ALTRONIC RESEARCH, INC.

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U.S.A.

LIQUID-COOLED
COAXIAL LOAD RESISTOR
MODEL 5705

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INTRODUCTION

This manual gives you specific information on the installation, operation and service of OMEGALINE® coaxial resistors. Most of the loads are field serviceable, but we recommend their return to us for repair. Mistakes can be costly compared to the low cost for our trained personnel to make the repairs and return the load to new performance specifications. Labor and packaging costs are minimal. We take the load completely apart, clean and inspect all parts, repair/replace as necessary, reassemble, water pressure test, power test, VSWR test and package the load for shipment. If new parts are required in the load (such as resistors etc.), this will be an additional cost. The average turn-around time on repairs is approximately 7 working days and generally will depend on your needs. When sending in repairs, please include: your company name and address, the operating frequency you use, fax number, telephone number and your name in case we need to talk to you about the load or obtain shipping instructions. We can accommodate most shipping modes.

SHIP TO: Altronic Research, Inc., Hwy. 14 South, Yellville, AR 72687. Our mailing address is P.O. Box 249.

Note: We also repair dummy loads manufactured by many other companies.

Call for information (870-449-4093).

PRECAUTIONS

CAUTION

USE ONLY CLEAR, COLORLESS, ANALYTIC OR TECHNICAL GRADE ETHYLENE GLYCOL WITH PURE TAP OR POTABLE* WATER AS A SOURCE COOLANT. DO NOT USE ANY STOP LEAK, SEALANTS, AUTOMOTIVE ANTIFREEZE OR UNION CARBIDE UCARTHERM™ IN COOLANT. USE OF THESE SUBSTANCES WILL VOID THE WARRANTY.

IMPORTANT

ADDITION OF ETHYLENE GLYCOL TO THE WATER REDUCES THE HEAT CAPACITY OF THE COOLING SYSTEM. COOLANT FLOW RATE MUST BE INCREASED BY AT LEAST 20% OVER MINIMUM FLOW.

CAUTION

DO NOT APPLY MORE THAN THE MAXIMUM RATED RF POWER TO THE LOAD. THIS WILL CAUSE INTERNAL DAMAGE TO THE LOAD.

* **Potable Water:** The U.S. Health Department has established standards for potable water at a maximum of 500ppm of dissolved solids. Hard water (particularly dissolved salts) can cause damage to resistive film and load. Water condition can be adjusted by mixing distilled water in sufficient quantities with coolant water.

PRECAUTIONS

!!!DANGER!!!

THIS UNIT MUST BE TOTALLY DISCONNECTED FROM ALL RF POWER BEFORE ANY REPAIRS ARE ATTEMPTED. ANY ATTEMPT AT REPAIR WITHOUT DISCONNECTING THE POWER COULD RESULT IN *FATAL ELECTRICAL SHOCK*!!!

WARNING

DO NOT APPLY POWER WITHOUT THE MINIMUM RATED FLOW OF COOLANT THROUGH THE LOAD. A SAFETY INTERLOCK SWITCH IS RECOMMENDED. EVEN A BRIEF APPLICATION OF POWER TO THE LOAD WITHOUT THE CIRCULATION OF COOLANT WILL CAUSE IMMEDIATE BURN OUT.

WARNING

THE LOAD RESISTOR CONSISTS OF A CERAMIC SUBSTRATE COATED WITH A SPECIAL RESISTIVE FILM. IF ANY DAMAGE OCCURS TO THE RESISTOR, THERE COULD BE SHARDS OR SHARP BROKEN PIECES OF CERAMIC IN THE LOAD. CARE SHOULD BE TAKEN SO THAT NO INJURIES OR CUTS WILL OCCUR.

GENERAL DESCRIPTION

The OMEGALINE® dummy load is basically a termination-type unit having its characteristic impedance at the input end and tapered to zero impedance (short circuit) at the other end. The center conductor is a tubular resistor whose DC resistance is equal to the characteristic impedance of the line. The outer conductor of the coaxial line is a symmetrical horn-shaped enclosure, contoured logarithmically along its length to obtain a reflection-free termination. The RF dielectric medium consists of three distinct materials: the liquid coolant, the plastic water jacket and the air space. (See Fig. 1)

Coolant enters the load at the electrically shorted end, flows axially down the center of the resistor tube, mushrooms over into the annular channel under the water jacket, and makes a second pass over the resistor in direct physical contact with the resistive film. Thus the coolant makes intimate contact with both the inside and outside cylindrical surfaces of the resistor, providing optimum heat transfer with minimal flow rate.

The dummy load housing is constructed of aluminum and/or brass or bronze sections whose inner surfaces are machined to a modified logarithmic taper. The stepped housing sections are held in accurate alignment with stainless steel socket head cap screws. The power dissipating resistor consists of a conductive resistive film which is deposited on a tubular ceramic substrate with silver bands fired on the ends for electrical connection. Contact to the resistor is made by silver plated spring fingers. Coolant flows through the fingers and passes directly over the resistive film. The resistor is enclosed within a plastic water jacket which is custom machined to match the body and seal the coolant flow.

Fig. 1 - The OMEGALINE® Coaxial Load Resistor

ELECTRICAL CHARACTERISTICS

POWER RATING - All models of the OMEGALINE® series of coaxial loads are rated for continuous duty and may be operated in any position at any power level within their rating and with the proper water flow rate. A 10-20% GREATER FLOW RATE MAY BE USED AND IS RECOMMENDED. If the units are operated below the maximum power rating, a corresponding reduction in the coolant flow rate may be used. (See Fig. 4)

All loads are electrically tested prior to shipment. Testing is done at 60 Hz with input voltage and current measured on RMS meters. The (RMS) power being dissipated in the load is simultaneously checked by calorimetry. The relationship used for calculating the power dissipated in the load from the calorimetric data is:

(See Fig. 2 & 2A)

$$P = 0.264\,(T_2 - T_1)Q$$

Where P = Power in load in kilowatts

T_2 = Outlet water temperature °C

T_1 = Inlet water temperature °C

Q = Water flow in gallons-per-minute

WARNING!

Power should never be applied before turning on the WATER FIRST and allowing sufficient time (approx. 1 minute) for complete wetting of the resistor and elimination of air bubbles. Water flow must be maintained throughout the application of power and may be turned off within 15-30 seconds after the power has been turned off. Failure to observe these precautions will result in instant failure of the resistor and possible destruction of other parts of the load.

FREQUENCY RANGE - The OMEGALINE® terminations are designed to match the most common high frequency transmission media - - 50 and 75 ohm coaxial lines. The units are universal and operate over an extremely wide frequency range - from power line frequencies to beyond the UHF band. If we regard the upper limit of the frequency range to be the region where the VSWR reaches 1.25, then models with a 1-5/8" diameter input will have a useful range up to about 2200 MHz; models designed for 3-1/8" transmission lines will have a useful range up to 1800 MHz; those models adapted to 6-1/8" coaxial lines will have a useful range to 1200 MHz.

IMPEDANCE - The impedance of the loads, in the language of VSWR (voltage-standing-wave-ratio), is quite independent of frequency, water flow rate and water temperature. It is almost purely resistive. For most models, the VSWR is maintained below 1.1 to 800 MHz. Below 100 MHz the input impedance can be regarded as purely resistive and equal to the DC resistance of the load. The tolerance on the DC resistance is held within 4 percent.

Fig. 2

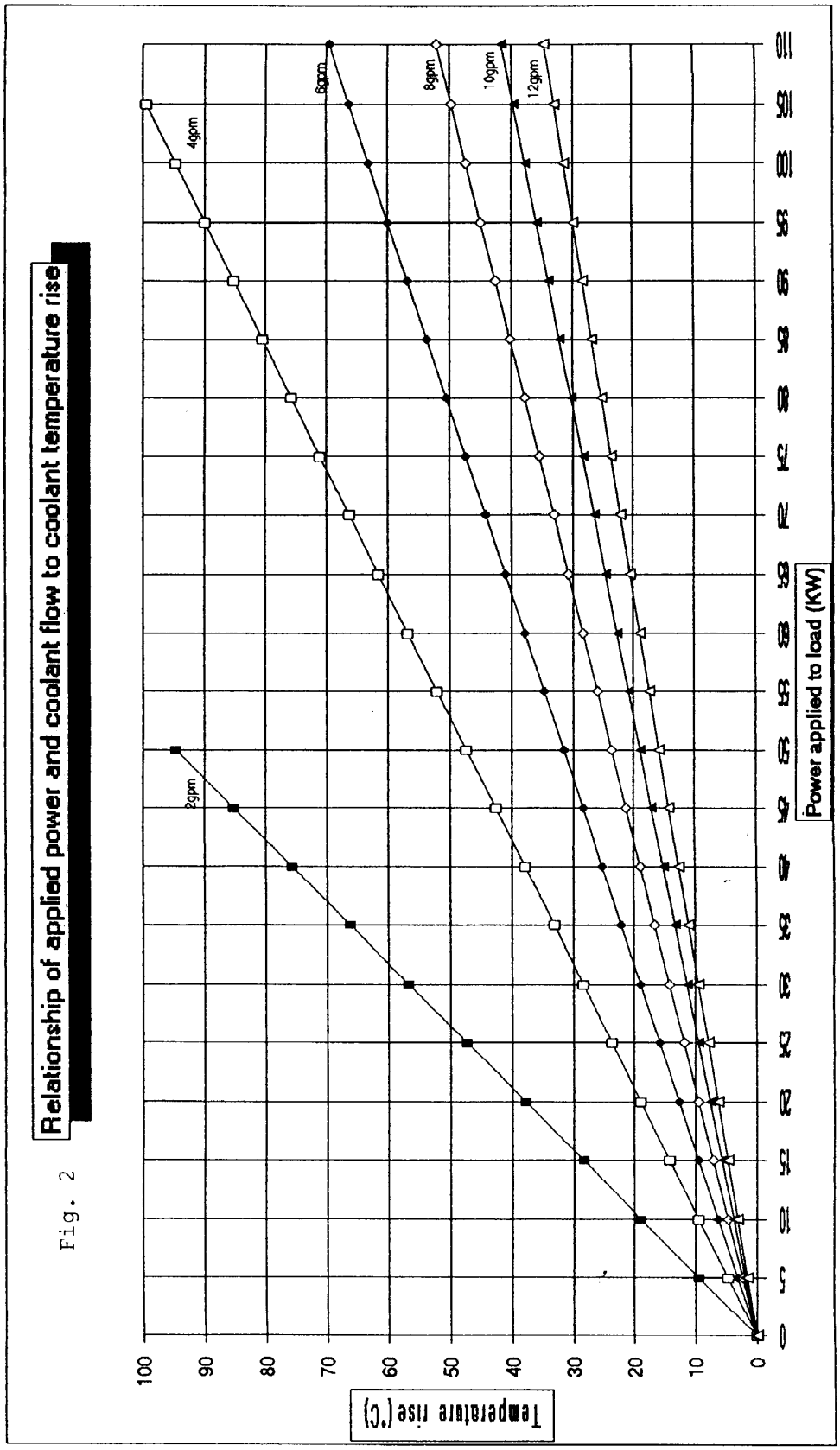
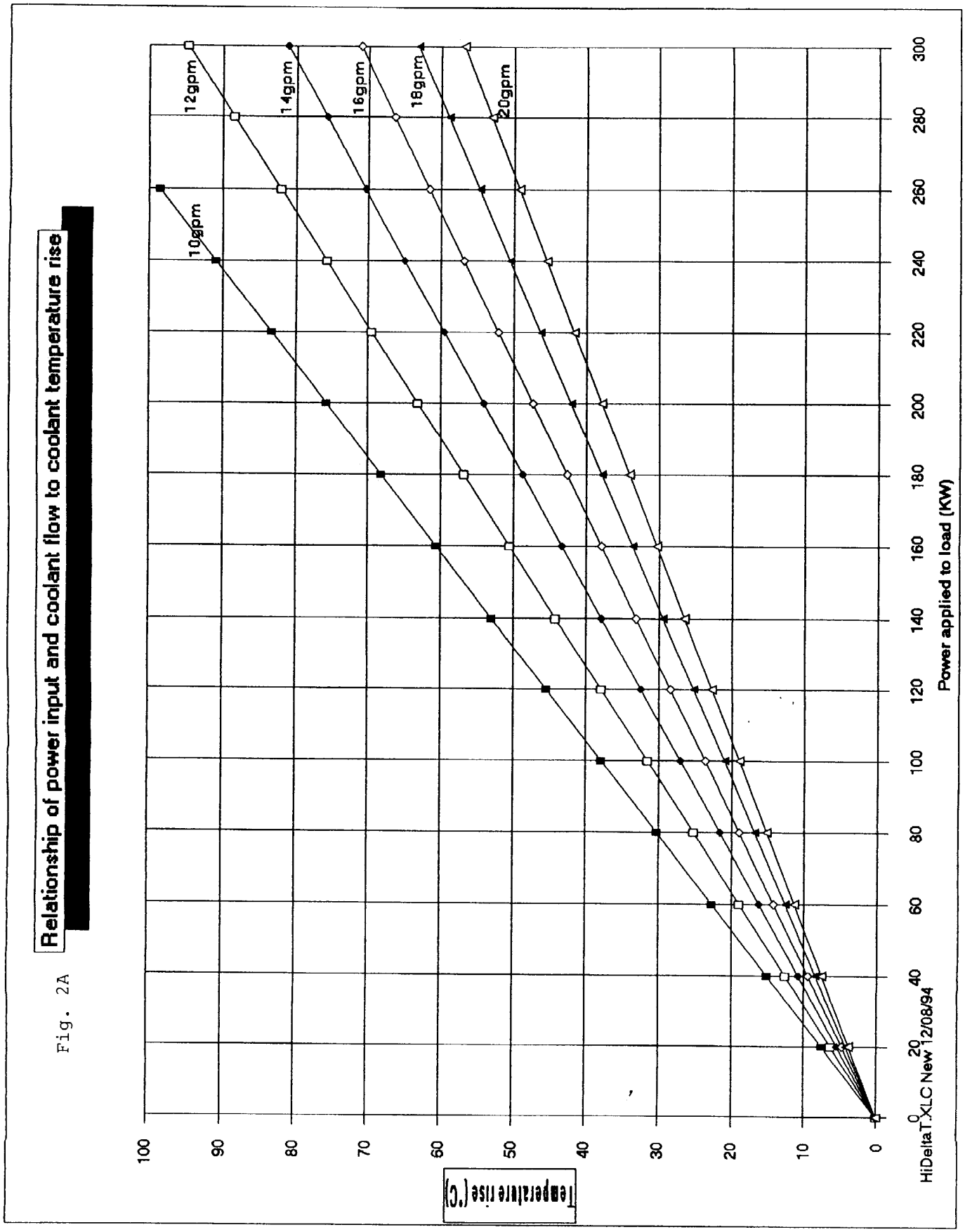

Relationship of applied power and coolant flow to coolant temperature rise
Temperature rise (°C)
Power applied to load (KW)
2gpm
4gpm
6gpm
8gpm
10gpm
12gpm
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110

Fig. 2A


Relationship of power input and coolant flow to coolant temperature rise
Temperature rise (°C)
Power applied to load (KW)
10gpm
12gpm
14gpm
16gpm
18gpm
20gpm
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
HiDeltaT.XLC New 12/08/94

COOLANT

COOLANT - The OMEGALINE® dummy load may be used with ordinary tap water, pure, or de-ionized water in open or closed cooling systems. The use of deionized and distilled water in OMEGALINE® loads has been reported to cause premature failures under some conditions. These failures are the result of the leaching action of the coolant on the silver and silver-plated surfaces of the resistors and contact material. The reported failures have generally been associated with deionized systems which are polished to 10-15 megohm levels and are operated intermittently. We suspect that the failure mechanism is attributable to bacterial growth in the coolant system and the subsequent high levels of sulfides usually found in conjunction with such contamination.

Altronic does offer a line of water-cooled loads with gold and gold-plated resistors and contacts, for use in systems where leaching action seems unavoidable. Contact our sales office for information.

We suggest the use of caution when determining what coolant to use. Potable water is certainly the most desirable coolant. Brackish or salt water is NOT permissible as a coolant for the load resistor! The load is designed with non-contaminating elements in the water circuit and may be used with transmitters that have pure water recirculating cooling systems. For operation below the freezing temperatures of water, ethylene glycol may be added to the water to prohibit freezing (see Fig. 3). If you have questions about coolants, please consult the factory.

IMPORTANT

We recommend a Glycol mixture of 40% (2:3) or less. Addition of ethylene glycol to water reduces the heat capacity of the mixture with a corresponding reduction in cooling effectiveness. Therefore, the coolant flow rate should be increased approximately 20% from that required with water only.

!!!WARNING!!!

Only clear, colorless analytic or technical grade ethylene glycol may be used**.** Dow Chemical Company's Dowtherm® SR1 has been reported to be fully compatible with OMEGALINE® loads when used in accordance with Dow's instructions (up to a 40% max). **DO NOT use any stop leak, sealants, automotive antifreeze or Union Carbide Ucartherm™ in coolant. To do so will void the warranty.** Damage to the resistor film may occur with applied power, resulting in failure!

CONCENTRATION OF COOLANT			FREEZING POINT		BOILING POINT	
Glycol: Water Parts by Volume at Room Temp.	**% Glycol by Volume**	**% Glycol by Weight**	**°C**	**°F**	**°C**	**°F**
(pure water)	0	0	0	32	100	212
3:7	30	32.3	-16	2	104	219
2:3	40	42.7	-26	-15	106	222
1:1	50	52.7	-40	-40	109	228

Fig. 3 Freezing and Boiling Points of Glycol-Water Mixtures

TEMPERATURE RANGE - The impedance of the load is practically independent of glycol-water mixture, water flow rate, and water temperature. A wide range of input water temperatures (0°C to 60°C) may be used as long as the output water temperature is not allowed to exceed 90° C.

WATER FLOW RATE - The water flow rates specified for the load is given as the least amount of water flow permissible for full power rating. AT LEAST MINIMUM FLOW OF WATER MUST BE MAINTAINED THROUGHOUT THE APPLICATION OF POWER. A greater flow rate (approx. 10% higher) should be used and is recommended. When used at lower than rated power, a reduced water flow rate may be used and combinations of power and water flow rates may be determined by using the table of Fig. 4. In all cases, ***water must be allowed to flow for about 1 minute before applying power*** so that all air bubbles are dispelled from the system.

MODEL	MINIMUM FLOW RATE (GPM)	MAXIMUM* AVERAGE (RMS) POWER (KW)	GALLONS PER KILOWATT (K_f)
5705	2	5	.40

Fig. 4 MINIMUM Water Flow Rate Requirements

* Single Frequency CW

To determine the water flow rate requirements at lower power levels, multiply the average input power in kilowatts by the water flow rate coefficient (K_f) from the above table and add 20% for ethylene glycol mixtures.

WATER PRESSURE - The table of Fig. 5 gives the maximum allowable inlet pressure. Continuous operation of the load at full power and up to an outlet water temperature of 90°C is permissible within the maximum operating pressure given in the table.

NOTE: Do not use a shut-off valve on the water output side of the load in systems that have no water expansion pressure relief. Pressure in the outlet line should be as low as possible to minimize internal pressure.

MODEL	INTERNAL PRESSURE DROP (PSI)	MINIMUM FLOW RATE (GPM)	ORIFICE COEFFICIENT (Ko)	MAXIMUM INLET PRESSURE (PSI)
5705	6	2	1.5	75

Fig. 5 Internal Pressure Drop vs. Flow Rate

To determine the pressure drop at other flow rates, use the orifice coefficient (K_o) from the above table in the following equation:

$$PSI = K_o Q^2$$

Where PSI = Internal pressure drop in lbs./sq.in.

K_o = Orifice coefficient

Q = Coolant flow rate in gallons/minute

COOLING SYSTEMS

TYPES - Four basic cooling systems are summarized in the table of Fig. 6; viz., municipal water, natural water, tank or reservoir, and heat exchanger. No single cooling system is the "best" under all the different circumstances and conditions encountered by the field. Closed loop systems are generally preferable since they afford much greater control over the purity, temperature, pressure, and flow rate of the coolant.

				BASIC COMPONENTS NEEDED			
METHOD		**COOLANT**	**COOLANT SOURCE**	**COOLANT LINES & INSTRUMENT-ATION**	**PUMP**	**RESERVOIR**	**HOURS OF CONTINUOUS OPERATION**
Open	1	Tap Water	Municipal Supply System	✓	In low flow areas	Optional	Unlimited
	2	Natural fresh water	Lake, river, pond, etc.	✓	✓	Optional	Unlimited
Closed	3	Tap or distilled water with or without glycol	Storage tank	✓	✓	100 to 1500 gallons	Up to 8 hrs.; depends on size of load & tank. See Fig. 7
	4	Tap or distilled water with or without glycol	Accumulator	✓	✓	1 to 5 gallons	Unlimited
	5	Tap or distilled water with or without glycol	Air-cooled core	✓	✓	Optional	Depending on BTU capacity of exchanger

Fig. 6 Alternative Cooling Systems

TAP-WATER SYSTEM - The most convenient way to cool the load resistor at the lowest initial cost is by tapping into the existing water supply on the premises. Most municipal sources can provide sufficient pressure to obtain a flow rate that will cool even the highest power model.

In the absence of a water flow-meter, a measure of the available flow rate in gallons-per-minute (GPM) may be made with a stop-watch or a watch with a sweep-hand and a gallon container. Connect the dummy load to the water faucet with a

short length of hose, and with the faucet full-on, observe the time in seconds required to fill the gallon container at the water outlet of the load.

When using the dummy load with a tap-water system, the flow rate is usually adjusted to 10-15% above the minimum requirement and left unattended. Since water lines ordinarily serve other appliances (flush toilets, etc.) over which there is no control, a flow switch should be installed to protect the load resistor element in case the flow rate drops due to a momentary change in water pressure. Choose a flow switch with a small "ON-OFF" flow rate dead band. The switch will also protect the resistor in cases where the RF power may be turned on before the water flow, or where accidental termination of water flow (pinched hose, debris, valve closing, etc.) may occur. In the tap-water system the heated water is discharged down the drain and therefore, the cost of the water becomes an important consideration.

NATURAL WATER SYSTEM - A close proximity to a natural supply of fresh water may suggest its utilization. Brackish or salt water may NOT be used as a coolant for the load resistor. The natural water system usually requires more extensive piping and heavier pumping equipment to handle attendant pressure drop.

The quality of natural water varies widely and straining is often necessary to handle the twigs, minnows, leaves and other debris frequently encountered. Small automatic self-cleaning strainers are available for this purpose. The strainer should be installed upstream from the pump to protect the pump as well as the load resistor. Additional filtering of smaller particles is sometimes required and this can be accomplished with finer mesh "Y-TYPE" strainers inserted in series with the line.

In this system, the water from the natural source may not be directly usable as a coolant for the load resistor element due to a high contamination, such as silt, iron content, mud, etc.; but it may be used as "dirty" water coolant in a water-to-water heat exchanger. The contaminated water could be piped via plastic tubing or hose to copper coils immersed in a holding tank containing clean water coolant for the dummy load. This arrangement would require a dual pump - one section to pump the "dirty" natural-source water and the other section to pump the clean water coolant through the dummy load.

HEAT EXCHANGER SYSTEM - In this system, an accumulator or receiving tank is used which only holds about one-half the flow rate in gallons-per-minute. Accordingly, a small quantity of coolant is required. The coolant functions solely as a heat transfer agent between the load resistor and the heat sink. A heat exchanger consisting of a radiator and a fan is the type recommended for this application. With ambient air as the ultimate heat sink, the operating temperature of the coolant will always be above the air temperature for heat to be transferred from the

load to the air. Some consideration should be given to exhausting the hot air to the outside so as not to have a temperature rise problem in the transmitter area. The heat exchanger may be a complete self-contained unit (portable) which includes the dummy load or the load may be separate and apart from the heat exchanger unit to facilitate installation and maintenance requirements, etc. Both types of heat exchanger packages are available from us.

TANK OR RESERVOIR SYSTEM - In this system, a practical amount of coolant is stored in a tank or reservoir and continuously recirculated (pumped) through the load until the coolant becomes hot. (NOTE: One kilowatt of power will raise a gallon of water 7°F per minute.) This relationship was used to calculate the curves of Fig. 7. The curves show the permissible hours of continuous operation for a given quantity of water in gallons, i.e., the number of gallons of water that will be raised from room temperature (70°F) to 170°F. If water from a swimming pool is used, care should be taken to filter out foreign debris to avoid clogging the system. The water flow rate as specified for each load (GPM) must be maintained throughout the application of power. A thermal switch and a water flow switch should be used as a protection against over-temperature and low coolant flow.

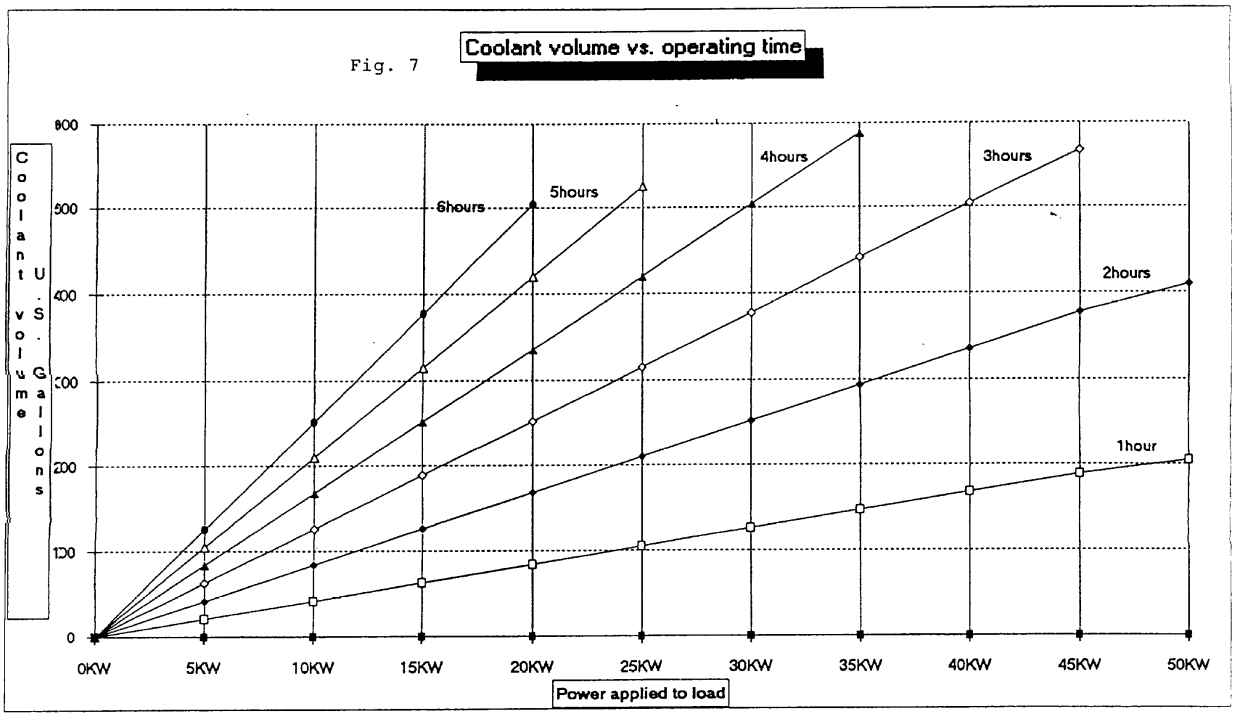


Fig. 7

Storage tanks between 200 and 500 gallons will satisfy most requirements. A waterproof concrete holding tank in the 1000 to 1500 gallon range may also be considered. (Similar to a septic tank and buried below the frost line.) It would be protected from extremes of temperature and could hold ordinary tap water as the coolant, while comparing favorably in cost to smaller metal tanks exposed to the elements. Storage tanks are normally vented to the atmosphere and allowance should be made for determining the liquid level in the tank and for adding make-up water. Some typical sizes of cylindrical tanks in the range of interest are shown in the table of Fig. 8 below.

CAPACITY IN GALLONS	**SIZE DIAMETER x LENGTH IN FEET**
120	2 x 5
200	2.5 x 5.5
300	3 x 6
500	3.5 x 7
1000	5 x 7
1500	5 x 10.5

Fig. 8 Tank Sizes

The pump selected for this service should have all wetted parts made from brass, bronze, ceramic or stainless steel. Cast iron and common steel will "poison" the water system and cause early failure of the load. Select the pump to overcome piping losses and the internal pressure drop of the load (shown in Fig. 5).

INSTALLATION

The OMEGALINE® loads may be used on both fixed and portable applications and they perform equally well in any mounting position. The units are very rugged and light and may be strapped, clamped, or secured with any practical and readily available mechanical device. They may be held by the RF connector on one end and by the plumbing on the other end. The coolant may be allowed to pass through the load in either direction without affecting its operation, but the axial water connector is normally used as the inlet since it contains the built-in filter screen.

Water lines connecting the load should be 3/4" copper water tubing and rigid enough to support the load. NOTE: (A fifty-foot length of 1/2" pipe has a pressure drop of 45-PSI at 10-GPM water flow rate, while a 3/4" pipe under the same conditions only develops a 5-PSI drop.) In typical installations, the rigid piping is terminated within a few feet of the load, and flexible hose is used to bridge the last few feet. The hose should be 3/4" I.D. and capable of withstanding the temperature and pressure of the system.

The water fittings on the load are 3/4" hose thread to accommodate standard hose couplings. Do not screw pipe thread fittings onto the hose thread - damage will result due to cross-threading. Pipe threads are tapered and hose threads are straight. If it is desired to mate with regular 3/4" pipe threads, use a hose-to-pipe adapter. The adapter is recommended since it eliminates the need of removing the side outlet water fitting and also allows the axial water fitting to be adapted directly to 3/4" pipe. The adapters may be obtained at a local hardware store or a plumbing supply house.

Provisions should be made to allow interruption of the transmission line at any position where the transmitter is to be terminated by the load or measurements are contemplated. Coaxial switches may be inserted in the transmission line run to provide rapid load switching.

Proceed as follows:

1. Install the unit in the selected location.

2. Connect the outlet water fitting of the dummy load to a convenient drainage.

3. Connect the water inlet to a water source capable of delivering the required flow in gallons per minute.

If the required source of water flow is not available from the local lines, refer to the previous section for a possible alternate cooling system.

We highly recommend the use of a flow switch in the inlet piping to detect low flow conditions which could damage the load. We recommend the IMO DeLaval Model AFS200, Adjustable Flow Switch. This switch has low internal pressure drop and operates reliably in pilot-duty applications. (This switch is available from us.) Mount the switch in a horizontal section of pipe where there is a straight horizontal run of at least five inches on each side of the switch.

4. Connect the microswitch contacts of the flow switch in series with transmitter interlock circuit.

5. Connect the dummy load to the transmission line. The unit is designed to connect to a 50 or 75 ohm line (or as stated on label).

OPERATION

To place the dummy load in operation, the following procedure is recommended:

1. Turn on the water pressure and make certain water is flowing through the load. Allow about 1 minute of water circulation to insure complete wetting of the resistor element in the load and exhaustion of air bubbles.

2. Check the water flow rate. This can be done with a gallon container and a wrist-watch with a sweep-hand if no water flow meter is available.

3. Apply RF power.

To cease operation, turn the RF power off and allow about 30 seconds before turning off the water.

CALORIMETRY

The OMEGALINE® loads may be used in conjunction with a flow meter, thermometer wells and thermometers to accurately measure transmitted power by calorimetry. Fig. 9 shows a complete arrangement. The flow meter and the thermometer wells may be placed at a convenient position and at eye level for ease of reading. There is no need to have them adjacent or in close proximity to the load. The components may be placed upwards of fifty feet away from the load without any loss in the accuracy of measurement.

The thermometer wells (Altronic type TW-2), which are closed to the main coolant stream, use water as the heat transfer medium and operate efficiently with the thermometers immersed in about 1 inch of water. The stabilization time for the system is approximately thirty seconds and a power measurement accuracy within 2% may be obtained with very little difficulty. The curves of Fig. 2 show the temperature rise as a function of power in kilowatts (KW) for various water flow rates in gallons-per-minute (GPM). Technical and component information on the calorimetry set-up may be obtained by contacting ALTRONIC RESEARCH, INC.

If an ethylene-glycol and water mixture is used, a correction must be applied to the flow meter reading due to a change in density and change in specific heat and gravity of the coolant.

Use the curves of Fig. 10 to obtain the new (K_t) multiplying factor for the calorimetric power equation and curves of Fig. 11 to obtain the density value to be used with the curve of Fig. 12 to get the flow meter correction factor. The calorimetric power equation when using ethylene glycol and water mixtures will be as follows:

$$P = Kt\,(T1-T2)\,Q.F$$

Where P = Power in load in kilowatts
T1 = Outlet water temperature °C
T2 = Inlet water temperature °C
Q = Water flow in gallons per minute
F = Flow meter correction factor
Kt = Coolant multiplying factor

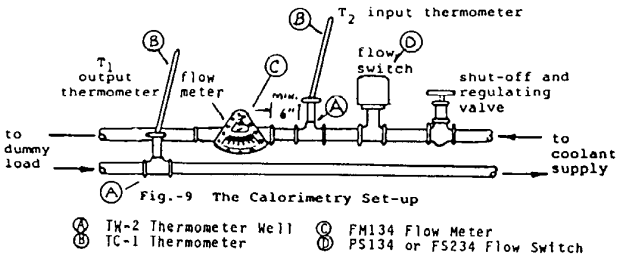


Fig. 9 The Calorimetry Set-up

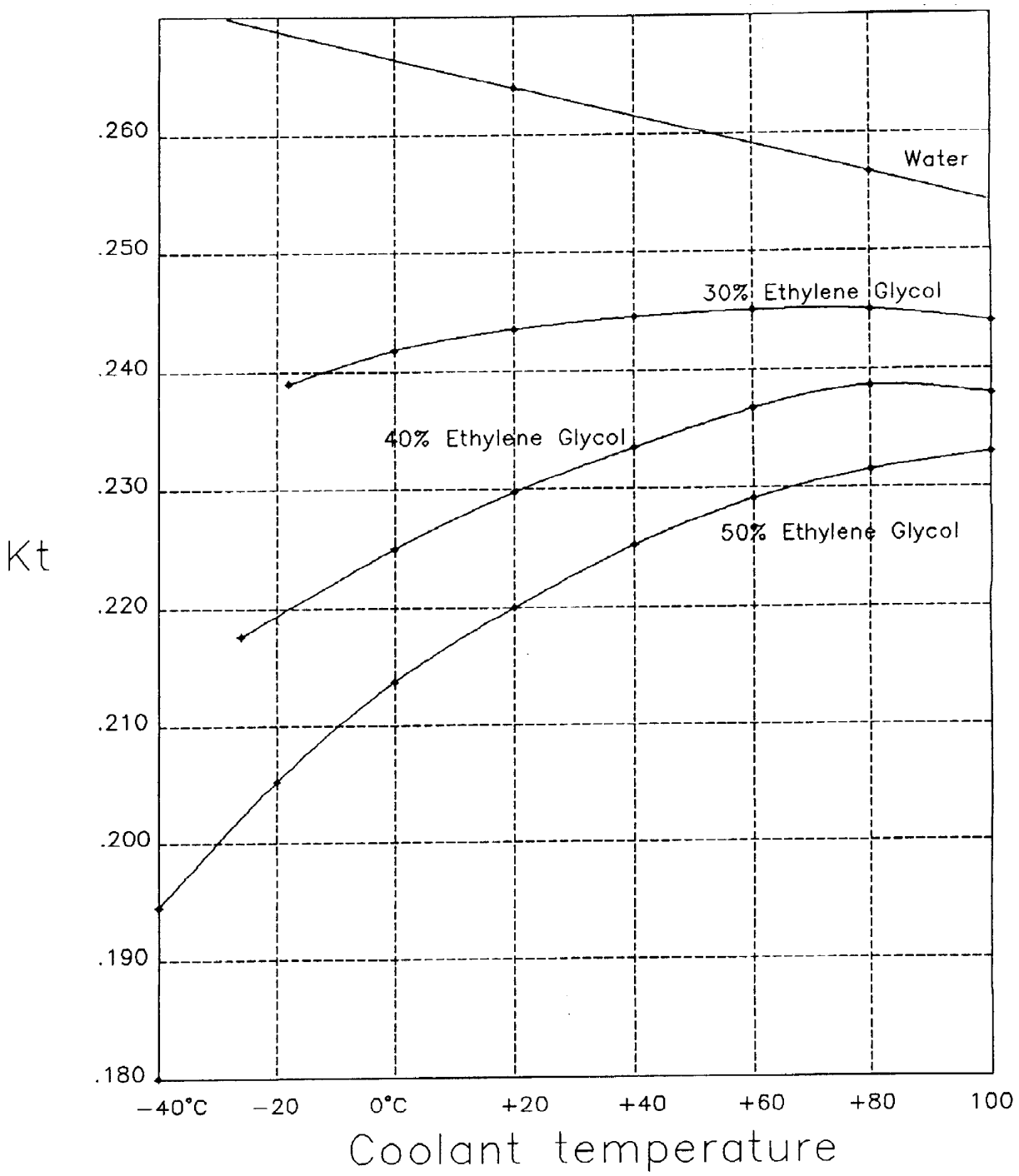


Fig. 10 Kt for Ethylene-Glycol/Water Mixtures vs. Temperature

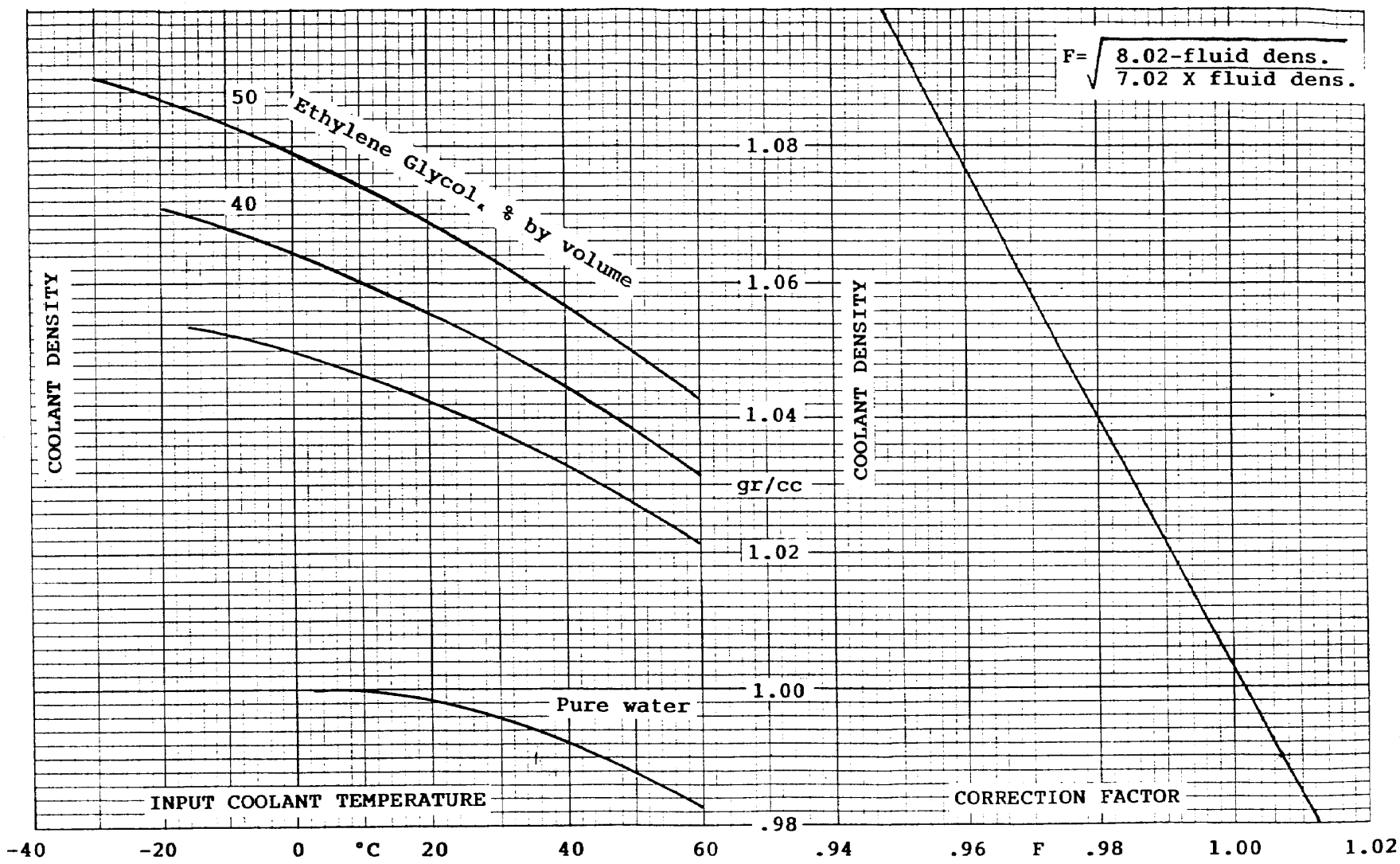


Fig.-11 Density of Ethylene Glycol and Water Mixtures at Various Temperatures

Fig.-12 Flow-Meter Correction Factor

(The above graphs may be used together as a nomagraph)

Altronic Research Inc., Yellville, Arkansas

SPECIFICATIONS

Model 5705

Impedance	50 ohm nominal
Maximum Power Rating	5 KW
Effective Frequency Range	60 Hz 1.0 GHz
Maximum VSWR	1.10 to .8 GHz; 1.2 to 1.0 GHz
Coolant	Ordinary tap water, pure water or technical grade Ethylene Glycol and water mixture 50%
Water Connectors	3/4" Garden Hose
Min. Water Flow Rate	2-GPM
Input Water Temperature	4°C to 60°C
Output Water Temperature	Maximum: 90°C
Maximum Inlet Pressure	75 PSI Max.
Resistor	Cylindrical film type-field replaceable
Input Connectors	QC Connector 1 5/8" EIA flanged
Dimensions	10-1/4" x 3-1/2"
Weight	4-1/2 lbs.
Operating Position	Any
Finish	Alodine, Nickel Plate & Acrylic Paint

DC Resistance_____

Serial No._____

Date_____

VSWR NOMOGRAPH

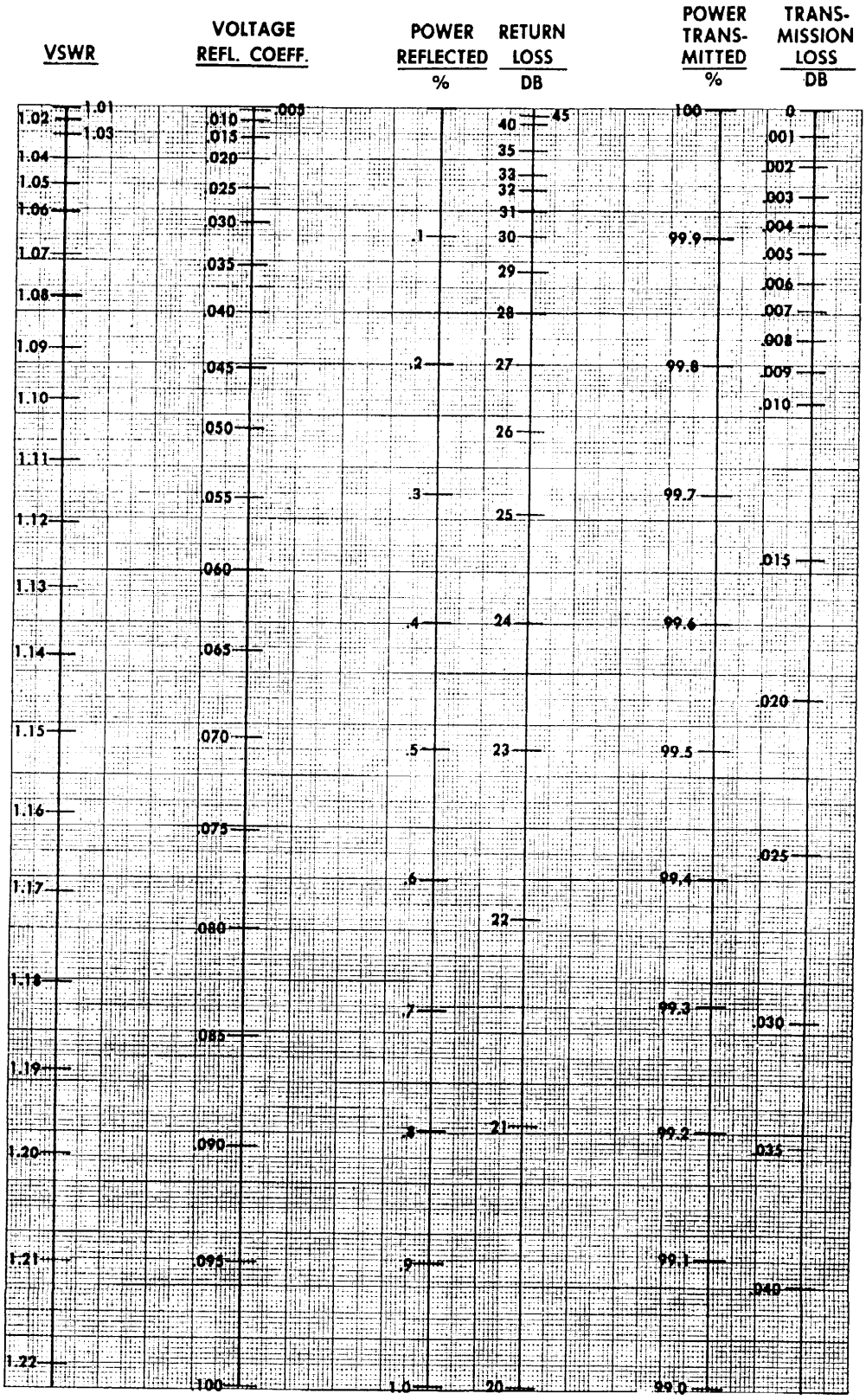


Fig. 13

MAINTENANCE

The OMEGALINE® RF loads will require little in the way of maintenance. Components located inside the unit other than the resistor element and the filter screen are not subject to field maintenance. The resistor is field replaceable in those instances where there is no extensive damage to the resistor contacts or rupture of the teflon water jacket, due to improper operation of the load. In the event of mechanical damage to the unit, operational difficulty, or information concerning a desired unusual application of the load, contact the factory.

NOTE: ANY LEAK FROM THE MAIN BODY OF THE LOAD IS AN INDICATION THAT THE UNIT SHOULD BE RETURNED TO THE FACTORY FOR REPAIRS.

The following checks, tests and procedures may be used periodically, when necessary, or when a malfunction is suspected.

1. **DC Resistance** - The DC resistance of the load may be checked at the RF input connector and a value within 4% of the required resistance is acceptable.

2. **Filter Screen** - The flanged water connector located at the rear of the load is equipped with a cone-shaped brass screen to prevent the entrance of foreign particles into the water circuit of the load. (Back flushing may be used to clean out foreign materials trapped in the screen.) If it becomes necessary to remove the screen, remove three socket head screws to disengage the flanged water fitting to gain access to the screen.

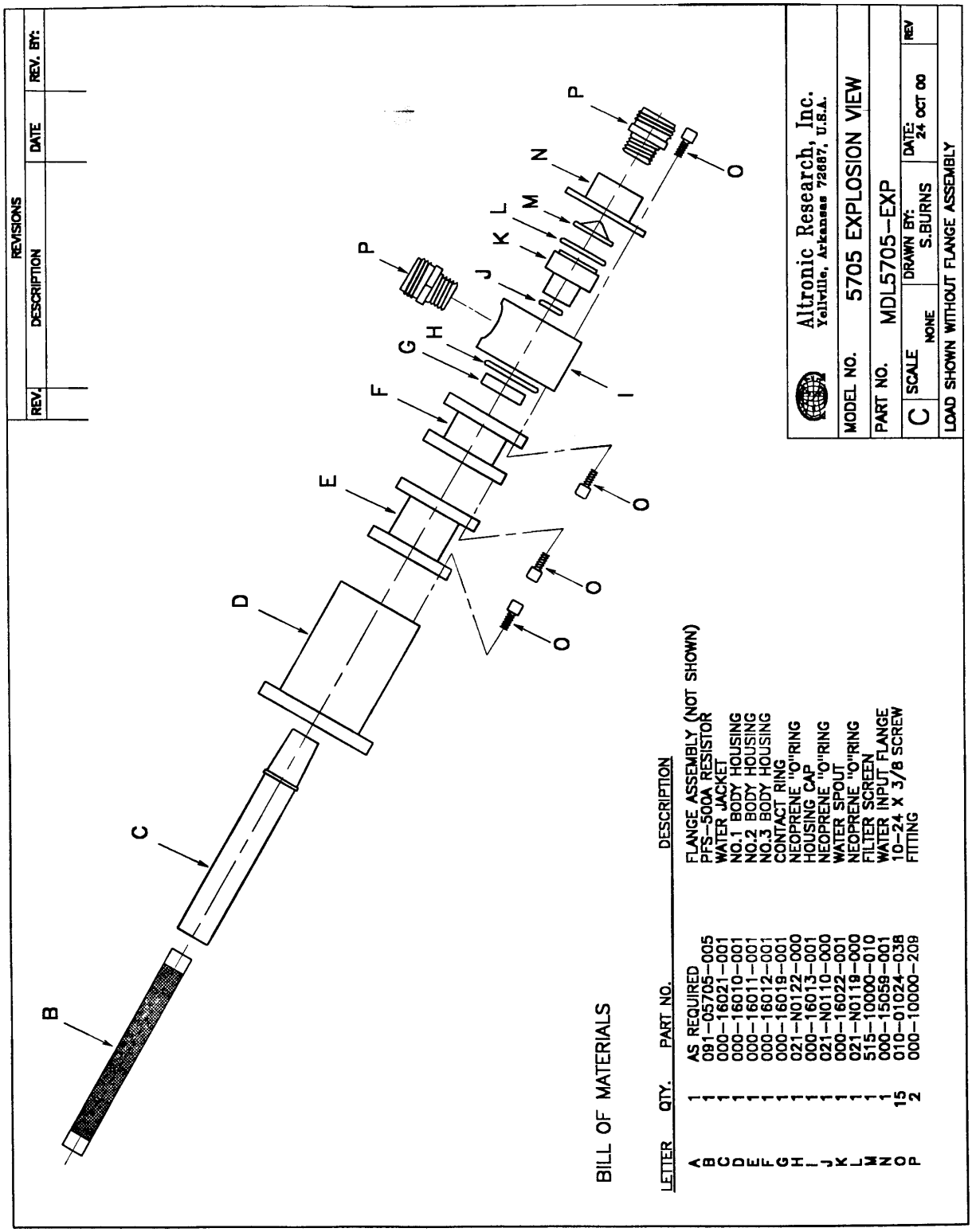
3. **VSWR** - The voltage-standing-wave-ratio of the load is the same with "stand still" water as it is with flowing water. To test for VSWR, fill the load with water. When filling with water, many small bubbles will form inside. These <u>must</u> be flushed out with excess water before measuring VSWR. After filling, cork it, connect to a slotted line or directional coupler and measure the VSWR at SIGNAL GENERATOR LEVELS ONLY.

4. **Resistor Replacement** - (Refer to Fig. 14) To replace the resistor element, remove the three 10-24x3/8" cap screws (item O). Remove water input assembly (items M, N, and P). Inspect filter screen for damage, replace if eroded or torn. Remove 10-24x3/8" cap screw connecting #4 body section (item F) to housing cap (item I). Remove housing cap assembly (items G, H, I, P, J, K and L). Inspect all O-rings for distortion or damage. Replace if pinched, cut, burned or no longer round in cross section. Inspect ring contact (item G) for signs of arcing or loss of silver in the area of contact with the resistor contact band. Replace if damage is noted. If resistor (item B) is not broken, grasp by the end extending from the #4 body section (item F) and pull it straight out of the load. (If resistor is broken, complete disassembly of load is necessary.) Inspect the silver contact band on the RF input end of the resistor element for signs of arcing or loss of silver as an indication of the condition of the front resistor contact. Visually inspect the inside of the water jacket and front resistor contact for any signs of overheat or damage. Any sign of internal damage indicates further disassembly and repairs are necessary.

5. **Removal of RF Input** - (Refer to Figure 15) To remove the RF input line adaptor flange, remove four 10-24x 3/8" socket head screws (item 2) that secure the line adaptor flange (item 1) to the load body housing (item 3, Fig. 14). The RF input assembly consisting of the center conductor, anchor insulator and front resistor contact (items C, D, E, F, G, H, I and J) will normally remain in the load body. Grasp the center conductor (item 3) by hand and attempt to pull the input assembly out of the load body using slight side to side motion while pulling. If strong resistance is encountered, it may be necessary to chill the load to allow the anchor insulator to shrink away

from the load housing. This can be done by placing the load in a freezer, or packing the load in ice for 20 to 30 minutes. Once the anchor insulator has shrunk away from the load housing, the RF input assembly should be easily removed. At this point of disassembly, all components of the load can be inspected or replaced as needed. Reassembly should be done in the reverse order of sequence. See Figure 16 for individual component identification.

For technical assistance, call 870-449-4093 or fax 870-449-6000.


REVISIONS
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BILL OF MATERIALS
LETTER QTY. PART NO. DESCRIPTION
A 1 AS REQUIRED FLANGE ASSEMBLY (NOT SHOWN)
B 1 091-05705-005 PFS-500A RESISTOR
C 1 000-16021-001 WATER JACKET
D 1 000-16010-001 NO.1 BODY HOUSING
E 1 000-16011-001 NO.2 BODY HOUSING
F 1 000-16012-001 NO.3 BODY HOUSING
G 1 000-16019-001 CONTACT RING
H 1 021-N0122-000 NEOPRENE "O"RING
I 1 000-16013-001 HOUSING CAP
J 1 021-N0110-000 NEOPRENE "O"RING
K 1 000-16022-001 WATER SPOUT
L 1 021-N0119-000 NEOPRENE "O"RING
M 1 515-10000-010 FILTER SCREEN
N 1 000-15059-001 WATER INPUT FLANGE
O 15 010-01024-038 10-24 X 3/8 SCREW
P 2 000-10000-209 FITTING
Altronic Research, Inc.
Yellville, Arkansas 72687, U.S.A.
MODEL NO. 5705 EXPLOSION VIEW
PART NO. MDL5705-EXP
C SCALE NONE
DRAWN BY: S.BURNS
DATE: 24 OCT 00
REV
LOAD SHOWN WITHOUT FLANGE ASSEMBLY

Fig. 14

LIMITED WARRANTY

We take pride in manufacturing products of the highest quality and we warrant them to the original purchaser to be free from defects in material and workmanship for the period of one year from date of invoice. Additionally, products of our manufacture repaired by us are warranted against defects in material and workmanship for a period of 90 days from date of invoice, with the provisions described herein.

Should a product, or a portion of a product of our manufacture prove faulty, in material or workmanship, during the life of this warranty, we hereby obligate ourselves, at our own discretion, to repair or replace such portions of the product as required to remedy such defect. If, in our judgment, such repair or replacement fails to be a satisfactory solution, our limit of obligation shall be no more than full refund of the purchase price.

This warranty is limited to products of our own manufacture. Equipment and components originating from other manufacturers are warranted only to the limits of that manufacturer's warranty to us. Furthermore, we shall not be liable for any injury, loss or damage, direct or consequential, arising out of the use, or misuse (by operation above rated capacities, repairs not made by us, or any misapplication) of the equipment. Before using, the user shall determine the suitability of the product for the intended use; and the user assumes all risk and liability whatsoever in connection therewith.

The foregoing is the only warranty of Altronic Research Incorporated and is in lieu of all other warranties expressed or implied.

Warranty returns shall first be authorized by the Customer Service Department and shall be shipped prepaid. **Warranty does not cover freight charges.**