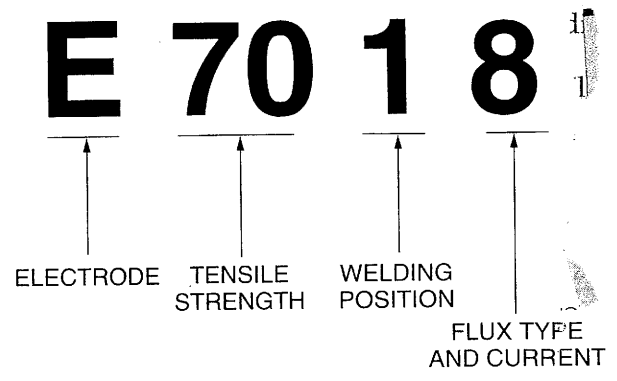


L A B

Figure 3 shows the electrode marking system. Table 1 shows the characteristics of mild steel electrodes covered by the A5.1 specification. The low-alloy steel electrodes that are covered by A5.5 have a suffix in addition to the standard classification numbers. The suffix has a letter and a number. The letter indicates the chemical composition of the deposited weld metal, and the number indicates the composition of the chemical classification. Figure 4 shows an electrode classification marking from the A5.5 specification.



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Figure 3 ♦ Electrode marking system.

The meanings of the suffix letters are:

- A – carbon-molybdenum alloy steel
- B – chromium-molybdenum alloy steel
- C – nickel steel alloy
- D – manganese-molybdenum alloy steel
- G – other alloys with minimal elements

The meaning of the numbers varies by alloy type but always indicates the percentages of the various alloying elements, such as:

- Carbon (C)
- Manganese (Mn)
- Phosphorus (P)
- Sulphur (S)
- Silicon (Si)

THINK ABOUT IT

Determining Tensile Strength

What factor determines the selection of an electrode with the proper tensile strength? How is this tensile strength determined?

Table 1 Mild Steel Electrode Characteristics

AWS Class	Flux Coating	Current Requirements	Position	Characteristics
EXX 10 EXX 20	CELLULOSE SODIUM	DCEP	All FLAT, HOR. FILLET	DEEP PENETRATION, FLAT BEADS
EXX 11	CELLULOSE POTASSIUM	AC, DCEP	All	DEEP PENETRATION, FLAT BEADS
EXX 12	TITANIA SODIUM	AC, DCEN	All	MEDIUM PENETRATION
EXX 13	TITANIA POTASSIUM	AC, DCEP, DCEN	All	SHALLOW PENETRATION
EXX 14 EXX 24	TITANIA IRON POWDER	AC, DCEP, DCEN	All FLAT, HOR. FILLET	MEDIUM PENETRATION, FAST DEPOSIT
EXX 15	LOW-HYDROGEN SODIUM	DCEP	All	MODERATE PENETRATION
EXX 16	LOW-HYDROGEN POTASSIUM	AC, DCEP	All	MODERATE PENETRATION
EXX 27	IRON POWDER, IRON OXIDE	AC, DCEP, DCEN	FLAT, HOR. FILLET	MEDIUM PENETRATION
EXX 18 EXX 28	IRON POWDER LOW-HYDROGEN	AC, DCEP	All FLAT, HOR. FILLET	SHALLOW TO MEDIUM PENETRATION



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Figure 4 ♦ Marking on a low-alloy, high-strength electrode.

- Nickel (Ni)
- Chromium (Cr)
- Molybdenum (Mo)
- Vanadium (V)

Figure 5 shows the electrode marking system for low-alloy, high-strength electrodes.

Figure 6 shows examples of various electrodes available listed by alloy content.

3.2.0 Manufacturers' Classification

All electrodes manufactured in the United States must have the AWS classification number printed on them as well as on the container in which they are shipped. In addition, electrode manufacturers generally print their own unique classification name or number on the electrode and/or on the container in which the electrodes are shipped. Manufacturers may also make more than one electrode within the same AWS classification. For example, Lincoln manufactures two electrodes with the AWS classification E6010. One is called Fleetweld 5P, and the other is called Fleetweld 5P+.

Lincoln recommends Fleetweld 5P for general fabrication and maintenance welding and states that it is good for pipe. However, Lincoln states that Fleetweld 5P+ is the best choice for pipe. The major difference between the two electrodes is the mechanical properties of the deposited weld metal. Even though both fall into the E6010 classi-

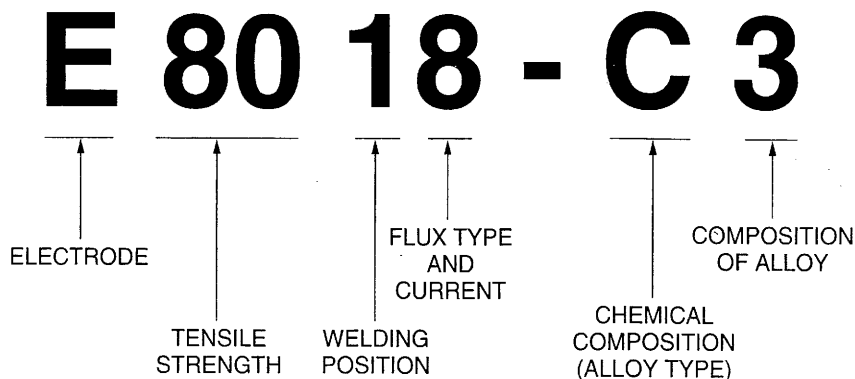
fication, 5P+ has a hardness lower than 5P. When 5P+ is used for the root pass, this lower hardness results in improved resistance to heat-affected zone cracking. Also, the 5P+ has slightly higher tensile strength, yield, and elongation.

When there is more than one electrode in an AWS classification and you are unsure about which electrode to use, check with your supervisor.

CARBON-MOLYBDENUM STEEL	CHROMIUM-MOLYBDENUM STEEL
E7010-A1	E8016-B1
E7011-A1	E8018-B1
E7015-A1	E8015-B2L
E7016-A1	E8016-B2
E7018-A1	E8018-B2
E7020-A1	E8018-B2L
E7027-A1	E9015-B3L
	E9015-B3
	E9016-B3
	E9018-B3
	E9018-B3L
	E8015-B4L
	E8016-B5
NICKEL STEEL	OTHER LOW-ALLOY STEEL
E8016-C1	EXX10-G
E8018-C1	EXX11-G
E8016-C2	EXX13-G
E8018-C2	EXX15-G
E8016-C3	EXX16-G
E8018-C3	EXX18-G
	E7020-G
	E9018-M
	E10018-M
	E11018-M
	E12018-M
MANGANESE-MOLYBDENUM STEEL	
E9015-D1	
E9018-D1	
E10015-D2	
E10016-D2	
E10018-D2	

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Figure 6 ♦ Examples of available electrodes listed by alloy.



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Figure 5 ♦ Example of marking system.