



Your welding power

**COPPER FREE SOLID
WIRE INE NR FOR
WELDING CARBON
AND HSLA STEELS
(DIN SG2/SG3)**



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INE NR copper free solid wires for welding S355/ S420/ S460 carbon and High Strength Low Alloy (HSLA) steels. From an innovative production process and careful selection of raw materials comes the copper-free range of INE NR wires, specially designed to ensure optimum arc stability in systems characterized by high current intensities combined with long wire feeding systems. Optimized for welding in automated and robotic stations employing high welding parameters and speeds. Due to their characteristics, INE NR wires contribute to reducing welding time and costs while increasing efficiency.

CHARACTERISTIC FEATURES OF THE WIRE

Feeding the wire into the conduit evenly and without snags

Suitable for use at high current densities

Less spatter

Longer contact tips life

No copper shavings in the conduit

Controlled morphology of silicate islands

BENEFIT TO THE USER

Consistency in performance and highly reproducible welds

Higher deposition rate

Reduced time and cost for post welding cleaning

Reduced downtime, increased productivity

Increases the longevity of conduits and reduces their maintenance

Reduced post-weld cleaning, improved adhesion of coatings and paints

SURFACE OXIDATION



Fig.1 Surface appearance of INEFIL NR 1.2 mm after an 88-hour exposure in a climatic chamber at 35°C and 95% humidity (tropical conditions).

An oxidation reaction due to the interaction between the oxygen naturally present in the atmosphere and the wire gradually leads to the formation of a surface oxide layer, significantly altering the welding behavior of the consumable. This phenomenon is accentuated under conditions of high humidity or in the presence of sodium chlorides, typical of the marine environment and during sea transport of the product. A decisive factor in preventing and slowing the oxidation phenomenon is the surface cleanliness of the wire, which must be free of roughness, crevices and drawing residues. Thanks to the innovative manufacturing process, INE NR wires achieve an excellent level of surface cleanliness. In addition, the special coating and the absence of copper prevents oxidation and the formation of galvanic-type corrosion between copper and iron. All our products are tested in the company's in-house laboratory in a special climatic chamber with the ability to simulate tropical climates up to 40°C and 90 percent humidity.

Wire oxidation during use, benefits of wires INE NR:

- Cleaner and smoother wire
- Slowed corrosion process
- Absence of galvanic corrosion due to the possible presence of microdefects in the copper coating.

WEAR OF CONTACT TIPS



Fig.2 Contact tips outlet hole wear after 30 minutes of pulsed MAG welding. 240 A, 29 V.

Contact tips are located at the end of the welding gun and play the key role of transferring the welding current from the generator to the end of the wire so as to give rise to the electric arc between electrode and workpiece. Impurities lurking on the surface of the wire can result in uneven electrical contact with the initiation of micro-arcs inside the tube. This phenomenon causes the temperature of the contact tube to rise, resulting in wear and deformation of the exit hole, which, in turn, generates arc instability and defects in the weld. Thanks to the special surface treatment, INE NR wires limit contact tips wear, ensuring a stable and homogeneous arc over a wide welding range.

Contact tips wear, benefits of INE NR wires:

- Wear 4 times less than a standard copper-free wire.
- Wear comparable to a good quality copper-plated wire.

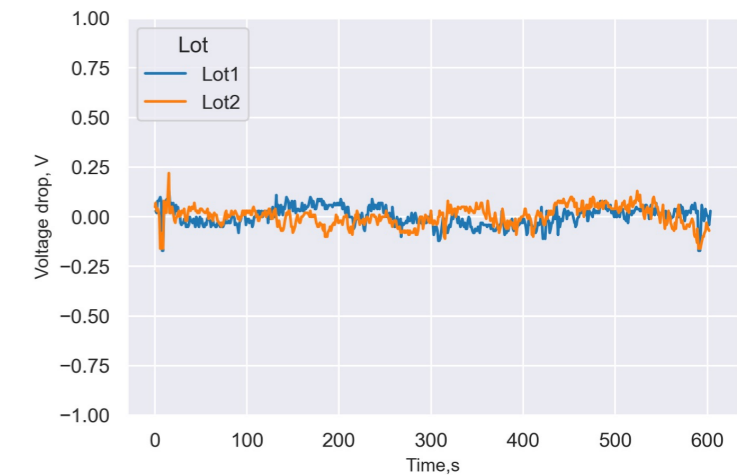
CURRENT CARRYING EFFICIENCY

INE SpA's R&D lab analyzes the electrical and physical parameters that are essential to ensure good weldability. Among these, voltage drop at the contact tips indicates the ability of the wire to conduct electric current, which is directly proportional to arc stability during welding. Spot checks are carried out on INE production to ensure consistent quality over time.

Current carrying efficiency: benefits of INE NR wires:

- Uniform weld appearance.
- Homogeneous weld penetration
- Good arc stability.

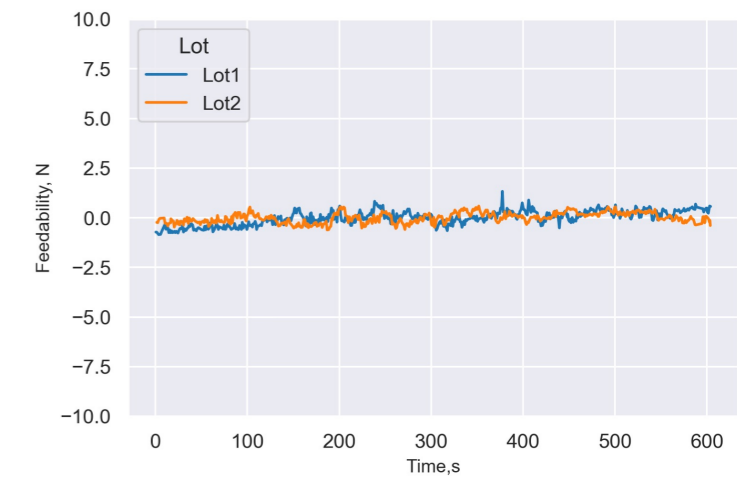
Fig.3 Current transfer between the contact tube and the wire. The variation of voltage drop measured is less than 100 mV, ensuring a stable current transfer during welding that results in uniform welds and even penetrations along the entire bead.



WIRE FEEDING IN THE CONDUIT

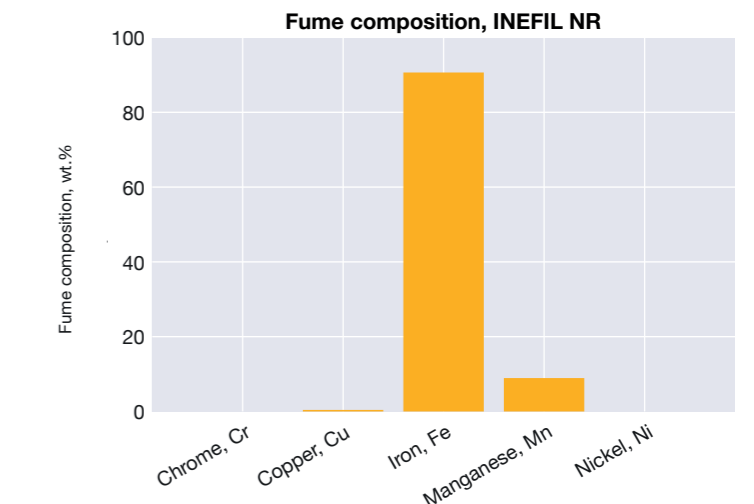
Sliding in the conduit is monitored to assess the ability of the wire to run smoothly over long stretches of conduit, typical of robotic stations, in which the length of the wire carriers can be as long as 20 meters. The ability of the wire to travel long lengths of conduit with constant speed and without tearing is critical to ensure consistency of electrical parameters during welding.

Fig.4 Wire slip in conduit during a 10-minute weld with average wire speed equal to 11 m/min. Conduit slip is measured using a load cell that measures the force required to push the wire into the sheath and up to the gun. The average change in force is less than 1N, a symptom of extremely smooth and snag-free sliding. This ensures consistent delivery of the wire into the melt pool.



WELDING FUMES

During welding, depending on the process, parameters and type of material used, a considerable amount of fumes are developed. With regard to GMAW welding, these are composed partly of the gas used during welding and partly of fine metal particles due to the evaporation of metal as a result of the very high temperatures developed inside the arc (up to 10000°C). As for the consumable, the degree of surface cleanliness is of particular importance for smoke emission. A surface free of organic and inorganic residues from the drawing process significantly lowers the amount of fumes emitted. Thanks to the special surface treatment and careful selection of raw materials, INE NR wires emit 10% to 20% less fumes than a copper-plated wire. The graph shows the relative amount of particles measured according to UNI EN 14385:2004 on a particulate produced by pulsed GMAW welding (340 A, 33 V) with M21 gas.



PRODUCTS	AWS A5.18	EN ISO 14341-A	APPROVALS	DIAMETERS
INEFILNR	ER70S-6	G 46 4 M21 3Si1 G 42 2 C1 3Si1	ABS / TÜV / RINA / DB / DNV-GL / LR	1.0 - 1.2 mm
INEFIL 19.12 NR	ER70S-6	G 46 4 M21 4Si1 G 42 2 C1 4Si1	ABS / TÜV / RINA / DB / DNV-GL	1.0 - 1.2 mm

SPOOLS			DRUMS		
TYPE	WEIGHT	PALLETIZING	TYPE	WEIGHT	PALLETIZING
BS300	18 Kg	56 Spools/Pallet	Drum F250	250 Kg	4 Drums/Pallet
			Drum F500	500 Kg	1 Drums/Pallet

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