



Application Note: 002
March 2009

Waltron 9091 Dissolved Hydrogen Analyzer – Use in Nuclear Power Plants

Overview –

Online dissolved hydrogen analyzers provide an accurate method of measuring the presence of dissolved hydrogen in sample water. Waltron's 9091 dissolved hydrogen analyzers come with **fully automatic remote calibration**; a unique and important feature which reduces the amount of time operators need to spend servicing the instrument in nuclear power plant "hot" zones.

In nuclear power plant applications, hydrogen gas is added to the process water to reduce the amount of dissolved oxygen in the sample. Lowering the concentration of dissolved oxygen is important due to the fact that corrosion occurs when dissolved oxygen reacts with metal surfaces. The hydrogen acts as an oxygen scavenger by bonding with oxygen to form water.

Dissolved Hydrogen Monitoring (Technical Details) –

In nuclear power plant applications hydrogen is added to scavenge the oxygen which is produced during radiolysis. The measurement of dissolved hydrogen is important in both pressurized water reactors (PWR) and boiling water reactors (BWR). In the primary loop of a PWR, typical dissolved hydrogen measurements range from 25-50ppb. For BWR systems, dissolved hydrogen is measured in both feedwater and reactor coolant samples. Dissolved hydrogen in BWR feedwater is typically 0-2ppm. Dissolved hydrogen concentrations in reactor coolant water will range between 0.1-0.5ppm.

The use of dissolved hydrogen as an oxygen scavenger is preferred in nuclear power plant applications due to the fact that other chemical oxygen scavengers (such as hydrazine) decompose rapidly at high temperatures (200F). Use of other chemical oxygen scavengers may also pose chemistry control problems by changing the pH of the water.

The main benefit of the Waltron 9091 Dissolved Hydrogen analyzer is that it offers fully automatic remote calibration. Calibration is performed automatically and no external calibration materials or procedures are required. It is not necessary to shut down the operation of the analyzer during the calibration.

The automatic remote calibration is performed based on the Faraday Law. An electrode sends an electrical current through the sample water. This process produces a known amount of dissolved hydrogen by electrolysis. The instrument then calibrates itself to this known amount of dissolved hydrogen.

In order for the automatic remote in-line calibration to function correctly the following sample conditions must be met:

- Sample flowrate $\geq 10\text{l/h}$
- Sample conductivity $\geq 10\mu\text{S/cm}$ (if conductivity is less a salting cell can be installed in the system. This cell is offered by Waltron.)

Summary –

- Waltron's 9091 analyzer can be used to monitor the concentration of dissolved hydrogen which acts as an oxygen scavenger thereby reducing corrosion rates.
- The 9091 offers **fully automatic remote calibration**; a unique and important feature which reduces the amount of time operators need to spend servicing the instrument in nuclear power plant "hot" zones.

Features of Waltron's 9091 dissolved hydrogen analyzer include:

- Fully automatic remote calibration
- Wide range analysis: 0.1ppb – 20ppm
- Automatic temperature and flow compensation
- Quick response time ($t_{90} = 30\text{sec}$)
- No zero point adjustment required
- Withstands pressure up to 8 bar (116 psi)
- Analog and digital outputs

Benefits of Waltron analyzers include:

- Low reagent consumption
- Minimal maintenance
- Automatic operation

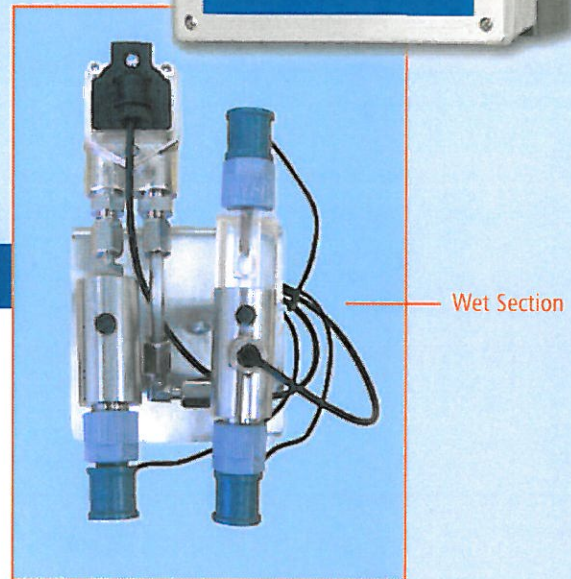
AQUALYZER® 9001 SERIES Dissolved Hydrogen Analyzer Aqualyzer® 9091

The Waltron Aqualyzer® 9091 Dissolved Hydrogen Analyzer has been developed specifically for use in measuring low and high concentrations of dissolved hydrogen. It is the industry standard for all low range dissolved hydrogen analyzers.

Fully Automatic Remote Calibration

Calibration is carried out automatically online and involves no operation. An automatic calibration check is performed at a predetermined frequency by the instrument. Calibration can be initiated at any time manually if needed.

Common applications include online monitoring of hydrogen concentrations in: primary loop of nuclear power plants, boiler feedwater in fossil power plants, denitrification (removal of nitrate NO_3) in drinking water, and the catalytic reduction of oxygen on noble metal surfaces in water treatment plants.



FEATURES

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- Wide range analysis: 0.1ppb – 20ppm
- Automatic temperature and flow compensation
- Quick response time ($t_{90} = 30\text{sec}$)
- No zero point adjustment required
- Withstands pressure up to 8 bar (116 psi)
- Analog and digital outputs

BENEFITS

- Low reagent consumption
- Minimal maintenance required
- Automatic operation

GENERAL SPECIFICATIONS

PERFORMANCE

Range:	0 – 1000 ppb, 0 – 20 ppm
Accuracy:	± 3% of reading
Response Time:	t90 = 30sec
Temperature Compensation:	Automatic
Calibration:	Automatic or manual
Analog Outputs:	0 – 20mA, 4 – 20mA (shunt max. 500 Ohm)
Digital Output:	RS-232
Alarms:	Flow, calibration and power
Power:	100VAC – 240 VAC, 50/60 Hz
Power consumption:	10 VA

OPERATING CONDITIONS

Sample Flow:	3 – 18 l/h
Sample Temperature:	0 – 60° C
Ambient Temperature:	0 – 55° C
Sample Pressure:	0.3 – 8 bar (5 – 116 psig)
Recommended Conditioning:	Sample filtered to 60 micron
Sample Conductivity:	≥10 µS/cm (if conductivity is less - salting cell is required)

MECHANICAL

Construction:	IP54
Color:	Basic parts RAL 7035; front and rear parts RAL 7024
Piping:	Swagelok® tube diameter = 6mm