automatic sampling systems for liquids

proven solutions for complete systems using the FMA sampling technology manufactured by Doedijns B.V.
**Automatic Sampling**

Doedijns b.v. in the Netherlands has been designing and building pipeline sampling systems since 1995, using probes and samplers from FMA Ltd (UK.). In December 2002, Doedijns acquired the sampling activities of FMA. Doedijns now manufactures the FMA sampling devices itself plus complete automatic pipeline sampling systems to the customer’s specifications and in accordance to international standards, e.g. ISO3171 and ASTM D.4177.

For our systems we can offer fixed or retractable probes, in-the-line or fast-loop samplers and fixed or variable volume receivers. Sample receivers with high-energy internal mixing are available for handling high vapour pressure samples without loss of light ends.

As a supplier of in-line mixing systems, Doedijns has extensive knowledge of selecting systems required to condition the pipeline contents to permit representative sampling.

**Introduction to sampling**

Automatic sampling allows the quality (e.g. water and sediment content) of a pipeline transfer to be established. This together with the metered quantity is used to calculate the product volume for commercial and fiscal transactions. The dominant application is for crude oils, which commonly contain water and sediment.

Four steps essential to achieve an accurate analysis of the pipeline contents are as follows:

1- Pipeline conditioning/mixing to ensure free water and sediment are evenly distributed across the pipeline diameter before entering the sample or takeoff probe. Correct positioning of sample probe is essential for a representative sample.

2- Extraction of small samples (grabs) at flow/time related intervals under all conditions (changing pressure and temperature)

3- Maintaining the integrity of the receiver contents by adequately mixing before sub-sample extraction

4- Accurate analysis of the sub sample.

The two basic techniques for taking samples from pipelines are the fast-loop system and the in-the-line system. Both are described in ISO3171 and ASTM D.4177. Doedijns offers both types.
Fast loop or Bypass Sampling

The fast loop uses a cell sampler mounted in a bypass loop (typically 1"NB) through which a representative portion of the pipeline product is pumped. The cell sampler extracts a succession of small samples (grabs), typically 1 ml and pumps these into sample receiver. A relatively small pump is required to drive the fluid through the loop.

The fast-loop sampling system has a number of advantages over direct inline sampling especially for wet and dirty oils:

- Inlet area of the takeoff probe is approximately 6 times larger than an in-the-line sample probe. This means that the demands on pipeline mixing are less stringent.
- Large bore sampling probe and flow line are less prone to blockages
- The loop pump provides extra mixing
- Improved accessibility of the sampler for servicing

To obtain Isokentic flow in the fast loop line a flow control valve, bypass system or motor frequency controller is used.

Features of the Doedijns/FMA Cell Sampler are:

- Suitable for all applications up to ANSI Class 900 (150 barg)
- Pneumatic or hydraulic operation, double-acting motor
- NACE version available for sour service
- Optional sample grab volumes 0.5, 1.0 and 2.0 ml
- Choice of wetted-parts materials
- Fully meets all the requirements of ISO 3171 and ASTM D.4177
- Engineered for reliability, with duplicated oil seals

In-The-Line (ITL) Sampling

Our ITL sampler uses the same double-acting sampling mechanism as the cell sampler. This is mounted on a 1" NB probe for insertion in the pipeline.

The ITL sampler is an economic means of sampling directly from the pipeline where variation in the fluid quality is low. The ITL can be used on pipelines ranging from 4" to 48" NB and rated up to ANSI Class 900 (150 barg).

The ITL sampler is inserted through a pipeline nozzle, 2"-3" NB or larger. The ITL sampler is normally fitted with a seal housing and retractor to allow insertion and withdrawal on a live pipeline. Non-retractable versions are also available.

Other features of the Doedijns/FMA ITL Sampler :
- Pneumatic or hydraulic operation, double-acting motor
- NACE version available for sour service
- Optional sample grab volumes 0.5, 1.0 and 2.0 ml
- Choice of wetted-parts material
- Suitable for very high viscosity products
- Fully meets the requirements of ISO 3171 and ASTM D.4177
- Engineered for reliability, with duplicated oil seals
- Optional facilities for in-situ flushing, purging and testing
**Sampling probes**

In order to take samples at an optimum position in the pipeline a sample probe of some form or other is required. This may be for bypass sampling systems, for gas sampling systems or for taking manual samples.

Doedijns manufacture a standard range of probes but can also offer custom-designed units to suit the customer’s individual needs e.g. pipeline size, pressure rating, nozzle inlet size, high pipeline velocities, fixed or retractable, number and style of inlet ports, with or without sample return connection.

**Applications and features**

- Passive device installed in liquid or gas pipeline to extract flow of representative sample.
- Used for external loop automatic sampling systems, on-line analysis systems and manual sampling.
- Designs to suit all pipeline sizes and ratings, for any liquid or gas application.
- Fixed type probes for economy but need dead line for installation and retrieval.
- Retractable probes allow insertion and retraction with pipeline live, for sphere passage and servicing, twin-screw retractor, hand-operated.
- Stainless steel construction, carbon steel fittings when appropriate for economy, flange connection standard.
- NACE models for sour service.
- Conform to ISO3171 (ASTM D.4177) for sampling liquid petroleum products.
- Pitot-tube with chamfered sharp entry for sampling liquids containing suspended droplets, e.g. water in crude oils. Bevelled or other tip shapes available.
- Stem diameter typically 21 mm to 48 mm, depending on mechanical strength and flow rate required.
- Stem bore from 3mm upwards, to suit application.
- Probe isolation valves as specified by user.
Grab Samplers

In both fast loop and inline sampling the sampler is actuated by a solenoid valve which in turn is driven by a controller, generating either a flow proportional or time based signal, depending on the process.

Sampler actuation is usually air driven however in many circumstances where air is not available or is undesirable, a hydraulic or electrically driven actuator is a standard alternative.

Sample receivers

Samples collected with the automatic fast-loop or in-line samplers are transferred to a sample receiver for storage.

Some of the features of the Doedijns receivers are:
- all types are available for liquid, gas, automatic and manual sampling.
- Special designs and features can be produced to suit customers needs.
- Standard material 316 stainless steel, non standard special material available.
- Fixed volume and variable volume models for low and high pressure.
- Unique Piston Internal Mixing Receiver (PIMR) with piston shafts for homogenizing hvp oil/water mixtures.
- Large volume atmospheric 'cans' for stable crude oils etc.
- Full range of receiver ancillaries, local indicators, handles, protective frames and IATA approved transit cases.

Internal Mixing Receiver

A special sample receiver is the Internal Mixing Receiver or PIMR. Originally developed for BP this sample receiver is equipped with a high energy mixing facility.

The 1 liter PIMR is now generally used for collecting daily samples and the 3 liter PIMR for the weekly samples to send ashore. The 50 ml and 100 ml baby PIMRs are easier to handle for air freight, for manual sampling and for sub-sampling from fixed receiver PIMRs.

The Doedijns PIMR features:
- Unique piston receiver with high energy mixing.
- Ideal for live crude, liquid natural gas and condensate to homogenize the product without losing light ends.
- Approved by Lloyds to BS5500 and by DNV.
- Sub-sampling connection for pressure syringe.
- Pre-charging onshore avoids the need for gas supplies at site.
- Easily dismantled for servicing.
- Remote contents indicator.
Sampling Systems

In addition to the many specialised sampling products we manufacture Doedijns also offers turnkey sampling systems. These systems are designed and built according to your specifications.

Our sampling systems include:

- Design and engineering according to the applicable standards.
- Connection points.
- Weigh scale(s)
- Flow, level and pressure alarms.
- Pumps, filters, mixers
- Electronic control and data-acquisition components.
- Stainless steel or GRP enclosure.
- Full testing (FAT and SAT) and certification.
- Drawings, documentation, manuals etc.

Standards

Both the fast loop and inline sampling systems designed and built by Doedijns are based on the ISO-3171 and ASTM D.4177 standards and the equipment totally complies with these. Other standards (e.g. GOST) may be specified.

Doedijns B.V.

Doedijns b.v. is part of the Flutronics Group. From our branch offices in Waddinxveen, Cuijk, Hoogeveen, Valkenswaard and Labuan (Malaysia) more than 120 employees work in three disciplines: hydraulics, pneumatics and instrumentation. With a team of specialists we aim at the design and assembly of systems (standard and custom-design), the sales and distribution of high quality components (A-brands) and the rendering of 24-hours service.
## SAMPLING SYSTEMS

An overview of sampling products systems supplied by FMA & Doedijns

<table>
<thead>
<tr>
<th>Client</th>
<th>Plant</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerefco</td>
<td>(BP/Texaco) Kerosene Sampling</td>
<td>Holland</td>
<td>1995</td>
</tr>
<tr>
<td>Fisher Rosemount</td>
<td>Algyo</td>
<td>Hungary</td>
<td>1996</td>
</tr>
<tr>
<td>Emerson</td>
<td>Crude Sampling - Pancevo Refinery</td>
<td>Hungary</td>
<td>1996</td>
</tr>
<tr>
<td>Amoco</td>
<td>Fluor Daniels</td>
<td>United Kingdom</td>
<td>1997</td>
</tr>
<tr>
<td>Badger</td>
<td>I.S.A.</td>
<td>USA</td>
<td>1997</td>
</tr>
<tr>
<td>BP International oil</td>
<td>Marathon</td>
<td>Norway</td>
<td>1997</td>
</tr>
<tr>
<td>Brown &amp; Root</td>
<td>Mobil</td>
<td>North Sea</td>
<td>1997</td>
</tr>
<tr>
<td>Daniel Europe</td>
<td>Petronas</td>
<td>Malaysia</td>
<td>1997</td>
</tr>
<tr>
<td>Agip</td>
<td>Elf</td>
<td>France</td>
<td>1998</td>
</tr>
<tr>
<td>AMEC</td>
<td>Esso</td>
<td>Malaysia</td>
<td>1998</td>
</tr>
<tr>
<td>Conoco</td>
<td>Esso</td>
<td></td>
<td>1998</td>
</tr>
<tr>
<td>D.C.M. Ltd.</td>
<td>Occidental</td>
<td></td>
<td>1998</td>
</tr>
<tr>
<td>ABB Lummus</td>
<td>Condensate Sampling NAM</td>
<td>Holland</td>
<td>1999</td>
</tr>
<tr>
<td>ABB Lummus</td>
<td>Gas Sampling System</td>
<td>Holland</td>
<td>1999</td>
</tr>
<tr>
<td>Amerada Hess</td>
<td>Exxon</td>
<td>United Kingdom</td>
<td>1999</td>
</tr>
<tr>
<td>Brooks</td>
<td>Kaztransoil Crude Sampling</td>
<td>Kazakhstan</td>
<td>2000</td>
</tr>
<tr>
<td>ODS Veba Oil</td>
<td>Gas Sampling System</td>
<td>Holland (Africa)</td>
<td>2000</td>
</tr>
<tr>
<td>ODS</td>
<td>Exxon Mobil</td>
<td>Holland (Africa)</td>
<td>2001</td>
</tr>
<tr>
<td>Fisher Rosemount</td>
<td>KFU Project</td>
<td>Kazakhstan</td>
<td>2002</td>
</tr>
<tr>
<td>ODS</td>
<td>ESSO Deep water</td>
<td>Holland (Africa)</td>
<td>2002</td>
</tr>
<tr>
<td>ODS Veba Oil</td>
<td>Crude Sampling</td>
<td>Holland</td>
<td>2003</td>
</tr>
<tr>
<td>Emerson</td>
<td>Crude Sampling - Lukoil</td>
<td>Odessa</td>
<td>2003</td>
</tr>
<tr>
<td>Emerson</td>
<td>Crude Sampling - Lukoil Vysotsk</td>
<td>Kazakhstan</td>
<td>2003</td>
</tr>
<tr>
<td>Emerson</td>
<td>Shell - Sakhalin</td>
<td>Russia</td>
<td>2004</td>
</tr>
<tr>
<td>Emerson</td>
<td>Shell - Sakhalin</td>
<td>Russia</td>
<td>2005</td>
</tr>
<tr>
<td>ODS</td>
<td>Petro-Canada De Ruyter Proj.</td>
<td>Netherlands</td>
<td>2005</td>
</tr>
<tr>
<td>ODS</td>
<td>Gusto - Kikeh FPSO</td>
<td>Netherlands</td>
<td>2005</td>
</tr>
</tbody>
</table>