

SUBJECT PERMEABILITY TEST of
Feebly Paramagnetic Materials

SUPERSEDED DATE

This method of test covers the measurement of permeability of paramagnetic materials having a permeability less than 1.05.

1. EQUIPMENT

a. Permeameter - Consisting of an electromagnet and a balance conforming to the following requirements:

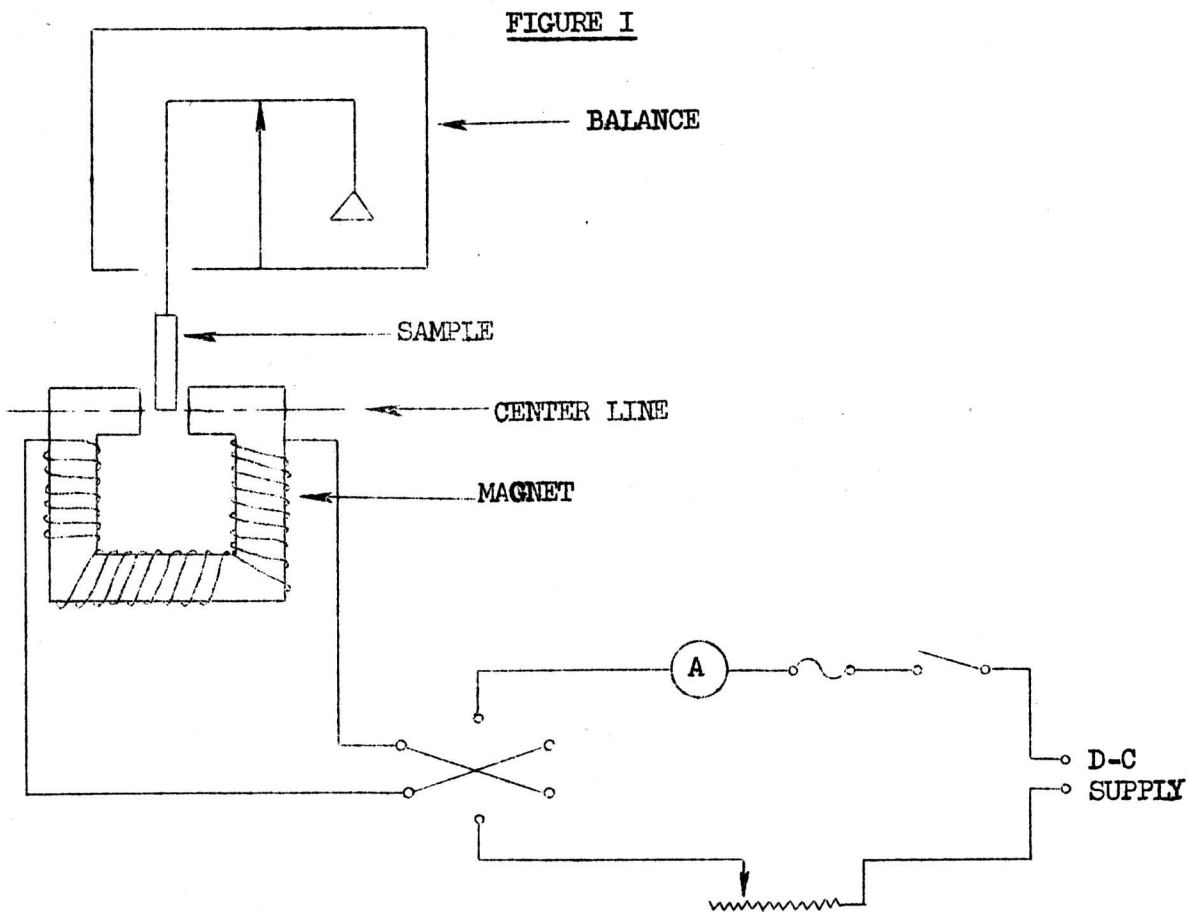
- (1) Electromagnet - shall have pole faces with minimum dimensions of $3/4$ in. x $1-1/2$ in. and with an air gap no greater than $3/4$ in.

The magnetizing winding shall be so wound as to produce a field of at least 1,000 oersteds between the pole pieces without overheating.

- (2) Balance - capable of weighing up to 50 grams and with a sensitivity of 0.1 milligram.

b. Power Supply - steady direct-current power.

c. Miscellaneous - current control equipment for the magnetizing circuit such as ammeter, rheostat, and reversing switch.



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2. TEST SPECIMENS

- a. The test specimens shall consist of straight bars, rods, wires, strips, or tubings of uniform cross-section.
- b. The length of the specimen shall be not less than 2-1/2 in. The minimum cross-sectional area shall be not less than 0.015 sq. in. (0.1 sq. cm.).
- c. The width of the specimen shall not exceed 1/2 inch.

3. PROCEDURE

- a. The sample shall be suspended from the balance in such a manner that the lower end of the sample is within $\pm 1/16$ in. of the center line of the air gap (see Figure 1).
- b. The sample shall be weighed before the application of magnetizing current.
- c. The magnetizing current shall then be turned on and reversed at least 5 times to nullify the effects of hysteresis in the electro-magnet core. The sample shall then be weighed with the current on.
- d. The cross-sectional area of the sample shall be measured.
- e. Measurements shall be made at two values of the magnetizing force in order to verify that the material is paramagnetic.

* 4. CALCULATION

The permeability shall be calculated as follows:

$$\mu = 1 + \frac{3.82 \times 10^6 F}{AH^2}$$

Where:

μ = permeability of the test specimen.

F = force in milligrams acting on the specimen due to magnetizing current.

A = cross-sectional area of specimen in sq. mils

H = magnetizing force in oersteds.

(See Chart on Page 3.)

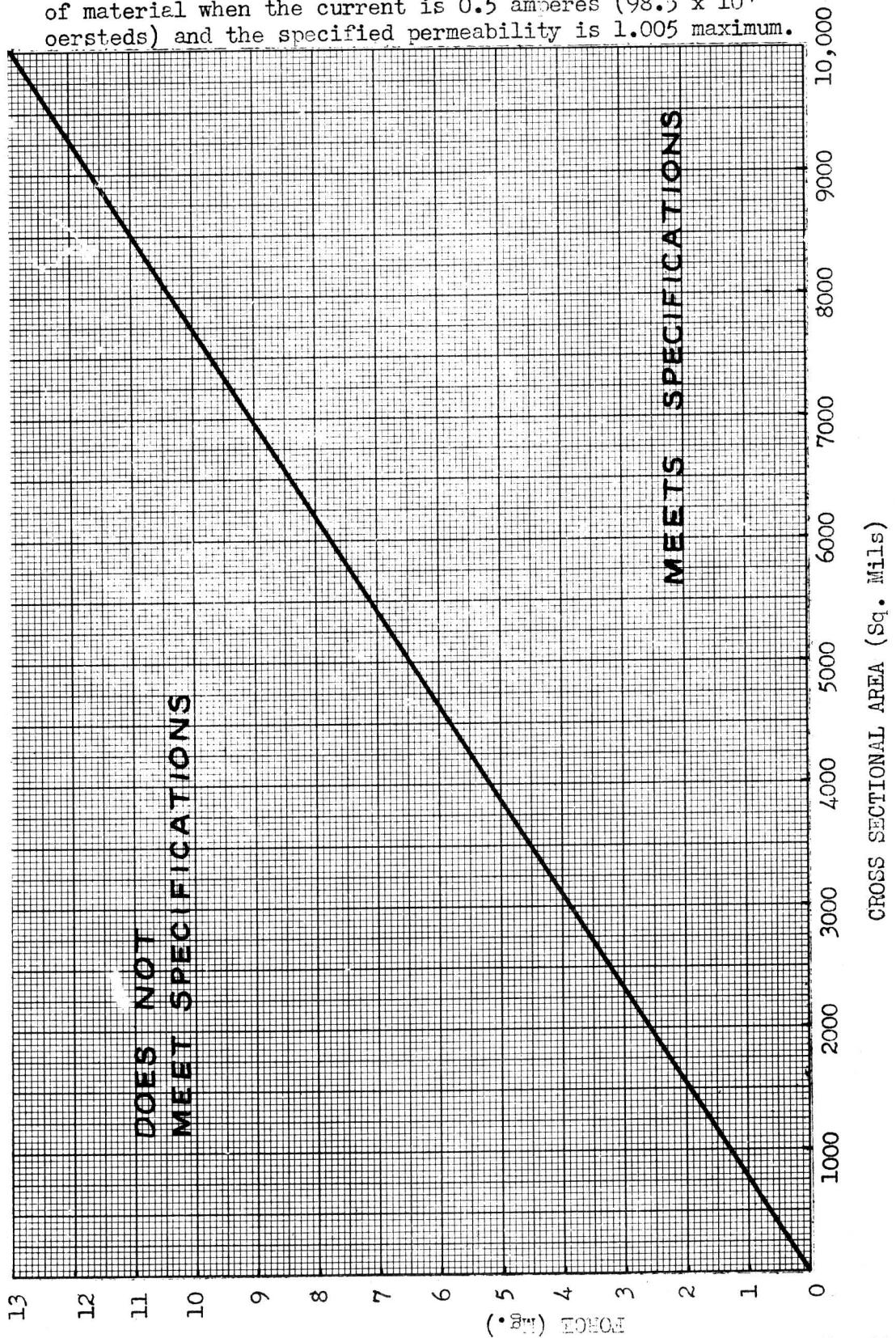
5. ACCURACY

For specimen having a satisfactory degree of magnetic uniformity along their length, and tested at a definite temperature, the quantity ($\mu-1$) should be accurate within ± 8 per cent or ± 0.0001 whichever is the greater.



CHART OF FORCE VS. AREA

This chart may be used for quick and accurate inspection of material when the current is 0.5 amperes (98.5×10^4 oersteds) and the specified permeability is 1.005 maximum.



*** CHANGE
 *** ADDITION
 *** DELETION

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