

THE SURFACE FINISHING EQUIPMENT GROUP

Abrasive Blasting and Surface Preparation Guide



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TECHNICAL REFERENCE

SURFACE PREPARATION

Pictorial Surface Preparation Grades of Blast Cleaned Steel

Surface Profile

- Understanding Surface Profile
- The Difference Between Surface Profile and Class of Blast
- The Pitfalls of Surface Profile
- Factors Which Have An Effect On Surface Profile

Reference Charts for Abrasive Size vs Profile

Measuring Surface Profile: Testex Tape Method

Surface Cleanliness: Subtle Contaminants

- Salt: causes, tests, prevention
- Oil/Grease: causes, tests, prevention
- Dust/Debris: causes, tests, prevention

Checking Compressed Air Quality

- Why Compressed Air Quality is Critical
- Contaminants to Check
- Recommended Check Intervals
- Test Procedure: Blotter Paper Method

Surface Preparation Grades Of Blast Cleaned Steel

Assessment of degree of removal of rust, mill scale and other visual contaminants (inspected without magnification)

IMPORTANT NOTE: Surface cleanliness is not a measure of surface profile – see the following pages for notes on surface profile

EXPLANATORY DETAILS

Rust Grade A

Steel with the millscale layer intact and very minor, or no rusting.

Rust Grade B

Steel with spreading surface rust, and the millscale commenced flaking.

Rust Grade C

Rusty Steel with the millscale layer flaked and loose, or lost, but only minor occurrence of pitting.

Rust Grade D

Very rusty steel with the millscale layer all rusted and extensive occurrence of pitting.

Blast Class 1 (SP-7/N4)

Very light, whip over blast clean with removal of loose surface contaminants.

Blast Class 2 (SP-6/N3)

Substantial blast clean with wide spread, visible contaminant removal and base metal colour appearing.

Blast Class 2 1/2 (SP-10/N2)

Intense blast clean leaving shaded grey metal with only tiny, isolated flecks or strips of visible contaminants.

Blast Class 3 (SP-5/N1)

Complete blast clean with consistent, metal colour all over and no visible contaminants.

NOTE: All blasting preparation grades must be free of oil, grease and dirt.

DISCLAIMER: The grades of rust and blast cleaned surfaces 'information', described and illustrated on these pages are a guide only and do not claim to be approved nor complying nor substitutable for or by any surface preparation standard. It is responsibility of the reader and/or users of this 'information' to separately determine and verify the specifications and/or methods and/or assessment of surface preparation as indicated or directed or required by or in any work specifications or standards. Blastmaster expressly disclaims any liability for the use or misuse of this 'information'.

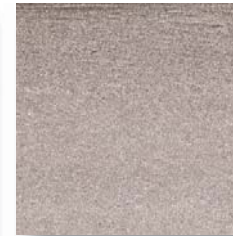
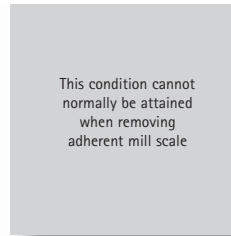
UNBLASTED

BLAST CLASS 1

BLAST CLASS 2

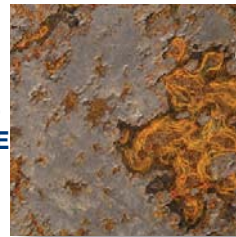
BLAST CLASS 2 1/2

BLAST CLASS 3



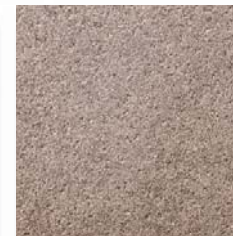
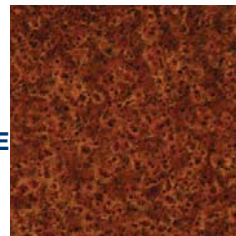
RUST GRADE A

RUST GRADE A



RUST GRADE B

RUST GRADE B



RUST GRADE C

RUST GRADE C



RUST GRADE D

RUST GRADE D

UNBLASTED

BLAST CLASS 1

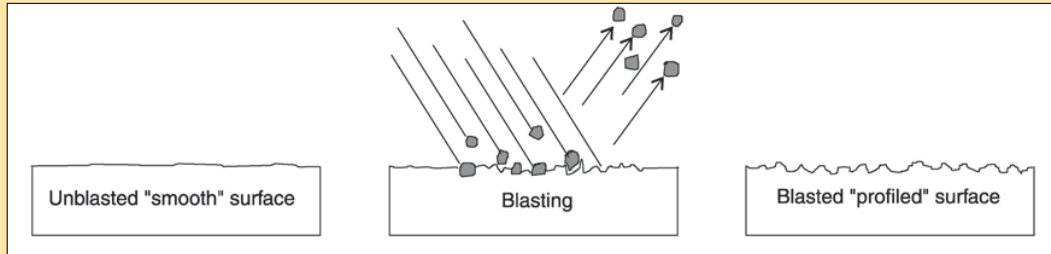
BLAST CLASS 2

BLAST CLASS 2 1/2

BLAST CLASS 3

Surface Profile - A Critical Element Of Surface Preparation

UNDERSTANDING SURFACE PROFILE



In the blast cleaning process, grains of abrasive are propelled with great force and energy at the work surface. Upon impact, the grains 'dig' into and then rebound out and off the surface leaving a rugged, miniature 'mountain - and - valley' finish.

This surface roughness/etch/texture is the surface profile.

Surface profile is critical to coating performance by

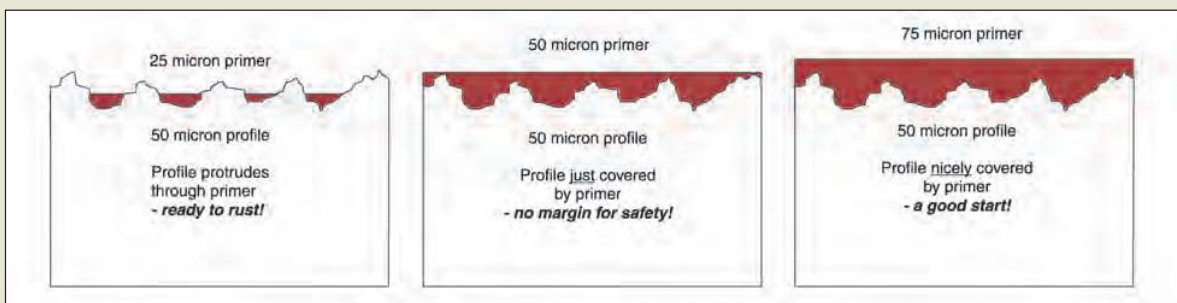
- 1) increasing the surface area
- 2) providing a 'key/tooth/anchor pattern' for the coating to lock and adhere to

THE DIFFERENCE BETWEEN SURFACE PROFILE AND CLASS OF BLAST

Surface profile is concerned with the 'shape' of the surface finish (and measuring the size of the 'shape' created) whereas Class of Blast is concerned with 'cleanliness' of the surface finish. (Putting it another way - Class of Blast is determining to what degree the rust, paint and other contaminants have been removed). Both the Profile and the Class of Blast are important features of the surface finish and need to be separately specified in preparing a blast cleaned steel surface.

THE PITFALLS OF SURFACE PROFILE

Excess Profile - While an absence of profile can be detrimental to coating adhesion, it can be equally disastrous to have an excessive profile height causing premature rusting and coating failure. In addition more profile means using more paint to cover the surface! Consider these cases...



Rule of Thumb #1 : Profile height should not exceed the primer coat DFT.

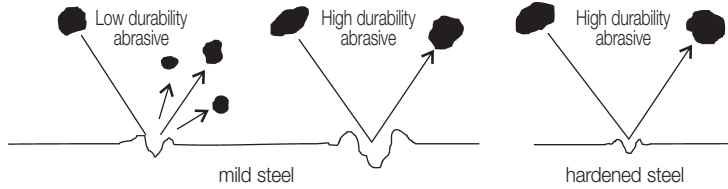
Rule of Thumb #2 : Profile height should not exceed 1/3 the total coating system DFT.

Embedment - Embedment of abrasive particles in the surface is a threat posed by friable, irregular shape abrasives. The embedded particle or fragment can stand out as a 'rogue' peak above the surrounding profile and protrude through the applied coating.

Surface Profile - A Critical Element Of Surface Preparation

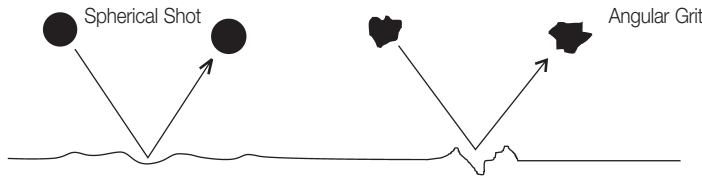
FACTORS WHICH HAVE AN EFFECT ON SURFACE PROFILE

Abrasive Durability - Surface Hardness eg. Bicarb media vs Alox, Mild Steel vs Hardened Steel



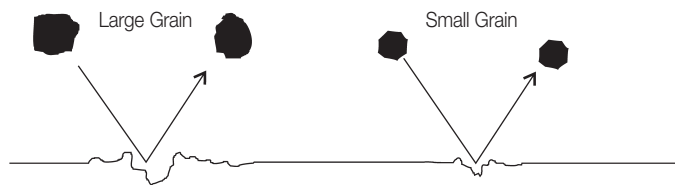
Variable	Effect
More durable abrasive	= deeper profile
Less durable abrasive	= shallower profile
Hardened steel	= shallower profile
Mild steel	= deeper profile

Abrasive Shape eg. Steel Shot vs Steel Grit



Round abrasive	= dimpled, peened profile
Angular abrasive	= sharper, rugged profile

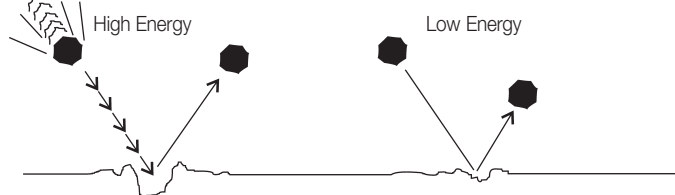
Abrasive Size eg. #20/40 Garnet vs 80# Garnet



Larger abrasive	= deeper profile
Smaller abrasive	= shallower profile

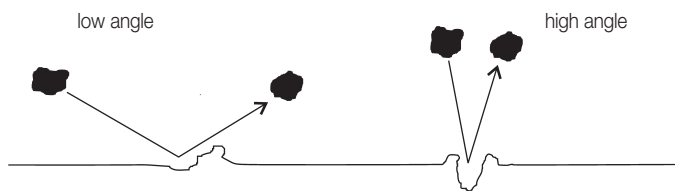
see charts on next page for further details

Impact Energy eg. Nozzle pressure (abrasive velocity), nozzle wear, nozzle standoff distance, dwell time



Greater energy	= deeper profile
Lesser energy	= shallower profile

Impact Angle eg. Straight on blasting vs side reach blasting



Low angle	= more scuffed profile
High angle	= more peak 'n' valley even profile

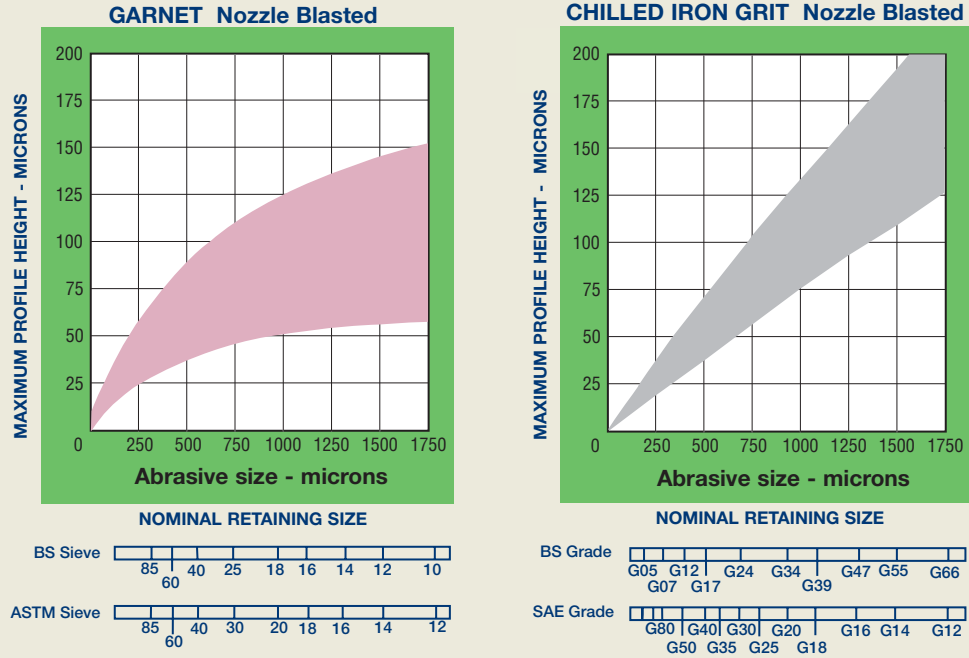
Embedment eg. Slag vs Garnet



Large friable, irregular grains	= higher risk of embedment
Smaller durable regular grains	= lower risk of embedment

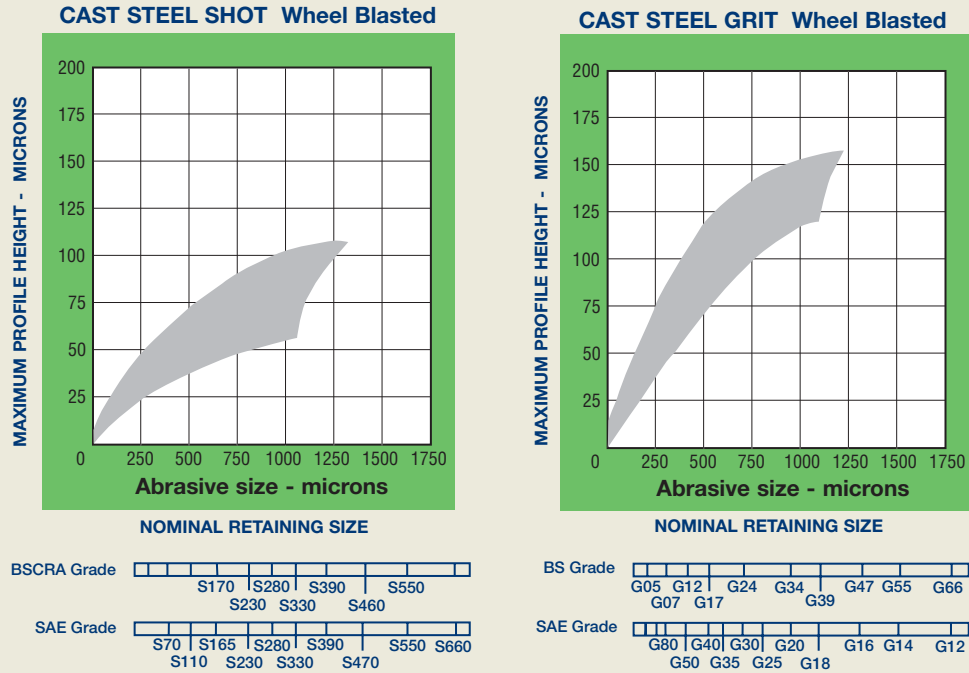
Abrasive Size vs Profile

NOZZLE BLASTED ABRASIVES



Plot of maximum profile height and nominal retaining size for nozzle blasted abrasives
 Note: See previous page for other factors that affect surface profile.

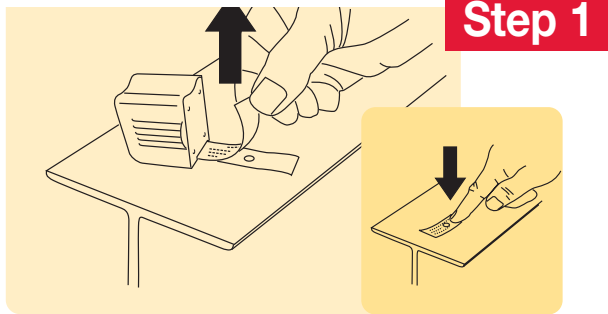
AIRLESS WHEEL BLASTED ABRASIVES



Plot of maximum profile height and nominal retaining size for airless wheel blasted abrasives
 Note: See previous page for other factors that affect surface profile.

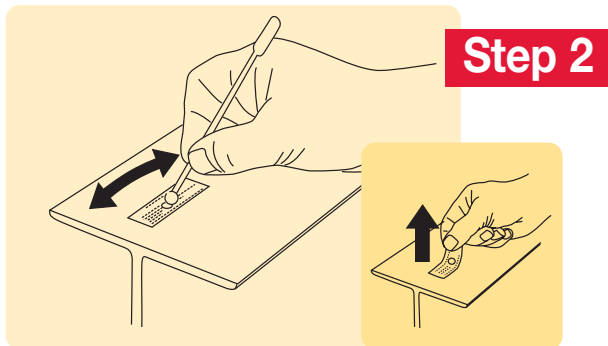
Measuring Surface Profile

USING THE REPLICA TAPE METHOD TO MEASURE AVERAGE MAXIMUM PEAK-TO-VALLEY PROFILE HEIGHT (Rz)



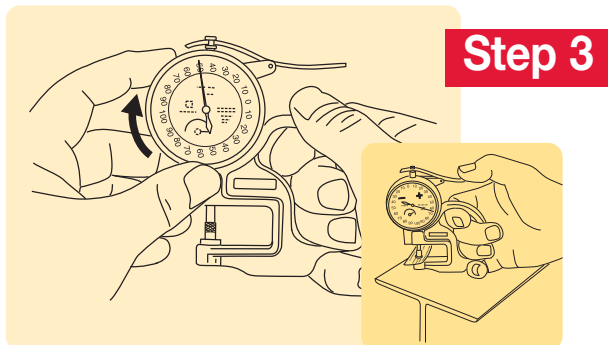
Test Preparation

- Select a representative test site free of dust, dirt and pitting.
- Choose the appropriate grade of Testex tape – refer to Inspection Instruments page 187 for details of the various scale measurement ranges.
- Peel a test tape strip from the roll – a 'bullseye' marker dot will remain on the slip paper.
- Apply the tape to the test surface – rub over the tape with a finger to ensure it is firmly adhered.



Perform the Test

- Using moderate to firm pressure, rub the test window with the round-tip burnishing tool - refer page 187.
- Take care not to dislodge the test tape (caused by bumping the tool against the edge of the circular cutout window).
- Burnish the test window until it has uniformly darkened – the colour indicates the profile has been impressed into the test tape.
- Peel the test tape strip from the surface.



Measuring the Test Result

- Use a dial thickness gauge with the correct specifications (ie accuracy, anvil spring pressure and anvil size) for replica tape – refer to Inspection Instruments page 187.
- Clean the anvils and check/adjust the zero point.
- After cleaning and checking the gauge zero point, adjust the dial to minus 50 microns (this compensates for the thickness of the tape carrier film and allows the profile measurement to be read directly from the gauge).
- Centre the test tape between the anvils, gently allow the anvils to close on the tape, and note the reading on the dial.
- Take several readings to establish accuracy. (Reposition the tape in the anvils between each reading.)

SOURCES OF ERROR

There are four major sources of error in determining the profile of a blast cleaned surface, which can be minimised with the following suggestions.

- 1. Inherent Profile Variation in the surface** – perform at least 3 tests per 10 square metres of area.
- 2. Contaminant particles in the anvils or tape** – select a clean surface; clean and check the anvils; examine the test tape; double check any questionable readings. To indicate the size significance of seemingly tiny contaminants, please note that human hair is approx. 50 microns thick.
- 3. Improper Gauge** – a good gauge has an accuracy of ± 5 micron, closing force of 1.5N and at least one anvil 0.25" (6.3mm) diameter.
- 4. Deficient Impressing Technique** – use a profile training tool to verify the burnishing technique is correct. See page 187.

DISCLAIMER: Whilst replica tape is recognised by AS1627.4, AS3894.5, ISO8503.5 and other standards, the above information and procedure does not nor shall not be taken as representing (nor intending) to be the approved nor the complying nor the standard method nor procedure for the use of replica tape. It is the responsibility of the reader and/or users of this information to separately determine and verify the correct method and procedure of use as directed or indicated in any work specifications or standards. Blastmaster expressly disclaims any liability for the use or misuse of the above information and procedure.

Other Surface Cleanliness Factors

SUBTLE CONTAMINANTS – causes, tests and prevention

In addition to the obvious gross surface contaminants such as rust and old coatings, there are some subtle but serious contaminants which can cause major coating failure.

Salt (specifically chloride ions)

possible causes

- New steel
- contaminated abrasive
 - contaminated water (rinsing or pressure washing)

Existing steel

- both of the above, plus environmental industrial exposure, e.g. marine location or industrial process.

tests

many methods are available – including ChlorTest kits, Bresle patches, SCAT kits, conductivity meters – refer work specification and relevant AS/ISO standards.

prevention

- use a traceable quality, low salt abrasive, e.g. GMA Garnet
- test abrasive for chloride content
- test cleaning water for chloride content
- pretest existing structures for chloride presence prior to blasting
- rinse with clean water and/or a soluble salts remover e.g. Chlor-rid.

Dust/Debris

possible causes

- poor quality abrasive causing excessive dust and debris, e.g. crushed glass
- failure to blowoff surface completely after blasting

tests

- Clean Rag Wipe Test, Pressure Sensitive Tape Method – refer work specifications and relevant AS/ISO standard.

prevention

- use a low dust abrasive, e.g. GMA Garnet
- blowoff all surfaces after blasting.

DISCLAIMER: The above information is a guide only. It in no way purports nor represents to cover all factors, causes, tests or prevention of contaminants. It is the responsibility of the reader and/or users of the above information to separately determine and verify surface cleanliness methods and procedures as directed or indicated in any work specification or standards. Blastmaster expressly disclaims any liability for the use or misuse of the above information.

Oil/Grease (thin film)

possible causes

- New steel
- mill or warehousing or fabrication treatments
 - contaminated compressed air

Existing steel – the above, plus environmental exposure

tests

Water Break Test, UV Illumination Test – refer work specifications and appropriate AS/ISO standards.

prevention

- test and maintain compressed air quality
- pretest and/or preclean work prior to blasting by degreasing and/or rinsing.

Checking Compressed Air Quality

PRIOR TO BLASTING AND/OR BLOWING OFF THE WORK SURFACE

Why compressed air quality is critical

One of the key aims of blast cleaning is to remove surface contaminants, corrosion, old paint etc. to ensure the performance of the coating system.

The compressed air must be clean, otherwise the blasting will introduce fresh contaminants as fast as the old contaminants are removed!

Contaminants to check in the compressed air

- dirt
- oil (mist or droplets)
- moisture (mist or droplets)

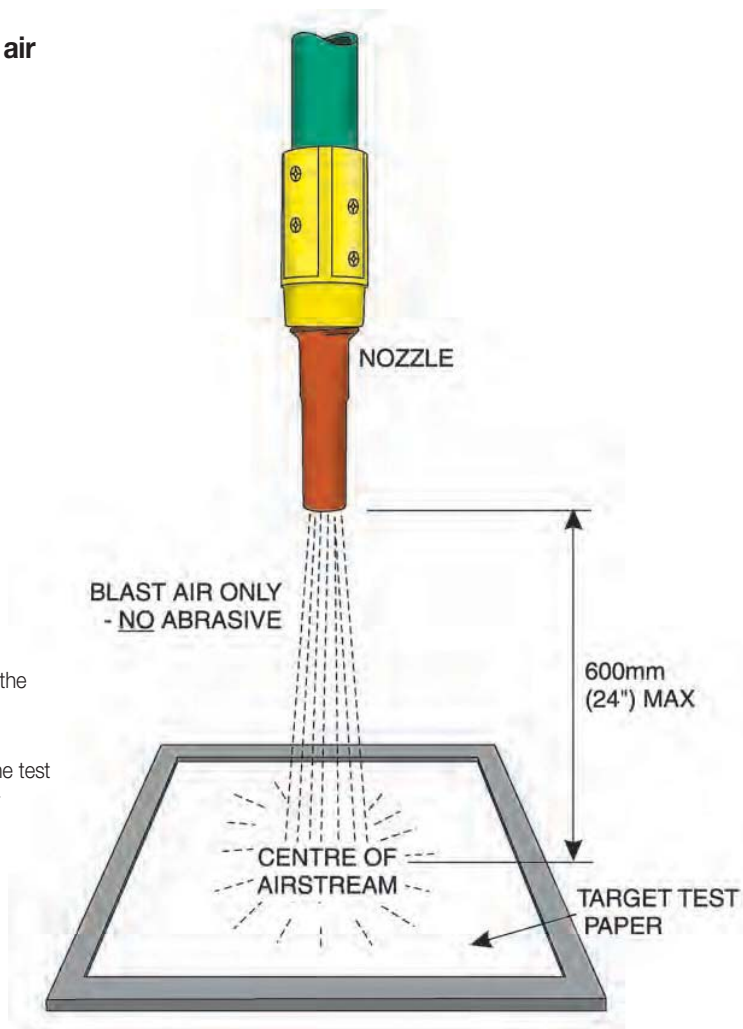
Each and all of these can cause coating failure!

Recommended check intervals

- Test before commencing blasting
- Every 4 hours when blasting continuously

Blotter Paper Method to check air quality

1. Start the compressor and set up the blast equipment
2. Secure the test paper apparatus
3. When the compressor is warmed up, start the blast equipment with **NO** abrasive in the airstream
4. Position the nozzle so the test paper is in the centre of the airstream and within 24" (600mm) of the nozzle
5. Sustain the test for 2 minutes continuously
6. After 2 minutes, stop the test and immediately check the test paper for any sign, feel or smell of oil, moisture or other contaminants.



DISCLAIMER: The above information and procedure does not nor shall not be taken as representing not intending to be an approved nor a complying nor a standard method nor procedure for testing compressed air quality. It is the responsibility of the reader and/or users of this information to separately determine and verify the correct method and procedure for testing compressed air quality as directed or required or indicated by any work specification or order or other standards. Blastmaster expressly disclaims any liability for the use or misuse of the above information and procedure.