

Oil Concentration & Droplet Size Solids Concentration & Particle Size



**Real Time Analysis
Visual Verification
Imaging Based Technology**

Inflow™ Skids - An Overview

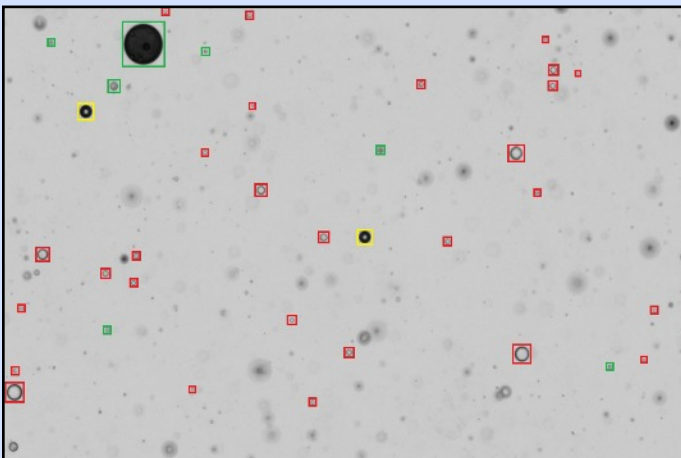
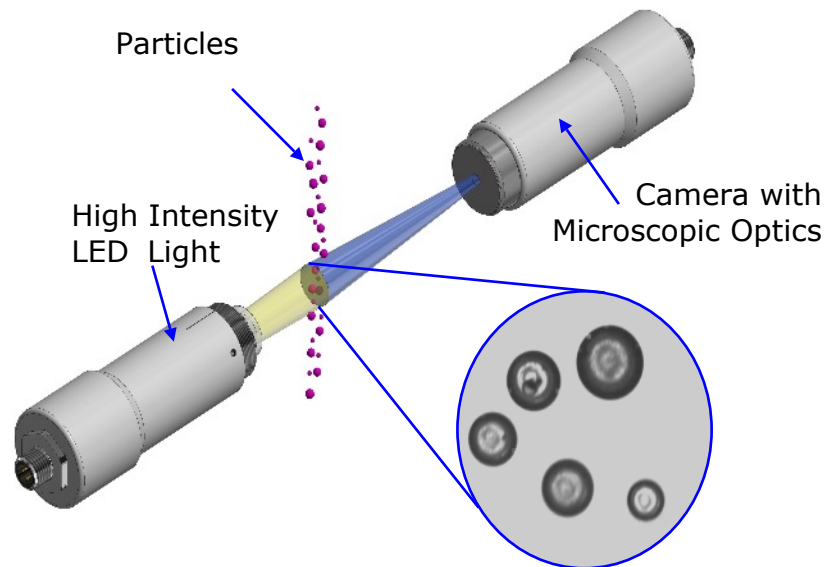
CANTY's Inflow™ Skid Systems are fully engineered solutions that utilize dynamic imaging technology to measure size distributions and concentrations of solids, and hydrocarbons online in aqueous streams. All measurements are captured concurrently and in real time using a single analyzer, while removing interference with gas bubbles- an issue that challenges other systems. CANTY has over 40 years of experience in the online implementation of dynamic imaging technology.



Inflow™ Skid Systems integrate an intelligent cleaning system with the analyzer so that the analyzer gets clean and stays clean without additional human intervention. This is backed up by a visual image of what the analyzer sees, providing confidence to engineers and operators alike that outputs are accurate and up to date.

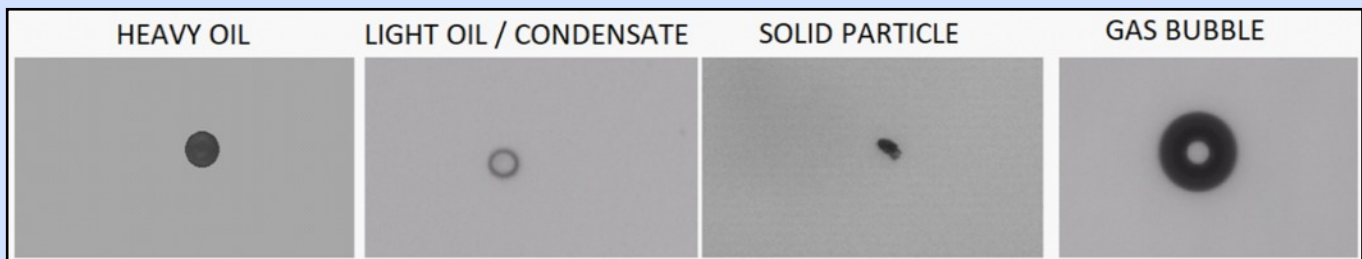
How the Measurements are Made

Dynamic imaging analyzes a live video stream of microscopic images of process fluid as it flows between a camera and light source. CANTY's Inflow™ analyzer captures these images and transmits them back to a Vector Control Module (VCM) which analyzes them to measure size distributions and concentrations of contaminants seen in the fluid.



On each image captured, the CantyVision™ software determines what might be a "particle" from what is the background fluid. At this stage, the "particle" could be anything - a solid, droplet, or bubble. If it is in focus, then this particle is within the depth of field of the lens used. That means it should be included in the analysis. If a particle is not in focus, it is thrown out.

Each type of particle, solids, droplets, and bubbles, look morphologically different from one another. The software is trained to recognize the trends in the measured shape factors belonging to each particle. This is key because it allows CANTY to distinguish between different kinds of particles that were captured in the same analysis and quantify measurements for each class of particle differently.



By averaging over hundreds of images, the Inflow™ is able to provide a representative concentration and particle size distribution for each particle class analyzed. Additionally, if there is ever skepticism about the reading, the images from the analyzer can be viewed live and/or saved as a recording for reference. This provides proof of a measurement and confidence in the analyzer that no other technology provides.

Auto Cleaning System

Each INFLOW™ Skid features an automated cleaning system to ensure the flow cell internals stay clean. This allows for reliable image capture, and therefore reliable image analysis and data generation.

The automated cleaning system features a high pressure pump (1200 PSI) and 2 actuated valves to alternately clean the camera and light side glass. Separate cleaning of the 2 sides of the flow cell glass, ensures maximum effectiveness of the high pressure cleaning water.

If available, it is recommended that non-process water is used as the cleaning fluid. In cases where only the process water is available, it may also be considered. However, that may have an influence on the allowable wetted materials for the cleaning system, so that should also be considered.

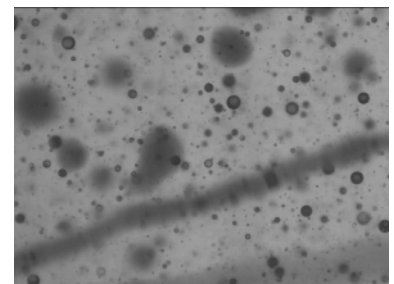
The standard wetted materials for the automated cleaning system are a brass pump head, and 316 / 316L SS fittings.



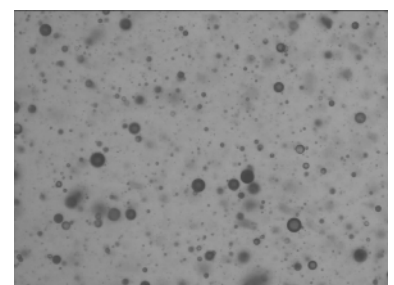
The inlet connection to the cleaning system is 1/2" NPT(F), with the user supplying the tubing up to that point. All fittings from the pump outlet to the INFLOW™ spray ring connections are factory fitted by Canty. As standard this includes a pressure gauge for verification of the cleaning system pressure and a pressure relief valve (PRV) to release any possible over pressure in the cleaning lines. The outlet connection of the PRV is 1/2" NPT(F), with the user responsible for directing that outlet fluid according to their own requirements.

The cleaning system is fully configured via the CantyVision™ software, with the cleaning sequence pre-programmed at the factory. The default frequency of the cleaning system is 1 time per hour, however that is user adjustable. The duration of the cleaning cycle is approximately 1 minute, and it should be noted that during this time, all process measurements and control signals are paused, so the turbulence created in the flow cell during cleaning does not affect any readings. Once the cleaning cycle is complete, the measurements and related control signals automatically resume.

In Water for Injection applications, the system is typically installed upstream of the injection pumps. The high pressure section downstream of the pump can be used to feed the analyzer cleaning system, which removes the need for an on skid pump / motor assembly, therefore simplifying the installation and reducing cost.



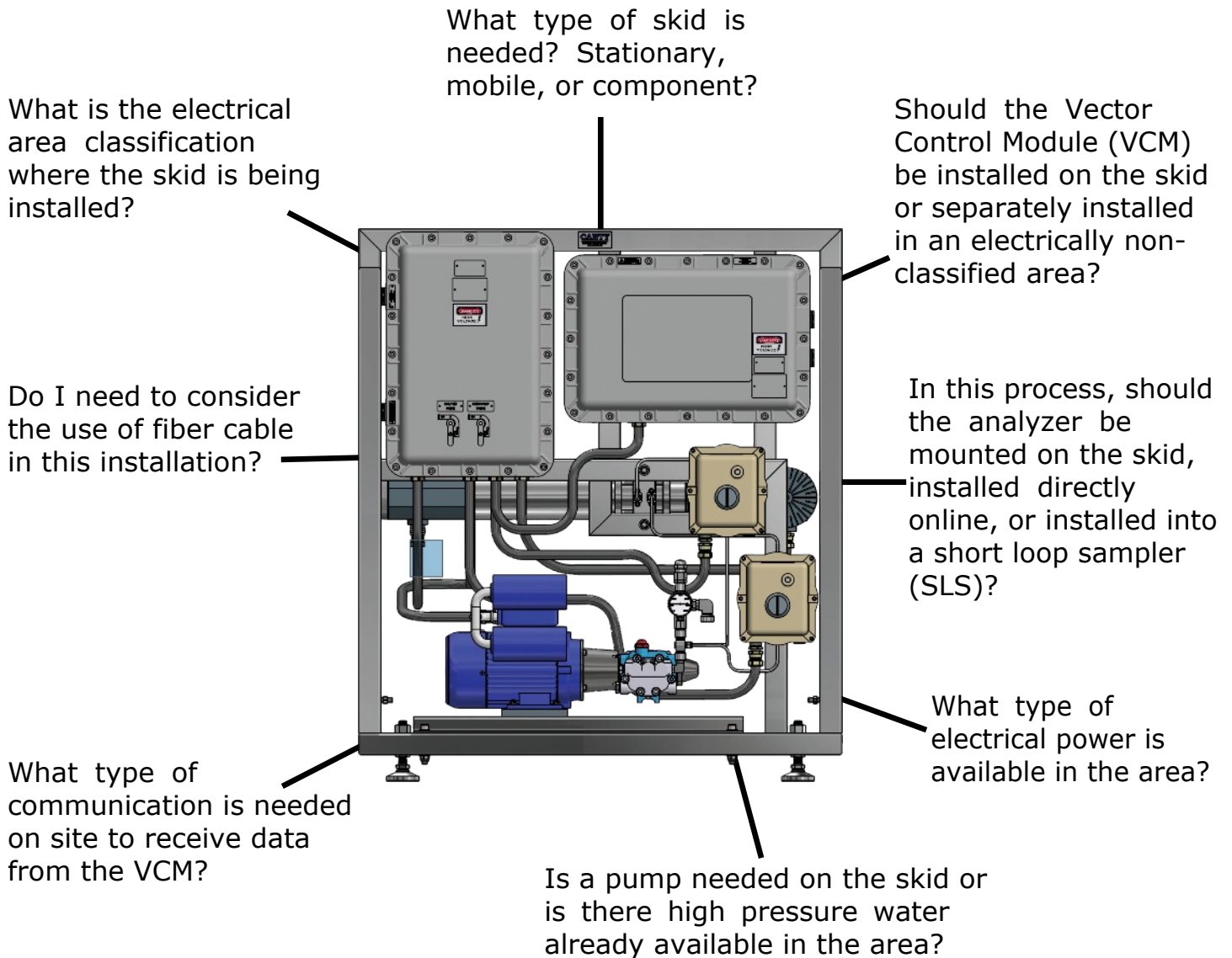
Visible Fouling on Glass



Fouling Removed

Selecting a Skid

To select the proper skid for a particular application, there must be answers available to the following questions.



The remainder of this document will explore and provide options for each of these questions.

Based on the specific skid ordered, other parts may also be required including:

- Inflow™ Analyzer - Refer to Document TA12100-1030
- Short Loop Sampler - Refer to Document TA11500-1027
- Vector Control Module - Refer to Document TA12100-1012

Skid Configuration Options

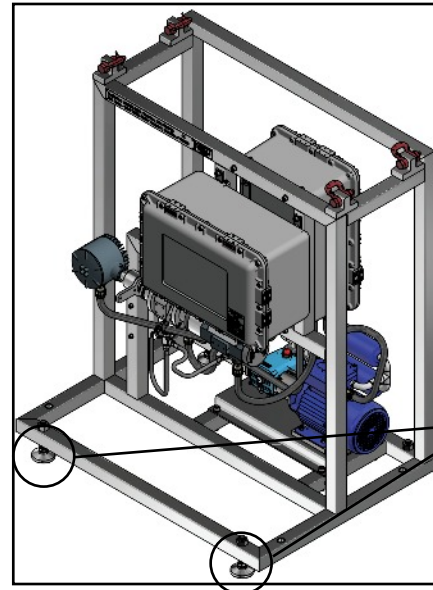
There are three ways skids can be configured:

1) Stationary

A stationary skid is the most common configuration chosen. It is designed to be left in one location for an extended period of time.

2) Mobile

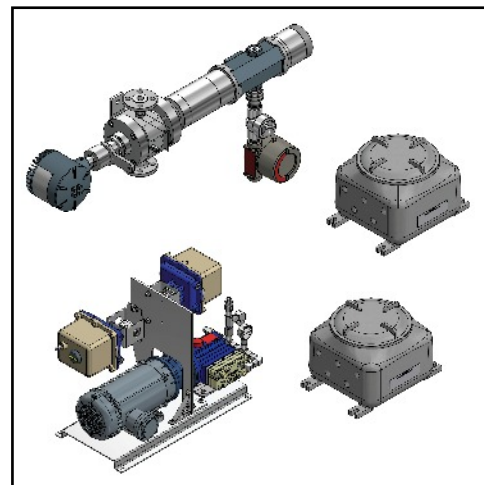
A mobile skid is designed for short-term tests. It has all of the functionality of a stationary skid, but the system includes wheels so that the skid can be moved around a job site in order to monitor several lines over time.



Stationary or Mobile Skid

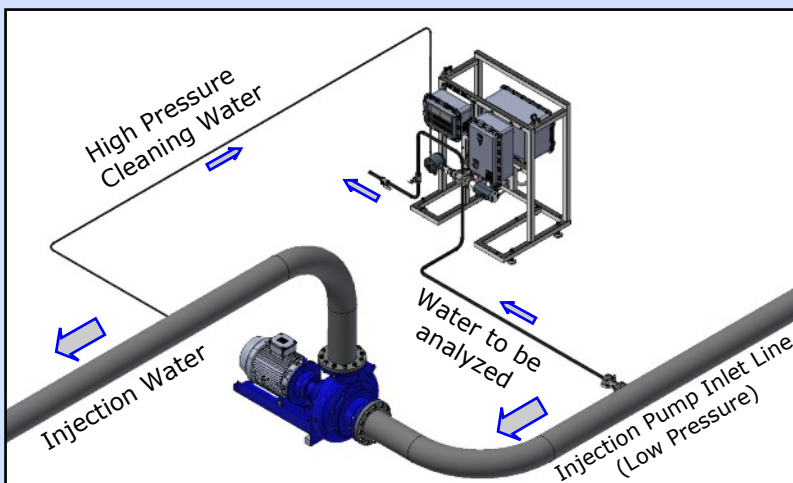
3) Component

A component skid is intended for use when space is a significant concern. The power supply, analyzer, and pump/valves are all shipped as separate components to give users flexibility on where to fit them. This, however, requires the user to run all of the wiring and conduit between the components in accordance with



Component Skid

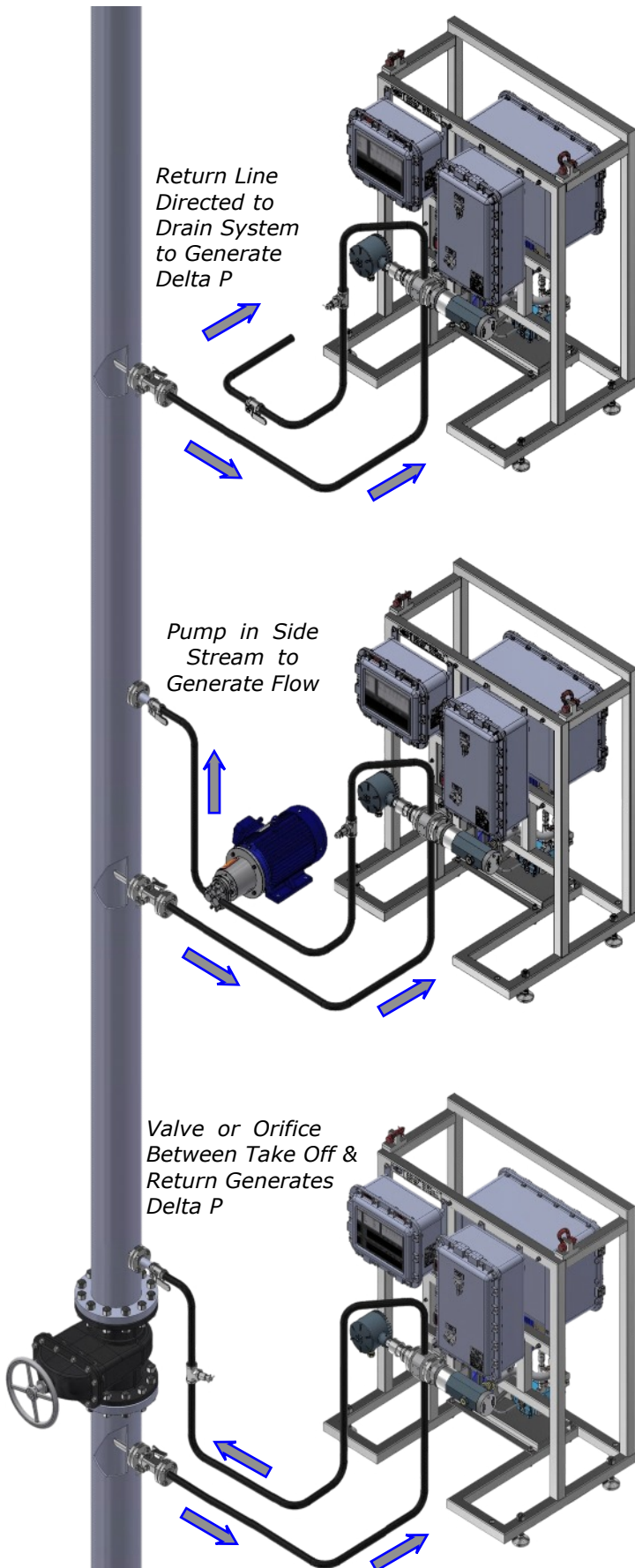
Cleaning System Configuration



Canty supplies a high pressure pump for cleaning in most applications. In some applications, like water for injection, the high pressure section downstream of the pump can be used for cleaning. This can eliminate the need for an on-skid pump/motor assembly, simplifying installation and reducing the overall system costs.

Inflow™ Mounting Overview

There are three ways that the Inflow analyzer can be installed into a process.



1. Inflow™ Mounted on Skid

CANTY's most popular option is to leave the Inflow mounted onto the skid frame. In this case all the user must do is bring power, process, and water to the unit as all other wiring and piping is already done by the factory.

In this case, the end user brings their process to the Inflow™. This is typically done utilizing a side stream, though the main line may also be used if it is < 3 inches in diameter. Common examples of installations can be seen to the left.

Guidance on Side Streams

- The distance between the sample point and the analyzer should be minimized as far as practically possible.
- Vertical up-flow is the preferred orientation for installation of a produced water sample point.
- Where practicable, a center line pitot should be used. Where installation of center line pitots may prove difficult, sidewall sampling may be used.
- For sample points in horizontal pipe work, sample points should be located at a point where the flow velocity is high enough to provide adequate turbulent mixing. If center line pitots are not available, sidewall sample points should be in the horizontal positions. Sidewall sample points on the top or bottom of horizontal pipe work is not recommended and should be avoided.

Above guidelines from UK Dept. For Business Energy & Industrial Strategy

Inflow™ Mounting Overview

2. Inflow™ Mounted Directly Online

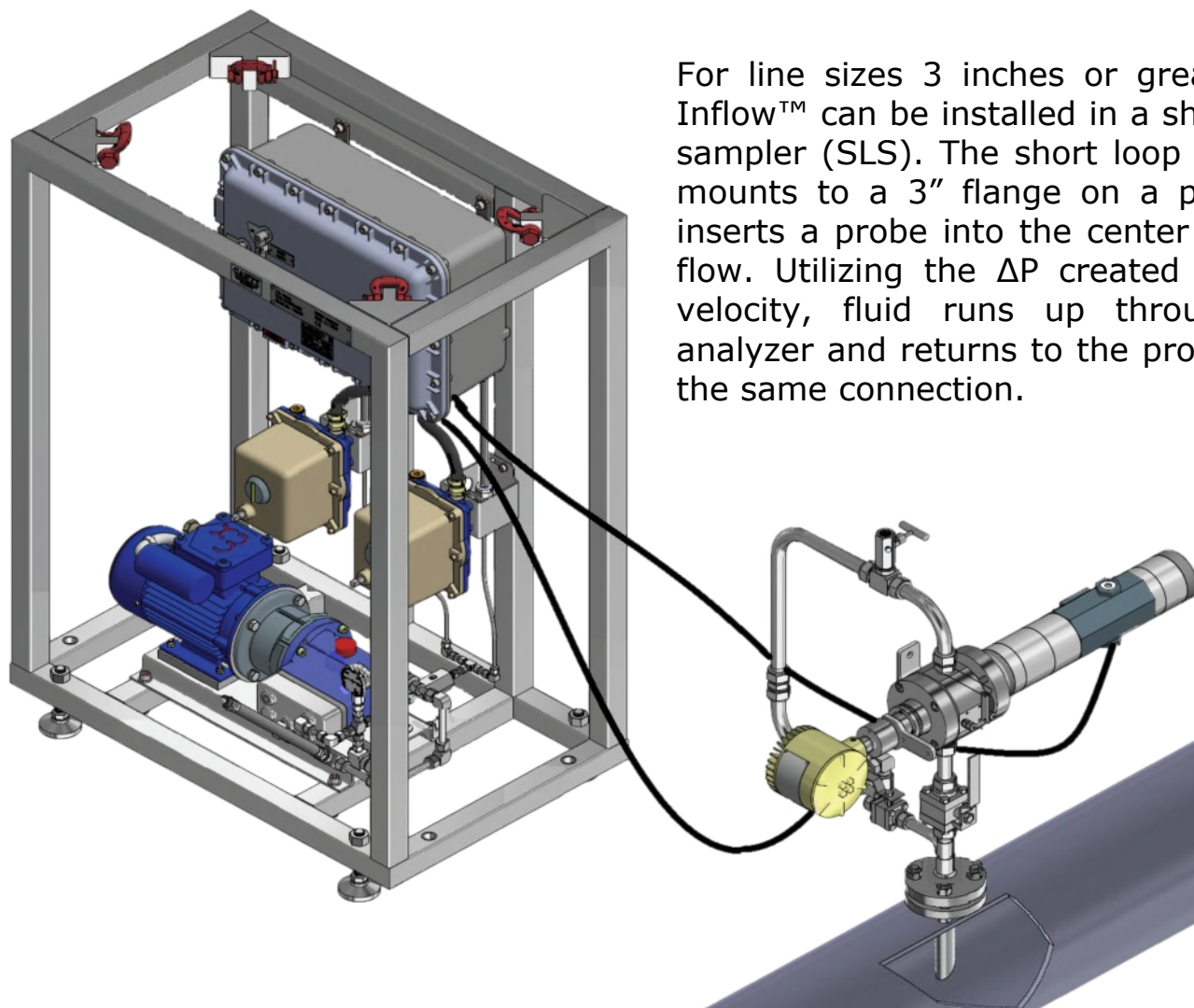
The Inflow™ can be mounted directly online. In this case, the skid must still be installed nearby to provide power and cleaning to the Inflow. The end user is responsible for providing wiring and conduit between the skid and analyzer in accordance with applicable standards and laws

This type of installation can be beneficial to avoid concerns about creating side streams, but line sizes must be < 3 inches in diameter and fluid must be well mixed.



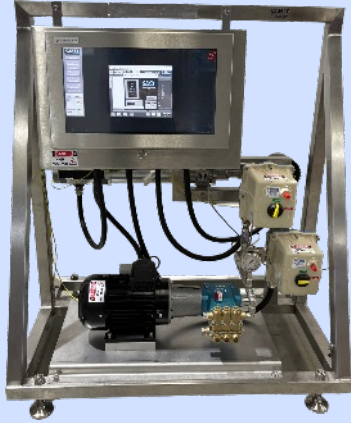
3. Inflow™ Mounted on Short Loop Sampler (SLS)

For line sizes 3 inches or greater, an Inflow™ can be installed in a short loop sampler (SLS). The short loop sampler mounts to a 3" flange on a pipe and inserts a probe into the center third of flow. Utilizing the ΔP created by flow velocity, fluid runs up through the analyzer and returns to the process via the same connection.



Vector Control Modules and Where They Are Located

Vector Control Modules (VCM's) are the hardware that perform analysis on images generated from the analyzer and send the data outputs. These components of the skid system can be installed and accessed in a few different ways.



VCM On Skid - Local Monitor Display

With this option the VCM is located directly on the skid. A local display is available on the skid that allows operators to see and interact with the software out in the field.

VCM On Skid - Wifi Access

Here the VCM is located directly on the skid again. Instead of a monitor, the skid produces a local wifi network that can be connected to by a laptop or tablet appropriate for the area classification. The VCM and software can then be accessed via VNC software.



VCM in Electrically Non-Classified Safe Area

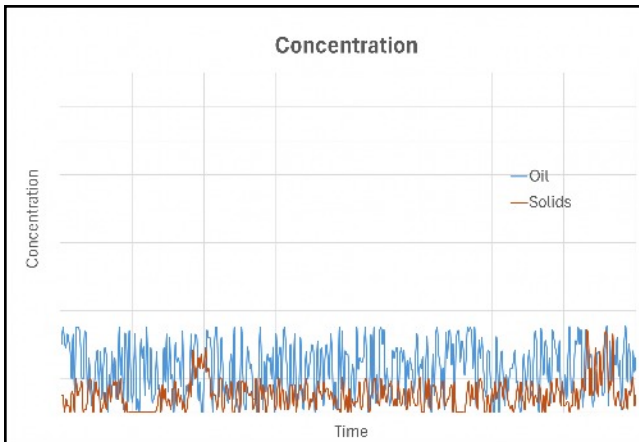
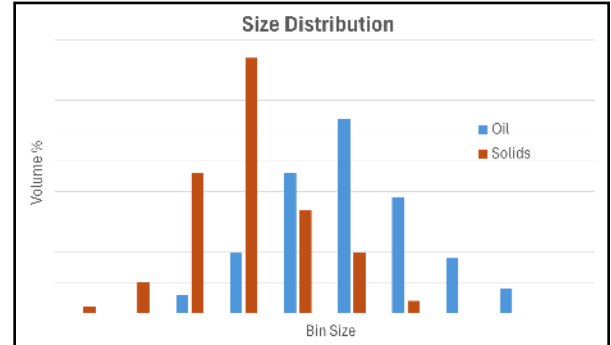
Sometimes putting the VCM elsewhere makes it simpler to access or pull data. In this case the VCM must be connected to the skid via a direct CAT6 or fiber connection.

No matter where the VCM is located, CANTY strongly recommends providing access to the VCM in a control room. This can be done by networking the VCM to the control room and providing access via a VNC connection. Doing so provides operators with greater process understanding and the all important visual verification of measurement outputs.

Outputs

The data generated by the analyzers can be communicated via a number of methods depending on the Vector Control Module used. They include but are not limited to:

- Modbus TCP/IP
- Modbus RTU
- Analog 4-20 mA
- OPC UA
- Profinet
- Profibus



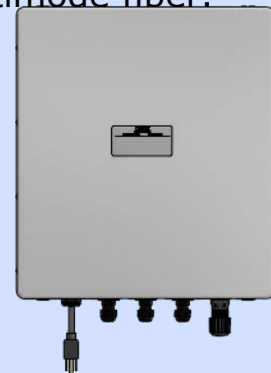
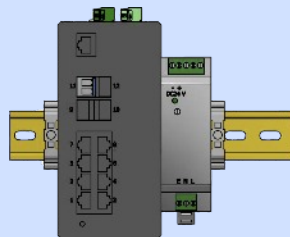
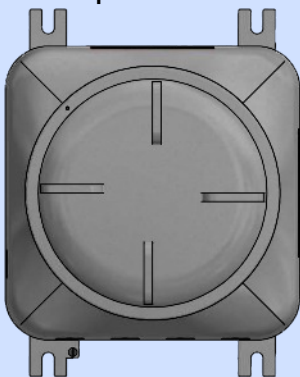
Typical output values include:

- Hydrocarbon (oil) concentration
- Hydrocarbon droplet size distribution
- Solids concentration
- Solids size distribution
- Analyzer communication alarm
- Cleaning Alarm

Media Converters

CAT6 Ethernet cable has a physical length limitation of approximately 100 m before signal is negatively impacted and data may be lost. This may be of concern when the VCM is not located on the skid or when networked data outputs from the VCM need to be sent over a long distance. In these cases, media converters can be used to change from Ethernet cable to fiber optic cable and back again. Over fiber cable signals can be sent as far as 10 km, resolving these distance limitations. Media converters are typically sold as pairs and can be purchased in any combination of no electrical classification, weatherproof only, or

EXP / Flame-proof for use with either single mode or multimode fiber.



Skid Specifications

Operating Temperatures: 33°F - 150°F [1°C - 60°C]*

*Can be installed in colder conditions, but customers are responsible for heat tracing lines to prevent freezing. Products covering temperatures and pressures larger of the standard range may also be available. Reach out to your local Canty representative for more information.

Operating Process Pressures: Dependent on Inflow™ model used. Refer to TA12100-1030.

Cleaning System Water Flowrate: 1.8 US gal/min during cleaning cycle. Cycles typically run for 1 minute every 1-2 hours.

Cleaning System Wetted Material: 316/316L Stainless Steel & Brass Pump. NACE options also available.

Process Wetted Material: 316/316L Stainless Steel. NACE options also available.

Power Requirements: Under normal operating conditions the system draws 360W. When the cleaning cycle runs the system draws 3,600W.

EXP rated power options:

- 230VAC 60Hz Single Phase

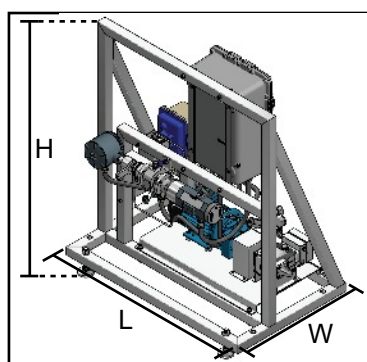
ATEX or IECEx/ATEX rated power options:

- 230VAC 50Hz Single Phase
- 230VAC 60Hz Single Phase

Environmental Ratings (Model Dependent):

	Inflow™	Power Supply	Monitor (If Applicable)	Actuators	Motor	Pump
EXP	EXP FM CL. I DIV. I GR. B, C, & D, T5	EXP UL, CSA, CL. I DIV. I GR. B, C, & D, T3		EXP CSA CL. I DIV. I GR. C, & D CL. I DIV. II, GR. E, F, & G., T6	EXP, UL, CL. I DIV. I GR. C & D, CL. II DIV. II GR. F & G., T3C	N/A
ATEX	ATEX ZONE 1 (Ex d IIC T5)	ATEX ZONE 1 (Ex db IIB+H2 T5 Gb)		ATEX ZONE 1 (Ex II 2G db IIB T6 Gb)	(Ex db IIB T4 Gb)	ATEX ZONE 1 (Ex II 2G h IIC T4 Gb)
IECEx/ATEX	IECEx ZONE 1 (Ex d IIC T5)	IECEx ZONE 1 (Ex db IIB+H2 T5 Gb)		IECEx ZONE 1 (Ex II 2G db IIB T6 Gb)	(Ex db IIB T4 Gb)	N/A
IP/NEMA	NEMA 4 / IP66	NEMA 4X / IP66		NEMA 4/4X/7 & 9	IP66 - Europe / IP55 - US	N/A

Typical Product Dimensions:



Dimension	Value
Height (H)	51 in [1295 mm]
Length (L)	44 in [1118 mm]
Width (W)	26 in [660 mm]

Max Distance from skid to analyzer: 10 ft

Note: Dimensions are approximate and may vary model to model. Consult factory or specific product documentation for more specific information.

Ordering Information

Use our online skid configuration system to select the right skid system for you and generate a quotation. Follow this QR code or visit us at www.jmcanty.com.

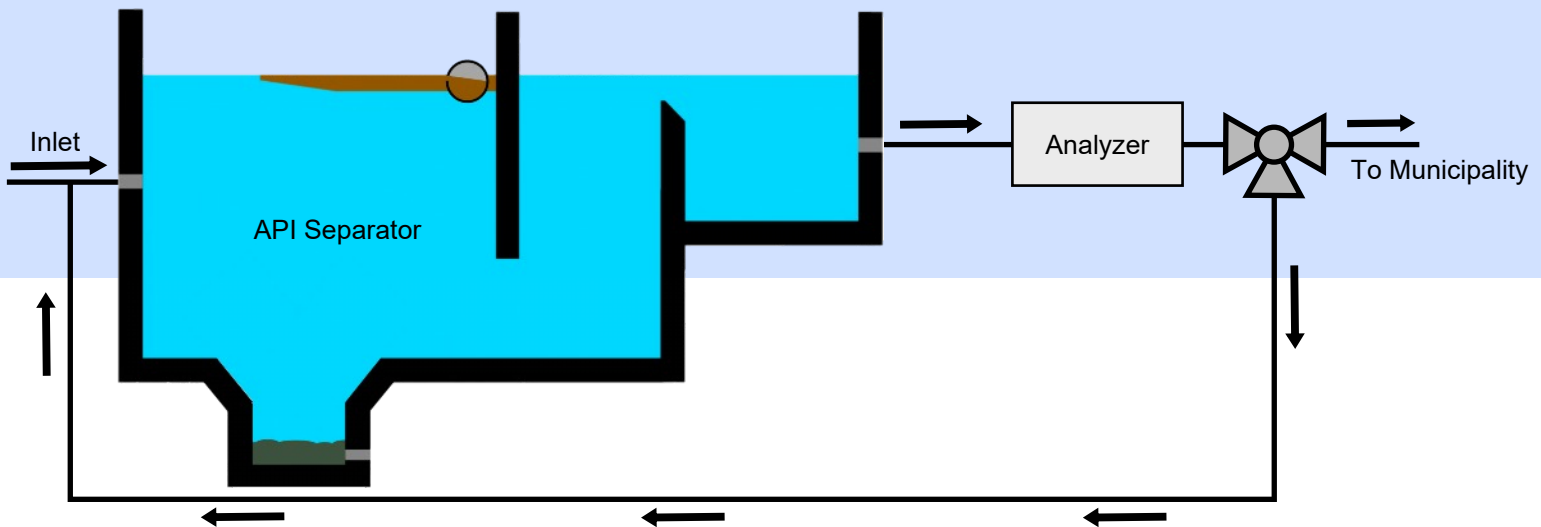


Real World Configuration Example 1

The Problem:

An oil refinery was discharging the clean water out of an API separator to the local municipality with a maximum limit of 30 ppm of oil. On occasion, an excursion would occur that caused concentrations to surge above this limit for short durations. These excursions were typically missed from their normal sampling, leading to intermittent fines from the municipality who then had to treat the water.

The refinery decided to install an analyzer to constantly measure oil concentrations. When an excursion was detected, the water discharge would be diverted and treated before being released to the municipality. Several technologies were tried, but each quickly fouled or outright failed, producing erroneous readings that operators quickly leaned to ignore.



The Solution:

An engineer from the refinery learned about CANTY's technology after an API meeting. After discussion, a skid was selected with the following criteria:

- EXP environmental rating
- Stationary skid design
- VCM located in control room
- Inflow™ mounted on skid with sample line
- Fiber converters used
- Data communication over Modbus TCP/IP



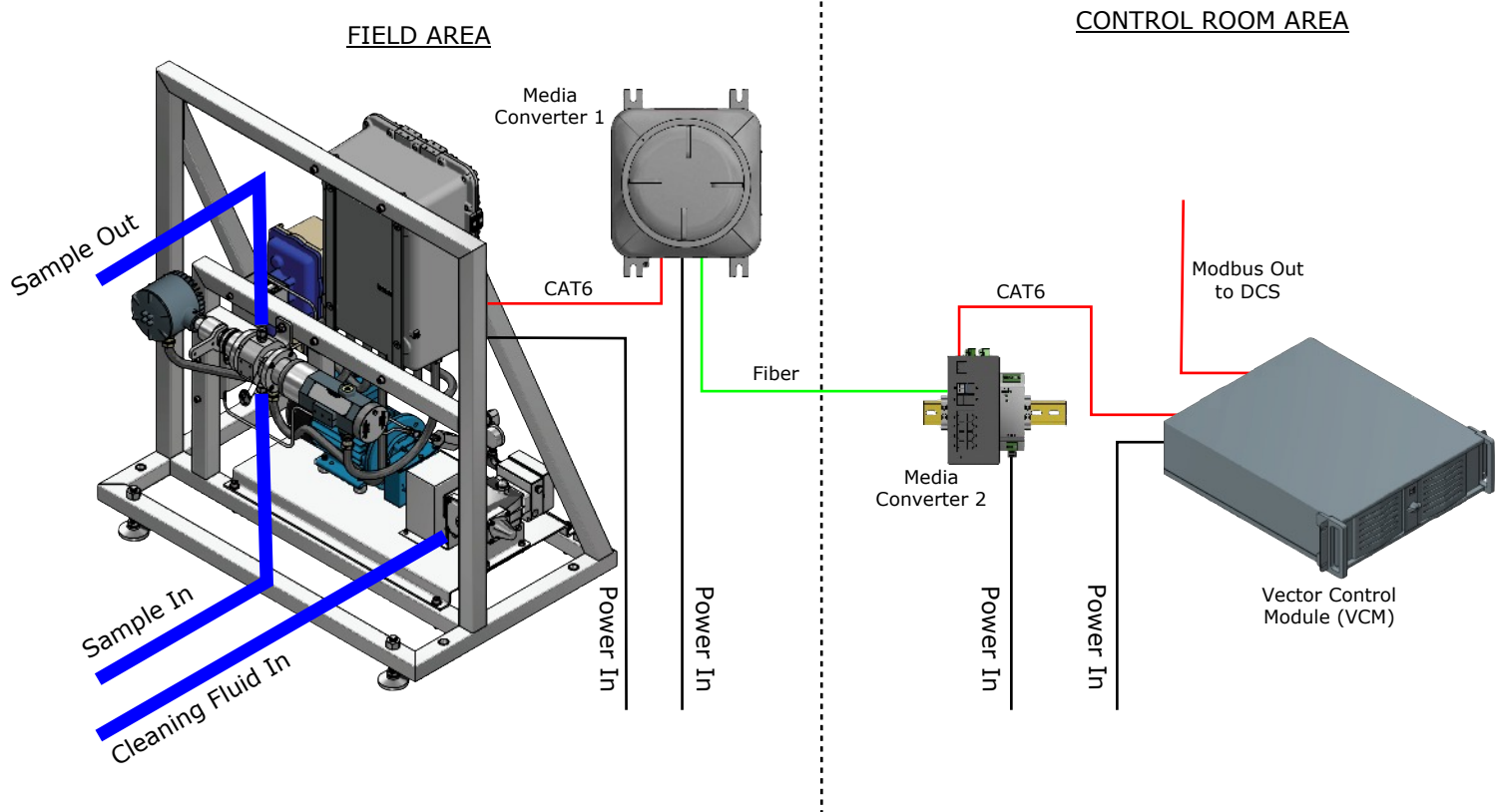
Deliverables:

From Canty:

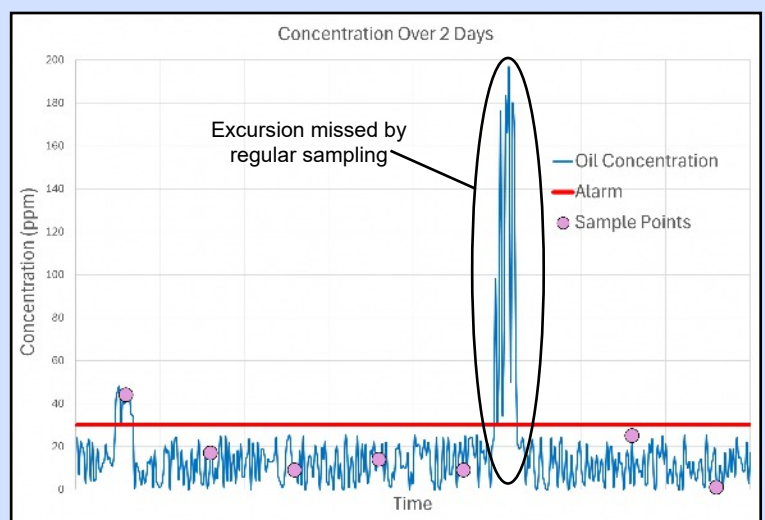
- Skid Cleaning System
- Inflow™ Analyzer
- Media Converters (x2)
- Vector Control Module
- Interconnecting wiring between PSU, Inflow™, pump, and actuators on skid

From User:

- Physical installation of equipment
- Input power for skid, media converters and VCM
- Cleaning fluid and tubing
- CAT6 and fiber cable between skid, media converters, and VCM
- Signal output cabling from VCM



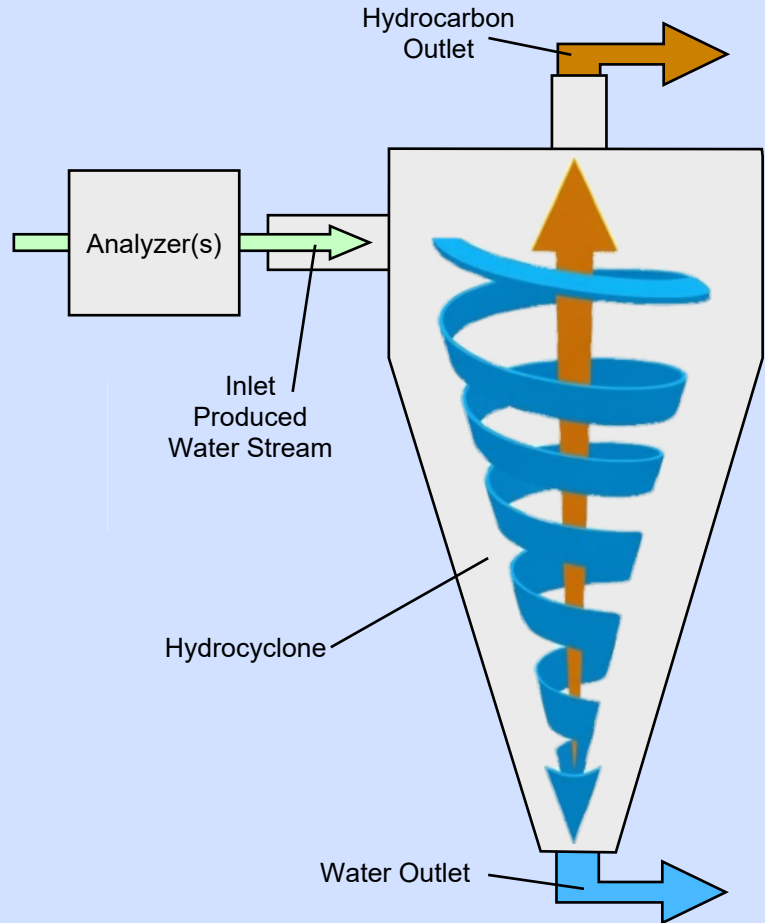
The analyzer is still used, providing constant oil concentrations that the regular sampling otherwise misses. An additional analyzer was later added to the inlet for more complete control of the entire process!



Real World Configuration Example 2

The Problem:

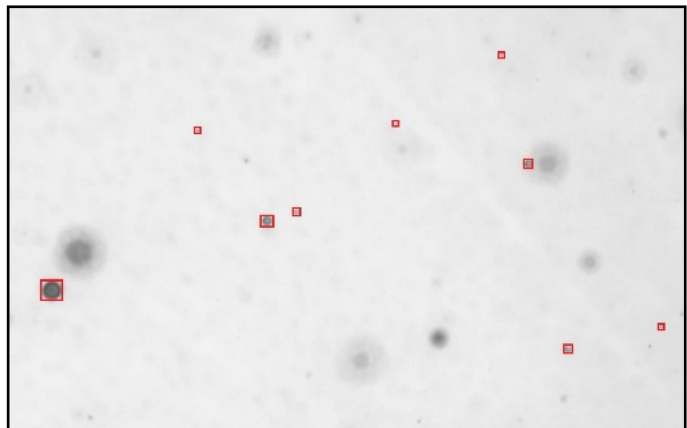
An oil rig was using a hydrocyclone to separate oil from a produced water stream. The size and concentration of oil droplets in that stream changed dynamically as the process ran, often leading to an inefficient separation and water needing to be reprocessed. Samples were taken frequently in an effort to control the process better, but there were two problems. First, the time it took to obtain a sample and get it analyzed would allow droplets to coalesce, often resulting in inaccurate size distributions. Second, it was quickly identified that it was impossible to keep up with the rate at which the process changed. Most inline solutions offered either concentration or size distribution and were often negatively impacted by gas bubbles and solids that were occasionally present.



The Solution:

During a sales visit with the company, the local Canty sales representative identified the problem and suggested a Skid Inflow™ System to make both the size and concentrations measurements inline with a single, reliable instrument. The rig required the following conditions:

- EXP environmental rating
- Stationary skid design
- VCM on skid with local display
- Inflow™ mounted on Short Loop Sampler in large pipe
- No media converters required
- Data communication over analog 4-20 mA.



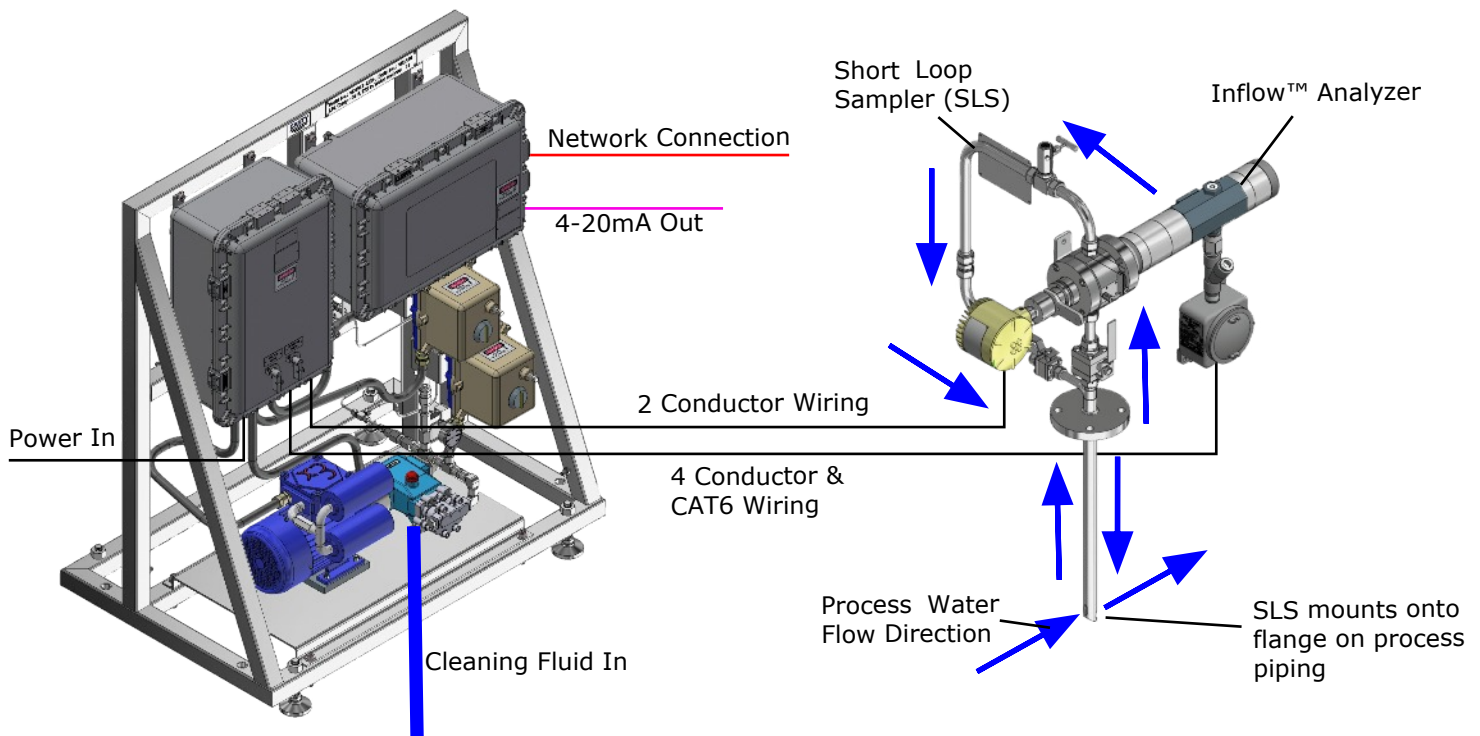
Deliverables:

From Canty:

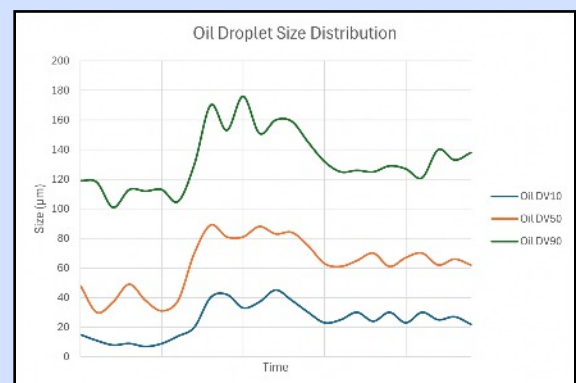
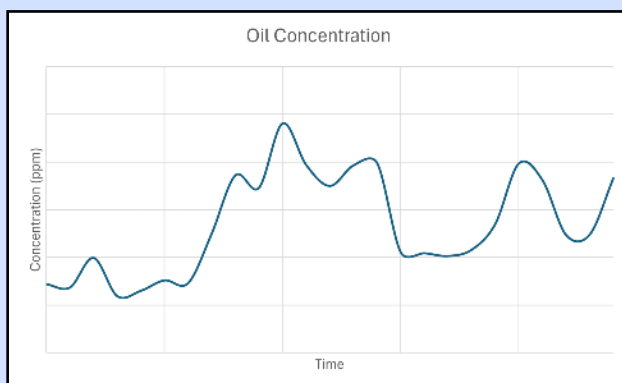
- Skid Cleaning System
- Inflow™ Analyzer
- Short Loop Sampler
- Interconnecting wiring between PSU, pump, and actuators on skid

From User:

- Physical installation of equipment
- Input power for skid
- Cleaning fluid and tubing
- Interconnecting wiring between skid PSU and Inflow™
- 4-20mA Signal output cabling from VCM (on skid)
- Network connection from skid to control room (for remote access)



The skid system was initially installed to monitor these parameters on the inlet to the hydrocyclone. After seeing great success, the rig later installed analyzers on both outlets from the hydrocyclone as well to establish total control over the operation.



CANTY'S GOAL IS TO PROVIDE EQUIPMENT TO ENHANCE PROCESS UNDERSTANDING AND CONTROL. WE ACCOMPLISH THIS BY DESIGNING, MANUFACTURING AND SERVICING THE FINEST EQUIPMENT IN THE WORLD.

CANTY

PROCESS TECHNOLOGY

SOME OF THE COMPANIES WE HAVE WORKED WITH

Exxon Mobil	ADNOC	Marathon Oil
Qatar Petroleum	Chevron	Shell
Petronas	Daleel Petroleum	Total
FMC	Saipem	BG Technical
Cameron	BP	ProLabNL
TUV NEL	Imperial Oil	Oil Plus
SINTEF	MYCELX	SMS Oilfield
Wintershall	Premier Oil	Siemens Water
SNF	Soiltech	SGS



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