

Using Ceramic Tile Hygrometers to Verify Pipeline Drying Processes

Application Background

Process Pipelines (and chemical vessels) which operate at elevated pressures need to be tested for the integrity of their construction and sealing at the time they are assembled and sometimes, periodically during usage to satisfy industrial safety legislation. There are a number of methods of conducting this pressure test, with the most common method being to seal the pipeline or vessel and pressurise with liquid water. Gas can be used to pressure test a vessel, but it is less commonly used because of its high compressibility which would be very dangerous if a leak or fracture developed in the pipeline.



Sasol Refinery, South Africa

The problem with using water is that it leaves the pipeline wet after the test. This has two effects. First, that the corrosion of the pipe or vessel will be accelerated and second, that the process itself may well require the pipe or vessel to be dry. So it is common practice for the pipeline to be dried after the pressure test before it is put into operation.

Drying Methods

Three methods of drying the pipeline are commonly used, each of which can make use of a Michell Impedance Hygrometer.

1. Hot Air Drying

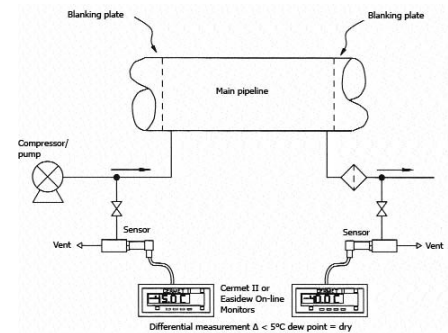
The pipeline is fed at one end with a supply of heated air from an air compressor. Heat energy is absorbed by the water in the pipeline which speeds evaporation. The water vapour is transported by the flowing air out of an exit port located at the opposite end of the pipe to the hot air entry.

An impedance instrument such as a Cermet II Online or Easidew Hygrometer located at the air outlet will indicate completion of the drying process when the outlet air dew point reduces significantly from its starting value. During

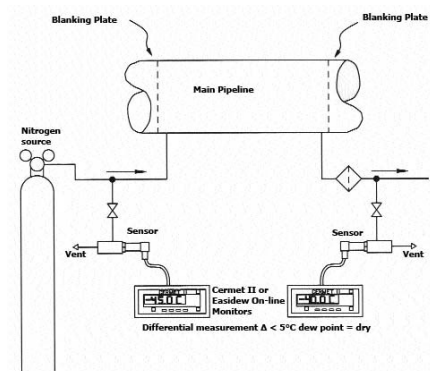
the process the air will be close to saturation at the prevalent ambient temperature. When the pipeline is dry, the dew point will reduce towards that of the feed air from the compressor.

2. Nitrogen Purge Drying

Instead of using hot air, an inert purge gas such as nitrogen may be used. Two advantages of using nitrogen are that it will be very dry and therefore have a high capacity for water adsorption and also that it is inert and can be used to prepare pipelines or process vessels that will later contain explosive or flammable gases.



An example of hot air drying

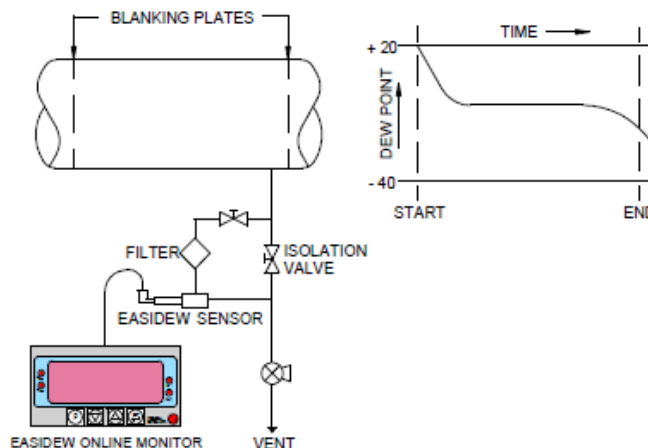


An example of nitrogen purge drying

The same procedure is used as in No.1 above, often with comparison of feed minus outlet gas dew point being the measurement which determines the dryness of the pipeline. It is common for a differential of 5 °C dew point to be used as the signal for the end of the drying process.

3. Vacuum Drying

In this method the pipeline is completely sealed and then a single port is connected to high power vacuum system, which extracts air from the pipeline. Over a period of time, the humidity level in the outlet will reduce rapidly as a stable vacuum level is formed.



An example of vacuum drying

There will be a period where the dew-point level stabilises as residual liquid water is evaporated and extracted. When all the water has been removed, the dew point will drop again and this signals the end of the vacuum purge process. A single Easidew or Cermet II Sensor mounted in the vacuum inlet will give rapid determination of the end point.

In any of the above applications, the Cermax or Easidew Portable Hygrometers may be used if the operator needs to make spot measurements or compare drying performance at various locations.

WARNING: Pipeline drying applications can easily damage any moisture sensors. Filtration is strongly recommended as is only exposing the sensors to gas towards the end of the drying process.

Reference Users

A-hak, AMEC, B J Process & Pipeline Services, Costain, Murphy



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