KAN-SUN DRYERS
(1982 AND LATER)

Introduction

This KAN-SUN service manual is intended to be a supplement to the owner's manual and should be used in conjunction with it. The trouble-shooting guide in the owner's manual helps identify the area of trouble. This manual gives specific checkout procedures for individual parts or systems. All wiring diagrams are in the owner's manual.

Technical Service Assistance

Technical Service assistance can be obtained by calling:

Butler Manufacturing Company
Agri-Products Division
7400 East 13th Street
Kansas City, MO 64126
Phone: 816/968-6140
816/968-6141

How To Use This Manual

1. Read Pages 1 through 7 to acquaint yourself with the test equipment and terms used in the information.
2. Find the part in question on the Index of Component Tests.
3. Turn to the proper page.
4. The part will be identified by a location Key #. This number refers to pages 11 through 10 and is helpful in locating the part on the dryer.
5. Follow the procedure step-by-step.

Safety Precautions

Always be sure that no one has *entered the dryer* before turning power on and making operational checks.

Always be careful not to break LP gas connections or tubing, as escaping LP can very seriously damage human tissue.

Always be sure that the dryer is properly grounded (to a driven ground) before attempting to service it.

Always disconnect power supply to the dryer before making alterations on the control panel or other parts of the dryer. When testing must be made on a live panel *be sure to wear dry, well insulated footwear and keep hands well away from all wire connections, terminal strips or any power conducting part of the panel.* It is best to use a meter with alligator type leads which can be attached to the connections.

Table of Contents

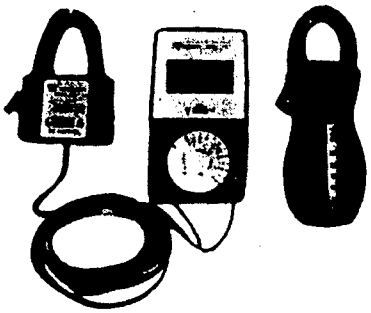
Index of Component Tests

Test Equipment Required

In order to run meaningful tests, you must have the right test equipment and understand how to use that equipment.

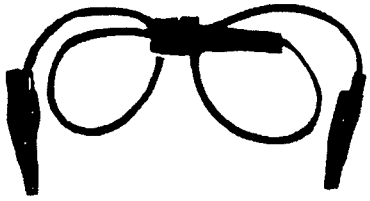
1. Multimeter. This meter is used for voltage, resistance and DC amperage measurements. The voltage scale should measure 0 to 300 VAC. The resistance scale should measure from 0 to 30,000 ohms.

   The DC amperage scale should be able to indicate 1 *micro* amp (1 uA) to 20 *micro* amps (20 uA).

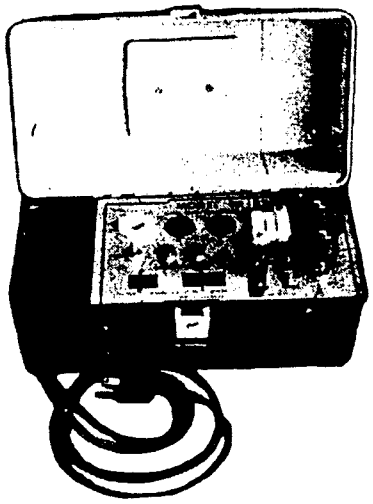


2. AC Ampmeter. This meter is used to measure motor-running amperage.

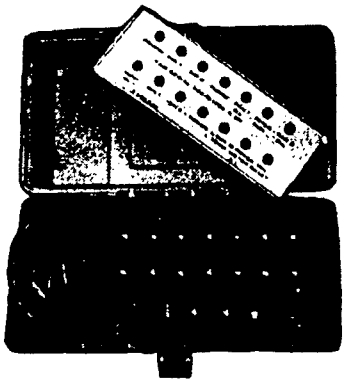
   The amperage scale should measure from 0 to 300 amps.



3. Fused Jumper Wire. This jumper is used to bypass components for testing purposes only. The fuse is to protect against accidental short circuits.



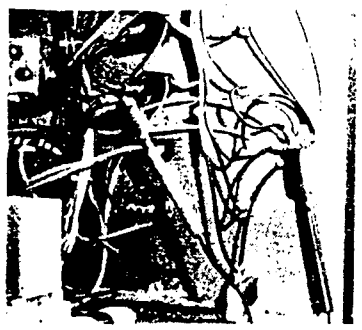
4. Model '80/'82 Tester. This tester is used as a component tester. It is designed to test most of the electronic components in the Kan–Sun Continuous Flow Dryer.



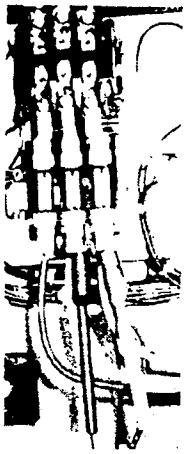
5. Model 100 Tester. This tester is used to locate momentary malfunctions that shut the dryer down but cannot be located by conventional testing. A special overlay must be used on dryers after Serial # SC101769.

Testing Tips

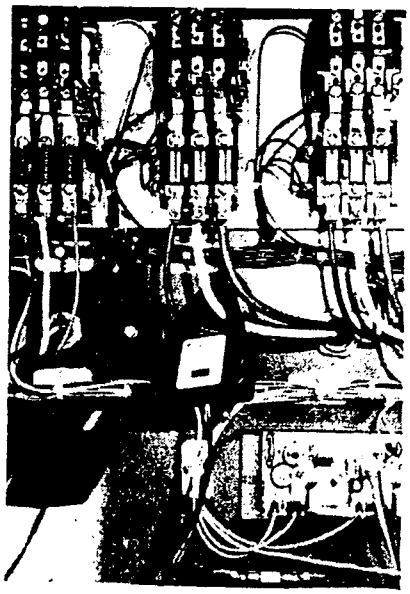
1. All 115 VAC checks are done by placing one probe of the voltmeter on the point to be tested and the other on a good ground. Such as X2 of the transformer or one of the ground studs on the side of the control panel.



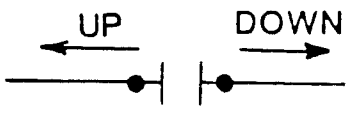
2. All 230 VAC checks are done by placing one probe of the voltmeter on one 115 VAC line and the other probe on another 115 VAC line. A normal reading would be 230 VAC.



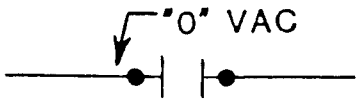
3. All AC amperage checks are done by placing the jaws of the amp clamp around one of the power wires.



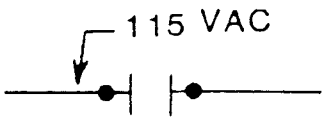
4. Upstream. This term will be used when a component in front of the part under test does not provide voltage to the part under test.

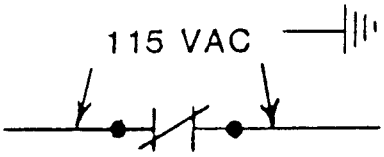


5. If you do not find voltage on at least one side of a switch, the problem in located upstream of that switch.

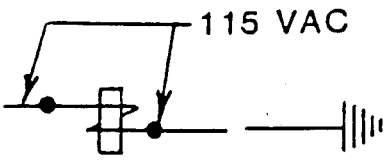


6. Open contacts must have voltage on one side in order to pass voltage when they are closed.

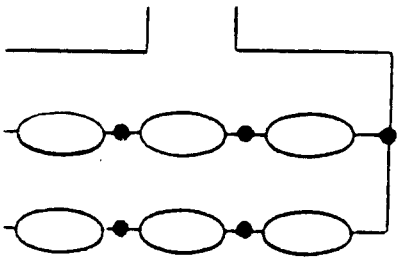




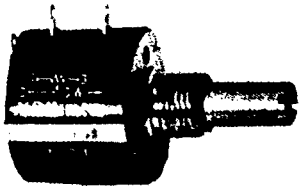
7. Closed contacts must show voltage on both sides when they are functioning properly.



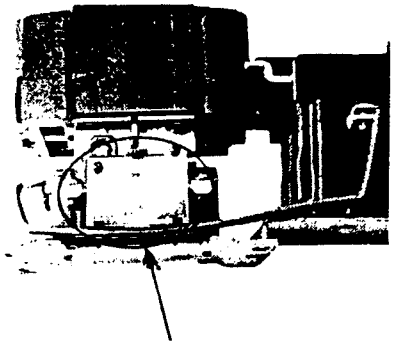
8. Voltage on the ground side of a coil or winding indicates that the ground is open.



9. When measuring resistance, turn off the power and disconnect one end of the circuit.
   1 KΩ = 1000 ohms.



9. Pot. - This is the abbreviation for Potentiometer, an adjustable resistor.



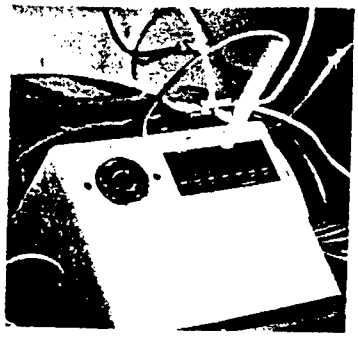
10. Aux. - This is the abbreviation for Auxiliary. It is normally an extra set of small contacts mounted on a starter to control auxiliary equipment. If a set of main contacts is not used, they may be used as an auxiliary.

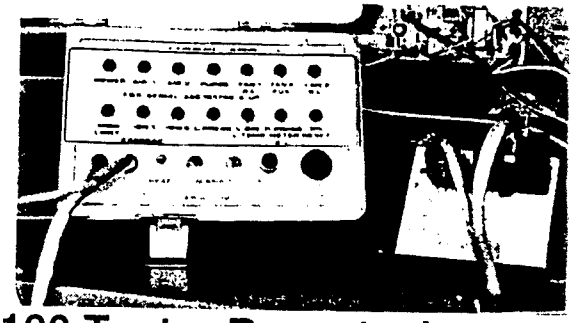
11. Shorts. There are two types. One type is a result of a component drawing more amperage than it is fused for. In this case, the fuse blows a short time after the circuit has been energized. The second type is a direct short to ground. This one will blow the fuse at the instant the circuit is energized.

There are 3 things you must know about a short.
They are:
1. Which fuse blew.
2. Which circuit it protects.
3. Exactly when did the fuse blow.

When the circuit has been isolated, disconnect the various components and test for zero resistance to ground. Zero resistance to ground is a short to ground. A small value of resistance (5 to 500 ohms) is the resistance through a component to normal ground and should be expected.

12. Model 100 Test Socket (brown wire). The socket is the connection necessary to use the Model 100 Tester. It is also used as voltage test points and jumper points.





Voltage Checks and Jumper Points at Model 100 Tester Receptacle

Voltage at the test point indicates the switch in question is closed.

Kan-Sun Dryer

10 - Foot

Test Point	Test Point	Test Point
1- FM2 AUX	2- #1 Air Switch Fuse MDL 1	3- #2 Air Switch
4- Purge Timer	5- FM1 Aux. Stop Switch (Fan)	6- Start Switch (Fan) FM1 O.R.
7- 6-sec. Timer	8- FM2 O.R.	9- Start-up Switch
10- High Limit	11- Burner Switch	12- V1 #1 Flame Fuse MDL 1
13- V1 #2 Flame Monitor	14- M M Aux.	15- Low Pressure
16- Door Switch	17- Low Temperature Thermostat Low Bin Switch	18- Stop Switch Start Switch (Meter) MM Aux.
19- MM O.R. High Pres. Sw.	20- Transformer 5 Amp Fuse	21- Reset 1 & 2 (Flame Monitor)

Kan-Sun Dryer

8 - Foot

Test Point	Test Point	Test Point
1- - - -	2- Air Switch	3- - - -
4- Purge Timer	5- Fan Stop FM Aux	6- Fan Start FM O.R.
7- - - -	8- - - -	9- Start-up Switch
10- High Limit	11- Burner Switch	12- V1 Flame Monitor
13- - - -	14- M M Aux.	15- Low Pressure
16- Door Switch	17- Low Temperature Thermistor Low Bin Switch	18- Meter Start-Stop. MM Aux
19- MM O.R. High Pressure	20- Transformer 5 Amp Fuse	21- Reset (Flame Monitor)

Kan-Sun Wire Code

Number	Color	Circuit
100	Brown	Model 100
200	Grey	Moisture Matic
300	Blue	Burner
400	Red	Fan & Meter
500	Yellow	Operate
600	Black	Power
700	Orange	Meters

Installation of Kan-Sun Dryers

rior to installation, the machine should be in-ɔected. Look for loose bolts, damaged con-ɔls and loose wires. Check to make sure the .n blade has sufficient clearance.

ransportation

Inflate tires to recommended pressure.

Tow bar height is not to exceed 17 inches.

Use safety chains.

Oversize permit may be required.

Do not exceed 20 mph.

Do not transport a fully assembled dryer.

Dryer must be empty.

ite Selection

/hether an installation is permanent or tempo-ıry, the following points should be considered:

Select a firm, well drained location.

Allow restricted air flow around the machine and a clean supply of intake air. (it is recommended locating the machine no closer than 10 feet to another machine.)

Place the fuel tank for L.P. gas machines at least 25 feet from the dryer.

A concrete pad is recommended for permanent installations (See Figure A in owners manual).

Use a ground rod embedded 8 feet.

ryer Orientation

To minimize noise disturbances, orient dryer with free air door directed to unoccupied area.

To minimize buildup of foreign material in dryer plenum, orient dryer with free air door directed toward prevailing winds. This is particularly important when drying sunflower seeds or milo

Assembly

1. Position section as shown on Dimensional Data page, of the owners manual. A boom truck or crane should be used to lift sections into place.
2. Be careful not to damage channel rings or perforations while handling.
3. Tighten all bolts.
4. Upon completion of assembly, level the dryer. Dryer legs are adjustable by 1/8 inch increments. Use a carpenter's level to do the job correctly.
5. Anchor dryer securely. Guy wires should be used on temporary installations to prevent wind damage.
6. Install ladders as shown on Ladder Installation page, of the Owner's Manual.

Fuel Requirements & Installation

L.P. Gas Dryers

L.P. gas dryers are equipped with an internal vaporizer. The L.P. tank ***"must be"*** equipped for liquid withdrawal. Locate tank at least 25 feet from dryer. It is recommended that an excess flow valve be installed.

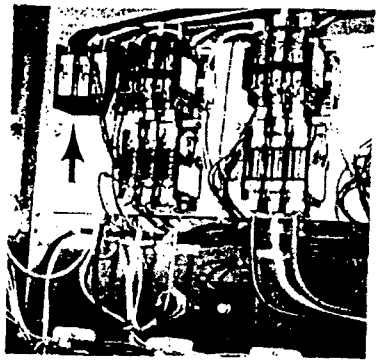
NOTE: Gas line from tank to dryer should be 1/2 inch Schedule 80 pipe or 1/2 inch I.D. Type K copper tubing.

Natural Gas Dryers

Kan-Sun dryers require 14 PSIG minimum operating pressure to maintain a 200-220° Fahrenheit plenum temperature with 20° Fahrenheit ambient. Incoming line size should be 1-inch to 1-1/2-inches for 8-foot machines and 1-1/2-inches to 2-inches for 10 foot machines for runs under 200 feet.

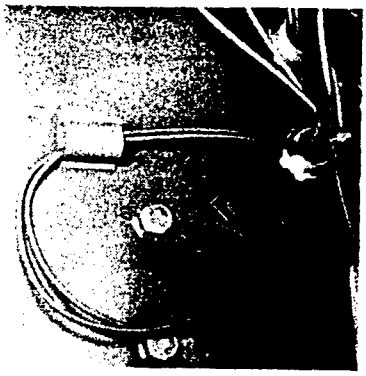
Special 5 PSI fuel kits are available for field installation when 14 PSIG is not available.

Electrical Hook-Ups

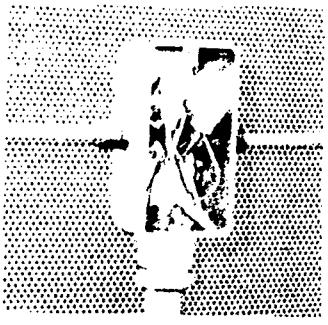


All electrical work to be performed by a qualified electrician.

1. See Recommended Electrical Specifications, page for power and ground lead hook-up. Check for proper fan rotation.



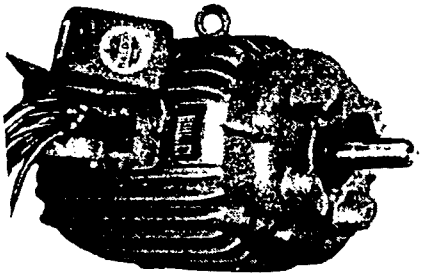
2. Connect bin fill and low bin conduit assembly from control box to unilet on holding section. Use wire nuts provided in unilet to make electrical connections. Unnumbered blue wires are connected to the bin fill switch for dryer bin fill equipment control. See page for suggested wiring of bin fill and take-away augers.



3. Attach thermistor conduit from four-way thermistor box to three-way box. Solder leads per decal inside four-way thermistor box cover, coat with silicon sealer and install wire nuts. (See page).

Motor Data

Meter Motor



The meter motor will be 3 H.P. 1Ø or 3Ø, depending on the source voltage.

	Full Load AMP
3 H.P. 1Ø 220 VAC	15.0
3 H.P. 3Ø 230 VAC	09.0
3 H.P. 3Ø 460 VAC	4.5

Kan-Sun axial flow fan motors are constructed to run on regular 3ϕ power or on 3ϕ converted from 1ϕ through an approved phase converter. The 12 motor leads have instructions for connection depending upon power input used.

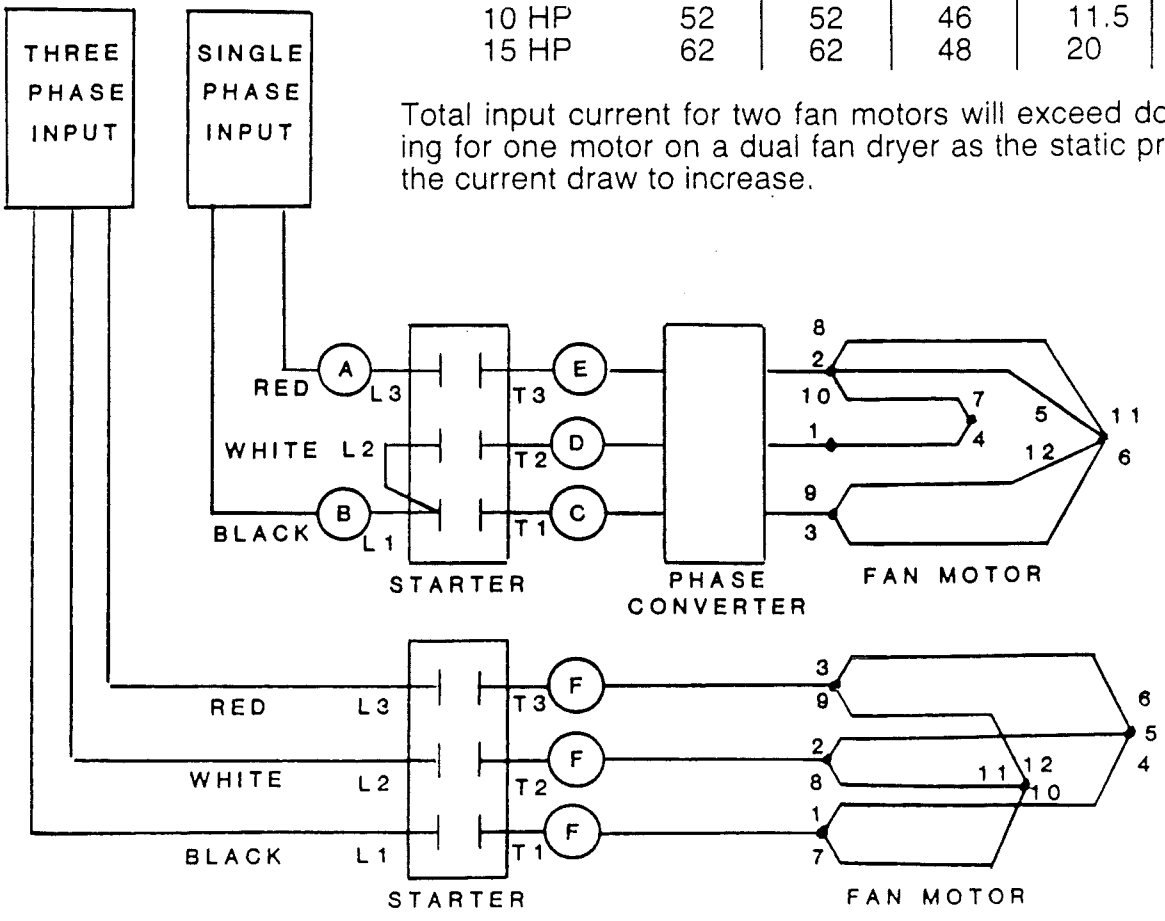
The phase convertor does not give a balanced current to each phase of the motor. However, the motor in sufficiently oversized to allow for the expected unbalance.

The schematic below indicates current measuring points and the nominal expected current readings. The motor can be reversed, if not properly wired. (Reverse 1-10)

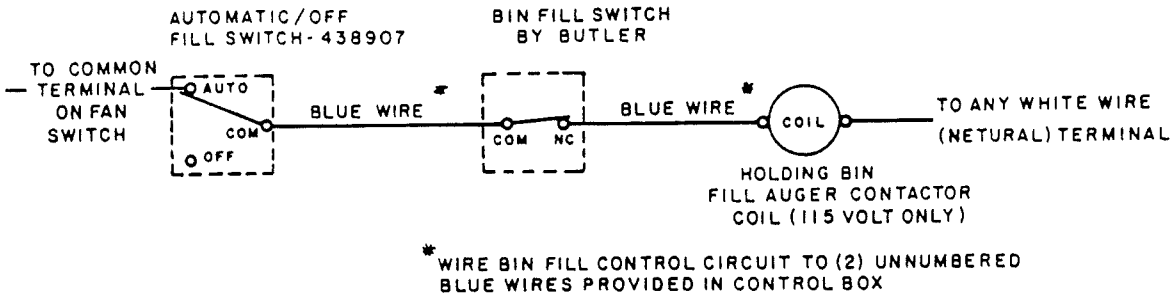
Motor Running Current Loaded (Typical)

Line No.	A	B	C	D	E	F
10 HP	52	52	46	11.5	52	31
15 HP	62	62	48	20	62	36

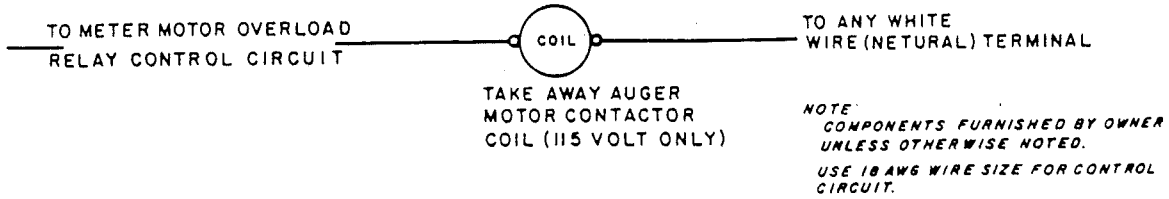
Total input current for two fan motors will exceed double the reading for one motor on a dual fan dryer as the static pressure causes the current draw to increase.



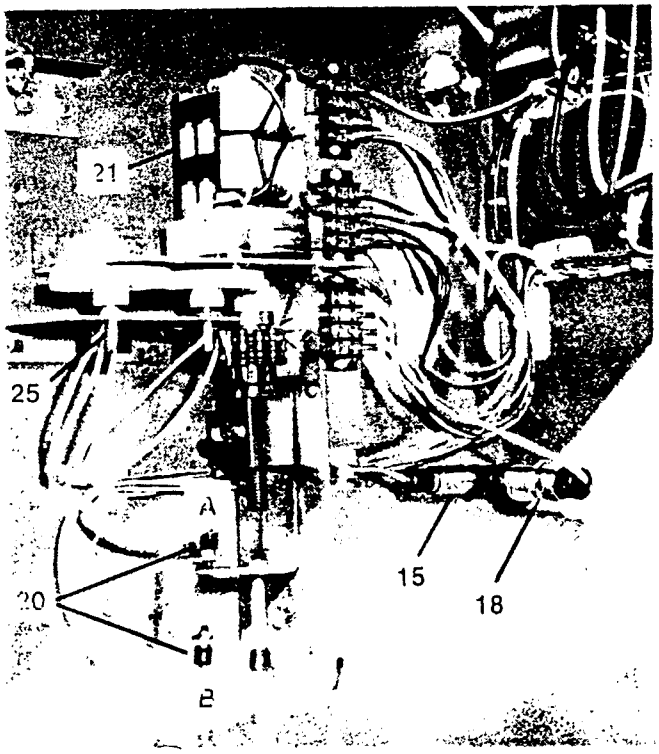
Suggested Wiring Of Auxilary Equipment



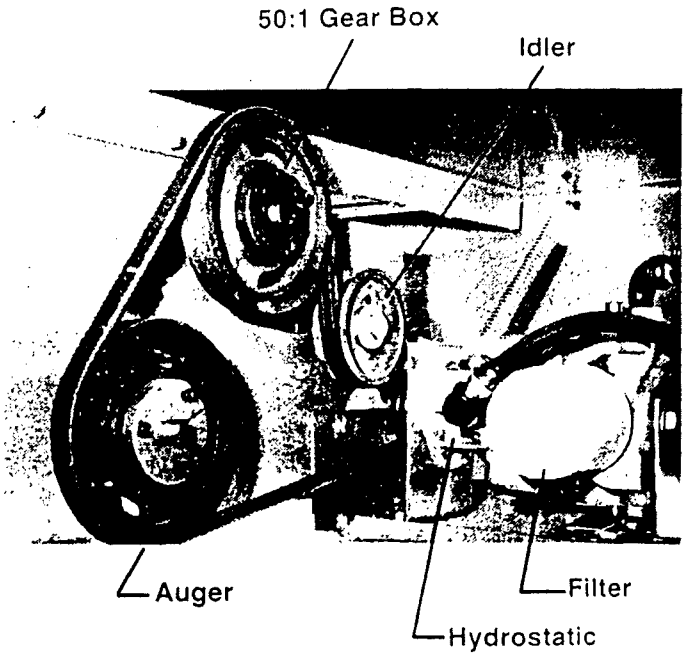
Fill Circuit



Discharge Take-Away

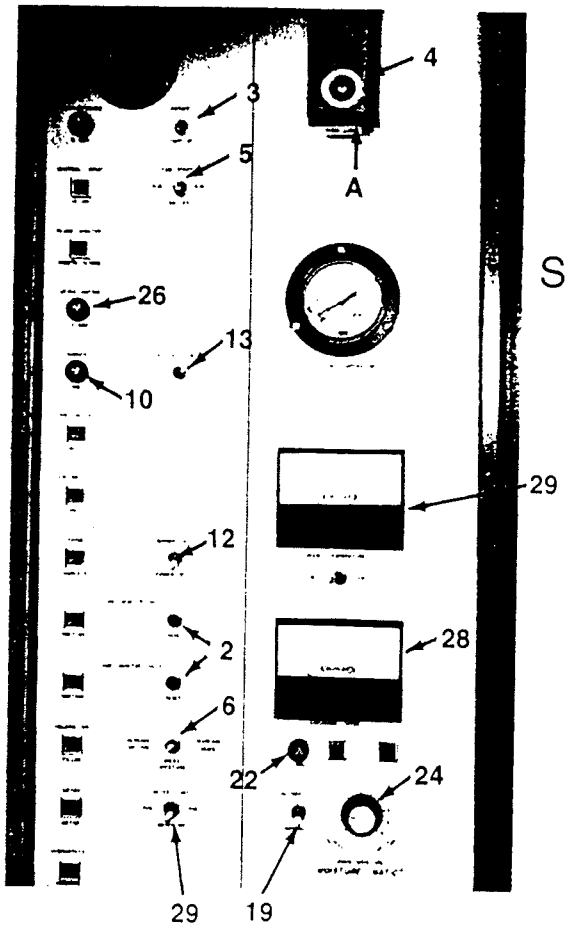


Shift Motor Assembly



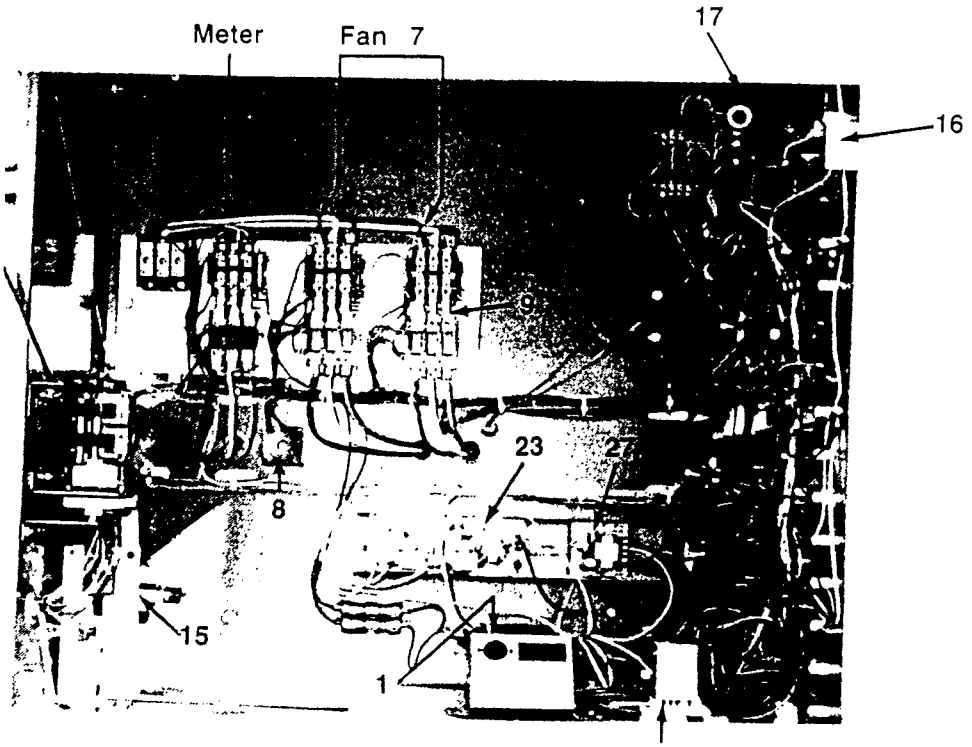
Hydrostatic Drive

Control Cabinet



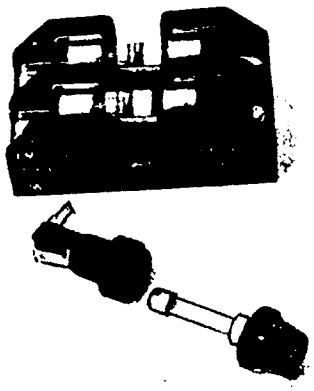
Switch Panel
Front

Switch Panel
Back



Control Cabinet
Inside

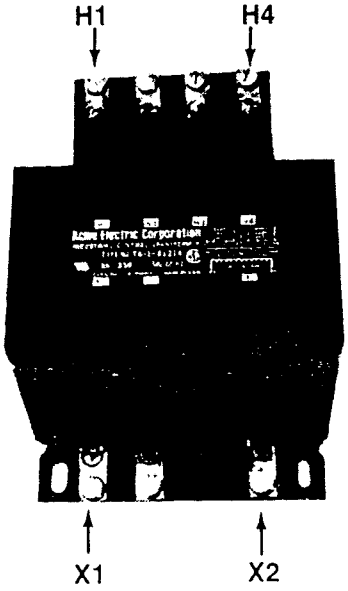
Power Circuit (Black Wire)



Fuse

Fuses are devices used to protect individual circuits from short circuits. A fuse is assumed to be bad if 110 VAC to ground is found on one side and not on the other.

2 AMP	protects the primary of the transformer.
5 AMP	protects the start-up, operate, fan, Metering and increase/decrease circuit.
1/2 AMP	protects the 8 volt power supply.
1 AMP	protects the burner circuit.
1 AMP	protects the moisture-matic circuits



Transformer (Key # 1)

All controls are operated on 115 VAC power.
A step-down transformer is used to reduce the voltage from 440 or 220 VAC to 115 VAC and to isolate the controls from power line transient voltages.

Test

1. Turn on main power.
   a. 230 VAC or 440 VAC should be found between H1 & H4.
   b. If voltage is not found, the problem is upstream.
   c. 115 VAC should be found between X1 & X2.
   d. If voltage is not found, transformer is defective.

Fuse (5 AMP)

See Page 12

Flame Monitor Reset (Key # 2)

This reset trips out any time the flame monitor goes through a 10-second trial for ignition and does not sense flame. When the button is popped out, the only circuit that will work is the indicator meter circuit. One circuit breaker is used on 8-foot dryers and 2 are used on 10-foot dryers.

Test on page 13

Test

1. Turn on main power to dryer.

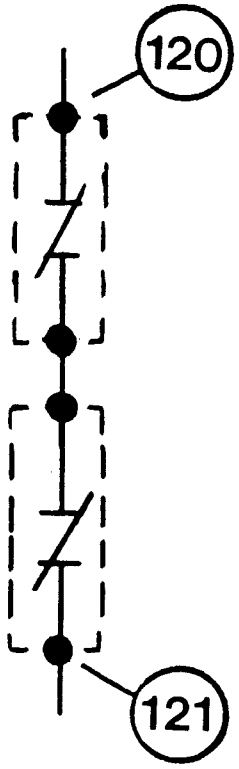
2. 8-foot Kan-Sun procedure:

   a. 115 VAC should be found at test points 120 and 121.

   b. If voltage is not found at test point 120, the problem is up-stream.

   c. If voltage is not found at test point 121, the button should be pushed and procedure "a" repeated.

   d. If voltage is not found after the button was pushed, the reset is defective.



3. 10-foot Kan-Sun Procedure:

   a. 115 VAC should be found at test points 120 and 121.

   b. If voltage is not found at test point 120, the problem is up stream.

   c. If voltage is not found at test point 121, the top reset button should be pushed.

   d. 115 VAC should be found on the jumper between the resets. If voltage is not found, the top reset is defective.

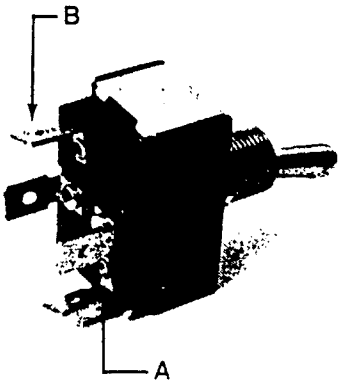
   e. Repeat procedure "a".

   f. If voltage is not found at test point 121, push the bottom reset and repeat procedure "a".

   g. If voltage is not found, the bottom reset is defective.

   If the button (or buttons) continues to pop out during ignition, the problem is in the flame monitor or the burner flame (See pages 21 & 23).

Start-up/Operate Switch (Key # 3)

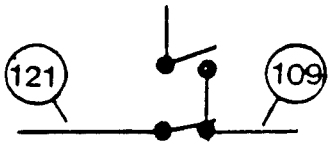


This switch is used to interlock all the safety devices after all the dryer circuits are functioning properly. This switch is made up of 2 seperate sets of contacts controlled by a common toggle. Contacts "A" must close before contacts "B" open.

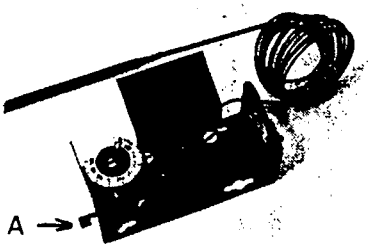
When the dryer is started, the start-up contacts must be closed.

Test on page 14

Test Start-Up F. n (See Page 35 For Operate)



1. Turn on the main power to dryer.
2. Place the start-up/operate switch in the start-up position.
   a. 115 VAC should be found at test points 121 and 109.
   b. If voltage is not found at test point 121, the problem is upstream.
   c. If voltage is not found at test point 109, the switch is defective, or the wire to 109 is open.



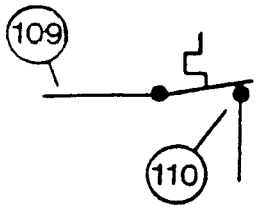
High Limit (Key # 4)

The high limit has closed contacts that are controlled by a capillary that goes into the heating section. The switch can be set to open at any temperature between 100° and 325° by turning the dial with a screwdriver. The normal set point should be 20° Fahrenheit above the drying temperature. When the open temperature has been exceeded there will be no voltage at test point 110.

Erratic operation can be caused by the capillary bulb being mounted with its end up (see picture). The end should be down.

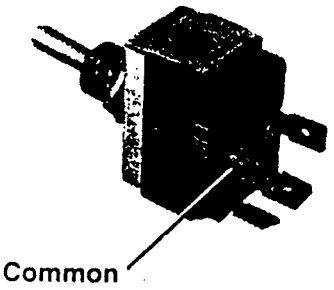
Test

1. Turn on main power to dryer.
2. Place start-up operate/switch in start-up.
   a. 115 VAC should be found at test points 109 and 110.
   b. If voltage is not found at test point 109, the problem is upstream.
   c. If no voltage is found at test point 110, push the reset lever (A) and repeat procedure "a".
   d. If no voltage is found, the switch is defective.



3. Verify the high limit open point.
   a. Set the dial at 20° Fahrenheit above the drying temperature.
   b. Raise the drying temperature by turning the modulating valve in.
   c. The high limit should shut off the dryer when temperature on the gauge is within 5 degrees of the drying temperature.

Start, Run Stop Switch For Fan And Meter (Key #5)

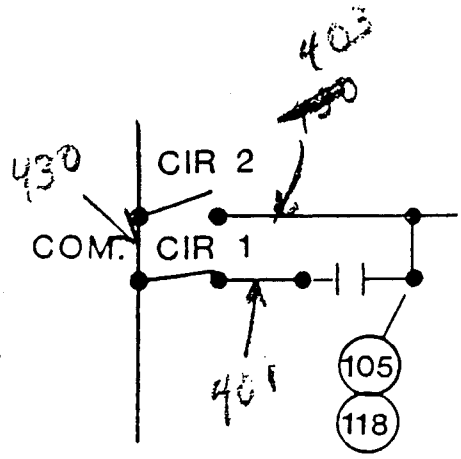


This switch is used to start, run and stop the fan and metering motors by providing voltage to the respective starter.

This switch is made up of 2 sets of contacts controlled by a common toggle. Circuit "2" is momentary-normally open contacts that must be held closed by moving and holding the toggle in the up or start position.

Circuit "2" is closed any time the toggle is in the mid or run position. Circuit "1" can be opened by moving the toggle to the down or stop position. The toggle will remain in the stop position until it is moved back to the Run position.

Test



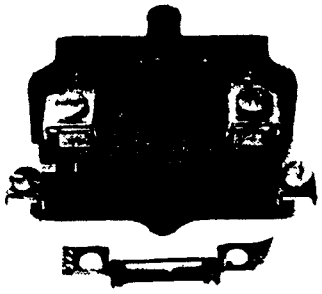
1. Turn on main power to dryer.
2. Place start-up/operate switch is start-up position.
3. Place start switch in the run position.
   a. 115 VAC should be found at common and circuit 1.
   b. If voltage is not found at common, the problem is upstream.
   c. If voltage is not found at circuit 1, the start switch is defective.
   d. If voltage is found at circuit 1, proceed to step 4.
4. Hold the toggle in the up or start position.
   a. 115 VAC should be found at test point 105 or 118.
   b. If voltage is not found at test point 105 or 118 the switch is defective or the wire to 105 or 118 is open.
5. Place the toggle on the down or stop position.
   a. 115 VAC should not be found at circuit 1.

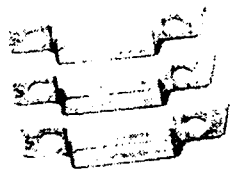
Increase/Decrease Switch (Key #6)

See page 35

Motor Starter Circuit (Red Wire)

Fan And Meter Starter (Key # 7)





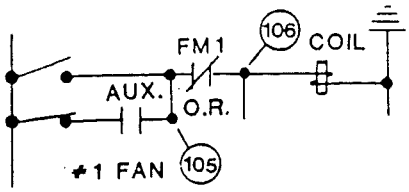
A starter is made up of a set of open contacts to provide run voltage to the motor being controlled. It also has auxiliary (aux) contacts that are used to provide 115 VAC control voltage from the start switch to the magnetic holding coil that holds the open contact and auxiliary contacts closed.

A starter will also have and over-amperage protection device called an overload relay (O.R.), which is made up of a set of heater strips that provide run voltage to the motor being protected. The heater strip increases in temperature any time the motor draws excessive amperage. The heat causes a bi-metallic strip under the heater to warp and open a set of closed contacts which provide 115 VAC control voltage to the starter coil. When the coil is de-energized, closed contacts open and the motor stops.

The operator's Manual has a breakdown of all starter repair parts.

Test Fan

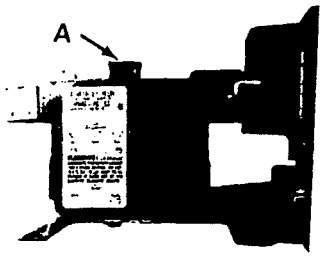
1. Turn on main power to the dryer
2. Place the start-up/operate switch in the start-up position.
3. **Hold** the start switch in the start position. If the contacts do not move, test the following:



   a. 115 VAC should be found at test point 105 and 106.

   b. If no voltage is found at test point 105, the problem is upstream

   c. If no voltage is found at test point 106, the overload relay is defective or open.



   d. The overload relay can be closed by pushing the reset bar (A). ***"Do not push the reset button."***

4. If the reset trips again, check the motor run amperage. See Page 9A.
5. **Hold** the start switch in the start position. If the contacts do not move, test the following:

   a. 115 VAC should be found at test point 106 and at the red wire in the coil.

   b. If voltage is not found at test point 106 and at the red wire, the problem is upstream.

   c. If voltage is found at test points 106 and 105, the coil is defective or the neutral (white wire) is open.

d. 115 VAC on the neutral wire (white) is proof of an open wire

6. Move the start switch to the start position. If the motor starts and then stops when the toggle is released, test the following:
   a. 115 VAC should be on one side of the fan motor auxiliary (aux)..

   b. If no voltage is found, the start stop switch is defective.

   c. If voltage is found, the fan motor auxiliary (aux) is defective.

Meter-Test

1. Turn on the main power to dryer.

2. Place the start-up/operate switch in the start-up position.

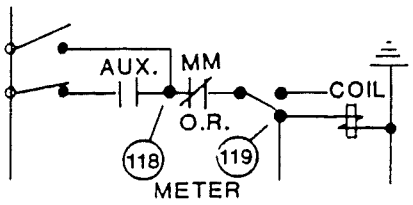
3. **Hold** the start switch in the start position. If the contacts do not move, test the following:

   a. 115 VAC should be found test points at 118 and 119.

   b. If no voltage is found test point at 118, the problem is upstream.

   c. If no voltage is found at test point 119, the overload relay is defective or open. The High Pressure switch may be open see page 27 for more information.

   d. The overload relay can be colsed by pushing the reset bar (A). ***"Do not push the reset button."***



4. If the reset trips again, check the motor run amperage. See Page .

5. Hold the start switch in the start position. If the contacts do not move, test the following:

   a. 115 VAC should be found at test point 119 and at the red wire to the coil.

   b. If voltage is not found at test point 119 and at the red wire, the problem is upstream.

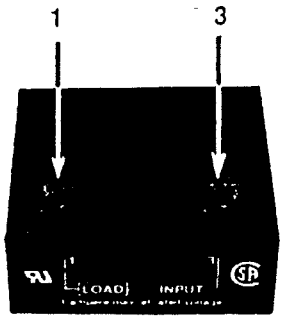
   c. If voltage is found at test points 118 and 119 the coil is defective or the neurtal (white wire) is open.

   d. 115 VAC on the neutral wire (white) is proof of an open wire.

6. Move the start switch to the start position. If the motor starts and then stops when the toggle is released, test the following:

   a. 115 VAC should be on one side of the fan motor auxiliary (aux)..

Test continued on page 18



b. If no voltage is found, the start stop switch is defective.

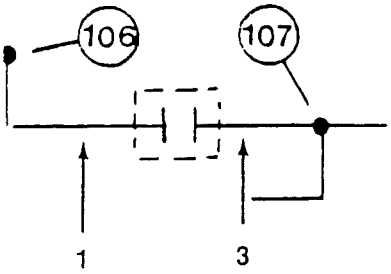
c. If voltage is found, the meter motor auxiliary (aux) is defective.

6-Second Timer (Key # 8)

Ten-foot dryers are equipped with a second fan which must be started 6 seconds after the first fan has started. Times less than 6 seconds will be hard on the motor due to starting amperage surges. Times greater than 6 seconds will allow the Number 2 fan to counter rotate (turn backwards), which must be overcome when the motor starts. Overcoming the counter rotation will increase the starting amperage surge. If counter rotation of sufficient RPM is achieved, a 3ϕ motor will start and run backwards.

Test

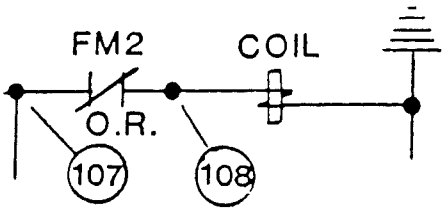
1. Turn on the main power to the dryer.
2. Move the start-up operate switch to start-up.
3. Start the number 1 fan.



a. 115 VAC should be found at Test points 107, five to seven seconds after the number 1 fan started.

b. If voltage was not found or the timing was not between five and seven seconds, the timer is defective or installed backwards. (Note position of terminals 1 and 3).

Fan Starter #2 (Key # 9)



a. If voltage was found at test point 107, proceed to test "d".

b. 115 VAC should be found at test point 108 five to seven seconds after the number 1 fan starts.

c. If no voltage was found at test point 107, the fan motor number 2 overload (FM20R) is open or defective. Perform tests 3-d and 4, Page 16.

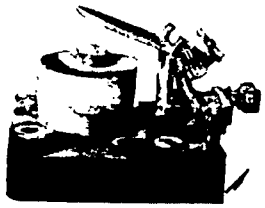
d. If 115 VAC was found at test point 108, the number 2 fan coil is defective or has an open neutral. Perform the tests 5-a, b, c, and d. Use test point 108, not 106, as the voltage test point.

PHASE Convertor **Note:** To Reverse Motor Rotation Reverse Leads 1 and 10

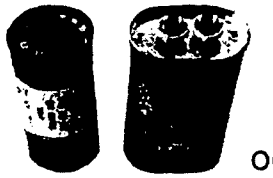
The static phase convertor used in the Kan-Sun Continuous Flow dryer requires a jumper from L1 to L2 of the Fan Starter. L2 provides a source of voltage to a network of oil and electrolitic capacitors in the phase convertor.
The capicators cause the current in L2 to lag the current in L1 This lag provides the 3rd phase necessary to start.

Test continued on page 19

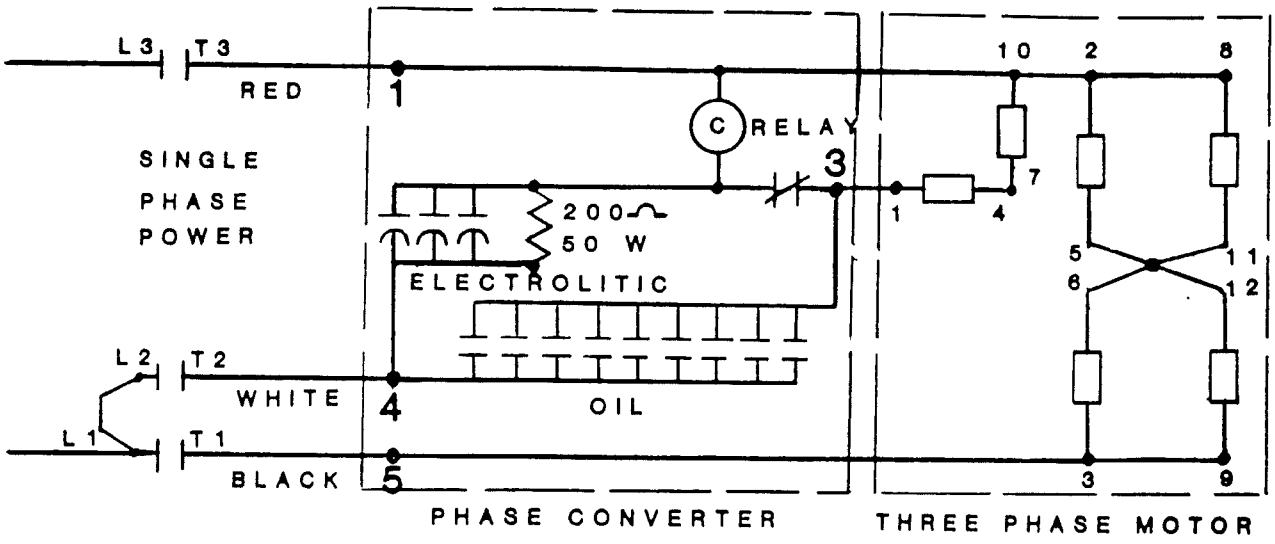
During starting, a potential relay keeps the electrolitic capacitors in the circuits until the motor reaches normal running speed. At that time the relay opens and drops the electrolitic capacitors out of the circuit.



The capacitors should be checked with a capacitor tester, such as the BK 820. Resistance checks with an ohmmeter are not reliable. Repeated capacitor failure indicates weak capacitors are being used, motor overload, or potential relay failure.



Electrolitic Oil

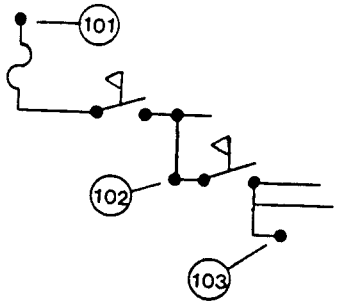


Burner Controls (Blue Wire)

Burner Fuse (MDL 1) (Key # 10)

See page 12 for test procedure.

Air Switch-Two required on 10-foot. Kan-Sun dryers.



The air switch (or switches) is another safety device to prevent the burner from being turned on before the fans are. They would also shut off the burner in case a fan blade would break.

The normally open contacts are activated by a sail attached to a control arm in the fan venturi. This is very critical and should be replaced with a direct replacement (837253). The long stainless steel sail that comes with a replacement air switch should not be used.

Test

1. Turn on main power to the dryer.
2. Place the start-up/operate switch in start-up.

Test continued on page 20

3. Start the fan or fans. (Number 1 air switch)

   a. 115 VAC should be found at test point 101 and 102.

   b. If voltage is not found at test point 101, the problem is up-stream.

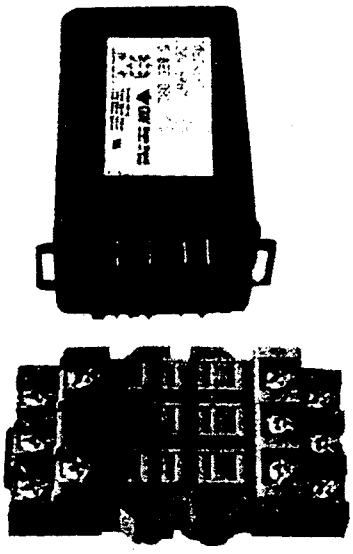
   c. If voltage is not found at test point 102, the problem is up-stream fuse, or the air switch is defective (Check for broken sail or a broken, wire.)

   Number 2 Air Switch *(10-ft. "Kan-Sun dryer" only)*

   d. 115 VAC should be found at test points 102 and 103.

   e. If no voltage is found at test point 102, the problem is up-stream.

   f. If no voltage is found at test point 103, the number 2 air switch is defective. (Check for broken sail or a broken wire).



Purge Timer (Key # 11)

The purge timer is another safety device that insures that there are four exchanges of air in the heat chamber before the burner is turned on.

A set of normally open contacts closes 15 seconds after 115 VAC is applied to its timing circuit by the air switch.

When the contacts close, the purge-completed lamp will come on, indicating the burner can be turned on. This timer is a standard square base timer and can be replaced with any standard square base 15-second timer.

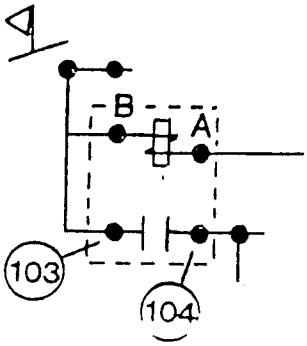
Test:

1. Failure of the purge-completed lamp will indicate a defective purge timer.

2. The Model 80/82 tester should be used to test all functions of the timer.

3. Turn on the main power to the dryer.

4. Move the start-up/operate switch to the start-up position.



5. Start the fan.

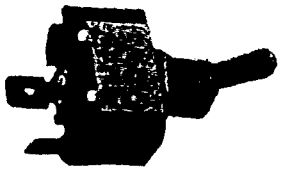
   a. 115 VAC should be found at test point 103 as soon as the fan or fans start. No voltage at test point 103 indicates that the problem is up-stream.

   b. No voltage should be found at test point 104 until 15 seconds after the fan or fans start.

   c. No voltage or voltage at test point 104 in less than 15 seconds indicated the Purge timer is defective.

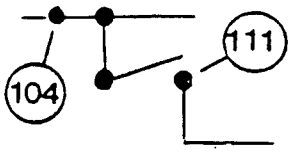
Burner Switch (Key # 12)

The burner switch is a manually activated switch that provides a source of 115 VAC to the flame monitor or monitors (10-ft. Kan-Sun Dryer only).



Test

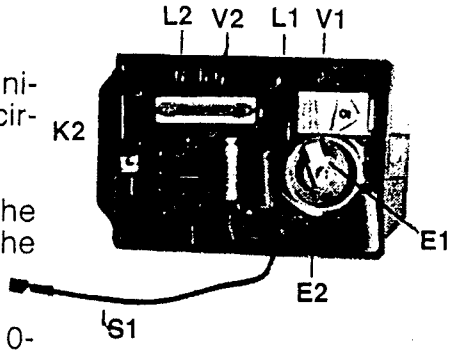
1. Turn on main power to dryer.
2. Move start-up operate switch to the start-up position.
3. Start the fan and burner.
   a. 115 VAC should be found at test point 104 and 111.
   b. If no voltage is found at test point 104, the problem is up-stream.
   c. If no voltage is found at test point 111, the burner switch is defective.



Flame Monitor

The flame monitor provides a source of high voltage for ignition, a relay circuit for solenoid power and a flame-sensing circuit.

It will try for flame for 10 seconds. If no flame is sensed, the monitor will shut off ignition and solenoid power and lock the system out until the power is removed from terminal L1.



L1 - 115 VAC in from burner switch or #1 flame monitor on 10-ft. Kan-Sun dryer.

L2 - neutral

V1 - 115 VAC out to solenoid or #2 flame monitor on 10-ft. Kan-Sun dryer

V2 - Neutral

E1 - high voltage to probe

E2 - flame sense (local)

S1 - flame sense (remote sense not standard).

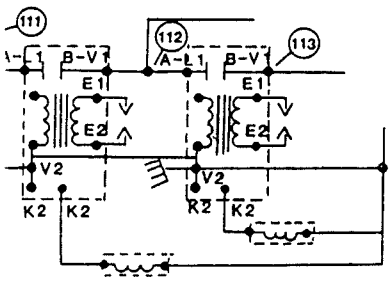
Test

All functions of the flame monitor should be checked with a Model 80/82 tester.

1. Turn on the main power to the dryer.
2. Place the start-up operate switch in the start-up position.

3. Place a jumper wire between test points 120 and 121.

4. Turn on the fan and burner.
Test for solenoid power:



a. 115 VAC should be found at test points 111, 112 and 113 (on a 10-ft) for 10 seconds after the burner switch is placed in the on position.

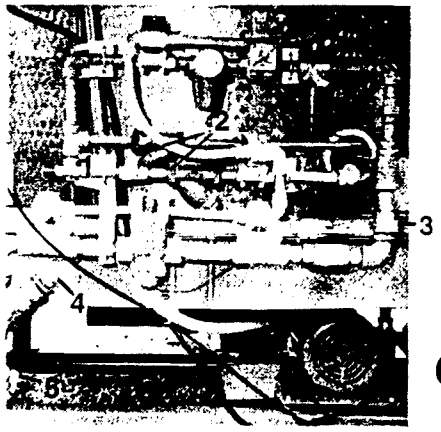
b. No voltage at test point 111 indicates that the problem is upstream.

c. No voltage at test point 112 indicates that the Number 1 flame monitor is defective.

d. (10-ft dryer) No voltage at test point 113 indicates that the Number 2 monitor is defective, or not getting 115 VAC from the Number 1 monitor.

5. Tests 4-a thru 4-d indicates that the relay circuit of the monitor is working. It does not prove that high voltage is being sent to the probes.

6. High voltage spark. This test requires a visual inspection of the burner. This requires that you go into the burner section to make this observation.



"Notice" ***If You Are Not An Experienced Serviceman With Knowledge Of The Kan-Sun Plumbing System, You Should Not Attempt This Procedure. Use A Model 80/82 Tester.***

a. Turn the gas off at the LP tank or at the meter if the dryer burns natural gas.

b. Open the quick shut-off valve on the dryer. (1)

On LP Gas Models:

c. Loosen both strainer screen plugs to bleed the LP out of the lines. (2)

"Notice" ***Severe Freezing Can Occur If The Escaping Liquid Comes In Contact With Your Flesh.***

On natural gas models:

d. Disconnect the pipe coupling where the plumbing goes into the dryer. (3)

e. To bleed the NG line, loosen the strainer plug and slowly open the quick shut-off valve and allow the gas to escape. (4-5)

7. After you are sure that all the gas has escaped from the lines, you are ready to proceed.

a. Place a jumper across test point 120 and 121.

b. Place a jumper across test point 104 and 110. This jump allows the flame monitors to be tested without the fan running.

c. Use the burner switch to turn the voltage in and off to the flame monitors.

8. Go inside the cooling chamber and make the following observations:

a. Have someone turn the burner switch on.

b. Watch and listen for spark jumping some place other than at the probes. This is normally at locations where the L1 wire is close to a metal object. Remember, you have 10 seconds to observe. Repeat test 8-a if more time is required.

c. If a spark leak is observed, check the line for a crack in the insulation. Replace the wire.

9. If the problem has not been located, climb into the heat chamber.

a. Have someone turn on the burner switch.

b. Watch and listen for spark jumping some place other than at the probe tips.

c. The probe should be centered in the cut-out in the burner shield.

d. If the probe ceramic is leaking spark, replace the probe with parts 448068 and 448064.

e. If no spark leak is found and no spark is produced, the flame monitor is defective.

f. Close all plumbing opened in 6-c through 6-e.

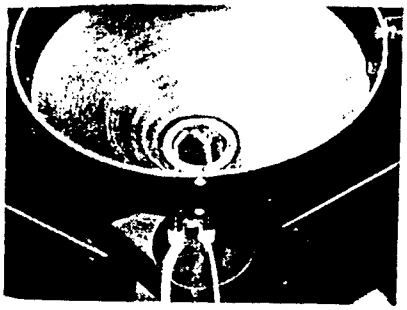
Notice: ***Be sure To Remove The Jumpers From test point 120 To 121 And test point 110 to 104. Failure To Remove Them Can Result In Fire.***

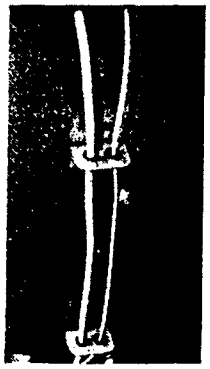
10. The next problem is the failure of the flame monitor to sense the presence of flame or the inability of the flame to carry the 5 micro amps of current necessary to maintain the sensing circuit of the monitor. The Model 80/82 Tester is the best way to test the flame sense circuit of a flame monitor.

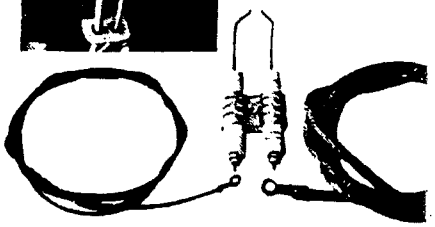
Some things to check are:

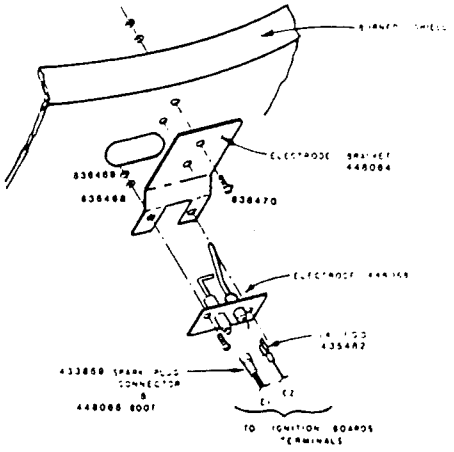
a. Be sure all grounds are good.

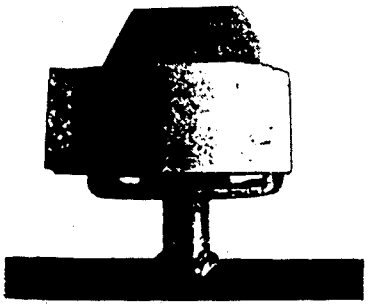
b. On natural gas burners a 3/16 LP orifice drilled to 5/16 will improve performance if there is enough gas pressure to give the desired temperature rise (10-14 PSI).







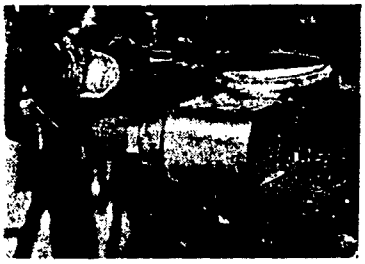




c. Remote sense monitors and probes can also be used to help this problem. Call Technical services for more information.

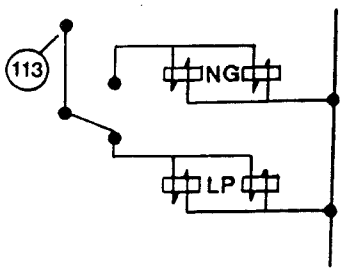
d. The air damper may need to be adjusted to 1/4-inch on LP gas, 1/8-inch on natural gas.

Solenoid



The solenoids are electro-magnetic valves that control the gas flow to the burner.

The solenoid is made up of 3 basic parts; a coil, plunger and diaphragm. The coil produces a magnetic field when 115 VAC is applied to it. The magnetic attraction lifts the ferrous metal plunger and releases the diaphargm to allow gas flow. Be sure that the solenoid is installed with the flow arrow pointing in the direction of fuel flow



Test

1. Place a jumper from test point 120 to 121
2. Turn on main power to dryer.
3. Move the start-up/operate switch to the start-up position.
4. Position the fuel selector switch to the proper fuel.
5. Start the fan and heater.
6. After the ignitor light or lights come on, perform the following test:

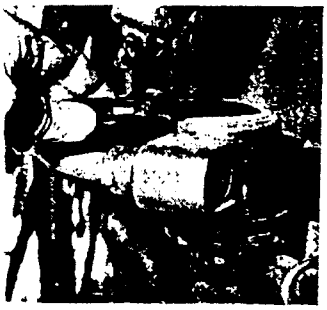
Note: ***Remember, you have 10 seconds to make tests before flame monitor locks out.***

a. If the Ignitor light or lights did not come on, the problem is upstream.

b. Test for 115 VAC at the center terminal of the fuel selector switch, Key #13. If no voltage is found, problem is upstream.

c. Test the LP and NG terminals for 115 VAC. If voltage is not found, the switch is defective.

d. If voltage is found, check wiring diagram to be sure switch is wired properly.



e. If switch is wired properly, test each coil for magnetic pull with a knife blade. If no magnetic pull is felt, the coil is defective.

f. If magnetic pull is felt, the mechanical valve parts should be checked.

g. Purge the fuel system. See page 22, items 6-a,b,c,d, & e.

h. Turn off the burner switch.

i. Remove the 4 screws holding the valve body together. Remove the diaphragm and plunger of ***one*** solenoid.

j. Re-assemble the valve, hook up the fuel system and test-fire the burner.

k. If the burner does not fire, repeat test 6-g, 6-h and 6-i on the second solenoid.

l. If the burner fires, replace the diaphragm of the valve. See Owners Manual for assembly instructions.

m. Remove jumper from test points 120 and 121.

7. Gas leaks usually indicate the diaphragm needs to be replaced, if tightening the screws will not seal the leak.

Fuel Strainer

Strainers are provided to prevent particles of foreign material from getting into the gas controls. The first strainer filters our contamination from the fuel supply. The second (on LP only) filters out by-products created during the vaporization process.

Test:

1. Turn off the main power to the dryer.
2. Turn off the fuel at the main supply.
3. Purge the fuel system (see page 22, items 6-a,b,c,d & e).

   a. Remove the strainer plug carefully. If the fuel system was not properly purged, the plug could be under pressure, or escaping liquid could cause severe freezing if exposed to flesh.

   b. Clean the screen . If it can't be cleaned, or if it is damaged, replace it.

   c. Re-install the plug and hook up the fuel system.

Fuel Regulator

The regulator is used on LP dryers to reduce the tank pressure to the working pressure (20-30 PSI). The working pressure should be high enough to provide at least 15 to 20 degree Fahrenheit above the drying temperature. This pressure is controlled by turning the "T" handle in to increase pressure or out to decrease pressure.

Note: *If plumbing system must be opened,refer to page , items 6a,b,c,d & e.*

Burner problems related to the regulator are generally identified in one of these 3 steps.

1. Failure to provide adequate pressure to get the desired temperature rise.

   a. No pressure or low pressure to the regulator. Check for restrictions between regulator and fuel source

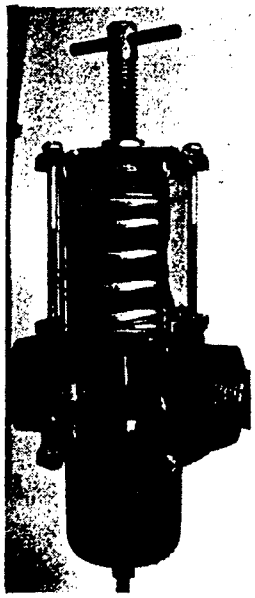
   b. If tank pressure is available to regulator, rebuild regulator with repair kit as detailed in the Owner Parts Manual.

   2. Maximum pressure on regulator does not achieve desired temperature rise.

   a. Screw modulating valve all the way in.

   b. Check for a restriction between the regulator and the burner orifice.

3. Gas leaks usually indicate the diaphragm needs replacing, if tightening the screws do not seal the leak.



Fuel Modulating Valve

This valve controls the fuel supply so a constant temperature is maintained in the heating chamber. This is done by means of a capillary tube located in the heating chamber. Increases in heat result in increased pressure in the capillary tube, which reduces the fuel flow to the burner. Decreases in heat decreases the pressure in the capillary tube, which allows the spring in the valve to increase the fuel flow to the burner.

Turning the "T" handle in increases fuel flow and raises the temperature.

Note: ***If the plumbing system must be opened, refer to page 22, items 6a,b,c,d, & e.***

Burner problems related to the modulating valve are generally identified in one of these 4 steps.

1. Cannot achieve temperature rise with maximum regulator pressure.

   a. Check for a restriction between the modulating valve and the pressure regulator.

2. Cannot achieve temperature rise with modulating valve screwed all the way in.

   a. Check for a restriction between the modulating valve and the burner orifice.

3. Cannot maintain constant temperature.

   a. Too much regulator pressure. See Owner's Manual for proper setting.

   b. If the procedure for setting the modulating valve is correct and the pressure is not fluctuating, check to be sure the capillary bulb tip ***is pointed down.*** See page 14.

   c. If the bulb is properly located, replace the capillary tube with parts as detailed in the Owner Parts Manual. ***Do Not Kink The Tube.***

   d. Rebuild the valve with repair kit if a new capillary tube did not solve the problem.

4. If tightening the screws do not seal a gas leak, the diaphragm must be replaced.

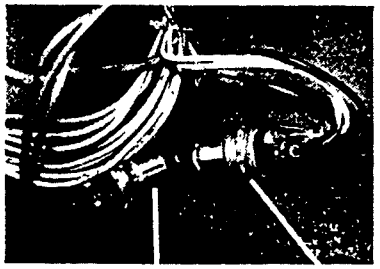
Metering System

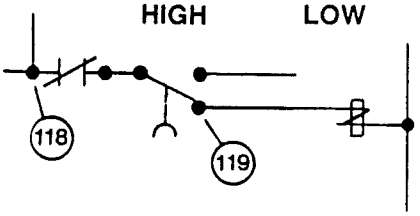
Meter Motor Switch (Key #29) See Page 15.

Meter Motor Overload Relay (Key #14) See Page 17.

High Pressure Switch (Key #15) .

This pressure switch opens any time the working pressure of the hydrostatic transmission exceeds 2000 PSI. On later dryers, the switch may be adjustable from 500 to 3000 PSI. The setting should be 1500 PSI.





If the factory-set pressure has been exceeded, the high pressure lamp will come on and the meter motor will stop. When the working pressure drops, the lamp will go off.

Problems related to high pressure shut-downs:

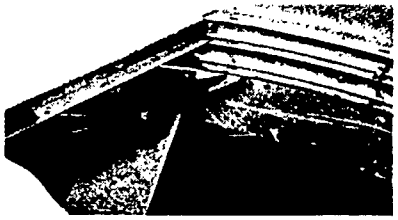
1. Sweep arms jammed:

   a. Some object in a column.

   b. Moldy, crusted grain left from previous drying season.

   c. Cooling section filled with wet grain and left still too long.

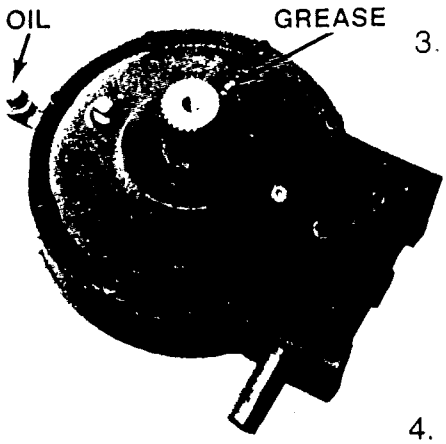
   d. A hard rain and/or freezing temperatures can also cause this problem.



2. Auger jammed:

   a. Some object in tube or sump.

   b. Grain not exiting the auger fast enough.

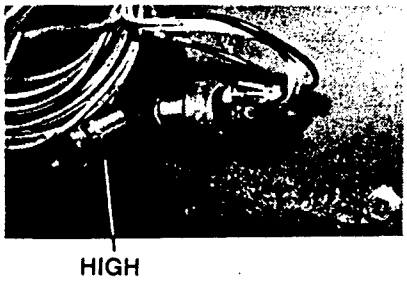


3. The 50:1 gear box can freeze up.
   a. Check oil level.
   b. Be sure output shaft is lubricated.

Note: ***See lubrication schedule for proper lubrication in owners manual.***

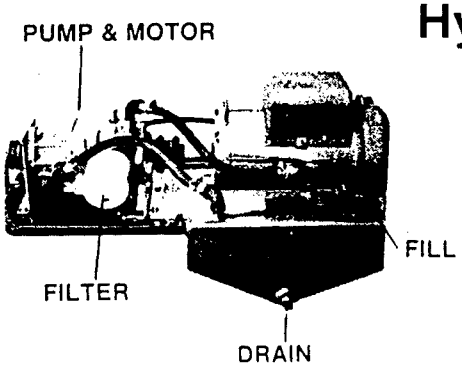
4. The Sundstrand Hydrostatic Transmission has seized.
   a. See "Hydrostatic Transmission Service Section".

5. Defective pressure switch:



   a. Replace switch. It is not field-adjustable.
   b. Replace switch with adjustable switch. It should be set for 1500 PSI
   c. Adjustments can be made by loosening the ring and turning the switch body clockwise to increase the pressure.
   d. The wiring requires (2) 1/4 spade connectors.

Hydrostatic Transmission

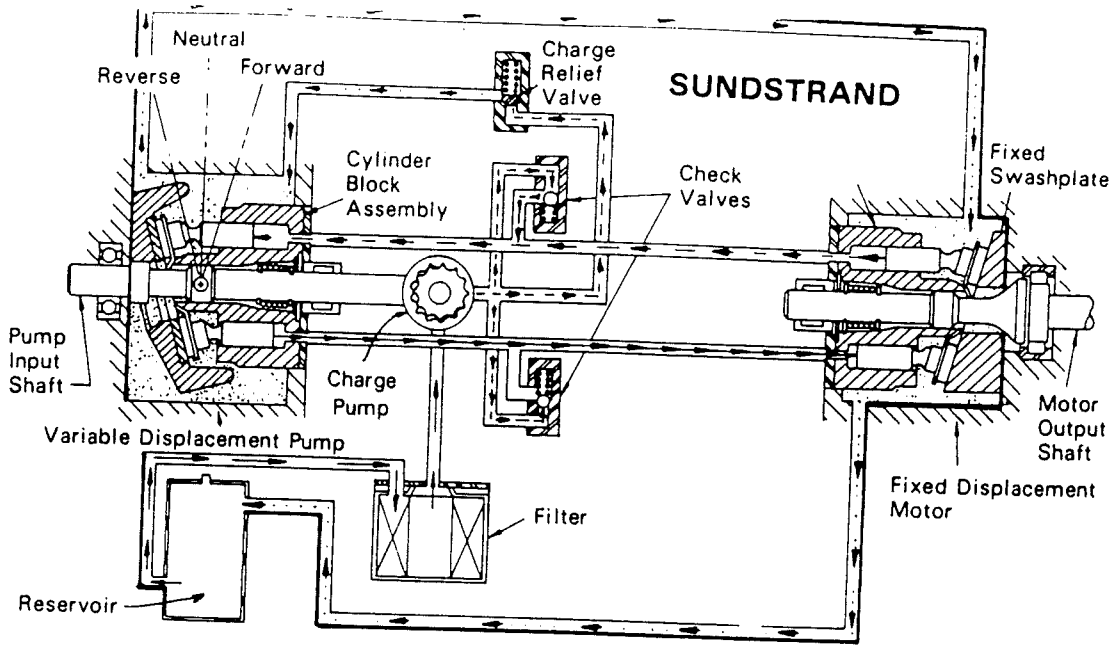


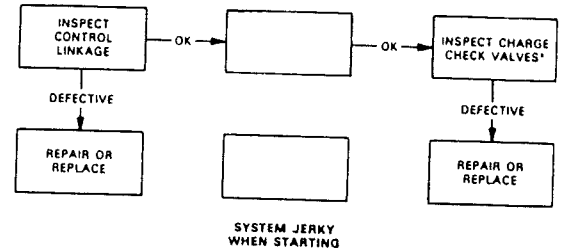
The 15 series hydrostatic transmission consists of a variable displacement axial piston pump connected in a closed loop to a fixed displacement axial piston motor. The variable displacement pump is driven by an electric motor - and the fixed motor, which is driven by the fluid from the pump, drives the dryer 50:1 gear box. The speed of the fixed motor output shaft depends on the flow from the pump and loop system pressure is determined by the gear box load.

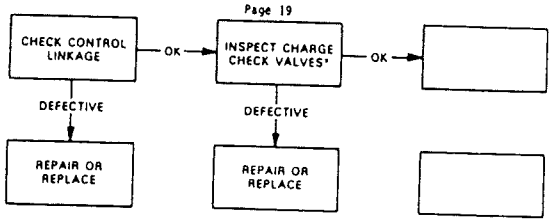
The piston pump and motor have a small amount of internal leakage which is lost from the pump/motors closed loop circuit. This fluid loss must be replenished to prevent cavitation. To accomplish this task, a fixed displacement pump is used. It is driven directly by the electric motor through the vairable displacement pump shaft. This charge pump provides a pre-determined amount of fluid that is used by the pump motor circuit as required to replenish leakage losses.

Since the pump motor circuit is a closed loop, and either side can be pressurized, two (2) directional control check valves are needed to direct charge pump flow into the low pressure side of the circuit.

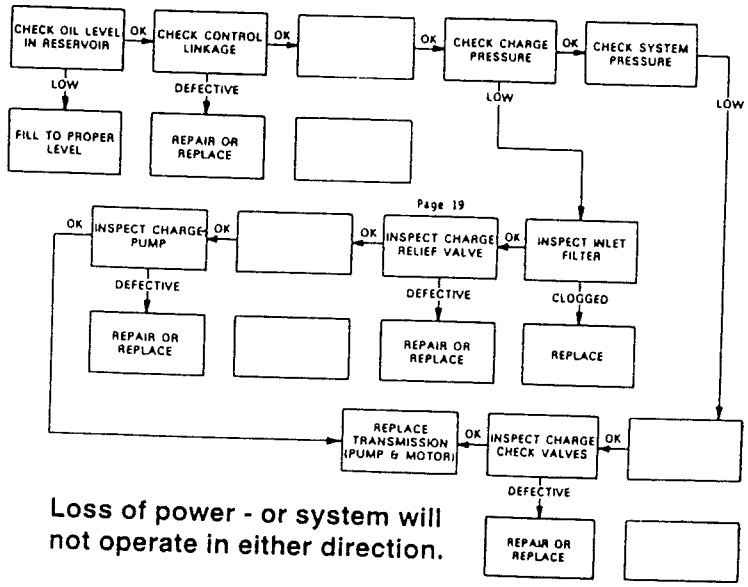
The pressure in this charge pump circuit is limited by a factory-set, direct operating relief valve. Any fluid not being used is discharged from the circuit over this valve and passes through the pump and motor housings back to the system reservoir.





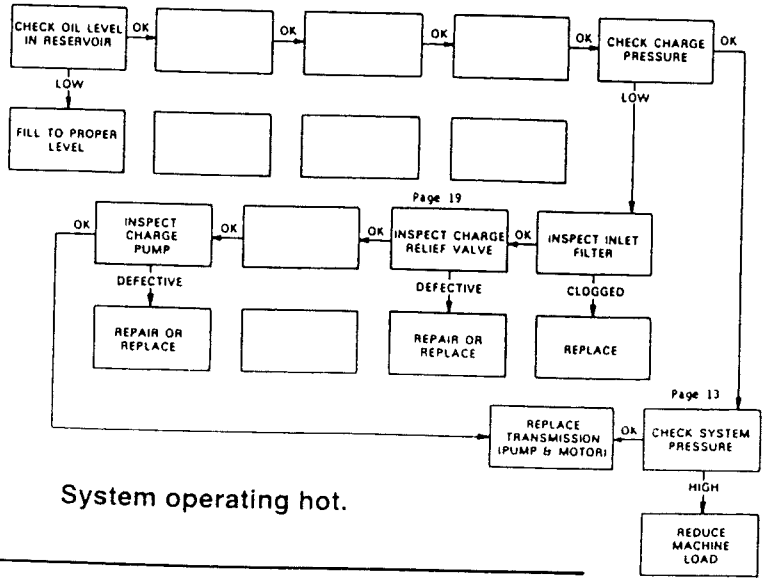


System operates in one direction only.

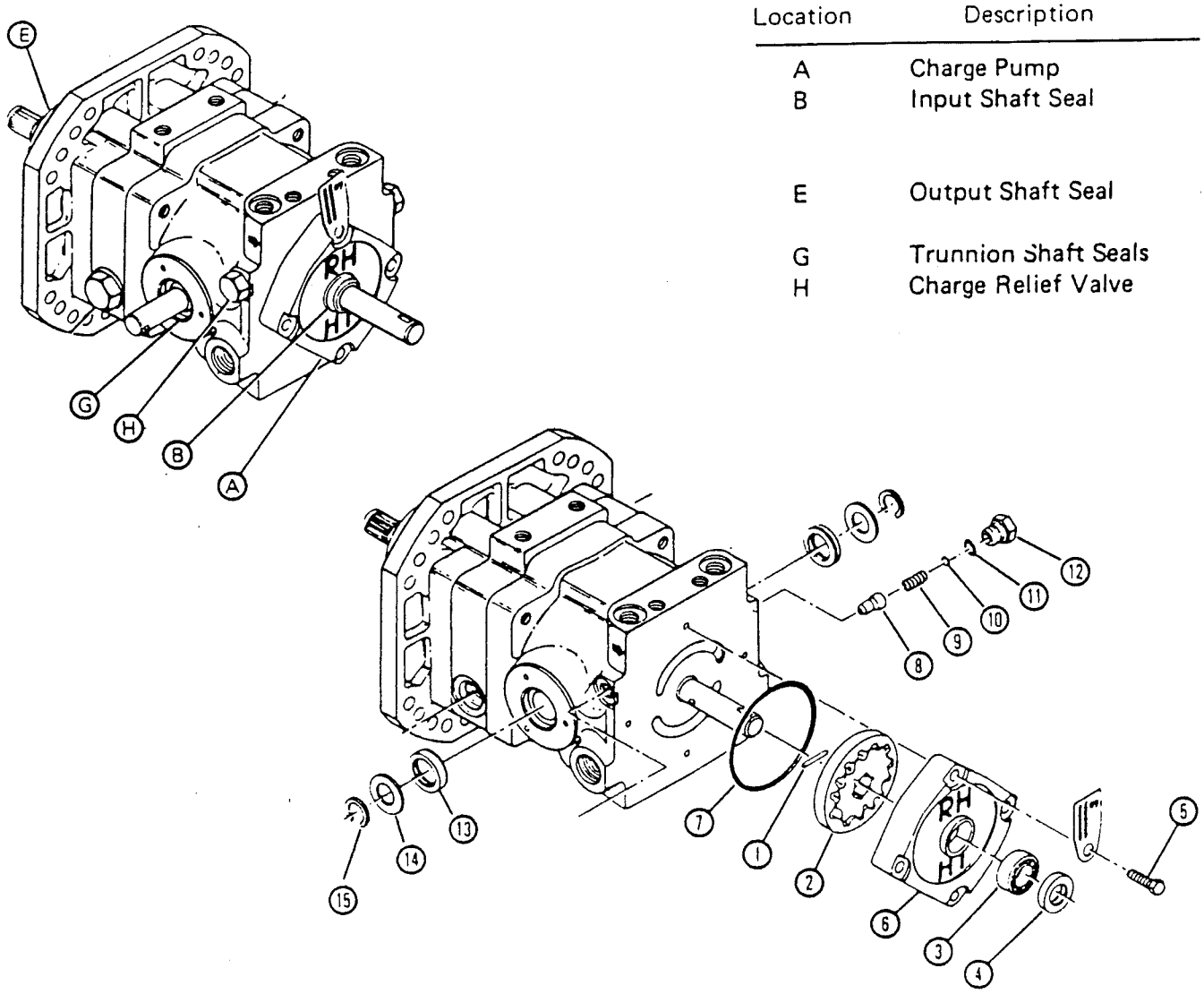


Loss of power - or system will not operate in either direction.

Trouble Shooting Procedures



System operating hot.



Location	Description
A	Charge Pump
B	Input Shaft Seal
E	Output Shaft Seal
G	Trunnion Shaft Seals
H	Charge Relief Valve

NO	DESCRIPTION	QTY
	CHARGE PUMP (A)	
1	Pin-Drive	1
2	Charge Pump (Gerotor)	1
3	Bearing	1
4	Seal-Lip	1
5	Screw-Hex.Head	4
6	Housing-Chg.Pump	1
7	O-Ring	1
	CHARGE RELIEF VALVE (H)	
8	Cone-Charge Relief	1
9	Spring-Charge Relief	1
10	Shim	A/R
11	O-Ring	1
12	Plug-Hex.Head	1
	TRUNNION SHAFT SEALS(G)	
13	Seal-Lip	2
14	Washer	2
15	Retaining Ring	2

Inlet Filter

It is imperative to insure that only clean fluid enter the hydrostatic transmission circuit; therefore, a 25 micron (nominal rating) filter is required in the charge pump inlet line. This filter should not have a bypass and must be changed regularly to insure system reliability.

Fluids

The following types of fluids have beem used successfully in the hydrostatic transmission:

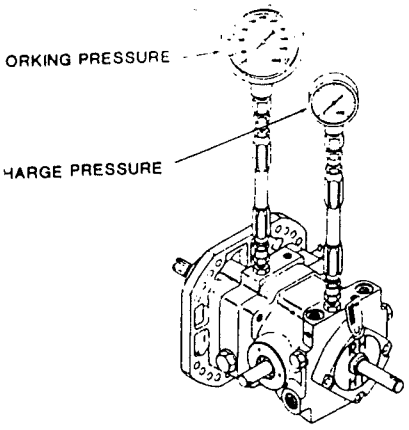
1. Anti-wear hydraulic oil.
2. Automatic transmission fluid - Type "F"
3. Hydraulic transmission fluid (type used by the Agricultural industry for combined transmission, hydraulic and wet brake systems).

Most of the above fluid types have acceptable viscosity characteristics in the operating range of 0 degrees to 200 degrees Fahrenheit). The fluids selected should provide a minimum viscosity of 47 SUS (Universal Second Saybolt) at 210 degrees Fahrenheit and a maximum measured viscosity of 6000 SUS at the lowest expected start-up temperature.

Your best assurance for a quality product is the assistance that can be offered in its selecton by a fluid supplier. The major oil companies are quite capable of providing suitable products.

Transmission Replacement

1. Prior to installing the transmission, inspect for damage during shipment and handling. Make certain all circuit components (reservoir, hoses, fittings, heat exchanger, etc.) are clean prior to installing and filling with fluid.
2. Fill the reservoir with recommended hydraulic fluid which should be passed through a 25 micron (nominal) filter prior to entering the reservoir. Never re-use fluid.
3. The inlet line leading from the reservoir to the pump housing on the transmission must be filled prior to start-up. If gravity feed does not fill this line, it must be filled manually. Remember that the maximum inlet vacuum at normal conditions should not exceed 5 in. Hg. (2.5 PSI). Check inlet line for properly tightened fittings and be certain it is free of restrictions.
4. Place the control lever in neutral. The control linkage must be disconnected from the transmission during initial start-up.
5. Remove the plug from the charge pressure port and slowly turn the input shaft (hand cranking is recommended) until fluid flows from this port.



6. Install a pressure gauge (1000 PSI) in the charge pressure port with a short section of hose and a snubber or needle valve to dampen pulsations. Charge pressures should read as follows after start-up.

15 Series	70-80 PSI

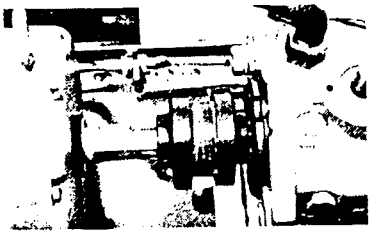
7. Start the meter motor and run at the lowest possible RPM until normal charge pressure has been established.

8. Once the proper charge pressure has been established, increase the speed to full speed. If charge pressure is not maintained (it may increase but not decrease), shut down system and determine cause.

9. Run system at full input and out-speed and observe charge pressure.

10. Operate system for at least fifteen (15) minutes; then shut down and replace the inlet filter. Remove gauge and plug port. Check fluid level in reservoir.

11. Transmission is ready for operation.



Coupling

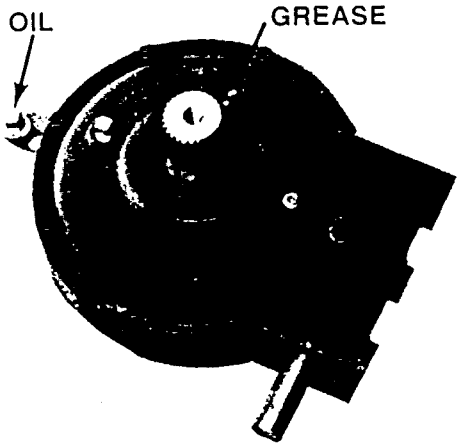
This Coupling connects the 3 HP metering motor to the hydrostatic transmission.

The motor and the transmission must be kept in perfect alignment or the rubber sleeve will be subjected to excessive wear.

The coupling set screws should be torqued to 85 inch-lbs. (14 lbs. on a 6-inch long wrench), to achieve the holding power necessary to transmit the torque from the motor to the transmission.

50:1 Gear Box

The gear box is used to turn the sweep arms. The bronze gear should be covered with oil.



Overfilling will cause the oil to overheat and push out the seals. The oil level should be to the bottom of the street el check plug.

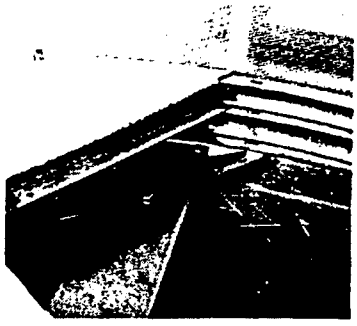
There is a grease fitting on the output shaft collar that should be greased regularly (See the Owner's Manual for proper lubrication).

Failure to properly lubricate the bearings and gears can cause an overload on the hydrostatic transmission.

A complete parts breakdown is given in the Operators Manual.

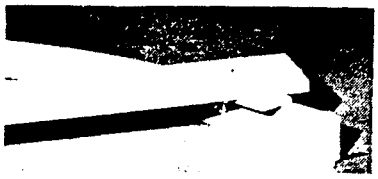
Sweep Arms

The sweep arms rotate in a clockwise directions.
The sweep arm tips extend into the grain column and pull the grain from the column and move it to the center hopper.

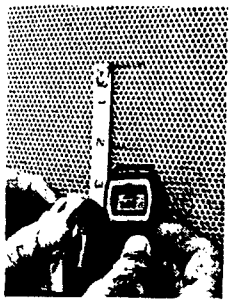


One arm has a rod finger on it. The tip of this finger should extend to within 1-1 2 inches of the outer wall. The other arm has a flat finger that takes grain from a different part of the column. The design of the arms allows the inside grain to move down faster than the outside grain.

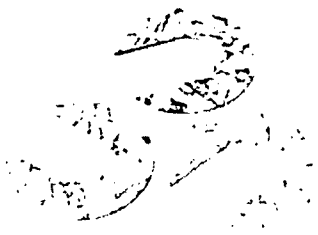
The arms are kept level by Teflon guide plates. These plates slide on the floor. The arms must travel in the same plane relative to the bottom of the inner wall.



If the arms do not track properly, the grain flow will be uneven. Uneven grain flow can be detected by checking the drop rate in several columns. This is done by watching a kernel through the perforated wall and timing how long it takes to travel 2 inches.



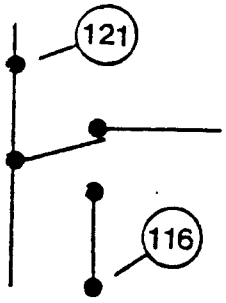
The columns that are flowing fastest will be located in the area where the arms are running low. To correct this flow, you must shim the gear box up in that area.



Note: ***If you overshim the gear box, you will have alignment problems between the input shaft and the drive pulley.***

Operate Circuit (Yellow Wire)

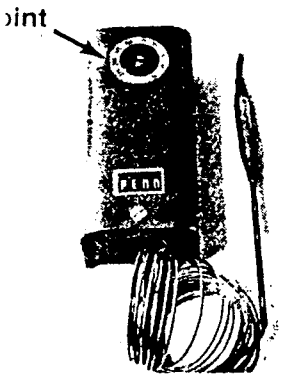
Door Switch (Key # 16)



The door switch is a normally open switch that is held closed when the control panel door is closed. It insures that any time the dryer is in Operate, the door is shut. This keeps dirt and chaff out of the cabinet. This switch can be jumped with a jumper wire from test point 121-116 for service work only. Never leave the dryer unattended with the jumper in place.

Test:

1. If the door lamp is on when the door is closed, the switch may be out of adjustment.
   a. Open the door and manually push the switch button in.
   b. If the lamp goes out, adjust the switch so it extends farther out of the cabinet and makes contact with the door more quickly when the door is closed.
2. If the door lamp never comes on:
   a. Check for 115 VAC at test point 121. If no voltage is found, the problem is upstream.
   b. If voltage is found, check the wiring diagram to be sure switch is wired properly.
   c. If it is properly wired, replace the switch.



Low Temperature Switch (Key # 17)

The low temperature switch has open contacts that are closed by a heat rise on a capillary tube in the heat chamber.

The close temperature can be set at any temperature between 25 and 255 degrees by turning the dial with a screwdriver. The normal set point should be 25 degrees Fahrenheit below the drying temperature. The dryer cannot be put in operate until the burner temperature has reached the set point.

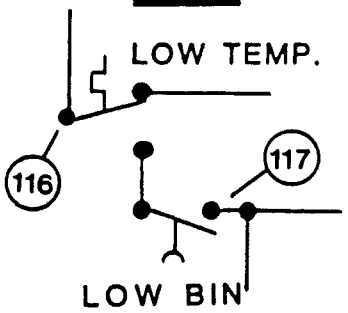
The operator should be made aware of the need to change this setting any time the drying temperature is changed.

Erratic operation could be caused by mounting the capillary tube end up . The end should be down.

Test

1. Jump from test point 121 to 116.
2. Turn on the main power to the dryer.
3. Place the start-up operate switch in the start-up position.

4. Set the close setting at 25 degrees Fahrenheit below the desired drying temperature.



   a. Check for 115 VAC on the bottom terminal. If no voltage is found, the problem is upstream.

   b. If voltage is found, turn on the fan and burner.

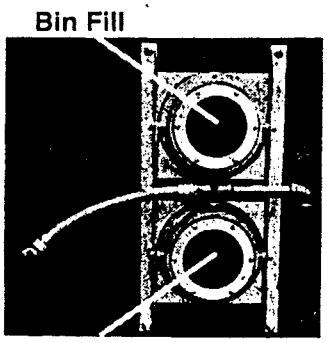
   c. Check the top terminal for 115 VAC as soon as the temprature gauge indicates 40 degrees below the drying temperature. You should not find voltage until the gauge reaches 25 degrees plus or minus 5 degrees below the drying temperature.

   d. If you don't find voltage, the low temperature switch is defective.

   e. Remove the jumper from test points 121-116.

Bin Switches

There are two switches mounted on the wall inside the holding bin. The top switch is the bin fill switch and the bottom one is the low bin switch.



The purpose of the normally open switch is to shut the dryer off if the grain level drops below the switch location.

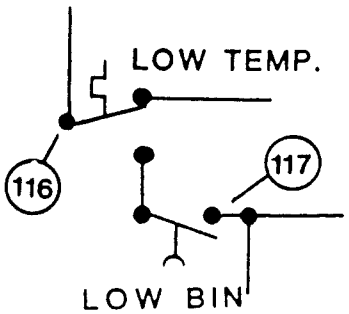
The normally closed bin fill switch controls the auger from the wet holding tank. When the grain level drops below the set point of the switch, the wet holding auger is turned on.

If the switch needs service, you must run the metering system until the grain level is below the switch.

The switch diaphragm should be inspected at an interval adequate to keep the diaphragm clean. Excessive buildup of fines and freezing weather can cause the switch to be erratic.

Test: (Low Bin)

1. Jump test points 121 - 116.
2. Turn on main power to the dryer.
3. Place the start-up operate switch in the start-up position.
4. Set low temperature at minimum setting.



   a. Check for 115 VAC at top terminal of the low temperature switch. No voltage at this point indicates that the problem is upstream.

   b. Check for 115 VAC at test point 117. No voltage at test point 117 indicates that:

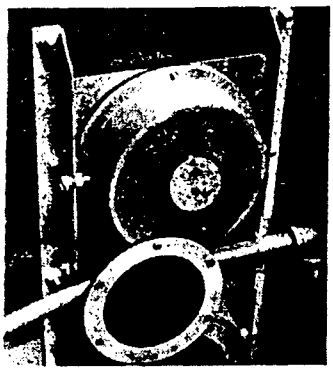
      There is no grain in the holding bin.

The switch is out of adjustment.

The switch is defective.

c. Remove jumper from test points 121-116 and reset the low temperature switch. (See Bin fill for replacement or adjustment).

Test: (Bin Fill)



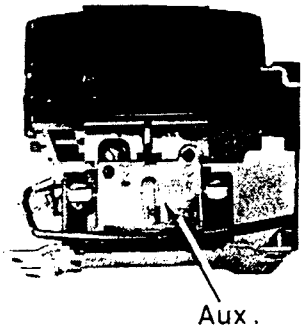
This switch will be wired into many different systems, so it will be up to the serviceman to determine the best method of testing this switch.

If adjustment or replacement is required, the switch assembly must be removed from the mounting angles (4 bolts).

The individual switch assemblies can be entered by removing the back plate, which is held in place with 4 bolts.

Adjustments of the switch is achieved by carefully bending the arm of the micro switch with a pair of needle-nose pliers. Moving the paddle out makes it more sensitive.

Meter Motor Auxiliary



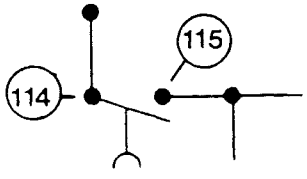
The meter motor auxiliary is a set of normally open contacts mounted on the meter motor starter. It will be wired with yellow wire.

This set of contacts will go open any time the meter motor starter is de-energized.

Test:

1. Jump test point 121-117.
2. Turn on main power to dryer.
   a. Check for voltage at test point 117. If no voltage is found, the problem is upstream.
   b. If voltage is found, turn on meter motor and test for voltage at test point 114.
   c. If no voltage is found, the auxiliary is defective. In order to remove the auxiliary, the Starter must be removed from the mounting plate.
   e. Remove jumper from test points 121-117.

Low Pressure Switch (Key # 18)

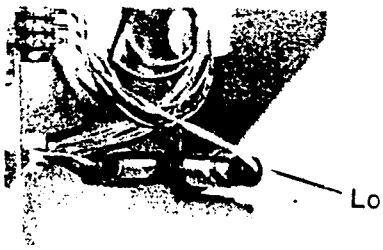


The low pressure switch is a normally open switch which must be held closed by hydraulic pressure produced by the hydrostatic transmission. This switch is factory-set to close at 200 PSI.

Test:

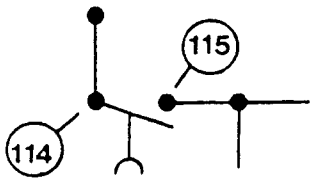
1. Jump test points 121-114.

2. Turn on main power.



   a. Check for 115 VAC at test point 114. If no voltage is found, the problem is upstream.

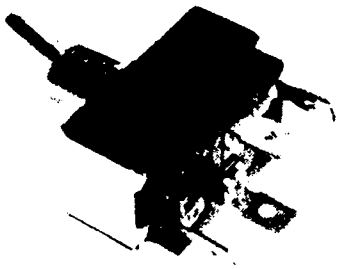
   b. If voltage is found, check for 115 VAC at test point 115. If no voltage is found, increase the hydrostatic speed to .2 with the increase/decrease switch and re-check at test point 115.



   c. If no voltage is found and the meter is discharging grain, the switch is defective. If no grain is being discharged, the hydrostatic transmission may not be working properly. See Page 28.

   d. Remove jumper from test points 121-114.

Start-Up Operate Switch (Key # 3)

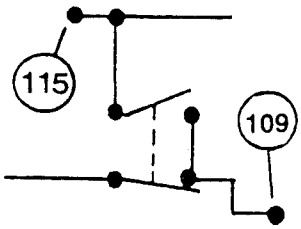


The start-up operate switch function and testing of the start-up circuit was discussed on Page 13.

In order to put the dryer in operate, the start-up contacts must remain closed until after the operate contacts close. This occurs as the toggle passes through the mid-position.

Test:

1. Jump test points 121-115.
2. Turn on main power to dryer.
3. Place start-up operate switch in start-up.



   a. Check for 115 VAC at test point 109. If voltage is not found, start-up circuit is not complete. See Page 14.

   b. If voltage is found at test point 109, move toggle to the mid-position while watching the voltmeter. If a voltage drop was seen, the switch is defective.

   c. If no drop was seen, move the toggle to the operate position. If a voltage drop is seen, the switch is defective.

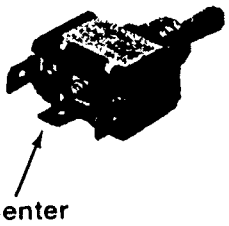
   d. Remove the jumper from test points 121-115. The voltage should drop from test point 109. If it ***did not,*** the start circuit has not opened and the switch is defective.

Moisture Control System (Grey Wire)

Increase/Decrease Switch (Key # 6)

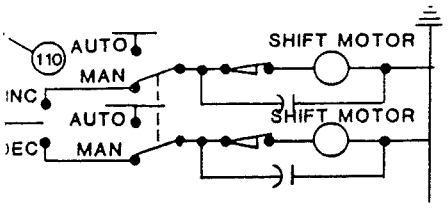
This switch is used to manually slow down or speed up the velocity at which the grain passes through the dryer. The slower the grain flows through the dryer, the drier the grain gets. If the grain flow is speeded up, the grain dries less.

This switch is used to manually set the moisture content of the discharged grain.



Test:

1. Turn on the main power to the dryer.
2. Place the start-up operate switch in the start-up position.
3. This switch is normally open, so it must be held in the closed position for all voltage tests.

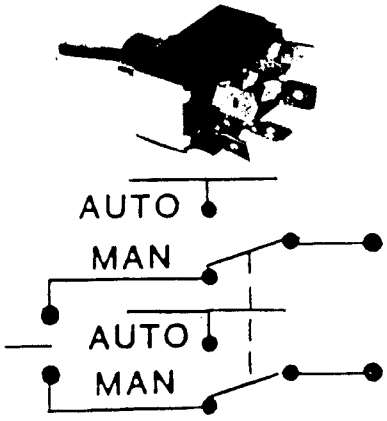


   a. Check for 115 VAC to the center terminal. If voltage is not found, the problem is upstream.

   b. Hold the switch in the increase position. Check for 115 VAC at the outside terminals. One terminal should have voltage and one should not. If no voltage is found, the switch is defective.

   c. If both outside terminals show voltage, you have an ***open ground*** to the shifting motor.

   d. Hold the toggle to the decrease position. Check for voltage on each of the outside terminals. One should have voltage and one should not. If no voltage is found, the switch is defective.



Automatic Manual Switch: (Key # 19)

This switch is used to set the moisture control for manual or automatic operation.

When it is in manual, the increase/decrease switch controls the grain speed.

When it is in automatic, the Moisture Matic controls the grain speed.

Test:

1. Turn on main power to dryer.
2. Place the start-up operate switch in the start-up position.
3. Place the automatic-manual switch in manual position.

   a. Hold the increase decrease switch in the increase position and check for 115 VAC on one top terminal and one center terminal of the automatic switch.

   b. If voltage is not found on one top terminal, the problem is upstream.

   c. If voltage was not found on one middle terminal, the automatic-manual switch is defective.

   d. Repeat test a, b and c with the increase/decrease switch in the decrease position.

Limit Switch (Key # 20)

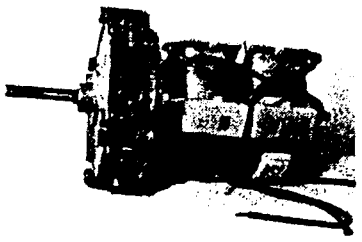
The limit switch is a normally closed switch. When opened, it shuts off the shift motor as the speed control linkage approaches the limits of its travel. It also prevents the 10-turn 10K pots from being turned past their limits.

Test:

1. Turn on the main power to the dryer.
2. Place the start-up operate switch in start-up.
   a. Check for 115 VAC on both sides of switch "A" while holding the increase/decrease switch in the decrease position. No voltage means the problem is upstream.
   b. If voltage is found on both sides of the switch, it is functioning properly. When the cable bracket pushes the switch, voltage should be lost on one side.
   c. Check for 115 VAC on both sides of switch "B" while holding the increase/decrease switch in the increase position. No voltage means the problem is upstream.
   d. If voltage is found on both sides of the switch, it is functioning properly. When the cable bracket pushes the switch, voltage should be lost on one side.

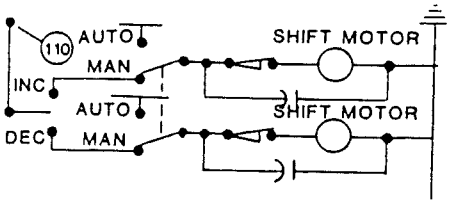
Page 43

Shift Motor (Key # 21)



The shift motor responds to the increase/decrease switch or the Moisture Matic circuit board. It provides the rotation to move the push-pull cable which speeds up or slows down the hydrostatic transmission and changes the (2) 10k pots.

This motor is made up of 2 seperate windings on a common shaft. The voltage is supplied to the motor by a red or brown wire and a common black ground wire. The red wire is "increase" and the brown wire is "decrease".



Part 833304 will not fit this application.
Part 444586 will replace 833304.

Test:

1. Turn on the main power to the dryer.
2. Place the start-up operate switch in start-up.
   a. Check for 115 VAC on the red wire while holding the increase/decrease switch in increase. No voltage means the problem is upstream or auto-manual switch is in auto.
   b. If voltage is found on the red wire, check the black ground. Voltage on the black wire means the ground is open and the motor is not defective.

c. Repeat tests "a" and "b" on the brown wire while holding the increase/decrease switch in the decrease position. If the motor checks out good and still won't run, check the following:

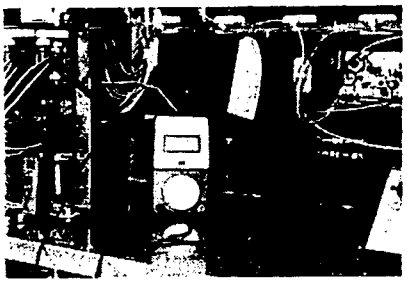
   1) Disconnect the push-pull cable and see if it is binding.

   2) Check the shift motor cable bracket to be sure it is not bound up.

   3) Check the drive screw for rust or lack of lubrication.

d. If the solution to the motor problem requires re-timing the shift assembly, see next section.

Shifting Motor Assembly — Timing



The shifting assembly is made up of a reversible AC electric motor, two 10k pots and two normally open limit switches. See specific part for description and testing. Its function is to provide a means by which the hydrostatic speed can be changed and monitored.

The motor provides the method for speed change. The 10k pot with grey wire is geared to the motor drive shaft and provides a speed reference in ohms for the Moisture Matic. It should always provide a resistance change equal to and opposite the resistance change of the thermistor circuit. If the thermistor ***increases*** 1000 ohms, the 10k pot must be wired so it will ***decrease*** 1000 ohms to re-balance the Moisture Matic.

The other 10k pot provides a variable resistance to the discharge speed bridge.

The limit switches are wired in series with the shifting motor. They shut off the shifting motor and prevent the 10k pots from being damaged, or the motor from stalling if the control linkage travel is exceeded.

It is very important to properly synchronize these parts any time repairs are required.

Procedure:

1. Disconnect the control cable at the shift assembly.
2. Turn off the meter motor.
3. Remove the 1/2-amp fuse.
4. Decrease the shift assembly to maximum "decrease".

   a. Monitor the resistance of both 10k pots to be sure they do not reach O ohms.

   b. To check the 10k in the Moisture Matic circuit, check between wires 230 and 231.

c. To check the 10k in the speed discharge circuit, check between wires 702 and 703

d. If the resistance approaches O, release the decrease switch and disconnect the pots from the gears.

e. After gears are disconnected, decrease the system until the shift motor stops.

5. Turn on the metering motor.

a. Center the shift arm assembly in the neutral position so the hydrostatic motor is not rotating.

b. Turn off the metering motor.

c. Re-connect the push-pull cable to the cable bracket on the shift assembly.

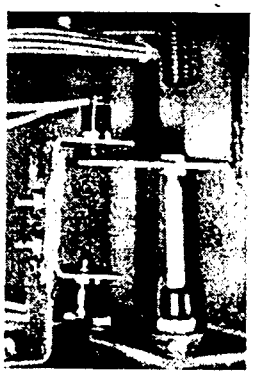
6. If it was required to remove the 10k pots, they must be re-timed.

a. Turn the Moisture Matic pot to its maximum ***counter-clockwise*** position and set 2k ohms on it.

b. Turn the discharge speed indicator meter to its ***maximum clockwise*** position and set 2k on it.

7. Re-Install the pots and gears.

8. Re-calibrate the speed discharge meter.



a. Replace the 1/2-amp fuse.

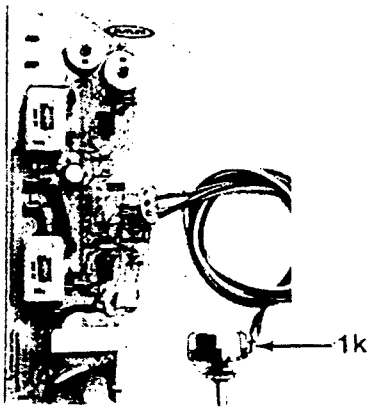
b. Zero the discharge meter with the small adjusting pot on the back of the bridge. Page 45

9. Increase the increase/decrease switch and monitor the Moisture Matic with an ohmmeter.

a. Monitor wires 230 and 231.

b. When pot reads 8k ohms, adjust the bottom switch clip so it turns the shifting motor off at 8k.

Moisture Matic 1 MDL Fuse (Key #22)

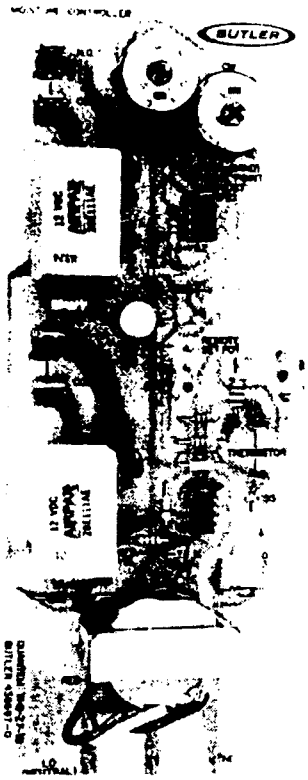


This fuse protects the Moisture Matic board. See page 12 for tests.

Moisture Matic Board (Key #23)

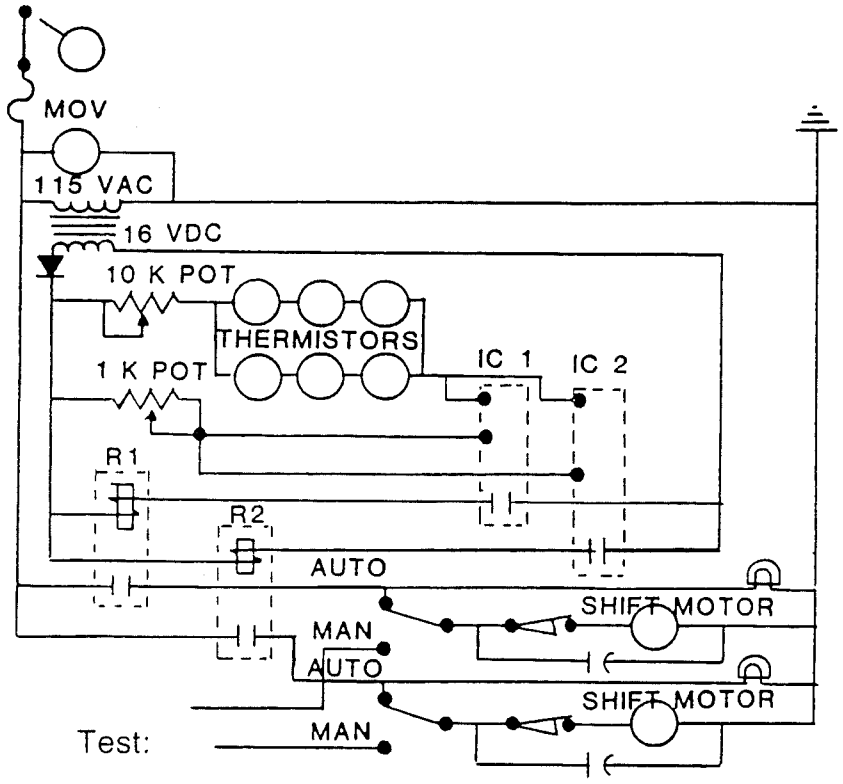
Green, Fenwal/Tan, Quantem.

The Moisture Matic board is sensing grain temperature any time the metering system is on. This board uses a transformer to reduce 115 VAC to 16 VAC. Diodes change the AC to DC. A constant DC voltage is applied to the thermistors and 1k pot

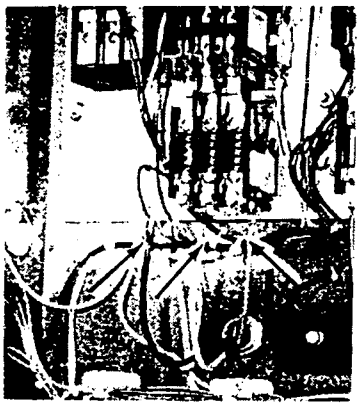


circuits. This voltage is monitored by the two integrated circuit chips. Any change in the voltage of either circuit will cause the integrated circuit chips to activate the R1 or R2 relay, which will send 115 VAC to the increase or decrease lights and the increase or decrease shifting motor. If the automatic/manual switch is in automatic mode, 115 VAC will be sent to increase decrease lights and the increase or decrease motor. If the automatic/manual switch is in manual, no speed changes can take place, the system cannot automatically re-balance (see and explanaton of balance under "10k and 1k....pot.)

The moisture board can be tested on the Model 80/82 tester or by the following procedure:



Test:



1. Turn off the main power to the dryer.
2. Disconnect the 220 VAC power leads going to the meter motor. This prevents the metering motor from running, but allows the contact to be activated so 115 VAC is supplied to the Moisture Matic board.
3. Turn on the main power to the dryer.
4. Place the start-up operate switch in start-up
5. Remove wires 231-219 from the Moisture Matic board.
   a. Attach a 10k jumper pot set for approximately 7k to the thermistor terminals on the board.
6. Turn on the metering system.

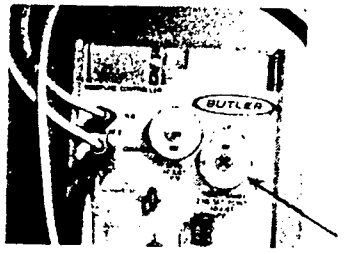
a. Rotate the 1k pot dial until the increase and decrease lights are out.

b. If the lights can be balanced out, the board and 1k pot are functioning properly.

c. If the lights can't be balanced out, the board is defective or the 1k pot is defective.

d. To check the 1k pot.

7. The null band (or off-distance) between the lights should not require over 1-1/2 marks rotation on the 1k pot dial. If there is more than 1-1/2 marks, the output moisture will have a greater variation. If there is less than 1-1/2 marks, the lights may not balance out. This can be adjusted with the second set point adjust.



Note: ***Normally, the board is shipped with a minimum null band width and the pot in the extreme counter-clockwise direction.***

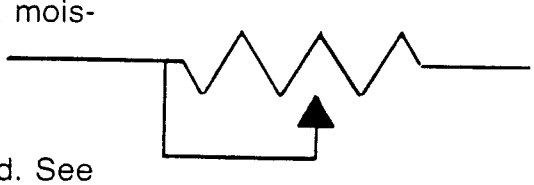
a. The null band width can be made wider by adjusting the pot in the clockwise direction.

b. The null band can be made narrower by adjusting the pot in the counter-clockwise direction.

c. If the null band cannot be satisfactorily set, the board must be replaced.

1k Potentiometer (Key # 24)

The 1k pot is a 1-turn 0-to-1000 ohm variable resistance. It is used as a point of reference against which all automatic moisture corrections are made. After the moisture content of the grain is set manually, the 1k pot is adjusted until both the increase and decrease lights are balanced out. When this pot is set, the Moisture Matic should always correct to a grain speed that will maintain a constant moisture content. If the 1k pot is changed after the moisture is set, you should expect a moisture change to take place.

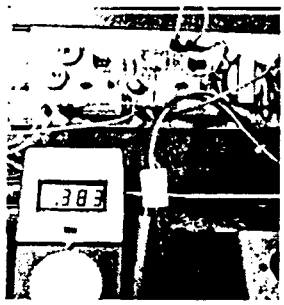


Test:

1. Remove the 3-wire molded plug from the moisture board. See Page .

a. Place one lead of the ohmmeter in the brown terminal socket, and the other lead in the yellow or purple socket.

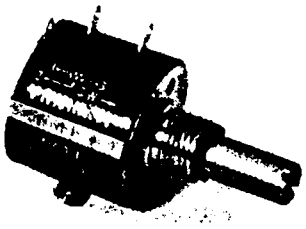
b. Slowly rotate the 1k pot knob and observe the change in resistance.



c. A smooth, uniform change in resistance from 0 to 1k indicated that the pot is performing correctly.

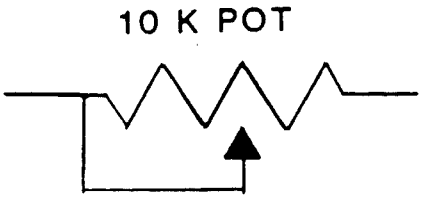
d. Erratic changes in resistance, or no change, indicates that the pot is defective.

10k Potentiometer (Key # 25)



The 10k pot is a 10-turn 0-to-10,000 ohm variable resistor. It provides the resistance required to re-balance the system after an automatic moisture correction has been called for by the thermistors.

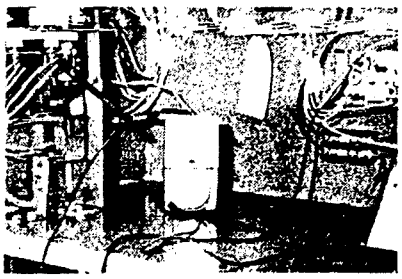
It is wired in series with the thermistor circuit and mechanically connected to the shifting motor with gears. The resistance on the 10k pot, plus the resistance in the thermistor circuit, is fed into the Moisture Matic board. When the thermistor resistance decreases as a result of grain moisture decreasing, the Moisture Matic board sees that change in resistance and turns on the shift motor. The shift motor rotates in a direction that will cause the hydrostatic transmission to speed up the grain flow.



The 10k pot will increase its resistance to match the decrease in thermistor resistance. When the 10k pot has changed enough to equal the thermistor change, the Moisture Matic board will respond by shutting off the shifting motor (see page 42B for "Moisture Matic Component Relationships").

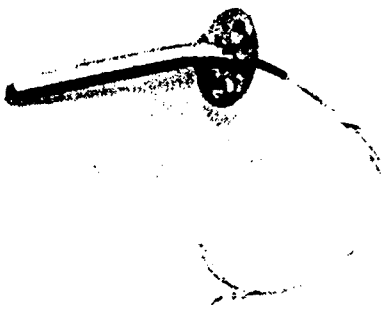
The system is now back in balance until the next moisture change occurs. If the system won't rebalance, check the wiring diagram for misplaced wires, starting with wires 226 and 227 on the board and shift motor. If wiring is correct, proceed with test.

Test:



1. Turn on main power to the dryer.
2. Place the start-up operate switch in the start-up position.
3. Remove wire 231 from the Moisture Matic board.
4. Increase and decrease the 10k pot from 2 to 8k with the increase/decrease switch.
   a. Check resistance on the pot at test points 220-231.
   b. A smooth, uniform change indicates that the pot is functioning properly. The pot should read approximately 2k when it is at its maximum decrease position. If it reads 8k, check the wiring diagram for the proper hookup.
   c. Erratic or no change means the pot is loose or defective (see page 38 for replacement instruction).

Thermistors

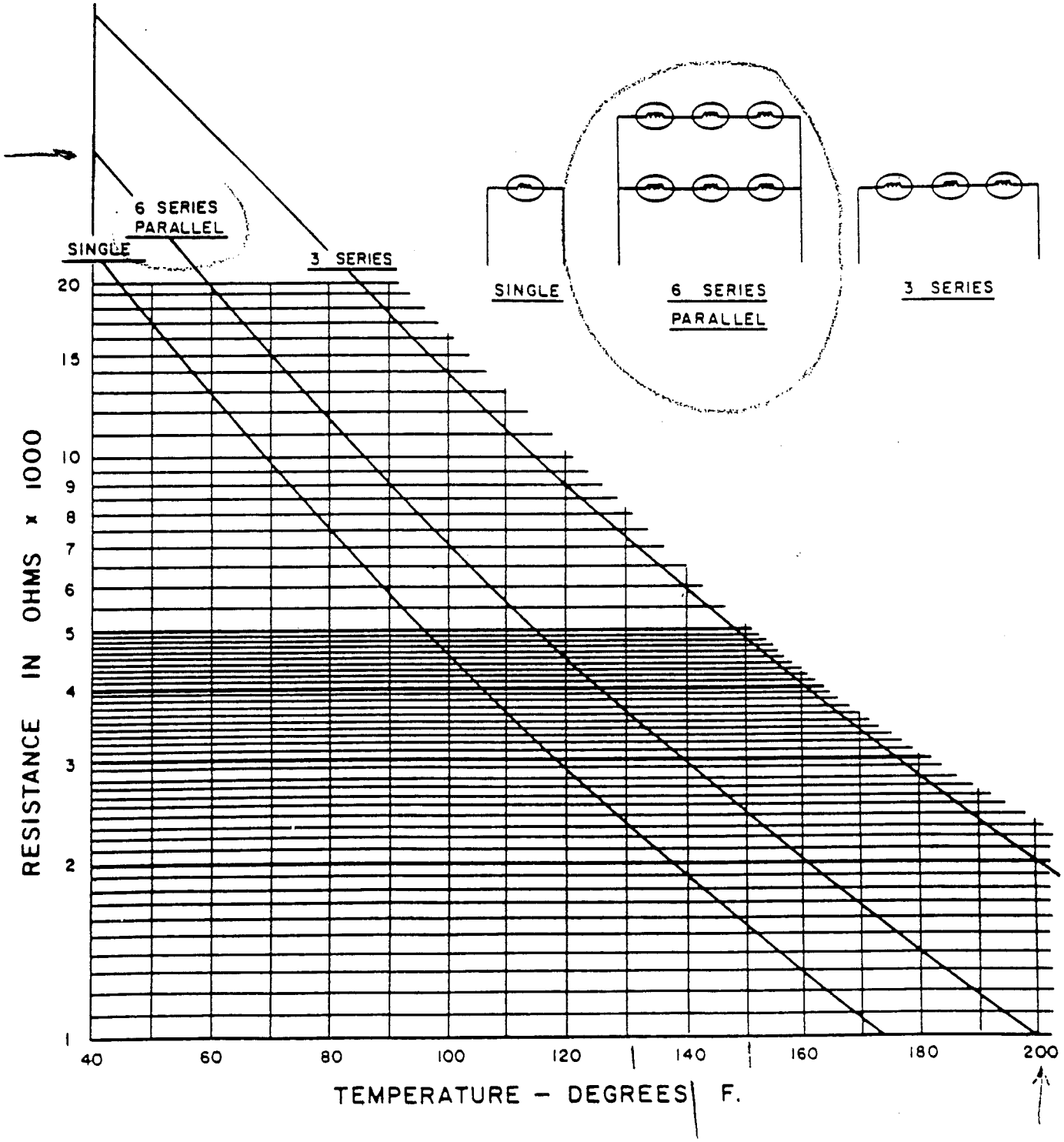


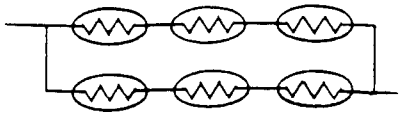
The thermistors are heat-sensitive resistors. They increase in resistance as they get cooler and decrease in resistance as they get warmer.

There are 2 banks of 3 series-wired thermistors located on the outside wall of the heating section. Each thermistor is wired into a terminal block in the control panel. The top bank is wired in parallel with the bottom bank.

MOISTURE, TEMPERATURE, RESISTANCE AND SPEED RELATIONSHIP

GRAIN MOISTURE CONTENT	GRAIN TEMP.	THERMISTOR RESISTANCE	10 K POT RESISTANCE	HYDRO SPEED
Increases	Cooler	Increase	Decrease	Decrease
Decrease	Warmer	Decrease	Increase	Increase





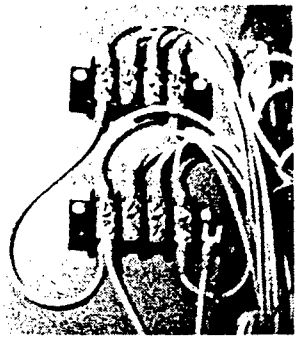
The resistance accuracy of thermistors can be checked by taking the average temperature of the grain around the thermistors with a probe thermometer and by reading the actual resistance of the thermistors. Compare the two values to the temperature resistance graph on page 42B .

EXAMPLE: Average grain temperature = 130 degrees. Total thermistor resistance measured at 220-219 = 3.6k

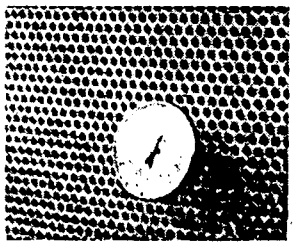
This confirms that all 6 thermistors are functioning properly.

The value of a single thermistor or a bank of 3 can be determined by the same method.

If the dryer is empty, air temperature can be used to check the thermistors.

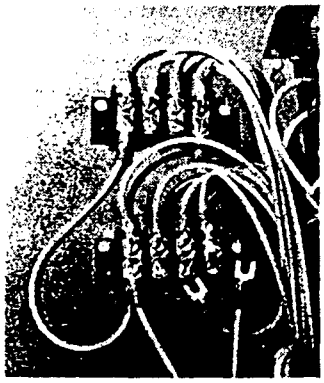


Test:



Full system of 6 thermistors

1. Disconnect wire 220 or 219 from terminal strip.
2. The full system is measured at the terminals where points 219-220 connect.
   a. Measure resistance at test points 219-220.
   b. Drill a hole large enough for a small probe thermometer half-way between the top and bottom banks.
   c. Compare the temperature and resistance to the charts on page.

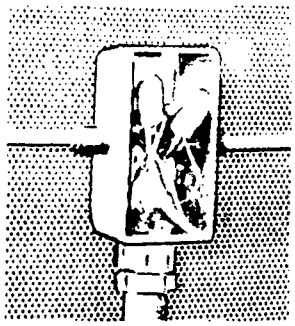


Top or bottom bank of 3 thermistors

1. Disconnect jumper 219 or 220 between terminal blocks.
   a. Measure resistance across top terminal block or bottom terminal block.
   b. Determine the temperature in the area of the thermistors in question.
   c. Compare the temperature and resistance to the chart on page.

Individual thermistors

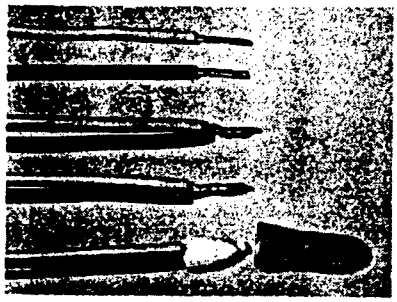
1. Disconnect jumper 220 or 219 between terminal blocks.
   a. Assume the thermistors are wired on the terminal blocks relative to their positions on the dryer.
   b. Place ohmmeter leads in appropriate terminals and read resistance.



c. Determine the temperature in the area of the thermistors in question.

2. A thermistor is normally defective when it reads "Open" or does not come within 10 degrees of the measured temperature.

3. To remove a thermistor:



a. Remove the box cover.

b. Unsolder the thermistor connections.

c. Remove the sheet metal screws holding the box to the wall.

d. Pull the box away from the wall to expose the thermistor. Corn will flow out of this hold unless it is plugged with cloth or paper.

e. Remove the old thermistor.

f. Install the new thermistor so it is pointed down.

g. Twist leads together and solder with resin core solder.

h. Apply silicone sealer to joint.

i. Install wire nut.

j. Replace jumper 219 or 220.

Indicator Meters (Orange Wire)

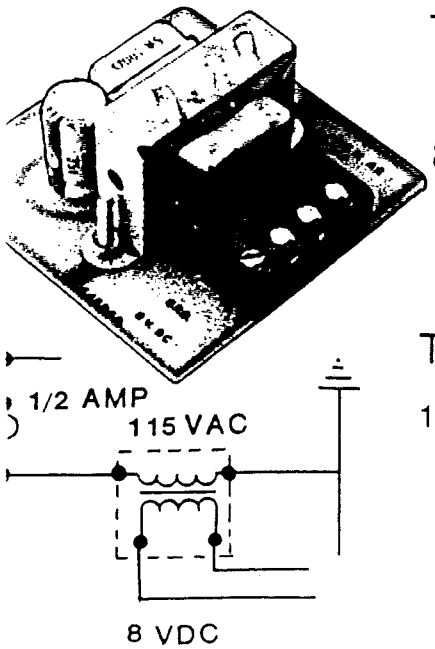
Meter Fuse 1/2-AMP (Key # 26)

This fuse protects the 8 VDC power supply and meters.

Test:

See page

8 VDC Power Supply (Key # 27)



The 8 VDC power supply reduces 115 VAC to 5 VDC to operate the discharge speed meter and the grain temperature meter.

Test:

1. Turn on the main power to the dryer.

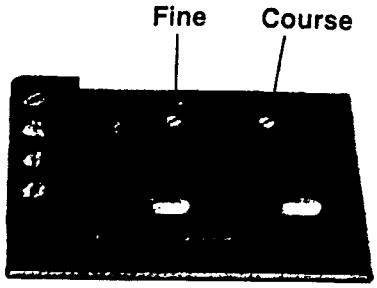
a. Check for 115 VAC between test point 613 and the White wire.

b. If voltage is not found, the problem is upstream.

c. If 115 VAC is found, check for 8 VDC between test points 701-705.

d. If no voltage is found, the power supply is defective.

Note: ***A local technician could fix this board. Contact Technical Services for a parts list.***



Discharge Speed Meter (Key # 28)

This meter indicates a relative speed of the discharge. It is not calibrated in bushels.

The circuit is made up of a micro ammeter, a bridge circuit and a 10k pot.

The 10k pot is geared to the shift motor. Any time the shift motor moves, the resistance on the pot is changed; that change causes a change on the bridge and shows a new speed on the meter.

Test:

1. If the meter does not return to zero when the transmission is in neutral, it can be calibrated by adjusting the balance pot.

   a. If the pot will not zero the meter, the 10k pot may be defective or out of calibration.

   b. When the meter is at zero and the shift assembly is at its maximum decrease position, the 10k pot should be set at 2k.

   c. Remove the 1/2-amp fuse.

   d. Remove wire 703 and measure resistance between wire 703 and wire 702.

   e. If 2k is not found, loosen the set screw on the gear that turns the pot and remove the locknut.

   f. Rotate the pot by hand and use the ohmmeter to determine if it is defective. You should expect a smooth, uniform change from 0 to 10k.

   g. If a new pot is required, unsolder the wires and solder them to the new pot.

   h. Rotate shaft to the extreme clockwise direction and...

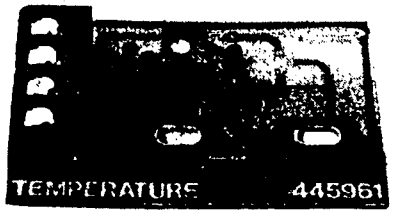
   i. Set 2k on the pot and re-install the pot.

   j. Re-install the gear.

   k. Re-connect the wires on the bridge.

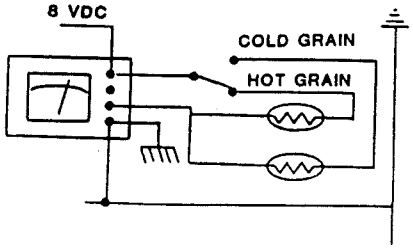
   l. Re-install the 1/2 amp fuse.

   m. Re-calibrate the meter to zero with the pot on the bridge.

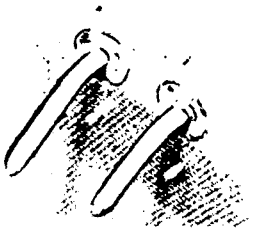


Grain Temperature Meter (Key # 29)

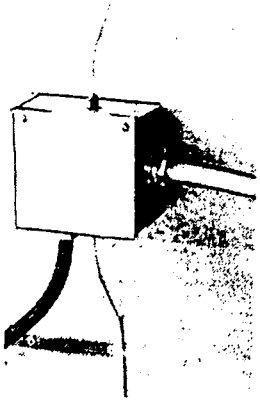
The grain temperature meter measures the temperature of the grain at the lower thermistor bank when the selector switch is in the hot position. When the selector is in the cold position, the meter indicates the temperature of the discharged grain.



The meter uses thermistors to detect the temperature. This is not the same thermistor as is used in the Moisture Matic. It is a more sensitive thermistor. For that reason, do not use standard thermistors. The calibration curve is the same for both thermistors, so they can be checked out on the standard resistance graph.



Test:



1. Turn on main power to dryer.
2. Set 1.37k on a 10k jumper pot (1370Ω).
   a. Remove wires 706-720 from terminal.
   b. Place 1.37k across terminal one and terminal three.
   c. Meter should read 160 degrees (Fahrenheit).
   d. If meter is close, adjust calibration pot. If meter cannot be calibrated, the meter is defective.
   e. The board could also be defective, but unless there appears to be some physical damage, it is probably good.
3. If the meter can be calibrated to 160 degrees F., the thermistor may be defective.

   a. Check resistance from wires 706-720 to 721.
   b. Measure the cool grain temperature.
   c. Compare the resistance and temperature to the resistance graph on page .
   d. Check the resistance from wires 706-720 to 707. Replace thermistor if it is not within 5 degrees.
   e. Measure the hot grain temperature. Compare the resistance and the temperature to the resistance graph on page 42B. Replace the thermistor if it is not within 5 degrees.

Capacity

Capacity figures are the average of several years' data, and refer to wet bushels into the dryer. In a given year, the rate may be above or below this average.

Drying rate is largely affected by physical characteristics of the grain. Variety, fertilization program, rainfall, sunlight (degree days), planting date, disease/insect damage, and hail and storm damage all affect drying rate. Capacity changes of up to 30% have been observed simply by changing from one field of corn to another of equal moisture content.

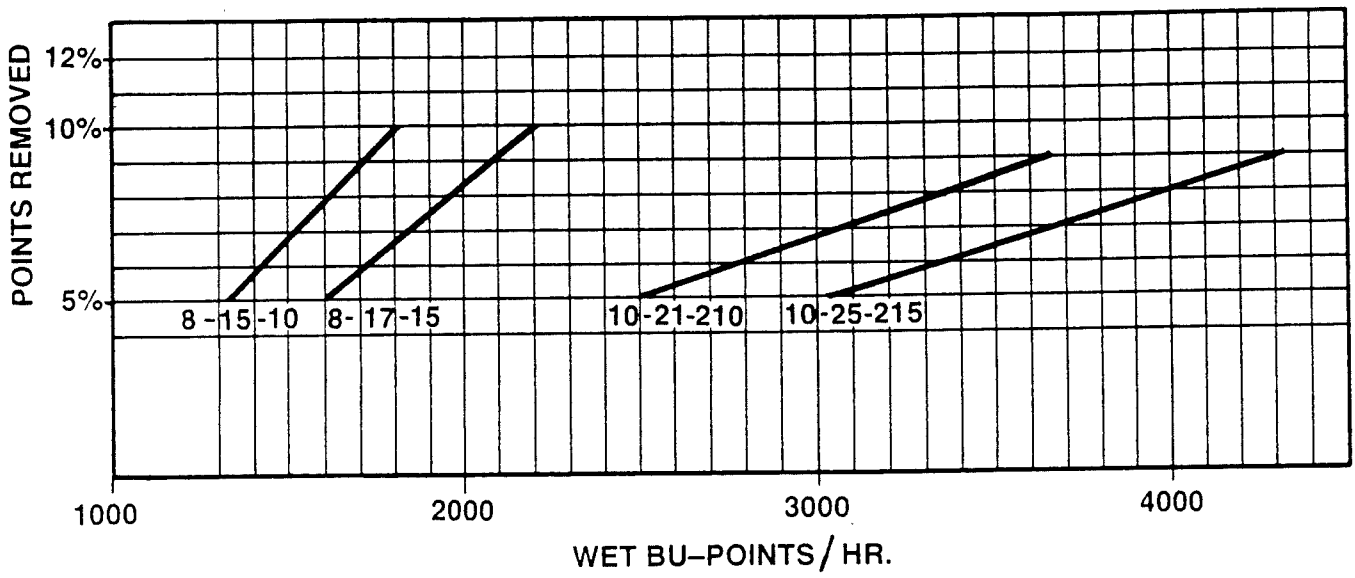
Capacity stated by industry standards is for 10-point moisture removal based on 25% moisture grain dried to 15% moisture content. Five point is from 20% to 15%. Drying below 15% is slower and drying to 13% may reduce capacity as much as 20%.

Trash in grain reduces the drying rate and may cause uneven drying and flow patterns..

Outdoor temperature and relative humidity variations have little affect on drying rate. The dryer will burn more fuel at lower ambient temperature, but will continue to heat and super-dry the air to 2-3% R.H.

Determining the actual drying rate of a dryer is much more complex than just calculating the capacity by saying it takes 6 hours to dry the 3,000 bushels in the wet holding bin, so the dryer capacity must be 500 bushels per hour. The stated capacity in Operators Manual is for optimum drying conditions. Capacities could be reduced as much as 25%, due to varying drying conditions and dryer maintenance.

Wet bushel-points/hour should be compared to our rated conditions rather than wet bushels/hour alone. Tabulated below are these values for Kan-Sun dryers for the two ratings we publish. Comparison should be made to the rating closest to actual conditions.



Also, you should emphasize that drying to a lower final moisture content than published will result in less wet-bu-points/hr. than published. For example, if 22% corn is dried to 12%, the capacity of a 10-25-215 would not be 4350, the 10-point removal rating. The percent reduction in wet-bu point/hr below 4350 is difficult to estimate, although we can make some estimate based on computer output available.

In evaluating dryer performance. the wet bu-point/hr is a much more accurate value than wet bu/hr, since the former takes into account the moisture removed. This concept of comparison has the concurrence of Professor Bob Peart of Purdue University. However, since thid comparison is based on moisture content readings, the accuracy of the moisture tester is critical. For example, if corn is dried 5 points as measured by a tester and its error is 0.5%, which is not unreasonably large for portable testers, the indicated points removed, and hence capacity, could be in error by as much as 20%. This illustrates the need for accurate moisture content readings.

When lack of capacity is suspected, you should accurately measure and record all of the items in Section A of the Capacity Test Form in this booklet. If a reasonable capacity is not obtained after these checks have been completed, a drying rate test should be conducted as outlined in Secton B of the Capacity Test Form. When Sections A & B are completed, they should be sent to Butler Mfg. Co., to the attention of the Technical Services Department.

Capacity Test Form

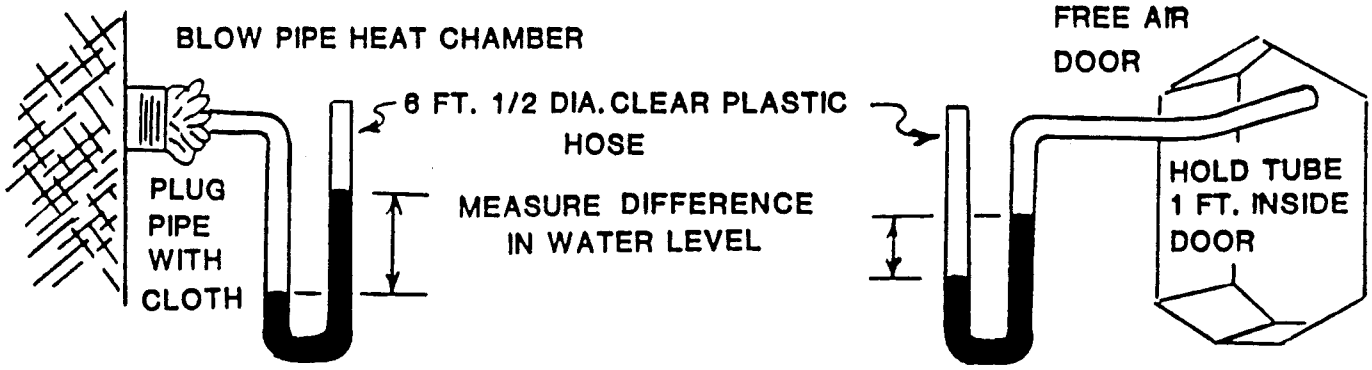
Capacity Test Instructions – Make copies of Sections A & B, and the data sheet. Use these copies to record test results.

Section A

Equipment Required.

1. A Kan-Sun temperature gauge in good condition.
2. 4-foot Level.
3. Wire brush.
4. Ammeter – and volt/ohm meter.
5. 6 feet of 1/2 clear plastic hose.
6. 24 Zip-lock 1-qt. plastic bags.
7. 6' Steel Ruler.

1. Kind of grain being dried _____
2. Brand and hybrid of grain _____
3. Verify the plenum temperature with a second thermometer.
   Verified temperature _____ ° F. _____ ° F.
   Panel Gauge Test Gauge
4. Remove roof cone covers in accordance with Manual.
5. Confirm that dryer is plumb with 4-ft. level; if not, re-plumb.
6. Confirm a uniform drop rate at 3 points around dryer. (See page31). If not, shim 50:1 gear box to reduce flow from fast columns. (See page31).
7. Run free air door so discharge grain temperature is 15 ° above outside air temperature.
8. Measure fan motor voltage. #1: L1____ L2 ____ L3 ____ . #2: L1____ L2 ____ L3 ____
   230 VAC ± 10%
9. Measure fan motor amperage. #1: L1____ L2 ____ L3 ____ . #2: L1____ L2 ____ L3 ____
   See page 9A
10. Measure fan blade tip clearance 5/32 with ruler #1:____# 2 ____
11. Measure static pressure in heat chamber_____. After cleaning_____
    Measure static pressure in cool chamber_____. After cleaning_____
    Door open – inches: _____



12. Clean perforations on inside and outside of heat chamber with wire brush and re-test static pressure.

13. Test moisture content - Use sample procedure outlined in Operator Manual. Seal samples in plastic food bags.
    Wet grain "in" with customer's tester _____
    Dry grain "out" with customer's tester _____
    Total points removed (customer) _____
    Check same samples at local Elevator
    Wet Grain "in" with Elevator tester _____
    Dry grain "out" with Elevator tester _____
    Total points removed (elevator) _____
14. Have elevator run a test weight _____ lbs.
    Have elevator run a % foreign matter (wet) _____ % (dry) _____ %
15. Customer estimated capacity _____ bu/hr.

    Estimate is based on wet bu. in _____

    Estimate is based on dry bu. out _____

Section B

Official capacity test procedure: (Approx. 4 hours required to run test)

Equipment required:
(1) 24 ziplock 1-quart plastic bags.
(2) Container large enough to hold 1 hr. discharge and take it to local elevator.
(3) Watch, to time test.

1. Bring the dryer up to normal drying temperature 220° F.
2. Establish the desired moisture content with the Increase/Decrease switch and customer's moisture tester. (If tester was found to be reasonably accurate in Step 13)
3. When discharge rate is established, take incoming grain samples at 15-minute intervals for 1½ hours. Store samples in plastic bags.
4. * Collect dry grain in a container large enough to hold 1 hour's discharge and which can be taken to an elevator to be weighed.
5. Collect dry grain moisture samples at 10-minute intervals for duration of test. Store samples in plastic bags.
6. Take 1 hour's discharge to the elevator to be weighed and test the wet and dry discharge samples.

* Run 1-hour test with dryer on "Manual Moisture Control" after 6 wet grain samples have been collected.

DATA SHEET Date _____

Dryer Size _____ Customer Name _____
Serial # _____ Dealer Name _____
Phase _____ Outside Temp. _____
Elevator used for test comparison: _____

Wet Grain Samples

1. Time ___:___ MC _____
2. Time ___:___ MC _____
3. Time ___:___ MC _____
4. Time ___:___ MC _____
5. Time ___:___ MC _____
6. Time ___:___ MC _____

÷ _____ 6 _____ MC_1

Dry Grain Samples

7. Time ___:___ MC _____
8. Time ___:___ MC _____
9. Time ___:___ MC _____
10. Time ___:___ MC _____
11. Time ___:___ MC _____
12. Time ___:___ MC _____

÷ _____ 6 _____ MC_2

$\overline{MC_1} - \overline{MC_2} = \overline{MC_3}$ (% moisture removed)

Weight of wagon or truck and 1 hour's discharge _____
Weight of empty wagon or truck − _____
W = weight of dried grain, lbs. _____

This formula will give wet bu/hr.

$$\frac{W}{56} \times \frac{(1 - MC\ 2)}{(1 - MC\ 1)} = \text{wet bu/hr.}$$

Express MC_1 & MC_2 as a decimal (13.6% = .136)

$$\frac{\quad}{56} \times \frac{(1-\quad)}{(1-\quad)} = \quad = \text{wet bu/hr.}$$

Wet bu/hr × MC_3 = wet bu. points per hour

_____ × _____ = _____ wet bu. points/hr.

$$\frac{\text{Wet Bu. points/hr}}{\text{Rated wet bushel Points/hr from chart}} \times 100 = \%\text{ of rated capacity}$$

_____ × 100 = _____ % of rated capacity.