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**2471F**

**MEGOHMMETER**

**USER INSTRUCTION MANUAL  
BARFIELD M/N 2471F**

*56-101-00220-B  
September 23, 2008*

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BARFIELD, INC.



T A T G R O U P

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## **CONTACT INFORMATION**

Users are requested to notify the manufacturer of any discrepancy, omission, or error found in this manual. Inquiries should include specific questions and reference the publication title, number, chapter, page, figure, paragraph, and effective date.

Please send comments to:

**TECHNICAL CUSTOMER SUPPORT - GSTE  
BARFIELD, INC.  
P.O. BOX 025367  
MIAMI, FL 33102-5367  
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### **ATTENTION**

Although every effort has been made to provide the end user of this equipment with the most current and accurate information, it may be necessary to revise this manual in the future. Please be sure to complete and return a *Revision Request Form* to Barfield revision services and visit the company website, <http://barfieldinc.com/>, for publication updates.

Additionally, Barfield **MUST** have your name and address on file as a registered user of this equipment to ensure validation of the warranty. Please complete the **OWNER WARRANTY REGISTRATION** card promptly. This card ensures validation of the warranty.

Please send to:

Barfield, Inc.  
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**REVISION RECORD**

<b>REV.</b>	<b>ECO #</b>	<b>REV. DATE</b>	<b>DESCRIPTION OF CHANGE</b>
A	N / A	June 1986	Initial Release.
B	260-00729	Sep/23/2008	Company logo and contact information was updated. Chapters were reorganized.



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### **LIST OF APPROVED REPAIR FACILITIES**

The manufacturer of this equipment does not recommend the user to attempt any maintenance or repair. In case of malfunction, contact the manufacturer, to obtain the list of approved repair facilities worldwide, ensuring that this equipment will be serviced using proper procedures and certified instruments. A Return Maintenance Authorization (RMA) number will be assigned during this call, to keep track of the shipment and the service.

#### BARFIELD PRODUCT SUPPORT DIVISION

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**INTRODUCTION**

**1. PUBLICATION BREAKDOWN**

This user instruction manual establishes the standards of operation for Barfield's 2471F Megohmmeter.

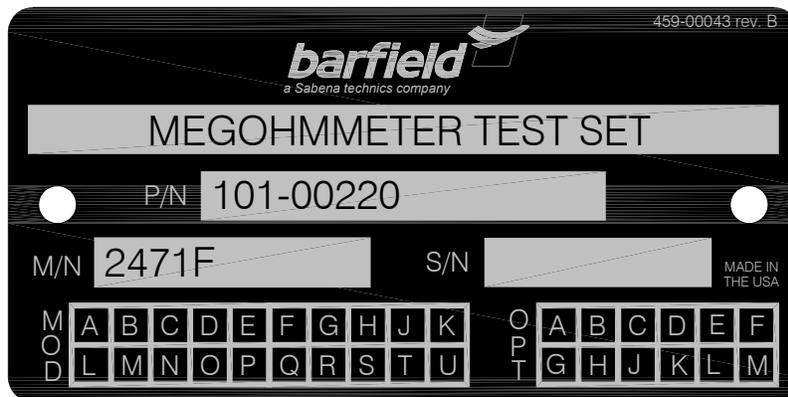
Its purpose is to provide sufficient information for the personnel unfamiliar with this unit to understand it, identify its parts, and operate it in accordance with proper procedures, operating techniques, precautions and limitations.

**2. INFORMATION PROVIDED WITH THE UNIT**

Besides this User Instruction Manual, the instrument is provided with the four items described below.

- A. The identification label, similar to Figure 1, is located on the back of the instrument and provides the following information:

- Manufacturer Name
- Designation of Equipment
- Equipment Part Number
- Equipment Model Number
- Equipment Serial Number
- Equipment Modification (if applicable)
- Equipment Options (if applicable)



**Figure 1: IDENTIFICATION LABEL**

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- B. The Owner's Warranty Registration card (Figure 2) is to be completed by the owner and returned to Barfield, Inc. within **ten (10) days** of purchase to ensure automatic update of printed matter and validation of warranty.

**OWNER WARRANTY REGISTRATION**

RETURNING THIS CARD COMPLETED ENABLES US TO KEEP YOU  
AUTOMATICALLY INFORMED OF TECHNICAL UPDATES and VALIDATES YOUR WARRANTY.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_  
 DEPARTMENT \_\_\_\_\_  
 COMPANY \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
 P/N \_\_\_\_\_ S/N \_\_\_\_\_ MODEL # \_\_\_\_\_  
 PURCHASED FROM \_\_\_\_\_ DATE \_\_\_\_\_  
 AIRLINE  REPAIR STATION  OEM   
 OTHER \_\_\_\_\_

*INFORMATION GIVEN ON THIS BARFIELD, INC. WARRANTY CARD IS AND WILL REMAIN  
 STRICTLY CONFIDENTIAL AND WILL NOT BE SHARED.*

OW-28 REV / 04.00

**Figure 2: OWNER WARRANTY REGISTRATION CARD**

- C. The Limited Warranty Statement Card (Figure 3) lists the manufacturer's obligation to the original purchaser.

**LIMITED ONE YEAR WARRANTY**

**BARFIELD INSTRUMENT CORPORATION** warrants to the original purchaser of this unit sold by us and/or our agent, and all the parts thereof, to be free from defects in material or workmanship under normal use and service within the specified ratings and operating conditions.

Its obligation under this warranty is hereby limited to the repair or replacement of this unit, or part thereof, which is returned to us within one year after date of invoice, suitably packaged in the original container or equivalent and which shall prove, after our examination, to be defective under terms of above paragraph.

No other warranty is expressed or implied. We are not liable for consequential damages.

Some states do not allow the exclusion or limitation of incidental or consequential damages so that the preceding limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

This warranty does not include the cost of transportation charges to and from the factory.

The repair or replacement of this unit, or any part thereof, does not void or extend the original warranty.

**BARFIELD INSTRUMENT CORPORATION** reserves the right to discontinue this unit without notice, or to make modifications in design at any time, without incurring any obligation to make these modifications in units previously sold.

**BARFIELD INSTRUMENT CORPORATION**  
 4101 N.W. 29 Street  
 Miami, Florida 33142 U.S.A.

FORM 991-00001

**Figure 3: LIMITED WARRANTY STATEMENT CARD**



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- D. The Certificate of Calibration: Each new unit and re-certified unit, is delivered with a Certificate of Calibration that shows the date of the last calibration and when the next calibration is due. It certifies the accuracy of the unit and lists the part number and serial number to which it applies.

### 3. **RECERTIFICATION**

This instrument has a one-year recertification requirement. Qualified technicians in a shop equipped with the necessary tooling and facilities must perform the maintenance required by this unit.



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### **CHAPTER 1: PRODUCT DESCRIPTION**

#### **1. GENERAL**

- (1) The 2471F (Fig. 4) is a self-contained, battery operated, high potential megohmmeter. Test potentials of 100, 200, and 500 volts DC are selectable by a panel switch. Current limiting circuitry provides safe, ABSOLUTELY SHOCK-PROOF operation.
- (2) A single four inch meter scale, increasing from zero at the left to infinity at the right, is incremented from .5 to 1,000 megohms. A pushbutton on the high potential test probe provides for conveniently activating the instrument. Flashlight type batteries are used, and a self-contained battery test is incorporated. Solid-state circuitry provides the means for size reduction, high sensitivity, and dependability. The meter is a ruggedized taut-band suspension type, which eliminates the need for pivots and jewels. The high potential probe is shield-guarded so that stray leakage through lead insulation will not affect the measurement accuracy.
- (3) The output current of the 2471F is limited to a maximum of 30 microamperes even at the 500 volt test potential. This current is well below human sensibility, so that there is no sensation of current if the bare probes are touched with the tester activated. This current limiting prevents damage to any circuitry or components that can withstand the applied voltage, and prevents additional damage to a circuit that exhibits any insulation deterioration.
- (4) The 2471F is also protected from damage due to inadvertently connecting the probes across an energized circuit. AC or DC voltages up to 300 volts can be safely applied.



**Figure 4:** General View of the Megohmmeter 2471F

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**2. THEORY**

A transistor converter increases the battery supply to the 100, 200, and 500 volt test potentials selected by the panel switch. A high performance operational amplifier increases the impedance and sensitivity of the panel meter to measure the voltage drop across the test probes in terms of resistance. A panel control adjusts the calibration for infinity with the probes removed from the circuit under test. The batteries are connected to the megohmmeter circuit through transistor switches activated by a subminiature pushbutton on the high potential probe. A single receptacle provides connection to all the test lead cable circuits, and a shieldguard isolates the high potential lead from stray leakage resistance. A panel switch connects the meter for testing of either of the battery circuits or for megohmmeter indication.

**3. SPECIFICATIONS**

(1) The electrical specifications of the instrument are indicated in Tables 1 and 2.

Table 1: Current Consumption during Resistance Measurement

Test Potential (V)	Max. Draw ( $\mu$ A)
$100 \pm 10\%$	6
$200 \pm 10\%$	12
$500 \pm 10\%$	30

Table 2: Resistance Reading Parameters

<b>Resistance Reading Range (<math>M\Omega</math>)</b>	0 to $\infty$
<b>Reading Accuracy</b>	$\pm 10\%$
<b>Megohm Increments</b>	
Low	0.5
Midscale	17
High	1000

(2) The physical specifications of the instrument are as follows.

- Weight: 3.8 lbs., approx. (with carrying case)
- Size: 8" x 6" x 4.75" approx. (with carrying case)



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(3) Accessories supplied with the instrument are as follows.

- Portable vinyl overall carrying case, Eveready type, with test cable compartment.
- Plug-in test cable leads.
- Separable probe clip.

(4) Batteries required for instrument operation are as follows.

- 3 each of 1.5 volt C cells (Eveready E93, or equivalent)
- 3 each of 1.5 volt AA cells (Eveready E91, or equivalent)



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## **CHAPTER 2: OPERATING INSTRUCTIONS**

**CAUTION:** DO NOT APPLY HIGH VOLTAGE TESTS TO CIRCUITRY NOT DESIGNED FOR HIGH VOLTAGE APPLICATION. MOST SOLID CIRCUITRY IS SUBJECT TO DAMAGE FROM EVEN MOMENTARY APPLICATION OF HIGH VOLTAGE.

**MAKE CERTAIN DEVICE UNDER TEST IS CLEAN. DIRT, MOISTURE, AND MOST DEPOSITS EXHIBIT RATHER LOW LEAKAGE RESISTANCE.**

### **1. GENERAL**

- (1) Consult component manufacturer's testing specifications for test voltage to be applied. Isolate the device under test from external power or circuitry.
- (2) Insert test cable plug fully into receptacle at the top of the test set.
- (3) Make certain meter pointer is resting at zero. (Adjust meter pointer zero adjust screw on meter cover bezel, if necessary).
- (4) Select **FUNCTION** switch to **B1** and then to **B2** to read battery condition.
  - (a) A reading above BATT. OK radial on the meter dial is satisfactory.

**NOTE:** Always return the **FUNCTION** switch to the **MEGOHMS** position after a battery test to avoid small amount of battery drain.

- (5) Place **FUNCTION** switch on **MEGOHMS** for megohmmeter operation.
- (6) With **RED** test probe free from contact with external circuits or black probe, press probe pushbutton, and then turn **FULL SCALE ADJUST** as required to produce full scale deflection of meter pointer.

**CAUTION:** THIS ADJUSTMENT MUST BE RECHECKED WHENEVER A DIFFERENT VOLTAGE SELECTION IS MADE.

- (7) Connect **BLACK** probe to low, common, or ground side of circuit to be tested. (If both sides of circuit to be tested are high, either point may be contacted with black probe). Insert accessory clip on black probe, if more convenient.
- (8) Connect **RED** probe to other test point, and with pushbutton depressed, read insulation resistance in megohms on meter scale.
  - (a) Consult component manufacturer's specifications for acceptable insulation resistance.

**CAUTION:** WAIT FOR METER TO COME TO FULL REST BEFORE READING. THERE MAY BE A MOMENTARY DELAY AFTER BUTTON IS PRESSED FOR HIGH VOLTAGE CONVERTER TO COME UP TO FULL POTENTIAL, AND CAPACITANCE IN THE CIRCUIT UNDER TEST MAY REQUIRE CHARGING TIME.

- (9) Consult the Application Notes (Next Section) for further details on specific application of the 2471F to insulation testing.

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### **2. APPLICATION NOTES**

- (1) Insulation sometimes will exhibit different leakage resistance with different test potentials applied. A reduced resistance reading with an increased setting of the **VOLTS** switch is a normal condition in such cases.
- (2) If the probes are connected across an appreciable value of capacitance, the meter will respond very slowly as a reaction to the charging time of the capacitor (approximately 5 seconds are required for 0.1  $\mu\text{F}$  and 1 minute for 1  $\mu\text{F}$ ). If higher capacitance values are to be tested, the capacitor should first be charged to the test voltage before applying the megohmmeter. Be certain to connect the **RED** probe to the positively charged capacitance terminal, and wait for the voltage across the capacitance to equalize to the megohmmeter test potential as indicated by an on-scale steady reading on the meter.
- (3) Even the slightest amount of electrical continuity to the bare red probe from a circuit not part of that being measured will introduce erroneous readings. Exercise care not to touch the bare end of the red probe or any circuitry not connected to the black probe while testing. Make certain that no part of the device under test is inadvertently grounded other than that which is normal ground.
- (4) When testing devices that have been exposed to moisture or dirt, low insulation resistance will often be indicated. Complete cleaning and dry baking at a temperature about 50°F above ambient will generally remove this source of leakage. In hot wet climates, even superior insulations may have conductive paths through fungus growths. Cleaning and drying may remove most of such growths, but if the spores are not killed, the growth may return in a few days. A fungus killing and growth inhibitor is recommended in such cases.
- (5) A DC megohmmeter is not a substitute for an AC high-voltage break down tester. Alternating voltage strains an insulation in first one direction and then another. The behavior of the insulation under such strain is quite different from the application of a low current DC test. In many applications, both types of test are required. If the device to be tested is not subject to high voltages or high temperatures under normal operation, high-voltage DC megohmmeter tests should suffice.
- (6) If a very low insulation resistance is indicated, a conventional ohmmeter should be used for fault isolation. The lower operating voltage and low resistance readability of a conventional ohmmeter is more satisfactory for finding direct or low resistance short circuits
- (7) The normal deterioration of insulation results in a lowering of resistance with time. Therefore, an insulation reading just slightly above a specified minimum, generally indicates an impending failure. Corrective measures should be taken to prevent further deterioration. By recording periodic insulation measurements, deterioration trends will be indicated so that preventative maintenance can be established.
- (8) Insulation minimums are generally specified (or implied) for dry atmospheric conditions. If the unit under test cannot be brought into a dry environment, or baked, reduced insulation resistance can be anticipated and allowances made accordingly.

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- (9) Sometimes insulation tests are required in polarized circuits that will exhibit low resistance when subjected to an opposite polarity. Consult the test specifications for polarity. The **RED** probe is always positive polarity from the megohmmeter. If in doubt, make a test with probes connected in one manner and then reversed for a second test. A substantial difference in reading will indicate a polarized circuit.
- (10) If the megohmmeter indicates either an upward or downward scale reading with the probes connected, but with the pushbutton released, the circuit under test is energized. (Small potentials may not produce a reading without button pressed but will introduce erroneous readings). Make certain that all power to the device has been removed and that all capacitances have been discharged. Some devices will retain residual voltages long after the power has been removed.
- (11) Some tests require that jumpers be placed between two or more points on the device under test while making insulation tests. This is generally done to prevent possible damage to portions of the circuit that are not designed for high voltage application, or to make an overall insulation test for a number of circuits simultaneously. Be certain to follow the test specification procedures when jumpers are indicated.

### **3. CARE AND MAINTENANCE**

The 2471F megohmmeter is designed to give lasting accurate performance provided reasonable care is exercised in operating and handling.

- (1) Keep test set in its carrying case at all times to reduce the danger of damage from vibration, shock, and moisture. Exercise reasonable care to avoid dropping or excessive shock. Protect from rain and exposure.
- (2) Store in cool, clean, dry place to reduce contamination and battery deterioration. **REMOVE BATTERIES IF TEST SET IS TO BE STORED FOR PROLONGED PERIODS.**
- (3) Do not subject megohmmeter to electrically energized circuit. The 2471F is safe from damage from externally applied AC or DC voltages up to 300 volts, but high voltages may be dangerous to the operator and will produce erroneous readings.
- (4) Two sets of batteries are used. The three smaller AA cells (Eveready E91, or equivalent) provide the positive 4.5 volts for the operational amplifier and triggering of the battery transistor switches. The three larger C cells (Eveready E93, or equivalent) provide the negative 4.5 volts for the operational amplifier and high voltage converter. The 2471F is designed for operation with alkaline type cells, but conventional zinc carbon cells may be used as temporary replacements.
- (5) The **B1** position of the **FUNCTION** switch connects the meter for testing the condition of the C cells, and the **B2** position for the AA cells. A reading below the **BATT. OK** radial on the meter scale is an indication of unsatisfactory battery condition. A more significant test may be made by observing the meter on the **B1** and **B2** positions with the probe pushbutton depressed. The pointer will drop slightly on the **B1** position, but should remain above the **BATT. OK** radial. There should be no more than a barely perceptible drop on **B2** with the button depressed.



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- (6) To gain access to the batteries, release the strap across the top of the meter and remove tester from its carrying case. Place the test set in a clean area. (A clean cloth or paper pad placed to the right of the test set to receive the inverted panel is desirable). Remove the four corner panel screws. Withdraw the panel and rest it inverted to the right of its case.
- (7) Push one of the battery holding clips aside while withdrawing the batteries. When replacing cells, make certain they are all inserted in the retainer tube in the same direction. The small terminal + (plus) end should connect to the **RED** terminal end of the respective battery holder.

## **CHAPTER 3: RECEIVING, SHIPPING, AND STORAGE**

### **1. RECEIVING**

No special unpacking procedures are necessary. It is recommended that the factory shipping container and packing materials be retained should it become necessary for any reason to reship the instrument.

It is also recommended to inspect carefully the instrument for damage. If damaged, do not use it and immediately notify the carrier and the manufacturer.

### **2. SHIPPING**

Use standard delicate electronic equipment packaging procedures, when packing the instrument for reshipment.

### **3. STORAGE**

Place a four-ounce bag of desiccant inside the carrying case (optional).

Store in a dry place with a temperature range of -10° C to +50° C.