AIRBLAST

CLIMATE CONTROL IN SURFACE PREPARATION AND FINISHING

Managing the climate in a state-of-the-art spray booth for the Omani Airforce

Designing facilities to operate consistently at target temperature and humidity

Climatic control is an exceptionally important variable to consider when regulating the environment for treating metallic surfaces – whether for surface preparation, or surface finishing.

Over the years, Airblast has perfected a sound technical approach to managing the internal environment of a blast or spray facility – delivering exceptional efficiency for processors.

What causes climate fluctuations inside a blast or spray facility?

External climatic conditions play a significant role in dictating the internal atmosphere (humidity and temperature) of the facility. For countries with especially harsh climates, there may only be a few months within a calendar year where surface preparation or finishing can take place without a well-integrated climate control system.

Why is it important to control internal climatic conditions?

Climatic conditions can deeply affect the material you are blasting or the coating system you are spraying. For instance, in the renewable energy sector, when blasting wind turbine steel before coating, exacting atmospheric and finishing standards must be met during the turbine's manufacturing process to prevent premature corrosion.

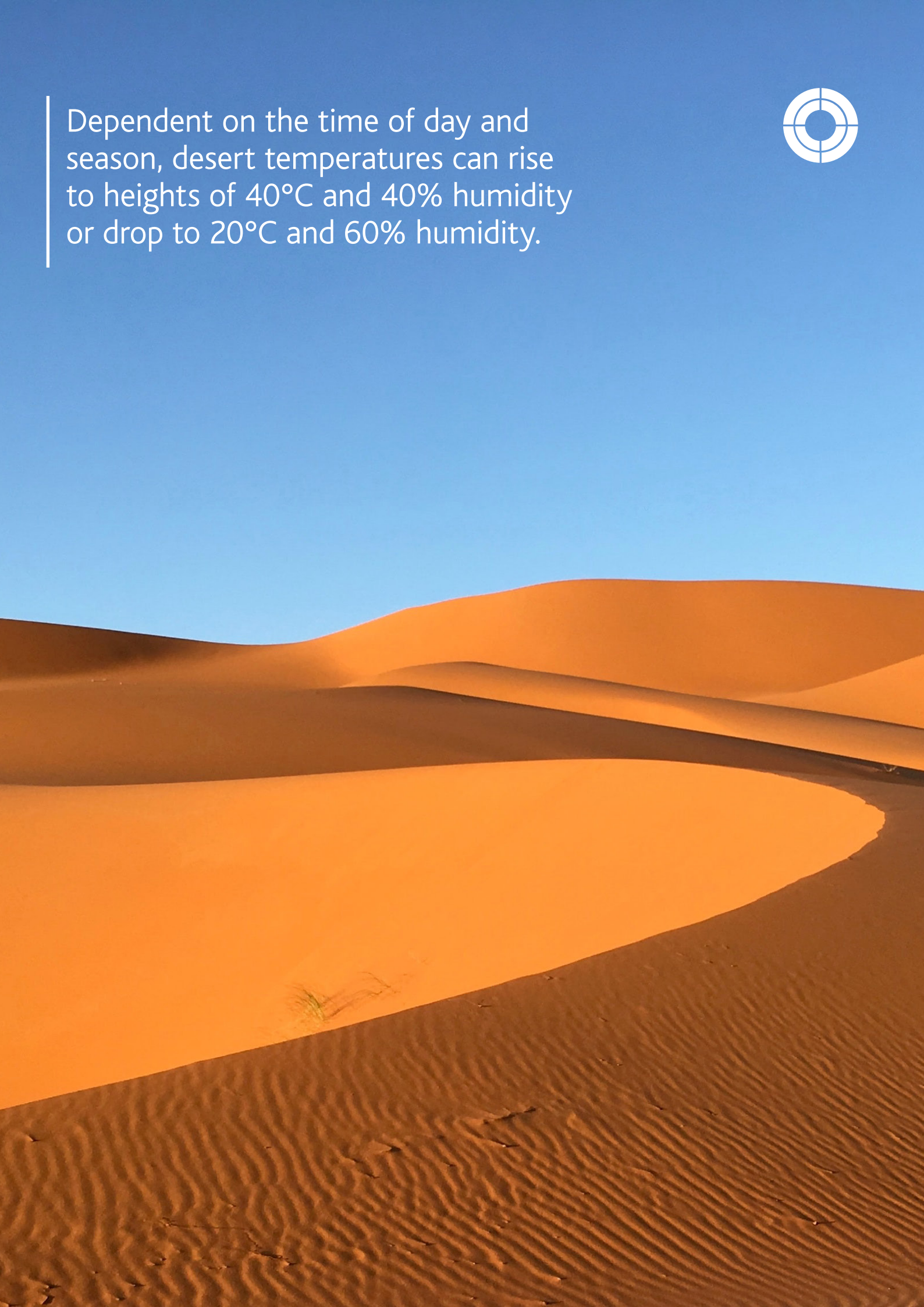
In this sector, the steel finish SP-5 or SA3 (as dictated by the abrasive blast cleaning standards SA and SSPC) must be achieved in order that high-performance coatings adhere evenly, enabling longer exposure to highly corrosive environments.

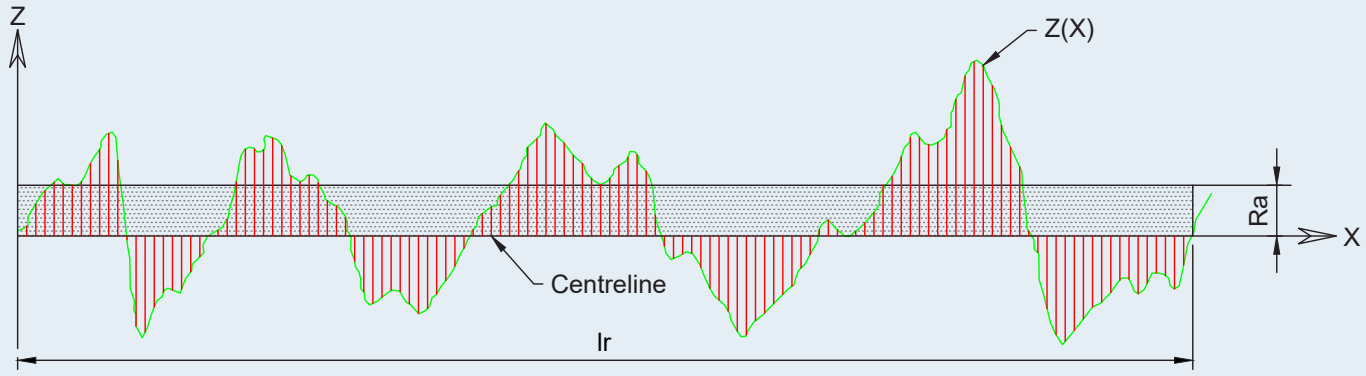
This grade of blasted steel is not only reserved for offshore turbines, but also applies to other sectors for whom this defined degree of steel surface finishing is critical to support material performance.

This includes nuclear reactors and submarines or where white metal is specified for steel serving under high temperatures, pressures and corrosive environments, and in cases where the catastrophic consequences of coating failure justify the procedure.

Steel Surface Finishing Standards.

Dependent on the time of day and season, desert temperatures can rise to heights of 40°C and 40% humidity or drop to 20°C and 60% humidity.

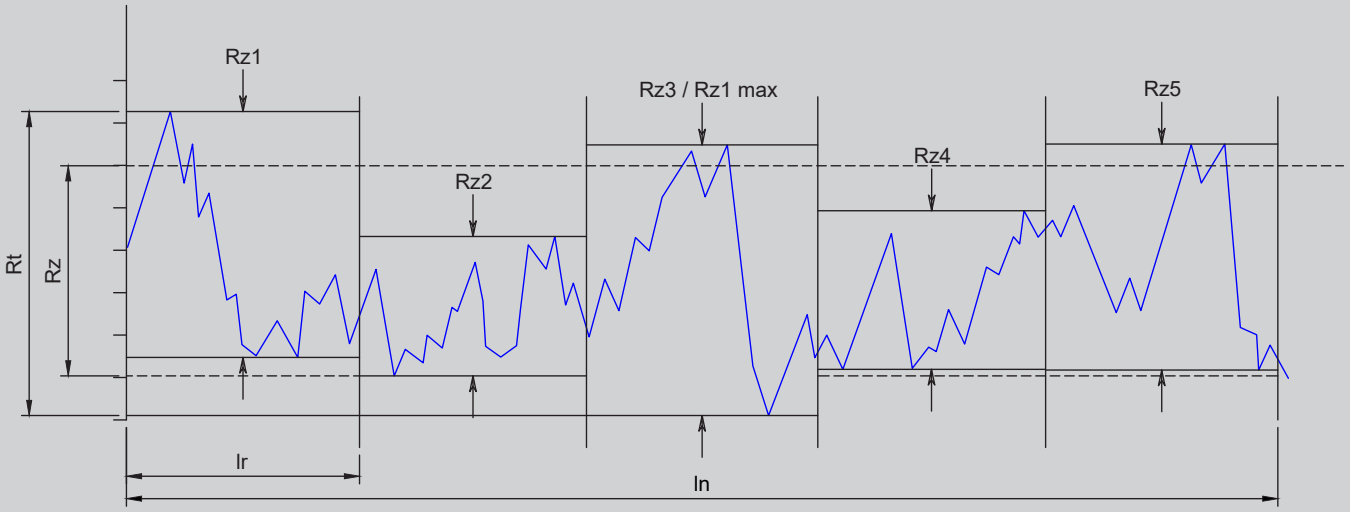




Ra = the arithmetical mean deviation of the assessed section profile.

The Ra is the arithmetic mean roughness value from the amounts of all profile values.

The Ra does not differentitate between peaks and valleys so therefor has a relatively weak information character.



In addition, for steel to be graded as SA3 or SP-5, it must be white with no observable shadows, streaks, or stains, and with no visible traces of oil, grease, oxides, or foreign matter present on the metal.

Moreover, for correct adhesion of high-performance coatings, the blasted steel must meet certain roughness parameters. Two factors make up the roughness parameter; Ra and Rz. The Ra is the average roughness of a surface, and the Rz figure represents the difference between the highest peaks and lowest troughs in the material's surface. Therefore, a coating can be applied to the steel if the middle of these two values is acceptable.

Even after achieving the correct SA finish and Ra & Rz values, steel is still at risk of "flash rusting" or gingering, if the humidity of the blast room is outside acceptable levels. This can potentially write off the product.

Controlling the humidity of surface preparation facility is therefore critical in:

- producing assets fully equipped to withstand their environments,
- preventing coating failure or waste through rusting,
- increasing the efficiency of the preparation process,
- preventing reaction in climate sensitive materials,
- preventing adhesion problems.

Even after achieving the correct SA finish and Ra & Rz values, steel is still at risk of “flash rusting”.

Offshore wind turbines have a service life of between 20-25 years, but due to the aggressive sea environment, corrosion poses a continuous maintenance challenge to overcome. Above and below the waterline and at the splash zone, structural steel is subjected to humidity with high salinity, wave action, storms, and UV light.

Compared with on-shore corrosivity, which is normally at C1*[1][2] and a thickness loss of 25-50 µm, the coatings used on offshore applications are rated at C5* and can provide a film thickness of more than 1000 µm.

***C1 through to C5 are corrosion protection standards set out by ISO. C1 being the lowest reserved for little to non-corrosive environments, C5 the highest level of protection in extremely corrosive environments.**

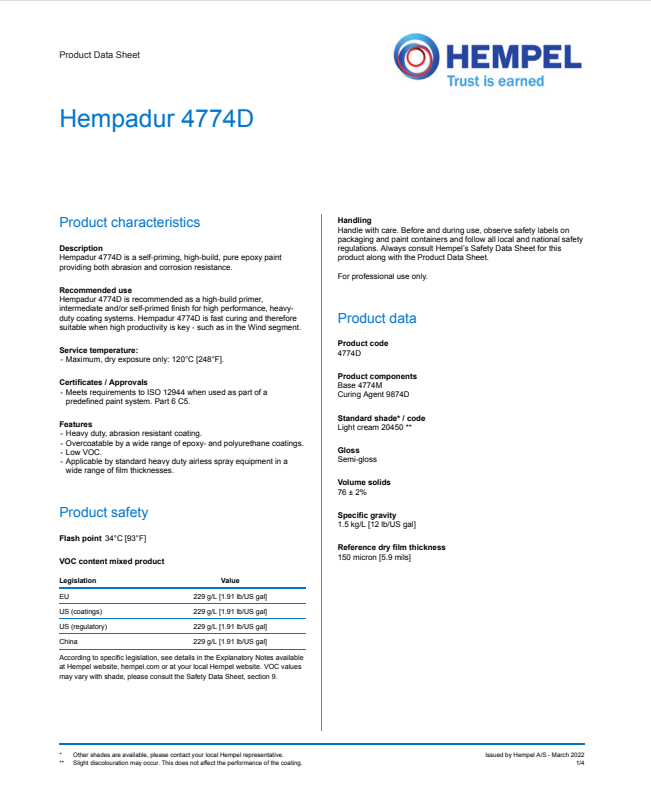
Understanding the coating process

Over the years, coatings for offshore wind turbines have become significantly more complex to prevent corrosion; however, these coatings require exacting climatic conditions to be applied inside a spray booth. Otherwise, they run the risk of curing prematurely.

High performance coating systems used by the offshore wind turbine sector include self priming, high-build, pure epoxy paints that provide advanced corrosion resistance. Many of these advanced paints however have a working life after spraying of only 20 minutes after application [in higher temperature environments (at 30°C)].

Having the ability to control the temperature and humidity inside the surface finishing facility therefore, can have a significant impact on the processing time and therefore impact production throughput.

Paint manufacturer chart outlinging 'pot' times at varying temperatures.



Product Data Sheet

HEMPEL
Trust is earned

Hempadur 4774D

Product characteristics

Description
Hempadur 4774D is a self-priming, high-build, pure epoxy paint providing both abrasion and corrosion resistance.

Recommended use
Hempadur 4774D is recommended as a high-build primer, intermediate and/or self-primed finish for high performance, heavy-duty coating systems. Hempadur 4774D is fast curing and therefore suitable when high productivity is key - such as in the Wind segment.

Service temperature:
- Maximum, dry exposure only: 120°C [248°F].

Certificates / Approvals
- Meets requirements to ISO 12944 when used as part of a predefined paint system. Part 6 C5.

Features
- Heavy duty, abrasion resistant coating.
- Overcoatable by a wide range of epoxy- and polyurethane coatings.
- Low VOC.
- Applicable by standard heavy duty airless spray equipment in a wide range of film thicknesses.

Product safety

Flash point 34°C [93°F]

VOC content mixed product

Legislation	Value
EU	229 g/L [1.91 lb/US gal]
US (coatings)	229 g/L [1.91 lb/US gal]
US (regulatory)	229 g/L [1.91 lb/US gal]
China	229 g/L [1.91 lb/US gal]

According to specific legislation, see details in the Explanatory Notes available at Hempel website, hempel.com or at your local Hempel website. VOC values may vary with shade, please consult the Safety Data Sheet, section 9.

Handling
Handle with care. Before and during use, observe safety labels on packaging and paint containers and follow all local and national safety regulations. Always consult Hempel's Safety Data Sheet for this product along with the Product Data Sheet.

For professional use only.

Product data

Product code
4774D

Product components
Base 4774M
Curing Agent 9874D

Standard shade* / code
Light cream 20450 **

Gloss
Semi-gloss

Volume solids
76 ± 2%

Specific gravity
1.5 kg/L [12 lb/US gal]

Reference dry film thickness
150 micron [5.9 mils]

* Other shades are available, please contact your local Hempel representative.
** Slight discolouration may occur. This does not affect the performance of the coating.

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How does Airblast ensure the internal climatic conditions of a blast or spray facility are strictly controlled?

Before ground work commences, we thoroughly monitor and analyse live psychrometric data at the installation site. This data gives us an insight into the typical seasonal climatic conditions of the facility's environment and, dependent on its temperature and humidity, determines how vigorous the climate control system will be.

To stabilise the internal conditions of a blast room or spray booth, we use a mix of automated monitoring equipment, chillers, insulation systems, condensers, and heaters.
As a result, we can actively raise and lower the internal temperature, humidity, or both, simultaneously.

As our climate changes and temperatures and humidity increase around the globe, there is sense in reviewing and monitoring the efficiency of your surface preparation and finishing facility.

We have much experience of these processes through several large installation projects in the Middle East. On each we have had to analyse psychrometric data and install complex climate management systems to compensate for the external climate – particularly challenging in this region as day and night time temperatures and humidity levels vary wildly.

The most notable of these is the Omani Airforce spray booth installation at Adam airforce base - where we manufactured and installed a high-specification spray booth to recoat aircraft components prone to operational wear (specifically for the Eurofighter Typhoon aircraft).

With low annual rainfall, Oman's climate is subtropical, humid, and very hot. Operating a spray booth in this environment is exceptionally difficult as even high-performance coatings can fail under these conditions.

Dependent on the time of day and season, desert temperatures can rise to heights of 40°C and 40% humidity or drop to 20°C and 60% humidity.

By analysing the psychrometric data of the desert base, we drew up the initial plan for the climate control system to automatically adjust the internal conditions of the spray booth to the exacting specifications of the coatings being applied. A complex system of chillers and condensers was installed to maintain a stable internal atmosphere for these coatings.

As our climate changes and temperatures and humidity increase around the globe, there is sense in reviewing and monitoring the efficiency of your surface preparation and finishing facility.

Airblast's climate-controlled surface preparation facility.

For organisations processing large assets, improved productivity in surface preparation and finishing is a key driver in minimising defects and improving processing time and output quality.

Airblast is a leading authority in the incorporation of advanced climate control systems in blast and paint facilities. If you would like to book a consultation with a member of our design engineer team, please get in touch, or find out more about our work designing and installing bespoke blast and spray facilities.

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[1] - steelconstruction.info. 2022. Standard corrosion protection systems for buildings. [online]
Available at: <https://www.steelconstruction.info/Standard_corrosion_protection_systems_for_buildings> [Accessed 23 June 2022].
[2] - Institute of Corrosion. 2022. Standards in Corrosion Protection | Institute of Corrosion. [online] Available at: <https://www.icorr.org/iso-12944-standards-corrosion-protections-part1/#:~:text=ISO%2012944%20is%20a%20globally,a%20second%20time%20in%202018.> [Accessed 23 June 2022].