

GASTEC AND DENSITEC



Reduced Pressure Test and Density Index



Check.

Change.

Control.

Process Control for Porosity



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GASTEC: Reduced Pressure Test Unit:



- A Reduced Pressure Test is
 - Simple
 - Quick
 - Cheap: No consumables
 - Realistic to casting conditions
- The RPT is a close simulation of the conditions inside a casting, where the effects of shrinkage, inclusion and gas is combined to grow porosity.
- This accurate simulation in the test under vacuum makes it the perfect test of the quality of the melt.



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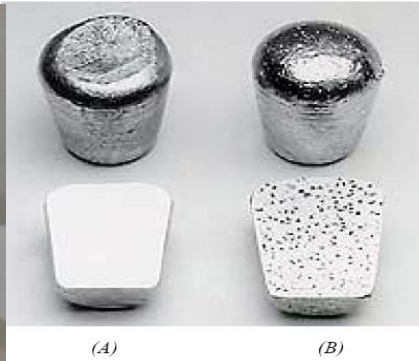
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What is Reduced Pressure Test



- **Reduced pressure test** : It is a shop floor tool which allows the operator to qualitatively assess the cleanliness of a batch of molten aluminum for Gas and Inclusion, allowing immediate corrective action to be followed.
- **Principle:** The porosity size will be magnified as a result of reduced pressure and will be visible as shown in figure. The samples are evaluated either by visual observation for bubble formation during solidification or by determining the density of the solidified sample. Visual evaluation of the sectioned sample is often done by comparing the results to a standard chart.



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Sampling and Checking:



- The sampling procedure is very simple. A small amount, about 100 gm each of aluminum melt is poured into two thin wall steel crucibles.
- One crucible is allowed to solidify under atmospheric pressure while other is seated in the chamber, where the pressure is reduced to 80 mbar and remains constant until the melt is fully solidified.
- After solidification, the samples are removed from the molds and evaluated either by density measurement or by sectioning to observe the porosity. The entire process requires roughly a few minutes for completion.



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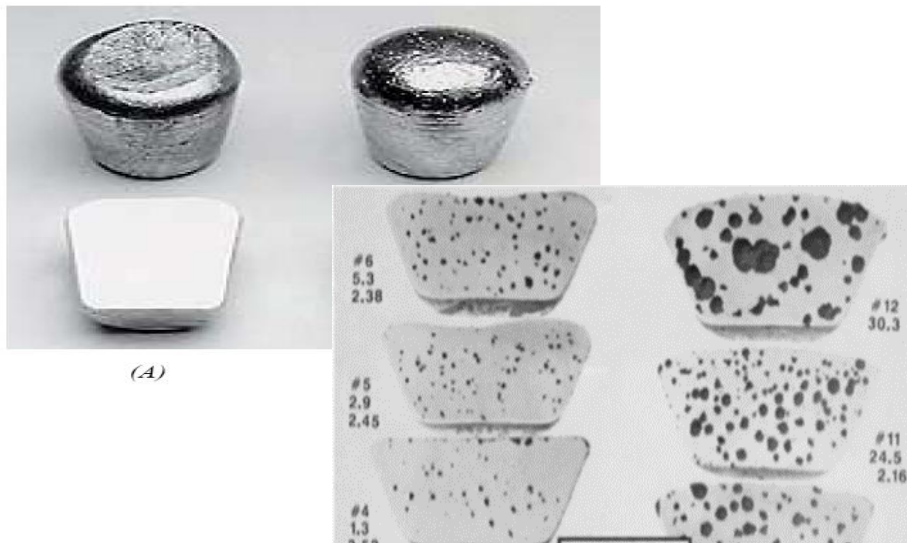


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Visual Inspections:



- A sample cooled under normal atmospheric pressure will look much better than its RPT counterpart. But we include reduced pressure to highlight the wide range of hydrogen possible in any given melt.
- Test samples (A) is solidified under atmospheric pressure and (B) is solidified under vacuum.
- If the surface is not sink or flat and is risen and inflated instead, this would be the indication of high gas level. An alternative way would be to cut the sample in half and visually inspect the cross section for pore morphology and distribution



Densitec: Procedure for Density:



- For a quantitative measurement:
- Density is measured by using Archimedes principle by Densitec as shown in the picture:
- A sample is cast and its density is measured by weighing the sample in air and in water and then calculating the density as follows:

$$DS = W_A / (W_A - W_W)$$

where D_s = density of the sample

W_A = weight in air

W_W = weight in water.



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Procedure for Density Index:



- Density index (DI) can also be calculated using following equation

$$\text{Density Index} = ((D_A - D_B) / D_A) \times 100$$

Where: D_A – density of test sample solidified under atmospheric pressure

D_B – density of test sample solidified under reduced pressure

- The density index is used as an indicator of the amount of total porosity present in the Cast condition



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Key Parameters:



- Several parameters influence the formation of pores and thus the test:
 - Higher metal temperature increases gas absorption due to solubility of hydrogen in the liquid
 - Increasing oxide levels lead to increased inclusion porosity
 - Chamber pressure: It is the most significant factor since reducing the pressure increases the pore formation leading to inaccurate results. Good sealing and adequate vacuum is the key



Why Gastec and Densitec:



- Easy procedure, no skills or training required
- Quick and reliable test: Allows course corrections
- No cost of consumables
- Very Close to Casting conditions for given metal quality
- Hence predictable casting results
- No calibration required

Course Corrections for Better results:



Why FOSECO:



- Robust design with reliable vacuum generation
- Installation and commissioning support, Strong after sales support (If required)
- Training of Staff and Operators
- Support in corrective actions based on results with Foundry Process knowledge



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