

# Equipment Specification

## MET-JET4L Liquid Fuel HVOF System



## 1 GENERAL

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The following specification covers the standard range of the MET-JET4L HVOF system. For the specific offer, please refer to the attached quotation and cross-reference the part numbers for each piece of equipment.

**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.

## 2 BENEFITS

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### 2.1 Overview

The Metallisation MET-JET 4L is the latest development to our kerosene fuelled HVOF system. All of the great features of the MET-JET III have been retained: the system is still mass flow controlled for repeatable coating quality and you can now have a choice of start-up gases either hydrogen or propane fuelled pilot. The system produces the densest metallic and carbide coatings of all. The coatings can be compressively stressed, allowing thick layers to be applied without fear of spalling. The latest developments are to the pistol, powder feeder and operator interface. The pistol combustion chamber has been modified to achieve cleaner burning and the nozzle arrangement simplified. The powder feeder has mass flow controlled carrier gas and closed loop motor control for reliability and repeatability of powder feed rates. The operator interface is still simple to follow but is now via touch screen rather than pushbuttons. The result is a high quality, compact and easy to use HVOF system.

- ✦ 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
- ✦ Propane or Hydrogen start-up
- ✦ Liquid fuel = thick, low stressed coatings
- ✦ High hardness, low oxide level coatings

# Metallisation

Thermal spray equipment and consumables

- ✦ High bond strength and low porosity coatings
- ✦ Safety interlocks to prevent running without coolant and gases
- ✦ Low running costs compared to hydrogen fuel

## 2.2 Typical Applications

- ✦ Hard chrome plating alternative
- ✦ CGL mill rolls
- ✦ Oil/Gas ball and gate valves
- ✦ Paper rolls
- ✦ Hydraulic rams
- ✦ Aircraft landing gear
- ✦ Suspension components
- ✦ Hydro-electric turbines
- ✦ Automotive valves
- ✦ Wire drawing blocks

## 3 MET-JET4L PISTOL



Part No	Description
<b>JET4L-100</b>	MET-JET4L liquid fuel pistol with 100mm nozzle
<b>JET4L-200</b>	MET-JET4L liquid fuel pistol with 200mm nozzle

### 3.1 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
- ✦ Hydrogen or Propane pilot lighting = easy start-up and shutdown, minimising fuel spray into the workshop and onto the work piece
- ✦ Sturdy, robust design for long service life
- ✦ Robot mounting interface

### 3.1.1 Technical data:

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

### 3.1.2 Typical performance figures for the MET-JET4L system:

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		70	44

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

## 4 SUPPLIES PACKAGE

Part No	Description
JET4L-SUP-IN	MET-JET4L input supplies package, 5m
JET4L-SUP-OUT	MET-JET4L output supplies package, 5m

### 4.1 JET4L-SUP-IN consists of:

- ✦ 1 x water input hose to the gas box from the chiller. Fitting =  $\frac{7}{8}$ " JIC
- ✦ 1 x water output hose from the gas box to the chiller. Fitting =  $\frac{1}{2}$ " BSP
- ✦ 1 x oxygen input hose to the gas box. Fitting =  $\frac{3}{4}$ " BSP
- ✦ 1 x nitrogen input hose to the gas box. Fitting =  $\frac{9}{16}$ "-18 UNF
- ✦ 1 x hydrogen or propane input hose to the gas box. Fitting =  $\frac{9}{16}$ " UNF Left Hand

Note: the fittings stated are those at the free ends of the hoses and not the interface at the gas box.

Fuel will also need to be gravity fed to the gas box and via a  $\frac{1}{4}$ "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 distance 250m.

All hose lengths are 5m as standard.

A 240/110v 1ph, 8A/15A supply will also be required to the gas box and the powder feeder.

### 4.2 JET4L-SUP-OUT consists of:

- ✦ 1 x water hose from the gas box to the pistol
- ✦ 1 x water hose from the pistol to the gas box
- ✦ 1 x oxygen hose from the gas box to the pistol
- ✦ 1 x liquid fuel hose from the gas box to the pistol
- ✦ 1 x hydrogen or propane hose from the gas box to the pistol
- ✦ 1 x powder feed hose from the powder feeder to the pistol (max. 5m)
- ✦ 1 x nitrogen carrier gas hose from the gas box to the powder feeder
- ✦ 1 x pressure transducer signal cable from the gas box to the pistol

Note: the high tension ignition lead is included in the gas box, 5m

## 5 CONTROL SYSTEM

Part No	Description
JET4L-CTRL	MET-JET4L control interface and gas box



The control system is shown with the powder feeder mounted onto the gas box for pictorial purposes only. The operator interface is also shown connected to the gas box for pictorial purposes only. 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.

## 5.1 Technical overview:

The control system for the MET-JET4L consists of a PC with a touch-screen operator interface and a gas box.

The PC provides a means of operator interface and overall system control. 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. The PC and PLC's are all linked by serial bus to minimise wiring and increase reliability.

### 5.1.1 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 serial bus interface. Up to 255 items can be interfaced, allowing multiple powder feeders to be linked
- ✦ Fixing points to floor or wall mount

## 5.1.2 Specification and supply requirements

Description	Characteristics
High grade premium paraffin	BS2869 Part 2:1988 Class C1
Oxygen	1000 l/min @ 21bar
Nitrogen	25 l/min @ 4 bar
Hydrogen or Propane	10 l/min @ 4 bar during pilot only
Coolant – deionised water	28 l/min thru the system @ 6bar
Max. coolant inlet temperature at the pistol	17 degrees Celsius
Electrical	240/110V 1ph, 8A/15A
Weight	Gas box – 100kg : Operator interface – 20kg
Dimensions (mm)	Gas box - W-700 x D-600 x H-900 Operator interface - W-560 x D-175 x H-410
Cooling requirements	83kW at 30 degrees C ambient

## 5.1.3 Operator interface:

- ✦ Integrated PC with 15" touch screen, mounted into an industrial enclosure
- ✦ Mounting system for operator interface as shown for wall mounting. Additional or alternative mounting methods are possible
- ✦ Security levels, password protected for operation or programming
- ✦ Comes with Windows XP as an operating system that is widely familiar
- ✦ Real time data logging with programmable intervals. System logs the required parameters and actual operating parameters (gas and fuel 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
- ✦ 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

## 5.1.4 Manual operation:



- Operator first selects MANUAL from the 'MODE' box
- Operator manually sets the desired parameters for kerosene, oxygen, carrier gas and feed rate. This can be done with either the + or – buttons or by pressing the Set button which displays a calculator style keypad
- 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 flame 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 main flame cannot be lit until the pilot flame is detected to be lit and stable
- During running, the gas and liquid flow parameter 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 messages box

## 5.1.5 Recipe operation:



- Operator first selects RECIPE from the 'MODE' 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
- Once the operator is happy that the components are ready to spray, the green AUTO SPRAY SEQUENCE 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
- Pre-loading of up to 10 recipes is included

## 5.1.6 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 advise 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.

## 6 POWDER FEEDER

Part No	Description
2007MF-PF	Mass flow powder feeder



### 6.1 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

### 6.2 Specification and supply requirements

Description	Characteristics
Canister capacity	2,750cc
Electrical supply	220/240v 1ph
Weight	40kg
Dimensions (mm)	W-400 x D-400 x H-700

## 7 TOOLKIT AND ACCESSORIES

Part No	Description
<b>JET4L-ACC-100</b>	MET-JET4L toolkit and accessories, 100mm
<b>JET4L-ACC-200</b>	MET-JET4L toolkit and accessories, 200mm

- ✦ Contains all tools for routine maintenance
- ✦ JET4L-ACC-100 contains all spares to convert a 100mm pistol to a 200mm pistol (nozzle, nozzle housing and front baffle)
- ✦ JET4L-ACC-200 contains all spares to convert a 200mm pistol to a 100mm pistol (nozzle, nozzle housing and front baffle)

## 8 REGULATORS/ARRESTORS

Part No	Description
<b>21245</b>	Oxygen regulator, high flow
<b>21240</b>	Hydrogen regulator
<b>21237</b>	Propane regulator
<b>21244</b>	Nitrogen regulator
<b>21122A</b>	Fuel gas flashback arrestor

- ✦ 21245 bottle connection =  $\frac{5}{8}$ " BSP
- ✦ 21245 outlet connection =  $\frac{3}{4}$ " BSP
- ✦ 21240 bottle connection =  $\frac{5}{8}$ " BSP Left Handed
- ✦ 21240 outlet connection =  $\frac{9}{16}$ " UNF Left Handed
- ✦ 21237 bottle connection =  $\frac{5}{8}$ " BSP Left Handed
- ✦ 21237 outlet connection =  $\frac{9}{16}$ " UNF Left Handed
- ✦ 21244 bottle connection =  $\frac{5}{8}$ " BSP
- ✦ 21244 outlet connection =  $\frac{9}{16}$ " UNF

## 9 REFRIGERATED HEAT EXCHANGER

Part No	Description
JET4L CHILL-35	MET-JET4L refrigerated chiller, 35 Celsius ambient
JET4L CHILL-45	MET-JET4L refrigerated chiller, 45 Celsius ambient

### 9.1 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 can be accommodated. Please contact Metallisation for a specific quotation

