

KUNWU ER70S-6 Carbon Steel Welding Rods and Wires

Identification

AWS A5.18	AWS A5.18M	UNS Number	DIN / EN
ER70S-6	ER48S-6	K11140	SG2 / G3Si1

Chemical Analysis

Element	Requirement	Average	Element	Requirement	Average
Carbon	0.06-0.15	0.07	Chromium (Maximum)	0.15	0.01
Nickel (Maximum)	0.15	0.01	Molybdenum (Maximum)	0.15	0.01
Manganese	1.40-1.85	1.60	Silicon	0.80-1.15	1.10
Phosphorus (Maximum)	0.025	0.012	Sulfur (Maximum)	0.035	0.01
Copper (Maximum)	0.50	0.02			

Single figures are nominal except where noted.

Weld Metal Mechanical Properties

	Tensile Strength, min		Yield Strength, min		Elongation, min	Impact
	Ksi	Mpa	Ksi	Mpa	Percent	KV2, J
Requirement	70	480	58	400	22	27
Average	80	550	65	440	26	100

General Information

Description

ER70S-6 [ER48S-6]. Electrodes and rods of the ER70S-6 [ER48S-6] classification are intended for both single- and multiple-pass welding. They are especially suited for sheet metal applications, where smooth weld beads are desired, and structural and plate steels that have moderate amounts of rust or mill scale. These electrodes permit the use of higher current ranges with either CO₂ (AWS A5.32 Class SG-C) shielding gas or with mixtures of argon and oxygen (AWS A5.32 Class SG-AO-X) or argon and carbon dioxide (AWS A5.32 Class SG-AC-Y).

However, these electrodes do require a higher level of oxidation than ER70S-2 electrodes when using either binary or ternary argon shielding gas mixtures per the AWS A5.32 specification. Typical base metal specifications are often the same as those for the ER70S-2 [ER48S-2] classification.

Applications

Electrodes and rods of the ER70S-2 [ER48S-2] classification are primarily used for single-pass welding of killed, semi-killed, and rimmed steels, but may be used for some multipass applications. Because of the added deoxidants, these filler metals can be used for welding steels that have a rusty or dirty surface, with a possible sacrifice of weld quality depending on the condition of the surface. ER70S-2 [ER48S-2] filler metals are used extensively to produce high quality, high toughness welds with the GTAW process. These filler metals are also well suited for use in single side, melt through welding without a protective root shielding gas on the backside of the joint. Typical specifications for these steels are ASTM A 36, A 285-C, A 515-55, and A 516-70, which have UNS numbers K02600, K02801, K02001, and K02700, respectively.

ER70S-6 as a kind of 500 MPa level carbon steel filler metal, can be used in the welding of carbon steel and low alloy steel in the corresponding strength grade, which can be used in engineering machinery, ship, vehicle manufacturing, petrochemical and other industries.

It take CO₂ or 80%Ar+20%CO₂ gas shielded arc welding. The welding spatter is small, and it has beautiful appearance, high cladding efficiency and small weld metal porosity sensibility.

Welding Positions: All Positions.

Welding Considerations

Gas metal arc welding (GMAW) can be divided into three categories based on the mode of metal transfer. These modes are (1) spray (conventional or pulsed), (2) globular, and (3) short circuiting transfer. In the spray, pulsed spray, and globular modes, transfer occurs as distinct droplets that are detached from the electrode, transferring along the arc column into the weld pool. In the short circuiting mode, the metal is deposited during frequent short circuiting of the electrode in the molten pool.

Spray Transfer. The spray transfer mode, for carbon steel, is most commonly obtained with argon shielding gas mixtures with up to 5% of oxygen (AWS A5.32 Class SG-AO-X, where X is 1 to 5) or up to 15% carbon dioxide (AWS A5.32 Class SG-AC-Y, where Y is 5 to 15). A characteristic of this shielding gas is the smooth arc plasma through which hundreds of very fine droplets are transferred to the weld pool each second. Spray transfer with argon-oxygen or argon-carbon dioxide shielding gas is, primarily, a function of current density, polarity, and resistance heating of the electrode. The high droplet rate (approximately 250 droplets per second) develops suddenly above a critical current level, commonly referred to as the transition current (for each size of electrode). Below this current, the metal is transferred in drops generally larger in diameter than the electrode and at a rate of from 10 to 20 per second (globular transfer). The transition current is also dependent, to some extent, on the chemical composition of the electrode. For 1/16 in. [1.6 mm] diameter carbon steel electrodes, a transition current of 270 amperes [direct current, electrode positive (dcep)] is common. Alternating current is not recommended for this type of welding because it does not produce a stable arc.

Pulsed Spray. Metal transfer in pulsed spray welding is similar to that of the spray transfer described above, but it occurs at a lower average current. The lower average current is made possible by rapid pulsing of the welding current between a high level, where metal will transfer rapidly in the spray mode, and a low level, where no transfer will take place. At a typical rate of 60 to 120 pulses per second, a melted drop is formed by the low current arc, which is then “squeezed off” by the high current pulse. This permits all-position welding.

Globular Transfer. The mode of transfer that characterizes 100% CO₂ (AWS A5.32 Class SG-C) as a shielding gas is globular. Common practice with globular transfer is to use low arc voltage to minimize spatter. This shortens the arc length causing the arc to be “buried” and results in deeper penetration and better containment of spatter within the weld pool. Electrodes of 0.045 in. through 1/16 in. [1.2 mm through 1.6 mm] diameter normally are used at welding currents in the range of 275 to 400 amperes (dcep), for this type of transfer. The rate at which droplets (globules) are transferred ranges from 20 to 70 per second, depending on the size of the electrode, the amperage, polarity, and arc voltage.

Short Circuiting Transfer. This mode of transfer is obtained with small diameter electrodes (0.030 to 0.045 in. [0.8 to 1.2 mm]) using low arc voltages and amperages, and a power source designed for short circuiting transfer. The electrode short-circuits to the weld metal, usually at a rate of from 50 to 200 times per second. Metal is transferred with each short circuit, but not across the arc. Short circuiting gas metal arc welding of carbon steel is done most commonly with mixtures of argon and CO₂ as the shielding gas or with CO₂ alone. The penetration of such welds is greater with CO₂ than it is with argon-CO₂ mixtures. Mixtures of 50 to 80% argon with CO₂ remainder (AWS A5.32 Class SG-AC-Y, where Y is 20 to 50) can be advantageous for thin material. However shielding gas mixtures of 50% to 70% argon with CO₂ remainder (AWS A5.32 Class SG-AC-Y, where Y is 30 to 50) are unstable in the gaseous state and must be mixed from single gas components immediately prior to use. They provide low penetration, higher short circuiting rates, and lower minimum currents and voltages than CO₂ alone does. This can be an advantage in welding thin plate.

Recommended Welding Parameters

Recommended parameters will be affected by changes in position, base metal, equipment and shield gas.

Diameter		Process	Tungsten Size	Amperage	Voltage	Flow Rate (CFH)
in	mm					
0.035	0.9	GTAW	0.40-1/16	60-120	12-15	20-30
0.045	1.1	GTAW	0.40-1/16	80-130	13-16	20-30
1/16	1.6	GTAW	1/16-3/32	100-150	14-16	20-30
3/32	2.4	GTAW	1/16-3/32	120-200	15-20	20-30
1/8	3.2	GTAW	3/32-1/8	150-250	16-20	20-30
5/32	4.0	GTAW	3/32-1/8	180-300	17-22	20-30