



INSTRUCTIONS FOR WELDING

THE STRUCTURE OF BORON STEEL

Hardened boron steel has a very high yield point of 1000 – 1200 [MPa] and has a high carbon equivalent, CEIIW (0.55), CET (0.41), which directly affects the risk of cold/hydrogen cracking.

COLD CRACKS

Cold cracks occur in areas adjacent to the welding bead at low temperatures when hydrogen (from moisture, rust and snow) accumulates in areas with high tension and “explodes” the steel, forming small cracks. This means that the piece to be welded must be preheated, and electrodes must be kept as dry and clean as possible. Electrodes from an opened package must be dried in a drying cabinet before use. In addition, the material to be welded must be clean and dry.

Rutile flux-cored wires must not be used since they capture hydrogen.

HOT CRACKS

Hot cracks/solidification cracks are accumulations of an alloying element and contaminants (carbon, sulphur and phosphorus), in the centre of the weld. Welding using a high amperage and a low welding speed can produce this type of cracking.

FATIGUE

Fatigue properties of a joint are improved by a smooth transition between the weld and the base material.

RECOMMENDATIONS

Extensive tests have been carried out at Olofsfors AB and we recommend that you follow the information below and attached weld data sheets for best results. In all cases, welding must only take place after snow, dirt and any rust has been removed from the material.

When welding ice calks, the main weld must be along the length of the crossbar; no welding across the crossbar must take place.

Preheat the material according to the WPS. When welding in an environment where moisture can accumulate on the steel, the steel must always be heated first. The welding dimension is a4.

ESAB OK 67.45 is a stainless austenitic filler metal and can be welded without pre-heating if the crossbar is free from snow, dirt, moisture and warmer than the surrounding.

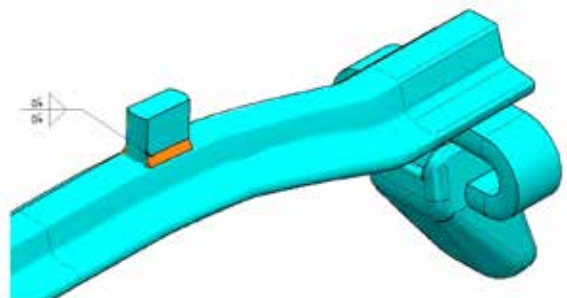
See WPS111PA02-03

ESAB OK 48.00 is a black filler metal and should be welded with the base material preheated to + 75 [°C] to avoid cold cracks.

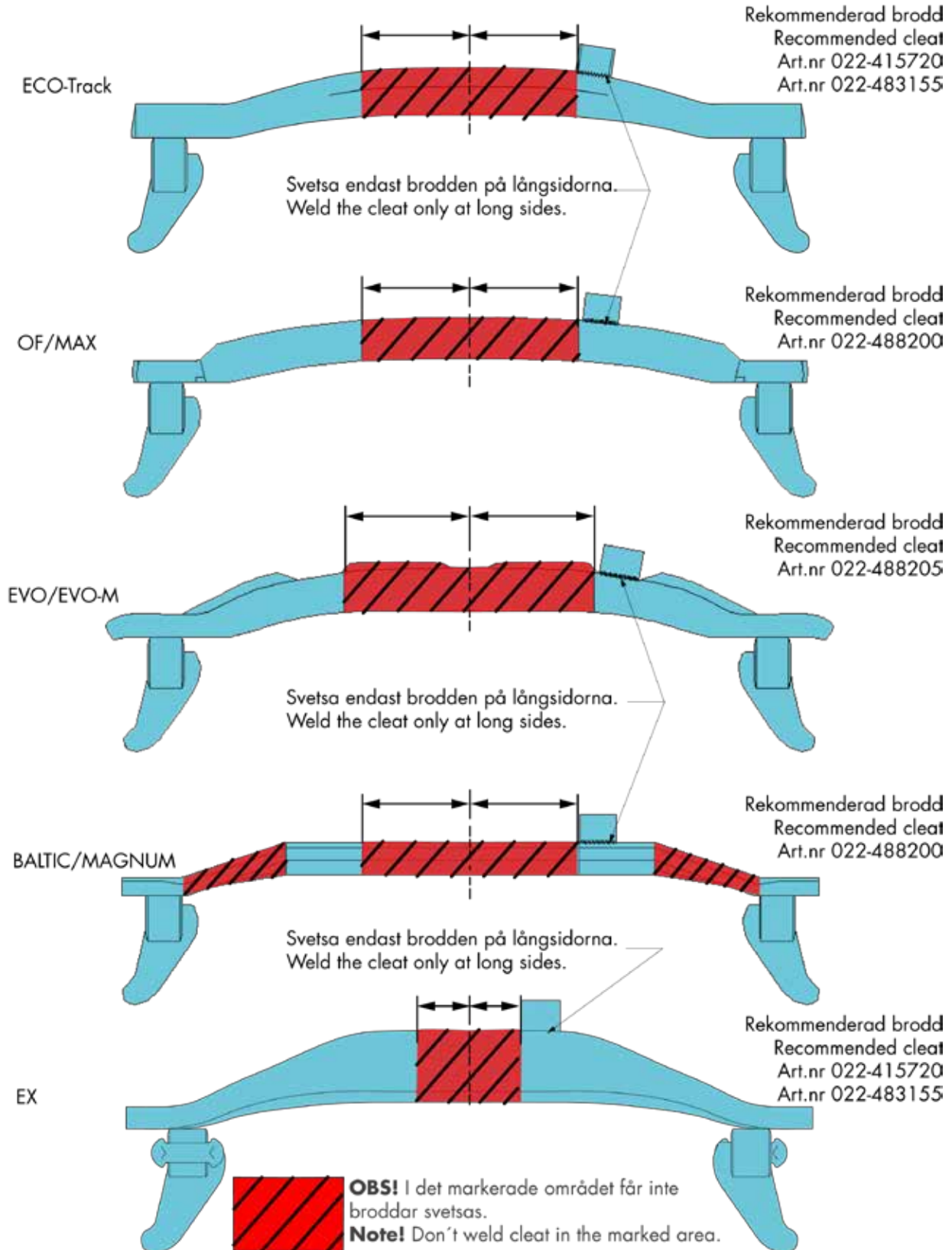
See WPS111PA01-03

ESAB OK Autrod 12.50/12.51 represents the MAG method and must be welded with the base material preheated to about + 50 [°C] to avoid cold cracks.

See WPS135PA04-03


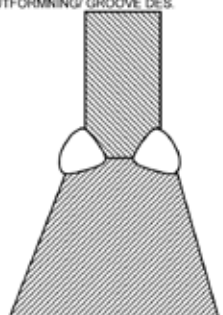


WELDING INSTRUCTION/SVETSINSTRUKTION


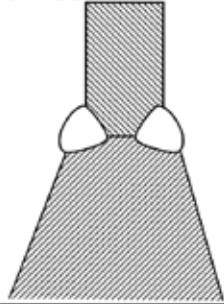


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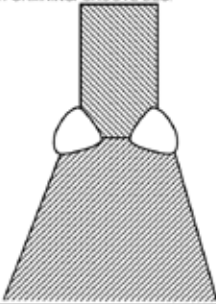
WELDING INSTRUCTION/SVETSINSTRUKTION

		STANDARD SVETSPROCEDUR WELDING PROCEDURE SPECIFICATION				WPS 111PA02-03			
Svetsdatablad WPS Welding Procedure Specification		111				SVETSMETOD WELDING PROCESS			
WPAR No Intrångningsgodkännade Penetration approval		WPAR111PA02-00 se svetsprover see welding tests				SVETSFÖLJD WELDING SEQ.			
GRUNDMATERIAL	BASE MATERIAL	MATERIALTYP MATERIAL TYPE OR GRADE	W03						
		TJOCKLEKSOMRÅDE TH. RANGE QUALIFIED	5 - 50mm						
		KOLEKVIVALENT C _{eq} (I _W) CARBON EQUIVLENT C _{eq}							
TILLSATSMATERIAL	FILLER MATERIAL	FABRIKAT TRADE NAME	ESAB						
		BENÄMNING DIN / EN CODE	OK 67.45 EN 1600: E 18 8 Mn B 4 2						
		TORKNING AV ELEKTRODER DRYING OF ELEKTRODES	ENL. LEVERANTÖR ACC. SUPPLIER						
SKYDDSGAS	SHIELDING GAS	SKYDDSGAS TYPE OF SHIELDING			FÖRÄRNING PREHEAT	RÖRIGHETSOMRÅDE RANGE OF POSITION ORA. PA, PB			
		SAMMANSÄTTNING COMPOSITION							
		FLÖDE FLOW RATE							
		ROTSTÖD BACKING							
		ROTSTÖD BACKING							
TEKNIK	TECHNIQUE	STRÄNG, PENDING STRING, WEAVE BEAD	STRÄNG STRING		VÄRMEBEHANDLING POST WELD HEAT TREATM.	VÄRMININGSMETOD ACETYLEN/PROPAN Acetylene/Propane			
		RENGÖRINGSMETOD CLEANING METHOD	SLIP GRINDING						
		HAFTNINGSMETOD FIT UP METHOD	SVETS WELDING						
		ROTSIDANS BEHANDLING ROOT PREPARATION							
		ENKEL/DUBBELEKTROD SINGLE/MULTIPLE ELECTRODE							
STRÄNG BEAD	METOD PROC.	TILLSATSMATERIAL FILLER MATERIAL			Anmärkning/ remarks Avlägsna snö, smuts och rost. Remove snow, dirt and rust. Materialet måste vara helt torrt före svetsning. The material must be completely dry before welding. Svetsa ej på kortsida brodd. Do not weld cleat on the short side Motsvets för önskad intrångning: 5 - 10 grader Backhand welding for best deep penetration: 5-10 degree NORM CODE				
		Säck/Out mm	VARUNAMN TRADENAME	DIAM. DC	AC POL.	AMPERE MIN MAX	VOLT MIN MAX	CM/ MIN TRAVELSP.	STRÄCKENERGI HEATINPUT
1 - 4	111		OK 67.45	3,2	DC (+)	90 100	22 25	11 - 14	1.0
GODKÄNNANDE APPROVALS		OLOFSFORS		KUND CLIENT		MYNDIGHET			
DATUM DATE		2012-05-24		DATUM DATE		DATUM DATE			

WELDING INSTRUCTION/SVETSINSTRUKTION

		STANDARD SVETSPROCEDUR WELDING PROCEDURE SPECIFICATION				WPS 111PA01-03 <small>REV: 01</small>					
Svetsdatablad WPS Welding Procedure Specification		111				FOGUTFORMNING/ GROOVE DES.					
WPAR No: WPAR111PA01-00						SVETS FÖLJD/ WELDING SEQ.					
Inträngningsgodkännande Penetration approval		se svetsprover see welding tests									
GRUNDMATERIAL	MATERIALTYP	W03									
	TJOCKLEKSOMRÅDE	5 - 50mm									
	KOLEKVIVALENT C _{eq} (IRV)										
TILLSATSMATERIAL	FABRIKAT	ESAB									
	BENÄMNING	OK 48.00									
	DIN / EN CODE	EN 499: E 42 4 B 42 HS									
SVETSGAS	SKYDDSGAS										
	TYP AV SVETSGAS										
	SAMMANSÄTTNING										
TEKNIK	STRÅNG, PENDLING	STRÅNG									
	STRING, WEAVE BEAD	STRING									
	RENGÖRINGSMETOD	SLIP									
STRÅNG	METOD	SVETS									
	BEAD	WELDNING									
Anmärkning/ remarks		Avlägsna snö, smuts och rost. Material et måste vara helt torr före svetsning. Svetsa ej på kortsida brodd. Motsvets för önskad inträngning: 5 - 10 grader Welder: NORM CODE				Remove snow, dirt and rust. The material must be completely dry before welding. Do not weld clear on the short side Backhand welding for best deep penetration: 5-10 degree					
VÄRMEBEHANDLING POST WELD HEAT TREAT		VÄRMINING/KYLNING HAST. HEATING/COOLING RATE HÅLLTEMPERATUR SOAKING TEMP. HÅLLTID SOAKING TIME VÄRMININGSMETOD APPLICATION METHOD									
FÖRVARMNING PREHEAT		RANG AV POSITION RANGE OF POSITION FÖRVARMNINGSTEMP. PREHEAT TEMP. MELLANSTRÅNGSTEMP. INTERPASS TEMP. VÄRMININGSMETOD APPL. METHOD MÄTMETOD METHOD OF MEASUREMENT				PA, PB 75° C 167° F 150-200° C 302-392° F Acetylen/ Propan Acetylene/ Propane Krita, termometer Chalk, thermometer					
STRÅNG METOD BEAD PROC.		TILLSATSMATERIAL FILLER MATERIAL		DIAM. AC P.O.L. AMPERE VOLT CM/MIN STRÄCKENERGI		VÄRMININGSMETOD APPLICATION METHOD					
		StickOut	VARUNAMN	DIAM.	AC	P.O.L.	AMPERE	VOLT	CM/MIN	STRÄCKENERGI	
		mm	TRADE NAME		DC		MIN MAX	MIN MAX	TRAVEL SP.	HEAT INPUT	
1		111	OK 48.00	3,2	DC	(+)	95 105	24 - 26	11 - 17	1,0	
2 - 5		111	OK 48.00	3,2	DC	(+)	140 150	25 - 27	16 - 24	1,2	
GODKÄNNANDE APPROVALS		OLOFSFORS DATUM DATE		KUND CLIENT DATUM DATE				MYNDIGHET DATUM DATE			
		2012-06-11									

WELDING INSTRUCTION/SVETSINSTRUKTION

		STANDARD SVETSPROCEDUR WELDING PROCEDURE SPECIFICATION				WPS 135PA04-03 <small>REV: 01</small>				
Svetsdatablad WPS Welding Procedure Specification		135				FOGUTFORMNING/ GROOVE DES.				
WPAR No WPAR135PA04-00 <small>Intrångningsgodkännande se svetsprover</small> <small>Penetration approval see welding tests</small>						SVETSFÖLJID/ WELDING SEQ.				
GRUNDMATERIAL	BASE MATERIAL	MATERIALTYP	W03		POS	GILTIGHETSOMRÅDE				
		MATERIAL TYPE OR GRADE	W03							
		TJOCKLEKSOMRÅDE	5 - 50mm							
TILLSATSMATERIAL	FILLER MATERIAL	FABRIKAT	ESAB		FÖRVARMNING	PÅHÄTT				
		TRADE NAME	ESAB							
		BENÄMNING	AUTOROD 12.50/51							
SVYDSDGAS	SHIELDING GAS	SKYDDSGAS	ATAL		VÄRMEBEHANDLING	POST WELD HEAT TREATM.				
		TYPE OF SHIELDING	ATAL							
		SAMMANSÄTTNING	Ar + 18% CO2							
STRÅNG	METOD	STRÅNG	STRÅNG		NORM	CODE				
		STRING, WEAVE BEAD	STRING							
		RENGÖRINGSMETOD	SLIP							
TEKNIK	TECHNIQUE	HÄFTNINGSMETOD	SVETS		Anmärkning/ remarks Avlägsna snö, smuts och rost. Remove snow, dirt and rust. Materialet måste vara helt torrt före svetsning. The material must be completely dry before welding. Svetsa ej på kortsida brodd. Do not weld cleat on the short side. Welder: _____ _____ _____					
		FIT UP METHOD	WELDING							
		ROTSIDANS BEHANDLING								
STRÅNG	METOD	TILLSATSMATERIAL								
BEAD	PROC.	FILLER MATERIAL								
		StöckOut	VARUNAMN	DIAM.	AC	POL.	AMPERE	VOLT	CM/MIN	STRÄCKENERGI
		mm	TRADE NAME		DC		MIN MAX	MIN MAX	TRAVELSP.	HEATINPUT
1	135	15-17	AUTOROD 12.50	1,2	DC	(+)	140 150	20 - 22	17 - 20	0,9
2 - 5	135	15-17	AUTOROD 12.50	1,2	DC	(+)	230 265	29 - 30	34 - 45	1,0
GODKÄNNANDE APPROVALS		OLOFSFORS		KUND CLIENT		MYNDIGHET				
DATUM DATE		2012-05-24		DATUM DATE		DATUM DATE				