

What's Wrong with Relative Humidity Above 100°C?

Water vapor above a temperature of 100°C, at atmospheric pressure is in the superheated state. The characteristics of the relative humidity scale change drastically in the super heat area. It is somewhat like going through the sound barrier, the physics take on new characteristics in the super heat area just as they do in the supersonic area. This can be confusing if not prepared for the change.

Below 100°C it is possible to achieve 100% relative humidity at any temperature. Above 100°C (in the super heat area) the maximum possible relative humidity plunges rapidly as the temperature increases. Pure steam (100°C dew point) will register only 20% on the relative humidity scale at 149°C. At 177°C the maximum possible RH is only 10%. At 204°C, maximum RH is only 5.9% and at 371° C, maximum RH is a mere .48%.

An RH instrument with a published accuracy of +/-1% will only indicate true moisture level with an accuracy of +/-5% at 149°C (+/-1% out of 20%), +/-10% at 177°C, +/-17% at 204°C, and will be useless at 371°C, even if the sensor is not destroyed by the high temperature.

Most RH instruments have a reduced accuracy specification above some specific temperature. An instrument with a published accuracy of +/-1% may be +/-2% above 93°C. This is sometimes hard to find on the data sheet, but is usually there somewhere. If the RH accuracy drops to +/-2% at elevated temperatures the true moisture level will have an accuracy of +/-10% at 149°C, +/-20% at 177°C, and +/-34% at 204°C.

Even if we forget about the absolute accuracy of an RH instrument above 100°C, the RH scale itself has problems in the super heat area. An RH instrument that is totally accurate may indicate 10% RH at a temperature of 149°C. This point is equivalent to 50% moisture by volume, or a dew point of 82°C or a humidity ratio (kg water vapor/kg dry air) of .622. This same instrument will display 10% RH at 177°C at 100% moisture by volume, or a dew point of 100°C, or a humidity ratio of infinity.

The above shows that the relative humidity scale is essentially useless or even misleading at temperatures above 100°C.

Some relative humidity instruments can indicate dew point or another absolute humidity scale. This is done by measuring RH and temperature and then calculating absolute humidity. This method is not accurate above 100°C because of the limited maximum indication on the RH scale.

For more in depth information on this subject refer to pages 7 & 8 of the ["MAC Humidity/Moisture Handbook."](#)

The [Mac Humidity / Moisture handbook](#) can be viewed online at [**www.macinstruments.com.**](http://www.macinstruments.com)