

**TYPICAL JOINT
GEOMETRIES
FOR SHIELDED
METAL ARC WELDING**

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The Everyday Pocket Handbook for Shielded Metal Arc Welding (SMAW)



Number 7 in a series

Compiled as a useful tool for
on-the-job welding personnel by the
AWS Product Development Committee

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Basic Safety Precautions

Burn Protection. Molten metal, sparks, slag, and hot work surfaces are produced by welding, cutting, and allied processes. These can cause burns if precautionary measures are not used. Workers should wear protective clothing made of fire-resistant material. Pant cuffs, open pockets, or other places on clothing that can catch and retain molten metal or sparks should not be worn. High-top shoes or leather leggings and fire-resistant gloves should be worn. Pant legs should be worn over the outside of high-top shoes. Helmets or hand shields that provide protection for the face, neck, and ears, and a head covering to protect the head should be used. In addition, appropriate eye protection should be used.

Electrical Hazards. Electric shock can kill. However, it can be avoided. Live electrical parts should not be touched. The manufacturer's instructions and recommended safe practices should be read and understood. Faulty installation, improper grounding, and incorrect operation and maintenance of electrical equipment are all sources of danger.

All electrical equipment and the workpiece should be grounded. The workpiece lead is not a ground lead. It is used only to complete the welding circuit. A separate connection is required to ground the workpiece. The workpiece should not be mistaken for a ground connection.

Fumes and Gases. Many welding, cutting, and allied processes produce fumes and gases which may be harmful to health. Avoid breathing the air in the fume plume directly above the arc. Do not weld in a confined area without a ventilation system. Use point-of-welding fume removal when welding galvanized steel, zinc, lead, cadmium, chromium, manganese, brass, or bronze. Do not weld on piping or containers that have held hazardous materials unless the containers have been inerted properly.

Compressed Gas Cylinders. Keep caps on cylinders when not in use. Make sure that gas

cylinders are chained to a wall or other structural support.

Radiation. Arc welding may produce ultraviolet, infrared, or light radiation. Always wear protective clothing and eye protection to protect the skin and eyes from radiation. Shield others from light radiation from your welding operation.

Refer to AWS/ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, for additional information.

AWS Specifications for Covered Electrodes

Type of Electrode	AWS Specification
Carbon steel	A5.1
Low alloy steel	A5.5
Corrosion resistant steel	A5.4
Cast iron	A5.15
Aluminum and aluminum alloys	A5.3
Copper and copper alloys	A5.6
Nickel and nickel alloys	A5.11
Surfacing	A5.13 and A5.21

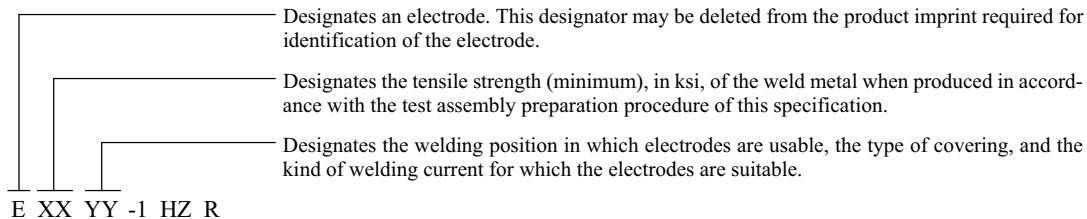
Engineering Functions of SMAW Electrode Coatings

- | |
|---|
| • Promotes electrical conductivity by ionization of gases |
| • Produces shielding gas |
| • Adds slag formers for grain refinement |
| • Provides materials for controlling bead shape and width |
| • Provides alloy additions to deposit |
| • Concentrates arc stream |
| • Imparts characteristics for welding position |
| • Insulates core wire |

Current Requirements for SMAW Electrode Classifications

Electrode Class	Current
EXX10	DCRP
EXX11	AC or DCRP
EXX13	AC or DC either polarity
EXX15	DCRP
EXX16	AC or DCRP
EXX18	AC or DCRP
EXX20	AC or DCSP (horizontal fillet) AC or DC either polarity (flat)
EXX27	AC or DCSP (horizontal fillet) AC or DC either polarity (flat)

Classification System for Carbon Steel Electrodes for SMAW



Optional Supplemental Designators:

Designates that the electrode meets the requirements of the absorbed moisture test (an optional supplemental test for all low hydrogen electrodes except the E7018M classification, for which the test is required).

Designates that the electrode meets the requirements of the diffusible hydrogen test (an optional supplemental test of the weld metal from low hydrogen electrodes, as-received or conditioned — with an average value not exceeding “Z” mL of H₂ per 100g of deposited metal, where “Z” is 4, 8, or 16).

Designates that the electrode (E7016, E7018, or E7024) meets the requirements for improved toughness — and ductility in the case of E7024.

Interpretation of Last Digit in AWS Electrode Classification

Last Digit	0	1	2	3	4	5	6	7	8
Power supply	Note a	AC or DC reverse polarity	AC or DC	AC or DC	AC or DC	DC reverse polarity	AC or DC reverse polarity	AC or DC	AC or DC reverse polarity
Type of slag	Note b	Organic	Rutile	Rutile	Rutile	Low Hydrogen	Low Hydrogen	Mineral	Low Hydrogen
Type of arc penetration	Digging Note c	Digging Deep	Medium Medium	Soft Light	Soft Light	Medium Medium	Medium Medium	Soft Medium	Medium Medium
Iron powder in coating	0–10%	None	0–10%	0–10%	30–50%	None	None	50%	30–50%

- a. E6010 is DC reverse polarity; E6020 is AC or DC.
 b. E6010 is organic; E-6020 is mineral.
 c. E6010 is deep penetration; E-6020 is medium penetration.