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UNDERSTANDING FCAW-G AWS CLASSIFICATIONS & APPLICATIONS

E71T-X Electrodes Fact Sheet

FCAW-G AWS Classification E71T-X Fact Sheet

1. What are the technical differences between an E71T-1, E71T-9, and E71T-12 electrode classification?

There are three key differences:

1. Chemical Composition
2. Tensile Strength Range
3. Impact Properties

AWS Classification	Chemical Composition		Tensile Strength (ksi)	CVN Impact Properties
	Max. Carbon	Max. Manganese		
E71T-1	0.12%	1.75%	70-95 ksi	20 ft•lbf @ 0°F
E71T-9	0.12%	1.75%	70-95 ksi	20 ft•lbf @ -20°F
E71T-12	0.12%	1.60%	70-90 ksi	20 ft•lbf @ -20°F

2. What is the difference between an E71T-1M and E71T-1C classification?

The “M” designator indicates the product will meet the mechanical and chemical composition requirements for a particular AWS classification under mixed shielding gas (75 – 80% Argon / balance CO₂). A “C” designator denotes that the product is designed for use with 100% CO₂ shielding gas only. Some products are designed to be used under both 100% CO₂ and 75 - 80% Argon/balance CO₂ shielding gases. These products are considered Dual Classified wires (e.g. UltraCore® 71A75 Dual and Outershield® 71M).

3. What do the optional supplemental designators J, D, and H signify?

In addition to the mandatory classification designators, AWS A5.20/A5.20M: 2005 also offers supplemental designators to indicate that the product meets additional property requirements. These designators are optional.

- A “J” designator in an AWS A5.20 classification indicates that the product produces impact properties at lower temperature. Products with the J designator must meet a minimum of 20 ft•lbf at -40°F. E71T-12 products typically meet the -40°F impact toughness requirement and carry the supplemental “J” designator. This has led to the false belief that all E71T-12 products have superior toughness. It is important to realize that not all E71T-12 products meet “J” designator requirements. However, all UltraCore® E71T-12 products do carry the “J” designator.
- The “D” designator indicates that the electrode meets minimum strength requirements and CVN impacts of 40 ft•lbf @ 70°F when tested under high heat input (slow cooling rate) and low heat input (fast cooling rate) procedures. Products with a “D” designator meet high and low heat input testing requirements for Demand Critical welds as specified in AWS D1.8 (Seismic Structural Supplement).
- AWS A5.20 has three H designations which represent maximum diffusible hydrogen levels as measured in milliliters of diffusible hydrogen per 100 grams of deposited weld metal. The designations are H4, H8, and H16. These represent 4.0 mL, 8.0 mL, and 16.0 mL of diffusible hydrogen per 100 grams of deposited weld metal when tested in accordance with AWS guidelines.

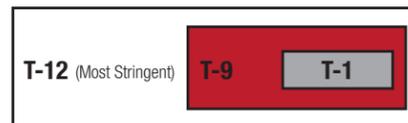
4. What benefit is gained by using an E71T-12 instead of an E71T-9, or E71T-1?

The main benefit is the upper limit on tensile strength (see question 1). This may reduce weld cracking tendencies and hardness. These products meet the lower manganese requirements of the A-1 analysis group in the ASME Boiler and Pressure Vessel Code, Section IX.

5. Who should use an E71T-12 product?

Mainly pressure vessel, offshore, and shipbuilders use E71T-12 products, but bridge and heavy equipment fabricators often use them as well.

Generally speaking, anyone who is using an E71T-1 product can use an E71T-12 product. The welding characteristics of the products are similar and the E71T-12 mechanical properties, chemical composition, and impact requirements exceed the E71T-1 requirement. The E71T-12 classification is a more stringent specification.



All of Lincoln’s E71T-12 electrodes are tri-classified, so procedure re-qualification may be avoided if a customer has already qualified with an E71T-1 or E71T-9. However, be sure to verify the qualifications needed before the job starts. An E71T-12 product also delivers better impact toughness for low temperature or fracture critical applications.

6. Do industries that use E71T-12’s have other requirements that E71T-12 electrodes do not automatically meet?

Yes, in many cases they do have additional requirements. The two most common are:

1. Higher Impact Toughness Properties
2. Lower Hydrogen Levels

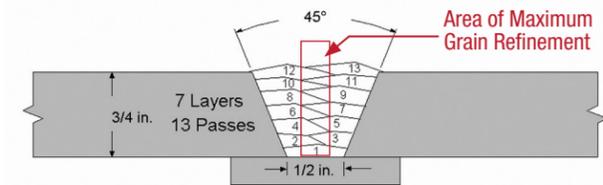
In many cases an H4 diffusible hydrogen designator is required for E71T-12’s. In addition, customers often require toughness properties that exceed 20 ft•lbf @ -20°F. UltraCore® 712C, 712A80, and 712A80-H all carry the “J” supplemental designator and produce weld metal that exceed the minimum toughness requirement. In addition, UltraCore® 712A80-H produces hydrogen levels below 4mL per 100g of weld metal.

7. Who might use UltraCore® 712A80, 712A80-H, or 712C?

- Bridge fabricators with fracture critical requirements.
- Tank/vessel fabricators that require an E71T-12.
- Offshore Fabricators with stringent toughness requirements.
- Shipbuilders with stringent toughness requirements.
- Any customer who needs higher toughness values without moving to a higher tensile strength product.
- When 80ksi tensile products are being used only for impact toughness, E71T-12’s may be a suitable replacement.

8. What other specific benefits do UltraCore® 712A80, 712A80-H, 712C and low alloy products possess?

The toughness properties of these electrodes are very consistent. Typically, impact toughness is best where there is grain refinement. In an AWS classification test plate, this is the center of the weld where the passes overlap. If examined off-center, toughness will often be lower. The microstructures of 712A80, 712C and 712A80-H were designed in a way that minimizes sensitivity to grain refinement, providing good impact toughness throughout the weld.



UltraCore® Products and Classifications

Product	AWS Classification ⁽¹⁾	Key Features	Typical Applications
UltraCore® 71C	E71T-1C-H8, E71T-9C-H8	Premium arc performance, flat bead shape, and low spatter at lower wfs procedures.	General Fabrication, Structural Fabrication, Railcar Fabrication & D1.8 Seismic Applications
UltraCore® HD-C	E71T-1C-H8, E71T-9C-H8	Faster freezing slag for high deposition rates out of position. Flat bead shape and low spatter at moderate to high wfs procedures. Ability to weld over light rust, mill scale and primer.	Shipbuilding, General Fabrication & Railcar Fabrication
UltraCore® 71A85	E71T-1M-H8, E71T-9M-H8	Premium arc performance, flat bead shape, and low spatter at lower wfs procedures.	General Fabrication, Structural Fabrication & D1.8 Seismic Applications
UltraCore® 71A75 Dual	E71T-1C-H8, E71T-9C-H8 E71T-1M-H8, E71T-9M-H8	Flat bead shape and low spatter at lower wfs procedures. Dual classified for welding on mixed gas or 100% CO ₂	General Fabrication
Outershield® 71M	E71T-1C-JH16, E71T-9C-JH16 E71T-1M-JH16, E71T-9M-JH16	Low temperature impact toughness. Best in class wire feeding characteristics. Dual classified for welding on mixed gas or 100% CO ₂	Bridge, Ship & Barge Manufacturing, General Fabrication, Machinery Fabrication, Offshore & Structural Fabrication
UltraCore® 712C	E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8	Premium arc performance and low temperature impact properties. Ability to weld over light rust, mill scale and primer	Bridge Fabrication, Offshore, Pressure Vessels, ASME Related Applications & Shipbuilding
UltraCore® 712A80	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8	Premium arc performance and low temperature impact properties.	Pressure Vessels, ASME Related Applications, Shipbuilding & Offshore
UltraCore® 712A80-H	E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4	H4 diffusible hydrogen levels and low temperature impact properties.	Offshore, Heavy Equipment, Pressure Vessels & Shipbuilding

⁽¹⁾A5.20: 2005