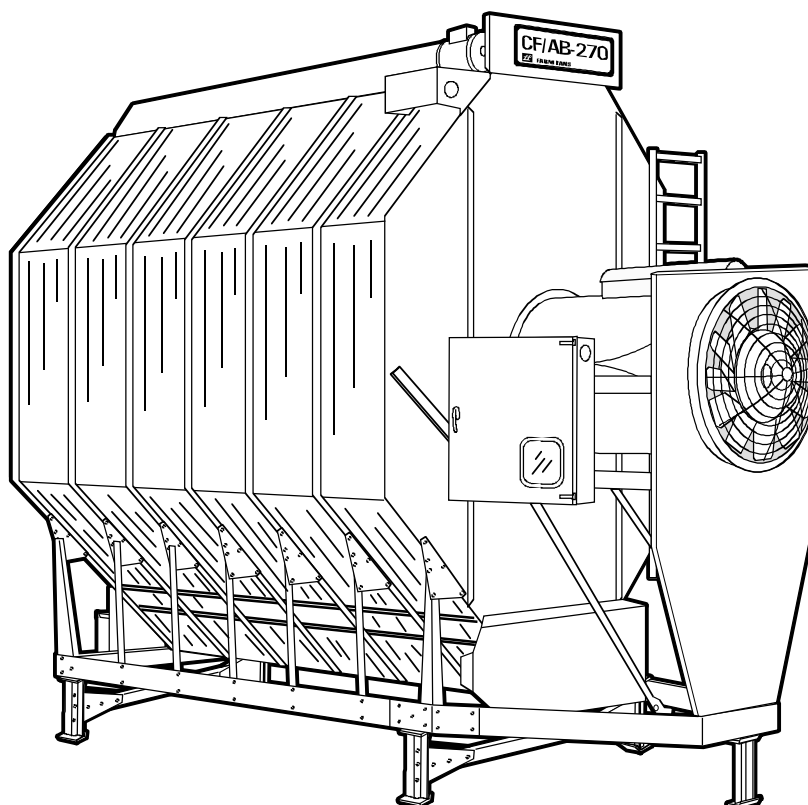


# **OPERATOR'S MANUAL**

## ***CF/AB SERIES GRAIN DRYERS***

### **CF/AB-150, 190, 270, and 320 MODELS**



**FARM FANS**

Division of ffi Corporation

5900 Elmwood Avenue • Indianapolis, Indiana  
© 1997 ffi Corporation Printed in U.S.A.



---

**READ THESE INSTRUCTIONS BEFORE  
INSTALLATION and OPERATION.  
SAVE FOR FUTURE REFERENCE.**

Thank you for choosing a Farm Fans CF/AB Series grain dryer. These units are among the finest grain dryers ever built; designed to give you excellent operating performance and reliable service for many years.

This manual describes the installation and operation for all standard production CF/AB-150, 190, 270, and 320 model dryers. These dryers are available with liquid propane or natural gas fuel supply, three phase 230 or 460 volt (60Hz) electrical power, or single phase 230 volt power.

**USE CAUTION IN THE OPERATION OF  
THIS EQUIPMENT**

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

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

Continued safe dependable operation of automatic equipment depends, to a great degree, upon the owner. For a safe and dependable drying system, follow the recommendations within the manual and make it a practice to regularly inspect the operation of the unit for any developing problems or unsafe conditions.

Take special note of the Operating Precautions listed on Page 2 before attempting to operate the dryer.



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

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

---

**WARRANTY**

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

This warranty does not cover products or parts which have been damaged by negligent use, misuse, alteration or accident. Some components supplied by manufacturers are warranted separately by those suppliers. This warranty is exclusive and in lieu of all other warranties, expressed or implied. Farm Fans reserves the right to make design or specification changes at any time, without any contingent obligation to purchasers of products already sold.

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

# CONTENTS

<b>OPERATING PRECAUTIONS</b> .....	2
<b>Section 1: SPECIFICATIONS</b> .....	3
Dryer Specs .....	4
Auger Data .....	4
<b>Section 2: TRANSPORTATION &amp; INSTALL.</b> .....	5
Transporting Dryer .....	5
Installation .....	5
Fuel Connections .....	5
Fuel Specs .....	6
Electrical Power Supply .....	7
Connecting Auxiliary Conveyors .....	8
Electrical Load, Overload Relays, and Circuit Breaker Tables .....	8
<b>Section 3: OPERATING CONTROLS</b> .....	11
Main/Safety Gas Shutoff Valve .....	11
Hi-Lo Fire Thermostat and Gas Pressure .....	11
Meter Roll Adjustment .....	11
Dryer Operator Light .....	11
Unload Auger Switch .....	12
Discharge Safety Shutoff Switch (DSS) .....	12
Fan Switch .....	12
Burner Switch .....	12
Mode Switch .....	12
Timers .....	13
Digi-Trol Moisture Control .....	14
Auto Two-Speed Module .....	15
Electronic Moisture Control (MC) Switch .....	15
Digi-Trol Operation Summary - CF Mode. ....	16
Digi-Trol Operation Summary - Batch Mode ..	17
Overload Relays .....	17
Shut-Down Indicator Lights .....	17
Restarting Dryer After a Shut-down .....	18
<b>Section 4: TEST FIRING</b> .....	19
<b>Section 5: DRYER OPERATION</b> .....	21
Full Heat Drying .....	21
Drying Temperature .....	21
Final Moisture Content .....	21
Dryer Shutdown .....	21
Continuous Flow Start-Up Procedure .....	22
Batch Drying Operating Instructions .....	23
Automatic Batch Start-Up Procedure .....	24
Drying Tables .....	25
<b>Section 6: DRYER ILLUSTRATIONS</b> .....	34
<b>Section 7: SERVICE</b> .....	43
Seasonal Inspection and Service .....	43
Propane Vaporizer Seasonal Inspection ....	44
Vaporizer Adjustment .....	44
Burner Control – Sequence of Operation ....	45
Fan Propeller Removal and Installation .....	45
Fan Motor Removal and Installation .....	47
Heater Parts Removal and Installation .....	47
Grain & Plenum Temp. Sensor Locations ....	48
SCR and Meter Roll Information .....	48
Meter Roll Blockage .....	48
SCR Motor Control .....	49
<b>Section 8: WIRING DIAGRAMS</b> .....	51
Contents Listing .....	51
<b>Section 9: TROUBLESHOOTING</b> .....	61
General Troubleshooting .....	61
Digi-Trol Troubleshooting .....	65

---

## OPERATING PRECAUTIONS

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

**TYPE:** Continuous Flow Full Heat or Automatic Batch operation in either Dry and Cool or Full Heat. Dryers equipped with one fan-heater unit.

**GRAIN COLUMNS:** Two grain columns, 14" thickness, with grain movement through dryer controlled by metering rolls. Grain columns constructed of galvanized steel, with heavy steel partitions each two feet of length, and with meter roll access panels and grain clean-out mechanism.

**FAN:** Heavy-duty axial fan, direct drive, with total airflow, static pressure, and horsepower matched to grain volume, and with full motor overload protection.

**HEATER:** High capacity direct-fired heater, with Star-Fire burners used on CF/AB-150, -190, and -270 models, and stainless steel octagonal burners used on the CF/AB-320 model. Full electronic ignition, and thermostat temperature control by two-level fuel flow modulation (Hi-Lo burner control).

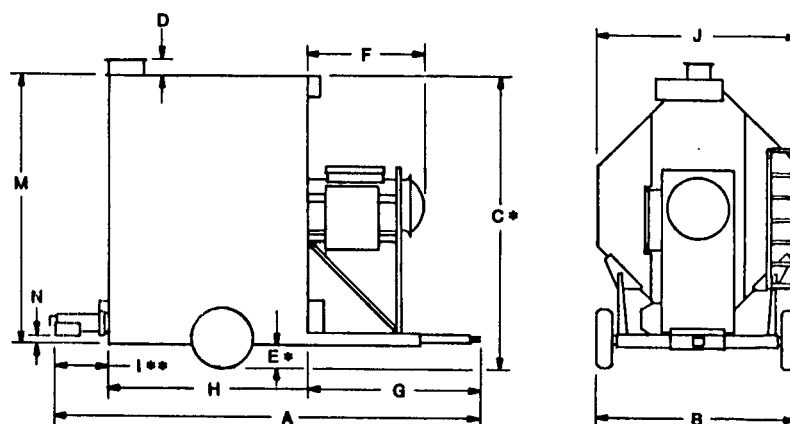
**METER ROLL DRIVE:** All current CF/AB models are equipped with variable speed DC motor drive using SCR motor control.

**AUGERS:** Top leveling auger automatically controlled, with power circuit provided for simultaneous operation of

auxiliary loading conveyor; bottom auger for grain discharge from metering rolls, with power circuit provided for operation of take-away conveyor; heavy-duty construction in augers and auger drive systems.

**AUTO CONTROL:** The following features come standard on all CF/AB dryers.

- Fully equipped for automatic control of all functions such as loading, drying and discharge.
- Continuous Flow Full Heat, or Automatic Batch with either Dry and Cool or Full Heat.
- Grain discharge process controlled by variable, adjustable rate metering roll system.
- Hourmeter
- Dual-Temp drying control for automatic batch operation
- Digi-Trol moisture control system
- Full safety control system:
  - Automatic shut-down on wet grain outage or excessive temperature
  - Discharge shutoff feature designed to shut down dryer and relieve grain pressure in the event the auxiliary grain unloading system stops or becomes plugged
  - Circuit monitor system to identify the cause of safety shut-down



MODEL	A	B	C*	D	E*	F	G	H	I**	J	M	N
CF/AB-150	16'-7-1/2"	7'-11"	11'-11"	8'	11'-1/2"	3'-9-1/2"	6'-11"	8'	20"	7'-11-1/2"	10'-11-1/2"	3/4"
CF/AB-190	18'-7-1/2"	7'-11"	11'-11"	8'	11'-1/2"	3'-9-1/2"	6'-11"	10'	20"	7'-11-1/2"	10'-11-1/2"	3/4"
CF/AB-270	20'-7"	7'-11"	13'-5"	8'	11'-1/2"	5'-4"	6'-11"	12'	20"	8'-0"	12'-5-1/2"	3/4"
CF/AB-320	22'-7"	7'-11"	13'-5"	8'	11'-1/2"	5'-4"	6'-11"	14'	26"	8'-0"	12'-5-1/2"	3/4"

Fig. 1-1 Dryer dimensions

## Table 1-1 Dryer Specifications

	CF/AB-150	CF/AB-190	CF/AB-270	CF/AB-320
Grain Column	14" Thick, 8' Length	14" Thick, 10' Length	14" Thick, 12' Length	14" Thick, 14' Length
Grain Column Holding Capacity	150 Bu.	190 Bu.	270 Bu.	320 Bu.
Transport Length (Hitch to Discharge Auger)	16'-7"	18'-7-1/2"	21'-2"	23'-2"
Transport Width	8'	8'	8'	8'
Transport Height	11'-11"	11'-11"	13'-5"	13'-5"
Installed Length	15'	17'-6"	20'	21'
Installed Width	8'	8'	8'	8'
Installed Height (Above Foundation Supports)	11' + 8" Fill Hopper	11' + 8" Fill Hopper	12'-6" + 8" Fill Hopper	12'-6" + 8" Fill Hopper
Fan Heater				
Fan	(1) 7-1/2-9 HP, 24" 3450 RPM	(1) 10-13 HP, 28" 3500 RPM	(1) 10-16 HP, 36" 1750 RPM	(1) 20 HP, 39" 1750 RPM
Heater (Max. Btu)	2,330,000 Btu/Hr.	3,000,000 Btu/Hr.	4,600,000 Btu/Hr.	6,000,000 Btu/Hr.
Top Loading Auger Capacity	6", 1.5HP 680 BPH	6", 2 HP 925 BPH	6", 2 HP 1150 BPH	6", 5 HP 1800 BPH
Bottom Auger	6", 8" Tube, 1 HP	6", 8" Tube, 1.5 HP	6", 8" Tube, 2 HP	8", 10" Tube, 3 HP
Meter Roll System	SCR Type, 1/3 HP	SCR Type, 1/3 HP	SCR Type, 1/3 HP	SCR Type, 1/3 HP
Max. Rate <sup>1</sup>	400 BPH	650 BPH	780 BPH	1050 BPH
Electrical Load (Fan, Top Auger, Bottom Auger <sup>2</sup> )				
Single Phase, 230 Volt	59 Amps	80 Amps	99 Amps	130 Amps
Three Phase, 230 Volt	39 Amps	47 Amps	55 Amps	81 Amps
Three Phase, 460 Volt	20 Amps	24 Amps	27 Amps	41 Amps
Drying Capacity <sup>3</sup>				
Shelled Corn - Full Heat				
25% Input - 17% Output <sup>4</sup>	180 BPH	240 BPH	335 BPH	400 BPH
25% Input - 20% Output	286 BPH	375 BPH	520 BPH	620 BPH
30% Input - 17% Output <sup>4</sup>	117 BPH	155 BPH	215 BPH	255 BPH
30% Input - 22% Output	203 BPH	265 BPH	365 BPH	435 BPH
Dry and Cool Method, Batch Mode Only				
25% Input-15% Output	105 BPH	150 BPH	205 BPH	240 BPH
20% Input-15% Output	142 BPH	202 BPH	275 BPH	320 BPH

1. Actual discharge rate is controlled by meter roll speed adjustment, at 5% to 100% of maximum rate.

2. Excludes auxiliary load and unload motors.

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

4. Grain discharged hot from the dryer at 17% output moisture should result in a final moisture content of 15% to 15-1/2% after cooling (dryeration).

## Table 1-2 Auger Drive Data

	AUGER		MOTOR			SPROCKETS			SHEAVES	
	Size	Approx. Capacity Bu./hr. <sup>1</sup>	HP	RPM	Belts	Drive Chain	Drive (Teeth)	Driven (Teeth)	Drive PD/Hub Bore	Driven PD/Hub Bore
Top Auger										
CF/AB-150	6"	680	1.5	1750	A-52 (two)	#40	15	45	2.3/.625	8.0/H1
CF/AB-190	6"	925	2	1750	A-52 (two)	#40	15	45	3.0/H7/8	8.0/H1
CF/AB-270	6"	1150	2	1750	A-52 (two)	#40	15	45	3.0/H7/8	8.0/H1
CF/AB-320	6"	1800	5	1750	BX-112 (two)	#50	25	36	3.6/H1-1/8	10.4/H1-1/4
Bottom Auger										
CF/AB-150	6"	400 <sup>2</sup>	1	1750	A-41 (two)	#40	15	60	2.3/.625	8.0/H1
CF/AB-190	6"	650 <sup>2</sup>	1.5	1750	A-41 (two)	#40	15	60	3.0/H.625	8.0/H1
CF/AB-270	6"	780 <sup>2</sup>	2	1750	A-41 (two)	#40	15	45	3.0/H7/8	8.0/H1
CF/AB-320	8"	1050 <sup>2</sup>	3	1750	BX-93 (two)	#50	15	48	3.2/H1-1/8	13.4/H1-1/8

1. Dryer auger capacities and power requirements vary with grain moisture content and amount of fine material in grain.

2. This Bu./Hr. listing represents the maximum meter roll discharge rate. The bottom auger capacity exceeds the max. meter roll rate.

## TRANSPORTING DRYER

An optional Transport Kit is available for transporting the unit by truck or tractor. Make certain to observe the following **safety precautions**:

1. Recommended towing hitch height: 16" to 17".
2. Hitch pin to be not less than 3/4 inch in dia. and securely fastened so it will not come out in travel.
3. Use a safety chain.
4. Dryer must be towed empty and in accordance with applicable state or provincial regulations.
5. Recommended tire pressure 55-60 psi (cold).
6. Maximum towing speed: 45 mph.
7. After first 50 miles and every 200 miles thereafter:
  - a. Check hub and spindle temperature immediately after stopping. Temperature should not exceed 150 degrees F. May be hot to touch, but not melting lubricant.
  - b. Check wheel lug bolts; they are factory torqued at 115 to 120 ft/lbs. Retighten, if required, to approximately 90 ft/lbs.

## INSTALLATION

**SYSTEM LAY-OUT** — Consider the grain handling system, storage bins, and existing conveyors in selecting the dryer site, in order to facilitate wet grain supply and dry grain discharge to conveyors.

**SITE SELECTION** — The dryer is not to be operated inside a building or in any area not permitted by electrical codes, fuel installation regulations, or insurance requirements. Do not operate in an area where combustible material can be drawn into the fans. Maintain a minimum distance of three feet to other structures. Refer to Fig. 1-1 for dryer dimensions.

**LEG SUPPORT** — The wheels are provided only for transportation of the empty dryer. Before loading any grain into the dryer, it is necessary to support the frame of the unit on each side, preferably with an optional Leg Support Package (LSP). Concrete blocks or other means may be used provided they can carry the total weight when filled with grain. If using blocks or other means, use shims to provide uniform, level support, at a minimum of 16" above the concrete slab, to provide space for clean-out and for auxiliary conveyors. Use a minimum of one support at hitch point and two supports on each side for CF/AB-150 and 190, or three supports each side for CF/AB-270 and 320. Hitch tongue should be removed, but hitch and fan support must be left on; they are not a part of the transport.

**CONCRETE SLAB** — A reinforced concrete slab is recommended as the basic support for the dryer, located in a well drained area. The slab should be large enough to provide working area around the dryer, with a surface elevation consistent with other parts of the grain handling and storage system.

**TIE-DOWN ANCHORS** — Anchor points may be cast into the concrete slab, or dryer may be tied down by cable and turn-buckle to anchors installed at edge of slab. In any case, dryer must be securely anchored to support blocks and concrete base, to prevent overturn or lateral movement by wind forces.

**FILLING POINT** — Wet grain must enter the dryer at the hopper at the rear end of the top auger, since the top auger moves grain forward, toward the paddle switch controlling the top auger (except for special front-loading units).

**WET GRAIN SUPPLY** — A wet holding bin may be utilized to supply grain to the dryer, with gravity flow into the dryer loading conveyor, or gravity flow from a wagon or truck into a loading conveyor may be used to fill the dryer. The top leveling auger will accept grain at any rate up to its maximum capacity as listed in Table 1-2. In any case, the dryer must have a constant supply of wet grain. Auxiliary loading conveyors should be sized to nearly match the capacity of the top auger, to avoid air loss problems caused by underfilling during high drying rate operations.

**WET GRAIN LOADING** — The dryer will automatically start the top auger and any loading conveyor electrically connected to the power circuit provided in the main control box. At the beginning, dryer will completely fill, requiring approximately its full holding capacity. During drying, the top auger will start and stop, as required to maintain the dryer full of wet grain.

**TOP AUGER TIMER** — The unit is equipped with a top auger timer (within ASC control box), to provide automatic shut-down on wet grain outage, if the top auger operates for a time exceeding the timer setting (field adjustable).

**DISCHARGE AUGER EXTENSIONS** — Special discharge auger extension kits are available, with an additional length of 1 to 10 feet (one foot increments) to provide dry grain discharge points at various distances from the rear of the dryer, for direct discharge into elevator legs or other conveyors. Extensions are available with either a solid or perforated tube.

**AUXILIARY CONVEYOR OVERLOAD RELAYS** — Overload relays for the loading conveyor and take-away conveyor are factory equipped with heater elements for 5 HP motors (7.5 HP on CF/AB-320 Aux. Load) on the auxiliary conveyors. If other HP ratings are used, it is necessary to change heater elements to provide running load protection for the motors. See Tables 2-2 to 2-5 for heater element specifications.

## FUEL CONNECTIONS

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

**LIQUID DRAW** — The dryer is designed to operate on liquid propane, with liquid draw from a supply tank. A piping system is provided on the dryer, including strainer, pressure relief valve, and manual shut-off valve; a pressure regulator is provided on the fan-heater unit, between vaporizer and burner.

**AMMONIA TANKS** — Do not use propane supply tanks that have previously held ammonia or fertilizer solutions. These substances are extremely corrosive and may damage fuel supply and burner parts.

**OIL OR WATER IN TANKS** — With liquid draw from the supply tank, any water present in the tank may freeze in the piping and controls in cold weather. To ensure that tanks are free of moisture, the usual precaution is to purge with methanol. Avoid tanks which may contain an accumulation

of oil or heavy hydrocarbons from long use on a vapor withdrawal system.

be provided at the connection to the dryer, with gas available in sufficient volume to maintain operating pressure.

## NATURAL GAS (N)

**GAS VOLUME AND PRESSURE** — The dryer is designed to operate on natural gas having a heat value of about 1,000 BTU per cubic foot. The dryer is equipped with a natural gas supply pipe system connected to the heater solenoid valves. A regulated pressure of 5 to 10 PSI must

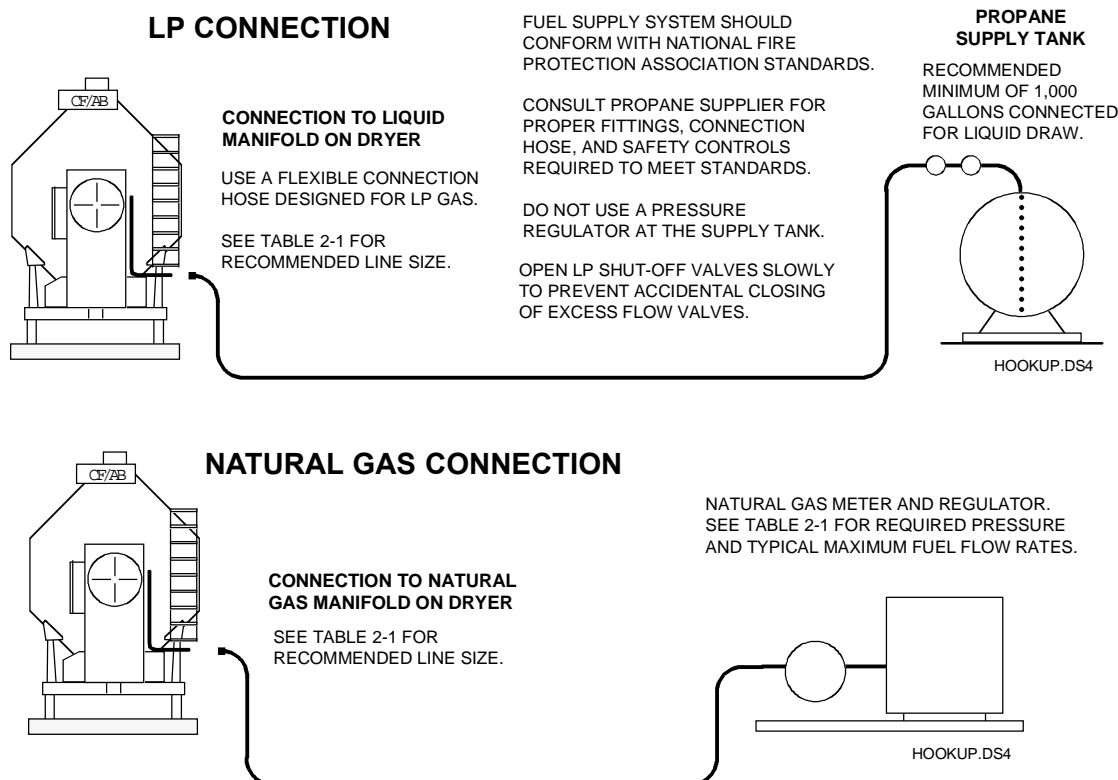


Fig. 2-1 Fuel hookup

**Table 2-1 Fuel System Recommendations**

	CF/AB-150	CF/AB-190	CF/AB-270	CF/AB-320
Maximum Heat Capacity (Million BTU/hr)	2.33	3.0	4.6	6.0
Typical Max. Fuel Flow 1 (Gal/Hr)	25	32	49	64
Recommended Liquid Line Size	3/8" pipe	1/2" pipe	1/2" pipe	1/2" pipe
Heater Orifice Drill Size	0.218"	0.250"	0.281"	0.4375"
Operating Pressure Range (Heater Gauge)	4-20 PSI	3-15 PSI	5-20 PSI	3-8 PSI
Lo-Fire Pressure Setting	4 PSI	3 PSI	5 PSI	3 PSI
Typical Max. Fuel Flow 1 (Cu.Ft./Hr)	2,330	3,000	4,600	6,000
Min. Pressure at Connection to Dryer	8 PSI	8 PSI	8 PSI	8 PSI
Recommended Min. Line Size - 100'	1" pipe	1.25" pipe	1.5" pipe	2" pipe
Heater Orifice Drill Size	0.3125"	0.375"	0.438"	0.5625"
Operating Pressure Range (Heater Gauge)	2-7 PSI	2-7 PSI	4-8 PSI	3-7 PSI
Lo-Fire Pressure Setting	2 PSI	2 PSI	4 PSI	3 PSI

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



## ELECTRICAL POWER SUPPLY

**POWER SUPPLY** — An adequate power supply and proper wiring are important factors for maximum performance and long life of the dryer. Electrical service must be of adequate size to prevent low voltage damage to motors and control circuits. Power supply for 1-phase models must include a neutral wire. All dryers should be field provided with a dependable equipment ground. Electrical power supply should conform to local, state, or provincial requirements.

**POWER SUPPLY DISCONNECT** — All dryers should be equipped with a power disconnect switch external to the ASC Control Box to permit total power shut-down before opening ASC dead front, as required for inspection and service. The power disconnect switch should be located close to the dryer for quick shut-down.

**TRANSFORMERS WIRING VOLTAGE DROP** — Contact the service representative of the power supplier, to advise of the additional load to be placed on the line. Check on KVA rating of transformers, considering total horsepower load. The power supply wiring, main switch equipment, and transformers must be capable of providing adequate motor starting and operating voltage. Voltage drop during motor starting should not exceed 14% of normal voltage, and running voltage (after motor is at full speed) should be within 8% of normal voltage.

**ELECTRICAL LOAD** — Tables 2-2 to 2-5 indicate the electrical load in horsepower and full load current, for motors on the dryer, and for auxiliary loading and take-away conveyors which can be directly connected to the power circuits in the dryer control panel.

**OVERLOAD RELAYS** — Overload relays are adjustable from 85% to 115% of normal load in amperes, as shown by the overload relay heater specifications of Tables 2-2 to 2-5, by an adjustment knob in each relay. Dryers are shipped with overload relay heaters for auxiliary conveyors

(adjacent to top and bottom auger contactors) to operate 5 HP, 1-phase, or 5 HP, 3-phase motors; if different motors are used, heater elements must be changed to provide adequate motor overload protection.

### CONNECTING AUXILIARY CONVEYORS

The maximum size auxiliary conveyor motors which can be powered directly from the power terminals of the dryer is 5 HP for single phase and 7-1/2 HP for three phase models. See appropriate power circuit wiring diagram for terminal connection numbers.

To connect auxiliary auger motors which are LARGER than the maximum, refer to the following information.

A. Motors must be powered from a source outside of the dryer with the use of a separate contactor and overload protection device for each motor.

B. For automatic operation with single phase dryers — use 230V contactor coils and connect LOADING coil to POWER TERMINALS 10 and 12. Connect UNLOADING coil to POWER TERMINALS 4 and 6.

C. For automatic operation with 230V, 3-PH dryers — use 230 V contactor coils and connect LOADING coil to POWER TERMINALS 10 and 12. Connect UNLOADING coil to POWER TERMINALS 4 and 6.

D. For automatic operation with 460V, 3-PH dryers — either use a control stepdown transformer to power a 230V contactor coil, or use 460V contactor coils and connect them as described earlier in Item C.

E. When conveyor motors are powered from an external source and are connected for automatic type operation, their overload protective switches should be connected in series and then connected into the dryer safety circuit. For recommended connections, refer to motor overload protection connections shown within the SAFETY CIRCUIT portion of the general control circuit wiring diagram in Section 8.

**Table 2-2 CF/AB-150 Electrical Load, Overload Relays, & Circuit Breakers**

	Voltage	Fan	Top Auger	Bottom Auger	Auxiliary Conveyor <sup>1</sup>
Horsepower	1-PH - 230V	7½-9	1½	1	5 (two)
	3-PH - 230V	7½-9	1½	1	5 (two)
	3-PH - 460V	7½-9	1½	1	5 (two)
Full Load Current (Amps per Motor)	1-PH - 230V	42	8.0	6.2	25
	3-PH - 230V	28	4.8	3.4	13
	3-PH - 460V	14	2.4	1.7	6.5
Max. Running Load (Dryer Only) - Amps	1-PH - 230V		59		
	3-PH - 230V		39		
	3-PH - 460V		20		
Max. Running Load <sup>1</sup> , with Aux. Conv. - Amps	1-PH - 230V		109		
	3-PH - 230V		65		
	3-PH - 460V		33		
Recommended Service Equip. Rating - Amps	1-PH - 230V		150		
	3-PH - 230V		100		
	3-PH - 460V		80		
Control Panel Overload Relay Heater Element Spec.	1-PH - 230V	F43.0	C8.67	C6.95	C22.8
	3-PH - 230V	C30.3	C6.30	C4.66	C16.3
	3-PH - 460V	C16.3	C3.56	C2.68	C8.67
Control Panel Circuit Breaker Rating - Amps	1-PH - 230V	80	80	80	--- <sup>2</sup>
	3-PH - 230V	100	50	50	--- <sup>2</sup>
	3-PH - 460V		90 (one breaker)		
SCR Motor	Size 1/3 HP DC		Control Amps / Volts 2.2A / 230VAC		Motor Amps / Volts 1.7A / 175VDC

1. Motor current and maximum dryer running loads shown are based on listed HP auxiliary conveyor motors. The maximum size motor which can be powered directly through dryer ASC control is 5 HP for 1-PH 230V, or 7½ HP for 3-PH 230V models. Motors larger than this require separate contactors and overload protectors with their coil circuits connected to dryer for automatic operation.

2. Auxiliary motors are controlled by the top and bottom auger circuit breakers.

IMPORTANT: All standard CF/AB dryers are factory equipped with overload relay heater elements sized for the listed HP auxiliary motors. If the actual motors used are different, the element must be changed.

**Table 2-3 CF/AB-190 Electrical Load, Overload Relays, & Circuit Breakers**

	Voltage	Fan	Top Auger	Bottom Auger	Auxiliary Conveyor <sup>1</sup>
Horsepower	1-PH - 230V	10-13	2	1½	5 (two)
	3-PH - 230V	10-13	2	1½	5 (two)
	3-PH - 460V	10-13	2	1½	5 (two)
Full Load Current (Amps per Motor)	1-PH - 230V	58	11.0	8.0	25
	3-PH - 230V	25	5.3	4.8	13
	3-PH - 460V	12.5	2.65	2.4	6.5
Max. Running Load (Dryer Only) - Amps	1-PH - 230V	80			
	3-PH - 230V	47			
	3-PH - 460V	24			
Max. Running Load <sup>1</sup> , with Aux. Conv. - Amps	1-PH - 230V	130			
	3-PH - 230V	73			
	3-PH - 460V	37			
Recommended Service Equip. Rating - Amps	1-PH - 230V	150			
	3-PH - 230V	100			
	3-PH - 460V	80			
Control Panel Overload Relay Heater Element Spec.	1-PH - 230V	F65.8	C12.5	C8.67	C22.8
	3-PH - 230V	C33.0	C7.78	C6.30	C16.3
	3-PH - 460V	C18.0	C3.79	C3.56	C8.67
Control Panel Circuit Breaker Rating - Amps	1-PH - 230V	100	80	80	--- <sup>2</sup>
	3-PH - 230V	100	50	50	--- <sup>2</sup>
	3-PH - 460V	90 (one breaker)			
SCR Motor	<u>Size</u> 1/3 HP DC		<u>Control Amps / Volts</u> 2.2A / 230VAC		<u>Motor Amps / Volts</u> 1.7A / 175VDC

1. Motor current and maximum dryer running loads shown are based on listed HP auxiliary conveyor motors. The maximum size motor which can be powered directly through dryer ASC control is 5 HP for 1-PH 230V, or 7½ HP for 3-PH 230V models. Motors larger than this require separate contactors and overload protectors with their coil circuits connected to dryer for automatic operation.

2. Auxiliary motors are controlled by the top and bottom auger circuit breakers.

IMPORTANT: All standard CF/AB dryers are factory equipped with overload relay heater elements sized for the listed HP auxiliary motors. If the actual motors used are different, the element must be changed.

**Table 2-4 CF/AB-270 Electrical Load, Overload Relays, & Circuit Breakers**

	Voltage	Fan	Top Auger	Bottom Auger	Auxiliary Conveyor <sup>1</sup>
Horsepower	1-PH - 230V	10-16	2	2	5 (two)
	3-PH - 230V	10-16	2	2	5 (two)
	3-PH - 460V	10-16	2	2	5 (two)
Full Load Current (Amps per Motor)	1-PH - 230V	74	11.0	11.0	25
	3-PH - 230V	41	5.3	5.3	13
	3-PH - 460V	20.5	2.65	2.65	6.5
Max. Running Load (Dryer Only) - Amps	1-PH - 230V	99			
	3-PH - 230V	55			
	3-PH - 460V	27			
Max. Running Load <sup>1</sup> , with Aux. Conv. - Amps	1-PH - 230V	149			
	3-PH - 230V	81			
	3-PH - 460V	40			
Recommended Service Equip. Rating - Amps	1-PH - 230V	200			
	3-PH - 230V	100			
	3-PH - 460V	100			
Control Panel Overload Relay Heater Element Spec.	1-PH - 230V	F84.8	C12.5	C12.5	C22.8
	3-PH - 230V	C44.0	C7.78	C7.78	C16.3
	3-PH - 460V	C25.0	C3.79	C3.79	C8.67
Control Panel Circuit Breaker Rating - Amps	1-PH - 230V	125	80	80	--- <sup>2</sup>
	3-PH - 230V	100	50	50	--- <sup>2</sup>
	3-PH - 460V	90 (one breaker)			
SCR Motor	<u>Size</u> 1/3 HP DC		<u>Control Amps / Volts</u> 2.2A / 230VAC		<u>Motor Amps / Volts</u> 1.7A / 175VDC

1. Motor current and maximum dryer running loads shown are based on listed HP auxiliary conveyor motors. The maximum size motor which can be powered directly through dryer ASC control is 5 HP for 1-PH 230V, or 7½ HP for 3-PH 230V models. Motors larger than this require separate contactors and overload protectors with their coil circuits connected to dryer for automatic operation.

2. Auxiliary motors are controlled by the top and bottom auger circuit breakers.

IMPORTANT: All standard CF/AB dryers are factory equipped with overload relay heater elements sized for the listed HP auxiliary motors. If the actual motors used are different, the element must be changed.

**Table 2-5 CF/AB-320 Electrical Load, Overload Relays, & Circuit Breakers**

	Voltage	Fan	Top Auger	Bottom Auger	Auxiliary Conveyor <sup>1</sup>	
					LOAD	UNLOAD
Horsepower	1-PH - 230V	20	5	3	5	5
	3-PH - 230V	20	5	3	5	5
	3-PH - 460V	20	5	3	5	5
Full Load Current (Amps per Motor)	1-PH - 230V	92	22	16	25	25
	3-PH - 230V	56	13	8.6	13	13
	3-PH - 460V	28	6.5	4.3	6.5	6.5
Max. Running Load (Dryer Only) - Amps	1-PH - 230V			130		
	3-PH - 230V			81		
	3-PH - 460V			41		
Max. Running Load <sup>1</sup> , with Aux. Conv. - Amps	1-PH - 230V			180		
	3-PH - 230V			114		
	3-PH - 460V			57.5		
Recommended Service Equip. Rating - Amps	1-PH - 230V			225		
	3-PH - 230V			150		
	3-PH - 460V			100		
Control Panel Overload Relay Heater Element Spec.	1-PH - 230V	E97	C22.8	C15.1	C22.8	
	3-PH - 230V	E77	C16.3	C11.3	C16.3	
	3-PH - 460V	E71	C8.67	C5.92	C8.67	
Control Panel Circuit Breaker Rating - Amps	1-PH - 230V	200	80	80	--- <sup>2</sup>	
	3-PH - 230V	100	50	50	--- <sup>2</sup>	
	3-PH - 460V	90 (one breaker)				
SCR Motor	Size 1/3 HP DC		Control Amps / Volts 2.2A / 230VAC		Motor Amps / Volts 1.7A / 175VDC	

1. Motor current and maximum dryer running loads shown are based on listed HP auxiliary conveyor motors. The maximum size motor which can be powered directly through dryer ASC control is 5 HP for 1-PH 230V, or 7½ HP for 3-PH 230V models. Motors larger than this require separate contactors and overload protectors with their coil circuits connected to dryer for automatic operation.

2. Auxiliary motors are controlled by the top and bottom auger circuit breakers.

IMPORTANT: All standard CF/AB dryers are factory equipped with overload relay heater elements sized for the listed HP auxiliary motors. If the actual motors used are different, the element must be changed.



### FUEL CONTROLS

#### MAIN/SAFETY GAS SHUT-OFF VALVE (NATURAL GAS MODELS ONLY)

**VALVE OPERATION** — This valve is of the electrical type and is installed only onto NATURAL GAS model dryers. This unit is a electrically energized, manual reset valve. The valve is equipped with an electric solenoid which is energized only when the dryer CONTROL CIRCUIT is turned ON.

The valve has a "free handle" lever that cannot allow gas flow to the dryer until the dryer control circuit is energized. Only then does the lever engage to allow the handle to be manually raised to the latched position, thereby opening the valve. The valve will trip closed instantly when its solenoid is de-energized or when the lever is rotated to the closed position.

Visual indication of "open" and "shut" positions is provided by a position indicator in the side of the unit. An orange indicating bar aligns itself with the words "open" or "shut."

#### HI-LO FIRE THERMOSTAT and GAS PRESSURE SETTINGS

**THERMOSTAT OPERATION** — Combustion in the fan-heater unit is controlled by the Hi-Lo Fire burner thermostat assembly located on the front of the dryer.

The thermostat senses the air plenum temperature and cycles the burner from Hi-Fire to Lo-Fire operation to maintain the desired drying temperature AS INDICATED BY THE THERMOMETER.

**HI-FIRE, LO-FIRE** — When the heater is operating on Hi-Fire, the burner is supplied with a relatively large flow of gas from both the Hi-Fire gas solenoid valve and the flow control valve. When the burner is operating on Lo-Fire, only the flow control valve supplies the burner operation.

**PROPANE HI-FIRE** — On propane models, the Hi-Fire gas pressure for the burner is controlled by the gas pressure regulator. For maximum heat capacity, the regulator should be adjusted to the burner's highest recommended operating pressure WHILE OPERATING ON HI-FIRE, as indicated by the fan-heater control box pressure gauge. See Table 2-1 (maximum listing under "Operating Pressure Range").

**NATURAL GAS HI-FIRE** — For natural gas models, the Hi-Fire gas pressure is controlled by adjusting the large manual shut-off valve within the line which supplies the fan-

heater. For maximum heat, set the shut-off valve to provide approx. 7 to 8 psi WHILE THE BURNER IS OPERATING ON HI-FIRE. See Table 2-1 (max. listing under "Operating Pressure Range").

**LO-FIRE** — The Lo-Fire gas pressure is controlled by the flow control valve.

**PROPANE LO-FIRE** — On propane models, set the Lo-Fire gas pressure to the "Lo-Fire" setting as listed within Table 2-1 by rotating the knob on the flow control knob. Lock setting with an Allen wrench after making this adjustment. Burner must be operating on Lo-Fire when making this adjustment.

**NATURAL GAS LO-FIRE** — For natural gas models, turn the handle on the small gas shut-off valve to provide the "Lo-Fire" gas pressure as listed in Table 2-1, while the burner is operating on Lo-Fire.

**BURNER CYCLE** — When burner is operating properly, it should automatically cycle at regular intervals from Hi-Fire to Lo-Fire, as indicated by the corresponding pressure change on the gas pressure gauge. It is not necessary for burner to cycle with short 5 to 10 second intervals, BUT IT IS IMPORTANT THAT THE BURNER DOES CYCLE OCCASIONALLY.

If the burner remains in Hi-Fire and does not cycle, increase gas regulator setting on propane models, or the main gas supply pressure on natural gas models, in order to satisfy the thermostat setting. DO NOT EXCEED THE MAXIMUM PRESSURE LISTED IN Table 2-1.

If the burner remains in Lo-Fire and does not cycle, decrease the Lo-Fire gas pressure slightly by readjusting the flow control valve. *Do not decrease the valve setting to the extent where a noticeable burner flutter or popping noise can be heard, as caused by flame backfire into the burner cup.*

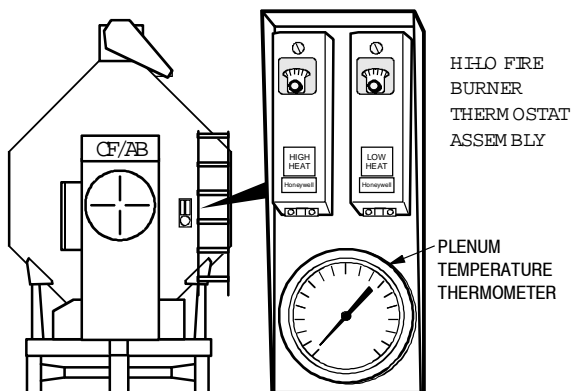
#### METER ROLL ADJUSTMENT

The dry grain discharge rate is adjusted by rotating the SCR speed control knob, labelled "UNLOAD RATE" on the ASC control panel. This control ranges from 0 to 100, representing the flow of grain past the metering rolls as a percent of the maximum grain discharge rate for the dryer. See Table 3-1 for a rate table and other meter roll drive information.



UNLOAD RATE

**ADJUSTMENT** — Turn the Unload Rate knob clockwise to increase the discharge rate, counterclockwise to decrease.



CFABHILO.DS4

#### DRYER OPERATOR LIGHT

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

**SWITCH POSITIONS** — The three-position switch provides ON, OFF, or MONITOR operation. When the switch is set ON, the light will stay energized even when the dryer is shut down. When the switch is set to MONITOR, the light will be ON only when the dryer is operating. **NOTE:** The light circuit is 115V and is intended for 100 watt bulb operation. Do not install an oversize light bulb.



## MISCELLANEOUS SWITCHES

### UNLOAD SWITCH (Bottom Auger)

If switch is turned OFF the bottom auger will not operate. When operating in AUTOMATIC BATCH mode, setting the switch to OFF will stop the automatic cycle when the dryer would normally begin unloading (at the end of the Cool timer setting). The ability to "Hold" or delay the unloading is helpful where an elevator leg may be in use for wet grain when the dryer would start unloading (if on AUTO), or where the operator desires to be present when unloading occurs. If switch is set to OFF position when dryer is operating, the fan and burner (if Burner switch is in ON position) will continue to operate. If switch is turned OFF after unloading has begun, the cooling fan will remain on and the Unload timer's "in-progress" memory will allow dryer to resume the unload cycle when Unload switch is set back to AUTO. Leaving the Unload switch OFF during Full-Heat Batch drying is not recommended, as the dryer would remain on full heat until a grain or plenum hi-limit thermostat would cause a safety-circuit shut-down.



restarted. It may be necessary to clear grain from under the door to allow it to fully clear and reset the circuit.

The discharge assembly is equipped with a Collect-A-Sample tube to allow a safe and easy method of obtaining a grain sample. To operate, simply rotate the tube; 180 degree rotation provides maximum discharge.

### FAN SWITCH

The FAN SWITCH has two operating positions, OFF or ON. If the switch is set to OFF, the fan, and likewise the burner, will not operate. In Batch mode, the batch timers will not operate unless the Fan switch is ON.

If switch is set to ON position, the fan will operate continuously (for both CF and BATCH modes of operation).



### BURNER SWITCH

ON, OFF or AUTO — The Burner switch has three operating positions. With switch in the OFF position, the burner will not operate. With switch in the ON position, the burner will operate continuously when the fan is running. When Burner switch is in AUTO position with the dryer operating in BATCH MODE, the burner will be automatically controlled by the dryer (to provide the desired grain heating and cooling time).

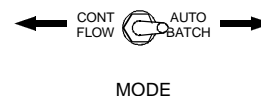


### DISCHARGE SAFETY SHUTOFF SWITCH (DSS)

The DSS functions as an electrical safety shutoff switch and a grain release hatch. Located on the discharge tube assembly, this feature is designed to automatically shut down the dryer and relieve grain pressure, in the event the auxiliary grain unloading system stops or becomes plugged. After grain overflow is removed from the discharge tube and the grain release hatch falls to its normal position, the device will automatically reset and allow the dryer to be

### MODE SWITCH

CONTINUOUS FLOW or AUTO BATCH — When Mode switch is set to the CONT. FLOW position the dryer will operate as a full-heat continuous flow type dryer. In this mode the batch timers are bypassed and become inoperative. Drying charts and the recommended start-up procedure for CF



**Table 3-1 SCR Drive Information and Data**

APPROX. DISCHARGE RATES • BU/HR at VARIOUS % UNLOAD SETTINGS (Standard Discharge Models)										
Setting	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
CF/AB-150	40	80	120	160	200	240	280	320	360	400
CF/AB-190	65	130	195	260	235	390	455	520	585	650
CF/AB-270	78	156	234	312	390	468	546	624	702	780
CF/AB-320	105	210	315	420	525	630	735	840	945	1050

SCR Component or Specification	CF/AB-150	CF/AB-190	CF/AB-270	CF/AB-320
SCR Control - Parts & Volts	415-3019-7	415-3019-7	415-3019-7	415-3019-7
DC Motor				
HP & Set RPM	1/3, 1750	1/3, 1750	1/3, 1750	1/3, 1750
Type	PM	PM	PM	PM
Set Voltage (Arm.)	175	175	175	175
Full Load Amps (Arm.)	1.7	1.7	1.7	1.7
Motor Sheave				
Pitch Diameter	2.6	2.6	2.6	3.0
Number & Bore	AK28-5/8	AK28-5/8	AK28-5/8	AK32H-5/8
Gearbox - Part No. & Ratio	017-1393-2, 50:1	017-1393-2, 50:1	017-1393-2, 50:1	017-1393-2, 50:1
Gearbox Drive				
Input Sheave				
Pitch Diameter	5.7	5.7	5.7	5.7
Number & Bore	AK61H	AK61H	AK61H	AK61H
Belt	A26	A26	A26	A26
Output Sprocket No. & Bore	H4012-1	H4015-1	H4015-1	H4015-1
Chain	#40 x 53"	#40 x 53"	#40 x 53"	#40 x 53"
Meter Roll				
Type & Max. RPM	6 Flute, 6.39 RPM	6 Flute, 7.98 RPM	6 Flute, 7.98 RPM	6 Flute, 9.21 RPM
Drive Sprocket No. & Bore	40H30, H-1	40H30, H-1	40H30, H-1	40H30, H-1

tab3-1.fh5

dryer operation are located in OPERATION section of manual. When mode switch is set to the AUTO BATCH position, the dryer will operate as a batch dryer and be controlled by the adjustment settings of the DRY, COOL, UNLOAD, and Dual Temp timers. See TIMERS heading for additional information.

## TIMERS

Beginning with 1997 models, solid-state timers are being used to control the Dry, Cool, and Unload times used in Automatic Batch operation. The timers can be set to the nearest 1/10 of a minute. The timing sequence is in operation when the display on the timer is backlit and the Run Indicator is blinking. The timing sequence is completed when display reads 0.0 and the OUT indicator is lit.

In the event of a safety shut-down or power failure during timer operation, each timer has a battery backup that retains the elapsed time in memory. When dryer is turned back on, the timer will resume its cycle where it left off. If desired, timer settings can be changed or reset during the power outage or safety shutdown.

### KEY DEFINITIONS

**Set Value:** The timer setting in minutes.

**Present Value:** Time remaining until timer "times out."

**Reset:** Resets Present Value to Set Value. Pressing the Reset button causes the timer to start at the beginning of its cycle, regardless of the previous timing cycle. For example, pressing the Dry Timer's reset button during the Unload cycle would immediately restart the Dry cycle. Therefore, use care to avoid accidentally resetting the cycle timers. See the following definition for how to change a timer's setting without disrupting the cycle in progress.

**Up Keys 1 to 4:** Used to enter a Set-Value time. Keys 1 to 4 increase the corresponding digits as follows: key 1 changes 1st digit, key 2 changes 2nd digit, etc.

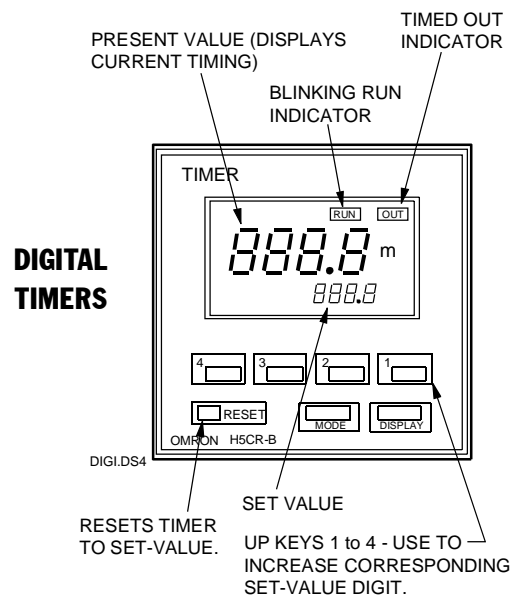
The best time to change the Set Value is before the drying cycles have begun. However, the Up Keys allow the Set Value to be changed at any time (even when the dryer is shut down). If a timer's Set Value absolutely must be changed while its cycle is in progress, take note of the following important precautions:

If you try to set the timer to an amount less than the possible remaining time, the timer will reset to 0 and begin the next cycle.

The Set Value can be safely increased at any time during a particular cycle, provided the Set Value never falls below the Present Value, as might happen accidentally when pressing the keys.

The Set Value can be safely lowered during a particular cycle as long as the Set Value never falls below the Present Value. The following tip allows you to bypass this restriction.

**Example:** A timer that is running was initially given a Set Value of 20 minutes. Ten minutes have elapsed, with ten minutes remaining. You wish to lower the Set Value to 15 minutes, which is more than the possible remaining time. First, increase the Set Value by pressing the number 4 Up Key once to display 120.0. Next, increment the number 2 and 3 Up Keys until the 115.0 is displayed. Then increment the number 4 Up Key until



15.0 is displayed. You will then have safely shortened the cycle by 5 minutes.

### TIMER FUNCTIONS

**DRY TIMER** — Allows the burner to operate for a pre-determined time at the temperatures set by the Hi-Lo Fire (dual temp) plenum thermostats. At the end of the dry time period, the Digi-Trol controller will check whether the grain has reached the set-point temperature. When grain reaches setpoint, the burner will stop operating and the cooling cycle will start.

**DUAL DRYING TEMPERATURE** — The Dual Temp feature provides two drying stages (high heat and low heat) for Automatic Batch mode operation. Dual Temp operation is controlled by adjusting the Dual Temp timer (4TR) located behind the control panel deadfront. Use this timer to set the initial high-heat drying stage from 0 to 60 minutes. See Figs. 6-9 and 6-10 for component identification.

**NOTE:** The Dual Temp timer does not effect total drying time, which is set by the Dry timer on the ASC control panel. As a general recommendation, the high heat period should be approximately 2/3 the total drying time, although wide variation is possible.

For shelled corn with an initial moisture content of 25% to 30%, the suggested High Heat thermostat setting is 220 to 240 degrees F, with a Low Heat thermostat setting of 160 to 180 degrees F.

To establish the optimal Dual Temp setting for your drying needs:

1. Run a full drying cycle with the Dual Temp timer set at approximately 2/3 the total drying time.
2. Test grain for moisture content. If a lower moisture content is desired, increase Dry timer setting. If a higher moisture content is desired, decrease Dry timer setting.
3. Repeat steps one and two until correct final moisture content is obtained.

**CAUTION:** If significant changes in grain input moisture occur, repeat set-up procedure to reset the drying times.

**COOL TIMER** — The Cool timer may be adjusted for either full cooling or any degree of partial cooling. At the completion of the cooling cycle, the unload cycle will start.

**Mechanical Timers Only (pre-1997 models):** For Full-Heat operation, set the Cool timer on 5 seconds to produce

a brief delay between the end of the drying cycle and the beginning of the unload cycle. This delay is required by the existing relay logic to ensure continuous dryer cycling. To set the 5-second delay, first switch the Cool Timer's range to 30s (30 seconds), then set the time indicator to 0.5 (see "Adjusting the Omron Mechanical Batch Timers Range and Hertz" heading). **IMPORTANT:** Do not set the Cool timer to 0 (zero) for full-heat operation, as this will result in improper drying operation.

**UNLOAD TIMER** — The Unload timer should be set to the time to unload one full content of the dryer. During the unload cycle, wet grain is being added, thus eliminating the down time to load, as is required in typical batch dryers. Also the fan continues to run, permitting cooling to continue during unloading. For the Batch drying mode, the meter rolls should be adjusted to provide maximum (100%) discharge rate if possible (see Batch Drying Operating Instructions in Section 5 for an adjustment formula).

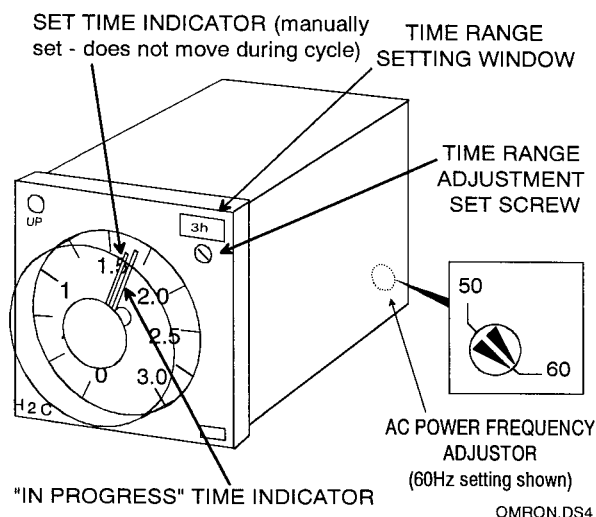
See AUTOMATIC BATCH OPERATION CHARTS in Section 5 for suggested dryer start-up and initial trial settings for timers for different grain types and moisture conditions.

#### TIMER SETTINGS and ADJUSTMENT for OMRON MECHANICAL TIMERS USED BETWEEN 1993 and 1996

These model dryers were factory shipped with the COOL, UNLOAD, and DRY timers set in the 30m (thirty-minute) mode of operation. This setting normally need not be changed for the COOL TIMER and UNLOAD TIMER. However, the DRY TIMER will require the 3h (three-hour) mode of operation for drying times greater than 30 minutes. Check time tables in Section 5 to determine whether resetting the DRY TIMER range is necessary for a specific application. Also see ADJUSTING THE DRYING TIME RANGE AND HERTZ below for how to change the range setting.

#### ADJUSTING THE OMRON MECHANICAL BATCH TIMERS

To adjust the time on mechanical Omron batch timers, simply rotate the outer dial face to the desired setting when the timer is not energized. The No. 1 mark equals 1/3 of the



#### OMRON MECHANICAL BATCH TIMER

selected range (for example, 1/3 of the 30- min. range = 10 min.). The timer normally begins timing when power is applied to the Control Circuit Start button (in the AB mode). Cycle progress is tracked during operation by the "in-progress" indicator. If the dryer is shut down by pressing the Control Circuit Stop button or by a safety circuit shut-down, the Dry timer will retain its memory and resume its cycle when the dryer is turned back on. If the dryer is turned off due to the unload breaker being turned off, main power to the dryer being disconnected, or the ASC panel Reset button being pressed, the Dry timer's "in-progress" memory will be lost because it is held by power from the control fuse 1FU.

**NOTE:** When a timer is energized, the time setting may be immediately decreased manually, but setting cannot be increased until later when the timer is de-energized and becomes reset.

#### ADJUSTING THE OMRON MECHANICAL BATCH TIMERS' RANGE AND HERTZ

To adjust the time RANGE (not the time setting) of the Omron timer:

Use a small screwdriver to rotate the time range adjustment screw to the desired range (30m, 3h, or 30s) as shown in illustration.

To change the Hertz setting:

Use a small screwdriver to rotate the Hertz adjustment screw to either 50 or 60 Hertz as shown in illustration.

#### ASC PANEL TIMER RESET BUTTON — All Timers

A Timer Reset button is located on the ASC control panel below the Batch Timers. Pressing the Reset button will reset the Dry, Cool, and Unload timers to their previous set point. For mechanical timers only, the timers' "in-progress" memory will also be reset.

#### DIGI-TROL AUTOMATIC MOISTURE CONTROL

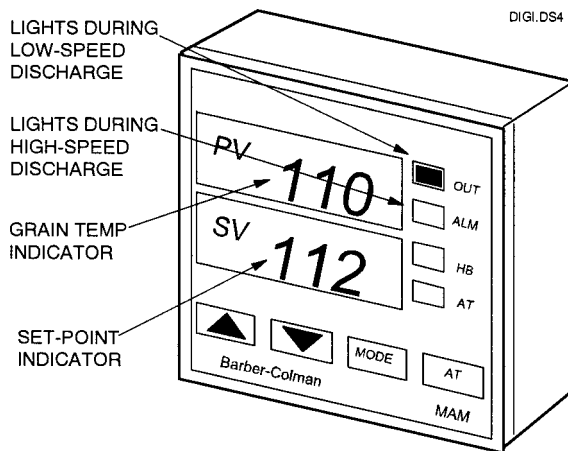
Digi-Trol™ is a temperature-based moisture control system consisting of a Moisture Controller unit and an Auto Two-Speed module to control the unloading rate.

Digi-Trol uses grain temperature sensed within the grain column to monitor, predict, and steer the drying process. Whenever the sensed temperature varies from an operator-set moisture control temperature, the Moisture Controller will vary the discharge rate during Continuous Flow (CF) operation or alter the drying time during Automatic Batch (AB) mode. If the sensed temperature falls below the set-point temperature, Digi-Trol increases the drying time by either slowing the discharge rate for Continuous Flow (CF) operation, or extending the dry time for Automatic Batch (AB) operation. A rise in sensed grain temperature indicates to Digi-Trol that drier than expected grain has entered the dryer, calling for quicker discharge (CF mode) or reduced drying time (AB mode).

In the Continuous Flow (CF) mode, Digi-Trol uses a technique called "pulse width modulation" to make a two-speed motor simulate a more advanced variable speed control such as Farm Fans' Vari-trol™. Digi-Trol's micro-processor-based controller sends a series of Hi and Lo pulses to the Auto Two-Speed module. Based on the ratio of Hi to Low signals, drying time is proportionally changed to control discharge moisture.

In Automatic Batch (AB) mode, Digi-Trol's controller automatically extends drying time as needed. In this mode,





### DIGI-TROL MOISTURE CONTROLLER

the controller has no effect on the unload rate but simply extends drying time in response to wetter than expected grain.

The Moisture Controller unit displays both grain temperature, indicated by PV (short for "Process Variable") and set-point temperature, indicated by SV (short for "Set-point Value"). The control utilizes an averaging RTD sensor inside a grain column, extending horizontally across the entire dryer length, at approximately 1/2 to 2/3 of the way down from the top of the grain column.

## KEY COMPONENTS and DEFINITIONS

### MOISTURE CONTROLLER UNIT

**PV** Process Variable. Grain temperature sensed at the RTD sensor.

**SV** Set-point Value. The grain temperature corresponding to the target moisture level. Digi-trol will attempt to operate at temperatures below this set-point. To set this value, press the Mode key on the Moisture Controller, then use the up or down arrow keys to change. After the Set-point Value is displayed, push the Mode key to save and exit.

**NOTE:** An accurate Set-point Value is critical in obtaining effective moisture control, therefore care should be taken when determining this value. The proper Set-point Value should be equal to the grain temperature (PV) when the drying process has stabilized and the dryer is discharging grain at the target moisture content. Because the sensor is located 1/2 to 2/3 into the drying pass, however, note that grain being sensed and displayed will not be discharged for another 1/3 to 1/2 of a drying pass (this lag is illustrated near the heading Reacting to Moisture Variation ahead).

**OUT** Lights when Digi-Trol senses wetter than expected grain, calling for the lower speed meter roll operation. When not lit, the higher speed signal is sent. (In AB mode, the high or low signal has no effect on the unload rate or drying time.)

**ALM** Lights primarily when grain temperature meets or exceeds the operator-set moisture control temperature, allowing the higher of the two meter roll speeds. In AB mode, the drying time will be extended until grain temperature meets or exceeds the set-point.

## AUTO TWO-SPEED MODULE

### Selector switch settings

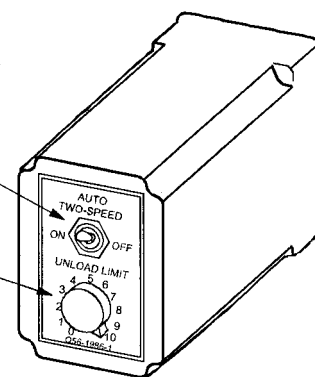
**ON** In Continuous Flow (CF) mode, allows for two-speed meter roll action needed for Digi-Trol control. When the ASC panel's Unload Auger switch is set to AUTO, the meter roll speed will cycle between low speed (2/3 of manually set Unload Rate) and high speed (twice the manually set Unload Rate). The cycling interval is controlled by the Moisture Controller unit.

**OFF** The Auto Two-Speed should never be placed in the OFF position. (The meter rolls will not operate with switch in the OFF position.)

**Unload Limit** Provides maximum discharge rate protection by allowing an operator to set the maximum discharge rate allowable to prevent overloading the take-away equipment. The Unload Limit is always active regardless of the drying mode (CF or AB). For maximum capacity in AB mode and for best moisture control in CF mode, set the Unload Limit as high as possible within the limits of the take-away equipment.

ALWAYS SET TO "ON" POSITION FOR MANUAL OR AUTOMATIC MOISTURE CONTROL OPERATION

LIMITS DRYER'S UNLOAD RATE TO MATCH CAPACITY OF TAKE-AWAY EQUIPMENT



## AUTO TWO-SPEED MODULE

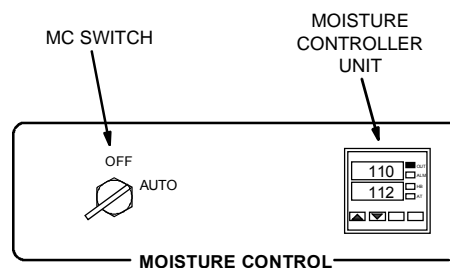
### ELECTRONIC MOISTURE CONTROL (MC) SWITCH

Meter roll control is enabled by the MC switch in the Moisture Control area of the control panel. This switch has two positions: OFF and AUTO.

**OFF** — For MANUAL meter roll control, turn the MC switch to OFF. Meter rolls will discharge at the rate set by the % Unload Rate dial. The Moisture Controller does not display or control when in the OFF position.

**AUTO** — Automatic operation. The Moisture Controller unit displays and controls meter roll action.

1. Setting the Auto Two-Speed Unload Limit Setting — Determine the maximum unload rate allowed by the take-away equipment. Divide this amount by the 100% dryer discharge rate for the dryer model and multiply by 10. This is the correct Unload Limit setting.



**Example:**

Take away auger capacity = 800 BPH

Max btm. auger capacity = 1000 BPH

$(800 / 1000) \times 10 = 8.0$

Conclusion: Set Unload Limit to 8.0

**2. Manual Start-up & Initial Temperature Reading —**

Refer to the continuous flow start-up procedure chart in section 5 of this manual. Follow the listed procedures including starting and filling the dryer, using the drying times from the DRYING TIME TABLE. During this initial start-up the Moisture Controller unit must not be in a controlling mode, so the MC switch should be in the OFF position. As this initial grain is being dried, periodically monitor it for moisture content. To observe grain temperature for determining the proper Set-point, the MC switch can be momentarily switched to the ON position. It is important to set the MC switch back to the OFF position as this guarantees a constant meter roll speed during set-up to help establish the proper Set-point.

**3. Stabilizing Grain Moisture in Manual Mode —**

If grain moisture variation requires adjustment of the meter roll rate, rotate the Unload Rate knob slightly in the required direction (decrease setting to reduce grain moisture). Allow dryer to operate for one complete grain pass to stabilize grain moisture, then recheck moisture.

The Minutes for one grain pass is calculated as follows:

$$\text{Minutes for one grain pass} = \frac{\text{Holding Capacity (Bu)} \times 60}{\text{Unload Rate (BPH)}}$$

**4. Establishing the Set-Point Value —**

After discharge grain moisture has been stabilized by adjustment of the meter roll rate and the output moisture is at the desired level, the Set-point Value is determined to be equal to the grain temperature (PV) observed over the last 1/2 to 1/3 of the drying pass. To set the Set-point Value, turn the MC switch to AUTO, push the Moisture Controller's Mode key, then use the arrow keys to change the Set-point Value. Once the correct Set-point is displayed, press the Mode key to exit the Set mode.

Variations of incoming grain moisture may not allow the grain temperature and moisture to fully stabilize during

setup. A proper Set-point temperature can be determined when a sample of discharged grain meeting the target moisture is known to have the same PV temperature as when it had passed the sensor 1/2 to 1/3 of a drying pass prior to sampling. Minor temperature variation in the meantime can be disregarded.

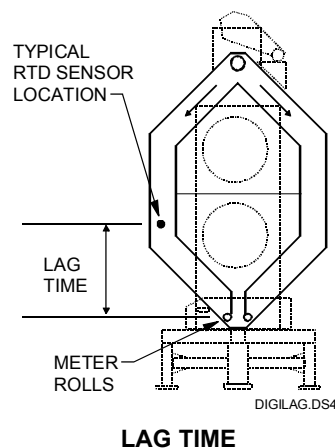
**5. Reacting to Moisture Variation —**

The Moisture Controller will react to changes in input grain moisture by automatically changing the unload rate. In drastic moisture change situations, however, such as a sudden slug of wetter grain, temporary changes in the discharge grain moisture are to be expected. Be assured that the controller will bring the discharge moisture back to the target after a necessary adjustment period. Since the Moisture Controller's temperature sensor is located 1/2 to 2/3 into the drying pass, the different moisture grain has already seen over half its dry time before the controller can act to correct the discharge rate (see "LAG TIME" illustration). Grain discharged 1/2 to 2/3 of a drying pass after a sharp moisture/temperature variation should fall back into line with the target moisture.

**6. When to Change the Set-Point —**

If discharged grain is not at the desired moisture content, investigate the following points before changing the Set-point:

a. Check incoming moisture to determine if a significant change has occurred. If this change averages more than 3% from the moisture measured during the set-up pro-

**DIGI-TROL CONTINUOUS FLOW OPERATION SUMMARY**

After initial start-up procedure and the Continuous Flow (CF) mode has been selected:

- A. Set Unload Limit on the Auto Two-Speed.
- B. Ensure that the Auto Two-Speed is set to the ON position.
- C. Set the Electronic Moisture Control (MC) switch to the OFF position.
- D. Set unload rate (using the % Unload Rate control knob) according to recommended setting based on incoming moisture, desired moisture, and the drying time tables.
- E. Allow dryer to operate one complete pass without any changes to the % Unload Rate.
- F. During the last 1/2 to 1/3 of the drying pass, observe the grain temperature (PV) on the Moisture Controller by momentarily switching the MC switch to the ON position, and then back to the OFF position.
- G. Measure discharge grain moisture content at the end of the drying pass.
- H. If grain is discharged at the desired moisture content, then the Set-point Value should be set to the grain temperature (PV) observed. If grain moisture is too dry or wet, then adjust the % Unload Rate control knob and repeat steps E through H.
- I. Turn the MC switch to the ON position.
- J. Enter the appropriate Set-point Value into the Moisture Controller.

cedure, then repeat the set-up procedure to establish a new Set-point.

b. Determine whether a change in moisture is a result of a temporary condition (for example, a small load of wetter or drier grain). The Set-point should not be changed if incoming moisture returns to the average seen during the most recent set-up procedure. (The Moisture Controller will allow a slight moisture deviation for a short period of time.)

c. Observe either the meter roll speed or the Moisture Controller's "Out" indicating light for 15 to 20 seconds. If the meter roll speed is not noticeably cycling between High and Low speed every 5 to 10 seconds, and the lack of cycling is not due to a temporary change in incoming grain moisture, then repeat the manual set-up procedure to establish a new Set-point.

7. Restarting a Loaded Dryer after a Shut-down — When restarting a loaded dryer following a shut-down period, the operator should run the dryer in MANUAL mode until the grain that had sat in the dryer is purged and the grain temperature has stabilized before switching to the AUTO mode. The grain temperature Set-point should not necessarily require readjustment.

See the "Digi-Trol Continuous Flow Operation Summary" chart for a summary of the operation procedure. Refer to Section 5, DRYER OPERATION, for further operation details.

## **AUTOMATIC BATCH OPERATION USING DIGI-TROL — PRELIMINARY SETTINGS and INFORMATION**

To establish the Set-point Value in the AB operating mode, set the batch timers according to suggested initial settings listed in the cycle time chart in Section 5. Set the MC switch to the OFF position. Run a batch of grain at the suggested timer settings. Then check the grain temperature at the end of the batch to see whether discharge moisture is near target. If it is near target, the Set-point Value (SV) should be set to the grain temperature (PV) displayed at the end of the batch cycle.

If grain temperature is failing to reach the Set-point Value during Digi-Trol control, this would normally indicate the grain has become wetter than when the Set-point was established, requiring additional drying time. The Moisture Controller will then "hold" in the drying mode until the grain temperature rises to the Set-point Value. This control feature only helps to protect against discharging wetter than desired grain and does not alter the dry time for AB operating mode, however. The risk of over-dried grain can be reduced by lowering the Dry Timer setting and relying on the Moisture Controller to "hold" the grain during normal operation.

See the "Digi-Trol Automatic Batch Operation Summary" chart for a summary of the operation procedure. Refer to Section 5, DRYER OPERATION, for further operation details.

## **OVERLOAD RELAYS**

**STANDARD EQUIPMENT** — The dryer is equipped with a complete set of current overload relays with heater ratings as shown by Tables 2-2 to 2-5. The safety control circuit of single phase units includes five current overload relays, plus a thermal overload protector in the fan motor winding. Three phase units have five current overload relays in the safety circuit.

**MANUAL RESET** — All current overload relays are manual reset, except for the automatic reset locked rotor overload and the thermal protector on single phase fan motors. If an electrical overload occurs, the control box must be opened to push the reset lever.

**LOAD ADJUSTMENT** — Current overload relays are adjustable from 85% to 115% of the rated current of the heater strip, by turning the knob (clockwise turning to 85%).

## **SHUT-DOWN INDICATOR LIGHTS**

**LIGHT OPERATION** — The shut-down indicator lights are connected within the 115 volt safety control circuit to identify the cause of unexpected dryer shut-down problems.

Due to the special circuitry of the shut-down indicators,

---

## **DIGI-TROL AUTOMATIC BATCH OPERATION SUMMARY**

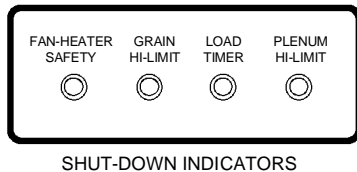
After initial start-up and Automatic Batch (AB) mode has been selected:

- A. Set Unload Limit on the Auto Two-Speed module.
  - B. Set the Electronic Moisture Control (MC) switch to the OFF position.
  - C. Set the Dry/Cool/Unload timers to recommended setting based on incoming moisture, desired moisture, and drying time tables.
  - D. When the Dry Timer times out, immediately observe the grain temperature (PV) on the Moisture Controller by momentarily switching the MC switch to the ON position, and then returning control back to the OFF position.
  - E. Measure the discharge grain moisture content during the next Unload cycle. Grain samples should be taken over a period of 5 minutes during the middle portion of the Unload cycle to get a good representative sample. (Avoid sampling immediately after the Unload cycle begins or just before the cycle ends.)
  - F. If discharged grain is at the desired moisture content, then the correct Set-point Value should be the grain temperature (PV) observed in step D above. If the grain moisture is too dry or too wet, then adjust the Dry/Cool/Unload timers and repeat steps D through F.
  - G. Turn the MC switch to the ON position.
  - H. Enter the appropriate Set-point Value into the Moisture Controller.
-

they will quickly verify power interruption problems and locate intermittent malfunctions within the various self-resetting type safety devices within the dryer. Once an indicator light is activated, it will continue to identify the cause of dryer shut-down until the dryer is manually restarted. This will apply even if a safety device which has interrupted the dryer circuit may have already reset itself.

Any time the circuit breakers are turned ON to energize the safety and control circuits, the Fan-Heater Safety indicator light should come ON and remain ON until the dryer has been started. Once the start button has been depressed and the dryer starts operating, the light should go out.

**NOTE:** The detector unit is designed so that if a malfunction occurs within the unit, such as a bad light or poor wiring connections, it will not prevent the dryer from operating, but will only cause abnormal action of the indicator lights.



## RESTARTING DRYER AFTER A SHUTDOWN

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

**NOTE:** On rare occasions, several dryer safety devices may act to interrupt the safety control circuit simultaneously. If this occurs, the LOWEST NUMBER INDICATOR LIGHT on the detector will always take priority, as the unit is constructed to indicate only one cause at a time.

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

For the most common shutdown causes, see Section 9, Troubleshooting.

Before the dryer is filled and placed into actual drying operation, thoroughly inspect the unit and check out the operation as described:

**1. Set controls and switches as follows:**

<u>CONTROL</u>	<u>TEST FIRING SETTING</u>
Mode Selector Switch	CONT. FLOW
Elec. Moisture Control (MC) Switch	OFF
Unload Switch	OFF
Fan Switch	OFF
Burner Switch	OFF
Loading Timer	30 Minutes
Metering Roll Setting	Adjust to Zero Position

**2. Inspect Metering Rolls and inside of Dryer.** Open all metering roll access doors and inspect each compartment for any bolts, nuts or other foreign hardware. Remove any material present to prevent possible jamming of the meter roll. Also check inside plenum chamber of dryer and remove all foreign material.

**3. Turn ON the main electrical power supply and set all circuit breakers in the PSC box to the ON position.**

**4. Open the main fuel supply valve to allow fuel flow to the dryer and inspect all gas lines and connections for possible leaks. ANY GAS LEAKS MUST BE CORRECTED.**

**NOTE:** On LP models, open shut-off valves SLOWLY to prevent accidental closing of excess flow valve within system. On natural gas models, step 5 must be performed before the main/safety valve can be manually opened.

**5. Depress the dryer START button.** The control circuit indicator light should immediately come ON, indicating that safety circuit and control circuit are energized to allow dryer operation.

**6. Check Conveyor Motors for proper direction of rotation.**

A. With the wet grain supply shut off, quickly bump (jog) the LOAD auger switch to the ON position. The top auger should rotate CLOCKWISE, as viewed from the drive end. Any wet grain auxiliary supply conveyors connected to the dryer power terminals should also start and rotate in the proper direction. Refer to NOTE in Item 8.

B. Quickly bump (jog) UNLOAD switch to AUTO position. The bottom auger drive motor should rotate COUNTERCLOCKWISE, as viewed from the drive end. Any dry grain auxiliary conveyors connected to dryer power terminals should also start and rotate in the proper direction.

**NOTE:** The meter roll drive motor will stop first, then after a short delay the auger will stop.

**7. Check Metering Roll operation.** With bottom auger still operating, turn the meter roll adjustment control and check metering roll drive mechanism for proper operation throughout the full speed range of operation. Make sure all drive chains are properly tensioned and that all sections of the meter rolls rotate properly.

**8. Check Fan Motor direction of rotation.** Bump (jog) fan switch and observe direction of motor rotation. The fan should turn COUNTERCLOCKWISE, as viewed from the fan inlet.

**NOTE:** On three phase model dryers, if all of the motors run backward, they can easily be reversed by interchanging ANY TWO of the three power supply connections to the dryer. Auxiliary conveyors which have been field connected may have to be reversed individually.

**9. Turn fan switch ON and observe the number of seconds required for the fan to reach FULL RPM.** (On dual-fan models, the second fan will start approximately 5 seconds after the first.) The fan should reach full speed within 7 seconds and motor running current should be within acceptable limits to the full load amperage listed in Tables 2-2 to 2-5.

**10. Burner Firing.** Turn burner switch to ON position. The burner should fire after a short purge interval and gas pressure should be indicated on pressure gauge.

Set the High Heat plenum thermostat on front plenum panel to approximately 200 deg. F, to cause burner to operate on Hi-Fire. Observe gas pressure indicated on pressure gauge, then turn thermostat down to its MINIMUM setting to cause burner to cycle into Lo-Fire. As the thermostat is turned down, the gas pressure gauge should show a noticeable drop in pressure, indicating the Hi-Fire gas solenoid valve has closed and the burner is being supplied with only the reduced flow of gas through the flow control valve.

**NOTE:** Gas pressures and thermostat settings cannot be finalized until dryer is filled with grain. For additional information concerning the actual recommended gas pressure settings and the adjustment procedures, refer to Table 2-1 and Section 3, OPERATING CONTROLS.

If heater fails to ignite within one to two minutes (due to gas being shut off or for any other reason), the safety lock-out within the burner control assembly will automatically shut down the entire dryer. If this condition occurs, wait several minutes for lock-out to cool before again restarting dryer and attempting to fire the burner.

On single phase models, the fan starting capacitors can be damaged by heat if the motor is started repeatedly. Allow capacitors to cool down before restarting motor.

**11. Check Burner Safety Lockout function.** With the fan-heater operating, shut off the main fuel supply valve. With the main gas shutoff valve closed, the burner control system's P/L safety circuit should force the dryer into a safety shutdown shortly after the flame extinguishes. If heater cannot be forced into safety lock-out condition, consult your local serviceman or the Factory Service Department. Do not attempt to place the dryer into actual operation until the problem has been located and corrected.

**12. Check Discharge Safety Shutoff operation.** Test the operation of the Discharge Safety Shutoff (DSS) by lifting the discharge box cover while the unload auger is running. If a dryer shutdown does not occur, check that all related components and wiring are in place and functioning properly.

### 13. Check Moisture Control.

- Start dryer control circuit and turn Unload Switch to AUTO, and set the Unload Rate to the 50% setting.
- Turn the Electronic Moisture Control Switch to ON and set the Moisture Controller Set-point Value equal to the current grain temperature (PV) displayed on the Moisture Controller.

The Out indicator on the Moisture Controller should pulse on and off. With the Set-point Value equal to the grain temperature display, the Out indicator should be on for approximately 5 seconds and off for 5 seconds. When the Out indicator is off, the meter-rolls should operate at approximately 2 times the Unload Rate setting. When the Out indicator is on, the meter-rolls should operate at two-thirds the Unload Rate setting.

- Adjust the Set-point Value on the Moisture Controller so that it is 20 degrees greater than the grain temperature display.

The Out indicator should remain ON for a period of time longer than the length of time than the indicator is OFF.

- Adjust the Set-point Value on the Moisture Controller so that it is 20 degrees less than the grain temperature display.

The Out indicator should remain OFF for a period of time longer than the length of time than the indicator is ON.

- Turn the Moisture Control Switch to the Off position and turn the Unload Switch to the Off position.

The meter-rolls should stop as soon as the Unload Switch is placed in the Off position. The Unload auger will continue to operate for a few seconds as set by the Unload Delay timer.

### 15. Check Digital Batch Timers.

Set the batch timers a listed:

Dry Timer:	4 minutes
Cool Timer:	1 minute
Unload Timer:	1 minute
Dual Temp Timer:	2 minutes

Start dryer control circuit, turn the Mode Switch to the AUTO BATCH position, set the Burner Switch to the AUTO position, and turn the Fan Switch to the On position. The Dry Timer and the Dual Temp timer should start operating. While the Dual Temp timer is operating, the Hi-Heat thermostat may be adjusted up and down to verify that the Hi-Heat thermostat is operating. After two minutes, the Dual Temp Timer will reach zero. The Lo-Heat thermostat may now be adjusted up and down to verify that the Lo-Heat thermostat is operating. While the Dual Temp Timer is timing, the Lo-Heat thermostat should not have any effect on the control of the burner. Once the Dual Temp Timer reaches zero, the Hi-Heat thermostat should not have any effect on the control of the burner.

When the Dry Timer reaches zero, the burner should stop and the Cool Timer should illuminate and start timing. When the Cool Timer reaches zero, the Unload Timer should NOT start. Turn the Unload Switch to the AUTO position. The Unload Timer should illuminate and start timing. When the Unload Timer reaches zero, all timers should reset to the set value, the Cool and Unload Timers back light should turn OFF, and the Burner should start operating.

Allow the timers to cycle several times to ensure proper operation. Turn the Fan Switch OFF, turn the Unload Switch OFF, and reset the timers by pressing the Reset button on each timer.

### 16. With dryer properly functioning, as described in previous steps, the unit may be considered ready for drying operation. Refer to operating instructions for procedure and control settings.

Shut off the circuit breakers, the main power supply, and fuel supply valves.

## FULL HEAT DRYING

**FULL HEAT OPERATION** — With this type of drying, the grain is discharged hot, with no cooling. Drying capacity is substantially higher with FULL HEAT than the DRY AND COOL process. Refer to FULL HEAT heading within either CONTINUOUS FLOW DRYING CHARTS or AUTOMATIC BATCH OPERATION CHART for additional information concerning dryer capacity and settings

**DRYERATION PROCESS** — The full heat process is called "Dryeration." The recommended procedure is to temper the hot grain for 4 to 10 hours in a cooling bin or storage bin, then cool by an aeration fan at an air flow rate of 1/2 to 1 CFM per bushel of grain in the hot batch being cooled. The process of tempering and slow cooling provides higher quality in shelled corn because of less stress cracking of kernels and less breakage during subsequent handling of the grain.

**FINAL MOISTURE** — From 1 to 3% moisture is usually removed in the cooling process, so hot shelled corn is removed from the dryer at about 17% moisture if the final desired moisture content is 15%.

## **DRYING TEMPERATURES** (Plenum Temp.)

**THERMOMETER** — The drying temperature is shown by the thermometer located on the front left-hand side of the dryer.

**SHELLED CORN** — For shelled corn with an initial moisture content of 25-30%, the recommended maximum drying temperature is 210-220 degrees F. For lower initial moisture content, lower drying temperatures are recommended.

**SMALL GRAIN** — For small grain (wheat, oats, milo), 155 degrees F is the suggested drying temperature, with 175 degrees F maximum.

**RICE, SOYBEANS** — Drying temperatures are critical in drying rice and soybeans. A temperature of 130 degrees F is recommended to keep grain temperature low.

**DRYING EFFICIENCY** — The general rule for obtaining highest drying efficiency is to use the highest possible drying temperatures which will not adversely affect grain quality.

## **FINAL MOISTURE CONTENT**

It is necessary to frequently check the moisture content of discharge grain while the final adjustment setting(s) is (are) being established (meter roll setting for CF mode, or Dry Timer setting for Batch mode), and moisture should subsequently be checked periodically to indicate the need of any change in the setting. Such a change will be necessary if there is an appreciable change in average initial moisture content.

## **DRYER SHUT-DOWN**

**COOLING HOT GRAIN** — If the dryer is to be shut down while filled with grain, it is recommended that hot grain be fan-cooled for 10 to 15 minutes, especially in cold weather, to prevent water vapor condensation and possible freezing of such condensate following shut down.

**FUEL-BURN OUT** — When a vaporizer equipped burner is to be shut down for several hours or more, it is recommended that pressure be relieved on the vaporizer and supply lines by first closing the valve at the supply tank, then letting the burner operate until flame stops from lack of fuel; immediately turn burner OFF. After the burner is OFF, close all other valves in the fuel supply piping.

**SHUT-DOWN** — To stop the dryer, push control circuit STOP button, move all circuit breakers OFF, turn main power supply OFF, and CLOSE all valves in the fuel supply lines to the dryer.

## **CONTINUOUS-FLOW OPERATING INSTRUCTIONS**

The following is an outline of the continuous-flow drying instructions.  
Continuous-flow drying charts appear later in this section.

## BATCH DRYING OPERATING

---

### CONTINUOUS FLOW START-UP PROCEDURE

Test operate the dryer immediately prior to start-up to make certain all motors and controls are functional before loading the dryer with wet grain.

**Set Controls** 1. Set Controls as follows:

- A. Set Mode Switch to CONTINUOUS FLOW.
- B. Set High Heat plenum thermostat on the Dual Temp control assembly to the drying temperature recommended for normal operation (for example, 210 deg. F for shelled corn).
- C. Set the Electronic Moisture Control (MC) switch OFF.
- D. Temporarily set Load Timer at 30 min.
- E. Set Unload Switch OFF.
- F. Set Fan Switch OFF; set Burner Switch OFF.
- G. Turn ON Unload Circuit Breaker.

---

**Load Dryer** 2. Depress dryer START button; Control Circuit indicator light should come ON.  
3. Turn load circuit breaker switch ON; fill the dryer.

---

**Determining Drying Time** 4. For start-up purposes, the following procedure is necessary to determine approximate total drying time for the type of grain and moisture reduction needed. See Continuous Flow drying charts in this section of the manual for Meter Roll % setting and max Unload Rate (100%) for your model dryer. The time formula is then:

$$\frac{\text{Model No.}}{\text{Max Unload} \times \% \text{ Setting (decimal)}} \times 60 = \text{Minutes in Dryer}$$

Example: With shelled corn at 25% initial moisture content, using DRYERATION in a CF/AB-190 Dryer, Fig. 5-1 shows the max unload rate is 650 Bu/Hr and the % setting is 33%. With this data, the approximate total drying time is:

$$\frac{190 \times 60}{650 \times .33} = 53 \text{ minutes}$$

---

**Start-up Cycle** 5. Turn FAN Circuit Breaker ON and set FAN switch and BURNER switch ON. Check and readjust gas pressure as required, then operate dryer for approximately 1/2 the total drying time, as established in Step 4.

---

6. At the end of the start-up cycle, turn UNLOAD SWITCH to AUTO and set METER ROLL % as indicated by appropriate Continuous Flow drying charts in this section of the manual.

**Normal Continuous Operation**

**NOTE:** The time required for grain to pass completely through dryer is the time necessary to notice a stabilized change in final moisture content after adjustment. During start-up, some variation will naturally occur. The first half of grain discharged from the dryer will be slightly underdried, while the next half discharged will be slightly overdried.

7. Check the final moisture content and readjust the meter roll Unload Rate slightly, if required.

8. Set the Digi-Trol's grain temperature Setpoint and Top Auger Timer as described in Section 3 of this manual.

---



## INSTRUCTIONS

Refer to the appropriate AUTOMATIC BATCH OPERATION CHART and find the suggested Dry Timer setting, depending upon the type of grain, initial moisture content and drying method (DRY AND COOL, or FULL HEAT).

**NOTE:** Drying method may be changed from DRY AND COOL to FULL HEAT by rotating the COOL TIMER dial fully counterclockwise to "0" and setting the BURNER SWITCH to "ON."

The **DRY TIMER** (on the ASC panel) sets the drying cycle. When set to the recommended setting, it allows the burner to operate for this predetermined time at the temperatures set by the High Heat and Low Heat thermostats on the Dual Temp control assembly.

The **DUAL TEMP TIMER** is located behind the dead front inside the ASC control box and is labelled "4TR - Dual Temp Timer." In the wiring diagrams it is labelled 4TR and Hi-Lo Timer. This timer determines the portion of the total Dry Timer setting dedicated to high heat. The balance of the drying cycle is controlled by the Low Heat plenum thermostat setting. As a general rule, the Dual Temp timer should be set to approximately 2/3 the Dry Timer setting.

The **COOL TIMER** is adjustable for either full cooling or any degree of partial cooling. At the completion of the cooling cycle, the unload cycle will start. As discussed in Section 3, Operating Controls, Full Heat drying requires a slight cooling time of at least a few seconds. Zero cooling time results in improper drying operation.

The **UNLOAD TIMER** is set to the time it takes to unload one full content of the dryer. During this unload cycle, wet grain is being added, thus eliminating the down time to load, as is required in typical batch dryers. Also the fan continues to run, permitting cooling to continue during unloading. For Batch drying, the meter rolls should be adjusted to provide maximum (100%) discharge rate. If the take-away equipment cannot handle the 100% discharge rate, then the Unload timer setting will need to be increased accordingly. A handy formula for calculating the adjusted Unload time is as follows:

### Unload Timer Adjustment Formula

$$\frac{\text{Unload Time} \times 100}{\% \text{ Unload Rate (no decimal used)}} = \text{Adjusted Setting}$$

At the completion of the unloading cycle, the time delay relay will allow a 10-second delay, and will then automatically reset all three timers to their initial settings and a new drying cycle will begin.

**MOISTURE CHECK:** Check the final grain moisture during unloading. The discharged grain should be near the desired moisture level right up to the completion of the unload cycle. To make a quick check at the end of the cycle, immediately change the Unload Auger switch setting to "AUTO" and change the Mode selector setting to "CONT FLOW" to briefly continue dryer unloading. The desired Unload timer setting will allow a few additional bushels of

dry grain to be discharged (15 to 30 seconds of unloading) before wet grain is observed. Make the necessary Unload timer adjustments and return the Mode selector and Unload Auger switch to their previous positions.

See AUTOMATIC BATCH START-UP PROCEDURE ahead for start-up instructions.

---

## AUTOMATIC BATCH START-UP PROCEDURE

Test operate the dryer immediately prior to start-up to make certain all motors and controls are functional before loading the dryer with wet grain.

---

### **Set Controls**

1. Set Controls as follows:
    - A. Set Mode switch to AUTO BATCH.
    - B. Set Hi-Heat and Lo-Heat plenum thermostats.
    - C. Set the Electronic Moisture Control (MC) switch OFF.
    - D. Temporarily set Load Timer at 30 min.
    - E. Set Unload Auger switch OFF.
    - F. Set Fan switch OFF; set Burner switch OFF.
    - G. Turn all circuit breakers ON.
- 

### **Load Dryer**

2. Depress dryer START button; The Control Circuit "On" light should illuminate and the load auger should start.
- 

### **Set Timers**

3. Measure wet grain moisture.
  4. Set timers using drying charts:
    - A. Set Dry timer to minutes shown in the appropriate chart.
    - B. Set the Hi-Heat timer to 2/3 of Dry timer.
    - C. Set Cool timer per drying time chart for dry/cool. Set to 0 minutes for full heat.
    - D. Set Unload timer based on chart for 100% discharge. Use the Unload Time Adjustment formula in this section to calculate other discharge rates.
- 

### **Start Batch**

5. Set switches as follows:
    - A. Burner switch to AUTO for dry/cool or ON for full heat operation.
    - B. Set Unload switch to AUTO, and set % Unload Rate.
    - C. Reset counter as desired.
    - D. Set Fan switch to ON (batch will begin).
  6. Adjust Hi-Lo firing valves to the pressure ranges listed in Table 2-1.
- 

### **Unload First Batch**

7. Observe Moisture Controller temperature near end of drying time by temporarily turning Moisture Controller switch ON.
  8. As grain unloads, observe top auger refill time and adjust top auger timer as described in Section 3.
  9. As grain unloads, check moisture and record average final moisture. Observe moisture toward end of Unload cycle as described under the MOISTURE CHECK heading on the preceding page.
- 

### **Moisture Control and Adjustments**

10. Make adjustments to heating and unload times as required.
  11. Set the Digi-Trol's grain temperature Setpoint as described in Section 3.
-

## DRYING TABLES — CF/AB-150

### CORN...Dry & Cool (automatic batch)

MOISTURE %In %out		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	15	21	0.35	9	174	18	0.31	9	184				
18	15	28	0.47	9	154	25	0.41	9	164				
19	15	34	0.57	9	139	30	0.50	9	149	27	0.45	9	158
20	15	40	0.67	9	128	35	0.59	9	137	31	0.52	9	146
21	15	47	0.78	9	118	41	0.68	9	127	36	0.60	9	136
22	15	53	0.88	9	109	46	0.77	9	118	41	0.69	9	126
23	15	60	0.99	9	101	52	0.87	9	110	46	0.77	9	118
24	15	67	1.11	9	93	58	0.97	9	102	52	0.87	9	110
25	15	75	1.24	9	87	65	1.09	9	95	58	0.97	9	103
26	15	83	1.39	9	80	73	1.21	9	88	65	1.08	9	95
27	15	93	1.54	9	74	81	1.35	9	82	72	1.20	9	89
28	15	103	1.71	9	68	90	1.50	9	76	80	1.33	9	82
29	15	114	1.90	9	63	100	1.66	9	70	89	1.48	9	76
30	15	126	2.09	9	58	110	1.83	9	65	98	1.63	9	71
32	15	151	2.51	9	50	132	2.20	9	56	117	1.96	9	62
35	15	191	3.18	9	41	167	2.78	9	46	149	2.48	9	51

### CORN...Full Heat (automatic batch)

MOISTURE %In %out		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	17												
18	17	2	0.04	0	361								
19	17	8	0.14	0	294	4	0.07	0	335	1	0.02	0	377
20	17	14	0.23	0	250	9	0.15	0	286	6	0.09	0	321
21	17	19	0.32	0	218	14	0.23	0	249	10	0.16	0	280
22	17	25	0.41	0	193	19	0.31	0	220	14	0.24	0	248
23	17	31	0.51	0	171	24	0.40	0	196	19	0.31	0	220
24	17	37	0.62	0	153	30	0.49	0	175	24	0.40	0	196
25	17	44	0.74	0	137	36	0.60	0	156	29	0.49	0	176
26	17	52	0.87	0	122	43	0.71	0	140	35	0.59	0	157
27	17	61	1.01	0	110	50	0.84	0	125	42	0.70	0	141
28	17	70	1.17	0	98	59	0.98	0	112	50	0.83	0	127
29	17	81	1.34	0	89	68	1.13	0	101	58	0.96	0	114
30	17	91	1.52	0	80	77	1.29	0	92	66	1.10	0	103
32	17	114	1.91	0	67	97	1.62	0	76	84	1.40	0	86
35	17	149	2.49	0	53	128	2.13	0	61	111	1.85	0	69

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%

Drying table based on 100% meter roll speed of **400 bph**  
 unload timer set for **23.0 minutes**  
 cool timer set to **2 sec** in Full heat mode.

CFAB1.TIF  
150

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

## DRYING TABLES — CF/AB-150

### CORN...Full Heat (Continuous flow)

MOISTURE %In %out*		190 °F			210 °F			230 °F		
		Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph
18	17	90	25	361						
19	17	73	31	294	84	27	335	94	24	377
20	17	62	37	250	71	32	286	80	29	321
21	17	55	42	218	62	37	249	70	33	280
22	17	48	48	193	55	42	220	62	37	248
23	17	43	54	171	49	47	196	55	42	220
24	17	38	60	153	44	53	175	49	47	196
25	17	34	67	137	39	59	156	44	52	176
26	17	31	75	122	35	66	140	39	58	157
27	17	27	84	110	31	73	125	35	65	141
28	17	25	93	98	28	82	112	32	73	127
29	17	22	104	89	25	91	101	29	81	114
30	17	20	114	80	23	100	92	26	89	103
32	17	17	137	67	19	120	76	21	107	86
35	17	13	172	53	15	151	61	17	134	69

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%  
Drying table based on 100% meter roll speed of **400 bph**

### WHEAT, BARLEY, MILO...Dry & Cool (automatic batch)

MOISTURE %In %out		140 °F				155 °F				175 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15	13	28	0.47	9	154	24	0.40	9	165	20	0.34	9	177
16	13	37	0.62	9	133	32	0.53	9	144	27	0.45	9	157
17	13	46	0.77	9	119	39	0.66	9	130	33	0.55	9	142
18	13	54	0.90	9	107	46	0.77	9	118	39	0.65	9	130
19	13	62	1.04	9	98	53	0.89	9	108	45	0.75	9	120
20	13	71	1.18	9	90	61	1.01	9	100	51	0.85	9	112
21	13	80	1.33	9	83	68	1.14	9	92	57	0.95	9	103
22	13	89	1.49	9	76	76	1.27	9	85	64	1.07	9	96
23	13	100	1.66	9	70	85	1.42	9	79	72	1.20	9	89

### SOYBEANS...Dry & Cool (automatic batch)

MOISTURE %In %out		120 °F				130 °F				140 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15	13	28	0.46	9	155	24	0.40	9	165	22	0.36	9	173
16	13	37	0.61	9	135	32	0.53	9	144	29	0.48	9	153
17	13	45	0.75	9	120	39	0.66	9	130	35	0.58	9	138
18	13	53	0.88	9	109	46	0.77	9	118	41	0.69	9	126
19	13	61	1.02	9	99	53	0.89	9	108	47	0.79	9	116
20	13	69	1.15	9	91	61	1.01	9	100	54	0.90	9	108
21	13	78	1.30	9	84	68	1.14	9	92	61	1.01	9	100
22	13	87	1.46	9	77	76	1.27	9	85	68	1.13	9	92
23	13	98	1.63	9	71	85	1.42	9	79	76	1.27	9	85

Drying table based on 100% meter roll speed of **400 bph**  
 unload timer set for **23.0 minutes**  
 cool timer set to **2 sec** in Full heat mode.

CFAB2.TIF  
150

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

## DRYING TABLES — CF/AB-190

### CORN...Dry & Cool (automatic batch)

MOISTURE %in %out		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	15	20	0.33	11	235								
18	15	26	0.44	11	207	23	0.39	11	221				
19	15	32	0.54	11	187	28	0.47	11	200	25	0.42	11	212
20	15	38	0.64	11	171	33	0.56	11	184	30	0.49	11	196
21	15	44	0.73	11	158	38	0.64	11	171	34	0.57	11	182
22	15	50	0.83	11	146	44	0.73	11	158	39	0.65	11	170
23	15	56	0.93	11	135	49	0.82	11	147	44	0.73	11	158
24	15	63	1.05	11	125	55	0.92	11	137	49	0.82	11	147
25	15	70	1.17	11	116	62	1.03	11	127	55	0.91	11	137
26	15	78	1.31	11	107	69	1.14	11	118	61	1.02	11	128
27	15	87	1.46	11	99	76	1.27	11	109	68	1.13	11	118
28	15	97	1.62	11	91	85	1.41	11	101	75	1.26	11	110
29	15	107	1.79	11	84	94	1.56	11	93	83	1.39	11	102
30	15	118	1.97	11	78	104	1.73	11	87	92	1.53	11	95
32	15	142	2.37	11	67	124	2.07	11	75	111	1.84	11	82
35	15	180	3.00	11	55	157	2.62	11	62	140	2.33	11	68

### CORN...Full Heat (automatic batch)

MOISTURE %in %out*		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	17	0	0.00	0	643								
18	17	6	0.11	0	478	3	0.06	0	546	1	0.02	0	615
19	17	12	0.20	0	389	8	0.14	0	444	5	0.09	0	500
20	17	17	0.28	0	331	13	0.21	0	378	9	0.15	0	426
21	17	22	0.37	0	289	17	0.28	0	330	13	0.22	0	371
22	17	27	0.45	0	255	22	0.36	0	292	17	0.29	0	328
23	17	33	0.55	0	227	27	0.44	0	259	22	0.36	0	292
24	17	39	0.65	0	202	32	0.53	0	231	26	0.44	0	260
25	17	46	0.76	0	181	38	0.63	0	207	32	0.53	0	233
26	17	53	0.89	0	162	44	0.74	0	185	37	0.62	0	208
27	17	61	1.02	0	145	51	0.86	0	166	44	0.73	0	187
28	17	70	1.17	0	130	59	0.99	0	149	51	0.85	0	168
29	17	80	1.33	0	118	68	1.13	0	134	58	0.97	0	151
30	17	90	1.50	0	106	77	1.28	0	122	66	1.10	0	137
32	17	112	1.86	0	89	96	1.59	0	101	83	1.38	0	114
35	17	145	2.41	0	71	124	2.07	0	81	109	1.81	0	91

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%

Drying table based on 100% meter roll speed of **650 bph**

unload timer set for **17.6 minutes**

cool timer set to **2 sec** in Full heat mode.

CFAB3.TIF  
190

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

## DRYING TABLES — CF/AB-190

### CORN...Full Heat (Continuous flow)

MOISTURE %In %out*		190 °F			210 °F			230 °F		
		Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph
18	17	74	24	478	84	21	546	95	19	615
19	17	60	29	389	68	26	444	77	23	500
20	17	51	35	331	58	30	378	66	27	426
21	17	44	40	289	51	35	330	57	31	371
22	17	39	45	255	45	39	292	50	35	328
23	17	35	50	227	40	44	259	45	39	292
24	17	31	57	202	36	50	231	40	44	260
25	17	28	63	181	32	55	207	36	49	233
26	17	25	71	162	28	62	185	32	55	208
27	17	22	79	145	26	69	166	29	61	187
28	17	20	88	130	23	77	149	26	68	168
29	17	18	98	118	21	85	134	23	76	151
30	17	16	108	106	19	94	122	21	84	137
32	17	14	129	89	16	113	101	18	101	114
35	17	11	162	71	12	142	81	14	126	91

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%  
Drying table based on 100% meter roll speed of **650 bph**

### WHEAT, BARLEY, MILO...Dry & Cool (automatic batch)

MOISTURE %In %out		140 °F				155 °F				175 °F			
		DRYTIME min.	COOL hrs	min.	Capacity Dry Bph	DRYTIME min.	COOL hrs	min.	Capacity Dry Bph	DRYTIME min.	COOL hrs	min.	Capacity Dry Bph
15	13	28	0.47	11	201	24	0.40	11	216	20	0.34	11	233
16	13	37	0.62	11	173	32	0.53	11	188	27	0.45	11	205
17	13	46	0.77	11	153	39	0.66	11	168	33	0.55	11	185
18	13	54	0.90	11	138	46	0.77	11	152	39	0.65	11	169
19	13	62	1.04	11	126	53	0.89	11	140	45	0.75	11	156
20	13	71	1.18	11	115	61	1.01	11	128	51	0.85	11	144
21	13	80	1.33	11	106	68	1.14	11	118	57	0.95	11	133
22	13	89	1.49	11	97	76	1.27	11	109	64	1.07	11	123
23	13	100	1.66	11	89	85	1.42	11	100	72	1.20	11	114

### SOYBEANS...Dry & Cool (automatic batch)

MOISTURE %In %out		120 °F				130 °F				140 °F			
		DRYTIME min.	COOL hrs	min.	Capacity Dry Bph	DRYTIME min.	COOL hrs	min.	Capacity Dry Bph	DRYTIME min.	COOL hrs	min.	Capacity Dry Bph
15	13	28	0.46	11	203	24	0.40	11	216	22	0.36	11	228
16	13	37	0.61	11	175	32	0.53	11	188	29	0.48	11	200
17	13	45	0.75	11	155	39	0.66	11	168	35	0.58	11	180
18	13	53	0.88	11	140	46	0.77	11	152	41	0.69	11	164
19	13	61	1.02	11	128	53	0.89	11	140	47	0.79	11	150
20	13	69	1.15	11	117	61	1.01	11	128	54	0.90	11	139
21	13	78	1.30	11	107	68	1.14	11	118	61	1.01	11	128
22	13	87	1.46	11	99	76	1.27	11	109	68	1.13	11	118
23	13	98	1.63	11	91	85	1.42	11	100	76	1.27	11	109

Drying table based on 100% meter roll speed of **650 bph**  
unload timer set for **17.6 minutes**  
cool timer set to **2 sec** in Full heat mode.

CFAB4.TIF  
190

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

## DRYING TABLES — CF/AB-270

CORN...Dry & Cool (automatic batch)													
MOISTURE %In %out		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	15	20	0.34	10	308								
18	15	27	0.45	10	272	23	0.39	10	289				
19	15	33	0.55	10	246	29	0.48	10	263	25	0.42	10	278
20	15	39	0.64	10	225	34	0.56	10	242	30	0.50	10	257
21	15	44	0.74	10	208	39	0.65	10	224	35	0.58	10	239
22	15	50	0.84	10	192	44	0.73	10	209	39	0.65	10	223
23	15	57	0.95	10	178	50	0.83	10	194	44	0.74	10	208
24	15	64	1.06	10	165	56	0.93	10	180	49	0.82	10	194
25	15	71	1.19	10	153	62	1.04	10	167	55	0.92	10	181
26	15	79	1.32	10	141	69	1.16	10	155	62	1.03	10	168
27	15	88	1.47	10	130	77	1.29	10	144	69	1.14	10	156
28	15	98	1.63	10	121	86	1.43	10	133	76	1.27	10	145
29	15	109	1.81	10	111	95	1.58	10	124	84	1.41	10	135
30	15	120	1.99	10	103	105	1.75	10	115	93	1.55	10	125
32	15	144	2.40	10	89	126	2.10	10	99	112	1.86	10	109
35	15	182	3.03	10	73	159	2.65	10	82	142	2.36	10	90

CORN...Full Heat (automatic batch)													
MOISTURE %In %out*		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	17	-2	-0.03	0	856								
18	17	4	0.07	0	636	1	0.02	0	727				
19	17	10	0.17	0	517	6	0.11	0	591	3	0.06	0	665
20	17	15	0.25	0	441	11	0.18	0	503	7	0.12	0	566
21	17	20	0.34	0	384	15	0.26	0	439	11	0.19	0	494
22	17	26	0.43	0	340	20	0.33	0	388	16	0.26	0	437
23	17	31	0.52	0	302	25	0.42	0	345	20	0.33	0	388
24	17	37	0.62	0	269	30	0.51	0	308	25	0.41	0	346
25	17	44	0.74	0	241	36	0.60	0	275	30	0.50	0	310
26	17	52	0.86	0	215	43	0.71	0	246	36	0.60	0	277
27	17	60	1.00	0	193	50	0.84	0	221	42	0.71	0	248
28	17	69	1.15	0	173	58	0.97	0	198	49	0.82	0	223
29	17	79	1.31	0	156	67	1.11	0	179	57	0.95	0	201
30	17	89	1.49	0	141	76	1.26	0	162	65	1.08	0	182
32	17	111	1.85	0	118	95	1.58	0	135	82	1.37	0	151
35	17	144	2.40	0	94	124	2.06	0	107	108	1.80	0	121

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%

Drying table based on 100% meter roll speed of **780 bph**  
 CFAB5.TIF unload timer set for **19.8 minutes**  
 270 cool timer set to **2 sec** in Full heat mode.

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

## DRYING TABLES — CF/AB-270

### CORN...Full Heat (Continuous flow)

MOISTURE %in %out*	190 °F			210 °F			230 °F		
	Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph
18 17	82	24	636	93	21	727			
19 17	66	30	517	76	26	591	85	23	665
20 17	56	35	441	65	31	503	73	27	566
21 17	49	40	384	56	35	439	63	31	494
22 17	44	45	340	50	40	388	56	35	437
23 17	39	51	302	44	45	345	50	40	388
24 17	35	57	269	39	50	308	44	45	346
25 17	31	64	241	35	56	275	40	50	310
26 17	28	72	215	32	63	246	36	56	277
27 17	25	80	193	28	70	221	32	62	248
28 17	22	89	173	25	78	198	29	69	223
29 17	20	99	156	23	86	179	26	77	201
30 17	18	109	141	21	95	162	23	85	182
32 17	15	131	118	17	115	135	19	102	151
35 17	12	164	94	14	144	107	15	128	121

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%

Drying table based on 100% meter roll speed of **780 bph**

### WHEAT, BARLEY, MILO...Dry & Cool (automatic batch)

MOISTURE %in %out	140 °F				155 °F				175 °F			
	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15 13	28	0.47	10	265	24	0.40	10	285	20	0.34	10	307
16 13	37	0.62	10	229	32	0.53	10	249	27	0.45	10	271
17 13	46	0.77	10	203	39	0.66	10	223	33	0.55	10	245
18 13	54	0.90	10	184	46	0.77	10	202	39	0.65	10	224
19 13	62	1.04	10	167	53	0.89	10	185	45	0.75	10	207
20 13	71	1.18	10	153	61	1.01	10	171	51	0.85	10	191
21 13	80	1.33	10	141	68	1.14	10	157	57	0.95	10	177
22 13	89	1.49	10	130	76	1.27	10	145	64	1.07	10	164
23 13	100	1.66	10	119	85	1.42	10	134	72	1.20	10	152

### SOYBEANS...Dry & Cool (automatic batch)

MOISTURE %in %out	120 °F				130 °F				140 °F			
	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15 13	28	0.46	10	268	24	0.40	10	285	22	0.36	10	300
16 13	37	0.61	10	232	32	0.53	10	249	29	0.48	10	264
17 13	45	0.75	10	206	39	0.66	10	223	35	0.58	10	238
18 13	53	0.88	10	186	46	0.77	10	202	41	0.69	10	217
19 13	61	1.02	10	170	53	0.89	10	185	47	0.79	10	200
20 13	69	1.15	10	156	61	1.01	10	171	54	0.90	10	184
21 13	78	1.30	10	143	68	1.14	10	157	61	1.01	10	170
22 13	87	1.46	10	132	76	1.27	10	145	68	1.13	10	158
23 13	98	1.63	10	121	85	1.42	10	134	76	1.27	10	146

Drying table based on 100% meter roll speed of **780 bph**

unload timer set for **19.8 minutes**

cool timer set to **2 sec** in Full heat mode.

CFAB6  
270

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



## DRYING TABLES — CF/AB-320

CORN...Dry & Cool (automatic batch)													
MOISTURE %In %out		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	15	19	0.32	12	382								
18	15	26	0.43	12	337	22	0.37	12	359				
19	15	31	0.52	12	304	27	0.46	12	326	24	0.41	12	345
20	15	37	0.62	12	278	32	0.54	12	299	29	0.48	12	318
21	15	42	0.71	12	256	37	0.62	12	277	33	0.55	12	296
22	15	48	0.80	12	237	42	0.70	12	257	37	0.62	12	276
23	15	54	0.90	12	219	48	0.79	12	239	42	0.70	12	257
24	15	61	1.01	12	203	53	0.89	12	222	47	0.79	12	239
25	15	68	1.13	12	188	60	0.99	12	206	53	0.88	12	223
26	15	76	1.27	12	173	66	1.11	12	191	59	0.98	12	207
27	15	85	1.41	12	160	74	1.23	12	177	66	1.10	12	192
28	15	94	1.56	12	148	82	1.37	12	164	73	1.22	12	179
29	15	104	1.73	12	137	91	1.51	12	152	81	1.35	12	166
30	15	115	1.91	12	126	100	1.67	12	141	89	1.48	12	154
32	15	138	2.29	12	109	120	2.01	12	121	107	1.78	12	133
35	15	174	2.90	12	89	152	2.54	12	100	135	2.26	12	110

CORN...Full Heat (automatic batch)													
MOISTURE %In %out*		190 °F				210 °F				230 °F			
		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
17	17	2	0.03	0	1044								
18	17	8	0.13	0	776	5	0.08	0	887				
19	17	13	0.21	0	631	9	0.16	0	721	7	0.11	0	811
20	17	18	0.30	0	537	14	0.23	0	614	10	0.17	0	691
21	17	23	0.38	0	469	18	0.30	0	536	14	0.24	0	603
22	17	28	0.46	0	414	22	0.37	0	473	18	0.30	0	533
23	17	33	0.55	0	368	27	0.45	0	421	22	0.37	0	474
24	17	39	0.65	0	329	32	0.54	0	376	27	0.45	0	422
25	17	46	0.76	0	294	38	0.63	0	336	32	0.53	0	378
26	17	53	0.88	0	263	44	0.74	0	300	38	0.63	0	338
27	17	61	1.01	0	236	51	0.85	0	269	44	0.73	0	303
28	17	69	1.16	0	212	59	0.98	0	242	51	0.84	0	272
29	17	79	1.31	0	191	67	1.12	0	218	58	0.96	0	245
30	17	89	1.48	0	173	76	1.26	0	197	65	1.09	0	222
32	17	110	1.83	0	144	94	1.57	0	164	82	1.36	0	185
35	17	141	2.36	0	115	122	2.03	0	131	106	1.77	0	147

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%

Drying table based on 100% meter roll speed of **1150 bph**

unload timer set for **15.7 minutes**

cool timer set to **2 sec** in Full heat mode.

CFAB7.TIF  
320

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

## DRYING TABLES — CF/AB-320

### CORN...Full Heat (Continuous flow)

		190 °F			210 °F			230 °F		
MOISTURE %In %out*		Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph	Unload %Rate	Dry Time	Dry Bph
18	17	67	23	776	77	20	887			
19	17	55	29	631	63	25	721	71	22	811
20	17	47	33	537	53	29	614	60	26	691
21	17	41	38	469	47	34	536	52	30	603
22	17	36	43	414	41	38	473	46	34	533
23	17	32	49	368	37	43	421	41	38	474
24	17	29	55	329	33	48	376	37	43	422
25	17	26	61	294	29	54	336	33	48	378
26	17	23	69	263	26	60	300	29	53	338
27	17	20	76	236	23	67	269	26	59	303
28	17	18	85	212	21	74	242	24	66	272
29	17	17	94	191	19	83	218	21	73	245
30	17	15	104	173	17	91	197	19	81	222
32	17	12	125	144	14	110	164	16	97	185
35	17	10	157	115	11	137	131	13	122	147

\*represents the target moisture out of the dryer. Expected final moisture in the bin is 15.0%  
Drying table based on 100% meter roll speed of **1150 bph**

### WHEAT, BARLEY, MILO...Dry & Cool (automatic batch)

		140 °F				155 °F				175 °F			
MOISTURE %In %out		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15	13	28	0.47	12	321	24	0.40	12	346	20	0.34	12	374
16	13	37	0.62	12	276	32	0.53	12	300	27	0.45	12	329
17	13	46	0.77	12	244	39	0.66	12	268	33	0.55	12	296
18	13	54	0.90	12	220	46	0.77	12	243	39	0.65	12	270
19	13	62	1.04	12	200	53	0.89	12	222	45	0.75	12	248
20	13	71	1.18	12	183	61	1.01	12	204	51	0.85	12	229
21	13	80	1.33	12	168	68	1.14	12	188	57	0.95	12	212
22	13	89	1.49	12	154	76	1.27	12	173	64	1.07	12	196
23	13	100	1.66	12	141	85	1.42	12	159	72	1.20	12	181

### SOYBEANS...Dry & Cool (automatic batch)

		120 °F				130 °F				140 °F			
MOISTURE %In %out		DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity	DRYTIME		COOL	Capacity
		min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph	min.	hrs	min.	Dry Bph
15	13	28	0.46	12	324	24	0.40	12	346	22	0.36	12	365
16	13	37	0.61	12	279	32	0.53	12	300	29	0.48	12	319
17	13	45	0.75	12	247	39	0.66	12	268	35	0.58	12	287
18	13	53	0.88	12	223	46	0.77	12	243	41	0.69	12	261
19	13	61	1.02	12	203	53	0.89	12	222	47	0.79	12	239
20	13	69	1.15	12	186	61	1.01	12	204	54	0.90	12	221
21	13	78	1.30	12	170	68	1.14	12	188	61	1.01	12	204
22	13	87	1.46	12	156	76	1.27	12	173	68	1.13	12	188
23	13	98	1.63	12	143	85	1.42	12	159	76	1.27	12	173

Drying table based on 100% meter roll speed of **1150 bph**  
unload timer set for **15.7 minutes**  
cool timer set to **2 sec** in Full heat mode.

CFAB8.TIF  
320

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

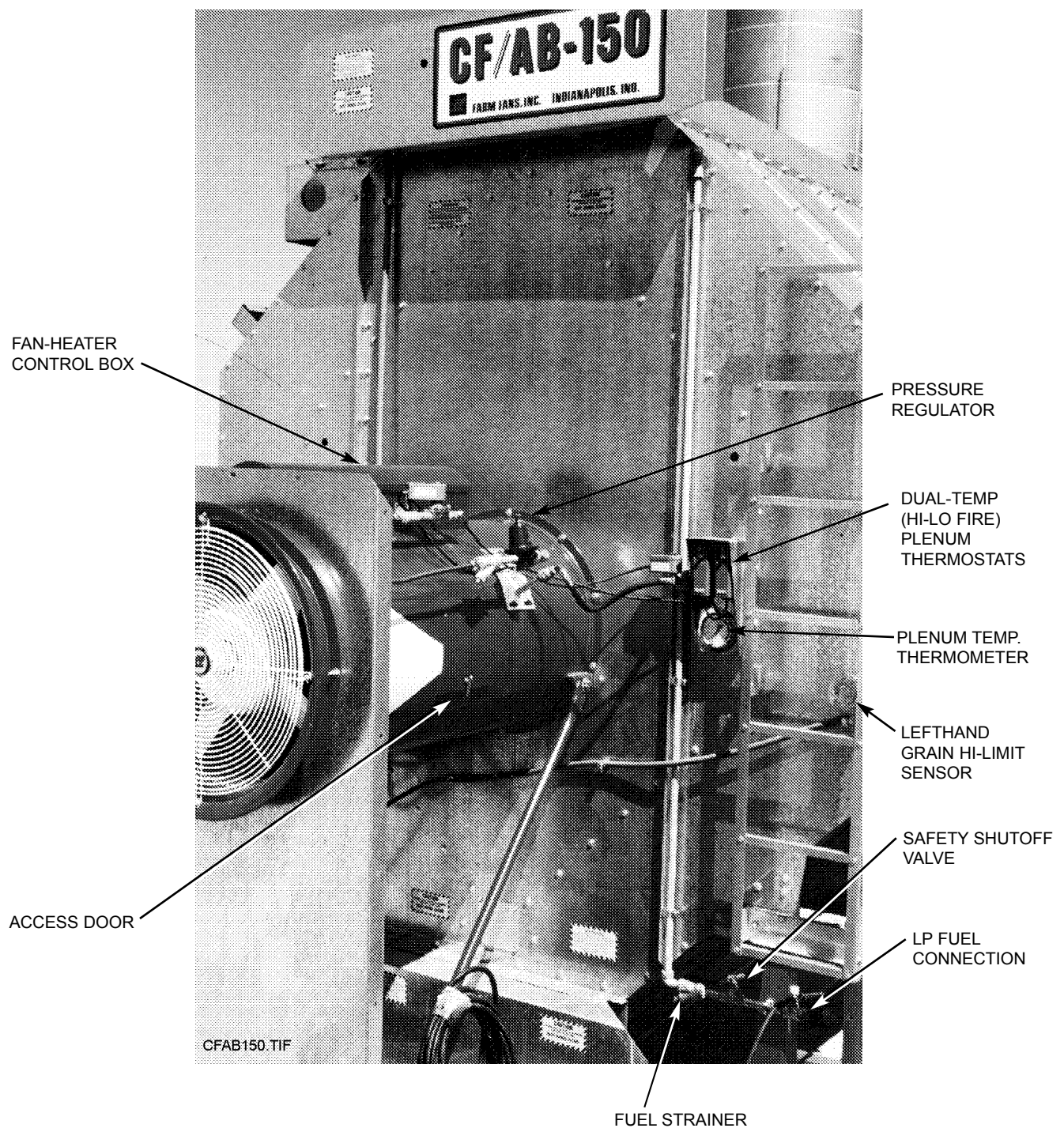


Fig. 6-1 CF/AB-150 LP model

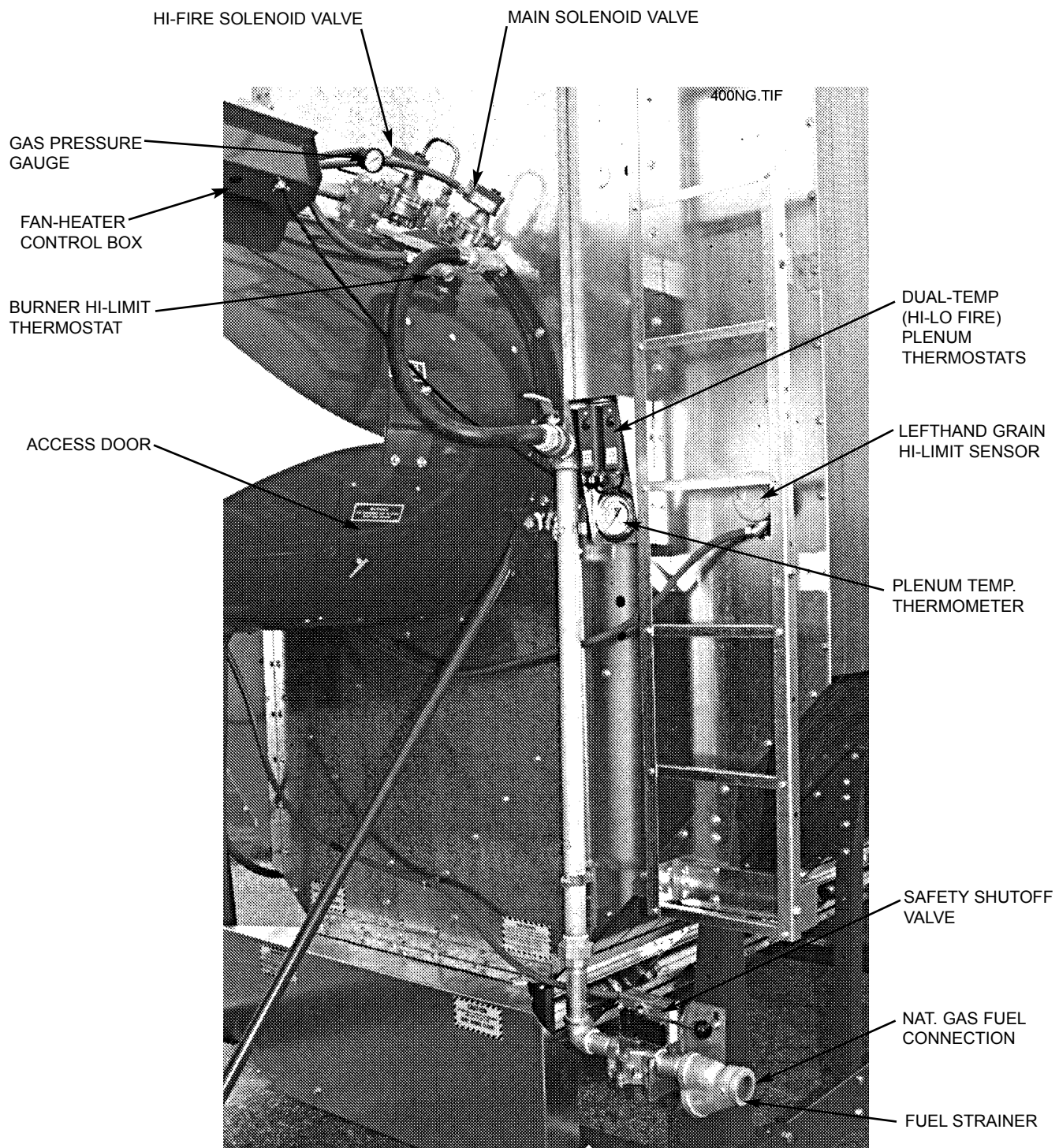


Fig. 6-2 CF/AB-320 natural gas model

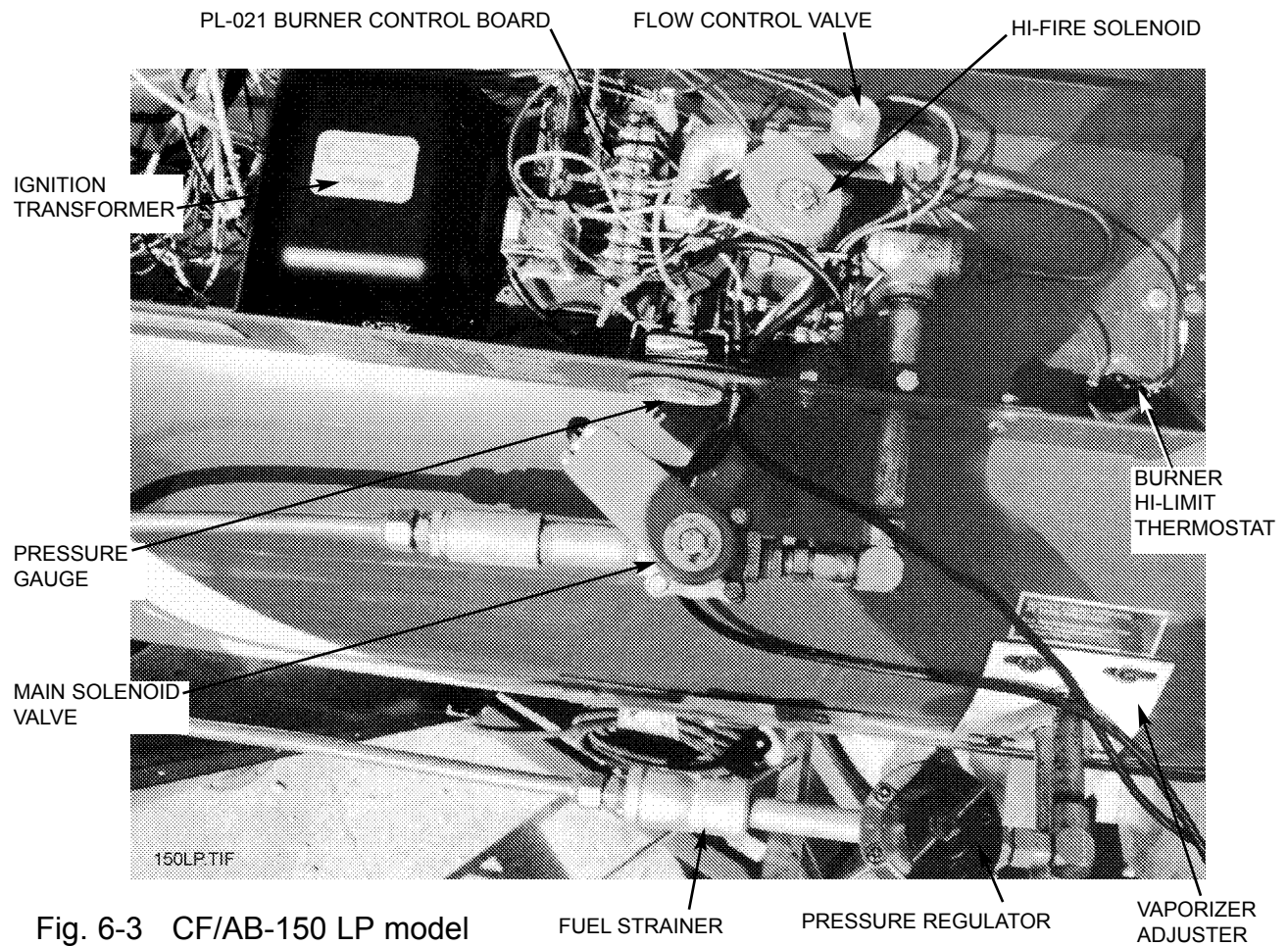


Fig. 6-3 CF/AB-150 LP model

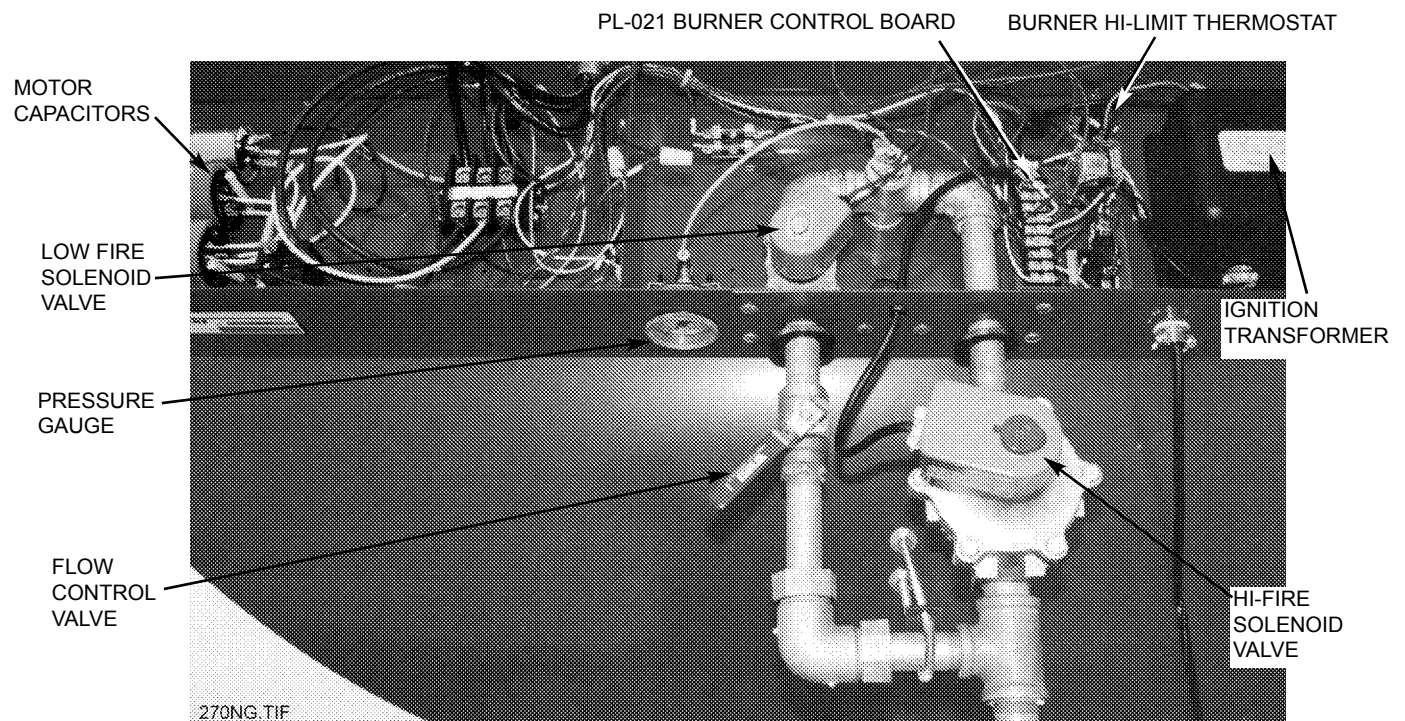


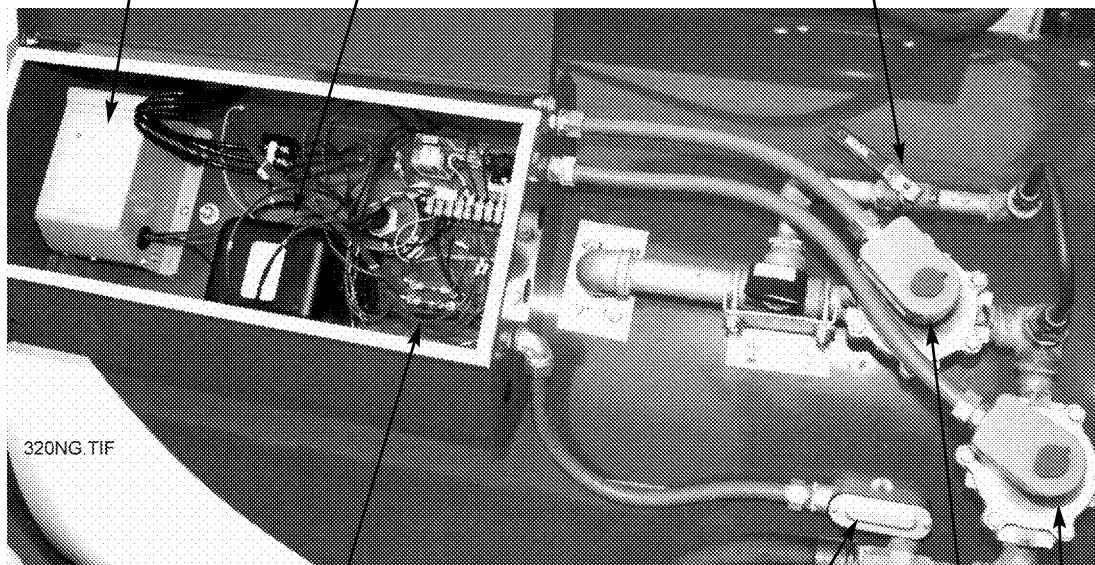
Fig. 6-4 CF/AB-270 natural gas model, single phase



460V TO 230V STEP-DOWN TRANSFORMER  
(460V MODELS ONLY)

IGNITION TRANSFORMER

FLOW CONTROL VALVE



PL-021 BURNER CONTROL BOARD

BURNER HI-LIMIT THERMOSTAT

HI-FIRE SOLENOID

MAIN SOLENOID VALVE

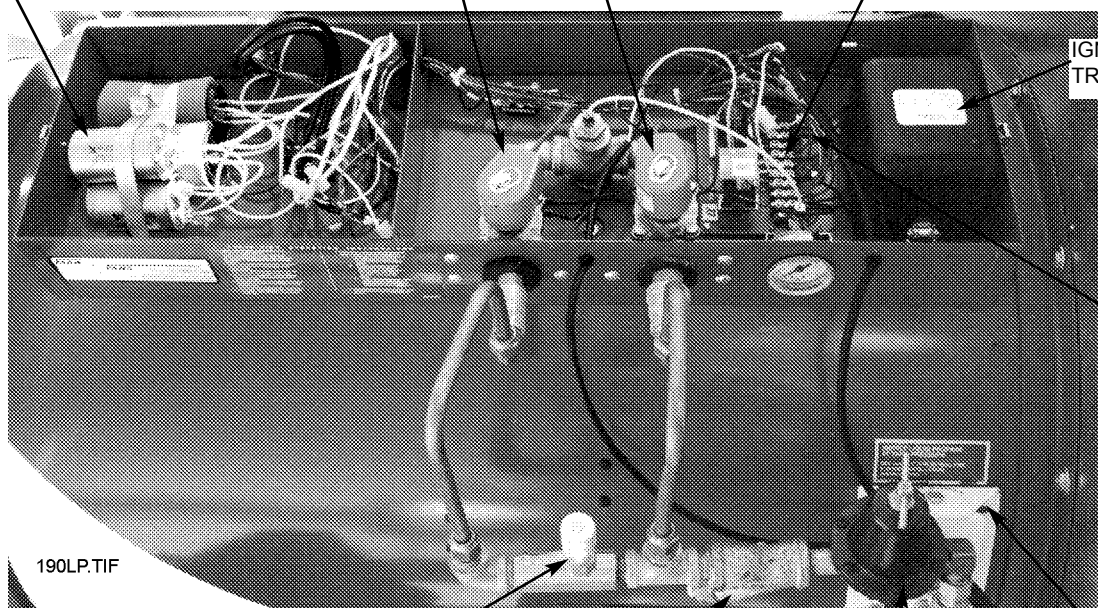
Fig. 6-5 CF/AB-320 natural gas model

MOTOR  
CAPACITORS

LOW FIRE SOLENOID VALVE

HI-FIRE SOLENOID

PL-021 BURNER CONTROL BOARD



FLOW CONTROL VALVE

FUEL STRAINER

PRESSURE REGULATOR

VAPORIZER  
ADJUSTER

Fig. 6-6 CF/AB-190 LP model, single phase

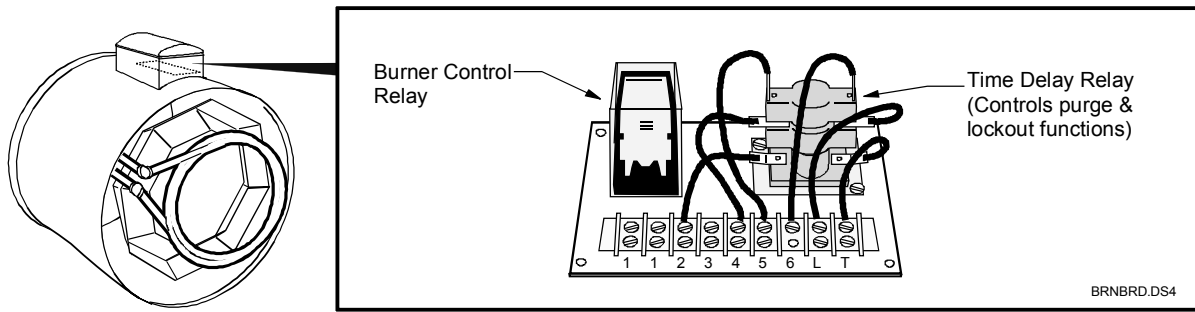


Fig. 6-7 PL-021 burner control board

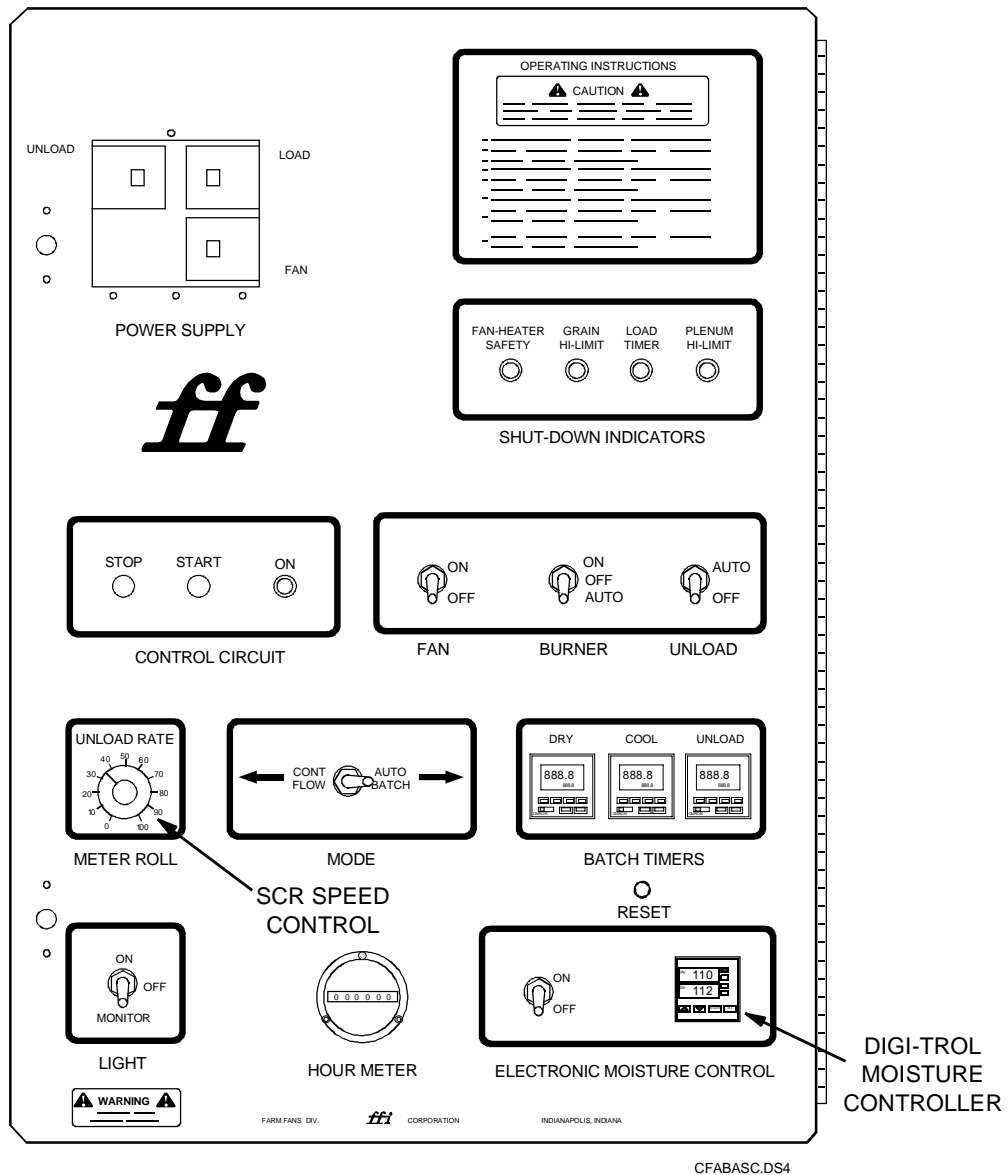


Fig. 6-8 ASC control panel

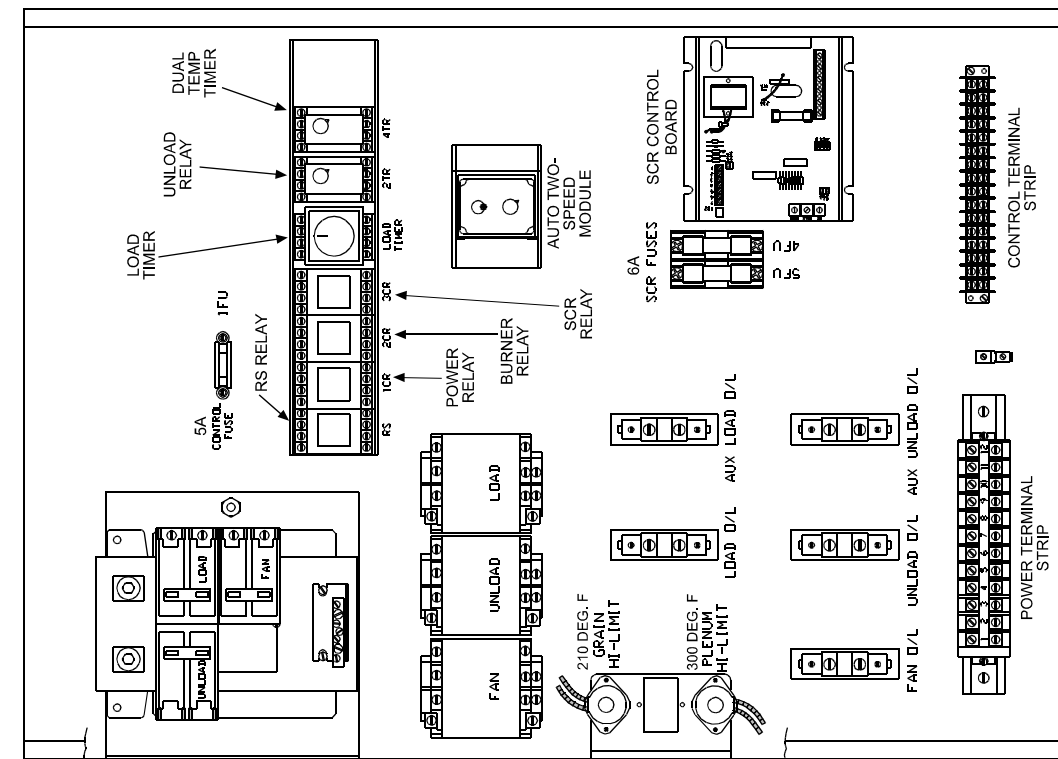


Fig. 6-9 1-phase ASC control panel, internal view

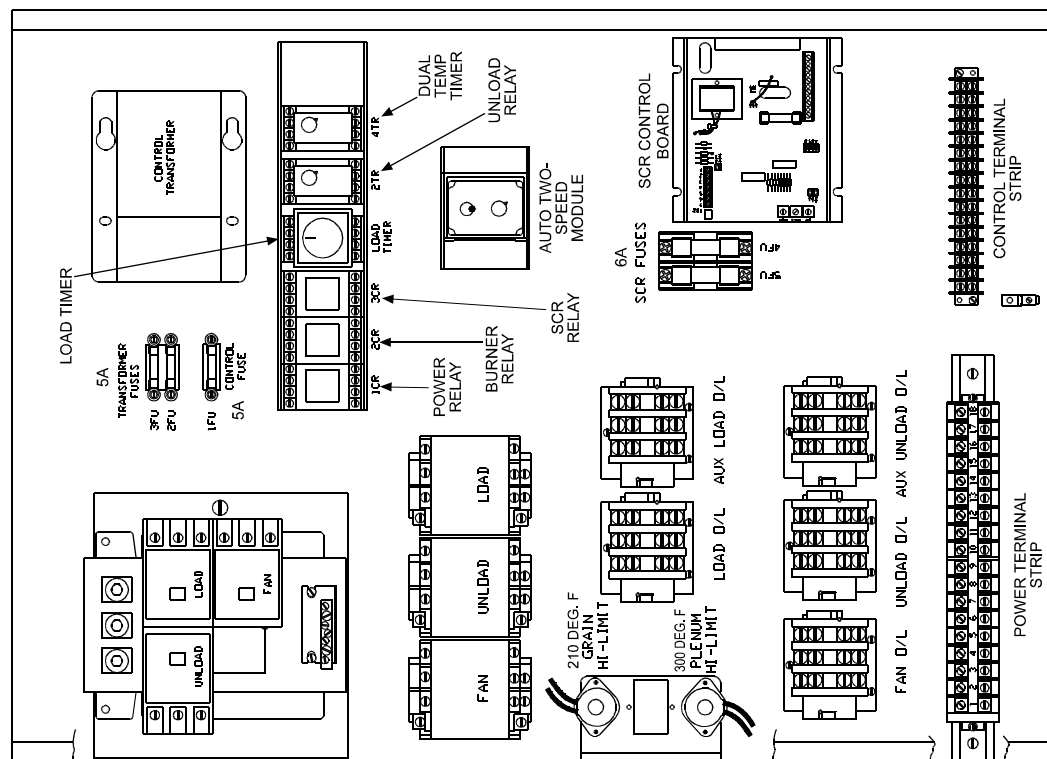


Fig. 6-10 3-phase ASC control panel, internal view



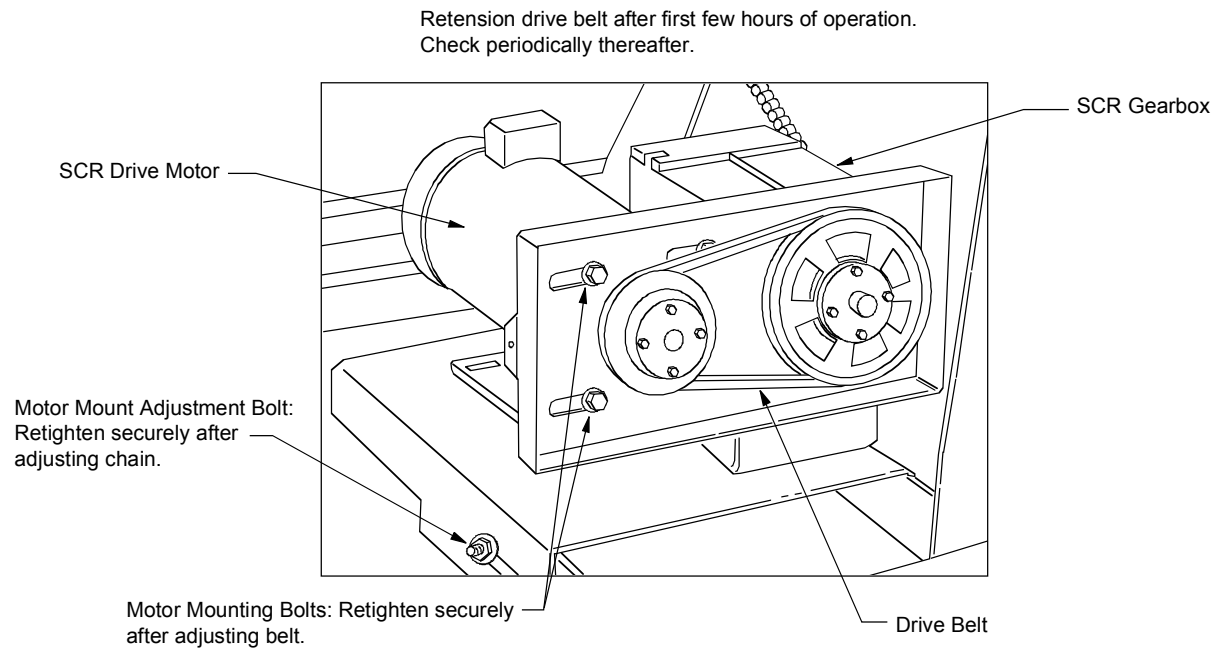
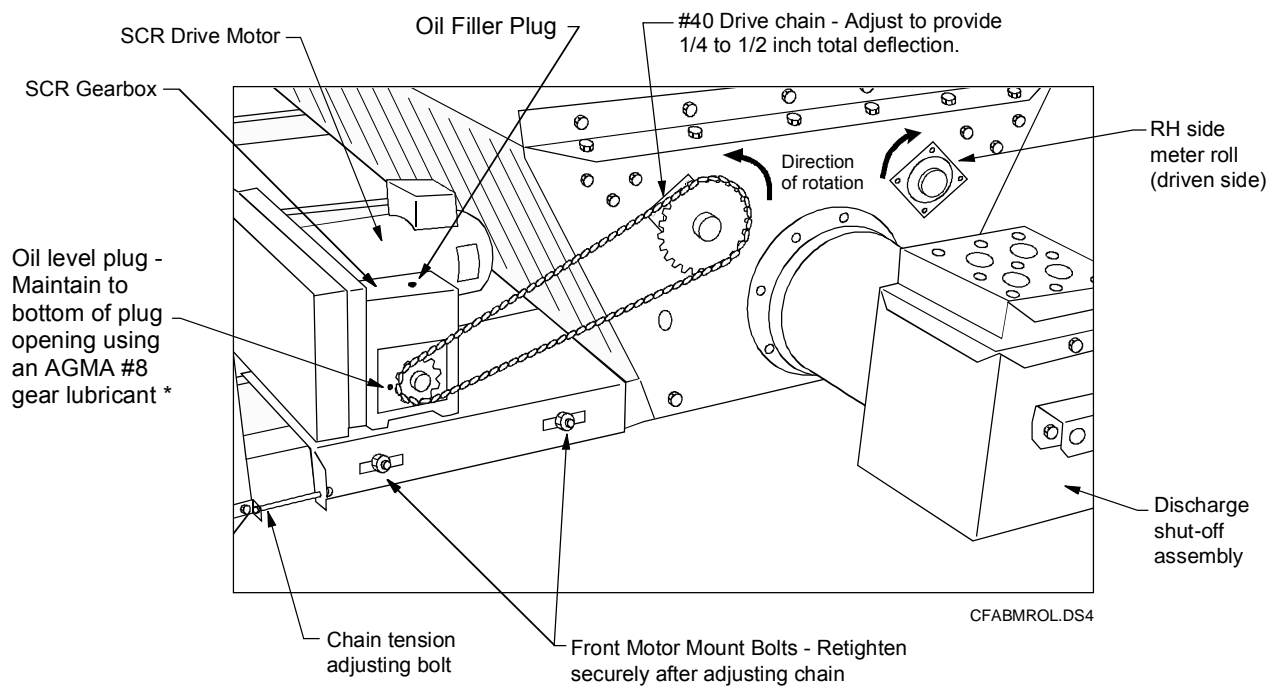


Fig. 6-11 SCR gearbox, motor, and belt drive



\* Under normal conditions, replace lubricant after first 250 hours of operation, then change every drying season (or 2500 hours usage) thereafter. For cold ambient temperature conditions, (16 to 50 degrees F), use AGMA #7 gear lubricant.

Fig. 6-12 SCR gearbox and meter roll drive

RETENSION DRIVE BELTS AFTER SEVERAL HOURS OF OPERATION. CHECK PERIODICALLY THEREAFTER.

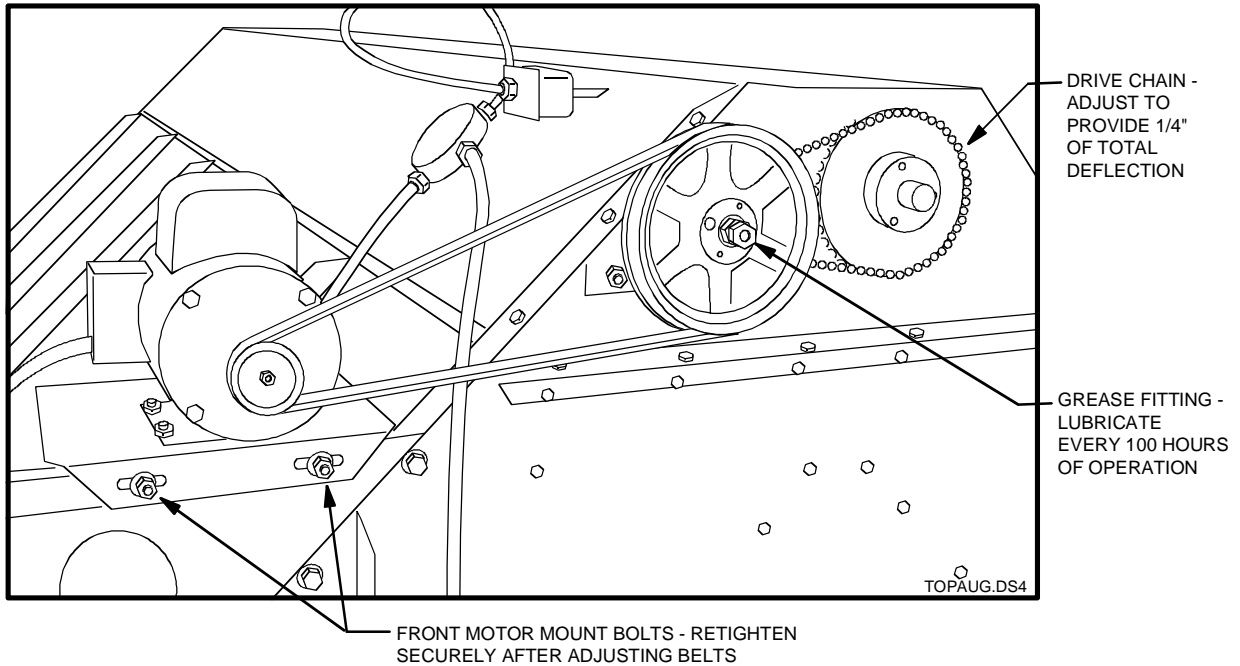


Fig. 6-13 Top auger drive

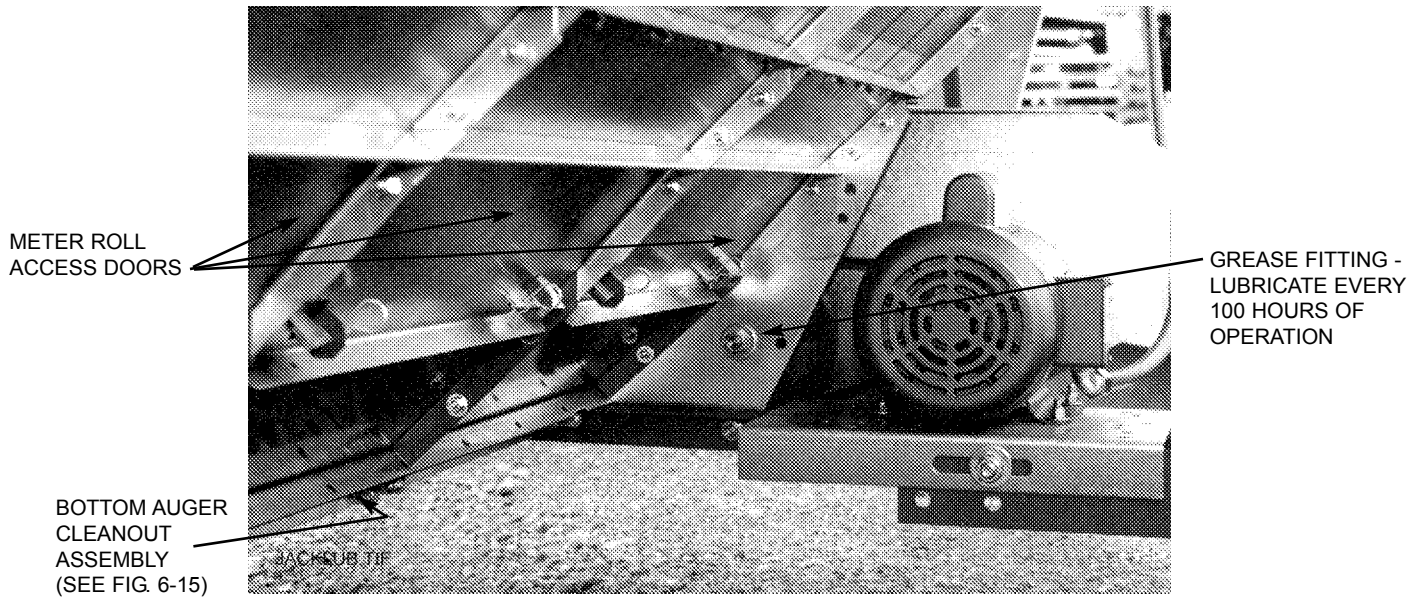
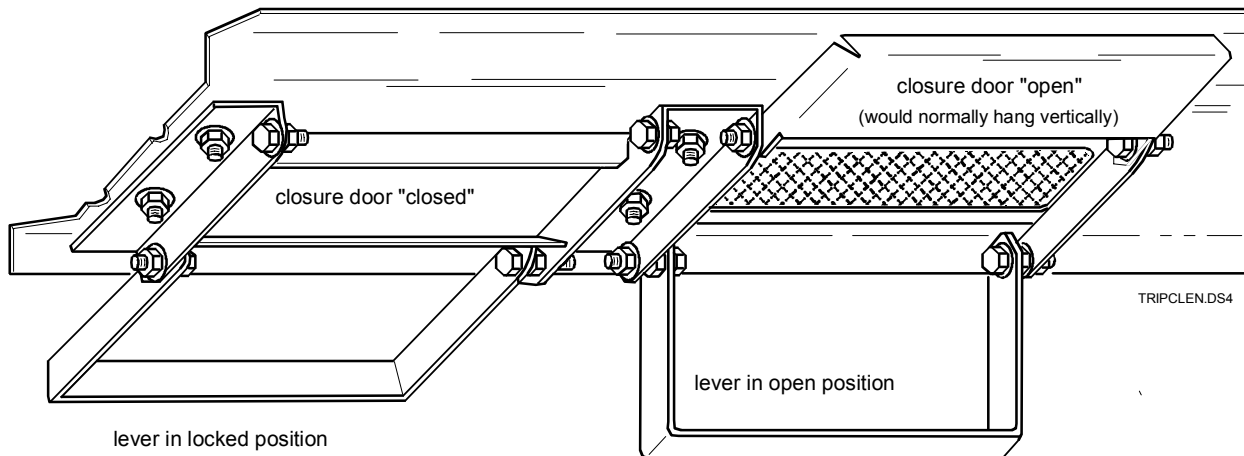


Fig. 6-14 Bottom auger speedjack sleeve lubrication and meter roll access door.

To "fast dump" grain, swing levers downward. To close, swing door closed and pull lever upward into locked position.



**SERVICE TIP:** Open cleanout doors at end of season and remove debris. Doors may be left open during the off season for better drainage.

Fig. 6-15 Underside view of hinged fast-trip cleanout



Fig. 6-16 Grain column cutoff damper decal showing installation

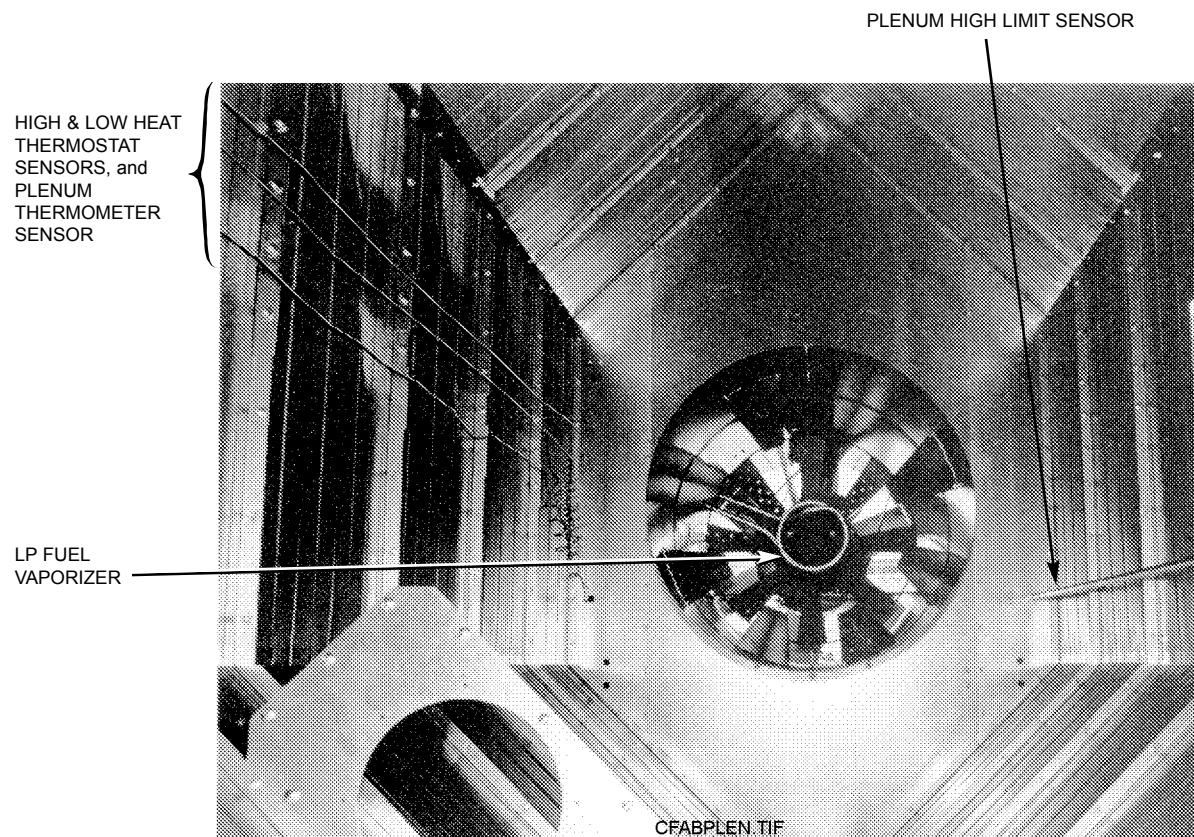


Fig. 6-17 Plenum chamber

## SEASONAL INSPECTION AND SERVICE

The dryer is made of weather resistant construction and is designed to require a minimum of service; however, we recommend the following items be checked before the unit is used each season. Replace any damaged or questionable parts. These checks will help eliminate possible minor failures and assure dependable operation of the equipment when it is needed.

1. Shut off electrical power. Open ASC and PSC control boxes and inspect for any moisture, rodent damage, or accumulated foreign material. Remove all foreign material present. Inspect for and tighten any loose terminal connections. Replace any damaged or deteriorated wiring. Remove fan-heater control box cover and repeat the inspection and cleaning procedure.

2. Check propeller for freedom of rotation and uniform tip clearance. It should also be inspected for accumulated dirt and grain dust, especially inside the hub, as any additional weight can seriously affect the balance and result in harmful vibrations and shortened bearing life. Keep inside of the housing free of dirt build-up for efficient fan performance.

3. Check propeller for free side play. Any side play is an indication of defective motor bearings which should be replaced to prevent a complete motor failure. Make sure motor mount bolts are tight.

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

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

To keep motor bearings properly lubricated and dispel any accumulation of moisture within the windings, the fan and auger motors should be operated for 15 to 30 minutes each month.

The motor manufacturers' Authorized Service Station lists are packed with all units and should be saved for reference and identification of service stations.

5. Remove and clean the gas line strainers. Make certain gas valves are closed and that gas is purged from system before attempting disassembly.

6. Starfire Burner models (CF/AB-150, 190, & 270): Inspect the primary air screen (at the top of the burner casting) and the burner cup for any accumulation of foreign material. Clean, if required. Foreign material in the burner cup or casting will not burn out and will impair burner operation.

Octagonal Burner models (CF/AB-320): Check burner for loose or missing hardware. Also, inspect the burner's combustion holes for excess buildup, using a .086 dia. (#44) drill bit to clean if necessary. See Fig. 7-1.

7. Inspect ignitor plug and clean the electrodes, if required. Use an ignition point file to remove carbon and rust between the electrode surfaces. Spark gap should be about 3/32 inch.

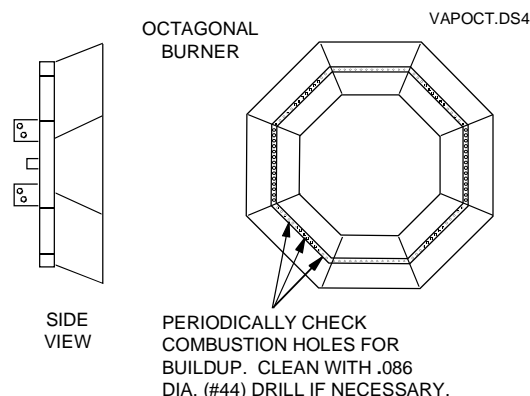


Fig. 7-1 Octagonal burner

8. Inspect flame switch for possible damage or poor connections. The flame switch and ignitor plug wires must be in good condition.

9. Inspect and manually rotate the top auger paddle assembly. The paddle unit must rotate freely without any indication of sticking or binding.

10. Inspect the top auger and bottom auger drive belts and chains for proper adjustment and condition. Readjust tension as required. See Figs. 6-11, 6-12, and 6-13. Also check all meter roll drive chains.

**NOTE:** All of the auger and meter roll end bearings are lifetime lubricated and do not require service relubrication.

Remove gearbox drive cover and check drive belt for proper adjustment and condition. Also check oil level in bottom auger gearbox.

### Speedjack sleeve bearing fittings — all models:

11. Lubricate the drive mechanism parts as follows: Relubricate the bottom auger speedjack bearings every 100 hours of operation using a dependable brand of multi-purpose lithium base bearing grease. See Fig. 6-14.

12. Operate dryer clean-out mechanism and check it for proper operation. See Fig. 6-15. With clean-out open, inspect for and remove any trash accumulation.

**NOTE:** Do not allow high moisture material to collect within the trough area as it may adversely affect the metal parts.

13. Inspect entire dryer for loose, worn, or damaged parts. Include check of auger flighting, meter rolls, and other internal parts. Check that temperature sensors within air plenum chamber are secured within insulated clamps and do not chafe on other metal parts.

14. Inspect that all dryer guards and warning decals are securely installed. Make certain guards do not interfere with moving parts.

15. Test fire the dryer several weeks ahead of the drying season. Include a check for possible gas leaks. See Section 4, TEST FIRING, for procedure.

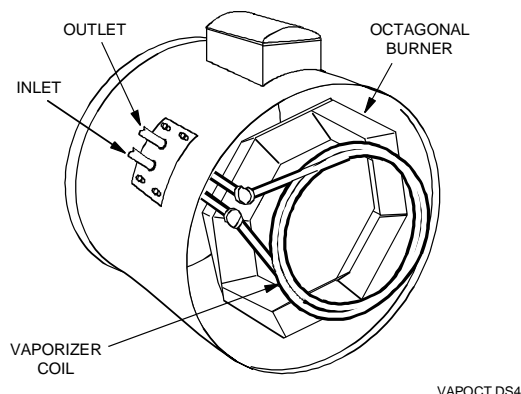


Fig. 7-2 Octagonal burner and vaporizer

## PROPANE VAPORIZER SEASONAL INSPECTION

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

1. Carefully inspect the surfaces of the vaporizer coil and the liquid inlet and vapor outlet pipes for evidence of severe corrosion or abrasion of metal which could cause subsequent leakage of liquid propane, gross overheating, and fire hazard. Such inspection may be through the inspection port, and by inspection from the exhaust end of the fan-heater unit, and by removing the vaporizer mounting plate and partially withdrawing the vaporizer.

Insecure mounting of either the vaporizer or the burner, due to loosened bolts, can cause interference between burner vanes and vaporizer pipes, with the natural vibration of the unit causing erosion of the pipe metal at the point of maintained contact. Such contact also depends on adjustment of the vaporizer toward or away from the burner.

If there is contact between burner vane and vaporizer pipe, adjust the position of the burner and/or vaporizer, or bend the edge of the burner vane if necessary (CF/AB-510



Starfire burner models only), to provide clearance. If there has been significant abrasion of the steel vaporizer pipe, it must be replaced. See Figs. 7-2 and 7-3 for vaporizer and related components.

2. Inspect the fuel train components — Liquid solenoid valve, pressure relief valve, pressure regulator, Vapor Hi-Limit thermostat, and the fuel lines and fittings. The Burner Hi-Limit thermostat should also be checked, since it is an automatic reset safety device that stops burner operation by closing the liquid solenoid valve in the event of excessive heat from liquid propane release, possibly due to vaporizer leakage.

## VAPORIZER ADJUSTMENT

**LIQUID PROPANE MODELS ONLY** — After initial installation and occasionally during the drying operation, check the temperature of the gas line between the regulator and the fan-heater control box. *Allow heater to operate and stabilize temperatures before making this check.* See Figs. 6-1 to 6-6 for many of the major fuel line components.

**NOTE:** If the gas temperature exceeds 220 degrees F the high vapor temperature thermostat will open the electrical circuit to the liquid solenoid valve and shut off fuel flow to heater, thereby causing automatic shut-down of the dryer.

**Stainless Steel Octagonal Burners (CF/AB-320):** If the gas line is very cold or "frosted," ensure that vaporizer coil is centered with the burner. If gas line is too hot to touch, locate vaporizer slightly off center to cool it, by manually forcing the coil up or down. Recheck fuel line for leaks following adjustment. See Fig. 7-2.

**Starfire Burner Models, Slotted Plate Vaporizer Adjusters:** If the gas line is very cold or "frosted," loosen the adjustment plate bolts and move the vaporizer slightly closer to the flame. If gas line is too hot to touch, move vaporizer slightly away from the flame. See Fig. 7-3.

**Starfire Burner Models, Swivel Vaporizer Adjusters:** Vaporizer adjustment is accomplished by first loosening the swivel elbow adaptor on the LP plumbing assembly and the bolts on the hinged vaporizer plate. The vaporizer can now be rotated closer to or farther away from the burner by loosening and tightening the two 5/16" bolts on the hinged plate. After the vaporizer has been repositioned, tighten the swiv-

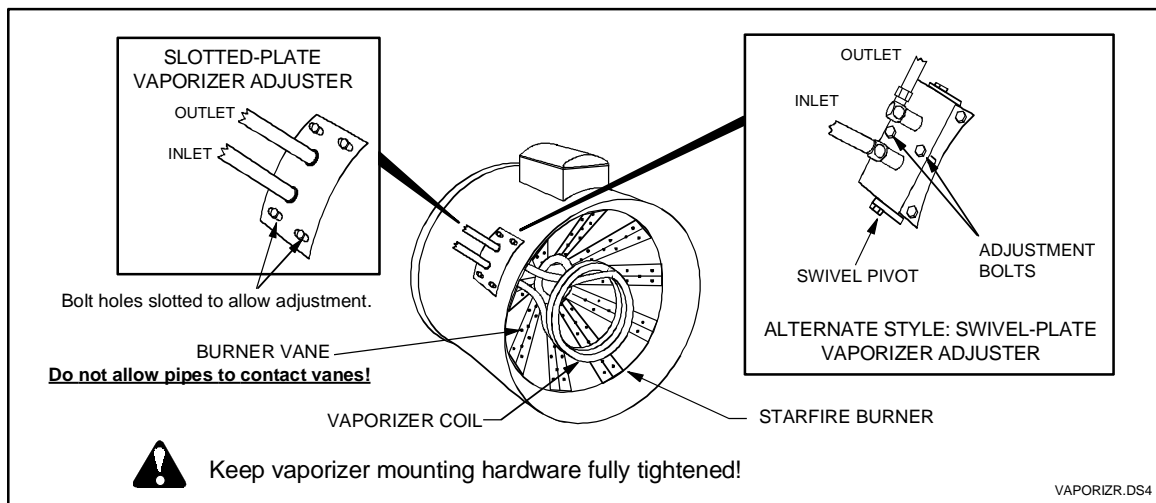


Fig. 7-3 LP fuel vaporizer, Starfire burner models

el elbow adaptor, making certain the LP plumbing assembly runs parallel to the fan housing. See Fig. 7-3.

**Additional Adjustment for Starfire Burners:** Also, the vaporizer's small wedge-shaped heat baffles can be removed from burner vanes to reduce the vapor temperature. If due to extreme operating conditions it is necessary to further reduce the vapor temperature, the vaporizer coil may be withdrawn slightly toward the fan housing. If vaporizer coil is shifted, use care not to kink gas lines or allow vaporizer to contact the burner vanes.

**High Vaporizer Temperatures (all burners):** High Vaporizer temperatures may be caused by fuel vaporizing before reaching the vaporizer. Check for:

A. Improper fuel hookup. Should be drawing liquid from tank.

B. Frosted lines, fittings or valves. Frost indicates a restriction or pressure drop in piping, causing vaporization.

## BURNER CONTROL — SEQUENCE OF OPERATION

The operating principle of the PL-021 burner control is as follows. See Fig. 8-6, Burner Control Circuit schematic, in Section 8 for circuit diagram.

1. Power is available to the burner control only when the fan is operating.

With the fan operating and the burner switch closed, power is transmitted from indicated motor lead wires through the two fuses, burner switch and flame switch to supply power to P/L Terminals No. 2 and No. T, thereby energizing the heater elements within the purge/lock-out relay.

2. After the purge relay has been energized for approximately 15-30 seconds, the purge relay contacts CLOSE the circuit between P/L Terminals No. 5 and No. 1 and energizes the control relay coil. As the relay coil becomes energized it supplies voltage to the ignition transformer and gas solenoid valves by CLOSING the relay contact points located between P/L Terminals No. 3 and No. T, thereby starting ignition and gas flow.

3. Shortly after the heater starts operating, the flame switch responds to burner heat and OPENS its contact points, thereby de-energizing the purge relay and lock-out relay heater element circuit. After the circuit becomes de-energized and the purge relay contacts reopen, a second

set of closed contact points within the relay acts to keep the relay coil energized to maintain heater operation.

4. The heater will operate on Hi-Fire (with Hi-Fire gas solenoid valve energized) until Hi-Lo thermostat control opens its contacts and interrupts the circuit to de-energize the Hi-Fire gas solenoid valve.

When the thermostat control senses that additional heat is required and closes its contact points, the Hi-Fire gas solenoid valve will immediately open and repeat the ON-OFF cycle to maintain the desired heat.

5. If the heater fails to start operating, due to lack of fuel or possible malfunction, after the ignition transformer and gas solenoid valves are energized:

A. The flame switch remaining in its COLD (closed contacts) position will continue to energize the lock-out relay heater circuit.

B. After the lock-out heater has been energized for approximately 60-120 seconds, the lock-out relay contacts will OPEN and interrupt the circuit, thereby providing automatic shut-down of the entire dryer.

C. Once the dryer shuts down, the lock-out relay will cool down within several minutes and automatically reset itself.

## FAN PROPELLER REMOVAL and INSTALLATION

The fan propeller is secured to the motor shaft by the use of a taper-lock bushing, motor shaft key and three\* cap-screws. Figure 7-5 shows a typical cutaway sketch of the propeller and bushing installation. (\*NOTE: H-type bushings have only two threaded holes instead of three.)

**CAUTION:** Although the taper-lock method of retaining the propeller onto the motor shaft is very simple and obvious, it is essential that the following points be read carefully and fully understood, as improper installation can result in serious or fatal injury caused by a loose, flying propeller.

**THREADED BUSHING HOLES** - The threaded holes within the bushing are provided for disassembly purposes only. See Fig. 7-6. Do not attempt to use these holes for reassembly, as they will not allow the parts to become locked onto the shaft, thereby causing a hazardous operating condition.

**CLEARANCE HOLES** - When reassembling parts, the cap screws must be installed through the UNTAPPED CLEARANCE HOLES, as shown in Fig. 7-7, to cause the propeller to be pulled forward onto the tapered bushing, thus locking the parts securely onto the motor shaft. Refer to Installation heading for assembly details.

Whenever any drying fan servicing is to be performed which requires removal and installation of the propeller, make sure the propeller is removed and installed properly. The recommended procedure is as follows:

### REMOVAL

1. LOCK-OUT THE MAIN POWER SUPPLY and remove the fan guard and also the venturi if so equipped.

2. Remove the three\* capscrews from the clearance holes in taper-lock bushing. Inspect for thread damage and set aside for later reinstallation (do not use for step 3, bushing removal). (\*NOTE: H-type bushings have only two threaded holes instead of three.)

3. Install three Grade 5 (or better) capscrews into the THREADED HOLES in the bushing and turn them in by hand until they bottom against the front surface of the

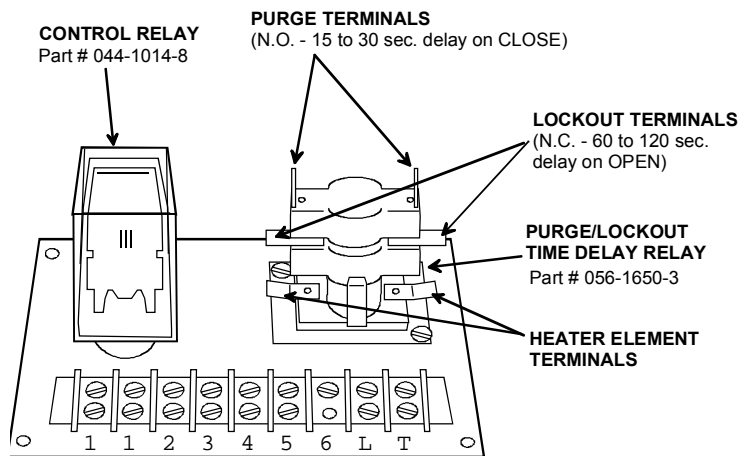


Fig. 7-4 Burner control board components

propeller. These capscrews should not be used for reassembly, as some thread distortion could occur during the removal operation. Grade 5 screws are marked with three 120 degree spokes on the head and are more durable than low strength unmarked bolts.

Do not attempt to use low strength (unmarked) bolts to remove the bushing, as the bolts may break off. This is especially important for the H-type (two-hole) bushings, which provide off-center forcing action.

4. Block propeller to prevent it from turning, and gradually turn in the capscrews (up to 1/4 turn at a time), as shown in Fig. 7-6, until the propeller breaks loose from the bushing and motor shaft. Carefully remove bushing and propeller. With the propeller free from the bushing, a wheel puller can be used to pull the bushing off of motor shaft, if required. Reattach bushing onto propeller to prevent the loss of parts and also to maintain the original alignment of bushing to propeller. Inspect propeller and bushing at this time, looking for any cracks, thread or bolt damage, warpage, etc. Consult your dealer or the factory for any questions concerning damage.

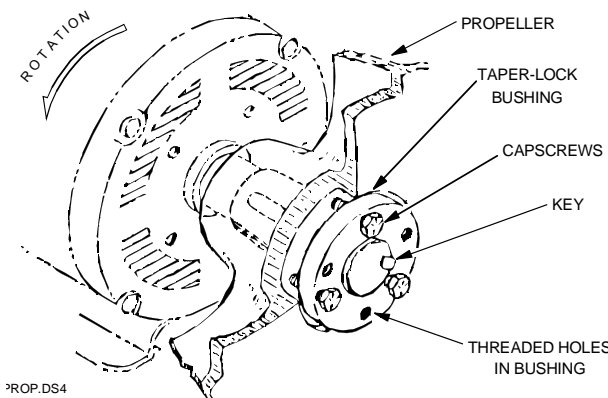


Fig. 7-5 Cutaway of typical propeller installation

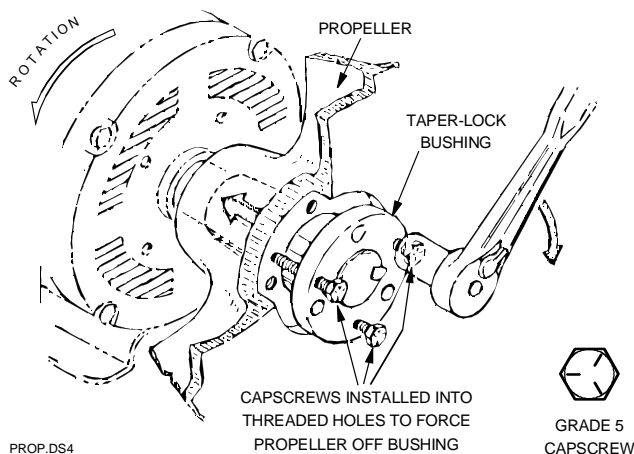


Fig. 7-6 Capscrew arrangement for disassembly

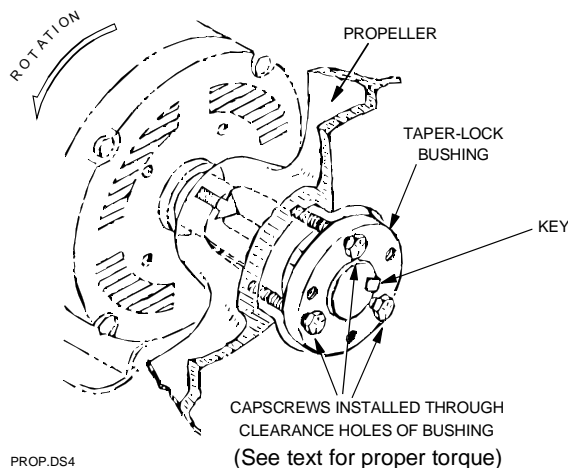


Fig. 7-7 Capscrew arrangement for reassembly

**NOTE:** During manufacture, the propeller and bushing are balanced together and the parts are marked with two small punch dots to identify their original alignment position (propeller hub punch dots are near bushing keyway). Observe bushing and propeller to make sure they have alignment marks. Mark the alignment of the propeller and bushing, if required.

#### INSTALLATION

1. Carefully clean motor shaft, key, bushing and bore of propeller. Make sure main power is locked out, and that shaft and key are completely free of rust and burrs. Do NOT lubricate the bushing or capscrews. Check and make sure all motor mount bolts are properly tightened.

2. Slide propeller over motor shaft and locate it against the motor.

3. Align the keyway in the bushing with the key and SLIDE bushing onto motor shaft. Do not attempt to drive the bushing onto the shaft, as it may damage the motor bearings.

4. Rotate the bushing and propeller so their alignment marks are in line and loosely attach the propeller to the bushing. Make sure the capscrews are inserted into the unthreaded clearance holes in the bushing. Refer to previous CAUTION note. Locate the bushing so it is approximately flush with end of motor shaft. Make certain that proper capscrews are used for reassembly and no damage has occurred to these screws during disassembly! Use only the special type bolts supplied with the original propeller.

**NOTE:** The bushing must be located far enough forward so the inside web portion of the propeller will not contact the motor. If motor make has a short shaft, it may be necessary to position bushing slightly beyond end of shaft.

5. Slide the prop forward onto taper-lock bushing and turn cap screws in by hand as far as possible.

6. Use an INCH-POUNDS torque wrench and gradually tighten the three cap screws (1/4 turn at a time) until the taper bushing becomes fully seated. Refer to the following chart for recommended cap screw tightening torques. Do not excessively overtighten the bushing.



## BROWNING TAPER-LOCK BUSHING BOLT TIGHTENING TORQUES

Bushing Size	Bolt Dia.	Torques (inch/lbs.)
H	1/4"	95 in-lbs
P	5/16"	192 in-lbs
Q	3/8"	348 in-lbs

**Caution:** Do not attempt to pull the flange of the bushing flush with the propeller hub. A clearance of from 1/8" to 7/32" must be maintained between bushing flange and propeller hub surface. See Fig. 7-8.

7. Turn propeller by hand and check it for freedom of rotation and uniform tip clearance before reinstalling the fan guard.

### FAN MOTOR REMOVAL and INSTALLATION

In the event of motor failure, remove the motor, as described, and take it to the nearest authorized service station. Authorized service stations are the only places that can provide possible motor warranty. Motor service and repair at other places will be at owners expense.

If service station determines motor failure to be caused by faulty material or workmanship, repair will be under warranty when it is within the warranty period. Motor failure because of external causes will result in a charge to the owner for repair.

1. Make certain power is shut-off and locked out, then remove fan guard and propeller, as outlined earlier.

2. Remove cover from fan-heater control box and disconnect the motor lead wires from within the box.

**NOTE:** Tag or otherwise identify wires for ease of reassembly.

3. Remove motor mount bolts. If there are any shims between the motor and its base, note their location so they can be properly installed during reassembly.

4. Disconnect the upper end of the motor conduit, if required, then carefully pull conduit and wires through hole in fan-heater housing.

Remove motor with conduit still attached from fan-heater unit. If motor requires service, take it to an authorized service station.

5. To re-install motor, slide onto motor base plate and replace shims (if required) between motor and base plate.

Re-install motor mount bolts and washers, BUT DO NOT FULLY TIGHTEN THEM AT THIS TIME.

Re-install conduit and wires through hole in fan-heater housing and carefully remake all electrical wiring connections.

Check and adjust position of motor by temporarily mounting fan blade on motor shaft, and rotate it by hand, making the necessary adjustments so that the tip clearance between blade and housing is uniform. Remove the fan blade, if required, and FULLY TIGHTEN ALL FOUR MOTOR MOUNTING BOLTS.

**NOTE:** Make sure to install and tighten the propeller in accordance with earlier instructions.

### HEATER PARTS REMOVAL and INSTALLATION

Most of the heater parts can be removed by simply identifying any attached wiring and then disconnecting the obvious mounting parts.

The following list provides information and procedures for some of the more important components:

1. **FLAME SWITCH** — For removal, disconnect the two slip-on connectors and unscrew flame switch from its mounting bracket. Make sure to use a wrench. Do not attempt to turn by twisting the terminals, as it may ruin the switch. For installation, finger-tighten only — do not use a wrench.

2. **GAS SOLENOID VALVE COIL** — Unsnap either the plastic cap, or the metal clip, on the gas valve and slide the housing and coil off the valve stem and body. Do not energize the coil when it is removed, as the coil may become damaged due to excessive current flow.

3. **REGULATOR AND GAS SOLENOID VALVE(S)** — The gas regulator and solenoid valve(s) are DIRECTIONAL and must be connected as indicated by the markings near the port openings. Make sure gas is shut off and purged from the system (including LP vaporizer) before removing parts.

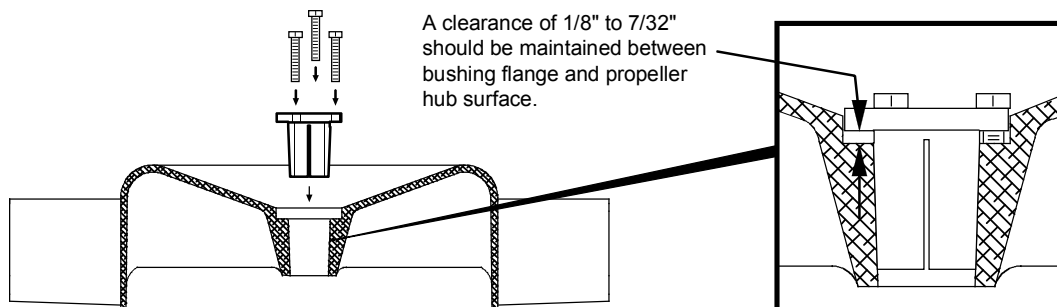
When installing a liquid gas solenoid valve on LP models, do not overtighten the connection into the inlet side, as the inlet orifice may become partially blocked.

4. **MAIN GAS ORIFICE** — With fuel shut off and gas purged from system, proceed as follows:

#### Starfire Burners:

A. Disconnect gas supply line close to the fan-heater control box and disconnect the plumbing closure plate from side of control box.

B. Disconnect the pressure gauge line fitting from the pipe tee.



BUSHING.DS4

Fig. 7-8 Ensuring the necessary hub to flange clearance

C. Disconnect electrical connections to gas solenoid valve(s) located within control box.

D. Lift pipe tee (with orifice, solenoid valve, and other parts attached) straight up and remove from control box. Orifice and other parts can now be removed from pipe tee, if desired.

#### Octagonal Burner Models (CF/AB-320):

Disconnect the gas supply line where it connects with the octagonal burner, loosening nearby plumbing elbows and joints as required. Orifice is located where gas supply line joins with octagonal burner. See Fig. 7-9.

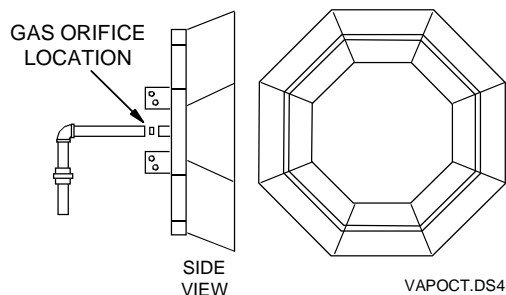


Fig. 7-9 Octagonal burner orifice

5. REASSEMBLY — To reassemble parts, reverse the disassembly procedure, noting the following special points.

A. Make sure all parts are thoroughly cleaned and open.

B. Use a dependable brand of high temperature pipe caulking compound when assembling gas connections. Apply only a slight coating onto male threaded end of fittings.

C. Solenoid valves and gas regulator are directional and must be properly installed. Do not attempt to connect gas solenoid valve by applying force to the valve core stem as it may ruin the unit.

D. Make sure all electrical wires are properly connected. Refer to wiring diagrams for connection details.

## TEMPERATURE SENSOR LOCATIONS

The sensor location diagram, Fig. 7-10, is provided as a reference for any related servicing needs that might arise.

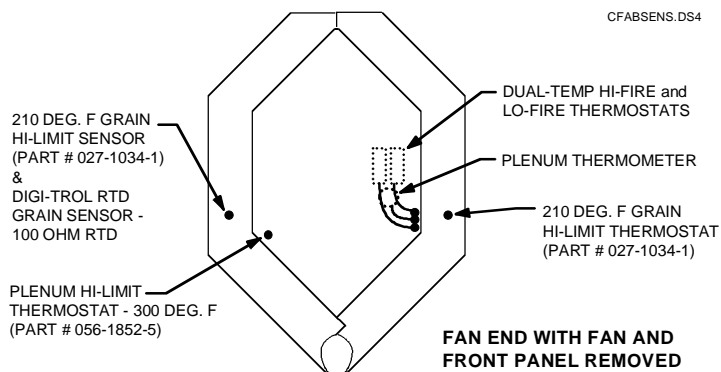


Fig. 7-10 Grain and plenum temperature sensors

## SCR DRIVE and METER ROLL INFORMATION

### SCR DRIVE — GENERAL INFO.

The meter rolls (which regulate the rate of grain flow through the dryer) are driven by a separate DC type electric motor. The speed of the DC motor is variable and is controlled by an electronic SCR type (silicon controlled rectifier) control located within the ASC control box. See Table 3-1 for SCR system information.

The main SCR components are the SCR control board assembly, DC motor, and speed reducer gear box. These parts are briefly described as follows:

1. SCR SPEED CONTROL — The speed control knob on the ASC control panel, regulates the output from the SCR control board, to control the speed of the DC motor which drives the meter rolls.

2. DC ELECTRIC MOTOR — The 1/3 HP direct current (DC) motor provides the drive for the meter rolls and is located on the rear left-hand side of the Dryer (except on special front discharge models). The motor powers the gear box through a V-belt drive arrangement. The V-belt drive provides protection from possible severe damage to the meter rolls and other components, in the event the meter rolls ever become jammed with any large foreign object.

The DC motor requires no operational adjustments and is completely controlled by the SCR control board assembly.

3. SPEED REDUCER GEARBOX — The 50:1 gearbox provides the required speed reduction and transmits power to the meter rolls through a drive chain arrangement. The drive chain should be periodically lubricated and the drive belt and drive chain should be checked and retensioned as required.

### SCR Geabox

The gearbox requires no adjustment, and under normal conditions is considered lifetime lubricated. Although the gearbox requires no adjustment, it is initially filled with an AGMA #8 mineral-base oil which should be replaced after the first 250 hours of operation, then changed every drying season (or 2500 hrs.) thereafter. AGMA #8 oil has an operating temperature range of 5 to 110 deg. F. For cold ambient temperatures (16 to 50 deg. F), use AGMA #7 rated oil. If the unit requires additional lubricant due to leakage or repairs, be advised that Farm Fans offers a highly durable, synthetic oil, FF part no. 069-1132-5 (Mobil SHC634 or equivalent lubricant). Fill to oil level plug (near shaft level). Before changing to synthetic oil, first drain and flush with solvent. Synthetic oil allows for wider temperature operation (minus 40 to 250 deg. F typical) and longer lifetime use (5000 hours operation typical).

## METER ROLL BLOCKAGE

In the event a foreign object becomes lodged in the meter rolls and jams the system, the following events could be expected to occur.

A. The unloading auger and the SCR meter roll drive would briefly continue to operate.

B. However, the moment the meter roll becomes jammed, the self-limiting SCR drive motor will stop rotating (and SCR drive belt may begin slipping) and the meter rolls would not rotate.

## HOW TO DETERMINE A METERING PROBLEM

To determine if a metering problem is caused by blockage of the meter rolls, remove the drive covers from front and rear ends of dryer and perform the following: Refer to Fig. 6-12 and remove meter roll drive chain from the meter roll sprocket. Using a pipe wrench, rotate the hub of the drive-side meter roll sprocket back and forth. Apply up to 100 ft.-lbs. of force to attempt to free any lodged object. If both metering rolls will turn, it can be assumed that no blockage exists and that the problem is due to some other cause. Check for a break in the power train (broken chain, drive key, clevis pin, coupler, etc.).

**NOTE:** In freezing weather, the meter rolls may be loaded with frozen grain. Operate lower burner for several minutes to thaw grain, then reattempt to operate meter rolls.

### TO LOCATE THE JAM

To determine which meter roll is jammed, whether drive-side or driven-side, feel the tension in the top and bottom sections of the meter roll crossover chain (see Fig. 6-12). If tension is equal in both sections, the drive-side meter roll is likeliest to be jammed. If lower section of crossover chain is extremely tight and the tension will not equalize when attempting to deflect the bottom section, the jam is likely to be in the driven-side meter roll.

### TO CLEAR JAM FROM METER ROLL

Make certain power is OFF and locked out. Loosen the chain tightener and remove the crossover chain.



**CAUTION:** Keep hands away from sprocket teeth to avoid injury from chain backlash as a result of any torsional buildup in the system (as caused by the jam).

With crossover chain removed, place a pipe wrench on the sprocket hub of the jammed meter roll and attempt to turn the meter roll. Rotate backward and then forward several times in an attempt to dislodge the object and clear it through the roll. If this is not successful, have an assistant turn meter roll and attempt to locate jam by sound. Once location is determined, first seal off grain flow by inserting the Grain Column Cut-Off Damper service tool from inside the plenum as described in Fig. 6-16. Then from outside the dryer, open the meter roll access door to remove any foreign object. (See Fig. 6-14.)

## SCR MOTOR CONTROL

When installing a new SCR motor control, check torque switch setting, control voltage jumper position, and armature voltage jumper position. Set as shown in Fig. 7-11.

### ADJUSTING SCR MOTOR SPEED

#### 1. Max Pot Adjustment

With dryer unload circuit energized, set the SCR Speed Control knob on the ASC panel to 100%. Using a small-blade screwdriver, adjust the Max pot to obtain 175 VDC across the DC motor armature terminals A1 and A2 on the Woods SCR motor control board.

**NOTE:** Be sure the Unload Rate Limit on the Auto Two-Speed Module is set to the maximum of 10 before making the Max pot adjustment.

#### 2. Min Pot Adjustment

Set the SCR Speed Control knob on the ASC panel at the 10% setting. Adjust the Min pot to obtain 17.5 VDC across the DC motor armature terminals A1 and A2.

3. Recheck Max pot setting (step 1) and readjust if necessary. Repeat step 2 and readjust Min pot if necessary. Rechecking the Max and Min pot settings one time should be sufficient.

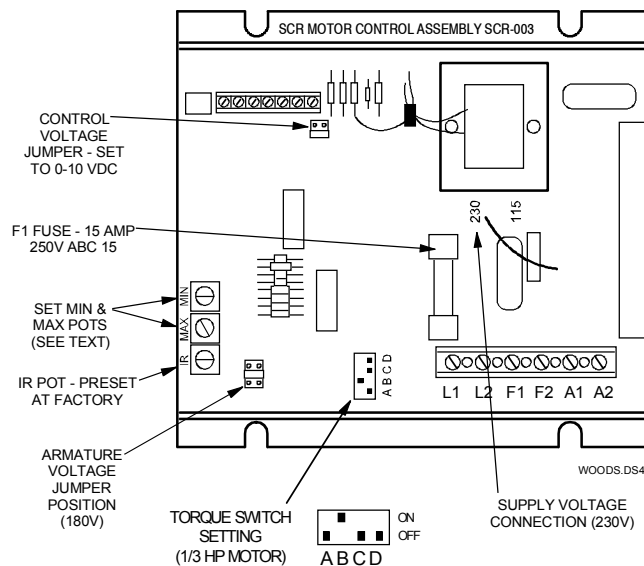


Fig. 7-11 Wood SCR motor control board



## CONTENTS

Fig. 8-1	Power circuit — 220V 1-phase CF/AB-150, 190, and 270 . . . . .	58
Fig. 8-2	Power circuit — 220V 1-phase CF/AB-320 . . . . .	59
Fig. 8-3	Power circuit — 220V 3-phase, all models . . . . .	60
Fig. 8-4	Power circuit — 440V 3-phase, all models . . . . .	61
Fig. 8-5	Control circuit — All models . . . . .	62
Fig. 8-6	Burner control circuit — All models . . . . .	65
Fig. 8-7	Top auger mercury switch and control circuit . . . . .	66

---

**NOTE:**

The wiring diagrams within this section have been updated for the 1997 production models. When servicing dryers made prior to 1997, it is best to follow the circuits provided in the literature that shipped with the dryer.

---



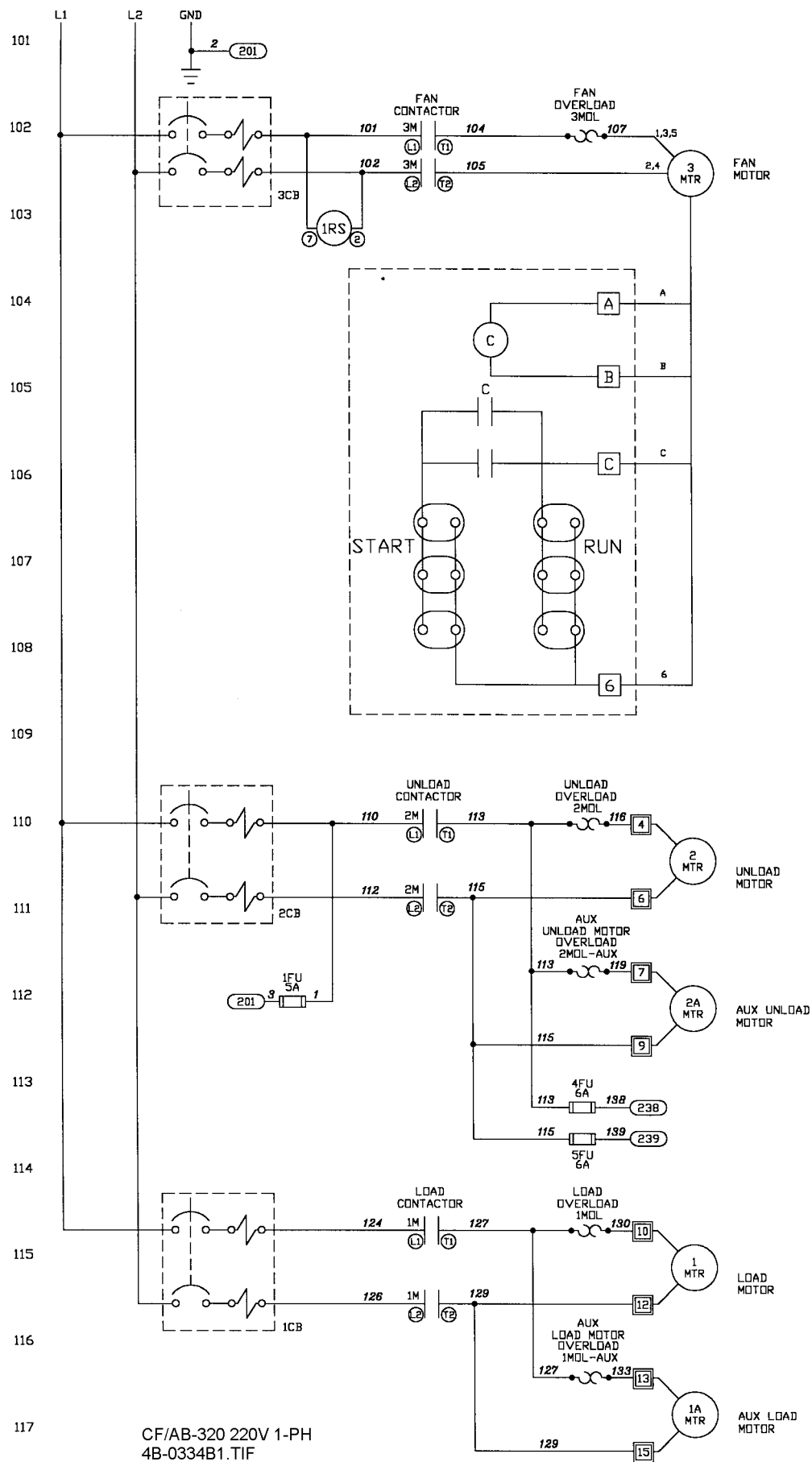


Fig. 8-2 Power circuit — 220V 1-phase CF/AB-320 models

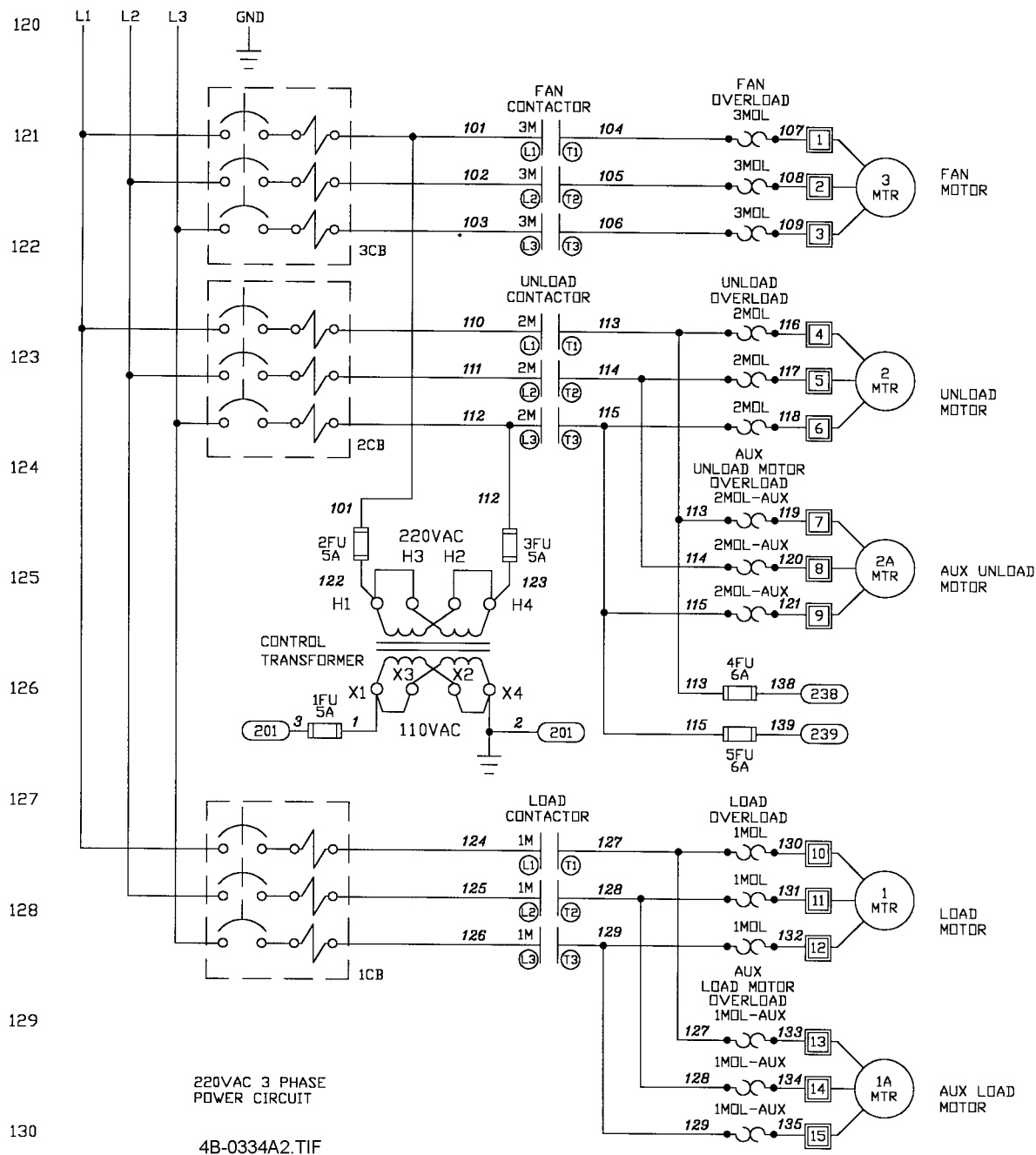


Fig. 8-3 Power circuit — 220V 3-phase, all models



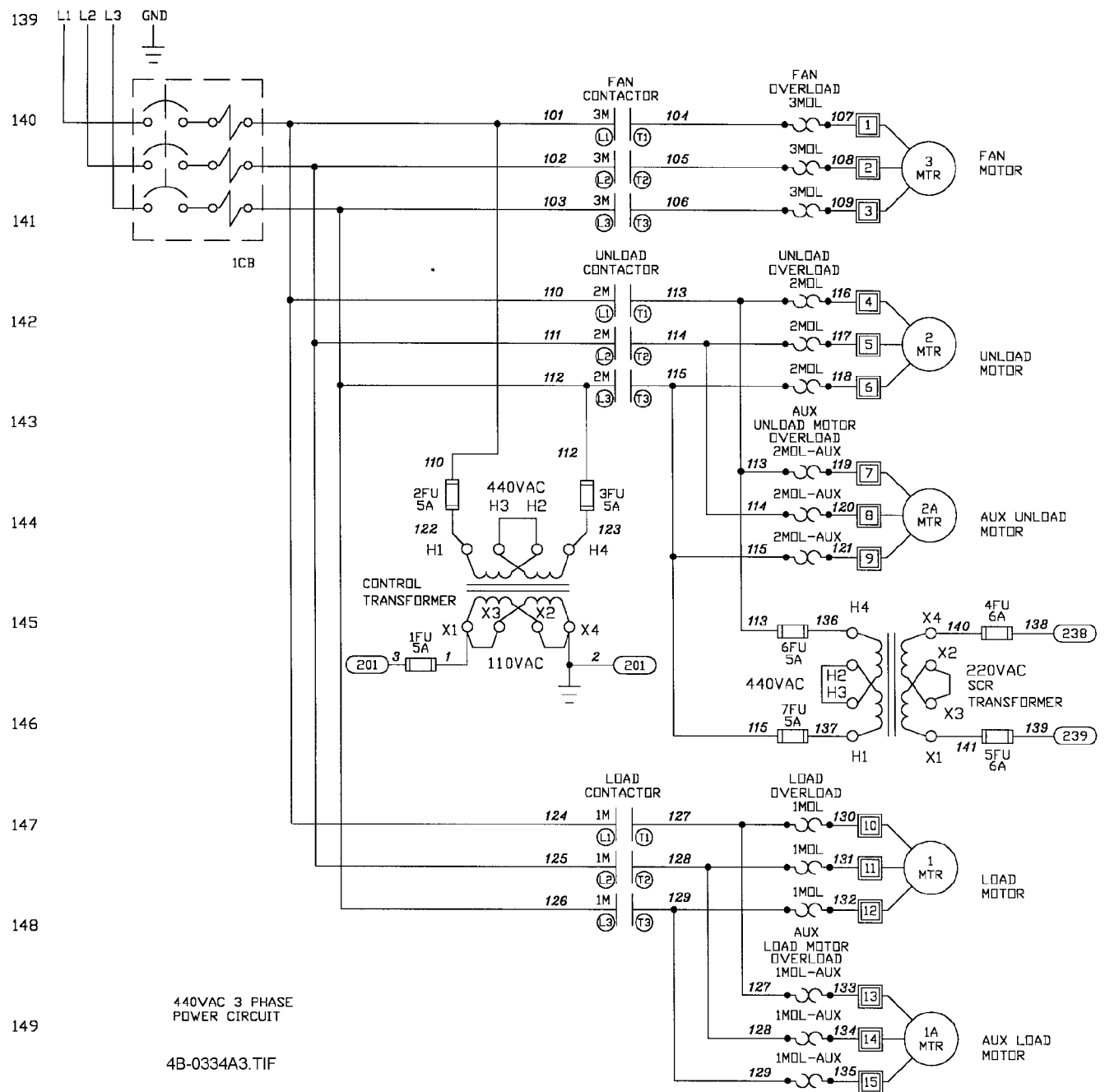


Fig. 8-4 Power circuit — 440V 3-phase, all models

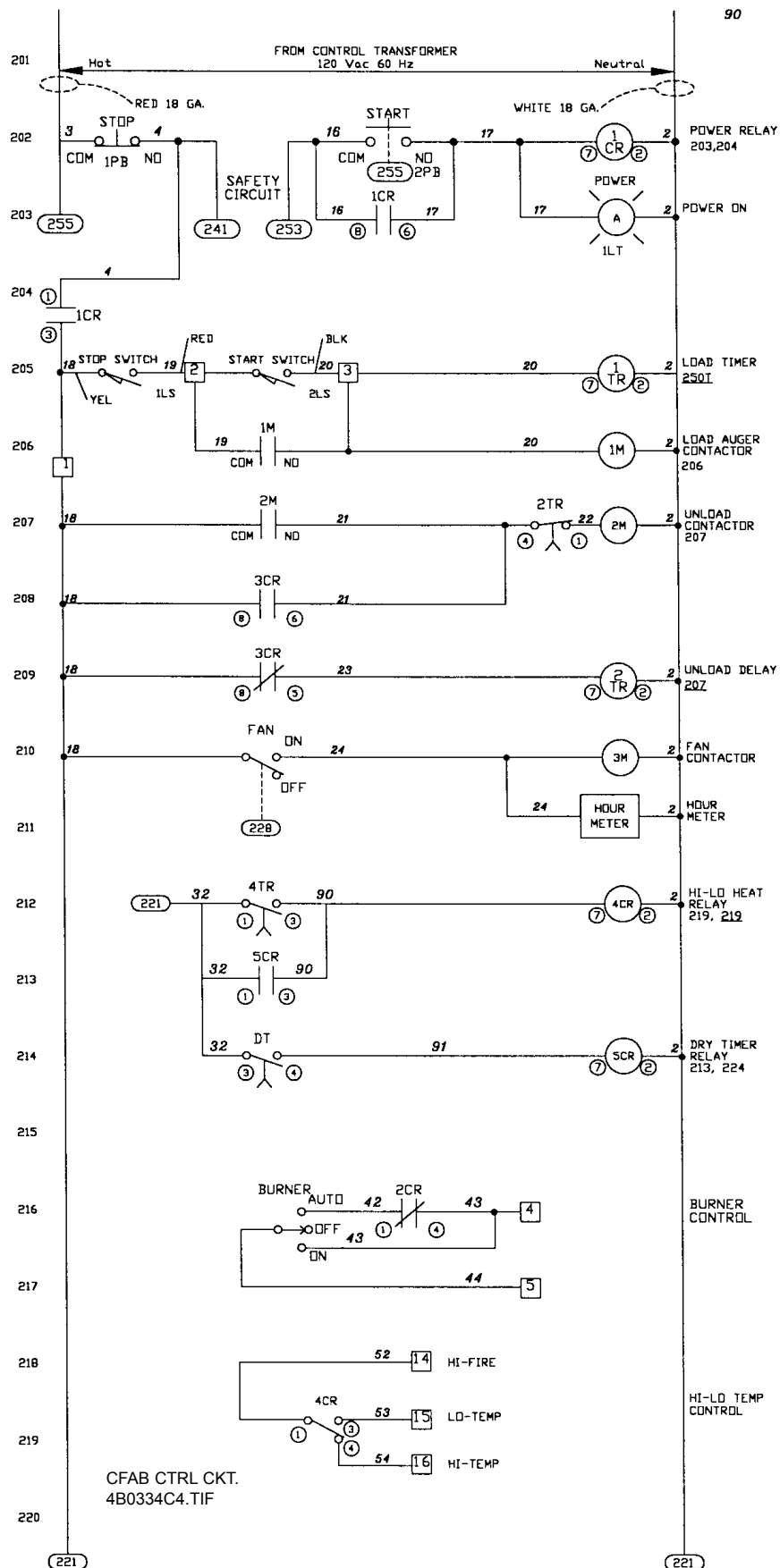


Fig. 8-5 CF/AB Control circuit — page 1 of 3

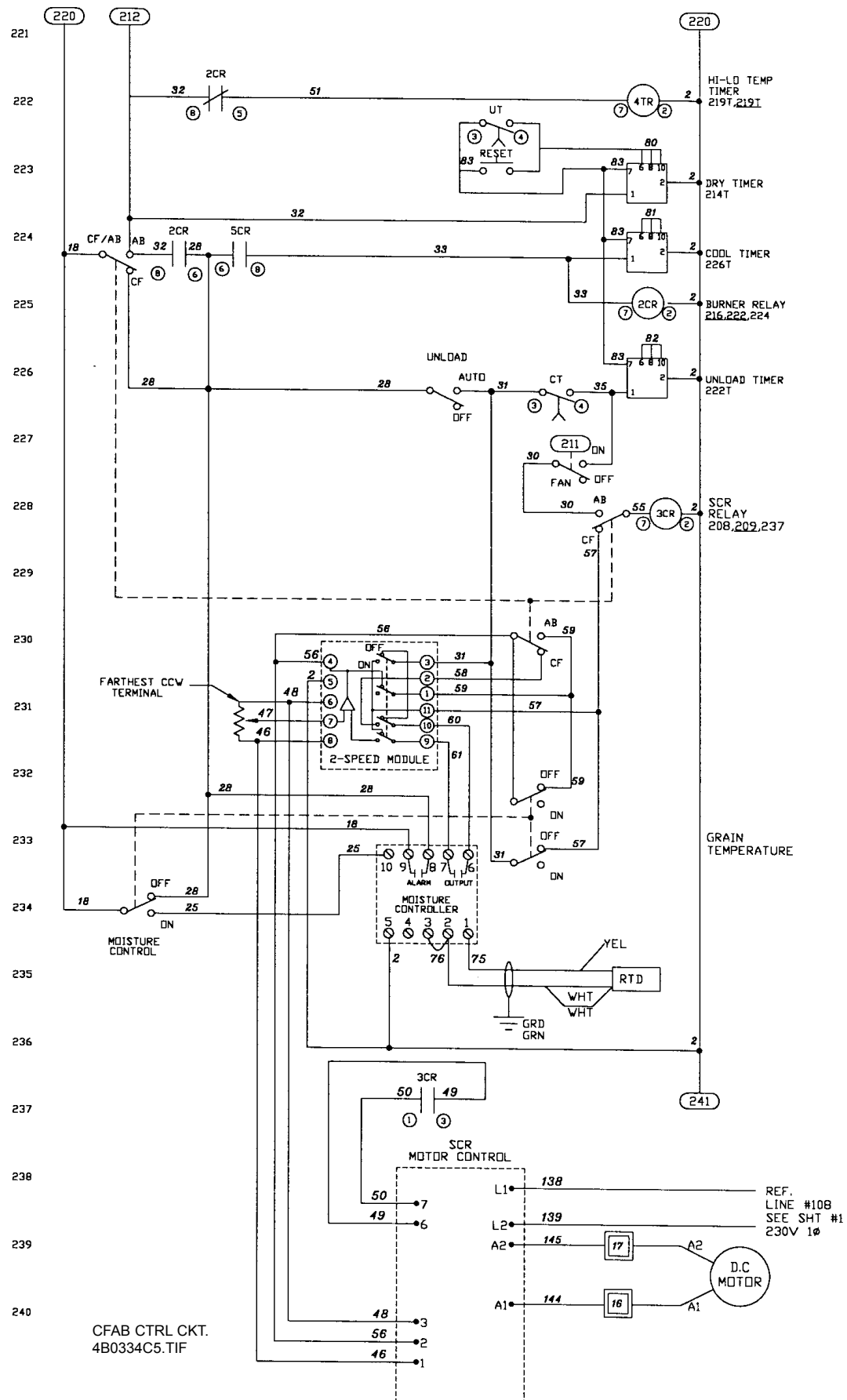
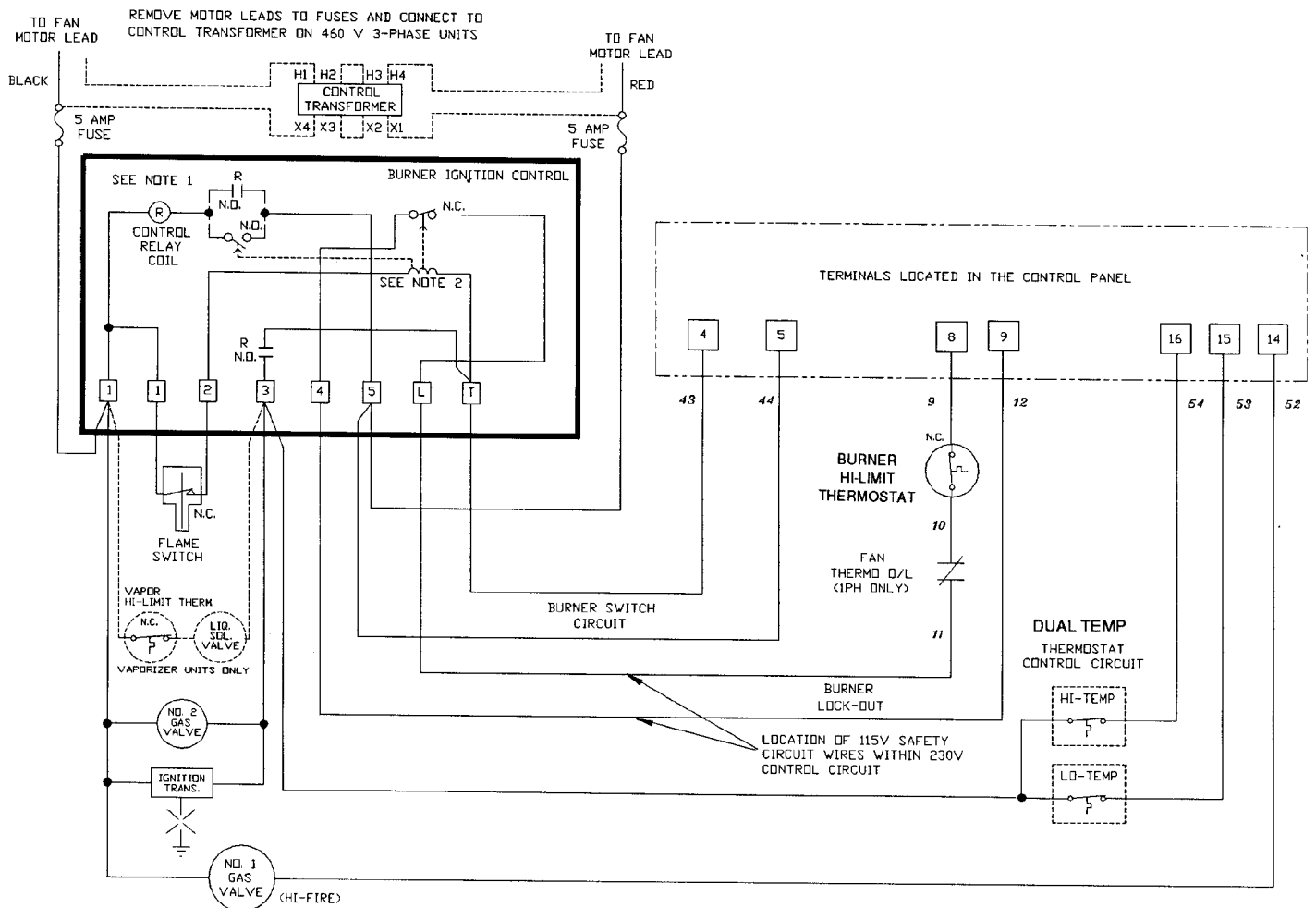


Fig. 8-5 CF/AB control circuit — page 2 of 3





NOTE:

1. SIMPLIFIED CIRCUIT SHOWN DIFFERS SLIGHTLY FROM ACTUAL BOARD CIRCUIT. TERMINAL NO. 6 IS FOR FACTORY PURPOSES ONLY AND IS NOT SHOWN.

2. TIME DELAY RELAY DEVICE HAS A SPECIAL HEATER CONSTRUCTION. WHEN ENERGIZED, IT CAUSES N.O. CONTACTS TO 'CLOSE' IN APPROX. 15 SEC. AND N.C. CONTACTS TO 'OPEN' WITHIN APPROX. 60 SEC.

4B0240.TIF

Fig. 8-6 Burner control circuit — all models

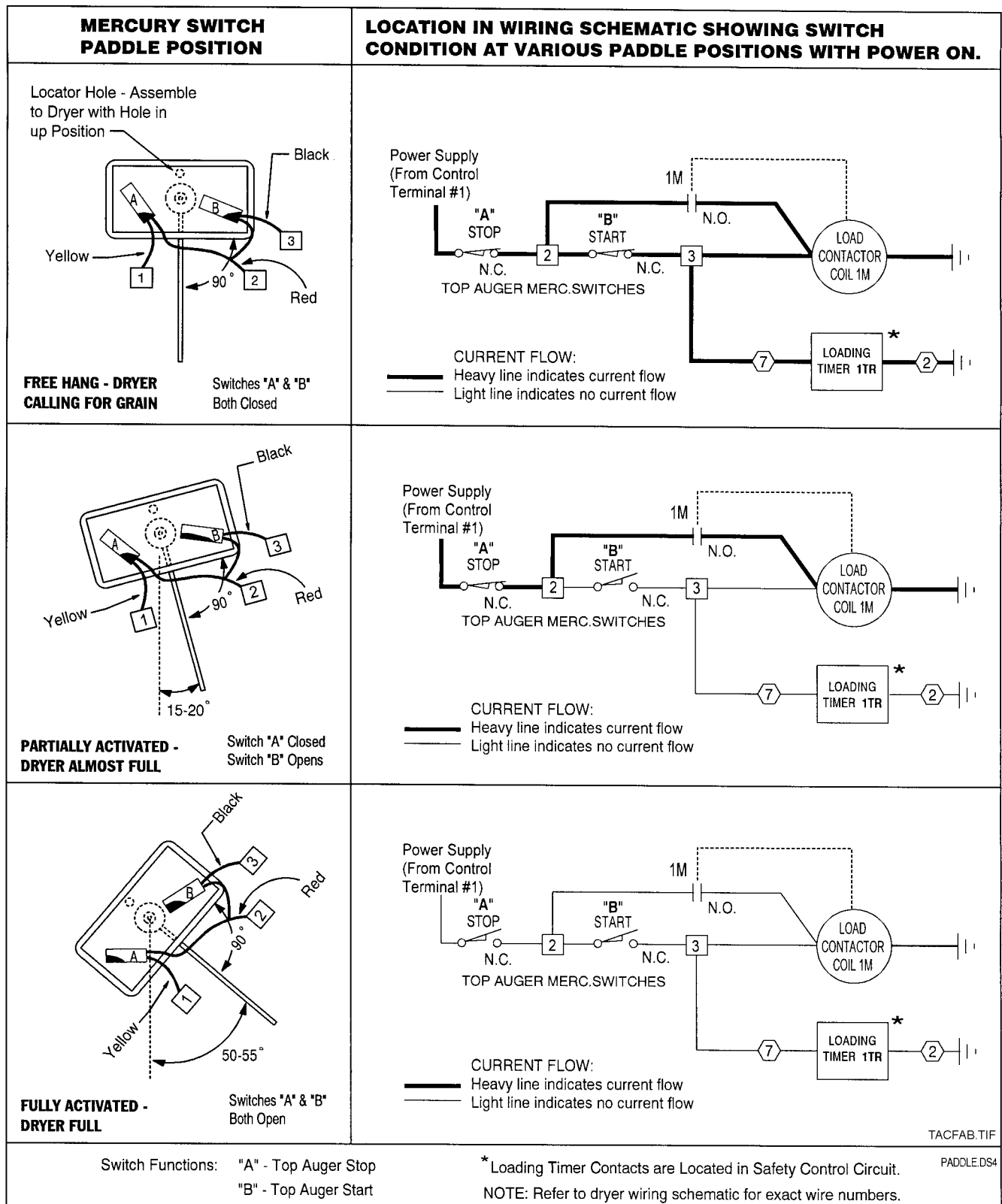


Fig. 8-7 Top auger mercury switch and control circuit

A voltmeter is required for some of the following checkout procedures. Before performing any tests, make certain to determine if dryer power supply is 1-phase 230V, 3-phase 230V, or 3-phase 460V.

The burner control circuit is 230 volts on all standard U.S. production dryers. When performing tests within the burner circuit, measure voltage ACROSS BOTH SIDES OF THE LINES AND NOT TO GROUND.

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

REFER TO WIRING DIAGRAMS AND PARTS LIST FOR IDENTIFICATION OF PARTS AND ELECTRICAL TERMINALS. When right- or left-hand side of dryer is mentioned, it is as viewed from the end opposite the fan.



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

TROUBLE	CHECKOUT PROCEDURE & INFORMATION
Control Circuit Not Energized - Panel Light and Shutdown Indicator Light OFF.	<ol style="list-style-type: none"> <li>1. POWER SUPPLY - Check that MAIN POWER SUPPLY and CIRCUIT BREAKERS are turned ON. Also check for a tripped circuit breaker. All circuit breakers must be ON before the control circuit light will come ON.</li> <li>2. FUSES - Check for blown safety circuit fuse or control transformer fuses (460v models). See appropriate POWER CIRCUIT diagram for location and number used.</li> <li>3. OVERLOAD RELAY - Check for tripped overload relay.</li> <li>4. STOP OR START SWITCHES - Check for a defective STOP or START switch. Also check switch wiring connections.</li> <li>5. 1CR RELAY - Check for a defective 1CR relay, relay base, or faulty wiring.</li> <li>6. RS RELAY (1-phase models only) - Check for defective RS Relay, relay base, or faulty wiring.</li> </ol>

Control Circuit Not Energized - Panel Light OFF with Shutdown Indicator Light ON.

## SHUTDOWN INDICATORS - Within ASC Control Box

FAN HEATER SAFETY LIGHT May be any of the following safety devices.

### BURNER HIGH LIMIT

Auto-resets after cooling. Indicates burner high limit switch has reached 200 deg. F for the following possible reasons:

- a. Inadequate air flow:
  - inlet air blocked
  - fan motor failed
- b. Backdraft currents during shut-down period.

**NOTE:** In the event the dryer shuts down, the backdraft currents of hot air passing through the housing may cause the burner hi-limit to trip open.

### FAN THERMAL OVERLOAD (1 motors only)

Auto-resets after cooling. Indicates excessive temperature within the motor windings.

- a. Voltage supply problem
- b. Defective motor

### GRAIN HI-LIMIT LIGHT

Auto-resets after cooling. Indicates that the RH and/or LH grain column high limit switch has reached 210 deg. F.

- a. Grain has over-dried due to:
  - Unload Auger is turned OFF
  - Meter roll speed is set too low
  - Batch dry timer set too long
  - Moisture control temperature is set too high
  - Grain column is plugged
  - Meter roll system has jammed or failed
- b. Failed grain high limit thermostat.

### BURNER LOCKOUT

Auto-resets after cooling. Indicates flame was not sensed for 60 seconds for

... continued

Control Circuit Not  
Energized - Panel Light  
OFF with Shutdown  
Indicator Light ON

the following possible reasons:

- a. Burner failed to ignite:
  - main shutoff valve was not opened
  - minimum fire set too low
  - hand valves closed
  - insufficient fuel supply
  - failed or fouled ignitor plug; also check for defective flame switch
  - failed liquid LP solenoid valve
  - vapor high limit sensor has reached 220 deg. F and has closed the liquid solenoid
- b. Burner flame has gone out:
  - minimum fire set too low
  - insufficient fuel supply
  - defective or improperly located flame switch
  - failed liquid LP solenoid valve
  - vapor high limit sensor has reached 220 deg. F and has closed the liquid solenoid

#### LOAD TIMER LIGHT

Auto-resets immediately. May indicate:

- a. Insufficient grain to fill dryer.
- b. Load Timer is set incorrectly:
  - load time set too low
  - timer set to incorrect range
  - timer memory set incorrectly to ON
- c. Failed load drive

#### PLENUM HI-LIMIT LIGHT

Auto-resets after cooling. Indicates Plenum high limit thermostat has reached 300 F for the following possible reasons:

- a. Plenum temperature set too high, or blocked air flow within dryer perforations.
- b. Minimum gas pressure setting is too high.
- c. Plenum thermostat has failed.
- d. Plenum high limit switch failed.

#### UNMONITORED Safety Shut-down devices are as follows:

Various circuit breakers (as shown in wiring schematics or Power Panel illustration)

Overload relays (manual reset required):

- Auxiliary load overload relay
- Load auger overload relay
- Auxiliary unload overload relay
- Unload auger overload relay
- Fan overload relay
- a. amperage draw on motor is too high
  - low voltage
  - motor load too high
  - failed motor
  - shorted motor wires
- b. overload heaters improperly sized
- c. failed heater strip or relay

#### DISCHARGE SHUT-OFF SWITCH

May require cleaning of grain from under the grain discharge door for switch to reset. Indicates that the discharge switch has opened for the following possible reasons.

- a. Auxiliary unload equipment has failed or overloaded.
- b. Discharge door is not seated properly.
- c. Discharge switch has failed.

Top Auger Will Not Start

1. Check that top auger circuit breaker is turned ON, also that control circuit is energized.
2. Check position of upper auger paddle & its switch box: paddle must be "down" with switch box horizontal to start auger. Paddle should rotate freely without "sticking."
3. Inspect for secure mounting and wiring of mercury switches in terminal box on top auger paddle switch shaft. Include check for defective mercury switch. When calling for grain, both mercury switches should be closed and passing 120V to top auger contactor coil.
4. Verify closing of top auger contactor; check voltage on load side of contactor. Inspect contactor for defective points or a burned out coil.
5. Inspect connections and check voltage applied to motor leads in motor junction box to determine if motor is defective.



Fan Motor Will Not Start	<ol style="list-style-type: none"> <li>1. Check that fan circuit breaker and fan switch are ON; also for defective switch or bad wiring connections.</li> <li>2. Verify closing of fan motor contactor; check for voltage on load side of contactor and for 120V to contactor coil. See POWER CIRCUIT and GENERAL CONTROL CIRCUIT wiring diagrams for fan circuit details. Inspect contactor for defective points or burned-out coil.</li> <li>3. Inspect connections and check voltage applied to motor leads in fan-heater control box to determine if motor is defective.</li> <li>4. If motor starts slowly, check for low voltage during starting, due to excessive voltage drop in power supply wiring.</li> </ol>
Bottom Auger Will Not Start	<ol style="list-style-type: none"> <li>1. Check that bottom auger circuit breaker is ON.</li> <li>2. Check that UNLOAD switch is set to AUTO. Check that SCR relay (3CR) and contactor are energized.</li> <li>3. Isolate problem by performing the following checks: <ol style="list-style-type: none"> <li>a. Rotate DRY and COOL timers to "0" and set UNLOAD TIMER to approximately 1 min.</li> <li>b. Temporarily set MOISTURE CONTROL SWITCH to OFF.</li> <li>c. Set DRYING MODE SELECTOR switch to BATCH mode, then turn ON fan switch. The auger should now operate, after a one to two minute delay.</li> <li>d. Set Selector switch to CONTINUOUS FLOW MODE. The auger should operate. If auger will operate in CF mode, but NOT in Batch mode, check for an improperly adjusted or defective unload timer.</li> </ol> </li> <li>4. Verify closing of bottom auger contactor by checking for power on the unload motor power terminals.</li> <li>5. If power was present in previous step, inspect connections and check voltage applied to motor leads in junction box to determine if motor is defective.</li> </ol>
Meter Rolls Will Not Operate (SCR Drive)	<ol style="list-style-type: none"> <li>1. Check that UNLOAD circuit breaker is ON, SCR SPEED CONTROL is properly set, UNLOAD switch is on AUTO and that meter rolls are not jammed (with SCR motor stalled or drive belt slipping).</li> <li>2. Check that 120VAC is present at the SCR relay 3CR. Also that 240VAC is present across the load side of the special 6-amp rectifier fuses. Replace fuses if blown and determine cause (short circuit or severe voltage spikes, etc.).</li> <li>3. If bottom auger is also not operating, see step 3 under previous bottom auger heading and reattempt operation with the MC and MODE switches reset. SCR and bottom auger control circuits are both controlled by the MC, MODE and UNLOAD selector switches.</li> <li>4. Check that SCR relay (3CR) or the unload contactor is energized and that it has closed its contacts which complete the switch circuit of SCR board assembly (terminals 6 &amp; 7 on Woods SCR board).</li> </ol> <p>Check for 240V present across AC line terminals L1 and L2 on SCR board assembly (with unload auger operating). If no voltage, check SCR fuses.</p> <p>Motor field terminals (F1 [+] and F2 [-] on Woods make boards) should indicate 190-200V DC. If no voltage, replace board.</p> <p>Check terminals 1 and 3 for 10V DC.</p> <p>Check terminals 2 and 3 for 0-10V DC varying with speed setting (with Meter Roll Selector Switch in manual). If no voltage or voltage does not vary, check SCR speed control pot (on the ASC panel) or wiring to pot.</p> <ol style="list-style-type: none"> <li>5. Turn SCR speed pot. fully clockwise; check DC voltage between ARM. A1 (+) and A2 (-) terminals on SCR board. Voltage should increase from near 0 V DC to 175V DC as speed control is moved to the MAXIMUM SCR speed setting. If no voltage or erratic voltage is indicated, check for possible bad wiring connections or a defective speed pot. before replacing SCR board.</li> <li>6. Inspect wiring connections and check voltage applied to motor leads in motor junction box to determine if DC motor is bad.</li> </ol>
Burner Will Not Fire with Fan Operating (Control Circuit Malfunction)	<ol style="list-style-type: none"> <li>1. Burner switch must be ON or in AUTO.</li> <li>2. Check for 230 volts across burner side of fuses located within fan-heater control box. Replace fuses, if blown, and determine cause of excess current (shorted wiring connections, etc.).</li> <li>3. Check for 230 volts across P/L Terminal Nos. 1 and 5. If there is no voltage, check for improper wiring connections. See BURNER CONTROL CIRCUIT wiring diagram for circuit details.</li> <li>4. Check for proper voltage across No. 1 and No. T terminals. If there is no voltage, check burner switch circuit.</li> </ol>
Burner Will Not Fire - No Gas Pressure with Fan Operating at Least 15 Seconds (Gas Supply or Fan-Heater Component)	<ol style="list-style-type: none"> <li>1. Check gas supply. Also, check gas filter and gas line for possible obstructions or closed valves. Refill tank and service parts, as required.</li> </ol> <p>NOTE: The electric main/safety gas valve cannot be opened until after the dryer control circuit has been energized.</p>

... continued

Burner Will Not Fire - No Gas Pressure with Fan Operating at Least 15 Seconds (Gas Supply or Fan-Heater Component)

2. Check for proper voltage across P/L Terminal Nos. 2 and T. If there is no voltage, check for a defective flame switch or improper burner switch circuit wiring. If burner will operate in ON switch setting, but not in AUTO, check for a problem within the burner relay or its wiring connections.
3. Check voltage across Terminal Nos. 2 and 3. If no voltage, substitute a new control relay and time delay relay assembly, then repeat the test. If these new parts do not correct the problem, replace the printed circuit base and repeat test.
4. If 230 volts is present across Terminal Nos. 2 and 3, but burner will not operate, check the following:
  - a. Inspect gas solenoid valves (includes liquid valve on LP units) for defective coils or improper wiring. Replace valve or valve coil if valve will not open with proper voltage applied.
  - b. Inspect for a defective high vapor thermostat (LP models only). Replace thermostat if its circuit is open (without overheated vapor).

Burner Fires - But Operates Only About One Minute and Dryer Shuts Down

1. Wait for several minutes for lock-out device to cool down, then restart the dryer. Immediately after the burner starts operating, connect voltmeter leads across Terminal Nos. 2 and T and continue to observe the meter. When fan first comes ON (with a cold flame switch), the voltmeter should indicate 230 volts. After the flame switch becomes HOT and opens its contacts, the meter should read ZERO. After the burner fires, the flame switch should OPEN within approximately 15 seconds or less.

If burner shuts down without the meter indicating that the contact points have opened, it indicates either a defective flame switch or insufficient heat exposure on the flame switch

Burner Will Not Fire - But Gauge Shows Gas Pressure

1. IGNITION TRANSFORMER - Check transformer for spark by removing ignition wire from transformer and holding an insulated handle screwdriver against the output terminal and 1/4" away from the case. There should be a strong spark. Check transformer wiring and connections. Replace the ignition transformer, if required. Make sure transformer case is properly grounded to heater housing.
2. IGNITOR PLUG - Check that ignitor plug is properly gapped to 3/32 inch and has a strong spark. Inspect ignition wire and its connections. Make sure wire is not shorted or broken. Check ignitor plug for damaged electrodes or cracked insulator. Replace, or clean and service ignitor plug, as required.
3. FUEL SUPPLY - Inspect burner venturi and orifice for possible obstructions. Clean parts as required.

Burner Operates But Will Not Cycle From Lo- Fire to Hi-Fire

1. Check for an excessive Lo-Fire gas adjustment setting. Observe pressure shown on gauge and compare reading with recommended flow control valve pressure setting listed in manual. Readjust Lo-Fire setting on flow control valve, if required.
2. Check for improperly adjusted or problems within Hi-Lo Fire thermostat control (plenum controller) circuit. Temporarily increase the temperature setting. If heater will still not cycle, check for problem in control wires connections or thermostat. The control cord should be connected to the VIOLET (common) and BLACK (normally closed) thermostat wires, so the switch will open on temperature rise. If burner will cycle to Hi-Fire with control cord wires connected together, the thermostat is faulty.
3. Check for improperly connected or faulty Hi-Fire gas vapor solenoid valve. Correct any poor connections or defective wiring. If wiring appears proper, problem may be caused by a burned-out valve coil or defective valve. Replace Hi-Fire solenoid valve, or its coil, if defective.

Burner Operates But Will Not Cycle From Hi- Fire to Lo-Fire

1. Check gas pressure reading on gauge. Problem may be due to insufficient gas regulator setting. Temporarily decrease the thermostat setting to verify that thermostat will function and cause the burner to cycle. If burner will cycle at reduced thermostat setting, it indicates that problem was due to insufficient heat to satisfy the original thermostat setting. Reset thermostat to original setting and increase gas regulator setting for additional heat output. Do not exceed the maximum pressure listed in manual.
2. Hi-Lo Fire thermostat control may be defective. If burner still will not cycle to Lo-Fire after decreasing the thermostat, the problem may be due to a failed sensor. Observe reading on thermometer. Replace control assembly if it cannot be set to cause its switch to go to the open circuit position with normally hot air plenum temperatures.
3. If burner continues to operate on Hi-Fire, check the Hi-Fire gas solenoid valve for a stuck or blocked open condition, or for reversed gas pipe connections. THE SOLENOID VALVE MUST NOT ALLOW GAS FLOW WHEN ITS COIL IS NOT ENERGIZED.

Burner Maintains Desired Drying Temperature, but Cycles from Hi-Fire to OFF (without going into Lo-Fire)


1. Make sure the flow control valve is not set completely closed. Valve must be adjusted open to provide the proper Lo-Fire gas pressure listed in manual.

# DIGI-TROL TROUBLESHOOTING

## TROUBLE

## CHECKOUT PROCEDURE & INFORMATION

Temperature or Moisture  
Controller Error Messages

1. Controller displays three blinking bottom dashes. 

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

2. Controller displays three blinking top dashes and the HB light is ON. 

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

1. Grain moisture discharged too wet.

- Increase moisture control temperature set point.
- If controller's OUT (low speed) indicator is ON during most of the 10-second cycle, switch to manual and establish a new lower unload rate.

2. Grain moisture discharged too dry.

- Decrease moisture control temperature set point.
- If discharge rate is running at or near 100%, it may be necessary to reduce plenum temperatures to allow moisture control more freedom to work.
- If controller's OUT (low speed) indicator is OFF during most of the 10-second cycle, switch to manual and establish a new higher unload rate.

3. Grain moisture discharged inconsistent.

- Check that plenum temperatures are being held consistent.
- Check for plugged grain columns (empty column to correct).
- If large variations in incoming moisture are occurring, the control can only minimize changes in discharge moisture. Some variation must be accepted.
- Check fill auger for proper operation and that an adequate grain supply is available to maintain grain seal.

4. Moisture controller temperature is not stable.

- Be sure to allow 2/3 grain pass before starting into Auto control. See operation sections. Starting Auto Control when grain temperature and Set Point temperature are not nearly equal will greatly increase the time required to stabilize on set point.
- Be patient, as grain drying is a slow process. 1-3 hours for a grain pass is not uncommon.



**FARM FANS**

Division of ffi Corporation  
5900 Elmwood Avenue • Indianapolis, Indiana  
©1997 ffi Corporation Printed in U.S.A.