

EWF-GA-075-09  
December 2009

EWF – WG directives doc 1 rev 1 2009\_11\_11

## **BEST PRACTICE FOR INSPECTION OF IN SERVICE EQUIPMENT IN WELDING**

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## Foreword Directive 95/63/EC

This directive is concerning the minimum safety and health requirements for the use of work equipment by workers at work

In this directive the article 4 is:

Inspection of work equipment

1. The employer shall ensure that where the safety of work equipment depends on the installation conditions, it shall be subject to an initial inspection (after installation and before first being put into service) and an inspection after assembly at a new site or in a new location by competent persons within the meaning of national laws and/or practices, to ensure that the work equipment has been installed correctly and is operating properly.

2. The employer shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is subject to:

- periodic inspections and, where appropriate, testing by competent persons within the meaning of national laws and/or practices,

- special inspections by competent persons within the meaning of national laws and/or practices each time that exceptional circumstances which are liable to jeopardize the safety of the work equipment have occurred, such as modification work, accidents, natural phenomena or prolonged periods of inactivity, to ensure that health and safety conditions are maintained and that the deterioration can be detected and remedied in good time.

3. The results of inspections must be recorded and kept at the disposal of the authorities concerned. They must be kept for a suitable period of time.

# 1. Introduction

This guide for the inspection of working equipment has been prepared by the working group regulation of the EFW. It is designed to provide the basic information for manufacturers to be in conformity with the COUNCIL DIRECTIVE 95/63/EC of 5 December 1995 amending Directive 89/655/EEC concerning the minimum safety and health requirements for the use of work equipment by workers at work.

This guide furnishes indications for periodic inspection.

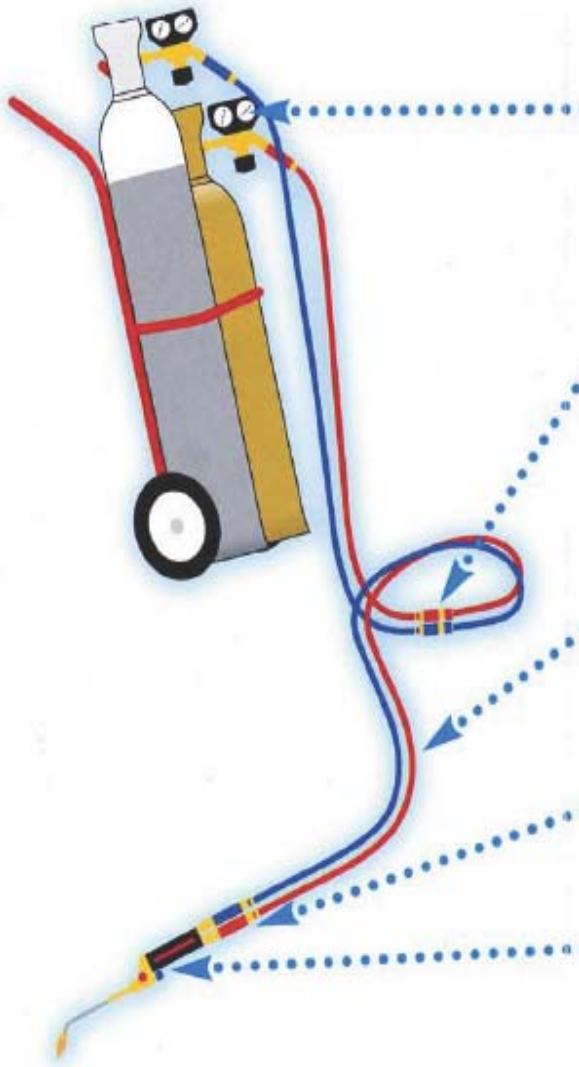
## 2. Gas welding equipment

### 2.1 Recommendations for the maintenance of equipment for welding and cutting

These recommendations are summarised in following table:

Equipment	Visual examination – Verification tightness test		Revision or replacement (1) (2)
	At each change of cylinder	Annually	
Pressure regulator (2)	Visual examination of: <ul style="list-style-type: none"> <li>• Good state of threads, gaskets, manometers, hose assemblies, hose clamps</li> <li>• Absence of grease</li> </ul>	<ul style="list-style-type: none"> <li>• Tightness test at service pressure</li> </ul>	<ul style="list-style-type: none"> <li>• Verification or replacement at least after five years</li> </ul>
quick-action coupling with shut-off valve	<ul style="list-style-type: none"> <li>• Verification of good functioning of locking</li> </ul>	<ul style="list-style-type: none"> <li>• Tightness test at service pressure</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic replacement if malfunction</li> </ul>
assembled hoses	<ul style="list-style-type: none"> <li>• Verification of hoses colour in function of gases</li> <li>• Visual examination to be sure of good state and cleanness of hoses</li> </ul>	<ul style="list-style-type: none"> <li>• Visual examination on bended hose to verify absence of failures, cracks, inflating, injury</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement if visual examination discovered a defect</li> <li>• at least three years after put into service if intensive service</li> <li>• at least five years after put into service in every case</li> <li>• Note: date on hose is fabrication date and not date of put into service</li> </ul>
non-return valve flame arrestor	<ul style="list-style-type: none"> <li>• verification that they are in place</li> <li>• Verification of their colour in function of gases</li> </ul>	<ul style="list-style-type: none"> <li>• Visual examination and tightness test</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement in case of backflow, backfire or at least three years after put into service</li> </ul>
blowpipes	<ul style="list-style-type: none"> <li>• Visual examination of good state of nozzles</li> </ul>	<ul style="list-style-type: none"> <li>• Full visual examination and tightness test</li> </ul>	<ul style="list-style-type: none"> <li>• Revision or replacement at least five years after put into service</li> </ul>
(1) Revision shall be performed by the manufacturer or by repairers approved by him. In addition in case of malfunction equipment shall be changed. (2) See with your gas furnisher the safety data of the gas you are using (3) Not applying to the gas regulator integrated on the cylinder which are maintained by gas furnisher			

## 2.2 Standards references



Pressure regulator



EN ISO 2503

Quick-action coupling with shut-off valve



EN 561

Hoses



EN 559

or

EN 1327

Non-return valve  
Flame arrester



EN 730-1  
EN 730-2

Blowpipe



EN ISO 5172

## 2.3 Recommendations for maintenance of installations for manifolds systems for welding and cutting

### 2.3.1 Cylinders and frames (see figure 1 rep 1)

- verify the good state of cylinders fastening, to avoid they fall down which can produce strains on lyres and flexible tubes. In addition, in case of flexible tubes are breaking, their flapping can cause fall of cylinder;
- all valves of cylinders and frames of the same rack or in the same frame shall be open to balance the pressures;
- verify the tightness of connecting at each change of cylinder or frame with a product to detect leaks;
- Ground on which are cylinders or frames shall be flat and free to access quickly to valves in case of emergency,
- area of storage shall be maintained clean and regularly cleaned to avoid amassing of combustible products (papers, cardboard, leaves ...).

### 2.3.2 Flexible tubes, lyres and articulated piping for joining (see figure 1 rep 2)

Warning: verifications listed thereafter shall be performed without pressure.

- verify that safety cables are correctly attached to avoid their flapping in case of breaking,
- for flexible tubes, visual examination of the braid at each change of cylinders to be sure of absence of crack, break of braid wires, corrosion and good state of tightness gasket,
- even if visual examination is satisfactory, it is recommended to change flexible tubes at least after five years of use, date of reference being marked on the tube,
- for lyres and articulated piping, verify their suppleness (contact the furnisher for more information if necessary),
- verify tightness of the joint at each change of cylinder or frame with a product to detect leaks.

### 2.3.3 Collecting racks (see figure 1 rep 3)

- verify at least one time a year external tightness under gas, at service pressure, by examination with product to detect leaks,
- verify at least one time a year, the good functioning of rack equipment by a company recommended by the manufacturer (valves, non return valves, manometers ...)

### 2.3.4 Equipment for expansion and inversion (see figure 1 rep 4)

- Manometers:
  - verify by visual examination that all manometers are in good state and are giving correct indications, e.g. for maximal pressure and at zero
- Pressure regulators:
  - verify at least one time a year external tightness under gas, at service pressure, by a leak test with a product to detect leaks,
  - verify at least one time a year the assembly of expansion (filter, valves, exhaust valves, membrane, stopping and draining valves ...) by a company recommended by the manufacturer.
- System of signalisation:
  - verify at least one time a year the good functioning of remote signalisation system if existing.

### 2.3.5 Devices for acetylene safety (see figure 1 rep 5)

- gas non return valves placed at exit of acetylene cylinders and frames, shall be revised at least one time a year by a company recommended by the manufacturer,
- in case of bursting disc, it is necessary to perform a visual examination on external side to be sure of absence of defect,
- full verification shall be performed also after each incident. If necessary, equipment shall be changed according to instructions of manufacturers.

### 2.3.6 Distribution piping (see figure 1 rep 7)

WARNING. Dismantling of equipment and draining plugs eventually can make a risk of burst (case of combustible gases). This operation shall be performed by trained personnel, or by a company recommended by the manufacturer of this equipment.

- One time a year :
  - perform visual examination to verify absence of external corrosion and damages,
  - be sure that electrical ground connexion of the piping is existing and continuous,
  - perform tightness test, under gas, of joining parts, with a product to detect leaks,
  - verify correct identification of the piping in relation with gas inside,
  - for underground piping, be sure that there is no ground caving in.

### 2.3.7 Working place (see figure 1 rep 7)

- Perform one time a year:
  - an external tightness test under gas , with a product to detect leaks,
  - a visual examination to be sure of good external state of manometers, flowmeters, valves and pressure regulators,

- for other equipment see clause 2.1.

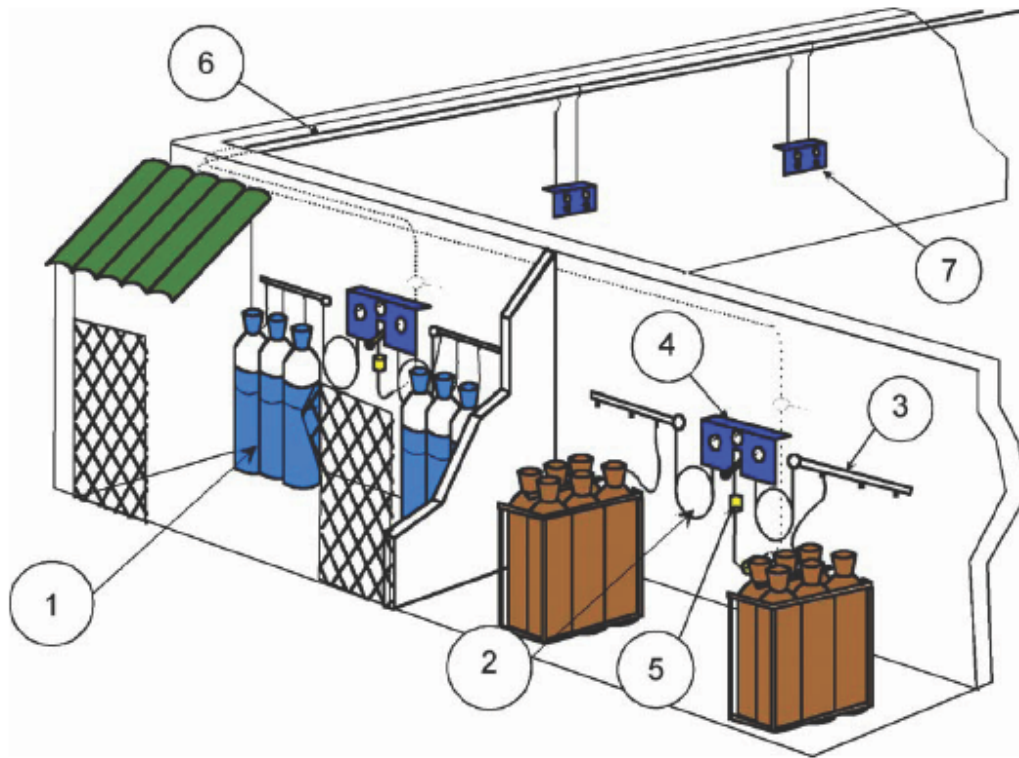


Figure 1: scheme of a manifold system

## 2.4 Standards of reference for manifolds

- EN 562 «**Erreur ! Source du renvoi introuvable.**»
- EN ISO 14113 «Gas welding equipment - Rubber and plastic hoses assembled for compressed or liquified gases up to a maximum design pressure of 450 bar. »
- EN ISO 15615 «Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — Safety requirements in high-pressure devices . »

## 3. Arc Welding Equipment

Inspection and maintenance of arc welding equipment is described in standard IEC 60974-4 : Safety, maintenance and inspection of arc welding equipment in use  
Instructions manual of manufacturer should include recommended cycle for cleaning, partial and complete test or other operation.

This standard is giving two type of inspection and tests:

partial tests  
complete tests

**Warning:** Tests of welding power sources could be dangerous and shall be carried out by an expert.

Normally complete test are performed by the manufacturer or a company recommended by the manufacture why normally performed after repair.

Complete test will not be considered in this document. Only visual inspection will be considered.

The test sequence is given in table 1. Any of the tests shall be passed before starting the next test. If defects are detected during a test, and repaired, (e.g. by changing parts such as lamps, circuit breakers, actuators, connecting cables with coupling plugs, plugs etc.), the entire test sequence shall be carried out after repair

Table 1 : sequence of tests on used arc welding equipment

Partial test	
a)	<b>visual inspection according to</b> Erreur ! Source du renvoi introuvable.;
b)	<b>electrical test, measurement of the:</b> <ul style="list-style-type: none"> <li>• 1. protective conductor resistance according to 6.2;</li> </ul>
c)	<b>functional test according to</b> Erreur ! Source du renvoi introuvable.
d)	<b>documentation according to 7</b>

### ***3.1 Protection against electrical shock***

Power source, ancillary equipment, torch, cables and harness shall be visually inspected.

Visual inspection shall be carried out in accordance with the conditions of use of welding equipment and the manufacturer's instructions.

An example of items for a visual inspection during partial test is given in Table 2

Table 2: Items for the visual inspection

Partial test	Items
X	<p>Torch/electrode holder, welding current return clamp</p> <ul style="list-style-type: none"> <li>• missing or defective insulation at the torch/electrode holder</li> <li>• defective connections at the electrode holder/torch or at the welding current return clamp</li> <li>• defective, damaged switches (torch)</li> <li>• blocked, burnt out nozzle (torch)</li> <li>• worn contact tube (torch)</li> <li>• signs of overload and improper use</li> <li>• other damages</li> </ul>
X	<p>Cables, including plugs and couplers (Mains supply-, welding current- and –return cable, cable hose assembly, supply conductors for remote control or external wire feeder etc.)</p> <ul style="list-style-type: none"> <li>• deformed and/or faulty plug/coupler enclosures</li> <li>• used, broken or thermally damaged plug pins</li> <li>• corroded, deformed or broken protective contacts</li> <li>• ineffective cable anchorage</li> <li>• defective bending and buckling protection</li> <li>• unsuitable cable guiding</li> <li>• no compliance between protection class and connecting cable / plug, coupler, if relevant</li> <li>• cables and plugs unsuitable for the intended use and performance</li> <li>• defects at the welding current appliance inlets (bayonet or central coupling device), not tightly fixed, parts of insulating material damaged</li> </ul>

Partial test	Items
X	<p>Enclosure (welding power source, wire feeder, cooling system ...)</p> <ul style="list-style-type: none"> <li>• incompleteness</li> <li>• ineffective contact protection, minimum degree of protection IP 2x</li> <li>• inadmissible interventions and modifications, strong fissures/wear</li> <li>• impairment of the degree of protection by destruction and/or indentation at the enclosure or casing</li> <li>• rupture damages at insulating material and cast iron enclosures</li> <li>• excessive pollution and corrosion, conductive deposits, humidity</li> <li>• cooling openings not free, missing of required air filters</li> <li>• signs of overload and improper use</li> <li>• burnings/welding points caused by electrode holder or welding current return cable put down on the enclosure (danger of PE overload)</li> <li>• missing or bad condition of protective devices, such as gas cylinder holder</li> <li>• missing or bad condition of transport rolls, rope eyes, holder etc.</li> <li>• failings at the wire reel fixing (e.g. destroyed insulation material, reel fixing does not operate properly, traces of sliding/contact in the enclosure)</li> <li>• conductive objects placed in the enclosure</li> </ul>

### **3.2. Insulation resistance**

Only checked by measurement

### **3.3. Leakage current**

Only checked by measurement

### **3.4. No-load voltage ( $U_0$ )**

Only checked by measurement

### **3.5. Function**

#### **3.5.1 Functional test**

Where a selector switch or a control device is fitted, this shall operate correctly.

*Conformity shall be checked* by operating the device and by checking whether the welding power source operates correctly.

### 3.5.2 Supply circuit on/off switching device

Where an integral supply circuit on/off switching device (e.g. switch, contactor or circuit-breaker) is fitted, this shall:

- open or close all ungrounded mains conductors, and
- clearly indicate whether the circuit is open or closed.

*Conformity shall be checked* by visual inspection and measurement.

### 3.5.3 Voltage reducing device

Checked only by measurement.

### 3.5.4. Magnetic gas valve

Where a magnetic gas valve is fitted (e.g. TIG, MIG/MAG, PLASMA power sources), this shall operate properly.

*Conformity shall be checked* by visual inspection and the following operations:

- a) Function:  
Operate the trigger of the torch and check by means of the gas flow, whether the magnetic gas valve operates.
- b) Leakage:
  1. Connect the power source to the shielding gas supply (e.g. gas cylinder) and set maximum admissible operating pressure by means of the pressure regulator;
  2. Operate the trigger of the torch and put it then into the OFF position;
  3. Stop gas supply by means of the pressure regulator;
  4. Check if pressure is maintained for at least 2 min in the system, i.e. that it does not drop by more than 0,1 bar.

Warning:: Attention shall be paid to the fact that also flexible gas tubes and their connections may leak.

### 3.5.5. Signal and control lamps

Where a signal or control lamp is fitted, this shall operate properly.

*Conformity shall be checked* by visual inspection.

## 4. Test or inspection report

The tests shall be reported in such a way, that

- the identification of tested arc welding equipment;
- the date of testing and the date of future tests;
- the test results;
- the name of the technician;

can be clearly identified and reconstructed.