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Specification for Welding Shielding Gases



American Welding Society



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Specification for

Welding Shielding Gases

Prepared by
AWS Committee on Filler Metals

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AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This specification for welding shielding gases specifies minimum requirements for the composition and purity of the most popular single-component shielding gases. Classification designators for both single and multicomponent gases are introduced. Other topics include testing procedures, package marking, and general application guidelines.

This specification makes use of both U.S. Customary Units and the International System of Units (SI). Since these are not equivalent, each system must be used independently of the other.



American Welding Society

550 N.W. LeJeune Road, Miami, Florida 33126

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Specification for Welding Shielding Gases

1. Scope

This specification prescribes requirements for the classification of shielding gases. Gases may be supplied in either gaseous or liquid form, but when used in welding, the shielding is always in the gaseous form. Gas shielded arc welding processes include, but are not limited to: manual, semiautomatic, mechanized, and automatic gas tungsten arc welding (GTAW), gas metal arc welding (GMAW), flux cored arc welding (FCAW), electrogas welding (EGW), and plasma arc welding (PAW).

Part A *General Requirements*

2. Normative References

2.1 ASTM Standards¹

E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

E260, *Standard Practice for Packed Column Gas Chromatography*

2.2 CGA Publications²

G-4.3, *Commodity Specification for Oxygen*

G-5.3, *Commodity Specification for Hydrogen*

G-6.2, *Commodity Specification for Carbon Dioxide*

1. ASTM standards can be obtained from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

2. CGA publications can be obtained from Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102.

G-9.1, *Commodity Specification for Helium*

G-10.1, *Commodity Specification for Nitrogen*

G-11.1, *Commodity Specification for Argon*

P-15, *Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders*

3. Classification

3.1 The shielding gases covered by the A5.32/A5.32M specification are classified using a system that is independent of U.S. Customary Units and the International System of Units (SI). Classification is according to chemical composition of the shielding gas as specified in 13.1.

3.2 Gases classified under one classification shall not be classified under any other classification in this specification. Individual gases shall meet or exceed the requirements of Table 1.

3.3 The gases classified under this specification are intended for use with the gas shielded arc welding processes listed in the Scope. This does not prohibit their use with any other process for which they are found suitable.

4. Acceptance

Acceptance³ of the gases by the user shall be in accordance with the tests and requirements of Parts B and C of this specification.

3. See Section A3 (in the Annex) for more information.

Table 1
Gas Type, Purity, and Dew Point Requirements for Shielding Gas Components

Gas	AWS Classification	Product State	Minimum Purity (%)	Maximum Moisture ^a (ppm)	Dew Point Maximum Moisture at 1 Atmosphere		CGA Class
					°F	°C	
Argon	SG-A	Gas	99.997	10.5	-76	-60	Type I G-11.1 Grade C
		Liquid	99.997	10.5	-76	-60	Type II G-11.1 Grade C
Carbon Dioxide	SG-C	Gas	99.8	32	-60	-51	G-6.2 Grade H
		Liquid	99.8	32	-60	-51	G-6.2 Grade H
Helium	SG-He	Gas	99.995	15	-71	-57	Type I G-9.1 Grade L
		Liquid	99.995 ^b	15	-71	-57	Type II G-9.1 Grade L
Hydrogen	SG-H	Gas	99.95	32	-60	-51	Type I G-5.3 Grade B
		Liquid	99.995 ^c	32	-60	-51	Type II G-5.3 Grade A
Nitrogen	SG-N	Gas	99.9	32	-60	-51	Type I G-10.1 Grade F
		Liquid	99.998	4	-90	-68	Type II G-10.1 Grade L
Oxygen	SG-O	Gas	99.5	Not Applicable	-54	-48	Type I G-4.3 Grade B
		Liquid	99.5	Not Applicable	-82	-63	Type II G-4.3 Grade B

Notes:

a. Moisture specifications are guaranteed at full cylinder pressure, at which the cylinder is analyzed.

b. Including neon.

c. Including helium.

5. Certification

By affixing the AWS specification and classification designations on the packaging enclosing the product, the supplier (manufacturer) certifies that the product meets all of the requirements of the specification.⁴

6. Units of Measure and Rounding-Off Procedure

6.1 This specification uses U.S. Customary Units and the SI Units. The measurements are not exact equivalents; therefore each system must be used independently of the other without combining values in any way. The specification with the designation of A5.32 uses the U.S. Customary Units. The specification with the designation of A5.32M uses SI Units. The latter are shown in appropriate columns in tables and in figures, and within brackets [] when used in the text.

4. See Section A4 (in the Annex) for further information concerning certification and the testing called for to meet this requirement.

6.2 For the purpose of determining conformance with this specification, values shall be rounded to the nearest unit in accordance with the rounding-off method given in ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*.

Part B

Tests, Procedures, and Requirements

7. Summary of Tests

Compositional analysis of the shielding gas is the only test required for classification of a product under this specification. Tests required for each single gas are specified in Table 2. The purpose of these tests is to determine the purity and dew point of the shielding gas.

8. Retest

If any gas fails to meet its requirements, that test shall be repeated twice. The results of both retests shall meet the requirement of this specification.

Table 2
Tests Required for Classification

	Gas Purity	Dew Point	Mixture Composition
Single gas	Req.	Req.	Not Applicable
Multicomponent gas	Req. ^a	Req. ^b	Req. ^c
Special gas mixture ^d	Req.	Req.	Not Required

Notes:

- Each gas of a multicomponent mixture shall be tested for and meet the purity requirements of that specific gas (see Section 9 and Table 1).
- The multicomponent gas mixture shall meet the dew point requirement not greater than the highest dewpoint of the individual gases in the mixture (see Section 10 and Table 1).
- Individually filled cylinders or one cylinder from each filling manifold group, shall be tested for and meet the requirements of Part B, Tests, Procedures, and Requirements for the mixture composition.
- These gases are classified as SG-B-G.

If the results of one or both retests fail to meet the requirement, the gas being tested shall be considered as not meeting the requirements of this specification for that classification.

In the event that appropriate procedures were not followed in preparing the test sample(s) or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether test results met or failed to meet the requirement. In this case, the requirement for two retests of the gas sample does not apply.

9. Chemical Analysis

Samples of gas(es) for chemical analysis shall be drawn from an individual cylinder, vessel or from the gas outlet source. The sample shall be analyzed by acceptable methods. Results of chemical analysis of a specific gas(es) shall comply with the requirements of Table 1 for the gas being analyzed. The referee method for chemical analysis of gases shall be ASTM E 260, *Standard Practice for Packed Column Gas Chromatography*. When mixed gases are being analyzed, the volumetric percentage of minor components shall be within ± 10 percent relative to the nominal percentage of the minor component of the classification. See 13.1 and 13.3 for examples.

10. Dew Point Determination

Sample gases for dew point analysis shall be drawn from the individual cylinder, vessel, or gas outlet source. Any standard dew point measurement method may be used. Dew point may be expressed in °F at one atmo-

sphere pressure (14.7 psia), [°C at 760 mm of mercury], or in ppm. The Dew Point Conversion Chart, see Table 3, may be used to convert dew point measurements to or from °F, °C, or ppm. Results of the dew point test shall meet, or exceed, the requirements of Table 1 for the gases being analyzed.

Part C

Manufacture, Packaging, and Identification

11. Method of Manufacture

Shielding gases classified according to this specification may be manufactured by any method that will produce gas or gas mixtures that meet the requirements of this specification.

11.1 Cylinder Residual Gases. All gas containers shall either be evacuated or, if not evacuated, residual gases shall be analyzed for composition and purity prior to filling.⁵

12. Packaging

Gases and gas mixtures shall be packaged in accordance with Department of Transportation (DOT) regulations for protection during shipment and normal storage conditions.⁶ Cylinder sizes shall be as agreed upon between purchaser and supplier. Cylinders shall be labeled in accordance with Sections 13 and 14.

13. Identification

13.1 Individual gas components are identified by the following codes:

- A — Argon
- C — Carbon Dioxide
- He — Helium
- H — Hydrogen
- N — Nitrogen
- O — Oxygen

5. CGA P-15, *Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders*, can be obtained from the Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102.

6. DOT regulations can be obtained from the Department of Transportation, NASSIF Building, 400 7th Street S.W., Washington, DC 20590.