Closed Loop and Open Loop Sampling Systems
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Forbes Marshall provides customised solutions for gas and liquid sampling. Samples in petroleum refineries, petrochemical complexes and chemical industries are either flammable or hazardous. Forbes Marshall's closed loop sampling system provides a safe means to sample these fluids.

Since the final product produced in the petrochemical industry is required to be of high standard quality, the need to analyse the process at various points is very essential.

Further to this, samples extracted can be collected in a sample cylinder or sample bottles for lab analysis with an ease of operation, handling and safety of the operator.

These sampling systems are available in flow through to vent and flow through to process plus vent configuration and are designed to handle a wide range of fluids like:

- High pressure gases
- Hot gases
- Hot flashing liquids
- Toxic fluids
- Light and medium distillates

### Salient Features

**Safety**
- Sample cooling for high temperature and pressure fluids
- Recommended for phase changing fluids
- Non-return valve in the venting helps avoid back-flow of sample in case of hazardous/flashing liquids
- Quick disconnect coupling for safe removal and assembly without backflow of sample cylinder
- Seamless spun sample cylinder (no welds, less corrosion) for safe collection of upto1000cc of sample
- Pressure gauge to indicate thorough sample collection
- Metallic braided hose with PTFE core to handle sour service - added safety for the operator
- Dip tubes and rupture disc for protecting equipment or system from over pressurization or potentially damaging
- Vacuum conditions
- Expansion chamber
- Operator safety including safe handling of sample while ensuring representative sampling
- No contact between sample and environment leading to a safer environment
- Sample unloading station

**Representative sampling**
- Fast looping option
- Heat tracing for wax forming and viscous services
- Pressure indications
- Purge sampling

**Quality**
- NACE
- IGC
- HIC for valves
- IBR form IIIC for pressure parts
- PMI testing
- Inhouse hydrotesting
- Sulfinert coating
- WPS PQR

**Special painting requirements (for Refinery Sample Cooler)**
- External painting
- Internal painting (epoxy, powder coating as per requirement)
- Internal liquid epoxy lining to the cooler shell
Low Pressure Liquid Sampling Application

Liquid samples are collected for laboratory analysis by a bottle configured sampler system.

- Injection manifold
- Injection manifold with vent port
- Glass Bottles with automatically sealed septum
- Fixed volume cylinders
- Suitable for high viscous liquids
- Customized end connections

High Pressure Low Temperature Liquid / Gas Sampling Application

High pressure low temperature liquid/gas samples are collected for laboratory analysis by a cylinder configuration system.

- Closed sampling
- Fast looping
- Fixed volume cylinders
- Dip tube and rupture disc for toxic/hazardous sample
- Expansion chamber
- NRV at outlet
- Pressure gauges at inlet and outlet
- Representative sample
- Clean and hygienic sample collection
- Customized end connections

For High Temperature Sampling Application

High temperature liquid samples are collected for laboratory analysis by a cylinder configuration system along with sample cooler

- Sample cooler
- Fast looping
- Closed sampling
- Fixed volume cylinders
- Dip tube and rupture disc for toxic sample
- Expansion chamber
- NRV at outlet
- Temperature and pressure gauges at inlet and outlet
- Representative sample
- Clean and hygienic sample
- Thermal shut off valve for temperature protection
- Special painting requirements for sample cooler
Injection Manifold

Liquid samples are collected for laboratory analysis by a bottle configured sampler system with injection manifold. Two needles with different lengths are designed and inserted in the septum, ensuring that there is no spillage of the sample. The sample enters through the longer needle and the other acts as a vent to avoid pressurisation.

After successful extraction of the sample into the bottle, the septum at the top seals the holes where the needles are pierced. After this, the sample bottle can be removed from the mounting bracket and carried to the lab for analysis.

Salient Features:
- Representative sampling
- Fast looping option
- Heat tracing for wax forming and viscous services
- Pressure indications
- Purge sampling
- Quality:
  - NACE
  - IGC

Manual Process Sampling System

Open Loop (Non-Hazardous):
- High Temperature Sample>50ºC (With Sample Cooler)
- Gas Sample (Including Hose to Sample Collection Cylinder)
- Liquid Sample (Direct to Sample Collection Cylinder)
- Low Temperature Sample>50ºC (With Sample Cooler)
- Gas Sample (Including Hose to Sample Collection Cylinder)
- Liquid Sample (Direct to Sample Collection Cylinder)

Close Loop (Hazardous):
- High Temperature Sample>50ºC (With Sample Cooler)
- Flashing Liquid
- Gas
- Liquid
- Low Temperature Sample>50ºC (With Sample Cooler)
- Flashing Liquid
- Gas
Sample Cylinder

Spun type Weld-less Sample cylinder, welded cylinder is not recommended due to following reasons:-

So far welded assembly of cylinder is considered, over the time of operation there are chances of corrosion due to process fluid, and this is not safe in view of operator safety.

Unnecessary corrosion at welded joints in cylinder assembly leads in endangering operator safety

Spun type weld-less sample cylinder is suggested considering above reasons, ease of maintenance, operators safety.

300cc/500cc (for gas/liquid sampling) or as per specification

DOT specification

Carrying handle

MOC: SS304 / SS316 / SS316L / Inconel / Monel / Hastelloy

Valves and Fittings

Each CLS system shall have its own isolation valves both at the inlet and outlet connections, for controlling sample flow, venting, bypass and isolating the system from the process.

MOC: SS316 / Inconel / Monel / SS316L / Hastelloy

Quality: IGC, NACE, HIC, 3.1 Certification, Dual certification as applicable

Sample Racks/Cabinets/Enclosure

Complete sampling system shall be mounted on fabricated racks/cabinets/enclosure as per requirement

MOC: MS/CRCA/FRP/SS304/SS316

Mfg standard epoxy powder coating or other project special painting requirement as applicable

Sample Cooler

Standard – DHx-series and CoolMax series

Special refinery sample cooler (single helix coil in shell type) for high temperature fluid samples

Quality: IBR, NACE, IGC, 3.1 Certification for wetted parts

MOC: CS / SS304 / SS316 / SS316 / Inconel / Duplex / Super duplex

Painting: External painting for cooler shell, internal painting for project requirement as applicable

End connections: Double ferrule for standard and flanged for special cooler

Flexible Hoses

MOC: PTFE Core with SS braiding/SS316 Core

End Connections

Double ferrule compression type

Flanged – class and rating as per process details

Special Requirements

Hot Insulation for personal protection

Handheld aspirator for vacuum or very low pressure application

Chemical filters

6-Port valve instead of manifolds

Solution for UOP design with better aspects

Unloading stations for liquid/gas samples

Pressure gauge: high pressure gauge (for gas applications with different pressure ranges)

Double block and bleed valve (DBB) for system isolation

Pressure rating: Up-to 6000 psi or as per specification

Flexible hoses with quick disconnect coupling for better operator safety
What Forbes Marshall Can Do For You?

With a lot of experience in providing systems for various processes for metering, measuring, analysis, control and other requirements in oil and gas industry we are in better position to understand your process.

With more than 60 years experience in Steam Engineering and Control Instrumentation, we are better placed to understand the thermodynamics, piping design, welding practices and other mechanical aspects of design with inhouse manufacturing capability.

With more than one decade of experience in the field of sampling system for oil and gas sector and petroleum Industry, with around 100 references, we have expertise and infrastructure to suffice various sample handling applications such as hazardous/high temperature fluids.

Safety First

Safety Chart

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Area Of Concern</th>
<th>Forbes Marshall Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>![warning]</td>
<td>High Temperature Samples</td>
<td>Forbes Marshall designs sample coolers for proper cooling of sample for equipments and operators safety before collecting sample for lab analysis</td>
</tr>
<tr>
<td>![warning]</td>
<td>Flammable Fluids</td>
<td>Forbes Marshall designs sampling system with fast loops and venting arrangements before collecting for analysis</td>
</tr>
<tr>
<td>![warning]</td>
<td>Humane Hazard (Toxic Fluids)</td>
<td>Forbes Marshall designs sampling system with safety interlocks for safety of operator collecting toxic liquids, flammable liquids</td>
</tr>
<tr>
<td>![warning]</td>
<td>Corrosive Samples</td>
<td>Forbes Marshall designs system with correct metallurgy for collecting sample fluids for handling corrosive fluids</td>
</tr>
<tr>
<td>![warning]</td>
<td>Fumes</td>
<td>Forbes Marshall designs system with correct venting, draining and purging arrangement</td>
</tr>
</tbody>
</table>

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