Metallisation

Thermal spray equipment and consumables

ARC150

Arcspray System

Operating Manual

This operating manual must be read and understood before any attempt is made to operate the equipment described herein. In particular, refer to the Safety Warnings / Risk Assessments in Section 1.

Under no circumstances should any modifications be made to the equipment without prior written approval from Metallisation.

MAN-ARC150-OP

For Pistols: ARC150-CG23
ARC150-CG25

For Energiser: S500-PLC

Related Manuals:

Pistol Maintenance Manual:
MAN-ARC150-MA

Energiser Maintenance Manual:
MAN-ENE-S500(150)

Issue: 15-09-2015

SPECIFICATIONS

The Metallisation ARC150/S500-PLC Arc Spray System is designed for anti-corrosion coatings and will give consistent throughputs with high coating quality.

The following specification covers the standard range of ARC150 Pistol with S500-PLC (ARC150) Energiser with closed loop current control.

The Pistol Pistol Rating - Max Current: 500 Amps

Dimensions:

			WEIGHT	
LENGTH	**HEIGHT**	**WIDTH**	**STAND ALONE**	**INC. CABLE & HOSES @ 1.2M**
275mm (10.8”)	240mm (9.4”)	102mm (4”)	2.1kg (4.65lb)	5.1kg (11.24lb)

The Energiser (S500-PLC)

Dimensions:

LENGTH	HEIGHT	WIDTH	WEIGHT
900mm (35.4”)	800mm (31.5”) 875mm (34.5”) To Handle	485mm (19.1”) 670mm (26.4”) Wheel to Wheel	291.6kg (644lb)

S500-PLC Energiser Specification:

DESCRIPTION	CHARACTERISTICS
Input Power Requirements	380/415/460 Vac 50-60Hz 3 Phase
Optional Input Power	220V 50-60Hz 3 Phase
Fusing Required	37A @ 460 Vac 40A @ 415 Vac 44A @ 380 Vac 76A @ 220 Vac 84A @ 200 Vac
Max Power Consumption	29 KVA (46Vdc/500A output)
Typical Power Consumption	16 KVA (Zinc 26Vdc/500A output) 22 KVA (Aluminium 35Vdc/500A output)
Duty	0-500 AMPS @ 100% Duty Cycle
Output Voltage	0-49 Vdc Switched High/Low & 1 – 5 (Nominal Spray Voltage 19 to 44Vdc)
Air Requirements	1.5m³ /min @ 5 bar (53cfm @ 72.5 psi)
Power Factor	0.85 Lag
Auxiliary Circuits	110Vac and 24Vdc
Pressure Switch Setting	30 psi (2.0 bar)

CONTENTS

SECTION 1

SAFETY PRECAUTIONS & RISK ASSESSMENTS

1.1 Safety Precautions

Provided that the equipment is properly set up, regularly maintained and used correctly, metal spraying does not present any great danger. However, like most industrial processes, misuse and careless practices can create hazards for personnel and damage to the equipment.

The equipment detailed in this manual will produce levels of noise, UV light and dust that require safety measures to be taken by personnel using the equipment. Careful consideration should be taken when positioning this equipment.

It is the responsibility of the user to ensure that all appropriate measures are in place for safe operation, before the equipment is used. Metallisation will be pleased to assist and advise as appropriate.

1.1.1 Equipment Dos and Don'ts

- Ensure that all appropriate Risk Assessments are carried out before using this equipment.
- Ensure the equipment is properly set up as per Section 3.1 of this Manual.

- **NEVER** point the pistol towards other personnel or combustible material.
- **NEVER** spray onto hoses, cables or instruments.
- **NEVER** operate the pistol without using ear defenders and the appropriate eye protection.
- **NEVER** look into the arc zone, without first ensuring that the power switch is in the "off" position and the drive motor is switched off.

1.1.2 Handling of the Energiser

The Energiser must only be lifted from the base, under no circumstances should it be lifted by the handle or by the M12 thread that locates the dispenser spigot.

Care must be taken if attempting to transport the Energiser by fork lift truck not to damage the underside of the unit.

1.1.3 The Energiser Mains Supply

The mains supply **MUST** be disconnected before removing any of the outer panels.

- Isolate the mains supply.
- **ALL** maintenance or overhaul should be conducted by a fully qualified electrician in accordance with local regulations.

1.2 Risk Assessment

Prior to commencing work with Thermal Spray equipment, a Risk Assessment should be carried out on the equipment and the way in which that equipment is to be used.

The Risk Assessment should identify the hazards associated with the work and also the control measures required. This will either eliminate the risk, or reduce it to an acceptable level to prevent ill health or injury to the persons carrying out, or who could be affected by the work.

The results of the Risk Assessment and the control measures necessary should be made known to the persons carrying out, or those affected by the work.

Some control measures are better able to produce the desired result than others.

The safety precedence sequence shows the order of effectiveness of measures.

Hazard Elimination

Use of alternative work methods, design improvements or change of process.

Substitution

Replacement of material/substance with another of less risk.

Use of Barriers

Isolation or segregation.

Use of Documented Procedure

Limiting exposure times, dilution of exposure. Safe systems of work that depend on human response.

Use of Warning Signs

Signs, instructions, labels that depend on human response.

Use of Personal Protective Equipment (PPE)

Depends on human response, used as a sole measure only when all other options have been exhausted. PPE is the last resort.

It is the responsibility of the user of the equipment to ensure that all appropriate control measures identified in the Risk Assessment are in place before using the equipment.

To assist you in carrying out your Risk Assessment we have identified the Key Hazards in the operation of Thermal Spray Equipment and this information can be found in Section 1.3.

1.3 Key Hazards

In this section the key hazards associated with Thermal Spraying are described. It includes a brief description of the hazards and their possible consequences. In any Risk Assessment for a Thermal Spray Process, a consideration of all relevant hazards will need to be included. Ancillary activities that are likely to be undertaken, such as grinding, grit blasting, solvent cleaning, machining etc. are not included in this section.

1.3.1 Noise

The two main factors that make noise in the workplace harmful are the loudness of the noise and the length of time a person is exposed to it each day. Noise destroys the delicate nerve cells in the inner ear that transmit sound messages to the brain. The nerve cells are replaced by scar tissue that does not respond to sound. This damage occurs painlessly and very slowly, but is permanent. There is currently no cure for noise-induced hearing loss, and it cannot be helped by hearing aids. All spraying processes are noisy and may generate noise levels in excess of the first action level. Users of thermal spray equipment are responsible for conducting their own noise assessments, which must be based on the exposure of the persons in the workplace, and of which a noise survey is only part.

Key Hazards: Stress, difficulty in communication, long term hearing loss, Tinnitus.

NEVER operate the system without adequate hearing protection.

ALWAYS ensure that **ALL** personnel likely to be exposed are adequately protected, including those not directly involved in the process.

1.3.2 Radiant Energy

Always wear eye protectors when operating, or watching the arc spray operation.
Inspect the eye protectors frequently. Lenses and over plates, which are scratched, pitted or damaged, can impair vision and seriously reduce protection. All personnel in eye hazard areas should wear protective eyewear. This includes employees, visitors, researchers, contractors, or others passing through an identified eye hazard area. To provide protection for these personnel, a sufficient quantity of goggles and/or plastic eye protectors should be available. If personnel wear personal glasses, eye protectors suitable to wear over them should be provided.

Key Hazards: Cataract, burns, Arc-Eye.

NEVER operate the system without adequate eye protection.

ALWAYS ensure that **ALL** personnel likely to be exposed are adequately protected, including those not directly involved in the process.

1.3.3 Fume & Dust

Powdered metals, particularly titanium, aluminium and magnesium give rise to a fire and explosion risk, depending on the circumstances. Powdered materials can collect in ducting, on filters, and around the spray booth. If these accumulations are heavy, and they are disturbed, they can be ignited. An explosion may result from the ignition of a dust cloud, inside, or outside the equipment. A fire may follow from an explosion and its fireball, or may result from self-ignition of layers of accumulated dust on hot surfaces, including some electrical equipment.

Many of the materials that are routinely sprayed have the potential to be hazardous to health due to their intrinsic properties. Even the least toxic materials, if present in the air in sufficient quantities, can be hazardous to health. Dust produced by the process produce airborne particulate matter, in size ranges that can be inhaled. Both inhalable and respirable matter may be produced. Respirable particles are more dangerous because they can be breathed deeply into the lungs. The user must therefore identify the hazards, assess the risks, and prevent or, where not reasonably practicable, adequately control them. The assessment must take into account all occasions where exposure may occur – which include spraying, cleaning, disposal and maintenance.

Several commonly sprayed substances are subject to statutory exposure limits. The assessment must take into account these exposure limits. When a substance or preparation has an occupational exposure standard, control of exposure is adequate if levels are maintained below that standard. Below are the most commonly sprayed materials. However, other materials may also be toxic. It is essential that users consult the MSDS (Material Safety Data Sheets) that arrive with their consumables (manufacturers must supply these), so that they can take into account the health effects, any exposure limits, and any properties such as explosion hazard, when conducting their risk assessments.

Key Hazards: Fire & explosion, toxic effects by inhalation, toxic effects by skin contact.

The information that follows highlights the most commonly sprayed materials and their potential effects.

Commonly sprayed materials

 = Fire / Explosion Hazard

 = May react with water to form hydrogen

Aluminium

Long term inhalation of aluminium powder or aluminium oxide may cause scarring of the lungs. Aluminium powder can form explosive mixtures with air.

Chromium

Prolonged exposure to Chromium metal dust may give rise to lung fibrosis. It is highly toxic. Chromium oxide and chrome carbide feedstock are both Chromium (III), the less toxic form of Chromium. However spraying may convert Chromium (III) compounds to Chromium (IV) compounds, which are suspected human carcinogens. Exposure to Chromium (IV) compounds must be kept as far below the maximum exposure limit (MEL) as is reasonably practicable.

Cobalt

Cobalt is moderately toxic. It may cause sensitisation by inhalation and skin contact, resulting in occupational asthma and allergis dermatitis. Exposure must be kept as far below the maximum exposure limit (MEL) as is reasonably practicable.

Copper

Copper fume may give rise to metal fume fever. Inhalation may cause muscle weakness and headache. Some compounds of copper are highly toxic and may cause long term effects.

Iron

Inhalation of iron oxides over a long period may cause scarring of the lungs without physiological symptoms.

Molybdenum

Occupational ill-health from exposure to Molybdenum is unlikely.

Nickel

Nickel is harmful. Repeated skin contact may cause allergis contact dermatitis. It is a suspect human carcinogen, and exposure must be kept as far below the maximum exposure limit (MEL) as is reasonably practicable.

Tin

Tin powder may cause irritation. Inhalation over a long period may cause scarring of the lungs without physiological symptoms.

Titanium

Occupational ill-health from exposure to titanium is unlikely.

Tungsten

Ingestion of soluble tungsten compounds may cause illness, but occupational ingestion of tungsten, other than in hard-metal alloy is not known to cause long term ill health.

Zinc

Zinc can cause metal fume fever, but is otherwise only moderately toxic.


NOTE: In certain concentrations, a mixture of aluminium dust and iron oxide (rust) can cause a thermitic reaction, resulting in a spontaneous combustion. This is very rare but efforts should be made to minimise cross contamination of aluminium dust and iron oxide.

1.3.4 Mechanical Hazards

If equipment has been installed to manipulate the component and/or spray gun, it is important that it is designed to protect the operator from mechanical hazards. It is possible for the operator to be struck by a moving table or manipulator, to be crushed against the wall of the booth, or to become entangled in rotating machinery. Serious injury could occur. Trailing cables and other obstructions present a tripping hazard, and because of the relatively confined area of a spray booth, and the close proximity to machinery, the consequences may be serious.

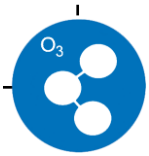
Key Hazards: Entanglement, being struck by machinery, trips and falls.

1.3.5 Electrical Hazards

Electricity can give rise to electric shock, fire, explosion and burns. It can also lead to falls and muscular injury. The risk of death from electric shock is related to the current that passes through the body, and the path it takes.
Voltages below 50Vac or 120Vdc are considered safe, except in conducting environments. A typical spray booth is a conducting environment. However, the power supply for the equipment will usually be fed from a higher voltage supply, typically 240V or 415V, which must always be considered hazardous.
Other related causes of electrical accidents include poor placement of cables. These may become trapped on booth doors, or damaged whilst on the floor, leading to exposure of the live conductors. Electrical apparatus can also be the source of sparks, and like electrostatic discharges can ignite explosive mixtures; additionally they can cause a fire, which, with gases present, could be dangerous.

Key Hazards: Electric shock, explosion, fire, burns.

1.3.6 OZONE



Arc systems with much brighter arc intensity operate between 280 and 220 nm, also called the UV-C region. Arc systems operating in this range also generate ozone. Ozone is formed from dioxygen by the action of ultraviolet light and also atmospheric electrical discharges.

It is a colourless gas with a sharp characteristic odour; it can be smelled at concentrations below the permissible exposure level. The odour is generally detectable by the human nose at concentrations of 0.02 and 0.05 ppm. It has a density of 1.244 g/l, around 1.6 times heavier than air.

Ozone affects the body by being inhaled or by irritating the eyes, nose and throat. When a person is exposed to very low concentrations of ozone, the person may notice a sharp irritating odour. As the concentration increases, the ability to smell it may decrease. Irritation of the eyes, dryness of the nose and throat, and cough may be experienced. If the Ozone concentration continues to rise, more severe symptoms may develop. These may include headache, upset stomach or vomiting, pain or tightness in the chest, shortness of breath or tiredness, which may last for several days to weeks. Finally, with higher levels of exposure, the lungs may be damaged and death may occur.

The following limits are widely accepted (USA, Sweden, UK and other parts of Europe):
- 8 hour per day/5 days per week (occupational exposure limit) - 0.1 ppm
- 15 minutes (short term exposure limit) - 0.3 ppm

Key Hazards: Irritation, headache, vomiting, lung damage, death.

1.3.7 Material Handling

The wire is supplied in either drums, coils or MIG reels. It is important to assess any manual lift before carrying out the lift, and if necessary, use a crane or suitable lifting device to prevent injury. Always lift the drums as indicated on the drums info label. Do not attempt to manually handle the drums, or to roll them, as this will render them useless.

1.3.8 The Pistol

The ARC150 Pistol is designed for handheld or automated use, where it can be attached to a manipulator / robot. Under these circumstances the Pistol should be installed in a manner where it cannot cause harm to the operator or the surrounding environment.

In the case of the automated operation, it is the responsibility of the client to risk assess the automatic installation and ensure all safety criteria are met.

1.3.9 Summary

Below is an approximate rating of the hazards in typical circumstances while using the ARC150 Arc Spray System. It must be stressed that the hazard ratings may change in individual circumstances. An example of this would be the rating for toxic consumables. This would relate directly to the consumable in use.

⚠ Lower level of hazard

⚠⚠ Medium level of hazard

⚠⚠⚠ Very high level of hazard

Compressed Gases	⚠
Asphyxiant Gases	⚠
Noise	⚠⚠
UV Radiation	⚠⚠
Fine Dusts, fume and powders (explosion risk)	⚠⚠⚠
Potentially toxic consumables	⚠⚠⚠
Water borne disease (water curtain fitted)	⚠
Mechanical Hazard (automated equipment)	⚠
Electric Shock	⚠
Burns	⚠⚠⚠
Stab Risk	⚠
OZONE	⚠⚠

SECTION 2

THE EQUIPMENT

2.1 System Configurations

2.1 System Configurations

Variations of the below standard configurations may be possible. Contact Metallisation to discuss your specific application requirements.

Standard Configuration – Push/Pull with wire in Drums

Most commonly used for in-house anti-corrosion applications where drums can easily be handled.

Wire in drums or coils

3m max.

Energiser and push/pull drive unit

10m / 20m supplies from wire drive to pistol

Pistol

STANDARD DRUM SYSTEM PART NUMBERS	
PART NO	**DESCRIPTION**
ARC150-2310D	ARC150 System, 2.3mm, 10m supplies, drum dispense
ARC150-2320D	ARC150 System, 2.3mm, 20m supplies, drum dispense
ARC150-2510D	ARC150 System, 2.5mm, 10m supplies, drum dispense
ARC150-2520D	ARC150 System, 2.5mm, 20m supplies, drum dispense

Standard Configuration – Push/Pull with wire on MIG reels

Most commonly used for on-site anti-corrosion applications where loading of the smaller MIG reels is more feasible than using drum material.

Energiser and push/pull drive unit

10m / 20m supplies from wire drive to pistol

Pistol

STANDARD MIG SYSTEM PART NUMBERS	
PART NO	**DESCRIPTION**
ARC150-2310M	ARC150 System, 2.3mm, 10m supplies, MIG dispense
ARC150-2320M	ARC150 System, 2.3mm, 20m supplies, MIG dispense
ARC150-2510M	ARC150 System, 2.5mm, 10m supplies, MIG dispense
ARC150-2520M	ARC150 System, 2.5mm, 20m supplies, MIG dispense

Extended Configuration – Push/Pull with wire on MIG reels

Most commonly used in hard to reach areas such as boilers/vessels where access for the energiser is limited. Hardboard reel variant can also be offered on the trolley.

Energiser

Extension Supplies

Push/pull drive unit and MIG reels on power extension trolley with quick release connections

Supplies from wire drive to pistol

Pistol

Extended Configuration – Push/Pull with wire in Drums

Most commonly used for very long access applications where there is a benefit to remotely site the energiser away from the spraying area and maintain the benefit of having wire in drums.

Energiser

Wire in drums 3m max. (2m std) wire

Extension Supplies

Push/pull drive unit on power extension trolley with quick release connections

Supplies from wire drive to pistol

Pistol

TYPICAL EXTENDED SUPPLIES CONFIGURATION		
EXTENDED SUPPLIES	**PISTOL SUPPLIES**	**TOTAL MAX**
10M	10/20M	50M
20M		
30M		
40M	10M	

NB: Maximum total supplies length is 50M. This can be a combination of 30 + 20 or 40 + 10.

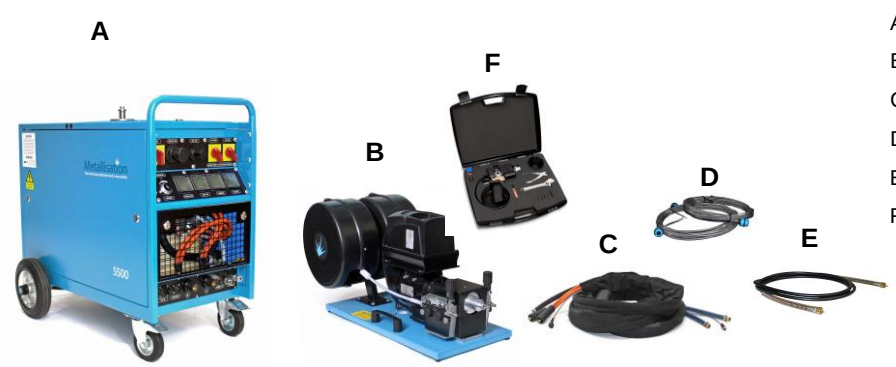
Also available is the Push/Pull with wire on hardboard reels configuration – most commonly used for on-site anti-corrosion applications where loading of Hardboard reels is more feasible than using drum or MIG material. Hardboard reels are common in some markets and allow a larger amount of wire to be held on the reel than traditional MIG reels.

SECTION 3

OPERATING THE EQUIPMENT

3.1 Connecting the System

1

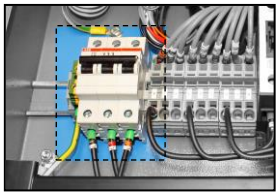


A. S500-PLC Energiser.
B. Drive Unit Assembly.
C. Power Cable / Air Hose Assembly.
D. Wire Feed Conduits.
E. Flexible Drive Cable.
F. ARC150 Pistol and Tool Case.

Remove any packing materials and ensure that all items are present and the equipment has suffered no damage whilst in transit (see conditions of sale). **NB:** if using long supplies with a powered extension trolley also refer to Section 3.2.

2

Rear of Energiser



Feed Power Cable through opening using a suitable Gland

Power Terminals

The Energiser should be connected to an appropriate 3 phase power supply by a competent qualified electrician in accordance with the following recommendations:

STOP

Position the Energiser to allow unrestricted airflow into / out of the unit and connect to a mains isolator fuse box ensuring each phase carries suitable fuses.

Remove the top panel and connect a suitable Power Cable to terminals 1, 2, 3 and Earth.

Check that the input voltage is correct for the unit (Refer to Energiser Maintenance Manual).

Connect suitable size hose to the air supply. It is strongly recommended that a filter unit be installed at the mains outlet point. A capacity of 1.5m³ /min @ 5 bar (53cfm @ 72.5 psi) is usually adequate.

3

AIRFLOW

Switch on Power Supply and turn the Mains Switch on.

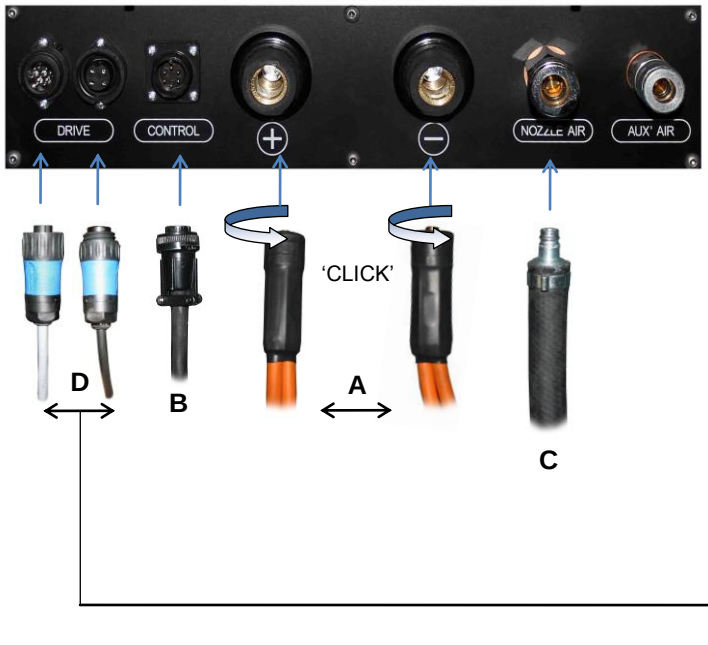
Cooling Airflow should pass from front to back. If air passes from the back to the front of the Energiser, the fan is running in reverse.

If this is allowed to continue damage to the Energiser may occur. **Isolate the Power Supply and reverse two phases of the input 3 phase.**

Once airflow is passing through correctly, turn the Mains Switch off and refit all panels.

Connecting the System continued…

4



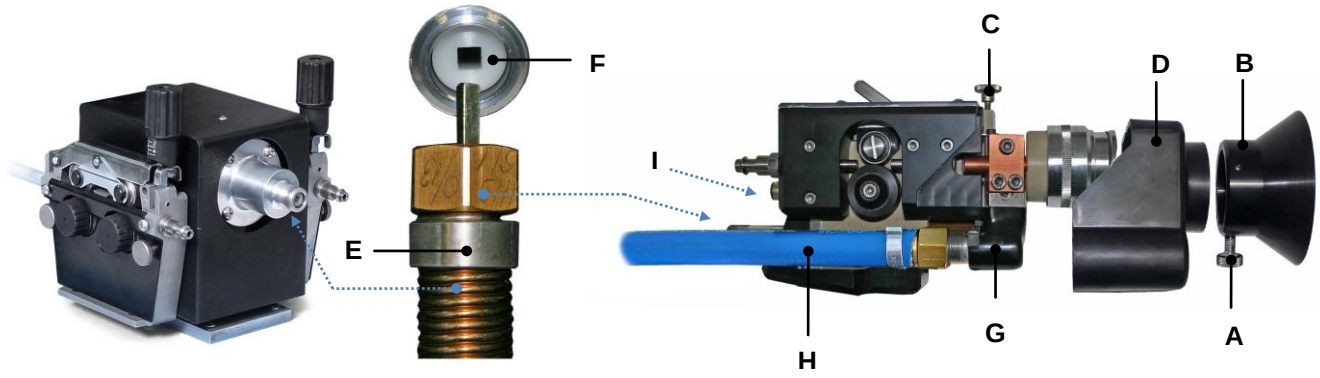
Ensure that power to the Energiser is isolated.

Connect the Supplies Pack, comprising Power Cables **(A)**, Motor Drive Cable **(B)** and Nozzle Air Hose **(C)** from the Manifold to the appropriate connections on the front of the Energiser**.**

Polarity of Power Terminals is unimportant unless spraying pseudo alloys (2 different materials) - twist power terminals clockwise firmly to lock.

Connect the Control Cables from the DUA Wire Feed Unit **(D)** to the Energiser.

5



1. Loosen the Pointed Shroud Screw **(A)** and remove the Shroud **(B).** Unscrew the Thumb Screw **(C)** and remove the Hood **(D)** from the Pistol.

2. Take one end of the Flexible Drive Cable **(E)** and carefully position the squared end of the inner into the rear of the Pistol coupling **(F).** Apply some grease to the thread on the drive connector and screw home the drive connector ring whilst holding the Flexible Drive in place. Lightly tighten with the provided spanner. Connect the other end of the Flexible Drive Cable to the DUA Wire Feed Unit applying grease to the Drive Connector as before.

3. Fit the 2 Cooled Conductors **(H)** to the Terminal Blocks **(G)** and firmly tighten. Use one spanner to hold the Terminal Block whilst tightening the conductor with another to prevent damage to the Terminal Blocks. This joint will carry up to 500 amperes so ensure they are securely tightened and check periodically.

4. Replace the Hood **(D)** and Shroud **(B)**.

5. Connect the Control Cable from the supplies pack to the rear of the Pistol **(I)**.

3.2 Connecting using a Powered Extension Trolley

Using a Powered Extension Trolley allows the Energiser to be sited further away from the spray job whilst still maintaining the power, air and control couplings quick release feature.

PART NO.	DESCRIPTION
ARC150-PET	ARC150 powered extension trolley for ARC150 system

FRONT

BACK

Connect the system using the powered extension trolley as follows:

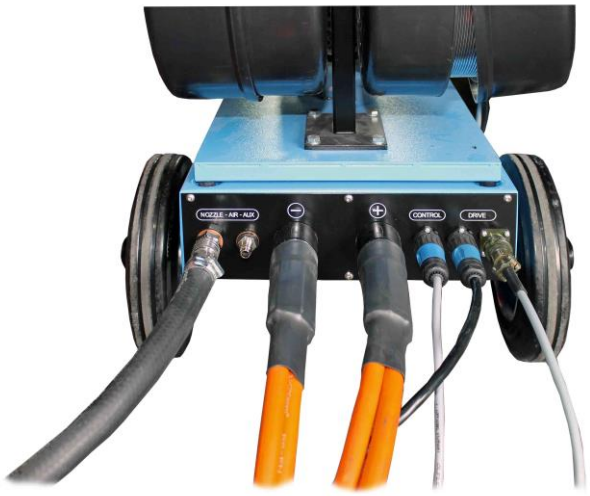
1

Ensure that power to the Energiser is isolated.

Connect the Extension Supplies Pack, comprising Power Cables, Motor Drive Cable and Nozzle Air Hose to the appropriate connections on the front of the Energiser and connect the Control Cables from the DUA Wire Feed Unit to the Energiser.

2

From the Energiser, connect the other end of the Extension Supplies to the rear of the Powered Extension Trolley as shown.



3

Finally, connect the Supplies Pack to the appropriate connections on the front of the Powered Extension Trolley.

Now the supplies can be fitted to the Pistol as per Section 3.1 – Point 5.

3.3 Preparing to Spray

1

If using MIG Dispensers, use the following procedure:

Open the Mig Dispenser and if attached, unscrew the retaining nut.

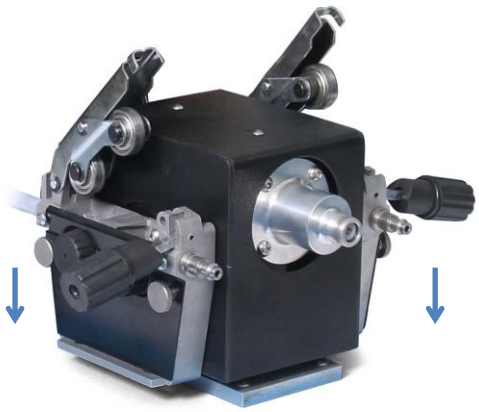
Load the Wire for spraying into the Mig Dispenser Reels with the wire feeding from the bottom of the reel.

Screw on the retaining nut.

Straighten the first 150mm.

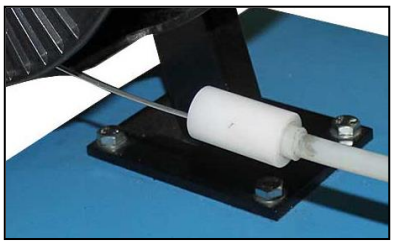
Using a file, smooth off any sharp edges on the wire end. This will dramatically improve the performance and life of the Wire Conduits and aid feeding the wire into the pistol.

2



Ensure that the drive roller tension is released by pulling the Fixing Arm Tensioners down on both sides of the unit.

3



Feed the wire through the PTFE tubes and the through the Right and Left Hand Drive Unit Assemblies.

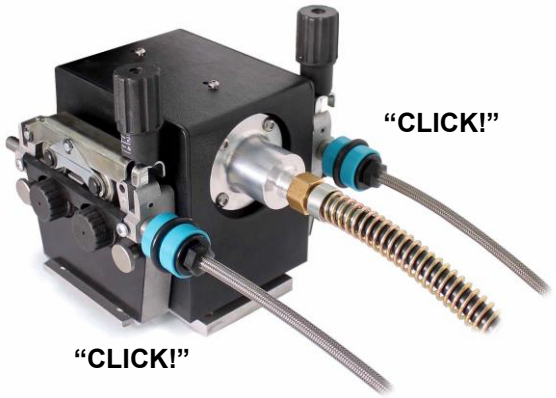
4

Allow 50mm to protrude through the Unit. Then pull down the Bearing Pressure Arms and close with the Fixing Arm Tensioners.

5

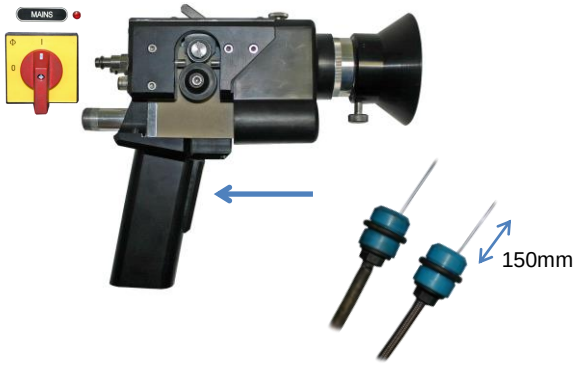
Attach an absorbent strip for wire lubricant to both reels and apply approximately 5ml of lubricant to each strip.

6



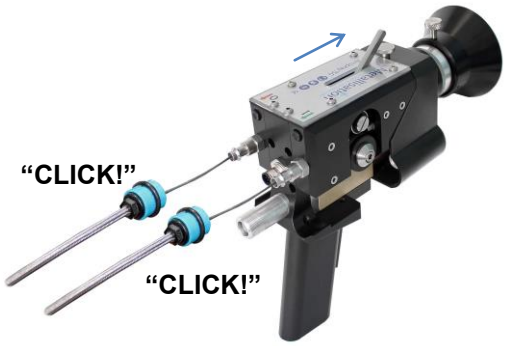
Connect the Conduits. A "click" will confirm they have attached correctly.

7



Turn the energiser on. Wait 10 seconds for the drive unit to power up. Pull the Trigger on the Pistol to drive the wire through the other end of the conduits. Allow approximately 150mm to protrude through the conduits.

8



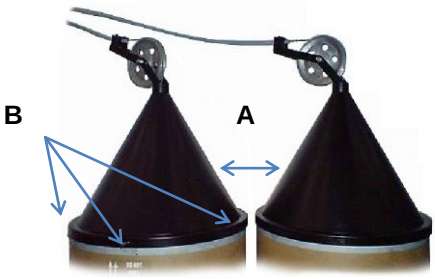
Ensure that the tension on the Pistol is off by pushing the lever in the direction shown. Push the wire manually through the Rear Wire Guides on the pistol until the wires exit the front of the Pistol.

Push the conduits onto the Pistol. A "click" will signal that they are on correctly. Then release the wire tension lever.

9

Using a pair of side cutters, trim the wires flush to the Air Cap Face. The wire ends **MUST NOT** touch each other or the Air Cap.

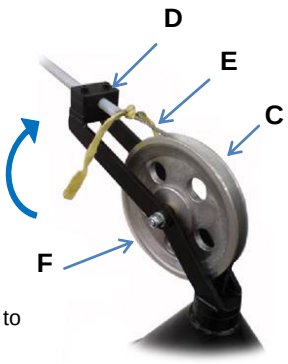
OR



If using Drum Dispensers: Ensure there is a gap between the feed cones to avoid a short circuit **(A).**

Remove the lid of the drum and pull out the wire. Feed the wire end through the top of the feed cone and place the cone on top of the drum.

Tighten up the 3 retaining screws located around the base of the cone **(B)** to secure the cone to drum.



Feed the wire over the Roller **(C)** and through the guide in the black block **(D)** then into the Wire Tube until 200mm emerges from the other end.

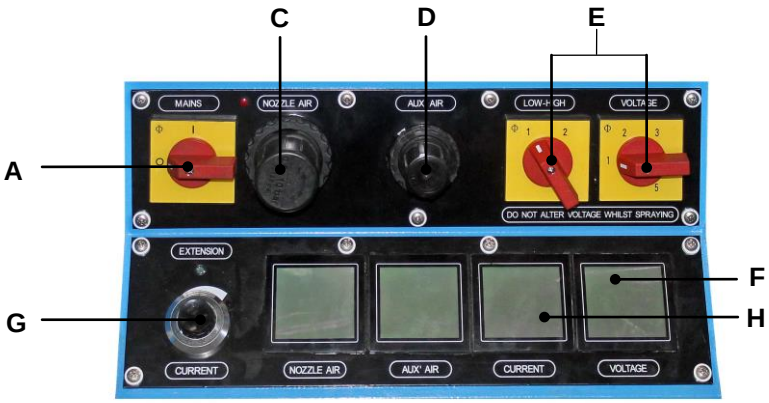
Attach an absorbent strip for wire lubricant **(E).**

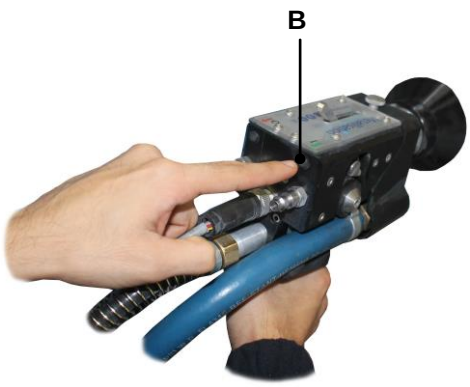
Apply approximately 5ml of lubricant to each strip (x2).

Adjust the pulley arm **(F)** to give a smooth flow of wire from the pulley to the Drive Unit. The wire can now be fed into the Drive Unit as per points 2 – 9.

3.4 Spraying

NB: Before spraying ensure that all the appropriate safety steps have been taken and the necessary eye and ear protection is being used, in accordance with the Risk Assessment. See Section 1 – Safety Precautions and Risk Assessment. It is also important to be familiar with the Shutting Down procedure – Section 3.5 before attempting to spray.





1. Check that the Trigger on the handle is open (trigger out).
2. Start the Dust Extraction System. Then switch on Air and power at the Mains.
3. Ensure that the Pistol is safely pointed away from all personnel and combustible materials.
4. Switch on the Power to the Energiser **(A)**. The fan will now be running.
5. Press the green START button on the back of the Pistol **(B)** – The Nozzle Air and main power will come on and air will be passing through the Pistol.

See Table 1 for Approximate Spraying Parameters.

6. Adjust the Nozzle Air Regulator **(C)** and Auxiliary Air **(D)** (if being used) to obtain the desired spraying pressures (see Table 1).
7. Adjust the Voltage Selector Switches **(E)** to obtain desired spraying voltage (see Table 1).
8. The 'BEFORE SPRAYING' voltage will now be displayed on the voltmeter **(F)**. This will drop to the 'DURING SPRAYING' figure when the pistol is in operation.

NB: CHANGING THE VOLTAGE WHILST SPRAYING WILL SERIOUSLY REDUCE THE LIFE OF THE SWITCHES.

9. When in Closed Loop Mode (factory set) you can pre-set the desired Spray Current via the Potentiometer **(G)**. For example, setting the potentiometer to 2.00 will pre-set the Energiser to spray at 200 Amps. The Spraying current is only displayed on the Ammeter **(H)** when the pistol is spraying. The Ammeter is a guide to the pistol throughput. Increasing the motor speed via the Potentiometer will result in increased

throughputs which in turn will increase the reading on the Ammeter. See Section 3.8 for information on Closed Loop and Open Loop Modes.

NB: THE NEXT OPERATION WILL INITIATE SPRAYING

10. Squeeze the trigger on the Pistol handle.

11. When spraying the voltmeter **(F)** will display the 'DURING SPRAYING' figure.

12. In Closed Loop Mode the spraying current will have already been set as per point 9. If in Open Loop Mode adjust the speed using the Motor control potentiometer **(G)** until the desired spraying current (throughput) is achieved.

NB: The system is designed to be operated at a maximum of 500A. In Closed Loop Mode (Factory set) the system will limit itself to 500A. If in Open Loop Mode and this current is exceeded the system will shut down to protect itself. See Section 3.8 for information on Closed Loop and Open Loop modes.

The ARC150 Arcspray System provides measurement of the Voltage at the Pistol. This allows for more accurate Voltage reading and makes redundant the need to make allowances for differing length supplies when setting voltage.

TABLE 1: APPROXIMATE SPRAYING PARAMETERS

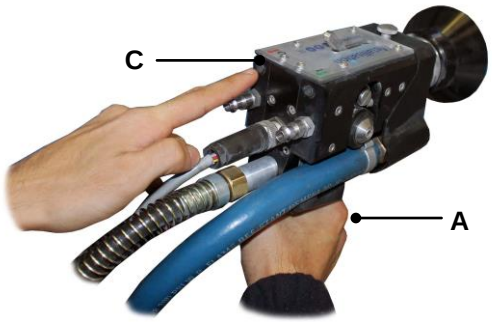
MATERIAL		VOLTAGE (volts – open current spray)		CURRENT (amps)	NOZZLE AIR
		BEFORE SPRAYING	DURING SPRAYING	MAX	
02E / 21E Zinc & Zinc Alloys	2.3	19	16	500	3-4 Bar (44-58psi)
	2.5				
01E Aluminium & Aluminium alloys	2.5	31	25-27	500	3-4 Bar (44-58psi)
28E Arctec**	2.3	36	32	500	2-4 Bar (29-58psi)
72E Inconel 625	1.6	39	35	300	3-4 Bar (44-58psi)

NB: The Voltages given are approximate minimums. The correct voltage is the minimum voltage that will maintain a stable arc. Voltages higher than required can result in a reduction of spray efficiency. Air pressures can be adjusted to suit application: Reduced pressures will result in a rougher coating finish. Higher air pressures will give a finer finish but may slightly reduce deposit efficiency. The system will shut down to protect itself if reduced below 2 bar. Increased pressures will result in finer coatings.

** 28E Wire requires that the 7507L - Low Pressure Transfer Tube **MUST** be used

3.5 Shutting Down

1. Release the Trigger on the Handle **(A)** to stop spraying.
2. The Pistol will stop spraying but air will continue to pass through the Spray Head and there will be voltage at the terminals and wire.
3. The Voltmeter **(B)** will once again display the 'BEFORE SPRAYING' Voltage.
4. Press the red STOP button on the Pistol **(C)**. After a short delay this will switch off the Air and Power to the Pistol.



NB: Pressing the STOP button before releasing the trigger on the pistol can result in damage to the Spray Head due to wire overrun.

5. Turn the Energiser Mains switch **(D)** to OFF.
6. If not spraying for an extended period, turn off the power and air supplies to the Energiser.
7. Once the environment has been cleared, turn off the Dust Extraction System.

3.6 Remote Pendant

An optional Remote Pendant is available. When connected, the Remote Pendant allows remote operation of the system when the pistol is mounted to a robot or manipulator. It connects to the rear of the Energiser – see below.

NB: When using the Remote Pendant the Pistol **MUST NOT** be handheld.
When fitted the Pistol ON / OFF and the trigger are diabled.

For information on the installation of the Remote Pendant please refer to **DIAG: EN 277** found in the Energiser Maintenance Manual: MAN-ENE-S500(150)
General Operation of the system when the Remote Pendant is fitted:

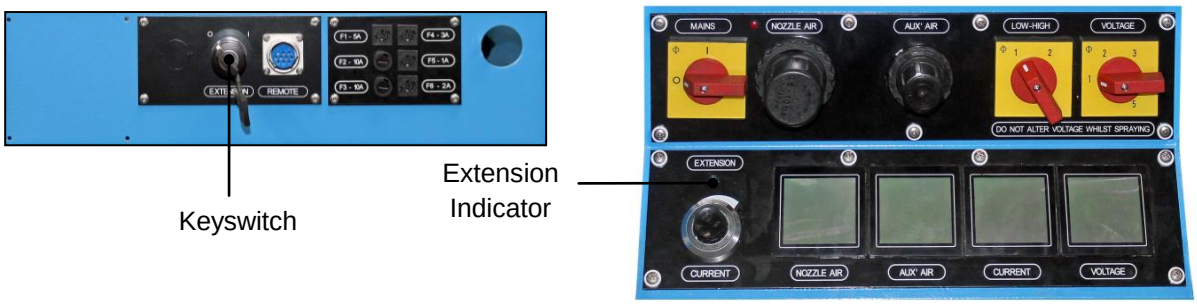
Green	–	Starts Air
Red	–	Stops Air
Keyswitch	–	Acts as a trigger starting and stopping Wire Feed

The Remote Pendant is fitted with an Emergency Stop button which will shut the Energiser down if needed.

3.7 Using Optional Arc Extension

The ARC150 Arc Spray System has the facility to be used in conjunction with a specially designed ARC Extension.

When this equipment is being used it is essential that prior to spraying, the keyswitch on the back of the Energiser is switched to ON. This switch limits current to 300A. Turn the Energiser on and the Extension Indicator will be illuminated to indicate the Arc Extension is being used.



3.8 Closed Loop and Open Loop Modes

The Energiser is factory set to run in Closed Loop Mode enabling the operator to set the spray current to a pre-defined value via the potentiometer independent of wire type before starting the job, enabling easier setup.

For example, setting the potentiometer to 2.00 will pre-set the Energiser to spray at 200 Amps.

This mode can be changed so that it will run as a speed control unit (Open Loop Mode). In this mode the continuously variable spraying current is controlled by the motor speed control potentiometer to the drive motor. The spray current of the system is a guide to the material throughput and is infinitely variable up to its full nominal rating at 100% duty cycle i.e. 500A

For details on converting the Energiser from Closed Loop Mode to Open Loop Mode please consult the relevant Energiser Maintenance Manual.

SECTION 4

BASIC MAINTENANCE

4.1 Routine Maintenance

The following table gives a basic routine maintenance schedule for the ARC150 System.

NB: Before commencing repairs or maintenance on any part of the System, ensure that the power is isolated. If possible, work should be carried out in a clean environment, if the system has not been used for a period of time it is strongly recommended that all electrical connections are checked before commencing operation. Failure to do this could result in damage to the equipment.

NB: Power to the Energiser **MUST** be isolated before performing any maintenance work. Failure to do so may result in serious injury.

MAINTENANCE SCHEDULE	MAINTENANCE OPERATION
EVERY 8 HOURS	PISTOL & SUPPLIES: • Remove the Hood and Shroud. • Clean any dust and debris from the Wire Roller Assy and surrounding areas on the Pistol. • Clean any dust and debris from the Drive Unit. • Ensure that the inside of the Air Cap is clean. • Clean and refit the Hood and Shroud. • Clean Wire Guides. • Check all cables and hoses for damage and dust – clean / replace as necessary. • Check the electrical connections at the Manifold (Section 4.8) for damage. Replace if necessary. Ensure electrical connections are tight. • Blow clean dry air through the Wire Conduits / PTFE Tubing for approximately 2 minutes. • Blow clean dry air over the wire being used to remove any dust residue. • Clean and / or replace the Contact Tip and Contact Tip Support Tubes to ensure smooth wire feed. • Change wire cleaner cloths and re-lubricate. ENERGISER: • Wipe down the exterior of the Energiser with a **DRY** clean cloth. • Check all external power and control cable connections for security. Re-tighten as necessary.
EVERY 20 HOURS	In addition to the above, carry out the following on the pistol: • Dismantle the CG Spray Head – Section 4.3. Clean all components and re-fit or replace as necessary. • Lubricate the Pinch Release Cam. • Generally look for signs of overheating on wire insulation.
EVERY 40 HOURS	PISTOL & SUPPLIES: • Check and ensure that all mechanical and electrical connections are secure. • Inspect the Supplies package and Manifold for any signs of damage, wear or perishing due to age. • Remove Rollers Tyres and reverse or if needed clean using a wire brush. • Inspect Wire Guides for wear. Please refer to the Pistol Maintenance Manual for information on dismantling the pistol for further maintenance. ENERGISER: • Isolate the electricity supply. • Remove the side covers and using a suitable vacuum cleaner remove any dust that has accumulated inside the unit, generally looking for signs of overheating on wire insulation. **DO NOT USE COMPRESSED AIR!** Compressed air can be damp and there is also a risk that dust can be propelled into the Energiser causing greater problems. • Check mains input and power output connections are tight and in good condition. Additionally, information on the Energiser Diodes, Thermal Switches, Over-Current Protection and Air Pressure Switch can be found in the Energiser Maintenance Manual.

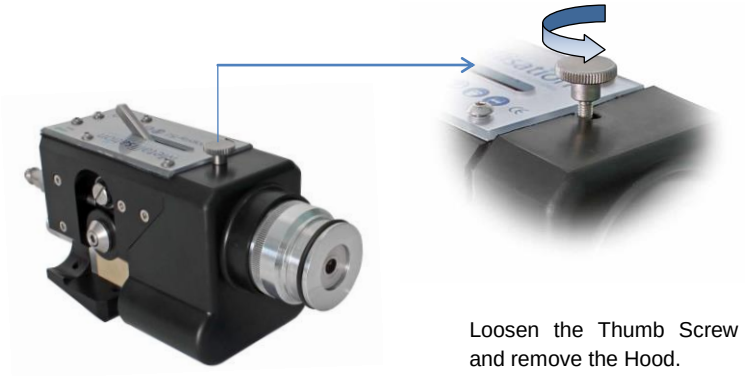
4.2 CG Spray Head – Checking Contact Tips

1

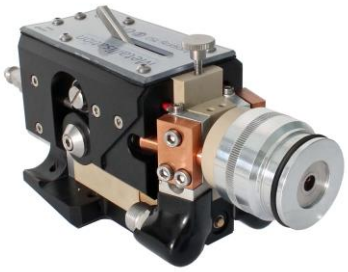
NOTE: Before attempting to disassemble the Spray Head always ensure that the mains power supply is isolated and the wire has been removed from the pistol.

If not already removed, loosen the Pointed Shroud Screw and remove the Shroud by pulling forward.

2



Loosen the Thumb Screw and remove the Hood.



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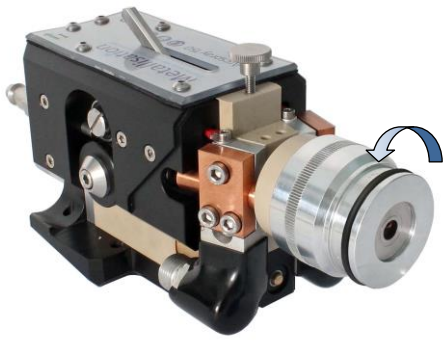
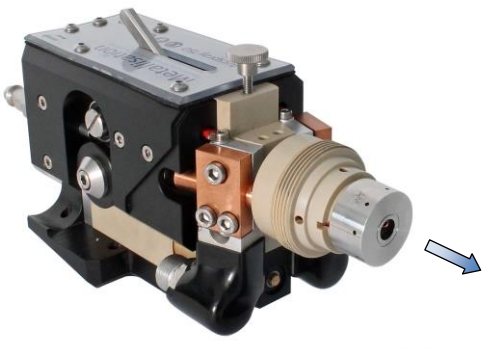


Remove the Air Cover by unscrewing in the direction shown.

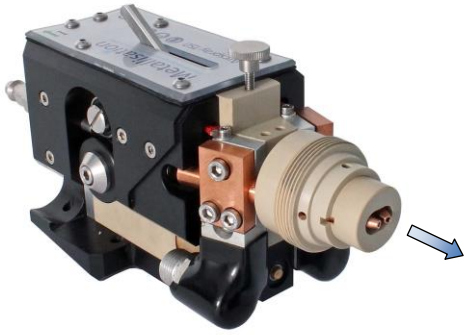
4



Remove the Air Cap by pulling forward.

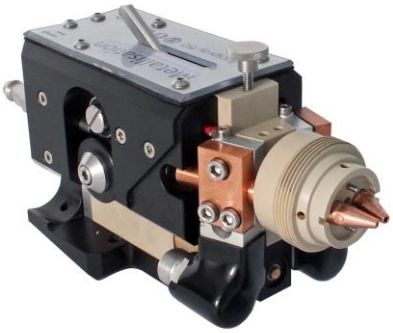
Continue to remove the Contact Tips using the following technique:

5



Remove the Air Concentrator by pulling forward.

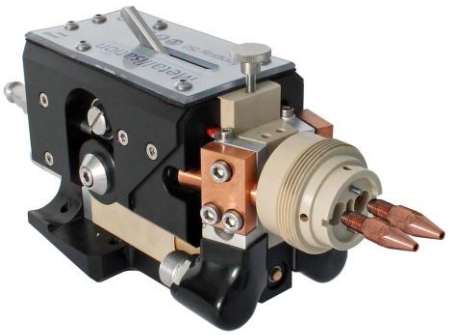
6



At this point the Spray Head will look as shown and the Contact Tips will be accessible.

7

Using a suitable spanner, remove the Contact Tips and check for damage and clean / replace as necessary.



Once satisfied, reassembly of the CG Spray from the point of the Contact Tip removal is a reverse of the above procedure. All components must be cleaned in an appropriate de-greasing agent and blow dried before replacing.

For complete disassembly instruction of the CG Spray Head please see Section 4.3.

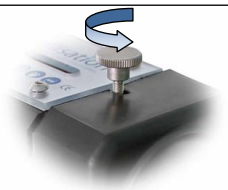
4.3 CG Spray Head – Complete Disassembly

1

NOTE: Before attempting to disassemble the Spray Head always ensure that the mains power supply is isolated and the wire has been removed from the pistol.

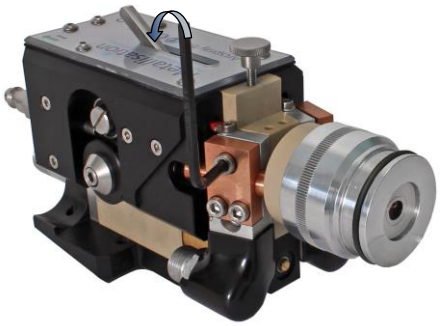
If not already removed, loosen the Pointed Shroud Screw and remove the Shroud by pulling forward.

2



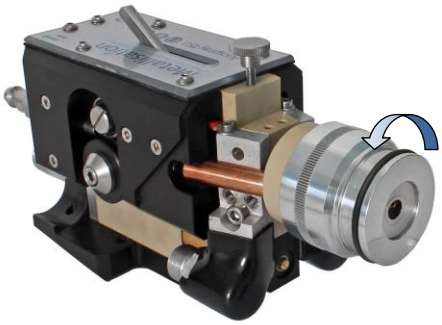
Loosen the Thumb Screw and remove the Hood. Check the 'O' Ring on the Air Cover for damage and replace as necessary.

3



Using an appropriate Hex Key remove the Screws and Clamp Pads from the left and right hand Terminals.

4



Loosen the Air Cover by turning in the direction shown. **DO NOT** unscrew completely. Now the complete Spray Head Assembly can be pulled forward from the pistol.

5

Contact Tip Support Tubes will need to be replaced periodically. The frequency of replacement will depend upon the wire used and adherence to maintenance schedule.

At this point the Contact Tubes can be removed and cleaned / replaced as necessary. The Contact Tubes can be removed by hand as shown above. If experiencing difficulty in removing, use **soft** jaws.

NB: Drills should **NOT** be used to clean tubes as they are likely to increase the size of the Contact Tube, potentially reducing its life.

Taking care not to drop any of the parts, continue to inspect the Spray Head parts using the following technique:

6

Taking care not to drop any of the Spray Head parts, unscrew and remove the Air Cover.

The Air Cover should be easy to unscrew having loosened it whilst attached to the pistol.

7

Lift out the Air Cap and check for damage.

This is an example of wear to an Air Cap – the central orifice is no longer perfectly round.

8

Lift out the Air Concentrator and check for damage.

This is an example of damage to an Air Concentrator– we can see the wear on either side of the central orifice.

9

The Transfer Plug should have come away with the Spray Head Assembly. Pull it out.

If it remained in the Pistol, pull it out from there.

10

Inspect the Transfer Plug and the two 'O' Rings for wear / damage.

Wash all components in an appropriate de - greasing agent and blow dry and if any parts are damaged renew as required.

4.4 CG Spray Head Reassembly

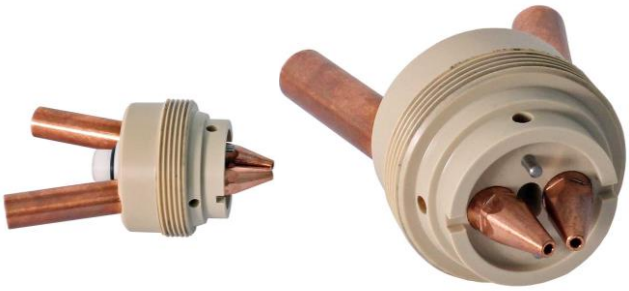
1

Once all Spray Head parts have been cleaned and any damaged parts have been renewed, the Spray Head can be reassembled using the following technique:

With both 'O' Rings fitted to the Transfer Plug, lubricate the larger 'O' Ring lightly with silicon grease.

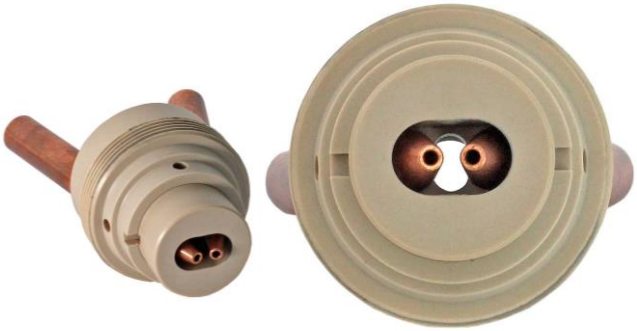
Press the Transfer Plug into the Contact Tube Support Block until the largest diameter touches the rear of the block.

2



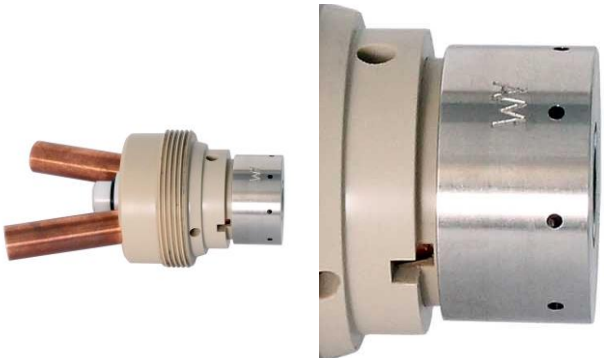
Select the correct Contact Tips for the wire being sprayed. Push the Contact Tubes through the Contact Tube Support Block until they bottom out and they protrude from the front face of the seat of the block.

3



Place the Air Concentrator in the seat of the Contact Tube Support Block with the Contact Tubes passing through the Air Concentrator.

4



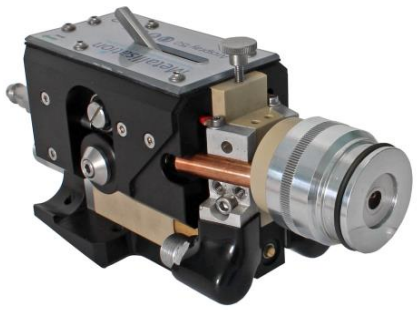
Place the Air Cap over the Air Concentrator.

5

Screw the Air Cover over the Air Cap. Hand tighten firmly but **NOT** excessively.

NB: Before refitting the Spray Head onto the pistol, ensure that the contact areas on the Terminals and Clamp Pads are clean and undamaged. Poor contact in these areas can cause overheating.

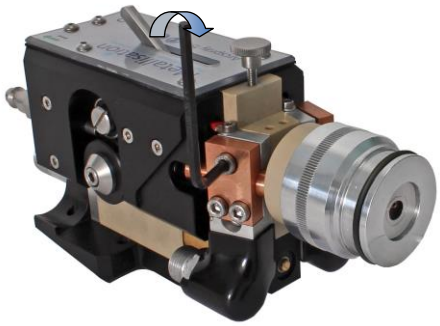
6



Place the Spray Head against the front of the pistol. Ensure the Transfer Plug locates in the Contact Tube Support Block and the Contact Tubes locate in the left and right hand Terminals.

It is important that the Contact Tubes are pushed fully through the Air Concentrator and that they are level with each other. If uncertain, check this is the case by removing the Air Cover and Air Cap.

7



Re-fit the Clamp Pads, by pressing the CG Spray Head against the Pistol. Fit the first Clamp Pad loosely and then fit the second Clamp Pad. Tighten both by screwing in firmly but **NOT** excessively. Excessive force will result in damage to the Clamp Pads / Terminals.

8

Slide the Hood over the front of the pistol and tighten the Thumb Screw.

9

Fit the Shroud onto the Air Cover and tighten the Pointed Shroud Screw in the direction shown.

NB: The Roller Guide Assy and Rear Wire Guides can be removed for cleaning / replacing at any point as per Sections 4.6 and 4.7 respectively of this Manual.

4.5 Tension Adjustment of Rollers

It may be necessary from time to time to adjust the tension of the Roller Guides.

Correct wire tension is the minimum tension required to satisfactorily feed the wire through the pistol.

The need to suddenly apply more tension is usually an indication of another issue such as worn wire guides, incorrectly assembled spray head, excessive drag from the wire dispenser, dirty/worn rollers or worn/damaged/seized pinch roll bearings.

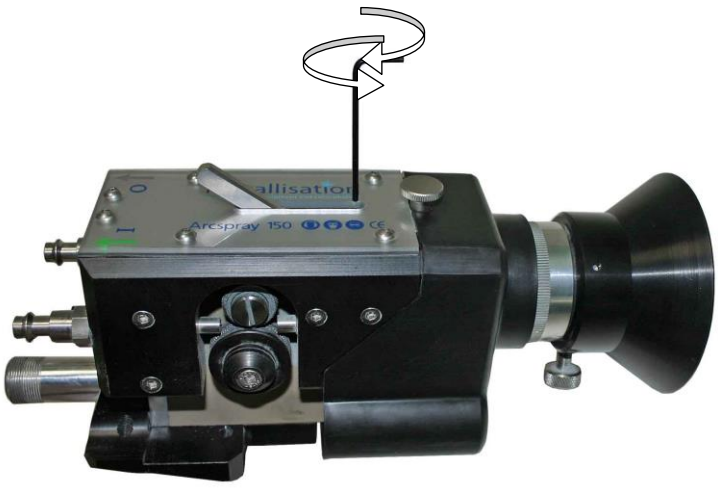
NB: These issues should be addressed rather than increasing the tension which can create other problems.

For example, excessive tension can deform the wire and make it out of round. This will cause problems feeding the wire through the Spray Head. Too much tension will also create heavy marks in the wire and create a lot of debris in the form of wire shavings in the roller area.

Tension should be reduced to the minimum required to satisfactorily feed the wire.

To adjust tension, locate the Tension Screw which can be found on the top of the Pistol, in the slot in front of the Pinch Release Cam. Using an appropriate Hex Key, turn the Tension Screw:

- **CLOCKWISE** – to increase the tension.
- **ANTI-CLOCKWISE** – to decrease the tension.

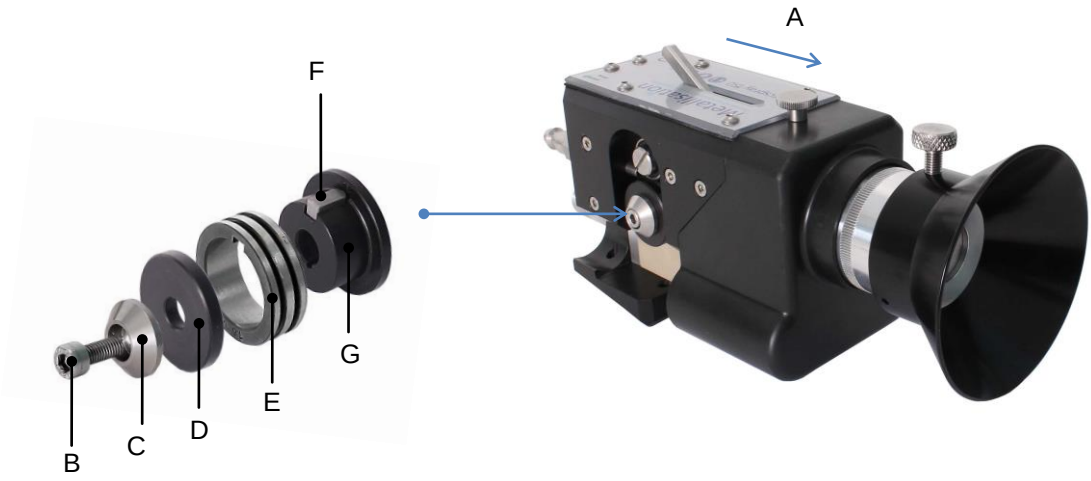


NB: Take care not to over tension the Roller Guides. Especially when using softer wires.

4.6 Roller Guide Assembly Maintenance

The Roller Guides will normally only need to be removed to renew if the Roller teeth are found to be broken, worn or choked with debris from the wire

Check for excessive spring tension and adjust accordingly (Section 4.5 – Tension Adjustment of Rollers). Also check for excessive friction in the wire conduits.



- Release the Tension on the Pistol **(A).**
- Using an appropriate Hex Key remove the Socket Head Cap Screw **(B).**
- Now the Roller End Cap **(C)** and the Pistol Roller Tyre End Cap **(D)** can be lifted away.
- The Roller Tyre Serrated 'V' **(E)** can be pulled away by hand and if found to worn or damaged the Roller Tyre can be reversed or cleaned of any clogging. At this point the assembly can be reassembled. Be sure not to loose the Pistol Roller Tyre Drive Key **(F)** and ensure that it is in place. If both grooves are damaged the Roller Tyre should be replaced.

  NB: New Roller Tyres can be pushed in by hand but ensure that the internal slot is aligned with the Drive Key in the Pistol Roller Tyre Housing.

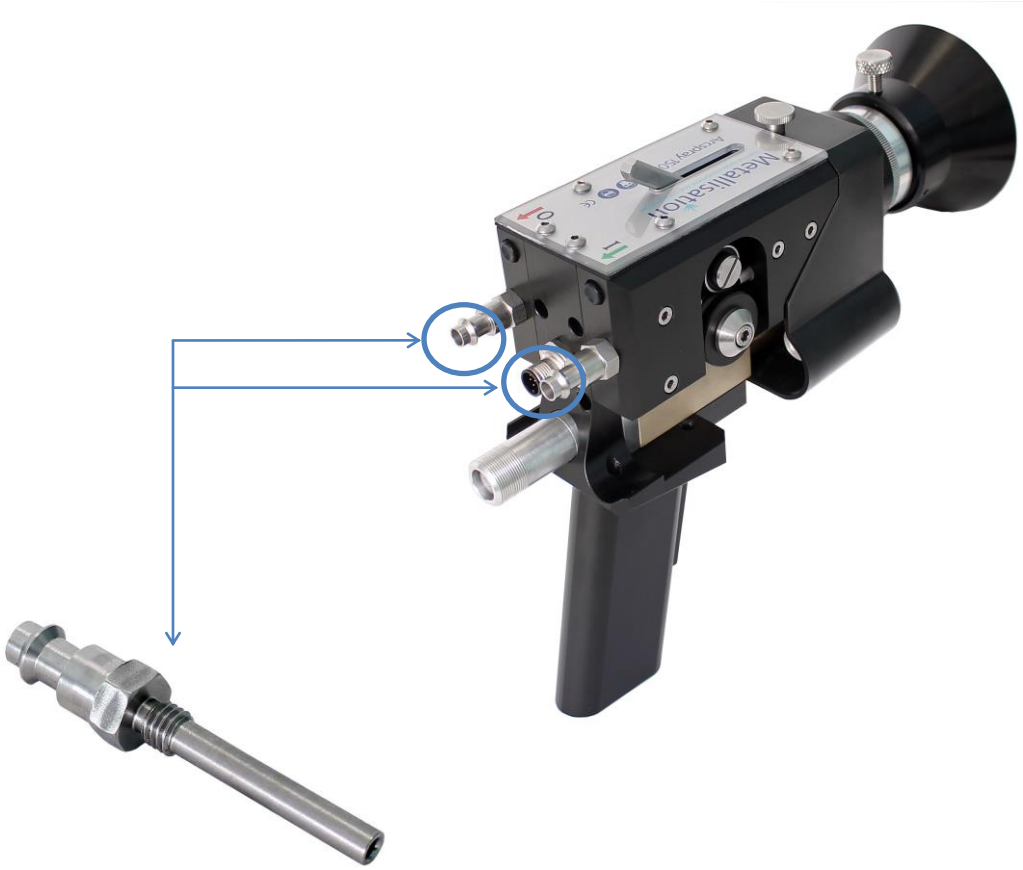
- The Pistol Roller Tyre Housing **(G)** will rarely need to be removed / replaced.
- Before replacing any cleaned / new parts, clean the area of dust and debris.

NB: For maintenance including the Drive Roller Shaft or any associated parts please refer to the ARC150 Pistol Maintenance Manual.

4.7 Rear Wire Guides - Checking

The Rear Wire Guides may be removed for cleaning or renewal whenever necessary i.e. when worn.

The Power Supply must be isolated and the wire completely removed from the rear of the Pistol.



Rear Wire Guide

The Rear Wire Guides can then be removed by unscrewing them from the Left and Right Hand Side Plates.

Clean the Rear Wire Guide as necessary or replace if damaged.

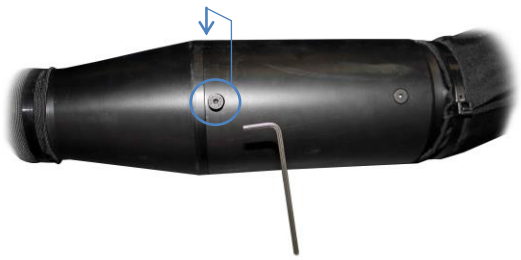
NB: For any further maintenance of the ARC150 Pistol please refer to the ARC150 Pistol Maintenance Manual.

4.8 Supplies & Manifold Maintenance

In accordance with the Routine Maintenance Schedule – Section 4.1, periodically it is necessary to check all electrical connections at the Supplies. Any loose cables / connections should be tightened. Also, as the supplies will be moved around frequently, all cables and connections should be checked for wear / damage and replaced when necessary.

The transfer of air and current to the conductors is achieved at a Power / Air Manifold. The conductors are rated at 500 Amps @ 100% Duty Cycle. These connections and cables should also be checked regularly and cleaned and replaced as necessary. Below is a guide to separating the Manifold in order to carry out the Manifold Maintenance procedure.

1



Using a 3mm Hex Key remove the 2 x screws on the Pistol side of the Manifold.

2

Separate the Manifold Block End Cap from the Manifold Block Cover by pulling away. Then unscrew the 2 x screws on the opposite side.

3

The Manifold Block Cover can now be pulled away to reveal the Manifold Block Body and all power connections.

4

The various fittings should now be checked for tightness using an appropriate adjustable spanner. The above images highlight the positions of these fittings. They should also be checked for damage and if necessary be replaced.

4.9 Wire Condition

The importance of supplying good quality wire to the arc spraying pistol cannot be over emphasised. Over many years, two simple principles have proven to be true:

1. If good quality coatings are required, attention should be given to the state of the Nozzle and the quality of the air supply.

2. For trouble free spraying, attention must be given to the condition of the wire dispensing system.

Due to the often dusty metal spraying environment and the large quantities of wire which modern pistols consume, the second principle requires awareness on the part of the sprayer, the store-keeper and the buyer to ensure uninterrupted spraying.

Ensure that:

a) Wire is not contaminated or damaged and is of proven quality.

b) Wire pulls easily from the conduits (wire should be able to be pulled through the conduits without excessive force).

c) Lubrication of the conduits is not excessive.

It is important to give good **Current Transfer** from the contact tubes to the wire. In order to do this the wire surface must be clean and able to touch the copper Contact Tubes. The contact area is drastically reduced if dust or other contaminants are allowed to enter the contact area and build up. This is known as **Surface Debris**.

All wires have Surface Debris in the form of drawing lubricant and dust particles, but this becomes a problem when the wire has been stored in an open state for a long period of time. If this is allowed to enter the system it can become compacted and cause the wire to seize.

The most common solution when debris is a problem is to wet a lint free pad with approximately 5ml of Metallisation Wire Oil and fold it over the wire where it enters the wire conduit. The pad may be held in place with a small spring clip and the pad removed and folded in a different place every hour or so depending on the amount of debris collected.

Surface Debris can also increase **Conduit Friction** which can produce a condition where the wire cannot be pulled through the conduit. Conduit friction is easily reduced to acceptable levels by an occasional light application of Metallisation Wire Oil upstream of the drive unit. Avoid over-oiling since this tends to wet the spray head and causes dust to collect around the Spray Head and Terminals. Excessive lubrication can also result in oil being carried onto the surface of the coating applied. Apply when changing reels of wire or after prolonged periods of down time e.g. the beginning of a new day or shift.

To summarise, for optimum Wire Feed and Current Transfer follow the below points:

a) Ensure the wire used is the correct size and is undamaged.

b) Store the wire where it will not be contaminated by dust and the surface will not oxidise or corrode.

c) Remove Surface Debris by applying a **very lightly** lubricated pad to the wire before it enters the conduits. **DO NOT** over lubricate. Change the pad regularly.

d) Maintain a gentle, even curvature of the wire conduits.

SECTION 5

FAULT FINDING

5.1 Operational Troubleshooting

5.1 Operational Troubleshooting

During normal operation the following faults may occur:

- Wires feed without spraying.
- Spraying is erratic or there is a reduced spraying voltage often causing a ‘popping’ noise.
- The spray jet is interrupted.

If any of these problems are incurred, this is likely to be due to insufficient voltage or problems with the wire feed to the pistol.

If there is insufficient voltage check the voltage requirement for the wire being used and adjust accordingly (see Section 3.4).

Where wire feed is concerned, check that the wire can be pulled freely from the dispenser through the conduits. Wire should always pull freely. If it does not and excessive force is needed check / clean / replace the wire conduits as necessary.

It is essential that the Metallisation ARC150 Arcspray System is properly maintained and operated. Faults may occur due to incorrect operation, lack of proper maintenance or incorrect component selection.

To avoid these issues follow these simple steps:

1. Always follow the maintenance schedules as recommended in the relevant Operating and Maintenance Manuals.
2. Always ensure the correct voltages and air pressures are being applied, for the wire being sprayed (See Section 3.4 – Spraying).
3. Always ensure that the correct components are being used for the wire being sprayed (See Section 6 – Illustrated Parts List).

If the problem still persists, then consult the relevant Pistol Maintenance and Energiser Maintenance Manuals. These outline the most commonly occurring problems, their causes and the action that should be taken to rectify the problem.

SECTION 6

ILLUSTRATED PARTS LIST

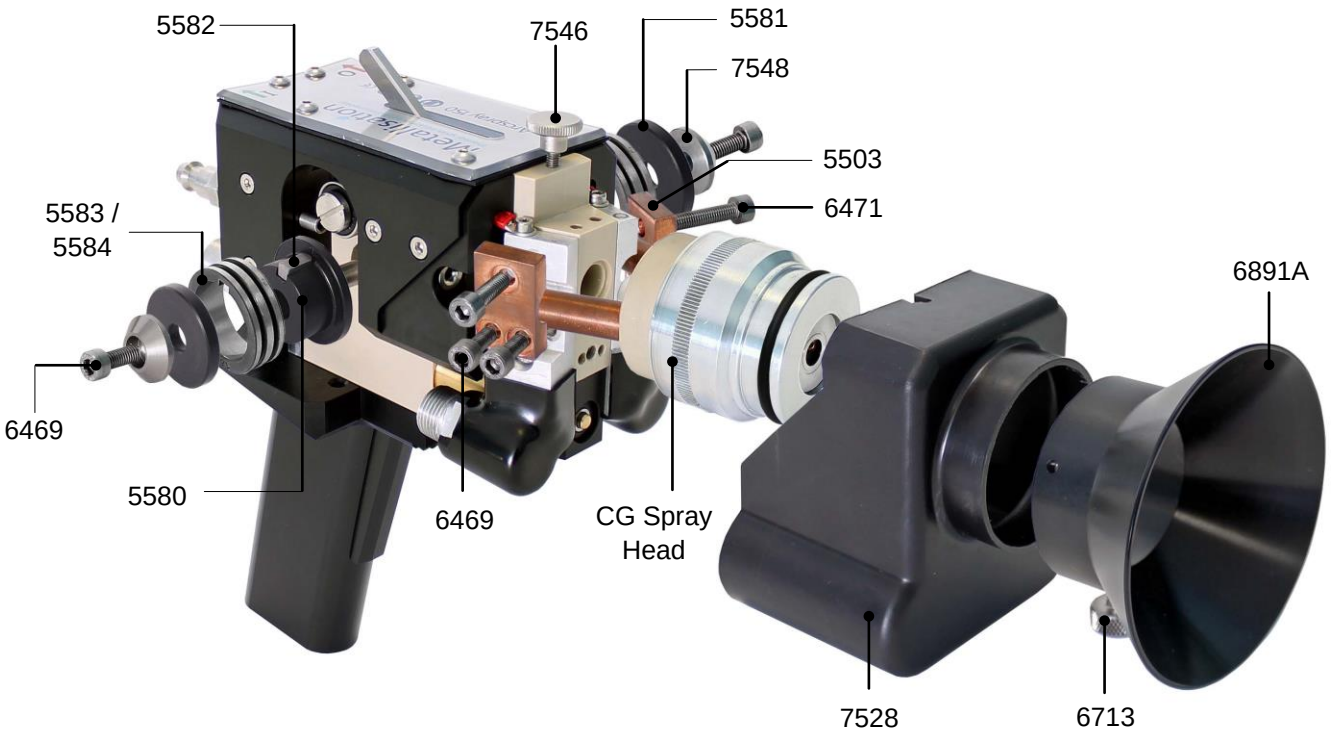
6.1 Main Components

6.2 CG Spray Head

6.1 Main Components

For general operation only certain components should ever need to be dismantled and / or replaced.

Periodically, more detailed maintenance will be required. For a complete Illustrated Parts Listing of the ARC150 Pistol and Energiser please see the relevant Maintenance Manual.



PART NO.	DESCRIPTION	QTY
5503	Clamp Pad	2
5580	Pistol Roller Tyre Housing	2
5581	Pistol Roller Tyre End Cap	2
5582	Pistol Roller Tyre Drive Key	2
5583	Roller Tyre 2.3mm/2.5m Serrated 'V'	2
or 5584	Roller Tyre 1.6mm/2.0mm Serrated 'V'	2
6469	Screw	6
6471	Socket Head Screw	2
6713	Pointed Shroud Screw	1
6891A	New Shroud	1
7528	Hood	1
7546	Thumb Screw	1
7548	Roller End Cap	2

6.2 CG Spray Head

FIG 1 gives an illustrated view of the Spray Head. **Table 1** lists the parts that remain the same for all Spray Head configurations. Please note that the Contact Tips vary dependant on the wire being sprayed and the appropriate part numbers are shown in **Table 2**.

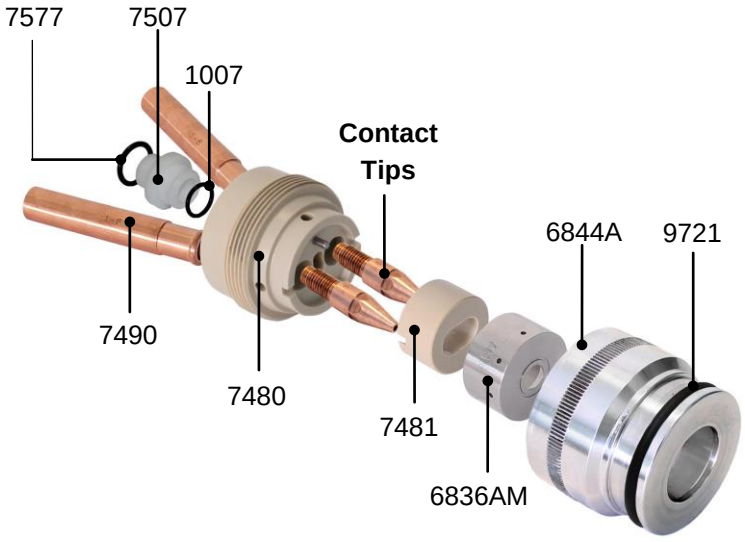


FIG 1

TABLE 1. Pistol Parts - Standard

PART NO.	DESCRIPTION	QTY
1007	'O' Ring	1
6836AM	Medium Air Cap (AM)	1
6844A	Air Cover	1
7480	Contact Tube Support Block	1
7481	Air Concentrator	1
7490	Contact Tip Support Tube	2
7507	Support Block Seal Tube	1
7577	'O' Ring	1
9721	'O' Ring	1

TABLE 2. Contact Tip Variations

WIRE SIZE	PART NO.	DESCRIPTION	QTY
1.6	7486	Contact Tip 1.6mm	2
2.3	7488	Contact Tip 2.3mm	2
2.5	7489	Contact Tip 2.5mm	2

SECTION 7

INFORMATION TABLES

7.1 Typical Performance Figures

7.1 Typical Performance Figures

MATERIAL	WIRE DIAMETER	THROUGHPUT(KG/HR) 500A	COVERAGE m² /kg/100
Metallisation Wire 01E Aluminium	2.3mm	12	2.88
Metallisation Wire 02E Zinc	2.3mm	51	0.82
Metallisation Wire 21E Zinc/Aluminium 85/15	2.3mm	44	1.00
Metallisation Wire 28E Arctec	2.3mm	12	3.85
Metallisation Wire 72E Inconel 625	1.6mm	13.6(@300A)	1.02

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