

KS-16001 DEHYDRATOR AND ASSOCIATED WAVEGUIDE ALARMS

1. GENERAL

1.01 This section covers the operation of the KS-16001 dehydrator and associated waveguide alarms for use in the TD-2/TH radio systems.

1.02 This section is reissued to include information for KS-16001 dehydrators equipped for humidity cycle operation, and KS-16001 dehydrators equipped for time cycle operation using a Humistat. Since this section covers a general revision, arrows ordinarily used to indicate changes have been omitted.

KS-16001 Dehydrator

1.03 The dehydrator is used to furnish a source of dry air for pressurizing the antenna and waveguide runs. The unit is designed to deliver dry air continuously at flow rates not greater than 400 cubic feet per hour at a delivered pressure of between 0.2 and 0.3 pounds per square inch. In operation, ambient air is drawn in through a filter arrangement to a centrifugal blower and passed through one of two drying towers, each of which contains approximately 150 pounds of activated alumina, where the moisture vapor in the air is removed. After drying, the air is delivered to a common outlet where it is distributed through the necessary piping and manifolds to the waveguide and antenna system. The dehydrator may be arranged for drying the air on a time or humidity cycling basis.

1.04 When the KS-16001 dehydrator is arranged to operate on a time cycling basis, it is equipped with a 24-hour timer. Air to be dried is passed through one drying tower for 12 hours while the second tower is being reactivated. When the KS-16001 dehydrator is arranged to operate on a humidity cycling basis,

it is equipped with a 5-hour timer. Air to be dried is passed through one drying tower until the relative humidity reaches approximately 4 per cent at 70°F, at which time the air to be dried is automatically routed through the second tower and the first tower is then reactivated.

1.05 In both the time and humidity cycle dehydrators reactivation consists of heating the alumina for 4 hours by internal nichrome heating coils which are embedded in the drying agent. Proper reactivation temperatures are maintained in the bed through the use of internal thermostats in series with the heating coils. During the 4-hour heating period, a small flow of ambient air purges the moisture released by the alumina from the system. Control of reactivated air flow is achieved through a solenoid valve which diverts the required purge flow through the reactivating tower.

1.06 Alarm facilities are provided which operate on either low pressure or high humidity. This alarm is connected to a pair of terminals on a terminal strip to which a low-pressure switch and an electronic relay or Humistat are connected. A humidity sensing element is connected to the electronic relay or Humistat. The low-pressure switch is connected to the delivered air stream and will operate the alarm when the delivered air pressure falls below approximately 1.4 inches of water. The humidity sensing element, which is mounted in the air outlet, will cause the alarm to operate when the relative humidity in the air exceeds a predetermined value.

1.07 A measurement on the pressure gauge located on the manifold will indicate whether low pressure or high humidity has developed in the dehydrator. If the pressure on the gauge is greater than 1.4 inches of water, the trouble may be due to high humidity. If the

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pressure on the gauge is less than 1.4 inches of water, the trouble is probably due to low pressure.

1.08 The instructions for the KS-16001 dehydrator operating on a time cycling basis are based on drawing SD-59698-01 and when operating on a humidity cycling basis on drawings SD-59841-011 and SD-59841-012. For detailed description of the operation, see the corresponding circuit description.

Waveguide Alarms

1.09 An individual pressure switch is connected by a length of copper tubing to each antenna system at the waveguide pressure window. The switches are electrically connected in parallel to the station alarm circuit and will register an alarm in the event that antenna pressure drops below a predetermined value.

1.10 The instructions for the waveguide alarms are based on drawing SD-59812-01. For detailed description of the operation, see the corresponding circuit description.

General

1.11 For more detailed information on the operation and maintenance of the apparatus refer to the following sections. All apparatus should be adjusted in accordance with these sections and with the circuit requirements table or circuit description associated with the circuit drawing.

A401.916 — KS-16001 Dehydrator
H51.342

A501.916 — KS-16001 Dehydrator
H51.343

2. LIST OF TOOLS, GAUGES, AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-2652	9-inch Adjustable Wrench (for the latest design sensing element) or
—	Spanner Wrench, American Instrument Co. Catalog No. 4-4896A

CODE OR SPEC NO.

TOOLS

DESCRIPTION

— B Pressure Hose
— 3-inch Cabinet Screwdriver

GAUGES

— Gauge, U. S. Gauge Company
No. 633S, 0-15 Inches of
Water, 1/4 inch N. P. T.

TEST APPARATUS

KS-14510,L1 Volt-ohm Milliammeter
— 200,000-ohm Resistor
— 270,000-ohm Resistor
— Set Plug, American Instrument
Co., No. 15-6220

3. OPERATION

Preparation for Starting Dehydrator

3.01 *Caution: Before starting, check that the dust cap on the reactivation air outlet is removed. This outlet is located on the back of the bottom 4-way valve. Do not remove any restriction plate found in this outlet.*

3.02 Operate the START-STOP switch to ON. The blower motor should operate.

3.03 Absence of an alarm indicates that the dehydrator is operating properly and that the pressure in the system is satisfactory.

3.04 The manifold pressure gauge should read at least 5 inches of water.

3.05 Timer

(a) *Dehydrator Equipped for Time Cycle Operation:* The timer, located inside the control box, cycles the dehydrator and controls the operation of the components in the proper sequence. The timer is driven by a synchronous motor and makes one complete revolution in 24 hours. A thumb wheel near the left end, when rotated outward and downward, may be used to test the series of operations. All manual operations of the thumb wheel should be sufficiently slow to insure that one operation is completed before the next operation.

(b) **Dehydrator Equipped for Humidity Cycle Operation:** The timer is set to terminate the heating period in about 4 hours, at which time the heater is shut off and the solenoid in the reactivation exhaust is closed. The tower is cooled for the balance of the cycle until reversal again occurs. The adsorption, reactivation and cooling cycle will be continued until the START-STOP switch is moved to the OFF position. The dehydrator cannot be operated manually through its cycle of operation.

(b) **Dehydrator Equipped for Humidity Cycle Operation:** To check the operation of the pressure switch, make sure that both towers are cold, then turn the timer (black hand) to zero to prevent 4-hour heating cycle from starting. Operate the STOP-START switch to OFF. The alarm should sound within a few minutes. Operate the switch to ON. The alarm should stop after a short interval.

Caution: Reset the 5-hour timer (black hand) for 4-hour operation.

Waveguide and Antenna Alarm System

3.06 The pressure switch in each antenna system should close its contacts and cause an alarm when the pressure within the system drops to approximately 1.4 inches of water.

4. ROUTINE CHECK

Dehydrator

4.01 **Caution:** Where a reset of the 5-hour timer is specified in the following routine checks do not attempt to reset the 5-hour timer during a timing period, otherwise damage to the timer will result. At the conclusion of the test reset the timer to 4 hours. Failure to reset the timer will disable the dehydrator.

4.02 **Routine Intervals:** The following are suggested maintenance intervals for making routine checks. These intervals may be changed depending on local conditions.

	INTERVAL	PARAGRAPH
Pressure Switch	3 Months	4.03
Sensing Element	3 Months	4.04
Electronic Relay	3 Months	4.05
Humistat	3 Months	4.06,4.07
Tower Heater	As Required	4.08
Waveguide and Antenna Alarm Pressure Switch	3 Months	4.09

4.03 Pressure Switch

(a) **Dehydrator Equipped for Time Cycle Operation:** To check the operation of the dehydrator pressure switch, operate the STOP-START switch to OFF. The alarm should sound within a few minutes. Operate the switch to ON. The alarm should stop after a short interval.

4.04 Humidity Sensing Element

(a) **Dehydrator Equipped for Time Cycle Operation:** To check the operation of the sensing element, unscrew the nut from the hexagonal fitting, using the spanner wrench or the adjustable wrench as required. Then, slowly remove the sensing element from the fitting. If the removal of the sensing element into room conditions does not cause an alarm to sound, breathe on it. This should cause the alarm to sound. To clear the alarm, insert the element in the fitting. The alarm should stop when the element is sufficiently dry. Repeat the operation several times to make sure that the element is satisfactory. After completing the test, remount the sensing element.

(b) **Dehydrator Equipped for Humidity Cycle Operation:** Remove the cover of the Humistat using the 3-inch cabinet screwdriver. Disconnect the lead to the sequence relay from terminal 1 on the Humistat using the screwdriver. With the KS-14510, List 1 voltmeter set to read 300 volts ac, connect it to terminals 1 and L1 on the Humistat. Remove the nut from the hexagonal fitting using the spanner wrench or the adjustable wrench as required. Then slowly remove the sensing element from the fitting. Breathe on the sensing element. This should cause the Humistat to operate as indicated by the meter reading of 115 volts ac. If the Humistat does not operate, make sure that the plug on the cable from the sensing element is firmly plugged into the receptacle in the Humistat case and examine the cable for a broken conductor. If the Humistat still does not operate, adjust the setting as covered in 4.07. Remount the sensing element, but do not connect the lead

from the sequence relay to terminal 1 on the Humistat until the meter reads zero. Disconnect the meter.

Caution: Do not use an ohmmeter to measure the resistance of the sensing element or in any manner apply a dc voltage to the sensing element as this will damage it.

4.05 Electronic Relay: To check the operation of the electronic relay, disconnect the sensing element connector from the relay. Momentarily bridge a 200,000-ohm resistor across terminals B and W on the relay. The alarm should operate.

4.06 Humistat (Dehydrator Equipped for Time Cycle Operation): To check the operation of the Humistat, insert the set plug furnished with the Humistat in the jack inside the Humistat case. The alarm should operate. Remove the set plug.

4.07 Humistat (Dehydrator Equipped for Humidity Cycle Operation): To check the operation of the Humistat, disconnect the lead to the sequence relay from terminal 1 on the Humistat using the 3-inch cabinet screwdriver. With the KS-14510, List 1 voltmeter set to read 300 volts ac, connect it to terminals 1 and L1 on the Humistat. Insert the set plug furnished with the Humistat in the jack inside the Humistat case. Turn the slotted potentiometer shaft clockwise with the screwdriver until the relay in the Humistat operates as indicated by the meter reading of 115 volts ac. Note the position of the potentiometer shaft. Then turn the shaft of the potentiometer counterclockwise until the meter reads 115 volts ac. Again note the position of the potentiometer shaft. Finally turn the shaft clockwise to a point midway between the two positions of the potentiometer shaft described above.

Caution: When the setting is completed, remove the set plug from the jack but do not connect the lead from the sequence relay to terminal 1 on the Humistat until the meter reads zero.

Disconnect the meter. Replace the Humistat cover.

4.08 Operation of the Tower Heater Circuit

(a) **Dehydrator Equipped for Time Cycle Operation:** To check the operation of the heater circuit, manually operate the timer through several time cycles. Alternate operation of the two heater contactors will indicate whether the circuits are functioning properly. To determine that the towers are heating, allow 30 minutes before shifting to the alternate tower. To determine whether the tower is heating, gauge by feel.

(b) **Dehydrator Equipped for Humidity Cycle Operation:** To check the operation of the heater circuit proceed as follows. The check should be made when both towers are at approximately room temperature to avoid circulation of hot moist air in the antenna system.

Caution: Set the 5-hour timer (black hand) for 30-minute operation before removing sensing element.

Unscrew the nut from the hexagonal fitting using the spanner wrench or the adjustable wrench as required. Then slowly remove the sensing element from the fitting. If the removal of the sensing element into ambient room humidity does not cause the towers to shift, breathe on it. This should cause the towers to shift. Insert the sensing element in the fitting. Allow 30 minutes to elapse and check by feeling the towers to make sure that one of the towers is heating. Completion of the 30-minute heating period as set by the timer is indicated by observation of the heater contactors. Observe that the spring coils of the contactor associated with the reactivating tower are in the down position during the 30-minute heating period. At the end of this period the spring coils should be in the up position. Set the timer to 30 minutes as covered in the Caution, above. Remove the sensing element and blow on it as covered above. This should cause the towers to shift. Insert the sensing element in the fitting. Again allow 30 minutes to elapse and check the second tower for heating as covered above. The switch of the towers the second time should restore the original tower to the antenna system.

Caution: Reset the 5-hour timer for 4-hour operation.

Waveguide and Antenna Alarm Pressure Switch

4.09 To check the operation of the individual waveguide pressure switch, remove the valve cap from the pressure testing valve at the pressure switch. Attach the No. 633S gauge equipped with the snap-on chuck to its testing valve. Stop the air flow into the pressure window (single air supply to a single antenna) or pressure windows (dual air supplies for waveguides connected to a common antenna) by disconnecting the tubing at the pressure window or windows. Record the pressure reading on the gauge at the time the alarm sounds. The reading should be approximately 1.4 inches of water. If the alarm does not sound or if it sounds at a pressure other than above, proceed as covered in 5.09. Repeat the test on each pressure switch.

5. CORRECTING TROUBLE

Dehydrator Alarm Operating

5.01 If a dehydrator alarm operates, proceed as follows.

(a) *Dehydrator Equipped for Time Cycle Operation:* Check the manifold pressure using the No. 633S pressure gauge. If low pressure exists, proceed as covered in 5.04. If the pressure is satisfactory, remove the connection from terminal 2 of the terminal strip inside the pressure switch. If the alarm stops, the trouble is in the pressure switch. Replace the switch. If removing the connection from the terminal strip does not cause the alarm to stop, the trouble is in the sensing element, the electronic relay, the Humistat, or the humidity is too high. Disconnect the sensing element cable from the electronic relay or the Humistat. If the alarm continues with the element cable disconnected, the trouble is in the electronic relay or the Humistat. If the trouble is in the electronic relay, replace the unit. If the trouble is in the Humistat, check the operation of the Humistat as covered in (b). If the alarm stops when the cable is disconnected, the cause is either high humidity or a defective sensing element. Reconnect the sensing element and manually shift towers as described in 4.08(a). If the alarm continues, check the sensing element as covered in 4.04(a). If, with a new element installed

the alarm continues, check the humidity in the dehydrator as covered in 5.02.

(b) *Dehydrator Equipped for Humidity Cycle*

Operation: Check the manifold pressure using the No. 633S pressure gauge. If low pressure exists, proceed as covered in 5.04. If the pressure is satisfactory, remove connection 61 from the terminal strip inside the pressure switch. If the alarm stops, the trouble is in the pressure switch. Replace the switch. If removing the connection from the terminal strip does not cause the alarm to stop, the trouble is in the sensing element, the Humistat or the humidity is too high. Disconnect the sensing element cable from the Humistat. If the alarm continues with the sensing element cable disconnected, the trouble is in the Humistat. Remove the cover from the Humistat using the 3-inch cabinet screwdriver. Disconnect the lead to the sequence relay from terminal 1 on the Humistat using the screwdriver. With the KS-14510, List 1 voltmeter set to read 300 volts ac, connect it to terminals 1 and L1 on the Humistat. Insert the set plug furnished with the Humistat in the jack inside the Humistat case. Turn the adjacent slotted potentiometer shaft clockwise with the screwdriver until the relay in the Humistat operates as indicated by the meter reading of 115 volts ac. Note the position of the potentiometer shaft. Then turn the potentiometer shaft counterclockwise until the meter reads 115 volts ac. Again note the position of the potentiometer shaft. Finally turn the shaft clockwise to a point midway between the two positions of the potentiometer shaft described above.

Caution: When the setting is completed, remove the set plug from the jack, but do not connect the lead from the sequence relay to terminal 1 on the Humistat until the meter reads zero.

Disconnect the meter. If this does not clear the trouble, change the tube and recheck the potentiometer as covered above. If trouble still exists, check the Humistat for defective components or replace the unit. If the alarm stops when the sensing element is disconnected, the cause is either high humidity or a defective sensing element. Turn the timer (black hand) to zero. Install a new sensing

element and reconnect; towers will shift. Wait a few minutes; if alarm clears, the cause was due to a defective sensing element.

Caution: *Reset the 5-hour timer for 4-hour operation.*

If the alarm continues with a new sensing element installed, check the humidity in the dehydrator as covered in 5.02.

5.02 Determine which tower is delivering air to the waveguide system by observing the arrows, if present, on the 4-way valve at the bottom of the dehydrator. The arrow pointing toward the front indicates the tower supplying air; the arrow to the rear indicates the tower in which reactivation is taking place. For those 4-way valves not equipped with arrows, the tower which is delivering air to the waveguide system can be determined by observing the position of the 4-way valve grease fittings. Tower No. 2 is supplying air to the system if the grease fitting is in the forward position. The grease fitting in the rear indicates that tower No. 1 is supplying the air. Shift the air supply to the other tower as covered in 4.08(b). Allow up to 30 minutes for the sensing element to clear. If the alarm stops, the released tower is high in humidity, in which case proceed as follows.

5.03 Determine if the heater in the released tower is operating and observe if the spring coils on the heater contactor are down. If so, allow up to 30 minutes for the heater to rise in temperature. Check for operation by feeling the outside of the tower housing and also check that the air is being purged as covered in 5.05. Failure of the tower to heat or the heater contactor to operate indicates circuit trouble.

(a) *Dehydrator Equipped for Time Cycle Operation.*

(1) If the heater contactor operates but the tower does not heat, the cause may be due to an open heater. The resistance is approximately 5.3 ohms. To check the resistance, disconnect the commercial power at the service panel. Connect a volt-

ohmmeter across terminals 24 and 36 on the heater contactor for the resistance of the heater in tower No. 1, and across terminals 25 and 37 on the heater contactor for the resistance of the heater in tower No. 2.

(2) If the heater contactor does not operate, see if the 6-ampere fuse on the fuse block is blown or an open circuit exists through the thermostat, limit switch, or timer.

(3) Failure of the tower to shift may be caused by the valve drive motor, valve drive motor starter, limit switch, or timer.

(4) Push the left overload reset button on the front of the control panel. If this clears the fault, the trouble was due to an overload condition. Possible cause for an overload condition might be binding in the motor, gear train, or 4-way valve.

(5) If restoral of the overload switch does not clear the trouble, check whether the left 5-ampere fuse on the fuse block is blown, or if the trouble is in the START-STOP switch or the circuit through the timer or limit switch.

(b) *Dehydrator Equipped for Humidity Cycle Operation.*

(1) If the heater contactor operates but the tower does not heat, the cause may be due to an open heater or blown 30-ampere fuse on the fuse block. If the fuse is blown, replace it. If the fuse is satisfactory, check the resistance of the heater which is approximately 5.3 ohms. To check the resistance, disconnect the commercial power at the service panel. Connect a volt-ohmmeter across terminals 15 and 21 on the heater contactor for the resistance of the heater in tower No. 1, and across terminals 22 and 34 on the heater contactor for the resistance of the heater in tower No. 2.

(2) If the heater contactor does not operate, see if the 6-ampere fuse on the fuse block is blown or an open circuit exists through the thermostat, limit switch, timer, or sequence relay.

(3) Failure of the tower to shift may be caused by the valve drive motor, valve drive motor starter, limit switch, sequence relay, sensing element, or Humistat.

(4) Push the left overload reset button on the front of the control panel. If this clears the fault, the trouble was due to an overload condition. Possible cause for an overload condition might be binding in the motor, gear train, or 4-way valve.

(5) If restoral of the overload switch does not clear the trouble, check whether a 5-ampere fuse on the fuse block is blown, or if the trouble is in the START-STOP switch or the circuit through the sequence relay and limit switch.

5.04 Checking Low Dehydrator Pressure: To determine the cause of low pressure, check the blower. If the blower is not operating, push the right overload reset button on the front of the control panel. If the motor starts and the pressure returns, the trouble was due to an overload condition. The cause of an overload condition could be binding of the motor or the blower impellers. If the motor does not start after resetting the overload reset button, check whether any of the 5-ampere fuses on the control panel are blown or whether the blower motor starter is faulty.

5.05 Checking Tower Purge: To determine if the tower is purging during the heating cycle, air should be felt being expelled at the reactivation air outlet at the rear of the lower 4-way valve. Failure of the tower to purge may be due to a faulty solenoid valve or the circuit through the timer. The electrical circuit (to the solenoid valve) should be closed during the 4-hour heating cycle for either tower.

Checking Electronic Relay

5.06 If the alarm does not sound, as covered in 4.05, replace the two electronic tubes

one at a time, and check for improper operation of the alarm relay or circuit trouble in the electronic relay proper. If the trouble cannot be cleared, replace the unit.

Note: If it is necessary to bench test the relay, remove the relay from its mounting and connect 115 volts ac across terminals 1 and 2. It will be necessary to temporarily connect 270,000 ohms across terminals R and W since the resistor normally connected across these terminals is located in the base and is not removed with the relay.

Checking Humistat (Dehydrator Equipped for Time Cycle Operation)

5.07 If the alarm does not sound, as covered in 4.06, adjust the potentiometer as covered in 4.07. If this does not clear trouble, change the tube and readjust the potentiometer. If trouble still exists, check the Humistat for defective components.

Checking Humistat (Dehydrator Equipped for Humidity Cycle Operation)

5.08 If the Humistat does not operate, as covered in 4.07, change the tube and readjust the potentiometer. If trouble still exists, check the Humistat for defective components.

Checking Waveguide and Antenna Pressure Switch

5.09 If the alarm does not sound, as covered in 4.09, loosen the two screws which secure the cover of the pressure switch in place and remove the cover. Turn the large, knurled adjusting screw until the contacts just close on 1.4 inches of pressure. If the contacts are open when the pressure is 1.4 inches, the adjusting screw should be turned clockwise until the "just close" point is reached on decreasing pressure. If the contacts are closed with a pressure of 1.4 inches, turn the adjusting screw counter-clockwise until the "just open" point is reached.