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IS 9604 (1994): Tungsten-inert gas (TIG) welding equipment
[ETD 21: Electric Welding Equipment]

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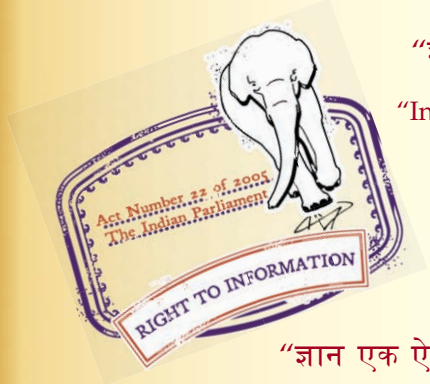

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"Knowledge is such a treasure which cannot be stolen"

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IS 9604 : 1994
(Reaffirmed 2004)

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(पहला पुनरीक्षण)

Indian Standard

TUNGSTEN-INERT GAS (TIG) WELDING EQUIPMENT — SPECIFICATION

(First Revision)

UDC 621·791·754·29·03

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 1994

Price Group 2

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by Electric Welding Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1980. In this revision the scope has been enlarged to cover pulsing units, gas regulators, flowmeters and gas mixers used for TIG welding. The Committee felt that the need for inclusion of 'high frequency insulation resistance test for torch for safety of the operator' will be included later on when details of the test are available.

Tungsten-inert gas (TIG) welding is that in which an arc plasma from a non-consumable tungsten electrode radiates heat on to the work surface, to create a weld puddle in the protective atmosphere provided by a flow of inert shielding gas; heat must then travel by conducting from this puddle to melt the desired depth of weld.

As the arc voltages experienced in TIG welding are lower than those of manual arc welding, the corresponding load voltages would be lower for TIG power sources. This necessitated changes in the requirements stipulated in the standards for welding power sources, in order to make them applicable for TIG process. The modifications, therefore, which are necessary as far as the requirements of power sources are concerned, are brought out in **6.**

In the preparation of this standard, considerable assistance has been derived from Doc : ISO/TC 44.SC4 (Secretariat -20 1975 'Draft proposal for revision of ISO R 700 — Rating of power sources for manual metal arc welding with covered electrodes and for TIG process' issued by the International Organisation for Standardization.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TUNGSTEN-INERT GAS (TIG) WELDING EQUIPMENT — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard lays down the general and safety requirements and test methods for TIG welding equipment.

1.2 Requirements for ancillary equipment (*see* 2.2 to 2.11) for TIG welding process are generally covered in this standard.

2 TERMINOLOGY

2.0 In addition to the definitions given in the relevant standards on welding power sources, the following definitions shall apply.

2.1 Welding Torch

A current carrying device which can accommodate non-consumable tungsten electrode (s) around which an inert shielding gas flows from a nozzle at the exit and of the device.

2.2 Arc Initiation Unit

High voltage high frequency injection in the welding circuit to enable an arc to be struck between the tungsten electrode and the workpiece without actual physical contact. For AC welding, this unit may be required to be continuously switched on for maintenance of the arc, whereas for DC welding, it may be switched off once the arc is established. In some modern designs, use of HF units (either separate or integral with power sources) is totally dispensed with by use of special electronic circuitry which reduce the current flowing through the tungsten electrode to a trickle, when touched to the workpiece, irrespective of current setting. The arc is initiated as soon as the torch is lifted and the set current is available. These are known as 'touch-start' and 'lift-arc' techniques.

2.3 H F Filter

The arc initiation unit as described in 2.2 is of high voltage, high frequency type, and HF filter circuit should be fitted to prevent damage to the power source.

2.4 DC Suppression

To block or reduce the dc component generated in the welding current while welding metals having refractory oxides, like Al, Mg, etc, and their alloys, with conventional ac power source. In ac power sources, where wave balancing facilities are available, no separate dc suppression unit is required.

2.5 Pre- and Post-Gas

To initiate the shielding gas flow before the welding operation and to prolong it after the arc is extinguished.

2.6 Slope-up

It implies a gradual increase in the current while starting.

2.7 Slope-down

It implies gradual decay in current at the end of a weld.

2.8 Pulsing

If the power source is fully thyristorized or transistorized, it is often possible to pulse the current to achieve thermal pulsing of the arc. This function is either built-in the power source or is provided by a separate pulsing unit.

2.9 Gas Regulator

A gas regulator is a mechanical device for reducing pressure automatically to a safe working level and controlling the volumetric flow of the compressed gas.

2.10 Flowmeter

This is used to control and monitor the flow of shielding gases.

2.11 Gas Mixer

When a mixture of two or more gases is used, the mixture is made in a mixing chamber metering the separate gases.

2.12 Type Tests

Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of welding equipment.

2.13 Routine Tests

Tests carried out on each welding equipment to check requirements which are likely to vary during production.

3 DESIGN AND CONSTRUCTION

3.1 Welding Torch

3.1.1 Torch shall be air, water or gas cooled.

NOTE — In case of water cooled torches, in the event of water failure, there protection should be provided to prevent damage to the TIG torch.

3.1.2 Torch shall be so designed that welding can be carried out with a minimum of effort by the operator and the tungsten electrode is housed concentrically with the gas nozzle.

3.1.3 The handle shall be so positioned as to prevent any inconvenience to the operator's hand.

3.1.4 Handles shall be constructed of or encased in insulating materials or they shall be insulated from the live parts.

3.1.5 The construction of handles shall be such that dirt which is likely to cause danger of electric shock cannot lodge in joints, holes or other crevices, and that the live ends of pins or screws cannot become exposed in use.

3.1.6 All exposed metal shall be insulated from current carrying parts.

3.1.7 The terminals for electrical connections shall be of adequate size so as to allow connections of cables of appropriate rating without getting overheated under normal conditions of use.

3.1.8 The risk of damage due to continuous flexing of cables and hoses at the point of entry to the gun shall be kept to a minimum.

3.1.9 Parts shall be adequately rated to prevent excessive temperature rise.

NOTE — Because of the wide variation in equipment and processes, it is not at present practicable to specify temperature rise tests.

3.1.10 Torch shall be able to direct an adequate flow of shielding under all conditions of welding for which the torch is designed.

3.1.11 The shielding gas and/or coolant flow to the torch shall be controlled by suitable means.

3.1.12 Gas nozzles shall be readily replaceable.

3.1.13 All parts affected by change of electrode size shall be easily replaceable and shall be permanently identifiable for the electrode size.

3.1.14 The voltage to earth of torch mounted controls shall not exceed 110 V.

3.2 Cables and Hoses

3.2.0 The design and construction of cables and hoses shall satisfy the following requirements.

3.2.1 Cables and hoses attached to the torch shall be of adequate capacity to carry :

a) the welding current,
b) the shielding gas,
c) the cooling liquid or gas (if used), and
d) the voltage and high-frequency.

3.2.2 Cables, hoses and/or complete assemblies shall be readily replaceable.

3.3 Arc Initiation Unit

3.3.0 The unit is basically a spark gap type oscillator comprising a low-powered iron-cored transformer with HV secondary winding, a spark gap, a high voltage capacitor and an air-core/open core (ferrite) output transformer.

This unit may be remote controlled either through a separate foot-switch or a switch mounted on the torch itself.

3.3.1 The unit should be capable of delivering the following output requirements:

a) RF frequency range (1/3 to say 3 Mega cycles)
b) Rated welding current
c) HF injection.

3.3.2 The unit should be housed in such an enclosure so that the following requirements are achieved:

a) Easy access to the components for maintenance.
b) A transparent window to observe spark.
c) Clearly marked terminals for power supply, torch work.

3.4 DC Suppressor Unit

3.4.0 For conventional ac power sources, this is basically a bank of capacitor housed in a sheet steel construction. It is used in series with *arc initiation unit & HF filter* for disposal of superficial refractory films during TIG welding of aluminium, magnesium and their alloys with ac power source (also refer **2.4**).

3.4.1 The sheet metal housing/enclosure should have robust positive gripped terminals to enable it to be connected in series with arc initiation unit.

3.4.2 The capacitor value and characteristic should be adequate to achieve the function mentioned in **3.4.0**.

3.5 Pulsing Unit

3.5.0 The design of separate pulsing unit of pulsation system unit in the power sources should have the following considerations:

a) the arc current should alternate between two levels (normally designated as background current and peak current). These levels should be independently adjustable.

b) the duration of these currents should also be adjustable independently.

3.6 Gas Regulator

3.6.0 The four principal elements of a pressure reducing regulator are:

a) A valve element consisting of a nozzle and a mating seat member.

b) An adjusting screw which controls the thrust of the bonnet spring.

c) A bonnet spring which transmits the thrust created by the adjusting screw to a diaphragm.

d) A diaphragm connected with the matting seat member.

3.6.1 There are two basic types of pressure reducing regulators:

a) The stem type (inverse or negative type)

b) The nozzle type (direct acting or, positive type)

3.6.2 Either of these two types or a combination may be used in two stage regulators.

3.7 Flowmeter

3.7.1 A flowmeter should consist of:

a) A manual throttle valve for gas flow adjustment.

b) A tube calibrated for the specific gas being used so that the operator can set the rate of flow.

3.7.2 A regulator-flow meter combination can be used to step down high pressure in the cylinder to a lower working pressure and measure the outflow.

3.8 Gas Mixers

3.8.0 Here in the mixing chamber the gases are combined and the mixture discharges through a single port.

4 MARKING

4.1 Each piece of tungsten-inert gas welding equipment shall be legibly and indelibly marked with the following:

a) Indication of source of manufacture,

b) Manufacture type — designation and serial No.,

c) Rated voltage,

d) Rated welding current,

e) Cooling medium, and

f) Insulation class.

4.1.1 *BIS Certification Marking* — The product may also be marked with the Standard Mark.

4.1.2 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5 TESTS

5.0 Classification of Tests

5.0.1 *Type Tests*

The following shall constitute type tests:

a) Insulation resistance test (*see* 5.1)

b) High voltage test (*see* 5.2), and

c) Performance test (*see* 5.3).

5.0.2 *Criteria for Approval*

One sample shall be submitted for testing. The sample shall comply with the requirement of tests given in 5.0.1.

5.0.3 In case of failure in one or more type tests, the testing authority shall call for fresh samples not exceeding two samples and subject them to the test(s) in which failure occurred. If, in the repeat test(s) no failure occurs, the tests may be considered to have been satisfied.

5.0.4 *Routine Tests*

The tests given in 5.0.1 (a) and (b) shall be carried out as routine tests.

5.1 Insulation Resistance Test

The insulation resistance shall be measured with dc voltage of 500 Volts applied for a sufficient time for the reading of the indicator to become practically steady, such voltage being taken from an independent source generated in the measuring instrument. The insulation resistance shall be not less than 2 megaohms. When carrying out this test for torch, the surface of the handle shall be wrapped securely in metal foil to within 12 mm of the ends of handle, the voltage applied between the electrode housing and the foil.

5.2 High Voltage Test

The test shall be carried out after the insulation resistance test (*see* 5.1). The torch shall be capable of withstanding voltage of 2 000 V rms at 50 Hz.

NOTES

1 Control or protective devices, if any, shall be disconnected during the test.

2 At the time of repeating the high voltage test, 75 percent of the full voltage shall be applied.

5.3 Performance Test

The criteria for assessing performance is under consideration. However, for the time being the evaluation of performance requirements shall be a matter of agreement between the manufacturer and the purchaser.

6 POWER SOURCE

6.1 The following Indian Standards on metal arc welding power sources are available:

IS 1851 : 1975	Specification for single operator type arc welding transformers *(second revision)*
IS 2635 : 1975	Specification for dc electric welding generators (*second revision*)
IS 4559 : 1968	Specification for single operator rectifier type dc arc welding power source
IS 6008 : 1971	Specification for single operator ac/dc arc welding power source

These power sources are suitable for the TIG welding process excepting the following changes in the requirements:

a) Minimum hand welding current shall not exceed 30 percent of the rated current.

b) Maximum hand welding current as given in **3.4.2** of IS 1851 : 1975 shall not be applicable for TIG welding equipment.

c) The formula for welding current welding load voltage shall be:

$V = 10 + 0.04\,I$ (up to 34V at 600 A & above)

where $V = 14 + 0.02\,I$ (*Min* 16V)

V is the load voltage, and
I is the load current.

d) Starting Voltage — In power sources having starting voltage circuit, the starting voltage shall be generated at the time of switching on to ease the starting of arc and shall not exceed 110 V.

6.2 Calibration

A separate calibration or calibrated chart shall be provided with power sources when normal MMA power source not fully drooping or vertical volt-amp characteristic is used for TIG welding.

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such a review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Addition'.

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Amendments Issued Since Publication

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