Optimization of Surface Preparation Process Prior To Glass Coating of Different Type Of M.S.G.L Pressure Vessel.

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Abstract
Surface preparation is the pre-treatment step before any application of paint or coating, for better resistance toward the corrosion and chemical reaction between metal and chemicals and long life of job. Surface preparation helps to remove contaminant like rust, dust, oil, moisture etc.
Surface preparation of metal is one of the key factors in order to ensure consequent properties of coating. This is mainly done to produce effective adhesion between coating and substrate.
Interfacial adhesion can be done through two general mechanisms electrostatic bond and mechanical inter locking. electrostatic bond between the coating and metal substrate can be improved by removing any significant oxide layer and impurities. Surface roughness enhance the mechanical inter locking of coating within the surface irregularities.
As a part of surface preparation sand blasting process is performed on the surface of M.S.G.L pressure vessel. Nozzle type, blasting pressure, stand of distance, Blasting angle, and Size of the abrasive are the parameter which affect the blasting time and surface roughness, Blasting process consume high time and high cost.
By changing above five parameter we have perform number of experiment and get conclusion that for a specific rang of roughness we need specific process parameter, so we get given roughness in minimum time.

Keywords: surface preparation, Sandblasting, roughness, time

1.INTRODUCTION

Surface preparation process is the essential stage treatment of a steel substrate before the application of any coating and is generally accepted as being the most important factor affecting the total success of a corrosion protection system. Surface preparation is the process of treating the surface in order to increase its adhesion to coatings.
The surface preparation process is used for clearing a surface of any:

- Pre-existing coatings
- Surface imperfections
- Organic matter
- Oxidation
- Others contaminant

Grit blasting is used for various industrial applications. The purpose of this process is to clean, roughen, remove material, texture, and deburr substrates. In this process, various parameters are varied in order to generate a desired result. Some of these parameters are as follows:

- Media propellant type of propulsion of media. Using different types will affect the roughness and energy required to power the system.
- Control type- manual, automatic, or semi-automatic. These types of control are selected prior to blasting based on the blasting application
- Media – properties of the abrasive in the process. These can be abrasive size, shape of abrasive, hardness, fracture strength, media type, and purity of media supply.
- Substrate- properties of the material being blasted. The material strength and hardness, size, thickness, cleanliness, and initial roughness influence media selection.
- Blast angle – nozzle angle with respect to the substrate during process.
- Blast distance- nozzle exit distance from the substrate.
- Blast pressure- pressure of the system set prior to blasting. This affects the media flow rate and velocity.

Process parameters are set by the operator prior to blasting. Characterization techniques occur at the surface of substrate upon completion of blasting. Subsequently, parts which are out of specification require re-work or are scrapped, both of which decrease yield and increase costs. Some of the common characterization properties are:

- Roughness characterization-microscopy, and mechanical profilometryoptical profilometry. These methods are used to gather information on various roughness parameters of blasted substrates.
- Cleanliness – microscopy, visual inspection, and impurity detection. These methods gather data on how well the surface was cleaned during blasting and how many residual debris are left behind.

- Removed Mass 3 dimensional mapping and weight of substrate post-blasting. This technique is used to see how effective blasting is on the erosion of the substrate mass.
- Strain- measurement with Almen gage with the amount of bending that occurred from the forces of the propelled media.

The experiments show the effects of media and substrate combinations along with process parameters on the post-blasting surface roughness. The problem arises because these are post-characterization techniques, and a better process control can be gathered from process analysis, which would reduce the amount of defective parts.

A simple representation of the blasting process with an unblasted or "smooth" surface, during blasting, and a blasted "profiled" surface is shown in Figure

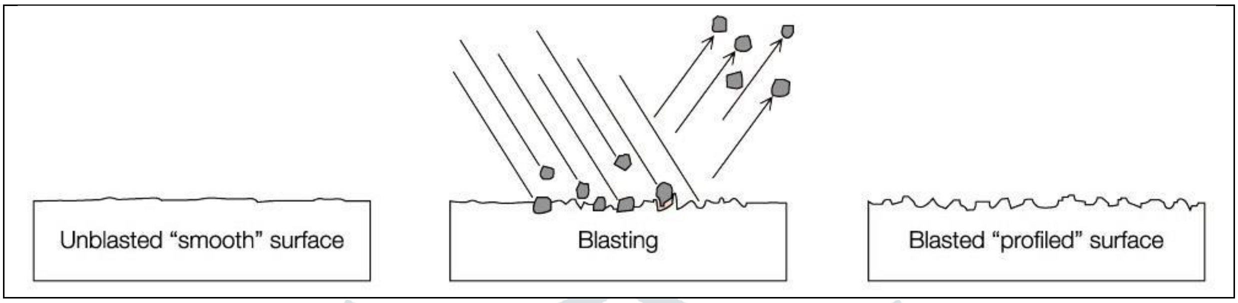


Figure no 1

The particles are propelled against the surface (substrate) via a flow of liquid and/or gas.

2.EXPERIMENTAL INVESTIGATION

Time of sand blasting and roughness of surface mainly depend on the following process parameter
- Types of nozzle.
- Stand of distance.
- Impact angle.
- Media size.
- Blasting pressure.

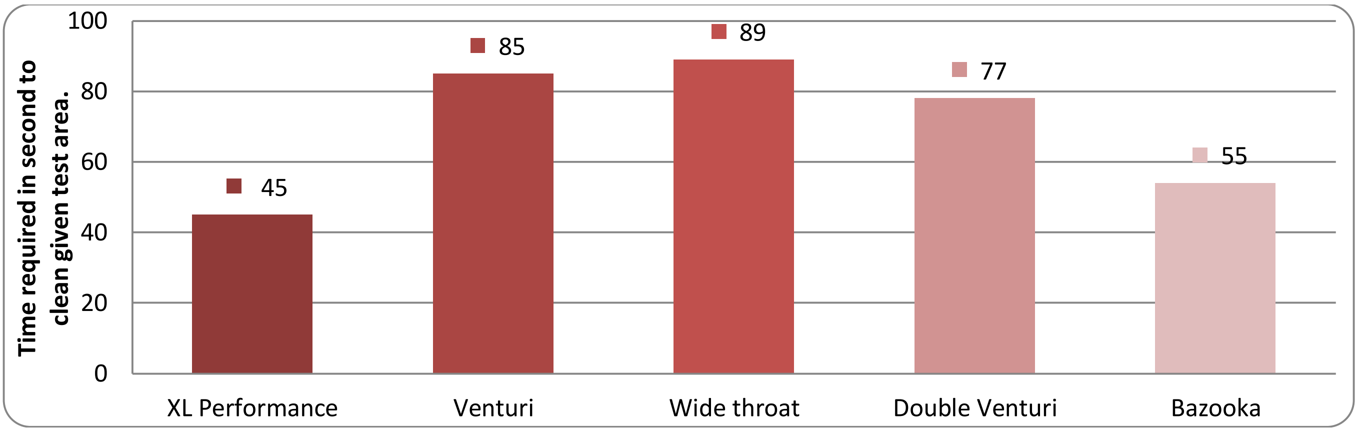
So, we have perform total five experiment by changing different parameter and six one by changing all parameter together.
So, we have used following parameter and equipment.
- Mild steel plate as raw material.
- Aluminium oxide grit of 14 mesh size.
- Compressed air blasting machine with 159 cfm compressor.
- Surface roughness tester.
- Blasting pressure 100 PSI.
- Standoff distance 50 mm.
- Impact angle 75^0.

Nozzle performance comparison[1]

In this experiment we have taken five different types of nozzle and perform experiment, so we get following results.

Table no 1

	XL performance	Venturi	Wide throat	Double Venturi	Bazooka
Size of blast pattern	5"	3"	3"	3"	4"
Nozzle to surface distance	48'	18'	18'	18'	18'
Time required for blasting in second	45	85	89	77	55



Changing the standoff distance

Blasting or stand of distance is the distance between the blasting nozzle and the substrate specimen and is usually listed in units of centimetres (cm), millimetres (mm), or inches.

If the distance is very small, then blasting might roughen the surface too much in localized zones, but if the distance is too far, media velocity would decrease and the substrate would barely be eroded, scarred, or grazed, if at all. Figure displays a similar effect when alumina was blasted on steel substrates at different distances. At a blast distance of 100 mm, the maximum roughness was obtained and distances shorter or further seemed to create smaller increases in surface roughness.

Table no 2

Sr no	Distance (mm)	Roughness(micron)	Time taken for Blasting of 1 sq m in second
1	50	6.5	167
2	80	6.85	172
3	100	6.98	178
4	140	6.77	181

Figure no 3 (50mm)

Figure no 4(80mm)

Figure no 5 (100mm)

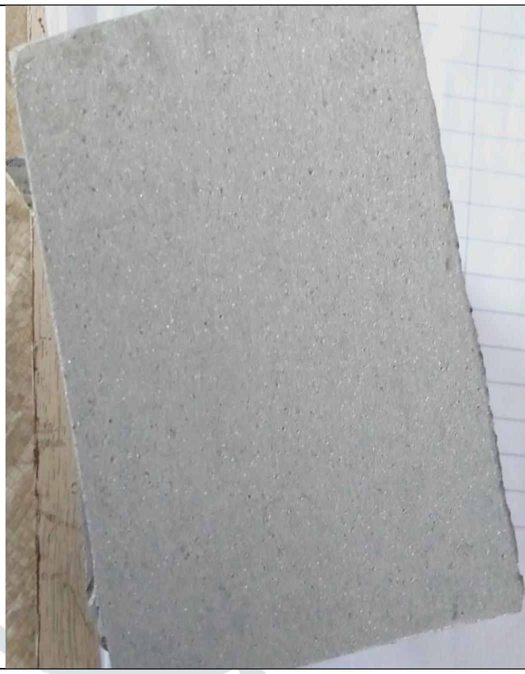


Figure no 6 (140mm)

Changing the blasting angle

Blasting angle is the angle at which the abrasive particles are propelling on the surface. We also call it as attack angle.
Depending on the application and substrate shape, the angle can be held constant or varied to generate certain mass erosion zones or surface roughness values. Figure displays the effects of various blast angles of 45°, 60° and 90°. Those same angles are displayed in Figure and show that the maximum roughness occurred at 45°, while time will less at the 90 angle. There is no big change in the roughness but there is variation in time so it affect the blasting time.

Table no 3

Sr no	Attack angle	Roughness(micron)	Time(second)
1	45^o	7.23	190
2	60^o	7.17	182
3	90^o	7.15	180

Figure no 7 (45^o)

Figure no 8 (60^o)

Figure no 9 (90º)

Changing the media size

Blasting media play an important role in achieving the good roughness.
Blasting media can be categorized into metallic and non-metallic abrasives. Cost, substrate type, and environmental effects play a role in which type of media is chosen for a particular application as well. Some common metal abrasives are iron grit, copper slag, and steel grit/shot. The difference in steel grit and shot is that the grit would remove more substrate mass, whereas the shot would just peen the surface more. By use of different size media we can get different roughness of the surface. High Mesh size of the abrasive particles means fine particles and small mean highly coarse.

Table no 4

Sr no	Mesh size	Roughness(micron)
1	14	7.13
2	20	6.94
3	40	6.18

Figure no 10 (14 mesh size)

Figure no 11 (20 mesh size)

Figure no 12 (40 mesh size)

Changing blasting pressure

Blasting pressure is the pressure at which the abrasive particles are exit the nozzle.
As we increase the pressure the flow rate of abrasive particles are being increase and as the flow rate increase the time taken for Blasting will decrease and roughness will increase, and vice versa. For that we have take four different blasting pressure and measure the roughness of the surface.

Table no 5

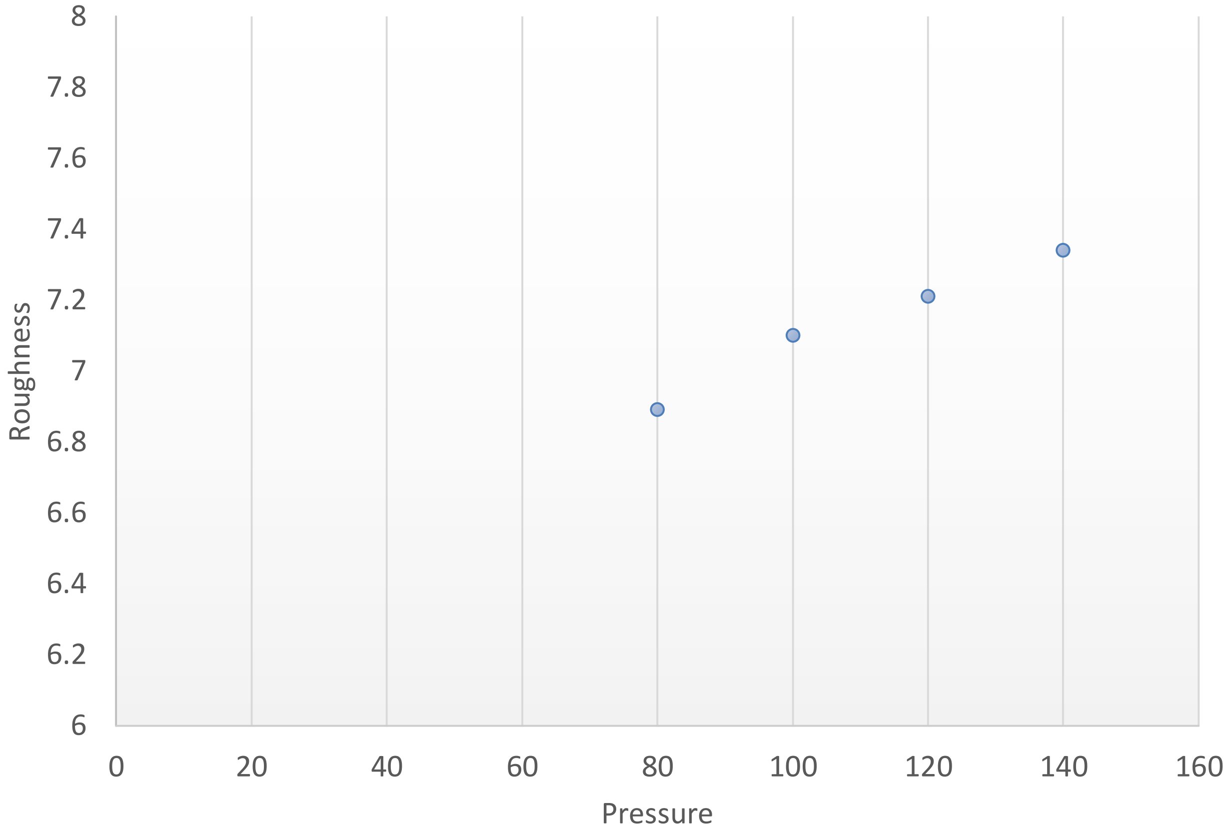
Sr no	Blasting pressure(psi)	Roughness(micron)	Time taken for Blasting of 1 sq meter in second
1	80	6.89	187
2	100	7.10	176
3	120	7.21	168
4	140	7.34	166

Figure non 13 (80 PSI)

Figure no 14 (100 PSI)


Figure no 15 (120 PSI)


Figure no 16 (140 PSI)



Changing all process parameter

In this experiment we have change all the parameter.
1. Blasting pressure
2. Standoff distance
3. Impact angle

We have changed five different Blasting pressure, Standoff distance, Impact angle so we get total 125 no of experiment. With the help of Design of experimental and taguchi method we get 25 no of experiment and we get following experiment with the help of Minitab application.

Table no 6

Sr no	Blasting pressure (PSI)	Standoff distance (mm)	Impact angle (Degree)	Roughness (Micron)
1	80	40	30	6.89
2	80	50	45	6.92
3	80	60	60	6.93
4	80	70	75	6.93
5	80	80	95	6.94
6	90	40	45	6.97
7	90	50	60	6.98
8	90	60	75	6.98
9	90	70	90	7.01
10	90	80	30	6.91
11	100	40	60	7.08
12	100	50	75	7.12
13	100	60	90	7.11
14	100	70	30	7.04
15	100	80	45	7.05
16	110	40	75	7.13
17	110	50	90	7.18
18	110	60	30	7.14
19	110	70	45	7.09
20	110	80	60	7.10
21	120	40	90	7.20
22	120	50	30	7.08
23	120	60	45	7.11
24	120	70	60	7.12
25	120	80	75	7.12

3.RESULT AND CONCLUSION

Result:

Followings are the results when we have changed only a one parameter and another constant.

Table no 7

Sr no	Stand of Distance (mm)	Impact angle(degree)	Media size (micron)	Blasting pressure (PSI)	Roughness (Micron)
1	50	90	14	100	6.5
2	80	90	14	100	6.85
3	100	90	14	100	6.98
4	140	90	14	100	6.77
5	50	45	14	100	7.23
6	**50**	**60**	**14**	**100**	**7.17**
7	**50**	**90**	**14**	**100**	**7.15**
8	**50**	**90**	**14**	**100**	**7.13**
9	50	90	20	100	6.94
10	50	90	40	100	6.18
11	50	90	14	80	6.89
12	**50**	**90**	**14**	**100**	**7.10**
13	50	90	14	120	7.21
14	50	90	14	140	7.34

Conclusion:

- To obtain the outcome of this project or to reduce the time of the sandblasting process we have to use XL performance nozzle or Bazooka nozzle.
- XL performance nozzle gives high velocity of abrasive partials.

- Roughness mainly depends on blasting pressure and the size of the abrasive particles.
- As we increase the Mesh size the abrasive become very fine so it can not much penetrate though the roughness will decrease and vice versa.
- And as blasting pressure increase the force for penetration also increase and so the roughness also increases in that case.
- We cannot see the much change in time in these two cases.

- Time is majorly depending on blasting angle and stand of distance.
- As we increase blasting angle and make flow perpendicular to surface than the time taken for Blasting is less.
- And as we increase from 50mm to 100mm the roughness of the surface increase and then decrease.
- But as we increase the distance the time is increase more as compare to other parameter because as we increase distance abrasive particles reach surface at slow velocity and that's why they cannot penetrate on surface.

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