

# **How to Select the Optimal A $\ell$ SCAN Probe Model**

## **Introduction**

The A $\ell$ SCAN technology, which allows direct measurement of hydrogen in liquid metal, was introduced 10 years ago in aluminum casthouses and was strictly for wrought alloys. At that time, only one probe model was available, the probe for wrought alloys (P/N HME0200D). In 1994, ABB extended the A $\ell$ SCAN application by introducing the A $\ell$ SCAN F to the aluminum foundry industry followed by the introduction of the probe for foundry alloys (P/N HME0300D) for measuring hydrogen in Al-Si alloys. Finally, in 1998, ABB launched a third probe model (P/N HME1200D) for continuous monitoring and/or for strontium modified foundry alloys. This was deemed necessary as the A $\ell$ SCAN application in foundry alloys was limited to the unmodified alloys and because of the relatively short probe lifetime under continuous immersion applications commonly found in continuous casting processes or for in-furnace measurements.

This engineering bulletin describes in detail each probe model available. The following information will assist the users to choose the best probe model for a given application.

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## **REFERENCES**

- (1) “In Situ Hydrogen Measurements in Liquid Al-Si Foundry Alloys”, John E. Gruzleski and Florence Paray, McGill University.
- (2) J.E. Gruzleski and B. Closset: “The Treatment of Liquid Aluminum-Silicon Alloys”, edited by the American Foundrymen’s Society, Inc., Des Plaines, Illinois USA, 1990.



## A $\ell$ SCAN Probes for Wrought Alloys – P/N HME0200D

Type of ceramic:	Grit
Material:	Fused non-ferrous aluminum oxide with amorphous silica
Color:	Brown-black
Porosity:	~120 microns
Permeability:	~31 darcys
Dimensions:	7/8" x 7/8" x 1/4"
Specified lifetime:	Dependent on alloy; in most cases at least 10 distinct dippings, or 3 hours cumulative time in metal, whichever comes first; longer in pure aluminum*.
Chemical resistance:	Medium**
Thermal shock resistance:	High
Mechanical shock resistance:	High
Typical cost per measurement:	\$2.10 US based on 3 measurements of 10 minutes per immersion.
Rev. 1-4 Compatible alloys:	Wrought Alloys; 1xxx, 2xxx, 3xxx, 6xxx***, 8xxx
Application:	Repetitive immersions in wrought alloys (for exception see point *** below)

### NOTES:

- \*The average probe lifetime in low alloyed wrought alloys (1xxx, 6xxx) is typically longer than the specified lifetime with proper manipulation of the probe.
- \*\*This probe should not be used in foundry alloys.
- \*\*\*In some extrusion billet applications produced from a secondary metal source (dirty alloys with small inclusions), the probe lifetime may be low. In this case, when you first start using the probe, usually a noticeable decreasing trend takes place right from the start. For these applications, we recommend using the HME0300D for repetitive immersions or the HME1200D probe for continuous monitoring or long sequence immersions.
- **For 5xxx series alloys**, especially those with high Mg content, we recommend using the HME0300D or HME1200D probe. Probe behavior and lifetime will improve with the HME1200D probe compared to the HME0200D probe.
- For 7xxx series applications (hard alloys), we recommend using the HME0300D for repetitive immersions and long sequence immersions.

Rev. 1-4


**ABB**

## A $\ell$ SCAN Probes for Foundry Alloys – P/N HME0300D

Type of ceramic:	Grit
Material:	Recrystallized Silicon Carbide (SiC)
Color:	Black with metal flakes
Porosity:	~ 68 microns
Permeability:	N/A
Dimensions:	7/8" x 7/8" x 1/4"
Specified lifetime:	Dependent on alloy; in most cases at least 10 distinct dipping, or 3 hours cumulative time in metal, whichever comes first; longer in pure Al. *
Chemical resistance:	High**
Thermal shock resistance:	Medium
Mechanical shock resistance:	Medium
Typical cost per measurement:	\$3.25 US based on 3 measurements of 10 minutes per immersion.
Compatible alloys:	Wrought alloys and foundry alloys (319, 355,356,357,413,...) This probe model (HME0300D) must be used in 7XXX alloys.
Application:	Repetitive immersions in wrought and foundry alloys

It has been proven that the A $\ell$ SCAN probe for foundry alloys (P/N HME0300D) provides better probe lifetime and measurement reproducibility in hypo and hyper-eutectic foundry alloys. These typically have lower surface tension and higher silicon content than wrought alloys. The high silicon content degrades the amorphous silica binder of the standard A $\ell$ SCAN probe model (P/N HME0200D) by reacting with it. Therefore, the absence of binder and smaller porosity of the HME0300D probe helps prevent metal penetration and material degradation, which result in a partial clogging of the probe.

### NOTES:

- \*The average probe lifetime in foundry alloys depends on the type of use. For dip-in/dip-out applications, it is similar to the specified lifetime. For continuous monitoring, a lifetime of up to 8 to 12 hours can be obtained.
- \*\*Not suitable for strontium modified foundry alloys.



## A/SCAN Probes for Continuous Monitoring – P/N HME1200D

Type of ceramic:	Ceramic foam
Material:	Pure alumina
Porosity:	80 ppi
Permeability:	N/A
Dimensions:	1" x 1" x 1/2"
Specified 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.*
Chemical resistance:	High**
Thermal shock resistance:	Medium
Mechanical shock resistance:	Low
Typical cost per measurement:	\$2.50 US based on 4 measurements of 15 minutes per immersion. \$3.25 US based on 3 measurements of 10 minutes per immersion.
Rev. 1-4 Compatible alloys:	All alloys (wrought alloys and foundry alloys, both unmodified and Sr modified). Not recommended for 7XXX and Al-Li alloy series.
Applications:	<ul style="list-style-type: none"> <li>▪ Repetitive immersion, continuous monitoring or long sequence of immersions</li> <li>▪ Strontium modified foundry alloys with a concentration of up to 300-ppm</li> <li>▪ High purity aluminum alloys where alloy contamination is a concern</li> </ul>

**NOTE:** The probe P/N HME1200D is normally used when the other probe models do not provide adequate performance except for 7XXX and Al-Li alloy series.

### NOTES:

- \* Refer to A/SCAN Engineering Bulletin No. 13, Pages 3 and 4 for additional information.
- \*\*Suitable for foundry alloys modified with up to 300 ppm of strontium.
- We suggest pre-heating the probe a few minutes over the melt. This will reduce the damage caused by thermal shock and should increase the number of dippings.
- In intermittent use, consisting of repeated immersions for a fixed time period, the response time of the HME1200D probe is 10 to 15% faster on re-immersion than the probes HME0200D or HME0300D. In the industry, where the time spent per test is at least as important as the cost per measurement, this probe offers a clear advantage over the other A/SCAN probe models.

