PoDFA Sampling in Cold Metal

How to take a good PoDFA sample with a filtered weight of over 0.5 kg, from a casting area where metal temperature is low

PoDFA sampling technique may be difficult when the metal's temperature is less than 40°C (76°F) over liquidus. Special care must be taken to ensure that enough liquid aluminum is filtered before the alloy solidifies. Table 1 shows the special care that can be taken at various sampling steps in order to minimize heat loss.

Table 1 Step-by-step operation for performing a PoDFA-f sample

Step		Description	Special care when working in cold metal
1.	Location	Install the PoDFA-f, the crucible heater and their accessories in a safe location. Supply power to both units and compressed air to the PoDFA-f.	The PoDFA-f unit should be as close as possible to the sampling location to avoid heat loss when bringing the metal sample from the trough to the PoDFA-f unit.
2.	Preheat Crucible	Preheat the crucible with the crucible heater until the filter becomes red. 	The PoDFA filter in the bottom of the crucible must turn red before attempting the test (about 30 minutes for the first crucible, then 20 minutes once the elements are warm). Maintain the crucible at preheated temperature until you are ready to pour the liquid metal into the crucible.
3.	Preheat Ladle	Preheat the sampling ladle in the liquid metal. 	Let the ladle float on the surface of the liquid aluminium for at least five minutes prior to each test. If you are performing consecutive tests, the ladle can be left to rest on the metal's surface between sampling stages.
4.	Crucible Holder	- Place the hot crucible in the Crucible Holder - Fill the ladle - Pour metal into the crucible - Place the Crucible Holder on the PoDFA-f station	Fill the ladle and pour the metal immediately into the crucible. If a distance separates the PoDFA-f station and the sampling location, the crucible should be brought to the sampling station by means of the crucible holder. It is important to minimize the time the metal remains in the ladle to avoid loss of temperature. The metal should be carried in the crucible as it retains heat more efficiently than the ladle. See Figure 1.

5.	Filtration	Press the START button and ensure that the vacuum reaches at least –23 inches of Hg[1].	Optional but helpful: Once the filtration is initiated, an insulating cover can be placed on the crucible to reduce the loss of heat during filtration.
6.	End of test	When the predetermined filtered weight has been reached, the filtration automatically stops. If the metal no longer flows (no more increase of weight on the display) press the Start button to manually stop the vacuum. Record the weight. Save the metal residue.	If the filtered weight is less than 0.5 kg after following the above recommendations, please refer to the section entitled "Filtered weight of less than 0.5 kg" at the end of this document.

To better illustrate Step 4, the following graph (Figure 1) demonstrates the importance of reducing the time the metal remains in the ladle. If a sample must be transported over a distance, it is better to transport it in the crucible rather than in the ladle. Even though time is crucial, please ensure that all necessary safety measures have been taken.

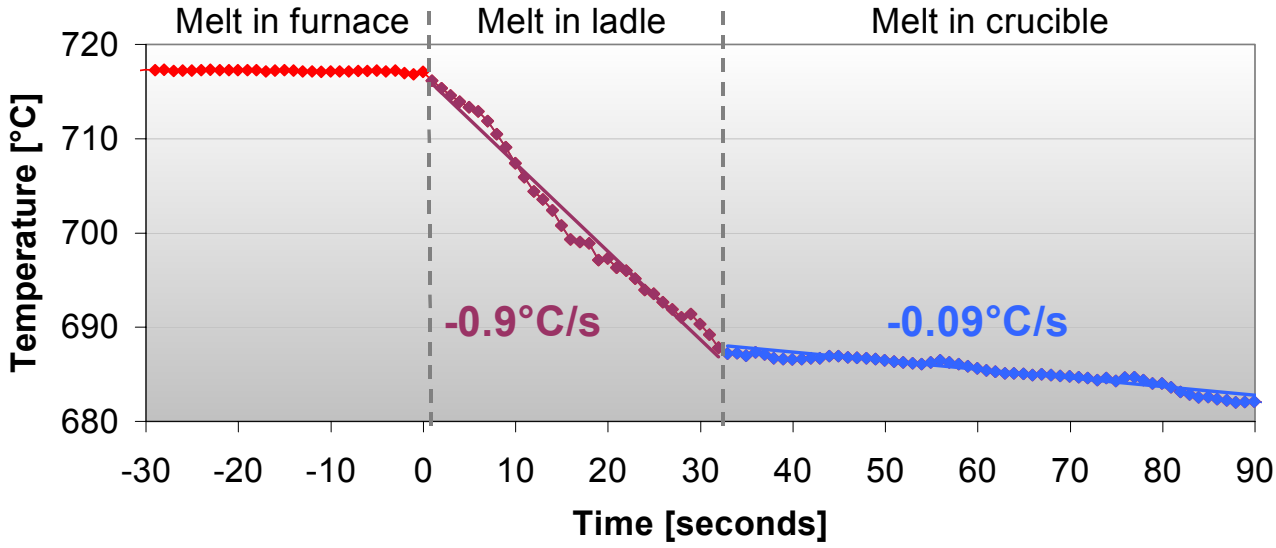

Figure 1: The most significant heat loss occurs when the metal is in the ladle (see PoDFA Eng Bulletin No. 1)

[1] When working with cold metal, it is suggested you supply the PoDFA-f unit with compressed air of 100 PSI (6.9 bars). This pressure will ensure maximum efficiency of the venturi vacuum generator.

Step 2 is to preheat the crucible before testing. The graph on Figure 2 shows how fast the filter temperature increases. At time 0, the element and the crucible were at room temperature.

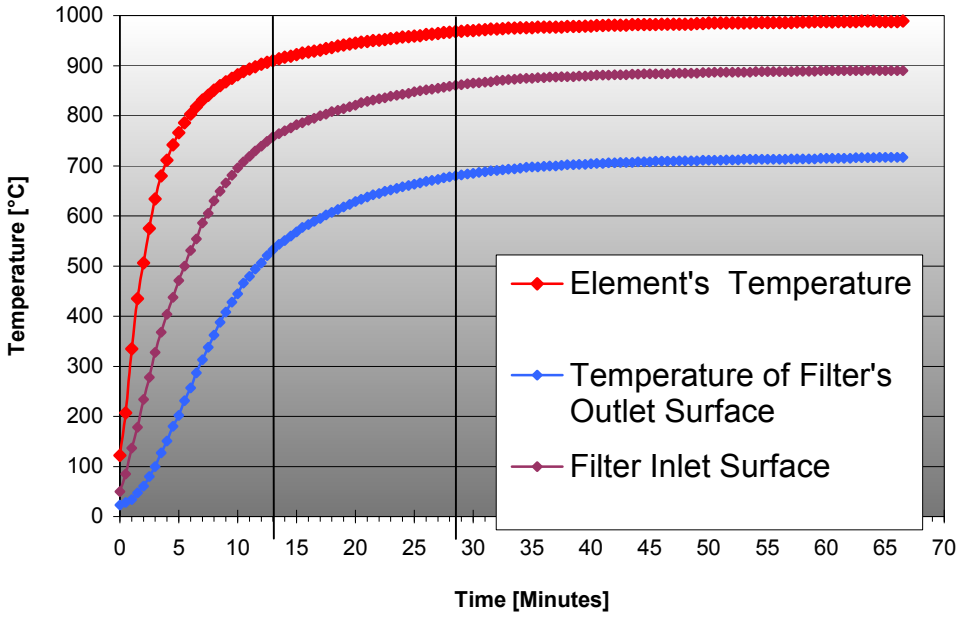

Figure 2: Filter Temperature During Preheating on the Crucible Heater

Filtered weight of less than 0.5 kg

a) Particles affecting the metal flow

Large quantities of inclusions such as grain refiner (TiB_2), primary silicon crystals (in high silicon alloys), or other types can clog the filter and thus stop filtration. In such cases, it is necessary to perform a metallographic analysis of the interface to identify the problem.

b) Problems relating to low temperatures

Warning: The following recommendation should be followed as a last resort. It may have an effect on the inclusion content of the metal being sampled. The longer the metal remains in the ladle, the higher the level of oxides. It may also allow the inclusions to settle down or to rise to the surface inside the ladle.

If heat loss during sampling cannot be corrected by the above methods, we recommend the following. Preheat the ladle as recommended in step 3. Fill the ladle, but rather than pouring it immediately into the crucible, carry the full ladle over to a process area where the metal temperature is high (i.e. a holding furnace). Immerse only the hind portion of the ladle into the hot metal and maintain this position for at least 10 minutes. Appropriate safety cloths must be worn when attempting this method and it is essential that all safety precautions and measures be strictly adhered to.

A thermocouple can be immersed in the ladle to determine the metal's temperature. Once it has reached at least 70˚C over liquidus, you can continue on to steps five and six.

If you are still unable to obtain the required 0.5 kg of filtered metal, please contact ABB.