

Dew Point Control and Water Bubbler Systems for Co-Fire Operation

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Definition:

The temperature at which a dew of frost will start to build up (ie - when a mirror in ambient air begins to mist-up, it's temperature has reached below the condensation point).

Design Rules:

- Unaided a dew point reading can never be higher than your ambient air temperature.
- The Dew Point of a gas run through a bubbler of water (water at 20°C / room temperature), will be approx 5°C lower than the water temperature (ie - 15°C dew point).
- In order to get a dew point *higher* than 20°C, you must heat the water bubbler (from 60°C to 80°C), and heat your gas inlet lines with self-regulating heat tape as well (to prevent condensation). Only then can you attain dew points of 60°C and higher.
- The Dewpoint of most process gases out of a gas bottle is approximately -60°C.
- Dew point sensors/gauges used in Hydrogen gas environments needs to be *intrinsically safe* for use in flammable gases.
- Design should include copper piping with brass fittings for inert gas and Hydrogen for dew point monitoring above -20°C . If dissociated ammonia is the process gas, system should use all SS piping. If dewpoints less than -20°C are desired, all SS piping (for either inert or H₂) should be used with Swagelock fittings for all connections. VRC fittings or orbital welding available upon request at extra cost.
- Dew point sensor location should be at the inert gas pipe entrance to the furnace for vacuum units (the only point that is at positive pressure). For continuous Belt or retort furnaces you sample the exit gas, so you know what the process has seen.
- Gas inlet into water bottle include SS dip tube with sintered SS aerator to provide high surface area to bubbles increasing the water-carrying capability.
- To maintain dewpoints below -40°C the customer is instructed to use SS tubing and SS regulators from house gas source to CVI gas panel and ensure tubing length is kept as short as possible.



Advantages of the Dew Point Control and Water Bubbler System

- Proven system for use in co-firing, brazing, metallization, and heat-treating.
- System provides rapid reading of Dew Point, allowing for better furnace control and process information.
- Available Dewpoint range from -100°C to +90°C.
- Fully automated control, or manual control via flowmeters with display of Dewpoint on Control Cabinet.
- Fast response to dewpoint changes.
- Dewpoint sensors not harmed by contact with water.

System Description:

Manual Gas Wetting Monitoring & Control System

Gas Bubbler System

Manual dew point control. Dew point is controlled by manually adjusting the proportions of wet and dry process gas based on input from Dew Point Monitor. All lines will be copper (stainless steel for Hydrogen process gas, or when very low dew points are desired) and should be heated above dew point (required self-regulating heat tape and insulation for systems operating up to 60°C).

Kahn Ceramic Hygrometer

One (1) Kahn Cermet II Ceramic Hygrometer sensor will be cabinet mounted with one (1) line at forming gas inlet (*OPTIONAL*: additional (1) line at exhaust tower outlet with switch on cabinet to select inlet or outlet measurement). The sensor will be utilized for measurement signal and mounted in heated enclosure to prevent condensation of moisture. The sensor can be completely saturated without damage resulting. For systems operating above ambient temperature, the lines will be heated above 60°C to prevent condensation.



Gas Distribution System

The main gas supply will be delivered to the chamber at one (1) location with quick disconnect fitting and additional tubing to reach inside the hot zone. The gas line will be stainless steel and heated above 60°C by radiant heat within the chamber.

Automated Gas Wetting Monitoring & Control System



Gas Bubbler System

Automated dew point control (accuracy +/- 2.5°C) system for -60°C to +90°C. Dew point is controlled by automatically adjusting the proportions of wet and dry process gas based on input from Dew Point Hygrometer. All lines will be stainless steel and heated above dew point.

Kahn Ceramic Hygrometer

One (1) Kahn Dewmet Optical Hygrometer will be cabinet mounted with one (1) sensor line at outlet from gas wetting system. The sensor will be utilized for control signal and mounted in heated enclosure to prevent condensation of moisture. The sensor can be completely saturated without damage resulting.

Gas Distribution System

The main gas supply will be delivered to the chamber at one (1) location with quick disconnect fitting and additional tubing to reach inside the hot zone (through floor). The gas line will be stainless steel and heated above 60°C by radiant heat within the chamber.

System Operation:

Manual:

Operator manually sets needle valves on flowmeters to regulate the amount of "dry" and "wet" process gas. Wet gas line passes through a water bubbler picking up moisture and mixes with the dry gas. Heated lines carry the wet gas into the furnace gas manifold and into the furnace hot zone or chamber (customer decides), to prevent condensation if the air temperature is lower than the water temperature. Kahn ceramic sensor reads dew point level and displays it on a digital display mounted on the control cabinet.

Automated:

System automatically controls flow of "dry" and "wet" forming gas. Wet gas line passes through a water bubbler picking up moisture and mixes with the dry gas. Heated lines carry the wet gas into the furnace gas manifold and into the furnace hot zone or chamber (customer decides), to prevent condensation if the air temperature is lower than the water temperature. Hygrometer sensor reads dew point level and displays it on a digital display mounted on the control cabinet.

Equipment Description:

Kahn Ceramic Digital OEM Hygrometer and Ceramic Dewpoint Transmitter

- Range: -80°C to +20°C.
- 4-20mA and 0-10VDC outputs
- OBSOLETE AS OF 2/14/2000

Kahn Cermet II Hygrometer

- Range: -100°C to +20°C.
- 4-20mA output

NOTE: Above systems utilize a ceramic sensor and have a realistic range of -80°C to +20°C for vacuum furnace use. Note that all dew point gauges can only be used to sense at *positive pressure*. In order to go to higher dew points, a change in technology is required, using an "optical tube mirror" design, as shown below:

Kahn Dewmet Optical Hygrometer

- Range: -40°C to +80°C (typical range).
- Max. Range: -60°C to +90°C (user must select a narrower range within the max.avail. range)
- 4-20mA and 0-10VDC outputs.
- Optional digital outputs.



Centorr/Vacuum
Industries
55 Northeastern Blvd.
Nashua, NH 03062
Ph: 603-595-7233
Fax: 603-595-9220