

# AquaWatcher Water Analysis Sensor

Detect and characterize water in multiphase and wet gas flows

## APPLICATIONS

- Oil production
  - Determining the origin of water, including formation water, injected water, and a mixture of both
  - Updating water properties for multiphase metering applications and other purposes
- Wet gas production
  - Detecting the onset of formation water production
  - Determining the rate of formation water
  - Determining the concentration of injected chemicals and optimizing dosage

## ADVANTAGES

- High-resolution water detection
  - Any water from 10 ppm
  - Formation water from 50 to 100 ppm
- Measurement of water conductivity
- Calculation of water salinity and ratio of injected chemicals to water
- Direct transmission of measurements to a multiphase flowmeter, subsea control system, or any suitable communications unit
- Process pressures up to 15,000 psi [103.4 MPa], temperatures up to 320 degF [160 degC], and water depths to 10,000 ft [3,000 m]

The AquaWatcher\* water analysis sensor has the unique capability to detect miniscule quantities of water in multiphase and wet gas flows, determine the salinity of the water, and quantify the ratio of injected chemicals to water. The sensor measures the conductivity of produced water at any gas volume fraction and most water cuts, including in the transition zone from oil- and water-continuous mixtures. Breakthrough of injected water in waterflood applications is detected at very low concentrations, and crucial information about the origin of produced water is provided. The precise water property measurements acquired using the AquaWatcher sensor also help improve the accuracy of multiphase meters when water properties vary over time.

## Industry-unique measurement-based water management

The AquaWatcher sensor revolutionizes water management in wet gas production with its patent-pending measurement-based approach, which enables chemical dosage to be based on a measurement of the ratio of chemicals to water downstream of the injection. This methodology helps significantly reduce risk and costs for chemical injection and reclamation. Additionally, the sensor facilitates bringing additional production on line through improved utilization of the available injection and reclamation capacity.

Installed as a stand-alone sensor or integrated with a multiphase or wet gas flowmeter, the AquaWatcher sensor uses the reflection of a microwave signal to locally measure fluid permittivity and conductivity, such as near the pipe wall in a process pipe. The sensor can be installed anywhere in a subsea production system, including at the wellhead or in a subsea tree.



*AquaWatcher water analysis sensor.*

## Performance Specifications<sup>†</sup>

		Accuracy	Sensitivity
Absolute	For water conductivity < 4 S/m, S/m	±0.2	0.05
	For salinity < 6.5 g/kg, g/kg [wt%]	±0.5 [±0.05]	0.15 [0.015]
Relative	For water conductivity > 4 S/m, %	±5	0.5
	For salinity > 6.5 g/kg, %	7.5	0.75

<sup>†</sup> Typical at line conditions.

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## Technical Specifications†

### Measurement section

Environment	Subsea
Maximum water depth, ft [m]	9,842 [3,000]
Seawater temperature range, degF [degC]	23 to 86 [–5 to 30]
Principle of operation	Microwave reflection, single probe
Position	Integrated with blind-T or flush mounted bottom of horizontal pipe; no intrusive parts
Maximum mixture conductivity, S/m	80
Equivalent maximum sodium chloride salinity, ppm	260,000
Mechanical connection	4 <sup>1</sup> / <sub>16</sub> -in API 6A, 5 <sup>1</sup> / <sub>8</sub> -in API 6A, other on request
Fluids compatibility‡	Oil, water, gas, methanol, monoethylene glycol (MEG), diethylene glycol (DEG), triethylene glycol (TEG), and all fluids normally found in a well stream
Minimum water acidity, pH	3.5
Sour service	Per NACE MR0175
Process temperature range, degF [degC]	–50.8 to 320 [–46 to 160]§
Pressure, psi [MPa]	
Process	10,000 [68.9], 15,000 [103.4]
Hydrostatic test	15,000 [103.4], 22,500 [155.1]
Envelope dimensions (h × d), in [mm]	Approximately 35.43 × 15.75 [900 × 400]
Weight, lbm [kg]	Approximately 660 [300]
Design code	ASME VIII Div. 2, API 6A

### Materials

Design lifetime	30 years
Body	22Cr duplex stainless steel; UNS N06625 (INCONEL® 625) on request
Wetted parts	UNS N06625 (INCONEL 625), cemented carbide, glass
Bolts and socket head (pressure retaining)	ASTM B637 UNS N07718
Structural bolts and nuts	L7 and A4
Metal seals	
Process wetted	INCONEL 718, gold plated
Seawater wetted	INCONEL 718, silver plated
Interfaces	
Electrical power	24-V DC (18–36), 15 W
Communication	RS-485 Modbus® RTU; upon request CANopen (SIIS Level 2) and Ethernet (SIIS Level 3)

### Testing

Environmental stress screening	According to API 17F, ISO 13628-6 (2006)
Pressure test, psi [MPa]	
Hyperbaric (two 15-min tests and one 1-h pressure cycle)	3,234 [22.3] (standard), 4,830 [33.3] (optional)
Hydrostatic (one 15-min test and one 1-h pressure cycle)	15,000 [103.4], 22,500 [155.1]
Helium leak test	Yes
Factory acceptance test and final inspection	Yes
NDE testing (body and pressure-retaining parts)	API 6A PSL 3

†Typical at line conditions.

‡ Not compatible with high concentrations of hydrofluoric acid, hydrochloric acid, or alkaline solutions.

§ For process temperature above 320 degF [160 degC] contact OneSubsea for technical advice.

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