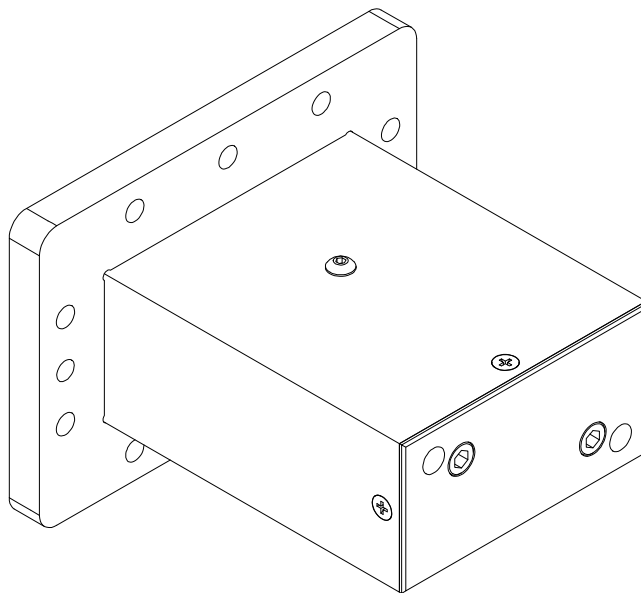

Product User Manual

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Models GA1202 Short Dummy Load, WR340



Document # 930098, Rev. 1



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REVISION HISTORY			
REV.	DESCRIPTION	DATE	APPROVAL
1	RELEASED	27MAR08	JFG

WARRANTY

Products manufactured and sold by Gerling Applied Engineering, Inc. (“GAE”) are warranted to be free of defects in materials and workmanship under normal use and service for a period of twelve (12) months from the date of original shipment. GAE’s obligation under this warranty is limited to repairing or replacing, at GAE’s option, all non-consumable component parts. Consumable parts are specifically excluded from this warranty and may include, but are not be limited to, magnetrons, fuses, lamps, seals, o-rings, v-belts, and fluids. All warranty repairs are to be done at GAE’s facility or as otherwise authorized by GAE. All shipping charges for warranty repair or replacement are the purchaser’s responsibility unless otherwise agreed to by GAE.

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DOCUMENT CONVENTIONS



NOTE: Means the reader should take note. Notes contain helpful information, suggestions, or references to other sections, chapters, or documents.



CAUTION: Means the reader should be careful. You are doing something that might result in equipment damage or loss of data.



WARNING: Means danger. A situation exists that could cause bodily injury or death. All personnel must be aware of the hazards involved with high voltage electrical circuitry and high power microwave devices.



WARNING

All waveguide dummy loads manufactured by GAE are intended for use with other equipment capable of producing a microwave field that is potentially hazardous to operating personnel. It must never be connected or operated in a manner that allows a field in excess of 10 milliwatts per square centimeter to be generated in an area accessible to operating personnel. Contact GAE, Inc. for technical support prior to installation and/or operation of this unit if there is any question or concern about microwave leakage.

All waveguide flange and electrical cable connections throughout the system must be secure prior to operation. Never operate the microwave generator without a properly rated absorbing load attached. To ensure safe operation and prevent microwave leakage, the equipment must be periodically inspected and maintained as required or recommended.

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EQUIPMENT DESCRIPTION

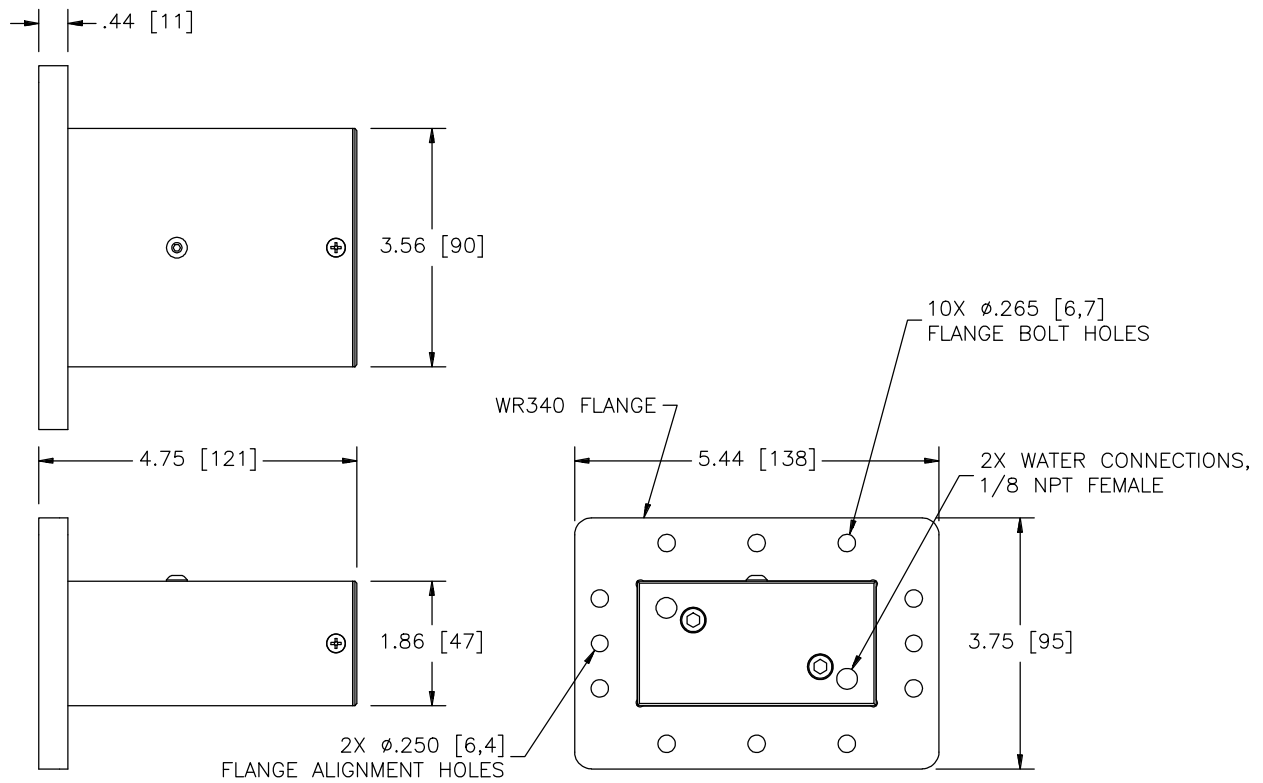
The GA1202 Short Dummy Load is designed for use in high power microwave networks as a means to dissipate up to 6kW of microwave power that is not being utilized for other purposes. The compact design and high reliability of these loads make them ideal for a variety of uses. Typical applications include magnetron isolation from reflected power (when used with a 3-port circulator), high power test stations and variable Q applicators.

Microwave power delivered to the dummy load is absorbed by water which internally flows through channels in a solid UHMW polyethylene block. Naval brass is used for all water fitting connections to minimize corrosion. The waveguide body is fabricated with dip brazed aluminum.

Specifications

Waveguide	WR340
Flange	UG-554/U
Frequency	2450 MHz nominal
Incident Power	Up to 6kW continuous
Return Loss	-20 dB min @ 2450 MHz
Water Connections	1/8 NPT female
Water Flow	1.0 gpm nominal, 2.0 gpm maximum
Water Pressure	70 psi maximum
Water Temp	Inlet: 40 °F (4 °C) minimum Outlet: 150 °F (66 °C) maximum

Outline Drawing



INSTALLATION

Preliminary Inspection

Upon arrival at the installation site the dummy load should be thoroughly inspected for damage or wear caused during shipping. Any visible damage to the packaging material or dummy load should be noted and reported immediately to the shipping company in accordance with standard claims procedures. The following components are included:

- a) Short Dummy Load
- b) Product User Manual

Waveguide Configuration

The dummy load can be connected to and used with any common waveguide component having a compatible flange. The mounting position can be in any orientation.

Figure 1 below illustrates a common configuration in which the dummy load is used in conjunction with a 3-port circulator to protect the magnetron by absorbing microwave power reflected from the process load.

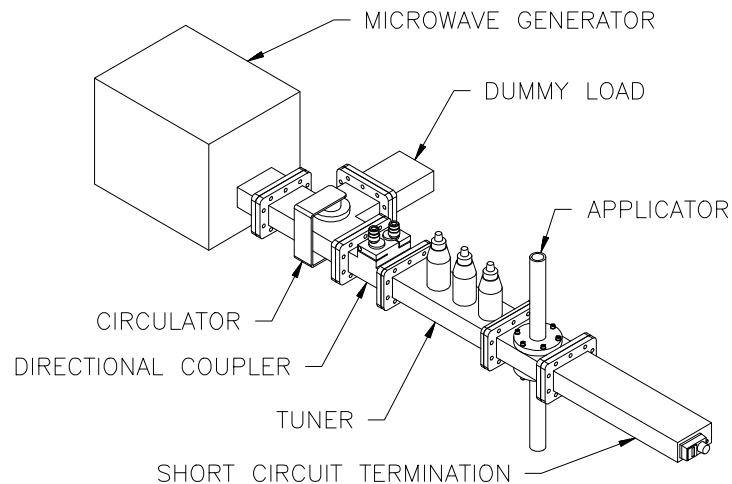


Figure 1 – Typical waveguide configuration using the dummy load to absorb reflected microwave power.

Flange Connections

The waveguide flange of the dummy load must be properly connected to another waveguide component having a similar flange style. Bolts and nuts must be installed at all flange bolt holes and tightened securely prior to operation.



Microwave Leakage – Regulatory limits for microwave leakage relate to standards for human safety and interference with other electronic devices. Standards for human safety as adopted by OSHA, the International Electrotechnical Commission (IEC) and other regulatory agencies limit leakage to 5 mW/cm² measured at 5 cm from the leakage source under normal operating conditions, and 10 mW/cm² at 5 cm from the source under abnormal operating conditions. The U.S. Federal Communications Commission (FCC) has established regulations limiting the emission of energy at frequencies outside the ISM bands. All GAE waveguide components meets these requirements when properly connected to another waveguide component.

Water Flow Requirements

A source of water must be connected to the dummy load that provides an adequate rate of flow. The nominal water flow rate is 1.0 gpm. However, the flow rate must be maintained such that the outlet water temperature does not exceed 150 °F. The minimum allowable flow rate depends on the level of incident microwave power and the inlet water temperature. Figure 2 below shows the minimum flow rate vs. incident microwave power and inlet water temperature.

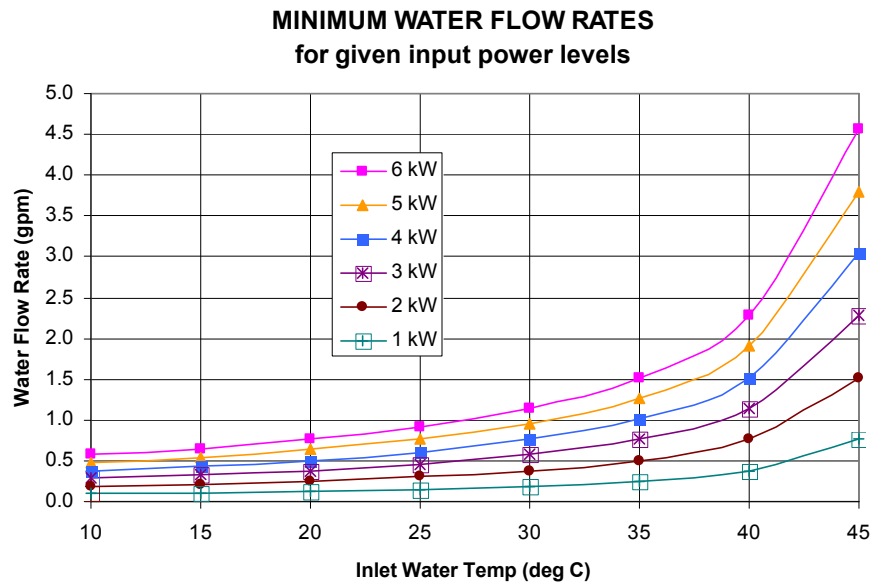


Figure 2 – Recommended minimum water flow rates for given inlet water temperature and incident microwave power level.



CAUTION: Failure to provide an adequate rate of water flow can result in severe damage to the dummy load. It is strongly recommended that an interlock device such as an in-line water flow

switch be used to prevent operation of the microwave generator in the event of inadequate or loss of water flow.

Water Fitting Connections

Standard 1/8 NPT female fittings are provided at the end of the dummy load opposite the waveguide flange. The source of water can be connected to either fitting. It is recommended that a thread sealant such as Teflon pipe thread tape be used to ensure a leak-free connection. Care should be taken to prevent debris from falling into the fitting holes.

Storage and Shipping

Upon removing the dummy load from the set-up it is recommended that all water be drained prior to storage or shipping. This precaution will prevent damage in the event that freezing temperatures are encountered during storage or shipping.

THEORY OF OPERATION

Basic Operation

The GA1202 dummy load utilizes water as the medium for absorbing microwave energy that enters through the waveguide flange. The internal UHMW polyethylene block through which the water flows is transparent to microwave energy (referred to as having “low dielectric loss” characteristics) and allows the energy to be absorbed directly into the water. The dielectric loss of water is relatively high and is capable of absorbing over 99% of the incident microwave energy.

Performance Considerations

In order to absorb substantially all of the incident microwave energy, the characteristic impedance of the dummy load must be a close match to that of the waveguide to which it is connected. The factors that influence this impedance match include the microwave frequency, the dielectric properties of the insert block and the water, and the physical geometry of the block and the channels through which the water flows.

The dielectric properties of most materials vary with changes in temperature. In the case of water, an increase in temperature causes a decrease in its dielectric loss and, in general, results in a decrease in microwave energy absorption. However, the geometry of the absorbing load can be optimized, or “tuned”, for the dielectric properties at a desired temperature. In this case, energy absorption is maximized at the design temperature and is reduced at both higher and lower temperatures.

The dummy load is designed for optimal performance at inlet water temperatures between 75 °F (24 °C) and 85 °F (29 °C). For best performance the outlet water temperature should remain as close as possible to the inlet temperature. A low water flow rate and high incident power causes a large increase in temperature which, since the heated water is still inside the load, results in a “detuning” of the load impedance and a decrease in energy absorption.

USER MAINTENANCE AND REPAIR

The GA1202 dummy load is designed to be maintenance free and does not require any user maintenance under normal operating conditions. However, the dummy load can sustain damage if the water flow rate is insufficient to prevent vaporization (boiling) while operating under conditions of high incident microwave power.

In the event of damage due to insufficient or lack of water flow, the dummy load can be easily repaired by replacing the polyethylene insert block. Repair kit model GA8105 available from GAE includes all necessary components for replacement of the insert block.

Insert Block Replacement Procedure

1.1 Equipment Requirements

Hex (Allen) drivers, 3/32", 3/16"

1.2 Disassembly

WARNING: Turn off microwave power and disconnect line power from the microwave generator before disconnecting any waveguide components.

- 1.2.1** Disconnect the water supply and drain from the water fitting connections at the back of the dummy load.
- 1.2.2** Remove the dummy load from the waveguide set-up and drain the water from inside the load.
- 1.2.3** Remove the button head screw from the waveguide side and remove the matching slug.
- 1.2.4** Remove the two socket head screws at the back of the dummy load.
- 1.2.5** Insert the hex driver into one of the two screw holes and gently push the insert block out of the dummy load waveguide.

1.3 Reassembly

- 1.3.1** Inspect the inside of the waveguide for signs of damage and/or corrosion. In particular, carefully inspect the four o-rings seats on the inside of the back wall. Additional repairs may be required in the event of internal damage or excess corrosion.

CAUTION: Excess corrosion can prevent a water-tight seal or cause premature failure of the seals and result in damage to other equipment. In this case the dummy load may not be repairable and should be discarded.

- 1.3.2 Remove the four greased o-rings from the polyethylene bag and place them into each of the four seats on the inside back wall of the dummy load.
- 1.3.3 Carefully slide the insert block assembly into the dummy load waveguide. Ensure that the two plugs (with smaller o-rings) on the sides of the block are fully inserted into the counter-bore holes.
CAUTION: If the plugs have come out (as may happen during shipping), ease them back in while being careful to avoid nicking the o-rings on the edge of the counter-bore.
- 1.3.4 Insert the two 1/4-20 socket head screws into the counter-bored holes at the end of the waveguide and engage the screw threads into the insert block. Carefully tighten the screws with the hex driver just enough to compress the o-rings.
CAUTION: Over-tightening the screws will cause the Helicoil inserts inside the block to become loose and may result in permanent damage to the insert block.
- 1.3.5 Reinstall the matching slug and secure with the #8-32 button head screw.
- 1.3.6 Install water fittings, apply water pressure (70 psi max.) and check for water leaks.
- 1.3.7 Reinstall dummy load into waveguide set-up.

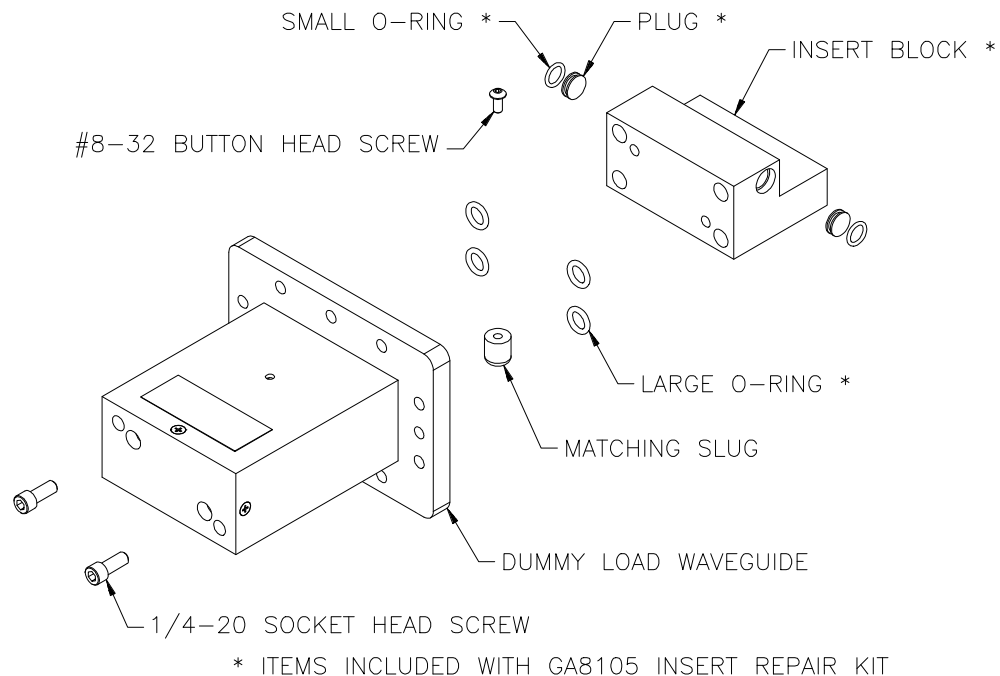


Figure 3 – Exploded view of dummy load assembly.