



SUBJECT TEST FOR MOISTURE & OXYGEN IN HYDROGEN BY DEW POINT

SUPERSEDED DATE

A. TEST FOR MOISTURE IN HYDROGEN

Herein described is a simple, accurate and flexible method for determining the amount of water vapor in hydrogen gas.

The process is based on the fact that if the temperature of gas is varied while its absolute humidity remains unchanged, then the dew point is that temperature at which the relative humidity is 100%.

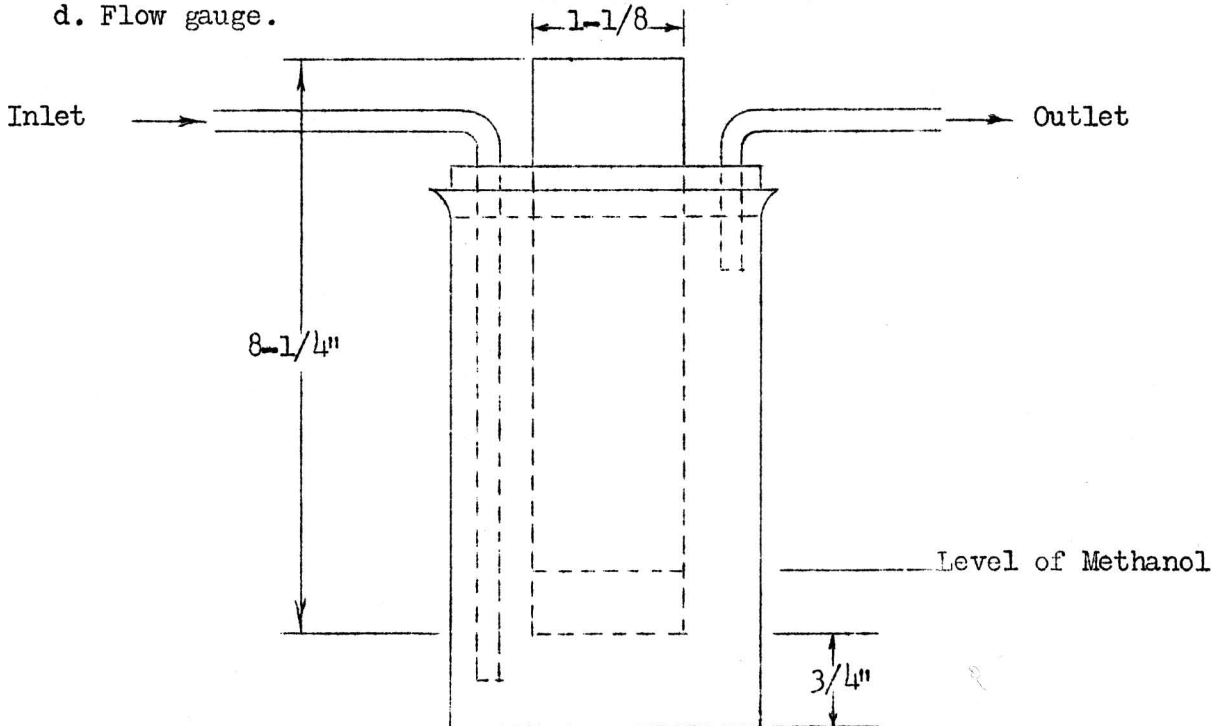
With the aid of the graph on following page, this test may be used in the following instances:

- a. Check moisture content of incoming hydrogen gas from gas house.
- b. Check efficiency of "Lectrodryer" (34-34-4B).
- c. Check efficiency of magnesium perchlorate dryer.
- d. Check for leaks in water cooling coils in bottle used for treating metal slugs and for moisture adsorption on inside of treating bottle.

For items b to d inclusive, determine the dew points (as described below) of the gas before and after the gas has contacted the respective apparatus or material to be checked and the differences in water vapor content as read from the graph will give the answers sought.

1. EQUIPMENT

- a. Thermometer (20°C. to -100°C).
- b. 600 cc Pyrex beaker (tall)
- c. Dew Point Tester (see sketch) - This consists of a chromium plated copper tube closed at one end, which is sealed into a glass beaker with a rubber stopper to which is fitted glass tubing for passing hydrogen.
- d. Flow gauge.



★ CHANGE
★★ ADDITION
★★★ DELETION

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2. MATERIALS

a. 33-L-16 Methanol or other higher alcohols like ethanol, propanol or butanol. The higher alcohols are more convenient to use.

b. Dry Ice

3. PROCEDURE

a. Pass portion of gas to be tested thru dew-point tester and flush thoroly to expel all air. If room is well ventilated, gas may be vented to room atmosphere.

Note: Since hydrogen has a high specific heat, it will be necessary to lower the rate that it passes thru the dew-point tester in order to obtain low enough temperatures. A rate of approximately 10 cu. ft. per hr. is used in determining the dew-point of purified hydrogen used in the manufacture of tungsten, moly, Downio, H wire and thori-ated tungsten wires.

b. Add methanol to copper tube to about the level indicated on diagram and add small pieces of dry ice to methanol, stirring continuously with the low temperature thermometer.

c. Temperature at which the passing hydrogen becomes saturated with water vapor will be indicated by a fine precipitation of moisture or by frost upon the brightly polished chromium plated tube. This precipitation or frost temperature is called the dew point and is expressed in degrees Centigrade.

B. TEST FOR OXYGEN IN HYDROGEN

The following test (conversion of oxygen to water vapor) in conjunction with dew-point test may be used in the following instances:

- Check oxygen content of incoming hydrogen gas from gas house.
- Check efficiency of purifying tube.
- Check for leaks at mercury seal of bottle used for treating metal slugs and thru bottle itself.
- As a check on thoro flushing of treating bottle.

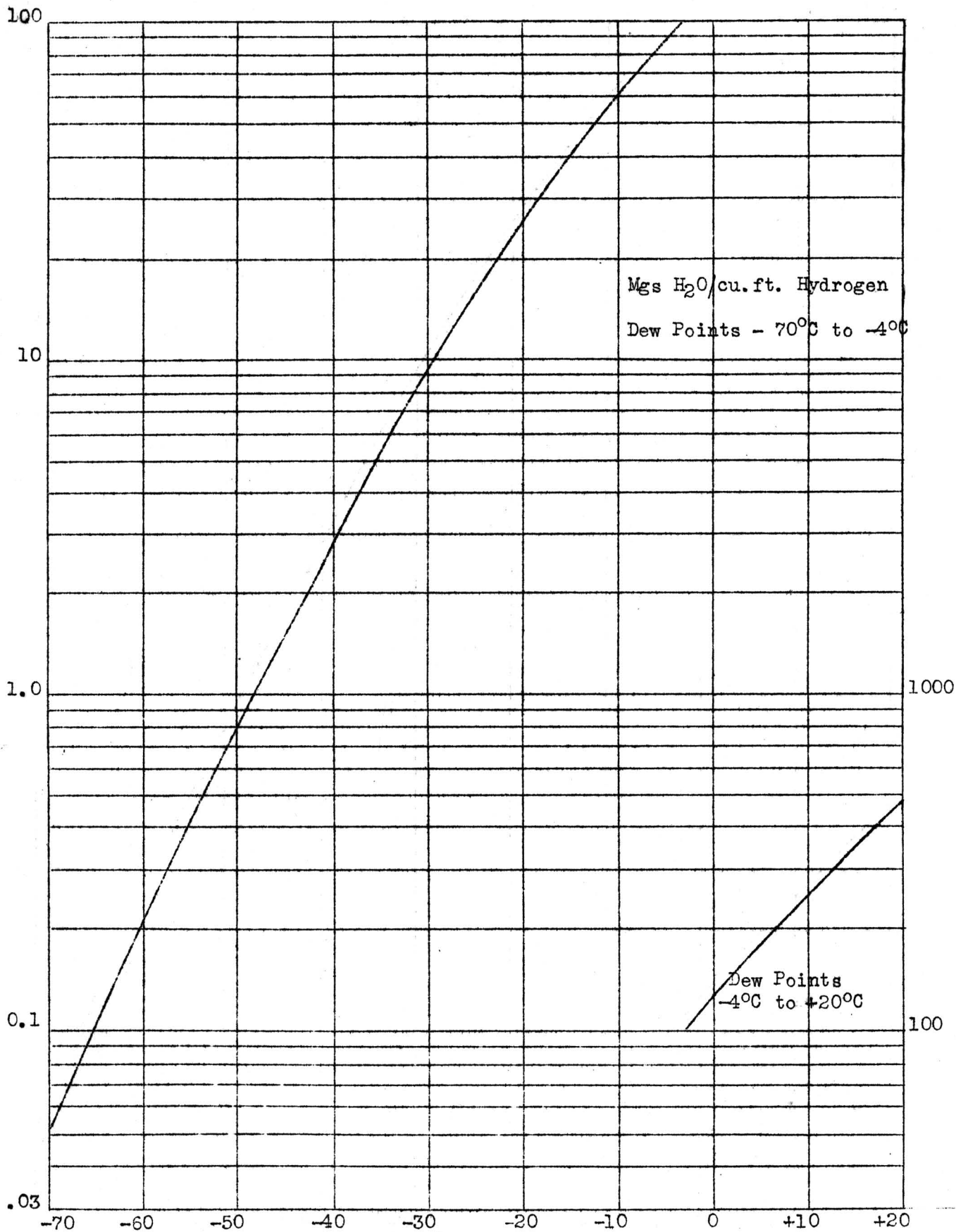
1. EQUIPMENT (Additional for this test)

a. Quartz or nichrome pipe - $3/4$ " diam. x 3' length, packed with copper or nickel shavings (or clippings). Tube extends thru a suitable tubular electric furnace such as Hoskins FD-303, maintained in a vertical position to insure passage of gas thru shavings since these materials have a tendency to pack on heating. Use of iron pipe is objectionable since it allows the passage of oxygen into the system at temperatures around 500°C .

b. Copper cooling coil - 12 turns of $3/8$ " tubing, coil I.D. - 6".

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2. PROCEDURE

Process consists essentially of determining the dew points of gas before it enters the respective apparatus and then passing the gas thru the quartz pipe heated to 500°C (where the oxygen is converted into vapor) and thru the cooling coil and then determining the dew point.

To determine the amount of oxygen/cu. ft. of hydrogen proceed as follows:

- a. From the graph determine the amounts of water vapor/cu. ft. present as indicated by the respective dew-points.
- b. The difference between these amounts will give the water equivalent of the oxygen formerly present (assuming that all oxygen has been converted).
- c. Multiply this water equivalent of oxygen by 16/18 (O/H_2O) or 0.888 to obtain the ngs. of oxygen/cu. ft.

STANDARDIZING SECTION
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