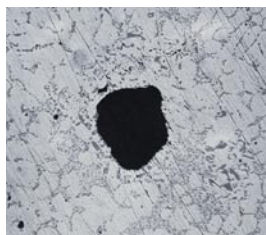


Analyzer for hydrogen in liquid aluminum



Hydrogen-induced porosity in castings

The hydrogen problem

Hydrogen measurement: essential in today's foundries

Hydrogen forms whenever molten aluminium comes into contact with water vapor, and easily dissolves into the melt. The gas tends to come out of the solution and forms bubbles when the melt solidifies.

The detrimental effects arising from the presence of an excess of dissolved hydrogen in aluminium are numerous. Hydrogen causes porosity in aluminum products leading to many casting defects, reduced mechanical properties and lower corrosion resistance. Today, several methods are used to reduce the amount of dissolved hydrogen from the melt, such as furnace fluxing prior to the casting process or using in-line degassing equipment during the casting process.

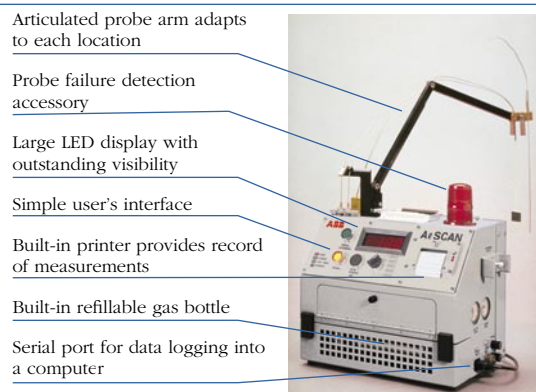
An on-line method of measuring hydrogen in aluminum is then required to characterize and optimize the process, which helps ensure the quality of outgoing products and monitors the performance of these degassing processes. Traditional laboratory methods, such as hot extraction, are too expensive for routine quality assurance, and too slow for effective process control. Reduced-pressure tests sometimes used on the production floor are only semi-quantitative and do not provide the required degree of accuracy.

A/SCAN: the leading hydrogen analyzer

Since its introduction in 1989, A/SCAN™ technology has established itself as the most-used hydrogen analyzer with more than 375 systems sold worldwide. Used by all major aluminum producers, its success is mainly due to the outstanding reproducibility of the A/SCAN and its rugged and low cost probe that

requires no preheating or careful handling. The A/SCAN analyzer is clearly superior to any other direct hydrogen measurement method:

- It is user-friendly and designed for long-term functioning on the shop floor.
- It is easy to use by non-technical floor personnel even when they wear gloves.
- It can be programmed to either perform single measurements or repeated automatic measurements. This flexibility enables the analyzer to continuously monitor the hydrogen level in molten metal using a sequence of several long measurements while being connected to a remote computer.
- Once started up, the unit operates autonomously and requires little or no attention.



Dual User Interface



Recessed panel controls

The key to simplicity and flexibility

The A/SCAN™ analyzer has distinct sets of controls. The control panel is used for routine procedures and can even be used by personnel wearing gloves! The second set of controls is located in a recessed panel to set operating parameters.

Operation principle

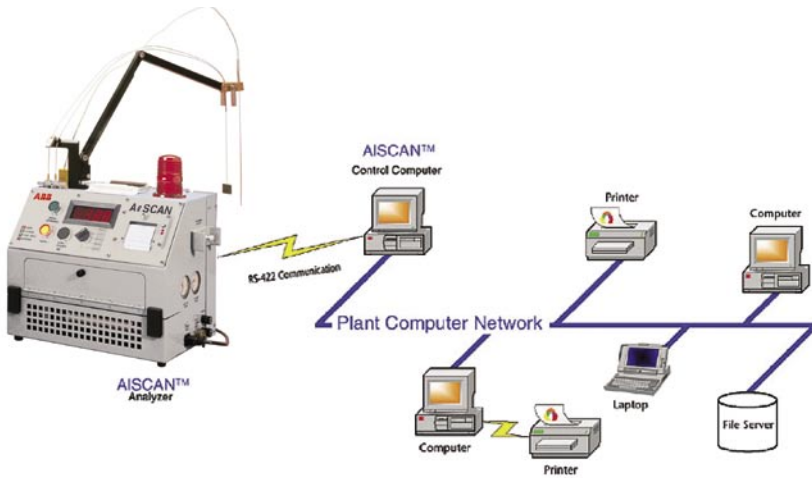
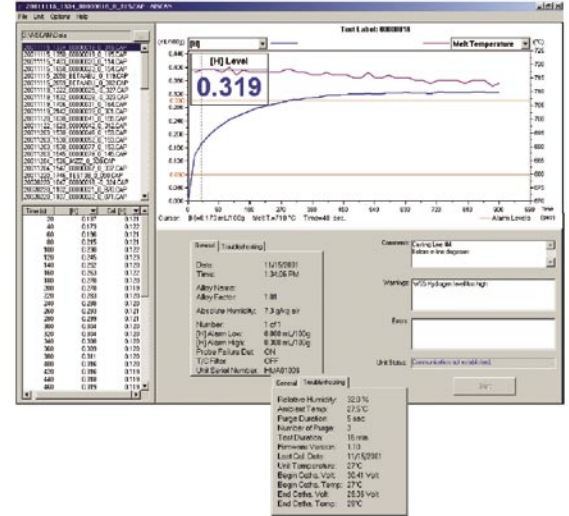
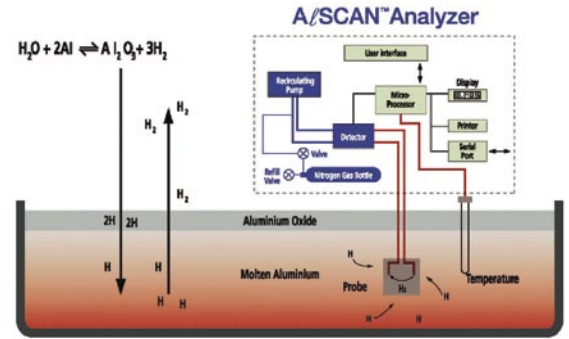
The Closed Loop Recirculation (CLR) is a proven method of directly monitoring hydrogen in molten aluminium. A small volume of carrier gas, usually nitrogen, is brought in contact with the melt by means of an immersed probe, and is continuously recirculated in the closed loop until its hydrogen content reaches equilibrium with the vapor pressure of H₂ in the melt. The H₂ concentration in the gas is measured and converted into a reading of the gas concentration in the metal. This method is fast, reproducible and accurate, and can be used “on-line” on the cast shop floor.

The amount of H₂ in the gas loop of the instrument is determined by a proprietary thermal conductivity sensor, which provides high reproducibility and a broad measurement range. The analyzer has a built-in microprocessor which controls its operation and processes data.

A/SCAN continuous monitoring option

The A/SCAN™ Continuous Monitoring Option is a powerful tool that links aluminum hydrogen content to its main source: the humidity content in ambient air. Using this option, the instrument also measures the ambient temperature and humidity and calculates the absolute humidity and the theoretical dissolved hydrogen level based on ambient conditions. Process characterization and equipment optimization of an in-line degasser or other degassing treatments can now be performed more rapidly and efficiently as all the information related to dissolved hydrogen are put together for easy data analysis.

In addition, the A/SCAN™ instrument can perform long sequences of measurements while being connected to a remote computer. Direct access to saved data and flexibility in the A/SCAN operation have never been so easy and straightforward, thanks to the networkability and multi-tasking capabilities of the Continuous Monitoring Option software!





Analyzer calibration

A simple solution for an essential need

All measurement techniques must be verified on a regular basis and all measurement techniques need to be verified and calibrated on a regular basis. A calibration module on the AISCAN™ system performs basic maintenance tests to verify the calibration and confirm its accuracy.

This module is also used to re-calibrate the analyzer as required. Current users have proven that the AISCAN™ analyzer remains stable and accurate month after month. New users do not have to believe this – they can verify it!

Calibration certification

ABB's internationally recognized calibration certification service meets ISO9000 standards. This service is offered to customers whose measuring and test equipment requires calibration for production service.

The external-supply calibration unit is connected to the external low-pressure sources of calibration gases, including argon, helium and nitrogen. The unit is installed at a fixed location, where the analyzer is brought for verification about every four to eight weeks.



Courtesy of GM Central Foundry

Practical accessories

Accessories such as the rugged universal mating plate (see cover page), probe failure detection accessory, continuous monitoring option, spare parts kit, transportation case to name only a few, are available.

The optional elongated probe arm is useful for reaching into the liquid metal in less accessible places, such as the interior of crucibles.

The dolly can be used as a platform from which to run measurements, instead of the trough fixation plate (please see photo on cover page).

A bottle-refilling accessory allows safe and easy refilling of the analyzer's built-in gas bottle.



Optional Dolly

The AISCAN concept has been developed and validated by Alcan International's R&D Centre in Arvida, Quebec. Alcan continues to apply its wide expertise and extensive facilities to support the technology. ABB Bomem Inc., a high-tech firm specialized in analytical instruments for laboratory and industry, commercializes and manufactures the whole system in-house, including probes, to high-quality standards. ABB also supports the product in the field, through its North American, European and Asian service outlets. The AISCAN equipment is protected by a 12-month warranty on both parts and labor on a return-to-factory-for repair basis. Consumables are not covered by this warranty.

AISCAN is a registered trademark of Alcan Aluminum Ltd.



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Analyzer for hydrogen in liquid aluminum



Measurement

Hydrogen Measurement

Sensor type:	Thermal conductivity catharometer
Range:	0 to 9.99 mL of hydrogen per 100g of aluminum (mL/100g)
Reproducibility:	± 0.01 mL/100g or 5% of reading, whichever is higher
Duration :	Typically 10 minutes, varies with alloy and hydrogen level, adjustable from 1 to 99 minutes
Automatic sequence:	Adjustable from 1 to 99 measurements

Melt Temperature Measurement

Sensor type:	Type K Thermocouple, ungrounded
Range:	650 - 1260°C (1202 - 2300°F)
Repeatability:	± 1.2%

Ambient Relative Humidity Measurement*

Sensor type:	Thin-Film Polymer Capacitor
Range:	3 to 95%
Accuracy:	± 2%

Ambient Temperature Measurement*

Sensor type:	Thin-Film 100 ohm Platinum RTD
Range:	0 to 100°C (32 to 212°F)
Accuracy:	± 0.6°C (± 1°F)

* Available with the continuous monitoring option

Hardware

Display:	3 1/2 digits, 2.5 cm (1 in.) high LEDs
Printer:	Dot matrix thermal printer
Memory:	192 Kb, will provide approximately 250 tests of 10 minutes with the 20-sec saving delay
Communications:	Serial, RS-232 (standard) Serial, RS-422 opto-coupled (optional)

Recommended RemoteComputer

Operating systems:	Windows 98, NT, 2000
CPU:	Pentium IV Processor 1.8 GHz
Memory:	256 MB or more RAM
Screen resolution:	1024x768 or 800x600
Drive:	20 GB Hard Drive, CD-ROM and Floppy
Serial Port:	One serial port per AISCANTM. Maximum of two analyzers on the same computer.

Supplies

Gas requirements

Gas:	Nitrogen
Purity:	99.998% high purity grade (99.995% minimum purity)
Rechargeable N2 bottle:	300 mL at 1800 PSIG, will provide gas for an average of 75 measurements

Electrical

Rated line voltage:	100 to 240 VAC (self-adjusting)
Rated line frequency:	50-60 Hz
Rated line current:	0.9 A at 100V 0.4 A at 240V
Fuse type:	Main fuse (top fuse): T3A/250V Probe stirring system (bottom fuse): T2A/250V

The AC supply must have a 3-wire configuration: live wire (100-240 VAC), neutral wire (0 V), and safety ground.



Optional elongated probe arm *Courtesy of GM Central Foundry*



A bottle-refilling accessory allows safe and easy refilling of the analyzer's built-in gas bottle.



Optional Dolly

Environmental and Physical

Environmental

Storage temperature:	10 to 50°C (50 to 122°F)
Operating temperature:	10 to 50°C (50 to 122°F)
Storage humidity:	Up to 60% (non-condensing)
Operating humidity:	Up to 90% (non-condensing)

Physical

Analyzer:	38 cm W x 23.5 cm D x 30.5 cm H (15 in. x 9 1/4 in. x 12 in.) / 16 kg (35 lb.)
Probe holding arm:	Aluminum, 2 segments, friction joints, 57 cm L (22.5 in.) (fully extended)
Extended probe holding arm:	Aluminum, 4 segments, friction joints, 114 cm L (45 in.) (fully extended)
Calibration module:	20.3 cm W x 25.4 cm D x 30.5 cm H (8 in. x 10 in. x 12 in.) / 5.6 kg (12.5 lb.)
Trough mating plate:	30.5 cm W x 20 cm D x 38 cm H (12 in. x 8 in. x 15 in.) / 5 kg (11 lb.)
Dolly:	56 cm W x 61 cm D x 122 cm H (22 in. x 24 in. x 48 in.) / 34 kg (75 lb.)

Probes

Probes for wrought alloys (P/N HME0200D)

Application:	Repetitive immersions in wrought alloys. Not suitable for 7xxx alloy series and high Mg 5xxx alloy series
Average probe lifetime:	Typically more than 10 immersions, or 3 hours cumulative immersion time, whichever comes first.

Probes for foundry alloys (P/N HME0300D)

Application:	Repetitive immersions in wrought and foundry alloys. Not suitable for strontium modified foundry alloys.
Average probe lifetime:	Typically more than 10 immersions, or 3 hours cumulative immersion time, whichever comes first.

Probes for continuous monitoring (P/N HME1200D)

Application:	Repetitive immersion, continuous monitoring or long sequence of immersions in wrought and foundry alloys. Recommended for strontium modified foundry alloys with a concentration of up to 300 ppm. Recommended for High purity aluminum alloys where alloy contamination is a concern. Not suitable for 7xxx and Al-Li alloy series.
Average probe lifetime:	Dependent on alloy; a rated life of 20 hours of continuous immersion in metal with a minimum of 8 hours, or a rated life of 11 distinct dippings with a minimum of 6 dippings, whichever comes first.

Physical

Length:	105 cm long (41 in.) - 160 cm (63 in.) with probe extensions
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Note: For additional information, refer to the latest version of the AISCANTM Engineering Bulletin #15

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