Need for Sampling in Oil and Gas Industry
Application Note: Oil & Gas

In an oil refinery, crude oil is processed and refined into more useful petroleum products, such as gasoline, diesel fuel, asphalt base, heating oil, kerosene, and liquefied petroleum gas. In these refineries there is extensive piping running throughout, carrying streams of fluids between large chemical processing units. These fluids are at different temperatures, pressures, viscosities and so on. For monitoring different process parameters for various purposes, it becomes essential to do the sampling of these processes, condition these samples and then analyze them by “on-line” or “off-line” methods.

Most processes in the Oil and Gas sector are critically controlled. It is impossible to control any process unless it is measured properly. In refinery or petrochemical complexes, various process fluids (both liquid and gases) need to be measured offline. As these fluids can be inflammable or toxic, they must be handled carefully. Moisture in these process samples poses many problems during analysis. Hence it must be removed. Sampling systems can help remove this moisture. Also some distillates from refineries are under high pressure and temperature. Hence proper conditioning of these fluids prior to analysis is a must. Sampling systems must provide a safe working environment for the operator.
Various Varieties of Sampling in a Petroleum Refinery are as Follows

**Crude oil sampling:** Crude oil sampling is done at strategic locations which include the offshore platform, marine loading terminal, pipeline or refinery, and is crucial for accurate allocation, custody transfer or BS&W measurement.

**Condensate sampling:** Representative condensate sampling and mixing systems are suitable for high pressure, onshore or offshore locations and designed to minimize the effects of process changes on the validity of the sample. Representative sample is the need for dependable analysis, hence the sampling system design is of utmost importance.

**LNG sampling:** Sampling liquefied hydrocarbon gases, many times at low temperature and high pressure, calls for precision system design using high quality materials and special sample handling equipment.

**Refined product sampling:** These sampling systems can be useful to provide ISO 9000 certification of refined products like naphtha, diesel, gasoline or aviation fuel. Special handling procedures allow samples to be quickly analyzed for density or quality.

**Wet gas sampling:** Metering wet gas using traditional differential pressure devices can cause errors in gas measurement. The wet gas sampler allows the extraction of samples to accurately measure the liquid/gas mass or volume ratio and determine the contents of the liquid phase.

**Gas sampling:** Isokinetic hydrocarbon gas samplers need to be designed to maintain sample composition throughout the sampling and handling process. Fluctuations in pressure and temperature can cause composition changes affecting laboratory results.

**Multiphase sampling:** Extracting representative samples from multiphase flow to be used for analysis and subsequent calibration of multiphase measurement instruments is crucial to accurate production measurement.

**Bunker fuel sampling:** Accurate sampling of bunker fuel for BS&W and viscosity measurement is crucial to the successful operation of marine vessels. Poor sampling can lead to catastrophic engine failure or marine accident.

**LPG sampling:** Sampling liquefied hydrocarbon gases, often at low temperature and high pressure, demands precision system design using high quality materials and special sample handling equipment.

**Sampling of other utilities:** Sampling of other utilities such as steam or water is required to analyse dissolved impurities such as silica, sodium, dissolved oxygen, total organic carbon (TOC), oil and other salts.
Off-line Sampling

Oil and gas industry samples are extracted from the inlet and outlet of various distillation columns, vessels, and pipelines. Sampling systems are used for liquids like diesel, naptha, kerosene, oil, and gases like LPG, propylene, etc.

Forbes Marshall provides the most customized solutions for gas and liquid sampling. Samples in petroleum refineries, petrochemical complexes, and chemical industry are either flammable or hazardous. Forbes Marshall’s closed loop sampling system provides a safe means to sample out these fluids.

These sampling systems are designed to handle a wide range of fluids like:
- High pressure gases
- Hot gases
- Hot flashing liquids
- Toxic fluids
- Light and medium distillates

These sampling systems are available in 'flow through to vent' and 'flow through to process plus vent' configuration. These configurations are customized for individual applications and operating parameters.

Refinery Process Schematic

Finished products are shown in blue.

Sour waters are derived from various distillation tower reflux drums in the refinery.

The “other gases” entering the gas processing unit includes all the gas streams from the various process units.
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 & Control Instrumentation, we are better placed to understand the thermodynamics, piping design, welding practices and other mechanical aspects of design.

With more than two decades of experience in the field of Steam & Water Analysis Systems (SWAS) for Power Industry, with more than 400 references, we have expertise and infrastructure to deal with very high sample temperatures and pressures.

We have supplied various sampling systems to renowned companies in the Oil & Gas sector.

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Forbes Marshall Offers Off-line Sampling Solutions in the Following Areas

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<thead>
<tr>
<th>Symbol</th>
<th>Area Of Concern</th>
<th>Forbes Marshall Solution</th>
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</thead>
<tbody>
<tr>
<td>🔥</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>
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<tr>
<td>🔥</td>
<td>Flammable Fluids</td>
<td>Forbes Marshall designs Sampling System with Fast Loops and venting arrangements before collecting for analysis</td>
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<tr>
<td>🕵️‍♂️</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>
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<tr>
<td>🏗️</td>
<td>Corrosive Samples</td>
<td>Forbes Marshall designs system with correct metallurgy for collecting sample fluids for handling corrosive fluids</td>
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<tr>
<td>🦚</td>
<td>Fumes</td>
<td>Forbes Marshall designs system with correct venting, draining and purging arrangement</td>
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