BALALJI UDHYOG

METAJET 2751

Technical Catalogue and Operator Guide

High Velocity Oxy Fuel Spray System

Equipment selection, operator training, machine installation and assembly, gas connections and gas converter setup.

This guide brings the equipment description and practical installation workflow together for the buyer and the operating team. Complete the machine-specific commissioning records before first use.

MODEL	EDITION	ISSUED
METAJET-2751	1.0	08 September 2026

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Document code	BU-MJ2751-TG-01
Prepared for	Buyer evaluation and operator training
Operational release	By signed commissioning record
Coverage	Manual system workflow with automatic and hybrid configuration notes

How to use this document

This document introduces the METAJET-2751 HVOF spray system and explains the preparation, assembly, gas connections, converter setup, operator training and handover activities required for a working installation. It is intended for the buyer, installation engineer, production supervisor and trained operator.

The catalogue sections support equipment selection. The installation and training sections support supervised setup of the delivered machine. The signed commissioning record defines the settings that operators may use for that machine, fuel, gun and powder combination.

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Before first ignition: complete the records on pages 23 to 25. Identify the delivered gun, panel, powder feeder and converter by their nameplates. A qualified commissioning engineer must release the installation and train the operators before production.

1 System overview and process

The METAJET-2751 is a high velocity oxy-fuel powder spray system. Oxygen and an approved fuel burn in the gun; the gas stream heats and accelerates coating powder towards a prepared component. Successive passes build the required coating thickness. Compressed air supports the gun's operating and cooling functions, while a separate carrier gas transports powder from the feeder.

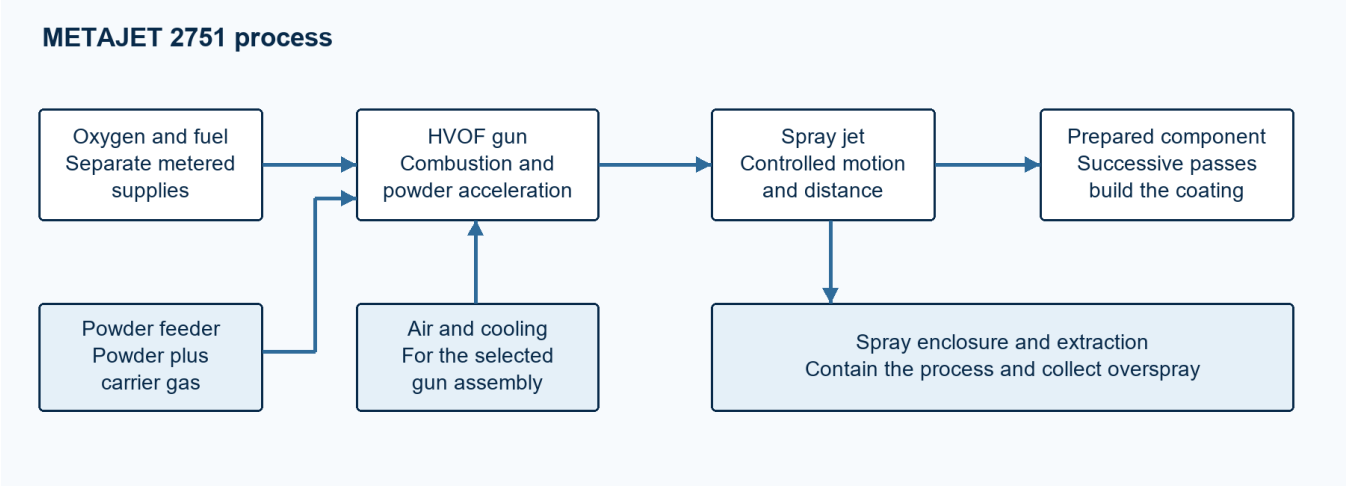

Figure 1. Functional process overview. Each supply has a separate controlled path. This illustration describes functions and does not replace the delivered piping drawing.

Main system functions

- **Spray gun:** combines the approved gases and powder to produce the coating jet. The nozzle, siphon plug and air cap must match the selected fuel and cooling arrangement.
- **Control panel:** displays pressure and meters oxygen, fuel and air. The delivered control version determines the alarm, shutdown and external interface functions available.
- **Powder feeder:** uses a controlled feed mechanism and carrier gas to supply powder. Feed rate must be checked by weighing; motor speed alone is not a universal powder rate.
- **Gas converter or vaporizer:** conditions the LPG supply so that fuel reaches the metering system and gun in the intended vapour condition.
- **Air treatment and cooling:** maintain clean, dry air and, where fitted, the water flow required by the hybrid gun.

Practical equipment advantages

Independent flow indication helps operators repeat a qualified recipe. A trolley arrangement brings the panel and feeder together. Replaceable gun wear parts support routine servicing. Manual and automatic control options allow the installation to be matched to the required production method.

Coating performance depends on the powder, substrate preparation, hardware condition, operating recipe and finishing process. Acceptance is established on an agreed test piece or component.

2 Technical specifications

The following catalogue data describe the METAJET-2751 product family. Confirm the selected version and the as-delivered nameplates against the order and record them on page 23.

Item	Automatic configuration	Manual configuration
Gun designation	METAJET-2751-A	METAJET-2751-M
Catalogue gun weight	1.7 kg	1.85 kg
Control panel designation	AP-2751	MP-2751
Catalogue panel dimensions	970 x 600 x 260 mm	870 x 500 x 140 mm
Catalogue panel weight	45 kg	39 kg
Panel electrical supply	220 V, single phase, 50/60 Hz	220 V, single phase, 50/60 Hz
Optional panel supply	110 V, single phase, 60 Hz	110 V, single phase, 60 Hz
Feeder designation	BPF-3350-HP	BPF-3350
Catalogue feeder capacity	3350 cm3; 700 cm3 option	3350 cm3; 700 cm3 option
Catalogue feeder weight	40 kg	32 kg
Standard hose length listed	7.5 m	7.5 m
Gun cooling choices	Air cooled or hybrid water-cooled assembly	Air cooled or hybrid water-cooled assembly

Configuration notes

The catalogue also uses HVOF-2751 for the console, while equipment may carry an MJ-2751 panel label. The physical nameplate and serial number identify the supplied unit. Feeder designations may include PF or BPF and the 700 or 3350 capacity.

LPG or propane is the basis of this guide. Natural gas and other fuel options require written confirmation of suitable hardware and a separate approved recipe. A fuel change is a configuration change, not a regulator adjustment.

Electrical and dimensional confirmation

Check the feeder, vaporizer, cooling unit and auxiliary equipment separately. Do not assume that the panel voltage also applies to every accessory. Feeder supply and phase must be read from its nameplate before connection. Overall trolley footprint, total installed mass, electrical load and required service clearances must be checked on the delivered arrangement.

Specification basis: supplied METAJET catalogue, page 2. Catalogue dimensions and weights are selection data; they are not lifting instructions or foundation loads.

3 Utilities and reference coating data

Catalogue gas requirements

These figures are reference planning data. They are not an ignition recipe, a pressure-test value or a substitute for the commissioned operating sheet. Verify pressures while the system is drawing its required flow.

Utility	Catalogue flow	Catalogue pressure indication
Oxygen	250 to 350 L/min	10.0 kgf/cm2, approximately 9.81 bar
LPG or propane	60 to 80 L/min	7.0 kgf/cm2, approximately 6.86 bar
Compressed air	600 to 700 L/min	7.0 kgf/cm2, approximately 6.86 bar
Powder carrier gas	Set for the delivered feeder, powder and calibrated meter	Record approved gas, pressure and flow on page 23

The catalogue prints pressure as “Kg/Cm”; kgf/cm2 is the intended pressure-unit interpretation to be verified at commissioning. Gauge or absolute basis and the measurement point must be stated on the approved sheet. L/min, NL/min and SL/min are not interchangeable without the meter's calibration conditions.

The manual gives a compressor planning value of at least 51 m3/h free air delivery at about 6 kgf/cm2, with about 7 kgf/cm2 upstream during spraying. Size the complete air system for the qualified recipe, pressure loss, duty cycle and any extra cooling or handling loads. Compressor motor horsepower alone does not establish delivered capacity.

Reference powder performance

Powder	Catalogue feed rate	Catalogue deposition efficiency
WC-12Co	38 g/min	70%
WC-17Co	38 g/min	60%
WC-10Co-4Cr	38 g/min	70%
Cr3C2-NiCr	25 g/min	58%

These figures are illustrative values for process evaluation. Deposition efficiency is the mass deposited divided by the mass fed during the same test. Establish an approved rate and verify the result for the actual component.

Utility quality

Use the specified industrial gas grades and their safety data sheets. Air must be clean, dry and free from oil contamination. Use the approved nitrogen or argon carrier gas where required by the powder process. Confirm extraction capacity and hybrid cooling performance before ignition.

Data basis: supplied catalogue page 2; METAJET manual pages 14, 15 and 30. The manual contains different settings for particular arrangements; do not mix figures from separate recipes.

4 Applications and supply scope

Typical coating applications

Application area	Examples	Coating objective
Pumps and valves	Shafts, sleeves, impellers, valve balls and seats	Wear, erosion or corrosion resistance
Steel and metal processing	Guide rolls, dies, cutters and capstans	Surface wear resistance and dimensional restoration
Paper and printing	Rolls and selected journals	Wear resistance and rebuilding
Power generation	Selected turbine and hydro equipment surfaces	Erosion, wear or corrosion protection
Textile and general machinery	Thread guides, wear rings and machine beds	Service-life improvement and repair
Hydraulic and transport components	Rods, sleeves and selected bearing surfaces	Wear resistance and qualified chrome-replacement applications

Material selection must consider service temperature, counterface, loading, corrosion medium, fatigue and finishing requirements. Aerospace or other controlled applications require the customer's process qualification and approval.

Equipment package to be agreed with the buyer

The usual system arrangement comprises the selected gun, control panel, powder feeder, oxygen and fuel regulators, air treatment unit, gas and powder hoses, trolley and recommended gun spares. The exact quantity and included accessories follow the accepted quotation and packing list.

Available catalogue items include an LPG vaporizer, its control box, hybrid water-cooled assembly, water control box, oxygen cylinder manifold, substrate cooling air unit and internal-spray extensions. Extended hoses and powder tubes are listed up to 30 m; their use requires a pressure-loss and feeding check.

Site equipment and services

Agree responsibility for gas cylinders or bulk supply, manifolds, compressor and dryer, electrical distribution and earthing, spray enclosure and extraction, dust collection, workpiece handling, blasting equipment, powder, inspection and finishing. Do not assume these items are included merely because they are necessary for spraying.

Coating acceptance

Set written targets for thickness, adhesion, hardness, porosity, surface roughness and any required finish. The catalogue describes low-porosity, hard, strongly bonded coatings; these are process-dependent capabilities. Contractual values must be supported by tests on the agreed powder and application.

5 Essential safety practices

People and work area

Only trained and authorised people may install, operate or service this equipment. Establish an enclosed spray zone with effective extraction, controlled access, suitable lighting and clear emergency exits. Secure workpieces and protect personnel from the jet, hot particles, motion and reflected spray.

Wear the respiratory, hearing, eye, face, hand and body protection selected for the powder and exposure assessment. Operators and observers need protection. Do not rely on discomfort as a warning that air contamination is unsafe. Read the powder and gas safety data sheets before use.

Gas and pressure hazards

- Keep cylinders upright and secured; protect valves during transport and keep cylinders away from spray heat and impact.
- Keep oxygen components free from oil, grease and unapproved compounds. Use gas-specific regulators, hoses, seals and fittings.
- Fit the approved non-return and flashback protection devices in their specified positions and flow direction. Confirm that their flow capacity suits HVOF service.
- A non-return valve and a flashback arrestor have different functions. Never bypass, remove or defeat a protection device to recover gas flow.
- Test connections with a compatible approved leak-detection fluid or instrument. Never use a flame. Isolate and depressurise before correcting a leak.
- Never use oxygen for cleaning, cooling people, blowing dust or pressure testing an unrelated circuit.

Dust and ventilation

Use a collector designed for the particular thermal-spray powder and its fire or explosion hazards. Do not assume that a general-purpose dry collector or a water collector is suitable for every metal. Keep ducts, floors and equipment free from accumulated overspray using the approved collection method; do not disperse powder with a shop air gun.

Isolation before work

Stop the process, isolate electricity and gas at their sources, apply the site's lockout procedure, release trapped pressure through the designated safe route and verify zero energy. Allow hot parts to cool. A zero panel gauge does not prove that every hose, feeder or converter passage is depressurised.

Stop immediately for a fuel leak, flashback, abnormal flame, cooling loss, damaged hose, failed extraction or unsafe motion. Use the emergency response on page 22. Do not restart until the cause is corrected and the system is released.

6 Site preparation and machine installation

Before delivery

Confirm the selected configuration and collect the general arrangement, connection drawing, electrical diagram, nameplate ratings, gas and powder safety data sheets and order-specific utility requirements. Agree access, lifting equipment, installation responsibilities and the commissioning date.

Positioning the equipment

1. Check the crate and its labels for damage. Compare all items against the packing list and record serial numbers before discarding packaging.
2. Plan a level route and suitable lifting method using the delivered equipment weight and designated lifting points. Do not lift the machine by its gun, hoses, feeder lid or instruments.
3. Position the trolley and console on a stable level floor. Lock the castors or secure the base as provided. Leave access to isolators, emergency controls, filter drains and service covers.
4. Place the controls where the operator can read them without entering the spray jet. Keep electrical components and fuel equipment out of direct spray, excessive heat and overspray.
5. Mount the gun and workholding securely. Check the full intended movement with all energy isolated, including the maximum travel and rotation of the workpiece.
6. Route the hose bundle and powder tube without sharp bends, tension or pinch points. Support their weight separately from gun fittings and protect them from hot surfaces and vehicle traffic.

Site readiness checks

Facility	Required verification
Gas supply	Correct gas, approved withdrawal method, sufficient capacity and accessible isolation
Compressed air	Clean and dry supply with measured capacity at operating demand
Electrical supply	Correct voltage, phase, frequency, earthing and protective devices
Spray enclosure	Extraction and dust collection proven for the selected process
Handling equipment	Secure fixture, guarded movement and emergency-stop response
Cooling equipment	Correct cooling mode; hybrid water circuit proven if fitted
Environment	Clear exits, suitable storage, housekeeping and operator protection

The installation engineer shall confirm site clearances and utility capacity from the actual machine arrangement. Complete page 25 before releasing the system for a hot trial.

7 Machine assembly

Carry out assembly with the electricity isolated, cylinder valves closed, regulators unloaded and all pressure released. Keep protective caps on clean gas connections until each joint is ready to be made.

Mechanical assembly sequence

1. **Trolley and panel.** Secure the panel and support brackets using the supplied hardware. Confirm that instruments are upright, visible and protected from impact. Do not drill or modify the panel enclosure to suit an improvised bracket.
2. **Powder feeder.** Secure the feeder in its designated position. Leave room to remove the lid only after depressurisation, inspect seals and fill the hopper without contamination. Confirm that the hopper is empty during initial assembly.
3. **Converter and control box.** Install the converter in its specified orientation and fasten it securely. Make the electrical and liquid-level connections only after identifying the unit type. Keep any relief or vent outlet unobstructed.
4. **Air treatment.** Mount the filter and regulator assembly in the indicated flow direction and position. Provide access for draining and element replacement. Use components of the correct pressure and flow rating.
5. **Gun mounting.** Fit the gun to its approved stand or manipulator using the designated mounting provision. Do not clamp onto the nozzle, air cap or service fittings. Confirm that the mount cannot loosen under hose load or movement.
6. **Hose support.** Arrange oxygen, fuel, air, carrier gas, powder and cooling lines as separately identified services. Use protective supports that do not crush or kink the lines.
7. **Auxiliary connections.** Connect approved control cables, remote controls and any cooling assembly according to the delivered drawings. Fit covers and guards before energising.

Assembly completion

Check fasteners, mounts, guards, hose labels and service access. Confirm that all lines reach their destinations without tension through the complete machine travel. No loose tools, packing material or transport restraints may remain in the operating area.

Gas and electrical connections are completed using pages 11 to 15. The assembled equipment is not ready to spray until the leak tests, protective-function checks and commissioning trial have passed.

8 Gun assembly and inspection

The following service sequence applies to the standard manual gun arrangement when the installed parts match the METAJET-2751M assembly. Internal gas-head valve overhaul and changes to fuel or cooling hardware require an authorised service technician and the correct parts drawing.

Front assembly sequence

1. Isolate and depressurise every service, including the powder feeder; allow the gun to cool. Clean its exterior before opening the assembly.
2. Identify the nozzle, sleeve, siphon plug, powder injector, nozzle nut, air cap, retaining body and seals. Confirm the part set for the approved fuel. Do not combine parts from different versions.
3. Inspect sealing faces, dowel pins and O-ring grooves. Replace cut, flattened, swollen or heat-damaged seals with the specified material and size.
4. Clean the nozzle jets and siphon passages with the specified cleaning-wire kit. Do not drill, enlarge or rotate oversized tools in the holes. Keep the small air-bleed passages clear.
5. Seat the nozzle sleeve inside the nozzle. Assemble the nozzle and retaining nut to the siphon plug using the approved parts arrangement. Check that all mating surfaces are clean and fully seated.
6. Fit the powder injector at the rear as shown in the assembly drawing. Align the siphon-plug flange slots with the gas-head locating pins and seat the flange fully.
7. Fit the correct air cap and retaining body. For the standard parts described in the manual, the nozzle nut and air-cap body are hand-tightened. Use specified torque wherever the supplied drawing requires it; do not force a tight assembly with an improvised tool.
8. Check the control valve for smooth travel and correct OFF, LIGHT and RUN detents. Reconnect the identified services, then complete leak and functional tests before ignition.

Nozzle sleeve wear check

For the standard sleeve identified in the supplied manual, nominal bore is 1.0 mm and the stated replacement limit is a bore greater than 1.2 mm. Inspect before operation with the correct measuring method. Apply this limit only to that sleeve; other nozzles require their own wear limits.

Seals and lubrication

Use only the manufacturer-approved lubricant for the specific gas-service internal parts, in the specified quantity. Keep excess lubricant out of passages. Do not apply general-purpose oil or grease to oxygen-service equipment, and do not soak O-rings in unapproved solvents.

9 Electrical connections and auxiliary equipment

Electrical connection sequence

1. A qualified electrician checks each unit's voltage, phase, frequency, load and protective-earth requirements against its nameplate and wiring drawing.
2. With the supply isolated, connect protective earth and the specified incoming cable, isolator and protective devices. Inspect plugs, cable glands and strain relief.
3. Connect the panel-to-feeder communication cable to the labelled sockets. Use the delivered wiring arrangement for the interlocked operating mode.
4. Connect converter controls, sensors, heater wiring and any cooling control box only to their designated terminals or connectors. Do not interchange similar-looking plugs.
5. Keep cables away from gas fittings, hot parts and moving equipment. Fit all guards and covers, then carry out the required electrical checks before energising.

Powder feeder setup

Confirm the hopper size, feed-disc type, carrier gas and tube diameter. Connect carrier gas through its dedicated regulator to the labelled feeder inlet. Connect the feeder powder outlet to the gun powder inlet. Use the specified clean tube with smooth bends and secure fittings.

Inspect the lid seal, close and secure the hopper as designed, and prove controlled pressurisation without powder during commissioning. Never loosen a pressurised lid. Record feeder control mode and prove that a protective trip stops powder delivery where this function is fitted. Standalone mode is used only under its separately approved procedure.

Hybrid cooling if fitted

Confirm the hybrid assembly's part number and approved water pressure, minimum flow, temperature range and water quality. With all energy isolated, inspect the cooling distributor, water adapter, seals and locking cap; assemble to the supplied drawing without damaging O-rings.

Connect water IN to the approved supply and water OUT to the specified return or discharge. Fill, vent and circulate as instructed. Prove actual flow through the gun, inspect for leaks and test loss-of-flow protection where fitted before introducing flame.

The legacy hybrid data contain inconsistent unit pairs. Use the delivered cooling specification to populate page 23. Do not select a pump, set a regulator or ignite the hybrid gun from an unverified converted number. Keep required cooling available throughout spraying and the approved post-run cooling period.

10 Gas and powder connection overview

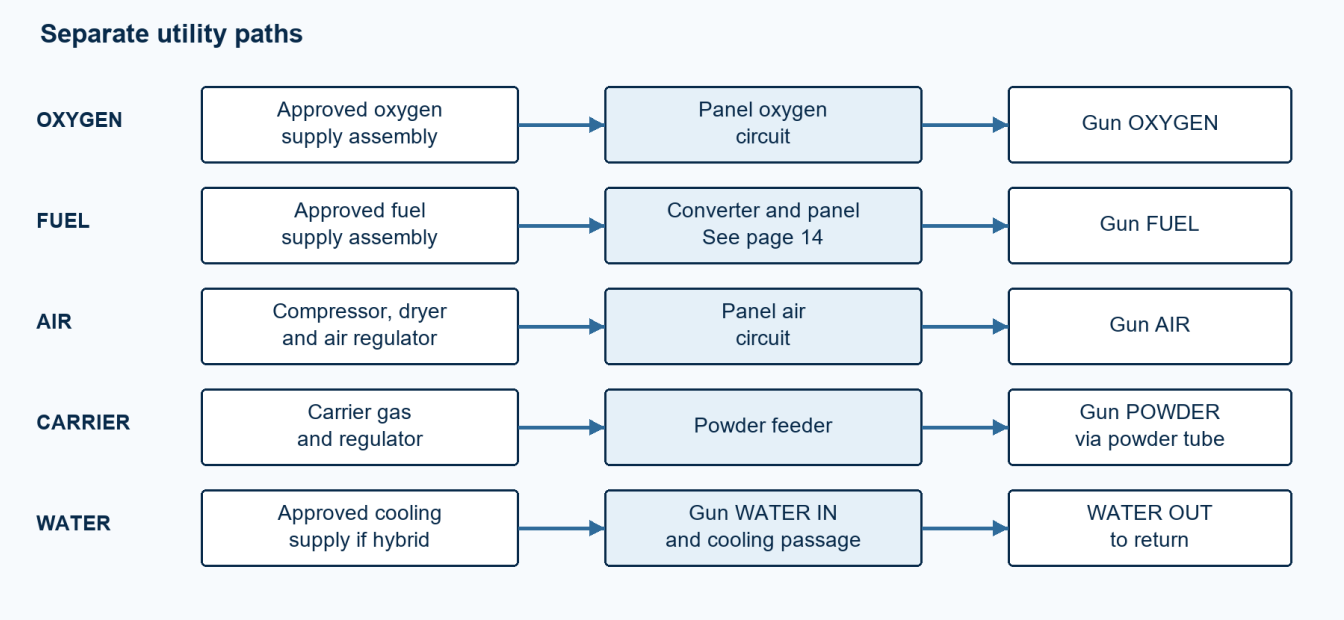

Figure 2. Functional service map. Gas-specific regulation, isolation and protection are part of the approved supply arrangement. Fuel-converter routing is detailed on page 14.

Service	Source and route	Final destination
Oxygen	Secured source through approved oxygen supply assembly to panel OXYGEN IN; panel OXYGEN OUT onward	Gun oxygen connection
Fuel	Approved LPG or propane supply through the identified converter and panel fuel circuit	Gun fuel connection
Air	Compressor, receiver, dryer and filtration through the air regulator to panel AIR IN and AIR OUT	Gun air connection
Carrier gas	Approved nitrogen or argon source and dedicated regulator	Powder-feeder carrier inlet
Powder	Sealed feeder outlet and specified powder tube	Gun powder injector inlet
Cooling water	Approved supply and return circuit, if hybrid gun is fitted	Gun WATER IN and WATER OUT

Identify the actual port labels, gas service, flow arrows and connection standard before fitting hoses. Hose colours may assist identification but do not establish the gas service. The same caution applies to the apparent left-to-right order of panel fittings.

Record every connection on the site drawing. Do not use adapters to defeat a gas-specific connector. Each service remains separate until it reaches the component where its intended function occurs.

11 Gas connection procedure

This procedure is for the qualified installation engineer. Keep ignition sources away and the spray system electrically isolated during connection work. Use only the approved gas-supply arrangement and compatible components.

1. **Identify the supply.** Read the cylinder or source label and confirm gas grade, cylinder condition, withdrawal method and available pressure. Secure cylinders upright. Confirm that the converter accepts the supplied fuel in its actual liquid or vapour phase.
2. **Inspect components.** Check regulators, hoses, filters, seals, non-return valves and flashback protection for gas compatibility, pressure rating, flow capacity, damage and service status. Oxygen components must be clean for oxygen service.
3. **Fit supply assemblies.** With valves closed and regulator adjustments unloaded, attach the correct regulators and approved manifold connections. Use the correct sealing method for that connection; no improvised adapters, general-purpose sealants or forced threads.
4. **Connect oxygen.** Trace from the oxygen source to the labelled panel inlet, then from the panel outlet to the gun oxygen connection. Install the specified protective devices in their correct direction.
5. **Connect fuel.** Identify the converter type and its connection drawing. Fit the inlet, panel and gun fuel hoses as described on page 14. Check the entire route before any pressure is applied.
6. **Connect air and carrier gas.** Connect the treated air to the panel and gun air circuit. Connect the carrier supply to the powder feeder. Keep the powder tube separate from the carrier-gas supply hose.
7. **Check the completed route.** Use a second-person check where practical. Record port labels, hose IDs and flow direction. Confirm that all unused service ports have the specified closure.
8. **Test for leakage.** The engineer introduces the approved test medium and pressure by the documented method, respecting the lowest-rated component. Check all joints with a compatible approved detector. Do not use a flame or an arbitrary pressure-test value.
9. **Correct and retest.** Isolate, release trapped pressure and verify zero pressure before repairing a leaking joint. Repeat the test and record the outcome. Never tighten or disconnect a pressurised gas fitting.
10. **Prepare for commissioning.** Complete any cleaning or individual-line purge under the approved procedure with discharge routed safely. Do not blow ordinary shop air through clean oxygen components or discharge unburned fuel into the room.

Release condition: line identity is correct, the leak test has passed, protection is fitted and the approved commissioning settings are available.

12 Gas converter connection arrangements

“Gas converter” in this document means the LPG vaporizer or fuel-conditioning unit. It changes the physical condition of the fuel; it does not make one fuel type interchangeable with another. It is also not a substitute for pressure regulation.

Identify the installed arrangement first

A two-connection unit and a four-connection unit require different external routing. Confirm the nameplate, fuel inlet phase, port markings and manufacturer connection drawing. The names below are functional labels; fit hoses only when they match the actual delivered unit.

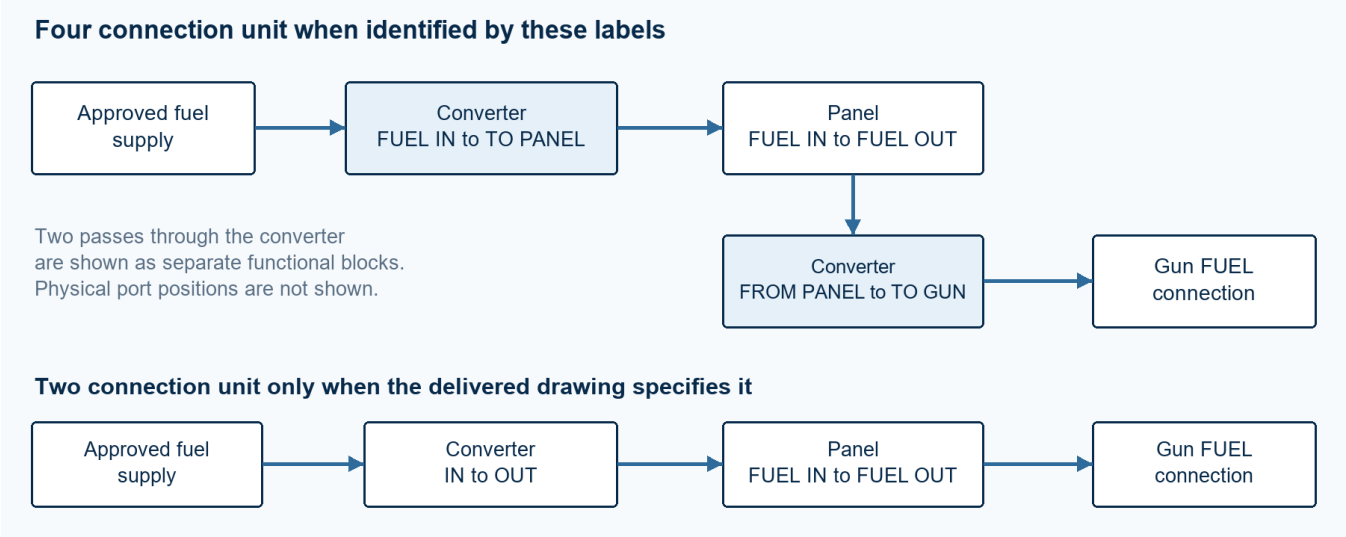

Figure 3. Conditional fuel-routing arrangements. Arrows show external flow only; they do not specify internal construction, port positions or relief-device placement.

Four-connection unit where these ports are provided

Converter marking	Connection to make
LPG IN or FUEL IN	Approved fuel supply outlet to converter inlet
TO PANEL	Converter outlet to panel FUEL IN
FROM PANEL	Panel FUEL OUT to converter return connection
TO GUN	Converter final outlet to gun FUEL connection

Two-connection unit

Connect the approved fuel supply to the converter inlet. Connect the converter outlet to panel FUEL IN. Connect panel FUEL OUT directly to the gun fuel inlet only where the delivered drawing specifies this arrangement.

Connection rule: never join TO PANEL directly to TO GUN or bypass a required converter passage. If labels are absent, damaged or different from the drawing, identify the ports with the manufacturer before applying pressure. A row of four fittings does not establish their function or left-to-right order.

13 Gas converter setup

Before applying heat or fuel

1. Confirm model, serial number, permitted fuel, inlet phase, capacity, pressure limits and electrical rating. Check whether the unit is a heated-water-bath design or another type. Record the details on page 24.
2. Inspect the unit for transport damage, secure mounting, correct orientation and clear service access. Verify all fuel connections against page 14 and the delivered drawing.
3. Have the electrician check protective earth, supply, heater control, sensors and protective devices with power isolated. Confirm that any relief or vent route is installed as specified and remains unobstructed.
4. For a water-bath type, fill only the designated bath connection with the specified liquid to the indicated level. Do not put water into a fuel port. Inspect for bath leakage and prove the low-level protection before heating.
5. Set the controller to the manufacturer's specified operating temperature, range, units and limits for this exact unit. Record the setting. Do not choose a temperature from a video display or adjust factory protection limits to suppress an alarm.

Controlled startup

Follow the unit-specific order for bath filling, electrical energisation, warm-up and fuel admission. Keep the gun isolated from fuel until the installation has passed its checks. A ready lamp or a temperature reading alone does not prove that the gas circuit is safe.

Confirm stable bath or heating-system conditions and the specified readiness indication. The commissioning engineer then admits fuel through the approved pressure-control sequence and checks all fuel joints. Verify stable downstream pressure and flow at the actual operating demand.

What to watch during operation

Stop the process for liquid carryover, repeated flow fluctuation, abnormal frost, loss of heat, low bath level, leakage, overheating or unexpected pressure rise. Frost can indicate supply withdrawal or capacity problems; do not compensate by increasing regulator pressure beyond the approved setting.

Never heat a cylinder or converter with a torch, defeat a low-level or overtemperature cutout, obstruct a relief outlet or open a hot or pressurised unit.

Shutdown and servicing

Stop spraying using page 19 and the unit-specific shutdown sequence. Isolate the fuel source and electrical supply as required. Release pressure only by the designated procedure and allow the bath or heater to cool before servicing. Inspect, replenish or drain the bath only under the maintenance instructions for the installed design.

14 Commissioning and acceptance

Commissioning is led by a qualified engineer with the buyer's representative present. Complete the machine and converter records before the first flame test. Use the delivered drawings and the approved recipe for the actual configuration.

Stage 1 Inspection with energy isolated

Confirm equipment identity, assembly, hose routing, gun part set, electrical connections, extraction, workholding and emergency access. Inspect calibration status and confirm utility capacity. Resolve every safety-related defect before energising.

Stage 2 Utility and protective-function checks

Prove electrical safety, leak-tightness, clean air, carrier gas and any hybrid water flow. Check each fitted permissive and trip by its approved test method. Verify the emergency stop, loss of air, loss of carrier gas, extraction interlock and converter or cooling protection wherever fitted. Record which outputs close and whether restart requires a deliberate reset.

Stage 3 Feeder calibration

With flame disabled and a controlled powder-capture arrangement, run the selected powder at the planned speed. Weigh the collected powder over a measured interval, calculate grams per minute and repeat to establish stability. Use the same disc, carrier gas, tube and powder lot intended for the trial.

Stage 4 First ignition and coating trial

Clear the spray zone, start extraction and required cooling, and use the approved ignition sequence. Establish a stable flame before introducing powder. Record pressures under flow, meter readings and calibration units. Spray an agreed test coupon using the planned distance, motion and temperature limits.

Stage 5 Inspection and release

Measure the specified coating properties and compare results with the agreed acceptance limits. Correct defects, repeat the trial where required and record the final recipe. Train the operators on this released configuration and obtain handover signatures.

Evidence to retain	Acceptance basis
Line and leak-test records	Correct routing; test passed by approved method
Protective-function test	Each fitted function performs its specified safe response
Feeder calibration	Measured rate and repeatability meet the agreed process requirement
Trial coating report	Required thickness and quality tests accepted
Operator assessment	Required tasks demonstrated competently

Passing a coating trial alone does not release an installation with an unresolved gas, electrical or protective-function defect.

15 Operator training programme

Training combines explanation, an isolated equipment walkthrough, supervised demonstration and practical assessment. The suggested sequence below is planned around two working days; additional supervised practice is provided where the operator has not demonstrated competence.

Module	Topics and practical work	Evidence of competence
1 Process and equipment	HVOF principle, components, manual versus automatic controls, approved recipe	Correctly identifies equipment and explains the spray process
2 Safety and isolation	Gas, oxygen cleanliness, dust, noise, hot parts, PPE, emergency actions and lockout	Demonstrates safe preparation and isolation
3 Connections and assembly	Trace oxygen, fuel, air, carrier, powder and cooling services; identify converter ports	Traces every service correctly with energy isolated
4 Converter and utilities	Bath level where applicable, readiness, approved settings, supply capacity and leak response	Explains startup prerequisites and stop conditions
5 Feeder and controls	Hopper safety, powder identity, mode selection and weighed feed calibration	Prepares and calibrates the feeder under supervision
6 Starting and spraying	Prestart check, approved lighting method, stable flow, motion and coating temperature	Completes a supervised trial within the recipe
7 Shutdown and maintenance	Normal stop, emergency stop, cleaning, wear inspection and defect reporting	Stops safely and identifies service limits
8 Assessment and records	Trial inspection, production log and practical questions	Completes the competency and handover record

Suggested delivery sequence

Day 1: modules 1 to 5, starting with theory and an isolated walkthrough, followed by utility checks and feeder practice. Gas and electrical commissioning remain the qualified engineer's responsibility.

Day 2: modules 6 to 8, including supervised starts and stops, sample coating, fault-response discussion, maintenance demonstration and assessment. Demonstrate a normal stop separately from an emergency stop.

Authorisation

Attendance alone is insufficient. Authorise each operator only for the configuration and tasks successfully demonstrated. Retraining is required after a material change to the gun, fuel, feeder, controls or process, and after an incident or extended absence where competence needs review.

16 Controls and checks before operation

Identify the actual controls

Control or indication	Operator purpose
Panel selector or power control	Selects the permitted mode or energises the controls as labelled
READY indication	Indicates the panel's defined ready state; confirm all other prerequisites separately
LOW PRESSURE indication	Signals a monitored pressure fault; identify the affected service before reset
EMERGENCY control	Stops the system in an emergency according to the tested machine response
Oxygen, fuel and air gauges	Show pressure at their respective measurement points
Flowmeters and control knobs	Indicate and adjust flow within the approved calibrated range
Feeder carrier and motor controls	Control carrier supply and powder feeding in the selected mode
Feeder speed display	Shows drive speed; compare with the measured powder calibration
Converter controller	Shows the temperature or process value defined for that unit

Do not interpret indicator colours or selector positions without checking the labels and commissioning record. A pressure gauge, flowmeter and feeder-speed display report different quantities.

Daily check before starting

- Confirm that the operator is authorised and the current recipe matches the job, powder, gun and fuel.
- Inspect the work area, extraction, collector, fixtures, hose supports and emergency exits.
- Check cylinders and supply capacity, hose condition, connections and protective devices. Resolve leaks or damage before operation.
- Check the nozzle, sleeve, air cap, seals and valve movement; check cooling where fitted.
- Verify the converter's correct fill level, condition and readiness for its design.
- Confirm powder identity, lot, dryness and sufficient quantity. Check the feeder lid seal and closure; never open a pressurised hopper.
- Confirm that gauges and flowmeters are readable and that approved gas units and limits are available.
- Check control mode, emergency-stop reset and required permissives. Clear people and loose items from the spray zone.

Record abnormal findings before starting. Do not continue with a bypassed trip, an unexplained alarm or an unapproved substitute part.

17 Starting and stopping the system

Use this sequence with the signed settings on page 23 and the approved lighting procedure for the delivered gun and panel. The standard manual gun uses OFF, LIGHT and RUN positions; confirm their markings during training. Do not transfer a lighting sequence from another gun version.

Startup sequence for trained operators

1. Complete the daily check. Secure the gun and job, clear the booth and establish extraction, required cooling and the converter's approved ready condition.
2. Confirm powder feed is OFF. Select the commissioned control mode. Establish clean air and the approved carrier-gas condition according to the feeder procedure.
3. Open gas supplies only in the approved commissioning sequence. Check the authorised pressures and any required individually controlled purge. Maintain safe discharge; do not release mixed fuel and oxygen into the booth to “set” the system.
4. Establish the specified feeder pressure and carrier flow. Position any gun powder-line ball valve exactly as required by the delivered feeder procedure. Its function and initial position must be recorded on page 23.
5. Place the manual gun valve at the verified LIGHT detent and ignite with the approved igniter while aimed into the protected spray zone. For an automatic version, use the commissioned start cycle.
6. Once ignition is established, move the manual valve fully to RUN as demonstrated. Check for stable flame and correct operating flows. Stop if ignition fails, the flame is abnormal or a trip occurs; identify the cause before another attempt.
7. Establish the approved carrier path to the gun and allow the feeder condition to stabilise. Start powder feeding only when the flame, cooling, motion and gas conditions are correct. Confirm the weighed feed rate and begin the coating passes.

Normal stop

End the coating pass and stop powder feeding. Clear residual powder only by the approved carrier-gas procedure. Shut down the flame with the delivered gun or panel stop sequence. Maintain extraction and any air or water cooling for the required post-run period, then isolate fuel, oxygen, carrier gas and electricity as instructed for the length of shutdown.

Release trapped pressure through the designated safe procedure before opening the hopper or disconnecting anything. Record operating hours and defects. For a short pause, retain only the services expressly permitted by the approved pause procedure.

Failed ignition or abnormal flame: do not repeatedly strike the igniter or continue adjusting gases while the fault remains. Stop fuel delivery, isolate as required and follow the fault response on page 22.

18 Coating operation and quality control

Prepare the component

Confirm component identification, material, drawing revision and coating area. Inspect the substrate for damage and contamination. Clean, mask and grit-blast to the specified process, then protect the prepared surface from moisture, oil and handling contamination. Apply the coating within the permitted preparation-to-spray time.

Establish the spray recipe

The released recipe must state powder specification and lot, gas types, gun hardware, pressure measurement points, flowmeter conditions, carrier settings, measured powder rate, spray distance, gun angle, traverse speed, rotation, overlap, substrate temperature limits and thickness target.

The manual gives differing distance guidance for different contexts, including approximately 150 to 200 mm in its parameter example. Use the qualified distance for the actual powder and geometry; do not treat a general range as permission to change distance during a production run.

Spray with controlled motion

Keep the approved distance and angle consistent, use overlapping passes and maintain the qualified movement. Avoid dwelling at an edge or on a small diameter. Monitor component temperature with the specified instrument and use only the approved cooling method. Stop to investigate unstable flow, unusual sound, heavy powder buildup or a changing flame pattern.

Inspection plan

Characteristic	Record or check
Thickness	Required minimum/maximum, measurement method and locations
Visual condition	Uniform coverage; no unacceptable cracking, lifting or uncoated areas
Surface roughness	As-sprayed or finished requirement and measurement condition
Hardness	Test method, load, locations and acceptance range
Adhesion or bond strength	Agreed test method, specimen and acceptance value
Porosity and microstructure	Sample preparation, image method and acceptance criteria
Finished dimensions	Grinding allowance, final size and any required runout

Inspect a trial coupon before accepting the first production recipe. Keep powder certificates, settings, calibration records and test results linked to the job. Requalify after a change that can affect the coating result. Do not promise one hardness, bond strength or deposition efficiency for every powder.

19 Maintenance and replacement parts

All servicing starts with isolation, pressure release and cooling. Keep a service log with operating hours, replaced parts, inspections and the person who released the machine.

Gun maintenance starting schedule

The following intervals come from the manual for continuous spraying under average conditions. Shorten intervals for heavy use, frequent ignition, contamination or deterioration; condition-based defects require immediate attention.

Item	Starting interval	Required work
Standard nozzle sleeve	Before operation	Clean and inspect; replace if bore exceeds its applicable wear limit
Gun exterior	Every 8 operating hours	Remove loose contamination using the approved method
Air cap	Every 8 operating hours	Inspect and remove deposits; check damage and seating
Nozzle jets	Every 16 operating hours	Clean with the correctly sized cleaning-wire kit
Siphon jets and bleed passages	Every 40 operating hours	Inspect and clean without enlarging the openings
Gas-head valve	At the 500-hour service review, or earlier for stiffness/leakage	Authorised service inspection; clean and lubricate only as required by the service procedure

System maintenance

Before each shift inspect hoses, cables, fittings, protection devices, feeder seals and converter condition. Drain air-treatment equipment according to its instructions. Check the water bath only where applicable and in the required safe condition. Maintain extraction, dust collection and cooling under their equipment-specific schedules.

Inspect and calibrate gauges, flowmeters, regulators and protective switches at the intervals established for the installation. Replace damaged or expired components. Never dismantle a flashback arrestor or non-return device unless its own service instructions expressly allow it and the work is performed by an authorised technician.

Recommended service inventory

Keep the correct gun O-ring set, nozzle sleeve and nozzle, air cap, siphon plug, powder tube, feeder seals, compatible cleaning-wire kit and approved internal valve lubricant. Record part numbers against the delivered assembly. Include filters and electrical spares only after confirming their ratings.

After work affecting a gas boundary, control function or cooling circuit, repeat the relevant leak and functional checks before a supervised restart. Fuel changes and hybrid conversions require the appropriate hardware and a new approved configuration record.

20 Troubleshooting and emergency response

Start every investigation with a safe stop and the isolation needed for the inspection. Operators perform visual checks and report defects; gas-circuit repairs and electrical work are performed by authorised personnel.

Symptom	Checks after safe stop	Required action
Gun will not ignite	Gas availability, approved settings, carrier condition, nozzle cleanliness and igniter	Correct the identified fault; use the approved restart procedure
Low or fluctuating gas flow	Source capacity, regulator behaviour, hose restriction, protection-device status and converter readiness	Restore the approved supply; replace defective parts; never bypass protection
Backfire, popping or uneven flame	Correct nozzle/air cap, sleeve wear, seals, blocked jets and gas balance	Isolate, inspect for damage and correct the cause before release
Irregular powder feed	Powder condition, hopper sealing, carrier supply, disc speed and tube condition	Depressurise before opening; clean or repair by the feeder procedure and recalibrate
Gun or job overheating	Air supply, hybrid flow, converter/gas stability, distance and movement	Stop; restore cooling and the approved recipe before restarting
Converter not ready	Electrical supply, level where applicable, sensor condition and heater protection	Have an authorised technician diagnose the fault; do not defeat a trip
LOW PRESSURE indication	Identify the monitored circuit and compare with the approved threshold	Correct the cause and test the permissive; do not lower the limit to continue

Emergency actions

For a gas leak, flashback, fire or uncontrolled operation, use the emergency stop and the designated safe gas isolation if it can be reached without entering danger. Move people away and raise the site alarm. Do not operate electrical switches in a suspected fuel-gas cloud. Follow the site emergency plan and call the designated emergency service when required.

For extraction or cooling loss, stop spraying immediately. Keep only those support services that the approved emergency procedure permits. Never approach a fire-exposed or damaged cylinder to make a repair.

Recovery

Record the event, isolate the equipment and have the cause investigated. Inspect affected hoses, regulators, protection devices, gun parts and controls. Complete the required repairs, leak test and functional checks before an authorised person releases a restart. Resetting an alarm or waiting a fixed time alone does not make the system safe.

21 Machine configuration and approved settings

Complete this sheet during commissioning. Keep a copy at the machine. Catalogue reference values must not be entered automatically as approved settings.

Customer and site: _____

Machine serial number: _____ **Date:** _____

Gun and cooling version: _____ **Panel:** _____

Feeder and disc: _____ **Converter:** _____

Fuel and inlet phase: _____ **Carrier gas:** _____

Powder specification and lot: _____

Parameter	Ignition or startup value	Running value	Unit and measurement point
Oxygen pressure	_____	_____	_____
Oxygen flow or meter reading	_____	_____	_____
Fuel pressure	_____	_____	_____
Fuel flow or meter reading	_____	_____	_____
Air pressure and flow	_____	_____	_____
Carrier pressure and flow	_____	_____	_____
Feeder hopper pressure	_____	_____	_____
Feeder speed	Powder OFF	_____	rpm
Measured powder rate	Powder OFF	_____	g/min
Hybrid water pressure and flow	_____	_____	_____

Meter gas and calibration conditions: _____

Pressure basis and gauge locations: _____

Spray distance / angle / motion: _____

Component temperature limits: _____

Approved ignition procedure reference: _____

Gun ball valve function and startup position: _____

Purge medium / route / duration and shutdown sequence: _____

_____

Fitted trips and approved thresholds: _____

Coating trial report and recipe revision: _____

Commissioning engineer name and signature: _____

Buyer representative name and signature: _____

22 Gas converter commissioning record

Customer and site: _____ **Date:** _____

Model and serial number: _____

Rated fuel / inlet phase / capacity: _____

Maximum permitted inlet and outlet conditions: _____

Electrical supply / load / protection: _____

Design: Water bath / Other _____ **Drawing ref:** _____

Port verification

Function	Actual port marking	Connected equipment or hose ID	OK
Fuel supply inlet	_____	_____	____
Outlet to panel	_____	_____	____
Panel return if fitted	_____	_____	____
Gun outlet if fitted	_____	_____	____
Bath fill and drain	_____	_____	____
Relief or vent	_____	_____	____

Settings and functional checks

Check	Recorded value or result
Bath liquid and correct fill level, if applicable	_____
Controller units, setpoint and operating band	_____
Ready condition and warm-up requirement	_____
Low-level protection where fitted	_____
Overtemperature protection where fitted	_____
Earth and electrical checks	_____
Leak-test method, pressure and duration	_____
Leak-test result and instrument ID	_____
Outlet pressure and flow at operating load	_____
Stable fuel condition and no liquid carryover	_____
Approved stop and depressurisation procedure	_____

Defects and corrective actions: _____

_____

Release for operation: Yes / No **Engineer signature:** _____

Buyer witness: _____ **Date:** _____

23 Installation acceptance checklist

Mark each item PASS, FAIL or N/A. Explain N/A and attach test records. Every safety-related failure must be corrected before operational release.

Customer: _____ **Machine serial:** _____

Location: _____ **Inspection date:** _____

Item	Verification	Result
1	Delivery inspected and packing list reconciled	_____
2	Equipment identity and selected configuration recorded	_____
3	Trolley, panel, feeder and converter secured	_____
4	Gun mount, guards and workholding checked	_____
5	Full machine movement clear of hoses and cables	_____
6	Oxygen, fuel, air, carrier and powder routes traced	_____
7	Converter ports and approved inlet phase verified	_____
8	Correct regulators, hoses and protection devices fitted	_____
9	Gas leak test completed and accepted	_____
10	Electrical supply, earth and protection checked	_____
11	Clean air and gas capacity proven under demand	_____
12	Converter ready condition and fitted trips tested	_____
13	Hybrid cooling circuit and protection checked if fitted	_____
14	Extraction and collector operation accepted	_____
15	Emergency stop and all fitted permissives tested	_____
16	Feeder calibrated for the selected powder	_____
17	First ignition and sample coating accepted	_____
18	Current operating recipe recorded and signed	_____
19	Operators assessed and authorised	_____
20	Manuals, drawings, spares list and records handed over	_____

Open items and corrective action reference: _____

_____

Operational release: Approved / Not approved

Installation engineer signature: _____ **Date:** _____

Buyer representative signature: _____ **Date:** _____

24 Operator competency and handover

Operator name: _____ **Employee ID:** _____

Customer and site: _____

Machine serial and configuration: _____

Trainer: _____ **Training dates:** _____

Practical assessment

Mark COMPETENT or FURTHER TRAINING for each task. Demonstrate hazardous fault responses by an approved simulation or isolated walkthrough.

Task demonstrated	Assessment
Identifies all utilities and traces every connection correctly	_____
Selects appropriate protection and confirms area readiness	_____
Explains gas isolation and demonstrates safe depressurisation	_____
Identifies converter ports, readiness and stop conditions	_____
Inspects the gun, sleeve, hoses and feeder safely	_____
Prepares powder and verifies the measured feed rate	_____
Uses the approved startup and lighting sequence	_____
Maintains distance, movement and temperature controls	_____
Performs normal shutdown and end-of-shift care	_____
Responds correctly to leak, flashback, cooling loss and alarms	_____
Records job settings, checks and defects	_____

Tasks authorised: _____

Restrictions or further training: _____

Operator signature: _____ **Date:** _____

Trainer signature: _____ **Date:** _____

Handover pack

Provide the signed configuration sheet, converter record, installation checklist, approved operating recipe, coating trial report, gas and electrical drawings, instrument records, component manuals, powder and gas safety data sheets, spares list and maintenance schedule.

Documents received by: _____ **Date:** _____

Customer supervisor authorisation: _____

25 Production record and technical references

Daily production record

Date / shift / operator: _____

Machine serial / recipe revision: _____

Job / component / drawing: _____

Powder / lot / measured feed rate: _____

Time or pass	Gas and carrier readings	Temperature and thickness	Observation
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Operating hours / powder used: _____

Inspection result and report number: _____

Defects, maintenance or replaced parts: _____

Operator / supervisor signatures: _____

Technical references and document control

Product data: supplied HVOF METAJET CATALOGUE, pages 2 to 4. Installation, gun assembly and maintenance basis: supplied METAJET 2751 operation and maintenance manual, pages 13 to 20, 22 to 28 and 30. Use current order-specific drawings and component instructions with the delivered equipment.

General gas-safety reference: UK Health and Safety Executive, Safety in gas welding, cutting and similar processes, INDG297, https://www.hse.gov.uk/pubns/indg297.pdf. This supports general leak-testing and flashback-protection principles; the installed HVOF system requires its own compatible, adequately rated equipment and approved arrangement.

Maintain this guide with the machine records. A change in fuel, gun hardware, feeder, hose length, converter, cooling or controls must be reviewed and the affected records and training updated before use.

Product enquiries and service information

BALALJI UDHYOG

Product: METAJET-2751 High Velocity Oxy Fuel Spray System

Catalogue contact: +91 9269288805 | sales@balajiudyog.in

Website: www.balajiudyog.in

Catalogue address: Plot No. 75, Hastinapur Nagar, Phase 1st, Sangriya, Jodhpur, Rajasthan 342013, India.

When requesting assistance, provide the machine serial number, gun and feeder versions, powder, approved recipe, alarm or symptom, and any relevant test or maintenance record.