

# Metallisation

Thermal spray equipment and consumables



## Equipment Specification

Met-PCC(HVOF-L) Liquid Fuel HVOF System

Met-PCC(HVOF-G) Gas Fuel HVOF System

## INTRODUCTION

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The following specification covers the standard range of the Met-PCC(HVOF) systems. For the specific offer, please refer to the attached quotation and cross-reference the part numbers for each piece of equipment.

The Metallisation Met-PCC(HVOF) system is the latest development to our range of liquid or gas fuelled High Velocity Oxygen Fuel (HVOF) systems.

The Met-PCC(HVOF) system applies all of the simple control / operator interface features of our previous HVOF and Plasma systems. The '-L' version can be interfaced with our own MET-JET4L pistol and/or other non-Metallisation liquid fuel pistols. The '-G' version can be interfaced to a range of non-Metallisation gas fuelled HVOF pistols.

The Met-PCC(HVOF) system has re-packaged the control elements and utilised the latest technology to optimise functionality and reliability. At the front end, the operator interface utilises an intuitive Graphical User Interface (GUI), including the option to integrate video images into the display. The interface runs on a familiar touchscreen Windows PC platform with Intel Dual Atom processor which is great for usability, integration and communication. Behind the scenes, the latest PLC runs the system with communication between devices via the reliable Ethernet protocol.

As you would expect from a system of this standard, the gases/fluids are all mass-flow controlled for optimum repeatability of coatings. All spray parameters can have real-time trending on the system.

The result is a truly unique, compact design, flexible, easy to operate HVOF system, backed up by Metallisation's 90 year+ industry experience and support.

**Safety:** The equipment quoted will produce levels of noise and dust that will require safety measures to be taken by those using the equipment. It will use pressurised and flammable gases including a liquid fuel such as kerosene. Careful consideration should also be given to the positioning of this equipment. It is the responsibility of the user to ensure that all appropriate measures are taken to ensure safe operation in accordance with local requirements. Metallisation will be pleased to advise as appropriate.

### BENEFITS

- ✚ Mass flow control of oxygen and carrier gas = repeatability.
- ✚ Easy to use, intuitive operator interface.
- ✚ PC control with touch screen operator interface.
- ✚ Optional keyboard control or operator interface unit.
- ✚ Unlimited recipes and parameter recording.
- ✚ Manual or fully sequenced start-up, operation and shut-down.
- ✚ Liquid fuel = thick, low stressed coatings.
- ✚ High hardness, low oxide level coatings.
- ✚ High bond strength and low porosity coatings.
- ✚ Safety interlocks to prevent running without coolant and gases.
- ✚ Other powder feeders can be interfaced.

## PISTOLS

Part No.	Description
<b>JET4L-100</b>	<b>MET-JET 4L liquid fuel pistol with 100mm nozzle</b>

Non-Metallisation pistols can also be used with the Met-PCC(HVOF) control system. See next page for more details.



### TECHNICAL OVERVIEW:

- ✦ Optimised, single point fuel injection system to promote a complete, clean burn within the combustion chamber.
- ✦ Two nozzle lengths available, 100mm and 200mm enable a wide range of coating properties to be achieved from hard but ductile coatings to extremely hard but more brittle coatings.
- ✦ Very simple nozzle design reduces consumable spares costs.
- ✦ Simple pistol maintenance for reduced downtime when changing consumables.
- ✦ Steel powder feed tubes for reliable operation – do not melt in operation.
- ✦ Robust chamber pressure transducer provides accurate feedback directly from the chamber.
- ✦ Sturdy, robust design for long service life.
- ✦ Robot mounting interface.

### TECHNICAL DATA

Description	Characteristics
<b>Weight – JET4L-100</b>	<b>4 kgs (8.8lbs)</b>
<b>Dimensions – JET4L-100 (mm)</b>	<b>L-400 x W-160 x H-120</b>
<b>Weight – with 200mm nozzle</b>	<b>4.4 kgs (9.7lbs)</b>
<b>Dimensions – with 200mm nozzle</b>	<b>L-500 x W-160 x H-120</b>

**TYPICAL PERFORMANCE FIGURES FOR THE MET-JET 4L PISTOL ON THE MET-PCC(HVOF-L) CONTROLLER:**

MATERIAL	Reference	Throughput g/min	Deposit efficiency %
WC Co Cr (86/10/4)	99745	70	49
WC Co (83/17)	99735	70	45
WC Co (88/12)	99725	70	45
Ni Cr B Si	99325	70	48
Inconel 625	99405	70	47
Copper	99407	70	63
Chrome Carbide	99785	70	50
Stellite™6	99856	70	44

All figures are approximate and dependent on many factors including powder type, parameters and fuel grade / quality.

**ALTERNATIVE PISTOLS – LIQUID FUEL:**

Metallisation’s Met-PCC(HVOF-L) system can operate pistols from other manufacturers. The Praxair JP5000 pistol has already been interfaced to the system but others could also be technically reviewed for suitability.

Alternative pistols can either be supplied by the customer or Metallisation can offer similar pistols to those mentioned.

The supplies package to each of the pistols would remain the same as the standard Metallisation supplies package. Adapter kits will be offers to fit at the pistol end to enable interchangeability of pistols if required.

**ALTERNATIVE PISTOLS – GAS FUEL:**

Metallisation’s Met-PCC(HVOF-G) system can operate pistols from other manufacturers. The Metco Diamond Jet (hydrogen) and Deloro Stellite Jetkote (hydrogen) pistol have already been interfaced to the system but others could also be technically reviewed for suitability.

Alternative pistols can either be supplied by the customer or Metallisation can offer similar pistols to those mentioned.

The supplies package to each of the pistols would be bespoke to the specific system as the hose requirements will vary more with gas fuelled systems.

Performance data for the non-Metallisation pistols is not offered. The performance of the pistol would be generally the same as if supplied by the OEM. The Met-PCC(HVOF) controller will provide the pistol with reliable, repeatable and easy to control fluids/gases and powder. The parameters are easily programmed and adjusted. The use of a Met-PCC(HVOF) controller would not detrimentally affect the coating produced by a non-Metallisation pistol.

Diamond Jet is a brand name of Oerlikon Metco, Jetkote is a brand name of Kennametal Stellite, JP5000 is a brand name of TAFE Praxair.

## SUPPLIES PACKAGE

Part No.	Description
SUP-PCC(HVOF-L)	Met-PCC(HVOF-L) 5m input and 10m output supplies pack for liquid fuel systems (MET-JET 4L)
SUP-PCC(HVOF-G)	Met-PCC(HVOF-G) 5m input and 10m output supplies pack for gas fuel systems (Jetkote)
AK-JP	Adaptor Kit for JP5000 style pistol on PCC system 5 & 10 Mtr
AK-DJ	Adapter kit for Diamond Jet (Hydrogen) style pistols

### SUP-PCC(HVOF-L) INCLUDES

- 5m input supplies for coolant (supply and return), oxygen and carrier gas into the gas box.
- 10m output supplies for coolant (supply and return), oxygen hose, fuel hose, anti-static powder feed hose, carrier gas hose and pressure transducer signal cable.

### SUP-PCC(HVOF-G) INCLUDES

- 5m input supplies for coolant (supply and return), oxygen, fuel gas and carrier gas into the gas box.
- 10m output supplies for coolant (supply and return), oxygen hose, fuel gas hose, anti-static powder feed hose and carrier gas hose.

### ADAPTER KITS INCLUDE

- Adapter fittings to interface between the end of our standard supplies pack hoses and the non-Metallisation pistol.
- Any additional hoses required, e.g. Diamond Jet style pistols require an additional air hose.

### GENERAL INFORMATION

- The fittings stated are those at the free ends of the hoses and not the interface at the gas box.
- Liquid fuel will also need to be gravity fed to the gas box and via a ¼" BSP fitting. Minimum 2m head is recommended.
- Cabling to link the operator interface to the gas box and powder feeder is included, 10m length plus the required plugs. Maximum possible distance is 250m.
- A 240/110v 1ph, 8A/15A supply will also be required to the gas box and the powder feeder.
- The high tension ignition lead is included in the gas box, 10m.

## CONTROL SYSTEM

Part No.	Description
PCC(HVOF-L)-CTRL	Met-PCC(HVOF-L) Control Interface and Gas Box
PCC(HVOF-G)-CTRL	Met-PCC(HVOF-G) Control Interface and Gas Box
MET-TROL**	Metallisation Ancillary Trolley
MF-PF-CTRL	Mass flow powder feeder kit in the gas box
MF-PF-G-CTRL	Mass Flow powder feeder kit to fit in HVOF-G gas box
PCC-DJ-KIT	Mass Flow Air Control Kit for PCC(HVOF-G)-CTRL (DJ)
PCC(HVOF-L)-FAK	Fuel Assist Kit



The control system is shown with the HMI on an accessory trolley (offered separately). The HMI can be wall mounted, post mounted or moving arm mounted via standard VESA mounting point on the rear of the box. In a typical installation, the gas box would be inside the spray booth. The powder feeder would either be inside or outside the spray booth. The operator interface would be outside the spray booth.

### TECHNICAL OVERVIEW:

The control system for the Met-PCC(HVOF) consists of a PC with a touch-screen operator interface, a gas box and a standard robot interface (robot master). The PC provides a means of operator interface. For reliability of operation, the actual control of the individual operations of the system are controlled by PLC's in the gas box and powder feeder.

### GAS BOX CONTAINS:

- ✦ Oxygen mass flow controller.
- ✦ Liquid fuel holding tank, pump and flow meter.
- ✦ Control PLC with relevant input/output interface.
- ✦ Control valves and switching for sequencing and safe operation of the system.
- ✦ E-stop circuit with external interface to integrate into the safety circuit of the spray booth. Signals from the booth door, extraction system, robot, etc can all be linked into the system.

- ✦ Interlocks to inhibit system operation unless the following are within preset limits: coolant pressure, temperature and flow; oxygen pressure and flow; liquid fuel flow; carrier gas pressure and flow.
- ✦ Fault indication strobe.
- ✦ Interface between the gas box, powder feeders and robot by Ethernet interface. Up to 255 items can be interfaced, allowing multiple powder feeders to be linked.
- ✦ New enclosure allowing supplies to exit to the front, rear or sides of the gas box.
- ✦ MF-PF-CTRL is a kit that is factory fitted into the gas box to enable non-Metallisation powder feeders to be operated and mass flow controlled if they don't have their own mass flow controller.
- ✦ MF-PF-G-CTRL is the same as a MF-PF-CTRL but suitable for the Gas fuelled HVOF systems.
- ✦ PCC-DJ-KIT Adds the additional Air Mass Flow Controller for use with a Diamond Jet pistol.
- ✦ PCC(HVOF-L)-FAK - Fuel Assist Kit allows the transfer of the fuel from a tank/drum at a low/ground level to the CTRL on the same level; this eliminates having to have a tank at a higher level to rely on gravity to feed the fuel into the CTRL ie: tank on the roof of the booth.

## SPECIFICATION AND SUPPLY REQUIREMENTS FOR LIQUID FUELLED HVOF.

Description	Characteristics
High grade premium paraffin	BS2869 Part 2:1988 Class C1
Oxygen	1200 l/min (2543 scfh) @ 21bar (305 psi)
Nitrogen	25 l/min (53 scfh) @ 4 bar (58 psi)
Coolant – deionised water	28 l/min minimum to 34 l/min (7.4 to 9 US Gal/min) maximum thru the system @ 5.5 – 7.5bar (80 – 109 psi)
Max. coolant inlet temperature at the pistol	17 degrees Celsius (62.6 Degrees Fahrenheit)
Max. coolant return temperature from the pistol	56 degrees Celsius (132.8 Degrees Fahrenheit)
Electrical	240/110V 1ph, 8A/15A
Weight	Gas box – 100kg (220.5 Lbs) Operator interface – 20kg (44.1 Lbs)
Dimensions (mm)	Gas box – W-860 (33 ¾”) x D-560 (22”)x H-1250 (49 ¼”) Operator interface – W-560 (22”) x D-175 (6 ¾”) x H-410 (16”)
Cooling requirements	90kW (307,349 BTU/Hr (25.61 Ton) at 30 degrees C (86 Degrees Fahrenheit) ambient

Diamond Jet is a brand name of Oerlikon Metco, Jetkote is a brand name of Kennametal Stellite, JP5000 is a brand name of TAFA Praxair.

**SPECIFICATION AND SUPPLY REQUIREMENTS FOR GAS FUELLED HVOF.**

Description	Characteristics
Hydrogen	950 l/min (2000 scfh) @ 13.5 bar (200 psi)
Oxygen	475 l/min (1000 scfh) @ 13.5bar (200 psi)
Argon	57 l/min (120 scfh) @ 10 bar (150 psi)
Air (Diamond Jet Only)	475 l/min (1000 scfh) @ 7.5 bar (110 psi)
Coolant – deionised water	Jet Kote™ - 30.3 to 51.1 l/min (8 to 13.5 US Gal/min) thru the system @ 2.76 to 14 bar (40 psi to 203 psi) Diamond Jet™ with DJ2600 - 9.5 l/min (2.5 US Gal/min) thru the system @ 2.76 bar (40 psi)
Typical coolant inlet temperature at the pistol	Jet Kote™ - 21 Degrees Celsius (70 Degrees Fahrenheit) Diamond Jet™ - 24 Degrees Celsius (75.2 Degrees Fahrenheit)
Electrical	240/110V 1ph, 8A/15A
Weight	Gas box – 100kg (220.5 Lbs) Operator interface – 20kg (44.1 Lbs)
Dimensions (mm)	Gas box – W-860 (33 ¾”) x D-560 (22”)x H-1250 (49 ¼”) Operator interface – W-560 (22”) x D-175 (6 ¾”) x H-410 (16”)
Cooling requirements	Jet Kote™ = 87kW (297,055 BTU/Hr (24.75 Ton) at 30 Degrees C ambient (86 Degrees Fahrenheit) Diamond Jet™ = 8.8 KW (30,047 BTU/Hr (2.5 Ton) at 30 Degrees C (86 Degrees Fahrenheit) ambient

Diamond Jet is a brand name of Oerlikon Metco, Jetkote is a brand name of Kennametal Stellite, JP5000 is a brand name of TAFA Praxair.

Maximum Process pressures i.e. the back pressures at which the above values can be reached

Hydrogen	9.5 bar	(140 psi)
Oxygen	10 bar	(150 psi)
Argon	7.5 bar	(110 psi)
Air	6.8 bar	(100 psi)

**OPERATOR INTERFACE:**

- ✚ Integrated PC with 17” touch screen, mounted in an industrial box with standard VESA mount.
- ✚ Security levels, password protected for operation or programming.
- ✚ Comes with Windows7 as an operating system that is widely familiar.
- ✚ Parameter trending allows real-time monitoring of operation and setting of ‘out-of-range’ limits.
- ✚ Real time data logging with programmable intervals. System logs the required parameters and actual operating parameters (gas/liquid flows, powder feeder speeds, chamber pressure) against time and also logs sequence events and faults.
- ✚ Data log output via .csv data format through USB or Ethernet to enable remote SPC analysis.



- ✦ If touch screen operation is not desirable, USB interfaces are included to allow connection of a keyboard, mouse or other generic/custom USB input devices. Industrial keyboard is included.
- ✦ Full, on screen diagnostics to advise operator of the system status

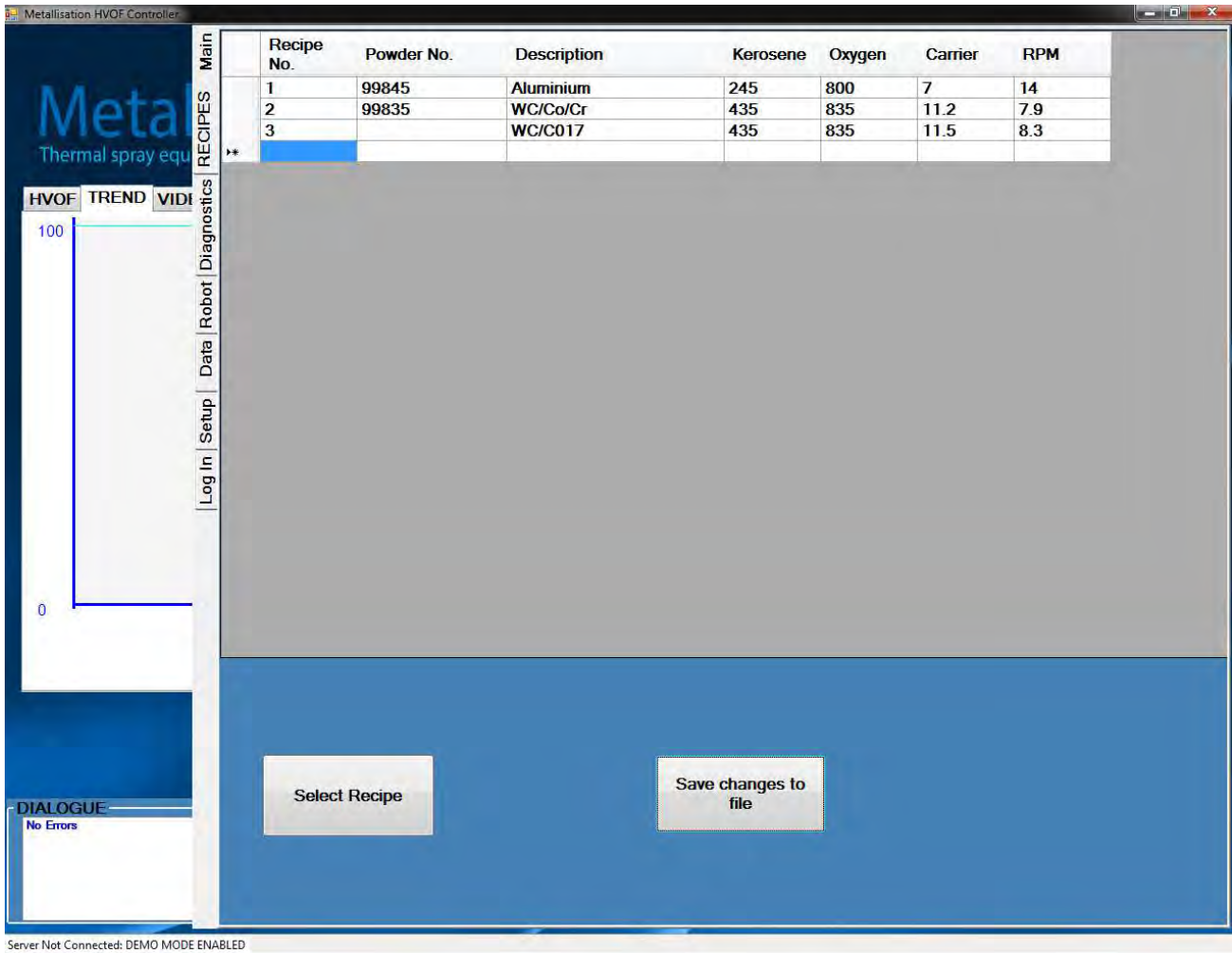
As the operator interface is PC based, it is extremely flexible to control. The functionality can be as complex or as simple as needed. However, as standard, the system can run in 3 modes of operation: manual; recipe or external interface.

## MANUAL OPERATION



- ✦ Operator first selects MANUAL from the 'MODE' box.
- ✦ Operator manually sets the desired parameters for kerosene, oxygen, carrier/powder gas and powder feed rate. This is done by double clicking on the parameter boxes on the right hand side which brings up a keypad to enter the desired values.
- ✦ Once parameters are set, the green buttons are manually sequenced through from left to right, first starting the coolant.
- ✦ Once the coolant is flowing and the system detects that coolant flow, pressure and temperature are within limits, the pilot light button can be pressed.
- ✦ The sequence continues from left to right until the powder is feeding and if appropriate, the robot sequence is started. Operation of the next button in sequence is inhibited until the interlocks are satisfied, e.g. the pilot cannot be lit until the coolant is on and flowing.
- ✦ During running, the kerosene and oxygen parameters plus powder feed rate can be adjusted.
- ✦ To stop the system, the button sequence must be actuated in reverse.
- ✦ Operating status and faults are displayed in the dialogue box.
- ✦ At each change of sequence, the animated pistol image will change to graphically show the status, e.g. when the coolant is off, it will not show blue on the pistol but will show when coolant on is pressed.

## RECIPE OPERATION



The screenshot shows the 'Metallisation HVOF Controller' software interface. The 'RECIPES' menu is selected, displaying a table with the following data:

Recipe No.	Powder No.	Description	Kerosene	Oxygen	Carrier	RPM
1	99845	Aluminium	245	800	7	14
2	99835	WC/Co/Cr	435	835	11.2	7.9
3		WC/C017	435	835	11.5	8.3

Below the table, there are two buttons: 'Select Recipe' and 'Save changes to file'. The interface also includes a 'DIALOGUE' box showing 'No Errors' and a status bar at the bottom indicating 'Server Not Connected: DEMO MODE ENABLED'.

- ✦ Operator first selects RECIPES from the tabbed menu box.
- ✦ Operator scrolls the recipe screen (that has a familiar Excel look to it) and selects the required recipe. The recipe selection screen is programmable so it can show recipe numbers or recipe descriptions. For example, the description could be the name of the part being sprayed.
- ✦ Once the recipe is chosen, the operator presses the SET RECIPE button. The parameters are loaded.
- ✦ If the operator has logged in with the appropriate permissions, they can create new recipes and save them on this screen.
- ✦ Once the parameters are selected, the system can either be manually sequenced as described on the previous page or automatically sequence as described on the following page.
- ✦ Pre-loading of up to 10 recipes is included.

## AUTOMATIC SEQUENCING



- ✦ Instead of manually sequencing through the process, a single button auto sequencing option is available.
- ✦ Once the operator is happy that the components are ready to spray, the green AUTO SEQUENCE ON button is pressed.
- ✦ The system automatically sequences the spraying cycle, starting the coolant, pilot flame, main flame and powder sequence.
- ✦ If manually manipulating the pistol, the system will spray until the operator presses the OFF button.
- ✦ If automatically manipulating the pistol, the system will interface with the robot or automation and start the spraying sequence. Once complete, the system will automatically sequence through to shutdown.
- ✦ Operating status and faults are displayed in the messages box and data logging can be activated during spraying.

## **ROBOT/AUTOMATION INTERFACE (ROBOT MASTER)**

As standard, the spray controller will act as the slave (robot master). The robot program will call the HVOF pistol to light and once it is stable, the spray controller will indicate back to the robot that the flame is lit. The robot can then signal to switch the powder feed on/off as required. Once again, when stable, a spray OK signal is given to the robot. Powder feed can be turned off/on independently, leaving the flame lit if required.

Any faults in the spray controller or robot are also communicated between the two systems as a single fault signal (not detail of fault reason).

The system can be programmed on request with the supply of some additional hardware for the robot to be slave to the spray system. If the robot is programmed in such way, the spray system can select the appropriate robot program and number of passes for the robot to make for a given spray job.

### **ROBOT/AUTOMATION INTERFACE (ROBOT MASTER) CONTAINS:**

- ✦ Contains a PLC mounted on a DIN rail which would be installed within the robot/external automation controller
- ✦ 4 off inputs: flame on/off, powder on/off, robot fault and air jets on/off
- ✦ 4 off outputs: flame OK, spray OK, air jets OK and fault signal
- ✦ PLC requires a 25vDC, 1.2 amps supply from the robot/external automation controller

## **EXTERNAL INTERFACE OPERATION**

The system is capable to interface via USB to an external interface source. This could, for example, be a barcode reader, an interlocked signal to production automation or a manual component selection switch box.

If, for example the system is barcode interfaced, once the barcode is scanned, it will set the correct parameters and advice the operator which powder to load into the powder feeder. Once the component is ready to spray, the system is started in an automatic sequence in the same way as recipe operation above.

If a multiple coating is required, the system can sequence through the bond coat and top coat, automatically selecting multiple powder feeders if required or stopping to prompt the operator to change powders.

Data can be logged against individual bar-codes and stored to produce traceability of the coating and component.

External interface integration and programming can be quoted to your exact specification.



## POWDER FEEDER

Part No.	Description
2007MF-PF(2800)-G	Mass Flow Powder Feeder - 2.8L Hopper, for Gas Fuel Systems
2007MF-PF(2800)	Mass flow powder feeder – 2.8L hopper
2007MF-PF(3350)	Mass flow powder feeder – 3.35L hopper
2007MF-PF-HC	Mass flow powder feeder with scales - 4.7L hopper
2007MF-PF(2.8)-QR-G	Mass Flow Powder Feeder, 2.8 Ltr with Quick Release hopper, for Gas Fuel Systems
2007MF-PF(2.8)-QR	Mass Flow Powder Feeder, 2.8 Ltr with Quick Release hopper
2007MF-PF(3.35)-QR	Mass Flow Powder Feeder, 3.35 Ltr with Quick Release hopper
QRPFH-2.8	Quick Release Powder Feeder Hopper (2.8 L)
QRPFH-3.35	Quick Release Powder Feeder Hopper (3.35 L)
QRPF-BRKT	Quick Release Powder Feeder Hopper Support Bracket for 2 hoppers
MET-TROL**	Metallisation Ancillary Trolley

### TECHNICAL OVERVIEW

- ✦ Mass flow control of carrier gas = repeatability.
- ✦ Volumetric feed via hopper and rotating disc design.
- ✦ Two disc variants to allow optimum feeding of a wide range of powders.
- ✦ Parameters are displayed on the powder feeder and also relayed to the operator interface unit for display and logging.
- ✦ Contains PLC for control and integration to operator interface unit.
- ✦ Feed disc rotational speed is controlled via a closed loop AC inverter for improved feeding accuracy.
- ✦ Control can either be via the operator interface or directly at the powder feeder for stand-alone operation.
- ✦ Multiple power feeders can be integrated into the system.
- ✦ Supplied with 1 x powder feeder control Ethernet cable from gas box to powder feeder.
- ✦ Various powder feeder options available with various sized hoppers, quick release hoppers or weigh scales to suit specific customer requirements.



\*\* Ancillary Trolley sold separately

### SPECIFICATION AND SUPPLY REQUIREMENTS

Description	Characteristics
Canister capacity	2,800cc or larger as indicated
Electrical supply	240/110V 1ph, 5A*
Weight	40kg
Dimensions (mm)	W-400 x D-400 x H-700

\* Use a suitable MCB or Motor / T rated fuses.

## TOOLKIT AND ACCESSORIES

Part No	Description
<b>JET4L-ACC</b>	<b>MET-JET 4L toolkit and accessories</b>

- ✦ Contains all tools for routine maintenance.
- ✦ Contains all spares to convert a 100mm pistol to a 200mm pistol (nozzle, nozzle housing and front baffle).

## REGULATORS/ARRESTORS

Part No	Description
<b>21245</b>	<b>Oxygen regulator, high flow</b>
<b>21244</b>	<b>Nitrogen regulator</b>
<b>21259</b>	<b>Hydrogen regulator, 20 bar</b>

- ✦ 21245 bottle connection =  $\frac{5}{8}$ " BSP.
- ✦ 21245 outlet connection =  $\frac{3}{4}$ " BSP.
- ✦ 21244 bottle connection =  $\frac{5}{8}$ " BSP.
- ✦ 21244 outlet connection =  $\frac{9}{16}$ " UNF.
- ✦ 21259 bottle connection =  $\frac{5}{8}$ " BSP Left Handed.
- ✦ 21259 outlet connection =  $\frac{3}{4}$ " BSP Left Handed.

Other bottle connections can be accommodated upon request.

## REFRIGERATED HEAT EXCHANGER

Part No	Description
JET4L-CHILL	MET-JET4L refrigerated chiller, max ambient 40 Degree C – 400v 50Hz 3 phase
PCC(HVOF)CHILL-MAN	HVOF Chiller Manifold

### TECHNICAL OVERVIEW

The Metallisation packaged water chiller is a complete, factory assembled unit, designed to provide chilled water for cooling HVOF systems.

- ✦ Self contained, including all control items.
- ✦ Despatched with a running charge of refrigerant.
- ✦ Cool water is produced within the chiller and used to cool the pistol water via a water/water heat exchanger.
- ✦ Demineralised water is pumped to the HVOF system via an integral pump.
- ✦ Units are designed to run continuously and will circulate chilled water as long as the unit is switched on.
- ✦ The two chillers are rated for operation at the ambient temperatures stated. Other ambient temperatures or chillers for non-Metallisation pistols can be accommodated. Please contact Metallisation for a specific quotation.





## NOTES:

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# Metallisation

Thermal spray equipment and consumables

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