

INCH-POUND

MIL-E-23765/2D(SH)  
AMENDMENT 1  
23 Oct 1990

MILITARY SPECIFICATION

ELECTRODES AND RODS - WELDING, BARE, SOLID, OR  
ALLOY CORED, LOW ALLOY STEEL

This amendment forms a part of MIL-E-23765/2D(SH), dated 18 August 1987, and is approved for use by the Naval Sea Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

PAGE 1

1.1, delete and substitute:

"1.1 Scope. This specification covers low alloy steel solid bare welding electrodes for use with the gas metal arc welding (GMAW) process and the submerged arc welding (SAW) process employing a neutral granular flux, low alloy steel alloy cored bare welding electrodes for use with the GMAW process and the SAW process employing a neutral granular flux, and low alloy steel solid bare cut length rods for use with the gas tungsten arc welding (GTAW) process."

PAGE 2

TABLE I, Delete and substitute:

AMSC N/A

1 of 9

FSC 3439

DISTRIBUTION STATEMENT A.  
distribution is unlimited.

Approved for public release;

MIL-E-23765/2D(SH)  
AMENDMENT 1TABLE I. Electrode type designation and chemical composition.

| Chemical composition (percentage) <sup>3/</sup>  |              |           |           |         |                 |        |           |            |               |               |               |               |                |
|--|--------------|-----------|-----------|---------|-----------------|--------|-----------|------------|---------------|---------------|---------------|---------------|----------------|
| MIL-type <sup>1/</sup><br>(with suffix<br>RC) <sup>2/</sup> (with<br>suffix C) <sup>4/</sup> | Pro-<br>cess | Carbon    | Manganese | Silicon | Phos-<br>phorus | Sulfur | Nickel    | Molybdenum | Chro-<br>mium | Vana-<br>dium | Alumi-<br>num | Tita-<br>nium | Zirco-<br>nium |
| 80S-1  | SAW          | 0.10-0.15 | 1.75-2.40 | 0.10    | 0.025           | 0.020  | 0.55-1.10 | 0.35-0.55  | 0.15          | 0.03          | 0.07          | —             | —              |
| 80S-2  | SAW          | .10- .17  | 1.70-2.20 | .05     | .025            | .020   | .15       | .45- .60   | .15           | .03           | .07           | —             | —              |
| 80S-3  | GMA<br>GTA   | .07- .12  | 1.60-2.10 | .50-.80 | .025            | .020   | .15       | .40- .60   | .15           | .03           | .02           | —             | —              |
| 100S-1   | ALL          | .08       | 1.25-1.8  | .20-.55 | .012            | .008   | 1.40-2.10 | .25- .55   | .30           | .05           | .10           | 0.10          | 0.10           |
| 100S-2   |              |           |           |         |                 |        |           |            |               |               |               |               |                |
| 100S-1C  | GMA<br>SAW   | .08       | 1.25-2.5  | .20-.55 | .012            | .010   | 1.4-2.10  | .25- .55   | .30           | .04           | .05           | .10           | .10            |
| 100S-2C  |              |           |           |         |                 |        |           |            |               |               |               |               |                |
| 120S-1   | ALL          | .09       | 0.90-2.35 | .60     | .012            | .008   | 1.00-3.0  | .30-1.00   | .80           | .03           | .10           | .10           | .10            |
| 120S-2   |              |           |           |         |                 |        |           |            |               |               |               |               |                |
| 120S-1C  | GMA<br>SAW   | .09       | 1.4-3.8   | .20-.55 | .012            | .010   | 1.0-3.5   | .30-1.10   | .60           | .04           | .05           | .10           | .10            |
| 120S-2C  |              |           |           |         |                 |        |           |            |               |               |               |               |                |

FOOTNOTES REMAIN THE SAME EXCEPT AS NOTED BELOW.

MIL-E-23765/2D(SH)  
AMENDMENT 1

PAGE 2

Table I, footnote 2/, second sentence, delete: "and phosphorus".

Table I, footnote 5/: delete in entirety.

PAGE 6

Add as new paragraph 3.2.6:

"3.2.6 MIL-types with suffix C. Alloy cored electrodes shall be designated by suffix C (see footnote 4 of table I)."

3.3, Delete and substitute:

"3.3 Chemical composition. Chemical composition of unwelded electrodes and rods or deposited weld metal, as specified below, shall be in accordance with table I. For solid electrodes and rods, unless otherwise specified below, chemical analysis shall be made on unwelded electrodes. For alloy cored electrodes used for GMAW, the chemical analysis shall be made on weld metal deposited in accordance with 4.8. For MIL-120S type electrodes used for SAW (see 4.2.4), and all alloy cored electrodes used for SAW (see 4.2.4), chemical analysis shall be made on weld metal deposited in accordance with 4.8 using the same brand flux used for qualification."

PAGE 7

TABLE III, Delete and substitute:

MIL-E-23765/2D(SH)  
AMENDMENT 1

TABLE III. Mechanical properties for as-welded SAW, GMA and GTA welds. 1/12/

| MIL-<br>type <sup>13/</sup>            | Heat<br>input | Yield<br>strength <sup>2/</sup><br>(lb/in <sup>2</sup> ) | Elongation<br>in<br>2 inches<br>minimum<br>(percent) | Transverse<br>bend | Impact <sup>3/</sup>                  |                   |                                       |                   | Explosion<br>bulge |
|--|---------------|--|--|--------------------|---------------------------------------|-------------------|---------------------------------------|-------------------|--------------------|
|  |               |  |  |                    | Charpy V-notch                        |                   | Dynamic tear <sup>4/</sup>            |                   |                    |
|  |               |  |  |                    | Energy<br>ft-lb<br>minimum<br>average | Temperature<br>°F | Energy<br>ft-lb<br>minimum<br>average | Temperature<br>°F |                    |
| 100S-1<br>100S-1F<br>100S-2<br>100S-2F | 5/<br>5       | 82,000 to<br>110,000                                     | 16   | 6/<br>6            | 7/ 35<br>7/ 60                        | Minus 60<br>0     | 8/ 300<br>9/ 450                      | Minus 20<br>30    | 10/<br>10          |
| 120S-1<br>120S-1F<br>120S-2<br>120S-2F | 11/<br>11     | 102,000 to<br>122,000                                    | 14   | 6/<br>6            | 7/ 45<br>7/ 60                        | Minus 60<br>0     | 8/ 400<br>9/ 575                      | Minus 20<br>30    | 10/<br>10          |

FOOTNOTES REMAIN THE SAME.

MIL-E-23765/2D(SH)  
AMENDMENT 1

PAGE 8

Table III, footnote 5(c): delete second sentence.

Table III, footnote 5, add the following: "(d) Any appropriate welding heat input shall be used for the root layer and minor repairs deposited by the GMAW, GTAW and SAW processes."

PAGE 10

3.6, add to the last sentence: "When reduced hydrogen requirements are specified (see 6.2) for MIL-100S-1 and MIL-120S-1 electrodes used for SAW and for MIL-100S-1F and MIL-120S-1F SAW fluxes, the maximum average and maximum single value shall be 5.5 ml/100grams."

PAGE 11

Table V, for MIL-type "100S-1 and 120S-1" for welding process "SAW, under Maximum average: delete and substitute: "5.5"; under Maximum single value: delete and substitute: "6.7".

Table V, for MIL-type "100S-1F and 120S-1F", under Maximum average: delete and substitute: "5.5"; under Maximum single value: delete and substitute: "6.7".

Table V, delete: "MIL-type", and substitute: "MIL-type 1/".

Table V, add new footnote 1/: "Alloy cored electrodes are designated by the suffix C".

3.7, delete and substitute:

"3.7 Moisture content of MIL-100 and MIL-120 type fluxes. The total water content (both hygroscopic and absorbed) of MIL-100S-1F, MIL-100S-2F, MIL-120S-1F, or MIL-120S-2F flux shall not exceed 0.10 percent by weight, or 0.05 percent by weight when reduced moisture requirements are specified (see 6.2)."

MIL-E-23765/2D(SH)  
AMENDMENT 1

PAGE 16

Add as new paragraph 4.2.4:

"4.2.4 Electrode/flux combinations. When qualification testing MIL-120S type electrodes and all alloy cored electrodes for the SAW process, each specific brand name wire and flux combination intended for production use shall be tested and listed as a unique combination on the QPL (see 6.1.2)."

Add as new paragraph 4.2.5:

"4.2.5 Chemical range limits. The chemistry limits specified in table I are not intended to be the allowable range for each product during production. Once a formulation is developed and qualified, the aim values for each element shall not be intentionally changed without notification of NAVSEA. At the time of qualification, the aim values and typical ranges shall be reported for each element which represent expected variations due to manufacturing tolerances."

PAGE 19

4.3.2.2, Delete and substitute:

"4.3.2.2 Welding process. Test weldments shall be made in accordance with 4.3.1.2. When alloy cored electrodes are tested using the SAW process, the same brand name flux that was used in qualification shall be used."

Add as new paragraph 4.3.5:

"4.3.5 Electrode/flux combinations. For conformance testing of MIL-120S type electrodes with the SAW process and all alloy cored electrodes with the SAW process, the specific brand name electrode and flux combination(s) specified (see 6.2) shall be used for conformance testing."

PAGE 20

Table IX, delete: "MIL-type 1/", and substitute: "MIL-type 1/ 4/".

Table IX, add new footnote 4/: "Alloy cored electrodes are designated by the suffix C."

MIL-E-23765/2D(SH)  
AMENDMENT 1

PAGE 21

4.6.1, add new sentence: "One specimen shall be prepared and tested."

4.8, Delete and substitute:

"4.8 Chemical analysis. Chemical analysis shall be performed as specified in MIL-E-23765. When chemical analysis of the weld deposit is required (see 3.3) , the sample shall be taken from a weld pad (see 4.8.1), or from a low dilution area in the groove weld or all weld metal tensile specimen. In case of dispute, the weld pad shall be the referee method."

Add as new paragraph 4.8.1:

"4.8.1 Weld pad specifications. The weld pad shall be deposited in even layers in the flat position and shall be built up to at least 4 layers, with 3 passes per layer as shown on figure 6. The final weld surface shall be ground flat for the chemical analysis and at least 3 full layers shall remain after grinding. The welding parameters for the weld pad shall be selected to minimize weld dilution."

4.9, delete the last sentence and substitute:

"When required to use a specific electrode/flux combination (see 4.2.4), the certification shall report the brand name of flux used in conformance testing."

PAGE 22

Add as new paragraph 5.2.1 (d):

"5.2.1 (d) Containers shall be hermetically sealed cans and filled to the maximum extent possible with flux directly from the baking ovens when reduced moisture requirements are specified (see 6.2)."

PAGE 23

6.1.1.8, delete and substitute: "Alloy cored electrodes are intended for use with the GMAW and SAW processes only."

MIL-E-23765/2D(SH)  
AMENDMENT 1

PAGE 23

Add as new paragraph 6.1.2:

"6.1.2 Electrode/flux combinations for SAW production welding. For production use of MIL-120S type electrodes with the SAW process and all alloy cored electrodes with the SAW process, only those wire and flux combinations listed on the QPL shall be approved for use, with appropriate welding procedures."

Page 24

Add as new paragraph 6.2 (m):

"6.2 (m) Which specific brand name electrode and flux combination(s) shall be used for conformance testing (see 4.3.5). See current QPL for qualified combinations."

Add as new paragraph 6.2 (n): "6.2 (n) Whether reduced moisture flux is required (see 3.7 and 5.2.1 (d))."

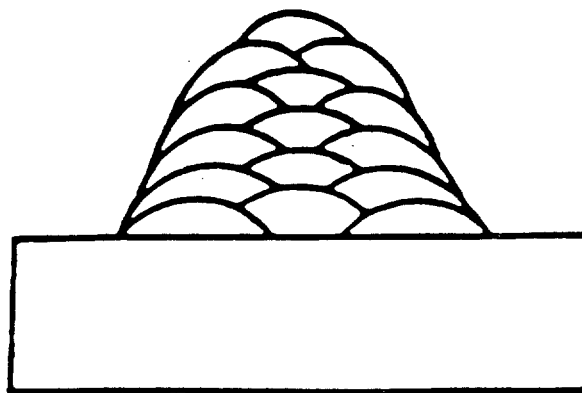
Add as new paragraph 6.2 (o): "6.2 (o) Whether reduced hydrogen wire is required (see 3.6)."

PAGE 29

Figure 3, column 1, under Gas metal-arc welding: delete "110 Kj/in" and substitute: "110 Kj/in 6".

PAGE 35

Add the following new figure 6:

FIGURE 6. Chemical analysis weld pad schematic.