**FACT SHEET**

**HIGH FIBRE INDEX**

Superwool® Plus™
Insulating fibre

# High Fibre Index...

# ...up to 20% reduction in thermal conductivity giving energy saving

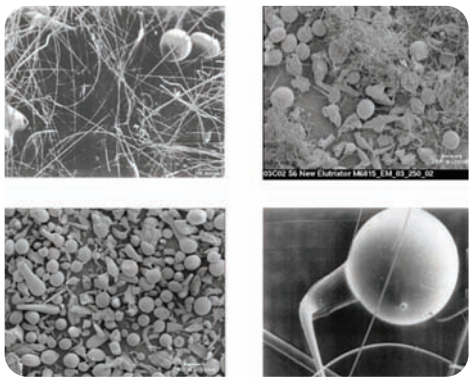
**By careful control of the manufacturing process, molten glass for Superwool® Plus™ insulation can be made to fiberise more completely which minimises the size of the shot pieces and improves the shot to fibre ratio.**

- Up to 20% reduction in thermal conductivity
- 30% more fibres
- Effective in restricting thermal energy transfer
- Less energy loss
- Less mass of fibre required to give the same performance
- Lower shot content than all other alkaline earth silicate (AES) and refractory ceramic (RCF) fibres

## What is shot and why is it important?

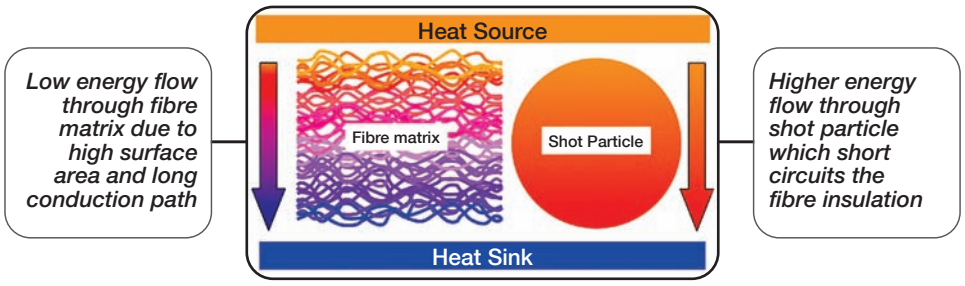
Shot consists of globular grains of glass that were not turned into fibre during the manufacturing process. Fibre production through a melt process is inevitably accompanied by shot. This is because the fibre starts as a ball of molten glass, which is drawn out into a long strand by the highly energetic spinning process. This globule will normally freeze before it has been completely drained into a fibre.

Shot therefore represents a lot of material which is not fibre and thus provides a short cut for thermal conduction. It has low specific surface area and as such, it is not an efficient blocker of thermal radiation.



**Effect of shot on insulation**

A 250µm shot particle can make 1 500 000µm (1.5 meters) of 3µm diameter fibre. A 250µm diameter particle has a specific surface area of 0.01m²/g, whereas 3µm diameter fibre has a specific surface area of 0.5m²/g the low specific surface area of shot makes it an inefficient blocker of thermal radiation.




Below is a comparison of two 1m² blanket samples each 25mm thick with a density of 128kg/m³ and weighing 3.2kg

| | | Superwool® 607® Blanket | Superwool® Plus™ Blanket |
|---|---|---|---|
| **Percentage shot over 45µm** | % | 50 | 35 |
| **Average fibre diameter** | µm | 3.6 | 2.6 |
| **Specific surface area** | m²/g | 0.21 | 0.39 |
| **Length of fibres** | km | 60 000 | 150 000 |
| **Surface area of fibres** | m² | 680 | 1240 |

**Footnote:** µm = micron



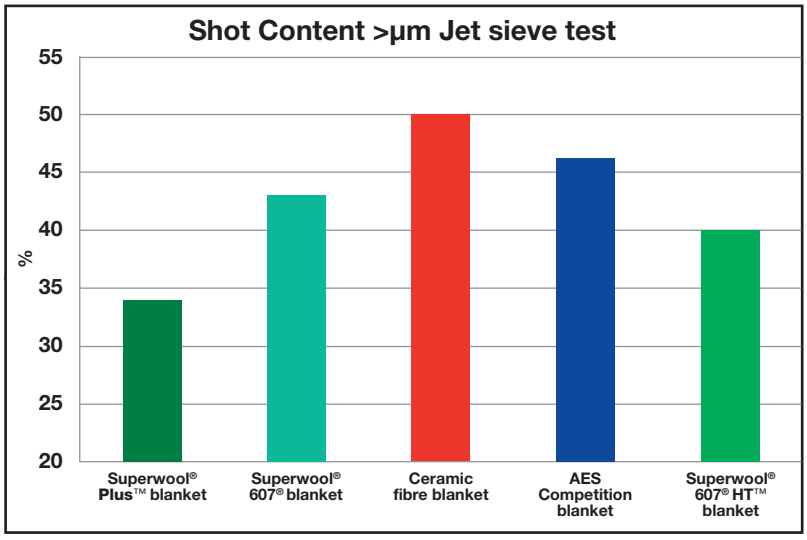
The new Superwool® **Plus**™ fibre yields a 20% improvement in conductivity at 1000°C (1832°F).

This translates to cooler cold surfaces, less energy loss or less mass of fibre required to give the same performance. The advanced control of the manufacturing process used in **Superwool® Plus™ fibre also allows the fibre diameter to be kept predominantly in the optimal 1 to 6µm range**. This maximises the amount of surface area available for interacting with thermal radiation.

## High fibre index

By careful control of the manufacturing process, molten glass for Superwool® **Plus™** insulation can be made to fiberise more completely, thus improving the ratio of shot to fibre and minimising the size of the pieces of shot. This **enhances the thermal conductivity of Superwool® Plus™ fibre by 20%. Superwool® Plus™ fibre gives you up to 30% more fibres.**

The implementation of the Jet Sieve allows us to measure the shot content at the production line quickly and regularly. This innovation allows us to use the shot content production control parameter.




*Comparison of shot measured at the recommended 45µm in various insulations.*

Morgan Thermal Ceramics defines shot as any portion of the material which will not pass through a 45µm aperture on a sieve. The 45µm sieve was selected as this was the smallest that could be reliably used for frequent process control measurements in production. It should be noted that other manufacturers use less stringent size classifications for shot. In fact ENV 1094-7: 1994 and ISO 106356: 1999 quote shot as being over 75µm and BS 1092-6: 1986 quotes shot as being over 106µm.

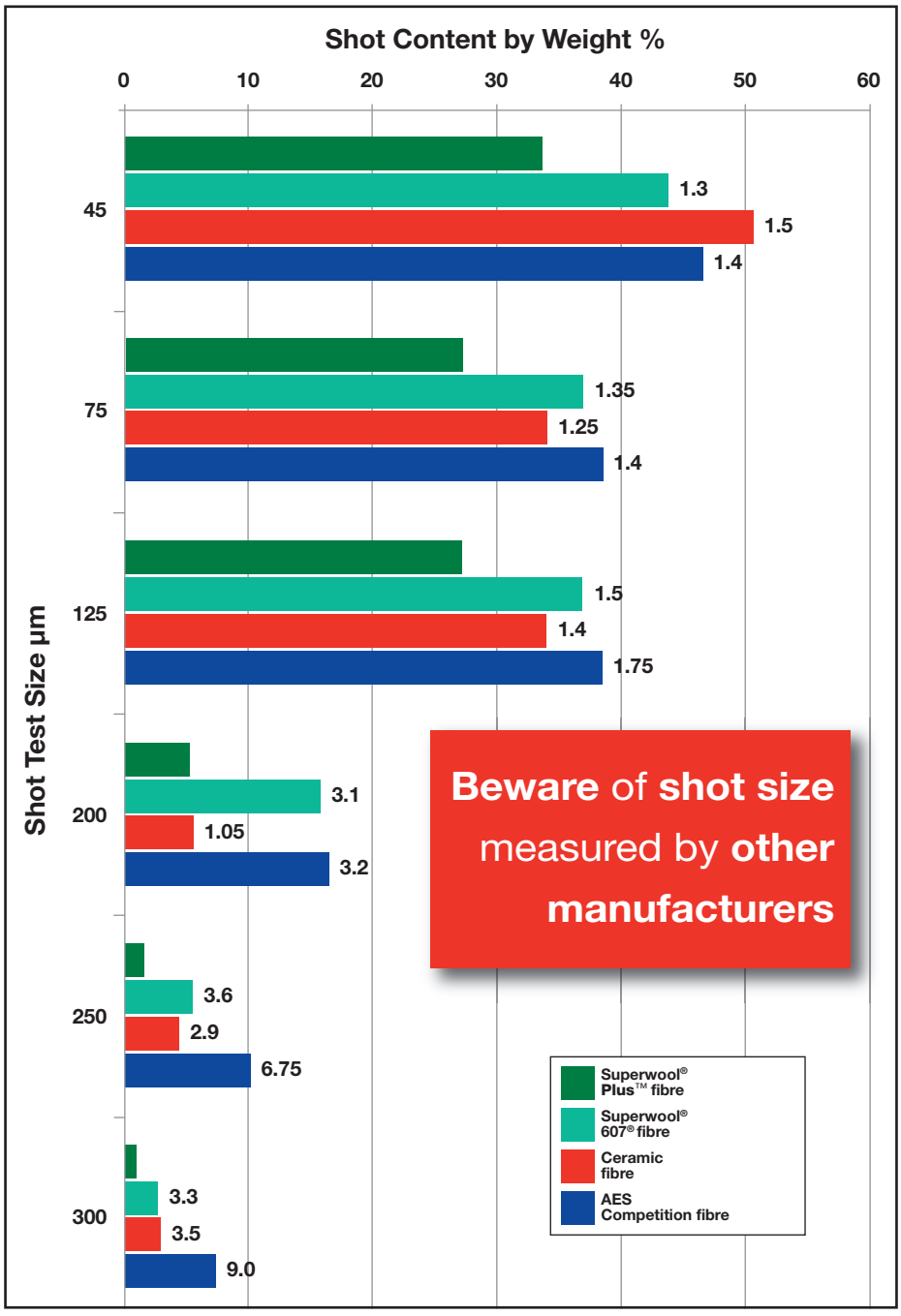
## Fibre Index

The fibre index is the proportion by weight of material which is turned into fibre during the production process and hence is effective in restricting thermal energy transfer and is just one measurement quoted in comparisons between different fibre insulation materials (Fibre index % = 100 - shot content %).

## Shot content comparison for various shot sizes

Shot measurements in various fibre insulation materials were taken and compared using the Jet Sieve method. The results outlined in the chart below show a significantly lower shot content for Superwool® **Plus**™ fibre at various sizes. i.e. at 45µm (the smallest shot size that can be used reliably in process control measurements) RCF has 1.5 times more shot than Superwool® **Plus**™ fibre. Alternatively using measurements from other manufacturers who are using less stringent methods, at 300µm competitor AES contains 9 times more measured shot content than Superwool® fibre.

It is important to note that you can normally start to feel shot in the hand at shot sizes above approximately 125µm. Superwool® 607® fibre and competitor AES contain up to 17% shot – over 3 times more than Superwool® **Plus**™ fibre.




*Measured Shot Content using the jet sieve test which allows regular and fast results on the production line*

# Superwool® Plus™

**Insulating fibre**

| Features | Benefits |
|---|---|
| An engineered solution (unique) | Takes insulation beyond normal performance |
| Patented technology | Proven chemical formulation |
| Exonerated from Carcinogen classification under Nota Q of European Directive 67/548 | Restrictions on use do not apply. No special requirements for dust control, supply to the general public or waste disposal |
| Lower thermal conductivity | Improves insulation by 20% |
| Up to 30% more fibres | Efficient prevention of heat transfer and greater strength |
| Less shot | Cleaner workplace |
| **High Fibre Index** | **Up to 20% reduction in thermal conductivity giving energy saving** |
| Stronger with good handleability (no tearing) | Ease of installation saving time and waste |
| Improved handling | Operator satisfaction |
| Soft & smooth feel | Less mechanical skin irritation |
| Consistent use of pure raw materials | Higher classification temperature, low shrinkage and consistent quality |
| Lower density grade for the same result | Material weight savings up to 25% |
| Thinner lining for the same result | Create more working space within unit |
| Resistant to vibration | Allows long lifetime under vibration conditions where other products fail |
| An environmental solution | Potential savings on waste disposal |
| Worldwide production | Availability |

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SUPERWOOL® is a patented technology for high temperature insulation wools which have been developed to have a low bio persistence (information upon request). This product may be covered by one or more of the following patents, or their foreign equivalents:

SUPERWOOL® PLUS™ products are covered by patent numbers:
US5714421, US5994247, US6180546, US7259118, and EP0621858.

SUPERWOOL® 607HT™ products are covered by patent numbers:
US5955389, US6180546, US7259118, US7470641, US7651965, US7875566, EP0710628, EP1544177, and EP1725503

A list of foreign patent numbers is available upon request to The Morgan Crucible Company plc.



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