Gantrail® Crane Rail Welding

Consumables for enclosed arc crane rail welding

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Gantrail® promote the use of continuously welded crane rails. This is most important for the efficient and trouble free operation of cranes. Crane rails are typically of high carbon and alloy content and cannot be welded by conventional welding techniques. Thus they must be welded following a qualified procedure by fully trained and qualified welders. This data sheet gives details of the consumables needed to weld rails and some details of the method. It should be read in conjunction with the relevant procedures and work instructions.

The benefits for continuously welded rail are considerable but they require the rail to be welded on site. Typically rails may be welded into lengths of 300 metres or more with no expansion joint. The rail cross sections are large and the metallurgy; with high carbon and manganese content; make welding difficult.

Several methods have been developed that can readily be used. Perhaps the easiest method to set up on a site is enclosed arc, sometimes known as puddle arc welding. This makes use of manual metal arc equipment and special welding rods.

METHOD

The rail ends are cut square by sawing. They are set with a gap of approximately 20 millimetres. The rails are set at a small camber to form a peak at the weld. This is then corrected with the shrinkage of the liquid weld metal leaving a flat top surface after welding. A copper strip is placed below the weld metal, this draws excess heat from the weld. This is protected with a small strip of steel, which ultimately becomes absorbed into the weld. The gap between the rail ends is filled with melted welding electrode. The bottom flange of the rail is welded with a series of passes with the slag being removed after each run. When this is complete, copper moulds are placed to each side of the rail and a little away from the rail.

The gap is then filled with weld metal in a continuous welding process. The slag is allowed to run off the top of the molten metal through the small gap between the copper and the rail. The weld is continued to above the top surface of the rail by a few millimetres. Ideally, it should then be allowed to cool slowly with a heat insulating blanket. The correct head profile of the rail is then achieved by grinding.

CONSUMABLES REQUIRED

- Railrod electrodes - 3.2mm for the foot and 5mm or 6mm for the remaining runs
- Strip in foot of rail to suit rail
- Copper mould for below the rail and for the two sides of the rail (to suit the section being welded)
- Heat insulating blanket, to be used if required

Gantrail can supply outline weld procedures, method statements, training for welders or production welders.

PRODUCT DESCRIPTION

Railrod is a manual metal arc welding electrode for rail welding utilising basic low hydrogen flux coating with low moisture absorption characteristics. Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.

SPECIFICATIONS

None strictly applicable, nearest AWS E12016-G and nearest BS EN E69 Z Z B.

ASME IX QUALIFICATION

QW432 F-No -, QW442 A-No -.

MATERIALS TO BE WELDED

Rail steels with up to 0.8% carbon and nominal tensile strength of > 700 MPa.

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APPLICATIONS

This electrode is especially designed for the butt welding of rails with square preparation. It can also be used for welding similar cross-sections such as bars, thick plates, flanges, etc. The electrode is specially designed to enable good fusion to the side walls to take place without excessive slag interference.

Weld metal has good resistance to collapse under compression by rolling loads.

MICROSTRUCTURE

Mainly auto-tempered bainitic ferrite.

WELDING GUIDELINES

Preheat typically 200°C for > 0.5%C rail steel, increasing to 300°C for > 0.7%C rail steel. It is important to maintain these minimum temperatures during welding. Maximum suggested interpass temperature 400°C. Slow cool under insulation after welding.

This electrode is normally used in the downhand (flat) position with a slag-over-slag technique. Rail ends are square butt welded by setting 15-20mm apart with a prepared 4-6mm thick steel insert at the weld root, then copper shims are stacked to form an enclosure for the weld pool whilst allowing excess slag to run free. Good surface profile underneath the weld root area will maximise fatigue resistance of the joint. Initial support for depositing the root can utilise a copper backing plate or wire-reinforced window glass. Before and during welding it is important to use a sufficient preheat-interpass range, and to retard cooling.

COMPOSITION (weld metal wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo
min	0.06	0.7	0.2	-	-	2.0	-	-
max	0.12	1.5	0.8	0.020	0.025	2.6	0.5	0.5
typ	0.19	1	0.5	0.008	0.012	2.3	0.2	0.2

ALL-WELD MECHANICAL PROPERTIES

As welded			Typical
Tensile strength		MPa	900
0.2% Proof stress		MPa	700
Elongation on 4d		%	17
Impact energy*	+20˚C	J	18-48
	0˚C	J	14-43
Hardness		HV	280

* For comparison, typical thermit rail weld: 8J @ 20˚C, 5J @ 0˚C.

PARAMETERS

DC +ve or AC (OCV: 70V min)

ø mm	3.2	5.0	6.0
min A	100	200	240
max A	160	280	360

WELD ROD DATA

ø mm	3.2*	5.0	6.0*
Length mm	380	450	450
kg/carton	15.0	17.7	18.3
pieces/carton	447	187	135

* supplied to order

PACKAGING AND STORAGE DATA

Three hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin will give hydrogen < 5ml/100g weld metal during 8h working shift.

For electrodes that have been exposed: **Redry** 250-300°C/1-2h to ensure H2 <10ml/100g, 300- 350°C/1-2h to ensure H2 < 5ml/100g. Maximum 420°C, 3 cycles, 10h total.

Storage of redried electrodes at 100-200°C in holding oven or 50-150°C in heated quiver: no limit, but maximum 6 weeks recommended.
Recommended ambient storage conditions for opened tins
(using plastic lid): < 60% RH, > 18°C.

FUME DATA

Fume composition, wt % typical:

ø mm	3.2	5.0	6.0
min A	100	200	240
max A	160	280	360

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