

# SMAW Electrodes for Nickel Steel (low temperature use)

## Welding Notes

Nickel Steel is commonly used on LPG (Liquid Petroleum Gas) carrier, LPG tank, low temperature service equipment, marine structure, and other low temperature required works. During the welding process, inter-pass temperature needs to be under 150°C.

### 1. Preheat, inter-pass temperature and PWHT process control

If the heat input is high, base metal is too thin, or if the inter-pass temperature is too high, the cooling speed of the weld metal will be affected and the weld metal toughness will decrease. The process of preheat, inter-pass, and PWHT temperature and all the welding parameters need to be followed according to the welding procedure specification depending the specific metal thicknesses and steel types.

### Nickel Steel Preheat, Inter-pass & PWHT temperature requirement

Product name	Preheat and inter-pass Temperature (°C)	PWHT Temperature × time (°C×hr)
GL55Ni, GL86/88C3	95~120	No need
GL86/88C1	95~110	605±15
GL86/88C2	95~110	605±15

Note: 1. The duration of PWHT temperature should be adjusted base on the thickness of the weldment according to the contract or related codes.

2. PWHT temperature must be tightly controlled; otherwise, the impact toughness will be reduced.

### 2. Recommending low electrical current (low heat input)

Nickel steel mostly has gone through mechanical properties improvement treatment or normalization heat treatment. Welding parameters must be rigidly controlled using low heat input welding to ensure proper weld metal's alloy element content, strength, impact toughness, and other good properties.

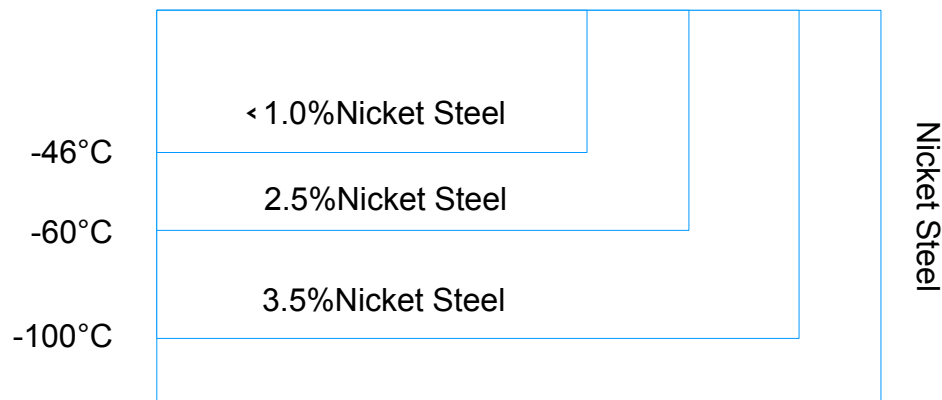
### 3. short arc welding technique

Nickel Steel SMAW Electrodes are mostly classified as low hydrogen type; thus, short arc technique should be observed during welding in order to prevent permeation of N<sub>2</sub> and O<sub>2</sub> into the arc creating blow hole and alloy elements burning loss. If weaving is necessary, the weaving width should not exceed 3 times of the core wire diameter. During welding, the arc starting point should be 1~2 cm behind the welding start point. Once the arc starts, pull it back to the welding start point to begin welding to avoid the occurrence of blow hole. This is known as the forehand & backhand arc starting technique.

#### 4. Welding consumables selection

Steel Category	ASTM	SMAW Electrode	Flux Cored Wire
< 1.0%Nickel Steel	A537 Cl 1 or 2 A516 Gr70	GK55Ni GL86C3 / GL88C3	GMX811Ni1
2.5%Nickel Steel	A203 Gr A or B	GL86C1 / GL88C1	GMX811Ni2 / GMX911Ni2
3.5%Nickel Steel	A203 Gr D or E	GL86C2 / GL88C2	----

#### 5. Nickel Steel usage temperature range chart :



6. For more information, please consult page A6 regarding Welding notes of SMAW Electrode for Mild and High Tensile Strength Steel use.