Sampling Systems by CRP

Safe, representative sampling systems for the chemical, pharmaceutical, biotechnology and petrochemical industries

De Dietrich

"The first sample is the right sample"

De Dietrich Process Systems, Inc
224 Sheffield Street
Mountainside,
NJ07092
United Kingdom

Phone: (908) 317 2585
Fax: (908) 889 4960

Email: sales@ddpsinc.com
Web: www.ddpsinc.com

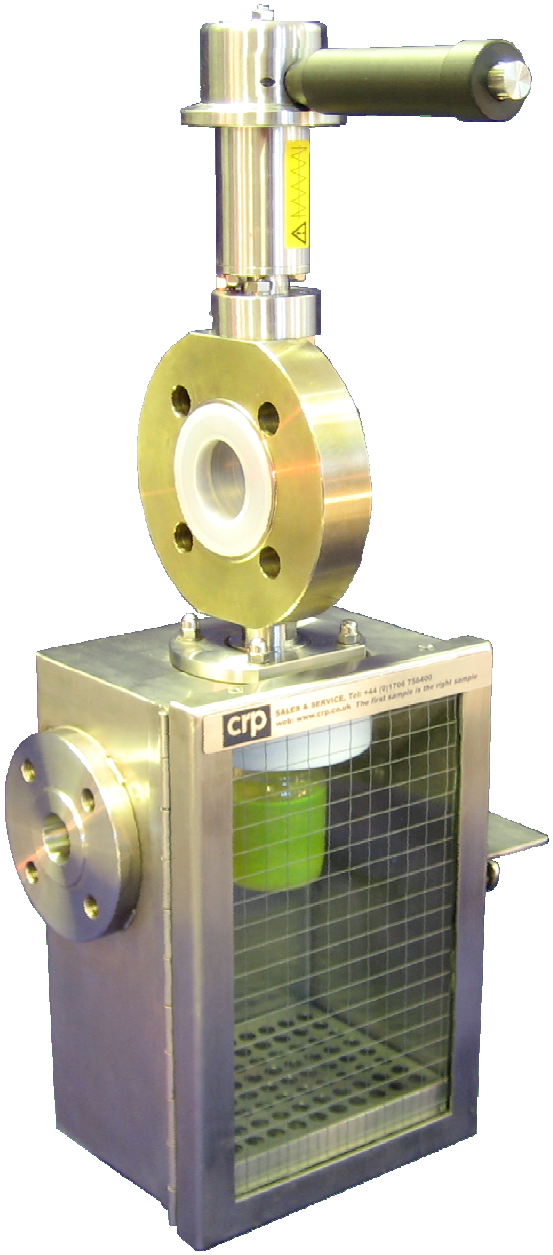
Introduction to Sampling

Within many process industries, including pharmaceutical, fine chemical and petrochemical taking samples of product has become an increasingly important activity. Reasons for this requirement are many and varied but can include confirming that a chemical reaction has been completed, checking that a product has the correct physical or chemical composition, taking a sample to retain for legal reasons, checking that a delivery of a chemical is within tolerance, etc. In tandem with the requirement to collect samples has been the requirement to ensure the health safety and welfare of all personnel, and the public more widely.

To address these twin requirements CRP has developed a comprehensive range of sampling equipment to allow representative samples of liquids, gases and powders to be taken safely from a wide variety of process equipment. While the standard range of equipment will allow samples to be taken in the majority of circumstances, CRP has a skilled team of engineers with many years of experience that can tailor equipment, or manufacture entirely bespoke equipment, to allow samples to be taken from equipment at the extremes of pressure and temperature that are encountered in the process industries. To back up this design expertise, CRP has in house PFA moulding expertise to allow bespoke designed equipment to be quickly turned into moulded products. Typical examples of this capability are special reactor sampler manifolds or custom pH probe connectors.

In-line Sampling Systems

In-line sampling systems provide a simple to operate means of taking representative samples from process lines.



Standard Variants

- Unlined stainless steel – wafer pattern to suit ASME 150/300, PN10/16. 1” - 6” NB. Suitable for -29°C to +200°C, full vacuum to 16 bar g (24 bar g for ASME 300 variant). Options: Exotic materials, such as Hastelloy and Monel. Alternative flange drillings.
- Unlined stainless steel – flanged pattern to suit ASME 150/300, PN10/16, Swagelok™, hygienic connections such as Tri-clamp, DIN 11851, etc. 1/2” – 6” NB. Suitable for -29°C to +200°C, full vacuum to 16 bar g (24 bar g for ASME 300 variant), unless otherwise dictated by end connections. Options: Exotic materials such as Hastelloy.
- PFA lined stainless steel – wafer pattern to suit ASME 150/300, PN10/16. 1” - 6” NB. Suitable for -29°C to +180°C, full vacuum to 10 bar g.

Pipework Orientations

- Vertical
- Horizontal

Operator Options

- Twin action, spring to close, dead man’s handle, with lockable feature.
- Pneumatic Actuator to allow remote/automated operation.

Features

- No internal dead legs to ensure representative sample collection.
- Stroke adjustor to ensure controlled flow rate of sample liquor.
- Stem seal arrangement tested to 20,000 cycles at elevated temperature without failure.

Sample treatment/dispensing and containment – see later.

Volumetric Sampling Valve

Ball valve with closed end ball to provide sample collection cup fitted to branch off main process line.

Features

- PFA lined and unlined stainless steel variants available.
- Flanged construction to suit ASME 150 & PN10/16 flanges.
- Size range 1" – 3" NB.
- Internal pressure isolated from sample outlet makes it ideal for sampling from process lines under vacuum.

Operation

Each 180˚ there and back turn of valve delivers 1 cup full of sample liquor to the sample container.

Surface Mount Sampling Systems

Unlined surface mount sample valve designed to attach to a pad flange on the side of a process line.

Features

- Connection types: ASME 150/300, PN10/16, Tri-clamp, etc.
- Pipeline sizes: 1"NB and larger
- Can be fitted to vertical or horizontal pipelines
- No obstruction of the process line
- Can be supplied protruding into the process line if required
- Stainless steel as standard. Exotic materials such as Hastelloy are available
- No internal dead leg
- Stroke adjustor to ensure controlled flow rate of sample liquor.
- Spring to close, lockable dead man's handle as standard. Can be supplied with pneumatic actuator as an option.
- Suitable for -29°C to +200°C, full vacuum to 16 bar g

Vessel Mounted Single Sampler

The vessel mounted sampling system is generally connected to a dip pipe at the top of a process vessel. The sample is drawn up from the vessel through the dip pipe and into the sampling system.
It is isolated within the sight glass chamber where it can be dispensed into a sample bottle.

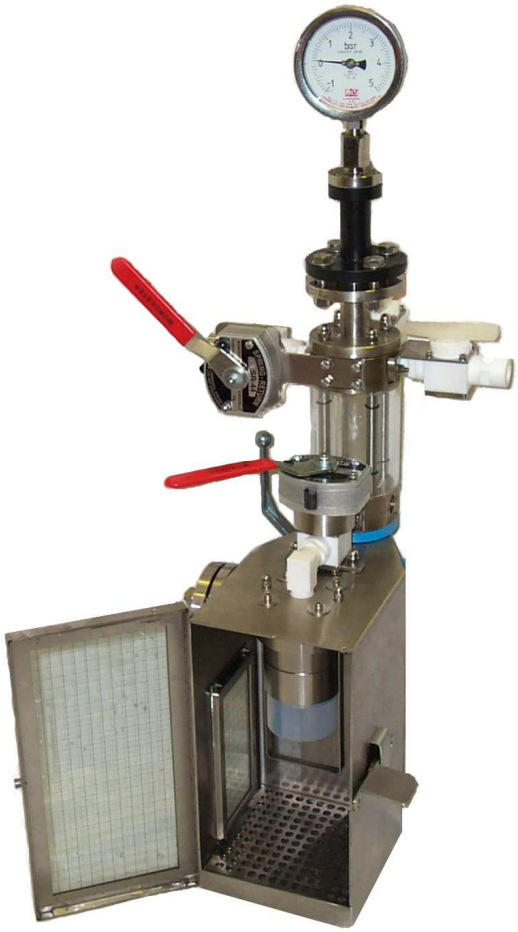
Product Description
Designed to mount on a dip pipe fitted to a vessel.
Typical construction:

- Small bore PTFE tube running down through centre of dip pipe
- Lower manifold
- Isolation Valve
- Centre manifold with outlet valve, cabinet and threaded bottle connector
- Sightglass with floating ball check valve to prevent liquor from being sucked down the vacuum line.
- Top manifold with three service valves connected to vacuum, wash liquor and nitrogen

Wetted parts: PTFE/PFA, borosilicate glass, chemraz
Pressure temperature envelope: -29 to + 180^{o}C: full vacuum to 10bar g

Operation

- Open isolation valve.
- Open vacuum valve to draw up sample into the sightglass.
- Blow sample back into vessel using nitrogen. Repeat suck up/ blow down step to ensure sample in sightglass is representative of vessel contents.
- Close isolation valve.
- Briefly open nitrogen valve to pressurise sightglass.
- Open sample outlet valve to dispense sample into sample bottle.
- Blow any remaining liquor back into the vessel.
- Flush through with wash liquor, and blow through with nitrogen
- Close isolation valve leaving sampler clean, empty and ready to take a further sample.



Options

- Sightglass volume can be varied to suit required sample size.
- Service valve types. Typically Atomac AKH2, but others available, such as solid PTFE ball valves, diaphragm valves etc.
- Sample outlet valve. Typically modified in-line sample valve, but ball valve/diaphragm valve available.
- Eductor to create vacuum if no site vacuum available.
- Temperature/pressure gauges available.
- pH probe mounting.
- Sample bottle venting back into sightglass.
- Catch pot for extra security.
- Multiport top mounted valve to control services.
- Spring return handles on sample outlet and/or service valves.
- Heat exchanger to heat/cool sampler prior to reaching sightglass section.
- Unlined versions available
- Purging of space between sightglass and shield to prevent frosting up of sightglass.

Vessel Mounted Recirculating Sampler

With recirculation sampling the sample is drawn from the vessel and pumped through the sampling system before being discharged back into the vessel often down the same dip pipe.
The sample is dispensed from the sight glass section using a small bore valve into the chosen sample receiver.

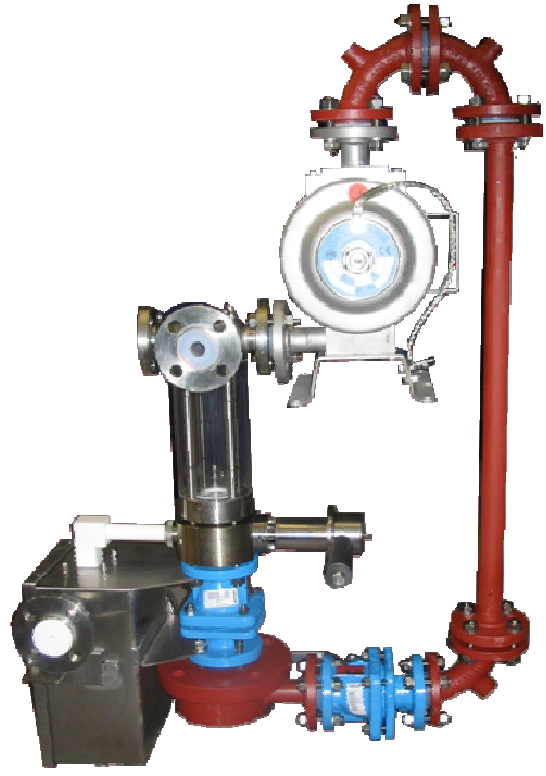
Product Description
Designed to mount on a dip pipe fitted to a vessel.
Typical construction:

- Isolation Valve mounted to dip pipe process flange.
- Centre manifold with outlet valve, cabinet and threaded bottle connector
- Sightglass with to allow operator to see that liquor is flowing.
- Top manifold with 3 service valves connected to wash liquor, nitrogen and pump.
- Pump, typically double diaphragm, air operated.
- Return leg pipework.
- Return leg isolation valve.
- Instrument tee to mount between dip pipe vessel flange and flange on vessel to allow circulating liquor back into the vessel.

Wetted parts: PTFE/PFA, borosilicate glass, chemraz
Pressure temperature envelope: full vacuum to 10 bar g: -29 to +180^{o}C max (limited by pump type)

Operation

- Open both isolation valves.
- Switch on pump and wait for flow to be established.
- Stop the pump, and close the inlet isolation valve.
- Briefly open nitrogen valve to pressurise sightglass.
- Open sample outlet valve to dispense sample into sample bottle.
- Flush through with wash liquor, and blow through with nitrogen.
- Close both isolation valves leaving sampler clean, empty and ready to take a further sample.

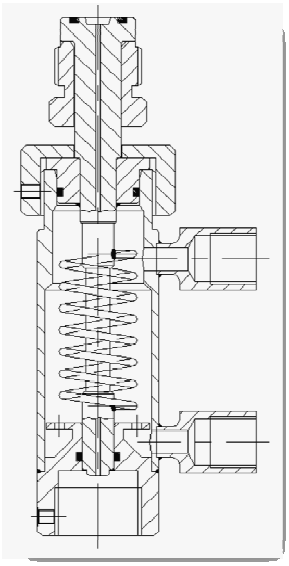


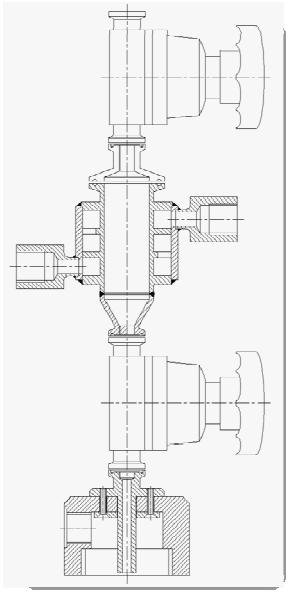
Options

- Sample valve can be mounted on pump outlet side so that sample can be taken while pump is running.
- Pump is typically made of virgin PTFE. Can be supplied in antistatic PTFE, or metallic construction. Can be supplied to comply with ATEX.
- Service valve types. Typically Atomac AKH2, but others available, such as solid PTFE ball valves, diaphragm valves etc.
- Sample outlet valve. Typically modified in-line sample valve, but ball valve/diaphragm valve available.
- Temperature/pressure gauges available.
- pH probe mounting.
- Spring return handles on sample outlet and/or service valves.
- Unlined versions available
- Purging of space between sight glass and shield to prevent frosting up of sight glass.
- Vessel seeding is an option.

Sample Treatment

On many occasions, the sample media is at a temperature (either high or low) where it would not be safe to discharge directly into the sample container. For such duties, a suitable heat exchanger can be supplied. Two options are available: the in-line heat exchanger and the volumetric heat exchanger.





In-line Heat Exchanger

- Description: Small bore tube surrounded by a bath of cooling water.
- Options: Tube length can be varied to give differing levels of cooling; water flow rate can be adjusted to vary cooling rate; not suitable for sample liquors with entrained solids; can be supplied with purge/flush to allow for cleaning after taking a sample.

Volumetric Heat Exchanger

- Description: Fixed volume chamber with additional outlet valve fitted to outlet of the sampler. Typically has a finned outer, which is surrounded by a water filled cooling jacket.
- Options: Volume can be varied to suit; can be supplied with external thermometer to allow for sample collection at predetermined temperature; can be fitted with purge/flush to clean out chamber after sample collection; air cooling options available.

Sample Dispensing

There are four principal sample dispense options available described in ascending order of operator safety.

Simple Nozzle

This is rarely used due to ease of spillage, and lack of operator protection.

Threaded Bottle Connector

The most common option. Threads can be cut to suit any customer bottle. All bottle connectors are vented to prevent bottle pressurisation.

Septum Assembly

The second most common dispensing arrangement. Much higher level of containment than threaded bottle connector. Comprises two needles, one for sample inlet and one for bottle venting. Needles have tip hole perpendicular to axis to prevent plug cutting of septum cap and consequent lack of sealing after needle removal.

Syringe

This system provides the highest degree of operator isolation from the liquor. It is suitable for gas sampling. The syringe unit docks with the sampling valve providing interlocked opening and closing. A single syringe can work with a number of sampling points around a plant.

Sample Containment

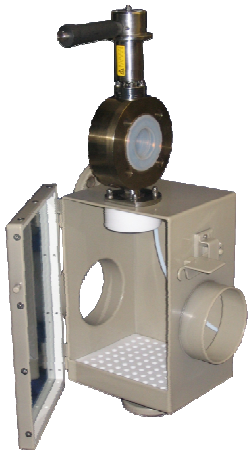
All our sampling systems can be supplied with safety cabinets.
The cabinet provides a number of key functions:

- Protecting the sample outlet from mechanical damage
- Keeping the sample outlet clean
- Protecting the operator from explosion or leakage
- Acting as a fume cabinet
- Providing secondary containment of the sample in case of spillage
- Reducing the level of PPE required by the operator and therefore making it easier to take a sample

The standard safety cabinet is manufactured from 3mm thick stainless steel with door fitted with reinforced glass to provide clear vision and withstand mechanical damage. The door latch is designed to allow opening with a single gloved hand. A bunded base catches spillages, whilst a standard flange provides for the addition of ventilation for fume clearance.

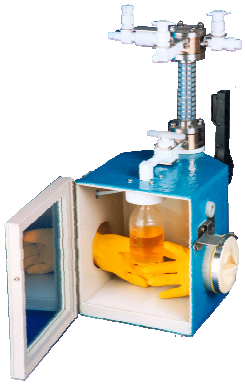
A number of cabinet material variants are available, together with options such as glove ports, tun dish bases and non-standard venting.

ETFE (Tefzel) Coated



GRP Reinforced Polypropylene

Glove Ports



High Containment Cabinets incorporating Rapid Transfer Ports

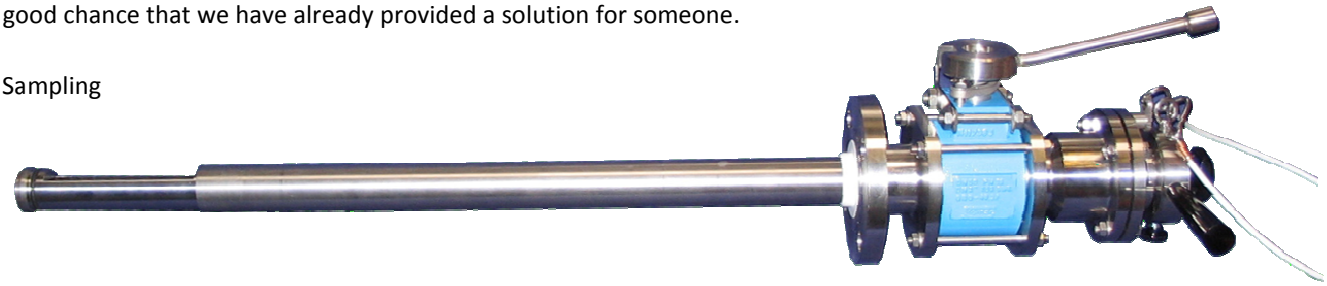
Special Products

CRP has manufactured a significant number of special sampling products and systems, a few examples being:

- Powder Sampling from Filter Dryers
- High Pressure and Temperature Sampling
- Cryogenic Sampling
- Gas Sampling
- Seeding Devices
- Automated and Remote Sampling

If your product is hot, cold, high pressure, under vacuum, contains solids, is viscous, abrasive, carcinogenic, acidic, a biological hazard, expensive or has any other characteristic that makes you need to think about how to sample it, then there is a good chance that we have already provided a solution for someone.

Powder Sampling



Free Mount Sampling Systems

Small lightweight samplers, ideally suited for laboratory/small scale pilot plant duties.
Designed to wall mount or can be supplied on a stand. Available in single and double valve/double bottle variants. Double valve gives added security against accidentally flooding vacuum system with process liquor if sample bottle overfilled.

Typical construction:

- Multiway, solid PTFE valve(s) with bottle connector(s) below.
- Valve(s) mounted below stainless steel or polypropylene mounting bracket.
- Nitrogen, vacuum and vessel connections via PTFE compression fittings.

Wetted parts:
PTFE, chemraz.

Pressure temperature envelope: -5 to + 100C: full vac to ambient/ slight positive pressure.

Single Valve Variant - Operation

- Ensure sample valve handle is at closed position.
- Connect vacuum, nitrogen lines to services, and vessel connection to dip pipe.
- Open vacuum, nitrogen & vessel isolation valves.
- Turn valve to “purge bottle” position – fills the sample bottle with nitrogen.
- Turn valve to “purge back to vessel” – flushes out dip pipe with nitrogen.
- Turn valve to “sample” position – sucks sample up dip pipe into bottle.
- Repeat previous steps in reverse order to clean out sampler and close valve.
- Remove bottle and fit a new bottle.
- Close isolation valves (& disconnect sampler from services).

Double Valve Variant - Operation

- Ensure sample valve handles are at closed position.
- Connect vacuum, nitrogen lines to services, and vessel connection to dip pipe.
- Open vacuum, nitrogen & vessel isolation valves.
- Turn sampler isolation valve to “open”. Turn service valve to “nitrogen purge” – fills both bottles with nitrogen, and blows down dip tube.
- Turn service valve to “vacuum” – sucks sample up dip pipe into right hand bottle.
- Turn service valve back to “nitrogen purge” – flushes out dip pipe with nitrogen.
- Close both valves.
- Remove sample bottle and fit a new bottle.
- Close isolation valves (& disconnect sampler from services).

Options

- Vessel seeding variant available.
- Bottles connectors can be threaded or septum type.

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