



**BIRD**  
**INSTRUCTION**  
**book**

MODEL 8781

OPERATING  
and  
MAINTENANCE MANUAL

for

7.5 kW LOAD RESISTOR  
Model 8781

Operating and Maintenance Manual  
for  
7.5 kW RF Load Resistor

SECTION I - DESCRIPTION

The Bird Model 8781 RF Load, Figure 1, is a THERMALINE Load Resistor for 3-1/8 inch 50/51.5 ohm coaxial lines, and is intended for operation in a frequency range from DC to 220 megahertz per second, with VSWR's below 1.1 to 1 in this range. It is also useful above this region, with slightly higher VSWR's. For test purposes, this unit may be connected to either transmitter output, the filterplexer output, or any point in the transmission system where power absorption is desired, up to approximately 7.5 kW continuous load.

a. Power Dissipating Section.

The Model 8781 Load equipment consists of the load resistor, an intermediate coolant, and a finned coil water cooling system (see Figure 1), which are contained in an upright steel cylinder mounted on a wheeled truck.

The load resistor is housed at the lower end of a length of a transmission line which projects through the top plate of the steel cylinder. At the lower end (terminating resistor) of the line section, the outer conductor of the transmission line is exponentially tapered down the resistor to provide a reduction of surge impedance directly proportional to distance. Thus at the upper end of the resistor the characteristic impedance is 51.5 ohms. Half way down the resistor the impedance is 25.75 ohms, to compensate for the resistance already passed over. At the lower end of the resistor the transmission line outer conductor joins the inner. The teflon seal at the top of the transmission line provides both mechanical support for the coaxial line inner conductor and a seal against leakage.

The intermediate coolant, which has been chosen for its chemical inertness, to prevent damage to the resistor, carries heat away from the resistor and provides a uniform dielectric constant for the transmission line. With RF power applied, the coolant is heated by the resistor, causing the fluid to rise inside the coaxial line section and enter the heat exchanger (cooling coils) through holes at the top of the transmission line outer conductor. At the same time, the lower temperature coolant around the heat exchanger moves to the bottom of the cylinder and then flows up past the resistor. This "chimney" action is enhanced by the height of the steel cylinder in much the same manner that a high chimney provides a good draft for a furnace. The level of the coolant is maintained above the lower surface of the teflon seal at the top of the tank.

The cooling coil, which is located at the top of the steel cylinder, is a double helix of finned copper tubing. The cooling water flows first thru the outer helix coils and then back through the inner helix, which further serves to assist the chimney action.

As mentioned previously, water carries off the heat produced by the RF energy flowing into the load. The lower the inlet temperature of the water, the more heat it can dissipate. In various applications around the station, the power and water temperature inputs to the load may vary. However, the actual water requirement of the load will not exceed four gallons per minute, provided that the inlet water temperature is never more than 30 degrees centigrade (86°F). This is a continuous flow requirement.

The 8780-040 Water Saver Valve is a component item that will minimize water flow when connected to the input of the water coil. It is controlled by the water thermostatic switch which is located at the base of the steel cylinder. In this manner, the water will flow only when the intermediate coolant temperature reaches a certain maximum limit. Thus, the water flow is automatically cut off when the load is not in operation. Power for the water saver valve should be available when the power is on at the transmitter.

In operation, the water saver valve solenoid is energized when the water saver thermostatic switch closes. The solenoid opens a small pilot valve which admits full line water pressure to a spring-loaded diaphragm. The pressure exerted on the diaphragm actuates the main valve allowing water to flow into the load. Upon de-energization of the coil, the pilot valve closes, the pressure over the diaphragm is dissipated into the low pressure (outlet) water line, and the spring closes the main valve thereby stopping the flow into the load.

In addition to the water saver thermostatic switch, an over temperature thermostatic switch is also located in the base of the steel cylinder. When properly connected, this switch will prevent an excessive rise in the intermediate coolant temperature and thence preclude any damage to the resistor element. The overtemperature switch should be connected in series with the transmitter interlock circuit, or if desired, to an auxiliary aural alarm system.

#### Summary Characteristics Model 8781

Impedance	51.5 ohms
Input Connector	3-1/8 inch coaxial (flush)
VSWR	1.1 to 1, 0 to 220
Power Absorption	7.5 kW max continuous
Coolant, Capacity	4 gallons Dowtherm A
Water Supply	4 gallons per min - 30°C max
Weight	175 pounds
Ambient Temperature	15°C to 45°C
Interlock Cutoff Temp	65°C - Open
Watersaver Temp	30°C - Close

## SECTION II - INSTALLATION

The unit is shipped in two boxes. One box contains the truck and the other contains the radio frequency load.

1. Assemble the truck to the load unless fixed mounting on the floor is desired.  
The equipment may be fixed mounted on the station floor by using the four 7/16-inch holes on a 10 by 9 inch rectangle in the face plate at the bottom of the unit.
2. Place the unit in its proper location.
3. Connect the water inlet and water drainage hoses to the unit in accordance with Figure 2. Use standard 1/2-inch hoses. Water supply requirements will be approximately 4 gallons per minute. Connect the water saver valve (with the solenoid up) to the water inlet before connecting the water inlet hose. Water flow into the load should be in the direction of the arrow on the water saver valve body.
4. Make the electrical connections to the unit.
  - (a) The over-temperature thermostwitch should be connected in series with the transmitter interlock circuit.
  - (b) Connect one side of the water saver thermostwitch at the base of the load tank to one side of a 115-volt, 50/60-cycle line. The other terminal on this switch should be connected to one of the water saver solenoid leads. The other solenoid lead should then be connected to the other side of the 115-volt line. The 115-volt line must be energized whenever the transmitter filament circuits are operated.
5. Make the transmission line connection to the unit. The Model 8781 equipment is designed for direct connection to unflanged 3-1/8 inch, 51.5 ohm VHF transmission line. Use the 3-1/8 inch 51.5 ohm Coupling Kit (part #5-039) which is provided with the equipment. When positioning the center bullet, and the sleeve, bottom each down to the stop dimples. Keep both clamping bands on the sleeve. Insert transmission line conductors down to the dimples also, and tighten sleeve clamps firmly above and below the joint.

6. Test the water saver valve operation. To do this, connect a temporary jumper across the water saver thermoswitch terminals, energize the circuit, and open the water supply valve. Proper operation will be indicated by water flow through the system. De-energize the circuit and remove the test jumper.
7. Remove the vent plug (painted red) from the top of the dissipating unit. The unit is now ready for operation.

### SECTION III - OPERATION

To place the unit in operation, the following procedure is recommended:

1. Make certain water pressure is on at the water saver valve.
2. Check the dielectric coolant level by removing the filler plug located on top of the power dissipating section. The coolant level must be above the lower surface of the teflon seal. (1-1/2 inches below surface of top plate).
3. Be sure that the coolant vent plug has been removed from the filler plug. This will allow the coolant to expand as the temperature increases.
4. Apply RF power to the load resistor. To avoid any possibility of damage to the resistor be careful not to exceed the 7.5 kW rating of the equipment, and assure that water pressure is always on, as in par. 1 above.

## SECTION IV MAINTENANCE

Bird Model 8781 Load Resistor will require little in the way of regular maintenance. Routine cleaning and reasonable care in handling are about all that will be generally required.

1. The outside surface of the instrument should be wiped free of dust as necessary. Place a covering over the input connector when equipment is not attached to transmission line. Keep the coaxial connector parts clean; if they should become grimy or dirt coated, clean carefully with a dry solvent on a cotton swab stick. Clean the metal contact areas and the face of the teflon insulator especially. Preferably, use Inhibisol\* or trichlorethylene. If carbon tetrachloride must be used, carefully observe precautions to avoid excessive skin contact or any inhalation of fumes.

2. Accurate measurement of the dc resistance between the inner and outer conductor of the RF input will provide a good indication of the condition of the load resistor. For this measurement, use a resistance bridge with an accuracy of one percent or better at 50 ohms, such as Leeds and Northrup Series 5300. Connect to load with short, low resistance leads. When the load unit is at room temperature, the measured resistance should be within one ohm of the value stamped on the nameplate. Results beyond this indicate possible damage to the resistor.

If it should ever be necessary to replace the load resistor, the entire assembly 8781-003 located within the steel cylinder must be removed since the resistor is released from the lower part of this assembly.

3. To remove the above resistor and cooling coil assembly, disconnect the coaxial power transmission line from the load, and detach water from the two brass street elbows. Unscrew the six binder head machine screws located radially around the upper end of the steel coolant tank. These screws are threaded into the top plate of the RF load resistor and cooling coil unit, and must be fully removed. This top mounting plate rests snugly in a counterbore at the top of the coolant tank.

Lifting of this load resistor assy 8781-003 out of the tank is best performed with an overhead power hoist or manual chain hoist. Use a tackle with a rope sling or two hooks, attaching loops or hooks under each of the water fittings. Lift up gently, and, if necessary, work the mounting plate about slightly to loosen the O-ring seal. Avoid using boards or sticks as levers to lift the mounting plate as they may tilt or wedge the unit, and if not used carefully, may break the water fittings. When loosened, hoist the load unit straight up, allow the coolant to drain back into the tank, and place the unit in an accessible position.

\* A non-toxic, non-flammable dry cleaning agent, manufactured by the Penetone Company, Tenafly, New Jersey.

The resistor unit (8781-008) within this assembly is changed by the procedure described in the Instruction Sheet furnished with the replacement resistor. After making this repair, the load resistor and cooling coils assembly is restored to the cooling tank by reversing the procedure outlined under par. 3 above.

4. After replacing the load and coils assembly as described above, check the coolant level in the tank. The coolant level should be 1-1/2 inches below the top of the cover plate. Unscrew the filler plug (1-1/8 hex head, in which the vent plug is seated) and measure thru the access hole. Check this level periodically. Replenish if necessary. Use only the Dowtherm A coolant referenced in the parts list.

#### SECTION V - PARTS LIST

Item No.	Description	Bird Electronic Part No.
1	Assembly, RF Load Resistor Equipment	8781-001
2	Assembly, Load Resistor and Cooling Coils	8781-003
3	Resistor Unit Assembly	8781-008
4	Caster, Swivel	8780-051
5	Caster, Rigid	8780-052
6	Box, Thermoswitch	8780-015
7	Cover, Thermoswitch Box: including gasket	8780-049
8	Thermoswitch, Over Temperature	8780-036
9	Thermoswitch, Water Saver	8780-042
10	Filler and Vent Plug Assembly	8780-017
11	Coolant: Dowtherm A - one gal. cans (4 gals. req'd)	5021-023
12	3-1/8 in. 51.5 ohm Coupling Kit	5-039
13	Water Saver Kit	8780-041
	Water Saver Kit includes the following items:	
	Valve, Water Saver	8780-057
	Pipe Nipple: 1/2-inch: brass	Std.
	Hose Nipple: 1/2-inch: cast brass	5-065
	Flexible Conduit: 3/8-inch x 39 inches long	Std.
	Cable Clamp: straight	5-055-1
	Cable Clamp: 90-degrees	5-055-6
	Clamp, Universal	5-064-1



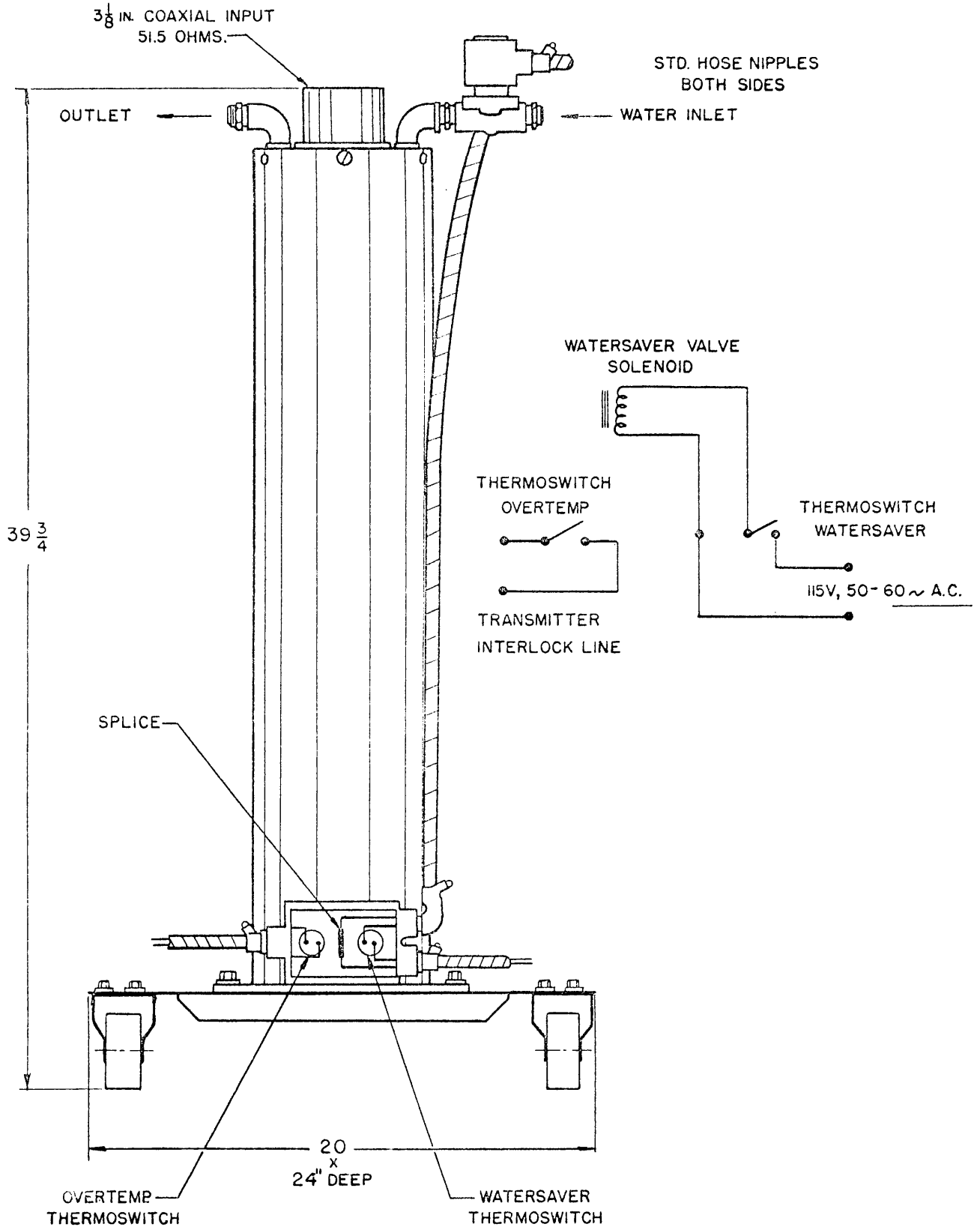


Fig. 1 - Installation Schematic