KS-16153 DEHYDRATOR

AND

ASSOCIATED WAVEGUIDE ALARMS

1. GENERAL

1.01 This section covers the operation of the KS-16153 dehydrator and associated waveguide alarms for use in the TD-2/TH radio systems utilizing a maximum of four horn reflector antennas.

KS-16153 Dehydrator

1.02 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 100 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 25 pounds of a drying agent, 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.

1.03 The dehydrator operates on a humidity controlled drying cycle. 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. Reactivation consists of heating the drying agent 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 drying agent from the system. Control of air flow through the reactivating tower is achieved through a solenoid valve which diverts the required purge flow.

1.04 Alarm facilities are provided which operate on either low pressure or high humidity. These alarms are connected in parallel and appear on a terminal strip as the alarm pair. A 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. A humidity sensing element, which is mounted in the air outlet, will cause the alarm to operate when the relative humidity in the air exceeds approximately 4 per cent relative humidity.

1.05 A measurement of pressure at the waveguide pressure 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 pressure on the gauge is less than 1.4 inches of water, the trouble is probably due to low pressure.

1.06 The instructions for the KS-16153 dehydrator are based on drawing SD-59742-01. For detailed description of the operation, see the corresponding circuit description.

Waveguide Alarms

1.07 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 1.4 inches of water.

1.08 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

1.09 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.

A401.921
H51.348 — KS-16153 Dehydrator

A501.921
H51.347 — KS-16153 Dehydrator

2. List of Tools, Gauges, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-2652	9-inch Adjustable Wrench (for new design sensing element) or
—	Spanner Wrench, American Instrument Co., Catalog No. 4-4896A
—	B Pressure Hose
—	3-inch Cabinet Screwdriver
GAUGES	
KS-14510, L1	Volt-ohm Milliammeter
—	Gauge, U. S. Gauge Company, No. 633S, 0-15 inches of water, 1/4-inch N. P. T.
TEST APPARATUS	
—	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.

Timer

3.05 The timer is set to terminate the heating period in approximately 4 hours, at which time the heater is shut off and the solenoid valve 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 starter switch is moved to the OFF position.

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
Humistat	3 Months	4.05
Tower Heater	As Required	4.06
Waveguide and Antenna Alarm Pressure Switch	3 Months	4.07

4.03 ***Pressure Switch:*** To check the operation of the pressure switch make sure that both towers are cold, then turn the timer (black hand) to 0 to prevent the 4-hour heating cycle from starting. Operate the starter 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.

4.04 ***Humidity Sensing Element:*** 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, L1 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 4.05. 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 ***Humistat:*** To check the operation of the Humistat, remove the cover 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, L1 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 of the Humistat case. This should cause the Humistat to operate as indicated by the meter reading of 115 volts ac. If the Humistat does not operate, 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 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 described above.

Caution: When the setting is complete, 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 cover.

4.06 ***Operation of the Tower Heater Circuit:*** 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. Set the 5-hour timer (black hand) to 30 minutes before removing the sensing element. Remove the ring 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, and start the 5-hour timer through a 30-minute time cycle. Insert the sensing element into 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 will be in the up position. Again set the 5-hour timer (black hand)

for 30-minute operation. Remove the sensing element and blow on it as covered above. This should cause the towers to shift. Insert the element into 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

4.07 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 5.07. Repeat the test on each pressure switch.

5. CORRECTING TROUBLE

Dehydrator Alarm Operating

5.01 Check the manifold pressure using the No. 633S pressure gauge. If low pressure exists, proceed as covered in 5.04. If not, remove connection 71 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, in 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, L1 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 into 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 slightly 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 5-hour 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 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 limit switch arm on the 4-way valve drive shaft. Tower No. 2 is supplying air to the

system if the limit switch arm is in contact with the rear limit switch. Tower No. 1 is supplying air to the system if the limit switch arm is in contact with the front limit switch. Shift the air supply to the other tower as covered in 4.06. 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 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) If the heater contactor operates but the tower does not heat, the cause may be due to an open heater or to blown associated 6-ampere fuses 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 63 ohms. To check the resistance, disconnect the commercial power at the service panel. Connect a voltohmmeter across terminals 12 and 26 on the heater contactor for the resistance of the heater in tower No. 1, and across terminals 14 and 28 on the heater contactor for the resistance of the heater in tower No. 2.

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

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

(d) Push the right 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.

(e) If restoration of the overload switch does not clear the trouble, check whether the associated fuses on the fuse block are blown or if the trouble is in the START-STOP switch or the circuit through the timer or 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 left 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 the associated 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, check by feel to determine whether air is 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 the Humistat

5.06 If the Humistat does not operate, check the adjustment of the potentiometer as covered in 4.05, change the tube, and readjust the potentiometer. If trouble still exists, check the Humistat for defective components.

Checking Waveguide and Antenna Pressure Switch

5.07 If the alarm does not sound, as covered in 4.07, 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 counterclockwise until the "just open" point is reached.