

Surface One Thermal Spray Coating Machine

As the world's first coating machine, Oerlikon Metco's Surface One™ brings forth a fresh approach towards thermal spray application technology.

Surface One is a fully contained coating machine, yet modular and configurable in design allowing customers to tailor Surface One to their needs.

Surface One's advantages include:

- Up to three spray processes in one coating machine
- Up to four, single-hopper powder feeders that can be operated independently or simultaneously
- Compact footprint uses less of your valuable shop floor space
- Faster commissioning than comparable thermal spray systems, thereby reducing shop floor disruption
- Readily relocates in weeks instead of months, if needed
- Exceptional safety features protect personnel and equipment
- A cleaner, safer operating environment as a result of a more efficient air flow design
- Cabin door configuration that allows for part loading from the front or from overhead
- Our new Clarity™ user interface that significantly improves productivity and efficiency
- Reconfigurable, should your needs change
- More efficient part loading and unloading
- Ready for Industry 4.0 and IIoT



1 General Description

The Surface One coating machine consists of two main modules that contain all necessary components and sub-systems for a complete thermal spray coating machine:

- Coating Module
- Process Module

If desired, the coating module and process modules can be purchased separately. Please contact your Oerlikon Metco Account Manager for more information.

1.1 Coating Module

The Coating Module is comprised of:

- Clarity user interface
- Spray gun(s)
- Material Feeder(s): up to 4
- Robot for gun handling
- Turntable for part handling
- Venturi air lines for part cooling
- Part loading / unloading doors: from front or overhead
- Air intake vents
- Exhaust plenum and duct

1.2 Process Module

The Process Module is comprised of:

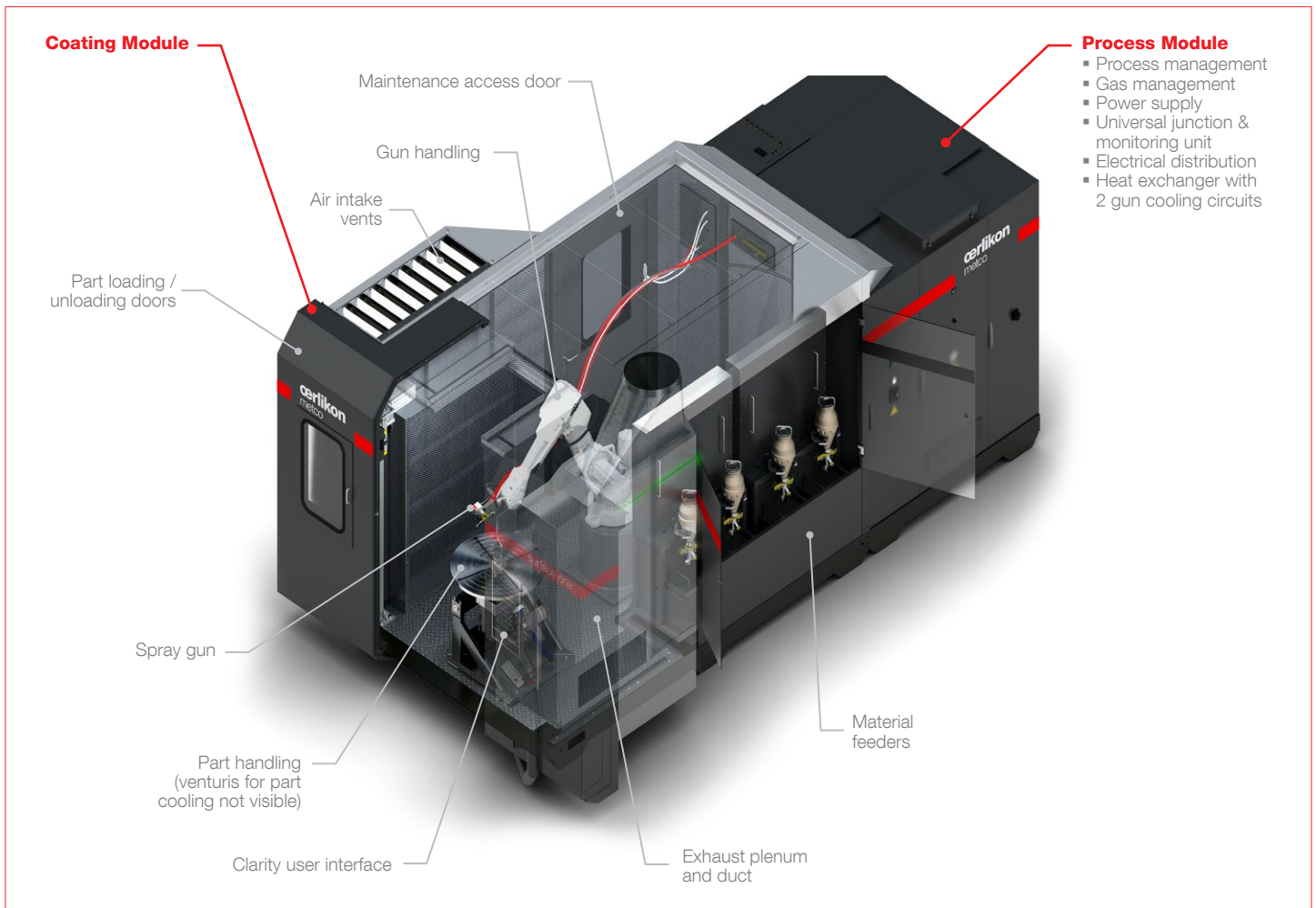
- Process Management
- Power supply
- Universal Junction & Monitoring Unit (Plasma spray only)
- Gas Management
- Electrical Distribution (customer supplies power to Surface One coating machine)
- Two gun-cooling water circuits
- Maintenance access door

1.3 Coating Processes





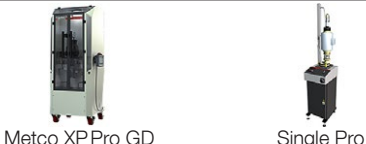
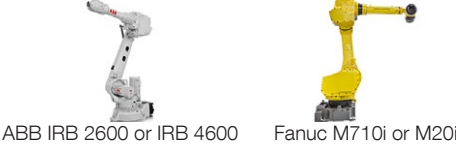





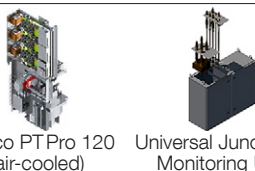
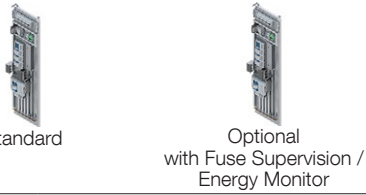

A single Surface One coating machine can be equipped with up to three thermal spray processes:

- Atmospheric Plasma Spray (required)
- Gas-Fuel HVOF
- Liquid-Fuel HVOF

Surface One coating machines ordered with less than three spray processes can be easily upgraded with additional spray processes or software functionality at a later time.



2 Customer Configurable Choices

		Atmospheric Plasma	Gas Fuel HVOF	Liquid Fuel HVOF
Coating Module	Clarity User Interface	 Single Monitor (standard) Dual Monitor (optional)		
	Spray Gun	 TriplexPro-210 SinplexPro F4MB-XL Metco 9MBM Metco 3MBM	 Diamond Jet 2600 Diamond Jet 2700	 WokaStar-610 WokaJet-410
	Material Feeders	 Metco XP Pro GD Single Pro		
	Gun Handling	 ABB IRB 2600 or IRB 4600 Fanuc M710i or M20i		
	Part Handling	 Robax 200	 Robax 1000	 Robax 1000-12S (12 station)
Process Module	Process Management	 Process Controller		
	Gas Management	 Gas Module		
	Power Supply, Universal Junction & Monitoring Unit	 Metco PT Pro 120 (air-cooled) Universal Junction & Monitoring Unit	---	---
	Electrical Distribution	 Standard Optional with Fuse Supervision / Energy Monitor		
Process Module	Heat Exchanger	 MC HE		

3 Coating Module

3.1 Clarity User Interface

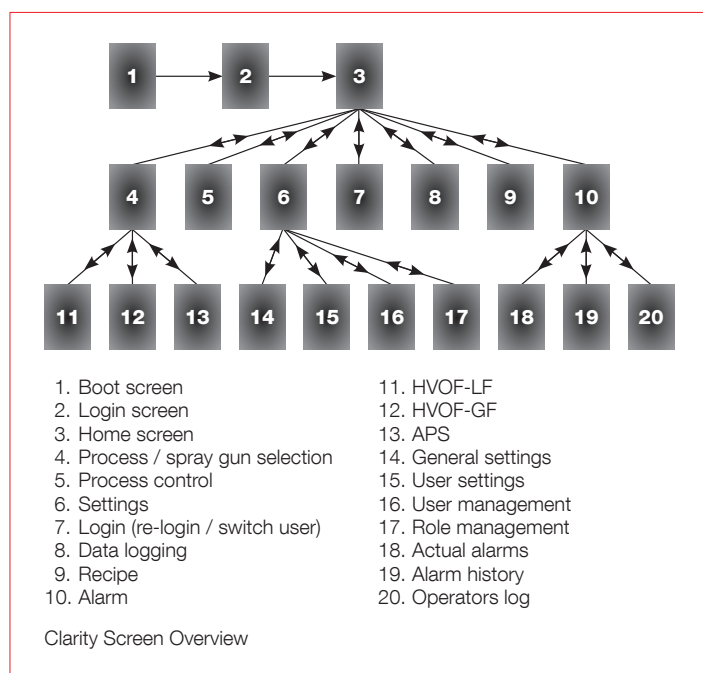


The Clarity User Interface simplifies your production process and enables an easier, faster and more efficient operation. Your company benefits from the intuitive, customizable user interface and integrated operator guidance that reduces learning curves and error potential.

The Clarity user interface is supplied standard with one 21-inch touchscreen, portrait-mode monitor or optionally with two 21-inch touchscreen, portrait-mode monitors, where the second monitor is available to display informational data such as live trending data, instruction manuals, alarm history, etc. An on-screen keyboard allows entry of alphanumeric values.

Clarity is your complete thermal spray data and control environment rather than an ordinary Human-Machine Interface. Clarity integrates your entire production line into an Industry 4.0 (IIoT) environment via Clarity's Production Manager.

Clarity guides the operator through the entire thermal spray process, using a well-structured and very logical on-screen presentation and interface.



3.1.1 Multi-Level Login and Security

Every aspect of Clarity is completely integrated for streamlined functionality and operation. This starts with the Multi-Level Login and Security features.

Clarity allows each user's permissions to be specifically defined based on your specific operational needs. These permissions can be securely stored and accessed using a

methodology that best suits your company's IT security protocols and infrastructure. You can choose to have users sign in via:

- On-screen keyboard
- RFID
- USB (available on request)

Credentials can be saved locally on the system via a local user database, or credentials can be managed via an external database such as Microsoft SQL or Active Directory (or other database systems on request), without the need to store credentials locally within the system. This flexible solution offers the following scenarios:

- **Dedicated server / dedicated database:** For each instance of Clarity, a dedicated server with a dedicated user database on the network.
- **Shared server / dedicated database:** A shared server using a dedicated per system database fully separates user information between systems.
- **Dedicated server / shared database:** This option simplifies user login on multiple systems, using a shared user database. Once a user is registered in the database, that user can login with the same credentials on all participating systems.

3.1.2 Home screen

The home screen guides the operator through the major functions of the Clarity user interface via a series of tiles. Tiles are color-coded to help guide the operator:

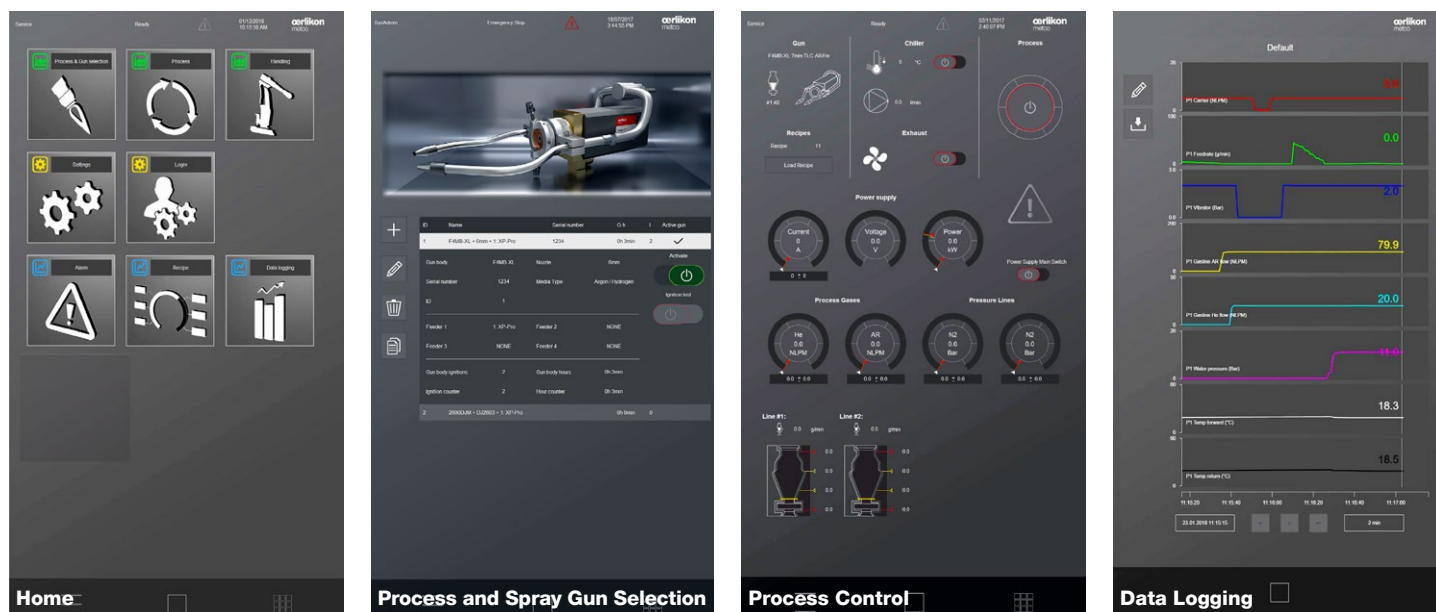
- Green: Processing functions
- Yellow: Clarity system functions
- Blue: Data and monitoring functions

3.1.3 Process and Spray Gun Selection

The Process and Spray Gun Selection screen allows the addition, editing or deletion of a specific thermal spray gun to the Surface One system by personnel with appropriate credentials. Each spray gun configuration is controlled by a unique system ID. Only activated spray guns can be used for spray processing and saved in parameter recipes.

Selection of a spray gun also prompts the user to activate the appropriate thermal spray process. Clarity first confirms that the appropriate spray process is installed on the system. If it is not, the user is alerted and the spray gun cannot be activated.

Once activated, the user can enter specific information for that spray gun, including serial number, powder feeders it may access. During use of that gun, Clarity tracks ignitions and running hours for the spray gun, to aid in maintenance and cost control.



3.1.4 Process Control

- Load a previously saved thermal spray recipe
- Start and stop the process
- Start and stop the chiller
- Start and stop the exhaust system
- Start, stop and monitor material feeders
- Open the alarm page
- Set parameter values, tolerances and limits
- Change process media (where appropriate)
- Change the display units (metric or U.S. Customary)

The settings shown on the process control screen will change based on the spray gun and process type chosen. Clarity will only show those items pertinent to that spray gun and process. In addition, the process screen will only indicate the number and type of powder feed lines available.

Slider bars are used to turn on and off items such as the chiller, exhaust and power supply. These display red when fully off, green when fully on, and yellow while turning on or off.

Powder line status is similarly shown. Visualized are the line identification, the actual feed rate, the feed rate range, the status of the feeder (hopper), feed rate status and indicators for carrier gas type and flow. Depending on the feeder technology being used, other settings and indicators are shown.

When Metco XP Pro feeders are used, the powder level is also tracked, where a low level will trigger a system shut down that must be rectified prior to restart.

3.1.5 Global and User Settings

- Alarm history retention
- The system default language in English or German (other languages on request)
- The default unit system (metric or U. S. Customary)
- The keyboard language
- Default tolerances
- Default limits
- System backup time and path
- Trend storage duration

- Language
- Keyboard language
- Unit system

3.1.6 User and Role Management

- User name
- User ID (generated automatically)
- Password
- Role

Roles are set up via the role management screen.

Companies can set up as many different roles as is needed for their security and operation.

Clarity allows for unprecedented granularity as to what various roles can or cannot do. Furthermore, roles can be later edited or deleted should needs change. Should an existing user's role be deleted from Clarity, that user will be locked out of the system until a new role is chosen for that user in the user management area.

3.1.7 Data Logging

Clarity allows for up to 10 configurable trend lines at any time, and up to 8 of those trend lines can be displayed on screen. Active trend lines sample at the rate of a data point every 500 ms.

Trend data can be customized by:

- Parameter data to be sampled
- Trending curve color
- Y-axis scale
- Displayed unit

The time scale (x-axis) for all trend lines can be instantaneously changed from as small as 1 minute up to 24 hours. Past values are easily viewed on screen using arrows, and the user can get back to the the current time at the touch of a button.

Trend data values are easily exported with time stamps making it simple to compare data by run, day, week or other time frame up to a month or the retention time interval set on the settings screen.

3.1.8 Recipe Screen

Up to 10000 thermal spray recipes can be saved in Clarity. Each criteria on screen, such as recipe name, process type and spray gun, makes it easy to find saved recipes.

Recipes can be created, edited or deleted from the recipe screen by users with appropriate credentials. In addition, a previously saved recipe is easily copied as the basis for a new recipe.

Clarity can import recipes from another Surface One system; however, Clarity will analyze and validate the imported recipe before it can be used. It provides a validation report with an action for each parameter. Recipes can also be exported for use on another Surface One system. Recipe values can be printed if a printer is configured for the system.

3.1.9 Alarms

With Clarity, responding to alarms is easier than ever before. Alarms are categorized as a warning or fatal event. A simple click on the alarm opens additional information. Alarm status

is also easier to track via a color-coded system:

- Red: Alarm is pending (operator has not yet confirmed)
- Yellow: Alarm has been confirmed by the operator. It will be removed automatically upon resolution of the condition that triggered the alarm.
- Green: Triggering condition that caused the alarm is no longer pending and will be removed automatically when confirmed by the operator.

Alarms can be filtered by type (warning or fatal) and status.

All alarms are retained in the alarm history for a period of up to 30 days. Historical alarms can be exported.

3.1.10 Operators Log

A log file is maintained of all users who have logged into the system for a maximum of 6 months. An audit trail of user actions can be turned on or off. If on, the audit trail is saved permanently within the system.

Both the log file and the audit trail can be exported, if desired.

3.2 Thermal Spray Guns



The Surface One coating machine is capable of operating Oerlikon Metco's most popular machine-mounted thermal spray guns, dependent on the thermal spray processes installed.

When a Surface One spray recipe is developed, the spray gun chosen is integrated into the recipe. The Clarity user interface intelligently sets operating limits for the installed spray gun.

In addition, Clarity will only allow the recipe to be developed and the system to operate with the installed and operational process gases appropriate for the spray process and the spray gun (see Section 2.5).

Clarity's preventative maintenance capability provides information on when a spray gun's consumable and wear parts should be replaced. Thus, quality and process control can be accurately predicted over time and spray gun consumable and wear part life can be more accurately included as part of the job costs.

Surface One coating machines include air lines for silvent air knives, air jets and venturis for part cooling, and two gun-cooling circuits (see Section 4.5 Heat Exchanger).

For more information on the thermal spray guns that can be used with Surface One, please refer to the data sheet specified in the following table:

Spray Gun Model	Data Sheet
Atmospheric Plasma Spray	
TriplexPro-210	DSE-0062
SinplexPro series	DSE-0061
F4MB-XL series	DSE-0035
Metco 9MBM	DSE-0019
Metco 3MBM	DSE-0007
Gas-Fuel HVOF	
Diamond Jet 2600	DSE-0026
Diamond Jet 2700	DSE-0026
Liquid Fuel HVOF	
WokaStar-610	DSE-0068
WokaJet-410	DSE-0067

All other Oerlikon Metco APS and HVOF machine-mount spray guns can be incorporated into a Surface One system and are available upon request. Please contact your Oerlikon Metco Sales Representative for more information.

3.3 Material Feeders



Surface One accommodates up to four powder feeders, which can be operated simultaneously or independently.

The use of an OPC UA communication protocol allows powder feeders to be seamlessly "plug and play" integrates into the Surface One system. OPC UA aids in fault identification, thereby increasing up time, and aids data analysis for Industry 4.0 (IIoT).

All feeder settings and functionality are available through Clarity. Feeder choice, carrier gas and feed parameters are integrated into the recipe. Clarity intelligently recognizes the feeder model(s) installed and sets operating limits accordingly.

All powder feeders for Surface One are factory-equipped for use with atmospheric plasma spray, gas-fuel HVOF and liquid-fuel HVOF without the need to change hardware. Specialized feeder cabinet configurations are used for integration into the Surface One coating machine.

Powder feeders available for use with Surface One are:

3.3.1 Metco XPPro Series Intelligent Feeders

Metco XPPro feeders are equipped with state-of-the-art intelligence. All Metco XPPro feeders have gravimetric feed-rate control capability.

Customers will appreciate new features that include:

- Powder level and powder out indicators
- On Board leak check

- Sophisticated feeding diagnostics and traceability records
- Closed loop carrier gas designed for optimum stability

The currently available model of the Metco XPPro powder feeder is the Metco XPPro GD, which offers well-proven disk feeding technology.

3.3.2 Single Pro Feeder

This feeder offers volumetric (disk) operation with exchangeable hoppers for various processes. Hoppers are equipped with an RFID chip that ensures the correct hopper is used. Digital mass flow for the carrier gas allows up to 20 l/min (45.7 ft³/h) of argon or nitrogen with the option to purchase an additional mass flow controller that allows high carrier gas flows up to 50 l/min (114.1 ft³/h).

For more information on these feeders, please refer to the data sheet specified in the following table:

Material Feeder Model	Data Sheet
Metco XPPro	DSE-0101
Single Pro	DSE-0108

3.4 Gun Handling



Customers can choose between the ABB IRB 2600, ABB IRB 4600, Fanuc M710i or Fanuc M20i robot for gun handling. Other robots or gun manipulation systems may be considered on request.

3.5 Part Handling



Customers can choose from Oerlikon Metco's Robax family of turntables on their Surface One coating machine to handle parts up to a diameter of 1200 mm (47.25 in) and a height of 800 mm (31.5 in). Robax turntables are designed to operate with well-known robotic brands, including ABB and Fanuc. Drive mechanisms for the turntable will be chosen by Oerlikon Metco's System Engineering based on the robot chosen for the Surface One.

Customers also have a choice of face plate sizes and design. For more information on the Robax family of turntables, please refer to the data sheets specified in the following table.

Turntable Model	Data Sheet
Robax-200	DSE-0099
Robax-1000 series	DSE-0048

Other part handling systems may be available upon request.

4 Process Module

4.1 Process Management



Process management is compactly arranged within Surface One, which can house functionality for up to three thermal spray processes.

A separate hardware module is used for each thermal spray process. This flexibility and modularity allows for very easy maintenance and calibration. A new process is quickly and easily installed into an existing Surface One coating machine.

Each process management module bi-directionally communicates with the Clarity user interface where process functions are visually displayed and controlled by the operator. Industry 4.0 (IIoT) functionality using the OPC UA protocol allows the system to be accessible via the customer's production and data networks.

Process management is equipped with an uninterruptible power supply (UPS). This allows the system to be safely shut down and recipes saved. In addition, a gas warning module can process up to eight gas safety sensors.

4.2 Gas Management



Gas management is accomplished, using modular plates, where each plate has the gas control functionality for a single thermal spray process.

The very modular design allows a new gas line, or even an entire gas plate, to be easily added to or replaced in an existing system.

Previously, some gases required two mass flow controllers to accurately operate at the very low or very high gas flows needed for thermal spray processing. Now, Surface One employs a single, state-of-the-art, dual-curve mass flow controller that accurately operates at all gas flow ranges. This more efficient design reduces hardware duplication and inventory costs.

Please refer to the table, "Gas Configuration Choices" for available customer-specified gas options for a Surface One coating machine.

4.3 Power Supply



Surface One employs the air-cooled Metco PTPro 120 power supply for atmospheric plasma spray operations. This power supply employs advanced technology for superb process stability that results in excellent coating reproducibility.

The power supply is standard for use with all compatible atmospheric plasma spray guns, including single- and triple-cathode cascading arc spray guns. Please see data sheet DSE-0106 for more information.

Gas Configuration Choices

Option	Gases	Maximum Flow	
Atmospheric Plasma Spray			
1 ^b	Ar ^c	200 nlpm	456.6 scfh
	H ₂	20 nlpm	45.7 scfh
2	Ar ^c	200 nlpm	456.6 scfh
	H ₂	20 nlpm	45.7 scfh
	N ₂	100 nlpm	228.3 scfh
3	Ar ^c	200 nlpm	456.6 scfh
	H ₂	20 nlpm	45.7 scfh
	N ₂	100 nlpm	228.3 scfh
	He	50 nlpm	114.1 scfh
4	Ar ^c	200 nlpm	456.6 scfh
	H ₂	20 nlpm	45.7 scfh
	N ₂	100 nlpm	228.3 scfh
	He	200 nlpm	456.6 scfh
Gas-Fuel HVOF			
6	H ₂ ^d	800 nlpm	1826.4 scfh
	O ₂	400 nlpm	913.2 scfh
	Air and N ₂ ^e	600 nlpm	1369.8 scfh
7	CH ₄ / Natural Gas ^d	250 nlpm	570.7 scfh
	O ₂	400 nlpm	913.2 scfh
	Air and N ₂ ^e	600 nlpm	1369.8 scfh
	H ₂ ^f	80 nlpm	182.6 scfh
Liquid-Fuel HVOF			
8	O ₂	1100 nlpm	2511.3 scfh
	Kerosene ^g	30 l/h	7.9 gal/h
Auxiliary Gases (standard)			
Air ^h	Air	6 bar	87 psi
Carrier gases	Ar and N ₂ ^e		

^a All Surface One machines come with atmospheric plasma spray installed

^b Required minimum for all Surface One machines

^c Employs a single, dual-curve mass flow controller (see explanation in Section 4.2 Gas Management)

^d Fuel gas

^e Switchable

^f Required for ignition

^g At 12 bar (175 psi)

^h On/off pressure or flow control for air jets, silvent air knives and venturis

4.4 Universal Junction & Monitoring Unit



The new, state-of-the-art Universal Junction & Monitoring Unit replaces the previous JAMBox. One Junction & Monitoring Unit accommodates all Oerlikon Metco plasma spray guns that can be used with Surface One, including both single cathode and triple cathode guns.

The Universal Junction & Monitoring Unit is only required for plasma spray processes; it is not required for HVOF processes.

4.5 Electrical Distribution



The electrical distribution system within the Surface One monitors and controls the distribution of all electrical requirements for the coating machine.

Surface One includes an external voltage supply for the booth operational lighting, that is functional even when the main power switch for the machine is off.

4.4.1 Optional Equipment

Customers can optionally choose to have the Surface One electrical distribution equipped with the Fuse Supervision and Energy Monitor package.

- **Fuse Supervision:** Supervises three-phase fuses for high-power consuming components and sub-systems, such as the dust collector, water chiller or power supply. Should a fuse fail, its location can be identified via the Clarity user interface, reducing downtime as faster fuse replacement can occur. Relevant data can also be sent over the customer's Industry 4.0 (IIoT) network.
- **Energy Monitor:** Monitors the complete electrical consumption of the system. This information is communicat-

ed to the Clarity user interface where it can be viewed by the operator and stored for off-line use using Clarity's trending and reporting features. The information is also accessible via the customer's data network or through the customer's Industry 4.0 (IIoT) network.

4.5 Heat Exchanger



Surface One is equipped with a highly efficient MC HE heat exchanger, which provides two gun water cooling circuits to accommodate atmospheric plasma spray and water-cooled HVOF spray guns.

Please refer to data sheet DSE-0053 for more information.

Note: Customers requiring additional gun cooling should choose an appropriate water chiller or plant-supplied chilled water. If a water chiller will be used, Oerlikon Metco recommends our Metco MC series chillers. Please refer to data sheet DSE-0086 for additional information.

5 Features and Benefits

Efficient

- Requires less shop floor space than comparable systems
- Installs faster than comparable systems, reducing disruption to your operations
- Advanced Clarity user interface guides operators through the thermal spray process, reducing time and training
- Customizable Clarity screens allows you to focus on process steps important to you
- If necessary, easily move a Surface One coating machine to another place in your facility or to a different facility
- Optimized door configuration for loading and unloading of parts from the front or from overhead
- Improved trending and reporting system is easier to use and provides more information

Effective

- Customer choices for spray guns, handling equipment and powder feed technology allows you to configure Surface One for your specific needs
- Advanced thermal spray processing ready for Industry 4.0 (IIoT)
- New 'plug and play' structure makes adding additional processes or powder feeders simple and quick
- Use up to 4 powder feeders individually or simultaneously
- Powder feeders are equipped to handle all Surface One spray processes, without the need to reconfigure the feeder or change feeders

- Reliably and repeatably apply thermal spray coatings using up to 3 different spray processes using the same coating machine
- Role and user security system is easy to customize to your company's security policies and operating standards
- Customizable parameter tolerances allows you to set up recipes that are more suitable for your applications

Economical

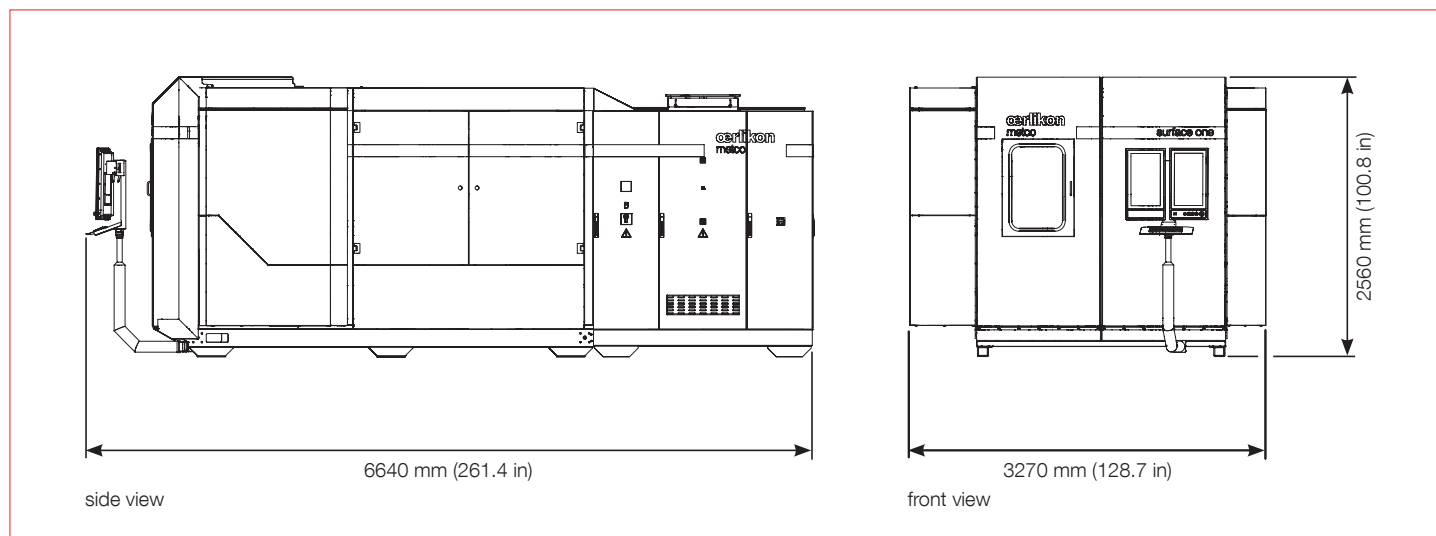
- Reduced footprint allows you to do more with your floorspace
- Improved user interface reduces navigation, thereby reducing processing time and learning curves
- Maintenance data helps prompt when spare parts and rebuilds are required, reducing guesswork and saving on spare part costs

Environmental

- Designed and built to the latest safety standards
- Optimized cabin air flow reduces dust and overspray
- Sophisticated warning and alarm system with easy to understand messaging
- User interface intelligently monitors system configuration for safer operating conditions
- Built-in cabin lighting shows machine operating status
- Acoustical protection up to 75 dBA

6 Technical Data

6.1 Dimensions



6.2 Specifications ^a

Power Requirements

Input Voltage	3Φ	200 V, 400 V 440 V 460 V, 480 V or 570 V
Frequency		50 / 60 Hz
Current	max	580 A

Cabinet Protection Ratings

Electrical Enclosures	IP 54
Gas Enclosures	IP 43

Environment

Temperature	10 to 40 °C	50 to 104 °F
Humidity	< 75%, non-condensing	
Floor Bearing Load Capacity	min	1000 kg/m ² 205 lb/ft ²
Noise Level	max (APS)	75 dBA @ 1 m 75 dBA @ 3.3 ft

Process Media Purity ^b

Argon	Ar	99.998 %
Nitrogen	N ₂	99.999 %
Hydrogen	H ₂	99.998 %
Helium	He	99.998 %
Oxygen	O ₂	99.9 %
Methane / Natural Gas	CH ₄	96 %
Kerosene		99.9 %

Air Requirements

Dust Allowance	particle size	< 0.1 μm	< 4 μm
	max	0.1 mg/m ³	6.2 E-09 lb/ft ³
Oil	max	0.01 mg/m ³	6.2 E-10 lb/ft ³

Water Quality

Conductivity	< 5 μS·cm ⁻¹
Hardness CaCO ₃	< 50 ppm
pH	6.6

^a See component data sheets for further specification

^b Required gases dependent on spray processes and customer gas configuration(s) chosen. Refer to table in section 4.2 for configurations and maximum gas flows.

Information is subject to change without prior notice.