling section floor.* 

PNEG-708

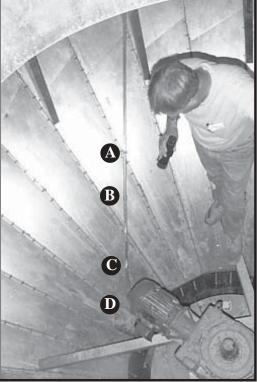
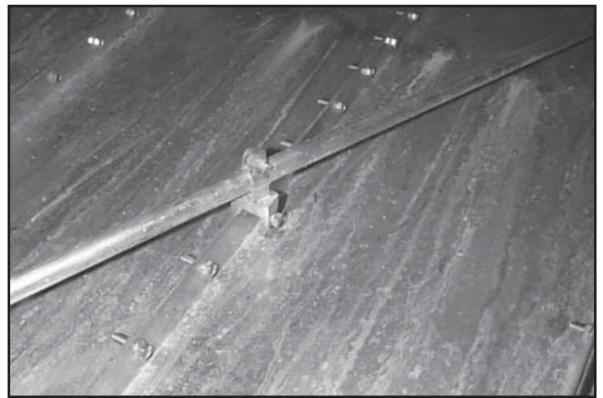


Photo 3-8 View - Below walk-in cooling section floor, inside Hopper. Conduit installed to Metering Drum Motor and along inner wall of Hopper with the following fittings.

- A. beam clamp.
- B. conduit coupling.
- C. liquid tite conduit straight connector.
- **D.** Install flexible conduit from point C to motor.
- See Close Up photos on next page.

Example 2 - Metering Drum Motor wiring continued. (Dryer shown after operation.)



Example 2 - Metering Drum Motor wiring continued. (Dryer shown after operation.)

Photo 3-10 Close Up - (A) beam clamp.



Photo 3-11 (B) Close Up - conduit coupling.

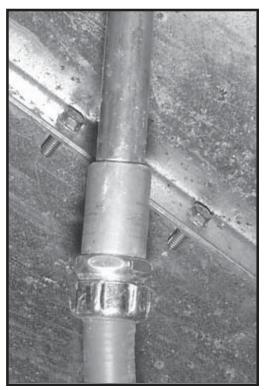


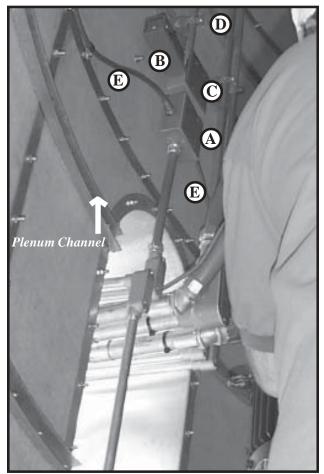
Photo 3-12 (C) liquid tite conduit straight connector

#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

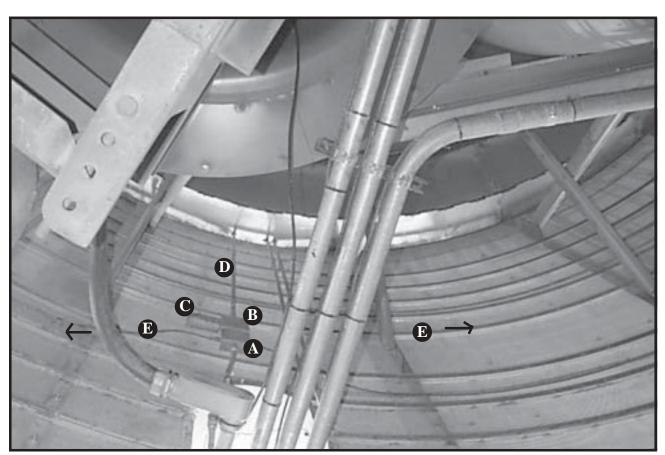
See Appendices for wiring notes and schematics.

# 4. Interior Hi-Limits Adjustable Plenum Hi-Limit Thermostat (overheat) Plenum Temperature Sensor (RTD)

- **4.1.** Determine where conduit for Interior Hi-Limit, Adjustable Plenum Hi-Limit Thermostat, and Plenum Temperature Sensor exits Power Box, and knockout hole for a single 1/2" conduit. Install Myers Hub.
- **4.2.** Install LB-body at back of Power Box, and run conduit up dryer.
- **4.3.** Bend conduit 90 degrees to turn conduit into dryer window (usually the motor window) and run conduit into dryer. Install LB-body and run conduit up inside walk-in cooling section to just above motor window.
- **4.4.** Connect Interior Hi-Limit to conduit.
- **4.5.** Extend Copper Capillaries from Interior Hi-Limit (horizontally to right and left) and secure with insulated clips and 5/16" whiz nuts.
- **4.6.** Install 4" Junction Box above Interior Hi-Limit with 1/2"x2" nipple.
- **4.7.** Install Adjustable Plenum Hi-Limit Thermostat to 4" Junction Box with 1/2" close nipple.



- Photo 4-1 Example 1.
- (A) Interior Hi-Limits.
- (B) Adjustable Plenum Hi-Limit Thermostat.
- (C) 4" Junction Box.
- (D) Conduit secured with mini clamps.
- (E) Copper capillaries extended (right and left) from Interior Hi-Limit and secured to dryer with insulated clips and 5/16" whiz nuts.



Example 2 - 4 fan, 7000 bph dryer after operation..



- (A) Interior Hi-Limits.
- (B) 4" Junction Box installed above dryer window.
- (C Adjustable Plenum Hi-Limit Thermostat.
- (D) Conduit secured with miniclips.
- (E) Copper capillaries extended (right and left) from Interior Hi-Limit and secured to dryer with insulated clips.

- **4.8.** Drill hole in Hopper Divider (from above), and run conduit up from 4" Junction Box to walk-in heating section of dryer.
- **4.9.** Secure conduit to dryer with mini clamps. (Photo 4-1 and 4-2)
- **4.10.** Approximately 3' above heat section walkway, install conduit Tee. Locate conduit Tee at level of bolted seam between sheets. (Photo 4-5)
- **4.11.** Feed Adjustable Plenum Hi-Limit Thermostat capillary up through conduit to conduit Tee in walk-in heating section.
- **4.12.** Extend Adjustable Plenum Hi-Limit Thermostat capillary horizontally from conduit Tee. Install Liquid Tite Cable Connector (Heyco, Appleton) on Tee.

Secure copper capillary to dryer wall with insulated clips and 5/16" whiz nuts.

- Do not mount capillary on Plenum Channels.
- **4.13.** Add approximately 3' of conduit above conduit Tee in walk-in heating section. Install Plenum Temperature Sensor.
- **4.14.** Pull wire/cable and terminate.

See Appendix C, "Power Box Wiring -Field Notes."

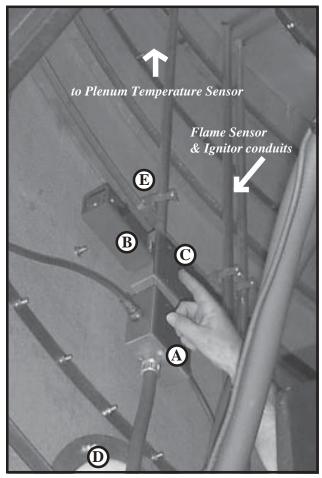


Photo 4-3 Close Up - Interior Hi-Limits (A), Adjustable Plenum Hi-Limit Thermostat (B), and 4" Junction Box (C) installed above motor window (D). Conduit secured with miniclips (E).

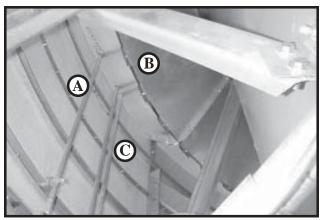


Photo 4-4 1/2" conduit for Plenum Temperature Sensor (**A**) installed through Divider Hopper (**B**). Also note 1/2" conduits for Flame Sensor and Ignitor (**C**).

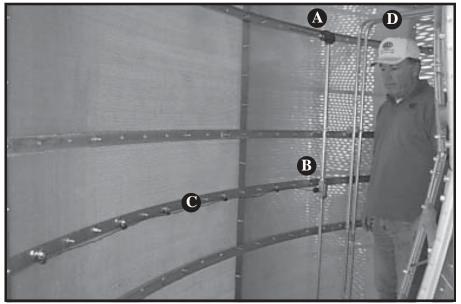
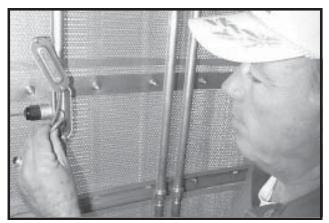
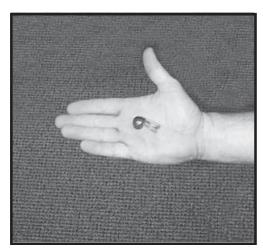


Photo 4-5 Walk-in heating section.

- (A) Plenum Temperature Sensor installed approximately 6' above burner floor.
- (**B** Conduit Tee installed approximately 3' above burner floor.
- (C) Copper Capillary pulled from Adjustable Plenum Hi-Limit Thermostat (in walk-in cooling section below), and secured with insulated clips and 5/16" whiz nuts to existing bolts on dryer.
- (**D**) Note that Ignitor and Flame Sensor conduits turn into Burner.



*Photo 4-7 Close Up - Conduit Tee in walk-in heating section with wiring and copper capillary.* 



*Photo 4-6 Insulated clip for copper capillary.* 

# Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics.

# 5. Exterior Hi-Limits (overheats)

During construction, Upper, Middle and Lower Exterior Hi-Limits (and their copper capillaries which encircle dryer) are installed on exterior of dryer.

During dryer construction, (one) 1/2" Conduit for the (three) Exterior Hi-Limits is installed behind ladder to approximately 10' above foundation.

- 5.1. Determine where conduit for Exterior Hi-Limits exits Power Box, and knock out hole for 1/ 2" conduit. Install Myers Hub.
- **5.2.** Install LB-body at back of Power Box. Run conduit up and around dryer to existing conduit.
- **5.3.** Pull wires and terminate. See Appendix C, "Power Box Wiring - Field Notes."



Photo 5-1 Exterior High Limit sensor with gas-filled copper tubing is installed inside copper capillary at factory.

Caution: do not cut off end of gas-filled copper tubing.

#### **During Dryer Construction**

**Upper Exterior Hi-Limits** are installed on perforated sheets, approximately 5" below top rows of solid sheets.

Middle Exterior Hi-Limits are installed on perforated sheets, between the Upper and Lower Exterior Hi-Limits.

**Lower Exterior Hi-Limits** are installed on perforated sheets, above or below middle row of solid sheets, 20' below Upper Exterior Hi-Limits.

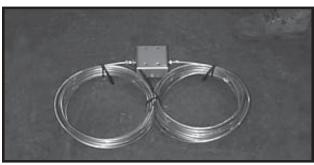
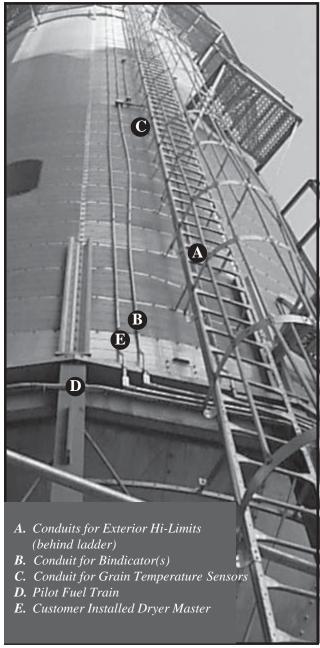


Photo 5-2 one Exterior Hi-Limits with copper capillaries.



Photo 5-3 Pulling wires for Exterior Hi-Limits.





*Photo 5-4* Side View - Conduit installed on 4 fan dryer.

## Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics.

# **6.**

# Bindicator(s) and Grain Temperature Sensors (RTDs)

During dryer construction, Bindicator(s) are installed on exterior of Roof Garner Section.

See Illustration 6-1 for placement of standard Lower Bindicator and optional Upper Bindicator.

One 1/2" conduit for Bindicator and Grain Temperature Sensors is installed beside ladder (and to left of Exterior Hi-Limits conduit) to approximately 10' from top of Discharge Hopper.

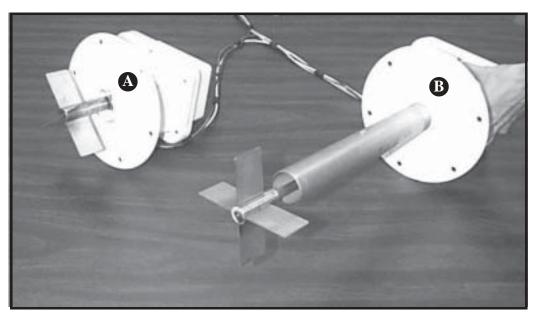
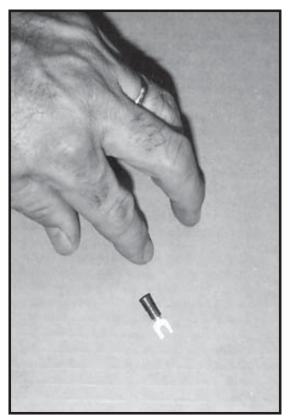


Photo 6-1 Bindicators (wired for demonstration) A. Upper Bindicator (optional) B. Lower Bindicator

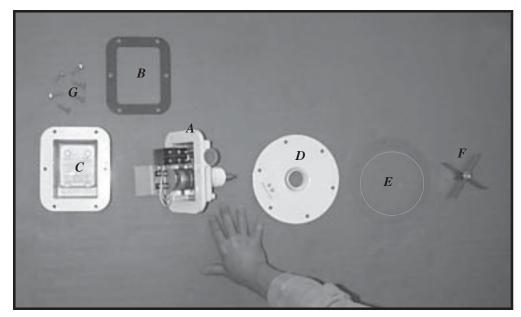
# **6.1. Bindicator**(s)

- **6.1.1.** Determine where 1/2" conduit for Bindicator(s) exits Power Box, and knockout hole. Install Myers Hub.
- **6.1.2.** Install LB-body at back of Power Box.
- IMPORTANT See section 6.2. "Grain Temperature Sensors" before installing Bindicator conduit. Grain Temperature Sensor cables are run in same conduit with Bindicator wires.
- **6.1.3.** After installing conduit Tee for Grain Temperature Sensors, run 1/2" conduit to existing Bindicator Conduit.
- 6.1.4. Pull wire/cable and terminate. (#14 fork)

See Appendix C, "Power Box Wiring - Field Notes."



*Photo 6-2* #14 fork.



A. bindicator

- **B.** gasket
- C. cover
- **D.** mounting bracket
- E. mounting gasket ring
- *F.* blades *G.* hardware

*Photo 6-3 Bindicator as shipped.* 

# 6.2. Grain Temperature Sensors (RTDs)

(Two) pairs of Grain Temperature Sensors on (two) 10' lengths of 1/2" conduit were installed on exterior of dryer during construction.

- **RH PAIR**of Sensors is located to right of ladder, and within reach of ladder.RH-Bottom Sensor is located just above heat section floor.RH-Top Sensor is on same conduit, 10' above Bottom RH Sensor.
- **LH PAIR** of Sensors is located in next grain column over from RH pair of Sensors, at the same level as RH pair, and within reach of ladder.

Grain Temperature Sensor (RTD) cables are pulled in the 1/2" Bindicator conduit.

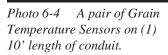


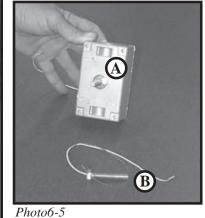
Grain Temperature reading is an average of the (4) RTD readings.

- **6.2.1.** While running 1/2" Bindicator(s) conduit, install conduit Tee for Grain Temperature Sensors at a height 6" below bottom of Grain Temperature Sensors.
- **6.2.2.** Run flexible conduit from conduit Tee to 4" junction box. Locate 4" junction box below LH-bottom Grain Temperature Sensor.
- **6.2.3.** Run flexible conduit from top of 4" junction box to LH-Bottom Grain Temperature Sensor.
- **6.2.4.** Run flexible conduit from RH side of 4" junction box to RH-Bottom Grain Temperature Sensor.
- **6.2.5.** Pull shielded cable for Grain Temperature Sensor with Bindicator wires and terminate.

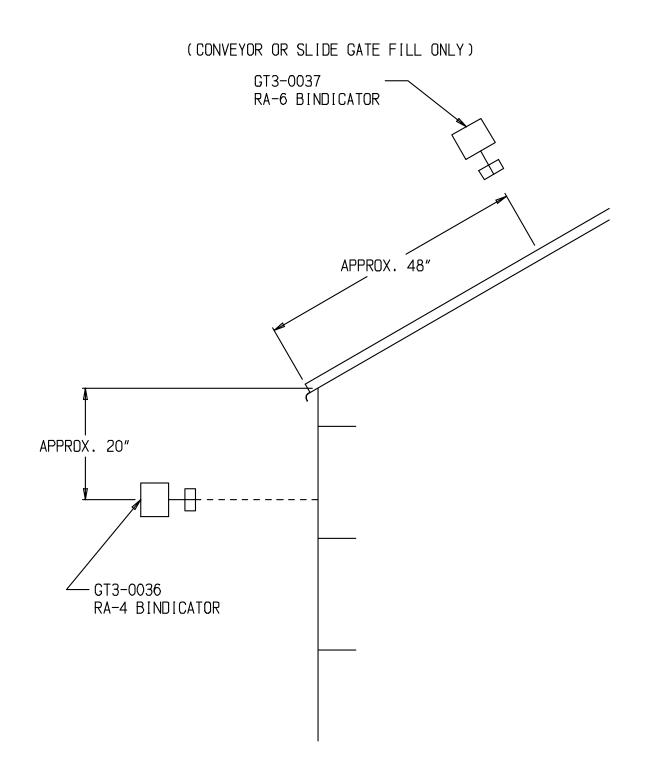
See Appendix C, "Power Box Wiring - Field Notes."







A. RTD - Grain Temperature Sensor
B. grain sensor is embedded in the stainless steel bolt



## **Illustration 6-1 Bindicator Placement**

## **Example - Wiring Bindicator(s).**



Photo 6-6 Installing Bindicator/Grain Temperature Sensor conduit.



*Photo* 6-7 *Pulling wire for bindicator(s).* 



*Photo* 6-8 *Pulling wire for Bindicator(s).* 

## **Example - Wiring Bindicator**(s) continued.



Photo 6-9



Photo 6-10



Photo 6-11

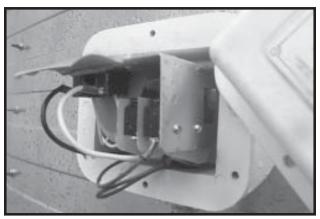


Photo 6-12 Close Up - Bindicator wired.

#### **Example - Grain Temperature Sensors installed.**



Photo 6-13 RH & LH Top Sensors (RTDs) installed.

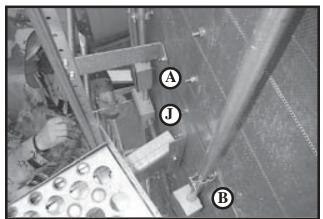


Photo 6-14 Bottom Sensors (RTDs) installed.

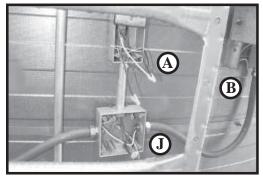


Photo 6-15 Close Up - Bottom Sensors (RTDs).

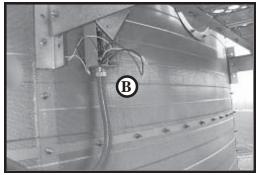


Photo 6-16 Close Up - Bottom Sensor (RTD).

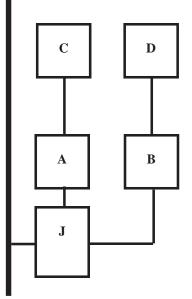


Illustration 6-1 Conduit/Sealtite placement forGrain Temperature Sensors (A,B, C, & D) and Junction Box (J) teeing off Bindicator conduit. (not to scale)

#### Example - Bindicator(s) and Grain Temperature Sensors installed continued.

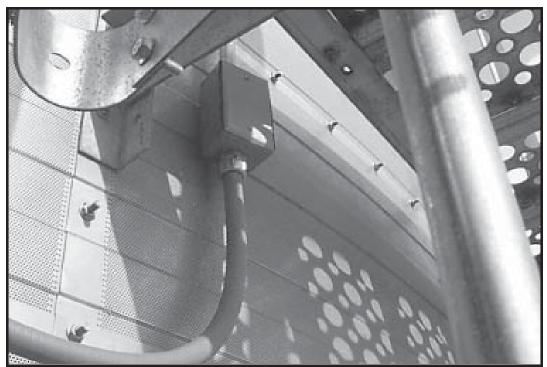


Photo 6-17 Close Up - Top Grain Sensor.

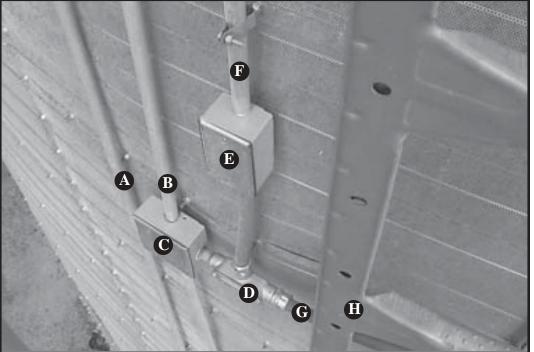
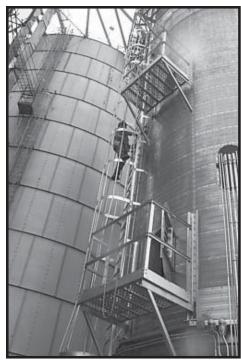


Photo 6-18 Close Up

#### Conduit runs

- A. Exterior Hi-Limits
- **B.** to Bindicator(s).
- C. 4" Junction Box.
- **D.** conduit Tee
- E. LH Bottom Grain Temperature Sensor.
- F. to LH Top Grain Temperature Sensor.
- G. to RH Bottom Grain Temperature Sensor.
- H. Ladder.

#### **Example - Grain Temperature Sensors continued.**



*Photo 6-19 Installing conduit Tee on Bindicator conduit for Grain Temperature Sensors cables.* 



Photo 6-20 Clamping conduit to dryer.



Photo 6-21 Threading conduit into Junction Box.

Example - Bindicator(s) and Grain Temperature Sensors installed.

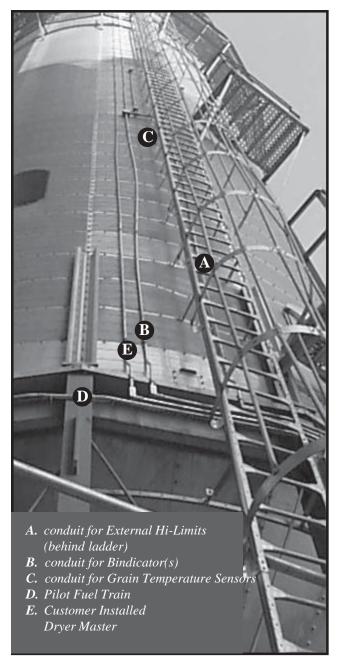


Photo 6-22 Side View - Conduit installed on 4 fan dryer.

#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics.

7. Ignitor and Flame Sensor

- **7.1.** Locate burner pilot section for Ignitor and Flame Sensor installation.
  - Run one conduit for Ignitor. Run separate and parallel conduit for Flame Sensor.

**7.1.1.** Determine where ignition cable exits Power Box, and knockout hole for 1/2" conduit. Install Myers Hub.

**7.1.2.** Determine where #14 wire (THW or THHN) for Flame Sensor exits Power Box, and knockout opening for 1/2" conduit. Install Myers Hub.

- **7.2.** Install LB-bodies for Ignitor and Flame Sensor at back of Power Box.
- **7.3.** Run (2) conduits parallel with other conduits up to dryer window (usually the motor window). Bend conduits 90 degrees and run in motor window to walk-in cooling section.
- **7.4.** Install LB-bodies and run conduits up inside of dryer to Divider Hopper. Stay as close as possible to inside wall of dryer.

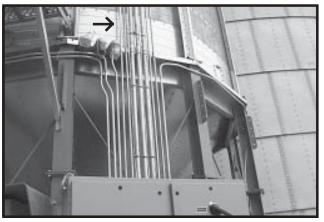
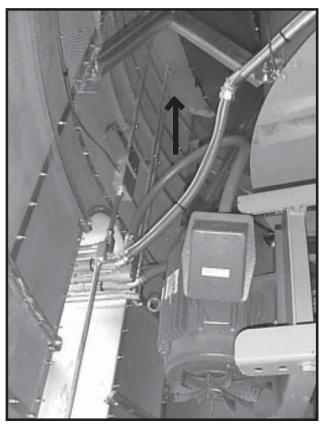


Photo 7-1 Conduits for Ignitor and Flame Sensor installed.



*Photo 7-2 Conduits for Ignitor and Flame Sensor installed through motor window and up through Hopper Divider.* 

# 7 Ignitor, Flame Sensor

#### 7.4. continued

Drill through Divider Hopper. Run conduits up to level with bottom of Burner.

**7.5.** Turn conduits 90 degrees toward burner housing.



Photo 7-3 Run conduits up to level with bottom of burner.

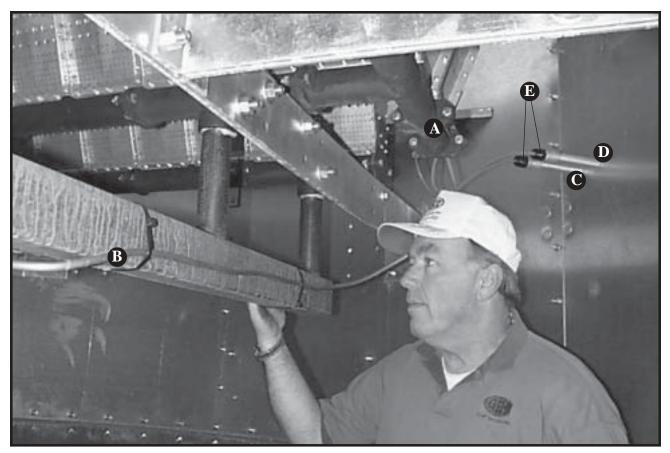
7.5. continued

Drill through Burner Housing. Extend conduit 4" through Burner Housing.

- Conduits must run within 16" of Ignitor to protect ignition cable.
- **7.6.** Install 1/2" Appleton (liquid tite cable connector) to each conduit.



*Photo 7-4 Aerial view of burner with Ignitor and Flame Sensor conduit installed through burner housing.* 



#### Photo 7-5

- A. Pilot Section of Burner with installation points for Ignitor and Flame Sensor.
- **B.** Pilot Gas Line.
- C. conduit for Ignitor.
- **D.** conduit for Flame Sensor.
- **E.** 1/2" Appleton Connectors.

7.7. Install Ignitor and Flame Sensor (with Rubber Boots) to installation points on burner.

The Make any necessary adjustments to Flame Sensor after dryer start-up.



Photo 7-6
Installed to Pilot Section:
A. Pilot Gas Line
B. Flame Sensor conduit
C. Ignitor conduit

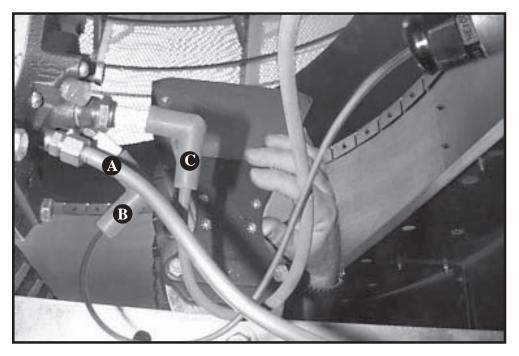


Photo 7-7 Close Up Installed to Pilot Section: A. Pilot Gas Line B. Flame Sensor C. Ignitor

**7.8.** Pull ignition cable to Ignitor and terminate at Ignition Transformer in Power Box. (See Photo 7-11)

Pull #14 wire red Flame Sensor wire and terminate at Protectofier terminal E in Power Box. (See Photo 7-12)

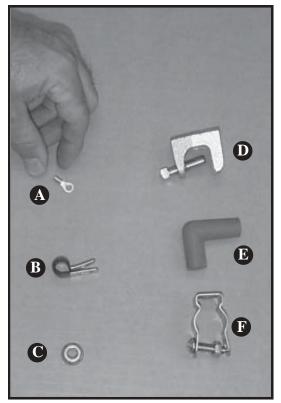


Photo 7-8 Hardware.

#### Hardware

- A. #14 eyelet connector
- **B.** insultated clip
- *C.* 5/16 whiz nut
- **D.** beam clamp
- E. rubber boot
- F. mini clamp

Not shown 6" or 8" electrical wire ties

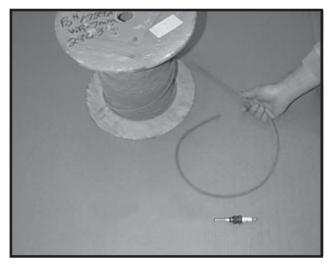
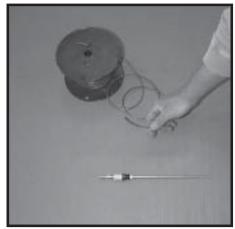


Photo 7-9 Ignitor and ignition cable.



*Photo 7-10* Flame Sensor and #14 red Flame Sensor wire.

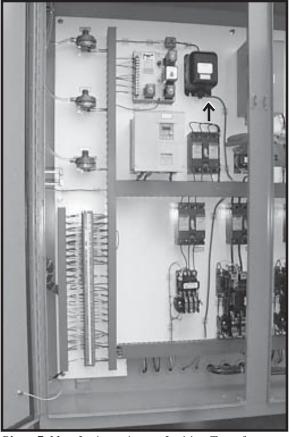


Photo 7-11 Ignitor wires to Ignition Transformer.

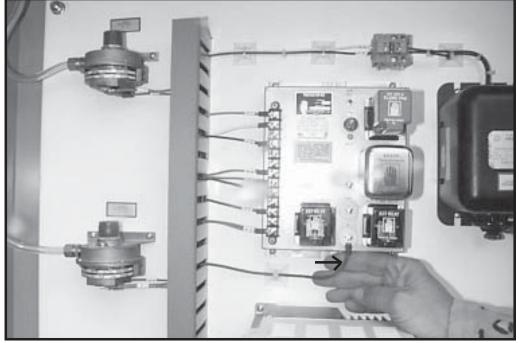


Photo 7-12 Flame Sensor wires to Protectofier terminal E.

# Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics.

# 8. Fuel Train Installations

(Natural Gas or Liquid Propane) Pilot Fuel Line A Fisher Regulator on Pilot Fuel Train B Pilot Solenoid on Pilot Fuel Train C Maxon Gas Valve - primary D Maxon Gas Valve - secondary E Modutrol Motor F

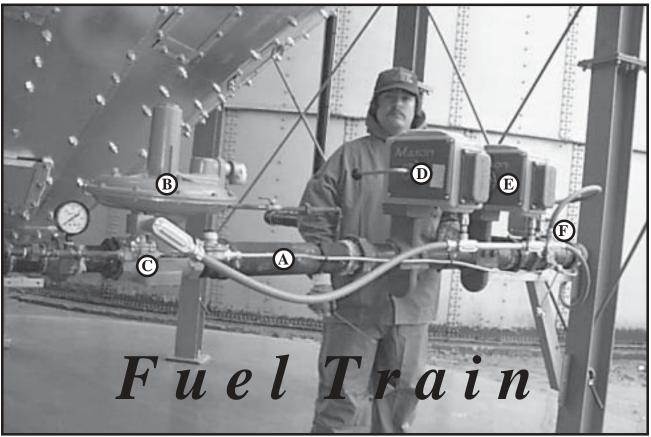
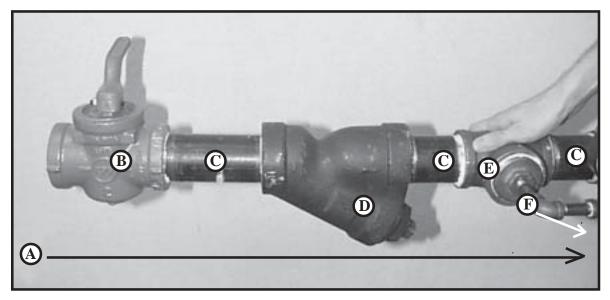
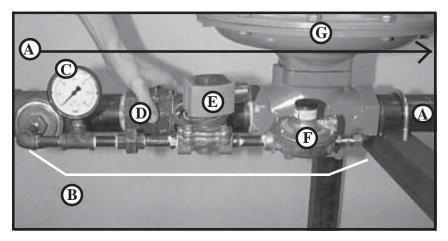


Photo 8-1

# Fuel Train - demonstration Close-Ups

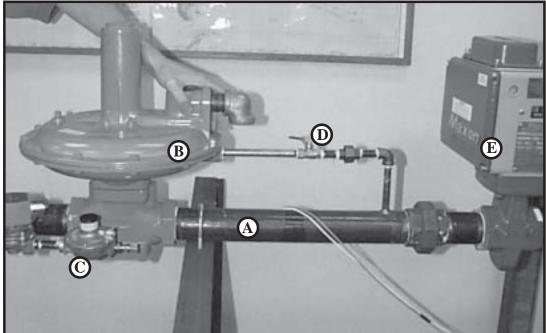


- Photo 8-2 A. Main Fuel Train
  - **B.** Shut-off (fuel train intake)
  - C. nipple
  - **D**. Strainer with clean-out
  - E. tee
  - F. Pilot Fuel Train



- Photo 8-3 A. Main Fuel Train
  - **B.** Pilot Fuel Train
  - C. Main Pressure Gauge, 30 pound (oil filled)
  - **D**. union
  - E. Pilot Solenoid
  - F. Pilot Regulator
  - G. Main Regulator

# Fuel Train - demonstration Close-Ups continued



- Photo 8-4 A. Main Fuel Train
  - **B.** Main Regulator
  - C. Solenoid Regulator on Pilot Fuel Train
  - **D.** Downstream Control Valve
  - E. Maxon

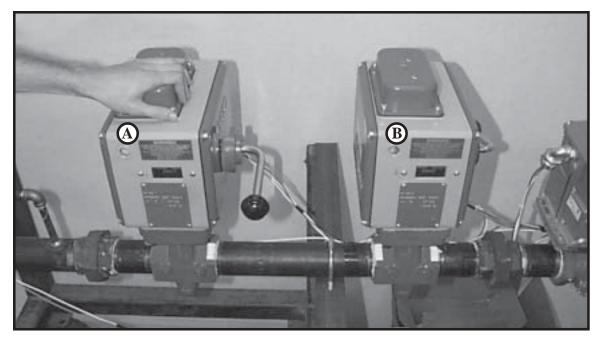


Photo 8-5A. Primary Maxon (closest to fuel intake)B. Secondary Maxon (downstream from primary maxon)

# Fuel Train - demonstration Close-Ups continued

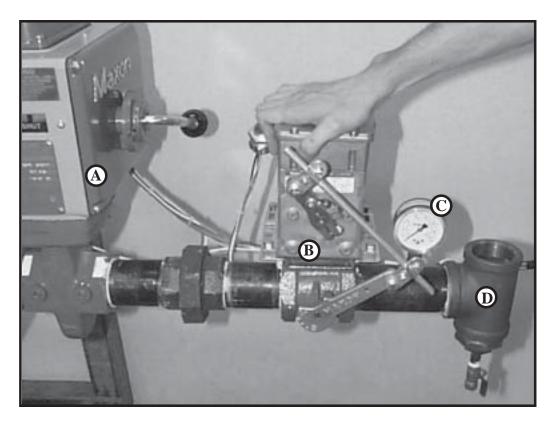


Photo 8-6	<i>A</i> .	Secondary	Maxon
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- **B.** Modutrol Valve with linkage (butterfly valve)
- C. Ounce Guage
- **D.** Tee (up to dryer) (down to drain valve)

### 8.1. Pilot Fuel Line

Note: 3/8" copper tubing used for Pilot Fuel Line is same tubing used for Air Switches.

- **8.1.1.** Connect Pilot Fuel Line to 3/8" brass compression fitting on Pilot Fuel Train. (Photo 8-6)
- 8.1.2. Run 3/8" copper Pilot Fuel Line up along Fuel Piping and through dryer window above Fuel Train. (Photo 8-2)
- **8.1.3.** Drill 1/2" hole (beside Fuel Piping) through Blower Splice Plate (Burner floor). (Photo 8-4)
- **8.1.4.** Run Pilot Fuel Line up to connecting point on Burner Pilot Section(wire tie to Burner Manifold). (Photo 8-5)
- **8.1.5.** Connect Pilot Fuel Line to connecting point on Burner Pilot Section with 3/8" brass compression fitting. (Photo 8-5)
  - Wire tie Pilot Fuel Line along Fuel Piping inside and outside of dryer.

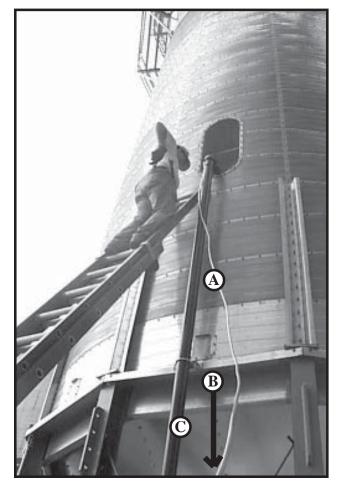


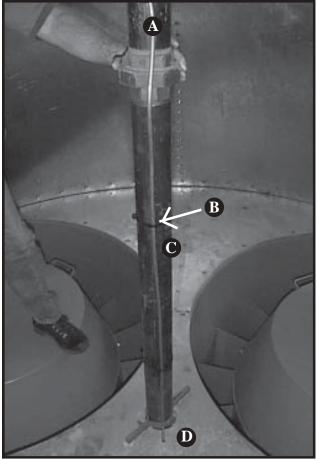
Photo 8-7 Run 3/8" copper Pilot Fuel Line (A) through window above Fuel Train (B), and wire tie to Fuel Piping (C).



# Pilot Fuel Line continued



*Photo 8-8 Running 3/8" Pilot Fuel Line up along Burner Manifold to connecting point in Burner Pilot Section. Wire tie.* 



*Photo* 8-9 3/8" *Pilot Fuel Line runs down through Burner floor to cooling section.* 

- A. Pilot Fuel Line
- B. Wire Tie
- C. Fuel Piping
- D. 1/2" hole drilled in Blower Splice Plate for Pilot Fuel line tubing.

# Pilot Fuel Line continued

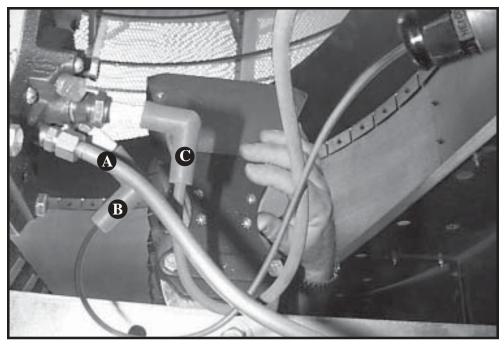


Photo 8-10 Pilot Fuel Line installed to connecting point on Burner Pilot Section:
A. Pilot Fuel Line
B. Flame Sensor

**C.** Ignitor

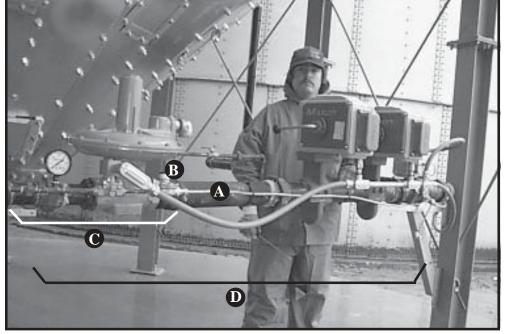


Photo 8-11 (A) 3/8" copper Pilot Fuel Line installed to

- (**B**) Fisher Regulator with
- (C) Pilot Fuel Train.
- (D) Fuel Train

# 8.2. Fuel Train Wiring

Use one 1/2" conduit for Pilot Solenoid, Maxon Gas Valves\* and Modutrol Motor (Photo 8-7) wiring.

- **8.2.1.** Determine where conduit for Fuel Train Wiring exits Power Box, and knockout hole for 1/2" conduit. Install Myers Hub.
- **8.2.2.** Install LB-body at back of Power Box, and run conduit up to top of nearest dryer leg.
- **8.2.3.** Run conduit around dryer, attaching to each leg with 1/2" Korn Clamp.
- **8.2.4.** Install 1/2" LB-body and run conduit down dryer leg closest to Fuel Train, then run flexible conduit to Fuel Train.
- **8.2.5.** Connect conduit to Pilot Solenoid, Maxon Valves, and Modutrol Motor.
- **8.2.6.** Group and pull wires.

See Appendix C, "Power Box Wiring - Field Notes"

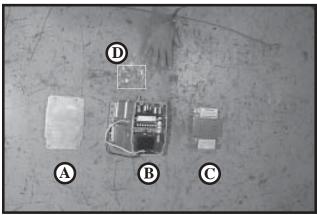


Photo 8-12 Modutrol Motor as shipped. (Installed on dryer during construction.)

- A. modutrol cover
- **B.** modutrol motor
- C. modutrol base (not installed to dryer)
- **D.** hardware

# **Example - Installing Conduit for Fuel Train Wiring.**



Photo 8-13 Running conduit for Fuel Train wiring.



Photo 8-14 Leveling conduit.



Photo 8-15 Running flexible conduit.



Photo 8-16 Installing LB-body.



Photo 8-17 Putting Korn Clamp on conduit.

# **Example - Wiring Fuel Train**

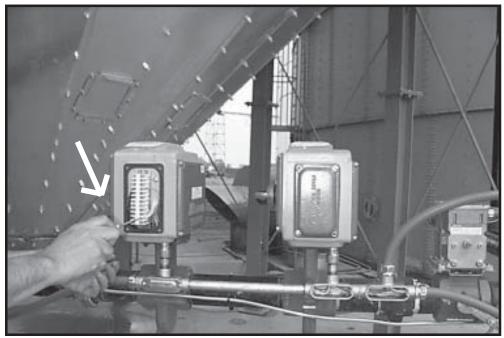


Photo 8-18 Wiring Primary Maxon.

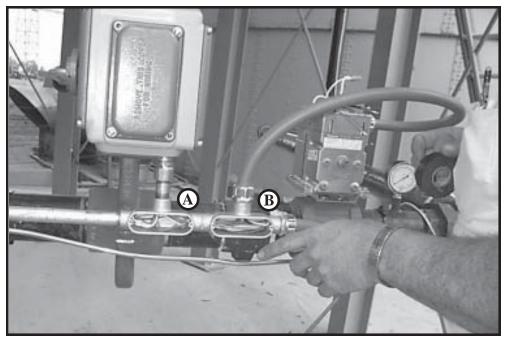


Photo 8-19 Wiring Secondary Maxon Valve (A) and Modutrol motor (B).

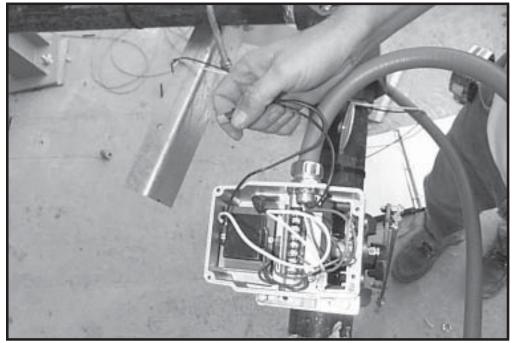


Photo 8-20 Wiring Modutrol Motor.

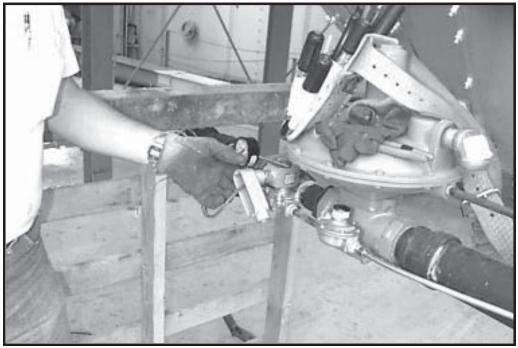


Photo 8-21 Wiring Pilot Solenoid on Pilot Fuel Train.



Photo 8-22 Attaching Sealtite to conduit Tee on Maxon Valve.



Photo 8-23 Cutting Sealtite.



Photo 8-24 Attaching Sealtite fitting to Sealtite.

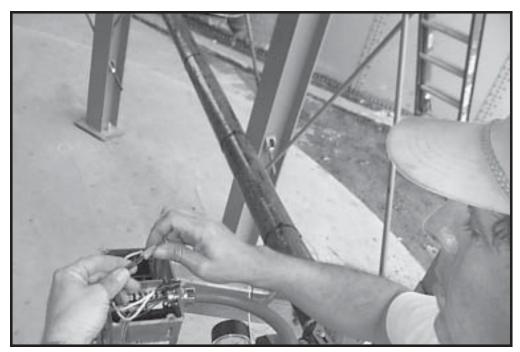
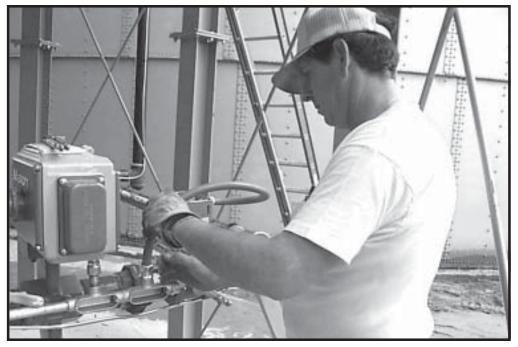


Photo 8-25 Wiring Modutrol Motor.



*Photo 8-26 Attaching Sealtite to conduit Tee from Modutrol Motor.* 

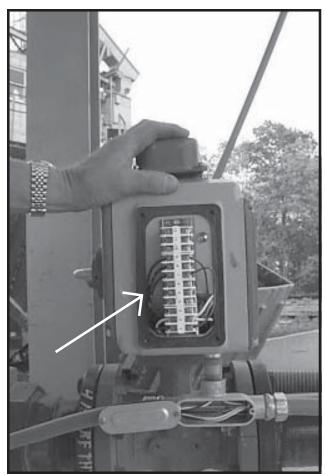


Photo 8-27 Maxon Gas Valve - Primary. Three wires indicate single switch (on left).

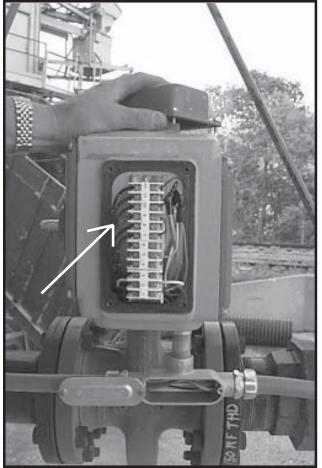


Photo 8-28 Maxon Gas Valve - Secondary. Six wires indicate double switch (on left).



Shielded cable runs to both Secondary Maxon and Modutol Motor - marked by arrow in Photos 8-25 and 8-26.



Photo 8-29 Modutrol Motor.

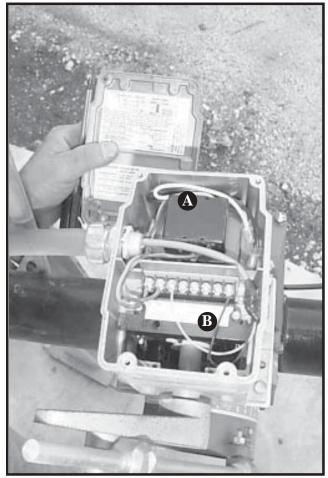


Photo 8-30 Modutrol Motor, (A) black wire = J9-9 white wire = J7-6 (B) black shielded cable = positive white shielded cable = negative



Photo 8-31 Fuel Piping and Pilot Fuel Piping.

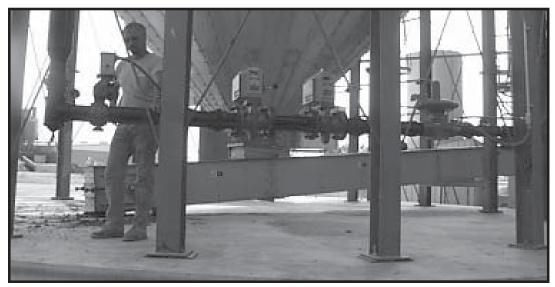


Photo 8-32 Fuel Train on 2000 bph dryer.



Photo 8-33

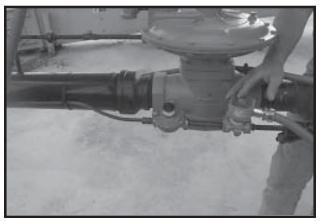


Photo 8-34

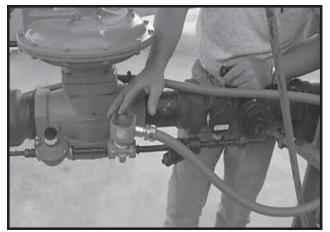


Photo 8-35 Conduit to Solenoid.

# Example - Wiring Fuel Train continued. (Dryer shown after operation.)

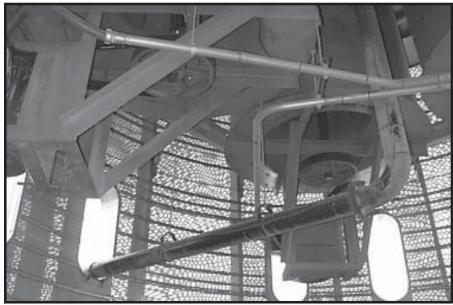


Photo 8-36 Pilot Fuel Train Piping wire tied to Fuel Piping.

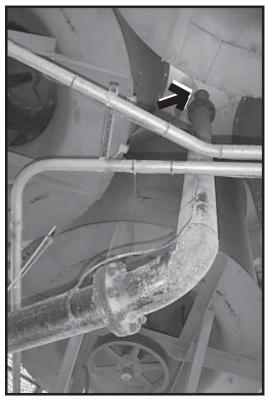


Photo 8-37 Pilot Fuel Train Piping and Fuel Piping runs up through Divider Hopper.

#### Important Safety Precaution ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

See Appendices for wiring notes and schematics.

# 9. Work Light Safety Light Safety Horn

Install lights and horn with parts provided in kits.

- **9.1.** Determine where conduit for Work Light, Safety Horn, and Safety Light exits Power Box. Knockout opening for 1/2" conduit. Install Myers Hub.
- **9.2.** Locate lights and horn according to customer preference. Often lights and horn are installed on dryer above Power Box. If so, run conduit up dryer to above Power Box.
- **9.3.** Measure for lights and horn.
- 9.4. Check with level.
- 9.5. Drill holes and install lights and horn.
- **9.6.** Pull #14 wires.

See Appendix C, "Power Box Wiring - Field Notes".

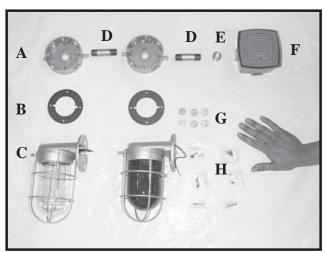


Photo 9-1.

- A. weather-tight electrical box.
- **B.** gasket.
- **C.** 90 degree light base with globe, and guard.
- **D.** 1/2" x 2" nipple.
- **E.** 1/2" to 3/4" reducer.
- **F.** safety horn.
- **G.** 1/2" weather-tight conduit plugs.
- H. screws and nuts.



Photo 9-2 Installing lights and horn. Locate according to customer preference.

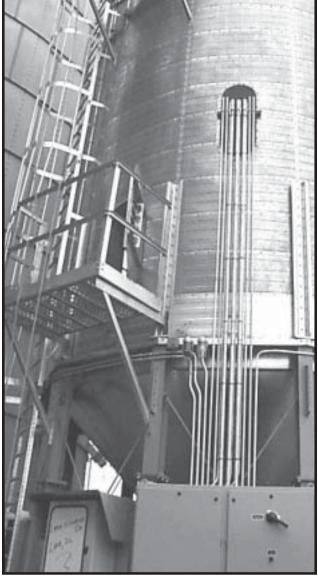


Photo 9-3 Front View - Lights and safety package installed on 3 fan dryer.

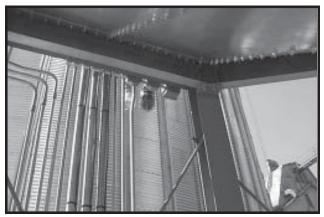


Photo 9-4 Rear View - Lights and safety package installed on 3 fan dryer.

#### **Important Safety Precaution** ALL ELECTRICAL INSTALLATIONS MUST BE MADE BY QUALIFIED PERSONNEL.

# 10. **Apply Safety Decals.**

DC-1060, DC-1061, DC-1062, DC-1063, and DC-1064.

The "Safety Decals on Dryer" section in the beginning of this manual identifies all safety decals and gives their location on the tower grain dryer. The safety decals are listed in numerical order.



The purpose of the safety decals is to immediately alert all personnel working near the tower dryer to the hazards of an operating dryer.

If the required safety decals are not available, or if they are damaged, immediately contact Grain Systems for replacement safety decals.

For proper placement of safety decals, refer to the "Safety Decals on Dryer" section in this manual.





Rotating drum below. Will cause serious injury or death. Lockout power before entering or servicing. DC-1060



Flame and pressure beyond door. May cause serious injury. Do not enter when dryer is running.

DC-1062





operation. May impair vision and breathing. Do not enter when dryer is running. DC-1063



High speed belt drive operating overhead. Can cause serious injury. Keep head and hands clear. Do not enter when dryer is running. DC-1064 THE GSI GROUP, INC. ("GSI") WARRANTS ALL PRODUCTS MANUFACTURED BY GSI TO BE FREE OF DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USAGE AND CONDITIONS FOR A PERIOD OF 24 MONTHS AFTER RETAIL SALE TO THE ORIGINAL END USER OF SUCH PRODUCTS. GSI'S ONLY OBLIGATION IS, AND PURCHASER'S SOLE REMEDY SHALL BE FOR GSI, TO REPAIR OR REPLACE, AT GSI'S OPTION AND EXPENSE, PRODUCTS THAT, IN GSI'S SOLE JUDGMENT, CONTAIN A MATERIAL DEFECT DUE TO MATERIALS OR WORKMANSHIP. ALL DELIVERY AND SHIPMENT CHARGES TO AND FROM GSI'S FACTORY WILL BE PURCHASER'S RESPONSIBILITY. EXPENSES INCURRED BY OR ON BEHALF OF THE PURCHASER WITHOUT PRIOR WRITTEN AUTHORIZATION FROM AN AUTHORIZED EMPLOYEE OF GSI SHALL BE THE SOLE RESPONSIBILITY OF THE PURCHASER.

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### Appendix A



#### RECOMMENDED TOOLS and EQUIPMENT LIST



#### **Important Safety Precautions:** Dryer Parts have sharp edges.

Dryer Parts have sharp edges. Use Appropriate Personal Protective Equipment. Use proper lifting technique.

- forklift(s) or tractor (optional to place electrical control system) with 2"x14' nylon lifting straps, rating 2000 pounds
- wrenches: 1/2", 7/16", 9/16", 5/8", 11/16", 3/4", 15/16" hex wrenches (allen wrenches): 1/8", 5/32", 3/16", 3/8"
- drill: 3/8" bits, assorted drill bits hammer drill: 1/2" masonry bits (to anchor power box)
  screwdrivers: #2 standard flat blade, phillips head side cut, tongue and groove, locking (vice grips), channel lock
- ladders: stepladder, 4', 8', extension
- 3/8" alignment punches
- 13 ounce ball-peen hammer
- banding cutters
- tape measure
- wire stripper
- 12" level (install horizontal conduit as level as possible)
- conduit deburring tool
- 1/2" pipebender (Photo A-1)
- reciprocating saw (Photo A-2) or hacksaw and pipejoint compound or heavy duty thread sealing compound
- hydraulic punch driver set (Photo A-3) or manual knockout with 1/2" to 2" knockout punches

A-4

- fish tape (Photo A-4)
- pipe threader (Photo A-5)



A-3

A-5



A-1









#### HARDWARE

#### Part

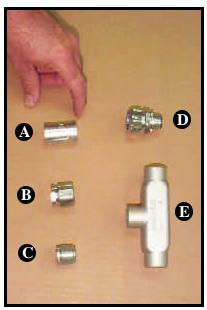


Photo B-1

- A. 1/2" coupling
- **B.** 1/2" to 3/4" reducing bushing
- *C.* 1/2" union
- **D.** 1/2" seal tite connector (Use 1/2" to 2-1/2".)
- **E.** 1/2" conduit tee



Photo B-2 Weathertite Myers Hub portion installed inside Power Box.

Running Conduit ..... solid conduit (10' lengths - cut to size) (aluminum, rigid, or IMC (intermediate) conduit uni-strut (10' lengths - cut to size) 1/2" to 2-1/2" Sealtite flexible conduit



Weathertite Myers Hub -Photo B-3 portion installed to rear of Power Box (connects to portion inside Power Box).



#### HARDWARE continued



Photo B-4 4" Junction Box as packaged for shipping.

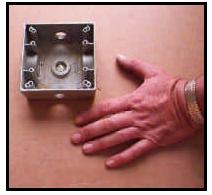


Photo B-5 4" Junction Box.



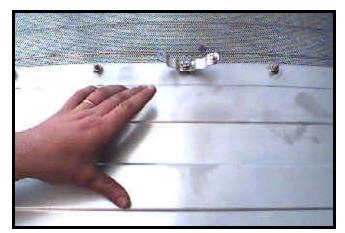


Photo B-7 Conduit Hanger.

Photo B-6 1-1/2" LB Body with gasket and cover. (Use 1/2" to 2-1/2".)

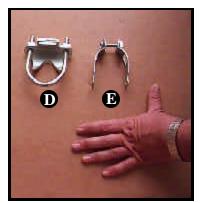


Photo B-8 D. 1-1/2" Korn Clamp. E. 1-1/2" Strut Clamp. (Use 1/2" to 2-1/2".)

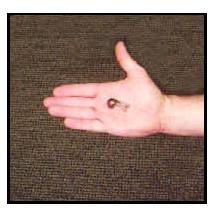


Photo B-9 Insulated clip for copper capillaries.



HARDWARE continued

#### <u>Part</u>

•	Air Switches	3/8" copper tubing, insulated clips, wire ties
•		3/8" copper tubing, wire ties, liquid tite cable connector (Appleton, Hayco, strain relief)
•	-	crimp connector or wire nuts, 1/2" sealtite connector Myers hub
•		rubber boot (Photo B-x) mini clamp beam clamp insultated clips 6' or 8' electrical wire ties 5/16 whiz nuts #14 eyelet connector beam clamp (2) LB-bodies with cover & gasket liquid tite cable connector (Appleton, Hayco, strain relief)
•	Interior Hi-Limits	#14 fork connector, crimp connector or wire nuts, 5/16" whiz nuts, insultated clips
•	Adjustable Plenum Hi-Limit Thermostat (overheat)	#14 fork connector, crimp connector or wire nuts
•	Plenum Temperature Sensor (RTD)	crimp connector or wire nuts
•	Exterior Hi-Limits (overheat)	crimp connector or wire nuts
•	Bindicator(s)	#14 fork connector
•	Grain Temperature Sensors (RTDs)	tee conduit, crimp connector or wire nuts
•	Maxon Valve	(wire according to diagram)
•	Modutrol Motor	(wire according to diagram)
•	Pilot Solenoid	crimp connector, or wire nuts



#### HARDWARE continued

#### <u>Part</u>

•	Fan Motors split bolt connectors (6 per fan)
	liner-less rubber splicing tape,
	for low and hi-voltage scotch 33+ electrical tape

<u>Fan Motor wiring Guide</u>							
Dryer		Conduit, IMC*	# of Conduits	Wire	Wire Required		
Model #	Voltage	(diameter)	(10' lengths)	Size	(feet)		
1200	230	2"	3	000	150'		
	380	1 1/2"	3	1	150'		
	460	1 1/4"	3	3	150'		
	575	1 1/4"	3	4	150'		
1500	230	2 1/2"	3	250	150'		
	380	2"	3	00	150'		
	460	1 1/2"	3	1	150'		
	575	1 1/4"	3	3	150'		
1800	230	2 1/2"	4	250	150'		
	380	2"	4	00	150'		
	460	1 1/2"	4	1	150'		
	575	1 1/4"	4	3	150'		
2000	230	2 1/2"	4	350	150'		
	380	2"	4	000	150'		
	460	2"	4	00	150'		
	575	1 1/2"	4	1	150"		
2500	230	1 1/2"	12	1	450'		
	380	1 1/4"	12	4	450'		
	460	1"	12	6	450'		
	575	1"	12	6	450'		
3000	230	2"	12	00	450'		
	380	1 1/4"	12	3	450'		
	460	1 1/4"	12	4	450'		
	575	1"	12	6	450'		
3500	230	2"	14	000	450'		
	380	1 1/2"	14	1	450'		
	460	1 1/4"	14	3	450'		
	575	1 1/4"	14	4	450'		
4000	230	2 1/2"	15	250	450'		
	380	2"	15	00	450'		
	460	1 1/2"	15	1	450'		
	575	1 1/4"	15	3	450'		
5000	460	1 1/2"	20	1	600'		
6000	460	2"	24	00	600'		
7000	460	2"	24	00	600'		

### Fan Motor Wiring Guide

\* IMC = Intermediate Conduit

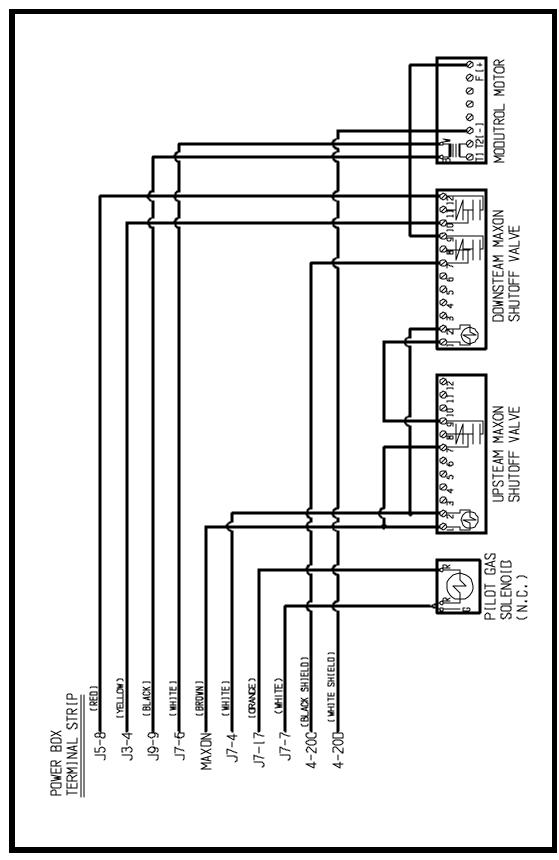
### Appendix C

Power Box Wiring - Field Notes						
		TERMINAL STR	VOLTAGE			
PART wire gauge	Wire Color	3 & 4 Fan Dryers	1Fan Dryer	(all dryers)		
Plenum Temperation 20 (shielded cable)	<u>ure Sensor</u>	JRTD-C (black) JRTD-D (white)	JRTD-C (black) JRTD-D (white)	12 volts DC		
Interior Hi-Limits 18 Adjustable Plenum Hi-Lim 18 18	red brown <u>ait Thermostat</u> gray orange	J1-12 J1-14 J1-16 J1-17	J1-10 J1-14 J1-16 J1-17	12 volts DC 12 volts DC 12 volts DC 12 volts DC 12 volts DC		
<b>Exterior Hi-Limits</b> 18 18 18 18 18 18 18 18 18 18 18 18 18	red yellow blue brown gray orange purple black	J5-8 J1-2 J1-4 J1-6 J1-8 J1-10 J1-12 J5-13	J5-8 J1-2 J1-6 J1-10 J5-13	12 volts DC 12 volts DC		
Bindicator(s) 18 18 (upper) 18 (lower) 16 (coil motor) 16 (coil motor) Grain Temperature 20 (shielded cable)	red yellow brown black white e Sensor	1, 3, and 4 Far J5-8 J2-18 J2-17 J9-9 J7-5 RTD-A (black) RTD-B (white)	n Dryers	12 volts DC 12 volts DC 12 volts DC 110 volts AC 110 volts AC 4 - 20 milliamps		
	brown	J7-17 J7-7 maxon J7-4 J5-8 J3-4 J9-9 J7-6 4-20-C (black) 4-20-D (white)		110 volts AC 110 volts AC 110 volts AC 110 volts AC 12 volts DC 12 volts DC 12 volts DC 110 volts AC 110 volts AC 4 - 20 milliamps		
Safety Horn and 1 14 (safety horn & light) 14 (work light)	Lights	J9-17 (red) J9-14 (white neutral) L1 (black) J9-3 (white neutral)	)	110 volts AC 110 volts AC		
Metering Drum Motor (230v/10 gauge, 460v/14 gauge) wires to inverter. (Terminals U,V, & W.) Ignitor (ignition cable) wires to ignition transformer. Flame Sensor (#14 red flame sensor) wire to protectofier (Terminal E)						

Flame Sensor (#14 red flame sensor) wire to protectofier (Terminal E).

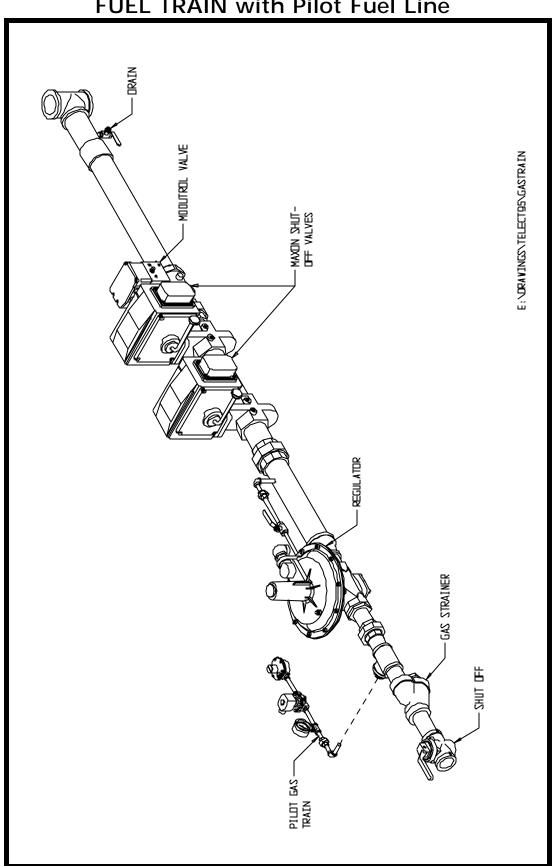
Fan Motors wire to electrical starters.

#### Appendix D

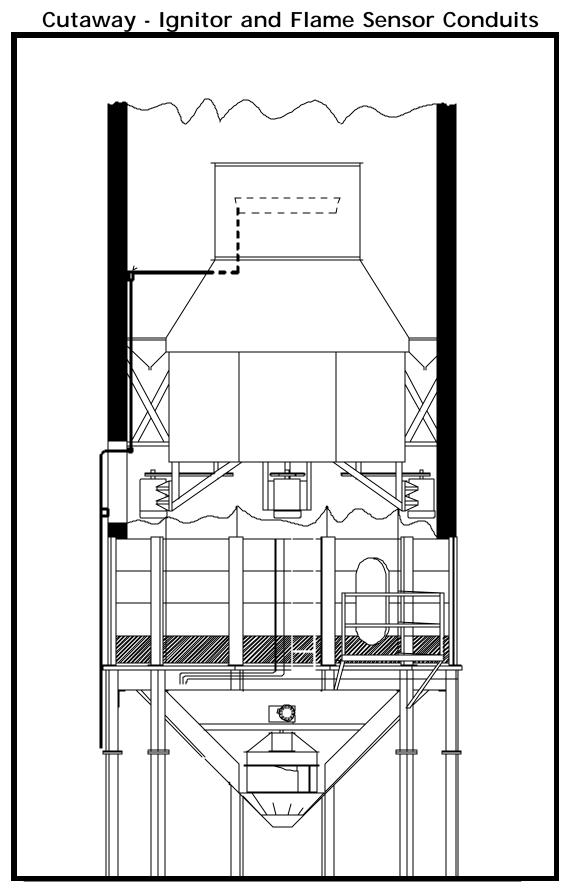


Gas Train Wiring Schematic Diagram

### Appendix E



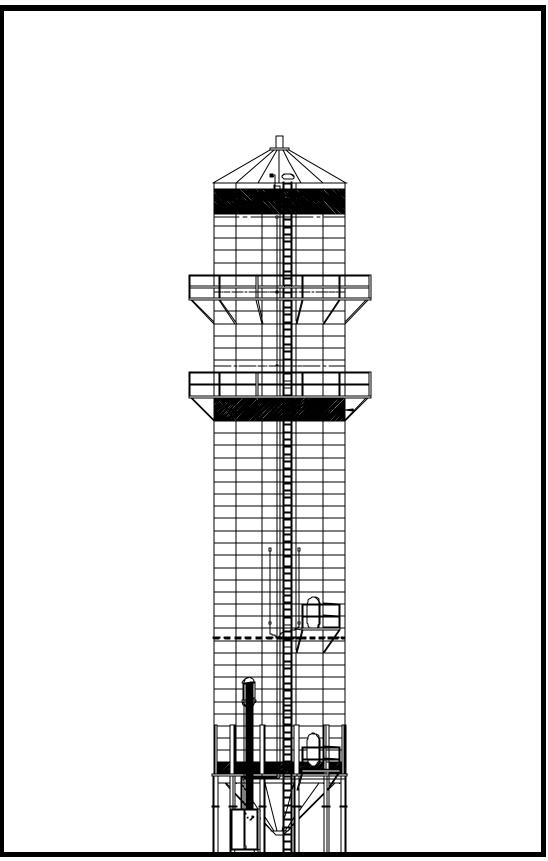
Appendix F



1998 tower lower interior.hgl

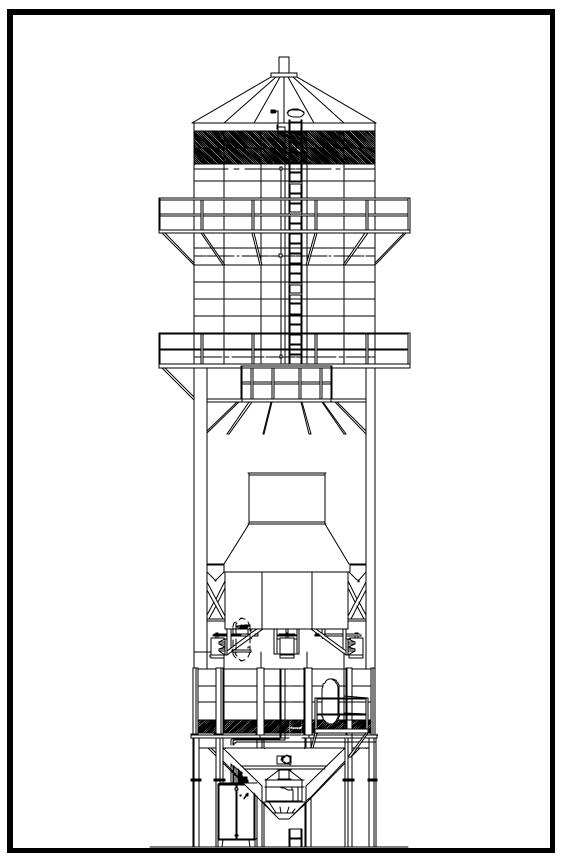
### Appendix G





### Appendix H

### Tower Cutaway



### Appendix I

#### GLOSSARY OF INSTALLATION TERMS

#### TERMS

#### MEANING

bph bushels per hour
cable connectors Liquid tite cable connector (strain relief), Appleton, Heyco
flexible conduit brand names include Sealtite, Ultratite, etc.
heavy duty thread sealing compound also called pipe thread sealer, pipe dope
icon a small symbol that simplifies message for quick reader recognition, for example:
this icon indicates communication options: phone, fax, e-mail, internet
field notes electrician's working summary of wiring requirements.
hoppers Divider Hopper - funnels any debris to cooling section (divides heating section from cooling section)
Discharge Hopper - discharges grain at bottom of dryer, it consists of Inner Hopper and Outer Hopper.
<u>Inner Hopper wall</u> - directs grain to metering drum (below cooling section floor) <u>Outer Hopper wall</u> - discharges grain from dryer
motor windowdryer fan motors conduits enter through motor window
RTD Resistance Temperature Device
RH Right Hand
LH Left Hand
venturi tube, e.g., curved inner wall of fan that constricts to increase air velocity and lower air pressure

#### Appendix J

#### U.S. TO METRIC CONVERSION TABLES

Refer to the conversion tables in Appendix D for conversions from U.S. measures to metric measurements.

To assemble this grain dryer, you may need standard U.S. dimension tools. However, some metric tools will fit on U.S. dimension hardware.

Fractions	Decimals	Millimeters	Fractions	Decimals	Millimeters
1/64	.0156	.3969	33/64	.5156	13.0969
1/32	.0313	.07938	17/32	.5313	13.4938
3/64	.0469	1.1906	35/64	.5469	13.8906
1/16	.0625	1.5875	9/16	.5625	14.2875
5/64	.0781	1.9844	37/64	.5781	14.6844
3/32	.0938	2.3813	19/32	.5938	15.0813
7/64	.1094	2.7781	39/64	.6094	15.4781
1/8	.125	3.1750	5/8	.625	15.8750
9/64	.1406	3.5719	41/64	.6406	16.2719
5/32	.1563	3.9688	21/32	.6563	16.6688
11/64	.1719	4.3656	43/64	.6719	17.0656
3/16	1.875	4.7625	11/16	.6875	17.4625
13/64	.2031	5.1594	45/64	.7031	17.8594
7/32	.2188	5.5563	23/32	.7188	18.2563
15/64	.2344	5.9531	47/64	.7344	18.6531
1/4	.250	6.3500	3/4	.750	19.0500
17/64	.2656	6.7469	49/64	.7656	19.4469
9/32	.2813	7.1438	25/32	.7813	19.8438
19/64	.2969	7.5406	51/64	.7969	20.2406
5/16	.3125	7.9375	13/16	.8125	20.6375
21/64	.3281	8.3344	53/64	.8281	21.0344
11/32	.3438	8.7313	27/32	.8438	21.4313
23/64	.3594	9.1281	55/64	.8594	21.8281
3/8	.375	9.5250	7/8	.875	22.2250
25/64	.3906	9.9219	57/64	.8906	22.6219
13/32	.4063	10.3188	29/32	.9063	23.0188
27/64	.4219	10.7156	59/64	.9219	23.4156
7/16	.4375	11.1125	15/16	.9375	23.8125
29/64	.4531	11.5094	61/64	.9531	24.2094
15/32	.4688	11.9063	31/32	.9688	24.6063
31/64	.4844	12.3031	63/64	.9844	25.0031
1/2	.500	12.7000	1	1.000	25.4000

#### Inch Conversion Table

### Appendix J

#### U.S. TO METRIC CONVERSION TABLES

#### **Conversion Factors**

Multiply	by	To Obtain	
British Thermal Unit (Btu)	2.928x10 -4	kilowatt <sup>·</sup> hr (kWh)	
Btu/hr	3.930x10 -4	horsepower (hp)	
Btu/hr	0.293	watt (W)	
horsepower (hp)	745.7	watt (W)	
inch (in)	2.540	centimeter (cm)	
foot (ft)	0.3048	meter (m)	
pound-mass (lbm avdp*)	0.454	kilogram (kg)	
pounds per square inch (psi)	6,895	Pascal (Pa)	
bushels (bu)	0.03524	cubic meter (m <sup>3</sup> )	
°F (Fahrenheit)	(F°-32) / 1.8	°C (Celsius)	
°C (Celsius)	1.8 (C°) + 32	°F (Fahrenheit)	

\* avdp = avoirdupois

### Appendix J

### U.S. TO METRIC CONVERSION TABLES

AWG Gage No.	Cross-sec	tional Area	Diameter of solid wire	Circular
NO.	mm²	inches <sup>2</sup>	mm	mils
32	.0032	0.00005	0.0202	63.2
30	0.0505	0.000079	0.255	100.5
28	0.0806	0.000125	0.321	159.8
26	0.129	0.000199	0.405	254
	0.196	0.000304	0.5	387
24	0.205	0.000317	0.511	404
	0.283	0.00483	0.6	558
20	0.518	0.000802	0.812	1022
	0.75	0.001162	0.977	1480
18	0.821	0.001272	1.022	1620
	1	0.00155	1.128	1973
16	1.307	0.002026	1.29	2580
	1.5	0.002325	1.382	2960
14	2.082	0.003228	1.628	4110
	2.5	0.003875	1.784	4934
12	3.309	0.005129	2.053	6530
	4	0.0062	2.257	7894
10	5.26	0.008152	2.588	10380
	6	0.0093	2.763	11841
8	8.365	0.012967	3.264	16540
	10	0.0155	3.568	19735
6	13.296	0.02061	-	26240
	16	0.0248	-	31576
4	4 21.15 0.03278		-	41740
	25	0.0388	-	49338
2	33.62	0.0521	-	66360

## AWG\* Wire Gage (solid conductor wire)

\* American Wire Gage.

### Appendix K

Address correspondence to:



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