

# **WELD FILLER METAL SELECTION GUIDELINE FOR VARIOUS METAL COMBINATIONS**



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# TABLE OF CONTENTS

- Weld Filler Metal Selection Chart for Shielded Metal Arc Welding (SMAW) For Various Metal Combinations:..... 3
- Welding Filler Metal Designators:..... 4
  - 1. Carbon Steel Electrodes: ..... 4
  - 2. Alloy Steel Electrodes:..... 5
  - 3. Stainless Steel Filler Metal..... 5
- Table 1: Carbon and Low-Alloy Steel Welding Consumables for SMAW Process..... 6
- Table 2: Austenitic, Super-Austenitic and Duplex Stainless Steel Alloys ..... 7

## **Weld Filler Metal Selection Chart for Shielded Metal Arc Welding (SMAW) For Various Metal Combinations:**

The attached Tables provide **generally accepted** electrode selections for the base materials shown, along with process areas that need special consideration. The special consideration cases have come about from past experiences in industry. The attached tables are as follows:

**Table 1:** Carbon and Alloy Steels

**Table 2:** Austenitic, Super-austenitic and Duplex Stainless Steels

**Note that these tables DO NOT attempt to include all possible choices.** Further, there are a number of proprietary base materials and castings for which the filler metals used do not have an AWS Classification available at this time.

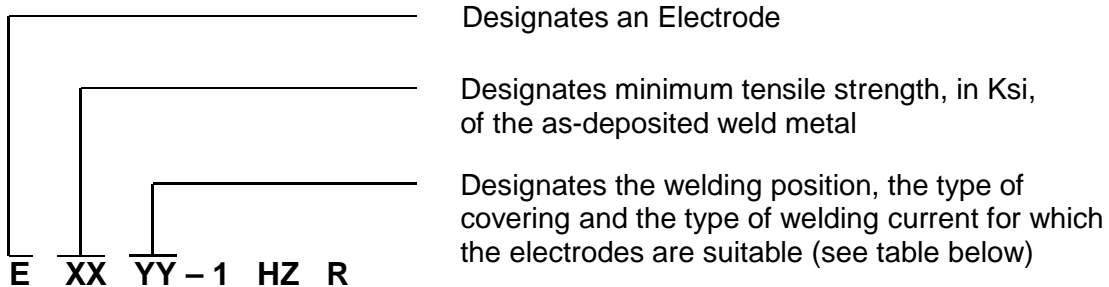
**When you are faced with a particular material or combination of materials not shown in these tables, please consult the manufacturer or the DFD**

There is an explanation of the salient designations where appropriate (next two pages). For a complete listing of electrode designations, usability Classifications, weld metal chemical compositions and testing methods involved, refer to the appropriate AWS Filler metal specifications mentioned in tables 1 and 2.

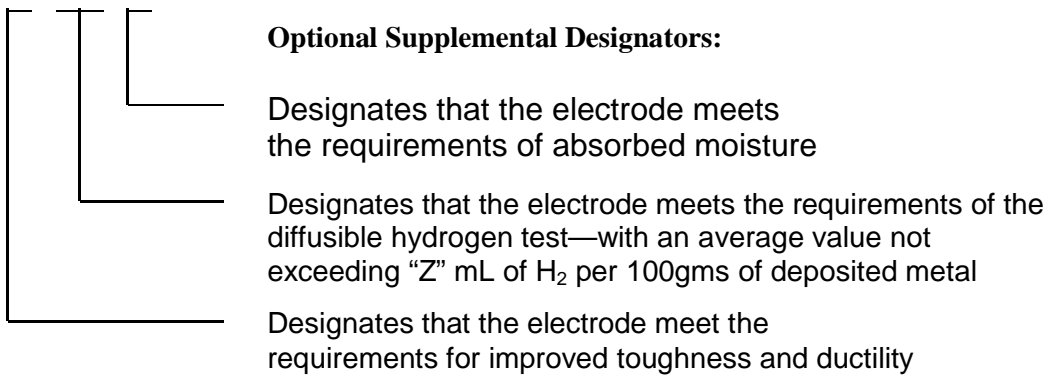
# Welding Filler Metal Designators:

## 1. Carbon Steel Electrodes:

### Mandatory Classification Designators:



### Optional Supplemental Designators:



Electrode Classification			
AWS Classification	Type of Covering	Welding Position <sup>a</sup>	Type of current <sup>b</sup>
E 6010	High cellulose, sodium	F, V, OH, H	dcep
E 6011	High Cellulose, Potassium	F, V, OH, H	ac or dcep
E 7018	Low hydrogen, Potassium, Iron Powder	F, V, OH, H	ac or dcep
E 7024	Iron Powder, Titania	H-Fillets, F	ac, dcep or dcen

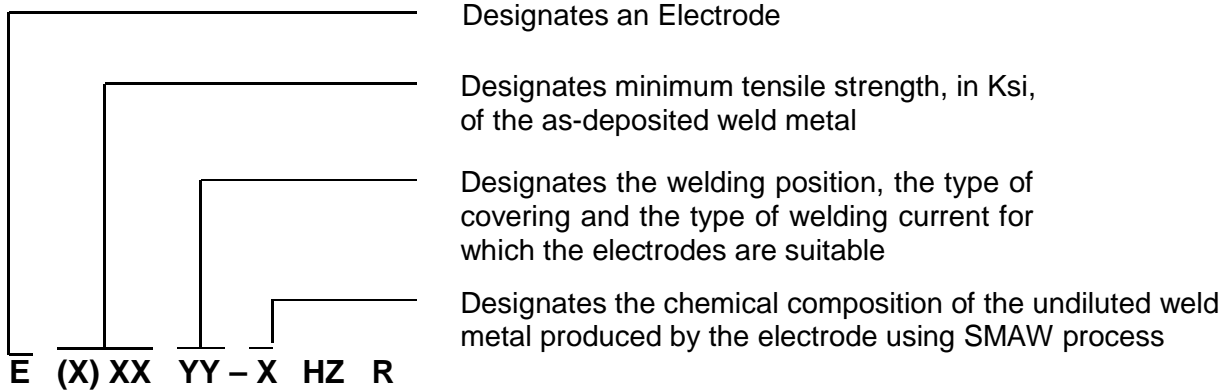
Notes: a. The abbreviations indicate the welding positions  
 F=Flat; V= Vertical, OH= Overhead, H= Horizontal,  
 H-Fillets=Horizontal Fillets.

b. The term dcep refers to direct current electrode positive (dc, reverse polarity).  
 The term dcen is direct current electrode negative (dc, straight polarity)

Also note that the above electrode classifications are the most widely used and does not include all of the available classifications. **Refer to AWS A 5.1 for complete listing.**

## 2. Alloy Steel Electrodes:

### Mandatory Classification Designators:



### Optional Supplemental Designators:

Designates that the electrode meets the requirements of absorbed moisture

Designates that the electrode meets the requirements of the diffusible hydrogen test—with an average value not exceeding “Z” mL of H<sub>2</sub> per 100gms of deposited metal, where “Z” is 4, 8 or 16

Refer to AWS A 5.5 for complete listing of mechanical properties, chemical composition of as-deposited weld metal and testing procedures for SMAW process.

## 3. Stainless Steel Filler Metal

Usability Classification

Type of Welding Current and Position of Welding		
AWS Classification	Welding Current	Welding position
EXXX(X)-15	dcep	All
EXXX(X)-16	dcep or ac	All
EXXX(X)-17	dcep or ac	All
EXXX(X)-25	dcep	H, F
EXXX(X)-26	dcep or ac	H, F

For more details on the usability classifications, refer to AWS A 5.4

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**Table 1: Carbon and Low-Alloy Steel Welding Consumables for SMAW Process**

Base Material	Carbon Steel	Carbon-Molybdenum Steel	1 and 1 1/4 Cr-1/2 Mo Steel	2 1/4 Cr-1Mo Steel	5Cr- 1/2 Mo Steel	9Cr-1Mo Steel
Carbon steel	AB	AC	AD	AE	AF	AG
Carbon-Molybdenum Steel		C	CD	CE	CF	CH
1 and 1 1/4 Cr - 1/2 Mo Steel			D	DE	DF	DH
2 1/4 Cr - 1 Mo Steel				E	EF	EH
5 Cr - 1/2 Mo Steel					F	FH
9 Cr- 1 Mo Steel						H

**Legend:**

- A AWS A 5.1 Classification E 70XX low hydrogen (E7018 preferred)
- B AWS A 5.1 Classification E6010
- C AWS A 5.5 Classification E70XX - A1, low hydrogen
- D AWS A 5.5 Classification E70XX-B2L or E80XX-B2, low hydrogen
- E AWS A 5.5 Classification E80XX-B3L or E90XX-B3, low hydrogen
- F AWS A 5.5 Classification E80XX-B6 or E80XX-B6L, low hydrogen
- G AWS A 5.5 Classification E80XX-B7 or E80XX-B7L, low hydrogen
- H AWS A 5.5 Classification E80XX-B8 or E80XX-B8L, low hydrogen

**Notes:**

1. Table 1 refers to coated electrodes (SMAW process) only. For bare wire welding (SAW, GMAW, GTAW and FCAW), use equivalent electrode classifications (AWS A 5.14, A 5.17, A 5.18, A 5.20, A 5.23, A 5.28)
2. Higher alloy electrode specified in the table should normally be used to meet the required tensile and toughness after post weld heat treatment (PWHT). If no PWHT is required, the lower alloy electrode specified may be required to meet the hardness requirements.

**Table 2: Austenitic, Super-Austenitic and Duplex Stainless Steel Alloys**

Base Metal	304L SS	304H SS	316L SS	317L SS	904L SS	6% Mo SS	7% Mo SS	Alloy 20Cb-3	2304 Duplex SS	2205 Duplex SS
<b>Carbon and Low Alloy Steel</b>	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC	N	N
<b>Type 304L Stainless Steel</b>	D	DE	DF	DG	DC	C	C	DCH	NL	NL
<b>Type 304H Stainless Steel</b>		E	EF	EG	*	*	*	ECH	*	*
<b>Type 316L Stainless Steel</b>			FG	FG	FC	FC	FC	FCH	NL	NL
<b>Type 317L Stainless Steel</b>				GC	GC	GC	GC	GC	L	L
<b>Type 904L Stainless Steel</b>					C	C	C	C	L	L
<b>Type 6% Mo Stainless Steel</b> Eg: 254 SMO, AL 6XN						CJK	CJK	*	*	*
<b>Type 7% Mo Stainless Steel</b> Eg: 654 SMO							CJK	*	*	*
<b>Type Alloy 20Cb-3</b>								H	*	*
<b>Type 2304 Duplex SS</b>									LM	LM
<b>Type 2205 Duplex SS</b>										LM

**Legend**

- A - AWS A 5.4 Classification E309L-XX
- B - AWS A 5.11 Classification ENiCrFe-2 or -3 (-2 is Alloy 718 and -3 is Inconel 182)
- C - AWS A 5.11 Classification ENiCrMo-3 (Inconel 625)
- D - AWS A 5.4 Classification E308L-XX
- E - AWS A 5.4 Classification E308H-XX
- F - AWS A 5.4 Classification E316L-XX
- G - AWS A 5.4 Classification E317L-XX
- H - AWS A 5.4 Classification E320LR-XX
- J - AWS A 5.11 Classification ENiCrMo-4 (Hastelloy C-276)
- K - AWS A 5.11 Classification ENiCrMo-11 (Hastelloy G-30)
- L - AWS A 5.4 Classification E2209-XX
- M - AWS A 5.4 Classification E2553-XX
- N - AWS A 5.4 Classification E309MoL-XX

**Notes:**

1. Table 2 refers to coated electrodes only. For wire welding (GMAW & GTAW) use equivalent electrode classification (AWS A 5.14)
2. There are many proprietary alloys available in the market and material combinations you might encounter. Consult the manufacturer or the DFD for proper filler metal selection