



MODULOAD<sup>®</sup> RF LOAD RESISTOR  
SERIES 8640 AND 8640B

INCLUDING MODELS  
8645-xxx & 8646-xxx

OPERATION MANUAL

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INSTRUCTION BOOK PART NUMBER 920-8640S REV. G

MODULOAD<sup>®</sup>, ECONOLOAD<sup>®</sup>, ECONOLINE<sup>®</sup>, AND THRULINE<sup>®</sup> ARE  
REGISTERED TRADEMARKS OF BIRD ELECTRONIC CORPORATION

## Safety Precautions

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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.



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

**Note:** *Calls attention to supplemental information.*

## 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**  
HEAVY. Do not lift this unit alone.

On page 4.

**WARNING**  
Disconnect the unit from all power sources before servicing.  
The unit may be energized from multiple sources.  
The potential for electric shock exists.

On pages 5, 10, 14, 18, and 19.

**WARNING**  
Improper wiring could result in electric shock and death.

On page 5.

**WARNING**  
Connect the power cord to the Moduload  
BEFORE connecting to AC mains.

On page 5.

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

On pages 6 and 12.

**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.

On pages 8 and 11.

**WARNING**  
Disconnect from RF power sources and the AC line before any disassembly or service.  
Electrical shock hazard.

On page 15.

## Caution Statements

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

**CAUTION**  
Do not block air flow. The air intake vents on the side of the heat exchanger and the exhaust on top must not be obstructed.

On page 4.

**CAUTION**  
Do not operate without the interlock. Even momentary application of RF power while coolant is not circulating could cause immediate destruction of the load.

On pages 5 and 9.

**CAUTION**  
Check the local electrical code for proper AC hookup prior to operation of the unit. Make sure the neutral or return hookup is only used for that purpose.

On page 5.

**CAUTION**  
Use only distilled water or ethylene glycol as coolant. Do not use tap water, automotive antifreeze, sealants, or leak stopping material.  
Use of these materials will damage the unit and void all warranties.

On page 6.

**CAUTION**  
Operation without sufficient coolant can damage the unit.

On pages 6, 9, and 12.

**CAUTION**  
Incorrect hose connections will reverse coolant flow and could destroy the load.

On page 15.

## Safety Statements

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### 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 HACERLO.

## **WARTUNG**

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

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

## **ENTRETIEN**

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.

**CONNECT INTERLOCK TO TRANSMITTER BEFORE OPERATING.**

**BRANCHER LE VERROUILLAGE À L'ÉMETTEUR AVANT EMPLOI.**

**CONECTE EL INTERBLOQUEO AL TRANSMISOR ANTES DE LA OPERACION.**

**VOR INBETRIEBNAHME VERRIEGELUNG AM SENDER ANSCHLIESSEN.**

**PRIMA DI METTERE IN FUNZIONE L'APPARECCHIO, COLLEGARE IL DISPOSITIVO DI BLOCCO AL TRASMETTITORE.**

## About This Manual

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

8640

8640B

## Changes to this Manual

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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.

## Terminology

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There are some unique terms used throughout this literature. They are defined here to clarify any misunderstanding.

**Moduload** — The entire unit.

**Load** — The component which connects to the RF line. It is inside the HEAT EXCHANGER, connected by two hoses. It contains the RESISTOR.

**Heat Exchanger** — The parts of the Moduload left when the LOAD is removed. It contains the pump, fans, coolant reservoir, and controls.

**Resistor** — A subcomponent of the LOAD. This is the ceramic resistor which actually absorbs the RF power

**Introduction** — Describes the features of the Moduload, lists equipment supplied and optional equipment, and provides power-up instructions.

**Theory of Operation** — Describes how the Moduload works.

**Installation** — Describes the power supply and load connection instructions.

**Operating Instructions** — Describes the base level operation instructions.

**Maintenance** — Lists routine maintenance tasks as well as troubleshooting for common problems. Specifications and parts information are also included.



# TABLE OF CONTENTS

<b>Safety Precautions</b> .....	<b>i</b>
Safety Symbols .....	ii
Warning Statements .....	ii
Caution Statements .....	iii
Safety Statements .....	iv
<b>About This Manual</b> .....	<b>vii</b>
Changes to this Manual .....	vii
Terminology .....	vii
<b>Chapter 1 Introduction</b> .....	<b>1</b>
Moduload Features .....	1
Indicators .....	1
Items Supplied .....	1
Items Required but not Supplied .....	1
Optional Items Available .....	1
<b>Chapter 2 Theory of Operation</b> .....	<b>3</b>
Resistor .....	3
Coolant .....	3
Flow Interlock .....	3
Thermal Interlock .....	3
<b>Chapter 3 Installation</b> .....	<b>4</b>
Unpacking and Inspection .....	4
Placement .....	4
Mounting .....	4
DC Resistance .....	5
Meter Rack .....	5
Interlock Connection .....	5
AC Mains Connection .....	5
Coolant .....	6
Adding Coolant .....	6
Connecting RF Power .....	8
<b>Chapter 4 Operating Instructions</b> .....	<b>9</b>
Normal Operation .....	9
Shutdown .....	9
Emergency Shutdown .....	9
<b>Chapter 5 Maintenance</b> .....	<b>10</b>

Maintenance .....	10
Cleaning .....	11
Inspecting .....	11
RF Assembly Resistance Test .....	11
DC Resistance Measurement .....	11
Coolant .....	12
Changing Coolant .....	12
Flushing the Coolant .....	13
Normal Coolant Flush .....	13
Coolant Flush after Load Replacement .....	13
Repair .....	14
Replacing the Fuse .....	14
Replacing the Interlock Relay .....	14
For Model 864x .....	14
For Model 864xB .....	14
Replacing the Flow Switch (For Units Manufactured BEFORE 3/1/2010) .....	15
Replacing the Pressure Switch (For Units Manufactured AFTER 3/1/2010) .....	15
Removing the Load .....	16
Model 864x .....	16
Model 864xB .....	16
Removing the Pump .....	18
Servicing the Resistor .....	19
Removing the Resistor .....	19
Inspecting the Resistor .....	20
Removing a Fractured Resistor .....	20
Replacing the Resistor .....	20
Replacing the Conductor .....	21
Preparation for Storage or Shipment .....	21
Customer Service .....	21
Specifications .....	22
Replacement Parts .....	23
Load .....	23
Heat Exchanger .....	24
<b>Limited Warranty .....</b>	<b>25</b>

Bird 8640 and 8640B Series Moduloads are self-cooling, nonradiating, low reflection terminations for high power RF lines. They dissipate up to 25 kW with a VSWR of less than 1.1:1 from 1 kHz to 900 MHz.

The Moduload has an interlock which triggers as a result of either high coolant temperature or low coolant flow. It will also be active for about 2 seconds after power up or reset to ensure proper operation of the cooling system before applying RF power.

## Moduload Features

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- Useable with CW, AM, FM, SSB, and TV modulation, and certain pulse types. Contact Bird Electronic Corporation for information on using Moduloads with pulsed signals.
- Useable to make RF power measurements when used with a Bird 4600 or 4800 Thruline Wattmeter
- Self-contained water-based cooling system
- Time-delay interlock ensures steady coolant flow before RF power is applied

## Indicators

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- Coolant Level Gauge

## Items Supplied

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- Moduload
- Instruction Manual
- Power Meter Rack-Mount Kit

## Items Required but not Supplied

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- No. 22 AWG wire, with ring terminals, for interlock connection
- RF Coupling Kit
- Distilled Water

## Optional Items Available

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- Dolly (Bird P/N 6771-011) for moving the load
- Ethylene Glycol, Industrial Grade, 1 Gallon - available from Bird

Figure 1 8640 Series Moduload Outline Drawing

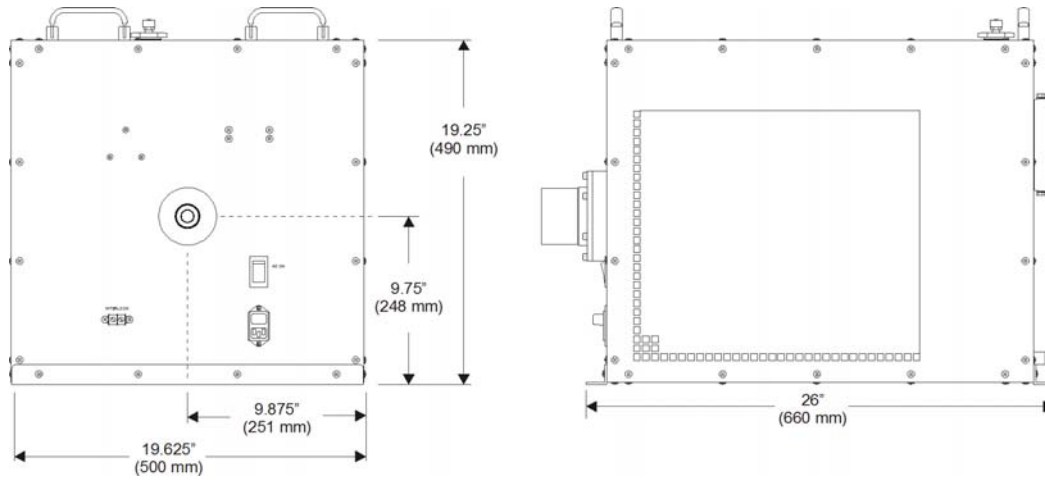
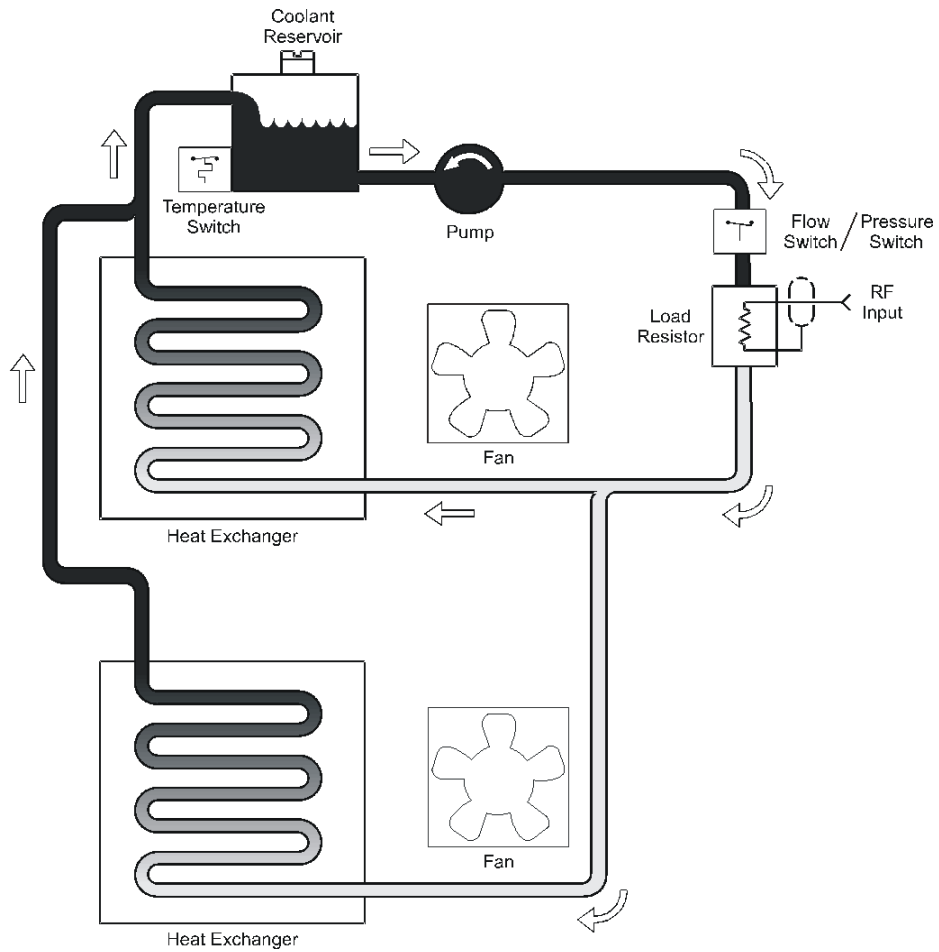


Figure 2 System Block Diagram



## Resistor

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Bird 8640 and 8640B Series Moduloads consist of a thin-film-on-ceramic resistor immersed in coolant. The coolant flows directly over the resistor instead of using an intermediate heat transfer system, reducing the load size to a minimum. After passing over the entire length of the resistor, the coolant is cooled in a forced air heat exchanger.

## Coolant

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The load's electrical and thermal performance is reduced by impurities or chemical additives in the coolant, especially ones which are deposited as scale on the resistor. This increase in the load's thermal resistance may cause the load to overheat and fail. Therefore, the coolant should be distilled water or a mixture of distilled water and ethylene glycol.

When the coolant is heated, thermal expansion causes an increase in the internal pressure. The vent plugs relieve this pressure while protecting the opening from dirt or other contaminants.

## Flow Interlock

---

Dissipation of the heat generated by RF power is critically dependent on a minimum coolant flow of six gallons per minute at all times, regardless of coolant temperature. When coolant flow drops below six gallons per minute, the low flow switch or pressure switch opens causing immediate transmitter shutdown. The flow or pressure switch or pressure switch is a "normally open" type, and is closed during normal operation.

After flow is restored, a time delay relay keeps the interlock open for an additional 2 seconds. This ensures proper operation of the cooling system before RF power is applied to the load, preventing resistor damage or burnout.

## Thermal Interlock

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The Moduload is equipped with a normally closed thermostwitch which opens when the coolant temperature exceeds 79 °C (174 °F), opening the interlock.

This chapter provides information on site requirements, unpacking, inspection, and preparing the Bird 8640 Moduload for use.

## Unpacking and Inspection

---

1. Carefully inspect shipping container for signs of damage.
  - If the shipping container is damaged, do not unpack the unit. Immediately notify the shipping carrier and Bird Technologies.
  - If the shipping container is not damaged, unpack the unit. Save shipping materials for repackaging.
2. Inspect unit for visual signs of damage.

**Note:** *If there is damage, immediately notify the shipping carrier and Bird Technologies.*

## Placement

---

**WARNING**  
HEAVY. Do not lift this unit alone.

**CAUTION**  
Do not block air flow. The air intake vents on the side of the heat exchanger and the exhaust on top must not be obstructed.

- Do not use outdoors or in areas of condensing humidity.
- Surrounding air must be free of contaminants or particles that could be drawn into the air intakes.
- The heat exchanger must be operated in a horizontal position.
- AC power is required.
- Allow a minimum of one foot clearance along the sides and three feet over the top to allow unobstructed air intake and exhaust.
- In small rooms or restricted areas, outside venting is recommended. Ductwork must not have sharp bends that would restrict air flow or create back pressure.

## Mounting

---

The Moduload is equipped for either portable use or fixed installation. The mounting brackets on the front and rear faces have four mounting slots arranged in a 17" x 25" rectangle (432 x 635 mm). Use a screw with a  $\frac{1}{4}$  inch (6.4 mm) diameter max. The brackets may be removed by removing the screws holding them to the Moduload.

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## DC Resistance

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Before first using the load, get a resistance baseline for future maintenance. Refer to "[RF Assembly Resistance Test](#)" on page 11 for instructions.

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## Meter Rack

---

If the Moduload will be used with a power meter, install the meter rack to provide a convenient place to keep the meter. Use the supplied #6-32 x  $\frac{1}{4}$  screws to assemble the rack. To install the rack, remove two screws from the Moduload where the rack will be mounted, then screw it into place with the supplied #8-32 x  $\frac{3}{8}$  screws.

**WARNING**

Disconnect the unit from all power sources before servicing.  
The unit may be energized from multiple sources.  
The potential for electric shock exists.

**WARNING**

Improper wiring could result in electric shock and death.

---

## Interlock Connection

---

**CAUTION**

Do not operate without the interlock. Even momentary application of RF power while coolant is not circulating could cause immediate destruction of the load.

- Use number 22 AWG (or heavier) wire for interlock connection. Attach solderless ring terminals to the wire for ease of installation.
- Connect the interlock wires to the interlock terminal strip as required for the transmitter.

**Note:** *Interlock contact resistance could be as high as 10 ohms for circuits drawing less than 250 mA.*

---

## AC Mains Connection

---

**CAUTION**

Check the local electrical code for proper AC hookup prior to operation of the unit.  
Make sure the neutral or return hookup is only used for that purpose.

**WARNING**

Connect the power cord to the Moduload  
BEFORE connecting to AC mains.

The AC power supply required for this unit is 115/230 V, depending on the model, @ 50/60 Hz, 1 $\phi$ . The unit is equipped with an IEC 320 "cold" (70 °C) AC inlet.

## Coolant

---

**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 distilled water or ethylene glycol as coolant. Do not use tap water, automotive antifreeze, sealants, or leak stopping material. Use of these materials will damage the instrument and void all warranties.

Distilled water is the primary coolant for the Bird 8640. 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.

**Note:** *When using both ethylene glycol and distilled water, add the water first, then the ethylene glycol, to ensure proper mixing.*

Figure 3 on page 7 shows the coolant’s freezing point for a given percentage of ethylene glycol in the mix. The following example shows the weights to make a 65% distilled water to 35% ethylene glycol mixture in 5 and 55 gallon quantities.

	<b>5 Gal. (18.9 L)</b>	<b>55 Gal. (208.2 L)</b>
<b>Distilled Water</b>	28.0 lb (12.7 kg)	310 lb (140.6 kg)
<b>Ethylene Glycol</b>	15.2 lb (6.9 kg)	167 lb (75.7 kg)

## Adding Coolant

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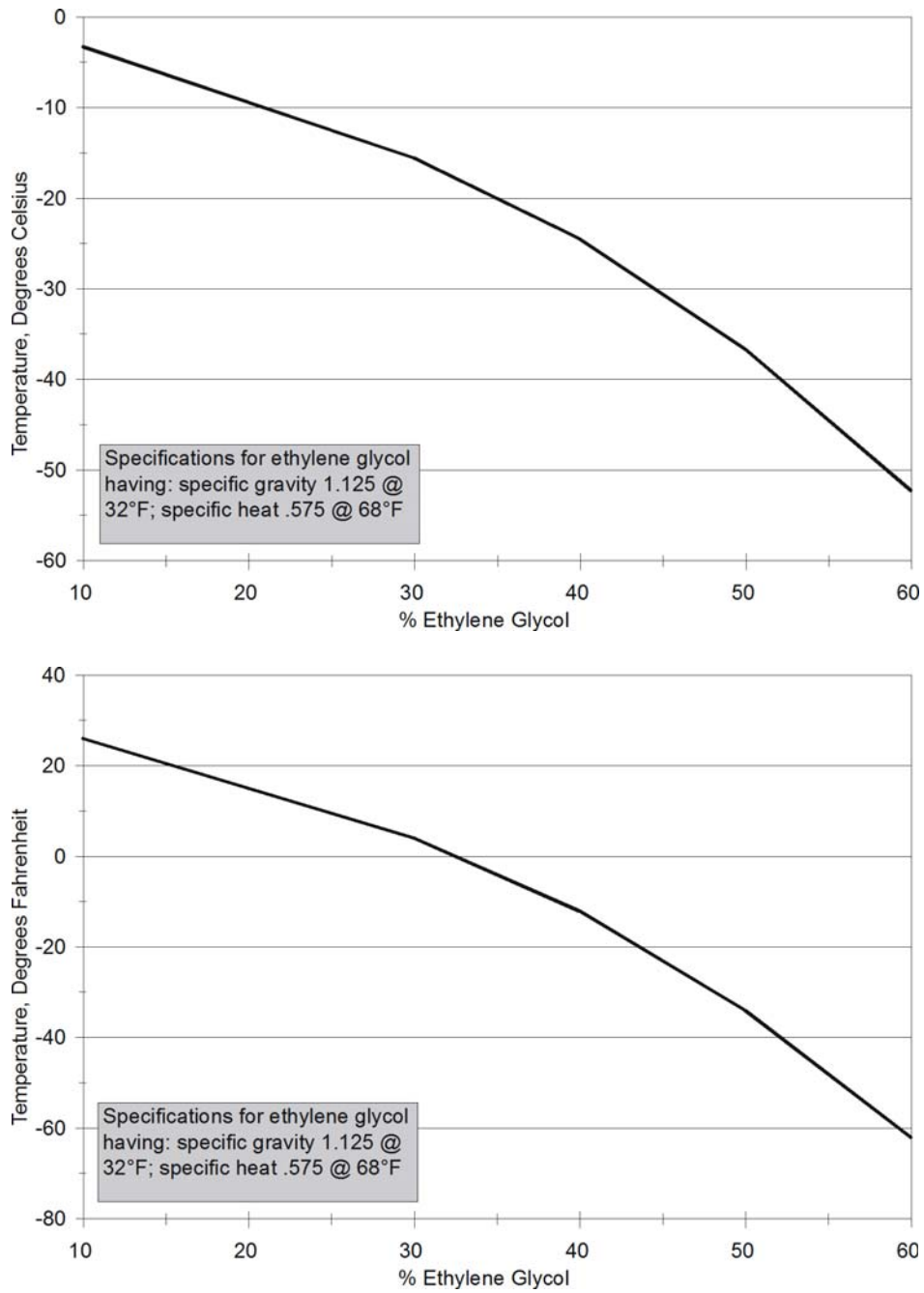
The Bird 8640 Moduload has a coolant capacity of about 9 quarts (8.5 L). To fill the coolant reservoir, follow these steps:

**CAUTION**  
 Operation without sufficient coolant can damage the unit.

1. Ensure that the drain plug is in place.
2. Remove the filler cap on top of the heat exchanger.
3. Add about 3 quarts (2.9 L) of coolant.
4. Turn the unit on for a few seconds to draw coolant into the system.
5. Repeat steps 3 and 4 twice more, until the coolant remains steady at or just below the high mark on the level gauge.
6. Replace the filler cap.
7. Turn the unit on and run it for five minutes to remove any air trapped in the system.



Figure 3 Freezing Point of Ethylene Glycol / Distilled Water Mixture



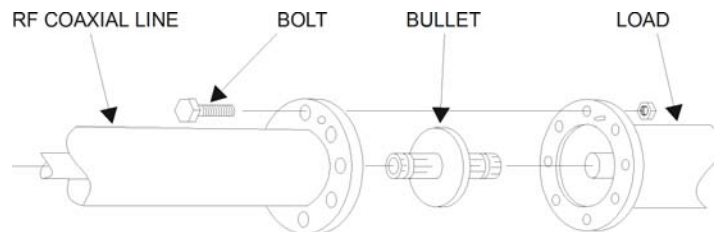
## Connecting RF Power

After installing the Moduload, the RF transmission line can be attached using standard coaxial line coupling kits.

**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.

**Swivel Flanged Coupling:** To couple the swivel flange with a flanged RF transmission line, use an appropriate coupling kit. Refer to [Figure 4](#) while following the instructions below:

**Figure 4 Swivel Flanged Coupling**

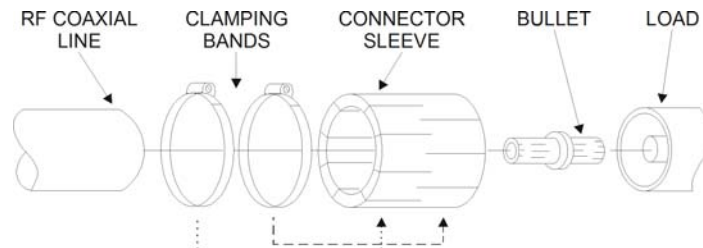


1. Insert the center bullet and push it in until it is fully seated.
2. Connect the coaxial input in a straight line and push carefully on the center conductor to close.
 

**Note:** The swivel flange on the load makes connection independent of the orientation of the fixed flange on the coaxial input outer conductor.
3. Insert the bolt sets and tighten evenly all around to transmission line manufacturer’s recommended torque. Use all of the bolts.

**Unflanged Coupling:** To couple the unflanged connector with an unflanged RF line, use an appropriate coupling kit. Refer to [Figure 5](#) while following the instructions below:

**Figure 5 Unflanged Coupling**



1. Insert the center bullet and bottom it on the midpoint nibs.
2. Position the outer sleeve, with clamping bands, over the input connector.
3. Set the transmission line snugly against the coupling stops.
4. Position the clamping bands evenly about 3/4” from the ends of the sleeve.
5. Tighten the clamping bands.

**CAUTION**

Operation without sufficient coolant can damage the unit.

**CAUTION**

Do not operate without the interlock. Even momentary application of RF power while coolant is not circulating could cause immediate destruction of the load.

## Normal Operation

---

1. Check that the coolant level is above the min. mark on the gauge.
2. Turn on the Moduload.
3. Check that the fans are running properly.
4. Wait about 2 seconds for proper coolant flow and for the interlock to close.
5. Apply RF power.

## Shutdown

---

1. Turn off RF power at the source.
2. Wait five minutes for the system to cool to room temperature.
3. Turn off the Moduload.

## Emergency Shutdown

---

Turn off RF power at the source.

**Note:** *If the interlock is properly connected, RF power will be automatically turned off if a fault occurs in the Moduload.*

**WARNING**  
 Disconnect the unit from all power sources before servicing.  
 The unit may be energized from multiple sources.  
 The potential for electric shock exists.

## Troubleshooting

The table below contains troubleshooting information for problems which can occur during normal operation. This manual cannot list all malfunctions that may occur, or their corrective actions. If a problem is not listed or is not corrected by the listed actions, notify a qualified service center.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Heat exchanger not operating.	No AC power.	Connected the unit to AC mains.
	Unit turned off.	Set the line switch to ON.
	Fuse burnout.	Replace fuse after correcting the burnout cause. See " <a href="#">Replacing the Fuse</a> " on page 14.
Coolant leaking.	Loose connections.	Tighten drain plug and all connections.
	Worn or cracked hose.	Replace defective hose.
Interlock opening repeatedly.	Insufficient coolant flow.	Check coolant level. Add coolant if necessary. See " <a href="#">Changing Coolant</a> " on page 12.
	Defective flow switch.	Check flow switch. See " <a href="#">Replacing the Flow Switch (For Units Manufactured BEFORE 3/1/2010)</a> " on page 15.
	RF power too high.	Lower RF power.
	Ambient temperature too high.	Lower ambient temperature.
	Air intakes or exhaust are blocked.	Check that clearances are at least 1 foot on the sides and 3 feet on top. Clean panels. See " <a href="#">Cleaning</a> " on page 11.
Excessive reflected power.	DC resistance of the load has changed.	Check DC resistance. See " <a href="#">RF Assembly Resistance Test</a> " on page 11.

## Maintenance

---

**WARNING**  
 Disconnect the unit from all power sources before servicing.  
 The unit may be energized from multiple sources.  
 The potential for electric shock exists.

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## Cleaning

---

The outside surface of the unit should be wiped free of dust and dirt when necessary. Clean the RF connector, both metallic and insulating surfaces, with a dry, non-residue forming solvent.

If dust has collected on the radiator coils, remove the top panel and vacuum the coils. To remove the panel:

1. Remove the screws around the edge of the top panel.
2. Lift the top panel to access the fan power connector then disconnect the fan cable.
3. Remove the top panel.

## Inspecting

---

Routinely check the load's center and outer conductors for visible damage or excessive wear. The coolant level should be checked once a week, more often if the Moduload is used continuously or under high ambient temperatures. The coolant level should be above the min. mark on the gauge even when the unit is on. To add coolant, see "[Changing Coolant](#)" on page 12.

## RF Assembly Resistance Test

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**Note:** *These tests are by no means a necessity to the operation of the load but merely guidelines for the users 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 resistance over time. Tracking the DC resistance should start *before* the unit is first put into service. Perform the following steps and record the value for future comparison. Resistance measurements should be taken periodically according to use.

Preparation:

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

## DC Resistance Measurement

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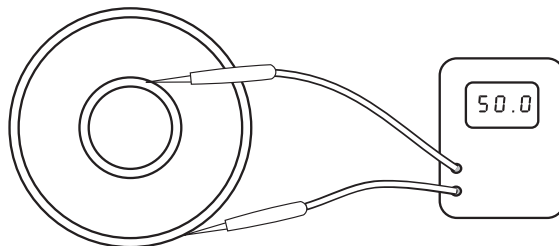
**WARNING**

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.

**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 making any disconnections.
2. Disconnect the RF coaxial line.
3. Connect the multimeter test leads across the center and outer conductor of the load resistor. See [Figure 6](#).
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 6 Measuring DC Resistance



## Coolant

---

**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 distilled water or the supplied ethylene glycol as coolant. Do not use tap water, automotive antifreeze, sealants, or leak stopping material. Use of these materials will damage the instrument and void all warranties.

**CAUTION**

Operation without sufficient coolant can damage the unit.

## Changing Coolant

---

**Note:** Follow these instructions to change the coolant.

- To just add coolant, go to step 5.
  - To just drain the coolant, follow steps 1 – 4.
1. Get a clean container, with a capacity of 3 gal. (11 L), to hold the old coolant.
  2. Remove the filler cap on top of the heat exchanger.

**Note:** This will allow the coolant to drain faster.
  3. Unscrew and remove the drain plug on the rear of the load. Drain the coolant into the container.

**Note:** If the coolant has no contaminants it may be reused.
  4. Replace the drain plug and screw it tightly into place.
  5. Remove the filler cap on top of the heat exchanger.
  6. Add about 3 quarts (2.9 L) of coolant.
  7. Turn the unit on for a few seconds to draw coolant into the system.
  8. Repeat steps 6 and 7 twice more, until the coolant remains steady at or just below the high mark on the level gauge.
  9. Replace the filler cap.
  10. Turn the unit on and run it for five minutes to remove any air trapped in the system.

---

## Flushing the Coolant

---

Whenever maintenance work has been performed, including resistor repair, or there is a reason to suspect that contamination has been introduced or dislodged into the coolant, the system should be thoroughly flushed.

**Note:** If the unit is to remain fully or partially drained for two weeks or more, see "[Preparation for Storage or Shipment](#)" on page 21.

**WARNING**

Disconnect from RF power sources and the AC line before any disassembly or service.  
Electrical shock hazard.

**CAUTION**

Incorrect hose connections will reverse coolant flow and could destroy the load.

---

### Normal Coolant Flush

---

As scheduled maintenance or if the coolant is contaminated, old and needs to be replaced, the system should be thoroughly flushed.

1. Drain the circulating system as completely as possible.
2. Fill the unit with fresh, clean, distilled water.
3. Run the load with coolant but without RF power applied for a period of five minutes.
4. Drain and discard the water.
5. Repeat the Steps 2 - 4 until the drained liquid is clear.
6. Fill the unit with distilled water and/or approved ethylene glycol mixture per "[Coolant](#)" on page 3.

---

### Coolant Flush after Load Replacement

---

Prior to installing a repaired load or a new load the cooling system needs to be flushed to remove any debris or contaminants that may remain when a damaged load is removed.

1. Open the drain plug.
2. Drain and discard the coolant.
3. Close drain plug.
4. Connect a suitable hose from the outlet of the pump to a drain or container to hold the discarded coolant.
5. Connect a second hose from the inlet of the heat exchanger to a source of clean potable water.
6. Open the fill cap.
7. Turn on water source and allow the tank to fill.
8. Replace the fill cap.
9. Leave the water source on and allow the system to flush for 1 to 3 minutes.
10. Turn the water source off.
11. Reverse the position of the hoses.
12. Flush the system with the water flowing in the opposite direction for 1 to 3 minutes.
13. Repeat steps 9 - 12 until there are no signs of debris or contaminants in the water being discharged.
14. Remove the hoses.
15. Reinstall the load.
16. Fill the unit with distilled water and/or approved ethylene glycol mixture per "[Coolant](#)" on page 3.

## Repair

---

<p><b>WARNING</b> Disconnect the unit from all power sources before servicing. The unit may be energized from multiple sources. The potential for electric shock exists.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

### Replacing the Fuse

---

1. Correct the fuse burnout cause.
2. Use a flat blade screwdriver to lift the tab securing the fuse drawer, above the AC mains connector.
3. Remove the defective fuse.
4. Replace with the same type and rating fuse

Series	115 Vac:	230 Vac
8640	15 amp	8 amp
8640B	15 amp	8 amp

5. Replace the fuse drawer.

### Replacing the Interlock Relay

---

The interlock relay cannot be repaired in the field. To replace it, follow the instructions below for your model.

<p><b>WARNING</b> Disconnect the unit from all power sources before servicing. The unit may be energized from multiple sources. The potential for electric shock exists.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

#### For Model 864x

**Note:** *The relay is located on the inside of the front panel at the upper right side.*

1. Loosen the screw at the top of the relay clamp.
2. Remove the relay cartridge.
3. Line up the center pin on the new relay with the hole in the socket.
4. Rotate until the key-way engages, then push in.

#### For Model 864xB

**Note:** *The relay is located on the inside of the front panel at the upper right side.*

1. Loosen and remove the nut and washers that secure the relay to the panel.
2. Record the color of each wire and the relay terminal to which it connects then remove the wires from the relay.
3. Remove the relay from its mounting screw.
4. Install the replacement relay by reversing Step 2 through Step 4.



---

### Replacing the Flow Switch (For Units Manufactured BEFORE 3/1/2010)

---

**Note:** *The coolant flow switch should be inspected every three to six months, depending on the amount of use. To inspect it:*

1. Drain the coolant. See ["Changing Coolant" on page 12.](#)
2. Remove the top panel
3. Unscrew the collar holding the wired sensor plug in the flow switch body.  
**Note:** *Being careful not to lose the spring and sliding valve on the sensor plug stem.*
4. Remove the sensor plug.
5. Clean and replace the sensor plug.
6. Reassemble the unit and replace the coolant.
7. Disconnect the wires at the flow switch.
8. Disconnect the hoses from the flow switch, then unscrew the flow switch from the load.
9. Install the new flow switch by reversing this procedure.

---

### Replacing the Pressure Switch (For Units Manufactured AFTER 3/1/2010)

---

1. Remove the top panel. See ["Removing the Load" on page 16.](#)
2. Drain the coolant. See ["Flushing the Coolant" on page 13.](#)
3. Pull the quick disconnect connector from the thermoswitch terminal.
4. Remove the black pressure switch wire from the thermoswitch.
5. Disconnect the red pressure switch wire by gently prying the retaining clips outward while pulling the connector away from its mating connector.
6. Unscrew the switch from the output plumbing assembly of the load.  
**Note:** *Use a 3/8 inch wrench on the hex portion of the pressure switch.*
7. Apply a thin coating of Teflon based thread sealant to the male threads of the pressure switch.
8. Thread the switch into the output plumbing assembly.
9. Tighten the pressure switch using a 3/8 inch wrench.
10. Reconnect the red wire to the front panel via the in-line connector.
11. Reconnect the black wire to the terminal of the thermoswitch.
12. Replace the coolant in the unit as described in the load replacement procedure,
13. Check for leaks by running the unit with the top panel removed.
14. Ensure the interlock circuit is working by checking the resistance between the two terminals of the interlock terminal strip on the front panel.  
**Note:** *Two seconds after the unit is turned on, the relay contact should close providing a low resistance. When the unit is turned off, the resistance should go high.*
15. Remove power from the unit.
16. Replace the top panel.  
**Note:** *Ensure that the fan power cable is reconnected to the connector on top of the radiator.*
17. Replace the screws and the coolant tank cap.

## Removing the Load

---

**WARNING**

Radiator fins are very sharp. Avoid contact with the radiator fins. Failure to comply may result in severe cuts and bleeding.

**WARNING**

Dangerous voltages are present.  
Disconnect the unit from all power line and RF power sources before servicing. Do not disconnect the unit from the RF transmission line while RF power is applied.  
Failure to comply may result in severe electrical shock or death.

### Model 864x

---

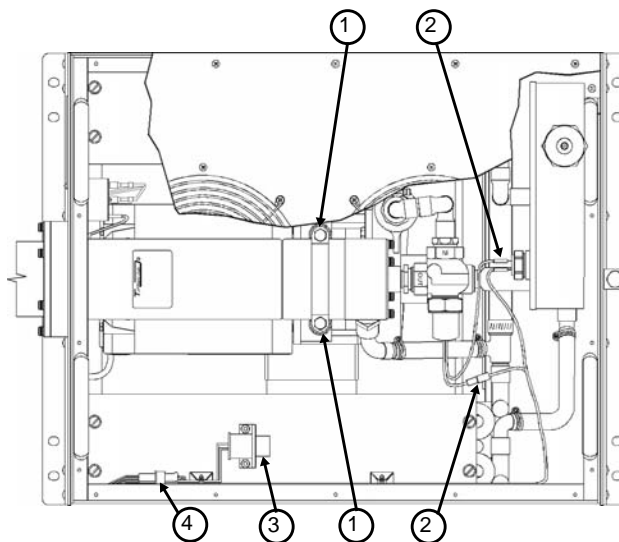
1. Disconnect the RF line.
2. Drain the coolant (See "[Changing Coolant](#)" on page 12).
3. Remove the screws that secure the top panel.
4. Lift the top panel and disconnect the fan-supply plug located on top of the radiator block.
5. Loosen the hose clamps on both water hose connections to the load.
6. On the inside of the front panel, remove the nuts holding the load to the front panel.  
**Note:** *Remove the nuts only. Do not disturb the screws. The screws also secure the outer conductor assembly to the load. Hold this assembly to keep it from falling and being damaged.*
7. Unscrew the mounting clamp holding the load to the rest of the unit. Remove the top half of the clamp.
8. Carefully push the load forward a few inches to access the wires and water connection fittings.
9. Disconnect the flow switch wires from the front panel.
10. Note the position and direction of the flow switch and the output elbow on the load. Unscrew these from the load.
11. The load can now be removed from the unit.

### Model 864xB

---

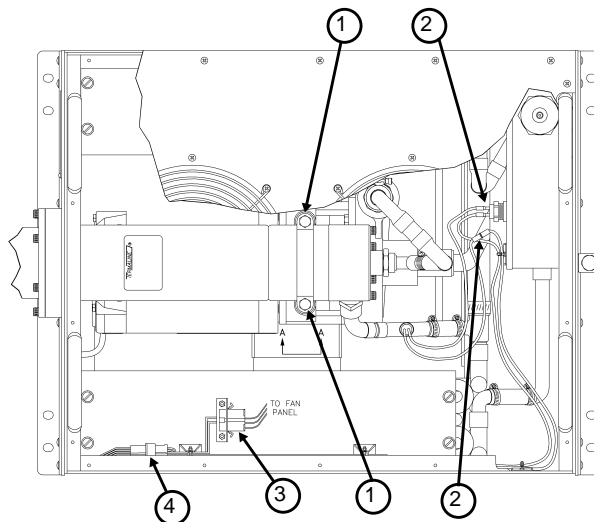
1. Disconnect the RF line.
2. Drain the coolant (See "[Changing Coolant](#)" on page 12).
3. Remove the screws that secure the top panel.
4. Lift the top panel and disconnect the fan-supply plug located on top of the radiator block ([Figure 9](#)).
5. Loosen the hose clamps on both water hose connections to the load.
6. Remove the screws that secure the load mounting clamp. Remove the top half of the mounting clamp.
7. Disconnect the flow or pressure switch wires. One at the thermal switch, the other at the in-line connector near the flow or pressure switch.
8. Disconnect the front panel wires at the connector on top of the radiator.

Figure 7 Removing the Load (Models BEFORE 3/1/2010)



Item	Description
1	Load mounting clamp screws
2	Flow switch wires
3	Fan-supply connector
4	Front panel connector

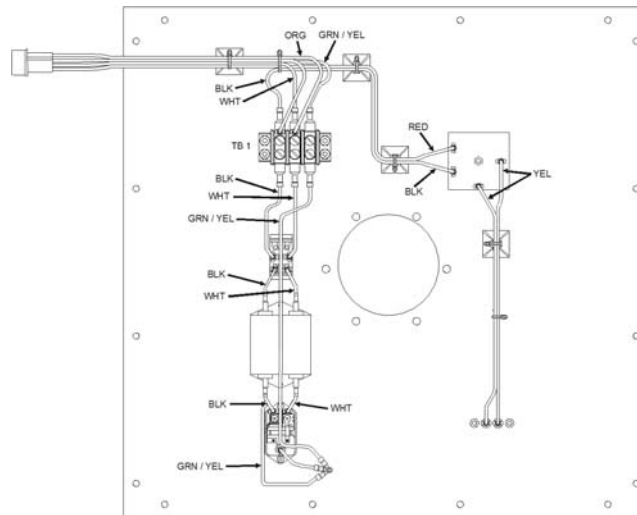
Figure 8 Removing the Load (Models AFTER 3/1/2010)



Item	Description
1	Load mounting clamp screws
2	Pressure switch wires
3	Fan-supply connector
4	Front panel connector

9. Record the wire colors and locations then disconnect the pump motor wires from the front panel terminal block (TB 1) (Figure 10).
10. Remove the screws that secure the front panel to the unit then tilt the top of the panel away from the unit and remove the two water hoses from the load water pipes.
11. Remove the front panel with the load attached.
12. Remove the nuts and lock washers that secure the load to the panel.
13. Remove the socket head cap screws that secure the water chamber to the load then remove the water chamber.
14. Inspect the water chamber to be sure it is in good condition and that the inner o-ring seal is good. If appropriate, order replacement parts.

Figure 9 Front Panel Wiring



## Removing the Pump

### WARNING

Disconnect the unit from all power sources before servicing. The unit may be energized from multiple sources. The potential for electric shock exists.

1. Drain the coolant (See ["Changing Coolant" on page 12](#)).
2. Remove the load (See ["Removing the Load" on page 16](#)).
3. Disconnect the pump wire leads from the terminal block on the inside of the front panel.
4. Loosen the hose clamps on the input and output hoses to the pump.
5. Remove the hoses.
6. Loosen the hose clamp on the drain tube at the base of the pump.
7. Remove the drain tube.
8. Unscrew the bolts securing the base of the pump to the unit.
9. Remove the pump, carefully, from the unit.

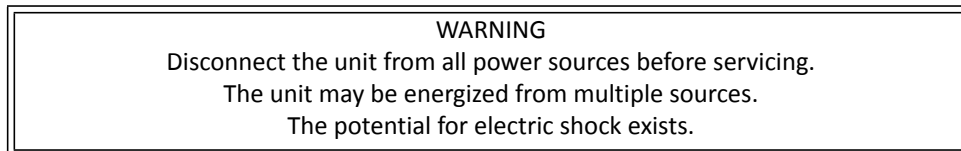
**Note:** Note the position and direction of the fittings, then twist them off counterclockwise.

10. To replace the pump, reverse the above steps.

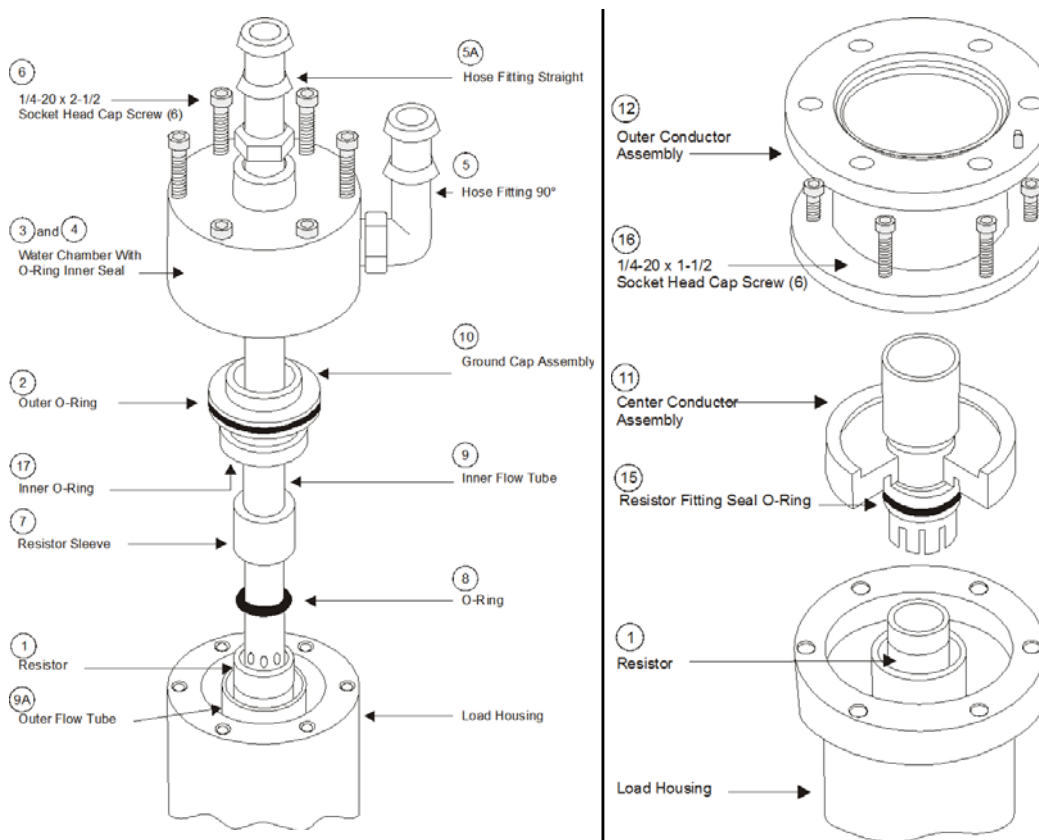
**Note:** When replacing the threaded fittings, carefully coat the external threads, ONLY, with a pipe sealing compound. Coating only the external threads reduces the chances of contaminating the coolant.

## Servicing the Resistor

The load is designed to be quickly and easily repaired in the field. If a significant change in the DC resistance is noted or if the resistor should fail, inexpensive replacement resistors are available.



**Figure 10** Load, Exploded View



## Removing the Resistor

**Note:** Numbers in brackets [ ] refer to the labeled parts in [Figure 10](#).

1. Disconnect the load (see "[Removing the Load](#)" on page 16).
2. Turn the load on end with the hose fitting up.
3. Use a  $\frac{3}{16}$  hex socket wrench to back the cap screws [6] approximately  $\frac{1}{2}$  inch.
4. Pull the water chamber assembly out. It may be necessary to rock the chamber gently while pulling.

**Note:** If the resistor [1] is intact it may be pulled straight out of the load housing and is ready for replacement. The outer flow tube is captive and will not come out of the housing at this stage.

The ground cap assembly [10] and the inner flow tube [9] should come out with the water chamber assembly. To remove the ground cap assembly [10], hold the resistor sleeve [7] on the flow tube and pull out the assembly. This includes the cushioning O-Ring [8] which fits loosely below the stop sleeve; do not lose it.

The resistor sleeve [7] has a small escape hole at the side and an access counter bore leading to it. If the sleeve is removed, be sure this counterbore faces the O-Ring and the resistor [1] during reassembly. This is essential for internal water venting. The base of the inner flow tube has water outlet holes and a small shoulder. At reassembly, these must fit into mating recesses in the input fitting.

## Inspecting the Resistor

---

**Note:** Carefully check the resistor [1] for fractures.

**Note:** Even in the event of resistor failure the resistor substrate will usually remain intact.

Check the inside of the load housing for damage to the internal parts.

- If no damage has been found proceed to [“Replacing the Resistor”](#).
- If the resistor is broken, other internal parts are damaged, or if the parts do not fit together properly, proceed to [“Removing a Fractured Resistor”](#).

## Removing a Fractured Resistor

---

1. Turn the load on end with the RF input connector up to allow any loose pieces of the resistor to fall out of the housing.
2. Use a  $\frac{3}{16}$  hex socket wrench to remove the cap screws [16].
3. Remove the outer conductor assembly [12].
4. Pull out the center conductor assembly [11].
5. Remove any remaining pieces of the resistor carefully.

**Note:** Normally the outer flow tube will remain with the load housing. If it comes out, return it after inspection and cleaning.

6. Check the inside of the load housing for damage.
7. Remove the inner flow tube [9] and ground cap assembly [10].

**Note:** Check them for broken pieces.

8. Under clear running water, thoroughly wash the inside of the conductor assemblies, load housing, and water chamber.
9. Replace the ground cap assembly and the inner flow tube.

## Replacing the Resistor

---

1. Insert the new resistor [1] into the resistor fitting of the center conductor assembly [15] to test its tightness.

**Note:** The resistor should be snug but should not have to be forced into the fitting. If the resistor is too loose, press the fitting fingers together slightly and try the resistor again. Continue closing the ends of the resistor fitting until a snug fit is obtained.

2. Bottom the resistor in the fitting.
3. Insert the resistor and the center conductor assembly into the load housing.
4. Replace the outer conductor assembly [12] and screw it into place.
5. Stand the load on its end with the RF connector down.
6. Replace the ground cap assembly onto the exposed end of the resistor. Make sure that it seats on the load housing.

**Note:** If the inner flow tube [9] is separated from the water chamber assembly [3], place it inside the resistor and lower until it reaches the resistor fitting. Gently twist the flow tube until it seats in the bottom of the resistor fitting.

7. Check that the O-Ring [8] is on the inner flow tube next to the resistor and the resistor sleeve [7] is right behind it.

8. Ensure the counterbore faces the O-Ring and the resistor.
9. Replace the water chamber [3], gently rocking and twisting the chamber to achieve a flat seat on the outer housing.

**Note:** *If the water chamber does not fit properly make sure that the inner flow tube is properly placed.*

10. Tighten the water chamber screws [6].
11. Check the DC resistance between the inner and outer conductors; it should be about 50 ohms.

**Note:** *Record this measurement as the new baseline reading.*

12. Install the load on the heat exchanger.
13. Connect the hoses and fill with coolant.
14. Run the pump for five minutes and check for leaks before applying RF power.

## Replacing the Conductor

---

1. Use a  $\frac{3}{16}$  Allen wrench to remove the cap screws [16] from the RF connector.
2. Remove the outer conductor assembly [12].

**Note:** *If only the outer conductor needs replaced, install it now and screw it into place.*

3. Remove the center conductor assembly [11] by pulling it carefully out of the load housing.
4. Ensure the resistor [1] and inner flow tube [9] do not come out with the center conductor.
5. Insert the new center conductor assembly into load housing.
6. Ensure the resistor fitting makes a snug fit with the resistor.
7. Replace the outer conductor and screw it into place.

## Preparation for Storage or Shipment

---

Store the Bird 8640 in a cool, dry area. For pure water-cooled units, the ambient temperature must be within 5°C to 50°C (41°F to 122°F). For units with 35% ethylene glycol, the ambient temperature must be within –25°C to 45°C (–13°F to 113°F). Drain the coolant (see "[Changing Coolant](#)" on page 12) if the unit will be stored for more than 30 days.

To ship, pack the unit in its original shipping container. If this is not available, securely pack and seal it in a sturdy wooden box or equivalent, with sufficient padding to avoid shock damage.

## Customer Service

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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](mailto:bsc@birdrf.com)

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

<http://www.birdrf.com>

## Specifications

<b>Frequency Range</b>	1 kHz – 900 MHz
<b>Power Rating</b>	25 kW continuous duty
<b>Mode</b>	CW, AM, FM, SSB, TV and certain pulse types
<b>Impedance</b>	50 ohms nominal
<b>VSWR</b>	1.10 max
<b>Connectors</b> 8645 8646	3 <sup>1</sup> / <sub>8</sub> inch EIA Flanged 3 <sup>1</sup> / <sub>8</sub> inch Unflanged
<b>Interlock Rating</b>	NO or NC Connections 5A @ 250 Vac 10A @ 125 Vac 48 Vdc
<b>Cooling Method</b>	Water dielectric and forced air convection
<b>Coolant<sup>1</sup></b>	Distilled water or distilled water/ethylene glycol mixture
<b>Coolant Capacity</b>	9 qts. (8.5 L) nominal
<b>AC Power</b> –115 –230 –230–6	115 VAC @ 11 A, 60 Hz 230 VAC @ 5.5 A, 50 Hz 230 VAC @ 5.5 A, 60 Hz
<b>Fuse Rating (864x)</b> 115 Vac 230 Vac	3AB Time-Delay 15 A 8 A
<b>Fuse Rating (864xB)</b> 115 Vac 230 Vac	Time-Delay 15 A (3AB) 8 A (5x20 mm)
<b>Ambient Temperature<sup>2</sup></b> Water only 35% Ethylene Glycol	+5 to +45 <sup>2</sup> °C (41 to 113 °F) –20 to +35 <sup>2</sup> °C (–4 to +95 °F)
<b>Dimensions</b>	26"L x 19-5/8"W x 19-1/4"H (670 x 500 x 490 mm)
<b>Weight, Nominal</b>	154 lb. (70 kg)

1 Below 5°C, ONLY use 35% E.G. and 65% Dist. H<sub>2</sub>O mixture

2 Above 30°C (86 °F) with water only, or 25°C (77 °F) with a 35% ethylene glycol mixture, derate power to 20 kW max.



## Replacement Parts

The parts lists in this section identify the components of the Bird Moduload. Exploded views are used to illustrate the component parts and indicate their relation to each other. Each part in the exploded view has an item number referencing the part list.

## Load

Item No.	Description	Qty	Part No.	
<b>Load Complete</b> 8645 8646		1	8745-101-1 8746-101	
1	Resistor	1	8755-027	
2	Outer O-Ring	1	8410-009	
3	Water Chamber	1	8755-014	
4	Water Chamber Inner O-Ring	1	5-099	
5	<b>Fitting, 90°</b>	1	<b>BEFORE 3/1/2010</b> 8640-089	<b>AFTER 3/1/2010</b> 8640A089
5A	<b>Fitting, Straight, consisting of:</b> Bushing Nipple	1 1	<b>BEFORE 3/1/2010</b> 5-489-1 5-490-1	<b>AFTER 3/1/2010</b> 8645A003
6	<b>Screw</b> 1/4-20 x 2-1/2 inch	6	1121-2508-00	
7	Resistor Sleeve	1	8755-026	
8	Sleeve O-Ring	1	8110-059	
9	Inner Flow Tube	1	8755-025	
9A	Outer Flow Tube	1	8755-024	
10	Resistor Ground Cap	1	8755-005	
11	<b>Center Conductor Assembly</b> 8645 8646	1	8755-007 8756-003	
12	<b>Outer Conductor Assembly</b> 8645 8646	1	8755-004 8756-002	
15	Center Conductor O-Ring	1	5-1127	
16	<b>Screw</b> 1/4-20 x 1-1/2 inch	6	1121-1808-00	
17	Inner O-Ring	1	5-567	

## Heat Exchanger

Description	Qty	Part No.
<b>AC Cord</b> 864x-115 864x-230	1	5-1836 5-1837
<b>Fan Assembly</b> (model 864x) 864x-115 864x-230 and 864x-230-6 8646-230-6-N	2	8640-668-1 8640-668-2 8640-668-4
<b>Fan Assembly</b> (model 864xB) 864xB - 115 864xB - 230 and 864xB - 230-6	2	5A2770-1 5A2770-2
<b>Pump</b> (model 864x) 864x-115 864x-230 864x-230-6	1	8640A505-1 8640A505-2 8640A505-4
<b>Pump</b> (model 864xB) 864xB - 115 864xB - 230 864xB - 230-6	1	8640B505-1 8640B505-2 8640B505-4
<b>Flow Switch Assy</b> (model 864x)	1	8645-004
<b>Flow Switch Assy</b> (model 864xB)	1	8645B004
<b>Interlock Relay</b> 864x-115 864x-230 864xB series	1	5-1627 5-1625 5A2787-1
<b>Pressure Switch</b> (Replaces Flow Switch in units AFTER March 2010)	1	8645C004
<b>Fuse</b> (model 864x) 864x and 864xB -115 864x - 230 864xB - 230	2	5-1828-36 (15 A 3AB time delay) 5-1828-33 (8 amp 3AB time delay) 5A2257-25 (8 amp 5x20 mm)
<b>Fuse</b> (model 864xB) 864xB - 115 864xB - 230	2	5-1828-36 (15 A 3AB time delay) 5A2257-25 (8 A 5x20 mm)
Coolant Gauge Kit	1	5-1200
Ethylene Glycol	1 Gal.	5-1134-3

## 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.