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**RED IS  
THE NEW  
GREEN**



**BRISTLE  
BLASTER®**

**INNOVATION IN SURFACE  
PREPARATION**



**MEI 2023**

RENOWNED UTILITY ASSET OWNER FROM THE UK

## WHAT IS IT? BACKGROUND

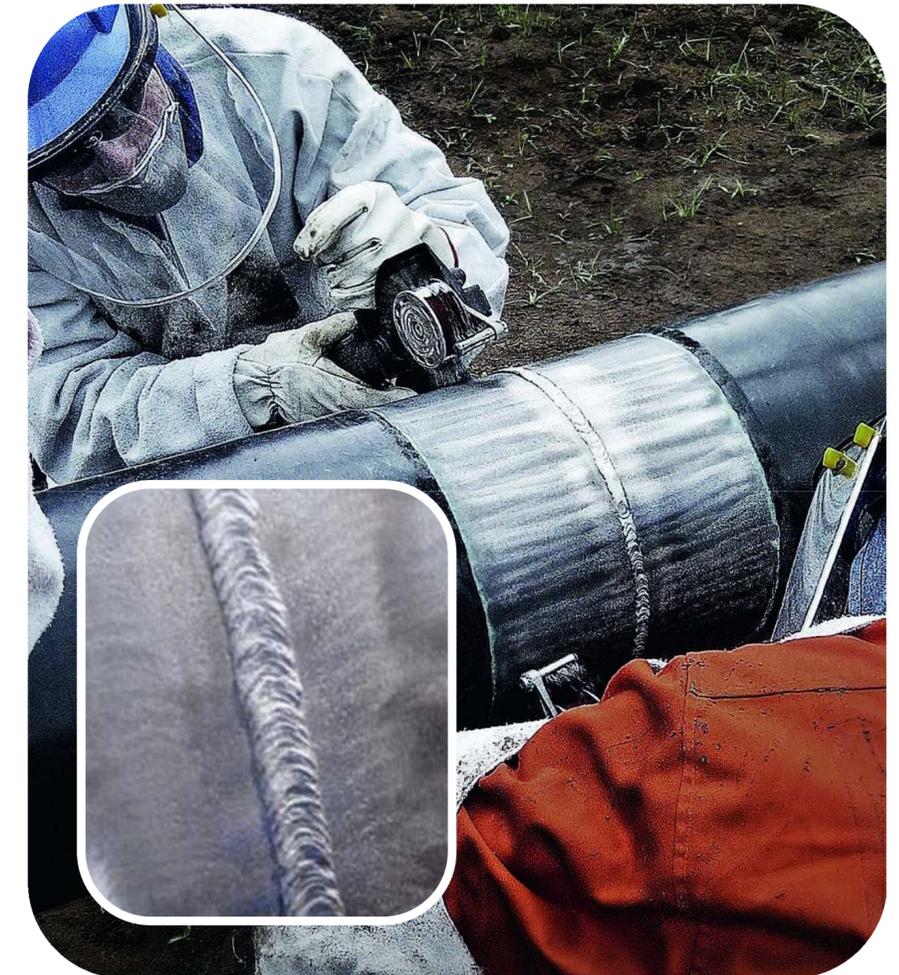
### THE PRODUCT:

- The Bristle Blaster® is an innovation in surface preparation. The patented technology provides the ability to clean surfaces to a Sa 2½ – Sa 3 (SSPC SP-10 / NACE No. 2 – SSPC SP-5/ NACE No. 1) finish, while generating a roughness up to 120µm Rz (4.7 mils).
- The core feature is the accelerator bar. It suspends each separate bristle during rotation and accelerates it to increase the kinetic energy of the bristle tips impacting the surface. The system combines the ability to produce an abrasive blasted finish with the high mobility and flexibility of a portable hand-held tool.

### FACTS:

- Hand-held and lightweight, weighing just 2.3 kg.
- Low-HAV of 2.8 m/s<sup>2</sup>, with 83 dB (A) noise level.
- Generate an anchor profile up to 120 µm Rz (4.7 mils).
- Low power requirements (air/electrical power).
- Minimal loss of base material.
- Environmentally friendly, not requiring grit.
- Produces low surface-temp. of below 100°C.
- Relatively low-cost at £810.85, including training.

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Weld Seam Preparation

### ACTIONS:

1. G23 Sign-off
2. Consider Investment
3. Draft & Issue Brief

## WHY USE IT? BACKGROUND

### COMPARISON:

- The Bristle Blaster® is considered to be a substitute for grit blasting – and this is certainly true when it is used over small areas. However it cannot be considered a substitute for grit blasting over larger areas where it cannot compete on many levels such as, production rate, profile and surface cleanliness.
- Its main advantage for small areas are that no heavy equipment needs to be mobilized, there is little dust contamination produced in the work area and therefore the clean up regimes are not as arduous. It is however much more advantageous than hand tools such as grinders and needle guns.

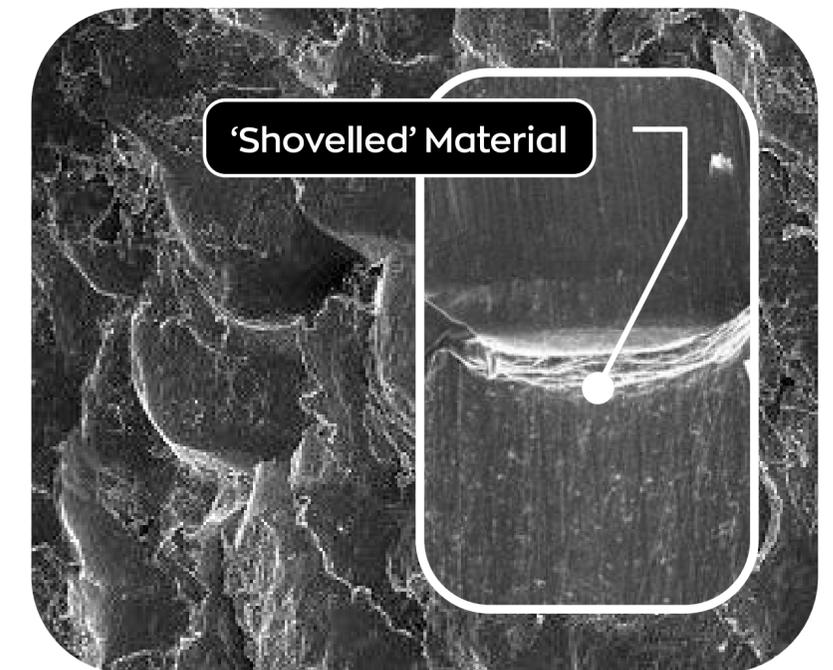
### BENEFITS:

- Corrosion, mill scale and coating removal to SA 2.5.
- Surface texture/anchor profile 40-120µm Rz.
- (1.6-4.7 mils) • Environmentally friendly / grit-free process.
- Improved surface integrity.
- Negligible heat generation.
- Simple / Economical compared to grit blasting.

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Bristles Closeup



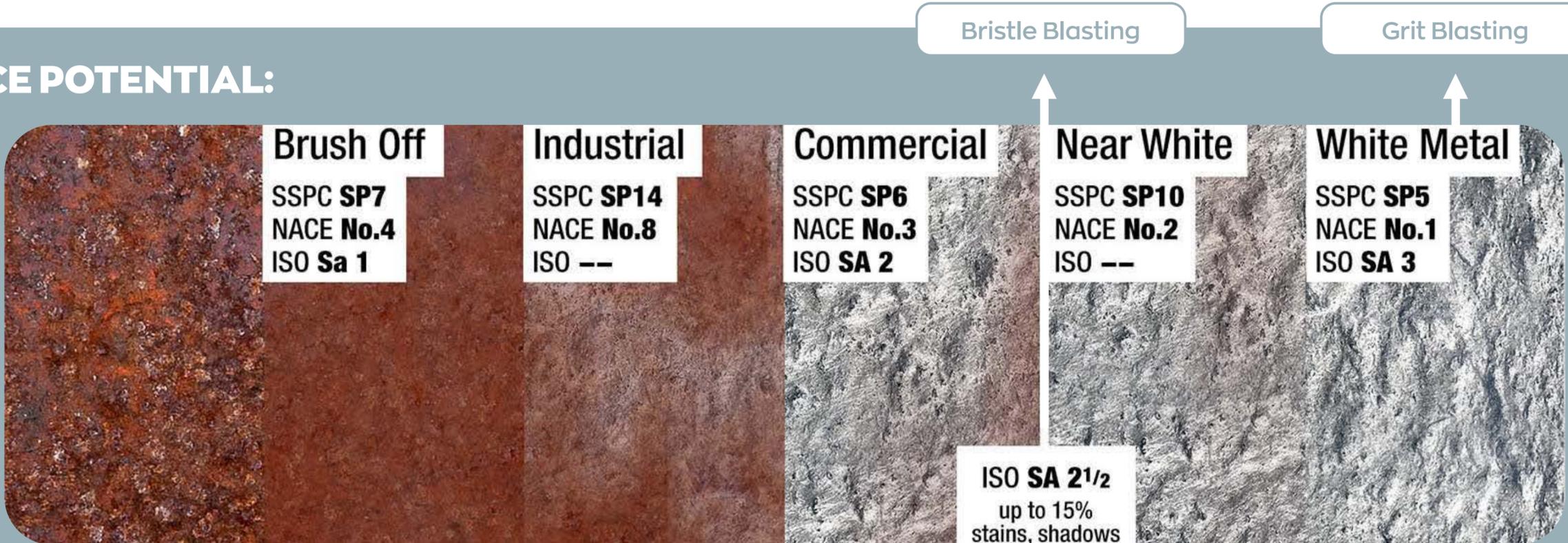
100x & 200x Closeup

# CURRENT PRACTICE BACKGROUND

## SCENARIOS:

- Currently Network Services when undertaking pipework paint preparation, corrosion removal and P11 damage assessment work utilise grit blasting. This can be cumbersome, produces waste and required a two-person team to undertake safely.
- The use of the Bristle Blaster® for the above activities is cheaper, produces little waste and can achieve the same results as grit blasting for small surface areas.
- The unit can be purchased in either 110v or pneumatic versions with the 110v version easily run from the team vehicle power source, or, coupled with the V2G mobile power supply, could allow for work in remote locations, without requirement for vehicle access.

## SURFACE POTENTIAL:



# POWER WIRE BRUSHING BACKGROUND

## RESEARCH COMPARISON:

- Research was completed on coating adhesion and cyclic corrosion tests for three different surface prep methods; power wire brushing, grit blasting and Bristle Blasting.
- Power wire brushes can deliver SP 11 bare metal finishes, however, surface conditions ultimately lead to adhesion failure of the coatings due to poor anchor profiles.
- In contrast, Bristle Blasting removes coatings and affords an anchor pattern giving surface profiles similar to grit blasting. The difference between wire brushing and Bristle Blasting is that score markings & striations are eliminated, as bristle tips retract after impacting target surface.

## BENEFITS:

- Corrosion tests were made under laboratory conditions after applying different coating systems on test specimens. Pull-off tests showed improved corrosion resistance for Bristle Blasting due to higher adhesion of coating systems.
- Surfaces machined by the power wire brushing were still corroded and therefore due to disbondment. That is, Bristle Blasting clearly outperformed power tool techniques, and is at least equivalent to and even can exceed the cleaning that is achieved by white metal blast cleaning SP 5.

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### Bristle Blasting Surface Preparation Method for Maintenance

Summary of NACE Paper No. 09004, Lukas Janotta, M.Sc. RWTH

This Abstract summarizes Neil Winks' work published by NACE International, 2006, focusing on coating adhesion and cyclic corrosion tests for three different surface preparation methods, namely: conventional power wire brushing, grit blasting and Bristle Blasting.

Key concern for end users is the question of how long remedial coating systems will last in corrosive environments. Maintenance carried out in areas which are difficult to access, especially where wet and abrasive blasting with respect to SSPC's surface condition SP 10 or SP 5 is not possible, can be up to 20 times more expensive than the maintenance carried out in the shop.<sup>1</sup>

Surface preparation tools like power wire brushes, grinders or needle scalars are capable of realizing SP 11. However, these surface conditions ultimately lead to adhesion failure of the coating system by generating poor anchor profiles. In contrast, the Bristle Blasting process removes coatings and affords an anchor pattern giving surface profiles that are similar to grit blasting. The main difference between traditional wire brushing and the Bristle Blasting surface treatment is that score markings and striations are eliminated, because bristle tips retract immediately after impacting on the target surface.<sup>1</sup>

Performance tests comparing the chosen surface preparation methods were carried out on carbon steel with rust grades A and D, respectively. In both rust grade cases, roughness values  $R_a$  were much higher for Bristle Blasting than for standard power tooling techniques. Moreover, the recorded values are similar to those of grit blasting.<sup>1</sup>

Cyclic corrosion tests according to ISO 20340 were made under laboratory conditions after applying different coating systems on test specimens simulating Korean shipyard conditions. Pull-off tests show an

improved corrosion resistance for Bristle Blasting due to higher adhesion of coating systems to substrates. Substrates being machined by the power wire brushing method were still corroded and therefore unstable due to disbondment. That is, Bristle Blasting clearly outperforms conventional power tool techniques, and is at least equivalent to and even can exceed the cleaning that is achieved by white metal blast cleaning SP 5 (see Fig. 1).<sup>1</sup>

System	Power Wire Brushing [MPa]	Grit Blasting [MPa]	Bristle Blasting [MPa]
System 1	5.0	9.5	8.5
System 2	5.0	8.5	8.0
System 3	6.0	8.5	9.5
System 4	3.5	7.0	7.5

**Key Facts**

- Surface condition (smoothness, roughness) and corrosion resistance equivalent to grit blasting

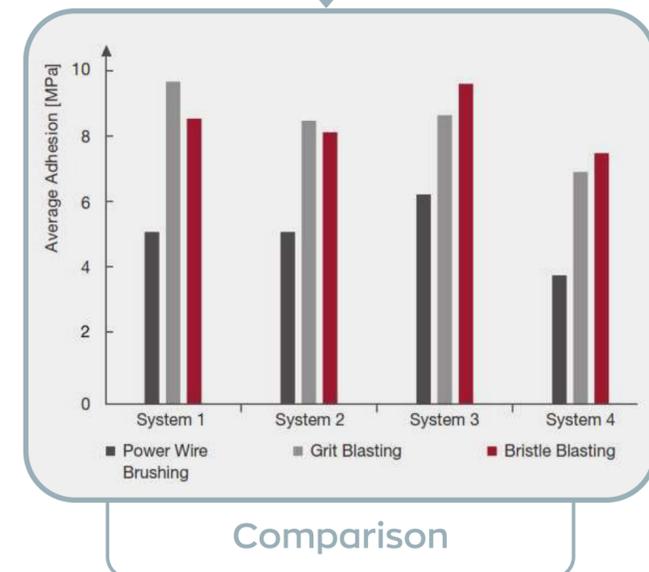
**References:** <sup>1</sup> Winks, N. "Bristle Blasting Surface Preparation Method for Maintenance", in NACE Corrosion Conference 2006, Atlanta, p. 1

<sup>1</sup> Ibid., p. 2; <sup>2</sup> Ibid., p. 3; <sup>3</sup> Ibid., p. 7; <sup>4</sup> Ibid., p. 9

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# HEALTH, SAFETY & ENVIRONMENT

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# CURRENT TECHNIQUES HS&E

## GRIT BLASTING:

- Grit blasting process can produce hazardous dust and debris and must be performed by an individual that is confined or encapsulated in a control-suit, which both filters dust and supplies fresh air from a remote source. Furthermore, the noise level emitted by such equipment varies from 112-119 dB(A).
- The equipment/apparatus used for carrying out grit blast operations is complex, costly, and requires considerable set-up and demobilisation time.

## POWER WIRE BRUSHING:

- Power wire brushing removes burrs and cleans impurities off various surfaces. This technique commonly involves the use of cup wire brush attachments, utilized with Makita GA4530 angle grinders.
- Cleaning and deburring with a wire brush remains by and large an intensely manual process, and produces a vibration magnitude of 7.5 m/s<sup>2</sup>. Choosing the right brush for the job and using the right technique can have a dramatic impact on throughput.
- The Makita grinders produce a Sound Pressure Level of 85 dB(A) or above.

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### Bristle-blast Surface Preparation Process for Reduced Environmental Contamination and Improved Health/Safety Management<sup>1</sup>

Robert J. Stango, Ph.D., P.E., Professor of Mechanical Engineering, Marquette University, Milwaukee, WI 53233 USA

#### ABSTRACT

Maintenance of both on-shore and off-shore petroleum installations is a key concern throughout the oil and gas industry. In particular, engineers must continuously monitor corrosion and establish a schedule for periodic maintenance of all physical systems that are prone to corrosion. To this end, the grit blast cleaning process is routinely used for corrosion removal and surface preparation, thereby providing an anchor profile for subsequently applied paints and coatings. However, grit blast cleaning processes are cumbersome and inevitably require special equipment, containment systems, and subsequent clean-up due to the widespread contamination that is inherent of the process. Consequently, there is a strong need to develop alternative surface preparation processes that forego the expense and environmental setbacks that are commonly associated with existing grit blast cleaning operations.

In this technical paper, several key surface preparation processes are reviewed that can *simultaneously* remove corrosion and generate a requisite surface profile. Included among these processes is the recently developed method termed *bristle blasting*, which is capable of generating cleaned, textured surfaces that are equivalent to commercial grit blasting processes. This newly developed process, however, does not require the use of complex equipment, containment, or the retrieval of spent media. It is demonstrated that the bristle blast cleaning process can reduce/eliminate environmental contamination, and can minimize the risk of health or safety hazards to the user or to those working in the nearby vicinity. In addition, this paper reviews the physical principles upon which the function of the tool is based, and results are presented for corrosion removal applications involving API 5L steel, which is commonly used in the petroleum industry. These results demonstrate that bristle blast technology produces surfaces having a cleanliness and texture quality that is ordinarily associated with traditional grit blast cleaning processes, namely, SP-10 (near-white metal blast cleaning) and SP-5 (white metal blast cleaning).

#### INTRODUCTION AND BACKGROUND

The physical infrastructure of both on-shore and off-shore oil and gas facilities relies upon properly functioning structural components for successful daily operation. Platforms, piping, and connectors, for example, are key elements that provide a framework for extracting, controlling and transporting the liquids and gases that are central to this industry's mission. Consequently, facilities maintenance is an important component of the overall effort and cost that is necessary to ensure uninterrupted and efficient operation. A significant portion of this effort involves the periodic evaluation and scheduled maintenance of any component whose deterioration and eventual failure can jeopardize the steady flow of product. To this end, maintenance engineers are responsible for ensuring that the integrity of all components is upheld and, in particular, that the damaging effects of corrosion are treated by using the

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<sup>1</sup> Submitted for presentation at the 18th International Oil and Gas Industry and Conference, OSEA, Singapore, November 30-December 3, 2010.



OSEA Report

# BRISTLE BLASTER® HS&E

## NOISE:

- The wire bristle impact or Bristle Blasting process for surface preparation utilises a rotary disk which operates at a spindle speed of approximately 2,500 rpm. Noise levels emitted by this equipment are the same (83.5 dB(A)) for both the pneumatic and electric versions.

## OPERATION:

- The compact 2.3kg tool is operated by grasping both the control handle and the main body of the tool, and directly exerting the working surface of the tool against the surface to be prepared. The user-applied force required for this operation are far below that required for grit blasting and power wire brushing operations.

## VIBRATION:

- The electric tool produces a vibration magnitude of 3.1 m/s<sup>2</sup>, and can be used for up to five hours before the action level is reached.

### Bristle-Blast Surface Preparation Process for Reduced Environmental Contamination and Improved Health/Safety Management

Summary of OSEA Paper, Lukas Janotta, M.Sc. RWTH

This Abstract summarizes Professor Stango's work presented at the OSEA International Oil & Gas Industry Conference 2010 in Singapore comparing Bristle Blasting to the grit blasting process and needle scalars as viewed from an occupational safety and health perspective. All three of these processes are capable of simultaneously removing surface contamination, exposing base metal and generating appropriate surface profiles for subsequently applied coatings.<sup>1</sup>

Needle scalars – also known as needle guns – are percussive power hand-tools with rapidly vibrating small diameter rods. The tool oscillates with frequencies ranging from 2,700 to 4,500 strikes per minute and reaches a noise level of 109 dB(A), which is well above the OSHA threshold level of 85 dB(A) requiring protection for the user and the workers nearby area. Mean forces exerted by the operator-tool system can

rise up to 75 N (17 lb). Moreover, the power tool induced vibrations range between 10.9 and 28.7 m/s<sup>2</sup>, which can lead to serious health disorders associated with the hand-arm vibration syndrome (HAVS).<sup>2,3</sup>

Grit blasting processes are characterized by a high-speed particle stream of granular media (i.e., steel, coal slag, etc.) that repeatedly impacts and erodes the target surface. However, grit blasting processes produce hazardous dust and residues, which demand considerable personal protective equipment such as encapsulated control-suits, dust-filtering devices as well as fresh air that must be supplied from a remote source. Throughout the cleaning operation, workers have to sustain a steady reaction force of approximately 88 N (20 lb) that results in operator fatigue. In addition, noise levels up to 119 dB(A) are often encountered, which necessitate the use of ear protection.<sup>4,5</sup>

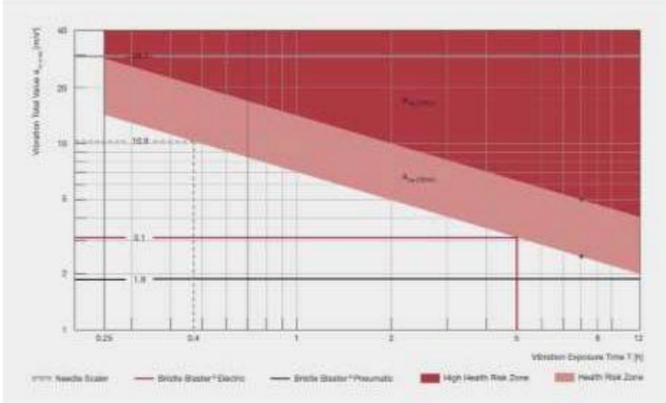


Figure 1: Relationship between the magnitude of tool vibratory acceleration and the worker's exposure time<sup>6</sup>

# FIELD TRIAL RESULTS



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# BRISTLE BLASTER® CASE STUDY

GRIT BLASTING:	
Resource	2 workers
Prep. Works	60 minutes
Working Time	10 minutes
Clean-up Time	60 minutes
Consumables	1. Ground Sheets 2. Grit
Equipment	1. Pot and Gun 2. Machine 3. Tethered Hose 4. Compressor
Environmental	1. Contaminated Waste 2. Noise Levels
Safety	Air-fed PPE
Time	260 minutes (130 x2)



BRISTLE BLASTING:	
Resource	1 worker
Prep. Works	20 minutes
Working Time	20 minutes
Clean-up Time	5 minutes
Consumables	• Ground Sheets
Equipment	• Bristle Blaster
Environmental	No grit required
Safety	Atmosphere Check
Time	45 minutes (45 x1)

## PERFORMANCE:

- The Bristle Blaster® requires just one person to operate, and cuts preparatory and clean-up times down to just a third of that required for a conventional grit blasting operation. However, the working time does take longer, which makes small area surface preparation ideal for this type of equipment.

# FIELD TRIALS TABLE & FEEDBACK

Location	Job Type	Time Saved (vs. Grit Blasting)	Ease of Use (1=Bad, 5=Good)	Comments
Bodfari AGI	1m area to be painted	20 mins vs 1.5 hours	5	Cleaned the area after welding to a level acceptable for painting
Mold DG	Patch painting	2 hours vs 6 hours	4	Generally excellent, some areas around bolts difficult to access

Kevin Jones  
TM

“We have had this piece of equipment for a few months now and have found it to be very useful in small area corrosion removal. It’s easy to use, is environmentally friendly as there is a no grit requirement.”

Chris Evans  
FLM

“Great hand held portable tool that is extremely useful for small areas of corrosion that are required to be surface cleaned prior to be painted or inspected.”

Neil Evans  
Craftsman

“I have personally used this equipment on quite a few occasions. Its ideal for cleaning and surface preparing corroded. Its lightweight, easily to set up and doesn’t produce the waste that grit blasting would produce for a similar task.”

- “Easy to use”
- “An excellent tool for completing small surface preparations”
- “No cleaning up of grit after the job!”

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# COMMERCIALS & PROCUREMENT

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# RECOMMENDATION

Following successful field trials and analysis of the benefits, Kevin Jones has recommended that Bristle Blasters are made available for purchase. It is suggested the tools be utilised for:

1. Small painting area preparation;
2. Corrosion removal on bolts and weld areas, and;
3. P11 damage assessment.

Utilisation of the Bristle Blaster® should be considered an additional activity alongside the use of Grit Blasting, and is not a full replacement. The use of a 'Bristle Blaster®' should be considered appropriate for small surface area works requiring SA 2 ½ (Near White Blast) metal finish.

# USEFUL ITEMS

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