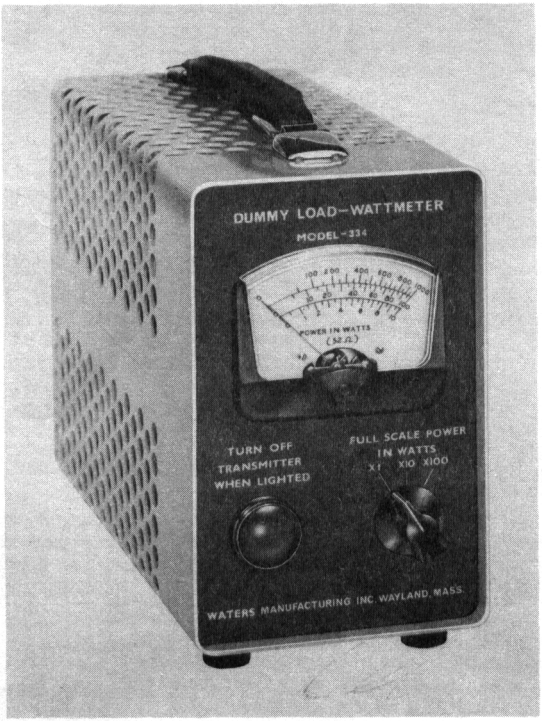
INSTRUCTION AND OPERATING NOTES

DUMMY LOAD - WATTMETER

MODEL 334



Waters MANUFACTURING, INC.
WAYLAND, MASSACHUSETTS

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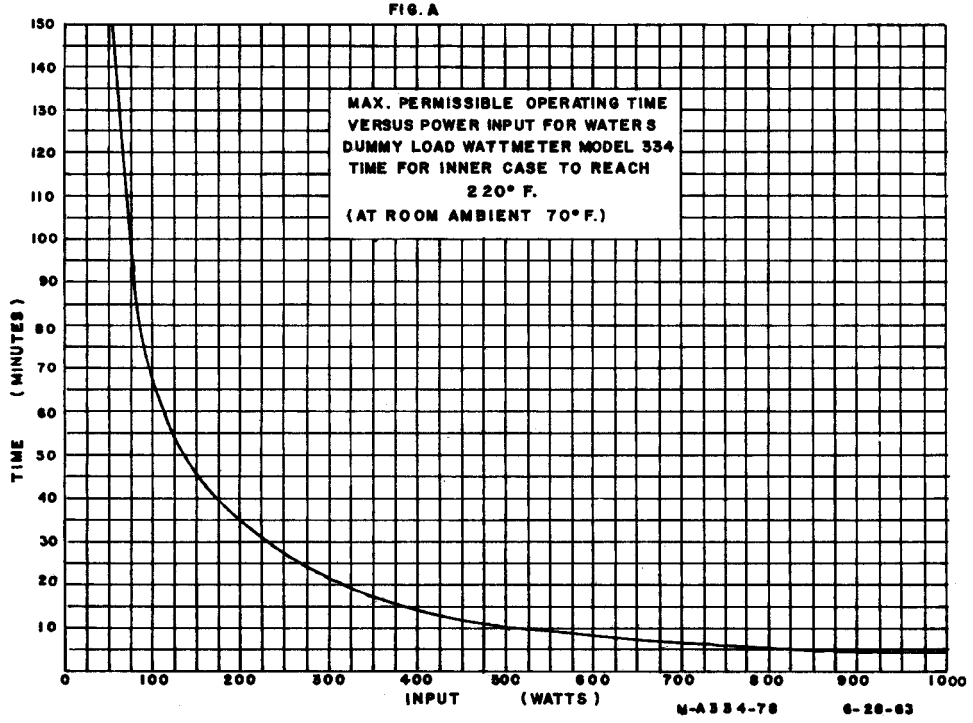
SPECIFICATIONS

Frequency Range:	2 to 230 megacycles.
Load:	Non-Inductive, oil cooled.
Load Impedance:	52 ohms.
VSWR:	Less than 1.3:1 up to 230 megacycles.
Power Range:	1000 watts peak (intermittent duty). See Fig. A below. (Maximum inner case temperature of (220° F. will be reached in 5 to 7 (minutes at 1 Kw input. Warning (light signals this point).
Wattmeter Range:	3 calibrated scales: 0 - 10 w 0 - 100 w 0 - 1000 w
Wattmeter Accuracy:	2 - 30 megacycles ± 5.0 % of full scale. 30 - 150 megacycles ± 10.0 % of full scale. 150 - 230 megacycles ± 20.0 % of full scale.
Input Connector:	Hermetically sealed SO-239 UHF mates with JAN standard PL-259. (Amphenol 83-1SP)
Size:	4 3/4" x 9" x 10 1/4"
Weight:	12 lbs.

FIG. A



DUMMY LOAD-WATTMETER

MODEL 334

OPERATING INSTRUCTIONS

DESCRIPTION

The WATERS Model 334 Dummy Load-Wattmeter is a Radio Frequency Power Absorption Device with an integral Wattmeter and is designed to permit non-radiating performance tests of radio transmitting equipment.

The frequency range of the Dummy Load-Wattmeter is 2 - 230 megacycles, and the intermittent duty power rating is 1000 watts. RF power input is by means of an hermetically sealed UHF connector on the rear panel of the unit. The nominal impedance of the unit is 52 ohms.

The Dummy Load-Wattmeter is mounted in a modular-designed steel case 4 3/4" x 9" x 10 1/4" and is equipped with a top-mounted carrying handle. Design of the case is such as to permit mounting of the unit in rack panels for fixed laboratory or station use.

OPERATING PRINCIPLES

The Dummy Load-Wattmeter is a completely passive device. The power absorbing resistor is a structured monolithic 52 ohm non-inductive resistance unit designed to present a constant impedance load to the transmitter under test over the entire frequency range of DC to 230 megacycles. The structured load resistor is tapped electrically to provide an attenuated RF voltage to a diode, and is mounted in a sealed, steel container filled with a controlled dielectric oil that is used as a coolant. Also mounted on the sealed container is a thermostatic switch, that together with the panel-mounted light, serves as an indicator of maximum safe operating temperature. Power for this warning light is furnished by a 120 volt AC line. (6 watts). Electrical connections to the sealed container are made through hermetic seals. The RF Wattmeter is mounted outside the sealed container on the front panel. A rectified DC voltage from the diode on the structured resistor is fed to the metering circuit through suitable filters and a resistive attenuator to provide three full-scale power ranges of 0 - 10, 0 - 100, and 0 - 1000 watts.

Accuracy - The Dummy Load-Wattmeter is calibrated at the time of manufacture, both for nominal impedance (52 ohms) and for power accuracy, using precision, laboratory standards for both impedance and power.

Impedance - The load impedance is determined solely by the geometry of the structured resistor and once sealed in the oil-filled container is not adjustable. The nominal resistance value is 52 ohms and will remain constant from zero frequency to 230 megacycles. The maximum VSWR is 1.3:1.

Power - The entire load and wattmeter is calibrated using a low frequency precision wattmeter. Each of the three power ranges has an adjustment potentiometer to set the end point of each scale. Since sufficiently accurate voltage and power measuring instruments are not generally available in the field, it is not recommended that these adjustments be changed by the user. The Wattmeter is accurate from 2 - 230 megacycles within the following limits:

2 - 30 Mc.	± 5.0 % full scale
30 - 150 Mc.	± 10.0 % full scale
150 - 230 Mc.	± 20.0 % full scale

OPERATING LIMITATIONS

WARNING - Under no conditions permit power levels in excess of 1000 watts PEAK to be connected to the Dummy Load-Wattmeter. The diode in the voltmeter will be destroyed above this level. Waters Manufacturing, Inc. will NOT accept warranty responsibility for burned-out diodes.

Power - The Dummy Load-Wattmeter is designed for intermittent duty at PEAK power levels up to 1000 watts, CW. In amplitude modulated service, the maximum RF carrier, 100% modulated, that may be applied is 500 watts. Maximum temperature for safe operation is 220° F. When this temperature is attained, the panel-mounted warning light comes on at which time the power should be turned off. At 1000 watts input to the Dummy Load-Wattmeter, the time warning indication will be 5 - 7 minutes. Normal cooling time to return to room temperature from maximum power is 90 minutes.

Frequency - The Dummy Load-Wattmeter is rated for operation from 2 - 230 megacycles. This range has been selected as a compromise between the resistor limitations and those of the wattmeter. At 2 megacycles and lower, the wattmeter accuracy will begin to fall off, although the load resistor is accurate to zero frequency and may, of course, be used as a termination to DC. At frequencies above 230 megacycles, the impedance of the resistive structure rises above 52 ohms and results in both a mismatch to the transmitter and, of course, in wattmeter readings considerably higher than expected. It is permissible to use the Dummy Load-Wattmeter as high as 450 Mc., subject to the limitation of accuracy and, in addition, we recommend that maximum power applied above 230 Mc. should be 250 watts.

Temperature - Since the Dummy Load-Wattmeter is a power absorbing device, it is expected to get hot in operation. Care should be exercised in the selection and use of a coaxial cable to connect into the Dummy Load-Wattmeter because of this heat. If it is contemplated to use the Dummy Load-Wattmeter continuously at maximum power, it is recommended that high temperature coaxial cable (RG-87A/U) be used, and that no bends be made in this cable less than 5-inches in radius. Do not operate the Dummy Load-Wattmeter without connecting the line cord to operate the Warning Light Circuit. Observe and use the chart for time versus power, Fig. A.

OPERATING INSTRUCTIONS AND APPLICATIONS

The Model 334 Dummy Load-Wattmeter is a termination unit and is not intended to be operated as a series line instrument. It serves as an artificial antenna and should

be connected only to the output of a radio transmitter, through appropriate coaxial cable and connectors. The line cord should be connected to a 120 volt line to provide power to operate the thermostatically controlled Warning Light. For field service where 120 volt power is not available, the 6S6 bulb may be replaced with a #6S6-12V bulb and the line cord connected to a 12 volts DC source. For convenience in fixed station use, it is suggested that a coaxial selector switch may be used to facilitate use of the Dummy Load-Wattmeter for both tune-up procedures, as well as checking output power of the transmitter. If the normal station antenna system is properly matched for 52 ohms, all tune-up may be done on the Dummy Load-Wattmeter, thus keeping interference from being radiated on the air. Once the transmitter is properly tuned and loaded into the Dummy Load-Wattmeter, the coaxial switch transfers the output from the Dummy Load-Wattmeter to the antenna with little or no further tuning. (See Fig. 2). CAUTION: Turn off transmitter when switching!

Other uses for the Dummy Load-Wattmeter are possible as follows:

a) Measuring Loss in Coax Cable. (See Fig. 3).

Connect the Dummy Load-Wattmeter to transmitter, either directly or through a WATERS Type 336 Coaxial Transfer Switch. Operate transmitter (on CW), read and record output power (W_1) from Dummy Load-Wattmeter. Next, insert in series with Dummy Load-Wattmeter and the transmitter, the cable under test. Again operate transmitter, reading and recording power output (W_2) from Dummy Load-Wattmeter. Cable loss is then determined:

$$\text{Attenuation (db)} = 10 \log \frac{W_1}{W_2}$$

b) Checking and Adjusting Calibration of VSWR Bridges

Since the Type 334 Dummy Load-Wattmeter is an excellent 52 ohm termination, it may be used to check the accuracy and balance of any type VSWR Bridge. Connect the Dummy Load-Wattmeter to output of VSWR Bridge in place of the antenna. Operate transmitter. Bridge indicating meter should read zero on reverse wave. If not, following VSWR unit instructions, perform balance adjustment for zero reading. Next, REVERSE VSWR Bridge coaxial connections and again read Bridge indicator but for FORWARD wave, which should be zero. If off zero, adjust Bridge balance to obtain zero.

MAINTENANCE

Since the entire load resistor, diode and filter are sealed in the oil-filled container, no field maintenance is possible. The only field replaceable part is the warning light bulb which may be obtained from most electrical distributors.

If the user has reason to suspect the accuracy of the power measurement, it is possible with simple equipment to obtain an APPROXIMATE indication of the overall system accuracy. The procedure requires a source of commercial AC power at 120 volts, 60 cycles, and an AC voltmeter of at least 5% full scale accuracy. Make up a line cord with a PL-259 male coaxial plug on one end and a standard AC appliance plug on the other

end. Using this line cord, connect the Dummy Load-Wattmeter to the power line and adjust the line voltage to 120 volts. Be careful to see that the ground side of the 120 volt line is connected to the case of the Dummy Load-Wattmeter to prevent shock hazard. With the Dummy Load-Wattmeter range switch on the 100 watt scale, the Wattmeter should read a value of power. On the rear panel label is an inspection stamp in the center of which is a hand-written number followed by the letter "W". This is the reading in watts on the 100 watt scale that was obtained at the factory test department immediately following calibration. Taking into account the accuracy of your AC meter and possible changes in the Dummy Load-Wattmeter itself, you should read the same power value, plus or minus 10%. No serious attempt should be made to equate this reading to an actual RF power rating, since the time constant of the Dummy Load-Wattmeter circuit is NOT compensated for use at 60 cycles.

No field adjustment of impedance is possible and under no condition should the sealed unit be opened in the field.

WARRANTY

Standard Electronic Instrument Warranty

Each instrument, or part, thereof, sold by Waters Manufacturing, Inc. is warranted to be free from original defects in material and workmanship.

The obligation under this warranty is limited to the repair or replacement of any instrument or part thereof, except tubes, semi-conductor devices, and batteries, which shall, within the period of 6 months from the shipment to the original purchaser, prove upon examination by Waters Manufacturing, Inc. to have become defective through normal use or handling, providing further that the original customer has filled out and returned the Warranty Record Card to the manufacturer within 10 days from date of purchase.

In all cases where service or adjustment is required, please write first to the factory, giving full information concerning the nature of the failure, including type and serial number of the equipment. Written procedure for returning the instrument to the factory will be given.

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications.

Factory Service

Since no field maintenance is practical, a uniform flate-rate service charge will be made on any sealed, load resistance units found defective or damaged in service. Units that have been damaged, opened, or tampered with in the field, are NOT subject to repair under any conditions.

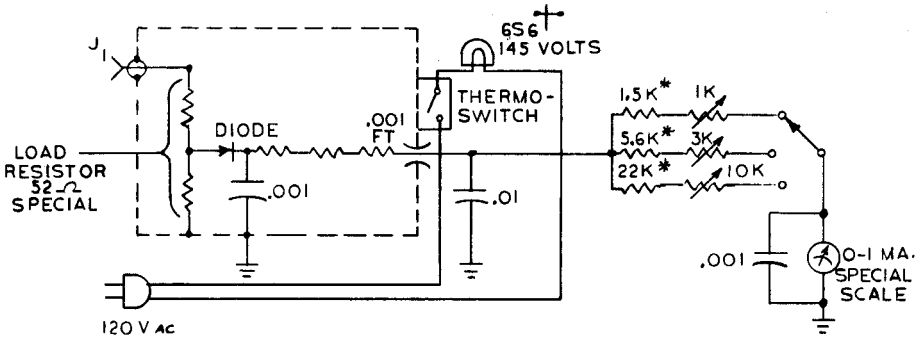


FIG. 1 SCHEMATIC

M-A334-69/AA 6-28-63

* EXACT VALUE SELECTED AT FINAL TEST.

+ FOR FIELD USE LAMP CAN BE CHANGED TO 6S6 12V FOR 12 VOLT D.C. OPERATION

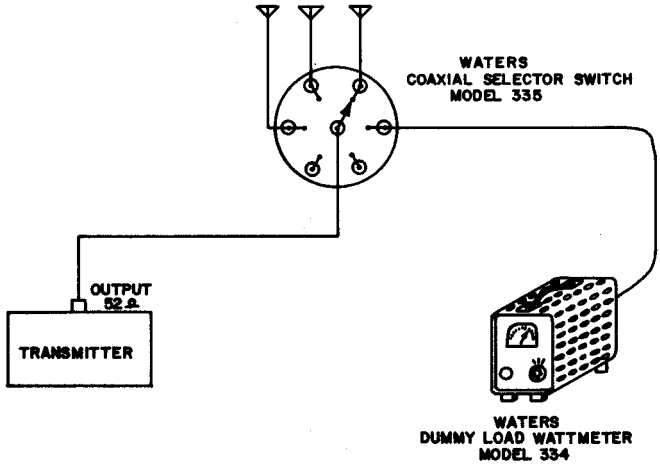


FIG. 2 CONNECTION TO RADIO TRANSMITTER

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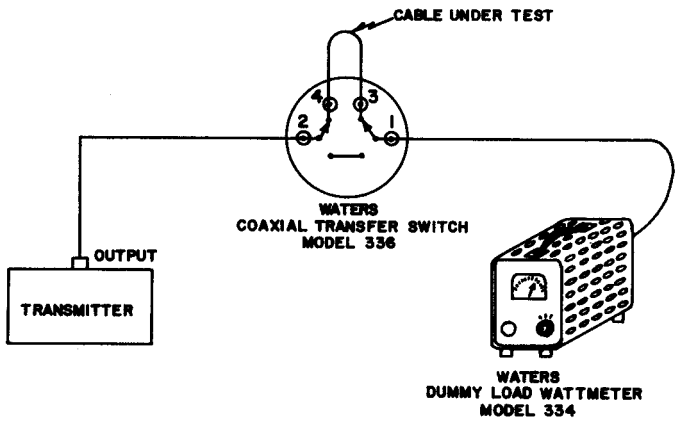

FIG. 3 MEASUREMENT OF CABLE ATTENUATION

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