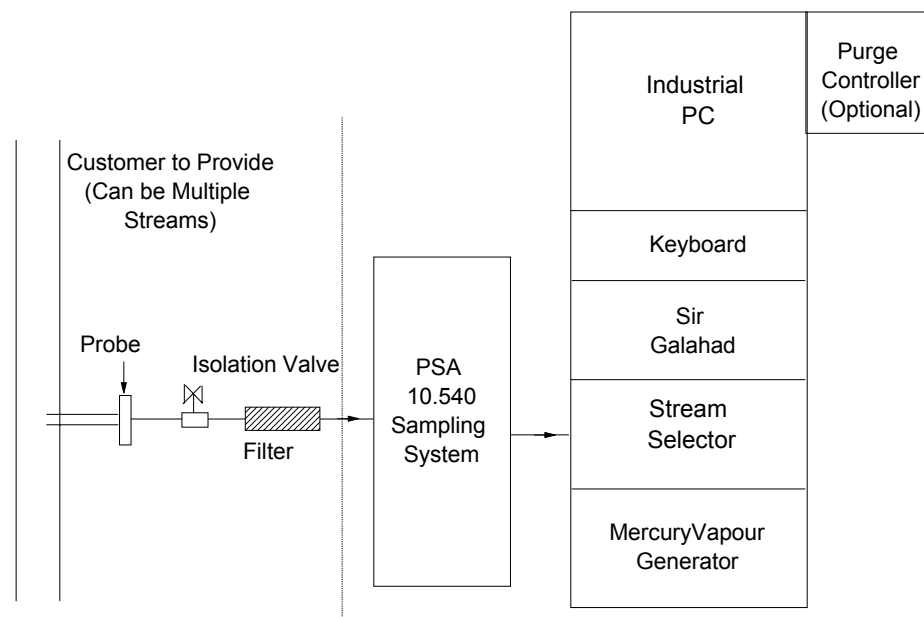


PSA 10.670 ONLINE DETERMINATION OF MERCURY IN PROCESS GAS STREAMS

The instrumentation described in this News Update is specifically designed to determine mercury online in process gas streams such as natural gas, LNG, LPG, hydrogen, carbon dioxide and Syngas. The system essentially consists of two units, a sampling system and a process analyser. This is shown in Figure 1 in the form of a block diagram.

Figure 1 Block diagram of instrumentation used for the online determination of Mercury in process gas streams.



P S Analytical work closely with the client to ensure that the instrumentation supplied is suitable for specified area classification. In most cases this will involve using a pressurised leakage compensation enclosure for the analyser and an Eexd sampling system. The customer's responsibility is to provide a suitable probe situated into the process stream, to give a representative sample free of particulates and the appropriate length of sample line made from a suitable material for the application. To avoid losses of mercury, Teflon sample lines braided with stainless steel and high primary bypass flowrates are recommended.



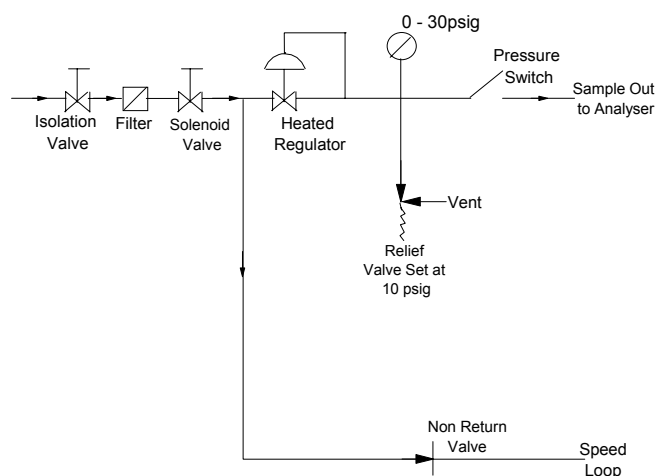
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Sampling System

The PSA sampling system is shown in Figure 2.

Figure 2 - Sample Stream Flow Diagram.



The sample stream enters the sampling system via an isolation valve. For additional protection of the sampling components a filter is included. The purpose of the solenoid valve is to shut down the sample stream via a contact closure in the event of an alarm condition. This prevents high-pressure gas entering the analyser enclosure.

Under normal operation, the gas flows continuously along the speed loop with a non- return valve to prevent sample backflow. The pressure of the gas stream is then reduced to between 6-10 psig. A relief valve downstream of the regulator set to 25 psig and a pressure switch set to 20 psig is used to prevent high-pressure gas entering the analyser enclosure.

Activation of the pressure switch will also close the solenoid valve installed in the speed loop. All components used in the sampling system are certified to ExD_11C_T3 or to the client's specifications. In some applications where toxic gases are present, the sampling enclosure can also be purged. Figure 3 shows a typical enclosure for a four stream sampling system.

Figure 3 - Typical Enclosure for a Four Stream Unit



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The Process Analyser

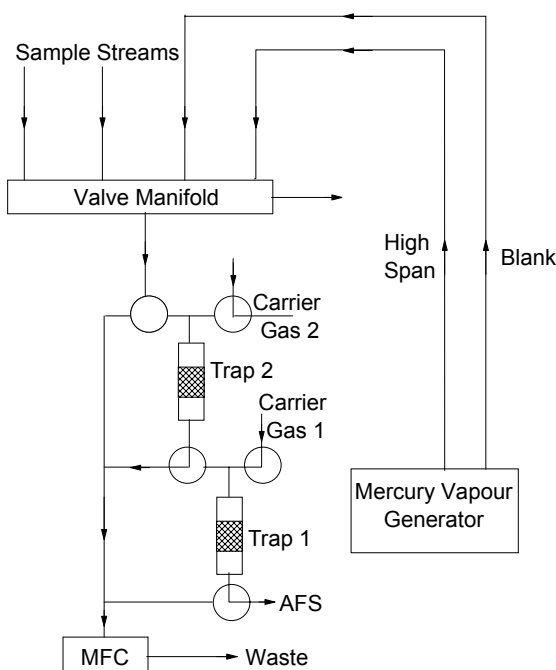
The pre-conditioned sample then flows to the process analyser. This consists of a stream selector, dual amalgamation atomic fluorescence spectrometer (Sir Galahad) and an automated calibration system (Cavkit). The various modules are controlled using the PSA Online Process Control Software (PSA C210S007, see News Update 34 for more information). For multiple stream applications, each sample flows continuously to the stream selector.

When a stream is selected the sample will flow over trap 2 so that the mercury can be collected. The sample flowrate is controlled using a mass flowcontroller. Once the required amount of sample has passed over trap 2 the mercury is released by thermal desorption into a carrier gas, which transfers the mercury onto trap 1. The mercury on trap 1 is then released by thermal desorption into the AFS detector. The whole period takes approximately 4 minutes per run based on a one-minute collection time. The system can also be used in a single trap mode provided the sample stream is dry. In dual amalgamation mode the collection temperature of trap 2 can be controlled, so we can sample above the dew point of gas. The Cavkit is used to deliver a high span of elemental mercury and blank to the value manifold so that automated calibration checking can be achieved. Alternatively the Sir Galahad can be calibrated in an absolute fashion using the vapour injection technique onto trap 1. The process analyser is shown in photograph form in figure 4 and by a schematic in Figure 5.

Figure 4 - Process Analyser



Figure 5 - Schematic Diagram of Online Hg Process Gas Analyser



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Table 1 - Specifications of Sampling System

Specifications Sampling System- Example for 4 Stream System	
Size (Disconnected)	Approx. 1500mm w x 1500mm h x 300mm d
Net Weight	100-200 Kg
Inlet Pressure (Regulator)	10 – 3000 psig (max)
Vent Back Pressure	Primary By-pass: Consult Supplier Sample Port Vent: Atmospheric
Sample Inlet Connection (Speed Loop)	¼" Compression(M)
Sample Outlet Connection (Speed Loop)	¼" Compression (M)
Solenoid Valve	110 - 220 Volts, (Normally Closed) Max Pressure (1500 psig)
Sample Wetted Components	316 st.st, Teflon, PFA
Ambient Conditions	-20 to +46°C
Area Classification (Customer to Specify)	Electrical Enclosures: EEx d IIC T3, Internal Interconnecting Flexible Cable Glands EEx IIC Over pressure vapour vent ¼" in compression Denotation Gas Group IIB, Option Available Detonation Gas Group IIC.
Sample bypass and Vent Connections	¼" Compression
Electrical Power Entry	M20 Female / ½" NPT
Heater Power 2x	Standard 100watt heater per Regulator.
Power Consumption	1 Amp @ 110 Volt 50 Hz per heater
Typical Flow Rate	Primary Bypass 12 l/min, secondary bypass 1 l/min Sample 0.5 l/min
Regulator Temperature per channel	197°C, set to 80-85°C compression
Outlet of Regulator Connection	¼" (Male) for ¼" Teflon o.d.
Pressure Switch	Adjustable between 7-30psig Set point typical 7psig



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Table 2 - Specifications of the Analyser

Specifications Analyser	
Approx Size (Disconnected)	Change to picture size NEW PIC NEEDED
Approx Weight	140 Kg NPT Female
Enclosure Classification	N ₂ purge 120 l/min 20 mins → l/min led cage compensation Air purge 120 l/min 20 mins → 120 l/min constant purge
Compressed Air Coolant	¹ / ₄ " Male Compression (60psi – 10 l/min at max flow)
Cavkit Gas Connection	¹ / ₄ " Male Compression (60psi) (Air) Typical Flowrate (2 l/min)
Sample Inlet Connection	¹ / ₈ " Male Compression (≈ 6 psig) Flowrate 0.5 l/min per stream
Mass Flow Controller	0-2 l/min RS232 Controlled
No of Streams	1-16 including blank and high span from Cavkit.
Analytical Runtime per Sample Measurement	4 minutes minimum (Dual) 2 minutes minimum (Single)
Output Signals Available	RS232, RS432, 4-20mA, Modbus, fibre optic, 0-5volts (Client Specification)
Working Concentration Range	1ng/m ³ → 3000µg/m ³
Power Requirements	110Volt, blank or 220Volt, (50 - 60Hz) (= 20 A max current load)



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