



## Study of costs and performances between Steel Abrasive and Sand

In this note the usage between steel abrasive and sand is compared in indoor places as blast rooms, tanks or ship holds, using blast cleaning equipment by compressed air.

Modern systems of projection of particles by compressed air, sandblasting or blast cleaning equipment, work interchangeably with any type of abrasive. This allows to select the suitable abrasive for each type of work using the same equipment.

In this note there is no reference to equipment that uses mechanic turbines for the impulsion of abrasives, because they can not use sand.

### Generic characteristics of sand and steel abrasive

#### Sand

It is the natural abrasive of highest availability and very low cost. It is historically "the abrasive", and gives the name to all processes of preparation of surface by projection of particles, commonly called "sandblasting".

The type of sand that is used, is silica not calcareous, because it has the necessary hardness for this type of work. As it is a natural abrasive it must be subjected to analysis, due to the pollutants that it can have from its place of origin, dunes, rivers, quarries, etc.

To work properly with the sand, it should not be used in bulk and must be sifted, removing the



fine, which does not perform a good sandblasting on the surface and the thick that would seal off the equipment. It should also be subjected to a drying process due to its capacity to absorb humidity.

It is extremely fragile and projected by high production equipment; it can only be used once because more than 80% is transformed into dust after the first impact. It creates great pollution in the working environment by the fragility of its particles that, after the impact, become dust in a high percentage, with sizes below 300 Mesh.

Due to its composition, as it divides finely releasing silica, it causes an irreversible illness called Silicosis. Because of this the safety requirements must be really strict, nevertheless the use of sand as an abrasive has been banned in most of the technologically advanced countries.

### **Steel Abrasive**

It is an abrasive that is obtained from steel through a fusion process with controlled chemical composition. Rounded particles that constitute the steel shot are obtained from the primary process of manufacturing. These particles in the state of largest diameter are split forming the angular steel grit.

For those works where the use of the sand is replaced, grit is exclusively used, in some cases with the addition of a small percentage of shot. A particle of grit has edges and nibs and as it is projected, works as a tool that fixes and drags on the surface to process.

This abrasive can be selected according to the work to be performed, not only by the size of the particle, uniform in all of them, but also be the hardness in certain range. It is highly recyclable, being able to be projected from 700 to 5000 times according to the diameter, type and hardness of the abrasive used. As they are particles of tempered and low tempered steel, they do not cause any problem of pollution in the surface to be treated.

The dust produced in the operation is just basically the result of the materials removed from the surface to be treated. Because it does not absorb humidity, steel shot does not require a previous drying and as all the particles are of similar size, they performed a totally uniform work.



In the following table, you can see the main characteristics of both abrasives:

Abrasive	Type	Shape	Hardness	Density	Free Silica	Meshes	Reusing Factor
Sand	Silica	Irregular rounded	5-6 MOHS	1600 Kg/m <sup>3</sup>	90 %	6-300	Once
Steel grit	Metallic	Angular	40 a 68 RC	4000 Kg/m <sup>3</sup>	0	18-200	From 700 to 5000 times

With these elements you can perform the following economic study

As an example, we will suppose that the same work is performed with sand or steel abrasive.

In the 3 examples the same blast cleaning equipment is used with similar consumption of compressed air.

- Blast cleaning equipment CB 250-CD (250 Lt of capacity)
- Nozzle: Long Ventury 8 mm
- Compressed air consumption: 3.8 m<sup>3</sup>/min 7 Kg/m<sup>2</sup>
- Blast cleaning Quality: SA 2 ½ (SSPC10) Near -white metal

Abrasive	Production	Abrasive consumption (1)		Abrasive Cost		Nozzle Life	Dust generated (4)
	m <sup>2</sup> /hr	Kgr/hr.	Kgr/m <sup>2</sup>	u\$/kgs (2)	u\$/m <sup>2</sup> (3)	Hours	
Steel Grit "Sablacier"	20	5	0.25	\$ 0.80	\$ 0.20	700	Very Low
Steel Grit "G40E"	15	5	0.33	\$ 0.80	\$ 0.26	1200	
Sand	10	400	40	\$ 0.09	\$ 3.60	300	Very High

Notas:

(1) The consumption of abrasive is average. The same may vary according to the quality, hardness, impact speed, etc.

(2) The average cost of the abrasive is estimated and varies according to the different suppliers.



Knowing the different characteristics of sand and steel grit abrasive, we can see how each abrasive, working in enclosed places behaves:

### **Operative cost of the abrasives (3)**

The average cost of consumption of sand per m<sup>2</sup> of shotblasted surface will be 14 times higher with regard to the use of steel shot G40E and 18 times higher for the Sablacier steel shot. It is important to consider the higher cost of logistics for carrying bigger volumes of sand and the dust generated in the process with regard to the steel grit.

### **Abrasive projection equipment and complementary information (4)**

Similar projection equipment and protection of the operator are used. However the sand is more abrasive and causes a higher wear of the line of transport of abrasive, hoses, couplings and nozzles.

The sand causes more pollution with regard to the use of grit, requiring removal and filtering systems between 3 to 5 times larger than the required for the metallic abrasive. The extraction and filtering equipment constitute the most expensive part in the installation and in addition it increases the cost of maintenance of the filtering elements.

If steel abrasive is used, it is necessary to have a recovery and cleaning system for the abrasive, ready to be used efficiently again. For the sand a collection and disposal system is required.

### **Roughness**

The obtained roughness is absolutely uniform in the case of the steel abrasive but with variations according to the area of the surface treated in the case of the sand.

### **Conclusion**

The use of steel abrasive in enclosed places, is extremely advantageous with regard to the sand, emphasizing the following points:

- Higher productivity
- Lower cost of abrasive by clean m<sup>2</sup>
- Reduction of maintenance costs
- Better quality in terms of the work performed (homogeneity, roughness, cleaning)
- Lower environmental pollution
- Lower residue and dust generation
- Better visibility for operators
- Lower risk for the health of the operators
- Lower investment in dust collecting systems



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