ABB MEASUREMENT & ANALYTICS

AlSCAN and AlSCAN Argon

Hydrogen analysis in liquid aluminum

Measurement made easy

Today's global economy and competition have compelled aluminum producers and foundries to produce the highest possible quality aluminum and shape castings.

Good process understanding is essential in securing top quality. It is reached by measuring key process parameters, thus enabling control of the melt quality at all stages of the manufacturing process.

AℓSCAN and AℓSCAN Argon
Hydrogen analysis in liquid aluminum

AℓSCAN™ technology provides a proven solution for direct measurement of dissolved hydrogen in molten aluminum. It provides an on-line quantitative measurement based on field-proven probe and closed-loop recirculation (CLR) technologies.

Benefits of AℓSCAN
- Accurate on-line quantitative measurement of dissolved hydrogen
- Continuous monitoring capabilities
- Probe failure detection option

AℓSCAN Argon for very low hydrogen levels
The AℓSCAN Argon is a special version of the AℓSCAN analyzer that uses argon as a carrier gas to allow accurate readings of very low hydrogen levels. AℓSCAN Argon can accurately read hydrogen levels below 0.06 ml H_2/100 g Al and will not interpret low hydrogen levels as a probe leak.

The hydrogen problem
Hydrogen forms whenever molten aluminum comes into contact with water vapor, and it easily dissolves into the melt. The gas tends to come out of the solution and form porosities as the melt solidifies.

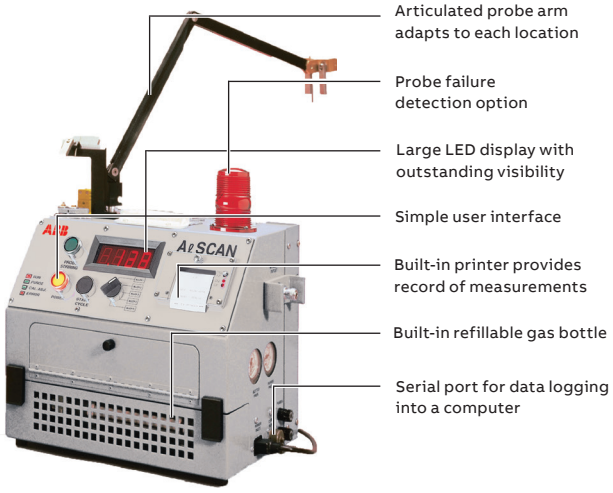
Detrimental effects arising from excess dissolved hydrogen in aluminum are numerous. Hydrogen causes porosity in aluminum products leading to many casting defects, reduced mechanical properties and lower corrosion resistance. Several methods are used to reduce the amount of dissolved hydrogen in the melt, such as furnace fluxing prior to the casting process or degassing during the casting process.

On-line hydrogen measurement in aluminum is required to monitor the performance of the degassing process and ensure the quality of outgoing products. 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.

AℓSCAN – the leading hydrogen analyzer
Since its introduction in 1989, AℓSCAN has established itself as the most-used hydrogen analyzer in the world with more than 600 systems installed. Used by all major aluminum producers, its success is mainly due to outstanding reproducibility and a rugged, low-cost probe that requires neither preheating nor careful handling. The AℓSCAN is clearly superior to any other direct hydrogen measurement analyzer:
- User-friendly and designed for long-term reliability on the shop floor
- Easy to use by non-technical floor personnel, even those wearing gloves
- Can be programmed to perform single measurements or repeated automatic measurements
- Flexible enough to continuously monitor hydrogen levels in molten metal
- Autonomous operation (once started) requiring little to no attention

Dual user interface
The AℓSCAN analyzer has two distinct sets of controls. The control panel is used for routine procedures and can even be used by personnel wearing gloves. The controls located in the recessed panel are only used to configure operating parameters.



01 AℓSCAN components

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Features

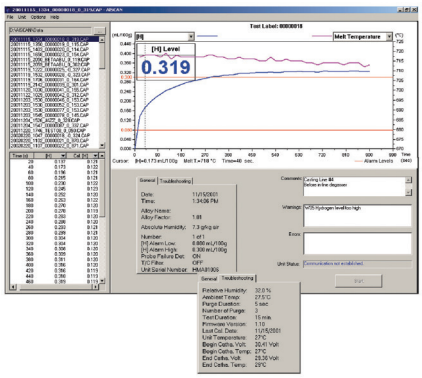
— 01 AℓSCAN measurement results

— 02 AℓSCAN analysis process

— 03 AℓSCAN communication process

Operation principle
Closed-Loop Recirculation (CLR) is a proven method for directly monitoring hydrogen in molten aluminum. A small volume of carrier gas, either nitrogen or argon, is brought in contact with the melt by means of an immersed probe, and is continuously recirculated in a closed loop until its hydrogen content reaches equilibrium with the vapor pressure of H_2 in the melt. The H_2 concentration in the gas is measured and converted into a reading of the gas concentration in the metal. This fast, reproducible and accurate method can be used on the cast shop floor for on-line measurements.

The amount of H_2 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 that controls its operation and processes data.



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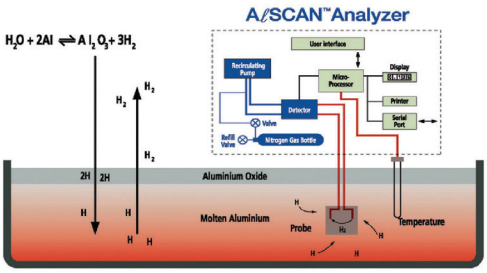
AℓSCAN continuous monitoring option
The AℓSCAN continuous monitoring option is a tool that allows the AℓSCAN to perform long sequences of measurements while being connected to a remote computer. There is no need to watch over the instrument as its operation can be remotely monitored from a control room or even from your own computer. Direct access to saved data and flexibility in the AℓSCAN operation have never been so easy and straightforward, thanks to the networkability and multi-tasking capabilities of the continuous monitoring option software.

As well, the AℓSCAN continuous monitoring option is a powerful tool that links aluminum hydrogen content to its main source: humidity in ambient air. With this option, the analyzer measures the ambient temperature and humidity then calculates the absolute humidity and the theoretical dissolved hydrogen content in the melt coming from this source. Process characterization and equipment optimization of in-line degassers or other degassing treatments can be performed more rapidly and efficiently as all the information related to dissolved hydrogen is put together for easy data analysis.



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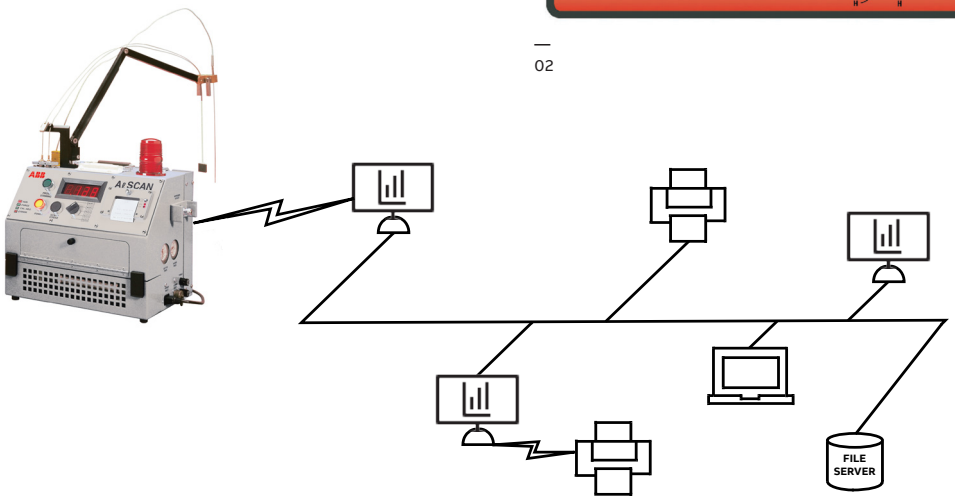

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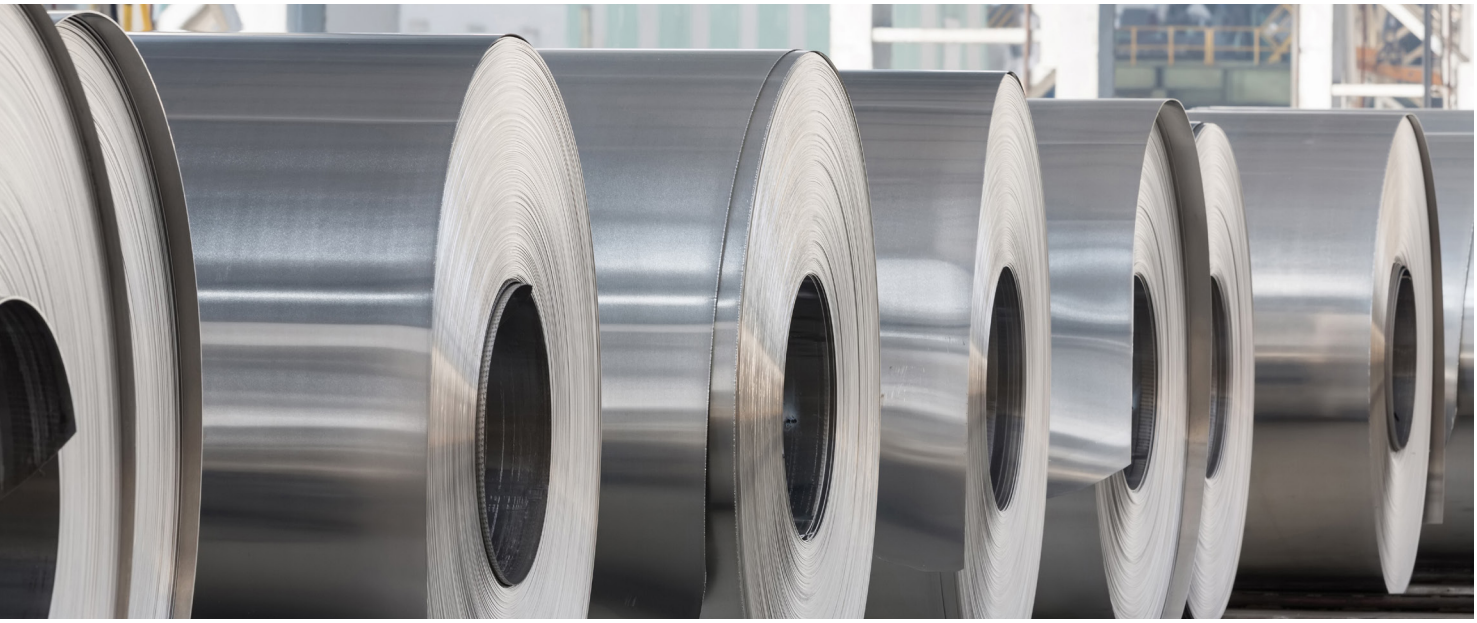

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01 Aluminum sheets

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02 Alscan probe in melted aluminum

Analyzer calibration module
The analyzer calibration module is used to perform basic validation tests and confirm accuracy. Additionally, the calibration module can be used to re-calibrate the analyzer as required.

The external-supply calibration unit is connected to 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 every four to eight weeks. Current users have proven that AlSCAN analyzers remain stable and accurate month after month. New users do not have to believe this – they can verify it.

ABB calibration certification service
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.

Practical accessories
There are a numerous practical and useful accessories available for the AlSCAN analyzer:
- Rugged universal mounting plate
- Probe failure detection accessory
- Continuous monitoring option
- Spare parts kit
- Heavy duty transport case
- Elongated probe arm, for reaching into less accessible locations like the interior of crucibles
- Dolly, to make the instrument more transportable; serves also as a platform for measurements
- Bottle refilling accessory, for safe and easy refilling of the built-in gas bottle

Types of Alscan probes

HME0200D 	• Used for repetitive immersion in wrought alloys, but not suitable for Series 7000 and high magnesium alloy Series 5000 • Made of fused non-ferrous aluminum oxide with amorphous silica • Typical life of 10 immersions or 3 hours of continous immersion, whichever comes first
HME0300D 	• Used for wrought and foundry alloys alloys, but not suitable for strontium modified alloy • Made of recrystallized silicon carbide (SiC) • Typical life of 10 immersions or 3 hours of continous immersion, whichever comes first
HME1200D 	• Used for repetitive immersions, continuous monitoring or long sequences of immersions in all alloys, or strontium-modified foundry alloys with a concentration of up to 300 ppm, or high purity aluminum alloys where alloy contamination is a concern. Not recommended for 7XXX and Al-Li alloys • Made of pure alumina • Typical life of 11 immersions or 20 hours of continous immersion, whichever comes first

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Specification

Hydrogen measurement
- Sensor type: Catharometer
- Range: 0 to 9.99 ml of hydrogen per 100 g of aluminum (ml/100 g)
- Reproductibility: ±0.01 ml/100 g or 5 % of reading, whichever is higher
- Duration: Typically 10 minutes, varies with alloy and hydrogen level, and 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 to 1260 °C (1202 to 2300 °F)
- Repeatability: ±1.2 %

Hardware
- Display: 3.5 digits, 2.5 cm (1 in) high LED
- Printer: Dot matrix thermal printer
- Communications: Serial, RS-232 (standard)

Supplies (gas requirements)
- Gas: Nitrogen or argon
- Purity: 99.998 % high purity grade (99.995 % minimum purity)
- Cylinder size: Typically 15 cm (6 in) dia., 63.5 cm (26 in) maximum height
- Delivery pressure: 300 mbar (5 psig) nominal pressure
- Average consumption: Typically 0.5 liter at STP per measurement

Supplies (electrical requirements)
- Rated line voltage: 100 to 240 V AC (self-adjusting)
- Rated line frequency: 50 to 60 Hz
- Rated line current: 0.9 A at 100 V, 0.4 A at 240 V
- Delivery pressure: 300 mbar (5 psig) nominal pressure
- Fuse type: T2A/250V

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)

Size (H × W × D)
- Analyzer: 30.5 × 38 × 23.5 cm (12 × 15 × 9.25 in)
- Calibration module: 30.5 × 20.3 × 25.4 cm (12 × 8 × 10 in)
- Trough mating plate: 38 × 30 × 20 cm (15 × 30.5 × 8 in)
- Dolly: 122 × 56 × 61 cm (48 × 22 × 24 in)
- Probe holding arm: aluminum, 2 segments, friction joints, length (fully extended): 57 cm (22.5 in.).
- Extended probe holding arm: aluminum 4 segments, friction joints, length (fully extended): 114 cm (45 in.)

Weight
- Analyzer: 16 kg (35 lb)
- Calibration module: 5.6 kg (12.5 lb)
- Trough mating plate: 5 kg (11 lb)
- Dolly: 34 kg (75 lb)

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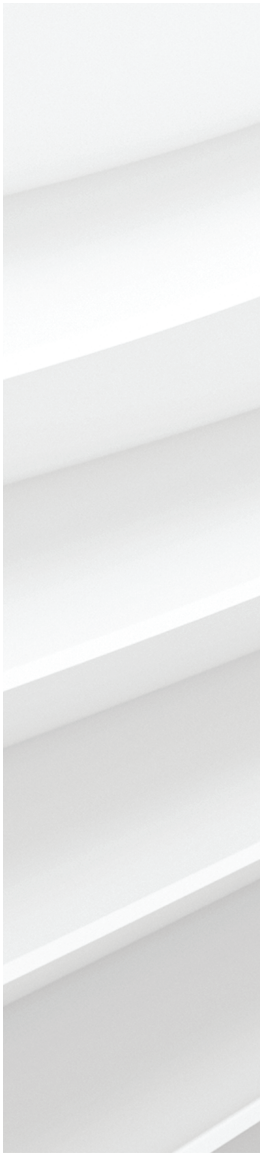

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