



The Everyday Pocket Handbook for Arc Welding Steel



a series

Compiled as a useful tool
for on-the-job welding
personnel by an AWS
Presidential Task Group

© 1994 by American Welding Society. All rights reserved
Printed in the United States of America



American Welding Society

NOTE: Although care was taken in choosing and presenting the data in this guide, AWS cannot guarantee that it is error free. Further, this guide is not intended to be an exhaustive treatment of the topic and therefore may not include all available information, including with respect to safety and health issues. By publishing this guide, AWS does not insure anyone using the information it contains against any liability or injury to property or persons arising from that use.

Table of Contents

Basic Safety Precautions	4	Carbon Arc Gouging Electrodes	15
Electrodes: Classification, Size, Amps, Deposition Rate		Deposition Rate for Mild Steel for GMAW	16
Classification System for Carbon Steel		Recommended Copper Cable Sizes	17
Electrodes for SMAW	6	Guide to Electrode Conditioning and Storage	18
SMAW E6010 Electrodes	7	Welding Positions — Fillet (plate)	19
SMAW E6011 Electrodes	7	Welding Positions — Groove (plate)	20
SMAW E6012 Electrodes	8	Welding Positions — Pipe	21
SMAW E6013 Electrodes	8	Thickness and Weight of Steel Plates — 1/32 to 2 inch	23
SMAW E7018 Electrodes	9	How to Use Weld Fillet Gage	25
SMAW E7024 Electrodes	9	Pipe Size and Wall Thicknesses	26
Classification System for Solid and Composite		Tests to Identify the Material	27
Carbon Steel Electrodes for GMAW	10	Schedule for Oxyfuel Cutting	
GMAW ER70S-X Short Arc Electrodes	11	using Natural Gas	29
GMAW ER70S-X Spray Arc Electrodes	11	using Acetylene Gas	30
GMAW E70C-XX Metal Cored Electrodes	12	using Propylene Gas	31
Classification System for Carbon Steel		Basic Welding Symbols and Their Location	32
Electrodes for FCAW	13	Location of Elements of a Welding Symbol	34
FCAW E7XT-X Gas-Shielded Electrodes	14		
FCAW Self-Shielded Electrodes	14		

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.

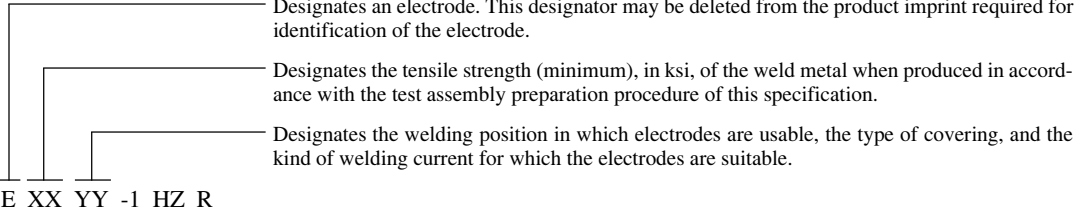
Fumes and Gases. Many welding, cutting, and allied processes produce fumes and gases which may be harmful to health. Avoid breathing the air in the fume plume directly above the arc. Do not weld in a confined area without a ventilation system. Use point-of-welding fume removal when welding galvanized 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.

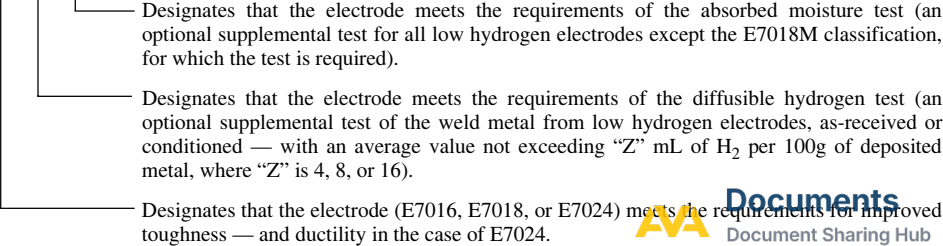
Radiation. Arc welding may produce ultraviolet, infrared, or light radiation. Always wear protective clothing and eye protection to protect the skin and eyes from radiation. Shield others from light radiation from your welding operation.

AWS also recommends a personal copy of “Arc Welding Safely” and “Fire Safety in Welding and Cutting.”

Classification System for Carbon Steel Electrodes for SMAW



Optional Supplemental Designators:



SMAW Electrodes		
E6010		
Diameter (in.)	Amps	Dep. Rate ¹
3/32	50	0.8
	70	1.2
1/8	100	2.1
	130	2.3
5/32	140	2.8
	170	2.9
3/16	160	3.3
	190	3.5
7/32	190	4.5
	230	5.1

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

SMAW Electrodes		
E6011		
Diameter (in.)	Amps	Dep. Rate ¹
3/32	50	0.8
	70	1.2
1/8	110	2.0
	130	2.3
5/32	140	3.5
	175	4.0
3/16	170	4.0
	190	4.2
7/32	175	4.5
	220	5.1

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

SMAW Electrodes		
E6012		
Diameter (in.)	Amps	Dep. Rate ¹
1/8	100	2.4
	130	2.9
5/32	165	3.2
	200	3.4
3/16	220	4.0
	240	4.2
7/32	275	4.8
	320	5.6
1/4	320	5.6
	380	7.1

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

SMAW Electrodes		
E6013		
Diameter (in.)	Amps	Dep. Rate ¹
3/32	60	0.9
	75	1.2
1/8	100	1.8
	135	3.0
5/32	140	2.6
	180	3.5
3/16	180	3.2
	220	4.1
7/32	250	5.3
	290	6.1

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

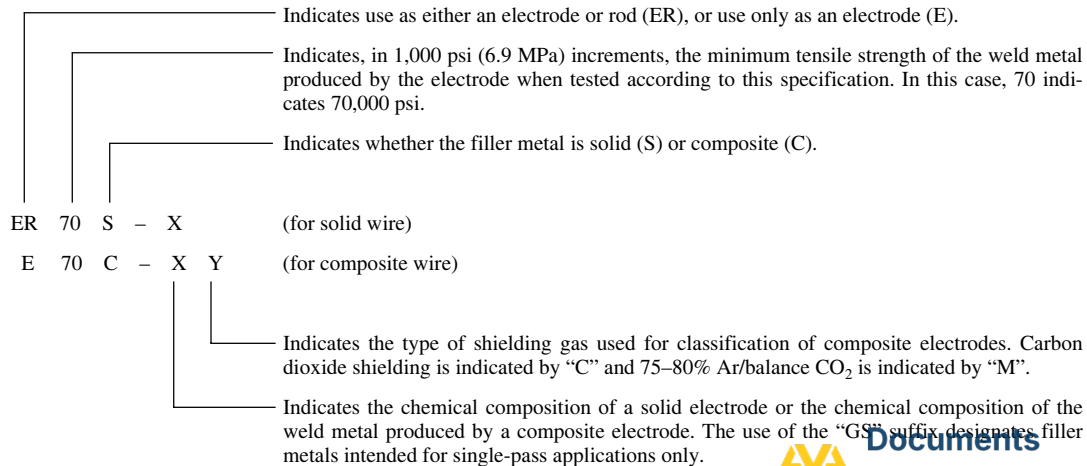
SMAW Electrodes		
E7018		
Diameter (in.)	Amps	Dep. Rate ¹
3/32	70	1.4
	110	1.7
1/8	120	2.6
	160	3.0
5/32	150	3.1
	200	4.3
3/16	200	4.9
	275	5.6
7/32	250	6.5
	340	7.4

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

SMAW Electrodes		
E7024		
Diameter (in.)	Amps	Dep. Rate ¹
1/8	140	4.2
	180	5.1
5/32	180	5.3
	240	7.2
3/16	245	7.5
	290	9.1
7/32	320	9.4
	360	11.6
1/4	400	12.6

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. The efficiency, with a 2" stub loss, is approximately 60%.

Classification System for Solid and Composite Carbon Steel Electrodes for GMAW



Documents

Document Sharing Hub

GMAW Electrodes			
ER70S-X Short Arc			
Diameter (in.)	Amps	Volts	Dep. Rate ¹
.030	70	15	1.2
	130	21	2.1
.035	80	16	2.1
	190	22	7.3
.045	100	17	2.7
	225	22	8.0

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. Deposition efficiency is assumed to be 94%.

GMAW Electrodes			
ER70S-X Spray Arc			
Diameter (in.)	Amps	Volts	Dep. Rate ¹
.030	150	24	4.1
	200	28	6.8
.035	175	24	6.1
	290	28	12.0
.045	200	24	6.7
	315	30	12.5
1/16	275	24	8.7
	500	32	18.0
3/32	350	29	10.0
	600	36	24.0

1. Deposition rate in lbs/hr based on 100% arc time. May vary within $\pm 10\%$. Deposition efficiency is assumed to be 98%.