P S ANALYTICAL

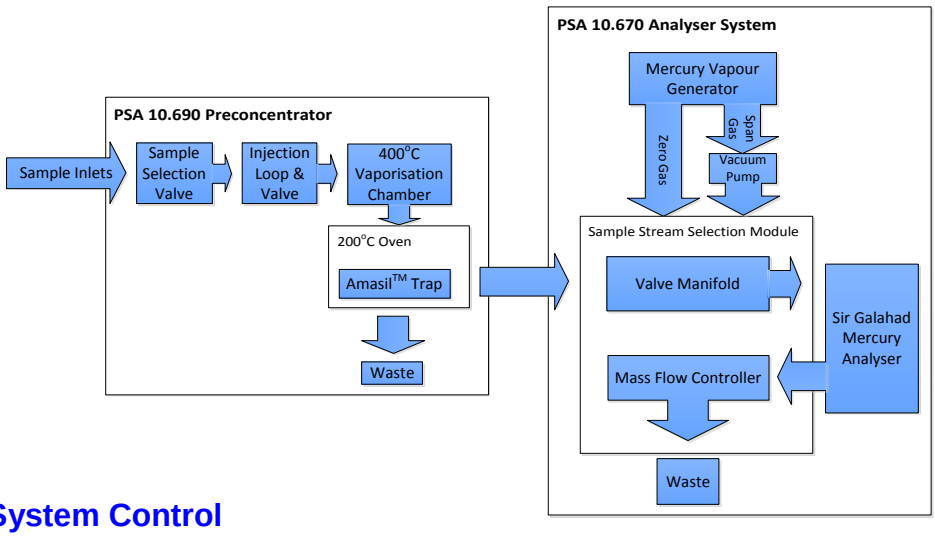
PRODUCT SPECIFICATION

PSA 10.690 ONLINE HG PRECONCENTRATOR SYSTEM

10.690 Online Hg Preconcentrator **10.690 + 10.670 When used together**

The PSA 10.690 Online Hg Preconcentrator System is used in conjunction with the PSA 10.670 Online Hg Analyser System and has been specifically designed to monitor the mercury concentration in multiple liquid-phase hydrocarbon samples. The Preconcentrator System is physically divided into two interconnected cabinets. A block diagram of the main components of the preconcentrator & analyser system is shown in Figure 1 and a flow schematic is shown in Figure 2.

Figure 1 The Main Components of the Preconcentrator & Analyser System



System Control

The Preconcentrator and Analyser are computer controlled for automatic unattended operation over prolonged periods. Results and Alarm conditions are reported via a DCS/PLC connection.

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Liquid samples are introduced to the analyser via a six-position sample introduction valve (N116V001) and a two position, six-port injection valve (N116V002) in the Electronic Cabinet of the PSA 10.690 Preconcentrator. Liquid samples are introduced under pressure to ensure that they are in the liquid phase when sampled. This is achieved by a back pressure regulator (BPR) located in the sample waste line downstream of the sample injection valve. A small pressure drop must be present between inlet and waste to provide sample flow through the system. Optionally, to reduce the pressure required to push liquid standards through the sample line, a BPR bypass valve may be included in the in the sample waste line discharge waste liquid standards at a lower pressure.

Once a sample has been selected for analysis, a flush period is allowed to ensure a representative sample is present in the injection loop. The sample is then injected into the Preconcentrator 400°C Vaporisation chamber in a stream of nitrogen carrier gas. This carrier gas flow rate is controlled to 200 ml min^{-1} by a rotameter labelled “liquid carrier” located within the Preconcentrator Electronics cabinet. Sample vaporised in the 400°C Chamber is passed over an Amasil™ trap located in a 200°C oven, where mercury on the sample is amalgamated onto the gold substrate. The vaporised organic material passes over the Amasil tube and out to waste via the sample waste port.

Mercury collected on the Preconcentrator Amasil trap is then transferred to the Sir Galahad for analysis. A further two-position, six-port valve within the Preconcentrator’s 200°C Chamber is actuated to direct a flow of nitrogen carrier gas over the Amasil trap and through a Stainless Steel Braided Teflon hose to the Sir Galahad Amasil Trap 1. The Preconcentrator Amasil trap is then heated to desorb mercury from the gold and transport it in the carrier gas stream to the Sir Galahad Amasil Trap 1 where it is collected by amalgamation.

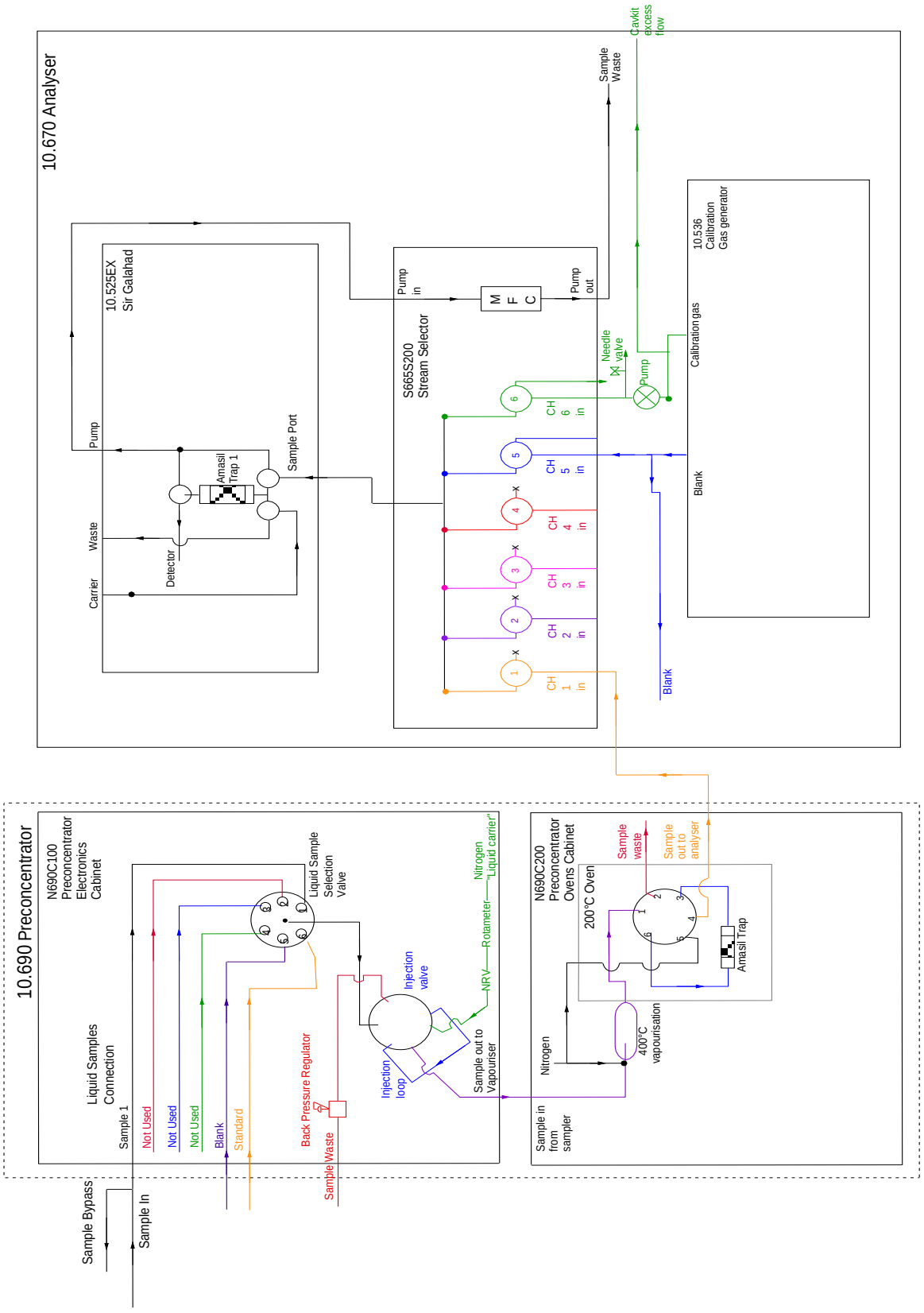
An argon carrier gas stream is then directed over Sir Galahad Trap 1 and into the detector. The Amasil trap is then heated, driving mercury off the gold into the carrier gas stream to detector where it determined by atomic fluorescence spectrometry.

The analyser is calibrated using calibration gas generated using the PSA 10.536 Calibration Gas Generator. The operation of this device is explained in the Calibration Gas Generator User Manual (Manual Part No. C536M050). To ensure gas flow is maintained through the analyser whilst isolating the reservoir in the Calibration Gas Generator from back pressure, calibration gas from the generator is delivered under pressure to the stream selector by a diaphragm pump with a Teflon-coated head. A tee-piece vent line is included prior to the pump to vent excess calibration gas. To remove mercury from this vented gas, the vent is passed through a carbon filter on the outside of the analyser cabinet.

Zero and span gas are delivered to the analyser via two-way solenoid valves in the stream selection unit within the PSA 10.670 Analyser cabinet. The gases are delivered under positive pressure, provided by the regulated air pressure for the zero gas and a vacuum pump for the span gas. Excess gas is vented via a T-piece in each stream prior to the stream selection unit, with a needle valve on the vent line used to restrict the vent and thereby pressurise the flow to the analyser

Once a sample stream is selected, it is passed straight through the Sir Galahad Amasil Trap 1 where any mercury present is collected on the gold substrate. Calibration gas delivered over the trap for a computer controlled time period and at a flow rate controlled by a mass flow controller located downstream of the analyser. The volume of sample collected is measured and recorded. An argon carrier gas stream is then directed over Sir Galahad Trap 1 and into the detector. The Amasil trap is then heated, driving mercury off the gold into the carrier gas stream to detector where it is determined by atomic fluorescence spectrometry.

Figure 1 Flow Schematic of the Preconcentrator and Analyser



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10.690 Cabinet

The PSA 10.690 consists of two enclosures joined with connecting umbilical tubes. This arrangement allows the separation of heat sensitive electronic equipment and heated components. The enclosures are nitrogen purged in series using a leakage compensation approach. Initially the purge rate is 225 L min^{-3} for a period of 9 minutes. During this period the nitrogen purge will pass through both cabinets and vent through the 10 mbar (gauge) relief valve of the electronics cabinet. The oven cabinet has a relief valve which opens at 15 mbar (gauge) to allow the bulk flow of nitrogen to pass back into the electronics cabinet. If the purge is interrupted during the initial purge period power to the enclosure will be isolated and the initial purge period will recommence.

After the initial purge period the flow will decrease to a minimum flow rate to maintain the enclosure in a blanket of nitrogen. If the purge is interrupted the power to the enclosure will be isolated and the initial purge period will recommence.

The purge gas has been distributed to each module within the enclosure to ensure that all compartments of the apparatus are fully purged.

A secondary “backup” nitrogen supply shall be used to provide a “top-up” facility in the event of loss of power or primary nitrogen purge gas. This secondary supply must be a separate gas supply that is not derived from the primary supply i.e. cylinder-fed nitrogen. In the case of cylinder-fed nitrogen, a changeover facility shall be used together with a pressure regulator and shutoff valve. This supply is connected to the ¼ in. tube bulkhead fitting located on the LHS of the Preconcentrator Electronic Cabinet. Flow control of this backup supply is by a normally open solenoid valve, a lockable needle valve and a rotameter. The needle valve allows flow to be adjusted up to 20 L min^{-1}, and this be monitored with the rotameter. In normal operation, the solenoid valve is closed, stopping flow of backup gas when the primary purge is functioning correctly. The valve opens only during loss of power or primary purge. The main purpose of the backup nitrogen purge is to prevent air entrainment into the cabinet from the outside during oven cool down.

Power Requirements

110 or 230v 50/60 Hz 2500 VA

Purge Gas requirements

Nitrogen (98.99% or better) at 4.1-7.9 bar gauge should be connected via the ½ in. NPT(F) connection (labelled “Nitrogen Purge Gas Inlet”) on the purge controller on the roof of the cabinet. The purge gas supply should be independently regulated and locally isolatable by an accessible ball valve or other device prior to entering the flow controller. Supply lines should be ½ in. o.d. or larger, sized to ensure the maximum rated gas flows of 225 L min^{-1} can be achieved.

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