

## 2. SURFACE PROFILE

Surface profile height is determined by a whole range of variables which include the following:

- 1        **The strength and hardness of the surface being cleaned.** It is more difficult to profile stainless steel than mild steel. You should note, however, that the thickness of the substrate being profiled has virtually no effect on the profile height produced.
- 2        **The velocity of the abrasive.** The relationship between abrasive velocity, mass and kinetic energy has already been discussed.
- 3        **The abrasive hardness and specific gravity.** Profile height increases as hardness and SG increase. This is why metallic abrasives generally produce higher profiles than sands or mineral slags.
- 4        **Abrasive particle size.** Profile height increases with the size of the abrasive.
- 5        **The angle of abrasive impact.** Profile height increases as the angle of impact moves towards the perpendicular.
- 6        **The time the surface is exposed to blasting.** The profile height generally increases as the standard of blasting improves. For example, a heavy sweep will produce a higher profile than a light sweep and an Sa2½ blast will produce a higher profile than an Sa2 blast, although this

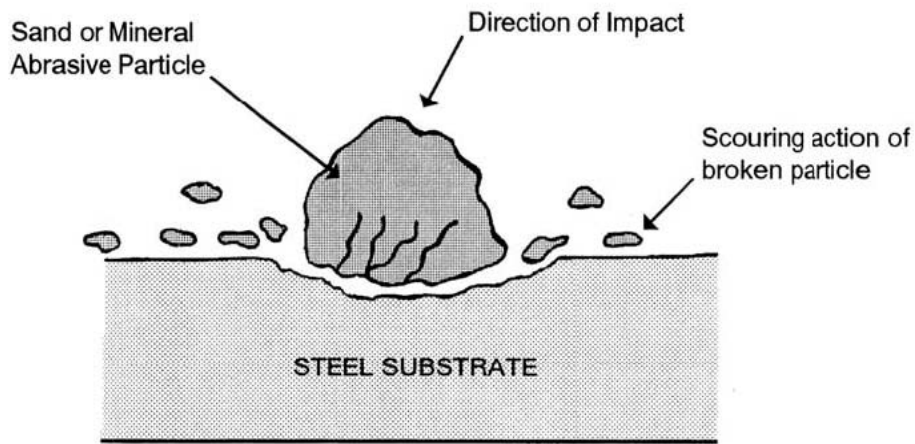
obviously does not apply to badly corroded steel where the profile is largely the result of corrosion in any case.

### 2.1 PROFILE AND ABRASIVE TYPE

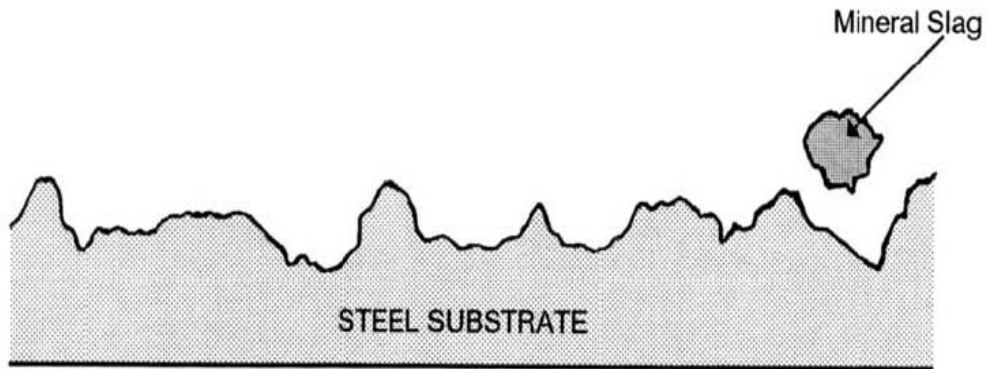
You will be aware that different types of abrasive clean surfaces in different ways and produce different types of profile. Sands and mineral slags produce a finely cut, abraded and scoured surface. Steel shot produces a compact and peened surface and steel grit produces a sharp angular cut surface. We will look at each type of abrasive profile in turn.

#### 2.1.1 Sand and Mineral Slag Abrasives

This type of abrasive tends to scour, as well as cut the surface. The scouring action is due to the abrasive particles fracturing as they strike the surface. They then speed away from the point of impact in a parallel direction to the metal surface, scouring rust and freeing pits from contamination as they go. This action produces a characteristic clean white appearance. See figure 21.

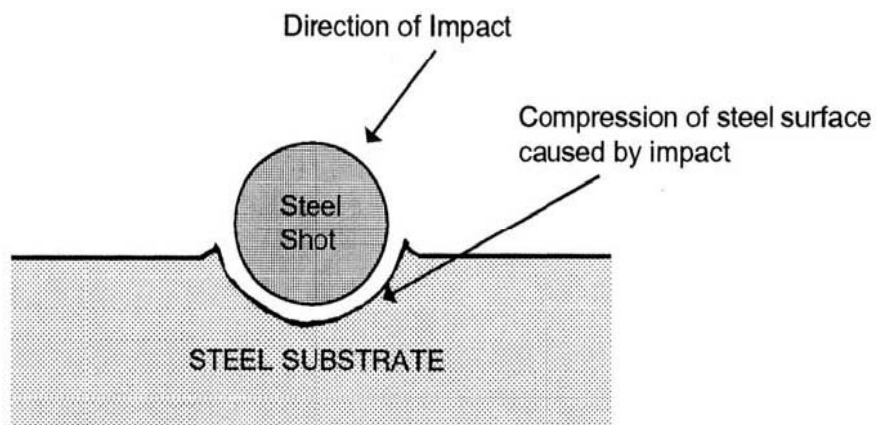


Sands and mineral slags are more effective at cleaning rusty areas and freeing pits from contamination than steel shots and grits which do not generally break upon impact. However, the smaller impact energy of sands and slags make them less effective at removing heavy rust and millscale than metallic abrasives.



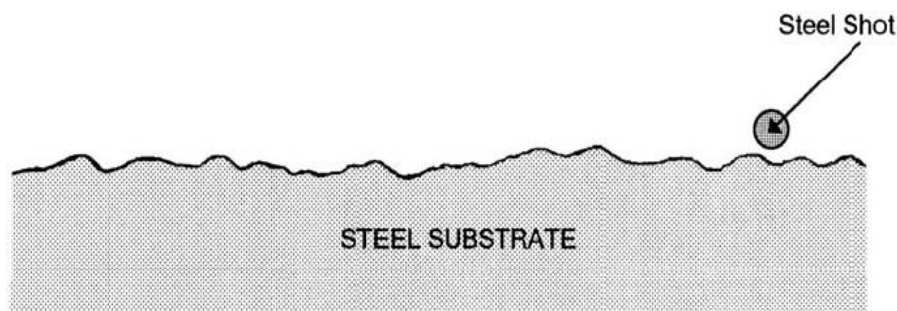
### 2.1.2 Steel Shot

Steel shot cleans primarily by impact damage and produces a 'peened' surface. (A finish similar to striking the surface with a ball peen hammer). See figure 23. This profile will be smaller than that produced by steel grit.



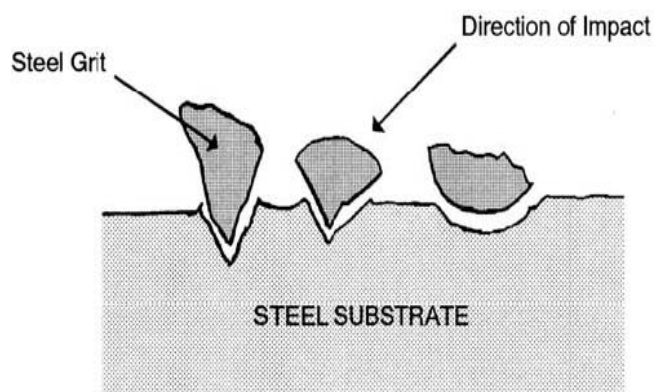
Steel shot is therefore good at breaking and removing brittle deposits such as heavy rust, scale and millscale, but it is not so good at removing thin surface residues which may be pounded into the surface of the substrate by the shot. The surface of the substrate is also warped and compressed by the impact of the shot. This may damage thin plates and it is also possible that this compression may reduce the number of surface reactive sites needed for effective coating adhesion.

A typical surface profile produced by steel shot is shown in Figure 24.

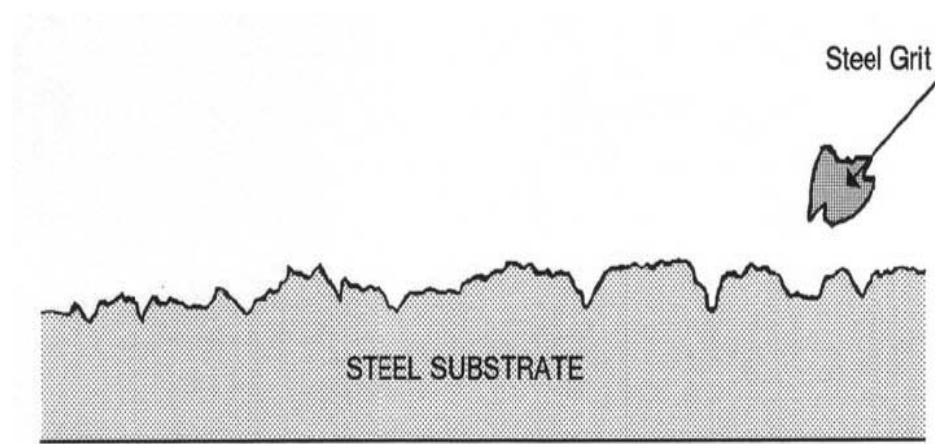


### 2.1.3 Steel Grit

When it is new, steel grit is angular and it has more of a cutting action than either sand or shot. New grit produces sharp peaks and troughs in the profile, however, as the grit becomes worn and rounded off, it will produce more of a peened surface. See figure 25.



In general, the cutting action of steel grit will tend to open up the substrate surface and increase the number of surface reactive sites needed for coating adhesion. However you should also be aware that new grit, particularly of a large particle size, can tend to throw up rogue peaks which can stick up above the rest of the surface profile. These rogue peaks will show through thin film coatings and produce 'rash rushing' unless they are removed by sanding or grinding prior to coating. A typical surface profile produced by steel grit is shown in figure 26.



### 3. ABRASIVE SIZE AND PROFILE REQUIREMENTS

The surface profile is the distance between the top of a peak and the bottom of an adjoining valley, in the surface indentations. This distance will vary between different peaks and valleys, so the distance quoted is usually an average. However, some specifications may also quote a maximum allowable value.

Achieving the correct profile is important. Too shallow a profile may seriously affect coating adhesion, while too high a profile may mean that excessive amounts of paint are used to 'fill' it, or the peaks may show through the paint film and cause flash rusting.

Various methods of measuring the profile are described in Module No. 7 of this course, and whilst the instruments used give reasonably accurate readings, they do not show **how** to produce the required profile height. It is useful that there is a definite relationship between the size of abrasive used and the size of profile it produces. In fact it is normal practice to produce the profile required by the **correct** selection of abrasive. Table 6 shows the average profile that will be produced on mild steel by using different sized copper slag abrasives. All abrasive manufacturers will provide this type of abrasive/profile table for their different products and you should become familiar with them for the abrasives you most commonly encounter. You should note that the abrasives are normally graded in a mixture of certain sizes to combine maximum profile **and** cleaning characteristics.

Abrasive Size, Range in mm	Profile Range in microns
1.00 – 3.1	~200
1.50 – 2.5	100 – 150
0.25 – 2.0	85 – 30
0.20 – 1.5	75 – 100
0.25 – 1.4	70 – 100
0.20 – 0.7	25 – 50
0.10 – 0.4	10 – 15

Table 6 – Abrasive Size and Profile Range

## 4. ABRASIVE CLEANLINESS

Abrasives that contain significant amounts of contaminants can cause serious problems for the substrates they are meant to clean. However, you should be aware that the **amount** of contamination that is actually transferred from the abrasive to the substrate varies tremendously with the type of abrasive used. There are three obvious sources of contamination.

### 1. Manufacture

Contaminants may get into abrasive during manufacture. For example, slags can be quenched with salt water rather than fresh water. This leads to high levels of chloride contaminants.

### 2. Storage

If abrasives are stored outside and are not properly bagged, they can become wet and contaminated with salts and oils.

### 3. Recycling

Abrasives that are recycled without proper cleaning are bound to be contaminated.

This is why International Paint recommend that expendable abrasives are **never** recycled during open blasting operations.

In general, controlling abrasive quality is the responsibility of the supplier, or the shipyard and its contractors, but you will be required to check abrasive cleanliness, for soluble salt levels in ballast and cargo tank coatings operations. The following comments on abrasive contaminants could be useful.

#### 4.1 Water/Moisture Contamination

Abrasives do not absorb water (they are not hygroscopic), but they can get damp if stored outside in wet conditions. International Paint's recommendations are that abrasives should not contain more than 0.2% water by weight. A laboratory test requiring abrasive to be weighed before and after heating is required to establish water content.

This should be in accordance with ISO 11125-7 for metallic abrasives or ISO 11127-5 for non-metallic abrasives.

#### 4.2 Oil Contamination

Any oil contamination at all is unacceptable. If abrasives are placed in clean water, oil contamination may be identified on the surface of the water, or as an emulsion in the water. This contamination will be clearly seen when you carry out conductimetric tests for soluble salt contamination. Alternatively, field or laboratory tests that utilize ultra violet light can detect oil contamination in abrasives, and on abrasive blasted surfaces.

#### 4.3 Soluble Salt Contamination

As mentioned in Section 1 of this module, the methods and procedures for measuring surface and blasting abrasive salt contamination are the subject of Module No. 8. This

consists of a workbook and video, that will show you when abrasive salt contamination tests have to be carried out. It will also show you how to carry out a conductimetric test procedure on site, and give you the criteria to either accept or reject the abrasive batch.

출처 : International Paint “TSTM – Module 3 : Surface Preparation “ 내용

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