

Classification

DIN 2302

E 42 0 Z RR 2 UW 10 fr

Characteristics and typical fields of application

Covered electrode for manual metal arc welding under hyperbaric wet conditions down to 20 msw. Very good weld-ability in vertical down position.

Base materials

S235JRG2 – unalloyed and fine grained structural steels.

Higher strength structural steels should not be welded with this type of electrodes as these materials are susceptible to “Hydrogen Induced Cold Cracking (HICC)” when welded in wet environment.

The carbon content of the parent metal should not exceed 0.15%.

Typical analysis of all-weld metal

	C	Si	Mn	Mo
wt.-%	0.08	0.30	0.55	0.50

Mechanical properties of all-weld metal

Heat-treatment	Yield strength R _{p0.2}	Tensile strength R _m	Impact work ISO-V KV J
	MPa	MPa	+20 °C
aw	420	500	38

Operating data

	Polarity: DC (+) / DC (-)	ø mm 3.2	L mm 350	Amps A 150 – 200
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Approval

DNV GL

Description

Special Characteristics

applicable for mild steels	reduced spattering
applicable in all welding position	good droplet transfer
good ignition and re-ignition of the arc	easy removable slag
well-structured bead appearance	smooth bead surface
reduced hardness in weldment	low porosity

Application

Phoenix Nautica 20 electrodes have been developed for ordinary mild steels which have to be welded in wet environment. They can be applied in shallow waters down to a water depth of 20 msw. It has to be recognized that porosity will increase with increasing water depth. Higher strength structural steels should not be welded with this type of electrodes as these materials are susceptible to Hydrogen Induced Cold Cracking (HICC) when welded in wet environment. The susceptibility to HICC is indicated by the Carbon Equivalent calculated (acc. IIW) with the following formula

$$CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

and which should not exceed the value of 0.40%. In this respect the carbon content of the base metal should not exceed the value of 0.15%. Materials with a higher "CE" value are regarded as susceptible for hydrogen-induced-cold-cracking.

Operating Procedure

The Phoenix Nautica 20 electrode has generally to be welded in straight polarity and is applied in multilayer stringer bead technique. Vertical beads should be welded in down had position. Welding in overhead position results in excessive hydrogen contamination of the weld metal. Therefore this welding position should be avoided to the maximum extent. It is recommended to set the welding current up to 150 – 200 A DC.

Material Properties

The following properties of the weldment can be achieved with the Phoenix Nautica 20 electrode in application of the multilayer-stringer-bead-technique:

Tensile strenght: > 500 MPa	Hardness: Weld metal: 220 – 260 HV10 Heat Affected Zone (HAZ): 250 – 320 HV10
Charpy values (at 32° F): >20 J (average)	

It has to be noticed that weldment produced in the overhead position may result in lower mechanical properties. Furthermore the cap layers will generally result in higher hardness as indicated above. Therefore it is strongly recommended that the cap layer is removed by grinding after the finalization of the welded joint to reduce hardness peaks and notch effects.

General Remarks

Welding in wet environment can be regarded as a procedure that is much more difficult to operate than under atmospheric conditions. It therefore requires a diver-welder with high practical skill, excellent knowledge about all process related interactions, an extremely high amount of concentration on the job during the whole operation and last but not least a good visibility for the exact observation of the arc and the bead performance. He must be able to judge the arc to correct its performance or deflection immediately.

Welding in wet environment requires a well-trained and responsible diver-welder. In case of a longer interruption with no welding activities an intensive training phase before starting a new wet welding job should be essential.

A special necessity for a good weld performance is an accurate joint preparation and an accurate fit of the parts to be welded. The better the preparation the better will be the welding result.

Job planning, -preparation and -performance has to include the notice of the related recommendations, requirements and rules set by government, authorities and/or standardization institutions.