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Installation Guidelines

For PHASE DYNAMICS Water Cut Analyzers

There are three components to the Analyzer: the Measurement Section (often called sensor or just pipe), the Electronics Enclosure (often called transmitter, or just electronics), and the System Cable which connects the two. Except for some comments on the Electronics Enclosure at the end of these Guidelines, in the following we will only refer to the installation of the Measurement Section on the pipeline.

There are three ways in which the Measurement Section can be installed - in a flow-through mode, in a fiscal by-pass mode where existing fast loops exist, and in an insertion mode:

- In the flow-through mode, the Measurement Section becomes an equal-diameter part of the pipeline. Flow-Trough Analyzers are available in 1", 2", 3" and 4" pipe sizes.
- In the by-pass mode, the Measurement Section is installed in parallel with the pipeline in an existing fast loop normally used for fiscal sample extraction and density measurement.
- In the insertion mode, the probe of the Insertion Analyzer is inserted in the pipeline. This system is not retractable under pressure as probes designed in this fashion are a safety hazard. The connecting flange size is 3". Low Range Analyzers have a fixed probe length of 11.9", and can be installed in pipelines of 6" and up; Mid/High/Full Range Analyzers have a fixed probe length of 16.6", and can be installed in pipelines of 8" and up (also in a 6" pipeline on a Long Radius Elbow only).

Wherever possible, we recommend a flow-through installation over a by-pass installation, and in turn a by-pass installation over an insertion installation. Although the Analyzer performance is the same for each type of installation, there is a difference in the degree of confidence that can be had in a good measurement. In a flow-through Analyzer, the entire cross section of the flow to be measured is subject to the microwave field and therefore the measurement has the highest degree of confidence. The Insertion Analyzer has the microwave fields exposed to the fraction of the flow that is located inside the "cage" (the slotted part of the probe) only.

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1. Regardless of installation mode, the Analyzer should be neither the high point nor the low point of the piping system. Being the high point may contribute to the accumulation of gas, being the low point to the accumulation of water and/or sediments inside the Analyzer. The goal is that everything which goes into the Analyzer goes out on the other. This prevents gas, oil, water or sand from accumulating and affecting good measurement.

2. Regardless of installation mode, the general recommendation is that the Analyzer be mounted horizontally, parallel to the ground, in the center plane of the pipeline. Please note that all our suggested installation drawings show the top view of the installations! For any low flow situations the analyzer is best located in the vertical plane of piping with the flow from the top to the bottom so that separated water does not reside unmixed. In this situation the water will distribute itself as it is falling downward and will give better performance than in a horizontal plane.

3. For a good measurement, every Analyzer needs to see a flow as homogeneously mixed as possible. A good mixture is usually guaranteed by a turbulent flow regime, and a minimum flow velocity of 2-3 feet/second is recommended. If the flow has a lower velocity, mixture needs to be obtained by some other means, such as installation near a pump, a valve or an elbow. Elbows can either help to mix or act as a separator depending upon viscosity and density of the oil.

4. To prevent possible vibration damage to the ceramic central conductor in all Mid/High/Full Range Analyzers, we recommend that the maximum flow velocity not exceed 14 feet/second.

5. Please note that the Measurement Section of flow-through and by-pass Analyzers is not a spool piece. Its connections are arranged either in a “U” configuration (“in” and “out” flanges on the same side), in a “Z” configuration (“in” and “out” flanges on opposite sides) or in an “L” configuration (“in” and “out” flanges as an elbow). No one configuration is preferred over the other, and they can be chosen strictly to best fit the overall piping arrangement.

6. There is no predetermined “in” and “out” to the Measurement section, and both flange connections can be used interchangeably.

7. Do not step up or down from the inline pipe size to install a meter unless a pipeline size which is too large for the maximum flow rate is in place. In this case a smaller line size would provide good velocities to keep the mix and it would be acceptable to step down the line size from the mainline diameter.

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8. A critical issue in by-pass installations is that there be enough pressure drop in the main pipeline, between the "in" and "out" flanges of the Measurement Section, so that active flow is assured in the by-pass line. We recommend an installation with pitot tube (with pitot tube reaching to center of pipe), since such an arrangement is recommended by API for sampling.

9. A by-pass installation makes it possible to include isolation valves in the inflow and outflow legs of the by-pass, and thus to remove the Measurement Section from the process for purposes of inspection and repair.

10. For recommended installations of Insertion Analyzers please see our Drawings No. 0070-00226-000 for Mid/High/Full Range Analyzers and No. 0070-00227-000 for Low Range Analyzers. A critical issue in insertion installations is that the Measurement Section (i.e. slotted) part of the probe, together with the tip of the RTD, be in full contact with the active flow. The drawings show dimensions for Class 150 flange and Schedule 40 pipe only. Other flange ratings and pipe wall thicknesses require individual analysis, in order to confirm acceptable clearances and sufficient insertion depths. Insertion Analyzers cannot be used – and are not available – with flange ratings of Class 1500 and higher.

11. In the Low Range Insertion Analyzer, the bottom of the probe ("cage") is closed; in the Mid/High/Full Range Insertion Analyzer, the bottom of the probe ("cage") is open. In both cases make sure that the flow is always directed against the bottom of the Analyzer. This is to remove the concern that the area inside of the weldolet is flushed well by the oncoming fluids.

12. In the piping arrangement next to or near to any Analyzer, try to avoid any expansion of the flow from a smaller to a bigger pipeline size. Such expansion may contribute to flashing of the liquid into gas; the presence of gas will introduce an error in the measurement of the Analyzer.
Do not design and build any expansion chambers in 3" or 4" pipelines with the purpose of installing the Insertion Analyzer!

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13. If free gas is present in the liquid stream of a flow-through or by-pass Analyzer, the “out” flange of the Analyzer should be mounted higher than the “in” flange, in order to allow the gas to escape the pipe section.

14. Since the only way to validate any Analyzer is to compare its readings with the result of samples analyzed in the laboratory. The sample port must be installed near the Analyzer. This sample port can be located either upstream or downstream of the Analyzer. Analyzer and sample port need to be close enough that the operator reading the Analyzer screen can communicate with the operator taking the sample, and that the flow regime the same at the sample port and at the Analyzer.

15. The Electronics Enclosure should be mounted on a panel near the pipeline, about 5 feet above the ground. Ease of viewing, convenience of wiring, and simplicity of operation are the only considerations in the installation of the Electronics Enclosure. The distance between Measurement Section and Electronics Enclosure is limited by the length of the System Cable; our standard length is 30 feet, the maximum length available is 150 feet.

16. When used with process temperatures higher than 100 °C, the Measurement Section should be mounted vertically, with the oscillator enclosure being located at the bottom. This will contribute to the hot air rising away from the oscillator electronics.

17. When prevailing ambient temperatures are above 100 °F, it is recommended that the Electronics Enclosure be protected by sun shade. Higher temperatures will not affect the performance of the Analyzer, but will reduce the life span of the electronic components.

18. When prevailing ambient temperatures are below 32 °F, it is recommended that the Electronics Enclosure be equipped with an internal heater. Lower temperatures will not affect the performance of the Analyzer, but will make the screen display unreadable. Install the Electronics Enclosure in such a way that it is not exposed to prevailing cold winds.