SEDEX*

THE CERAMIC FOAM FILTER

+ Highest efficiency
+ Even filling
+ Scrap reduction
+ Improved machinability
+ Improved yield
SEDEX foundry filters
Proven technology a billion times over

Trusted performance
SEDEX foundry filters have been used by the foundry industry for more than 25 years. During this time, the filter and its application have been continuously improved in co-operation with leading foundries around the world. The use of SEDEX foundry filters is a guaranteed way to produce quality, cost effective castings. For these reasons the use of SEDEX foundry filters has become state-of-the-art in many foundries. As the most commonly used foundry filter in the world, SEDEX foundry filter are proven in its ability to fulfill customer demands.

The application of SEDEX foundry filters for the production of the most demanding castings ensures that the full mechanical and dynamic properties of the casting alloy can be achieved. The use of conventional gating systems, even with generously dimensioned runner bars, is not sufficient to retain enough slag and suspended reaction products to meet the high quality standards of today’s castings. These demands can be readily and consistently achieved with the help of SEDEX foundry filters.
SEDEX gating systems result in

+ compact, short and direct systems
+ less returns
+ more free pattern plate area
+ lower melting costs per poured spray
+ effective retention of slag and sand contamination
+ reduced scrap risk
+ increased process security
+ improved physical properties of the casting
+ improved accuracy of scrap diagnosis

Application technique
Foseco offers unrivalled customer support. Depending on the problem, Foseco can offer support such as:

+ Metallurgical investigation of casting defects
+ Optimisation of pattern plate layouts with the support of mould fill and solidification simulation
+ Application support in the foundry
SEDEX foundry filters
Highest filtration efficiency and smooth mould filling

High filtration efficiency
The acknowledged effectiveness of SEDEX foundry filters is a result of their foam structure. Some of the volume consists of open, reticulated, interconnected pores providing a plurality of direction and velocity changes in the liquid metal flow. This leads to intensive contact with the filter surface which allows small non-metallic particles to be retained within the foam structure; they are not just sieved out on the product entry face.

This filter mechanism known as deep bed filtration and is only present in multi-dimensional structures like the SEDEX ceramic foam filters.

The shape of a single pore looks like a pentagondodecahedron.
The structure of SEDEX filters efficiently retains sand and slag as well as reaction products from magnesium treatment. An often underestimated but nevertheless very important advantage of ceramic foam filters is their ability to reduce the turbulence in the molten metal stream. This helps to ensure an even mould filling and protect the metal from re-oxidation.

The pictures below have been generated by real time x-ray and illustrate the metal flow into the mould cavity when different filter types are used. The red frame marks the filter position.
The application of SEDEX foundry filters is performed in three steps:

**Step 1**
**Calculation of gating systems with filters**
The mould filling speed and filling pattern is determined by the dimensions and design of the gating system. The time to complete the pouring sequence is determined by the smallest cross-section in the system. In the case of conventional gating systems, this choke, or controlling section, is the total area of the ingates. In gating systems for use with SEDEX foundry filters, the cross-section of the downsprue becomes the smallest or controlling section for the system.

In the case of moulding lines where a standardised downsprue is used, the controlling section must be placed in the runner bar directly behind the downsprue.

In order to ensure that the filling progresses evenly within the whole mould, it is recommended that all the runner bars are located in the drag and all the ingates are located at the top of the runners.

The calculation of the dimension of the controlling section for a specific gating system can be simply performed using the following formula:

\[
D_A = \frac{22.6 \times G}{\xi \cdot \eta \cdot t \cdot \sqrt{H}}
\]

- \(D_A\) = downsprue area [cm²]
- 22.6 = constant for acceleration
- \(G\) = poured weight [kg]
- \(\xi\) = friction factor
- \(\eta\) = density [g/cm³]
- \(t\) = required pouring time [s]
- \(H\) = effective pressure or pouring height [cm]
The following relationship between the gating system components has proven very successful in practice:

\[
\text{downsprue : runner : ingate(s)} = 1.0 : 1.1 : 1.2
\]

This gating system ratio with a progressive increase in cross-section encourages quiet, low turbulence mould filling. The resulting cross-sectional areas have to be allocated according to the pattern layout. The runner area is divided by the number of runner bars and the ingate area by the number of ingates required.

**Step 2**
**Determine the SEDEX filter area, type, number and porosity**

The required filter area will be influenced by the following factors:

+ The smallest cross-section in the gating system
+ Filter capacity (kg/cm²)
+ Poured weight
+ Level of metallurgical contamination
+ In the case of ductile iron, the treatment technique, %Mg alloy addition and the sulphur level before treatment

The selected filter area can either be applied as a single filter or in the case of a large area, a number of smaller filters. In the latter case they should be positioned as close as possible to the mould cavity so that the maximum amount of inclusion material can be collected.

Filtration capacity is influenced by many process variables, therefore the following values should only be regarded as guidelines.

<table>
<thead>
<tr>
<th>Filter capacity kg/cm²</th>
<th>Iron alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - 1.0</td>
<td>NiResist, SiMo, GJS (Inmold)</td>
</tr>
<tr>
<td>1.0 - 2.0</td>
<td>GJS / GJV</td>
</tr>
<tr>
<td>2.0 - 4.0</td>
<td>GJL / GM</td>
</tr>
</tbody>
</table>

According to application experience we recommend that for high alloyed ductile iron (e.g. NiResist or SiMo) a filter area which is 4 times as big as the downsprue area.

For ductile iron we recommend a ratio of Downsprue:Filter area of 1:3, for grey and malleable iron we recommend at least a ratio of 1:2.

These ratios ensure that the pouring time is determined by the downsprue area and not by the filter.
In the introductory phase, it is recommended that the filter area should be generously dimensioned. The resulting filter sizes can be optimised once sufficient application experience has been acquired in a given foundry environment.

Filter porosity is generally determined by the alloy to be poured. Ductile iron and the special alloy types Ni-resist and SiMo contain a high level of reaction products and the coarse (10 ppi) SEDEX filter is normally applied. Process improvements giving a lower level of reaction products have allowed some foundries to work with the finer (20 ppi) filtration product, but this is still an exception.

Grey iron which contains lower levels of reaction products is normally filtered using 20 ppi SEDEX filter. 30 ppi products may be applied if the molten metal is very clean.

Malleable iron with the lowest level of metallurgical contamination and high pouring temperatures has good pouring characteristics and the fine 30 ppi porosity SEDEX filter can be applied.

The extra fine 40 ppi porosity is used mainly for grey iron castings produced on vertically parted moulding lines.
Step 3
Selection of the appropriate SEDEX filter print
Filtration effectiveness is in great measure dependent upon the correct installation of the filter. To assist foundries in this operation Foseco has developed a range of filter position prints. It is strongly recommended that foundries take advantage of their availability – use of the SEDEX filter position prints will help to ensure correct position, entry face area and exit face support for the selected filter type. In many cases the application position of the filter and suitable filter print will, to a great extent, be decided by the layout of the pattern plate.

Specially designed filter prints are also available for use in connection with vertically parted moulds (such as DISAMATIC moulding machines). They are basically of two types for different application circumstances:

1. Positioning of the filter by hand in a specially designed pouring bush.
2. Positioning of the filter lower in the mould; this requires the availability of a coresetter to mechanically place the filter in the open mould half in the short time available and with the necessary accuracy.
The advantages of using SEDEX filters in vertically parted moulds:

+ Improved control over mould filling
+ Reduced mould filling velocity
+ Reduced turbulence and erosion
+ Fewer surface and gas defects
+ Improved machinability

In the case of vertically parted moulds there are some extra aspects which need to be taken into consideration when calculating and designing the gating system.

Moulds can be divided into three basic categories:
1. Single cavity
2. Two or more cavities at the same level
3. Two or more levels of cavities

As well as the three types of mould, the position of the ingate(s) must be taken into account - the lower the cavity in the mould, the smaller the ingates should be in order to ensure even filling of the complete spray of castings. To assist in achieving this, the position of the controlling section or choke also needs to be considered. Each of the three cavity types can be ingated in one of three ways, giving a total of nine gating system variations.
a) **Bottom gated:**
A downsprue controlled system can be applied, the cross-section of runner(s) and ingate(s) can each be increased by 10%.

b) **Side gated:**
The controlling section should be located just in front of the ingate(s) - the latter section can be increased by 10%.

c) **Top gated:**
Gating through a feeder or KALPUR unit, the controlling section must be positioned at the ingate(s); any runner or downsprue sections should be larger than that of the ingate(s). This is essentially a conventional vertical gating system.

In all cases the choke section must be located behind the filter; this will ensure that it is fully primed with liquid metal for the whole pouring operation. It is important that the filter is located in a correctly designed and dimensioned filter print. The print must ensure that the filter cannot move or fall out as the mould is blown out or moved and it is essential that the print provides good exit face support during pouring.

The introduction of additional friction to a gating system for vertical moulding lines (such as an inclined downsprue or sprue cross over) reduces the velocity and makes the mould filling more even. An example is shown on the right. Specific application issues can be addressed by contacting one of our product managers.
SEDEX quality is assured

Quality management
The Foseco quality management system is certified against DIN ISO 9001, VDA 6.1 and ISO 14001. All relevant product quality features of SEDEX filters are controlled and recorded according to these quality standards.

Important product attributes monitored in this way include:
+ Filter dimensions
+ Filter weight
+ Cold compression strength
+ Porosity
+ Thermal shock resistance (impingement test)

Next to filtration effectiveness, thermal shock and erosion resistance to the flowing liquid iron are the most important product attributes. These properties are evaluated regularly using liquid cast iron. A special test procedure, the impingement test, has been specifically developed for this purpose. Extensive use of this test has enabled Foseco to continually improve the quality and consistency of the SEDEX iron filter.

It ensures that the filter is to severe evaluation in the most practical and relevant manner possible before produced filters are released for dispatch.

*FOSECO, the Logo and SEDEX are trade marks of the Vesuvius Group, registered in certain countries, used under licence. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system of any nature or transmitted in any form or by any means, including photocopying and recording, without the written permission of the copyright holder or as expressly permitted by law. Applications for permission shall be made to the publisher at the address mentioned.

Warning: The doing of an unauthorised act in relation to a copyright work may result in both a civil claim for damages and criminal prosecution. All statement, information and data contained herein are published as a guide and although believed to be accurate and reliable (having regard to the manufacturer’s practical experience) neither the manufacturer, licensor, seller nor publisher represents nor warrants, expressly or impliedly: (1) their accuracy/reliability, (2) that the use of the product(s) will not infringe third party rights, (3) that no further safety measures are required to meet local legislation. The seller is not authorised to make representations nor contract on behalf of the manufacturer/licensor. All sales by the manufacturer/seller are based on their respective conditions of sale available on request.

© Foseco International Limited 05/15.