

AEROSPACE MATERIAL SPECIFICATION



AMS 5790C

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Superseding AMS 5790B

Steel, Corrosion and Heat-Resistant, Welding Wire
20Cr - 10Ni - 0.75Cb,
High Ferrite Grade

(Composition similar to UNS S34780)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant steel in the form of welding wire.

1.2 Application:

This wire has been used typically as filler metal for gas-tungsten-arc or gas-metal-arc welding of corrosion and heat-resistant alloys of similar composition, but usage is not limited to such applications.

- 1.2.1: The relatively high ferrite content promotes weldability by combating microfissuring and minimizing cracking in heavy sections but limits use of the wire to applications not operating in the sigma-forming temperature range, approximately 1100 to 1600 °F (590 to 870 °C).

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

| | |
|----------|---|
| AMS 2248 | Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys |
| AMS 2371 | Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock |
| AMS 2813 | Packaging and Marking of Packages of Welding Wire, Standard Method |
| AMS 2814 | Packaging and Marking of Packages of Welding Wire, Premium Quality |
| AMS 2816 | Identification, Welding Wire, Tab Marking Method |
| AMS 2819 | Identification, Welding Wire, Direct Color Code System |
| ARP1876 | Weldability Test for Weld Filler Metal Wire |
| ARP4926 | Alloy Verification and Chemical Composition Inspection of Welding Wire |

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

| | |
|------------|---|
| ASTM E 353 | Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys |
|------------|---|

2.3 AWS Publications:

Available from American Welding Society, 550 NW LeJeune Road, Miami, FL 33126 or www.aws.org.

AWS Handbook, Volume 4, 7th Edition - Metals and Their Weldability

3. TECHNICAL REQUIREMENTS:

3.1 Wire Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 – Composition

| Element | min | max |
|--------------------|-------|----------------|
| Carbon (3.1.1.1) | -- | 0.05 |
| Manganese | 1.00 | 2.50 |
| Silicon | 0.30 | 0.65 |
| Phosphorus | -- | 0.015 |
| Sulfur | -- | 0.015 |
| Chromium | 18.50 | 21.00 |
| Nickel | 9.00 | 11.00 |
| Columbium | 10xC | 0.80 |
| Molybdenum | -- | 0.75 |
| Tantalum | -- | 0.05 |
| Copper | -- | 0.50 |
| Nitrogen (3.1.1.1) | -- | 0.006 (60 ppm) |

3.1.1 Chemical analysis of initial bar or rod stock before drawing is acceptable provided processes used for drawing or rolling, annealing, and cleaning are controlled to ensure continued conformance to composition requirements.

3.1.1.1 Carbon and nitrogen shall also be determined periodically on finished wire (See 4.2.2).

3.1.2 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248.

3.1.3 Ferrite Control: Ferrite number of the wire shall be not less than 5.0, based on the calculated ferrite content from the DeLong diagram (See AWS Handbook, Volume 4, 7th Edition, Page 106).

3.2 Condition:

Cold worked, bright finish, in a temper and with a surface finish which will provide proper feeding of the wire in machine welding equipment.

3.3 Fabrication:

3.3.1 Wire shall be formed from rod or bar descaled by a process which does not affect the composition of the wire. Surface irregularities inherent with a forming process that does not tear the wire surfaces are acceptable provided the wire conforms to the tolerances of 3.6.

3.3.2 Butt welding is permissible provided both ends to be joined are alloy verified using a method capable of distinguishing the alloy from all other alloys processed within the facility, or the repair is made at the wire processing station. The butt weld shall not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment.

3.3.3 In-process annealing, if required between cold rolling or drawing operations, shall be performed in vacuum or in protective atmosphere to ensure freedom from surface oxidation and absorption of other extraneous elements.

3.3.4 Residual elements, drawing compounds, oxides, dirt, oil, dissolved gases, and other foreign materials picked up during wire processing that can adversely affect the welding characteristics, the operation of the equipment, or the properties of the weld metal, shall be removed by cleaning processes which will neither result in pitting nor cause gas absorption by the wire or deposition of substances harmful to welding operations.

3.4 Properties:

Wire shall conform to the following requirements:

3.4.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce acceptable welds, determined by a procedure acceptable to purchaser. ARP1876 may be used to resolve weldability disputes.

3.4.2 Spooled Wire: Shall conform to 3.4.2.1 and 3.4.2.2.

3.4.2.1 Cast: Wire, wound on standard 12-inch (305-mm) diameter spools, shall have imparted to it a curvature such that a specimen sufficient in length to form one loop with a 1-inch (25-mm) overlap, when cut from the spool and laid on a flat surface, shall form a circle 15 to 50 inches (381 to 1270 mm) in diameter.

3.4.2.2 Helix: The specimen on which cast was determined, when laid on a flat surface and measured between adjacent turns, shall show a vertical separation not greater than 1 inch (25 mm).

3.5 Quality:

Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to welding operations, operation of welding equipment, or properties of the deposited weld metal.

3.6 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.6.1 and 3.6.2.

3.6.1 Diameter: Shall be as shown in Table 2.

TABLE 2A - Sizes and Tolerances, Inch/Pound Units

| Form | Nominal Diameter Inch | Tolerance Inch Plus and Minus |
|-------------|--|-------------------------------------|
| Cut Lengths | 0.030, 0.035, 0.045 | 0.001 |
| Cut Lengths | 0.062, 0.078, 0.094, 0.125, 0.156, 0.187 | 0.002 |
| Spools | 0.007, 0.010, 0.015 | 0.0005 |
| Spools | 0.020, 0.030, 0.035, 0.045 | 0.001 |
| Spools | 0.062, 0.078, 0.094 | 0.002 |

Table 2B - Sizes And Tolerances, SI Units

| Form | Nominal Diameter Millimeters | Tolerance Millimeter Plus and Minus |
|-------------|------------------------------------|---|
| Cut Lengths | 0.76, 0.89, 1.14 | 0.025 |
| Cut Lengths | 1.57, 1.98, 2.39, 3.18, 3.96, 4.75 | 0.05 |
| Spools | 0.18, 0.25, 0.38 | 0.013 |
| Spools | 0.51, 0.76, 0.89, 1.14 | 0.025 |
| Spools | 1.57, 1.98, 2.39 | 0.05 |

3.6.2 Length: Cut lengths shall be furnished in 18, 27, or 36-inch (457, 686, or 914-mm) lengths, as ordered, and shall not vary more than +0, -0.5 inch (-13 mm) from the length ordered.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of wire shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1.1), ferrite number (3.1.3), sizes and tolerances (3.6), and alloy verification (5.2) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Determination of carbon and nitrogen on finished wire (3.1.1.1), weldability (3.4.1), cast (3.4.2.1), and helix (3.4.2.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.