

# ORBISPHERE HYDROGEN SENSORS

## Applications

- Power

## Accurately monitor hydrogen in your power production process

### *Thermal Conductivity Sensor*



#### **Hydrogen measurement in hydrogen cooled generators**

- Allows stability of high hydrogen purity to keep the generator at its highest efficiency
- Reduces risks of hydrogen leaks and unplanned outages
- Minimizes downtime during generator maintenance
- Improves operator and plant safety
- Reliable hydrogen sensing technology reducing risks of false alarms

#### **Analysis of waste or off gas hydrogen in nuclear power plants**

- Reliable gas analysis reduces possibility of unscheduled outages
- Self-contained, pre-tested sampling systems for simplified installation
- System detects and corrects potential explosive conditions

#### **Dissolved hydrogen analysis in reactor coolant systems (RSC in PWR or HWC in BWR)**

- In-process measurement minimizes personnel radiation exposure
- Continuous on-line analysis of RCS dissolved gas levels provides real-time process control
- Unique hydrogen measurement method yields high accuracy, requires virtually no service

### *Electrochemical Sensor*



#### **Measurement of dissolved hydrogen as a determination of corrosion rate in power plants**

- Accurate dissolved hydrogen measurement down to 0.03 ppb assures the ability to detect corrosion
- Fast response enables data to be gathered quickly and easily
- Process or portable configurations available for any application



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## Technical Data\*

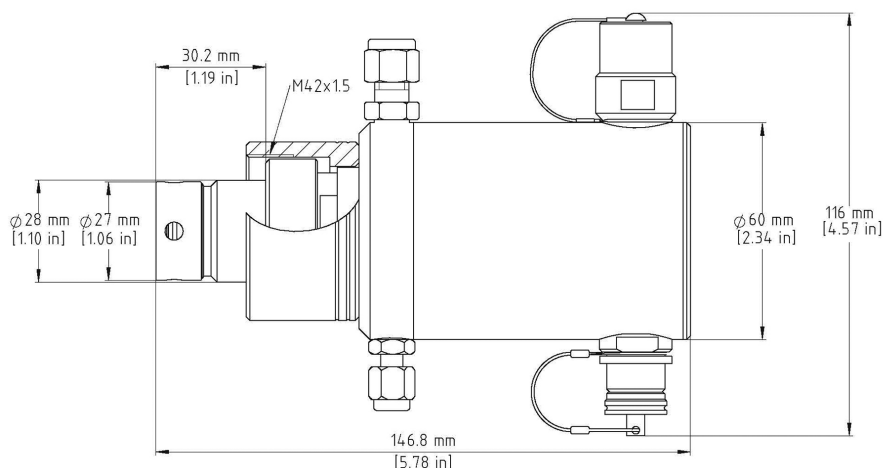
Thermal Conductivity Sensor			
Sensor Model	Orbisphere 31290 Sensors (or previous generation 31250 and 31260 sensors)		
Applications	Waste gas (PWR), off gas (BWR), and reactor water (HWC)	Reactor coolant (PWR)	High H <sub>2</sub> level
<b>Membrane</b>			
Model	29561A	2952A	2935A
Thickness Membrane	25 µm	25 µm	25 µm
Material	PFA	ETFE	ECTFE (Halar)
Radiation Dose Limits	10 <sup>5</sup> rad	10 <sup>8</sup> rad	10 <sup>8</sup> rad
<b>Sample</b>			
Temperature Range	0 to 50 °C		
Pressure Range at 25 °C	0 to 20 bar / up to 170 bar for 312xxHP		
Flow Rate <sup>1</sup>	220 mL/min	200 mL/min	100 mL/min
<b>Measurement</b>			
Range at 25 °C	0 to 2 ppm, or 0 to 25 cc/kg, or 0 to 1.5 bar	0 to 10 ppm, or 0 to 120 cc/kg, or 0 to 6 bar	0 to 20 ppm, or 0 to 220 cc/kg, or 0 to 12 bar
Accuracy, the greater of (Sample temperature 20 to 50 °C, within ±5 °C of calibration temperature)	±1% of reading, or ±2 ppb, or ±0.03 cc/kg, or ±1.5 bar	±1% of reading, or ±8 ppb, or ±0.1 cc/kg, or ±6 mbar	±1% of reading, or ±25 ppb, or ±0.4 cc/kg, or ±20 mbar
Accuracy, the greater of (Sample temperature 0 to 50 °C, independent of calibration temperature)	±3% of reading, or ±15 ppb, or ±0.18 cc/kg, or ±6 mbar	±3% of reading, or ±60 ppb, or ±0.6 cc/kg, or ±20 mbar	±3% of reading, or ±150 ppb, or ±2.5 cc/kg, or ±50 mbar
Cycle Time	17 s		
Recommended Purge Gas	Pure N <sub>2</sub> or air		
Recommended Calibration Gas	Pure H <sub>2</sub>		
Signal Drift (per year)	<1% of reading		
Certifications	2004/108/EC - EN 61326-1		
Weight	2.09 lbs. (0.95 kg)		
Maximum Distance to Analyzer	50 m		

<sup>1</sup>Recommended, through model 32001 flow chamber

\*Subject to change without notice.

## Dimensions

In millimeters (inches).



## Technical Data\*

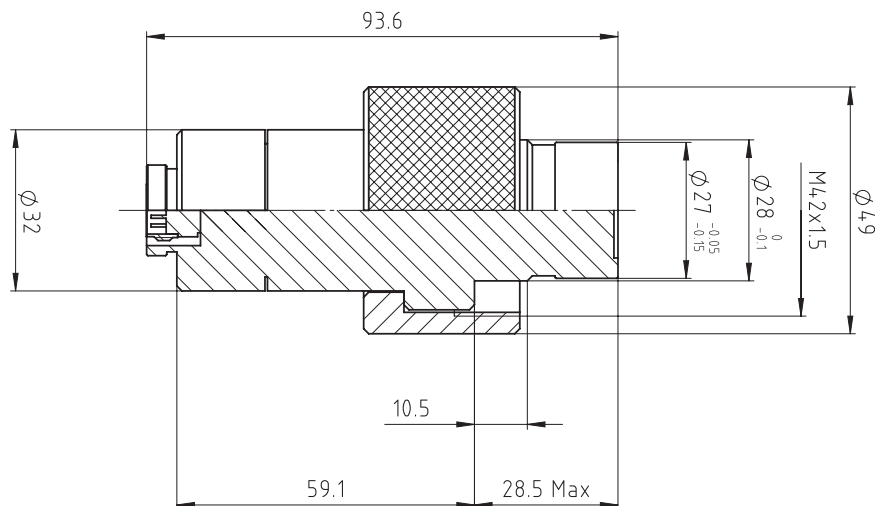
Electrochemical Sensor				
Sensor Model	Orbisphere 31210.12 / 31230.01 / 31240.01			
Applications	Corrosion rate			
<b>Membrane</b>				
Model	2956A	2952A	2995A	29015A
Thickness Membrane	25 µm	25 µm	12.5 µm	23 µm
Material	PFA	ETFE	Tedlar®	Saran
Radiation Dose Limits	2 x 10 <sup>4</sup> rad	10 <sup>8</sup> rad	10 <sup>8</sup> rad	N/A rad
<b>Sample</b>				
Temperature Range	-5 to 100 °C			
Temperature Compensation Range	0 to 50 °C	0 to 50 °C	10 to 45 °C	10 to 45 °C
Response Time <sup>1</sup>	2 s	5 s	6 s	50 s
Pressure Range at 25 °C	0 to 50 bar / up to 200 bar for 31240.01			
Recommended Liquid Flow Rate <sup>2</sup>	50 to 220 mL/min	40 to 200 mL/min	20 to 70 mL/min	20 to 40 mL/min
Recommended Min. Linear Flow Rate <sup>2</sup>	200 cm/s	150 cm/s	50 cm/s	30 cm/s
Recommended Gaseous Flow Rate <sup>2</sup>	0.005 to 3 L/min			
<b>Measurement</b>	<b>Trace measurement</b>	<b>Low concentration</b>	<b>Average concentration</b>	<b>High concentration</b>
Dissolved Measuring Range	0 to 75 ppb	0 to 300 ppb	0 to 3200 ppb	0 ppb to 32 ppm
Gaseous Measuring Range	0 Pa to 5 kPa	0 Pa to 20 kPa	0 Pa to 200 kPa	0 to 2000 kPa
Accuracy, the greater of	±1% of reading, or ±0.03 ppb, or ±1 Pa	±1% of reading, or ±0.09 ppb, or ±6 Pa	±1% of reading, or ±1 ppb, or ±50 Pa	±1% of reading, or ±10 ppb, or ±1 kPa
Expected Current in Pure Gas	150 µA	50 µA	5 µA	0.5 µA
Calibration Gas	1% pure H <sub>2</sub>	10% pure H <sub>2</sub>	100% pure H <sub>2</sub>	100% pure H <sub>2</sub>
Certifications	IP68 / NEMA4			
Weight	140 to 700 grams, depending on the construction material			
Maximum Distance to Analyzer	Up to 1000 m, 50 m if model 28117 pressure sensor is used			

<sup>1</sup>Response time at 25 °C for a 90% signal change; <sup>2</sup>Liquid flow through an Orbisphere 32001 flow chamber, with protection cap and no grid

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## Dimensions

In millimeters (inches).



## Order Information

### Hydrogen Thermal Conductivity Sensor (max. pressure rating)

- 31290TC** Standard hydrogen TC sensor with external temperature sensor adapter, with nitrogen purge and protection cap (20 bar)
- 31290HP** High pressure hydrogen TC sensor with external temperature sensor adapter, with nitrogen purge and protection cap 29108 (170 bar)

### Hydrogen Thermal Conductivity Accessories

- 32739** Maintenance Kit for high pressure hydrogen TC sensor. Includes membranes 29561A, membrane holding ring 29228.01, kit 29082, and tools for sensor maintenance.
- 32741** Maintenance Kit for hydrogen TC sensors with 29108 protection cap. Includes membranes 2952A, membrane holding ring 29228.01, kit 29082, and tools for sensor maintenance.
- 32605** Safety purge backup unit for Orbisphere TC sensors
- 32559.0** External temperature sensor for off-line use, supplied with 4 pin LEMO connector for TC sensors equipped with sensor adapter 32558. T piece for connection to 6 mm tubing included.
- 32559.1** External temperature sensor for off-line use, supplied with 4 pin LEMO connector for TC sensors equipped with sensor adapter 32558. T piece for connection to ¼" tubing included.
- 32505.XX** Cable to connect 31xxx sensors to Orbisphere 410/510 controllers. XX = 01, 03, 05, 10, 15, 20, or 25 m length

### Hydrogen Electrochemical Sensor (max. pressure rating)

- 31210.12** Hydrogen EC sensor, PEEK, guard ring: platinum, o-ring: viton (20 bar)
- 31230.01** Hydrogen EC sensor, stainless steel, guard ring: platinum, o-ring: EPDM (100 bar)
- 31240.01** High pressure hydrogen EC sensor, stainless steel, guard ring: platinum, o-ring: EPDM (200 bar)

### Hydrogen Electrochemical Accessories

- 29010** Electrolyte for H<sub>2</sub> sensor (50 mL)
- 29011** Chloridizing solution for H<sub>2</sub> sensor (50 mL)
- 29781** Polishing kit for O<sub>3</sub> and H<sub>2</sub> sensors, incl. 3 µm powder (29331) and cloth
- 3272X** Recharge kit for hydrogen electrochemical sensors (with X=0 for membrane 2952A, X=1 for membrane 29015A, X=2 for membrane 2956A, X=3 for membrane 2995A)
- 32301.A** Electrochemical sensor cleaning and regeneration unit, 115 VAC
- 32301.B** Electrochemical sensor cleaning and regeneration unit, 230 VAC

### Common Hydrogen Sensors Accessories

- 28117GP** Pressure sensor, 0 to 5 bar absolute (for gas phase applications)
- 28117.C** Pressure sensor, 0 to 1 bar absolute (for gas phase applications)
- 29006.0** EPDM O-rings for flow chamber/sensor socket 28x2 and 32x2 mm

### Flow chambers

- 32001.010** Flow chamber in stainless steel (316) with 6 mm fittings. Supplied with EPDM O-rings.
- 32001.011** Flow chamber in stainless steel (316) with ¼" fittings. Supplied with EPDM O-rings.
- 32002.010** Multi parameter flow chamber in stainless steel with 6 mm fittings. Supplied with EPDM O-rings.
- 32002.011** Multi-parameter flow chamber in stainless steel with ¼" fittings. Supplied with EPDM O-rings.
- 32006** Flow chamber in stainless steel (316) for use with for model 28117 and 28117.C pressure sensors

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