Termaline® Load Resistor
Series 8765/8766

Operation Manual

Instruction Book Part Number 920-8765/66 Rev. E

Safety Precautions

The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Shock Hazard

Do not attempt to remove the RF transmission line while RF power is present.

WARNING

Do Not Service Or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

WARNING

Safety Earth Ground

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

WARNING

Resuscitation

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power on.

Safety Symbols

WARNING

Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

CAUTION

Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.

NOTE

Calls attention to supplemental information.

The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.

This symbol indicates that the unit radiates heat and should not be touched while hot.

Warning Statements

The following safety warnings appear in the text where there is danger to operating and maintenance personnel, and are repeated here for emphasis.

WARNING

Ethylene glycol is toxic. Do not take internally.
Avoid contact with eyes, skin, and clothing. Avoid breathing vapor. Wash thoroughly after handling.

See page 3.

WARNING

Never attempt to disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

See pages 6 and 8.

WARNING

Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

See page 9.

WARNING

The resistor used in this load consists of a resistive film on a special substrate. If the substrate is broken, there will probably be sharp pieces or splinters inside the load housing. Caution should be exercised to avoid possible injury.

See page 14.

Caution Statements

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION

Do not use Automotive anti-freeze, stop-leak solutions, sealants, or corrosion inhibitors used in coolant solutions for these loads. Use of these additives can negatively impact load performance and may cause premature failure.
Use of unapproved coolants will void the warranty.

See pages 3 and 5.

CAUTION

Use only potable water or potable water mixed with pure technical grade ethylene glycol. Use of any other coolant, including those containing additives or dyes, stop leak solutions, sealants, or corrosion inhibitors will void the warranty. Use of unapproved coolants will negatively impact load performance and may cause premature failure.

See pages 3 and 5.

CAUTION

The water flow must be kept in the proper direction; incorrect flow will cause almost immediate burnout.

See page 5.

CAUTION

Do not apply more than rated RF power to the load. The water flow rate and inlet temp. (5° C to 60° C) must be as specified:

Models (8765/8766)	Power 40 kW	5° C 8 gpm (30 lpm)	60° C 10 gpm (38 lpm)
Adequate and uninterrupted full water flow is more critical than temperature.			

See page 6.

CAUTION

Verify cooling liquid is flowing through the load before RF power is applied and ensure the cooling liquid supply is not interrupted while load is in operation. Even momentary interruption of coolant supply while RF power is applied will cause almost immediate burnout.

See page 6.

CAUTION

Never reverse the cooling water connections. It is very important for the safety of the load resistor to observe proper flow direction. Also, when the load is first installed or is reconnected, run the water for approximately one minute to fill the system and remove all air pockets before applying RF power.

See page 6.

Safety Statements

USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERIO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRENTIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating and maintenance instructions for the following models

8765 8766

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number and revision on the title page.

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Chapter 1 Introduction

Purpose and Function

The Model 8765/66 Termaline Load Resistor is designed as a compact, low-reflection, and non-radiating termination for RF transmission lines. Cooled by internal water flow, it generates almost no surface heat, making installation space minimal and convenient. The load can safely dissipate up to 40 kilowatts of continuous power when used in a 50 ohm coaxial transmission line system.

Each model uses a 3-1/8 inch connector, see "Specifications" on page 18 for individual models. They will maintain a VSWR of less than 1.1 to 1.0 from 1000 Hz up to 900 MHz. These loads are intended for use on CW, AM, FM, SSB, and TV modulation envelopes, and within certain limitations on radar or pulse modes. Information on applications involving pulse-type signals should be obtained directly from Bird Electronic Corporation.

Description

The Model 8765/66 equipment consists of the Load Resistor unit. They have a field replaceable resistive element. The replacement procedure is included in "Maintenance" on page 8.

Direct Power Measurement

When used in conjunction with a Bird Model 6810 Series Thruline Wattmeter or 3127 Series Panel Meters, these RF load resistors may be used for direct reading power measurements up to 40 kilowatts.

Optional Equipment

Bird recommends the installation of an interlock control circuit to provide instantaneous fail-safe protection of the transmitter and load in the event of even a momentary interruption of the cooling water supply. This protection is beneficial because dissipation of the heat generated by the RF power absorption is critically dependent upon a required minimum water flow rate regardless of inlet water temperature.

A water flow switch, attached to the water inlet of the load, should be calibrated to open whenever the water flow drops below eight gallons per minute, and close when the water flow exceeds this value.

When the water flow switch contacts open, the interlock switch opens, causing immediate shutdown of the transmitter or other signal source. It is recommended to utilize a time delay relay to assure proper operation of the cooling system before RF power can be applied to the load, preventing damage or burnout of the resistor element.

The direction of water flow is marked on the casting of the flow tube and on the operating head. Observe flow direction carefully, as incorrect connection will restrict the water flow and cause load failure. The flow switch may be connected to the inlet or the outlet side of the load, preferably as close to the load as possible. Be certain the water flow through the switch is in the correct direction. If installed, the flow switch should not be over 20 feet from the load.

Chapter 2 Theory of Operation

General

The Termaline Coaxial Load Resistor utilizes an external water supply for the direct cooling of the resistor element. By using this technique, the need for an intermediate dielectric fluid to transfer the heat generated in the resistor element has been eliminated, reducing the physical size of the load to a virtual minimum. This simplified system allows the use of the loads in more varied environments, and attachment in any orientation.

Heat Transfer

The 50 ohm resistor consists of a high temperature substrate tube with a deposited resistive film. The heat generated by absorption of RF power is transferred from the heated film to the water flowing over it, through a restricted chamber surrounding the resistor body. This water, first diverted to the front of the load resistor by a special inside tube, passes over the entire length of the resistor and is discharged through the sealed water chamber at the rear. The dielectric characteristics and distinctive design of these enclosures provide a very accurate 50 ohm termination over the specified frequency range of this load (1000 Hz to 900 MHz).

The absence of intermediate cooling fluids considerably simplifies the construction and sealing of this unit. It can be readily disassembled in the field for resistor element replacement (see "Maintenance" on page 8).

Because there is practically no heat transfer to the outer housing of the load, the housing remains at a cool ambient temperature even under full power conditions. Virtually all of the power input to the load is transformed into heat which is carried away by the cooling water. Therefore, the differential in output and input temperatures of the water multiplied by the amount of flow constitutes a very accurate measurement of the power consumed by the load. The amount of power dissipation may be calculated using the following formula:

For Celsius Temperatures:	$P = 0.263(T_1-T_2)GPM$
For Fahrenheit Temperatures:	$P = 0.146(T_1-T_2)GPM$
Where:	P = Power in Kilowatts T_1 = Outlet Water Temperature T_2 = Inlet Water Temperature GPM = Water Flow in Gallons Per Minute

Cooling Water

Use only potable water or potable water mixed with pure technical grade ethylene glycol in these loads. See Water Quality below for acceptable forms of water. See Closed System Water Mixtures for the acceptable water mixture for use in a closed system.

Water Quality

CAUTION

Do not use Automotive anti-freeze, stop-leak solutions, sealants, or corrosion inhibitors used in coolant solutions for these loads. Use of these additives can negatively impact load performance and may cause premature failure.
Use of unapproved coolants will void the warranty.

The following types of water are considered safe for the cooling of the 8765/66 Loads: purified, filtered city, or soft water. In general, any potable water is suitable for cooling the load.

These RF loads are affected by impurities or chemical additives in the cooling water. The effects can include high VSWR, overheating, and/or leaks.

Sea water or silty water should not be used for cooling the loads. The presence of salts in the water will make the device unusable because the salt will cause a rapid increase in VSWR.

Impurities, particularly those impurities that accumulate in the form of scale on the exposed surfaces of the fluid paths of the load assembly. These deposits may result in an increase in the thermal and/or fluid resistance(s) of the load and may in turn cause the load to overheat and fail.

Closed System Water Mixtures

WARNING

Ethylene glycol is toxic. Do not take internally.
Avoid contact with eyes, skin, and clothing. Avoid breathing vapor. Wash thoroughly after handling.

CAUTION

Use only potable water or potable water mixed with pure technical grade ethylene glycol. Use of any other coolant, including those containing additives or dyes, stop leak solutions, sealants, or corrosion inhibitors will void the warranty. Use of unapproved coolants will negatively impact load performance and may cause premature failure.

Water is the primary coolant for the Bird 8765/66, however, a mixture of potable / distilled water and pure technical grade ethylene glycol is acceptable in closed systems. Ethylene glycol should be added to prevent bacterial growth and freezing; 10% to 35% ethylene glycol is recommended. Using at least 10% will prevent bacterial growth and at least 35% will protect against freezing to – 20°C.

Chapter 3 Installation

General

The compact design of the Termaline Load Resistor enables it to be installed in very small spaces. It requires no ventilation and may be placed in any orientation. Do not install where it will be subjected to severe vibration or physical shock.

The load is ready for connection as received from the factory. It is useful to first check the 50 ohm input resistance of the load and record this data before attachment, see "Maintenance" on page 8.

Load Resistor Connection

NOTE

Use a dry cleaning solvent that does not leave a residue.

1. Clean all conductor and insulator surfaces on the transmission line face and the RF input connector.

NOTE

Do not tighten the bolt and nut sets.

2. Attach the load resistor to the RF line but do not tighten.
3. Use connector kits for respective models as follows:
   - Model 8765, 3-1/8 inch EIA, swivel flange, 50 ohms
     a. Use 3-1/8 inch EIA coupling kit, P/N 4600-020, which includes: six each 3/8-16 x 1-1/2 inch bolt and nut sets, O-Ring, and insulated center bullet.
     b. Insert the center bullet.
     c. Push it in to seat the insulator in the facing.
     d. Install O-Ring in groove if required.
     e. Connect the coaxial input in a straight line, push carefully on the center contact to close.

     NOTE

     The swivel flange on the load makes connection independent of a fixed flange on the coaxial input.

     f. Insert bolt sets and tighten the nuts evenly all around.
   - Model 8766, 3-1/8 inch unflanged, 50 ohms, flush center conductor:
     a. Use coupling kit, P/N 5-726 or RCA MI-27791K-4A, which includes: outer sleeve with two clamping bands and the center conductor coupling bullet.
     b. Insert the center bullet.
     c. Bottom the center bullet on the midpoint nibs.
     d. Position the outer sleeve, with clamping bands over input connector.
     e. Introduce the transmission line and seat it snugly against the coupling stops.
     f. Position the clamp bands evenly about 1-3/4 inches apart and tighten.
4. Rotate the load so that the warning label shows and the outlet water tube is in a convenient position.
5. Secure the clamps or bolt set firmly and evenly around the RF connection.

NOTE

Do not disturb the socket head cap screws that join the connector section to the main housing.

6. Install water inlet and outlet connections. See "Water Line Attachment" on page 5.

Water Line Attachment

CAUTION

The water flow must be kept in the proper direction; incorrect flow will cause almost immediate burnout.

The RF Load comes supplied with standard 3/4 inch hose fittings for attaching the water supply and drain lines. The water INLET, at the back on center, and water OUTLET, adjacent at 90° to the inlet, mate with 3/4 inch water hose connectors.

For rigid piping connections, replace both the water inlet and outlet hose adapters, Bird P/N 5-065-2, with 1/2 inch male pipe or pipe fittings.

Cooling Water Quality

CAUTION

Use only potable water or potable water mixed with pure technical grade ethylene glycol. Use of any other coolant, including those containing additives or dyes, stop leak solutions, sealants, or corrosion inhibitors will void the warranty. Use of unapproved coolants will negatively impact load performance and may cause premature failure.

CAUTION

Do not use Automotive anti-freeze, stop-leak solutions, sealants, or corrosion inhibitors used in coolant solutions for these loads. Use of these additives can negatively impact load performance and may cause premature failure.
Use of unapproved coolants will void the warranty.

Water quality is important. See "Cooling Water" on page 3 for an explanation and description. In general, any potable water is satisfactory. This would include purified, filtered, city supply, or soft water.

Preoperational Checkout

NOTE

Before attempting to operate the RF load, whether under test or actual operating conditions, TEST the complete water system as follows:

1. Ensure the transmitter power is OFF.
2. Turn on water supply.
3. Ensure water flow from the OUTLET connection of load is at least 8 gpm (30 lpm) at 5° C (41° F) through 10 gpm (38 lpm) at 60° C (140° F).

NOTE

As a precautionary measure, the Preoperational Checkout should be performed each time the load is put into service.

Chapter 4 Operating Instructions

General

The Termaline RF Load is not equipped with any operating controls, therefore, operators don't need to be present when in use. Proper operation of the equipment is assured if the instructions contained in "Installation" on page 4 are followed exactly.

Do not apply more than the rated RF power to the load. The water flow rates 8 - 10 gpm (30 - 38 lpm) and inlet water temperature, 5° C to 60° C (41° F to 140° F), must be maintained. In reality, an adequate and uninterrupted water flow is more critical than the actual water temperature.

Normal Operation

WARNING

Never attempt to disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

CAUTION

Do not apply more than rated RF power to the load. The water flow rate and inlet temp. (5° C to 60° C) must be as specified:

Models (8765/8766)	Power 40 kW	5° C 8 gpm (30 lpm)	60° C 10 gpm (38 lpm)
Adequate and uninterrupted full water flow is more critical than temperature.			

CAUTION

Verify cooling liquid is flowing through the load before RF power is applied and ensure the cooling liquid supply is not interrupted while load is in operation. Even momentary interruption of coolant supply while RF power is applied will cause almost immediate burnout.

CAUTION

Never reverse the cooling water connections. It is very important for the safety of the load resistor to observe proper flow direction. Also, when the load is first installed or is reconnected, run the water for approximately one minute to fill the system and remove all air pockets before applying RF power.

Power On Procedure

1. Turn on the water supply (verify water flow rate is sufficient).
2. Check that all coaxial power line connections are properly tightened.
3. Apply RF power to the load.
4. Proceed according to instructions pertaining to the specific transmitting equipment.

Shutdown Procedure

1. Turn off the RF power to the load.
2. Wait at least one minute to allow the resistor substrate time to cool.
3. Turn off the water supply.

NOTE

Always do this last.

Operating as an RF Wattmeter

The RF load can be combined with a Bird Rigid Line Series Thruline Wattmeter to form an absorption-type wattmeter by inserting the wattmeter line section just ahead of the RF load. Installation and operation of the wattmeter is covered in the Thruline Wattmeter operation manual.

NOTE

Select a wattmeter type appropriate to the input connector of the load resistor, consult the Bird catalog or contact the Company.

1. Install wattmeter in the line section at the input of the RF Load.
2. Proceed with operating functions in "Normal Operation" on page 6.
3. Rotate the element in the Thruline Wattmeter's socket to monitor incident or reflected power.

NOTE

Measurements are taken as indicated by direction of the arrow on the element.

Chapter 5 Maintenance

General

WARNING

Never attempt to disconnect RF equipment from the transmission line while RF power is being supplied. Leaking RF energy is a potential health hazard.

The Model 8765/66 Termaline Coaxial Load Resistors are rugged units of simple design, requiring only nominal and routine attention. The load is designed to operate for long periods of time if care is taken not to exceed its power handling capabilities.

Preventative Maintenance

Due to the basic simplicity of construction, the major requirement for preventive maintenance is to keep the equipment clean.

Inspection

With the rugged and simple construction of the loads, periodic inspection will only be necessary at six-month intervals. Inspection should include the items listed below:

- Cleanliness - Keep the housing and connector free of grime.
- Inspect the load for completeness and general condition of the equipment.
- A Troubleshooting Chart lists the commonly encountered problems, their possible causes and remedies. Use this chart as a guide when analyzing symptoms.

Cleaning

Outside Surface

The outside surface of these loads should be wiped free of dust and dirt when necessary. Periodically wipe the accumulated dust and lint off of the load housing.

RF Connector Surfaces

If the Teflon insulator or metallic contact surfaces of the connector should become dirty or grimy, wipe them off with a soft cloth. Use a contact cleaner that is self-drying and leaves no residue to clean the hard to reach internal portions.

NOTE

Always handle the load with care to prevent subjecting it to unnecessary shock or impact.

RF Assembly Resistance Test

NOTE

These tests are by no means a necessity to the operation of the load but merely guidelines for the user's information.

Accurate measurement of the DC resistance between the inner and outer conductors of the RF input connector will provide a good check of the condition of the load resistor. Checking the DC resistance is simply used to measure a change in the condition of the resistor over time. The tracking of the DC resistance must start *before* the resistor is first put into service. Perform the following steps and record the value for future comparison. Check and record the resistance of the load periodically according to use.

Preparation:

- Tools: Common hand tools.
- Ohmmeter with an accuracy of ± 1% at 50 ohms (or use a resistance bridge).
- Use low resistance leads, preferably a short piece of 50 ohm coaxial cable fitted with alligator clips.
- Temperature of the load between 20°C to 25°C (68°F to 77°F).

WARNING

Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

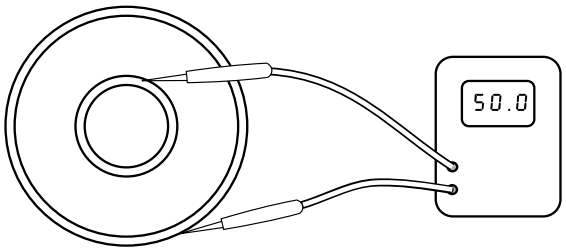
DC Resistance Measurement

NOTE

It is recommended that this resistance check be performed each time the load is to be used.

1. Turn off RF power and interlock circuitry before any electrical disconnections are made.
2. Disconnect the RF coaxial line.
3. Connect the multimeter test leads across the center and outer conductor of the load resistor. See Figure 1.
4. Record the value of the resistance *before* the load is put into service. Compare subsequent values with the latest reading. If the values vary more than 2 ohms this could be an indication of a failing resistive element.

Figure 1 Measuring DC Resistance



Troubleshooting

For corrections requiring repair or replacement of components, refer to the appropriate section for your specific model.

Problem	Possible Cause	Correction
High load VSWR.	Failing resistor	Perform "RF Assembly Resistance Test" on page 9. Resistance change of greater than 5 ohms indicates a failing resistor. Replace resistor, see "Replacing a Resistive Element" on page 10.
	Loose input connector.	Tighten connector.

Repair

Replacing a Resistive Element

This series of water-cooled loads is designed to be quickly and easily repaired in the field. If in performing the RF Assembly Resistance Test described previously, a significant change in resistance is noted, or if for any reason the resistive element should fail, inexpensive replacement resistors are available. They can be installed in the load, using the following procedure:

NOTE

Item numbers enclosed in brackets "[ ]" in the text are so indicated in Figure 2 on page 12 ***and*** Figure 3 on page 15 ***and in*** "Replacement Parts" on page 19***.***

NOTE

Turn off RF Power and interlock circuitry prior to proceeding.

1. Ensure the RF power and water supply are turned off.
2. Disconnect the water hoses at the hose fittings [5] on load. See Figure 2 on page 12.
3. Disconnect the unit from the RF transmission line.
4. Completely drain excess water from the load.
5. Set the load on end, with the water connections up.

NOTE

Use a 3/16 inch hex Allen wrench.

6. Unscrew the six 1/4-20 x 2-1/2 inch socket head cap screws [6] holding the water chamber [3] to the main load housing.

NOTE

It may be necessary to rock the chamber gently while carefully pulling it off.

7. Pull the water chamber assembly (with screws) straight off.

The inner flow tube [9] will usually come out with the water chamber assembly, being held to it by the compression of the inner O-ring [4] (water input) seal. This is normal, and if the resistor body is unbroken, there will be no need to remove the inner flow tube from water chamber assembly.

The resistor cap assembly [11] is fitted tightly within the water chamber and should normally remain with it. If the inner flow tube has stayed in the resistor section, simply grasp the resistor sleeve [7] on the flow tube and pull out the assembly.

NOTE

This includes the cushioning O-Ring [8] which fits loosely below the* resistor *sleeve - always take care not to lose it by falling off. Also, if the brass* resistor *sleeve [7] is removed at all, notice that it has a small escape hole at the side and an access counterbore leading to it.

8. For reassembly, ensure the counterbore is facing toward the O-Ring and the resistor [1].

NOTE

This is essential for internal water venting. Notice the water output holes and also the small shoulder at the base of the inner flow tube. At reassembly, this must fit into a mating recess in the input fitting at the bottom.

9. Pull the resistor [1], if intact, straight out of the load housing.

NOTE

The outer flow tube is captive, and will not come out of the housing at this stage.

Inspecting the Unit

NOTE

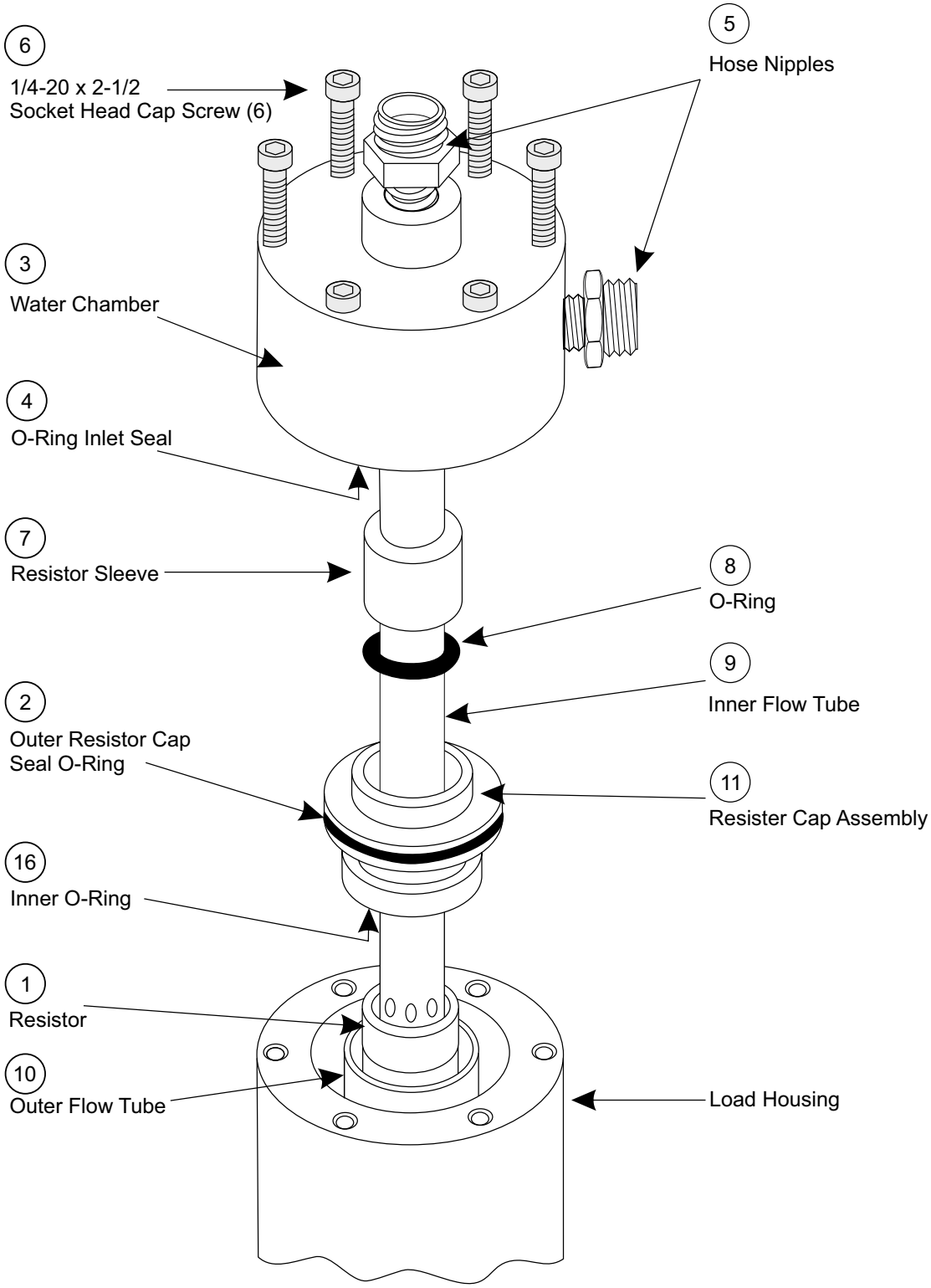
Perform this once the resistor has been successfully removed.

NOTE

In the majority of cases, even in the event of resistor failure, the resistor substrate will remain intact.

1. Inspect the resistor carefully to ensure that it is not fractured.
2. Examine the inside of the load housing assembly for any apparent damage to the internal parts.
3. Do one of the following:
   - **If no damage had been found** - Proceed with new resistor replacement, see "Installing the Resistor" on page 13.
   - **If the resistor is broken, other internal parts appear to be damaged, or if they do not fit together properly** - See "Replacing Fractured Resistors" on page 14.

Figure 2 Resistor Removal



Installing the Resistor

1. Inspect the load housing assembly. See "Inspecting the Unit" on page 11.
2. Insert new resistor [1] into the load housing until it reaches its fitting.
3. Push in the resistor until it bottoms snugly.

NOTE

The resistor should not have to be forced into the fitting, but it should be quite snug.

4. If the resistor is loose in the fitting, press the slotted finger contacts of the fitting together slightly and try the resistor again. Continue closing the ends of the resistor fitting until a snug fit is obtained.
5. Place the inner flow tube [9] inside the resistor.
6. Lower the inner flow tube until it reaches the resistor fitting.

NOTE

This operation may also be done if the inner flow tube is still in position in the water chamber.

7. Gently work and twist the inner flow tube until it seats in the bottom of the input resistor fitting.

NOTE

Watch the orientation of the sleeve, see step 8 ***of*** "Replacing a Resistive Element" on page 10***.***

8. Ensure that the O-Ring [8] cushion is placed on the inner flow tube next to the resistor and the “backup” resistor sleeve [7] is right behind it.

NOTE

There is no need to disturb the resistor cap assembly [11] in the water chamber for this procedure.

9. Replace the water chamber [3], gently rocking and twisting the chamber to achieve the proper flat seat on the outer housing.

NOTE

If the water chamber [3] does not seem to fit properly, refer back to step 7 ***to see that the inner flow tube is properly in place.***

10. Tighten the six 1/4-20 x 2-1/2 inch socket head cap screws [6].

NOTE

Resistance should be approximately 50 ohms, see "RF Assembly Resistance Test" on page 9***.***

11. Check the DC resistance between the inner and outer conductors.
12. Connect the load to a water source and check for leaks.

NOTE

If there are NO leaks, the load is ready for service.

Replacing Fractured Resistors

The resistor used in this load consists of a resistive film on a special substrate. If the substrate is broken, there will probably be sharp pieces or splinters inside the load housing. Caution should be exercised to avoid possible injury.

NOTE

The load should already be disassembled to the point of step 7 ***of*** "Replacing a Resistive Element" on page 10***.***

1. Turn the load on end with the RF connector up.

NOTE

The RF input connector should be up to allow any loose pieces of resistor to fall out of the load housing.

NOTE

Use a 3/16 inch Allen wrench.

2. Loosen and remove the six 1/4-20 x 1 inch socket head cap screws [15] from the flanged end of the load housing. See Figure 3 on page 15.

NOTE

As shown in Figure 3***, the outer conductor assembly may now be easily removed.***

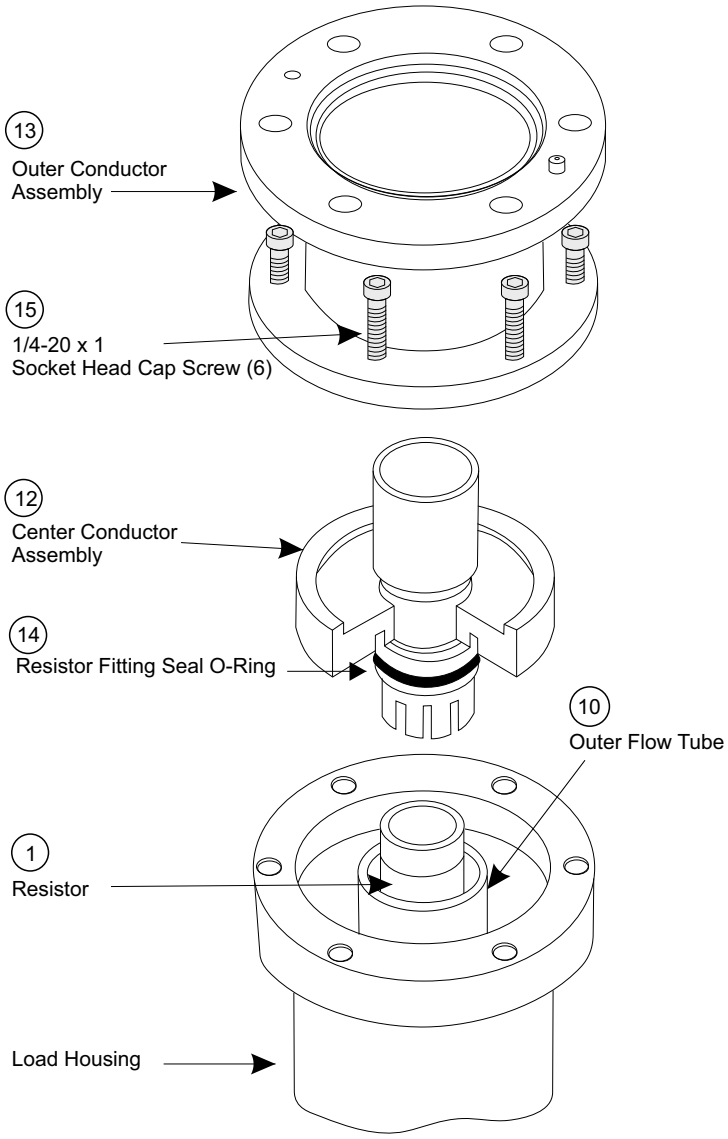
3. Remove the input center conductor assembly [12] by pulling it out of the load housing (Figure 3 on page 15).
4. Carefully remove any remaining pieces of the resistor.

NOTE

Normally, at this stage of the disassembly, the outer flow tube [10] will remain with the load housing. Restore it to this position after inspection and cleaning if it should come out.

5. Inspect the inside of the load housing for any apparent damage. See "Inspecting the Unit" on page 11.
6. Pull out the inner flow tube [9]. See Figure 2 on page 12.
7. Inspect the inner flow tube carefully for broken pieces.
8. Grasp the projecting hub of the resistor cap assembly [11] firmly.
9. Pull the projecting hub straight off with a strong even force.
10. Wash all the inside portions of the three assemblies (input section, load housing, and water chamber) thoroughly under clear running water.
11. Replace the resistor cap assembly in the water chamber.
12. Push the resistor cap assembly firmly onto the bottom.

Figure 3 RF Input Assembly



Installing a Replacement Resistor

1. Insert replacement resistor [1] into the resistor fitting of the input center conductor assembly to test its tightness.
2. Push in the resistor until it bottoms snugly.

NOTE

The resistor should not have to be forced into the fitting, but it should be quite snug.

3. If the resistor is loose in the fitting, press the slotted finger contacts of the fitting together slightly and try the resistor again. Continue closing the ends of the resistor fitting until a snug fit is obtained.
4. Bottom the resistor in the fitting.
5. Insert the resistor [1] and the input center conductor assembly [12] into the load housing with the resistor still in place in the resistor fitting (Figure 2 on page 12).
6. Replace the outer conductor assembly [13] and the six 1/4-20 x 1 inch socket head cap screws [15].
7. Stand the load on end with the RF input connector down.
8. Place the inner flow tube [9] inside the resistor.
9. Lower the inner flow tube until it reaches the resistor fitting.
10. Gently move and twist the inner flow tube until it seats in the bottom of the resistor fitting.
11. Continue using the procedure as given in "Installing the Resistor" on page 13.

Additional Repairs

Repairs beyond what is covered in this instruction book will require return of the equipment to Bird Electronic Corporation for service. See "Customer Service" on page 17.

Storage

NOTE

If the load is to be unused or stored for any length of time, completely drain it of any coolant and cap the openings.

1. Contain or cover the unit with plastic.
2. Store in a cool, dust free and dry area.

NOTE

Ambient storage temperatures are not critical, however, extreme temperatures should be avoided.

Shipping

1. Completely drain the unit of all coolant.
2. Cap all openings.
3. Pack the unit securely in a sturdy wooden box or equivalent.

NOTE

If possible, use the original shipping carton for reshipment.

4. Pad the container with sufficient padding to avoid shock damage.
5. Seal the container securely.

Customer Service

Any maintenance or service procedure beyond the scope of those in this chapter should be referred to a qualified service center.

If the unit needs to be returned for any reason, request an Return Material Authorization (RMA) through the Bird Technologies website. All instruments returned must be shipped prepaid and to the attention of the RMA number.

Bird Service Center
30303 Aurora Road
Cleveland (Solon), Ohio 44139-2794
Fax: (440) 248-5426
E-mail: *bsc@birdrf.com*

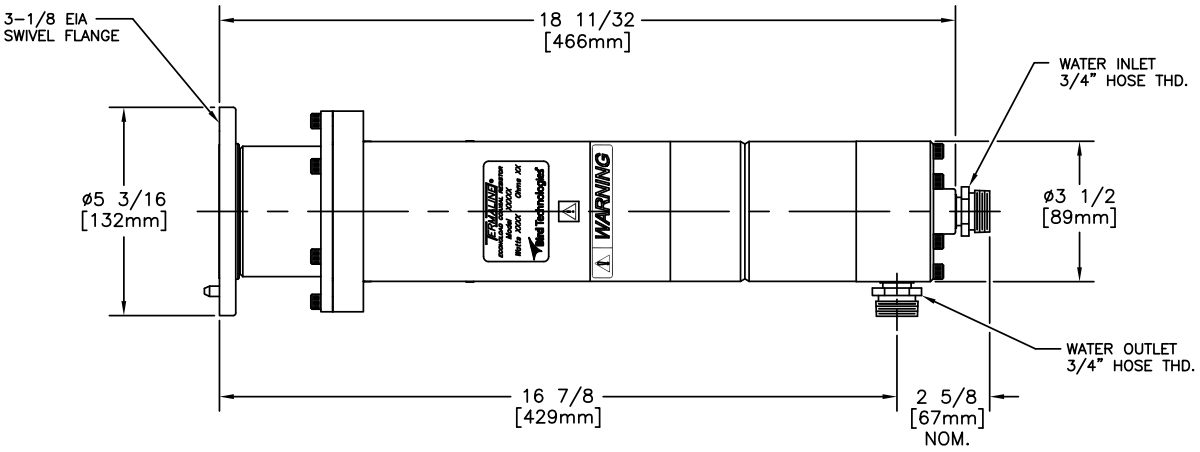
For the location of the Sales Office nearest you, visit our Web site at:

http://www.birdrf.com

Specifications

Power Rating	40,000 Watts
Impedance	50 ohms
Input Connectors Model 8765 Model 8766	 3-1/8 EIA Flanged, (50 ohm) 3-1/8 Unflanged, (50 ohm)
Frequency Range	1 kHz to 900 MHz
VSWR	1:10 maximum 1000 Hz - 900 MHz
Modes	CW, AM, FM, SSB, TV, and certain Pulse types
Input Water Temperature Range	5°C to 60°C (41°F to 140°F)
Water Flow - Minimum Rate	8 GPM (30.3 lpm) at 5°C (41°F) to 10 GPM (37.9 lpm) at 60°C (140°F)
Maximum Water Pressure	80 PSI (5.52 bar)
Water Connections	3/4 inch Standard Hose Thread
Cooling Water	100% Potable*/distilled water or up to 50% dilution with pure technical grade ethylene glycol.
Weight Model 8765 Model 8766	 15 lb 13 oz. (7.2k9) 15 lb 5 oz. (7.0 kg)
Dimensions Length Overall Housing Diameter Model 8765 Maximum Diameter (Input Flange) Model 8766 Maximum Diameter (Housing Flange)	 19-1/2" (495'3 mm) 3-1/2" (88.9 mm) 5-3/16" (13'l'8 mm) 5" (127.0 mm)
Finish	Black Powder Coat
Housing Material	Aluminum Alloy and Brass
Operating Position	Any

*. Standards for potable water have been established by the U.S. Public Health Service at a maximum of 500 ppm of total dissolved solids (ppm - parts per million or 1 mg per liter). Hardness of water (content of calcium and magnesium salts) should be less than 75 ppm. If the quality of the available water supply is doubtful or the mineral content is questionable, use distilled water.



Replacement Parts

Figure	Item	Qty	Description	Replacement Kit	Part Number
2 and 3	1	1	Resistor	RPK8755-027-4	8755-027-4
2	2	1	Outer resistor cap seal, O-Ring	8740-020	8410-009
2	3	1	Water chamber		8755-014
2	4	1	Inlet seal O-Ring	8740-020	5-099
2	5	2	Hose nipple		5-065-2
2	6	6	Socket head cap screws, 1/4-20 x 2-1/2", stainless steel		1121-2508-00
2	7	1	Resistor sleeve	8740-025	8755-026
2	8	1	Sleeve backup O-Ring	8740-020	8110-059
2	9	1	Inner flow tube	8740-025	8755-025
2 and 3	10	1	Outer flow tube	8740-025	8755-024
2	11	1	Resistor cap assembly	8740-025	8755-005

RF Connector Parts Assigned Per Model Type:

Model 8765 - 3-1/8" EIA Connector 50 ohms

Figure	Item	Qty	Description	Part Number
3	12	1	Center conductor input, assembly	8755-007
3	13	1	Outer conductor assembly	8755-004

Model 8766 - 3-1/8" Unflanged Connector Flush Center Conductor 50 ohms

Figure	Item	Qty	Description	Part Number
3	12	1	Center conductor input, assembly	8756-003
3	13	1	Outer conductor assembly	8756-002

For Both Models

Figure	Item	Qty	Description	Part Number
3	14	1	Center conductor assembly O-Ring	5-1127
3	15	6	Socket head cap screws, 1/4-20 x 1," stainless steel	1121-1508-00
2	16	1	Inner resistor cap seal O-Ring	5-567

Accessory Coupling Kits

Fits Model	Description	Part Number
Model 8765	Coupling Kit - 3-1/8” EIA consisting of: Anchor Bullet O-Ring Mounting Hardware	4600-020 4600-021 4600-022 4600-023
Model 8766	Coupling Kit - 3-1/8” Unflanged Flush - 50 ohm consisting of: Center Conductor Coupling Bullet Outer Conductor Sleeve Coupling Clamps-2	 5-726

Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.