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Technical Bulletin

Determining Durometer Hardness of Fireproofing Materials

A Durometer is a term that is used to refer to the measurement of the hardness of a material, as well as the measurement instrument itself. The hardness of any fireproofing material or any other type of substance may be defined as a material's ability to resist permanent indentation. Durometer hardness is an easily attainable, non-destructive means typically used to qualify the physical performance and level of cure for both intumescent and cementitious fireproofing coatings.

There are several different Shore hardness scales that have been developed for measuring the hardness of various materials. These scales were developed in order to evaluate the hardness of different types of materials. Each scale results in a value between 0-100, with higher values representing a harder material. These values are good measure for initial field quality control and material testing.

The ASTM D2240 standard recognizes several different Durometer Shore scales that use different combinations of specific spring forces and indentor shapes that correspond to specific material types. The main durometer types and materials they are used to measure are listed in the table below:

Durometer Type*	Material Types	Indentor Shape
Type A	Soft rubber, plastics, elastomers	Flattened point
Type B	Harder plastics, elastomers, fibrous products	Sharp conical point
Type C	Medium hard plastics, elastomers	Flattened point
Type D	Hard rubber, plastics, thermo-plastic coatings, epoxies, intumescent coatings	Sharp conical point
Type DO	Dense granular materials, cements, cementitious fireproofing	Spherical radius
Type O	Soft elastomers, soft granular materials	Spherical radius
Type OO	Light foams, sponge rubber gels, animal tissue	Spherical radius
Type OOO	Ultra soft gels and sponge rubber	Spherical radius
Type M	Ultra thin materials	Sharp conical point
*All durometer types are recognized in the ASTM D2240 test standard for the corresponding material types		

The hardness value of a fireproofing material depends on the depth at which the indentor can penetrate into the coating. The sharper the indentor, the more it can penetrate into the material. The depth that the indentor can penetrate depends upon the shape of the indentor and the properties of the materials being tested. For this reason, different types of durometers are used for different types of materials.

Traditionally, the Shore D scale has been the most commonly used type of durometer to measure the hardness of both intumescent and cementitious fireproofing materials. These values are commonly utilized to determine the minimum acceptable hardness level required before recoating, topcoating, handling or transporting steel coated with fireproofing materials.

- **Intumescent fireproofing**: These types of materials tend to have thermo-plastic properties when cured and require a sharper, pointed type of indentor to obtain a true hardness value. The correct scale to be used for these types of coatings is a Shore D Durometer due to the more pointed shape of the indentor.

- **Cementitious fireproofing**: These materials on the other hand, while still extremely hard, tend to have more granular surface characteristics due to the aggregates in the material and the applied surface texture. Shore D readings may not be accurate for these materials and can be misleading because the sharp point of this type of gauge may hit these particles or the interstitial spaces in between. The correct scale to be used for these types of materials is a Shore DO Durometer due to the spherical radius of the indentor.

Extensive work has been performed to determine the most reliable means to test for the true Shore hardness values of cementitious materials. These values are important as they are important indicators for recoat, topcoat, handling and curing schedules. The Shore DO scale is the most reliable and reproducible type of durometer scale for use with these cementitious fireproofing materials. This is because the Shore DO Durometer has a rounded, spherical shaped indentor that will take a reading over a larger surface area without hitting low points or voids. This produces an accurate value that measures the true hardness of a cementitious fireproofing product.

Moving forward, we will recommend shore DO values for use with all of our cementitious fireproofing products. These values will be reflected in all product literature and product data sheets. Although there is no direct correlation between the Shore D and Shore DO scales, the two types of durometer scales can be roughly compared as follows:

Comparison Chart *This chart is for comparison purposes only.*
This is **not** and **cannot** be used as a conversion chart.

A	10 20 30 40 50 60 70 80 90 100
B	10 20 30 40 50 60 70 80 90 100
C	10 20 30 40 50 60 70 80 90 100
D	10 20 30 40 50 60 70 80 90 100
DO	10 20 30 40 50 60 70 80 90 100
O	10 20 30 40 50 60 70 80 90 100
OO	10 20 30 40 50 60 70 80 90 100
M	30 40 50 60 70 80 90

Historically, the minimum acceptable hardness necessary for the handling and transportation of Pyrocrete 241 was a Shore D of 40 with typical laboratory readings as high as Shore D 55. This corresponds to a minimum acceptable hardness of Shore DO 65 for transportation with expected typical laboratory values as high as Shore DO 75.

In order to accurately measure the hardness of a fireproofing material, the correct Shore scale and corresponding device must be used in order to have a common point of reference between similar types of materials. Changing to this new Shore scale does not change the hardness of cementitious products but rather, more reliably measures the true hardness of the products with accurate reproducibility in the field.