

## ECO ARC 600 WIRE ARC SPRAY SYSTEM

### Manual



#### **NOTICE**

All personnel responsible for the proper and safe use of this equipment must read and understand this instruction manual.

In addition, the operator of this equipment must receive personal instructions in its use. A thorough understanding of the operation, maintenance, and safety requirements of this equipment is essential.

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# 1 General safety instructions

## 1.1 Safety pictograms



**Attention!**  
Special instructions, safety instructions, etc.



**Caution!**  
Explosive material



**Caution!**  
Hot surface



**Caution!**  
Inflammable materials



**Danger!**  
Risk of electric shock



**Caution!**  
Magnetic fields from high currents can affect pacemaker operation



**Danger!**  
Potentially dangers causing serious injury or death



**Attention!**  
Additional information of general importance



**Attention!**  
Respiratory equipment must be worn



**Attention!**  
Ear protection must be worn



**Attention!**  
Safety gloves must be worn



**Attention!**  
Eye protection must be worn



**Attention!**  
Safety overalls must be worn



**Caution!**  
Moving parts (Risk of injury)



## **1.2 Operating and safety regulations**

Thermal coating is a safe process. However, it is paramount that the operating crew is sufficiently familiar with the individual components, knows the safety regulations, and is competent in working with the system.

Our manual contains all necessary safety regulations and pointers for the safe operation of the system.

In addition to work specific information it contains also general safety regulations, which the operating crew must have read and understood.

Failure to comply with the operating instructions or the use of unsuitable equipment may damage the system or even present a danger to life and limb.

It is therefore vital that you read the operating and safety regulations carefully, and note the additional operational risks described here.

Never use the installation and its components unless everything is in perfect working order. Eliminate malfunctions immediately!

**1.3 Authorized use**

This system is intended for the sole use of thermal coating of workpieces in atmosphere. The system may be used solely in its configuration as delivered, using the components as supplied.

Any other use of the system or its components is considered illegal.

Authorized use also includes the reading of the manuals and compliance with all regulations.

**1.4 Unauthorized use**

The system has been manufactured in accordance with the current level of technology and accepted safety regulations. However, unauthorized use may result in bodily harm or death of the operator or third parties, or in harm to the product itself or other material assets.

Under no circumstances should the system be used for the following unauthorized purposes:

System and components	Unauthorized use
System	<ul style="list-style-type: none"> <li>- Use without previous instruction</li> <li>- Use beyond the operational limits</li> <li>- Use in an atmosphere at risk for explosions</li> <li>- Disabling safety devices, e.g. emergency shut-down devices</li> <li>- Use as control for other processes, e.g. for arc welding</li> <li>- Use for incineration of articles or waste</li> <li>- Installation of third-party components without coordination with Sulzer Metco</li> <li>- Installation of alternative or additional equipment for displaying, measuring, controlling or setting of coating parameters</li> </ul>
Control electronics	<ul style="list-style-type: none"> <li>- Use of wrong operation modes</li> <li>- Reconfiguration of control program</li> <li>- Installation of additional or alternative displaying and measuring devices without coordination with Sulzer Metco</li> </ul>
Spray device	<ul style="list-style-type: none"> <li>- Use of atomizer gas for cooling or cleaning any objects</li> </ul>
Spare parts	<ul style="list-style-type: none"> <li>- Installation of spare parts other than those from Sulzer Metco</li> </ul>

This listing is not comprehensive.

## 1.5 Measures concerning personnel and organization

Only trained and well instructed authorized personnel may operate the system. Responsibility and accountability must be ensured.

### Requirements:

- Medical check of aptitude
- Training and advanced training for wire arc spraying
- Safety thinking
- Basic knowledge of electricity
- Knowledge of hazardous materials
- Appropriate handling of hazardous materials

Sulzer Metco offers training courses, which provide both theoretical background and practical experience for safe operation of the system. This enables the operating crew to refuse following third party instructions not complying with the safety regulations.

It is vital to comply with mandatory local rules and regulations:

- laws / ordinances
- regulations pertaining to accident prevention
- trade union directives, safety rules, instructional leaflets, and other professional documentations
- standards

Keeping a cleaning / servicing / repair log is frequently required by law. A log book is also useful for other reasons, such as:

- accident prevention
- preservation of value
- environmental protection

Work on the electrical equipment of the installation may be carried out solely by professional personnel and in compliance with the electrotechnical regulations.





## 1.6 Ventilation and exhaust

All thermal spray processes produce fumes and dust particles from the materials being sprayed. To avoid the effects of dust and fumes generated by spraying, a suitable spray booth and sufficient exhaust system are required. Proper installation, operation and maintenance are important for system performance and maintaining a safe working environment. For additional safety, dust collectors should be provided with blow-out or relief panels in case of explosion. All local, state, and national fire codes must be complied with when determining the location of the exhaust system.

The arc spray process generates ozone, NO<sub>x</sub>, dust, and fumes that can damage the respiratory system. An adequate exhaust and ventilation system is required. A minimum air velocity of 90 m/min. (300 ft./min.) is recommended in the areas adjacent to the spray gun and the object being coated.

In addition to proper booth ventilation, appropriate personal respiratory equipment must always be used. An industrial hygienist should be consulted for recommendations on type and fit.

## 1.7 Emissions, caused by the system

### 1.7.1 Metallic dust and fumes

#### Caution!

Metallic dust and fumes can be toxic and harmful to your health!

- Use extraction and filtering!
  - Ensure extraction and filtering systems of adequate capacity.
  - Arrange extraction walls/hoods to promote the flow.
  - Seek our advice.
- Ensure that ventilation of spraying areas is sufficient and that it promotes the flow.  
**Do not ventilate with oxygen!**
- If filtered air is fed back into the work area, you will require additional filters and official approval.
- Activate the extraction system before the metal spraying system is started up.
- Comply with critical values at the workplace (AGW).
- Use personal respiratory equipment.
  - A clean air helmet has proven itself in practice.
  - Check the quality of the breathing air supplied to the clean air helmet.
  - Further information are provided in chapter "DIN Norms".
- During meal breaks ensure that toxic metallic dust does not enter the digestive tract. Before eating, drinking, smoking or taking snuff, wash hands and face thoroughly.
- Dispose of metallic dust!
  - The relevant national laws or regulations must be observed.
  - See also chapter "spray dust disposal".





### 1.7.2 Spray jet, comprising molten metal particles and compressed atomizer air

#### Caution!

Risk of combustion and fire.

- Do not direct at people.
- Do not direct at combustible substances.
- Remove combustible substances from the spraying area (room).
- Avoid all risks of fire.
- Never spray in explosion hazard areas.
- Take care when handling gas bottles. Leaking flammable gases can ignite in an explosive manner.
- Use personal protective equipment:
  - Breathing protection
  - Eye protection
  - Hearing protection
  - Body protection
  - Hand protection
- Hardly flammable protective clothing must be worn.
- If easily flammable substrates have to be coated, take appropriate measures to prevent spontaneous combustion.

### 1.7.3 Electric arc - UV radiation / Infrared radiation

#### Caution!

Danger to the eyes!

- Inflammation of the cornea or conjunctivitis.  
(Flashing before the eyes)
- Damage to the retina from infrared radiation!
- The radiation is more harmful than over-exposure to the sun.
- Use personal protective equipment:
  - Eye protection  
Use only eye protection lenses with a filtering effect in accordance with DIN EN 169 or other comparable relevant national standard.
  - Skin and body protection  
All body parts that are exposed to the arc UV radiation must be covered.
- Persons who are in the immediate vicinity of the radiation supply must also wear personal protection or be protected from the radiation by effective vision protection.
- Eyes must be protected from
  - rays reflected from bright walls or objects,
  - bright spray jet, e.g. in the case of spraying of aluminum.
  - Use eye protection lenses in accordance with DIN EN 169 or with other comparable relevant national standard.
  - Use goggles with side protection.





#### 1.7.4 Noise

##### **Caution!**

A high level of noise can lead to hearing damage!

- The sound pressure level is 104 - 118 dB (A) measured at 1m from the electric arc. As the current and arc voltage increase, so does the noise level.
- Take noise protection measures
  - Provide soundproofed work areas
  - Build soundproofed booths
  - Fit soundproofed capsules
  - Use personal hearing equipment.
- Persons who are in the immediate vicinity of the supply of the noise must also wear personal hearing protection.
- If the noise level exceeds 85 dB (A), hearing protection must be worn that is appropriate for the noise level.
  - Ear plugs; to be worn in the ear
  - Ear muffs; to be worn over the ear
- The level of noise that may reach the outside is laid down in the TA-Lärm.
- In other countries the relevant national regulations that must be observed are applicable.



### 1.7.5 Electrical energy

#### Caution!

Bodily contact with electricity can be fatal!

- Magnetic fields from high currents can effect Pacemaker operation.
- Electrical systems and equipment should only be set up, repaired or tested by an electrical engineer or under the supervision of one.
- Electrical equipment should only be used if it complies with the operational and local requirements on safety and any environmental effects.
- Electrical systems or equipment must be checked to ensure they are in a proper condition before being used for the first time, following repair or at the set inspection intervals.
- Live parts of an electrical system must not be worked on.
- Work should only take place on active parts of electrical systems and equipment if the five safety rules have been followed:

#### 1. Insulate

#### 2. Protect against reactivation

#### 3. Verify safe isolation from the supply

#### 4. Earth and short-circuit

#### 5. Cover or safeguard live neighboring parts

- Take special care in humid areas.
- Do not clean power supply with water.
- Power supply should not be exposed to rain.
- Sweaty or damp clothing and shoes are a hazard as they are electrically conductive.





### 1.7.6 Compressed air energy

#### **Caution!**

Compressed air can be a hazard if used carelessly.

- Protect the eyes.  
Compressed air can carry solid matter that may cause injury.
- It is prohibited to clean clothing being worn on the body with compressed air that is still at full pressure. There is a danger of injury. Apart from this, metallic dust, which can be toxic, is swirled up and thereby can enter the blood stream via the respiratory organs.

### 1.7.7 Dust combustion and dust explosion hazard

#### Caution!

Proper protection from dust combustion and dust explosions is only possible with sufficient knowledge of the hazards and the measures to be taken to prevent these.

- The safest method of protection is to prevent any accumulation of dust at the workplace and within the extraction system and also in the pipe system of the filter.  
(Primary Explosion Protection)
- For cleaning purposes it is best to use an industrial vacuum cleaner according to category C.
- Dust must not be swirled up. In the right concentration with air oxygen, an explosive dust/air mixture can form which through initial combustion can lead to an explosion.
- Avoid additional ignition supplies.
- The electric arc and the spray jet with the molten metal particles is an unavoidable ignition supply. You can mitigate this by never directing the spray jet at an accumulation of dust.
- **Do not extinguish burning dust with water.**
- Use a powder extinguisher with metal fire extinguishing powder according to fire class D. Take advance precautions by seeking the advice of the fire service.
- Moist or wet dust from zinc, aluminum, magnesium and alloys of these tend towards spontaneous combustion. A chemical reaction with water leads to a build-up of hydrogen, especially with aluminum. Suitable safety measures must be taken when filtering and storing the dust.
- Aluminum and aluminum alloy dust and other rapidly reacting metallic dusts should only be extracted using filter systems designed for the purpose. These dust/air mixtures are easily combustible and explosive.
- The relevant national regulations must be observed.





### 1.7.8 Hot surface

#### Caution!

While spraying radial nozzle nut can reach temperatures of 75° C (167° F). Do not touch!

- Do not touch with bare hands
- Risk of burning the skin
- The temperature of the radial nozzle nut depends on:
  - Spray capacity
  - Length of spray process
  - Used wire material



### 1.7.9 Danger of tripping / falling

#### Caution!

There is a danger of tripping / falling.

- Lay connecting pipe and hose bundles as well as cables in a safe position and if necessary protect them.



### 1.7.10 Moving Parts

#### Caution!

There is danger of moving parts at the running system as follows:

- Spray wire decoiling device
- Wire feed unit (if existing)

Therefore consider the following hints:

- **Risk of injury!**  
Never put your hands, fingers or any other object inside the rotating wire feed rolls.
- **Risk of injury by being pulled inside!**  
Long hair, loose clothing, etc. must not be close to any moving parts.

### 1.7.11 Oily compressed air (only at systems with air motor)

#### Caution!

An incorrect setting of the oiler can lead to a danger of fire and explosion!

- Oil mist emerging from the manual spraying apparatus can generate a combustible or explosive mixture.
- In the right concentration with air oxygen, an explosive oil/air mixture can form which through initial combustion can lead to an explosion.
- Avoid ignition sources.
- As far as possible, do not align the exhaust flow of the manual spraying apparatus in the direction of ignition sources.
- **Do not extinguish fires with water!**
- Use powder extinguishers on fires. Seek the prior advice of the fire service.
- Ensure adequate ventilation of the work area or extraction of the oil/air mixture. Avoid high room temperatures.
- Do not inhale oil mist, wear a protective mask. In the event of over exposure to oil mist remove the person from the hazard area.
- Do not direct the exhaust flow of the manual spraying apparatus towards clothing.
- The relevant national regulations must be observed.



## 1.8 Other instructions

### 1.8.1 Protective equipment, protective and work clothing



**Caution!**

Use of personal protective equipment is mandatory. Failure to use all or part of the PPE will necessarily result in damage to health.

- EU Directive 89/656/EEC lays down the minimum rules on health and safety when an employee is using personal protective equipment at work.
- Personal protective equipment must be provided and maintained by the employer. It must be worn by operating staff or their assistants whilst they are working.
- Keep your protective equipment in a serviceable condition at all times. Replace defective parts immediately. It is intended to protect YOUR health.
- The work clothing should not contain easily flammable or easily melting synthetic fibers. In the event of combustion these can cause additional injury.
- Wear close-fitting clothes, especially in the sleeves, because you will be working with moving parts.
- The national accident prevention rules must be observed.

### 1.8.2 Spray dust disposal



- The filtered metal and metal oxide dusts must be disposed of safely.
- They are subject to the "Verordnung über gefährliche Arbeitsstoffe" (Hazardous working materials act abbreviated to: Arbeitsstoffverordnung - ArbStoffV).
- They are subject to an identification requirement in order that safe handling and transport of these can be guaranteed.
- Article 4 of the ArbStoffV defines the packaging of materials, Article 5 the identification of materials and Article 9 the traffic regulations for the transport of hazardous goods.
- Appendices I and II to the ArbStoffV contain lists classifying hazardous substances that are subject to an identification obligation.
- All relevant national regulations and safety measures on dust combustion and dust explosion hazards must be observed.

### 1.8.3 Solvents used for degreasing

Parts to be coated must be cleaned and degreased. This is not possible without hazards and is officially regulated.

- Degreasing by means of high-temperature steam spraying is subject to the conditions of the waste water act. (Federal Water Act - WHG).
- Degreasing by means of solvent must, depending on the substance used, be classified as hazardous, harmful to health or toxic/carcinogenic. Here the "Verordnung über gefährliche Arbeitsstoffe" (Hazardous working materials act abbreviated to: Arbeitsstoffverordnung - ArbStoffV) is applicable.
- Since 1 January 1995, on the basis of the amendment to the BImSchG, degreasing and cleaning with chlorinated hydrocarbon solvents has been subject to new regulations and thus heavily restricted.
- In no event should solvents be used without taking suitable protective measures.
- Parts must be free from solvent residues. If solvent residues come into contact with naked flames or hot surfaces, they can generate toxic gases such as phosgene.
- The AGW values or other national regulations must be observed.

#### Caution!

- Obtain the safety data sheet for the substance used.
- Follow the operating instructions.
- Solvents are subject to an identification obligation in accordance with the ArbStoffV.
- No naked ignitions supplies in the vicinity.
- No smoking.
- Seal containers tightly.
- Use on warm surfaces will result in rapid evaporation and a rapid, uncontrolled increase in the AGW values.
- Wear suitable clothing during use.  
Change drenched clothing immediately.
- Work only in well ventilated areas.





## 1.9 Hazardous materials

All Sulzer Metco materials are supplied with a Material Safety Data Sheet. Never spray a material without reading and following the precautions contained in the Material Safety Data Sheet.

Some Materials (e.g. beryllium, tellurium and their oxides) are very dangerous to the respiratory system and should not be used at all, except under the supervision of a competent industrial safety engineer.

Blasting, spraying, and finishing all produce dust. Blasting, spraying, and finishing should be considered as hazardous as spraying such materials.

The following materials are specifically listed because they are commonly sprayed. There are many other hazardous materials that are not listed because they are not commonly sprayed. Because standards change and new information becomes available from time to time, it is strongly recommended that the information contained in the Material Safety Data Sheet, which comes with the material being used, be consulted.

Complete and current information should be obtained from national and local agencies.

The Federal Ministry for Labor and Social Affairs (Bundesministerium für Arbeit und Soziales - BMAS) released the Technical Regulation for Hazardous Materials (Technischen Regeln für Gefahrstoffe - TRGS) for Germany. These regulations pretend maximum work place values (Arbeitsplatzgrenzwerte - AGW) for the average concentration of a substance in the atmosphere at the work place. These limit values have to be obtained by the operator.

The corresponding limit values for elements in the wire are presented in the TRGS 900 list.

### Important note

The MAC-values (Maximum Admissible Concentration) as well as the TRC-values (Technical Reference Concentration) have been replaced by the AGW-values. Currently there are no fixed limit work place concentrations (AGW) for a multitude of hazardous materials. Therefore the following list presents the limit values of MAC and TRC (issue March 2002). These values should be understood as a guide line and have no claim for completeness.





Substance	Formula	MAC-value (mg / m <sup>3</sup> )	TRC-Value (mg / m <sup>3</sup> )	Hazards to health if MAC or TRC-values are exceeded
Aluminum (as metal) Aluminum hydroxide Aluminum oxide Aluminum oxide-fumes	Al Al(OH) <sub>3</sub> Al <sub>2</sub> O <sub>3</sub> AL <sub>2</sub> O <sub>3</sub>	1,5 A		Inhaling or swallowing may lead to coughing fit, shortness of breath and inflammation of the respiratory tract.
Beryllium and its compounds	Be		0,002	Carcinogenic
Lead	Pb	0,1		Lead and lead compounds are highly toxic. Loss of appetite, tiredness, constipation, cramp-like stomach aches and possible worsening of the general state of health often only start occurring after weeks or months of absorption.
Cadmium and its compounds	Cd	0,015		Carcinogenic
Chromium trioxide Chromium-3-chromate Calcium chromate Zinc chromate	CrO <sub>3</sub>  CaCrO <sub>4</sub> ZnCrO <sub>4</sub>	0,1	0,1 0,1 0,1	In general chromium compounds are caustic and irritating to the skin, the mucous membrane of the nose and the deep respiratory tract. These three chromates are carcinogenic.
Cobalt and its compounds	Co		0,1	Cobalt fumes are carcinogenic; the respiratory organs may be damaged.
Iron oxide	FeO Fe <sub>2</sub> O <sub>3</sub>	1,5 A		After a number of years iron and iron oxide can exposure to fumes build up in the lungs and in some cases lead to iron silicosis (siderosis) (reversible). Iron oxide can irritate the mucous membrane of the respiratory tract and the stomach.
Copper-fumes Copper-dust	Cu	0,1 1		Copper and copper compounds can cause metal-fume fever (brassfounder's fever). This is a brief acting fever with weakness and irritated respiratory tract. Recovery without after-effects, no lasting damage.
Magnesium oxide	MgO	1,5 A		Adverse effect on the functioning of the respiratory organs.
Molybdenum compounds (soluble and insoluble)	Mo	5		Symptoms of poisoning unknown to date, function of the respiratory tract may be adversely affected.

Substance	Formula	MAC-value (mg / m <sup>3</sup> )	TRC-Value (mg / m <sup>3</sup> )	Hazards to health if MAC or TRC-values are exceeded
Nickel as - Metal - Nickel carbonate - Nickel oxide Nickel compounds in form of inhalable droplets	Ni		0,5 0,5 0,5 0,05	Nickel and virtually all nickel compounds are deemed carcinogenic. Fumes and dust containing nickel can cause sensitization of the skin.
Tantalum	Ta	5		No known poisoning, adverse effect on the respiratory organs.
Titanium oxide	TiO <sub>2</sub>	1,5 A		No known irritation or toxic effects.
Tin compounds (inorganic)	Sn	2		Tin compounds can cause metal-fume fever. See copper.
Zinc oxide	ZnO	5		Zinc oxide can cause metal-fume fever. See copper.
Zirconium compounds	Zr	5		Adverse effect on the functioning of the respiratory organs.

**TRC-value**

For some substances there are no concentrations that are still harmless. If you have to use these substances for technical reasons anyhow, you must keep the quantity of such harmful substances in the breathable air below the technical reference concentration (TRC). Even if you adhere to the TRC values, you cannot fully avoid the risk of cancer or mutagenesis from such substances. Therefore you must improve constantly the protective measures and technical processes in order to undershoot the TRC values as far as possible. The TRC values are adapted constantly to the state of the art and analytical capabilities (see TRGS 900).

**MAC-value**

A substance will generally not harm your health if the concentration in the breathable air at the workplace does not exceed this value.

## 1.10 Europe - Laws, Regulations, Standards and Directives

<b>EC-Directives</b>	
<b>89/391/EEC</b> Issue 1989-06	Council directive on the introduction of measures to encourage improvements in the safety and health of workers at work
<b>98/37/EC</b> Issue 1998-06	Council directive for alignment of statutory provisions and administrative regulation of the member states for machines
<b>95/63/EC</b> Issue 1995-12	Council Directive concerning the minimum safety and health requirements for the use of work equipment by workers at work
<b>89/656/EEC</b> Issue 1989-11	Council Directive concerning the minimum safety and health requirements for the use by workers of personal protective equipment at the workplace
to source by:	<p><b>Vertretung der Europäischen Kommission in Deutschland</b></p> <p>Unter den Linden 78 10117 Berlin Germany</p> <p>Tel.: +49 (0)30-2280-2000 Fax: +49 (0)30-2280-2222 E-Mail: eu-de-kommission@ec.europa.eu Web: www.ec.europa.eu</p>

<b>EN-Standards</b>	
<b>DIN EN 626-1</b> Issue 1994-11	Safety of machinery - Reduction of risk to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufactures
<b>DIN EN 626-2</b> Issue 1996-08	Safety of machinery - Reduction of risk to health from hazardous substances emitted by machinery - Part 2: Methodology leading to verification procedures
<b>DIN EN 1127-1</b> Issue 1997-10	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology.
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## 1.11 German Laws, Instructions, Standards and Directives

Laws, Directions, Regulations and Directives	
<b>BImSchG</b>	Federal law for the protection against emissions
<b>TA-Luft</b>	Technical Instruction - Air
<b>TA-Lärm</b>	Technical Instruction - Noise
<b>WHG</b>	Federal water act
<b>ArbStoffV</b>	Hazardous working materials act
<b>ArbStättV</b>	Work places act
<b>ASR</b>	Work places directive
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<b>DVS-Information sheets - Thermal Spraying</b>	
<b>DVS 2302</b> Issue 2003-11	Corrosion protection of steel and cast iron materials by thermally sprayed coatings in zinc and aluminum
<b>DVS 2303-1</b> Issue 2003-12	Non-destructive testing of thermally sprayed coating; layer thickness measurement
<b>DVS 2304</b> Issue 2005-03	Quality assurance in thermal spraying
<b>DVS 2307-1</b> Issue 1999-01	Industrial safety when degreasing and blasting surfaces for thermal spraying
<b>DVS 2307-2</b> Issue 2005-01	Industrial safety in flame spraying
<b>DVS 2308</b> Issue 2000-07	Regulations on design of components and parts for spraying
<b>DVS 2310-1</b> Issue 1999-10	Instructions for producing metallographic sections and evaluation of thermally sprayed coatings under the light-optical microscope
<b>DVS 2311</b> Issue 1989-05	Priming of non-metallic materials for thermally sprayed coatings
<b>DVS 2314</b> Issue 2004-11	Environmental protection in thermal spraying
<b>DVS 2315</b> Issue 2005-10	Thermally sprayed coatings on components in non-reinforced and fiber-reinforced synthetic materials
to source by:	<p><b>Deutscher Verband für Schweißen und verwandte Verfahren e.V.</b></p> <p>Aachener Str. 172 40223 Düsseldorf Germany</p> <p>Tel: +49 (0)211-1591-0 Fax: +49 (0)211-1591-200 E-Mail: <a href="mailto:verwaltung@dvs-hg.de">verwaltung@dvs-hg.de</a> Web: <a href="http://www.dvs-ev.de">www.dvs-ev.de</a></p>

## 1.12 DIN-Standards

<b>Thermal Spraying</b>	
<b>DIN EN 169</b> Issue 2003-02	Personal eye protection - Filters for welding and related techniques - Transmittance requirements and recommended use
<b>DIN EN ISO 14919</b> Issue 2001-10	Thermal spraying - Wires, rods and cords for flame and arc spraying - Classification; Technical supply conditions
<b>DIN EN 13507</b> Issue 2001-07	Thermal spraying - Pre-treatment of surfaces of metallic parts and components for thermal spraying
<b>DIN 55928-8</b> Issue 1994-07	Protection of steel structures from corrosion by organic and metallic coatings; part 8: protection of supporting thin-walled building components from corrosion
<b>DIN EN 528</b> Issue 1994-01	Thermal spraying; determination of tensile adhesive strength
<b>DIN EN 657</b> Issue 2005-06	Thermal spraying - Terminology, classification
<b>DIN EN ISO 17834</b> Issue 2004-02	Thermal spraying - Coatings for protection against corrosion and oxidation at elevated temperatures

<b>Respiratory equipment</b>	
<b>DIN 3179-1</b> Issue 1982-07	Classification of respiratory equipment - Survey
<b>DIN 3181-3</b> Issue 1994-02	Respiratory protective devices; CO and reactor filters; classification, marking
<b>DIN EN 12021</b> Issue 1999-02	Respiratory protective devices - Compressed air for breathing device
<b>DIN EN 132</b> Issue 1999-02	Respiratory protective devices - Definitions of terms and pictograms

<b>Protective equipment</b>	
<b>DIN EN 170</b> Issue 2003-01	Personal eye protection - Ultraviolet filters - Transmittance requirements and recommended use
<b>DIN EN 407</b> Issue 2004-11	Protective gloves against thermal risks (heat and/or fire)
<b>DIN EN ISO 20346</b> Issue 2004-10	Personal protective equipment - Protective footwear
<b>DIN EN 352</b>	Hearing protectors - 8 parts
<b>DIN EN 175</b> Issue 1997-08	Personal protection - Equipment for eye and face protection during welding and allied processes

<b>other DIN-Standards</b>	
<b>DIN 1946</b>	Ventilation and air conditioning, 7 parts
<b>DIN 14406-4</b> Issue 1986-08	Portable fire extinguishers; Maintenance; information for application
<b>DIN 40050-9</b> Issue 1993-05	Degrees of protection (IP-code); protection against foreign objects; water and contact; electrical equipment
<b>DIN EN 1127-1</b> Issue 1997-10	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology
<b>DIN EN 60204-1</b> Issue 1998-11	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
<b>ISO 8573-1</b> Issue 2001-02	Compressed air - Part 1: Contaminants and purity classes
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### 1.13 Professional Insurance Association Accident Prevention Regulation

Regulations - VBG, BGV, BGI, BGR	
<b>VBG 4</b>	Electrical systems and equipment
<b>VBG 15</b>	Welding, cutting and related methods
<b>VBG 16</b>	Compressors
<b>VBG 101</b>	Use of respiratory protective devices
<b>VBG 113</b>	Protective measures when using carcinogenic working materials
<b>BGV A4</b>	Industrial medicine precautions
<b>BGV A5</b>	First aid
<b>BGV B3</b>	Noise
<b>BGI 503</b>	First aid in the event of accidents
<b>BGI 504-26</b>	Policy G26: Respiratory equipment
<b>BGI 504-20</b>	Policy G20: Noise
<b>BGI 593</b>	Harmful substances by welding and related methods
<b>BGI 553</b>	Arc welding
<b>BGI 594</b>	Use of electrical equipment by increased electrical dangers
<b>BGI 616</b>	Evaluation of danger by welding fumes



<b>Regulations - VBG, BGV, BGI, BGR</b>	
<b>BGR A3</b>	Working on energized parts of electrical equipment
<b>BGR B11</b>	Safety and health at work „electromagnetic fields“
<b>BGR 104</b>	Explosion protection guidelines
<b>BGR 109</b>	Aluminum-dust-explosions
<b>BGR 117-1</b>	Working in tanks and confined spaces
<b>BGR 121</b>	Safety and health protection at work place with ventilation and exhaust
<b>BGR 133</b>	Equip workplaces with fire extinguisher, Safety regulations
<b>BGR 189</b>	Use of protective clothing
<b>BGR 190</b>	Use of respiratory equipment
<b>BGR 192</b>	Use of eye and face protection
<b>BGR 194</b>	Use of ear protection
<b>BGR 195</b>	Use of safety gloves
<b>BGR 197</b>	Use of skin protection
<b>BGR 220</b>	Welding fumes
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## 1.14 TRGS - Technical Regulations on Hazardous Substances

TRGS-Regulations	
<b>TRGS 101</b>	Technical Regulation on Hazardous Substances
<b>TRGS 402</b>	Measuring and assessing the concentration of hazardous substances in the air in breathing areas
<b>TRGS 507</b>	Surface treatment in rooms and tanks
<b>TRGS 900</b>	AGW - Critical values at the workplace
to source by:	<p><b>Bundesanstalt für Arbeitsschutz und Arbeitsmedizin</b></p> <p>Friedrich-Henkel-Weg 1-25 44149 Dortmund Germany</p> <p>Tel: +49 (0)231-9071-0 Fax: +49 (0)231-9071-2454 E-Mail: poststelle@baua.bund.de Web: www.baua.de</p>



**Latest update of Standards: June 2007**

**The corresponding, national laws, regulations, norms and guidelines have to be obeyed by the operator!**

**No warranty is given to completeness of all lists!**

## **2 System-dependent Informations**

### **2.1 What you need to know about this wire arc spray unit**

#### **2.1.1 General Informations**

This arc spray unit consists of the following components:

- 1x Power supply ECO ARC 600
- 1x Spray device LD/U3 (with hose package)
- 1x Wire feed drive Push 4

The Sulzer Metco OSU - wire arc spray unit is designed for coating work pieces of all kind with metal layer

Sulzer Metco OSU GmbH has incorporated safety devices into the ECO ARC 600, such as automatic shut-off if the compressed air fails and if the minimal capacity is exceeded, temperature control of the transformer, rectifier and AC motor, and electrical protective circuits to guard against uncontrolled reactivation following faults.

Nevertheless: for your own safety always observe the safety regulations and technical rules and standards.

Repairs should only be performed by Sulzer Metco OSU - customer service or Sulzer Metco OSU authorized personnel. Sulzer Metco OSU original parts and accessories have been developed especially for Sulzer Metco OSU systems. Spares or accessories that have not been supplied by Sulzer Metco OSU have been neither tested nor approved by Sulzer Metco OSU. Use of such parts may adversely affect the features and safety of your system. Sulzer Metco accepts no liability for damage resulting from the use of non-original spare parts. The warranty conditions of Sulzer Metco OSU GmbH apply.

**2.1.2 Authorization procedure**

The machine has been developed and built in accordance with EU Machinery Directive 98/37/EC and can be operated safely if the relevant national accident prevention rules are followed and it is operated as directed.

EU Directive 95/63/EC lays down the minimum rules on health and safety for when an employee is using working substances. These are supplemented by harmonized standards and specifications at the national level.

The ECO ARC 600 wire arc spray system requires approval in accordance with Article 4 BImSchG. It does not fall under the approval process of Article 10, however, but the simplified process according to Article 19.

Extract from the 4. Federal Immission Control Ordinance:

„Systems for applying metallic protective layers to metal surfaces

- b) by means of flame or arc spray systems with a throughput of lead, zinc, tin, nickel, cobalt or alloys of these of between 2 kg and less than 50 kg per hour.“

The melting capacity is below the required 50 kg/h for the metals listed under b).

In other countries the national laws and environmental protection regulations must be observed.

**2.1.3 Spray wire**

according to DIN EN ISO 14919	
Material	Zn, Al and its alloys
Wire diameter	Standard: 2,5 mm
Decoiling device	Spool, drum
Storage	Dry, grease-free, clean, evenly spooled

## 2.2 Transport and Positioning

### 2.2.1 Transport

- The power supply must be exposed to shocks or strong vibrations.
- The power supply can be transported using a fork lift truck or by hoist / crane using suspension hooks and screwed-on lugs.
- Do not bend the hose and cable set.

**Note:**

If the machine is subjected to shocks or vibrations the screwed joints may loosen, in particular the cable and control line connections.

**Loose connections can lead to faults.**



### 2.2.2 Positioning

**Caution!**

Positioning and operation are only permitted in a dry environment.

- The power supply is cooled by convection.
- Therefore it should not be covered or obstructed.  
**Otherwise heat accumulation will occur!**
- There must be a clearance of at least 30 cm around the power supply.  
**Otherwise heat accumulation will occur!**
- If due to lack of space there are restrictions on the positioning of the power supply, other arrangements must be made to ensure an adequate supply of cooling air.
- The power supply should not be positioned in the blasting area or in the direct spraying area, because blasting and spraying dust
  - reduces the cooling capacity,
  - leads to the build-up of dust bridges which can result in leakage current and charring,
  - settles on the spray wires as far as the hose and cable set and is transported by the spraying device into the contact tips. This significantly impairs wire transport and spray wire contact. It can lead to faults and interruptions in spraying.
- When positioning the drum decoiling devices take note of the following (**Otherwise there is a danger of short-circuit**):
  - ensure there is sufficient clearance between the two devices, in particular when steel drums are being used.
  - Look out for metal dust bridges.  
Do not position on electrically-conducting floors, e.g. on steel plates.





## 2.3 Further Instructions

- Before starting work each day check that all safety measures and precautions for thermal spraying have been taken!
- Check personal protective equipment each day before starting work!
- Check the production parameters!
- For coating larger, joined surfaces it is an advantage to exchange the standard round stream system for a flat spray system!
- Please seek our advice!
- Perform functional monitoring of the machine each day!
- The hose and cable set should not be kinked!
- Lay out in large loops only!
- Ensure spray wire is clean and dust-free!
- Check the quality of the compressed air!
- Empty the condenser daily!

### 3 Technical Data und energy supply

#### 3.1 Technical Data

<b>Power supply ECO ARC 600 (without decoiling device)</b>	
Weight	405 kg
Dimensions	1450 x 690 x 1000 [mm] (LxWxH)
Electrical connections	400 V / 50 - 60 Hz / < 38 A
<b>Caution!</b> Pay attention to voltage mentioned on the machines type-plate	
Fuse	50 A
Nominal power	< 24 kVA
Secondary nominal DC	600 A (at 100% duty cycle)
Operating voltage	22 - 34 V
Off-load voltage	26 - 39 V
Cooling	passive - convection

<b>Wire feed drive Push 4 (on power supply)</b>	
Weight	ca. 12 kg
AC-motor	$\Delta$ 230 V
Nominal power	90 W
Control	via PLC

<b>Spray device LD/U3 (with air motor MD-Z-5300)</b>	
Weight	3 kg (incl. air motor)
Compressed air supply (Attributes)	filtered, dry, grease-free re-cooled to min. 25° C
Consumption atomizer air (closed nozzle system)	130 Nm <sup>3</sup> / h at 5.5 bar
Consumption comp. air (air motor)	20 Nm <sup>3</sup> / h at 600 A continuously supplied with air motor oil

<b>Hose package</b>		
	Weight	Length
Standard length	15,6 kg	8 m

<b>Spray capacity ECO ARC 600</b>	
max. melting capacity at 100% duty cycle	
• Zn	= 60,0 kg / h
• ZnAl15	= 53,0 kg / h
• Al	= 18,0 kg / h
• AlMg5	= 16,0 kg / h

<b>Permissible current loading for silicon rectifier</b>		
Continuous on-state current [%]	Ambient temperature [° C]	Positioning altitude [m above sea level]
100	45	1000
90	54	1700
80	63	2900
70	72	4200
60	81	6000
50	90	
40	100	

The rectifier is fitted with thermostatic switches to guard against overheating.

**Please note!**  
 Short-circuits can very quickly destroy the silicon rectifier.  
 Destruction due to short-circuit overloads can not be claimed as a cause of defects.

For other combinations of the values for ambient temperature and positioning altitude, the values of the continuous on-state current (from the same line) must be multiplied.

**Example:**

Ambient temp. = 63° C (corresponds to 80% of the cont. on-state current) and  
 Pos. alt. = 1700 m (corresponds to 90% of the cont. on-state current)  
 Continuous on-state current = 80% x 90% = 72%



### 3.2 Energy supply

**Caution!**

Work on electrical systems and equipment should only be performed by a qualified electrician.



#### 3.2.1 Electrical supply

4 - wire mains connection	
3 Phases 1 Earth	black, brown, grey yellow-green
Mains voltage	400 V, 50 - 60 Hz
Nominal current	< 38 A
Fuse	50 A

Cable extension	Dimensions (for Cu) (No. of leads x lead-profile in mm <sup>2</sup> )
up to 20 m	5 x 6
up to 50 m	5 x 10
up to 100 m	5 x 16

**Note**

- Making currents from major loads and other mains fluctuations interrupt spraying.
- 400 V mains voltage should only be under-/ overshoot by a maximum of 5%.





### 3.2.2 Compressed air supply

#### Note

- Conditioned, dry and oil-free compressed air is a condition for good quality of the sprayed coating. (in accordance with ISO 8573 Class 1).

#### Caution!

Max. compressed air supply of 10 bar

- Compressed air ring main - nominal width 25 mm (1 inch)
- Hose connection to power supply - nominal width 25 mm
- Hose connection to power supply - bayonet coupling

#### Note

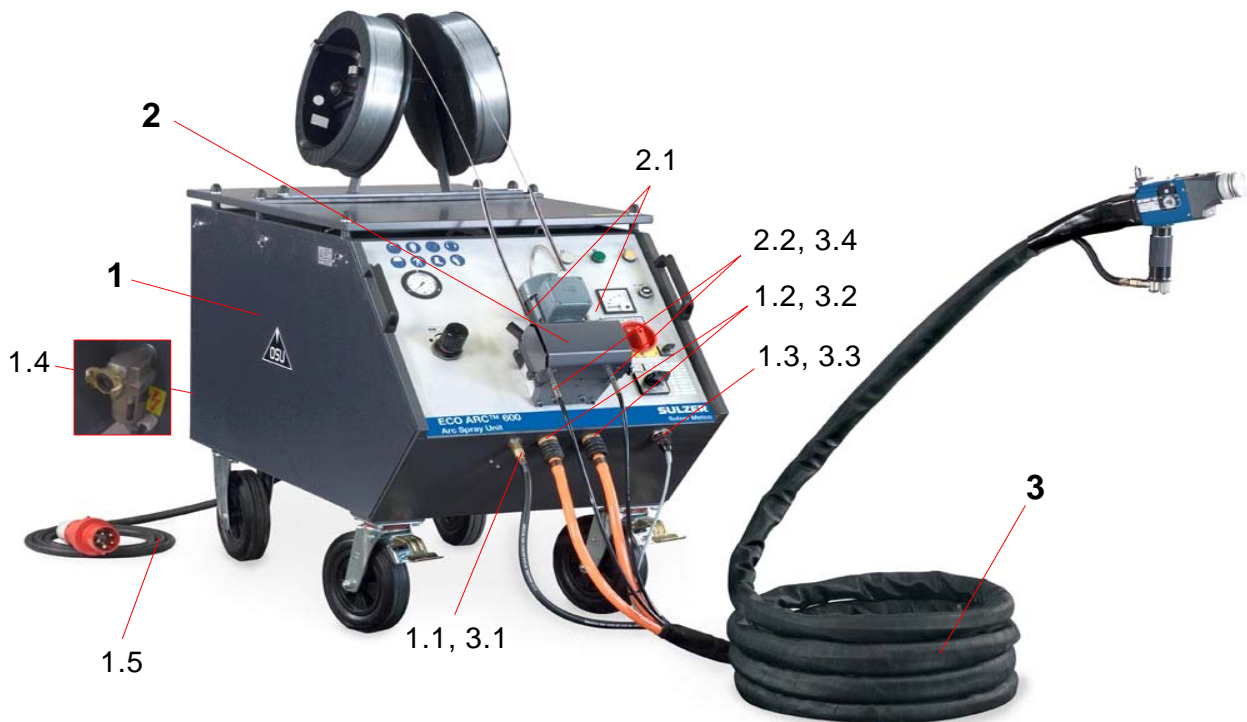
- In order to achieve 6 bar atomizer pressure, a minimum supply pressure of 8 bar is necessary.
- The compressed air of job compressors must undergo special conditioning. It contains a lot of oil and water. You will also need a compressed air reservoir as a buffer, because in the event of pressure fluctuations or a drop in supply the integral pressure switch will shut the system off.
- The incoming compressed air is passed through a condenser at the inlet to the power supply. Ongoing maintenance is necessary. See chapter "service and maintenance"

## 4 Installation of system

### 4.1 Installation instructions

- Make sure that all energy connections are fixed properly  
**Loose connections will lead to charring of cables!**
- Consider the preconditions for place of positioning.  
(see chapter 2)

## 4.2 Installation schema



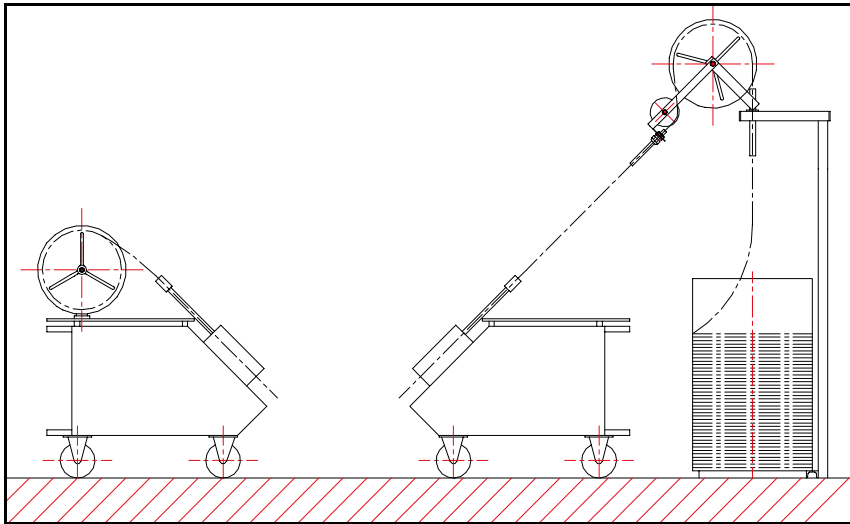
## 4.3 Connecting hose package to power supply

- Lay straight hose package without loops and bends.
- Connect atomizer air hose (3.1) to coupling (1.1).
- Connect current-air hoses (3.2) to current-air bolts (1.2).
- Connect control cable (3.3) to connector (1.3).
- Loose knurled screws at push drive.  
Insert wire guide tubes (3.4) into bore (2.2) and lock with knurled screws.

## 4.4 Connecting power supply to plant mains

- Connect adequate compressed air hose to coupling (1.4) and to plant compressed air supply. Make sure, that no impurities are inside the hose.
- Connect mains cable (1.5) to plant AC mains supply. Make sure that the correct voltage is available.

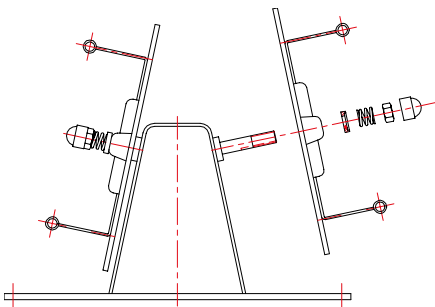
## 4.5 Installation of decoiling device



The ECO ARC 600 can be operated with hasp spools decoiling device as well as drum decoiling device.

### 4.5.1 Hasp spool decoiling device

- Take off caps from both screws located at the back (on top of power supply) and unscrew them.
- Position spool mounting on power supply and tighten with both screws.  
Put back caps on screws.
- Regarding to used wire spool mount adaptor for hasp spool (A) or basket / dorn spool (B).



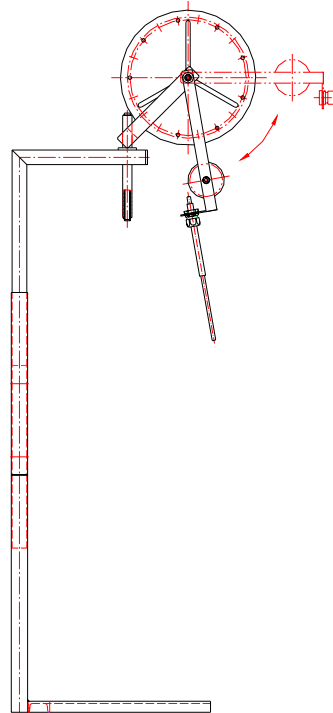
A



B

**4.5.2 Drum decoiling device**

- Assemble all components of drum decoiling device as shown below..



**4.6 Important notes to follow:**

**4.6.1 Hasp / dorn spools**

- The wire must be fed from the top of the spool into the wire guide tubes.
- The wires must not touch each other.  
**There is danger of short-circuit!**
- Check all wire guidings for smooth and easy running.

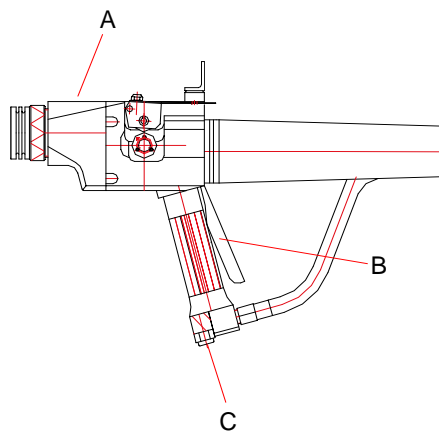
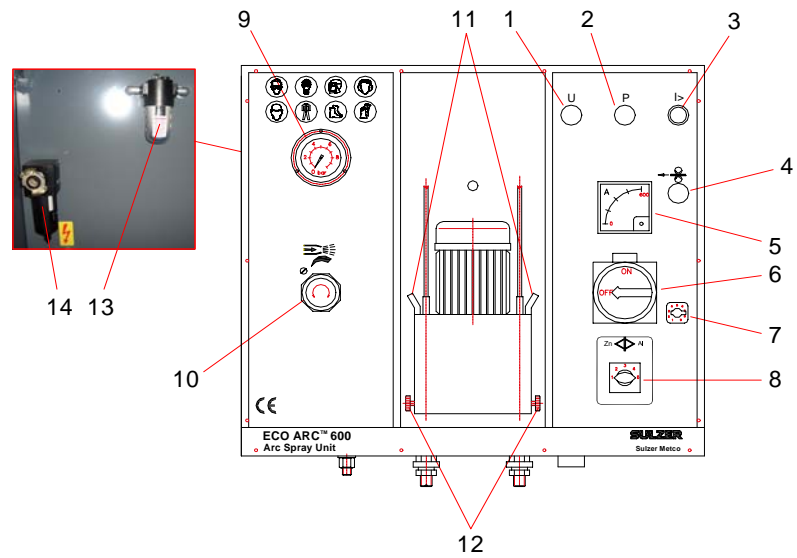
**4.6.2 Drum decoiling device**

- Ensure sufficient clearance of steel drums.  
**There is a danger of short-circuit!**
- Look out for metal dust bridges.  
**There is a danger of short-circuit!**
- Do not place drums on conductive floors such as steel plates.  
**There is a danger of short-circuit!**
- The wires must not touch each other.  
**There is danger of short-circuit!**



## 5 Operation of system

### 5.1 Operating devices and indicators





Pos.	Description	Function
1	Signal lamp white	Permant = System ON Blinking = Emergency stop
2	Signal lamp green	System ready
3	Signal lamp yellow	Reset-button Permanent = Error Overload Blinking = Error Temp. or Air
4	Wire feed button	Wire feed without spray voltage, without atomizing air
5	Ammeter	Indicator spray current
6	Main switch	Power supply On / Off
7	Step switch wire feed	Regulates wire feed (s. Changing spray capacity)
8	Step switch for spray voltage	Regulates spray voltage (s. Setting-up spray voltage)
9	Manometer	Indicator pressure of atomizing air
10	Pressure regulator	Regulates pressure of atomizing air
11	Wire pressure lever	Relieves tension of wire feed rolls
12	Knurled screws	Locking of wire guide tubes
13	Oiler Air motor	Reservoir for greasing the air motor
14	Drain valve	Filters water and dirt particles out of the compressed air
A	On / Off button	Starts / Stopps the spray process
B	Dead man's switch	Must be held while spraying
C	Adjustment screw (at exhaust throttle)	Regulates the spray current

## 5.2 Setting-up system

### 5.2.1 Introducing spray wire

- Put wire spool on its decoiling device.  
The wire must run off the spool from the top.  
Tighten spring breaks slightly so the spool is not running.  
**Alternatively:**  
Guide wire from drums over the deflection rollers.
- Clip off wire tips, round them off with a file and straighten them.
- Insert wire through the wire guide tubes up against the push drive.
- Keep wire pressure levers (11) pushed successively and guide wire between the pressure rolls through the push drive approx. 200 mm into the hose package.
- Make sure the wire is positioned in the correct groove.

### 5.2.2 Changing spray wire

- Clip off wire in front of push drive and spray the rest of the wire.  
Pull out rest of wire from the contact nozzles with a nipper.
- A new/different wire can be installed as described before.

### 5.3 Starting the system

Before you can operate the ECO ARC 600, please note the following:

- Check level of oil in the oiler (13).  
The level has to comply with the marks at the oiler.  
For refilling push down the retainer at the oiler and take out the protective grid including the glass plunger. After refill lock both component with the oiler.
- Check filter insert in drain valve (14).  
Filter insert must not be stained or blocked, otherwise the supply of compressed air is not guaranteed for the system.
- Check all connections.  
**Loose cable connections lead to charring of cable.**
- Ventilation and exhaust must be online while spraying at all times.

To set-up the system completely, following steps have to be done:

- Switch on power supply with main switch (6).  
White signal lamp (1) lights permanently, yellow signal lamp (3) is blinking.
- Push yellow button (3) once to acknowledge.  
White (1) and green signal lamp (2) light permanently.
- Push the wire feed button (4) until wires come out of the contact nozzles.
- Clip off wire tips at the contact nozzles shortly.  
The wire tips should not touch each other.
- The system is set-up completely.

If the system is already set-up, following steps have to be done:

- Direct and lock hand spray device into exhaust.
- **Open compressed air supply.**
- Switch on power supply with main switch (6).  
White signal lamp (1) lights permanently, yellow signal lamp (3) is blinking.
- Push yellow button (3) once to acknowledge.  
White (1) and green signal lamp (2) light permanently.
- Adjust spray voltage step switch (8) according to used wire.  
(s. Setting-up spray voltage)
- **Caution!**  
**Never switch voltage step switch while spraying.**
- Hold the dead-man switch (B) at the spray device.  
Push the ON-button (A) at the spray device.





- **Caution!** Atomizer air blows!  
**Do not direct spray device at people.**
- After approx. 2 seconds spray process starts!
- Set-up desired pressure of atomizing air.  
(s. Setting-up atomizing air pressure)
- If the spray voltage has to be modified, first press the OFF-button (A) at the spray device, then use the spray voltage step switch (8).
- The system can be started again; it is ready for operation.

## 5.4 Setting-up spray parameters

### 5.4.1 Setting-up spray voltage

- The spray voltage is adjustable at the step switch (8).

**Zink** = Step 1 and 2  
**Aluminum** = Step 3, 4 and 5

- **Caution!**  
**Never switch voltage step switch while spraying.**
- The spray voltage must be set high enough that a continuously burning arc guarantees trouble-free operation.
- The stability of the available electricity network determines the uniformity of the arc voltage and the melting performance.
- The adhesive tensile strength of Al-coatings will be enhanced using higher voltage (step 5).



### 5.4.2 Setting-up spray capacity

- The ECO ARC 600 is preset to a spray capacity of 600 A.
- The wire feed speed is regulated accordingly.  
Wire feed speed  $\Leftrightarrow$  Spray capacity
- The maximum spraying capacity (600 A) is monitored by a pre-adjusted current limiter relay. If this capacity is exceeded, the system automatically shuts off. It is thereby protected from overload.
- In the event of overload the yellow button (3) lights. The system can only be restarted once the fault has been acknowledged.
- The current limiting must not be changed, otherwise no protection is guaranteed.
- The air motor of the hand spray device is continuously adjustable via the regulation screw (C) at the exhaust throttle.  
So the spray capacity can be adjusted to any desired melting capacity. The regulation screw can be adjusted by an 3 mm screw driver.  
By turning the screw clock wise (counter clock wise) the spray capacity is increased (decreased).
- The pressure regulator for supplying the air motor is installed inside the power supply and fixed to 5 bar. The regulator can not be seen from the outside and must not be changed.
- The maximum capacity is only reached on work pieces with large surface areas and for coating thicknesses in excess of 100  $\mu\text{m}$ .

- Coating smaller workpieces e.g. small profiles too much spray material is lost. In this case the amperage should be reduced to an adequate level.

**5.4.3 Changing spray capacity**

- Turn regulation screw (C) at spray device, until throttle valve is half way opened.
- Set speed of wire feed via the step switch wire feed (7) as follows:

	200 A	400 A	600 A
Zn	Stufe 1	Stufe 2	Stufe 3
ZnAl15	Stufe 4	Stufe 5	Stufe 6
Al & AlMg5	Stufe 7	Stufe 8	Stufe 9

Step 0 = OFF



**Caution!**

**Never switch wire feed step switch while spraying.**

**Make sure the correct step is chosen.**

**Otherwise the pull drive at the spray device can be damaged in case of long operating period (if wrong step is chosen).**

- Start spray process.
- Turn regulation screw (C) slightly, until the ammeter (5) shows the desired spray capacity.  
(e.g. 200 A for Zn-wire with chosen step 1)
- Push the OFF-button (A) at the spray device.
- The system can be started again; it is ready for operation.

**5.4.4 Setting-up atomizer air pressure**

- The atomizer air is adjustable via the pressure regulator (9).
- The pressure of atomizer air can be set between 3,5 and 6 bar. For adjusting the pressure pull out the regulator button slightly, adjust to desired pressure, and push down the button.
- The correct atomizer air pressure will be determined by the required fineness of the coat and the application.
- Coarse spraying particles result in a coating with a high metallic content. This will have a coarse surface texture, however.
- Fine particles, atomized under high air pressure, on the other hand result in a fine surface texture. They are less well-suited to the subsequent soldering work, because they have a higher oxide content.

- Aluminum and aluminum alloys used as corrosion protection coatings should always be sprayed at the maximum voltage (step 5) and with the highest atomizer air pressure. These coatings are finer grained and more dense and have a higher anticorrosion value.

#### **5.4.5 Setting-up the oiler**

- The oiler is set to a frequency of 1 drop each 6 seconds (at a running machine). When the oiler set-up does not match this frequency, it can be regulated with a screw driver. The oil overrun is automatically traced back into the reservoir.

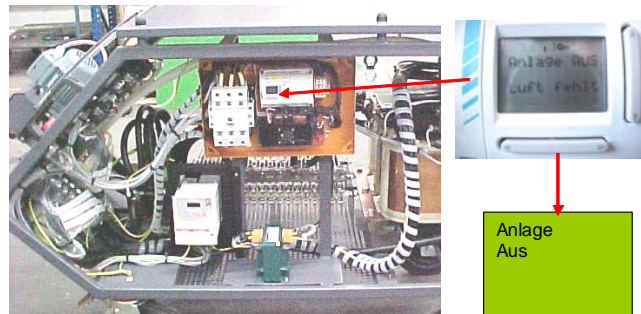
## 5.5 Further instructions

- Before starting work each day check that all safety measures and precautions for thermal spraying have been taken.
- Check personal protective equipment each day before starting work.
- Check the production parameters.
- For coating larger, joined surfaces it is an advantage to exchange the standard round stream system for a flat spray system.
- Please seek our advice.
- Perform functional monitoring of the machine each day.
- The hose and cable set should not be kinked. Lay out in large loops only.
- Ensure spray wire is clean and dust-free.
- Check the quality of the compressed air.
- Empty the condenser daily.
- Check the oil level and delivery of the oiler weekly. Top up only with suitable oil.
- If the compressed air contains large amounts of oil and water, this condensate will also reach the oiler and adversely affect the air motor oil. The oil must then be changed.



## 6 Troubleshooting

This wire arc spray system is equipped with a PLC. The PLC is located behind the right panel of the power supply. The PLC has a small display for status information and error messages.



- **Attention!**  
**Electrical energy may be fatal by bodily contact!**
- Electrical appliances and tools may be set up, repaired or checked only in the charge of or by specialist staff!
- Electrical appliances and machines may only be used if they satisfy internal company and local security request as well as possible influences of the surrounding!
- Electrical appliances and machines must be checked for their proper condition before putting into operation for the first time, after their maintenance or passing a definite period of inspection.
- It is forbidden to work at energized parts of an electrical appliance!  
You may work at energized parts of electrical appliances and machines if you pay attention to the five security rules:

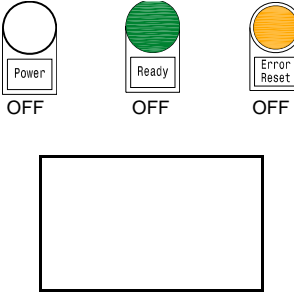
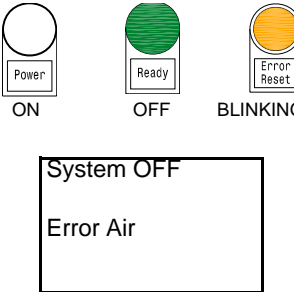


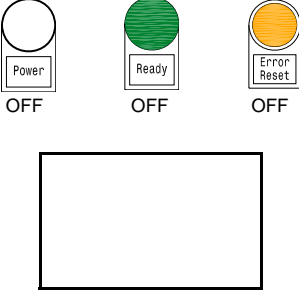
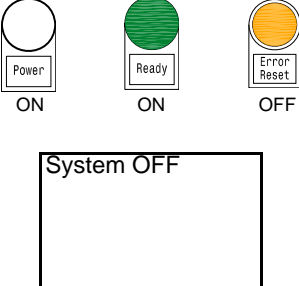
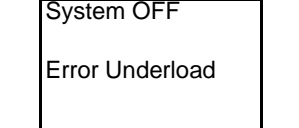
1. Turn off power
2. Protect against reactivation
3. Check if system is de-energized
4. Earth and short-circuit
5. Cover neighboring energized parts



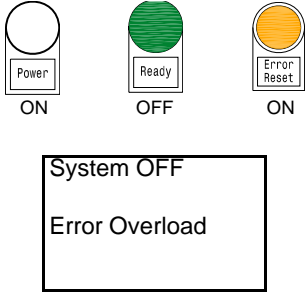
- Special caution in damp rooms!
- Do not clean the power supply with water!
- Do not expose the power supply to the rain!
- Sweaty or damp clothing and shoes are dangerous, they are conductive.

### 6.1 System does not start

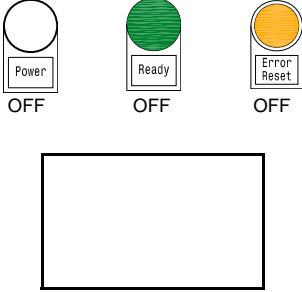
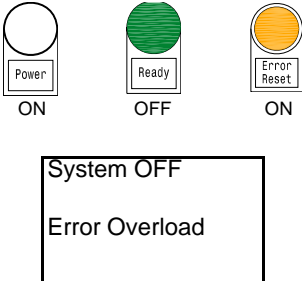
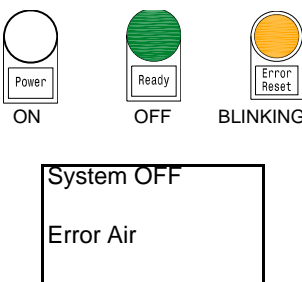
Indication	Cause		Remedy
	Three phase current	System is not switch ON	Switch ON system with main switch
		Three phase power supply of system	Check fuse in three phase current supply system
		Wrong mains power supply	Check mains power supply Check connections (see type plate)
	Compressed air supply	Compressed air not connected	Check compressed air connection
		Air compressor Malfunction or switched OFF	Check air compressor
		Valve closed in compressed air mains	Check ring mains and producer of compressed air
		Pressure is too low	Ring mains or compressor have to supply compressed air at min. of 2,5 bar
		Cross-section of pipe is too small Volumetric flow (Nm <sup>3</sup> / h) too low	Required cross-section of compressed air supply: min. 20 mm (3/4") max. 10 m better 25 mm (1") Volumetric flow: 150 Nm <sup>3</sup> / h at 4 bar
		Filter pad is blockedpad	Check filter pad in condenser, clean or change

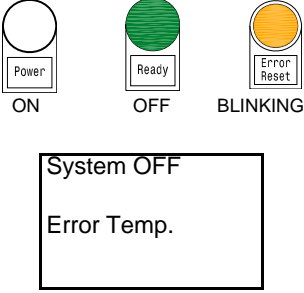
Indication	Cause		Remedy
	Power supply	Fuse	Check fuses at the power supply. If red LED is shining fuse -F4 on -A10 is defective.
	Power supply Spray device	Control cable towards spray device is faulty  or  ON / OFF signal not ready	Check control cable and signal
	Spray device	No oil in the oiler Air motor deadlocked	Check the oiler Refill air motor oil Oil the air motor (air input) (s. maintenance) Put air motor for repair

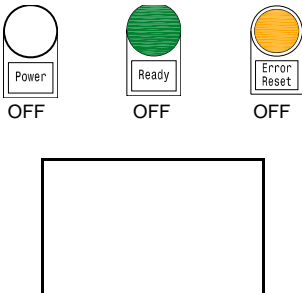
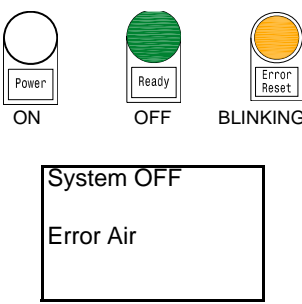
**6.2 System does not start, system cuts out**

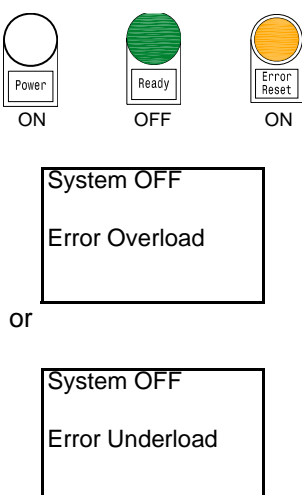
Indication	Cause		Remedy
 <p>Power ON    Ready OFF    Error/Reset ON</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>System OFF</p> <p>Error Overload</p> </div>	<p>Hose package</p>	<p>Short-circuit between both current-air-cables: Insulation damaged</p>	<p>Measure resistance (short-circuit) between current-air-cables</p> <p>Power supply</p> <ul style="list-style-type: none"> <li>- Turn main switch OFF</li> <li>- demount hose package</li> </ul> <p>Spray device</p> <ul style="list-style-type: none"> <li>- Clip off spray wire at the contact nozzles</li> <li>- Wire tips must not touch each other</li> </ul> <p>Measure resistance (short-circuit) between current-air-cables. Wire tips must not touch each other</p> <p>Short-circuit between both current-air-cable:</p> <ul style="list-style-type: none"> <li>- Put hose package for repair</li> </ul>
	<p>Spray device</p>	<p>Air motor does not work</p>	<p>Unscrew compressed air hose for air motor of spray device</p> <p>Compressed air is blowing:</p> <ul style="list-style-type: none"> <li>- Check grid in double nipple at the air input of air motor</li> </ul> <p>Clean or replace</p>




### 6.3 System cuts out

Indication	Cause		Remedy
	<p>Three phase current</p>	<p>Plug / connections are loose. or Wrong power / power failure</p>	<p>Check plug / connections Check mains power</p>
	<p>Three phase current</p>	<p>Fluctuations in mains power</p>	<p>Check mains power, if necessary install separate line</p>
	<p>Compressed air supply</p>	<p>Cross-section of pipe is too small Volumetric flow (Nm<sup>3</sup> / h) too low</p>	<p>Required cross-section of compressed air supply: min. 20 mm (3/4") max. 10 m better 25 mm (1") Check filter insert in drain valve; clean or replace</p>

Indication	Cause		Remedy
 <p>Power ON      Ready OFF      Error/Reset BLINKING</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>System OFF</p> <p>Error Temp.</p> </div>	<p>Power supply</p>	<p>Build-up of heat</p> <p>Power supply covered. Switching OFF by temperature sensitive switch. Convection cooling not insured.</p>	<p>Leave cooling air slot (in / out) blank</p> <p>Let cool down until green signal lamp lights.</p> <p><u>Cooling time:</u> Rectifier: ca. 5 min. Transformer max. 2 h AC-Motor: ax. 30 min.</p>
		<p>Build-up of heat Power supply dusty from the inside Switching OFF by temperature sensitive switch.</p>	<p>Clean power supply from the inside (s. maintenance)</p> <p>Let cool down until green signal lamp lights.</p> <p><u>Cooling time:</u> Rectifier: ca. 5 min. Transformer max. 2 h</p>
		<p>Temperature of environment too high</p>	<p>Ventilate</p>
		<p>Push-Motor too hot. Switching OFF by temperature sensitive switch.</p>	<p>Push-gear: Pressure rolls must run easily. Clean pressure rolls. Grease bore (drilling) of pressure rolls. (s. maintenance).</p> <p>Check position of wire feed step switch and change if necessary.</p> <p>Let cool down until green signal lamp lights.</p>

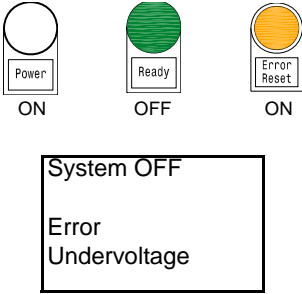
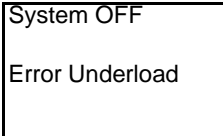
Indication	Cause		Remedy
	Power supply	Control transformer	Only specialist staff is allowed to work at electrical appliances. Before opening the power supply pull out the mains plug! Check control transformer.
	Power supply	Condenser for pre cleaned compressed air  Filter pad is blocked	Check filter pad (s. maintenance)  or  Change blocked filter pad  Operate system only with assembled filter pad. If not solenoid valve will be damaged
		No oil in the oiler Air motor deadlocked	Check the oiler Refill air motor oil Oil the air motor (air input) (s. maintenance) Put air motor for repair

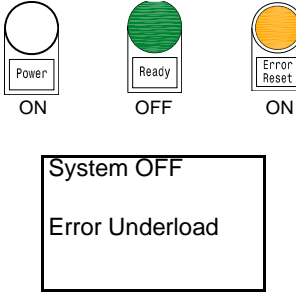
Indication	Cause		Remedy
	Spray wire	Gets scorched in contact nozzle. Inaccurate melting down. Forms short-circuit.	Use different spray wire. Get advised by SMOSU-customer service.

Indication	Cause	Cause	Remedy
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">                     System OFF Error Underload                 </div> <p>One or both of the green LEDs on the A10 interface module are off or only faintly lit. After removal of the wires 1;2;3 from X2 the LEDs light normally.</p>		<p>If the current in terminals X2:1 and X2.3 (measured between contact and wire) is above 50 mA, transformer B10 is defective. If the current is below 50 mA, interface module A10 is defective.</p>	<p>Replace defective component</p>
<div style="display: flex; justify-content: space-around; align-items: center; margin-bottom: 10px;"> <div style="text-align: center;">                       Power ON                 </div> <div style="text-align: center;">                       Ready OFF                 </div> <div style="text-align: center;">                       Error Reset ON                 </div> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">                     System OFF Error Overload                 </div>	<p>Spray device</p>	<p>Air motor runs too fast. Therefore spray capacity (amp) is too high.</p>	<p>Reduce air for air motor step-wise:</p> <ol style="list-style-type: none"> <li>1. Spray device (Exhaust throttle) Turn regulation screw 1/2 to the right.</li> <li>2. Power supply press yellow button.</li> <li>3. Do not point spray device at people! Push ON-button. Repeat these steps until system does not cut out.</li> </ol>

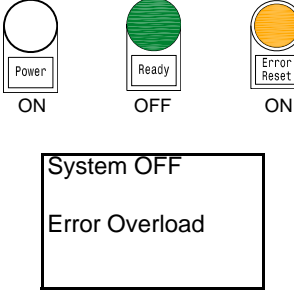


**6.4 Spray wires are not pushed forward, not melted down, electric arc breaks off, chatters**



Indication	Cause		Remedy
	Power supply	Power supply One phase is missing	Only specialist staff is allowed to work at electrical appliances. Check all three phases. Check fuse in your three phase current system.
	Decoiling device	Not smooth running	Must run smoothly. If not clean and grease. (s. maintenance).
	Spray wire	Spray wire badly spooled. Forms loops. Wire transport is blocked	Clip off spray wire. Round off edges. Re-insert spray wire.
	Spray wire	Bad quality	Use different spray wire. Get advised by SMOSU-customer service.

Indication	Cause		Remedy
 <p>Power ON      Ready OFF      Error/Reset ON</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>System OFF</p> <p>Error Underload</p> </div>	<p>Push-gear</p> <p>Power supply</p>	<p>No tension at pressure rolls</p>	<p>Check wire pressure lever Wire feed rolls and pressure rolls must be pressed together.</p>
		<p>Pressure rolls not smooth running Soiled or worn out</p>	<p>Clean and grease pressure rolls; if necessary change (s. maintenance)</p>
		<p>Wire feed rolls soiled or worn out</p>	<p>Clean or change wire feed rolls</p>
		<p>AC-Motor does not run</p>	<p>At push-gear: Check fuse and motor cable</p> <p>At power supply: Check fuses (s. circuit-diagram).</p>
	<p>Spray device</p>	<p>Wire feed rolls soiled or worn out</p>	<p>Clean or change wire feed rolls</p>
	<p>Hose package</p>	<p>Wire guide tube worn out or bended</p>	<p>Let check from SMOSU or authorized specialist staff.</p>
	<p>Spray device</p>	<p>Contact nozzles badly aligned, blocked or worn out. Spray wire scorched.</p>	<p>Check contact nozzles: Clean or change. Align nozzles. (s. maintenance)</p>

**6.5 Electric arc shuts off, spray wires not feeding, push gear running**

Indication	Cause		Remedy
 <p>Power ON    Ready OFF    Error Reset ON</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>System OFF</p> <p>Error Overload</p> </div>	Power supply	Solenoid valve defective. (Comp. air - air motor)	Spray device: Push OFF-button. Unscrew compressed air hose of power supply. Spray device: Push ON-button. If no air is blowing at the compressed air hose connection - replace solenoid valve.
	Spray device	Air motor defective	Compressed air is leaking: Demount air motor and put for repair. (s. maintenance)
	Hose package	Air motor hose defective	Replace air motor hose or put for repair.

### 6.6 Electric arc cuts out, coarse particles in spray coat, spray wires feeding, not melted

Indication	Cause		Remedy
 <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">System OFF Error Underload</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">System OFF Error Underload</div> <p>or</p> <div style="border: 1px solid black; padding: 5px;">System OFF Error Undervoltage</div>	Power supply	Rectifier, transformer, or main relays	Only specialist staff is allowed to work at electrical appliances. Check rectifier, transformer and main relays.
		Drain valve Filter insert dirty	Change filter (s. maintenance)
		Atomizer gas pressure too low	Regulate compressed air Set pressure > 3,5 bar
		Spray wire melts down irregularly. Voltage too low.	Check voltage and set correctly
 <div style="border: 1px solid black; padding: 5px;">System OFF Error Temp.</div>	Frequency inverter Push-gear		If frequency transformer is out of use (approx. 2 years), the condensers inside the appliance have to be activated. (see manual TOSHIBA Chap. 2.6.2).

## 7 Maintenance

### Legend:

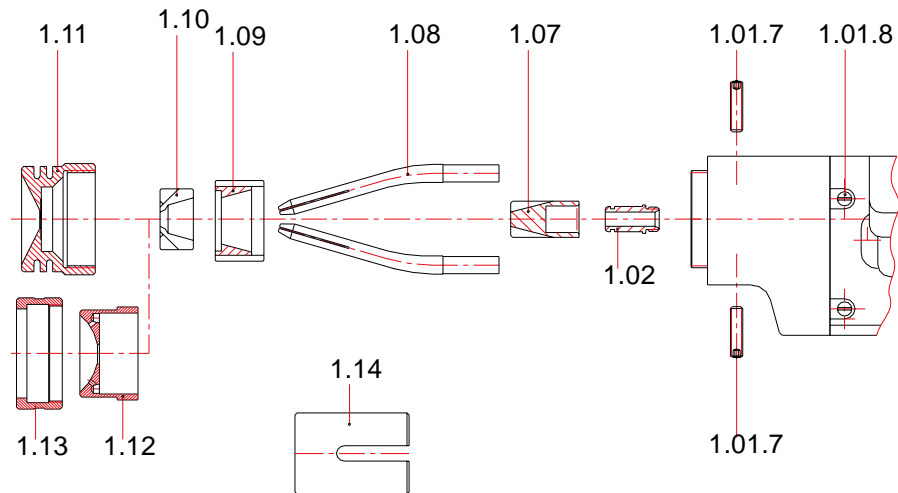
- (D) daily
- (W) weekly
- (M) monthly
- (A) annual

### 7.1 Spray device LD/U3

#### 7.1.1 Control intervals

- (W) Check contact nozzles for wear and centre alignment. Rub graphite powder or contact grease on to the inside of the new contact nozzles.
- (W) Clean and wash out atomizer nozzle
- (W) Clean or if necessary change gas nozzle.
- (W) Clean radial air nozzle nut inside and outside. Spray with Teflon spray.
- (W) Clean fan spray nozzle inside and outside. Spray with Teflon spray.
- (M) Check wear of the wire feed rolls, if necessary replace.
- (M) Check smooth running of pressure rolls (bearing), if necessary replace.
- (A) Grease worm gear in accordance with table of lubricants. To do this the compressed air motor and worm shaft must be unscrewed, left-hand thread
- (W) Each week flush the compressed air motor with an additional 10 drops approximately of air motor oil. To do this loosen the hose connection on the compressed air motor and allow the oil to drip directly into the motor

**7.1.2 Changing contact nozzles!**



**Removal**

- Unscrew the radial air nozzle nut (1.11). Remove gas nozzle (1.10).
- Remove cover ring (1.09).
- Slide atomizer nozzle (1.07) downwards.
- Loosen contact nozzle clamping screws (1.01.8).
- Pull out contact nozzle (1.08) with a slight rotational movement.

**Mounting**

- Apply a thin layer of contact grease to the seat of the new contact nozzles before fitting these. Contact grease can be found in the toolkit.
- Push in the new contact nozzles until you feel hem hit the stop, align them using the nozzle adjusting device (1.14) (in the toolkit) and gently tighten the clamping screws (1.01.8). Then remove the nozzle adjusting device.
- Ensure that the atomizer nozzles (1.07) sit in their recesses on the contact nozzles.
- Fit the cover ring (1.09), position the gas nozzle (1.10) and screw on and tighten the radial nozzle nut (1.11).
- Using the alignment screws (1.01.7) align the contact nozzles exactly with the center, using the bore of the gas nozzle (1.10) as a help, and then tighten the clamping screws (1.01.8) for the contact nozzles.
- Allow the system to spray for approximately 10 seconds and then again accurately align the melting point of the spray wire ends with the alignment screws (1.01.7).

Use only the slotted contact nozzles. Un-slotted contact nozzles prevent the sliding contacts from working.

The atomizer nozzle (1.07) is positioned in a floating manner. With the air pressure that is applied upon start-up it is pushed forwards and it aligns itself automatically. It pushes the two bottom halves of the contact nozzle tips onto the advanced spray wires and closes the sliding contact via the automatically adjusting pneumatic contact pressure.

When using the fan spray nozzle (1.12) the radial nozzle nut (1.11) should be replaced with parts (1.12) and (1.13).

## 7.2 Hose package LD/U3

- (M) Perform a visual external check for damage
- (M) Wire guide tubes:  
Check wire for smooth running through the tubes. Therefore loose wire guide tubes. Replace wire guide tubes if you meet with resistance when pushing the wire. Treat new wire guide tubes inside with graphite powder. You find a fill bottle in the toolkit.
- (W) Power cable, visual external check for damage. Check stick and screw connections to firm sit.
- (M) Check stick connections of control cable - motor cable - and solenoid valve cable (if existing).  
Check stick connections. Pay attention that numbers are corresponding. Check plugs. Check transition. (see circuit diagram)

## 7.3 Power supply with Push 4 drive

- (M) Check wire feed and pressure rolls of the push gear for wear. The wire is fed via highly wear-resistant plastic rolls. The continuous wire slip is intentional.
- (W) Check that pressure rolls are running smoothly, if necessary remove and grease them. (Sliding fit)
- (W, M) Blow out the power supply at the end of each shift.  
Caution!  
Only blow out in front of the dust extraction and with extraction running!

The frequency will have to be matched to where the machine is located and the amount of dust, if necessary once per week.

## 7.4 Oiler (back side power supply)

- (D) Check oil level and top up as necessary.  
Check oil delivery = 1 drop every 6 seconds when the manual spray device is running.



**7.5 Filter (back side power supply)**

- (D) Dewater daily. More often if the amount of water dictates so. Check filter insert and change as necessary. (If the filter is blocked the entire machine may fail to operate. It will be shut off automatically by the pressure monitoring.)

**7.6 Drum decoiling device**

- (D) **For metal drums in particular, the spray dust must be continuously removed as there is a danger from leakage current.**  
Position the two drum decoiling devices at a distance as there is a danger of short-circuit.
- (M) Check that reversing wheels run freely and grease as necessary.

**7.7 Spool decoiling device**

- (M) The adapters must run freely, grease as necessary.
- (W) Check brake.  
Tighten nut (spring) only until the hasp-spool no longer runs on.

**7.8 Table of lubricants**

Component	Interval for greasing	Grease
Worm gear (Spray device LD/U3)	1000 operating hours	MOS2 Installation grease Acheson „Molydag 49“
Air motor (Oiler at power supply)	Oiler setting each 6 seconds 1 drop	Sulzer Metco OSU air motor oil alternatively Esso „Pneumatic oil 32, 100“

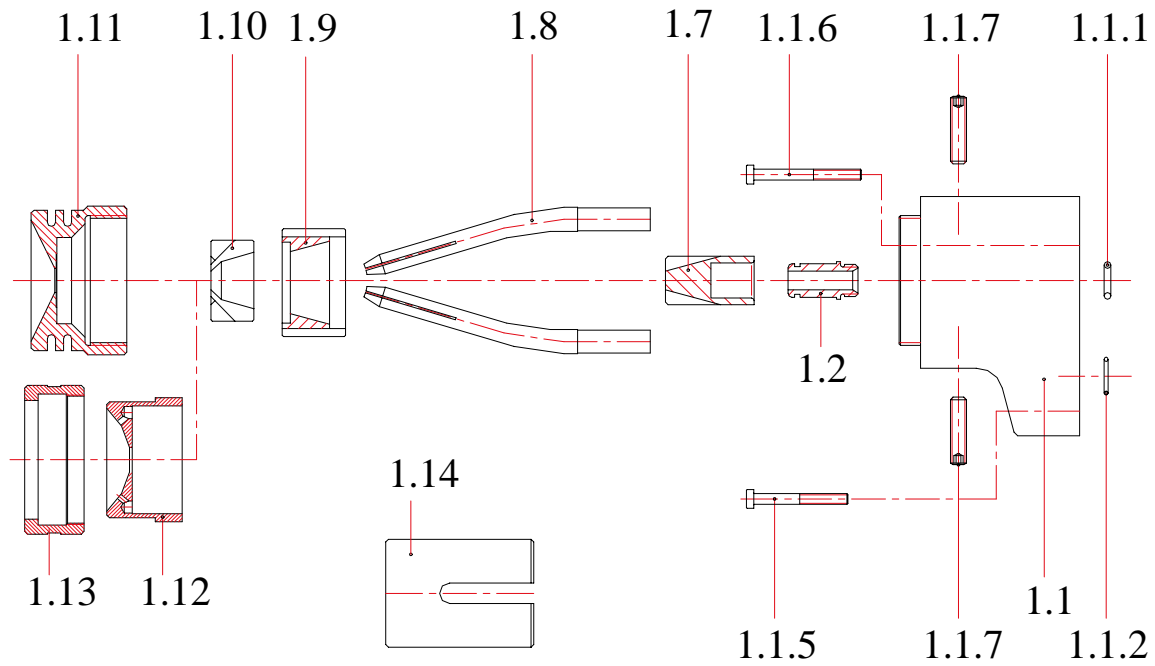




## 8 Spare part lists

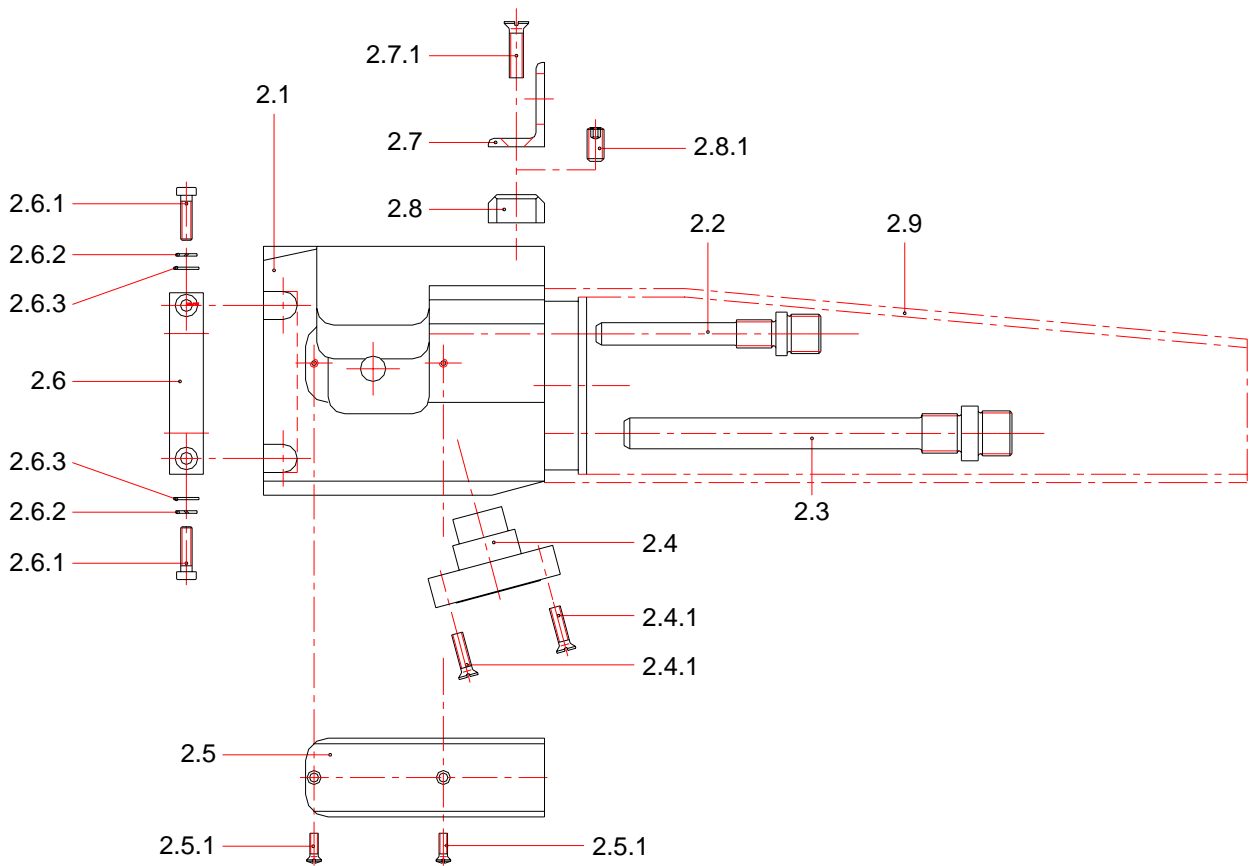
### 8.1 Spray device LD/U3

#### 8.1.1 Spray head LD/U3 (closed nozzle system)



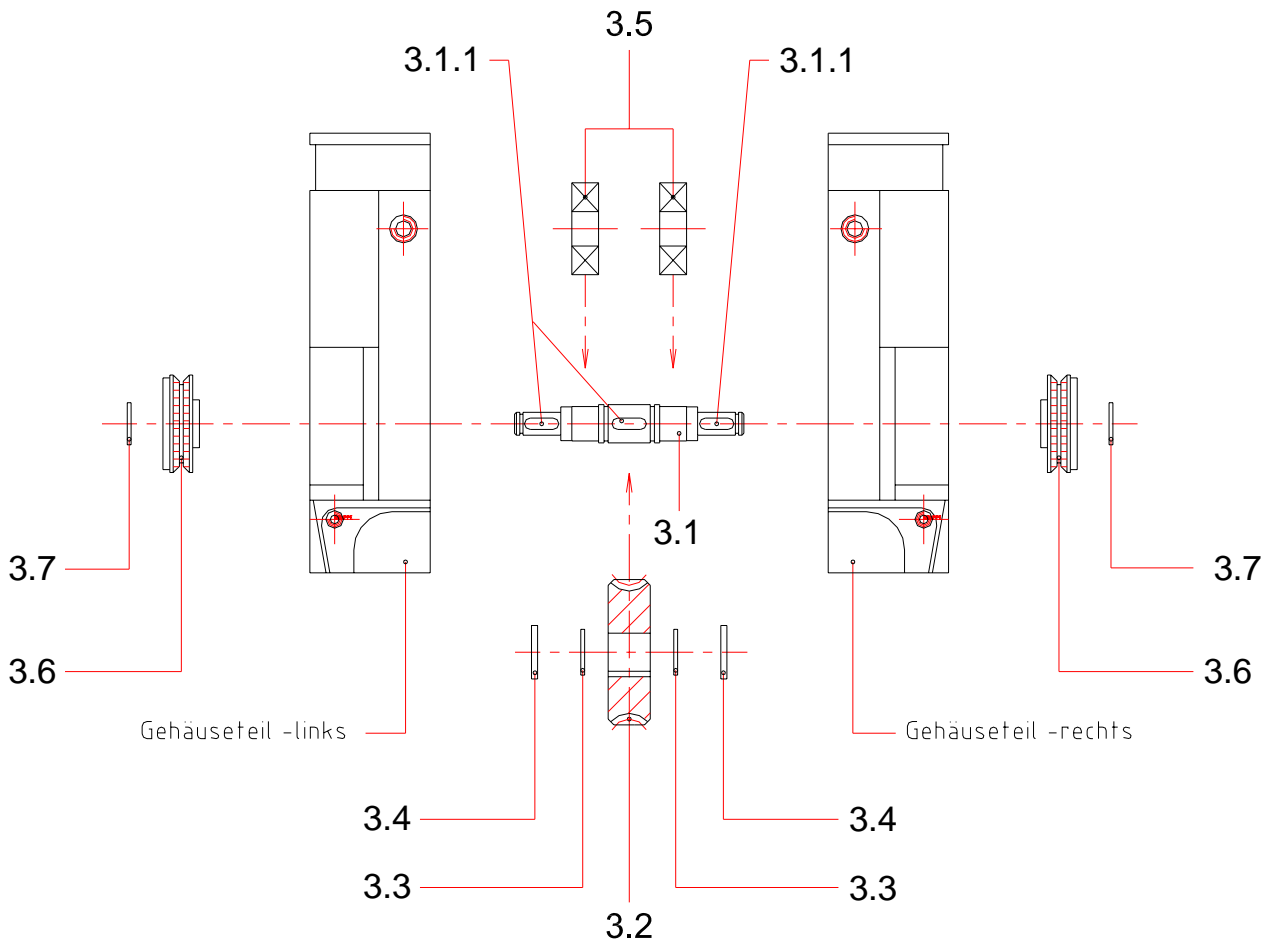
Pos.	Description	Article No.	SAP-No.
1.1	Spray head compl. LD/U3	13508002/1	1056580
1.1.1	O-Ring NBR 9x2.5mm	0304090250	1054409
1.1.2	O-Ring NBR 11x1.5mm	0304110150	1054417
1.1.5	Fillister head screw M4x35 DIN84 Zn	02000210435	1054707
1.1.6	Fillister head screw M4x40 DIN84 Zn	02000210440	1054708
1.1.7	Hex headl. setscrew M6x25 DIN913 45H	02002100625	1054788
1.2	Air nozzle tube LD/U3	13408041	1053727
1.7	Atomizer nozzle 2 hole LD/U3	13408065	1053737
1.8	Slot contact nozzle Ø 2.5 mm (for Zn, ZnAl15, AlMg5)	1340432/25	1056252
	Contact nozzle Ø 2.5 mm (for Al)	13401351/25	1056131
1.9	Cover ring. closed nozzle system	13408064	1053736
1.10	Gas nozzle Ø 1.6 and 2.0 mm	13404340/20-2	1056259
1.11	Radial air nozzle nut	13408066	1053738
1.12	Fan spray nozzle	13401001	1053683
1.13	Fan spray nozzle nut (LD/U2+3)	13401002	1053684
1.14	Nozzle adjusting device	1340199	1053252

**8.1.2 Gear housing LD/U3**



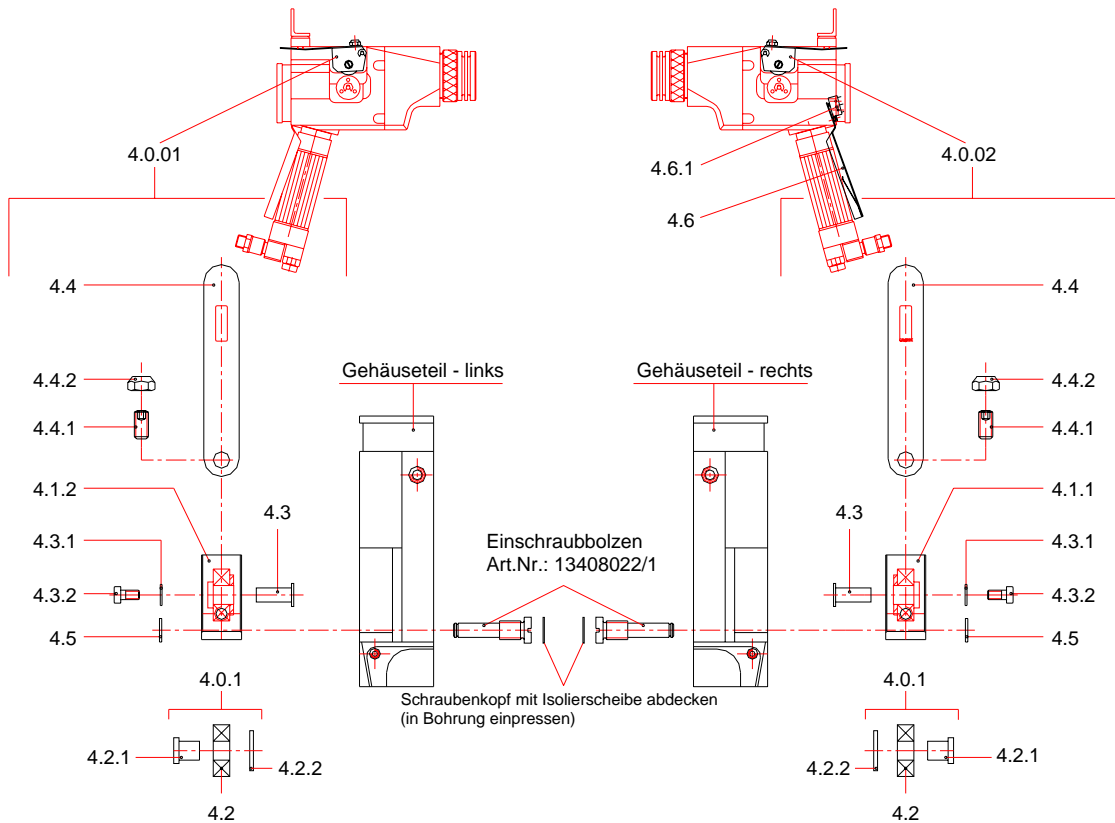
Pos.	Description	Article No.	SAP-No.
2.1	Housing compl. LD/U3	13508001	1053781
2.2	Wire line LD/U3	13408037	1053724
2.3	Current / gas connection LD/U3	13408035	1053722
2.4	Motor disk	1341720	1053338
2.4.1	Flat head screw M4x16 DIN963 Zn	02002910416	1054879
2.5	Bottom plate LD/U3	13408017	1053717
2.5.1	Oval head counters. screw M3x8 DIN964	0200302038	1054345
2.6	Contact plate LD/U3	13408016	1053716
2.6.1	Fillister head screw M4x16 DIN84 A2	02000220416	1054725
2.6.2	Spring washer A4 DIN127 Zn	020009104	1053897
2.6.3	Spring washer A4 DIN137 Zn	020010004	1053906
2.7	Suspension LD/U3	13408050	1053731
2.7.1	Counter sunk screw M5x20 DIN963 Zn	02002910520	1054886
2.8	Fixing plate LD/U3	13408040	1053726
2.8.1	Hex headl. setscrew M6x12 DIN913 45H	02002100612	1054785
2.9	Protective Bellow	0410302	1053094

**8.1.3 Wire feeding LD/U3**



Pos.	Description	Article No.	SAP-No.
3.0	Wire feeding LD/U3	13508005	1053783
3.1	Wire feed shaft LD/U3	13408013	1053713
3.1.1	Feather key 3x3x9 DIN6885	02022802	1053462
3.2	Worm wheel LD/U3	13408014	1053714
3.3	Circlip A10x1	02028	1051922
3.4	Distance ring LD/U3	13408063	1053735
3.5	Deep groove ball bearing 609-2RS	0204335-4	1055413
3.6	Drive roll, knurled-prof., wire size 2.5 (for Zn, ZnAl15, AlMg5)	13508003/925	1056586
	Drive roll, spline-prof., wire size 2.5 (for Al)	13508003/25	1056582
3.7	Lock washer RS5 DIN6799	020305	1052139

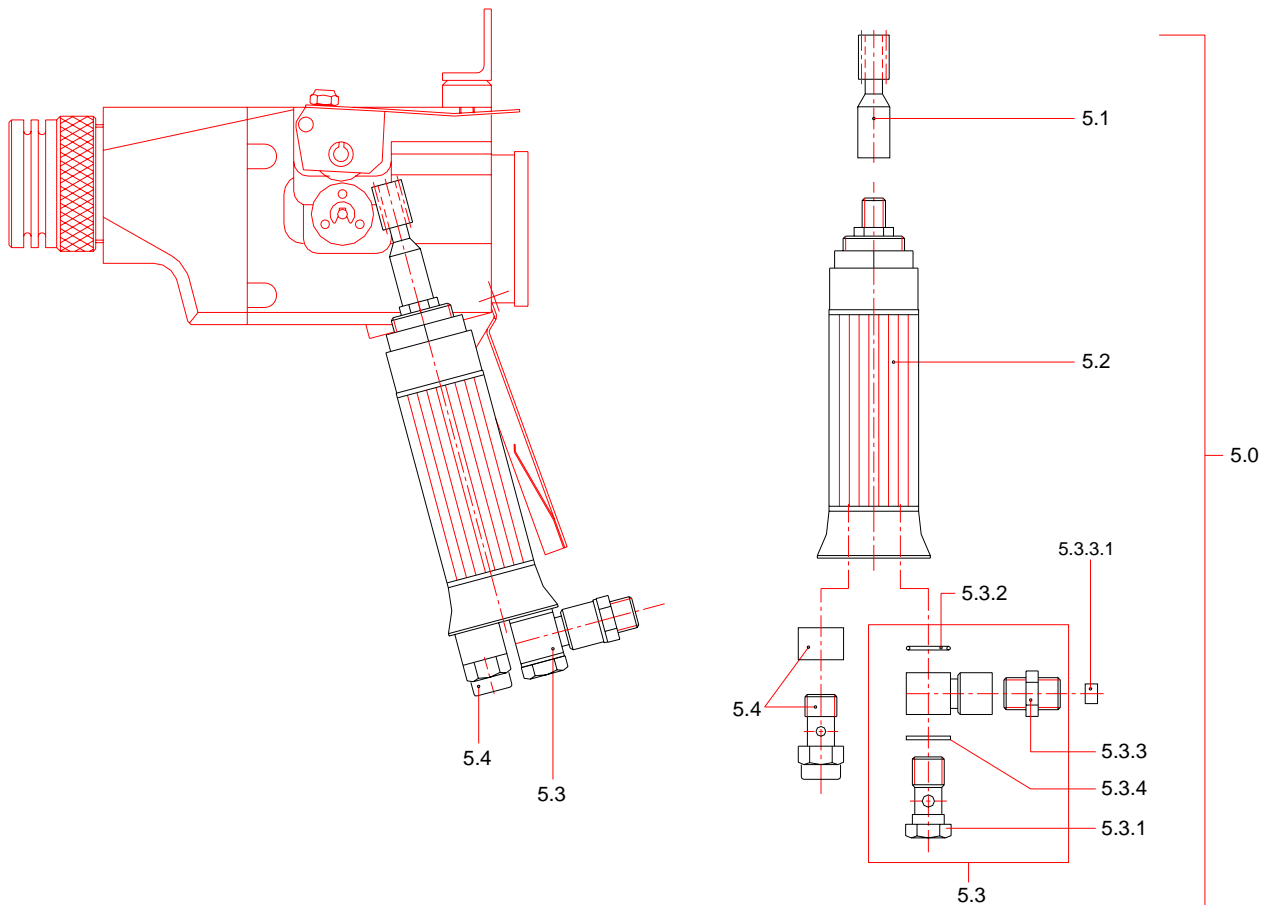
**8.1.4 Wire pressure LD/U3**



Pos.	Description	Article No.	SAP-No.
4.0.01	Pressure roll with clamp left	13508006/1	1056589
4.0.02	Pressure roll with clamp right	13508007/1	1056590
4.0.1	Pressure roll compl.	13508004/1	1056588
4.1.1	Pressure clamp left LD/U3	13408021	1053719
4.1.2	Pressure clamp right LD/U3	13408020	1053718
4.2	Deep groove ball bearing 608-2RS	0204334-4	1055412
4.2.1	Bearing bush LD/U3	13408062	1053734
4.2.2	Washer M8 DIN125 Ms	020008208	1053891
4.3	Axle LD/U3	13408024	1053721
4.3.1	Washer M4 DIN125 Zn	020008104	1053875
4.3.2	Fillister head screw M4x8 DIN84 Zn	02000210408	1054699
4.4	Compression spring LD/U3	13408042	1053728
4.4.1	Hex headl. setscrew M6x16 DIN913 45H	02002100615	1054786
4.4.2	Safety nut M6 DIN985 Zn	020032106	1053942
4.5	Lock washer RS5 DIN6799	020305	1052139
4.6	Compress. spring (dead man's switch)	13508070	1053787
4.6.1	Microswitch for dead man's switch	010002	1051956

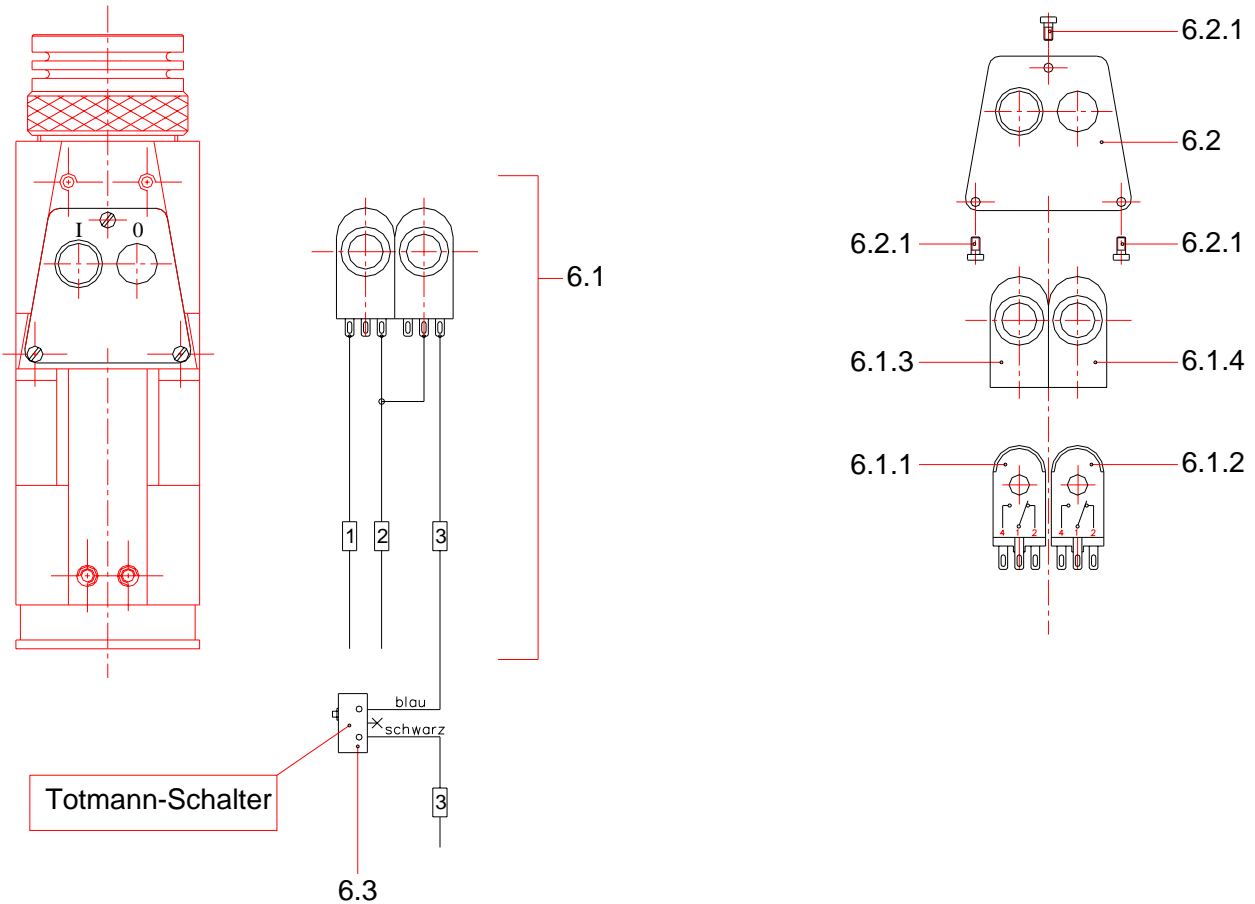


**8.1.5 Air motor LD/U3**



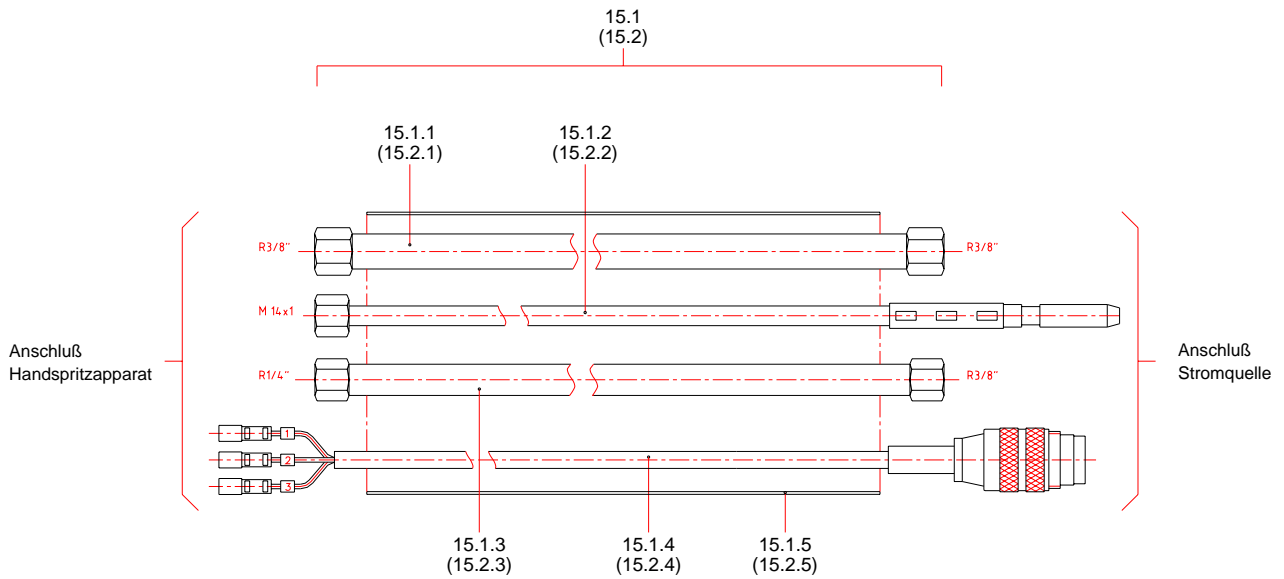
Pos.	Description	Article No.	SAP-No.
5.0	Drive compl. LD/U3	13508009	1053784
5.1	Worm shaft LD/U3	13408015	1053715
5.2	Air motor MD-Z-5300	13213-20	1056093
5.3	Swivel connector. complete	13508012	1053786
5.3.1	Swivel connector R 1/4"	0306811	1052956
5.3.2	O-Ring NBR 13x1.5mm	0304130150	1054428
5.3.3	Double nipple LD/U3	13408071	1053740
5.3.3.1	(Screen not installed)		
5.3.4	Aluminum ring		
5.4	Exhaust air throttle GRE-1/4"	031121	1052252

**8.1.6 ON / OFF switch LD/U3**



Pos.	Description	Article No.	SAP-No.
6.1	On/off switch compl. LD/U3	13508010	1053785
6.1.1	Switch "on"+"off"	010004	1051957
6.1.2	Switch "on"+"off"	010004	1051957
6.1.3	Covering cap OFF (with nobe)	010003/1	1055135
6.1.4	Covering cap ON (without nobe)	010003/2	1055137
6.2	Name plate for switch LD/U3	13408038	1053725
6.2.1	Fillister head screw M3x6 DIN84 (brass)	0200022036	1054292
6.3	Microswitch for dead man's switch	010002	1051956

**8.1.7 Hose package LD/U3 (8 m)**

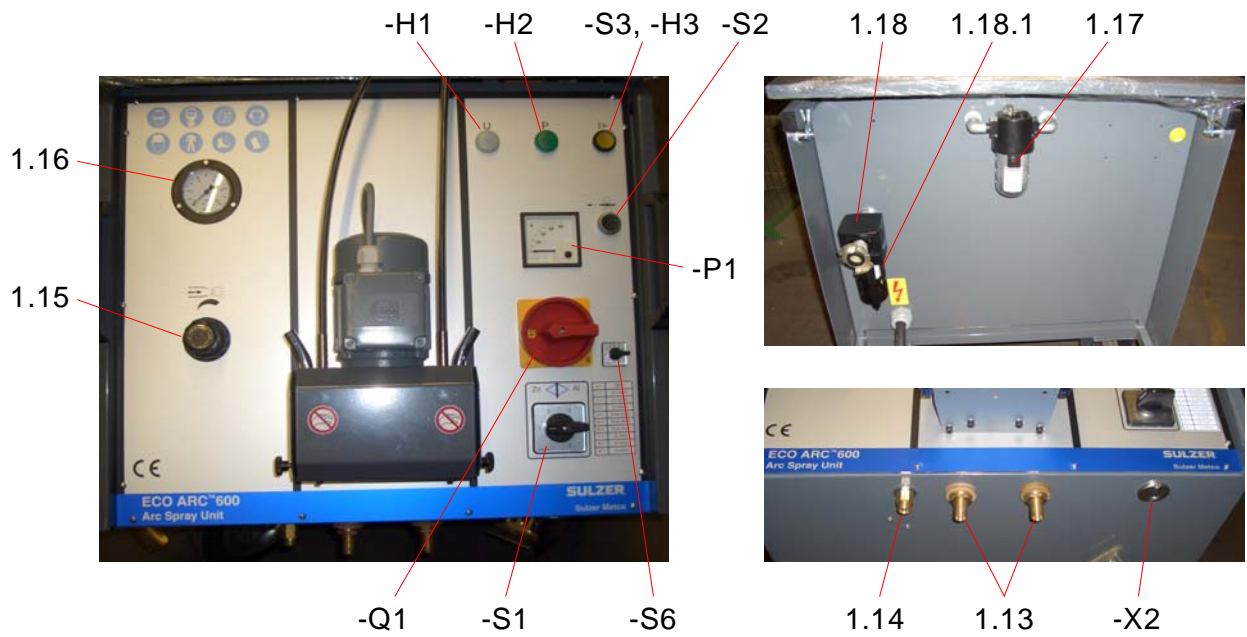


Artikel-Nr. in Klammern ( ) = 8m Schlauchpaket

Pos.	Description	Article No.	SAP-No.
15.2	Cable and hose set 8 m	136107-80	1057163
15.2.1	Current / air hose compl. 8 m	135107-80/1	1056697
15.2.2	Insulated wire guide hose 8 m	135107-80/2	1056698
15.2.3	Compressed air motor hose 8 m	135107-80/4	1056699
15.2.4	Control cable 8 m	135107-80/5	1056700
15.2.5	External hose 50x1.5mm	03003368	1053519

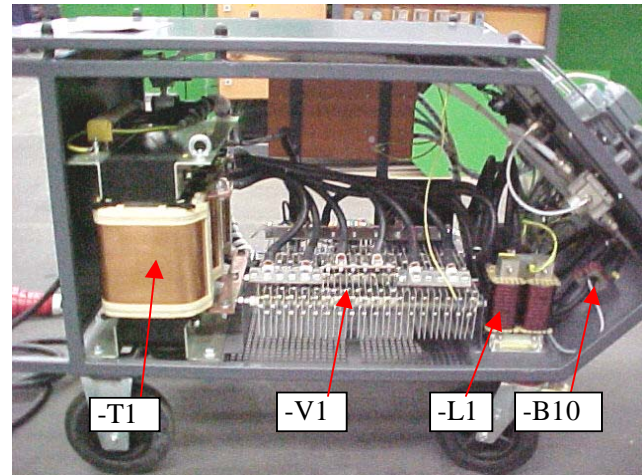
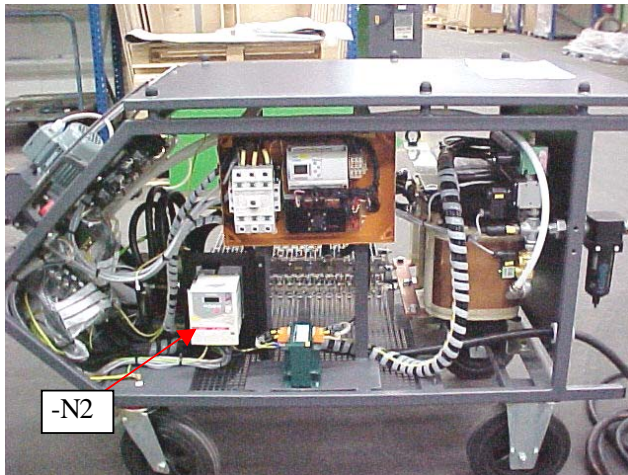
## 8.2 Power supply

### 8.2.1 Front and back side power supply

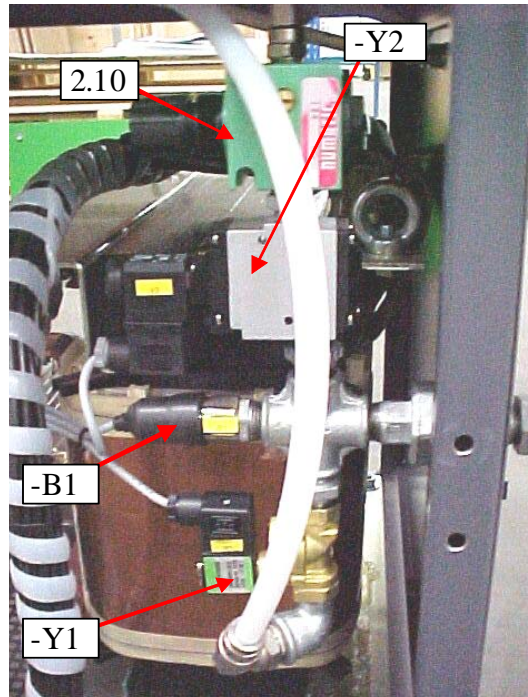


Pos.	Description	Article No.	SAP-No.
1.13	Current / air guide pin	134224	1052769
	Insulating bush compl.	135222	1052811
	Insulating disc 40x9	134223	1052768
	Washer M16 DIN125 Ms	020008216	1053894
	Tooth lock washer M16 DIN6798 AZ Zn	02005216	1053444
	Counternut MS R3/8"	03065862/2	1055499
	Bellow current/air connection	041112	1052392
1.14	Quick acting closure	03058	1051943
1.15	Pressure regulator R½ +adapter incl. nut	030722	1052228
1.16	Manometer with front ring black 1/4"	030803/2	1055553
1.17	Oiler R3/8" L17-C3-000	0307-12	1055540
1.18	Filter R1/2"	0307014	1052959
1.18.1	Filter insert	0307012/6	1055531
-H1	Signal lamp white RLF	0103070/1	1055225
	Fastening adapter BE3	01032110	1053142
	LED element direct voltage	0103050/1	1055222
-H2	Signal lamp green	0103030/1	1055219
	Fastening adapter BE3	01032110	1053142
	LED element direct voltage	0103050/1	1055222
-H3 -S3	Illuminated push button M22S-DL-Y	0103100/5	1055235
	Fastening adapter BE3	01032110	1053142
	LED element direct voltage	0103050/1	1055222
	Contact element normally open contact	0103230/2	1055252
-P1	Voltmeter/ammeter for 10 Volt	0102000	1052488
	Scale 0-800 A. for 10 Volt	0102000-7	1055207
-Q1	Main switch (P3-63-EA-SVB)	0100250	1052446
-S1	Step switch (for G60/5)	0100451	1052455
-S2	Hand-actuated aux. switch compl. M22-D-S	01031100	1053141
	Fastening adapter BE3	01032110	1053142
	Contact element normally open contact	0103230/2	1055252
	Sign 47T	0103120/4	1055242
-S6	Coding switch 9-stage	0100476	1052463
-X2	Tuchel socket 3 pole	0112021	1052622

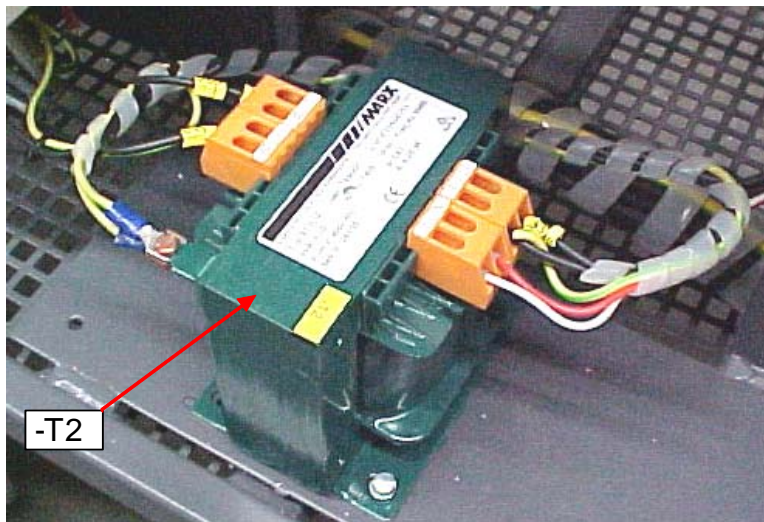
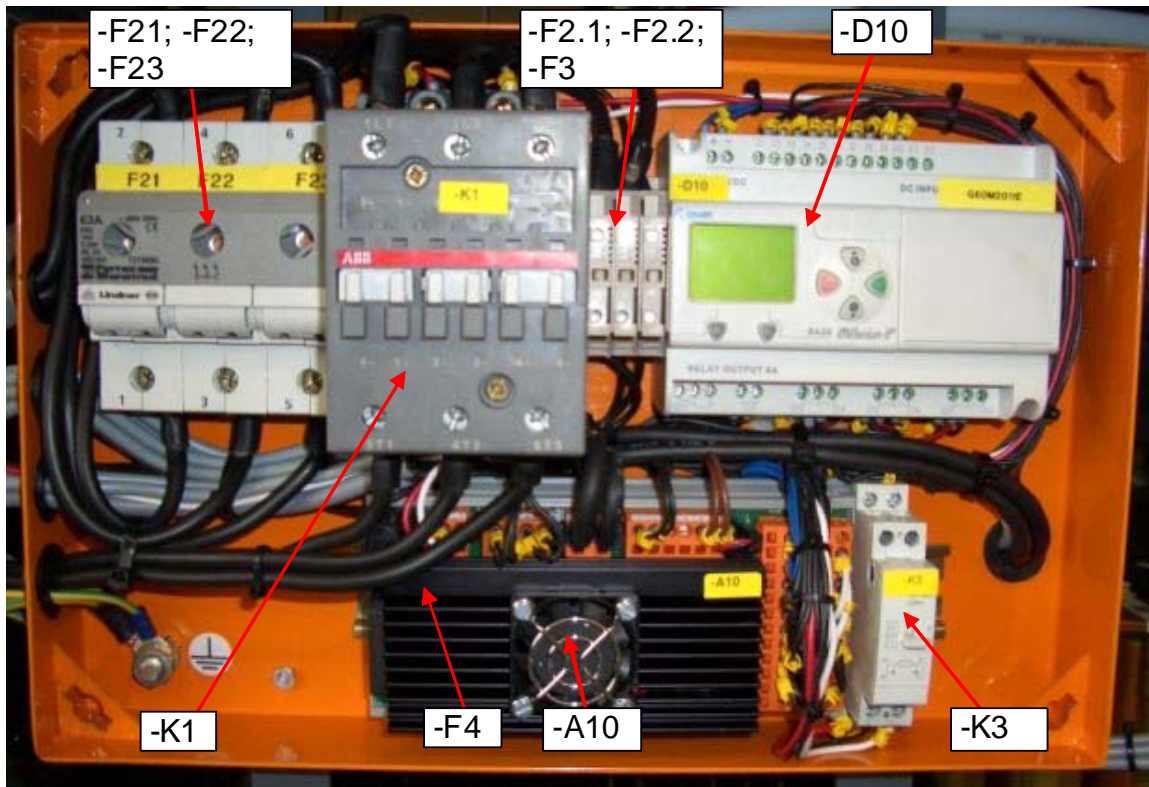
**8.2.2 Electrical system, pneumatics and control**



Pos.	Description	Article No.	SAP-No.
-B10	Current sensor w. 400A-calibrat. checked	132010254	1061571
-N2	Frequency converter 0.25 kW / 1.5 A	01145/2	1055333
-L1.1 -L1.2	Throttle 350 A	010441	1052003
-T1	Three phase transformer ECO ARC 600	0104265	1052509
-V1	Rectifier 600 A	0105016	1052517



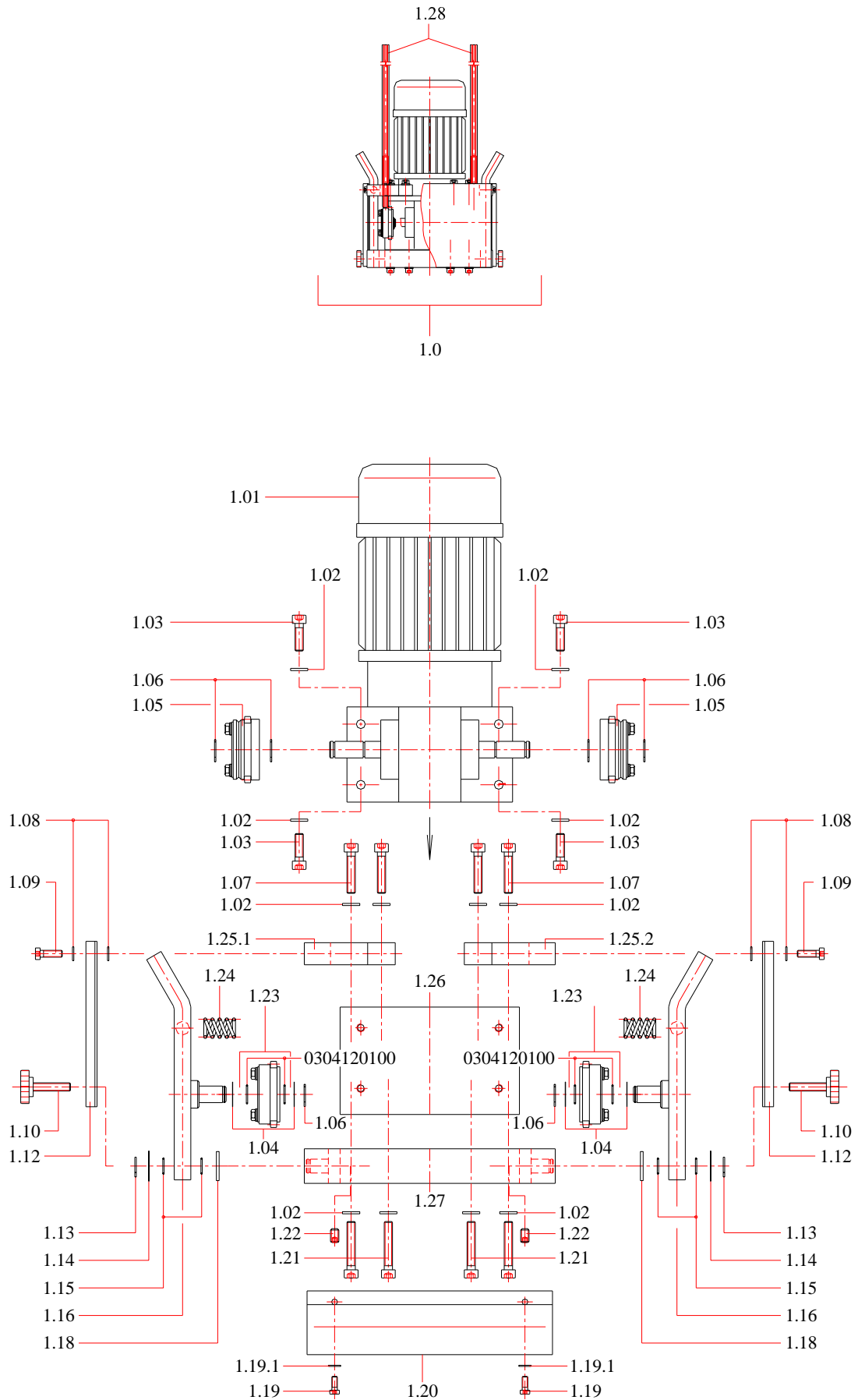
Pos.	Description	Article No.	SAP-No.
2.10	Pressure regulator (wire feed air)	030723	1052229
-B1	Pressure sensing switch 2.5 bar 1/4"	030900	1052241
-Y1	Solenoid valve 24V/50Hz (for atomizing air)	031011/24	1055557
-Y2	Solenoid valve 24V/50Hz (for wire feeding air)	03102/24	1055563





Pos.	Description	Article No.	SAP-No.
-A10	Interface Module II	01015403	1053140
-D10	M3 Control and logic relay programmed CD 20		1064969
-F2.1 -F2.2 -F2.3	Fuse 5x20mm 2A M	0113519	1052677
-F4	Fuse 5x20mm 4A M (integrated on -A10)	0113520	1052678
-F21	Load disconnecting switch 63A 3-pol.	01089630855	1054637
-F22 -F23	Fuse insert 63A. type 1701.063	0113507	1059325
-K1	Contactactor (A63-30-22 24 V / 50 Hz)	0101004	1052469
-K3	Auxiliary relay E259	010128	1058322
-T2	Control transformer (230 / 400 V - 24 V / 230 V)	010406-13	1055263

8.2.3 Wire feed drive Push 4



Pos.	Description	Article No.	SAP-No.
1.0	Module Push4 (for ECO ARC 600)	1360410/540	1057045
1.01 (-M2)	Gear motor Push 4 12:1-1g. shaft	011601/100	1055346
1.02	Washer M6 DIN 125 Zn	020008106	1053877
1.03	Allen screw M6x20 DIN912 sw	02002000620	1054755
1.04	Shim ring 12x18x0.2 DIN988	050113412802	1055057
1.05	Drive slip roll, spline-profile, 2.5	13504821/25	1056515
1.06	Retaining ring 12x1 DIN471	020210	1052131
1.07	Allen screw M6x30 DIN912 sw	02002000630	1054758
1.08	Washer M5 DIN125 Zn	020008105	1053876
1.09	Allen screw M5x15 DIN7984 sw	02004000515	1054937
1.10	Knurled screw M6x30 0710	02005000630	1054980
1.12	Cover two-piece (gear Push 4)	1340410	1053267
1.13	Circlip A10x1	02028	1051922
1.14	Distance disc 10x22x0.3	0200430102203	1055073
1.15	O-Ring NBR 10x1mm	0304100100	1054411
1.16	Pressure lever cpl. (right)	13504090/1	1056471
1.17	Pressure lever cpl. (left)	13504090/2	1056472
1.18	Washer M10 DIN125 Ms	020008210	1053892
1.19	Allen screw M4x10 DIN7984 sw	02004000410	1054929
1.19.1	Washer M4 DIN125 Zn	020008104	1053875
1.20	Covering cap (gear Push 4)	1340411	1053268
1.21	Allen screw M6x35 DIN912 sw	02002000635	1054759
1.22	Hex headl. setscrew M6x8 DIN913 45H	0200210068	1054325
1.23	Pressure slip roll, 1.6 - 3.2 (hard knur.)	13504810/25	1056489
1.24	Compression spring 2.2x12.8x20.8x3.5	0401313	1052988
1.25.1	Holder left (gear Push 4)	13404080/2	1056247
1.25.2	Holder right (gear Push 4)	13404080/1	1056246
1.26	Machine housing (gear Push 4)	13404060	1053700
1.27	Gearhead plate (Push 4)	13404070	1053701
1.28	Wire guide helices	136127/4-1	1057234

### 8.3 Wearing parts recommended for stockkeeping

Component / Description	Article No.	SAP-No.
<b>LD/U3</b>		
Slot contact nozzle Ø2.5 mm (for Zn, ZnAl15, AlMg5)	1340432/25	1056252
Contact nozzle Ø2.5 mm (for Al)	13401351/25	1056131
Gas nozzle Ø2.5 mm	1340434/25-2	1056257
Drive roll, knurled-prof., wire size 2.5 (for Zn, ZnAl15, AlMg5)	13508003/925	1056586
Drive roll, spline-prof., wire size 2.5 (for Al)	13508003/25	1056582
<b>Wire feed drive Push 4</b>		
Drive slip roll, spline-profile, 2.5	13504821/25	1056515
Pressure slip roll, 1.6 - 3.2 (hard knur.	13504810/25	1056489
Wire guide helices	136127/4-1	1057234
<b>Power supply</b>		
Filter insert	0307012/6	1055531
Fuse 5x20mm 2A M	0113519	1052677
Fuse 5x20mm 4A M (integrated on -A10)	0113520	1052678
Fuse insert 32A. type 1701.032	0113508	1059324
<b>Hose package</b>		
Insulated wire guide hose 8 m	135107-80/2	1056698
<b>Operating resources</b>		
PTFE-Spray	000403	1051832
Air motor oil	000900/11	1055104
Contact grease SMOSU	000931	1051843
Graphite atomizer	000932	1051844
Nozzle cleaner	000933	1051845

## 9 Appendix

### 9.1 Recommended spray parameters for Sulzer Metco wire arc spray systems

Wire type	Wire	Parameters for bond coat		Parameters for top coat	
		Voltage [V]	Air [bar]	Voltage [V]	Air [bar]
SOFT WIRES	OSU 001	--	--	18 - 20	3,0 - 5,0
	OSU 002	--	--	18 - 20	3,0 - 5,0
	OSU 004	27 - 42	1,5 - 2,0	26 - 29	3,0 - 5,0
	OSU 006	27 - 42	1,5 - 2,0	26 - 29	3,0 - 5,0

**Please consider:**

- The parameters in this chart are just for orientation. Depending of the coat's character parameters can be modified.
- The spray amperage has to be adjusted depending on the desired output. The higher the amperage the higher the output.
- You have to care that a faultless melting behavior of the wire is guaranteed, which means to adjust the operating voltage as needed.
- Small and thin-walled workpieces should be sprayed with reduced amperage to avoid high thermal stress inside the coating.

## 9.2 Circuit diagram