# Automated Inflow Control Device Testing

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Tridiagonal solutions provides testing of AICD/ICD which includes cavitation testing, flow performance test, erosion test and mud flow initiation and sediment plugging test (as per API 19 ICD). The facility offers testing with single phase and multiphase flow with pressure up to 200 bar.

## Facility capabilities

Our facility has tremendous capabilities for conducting performance and erosion tests (as per API 19 ICD) on AICD/ICD which include:

- Cavitation testing for determining the back pressure ratio to minimize liquid cavitation across ICD
- Flow performance test
- Erosion test for evaluation of AICD/ICD erosion resistance
- Mud flow initiation test and sediment plugging test to determine effect of settled mud on flow performance
- Flow integrity test and static pressure test

The facility includes the following: -

- For slurry preparation, 1000 liter mixing tank with agitation system, specialized sand feeder for proper addition of sand to mix with liquid.
- 18000-liter tank available for fresh water supply.
- Pump system include high pressure triplex plunger pumps.
- High pressure test chamber for AICD/ICD testing.
- Valve systems for regulating flow resistance at higher working pressures
- Cooling facility availability for temperature regulation of fluid during test.
- Instruments available for monitoring data for each second.
- Laser particle size analyzer for PSD analysis of sand.

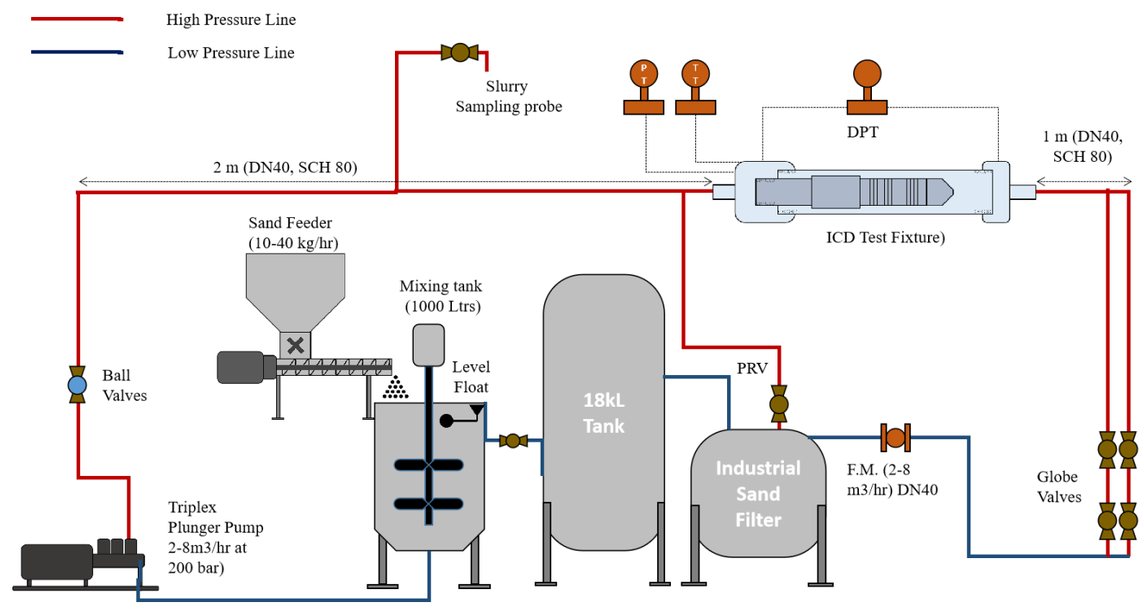


*Figure:1 Schematic of AICD/ ICD test loop*


*Figure 2: Actual test setup*


*Figure 3: Cooling facility*

| ICD flow performance test facility | |
|---|---|
| Upstream pressure for liquid/ liquid tests (bar) | upto 150-200 |
| Upstream pressure for Gas/liquid tests (bar) | upto 100 |
| Liquid Flow rate (Oil/water)($m^3$/hr) | upto 8 (but not limited to) |
| Test duration (hr) | As per requirement |

| ICD erosion test facility | |
|---|---|
| Upstream pressure(bar) | upto 150-200 |
| Water Flow rate ($m^3$/hr) | upto 8 (but not limited to) |
| Solid Concentration (ppm) | 5000-20000 |
| Test duration (hr) | As per requirement |

**About us:** Tridiagonal Solutions, founded in 2006, specializes in process R&D and digital transformation for global industries. With a team of 300 experts, we offer consulting services and digital solutions, leveraging our strong domain expertise and technology experience.

**Focus areas**: Sand Transport Analysis, Wax Deposition Evaluation, Asphaltene Deposition Investigation, Erosion testing, Erosion-Corrosion testing, Multiphase Flow Characterization, Hydrate Slurry Flow Analysis, Testing of ICD/AICD/AICV Technologies, CCUS Technology Readiness Assessment, Advancing Technologies from TRL 3 to TRL 10, Green Hydrogen Initiatives.

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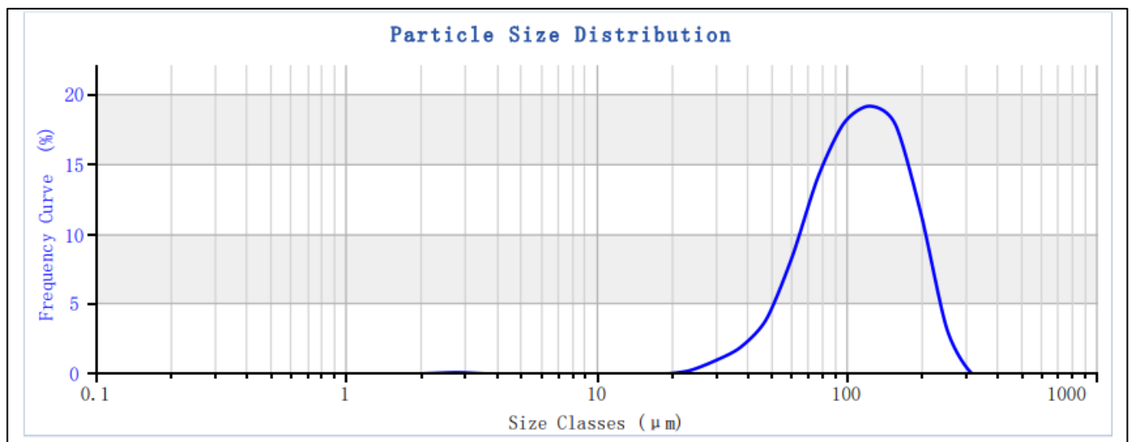
## Instruments

The facility is equipped with data monitoring system for each second measurement and recording of data. Instruments:

- Laser particle size analyzer – for particle size distribution with particle size range from 0.1 micron to 1000 micron.
- Pressure transmitter – for pressure measurement in the system with measurement up to 200 bar
- Differential pressure transmitter – for measurement of pressure difference across the system with capability of 160 bar
- Temperature transmitter – for temperature measurement in the system (range from 0 to 120$^{o}$C)
- Coriolis flowmeters – for flow rate measurement with range from 0 to 10 $m^3$/hr.
- Rotating Viscometer – for viscosity measurement of fluid.


*Figure 4: Laser particle size analyzer*




| Size(μm) | Volume In (%) | Volume (%) | Size(μm) | Volume In (%) | Volume (%) | Size(μm) | Volume In (%) | Volume (%) | Size(μm) | Volume In (%) | Volume (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | | | 1.075 | 0.01 | 0.01 | 11.565 | 0.00 | 0.36 | 124.370 | 19.24 | 67.39 |
| 0.127 | 0.00 | 0.00 | 1.364 | 0.03 | 0.04 | 14.666 | 0.00 | 0.36 | 157.715 | 17.92 | 85.31 |
| 0.161 | 0.00 | 0.00 | 1.729 | 0.03 | 0.07 | 18.598 | 0.03 | 0.39 | 200.000 | 11.45 | 96.76 |
| 0.204 | 0.00 | 0.00 | 2.193 | 0.08 | 0.15 | 23.584 | 0.27 | 0.66 | 253.620 | 3.23 | 100.00 |
| 0.259 | 0.00 | 0.00 | 2.781 | 0.14 | 0.29 | 29.907 | 0.97 | 1.63 | 321.620 | 0.00 | 100.00 |
| 0.328 | 0.00 | 0.00 | 3.527 | 0.07 | 0.36 | 37.925 | 1.95 | 3.58 | 407.850 | 0.00 | 100.00 |
| 0.416 | 0.00 | 0.00 | 4.472 | 0.00 | 0.36 | 48.094 | 3.96 | 7.55 | 517.200 | 0.00 | 100.00 |
| 0.527 | 0.00 | 0.00 | 5.671 | 0.00 | 0.36 | 60.988 | 8.44 | 15.99 | 655.868 | 0.00 | 100.00 |
| 0.669 | 0.00 | 0.00 | 7.192 | 0.00 | 0.36 | 77.339 | 14.15 | 30.14 | 750.000 | 0.00 | 100.00 |
| 0.848 | 0.00 | 0.00 | 9.120 | 0.00 | 0.36 | 98.075 | 18.01 | 48.15 | | | |

*Figure 5: PSD analysis using laser particle size analyzer*

## Deliverables

Tridiagonal solutions aims to deliver the test reports and data as per clients requirement with inclusion of PSD analysis, test reports which include flow performance curves, erosion test deliverables and other data for different tests (as per API 19 ICD and client requirement), images and performance curves of ICD/AICD.