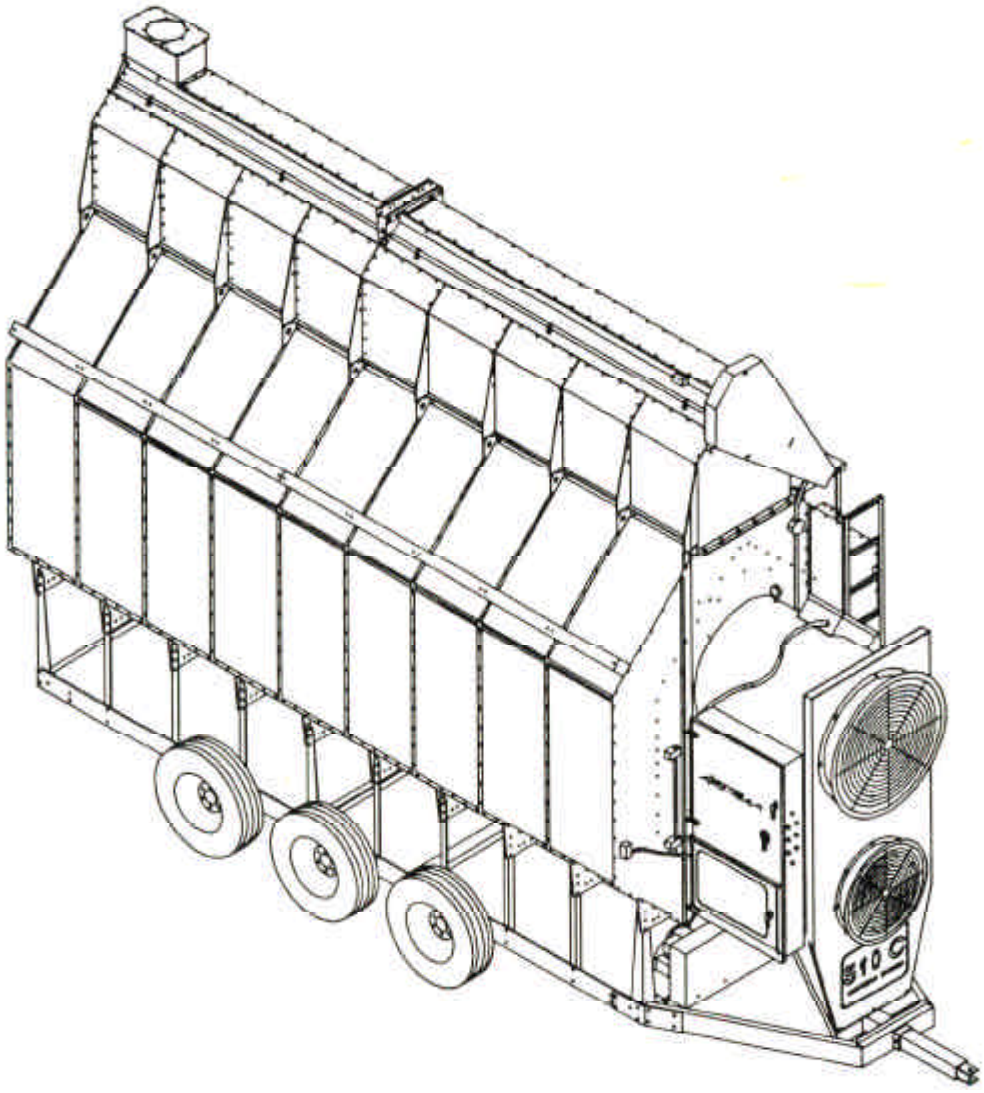
AIRSTREAM

OPERATION MANUAL



AIRSTREAM C-SERIES TWO-FAN GRAIN DRYERS

GSI
GRAIN SYSTEMS, INC.
ASSUMPTION, IL 62510 217/226-4421

PNEG-262B
8/15/92

OPERATION MANUAL

Thank you for choosing and AIRSTREAM C-Series Two-Fan grain dryer. These units are one of the finest grain dryers ever built and designed to give excellent performance and service for many years.

This manual describes the operation for all standard production 410C, 510C, 600C, 610C and 710C dryers. These dryers are available for liquid propane or natural gas fuel supply with either single phase 230 volt, or three phase 220 or 440 volt electrical power.

WARRANTY

Grain Systems, Inc. warrants its products to be free of defects in material and workmanship. The only obligation of the manufacturer is to repair or replace components which have been submitted and found to be defective within 24 months after installation. If so found to be defective, the components will be repaired or replaced without charge, this consitituting and entirely fulfilling the warranty obligation. Grain Systems, Inc. assumes no liability for expenses incurred without written authorizations; in no event shall 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. Electric motors, tires, and other components supplied by outside manufacturers are warranted separately by those suppliers. This warranty is exclusive and in lieu of all other warranties, expressed or implied. Grain Systems, Inc. reserves the right to make design or specification changes at any time, without any contingent obligations to purchasers of products already sold.

All instructions shall be construed as recommendation only. Because of the many variable conditions in actual installation, Grain Systems, Inc. assumes no liability for results arising from the use of such recommendations. Any alteration in design or operation of any Grain Systems, Inc. product must be submitted and approved in writing by Grain Systems, Inc. before alteration is made.

SAFETY FIRST

GENERAL SAFETY STATEMENTS

Grain Systems, Inc.'s principle concern is your safety and the safety of others associated with grain handling equipment. This manual was written with this thought in mind. We want to keep you as a customer. This manual is to help you understand safe operating procedures and some problems which may be encountered by the operator and other personnel.

As owner and/or operator, it is your responsibility to know what requirements, hazards and precautions exist and inform all personnel associated with the equipment or in the area. Safety precautions may be required from the personnel. Avoid any alterations to the equipment. Such alterations may produce a very dangerous situation, where serious injury or death may occur.

SAFETY ALERT SYMBOL

The symbol shown below is used to call your attention to instructions concerning your personal safety. Watch for this symbol; it points out important safety precautions. It means "ATTENTION", "WARNING", "CAUTION", and "DANGER". Read the message that follows and be cautious to the possibility of personal injury or death.

WARNING!

BE ALERT Personnel operating or working around dryer should read this manual. This manual must be delivered with equipment to its owner. Failure to read this manual and its safety instructions is a misuse of the equipment.

DANGER

Disconnect electricity before inspecting or servicing.

WILL CAUSE SERIOUS INJURY OR DEATH

Grain Systems, Inc. recommends that you contact your local power company and have a representative survey your installation so your wiring will be compatible with their system and so that you will have adequate power supplied to your unit.

SAFETY PRECAUTIONS

1. Read and understand the operating manual before trying to operate the dryer.
2. Never operate dryer while guards are removed.
3. Power supply should be OFF for service of electrical components. Use **CAUTION** in checking voltages or other procedures requiring power to be ON.
4. Check for gas leaks at all gas pipe connections, if any leaks are detected, do not operate dryer. Shut down and repair before further operation.
5. Never attempt to operate the dryer by jumping or otherwise bypassing any safety devices on the unit.
6. Set pressure regulator to avoid excessive gas pressure applied to burner during ignition and when burner is in operation. See chart for operating procedures. Do not exceed maximum recommended drying temperature.
7. Keep the dryer clean. Do not allow fine material to accumulate in the plenum chamber.
8. Keep auger drive belts tight enough to prevent slippage.
9. Use **CAUTION** in working around high speed fans, gas burners, augers, and auxiliary conveyors which **START AUTOMATICALLY**.
10. Do not operate in an area where combustible material will be drawn into the fan.
11. Before attempting to remove and reinstall any propellor, make certain to read the recommended procedure listed within the SERVICING section of the manual.
12. Be certain that capacities of auxiliary conveyors are matched to dryer auger capacities.
13. Clean grain is easier to dry. Fine material increases resistence to air flow and requires removal of extra moisture.

READ THESE INSTRUCTIONS BEFORE INSTALLATION AND OPERATION.
SAVE FOR FUTURE REFERENCE.

USE CAUTION IN 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 can not 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 heater, 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 this 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 Safety Precautions listed above 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.

CONTENTS: PAGE:

1. Test Firing

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

A. Inspect Metering Rolls:

1. 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 metering rolls. (Figure 1)
2. Set controls and switches as described in the chart below:

Control	Test Firing Setting
MC Switch	On
MC Thermostat	Min. Temperature
Hi-Limit Thermostats	Max. Temperature
Load Switch	Off
Unload Switch	Off
All Fan Switch	Off
All Burner Switch	Off
Loading Timer	30 Minutes
Metering Rate Adjustment	0
Dry Timer	1 Minute
Cool Timer	1 Minute
Unload Timer	30 Seconds
Mode Switch	Continuous Flow

3. Turn on Main Electric Power Supply.
4. Set all circuit breakers to ON and turn ON the Safety Disconnect.
5. Open the main fuel supply valve at the tank. Turn on electric shut off valve to allow fuel flow to the dryer and inspect all gas lines and connections for possible leaks. (Figure 3)
6. Make sure tank has adequate supply of gas, if using LP gas or adequate supply of natural gas, if using natural gas.

⚠ ANY GAS LEAKS MUST BE IMMEDIATELY CORRECTED.

⚠ NOTE: On LP tanks, open shut-off valves SLOWLY to prevent accidental closing of excess flow valve within the system.

7. Press the dryer START button. The red indicator light should come ON indicating that the safety circuit and control circuit are energized for dryer operation.

NOTE: The red indicator light will not come ON unless all circuit breakers are turned on.

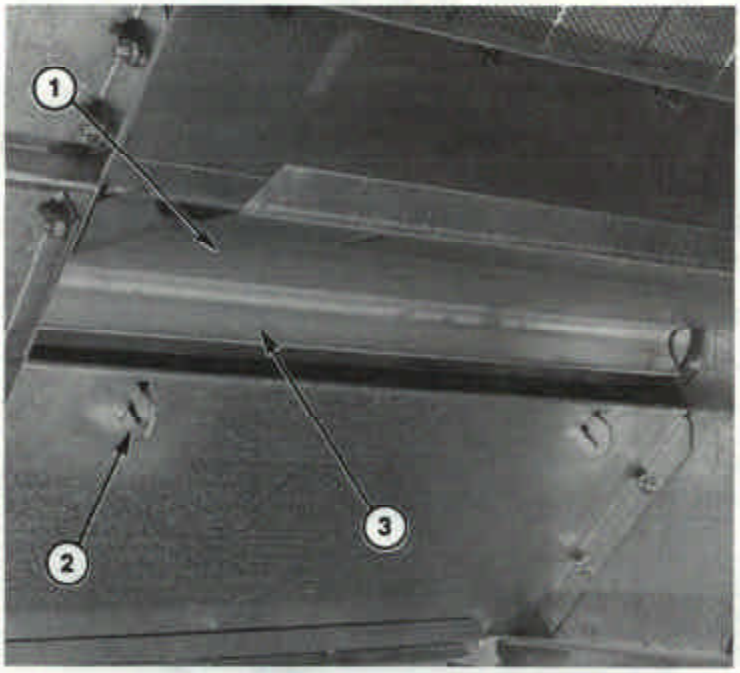


Figure 1

Metering Roll Access Door

1. Access Door
2. Meter Roll
3. Access Door Latch

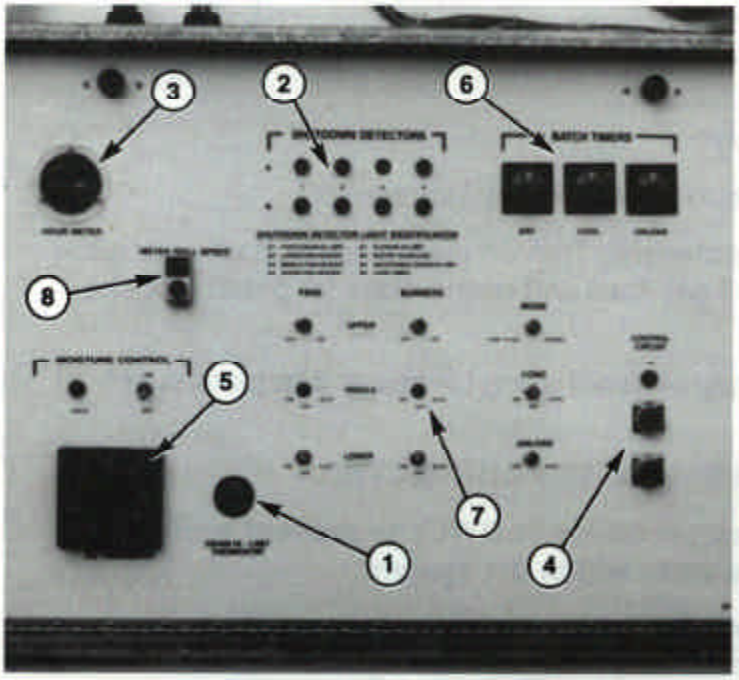


Figure 2

Dryer Control Board

1. Adjustable Grain Hi-Limit Thermostat
2. Shut Down Indicator
3. Hour Meter
4. Stop and Start Switches
5. MC Thermostat
6. Batch Timers
7. Control Switches
8. Meter Roll Adjustment

8. CHECK CONVEYER FOR PROPER DIRECTION:

A. With the wet grain supply shut off, quickly bump the LOAD switch ON. The top auger should rotate CLOCKWISE, as viewed from the drive end. Any wet grain, auxiliary supply conveyers connected to the dryer power terminals should start and rotate in the proper direction.

B. Flip the UNLOAD switch to AUTO. Turn up the meter roll dial until the meter roll begins. The bottom auger should rotate COUNTER-CLOCKWISE and the meter roll drive motor CLOCKWISE, as viewed from the drive end. Any dry grain, auxiliary conveyers connected to the dryer power terminals should start and rotate in the proper direction.

C. After checking bottom auger motor, leave the unloading switch on AUTO and slowly turn up the MC Thermostat control. As the MC Thermostat setting is increased, the MC indicator light should come on and the meter roll should stop operating.

NOTE: The bottom auger will stop after the 30 seconds clean-out if the dryer is still being held by the MC Thermostat. Rotate the MC Thermostat down to its minimum setting. The MC light should go OFF and the meter roll should restart. If the bottom auger has stopped, it will restart.

9. CHECKING METERING ROLL OPERATION:

With bottom auger still operating, turn the metering roll adjustment dial. Check the metering roll drive mechanism for proper operation throughout the full range of operation. Make sure drive chain tension is properly adjusted and that all sections of the metering rolls rotate properly.

Turn the UNLOAD switch OFF after checks are completed.

10. CHECK FAN DIRECTION:

Bump fan switch and observe direction of rotation. On 410C models, the 24-inch fan (bottom) should run clockwise, while the 28-inch (top) fan should run counterclockwise. On the 510C, 600C, 610C and 710C all fans should run counterclockwise.

NOTE: If all motors run backward on three phase model dryers, they can easily be reversed by interchanging wires L1 and L3 (leaving the high leg in the center) of the three power supply connections to the dryer. Auxiliary conveyors which have been field connected may have to be reversed individually.

11. CHECK BURNER SAFETY LOCK-OUT FUNCTION:

Start the bottom fan (and turn bottom burner switch ON). With the main gas shut-off valve closed, the safety circuit within the burner control system must function after a short interval and cause the dryer to shut down. Turn bottom fan switch OFF, then wait several minutes and turn the next fan and burner switches ON. Press the start button and perform the same type of safety circuit check for this burner.

Figure 3

Electronic Safety Shut-Off Valve

12. BURNER FIRING

Start all fans and turn all burner switches ON. All burners should fire after a short purge interval and gas pressure should be indicated on the pressure guage for each burner. Adjust bottom burner Hi-Lo Fire thermostat to approximately 200°F to cause burner to operate on Hi-Fire. Observe gas pressure indicated on pressure gauge, then turn thermostat to its minimum setting which will cause burner to cycle into Lo-Fire. As the burner thermostat is turned down, the gas pressure gauge should show a noticable 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: For additional information concerning the actual recommended gas pressure setting and the adjustment procedure, refer to Gas and Heat adjustment.

Repeat procedures for each burner and verify that all burners will function in both Hi-Fire and Lo-Fire.

13. CHECK STAGED AUTOMATIC MODE OF OPERATION:

A. With the unload switch OFF and the control circuit activated, set bottom burner switch to AUTO.

B. Turn bottom fan switch to AUTO. Both fans should start operating and the burners should fire after the purge interval.

C. Turn the mode switch to STAGED and set the unload switch to AUTO. Observe the following events as they occur:

1. The dryer timer will become energized and begin.

2. After approximately one minute, burners will shut down and the fans will continue to operate.

3. After another minute the cool timer will reach zero. This will cause the unload timer to begin. At the same time, the bottom auger and any auxiliary unloading conveyor should start and the bottom fan should stop operating.

4. When the unload timer reaches zero, it will automatically reset to its original setting and cause the dry timer to operate and begin. At the same time: (a) the unloading should stop (bottom auger will run for 30 seconds), and (b) the bottom fan should start operating and the bottom burner will start after the short purge period.

14. STOP DRYER OPERATION:

Push the STOP button. The fan, burner, and augers should immediately stop operating as the button is depressed. 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.

15. SHUT-DOWN:

To shut down dryer:

1. Close the valve on the fuel tank. Let the dryer run a few minutes to drain the fuel lines.
2. Close the fuel valves at the dryer.
3. Turn all switches OFF.
4. Push the Control Circuit Stop Button.
5. Turn off the Main Safety Disconnect.
6. Turn off the Main Power Supply.

2. GAS AND HEAT ADJUSTMENT HI-LO FIRE BURNER THERMOSTAT AND GAS PRESSURE SETTINGS

THERMOSTAT OPERATION:

The drying temperature from the fan-heater unit is controlled by the Hi-Lo Fire burner thermostat located on the front, left of the dryer.

The thermostat senses the air plenum temperature and cycles the burner from Hi-Fire to Lo-Fire to maintain the desired drying temperatures as indicated by the thermostat. (Figure 4)

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 flow of gas in order to sustain burner operation.

PROPANE MODELS

HI-FIRE:

The Hi-Fire gas pressure for the burner is controlled by the gas pressure regulator. For maximum heat capacity, the regulator should be adjusted while operating on HI-Fire to provide approximately 10-30 PSI, shown by the pressure gauge on the fan-heater.

LO-FIRE:

Set the Lo-Fire gas pressure to approximately 2-6 PSI by rotating the knob on the flow control valve. Lock the setting after making this adjustment. The burner must be operating on Lo-Fire when making this adjustment.

NATURAL GAS MODELS

HI-FIRE:

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 approximately 7-10 PSI while the burner is operating on Hi-Fire.

LO-FIRE:

Turn the handle on the small gas shut-off valve to produce a Lo-Fire gas pressure of approximately 1-3 PSI while the burner is operating on Lo-Fire.

BURNER CYCLE:

When the 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 guage. It is not necessary for the 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 the gas regulator setting propane models, or the main gas supply pressure on natural gas models, in order to satisfy the thermostat setting. Do not exceed 30 PSI for propane models, or 10 PSI for natural gas.

If the burner remains in Lo-Fire and does not cycle, decrease the Lo-Fire gas pressure slightly by readjusting the flow control valve.

NOTE: 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.

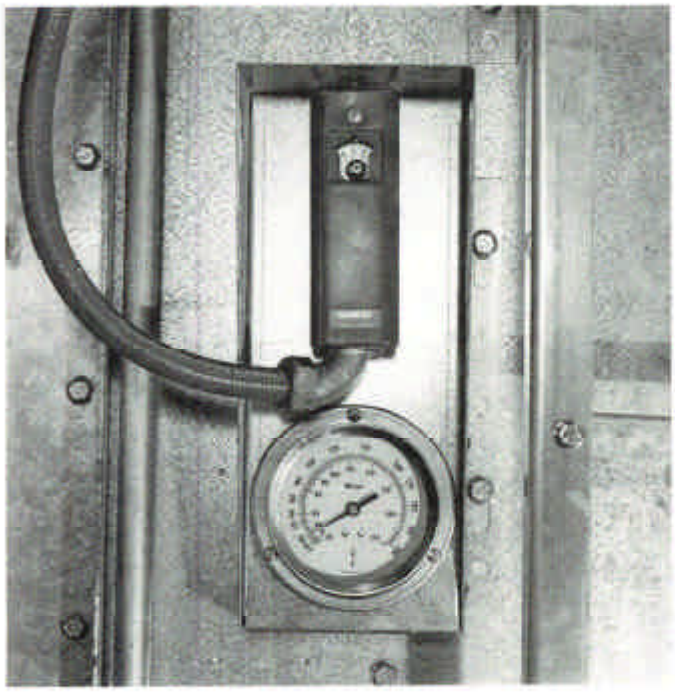


Figure 4

Hi-Lo Thermostat

3. OPERATING INFORMATION

LOAD SWITCH (TOP AUGER):

The load switch has three positions ON-OFF-AUTO. When the switch is set to AUTO, the load timer will be energized whenever the top auger is operating. If the top auger and timer operate continuously for a period longer than the timer setting, the timer will automatically shut down the dryer. The AUTOMATIC switch is the normal setting and is used to automatically stop the dryer when the wet grain supply is exhausted.

When the switch is ON, the load timer will not operate. The ON position is recommended when filling an empty dryer.

With the switch on either AUTO or ON, the top auger will automatically start and stop as required to keep the dryer full of grain. (Figure 5)

UNLOAD SWITCH (BOTTOM AUGER):

The UNLOAD switch has three positions: TWO, OFF and ONE.

When in Cont. Flow mode and operated on position ONE, the unloading auger will be controlled by the MC Thermostat. If the grain temperature is higher than the MC Thermostat setting, the unloading auger will run. If the grain temperature gets lower than the MC Thermostat setting, the unloading auger will stop.

When operated on the TWO position, the meter roll speed will change to the low speed will change to the low speed dial rather than stop. The low speed dial is licated on the lower back panel.

In staged mode, the mode switch should be in the single speed position. The MC thermostat will check the moisture at the end of the dry timer. It will hold the grain for further drying or release it for the next cycle.

When the switch is OFF, the unloading auger will stop, but the dryer fan and heater will continue to operate.

MODE SWITCH:

The MODE SWITCH is used to select either the CONT. FLOW or STAGED AUTOMATIC mode of dryer operation.

When in CONT. FLOW mode, the batch timers are switched out of the control circuit.

When in the STAGED AUTOMATIC mode, the batch timers are switched into the control circuit.

FAN SWITCH:

The fan switch for the bottom fan has two operating positions. If the switch is ON, the fan will operate continuously. If the switch is set to AUTOMATIC, the fan will automatically stop during unloading when the dryer is operating in the staged automatic mode.

The top fan switch is designed only for ON-OFF manual control of the fan.

BURNER SWITCH:

When the dryer is operating in the staged automatic mode, the burner switch for the bottom burner has two operating positions. When the switch is ON, the burner will operate continuously. When set on AUTOMATIC, the burner will be controlled by the dry timer and will automatically stop during cooling and unloading. If the switch is OFF, the burner will not operate.

The top burner switch controls the ON-OFF operation of the burner and is not controlled by the timers. With this arrangement, the burner is either on or off.

Refer to the appropriate STAGED AUTOMATIC OR CONTINUOUS FLOW operation chart for recommended burner switch settings for the different drying times and the type of drying process. As a general rule; if the fan switch is set in the AUTOMATIC position, the corresponding burner switch should also be set in AUTOMATIC.

NOTE: Regardless of switch position, the heater will not operate unless the fan is running.

METER ROLL ADJUSTMENT DIAL

DISCHARGE RATE:

The high speed meter roll adjustment shown in Figure 9A controls the rate of dry grain discharge through the dryer. The mechanism's dial has a 0 to 999 scale which represents the flow of grain past the metering rolls as a percentage of the maximum grain discharge rate for the dryer. The maximum setting of 999 represents 100%, or approximately:

A. 1800 bu/hr. for the 410C.
B. 2300 bu/hr. for the 510C.
C. 2800 bu/hr. for the 600C.
D. 3000 bu/hr. for the 610C.
E. 3500 bu/hr. for the 710C.

This dial also has a locking device to prevent accident movement of the setting.

The low speed meter roll adjustment shown in Figure 9B controls the grain discharge rate when the MC Thermostat has determined the grain moisture level is too high. The Low speed dial is only used in the continuous flow mode of operation. The dial is located on the lower back panel of the main control box. The mechanism's dial has a 0 to 100 Scale. Zero being the minimum and 100 being the maximum.

ADJUSTMENT:

Turning the dial CLOCKWISE will INCREASE the grain discharge rate, whereas COUNTERCLOCKWISE rotation will DECREASE the discharge rate.

Figure 9A
High Speed Meter Roll Adjustment

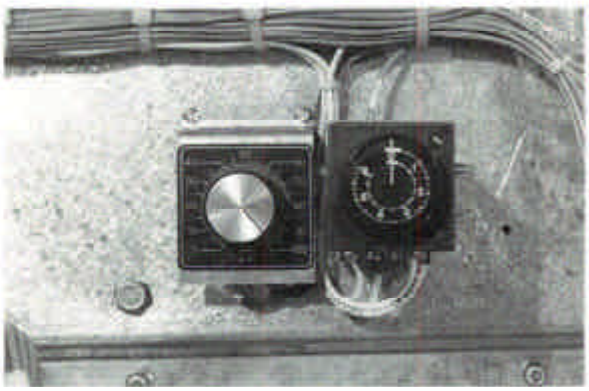


Figure 9B
Slow Speed Meter Roll Adjustments

MOISTURE CONTROL (MC) THERMOSTAT AND INDICATOR LIGHT

The function of the MC thermostat is to sense the temperature of the grain being dried within the grain column and to automatically hold (staged automatic) or slow the discharge rate (continuous flow) of higher moisture grain for additional drying until the grain temperature reaches the MC thermostat setting. With the thermostat properly set, it will prevent the unusually wet grain from being discharged at too high of a moisture content.

When the MC thermostat is holding the grain for further drying, the MC indicator will be ON, indicating that the grain temperature is below the MC setting.

The MC switch controls the operation of the MC thermostat within the dryer. The MC thermostat is located within the Main Control Panel and is equipped with four RTD platnum sensing probes. These probes are located in both grain columns and average the temperature of the grain.

The standard thermostat package is equipped with a long sensor lead which monitors the grain temperature near the outside of the right-hand grain column. This is only used in ON-OFF operation for the moisture control.

GRAIN COLUMN HI-LIMIT THERMOSTAT:

The Hi-Limit thermostats are located in electrical boxes mounted on both sides of the front panel. These thermostats sense the grain temperature near the outside of both grain columns between the fan heater units. The thermostats are safety monitoring devices designed to shut down the dryer if the grain column temperature exceeds the thermostat setting.

All two fan models have one Adjustable Hi-Limit Thermostat located with the Main Control Box and one Fixed Hi-Limit thermostat. (Figure 6)

BURNER CONTROL-SEQUENCE OF OPERATION

The operating principle of the burner control is listed as follows (see burner control wiring diagram):

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

   With the fan operating and the burner switch on, power is transmitted through the burner switch to supply power to the Fenwal board.

2. The Fenwal board will determine if a flame has been established. If so, the burner will continue to operate. If not the Fenwal board will shut off power to the solenoid valves, discontinuing gas flow and shut the dryer down after 60 seconds.

3. The heater will operate on Hi-Fire with both the main supply and the Hi-Fire gas solenoid valves energized until the 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 HI-Lo cycle to maintain the desired heat.

4. If the heater fails to start operating due to lack of fuel or possible malfunction, the Fenwal system will de-energize the gas solenoids and shut the system down automatically by way of a 60 sec. time delay relay.

VAPORIZER ADJUSTMENT:

LIQUID PROPANE MODELS ONLY

After initial installation and occasionally during the drying operation, check the temperature of the regulator and the pipe train. ALLOW HEATER TO OPERATE AND STABLIZE TEMPERATURES BEFORE MAKING THIS CHECK.

NOTE: If the gas temperature exceeds 160°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.

If the gas line is very cold or "frosted," move the vaporizer slightly closer to the flame. If gas line is too hot to touch, move vaporizer slightly away from the flame. The small wedge-shaped heat baffles can also be removed from the burner vanes to reduce the vapor temperature. If 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 burner vanes.

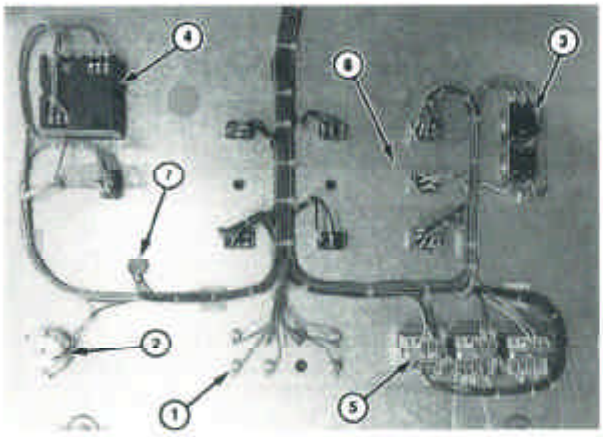


Figure 5

Dryer Control Board

1. Shut Down Indicator
2. Hour Meter
3. Stop and Start Switches
4. MC Thermostat
5. Batch Timers
6. Control Switches
7. High Speed Meter Roll Adjustment

Figure 6

Adjustable Grain Hi-Limit

4. TIMER SETTING AND ADJUSTMENT

Factory production dryers are shipped with the batch timers set in the 60M (sixty minutes) mode of operation with the timer memory adjustments screw ON. The load timer is shipped with the memory adjustment screw off. These settings should normally not be changed for the LOAD TIMER, COOL TIMER and the UNLOAD TIMER; however, for the DRY TIMER with the DRY AND COOL method, the 60M mode will normally be limited only to moderately wet grain (less than 25% moisture). When drying 25% or more initial moisture content grain, it will be necessary to set the DRY TIMER to the 12 HR (twelve-hour) mode of operation. This setting, as described within Adjusting the Time Range, allows longer timer settings. See chart for suggested drying times.

To adjust the time on any of the four timers, simply rotate the front dial to the desired setting when the timer is not energized. The No. 1 mark equals one-sixth of the selected range (for example, 1/6 of 60 Min. range= 10 minutes). The dial acts as a cycle progress indicated during operation, in that the outer mark shows the cycle time setting and the elapsed time.

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

5. LOAD TIMER

The load timer shown in Figure 8 is located within the Control Box. It is an adjustable, automatic reset type timer and is designed to provide automatic shut-down of the dryer should the top auger operate continuously for a time period exceeding the adjustment setting. This shut-down indicates the absence of wet grain.

NOTE: The timer is factory set in the 60 minute mode, with the memory OFF. This setting is correct for the load timer.

To set the timer, observe the normal time required for the dryer to refill. Set the timer at the average refill time plus five additional minutes.

6. ADJUSTING THE TIME RANGE

To adjust the time range (not the time setting) of the timer, proceed as outlined:

A. Use a small screwdriver and rotate the time range adjustment screw to the desired range (either 6M, 60M, or 12HR) as shown in Figure 7.

B. If the timer has been replaced or the memory adjustment has been disturbed, use a small screwdriver and rotate the memory adjustment screw ON. The screw is located on the base end of the timer. If a power interruption occurs, the timer will not be reset but will remain at that point in the time cycle and start timing from the point when the power is restored. If the timer is in the white section, the timer will reset.

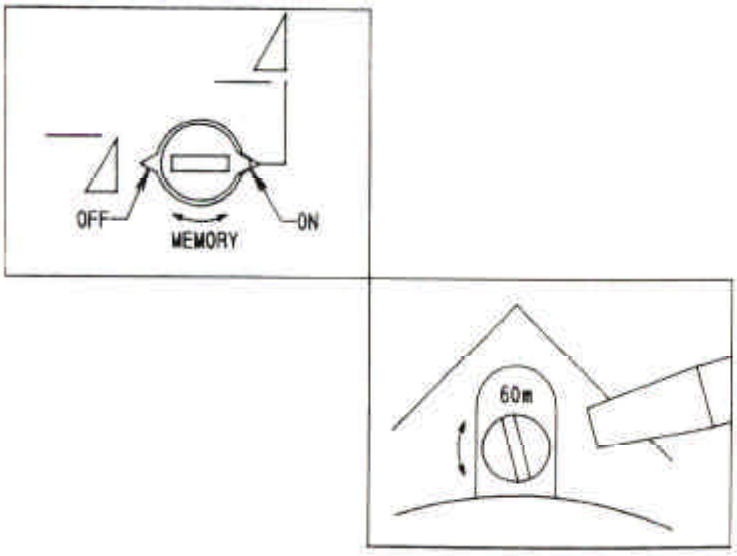


Figure 7

Memory and Time Range

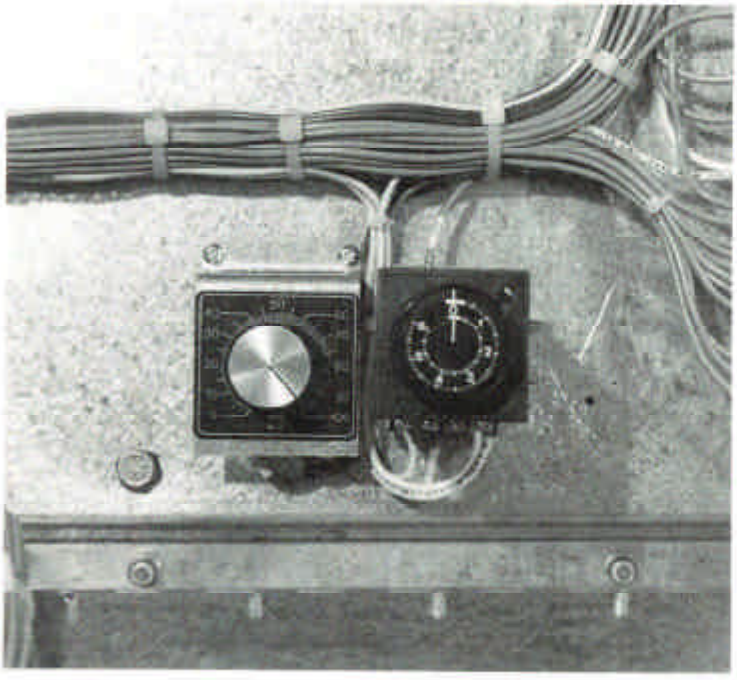


Figure 8

Load Timer

7. SETTING THE BATCH TIMERS FOR STAGED

A. DRY TIMER

These times will vary depending on the grain being dried. See drying time chart for the appropriate timer setting.

B. COOL TIMER

If no cooling is desired, set the time setting to zero. For dry and cool see drying time chart for proper setting.

C. UNLOAD TIMER

Check the final grain moisture during unloading. The discharge grain should be dry up to the completion of the unloading cycle. To check at the end of the cycle, immediately change the mode switch setting to CF to briefly continue the 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 switch and unload switch to their original positions. Changing the unload timer may affect the toatal drying time or cooling time. Necessary adjustment may need to be made.

8. OPERATING INSTRUCTIONS CONTINUOUS FLOW

1. Refer to OPERATING CONTROLS for important information concerning adjustments for gas pressure, thermostat settings, load auger timer, meter rolls, and control settings.
2. Measure moisture content of wet grain.
3. Refer to DRYING TIME TABLE and determine the approximate drying time required to provide the required moisture reduction.
4. Refer to TEST FIRING and START-UP INSTRUCTION chart and perform the procedures listed.
5. Using the recommended drying time, refer to the DRYING TIME CHARTS for suggested drying setting and other information.
6. For Continuous Flow mode, decrease meter roll discharge rate for lower final moisture content in the dried grain. Increase the discharge rate for higher final moisture content. Raising or lowering drying air temperatures will increase or decrease final moisture. Changes in moisture content of wet grain require adjustments of discharge rate.
7. Set MC Thermostat.
8. Set time on Load Timer.

9. CONTINUOUS FLOW START-UP

TEST OPERATE the dryer prior to start-up. Make certain all motors and controls are functional before loading the dryer with wet grain.

1. Set Controls As Listed:
   - **A.** Temporarily set all burner (plenum) thermostats at the drying temperature recommended for normal operation of the top stage burner (for example: 220°-230°F for shelled corn).
   - **B.** Turn MC switch OFF.
   - **C.** Turn Mode switch on CONTINUOUS FLOW.
   - **D.** Turn load switch OFF. Turn unload switch OFF.
   - **E.** Turn fans switch OFF. Turn burner switches OFF.
2. Press the dryer START button. The red indicator light should come on.
3. Turn Load Switch ON to fill the dryer.
4. Determine the approximate total drying time for the type of grain and the drying process to be used from the Drying Time Table.

   NOTE: For example, with 25% moisture shelled corn use the DRY AND COOL process. If the final moisture is to be 15% (10% removal), the estimated drying time is 60 minutes.
5. Using the total drying time from Step 4, refer to the appropriate drying time chart for Continuous FLow operation and determine the normal drying time per stage.

   NOTE: For the 60 minute drying time example mentioned earlier, the drying time per stage would be 30 minutes for the 410C with the DRY AND COOL process.
6. Turn BOTTOM FAN and BURNER switches ON and operate bottom stage for one start-up time period, as established in Step 5.
7. Operate the dryer for an additional start-up period.
8. For DRY AND COOL operation, turn BOTTOM BURNER switch OFF. For FULL HEAT drying, keep BOTTOM BURNER switch ON and readjust bottom stage drying temperature to the normal recomended setting.
9. Turn TOP FAN and BURNER switches ON.
10. Operate the dryer for approximately one start-up time, as determined in Step 5.
11. While the dryer is operating, adjust the metering roll dial to the recommended trial setting. To determine the setting, refer to the appropriate drying time chart for CONTINUOUS FLOW OPERATION and determine the approximate drying capacity corresponding to the proper total drying time. Then, use this capacity and refer to the metering roll discharge chart (located at the far right-hand side of the chart) to determine the required initial dial setting.
12. At the end of this cycle, turn unload switch to AUTO and set all FLOW OPERATION controls as indicated by the appropriate drying time chart.
13. Check the final moisture content and readjust the unloading rate slightly, if required.

    NOTE: The time required for the grain to pass completely through the dryer is the time necessary to notice a stabilized change in final moisture content after adjustment. During start-up, some variation will naturally occur.

APPROXIMATE DRYING TIME TABLE FOR VARIOUS INITIAL MOISTURE CONTENTS

CORN - DRY & COOL

Initial Moisture	Minutes *Approx. Time
15	NA
16	7
17	14
18	21
19	28
20	35
21	41
22	47
23	53
24	59
25	65
26	70
27	75
28	80
29	85
30	90
31	95
32	100
33	105
34	110
35	115

CORN - ALL HEAT

	Dryeration	Combination
Initial Moisture	Minutes *Approx Time	
15	NA	NA
16	6	NA
17	12	NA
18	18	NA
19	24	NA
20	30	NA
21	35	6
22	40	11
23	45	16
24	50	21
25	55	26
26	60	32
27	65	37
28	70	41
29	75	46
30	80	50
31	85	54
32	90	58
33	95	62
34	100	66
35	105	70

DRYERATION-SHELLED CORN
To approximate 17% final moisture in dryer: 15% in cooling bin by full heat process. 200-220°F average drying temp.

COMBINATION DRYING-SHELLED CORN
To approximate 20% final moisture in dryer. 220-230°F average drying temperature 15% in bin by low temperature drying.

OTHER GRAINS

	DRY & COOL	ALL HEAT
Initial Moisture	Minutes *Approx Time	
13	NA	NA
14	7	6
15	14	12
16	21	18
17	27	23
18	33	28
19	39	33
20	45	38
21	50	42
22	55	46
23	60	50
24	65	54
25	70	58
26	75	62
27	79	65
28	83	68
29	87	71
30	91	74
31	95	77
32	99	80
33	103	83

OTHER GRAINS
Wheat, Milo, Soybeans, Rough Rice to approximately 13% final moisture in dryer. 150°F drying temperature for Wheat and Milo, 130°F drying temperatures for Soybeans and Rough Rice.

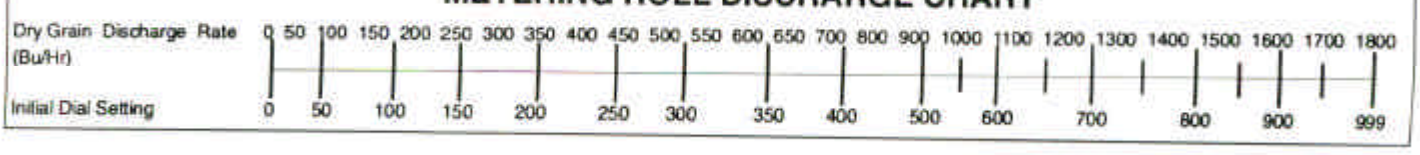
*Actual drying time varies with grain physiological factors (kernal size, chemical composition, seed variety, seasonal weather), weather conditions during drying, and other operating variables; lower final moisture content significantly increases drying time; moisture contents are % wet basis.

Basic Definition-Bushel, Shelled Corn:	56 lbs. @ 15.5%;
	56 x .845 = 47.32 lbs. Dry Matter
To Yeild a Bushel @ 15.5%:	47.32/.85 = 55.67 lbs. @ 15%
	47.32/.80 = 59.15 lbs. @ 20%
	47.32/.75 = 63.09 lbs. @ 25%
Dry to Wet Bushel Conversion Ratios:	20 - 15%, 59.15/55.67 = 1.06
	25 - 15%, 63.09/55.67 = 1.13

10. DRYING TIME CHART

C-Series 410C-Continuous Flow Operation					
	Dry and Cool Process			Full Heat Process	
Total *1 Drying Time Min.	Drying Time Per Stage Min.	Cool Time Min.	Approximate *2 Drying Cap. Bu/Hr.	Drying Time Per Stage Min.	Approximate *2 Drying Cap. Bu/Hr.
20	10	10	640	6.7	962
24	12	12	533	8.0	802
28	14	14	457	9.3	688
32	16	16	400	10.7	602
36	18	18	356	12.0	535
40	20	20	321	13.3	481
44	22	22	292	14.7	438
48	24	24	267	16.0	401
52	26	26	247	17.3	370
56	28	28	229	18.7	344
60	30	30	214	20.0	321
64	32	32	200	21.3	301
68	34	34	189	22.7	283
72	36	36	178	24.0	267
76	38	38	169	25.3	253
80	40	40	160	26.7	241
84	42	42	153	28.0	229
88	44	44	146	29.3	219
92	46	46	139	30.7	209
96	48	48	134	32.0	200
100	50	50	128	33.3	192
104	52	52	123	34.7	185
108	54	54	119	36.0	178
112	56	56	115	37.3	172
Top Auger Switch		Automatic		Automatic	
Bottom Auger Switch		Automatic		Automatic	
Mode Switch		Continous Flow		Continuous Flow	
Bottom Fan		On		On	
Bottom Burner		Off		On	
Top Fan and Burner		On		On	
MC Switch		On		On	
Batch Timers		Not Used		Not Used	
High Speed Mtr. Roll Adjustment		See Meter Roll		See Meter Roll	
		Discharge Chart		Discharge Rate	
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.					
*2. Approx. drying capacities are shown as dry bushels or 1.25 cu ft.; wet bushels of 25% corn=1.13 x dry bushels					

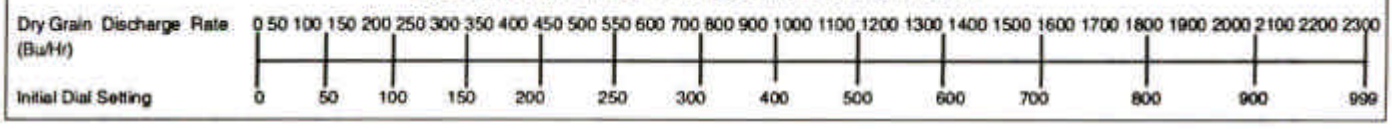
METERING ROLL DISCHARGE CHART



11. DRYING TIME CHART

C-Series 510C - Continuous Flow Operation					
	Dry and Cool Process			Full Heat	
Total *1 Drying Time Min.	Drying Time Per Stage Min.	CoolTime Min.	Approx. *2 Drying Cap. BU/HR	Drying Time Per Staged Min.	Approx. #2 Drying Cap. BU/HR
20	10	10	824	6.7	1233
24	12	12	686	8.0	1027
28	14	14	588	9.3	881
32	16	16	515	10.7	765
36	18	18	457	12.0	685
40	20	20	412	13.3	614
44	22	22	384	14.7	561
48	24	24	343	16.0	507
52	26	26	316	17.3	472
56	28	28	294	18.7	436
60	30	30	274	20.0	409
64	32	32	257	21.3	383
68	34	34	242	22.7	365
72	36	36	228	24.0	338
76	38	38	216	25.3	320
80	40	40	206	26.7	303
84	42	42	196	28.0	294
88	44	44	187	29.3	276
92	46	46	179	300.7	267
96	48	48	171	32.0	258
100	50	50	164	33.3	249
104	52	52	158	34.7	240
108	24	54	152	36.0	231
112	56	56	147	37.3	222
Top Auger Switch		Automatic		Automatic	
Bottom Auger Switch		Automatic		Automatic	
Mode Switch		Continuous Flow		Continuous Flow	
Bottom Fan		On		On	
Bottom Burner		Off		On	
Top Fan and Burner		On		On	
MC Switch		On		On	
Batch Timers		Not Used		Not Used	
High Speed Mtr. Roll Adjustment		See Meter Roll		See Meter Roll	
		Discharge Chart		Discharge Chart	
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.					
*2. Approx. drying capacities are shown as dry bushels or 1.25 cu. ft.; wet bushels of 25% corn=1.13 x dry bushels.					

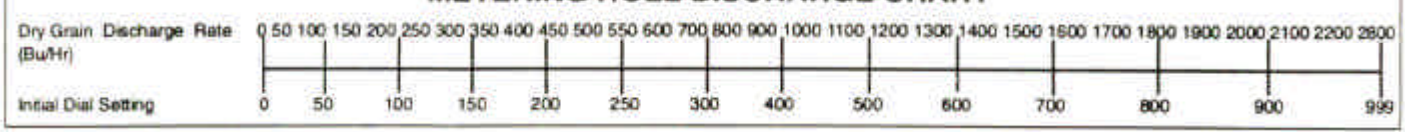
METERING ROLL DISCHARGE CHART



12. DRYING TIME CHART

C-Series 600C-Continuous Flow Operation					
	Dry and Cool Process			Full Heat Process	
Total *1 Drying Time Min.	Drying Time Per Stage Min.	Cool Time Min.	Approx. *2 Drying Cap. BU/HR	Drying Timer Per Stage Min.	Approx. *2 Drying Cap. BU/HP
20	10	10	920	6.7	1380
24	12	12	767	8.0	1150
28	14	14	657	9.3	985
32	16	16	575	10.7	862
36	18	18	511	12.0	767
40	20	20	460	13.3	690
44	22	22	418	14.7	627
48	24	24	383	16.0	575
52	26	26	353	17.3	530
56	28	28	328	18.7	493
60	30	30	306	20.0	460
64	32	32	287	21.3	431
68	34	34	270	22.7	405
72	36	36	255	24.0	383
76	38	38	242	25.3	363
80	40	40	230	26.7	345
84	42	42	219	28.0	328
88	44	44	209	29.3	314
92	46	46	200	30.7	300
96	48	48	191	32.0	287
100	50	50	184	33.3	276
104	52	52	177	34.7	265
108	54	54	170	36.0	255
112	56	56	164	37.3	246
Top Auger Switch		Automatic		Automatic	
Bottom Auger Switch		Automatic		Automatic	
Mode Switch		Continuous Flow		Continuous Flow	
Bottom Fan		On		On	
Bottom Burner		Off		On	
Top Fan and Burner		On		On	
MC Switch		On		On	
Batch Timers		Not Used		Not Used	
High Speed Mtr. Roll Adjustment		See Meter Roll Discharge Chart		See Meter Roll Discharge Chart	
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.					
*2. Approx. drying capacities are shown as dry bushels or 1.25 cu. ft.; wet bushels of 25% corn=1.14 x dry bushels.					

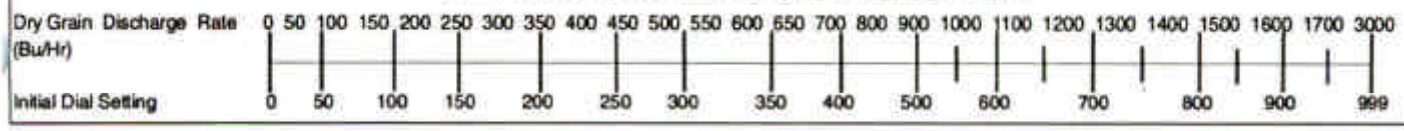
METERING ROLL DISCHARGE CHART



13. DRYING TIME CHART

C-Series 610C-Continuous Flow					
	Dry and Cool Process			Full Heat Process	
Total *1 Drying Time Min.	Drying Time Per Stage Min.	Cool Time Min.	Approx. *2 Drying Cap. BU/HR	Drying Time Per Stage Min.	Approx. *2 Drying Cap. BU/HR
20	10	10	1000	6.7	1500
24	12	12	833	8.0	1250
28	14	14	714	9.3	1071
32	16	16	610	10.7	938
36	18	18	555	12.0	833
40	20	20	500	13.3	750
44	22	22	454	14.7	682
48	24	24	416	16.0	610
52	26	26	384	17.3	575
56	28	28	357	18.7	535
60	30	30	333	20.0	500
64	32	32	312	21.3	469
68	34	34	294	22.7	441
72	36	36	278	24.0	416
76	38	38	263	25.3	395
80	40	40	250	26.7	375
84	42	42	238	28.0	357
88	44	44	227	29.3	340
92	46	46	217	30.7	326
96	48	48	208	32.0	312
100	50	50	200	33.3	300
104	52	52	192	34.7	288
108	54	54	185	36.0	278
112	56	56	178	37.3	268
Top Auger Switch		Automatic		Automatic	
Bottom Auger Switch		Automatic		Automatic	
Mode Switch		Continuous Flow		Continuous Flow	
Bottom Fan		On		On	
Bottom Burner		Off		On	
Top Fan and Burner		On		On	
MC Switch		On		On	
Batch Timers		Not Used		Not Used	
High Speed Mtr. Roll Adjustment		See Meter Roll		See Meter Roll	
		Discharge Chart		Discharge Chart	
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.					
*2. Approx. Drying capacities are shown as dry bushels or 1.25 cu. ft.; wet bushels of 25% corn=1.13 x dry bushels					

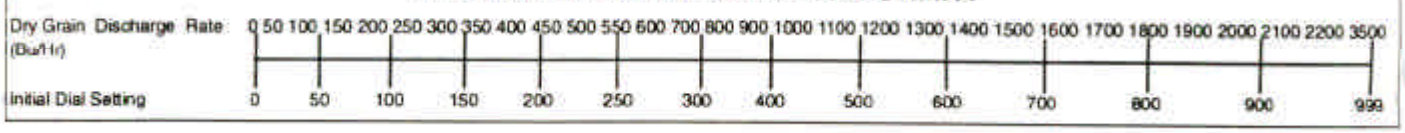
METERING ROLL DISCHARGE CHART



14. DRYING TIME CHART

C-Series 710C-Continuous Flow Operation					
	Dry and Cool Process			Full Heat Process	
Total *1 Drying Time Min.	Drying Time Per Stage Min.	Cool Time Min.	Approx. *2 Drying Cap. BU/HR	Drying Time Per Stage Min.	Approx. *2 Drying Cap. BU/HR
20	10	10	1200	6.7	1800
24	12	12	1000	8.0	1500
28	14	14	857	9.3	1285
32	16	16	750	10.7	1125
36	18	18	666	12.0	1000
40	20	20	600	13.3	900
44	22	22	545	14.7	818
48	24	24	500	16.0	710
52	26	26	461	17.3	692
56	28	28	428	18.7	643
60	30	30	400	20.0	600
64	32	32	375	21.3	562
68	34	34	353	22.7	529
72	36	36	333	24.0	500
76	38	38	315	25.3	473
80	40	40	300	26.7	450
84	42	42	285	28.0	428
88	44	44	272	29.3	409
92	46	46	260	30.7	391
96	48	48	250	32.0	375
100	50	50	240	33.3	360
104	52	52	230	34.7	346
108	54	54	222	36.0	333
112	56	56	214	37.3	321
Top Auger Switch		Automatic		Automatic	
Bottom Auger Switch		Automatic		Automatic	
Mode Switch		Continuous Flow		Continuous Flow	
Bottom Fan		On		On	
Bottom Burner		Off		On	
Top Fan and Burner		On		On	
MC Switch		On		On	
Batch Timers		Not Used		Not Used	
High Speed Mtr. Roll Adjustment		See Meter Roll		See Meter Roll	
		Discharge Chart		Discharge Chart	
*1. See Drying Time Table for estimated drying for various grain drying processes and moisture reductions.					
*2. Approx. drying capacities are shown as dry bushels or 1.25 cu. ft.; wet bushels of 25% corn=1.13 x dry bushels.					

METERING ROLL DISCHARGE CHART



15. DRYER OPERATION

DRYING TEMPERATURE

THERMOMETER:

The drying temperature is shown by the thermometer located on the front left-hand side of the dryer. The thermometer and the thermostat may not read the same as they use different sensors. Use the thermometer as the proper gauge for setting the thermostat.

SHELLED CORN:

For shelled corn with an initial moisture content of 25-30%, the recommended maximum drying temperature is 210°F-230°F. For lower initial moisture content, lower drying temperatures are recommended.

DRYING EFFICIENCY:

The general rule for obtaining the highest drying efficiency is to use the highest possible drying temperatures which will not damage grain quality.

SMALL GRAIN:

For drying small grain (wheat, oats, milo), 150°F is suggested.

SOYBEANS:

Drying temperatures are critical in drying soybeans. A temperature of 130°F-140°F is recommended to keep grain temperature low.

RICE:

Drying temperatures are critical in drying rice. A temperature of 105°F-120°F is required. It is recommended to keep the grain kernal temperature below 99°F. Rice quality is greatly affected by temperature.

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 OPERATION CHART (pages 30-35) for additional information concerning dryer settings and drying capacity.

DRYERATION PROCESS:

The full heat process is called Dryeration. 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 in the hot batch being cooled. The process of tempering and slow cooling provides higher quality in shelled corn because of less cracking of kernels and less breakage during handling of the grain.

FINAL MOISTURE:

1% to 3% moisture is usually removed in the cooling process. If the final desired moisture content is 15%, hot shelled corn is removed from the dryer at about 17% moisture.

16. MOISTURE CONTROL (MC) THERMOSTAT SETTINGS

WITH THE MC SWITCH ON, THE MC THERMOSTAT SHOULD BE SET AS FOLLOWS:

SETTING MC THERMOSTAT FOR CONTINUOUS FLOW OPERATION

ADJUSTMENT PROCEDURE:

1. Turn the MC thermostat to the lowest setting.
2. Operate the dryer and make final changes in DRYING TEMPERATURES and DRYER UNLOADING SPEED until the dry grain being discharged is stabalized at the desired moisture content.
3. Turn the MC thermostat up slowly. As the dial is turned up, the MC indicator light will come ON and the Meter Roll will stop unloading.
4. Immediately after the light comes ON, SLOWLY turn down the thermostat until the light just goes out and the Meter Roll starts unloading. The exact point where the MC light shuts off is the correct thermostat setting.

SETTING LOAD TIMER FOR CONTINUOUS FLOW OPERATION

Observe the amount of time required to refill the dryer. Add 5 minutes to this time. This is the correct amount of time to be set on the load timer. For further information.

FINAL MOISTURE CONTENT

METER ROLL ADJUSTMENT

It is necessary to frequently check the moisture content of discharged grain while the proper meter roll setting is being established. Moisture should be checked periodically to indicate any change in the setting. It will take about 1 hour to accurately see the results of a change in the Meter Roll speed.

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 vaporizer and supply lines. Close the valve at the supply tank, then let the burner operate until the flame stops: immediately turn burner OFF. After the burner is OFF, close all other valves in fuel supply piping.

SHUT-DOWN:

To shut down the dryer:

1. Close the valve on the fuel tank. Let the dryer run a few minutes to drain the fuel lines.
2. Close the fuel valves at the dryer.
3. Push the Control Circuit Stop Button, shutting the fans off and the dryer down.
4. Turn off the Main Safety Disconnect.
5. Turn off the Main Power Supply.

17. STAGED AUTOMATIC START-UP

TEST OPERATE the dryer prior to start-up. Make certain all motors and controls are functional before loading the dryer with wet grain.

1. Set Controls As Listed:

   A. Temporarily set all burner (plenum) thermostats at the drying temperature recommended for normal operation of the top stage burner (for example, 220°F-230°F for shelled corn).

   B. Turn MC switch OFF.

   C. For start-up purposes, set mode switch on CONTINUOUS FLOW.

   D. Turn Load switch OFF. Turn Unload switch OFF.

   E. Turn Fans OFF. Turn Burners OFF.

2. Press the dryer START button. The red indicator light should come on.

3. Turn Load switch ON to fill the dryer.

4. Determine the approximate START-UP drying time for the type of grain and the dry ing process to be used from the Drying Time Table (page 20).

   NOTE: For example, with 25% moisture shelled corn using the DRY AND COOL process, and the final moisture being 15% (10% removal), the estimated drying time is 60 minutes.

5. Using the total drying time from Step 4, refer to the appropriate drying time chart for Staged Automatic operation and determine the normal operating drying times.

   NOTE: For the 60 minute drying time example mentioned earlier, the dry timer would be 5.6 and cool timer would be 18 minutes for the 410C with DRY AND COOL process.

6. The start-up time is equal to the normal operating time plus 3.7 minutes (3.7 min utes is the approximate unload time at 100% discharge rate).

7. Turn BOTTOM FAN and BURNER switches ON and operate bottom stage for one start-up drying time period, as determined in Step 6.

   NOTE: The dry timer may be used as a timing device. Set it to the required time and move the mode switch to and observe timer operation.

8. Readjust BOTTOM STAGE drying temperature to the normal BOTTOM STAGE drying temperature (approximately 170°F for earlier examples).

9. Set mode switch to STAGED.

10. Set all controls as listed in the appropriate dryer time chart for the estimated dry ing time and proceed in the staged automatic mode of operation.

Cont. Next Page . . .

NOTE: The timer settings listed are based upon a meter roll adjustment setting of 100%. This setting provides an unload time of approximately minutes for the bottom stage. If a lower discharge rate is required, the unoading timer setting should be increased by the amount of additional unloading time needed. The drying timer needs to be decreased so that the overall time remains the same.

11. A couple of cycles are required for final moisture content to stabilize. Check final moisture and readjust the timers, if required.

18. DRYING TIME CHART

C-Series 410C-Automatic Operation									
	Dry and Cool Process						Full Heat Process		
Total *1 Drying Time Min.	Dry Timer Setting Min.	Cool Timer Setting Min.	Unload Timer Setting Min.	Bottom Fan Switch	Bottom Burner Switch	Approx*3 Drying Cap. BU/HR	Dry Timer Setting Min.	Unload Timer Setting Min.	Approx*3 Drying Cap. BU/HR
20 *2	7.0	0	3.5	ON	OFF	609	3	3.5	962
24 *2	8.5	0	3.5	ON	OFF	533	4	3.5	802
28 *2	100.5	0	3.5	ON	OFF	457	6	3.5	688
32 *2	12.5	0	3.5	ON	OFF	400	7	3.5	602
36 *2	14.5	0	3.5	ON	OFF	376	8	3.5	535
40 *2	16.5	0	3.5	ON	OFF	330	10	3.5	481
44 *2	18.5	0	3.5	ON	OFF	292	11	3.5	438
48	1.6	18.0	3.5	AUTO	AUTO	277	12	3.5	401
52	3.0	18.0	3.5	AUTO	AUTO	262	14	3.5	370
56	4.3	18.0	3.5	AUTO	AUTO	248	15	3.5	344
60	5.6	18.0	3.5	AUTO	AUTO	236	16	3.5	321
64	7.0	18.0	3.5	AUTO	AUTO	225	18	3.5	301
68	8.3	18.0	3.5	AUTO	AUTO	215	19	3.5	283
72	9.6	18.0	3.5	AUTO	AUTO	206	20	3.5	267
76	11.0	18.0	3.5	AUTO	AUTO	197	22	3.5	253
80	12.3	18.0	3.5	AUTO	AUTO	189	23	3.5	241
84	13.6	18.0	3.5	AUTO	AUTO	182	24	3.5	229
88	15.0	18.0	3.5	AUTO	AUTO	176	26	3.5	219
92	16.3	18.0	3.5	AUTO	AUTO	169	27	3.5	209
96	17.6	18.0	3.5	AUTO	AUTO	164	28	3.5	200
100	19.0	18.0	3.5	AUTO	AUTO	158	30	3.5	192
104	20.3	18.0	3.5	AUTO	AUTO	153	31	3.5	185
108	21.6	18.0	3.5	AUTO	AUTO	149	32	3.5	178
112	23.0	18.0	3.5	AUTO	AUTO	144	34	3.5	172
Top Auger Switch				Automatic			Automatic		
Bottom Auger Switch				Automatic			Automatic		
Mode Switch				Staged			Staged		
Bottom Fan and Burner				Set as Indicated			On		
Top Fan and Burner				On			On		
MC Selector Switch				On			On		
Dry Timer				Set as Indicated			Set as Indicated		
Cool Timer				Set as Indicated			0		
Meter Roll Adjustment				As Required by Transfer Equipment					
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reduction.									
*2. Grain may not be sufficiently cooled with this setting. Please check with factory representative.									
*3. Drying capacities assume a meter roll setting of 100% and are shown as dry bushels or 1.25 cu.ft.; wet bushels of 25% cor =1.13xdry bushels. Greater or less actual loading rate affects drying capacity for SA and D&C.									

19. DRYING TIME CHART

C-Series 510C-Staged Automatic Operation									
	Dry and Cool Process						Full Heat Process		
Total *1 Drying Time Min.	Dry Timer Setting Min.	Cool Timer Setting Min.	Unload Timer Setting Min.	Bottom Fan Switch	Bottom Burner Switch	Approx*2 Drying Cap. BU/HR	Dry Timer Setting Min.	Unload Timer Setting Min.	Approx*2 Drying Cap. BU/HR
20	7.0	0	3.5	ON	OFF	824	3	3.5	1216
24	8.5	0	3.5	ON	OFF	686	4	3.5	1012
28	10.5	0	3.5	ON	OFF	588	6	3.5	868
32	12.5	0	3.5	ON	OFF	515	7	3.5	759
36	14.5	0	3.5	ON	OFF	457	8	3.5	675
40	16.5	0	3.5	ON	OFF	412	10	3.5	607
44	18.5	0	3.5	ON	OFF	375	11	3.5	552
48	1.6	18	3.5	AUTO	AUTO	355	12	3.5	506
52	3.0	18	3.5	AUTO	AUTO	336	14	3.5	467
56	4.3	18	3.5	AUTO	AUTO	318	15	3.5	434
60	5.6	18	3.5	AUTO	AUTO	303	16	3.5	405
64	7.0	18	3.5	AUTO	AUTO	289	18	3.5	379
68	8.3	18	3.5	AUTO	AUTO	276	19	3.5	357
72	9.6	18	3.5	AUTO	AUTO	264	20	3.5	337
76	11.0	18	3.5	AUTO	AUTO	253	22	3.5	319
80	12.3	18	3.5	AUTO	AUTO	243	23	3.5	303
84	13.6	18	3.5	AUTO	AUTO	234	24	3.5	289
88	15.0	18	3.5	AUTO	AUTO	226	26	3.5	276
92	16.3	18	3.5	AUTO	AUTO	218	27	3.5	264
96	17.6	18	3.5	AUTO	AUTO	210	28	3.5	253
100	19.0	18	3.5	AUTO	AUTO	203	30	3.5	243
104	20.3	18	3.5	AUTO	AUTO	197	31	3.5	233
108	21.6	18	3.5	AUTO	AUTO	191	32	3.5	225
112	23.0	18	3.5	AUTO	AUTO	185	34	3.5	217
Top Auger Switch				Automatic			Automatic		
Bottom Auger Switch				Automatic			Automatic		
Mode Switch				Staged			Staged		
Bottom Fan and Burner				Set as Indicated			On		
Top Fan and Burner				On			On		
MC Selector Switch				On			On		
Dry Timer				Set as Indicated			Set As Indicated		
Cool Timer				Set as Indicated			0		
Meter Roll Adjustment				As Required by Transfer Equipment					
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.									
*2. Grain may not be sufficiently cooled with this setting. Please check with factory representative.									
*3. Drying capacities assume a meter roll setting of 100% and are shown as dry bushels or 1.25 cu.ft.; wet bushels of 25% corn = 1.13 x dry bushels. Greater or less actual unloading rate affects drying capacity for SA and D&C.									

20. DRYING TIME CHART

C-Series 600C-Staged Automatic Operation									
	Dry and Cool Process						Full Heat Process		
Total *1 Drying Time Min.	Dry Timer Setting Min.	Cool Timer Setting Min.	Unload Timer Setting Min.	Bottom Fan Switch	Bottom Burner Switch	Approx *3 Drying Cap. BU/HR	Dry Timer Setting Min.	Unload Timer Setting Min.	Approx *3 Drying Cap. BU/HR
20 *2	7.0	0	3.5	ON	OFF	876	3	3.5	1380
24 *2	8.5	0	3.5	ON	OFF	767	4	3.5	11500
28 *2	10.5	0	3.5	ON	OFF	657	6	3.5	985
32 *2	12.5	0	3.5	ON	OFF	575	7	3.5	862
36 *2	14.5	0	3.5	ON	OFF	511	8	3.5	767
40 *2	16.5	0	3.5	ON	OFF	460	10	3.5	690
44 *2	18.5	0	3.5	ON	OFF	418	11	3.5	627
48	1.6	18.0	3.5	AUTO	AUTO	398	12	3.5	575
52	3.0	18.0	3.5	AUTO	AUTO	375	14	3.5	530
56	4.3	18.0	3.5	AUTO	AUTO	356	15	3.5	493
60	5.6	18.0	3.5	AUTO	AUTO	339	16	3.5	460
64	7.0	18.0	3.5	AUTO	AUTO	323	18	3.5	431
68	8.3	18.0	3.5	AUTO	AUTO	309	19	3.5	405
72	9.6	18.0	3.5	AUTO	AUTO	295	20	3.5	383
76	11.0	18.0	3.5	AUTO	AUTO	283	22	3.5	363
80	12.3	18.0	3.5	AUTO	AUTO	272	23	3.5	345
84	13.6	18.0	3.5	AUTO	AUTO	262	24	3.5	328
88	15.0	18.0	3.5	AUTO	AUTO	252	26	3.5	304
92	16.3	18.0	3.5	AUTO	AUTO	243	27	3.5	300
96	17.6	18.0	3.5	AUTO	AUTO	235	28	3.5	287
100	19.0	18.0	3.5	AUTO	AUTO	227	30	3.5	276
104	20.3	18.0	3.5	AUTO	AUTO	220	31	3.5	265
108	21.6	18.0	3.5	AUTO	AUTO	213	32	3.5	255
112	23.0	18.0	3.5	AUTO	AUTO	206	34	3.5	246
Top Auger Switch				Automatic			Automatic		
Bottom Auger Switch				Automatic			Automatic		
Mode Switch				Staged			Staged		
Bottom Fan and Burner				Set as Indicated			On		
Top Fan and Burner				On			On		
MC Selector Switch				On			On		
Dry Timer				Set as Indicated			Set as Indicated		
Cool Timer				Set as Indicated			0		
Meter Roll Adjustment				As Required by Transfer Equipment					

*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.

*2. Grain may not be sufficiently cooled with this setting. Please check with factory representative.

*3. Drying capacities assume a meter roll setting of 100% and are shown as dry bushels or 1.25 cu. ft.; wet bushels of 25% corn=1.13 x dry bushels. Greater or less actual unloading rate affects drying capacity for SA and D&C.

21. DRYING TIME CHART

C-Series 610C-Staged Automatic Operation									
	Dry and Cool Process						Full Heat Process		
Total *1 Drying Time Min.	Dry Timer Setting Min.	Cool Timer Setting Min.	Unload Timer Setting Min.	Bottom Fan Switch	Bottom Burner Switch	Approx*2 Drying Cap. BU/HR	Dry Timer Setting Min.	Unload Timer Setting Min.	Approx*2 Drying Cap. BU/HR
20	7.0	0	3.5	ON	OFF	952	3	3.5	1500
24	8.5	0	3.5	ON	OFF	833	4	3.5	1250
28	10.5	0	3.5	ON	OFF	714	6	3.5	1071
32	12.5	0	3.5	ON	OFF	610	7	3.5	938
36	14.5	0	3.5	ON	OFF	555	8	3.5	833
40	16.5	0	3.5	ON	OFF	500	10	3.5	750
44	18.5	0	3.5	ON	OFF	454	11	3.5	682
48	1.6	18	3.5	AUTO	AUTO	433	12	3.5	610
52	3.0	18	3.5	AUTO	AUTO	408	14	3.5	575
56	4.3	18	3.5	AUTO	AUTO	387	15	3.5	536
60	5.6	18	3.5	AUTO	AUTO	369	16	3.5	500
64	7.0	18	3.5	AUTO	AUTO	350	18	3.5	469
68	8.3	18	3.5	AUTO	AUTO	335	19	3.5	441
72	9.6	18	3.5	AUTO	AUTO	321	20	3.5	416
76	11.0	18	3.5	AUTO	AUTO	307	22	3.5	395
80	12.3	18	3.5	AUTO	AUTO	295	23	3.5	375
84	13.6	18	3.5	AUTO	AUTO	285	24	3.5	357
88	15.0	18	3.5	AUTO	AUTO	274	26	3.5	340
92	16.3	18	3.5	AUTO	AUTO	265	27	3.5	326
96	17.6	18	3.5	AUTO	AUTO	255	28	3.5	312
100	19.0	18	3.5	AUTO	AUTO	247	30	3.5	300
104	20.3	18	3.5	AUTO	AUTO	239	31	3.5	288
108	21.6	18	3.5	AUTO	AUTO	232	32	3.5	278
112	23.0	18	3.5	AUTO	AUTO	224	34	3.5	268
Top Auger Switch				Automatic			Automatic		
Bottom Auger Switch				Automatic			Automatic		
Mode Switch				Staged			Staged		
Bottom Fan and Burner				Set as Indicated			On		
Top Fan and Burner				On			On		
MC Selector Switch				On			On		
Dry Timer				Set as Indicated			Set as Indicated		
Cool Timer				Set as Indicated			0		
Meter Roll Adjustment				As Required by Transfer Equipment					
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.									
*2. Grain may not be sufficiently cooled with this setting. Please check with factory representative.									
*3. Drying capacities assume a meter roll setting of 100% and are shown as dry bushels or 1.25 cu.ft.; wet bushels of 25% corn = 1.13 x dry bushels. Greater or less actual unloading rate affects drying capacity for SA and D&C.									

22. DRYING TIME CHART

C-Series 710C-Staged Automatic Operation									
	Dry and Cool Process						Full Heat Process		
Total *1 Drying Time Min.	Dry Timer Setting Min.	Cool Timer Setting Min.	Unload Timer Setting Min.	Bottom Fan Switch	Bottom Burner Switch	Approx*3 Drying Cap. BU/HR	Dry Timer Setting Min.	Unload Timer Setting Min.	Approx*3 Drying Cap. BU/HR
20 *2	7.0	0	3.5	ON	OFF	1173	3	3.5	1800
24 *2	8.5	0	3.5	ON	OFF	1000	4	3.5	1500
28 *2	10.5	0	3.5	ON	OFF	857	6	3.5	1285
32 *2	12.5	0	3.5	ON	OFF	750	7	3.5	1125
36 *2	14.5	0	3.5	ON	OFF	666	8	3.5	1000
40 *2	16.5	0	3.5	ON	OFF	600	10	3.5	900
44 *2	18.5	0	3.5	ON	OFF	545	11	3.5	818
48	1.6	18	3.5	AUTO	AUTO	519	12	3.5	710
52	3.0	18	3.5	AUTO	AUTO	490	14	3.5	692
56	4.3	18	3.5	AUTO	AUTO	465	15	3.5	643
60	5.6	18	3.5	AUTO	AUTO	443	16	3.5	600
64	7.00	18	3.5	AUTO	AUTO	421	18	3.5	562
68	8.3	18	3.5	AUTO	AUTO	403	19	3.5	529
72	9.6	18	3.5	AUTO	AUTO	385	20	3.5	500
76	11.0	18	3.5	AUTO	AUTO	369	22	3.5	473
80	12.3	18	3.5	AUTO	AUTO	355	23	3.5	450
84	13.6	18	3.5	AUTO	AUTO	342	24	3.5	428
88	15.0	18	3.5	AUTO	AUTO	328	26	3.5	409
92	16.3	18	3.5	AUTO	AUTO	317	27	3.5	391
96	17.6	18	3.5	AUTO	AUTO	307	28	3.5	375
100	19.0	18	3.5	AUTO	AUTO	296	30	3.5	360
104	20.3	18	3.5	AUTO	AUTO	287	31	3.5	346
108	21.6	18	3.5	AUTO	AUTO	278	32	3.5	333
112	23.0	18	3.5	AUTO	AUTO	270	34	3.5	321
Top Auger Switch				Automatic			Automatic		
Bottom Auger Switch				Automatic			Automatic		
Mode Switch				Staged			Staged		
Bottom Fan and Burner				Set as Indicated			On		
Top Fan and Burner				On			On		
MC Selector Switch				On			On		
Dry Timer				Set as Indicated			Set as Indicated		
Cool Timer				Set as Indicated			0		
Meter Roll Adjustment				As Required By Transfer Equipment					
*1. See Drying Time Table for estimated drying time for various grain drying processes and moisture reductions.									
*2. Grain may no be sufficiently cooled with this setting. Please check with factory representative.									
*3. Drying capacities assume a meter roll setting of 100% and are shown as dry bushels or 1.25 cu.ft.; wet bushels of 25% corn = 1.13 x dry bushels. Greater or less actual unloading rate affects drying capacity for SA and D&C.									

23. SETTING MC THERMOSTAT FOR BATCH OPERATION

ADJUSTMENT PROCEDURE:

1. Turn the MC thermostat to the lowest setting.
2. Make final changes in DRYING TEMPERATURES until the dry grain being discharges is stabilized at the desired moisture content.
3. Turn the MC thermostat to the highest setting.
4. When the drying timer has completed and the MC hold indicator light comes ON, slowly turn the MC setting DOWN until the light goes out and the next cycle begins.
5. This initial setting must be confirmed by testing the final grain moisture content during the unloading cycle.

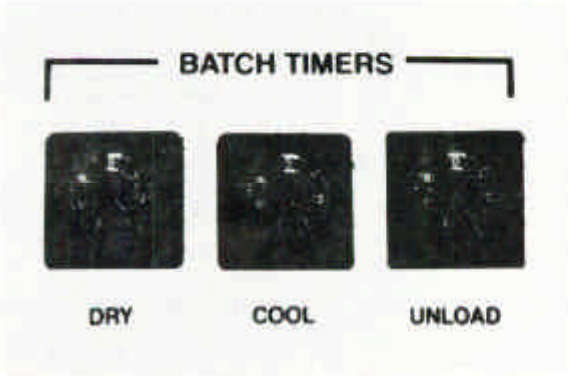


Figure 11
Batch Timers

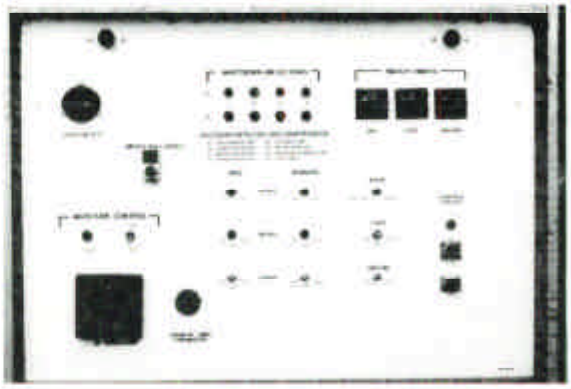


Figure 12
Control Box-Front Panel

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 vaporizer and supply lines. Close the valve at the supply tank, then let the burner operate until the flame stops: immediately turn burner OFF. After the burner is OFF, close all other valves in fuel supply piping.

SHUT-DOWN:

To shut down the dryer:

1. Close the valve on the fuel tank. Let the dryer run a few minutes to drain the fuel lines.
2. Close the fuel valves at the dryer.
3. Push the Control Circuit Stop Button, shutting the fans off and the dryer down.
4. Turn off the Main Safety Disconnect.
5. Turn off the Main Power Supply.

24. INSTRUCTION-STAGED AUTOMATIC

Refer to the following Staged Automatic 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). The method may be changed from the DRY AND COOL to the FULL HEAT by rotating the COOL TIMER dial counterclockwise to O. The load timer is designed to shut down when the grain supply is exhausted. The Load TImer will reset after each filling cycle.

The dry timer will allow the burner to operate for a predetermined time at the temperature set by the burner thermostat. At the end of the drying period, the moisture control (MC) thermostat will monitor the grain. If the grain temperature satisfies the moisture control setting, the burner will stop operating and the cooling cycle will start. If the dryer is filled with unusually high moisture grain, the MC thermostat will remain on MC HOLD and continue the drying prrocess until it meets the MC requirements.

NOTE: **Refer to MC thermostat section for additional details. The MC thermostat can be set so high as to hold on each drying cycle in an attempt to obtain automatic moisture control. However, the MC thermostat may not provide sufficient accuracy in controlling final moisture with uniform and consistent results; considering the somewhat variable relationship between grain temperature and final moisture. as well as the effect of other operating variables. Proper adjustment of the Dry Timer is a more reliable method of controlling final grain moisture.**

The cool timer is easily adjusted for either full cooling or any degree of partial cooling. At the completion of the cooling cycle, the unloading cycle will start. The unload timer is set at the time to unload the full content of the bottom stage. During this unloading cycle, wet grain is being added to eliminate the down time to load. Also, the fan continues to run permitting cooling to continue during unloading. For the Staged Auto drying mode, the meter rolls should be adjusted to provide maximum discharge rate, of the auxiliary take away system.

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

When setting load timer staged automatic to figure the proper amount of time, Add 5 minutes to the unload timer setting. For further information about the function of the load timer see page 16.

25. MAINTAINING GRAIN QUALITY

To properly maintain the quality of stored grain, it is necessary to keep the grain dry, cool, and insect free. If not, any one of these problems can contribute to spoilage. Wet, warm grain promotes insect growth as well as grain spoilage. Cool dry grain can keep for long periods of time if properly maintained.

It is recommended that the grain be kept cool (avoid freezing as freezing can reduce quality.) Grain should be cooled through the fall and winter, warmed in the spring and summer.

RULE OF THUMB FOR STORING GRAIN:

Average grain temperature should be above 35°F in the winter and below 65°F in the summer. Always try to keep the grain within 10-15°F of the average monthly outside temperature. This means grain may need to be aerated on warm days during the winter to stay above 35°F when freezing temperatures are predominate. During the summer, it may be necessary to aerate the grain on cool nights, so the 65°F temperature is not exceeded during the hot days of summer.

Conditions and requirements may vary from area to area. We suggest that you contact your local Agriculture Extension Office or State Ag. University for more exact guidelines, in your area.

If the grain is to be stored more than one year, it has to be re-cooled the following fall and winter, repeating the process as long as the grain is in storage. **Frequent and regular inspection (at least weekly during fall and spring) is the best prevention against grain spoilage.**

EQUILIBRIUM MOISTURE CHART

Air Temperature	Relative Humidity— Percent													
	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20°F	11.2	11.7	12.7	13.7	14.5	15.1	16.2	17.1	18.0	19.6	21.2	23.5	25.8	29.1
30°F	10.8	11.3	12.2	13.1	13.9	14.6	15.5	16.4	17.4	18.7	20.2	22.5	25.0	28.3
40°F	10.5	11.0	11.7	12.5	13.3	14.0	14.8	15.5	16.6	17.8	19.4	21.5	24.2	27.5
50°F	10.1	10.6	11.3	12.0	12.7	13.3	14.1	14.8	15.8	16.9	18.6	20.5	23.4	26.7
60°F	9.7	10.2	10.9	11.6	12.1	12.7	13.4	14.2	15.0	16.0	17.8	19.5	22.6	25.9
70°F	9.0	9.7	10.4	11.1	11.5	12.0	12.8	13.5	14.5	15.4	16.8	18.5	21.3	24.5
80°F	8.3	9.1	9.8	10.5	10.8	11.2	12.1	13.0	13.9	14.8	15.8	17.4	20.0	22.8

Safe moisture for normal winter storage of shelled corn is about 15%. Grain to be stored through the summer or long term, needs to be 1 to 3 points dryer.

For more information, see the chart on the following page.

APPROXIMATE ALLOWABLE HOLDING TIME FOR FIELD-SHELLED CORN, TO MAINTAIN GRADE*

	CORN MOISTURE							
Grain (°F) Temperature	15% days	18% days	20% days	22% days	24% days	26% days	28% days	30% days
40	898	195	85	54	38	28	24	20
50	451	102	46	28	19	16	13	11
60	242	63	26	16	10	8	6.5	5.5
70	147	37	13	8	5	4	3.5	3
80	109	27	10	6	4	3	2.5	2

* Allowable holding time for field-shelled corn at various grain temperatures and moistures

Drying fronts and/or temperature fronts move through grain at different rates for different size bins, different size fans and different moistures and temperatures.

The table below lists the approximate time required to completely change the temperature of a bin. Conditions at the time, can cause this time to vary greatly. Therefore this should only be used as a guide.

It may be necessary to run the fan only part of a day, because of changing weather conditions. It would be necessary to run it a few hours each day on several days to complete the temperature change.

APPROXIMATE HOURS OF FAN TIME TO CHANGE BIN TEMPERATURE

Fan Size H.P.	Bin Diameter Apx. 22 Feet to Eave Approximate Hours of Fan Time Required									Apx. 32 Feet To Eave		
	18	21	24	27	30	33	36	42	48	36	42	48
1	73	79	90	NR	NR	NR	NR	NR	NR	NR	NR	NR
1.5	56	61	65	66	76	82	92	NR	NR	NR	NR	NR
3	44	51	52	57	63	69	78	93	NR	NR	NR	NR
5-7	38	42	44	47	52	56	61	71	81	79	93	NR
7.5-10	35	37	41	42	45	49	53	62	71	72	82	92
10-15	30	32	35	39	40	42	45	54	63	62	70	80
Apx.Bu.	4,500	6,500	8,500	11,000	13,500	16,500	19,500	27,000	35,500	28,000	38,500	50,500

Bushels are rounded and approximate.

The hours required are based on clean grain. High moisture grain and grain containing fines or foreign material will require more time to complete the air change.

NR Not Recommended: Bins in the NR range, may require fan(s) of a different size to get the cool time into the acceptable range.

Bins requiring more than 100 hours of aeration to totally change the temperature may require continuous aeration at about 1/10th cfm per bushel or some other acceptable method.