WELDING INSTRUCTION
SVETSINSTRUKTION
SCHWEISSANLEITUNG

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HITSAUS OPETUSTA
ИНСТРУКЦИЯ ПО СВАРКЕ

INSTRUCTION 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.

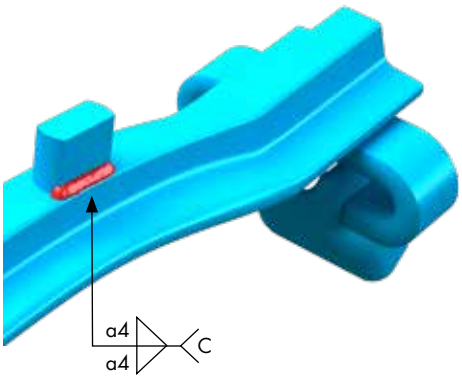
HOT CRACKS
Hot cracks/solidification cracks are accumulations of an alloying element and contaminants (carbon, sulphur and phosphorus), in the centre of the weld. Welding using a high amperage and a low welding speed can produce this type of cracking.

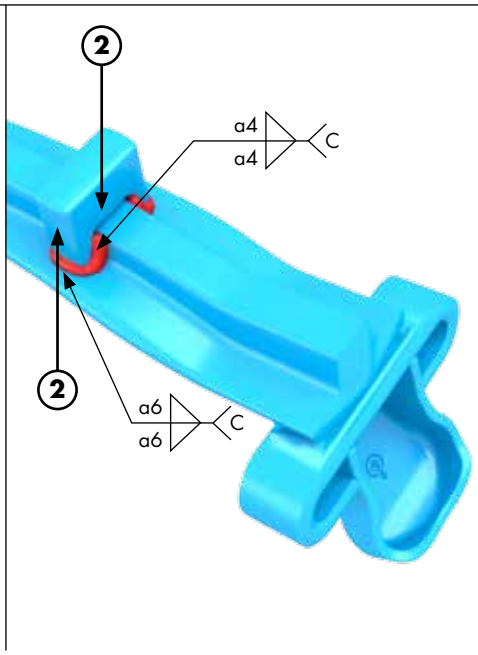
FATIGUE
Fatigue properties of a joint are improved by a smooth transition between the weld and the base material.

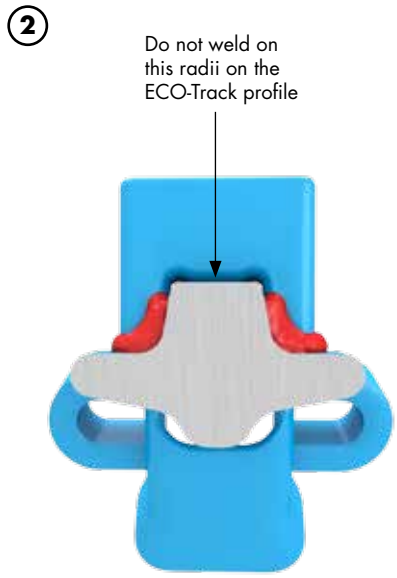
RECOMMENDATIONS
Extensive tests have been carried out at Olofsfors AB and we recommend that you follow the information below and attached weld data sheets for best results. In all cases, welding must only take place after snow, dirt and any rust has been removed from the material.

When welding cleats, 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 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

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

WELDING INSTRUCTION/SVETSINSTRUKTION

OlofsforsAB Svetsdatablad WPS Welding Procedure Specification			**STANDARD SVETSPROCEDUR** **WELDING PROCEDURE SPECIFICATION**								**WPS** **111PA01-03** REV: 01	
SVETSMETOD WELDING PROCESS			111		FOGUTFORMNING/ GROOVE DES.					SVETSFÖLJD/ WELDING SEQ.		
WPAR No			WPAR111PA01-00									
Inträngningsgodkännade Penetration approval			se svetsprover see welding tests									
GRUNDMATERIAL	BASE MATERIAL	MATERIALTYP MATERIAL TYPE OR GRADE	W03									
		TJOCKLEKSOMRÅDE TH. RANGE QUALIFIED	5 - 50mm									
		KOLEKVIVALENT Cew (IIW) CARBON EQUIVQLENT Cew										
TILLSATSMATERIAL	FILLER MATERIAL	FABRIKAT TRADE NAME	ESAB									
		BENÄMNING DIN / EN CODE	OK 48.00 EN 499: E 42 4 B 42 H5		POS		GILTIGHETSOMRÅDE RANGE OF POSITION QUA.			PA, PB		
		TORKNING AV ELEKTRODER DRYING OF ELEKTRODES	ENL. LEVERANTÖR ACC. SUPPLIER		FÖRVÄRMNING	PREHEAT	FÖRVÄRMNINGSTEMP. PREHEAT TEMP.			75° C 167° F		
		PULVER FLUX					MELLANSTRÅNGSTEMP. INTERPASS TEMP.			150-200° C 302-392° F		
		ROTSTOD BACKING					VÄRMNINGSMETOD APPL. METHOD			Acetylen/ Propan Acetylene/ Propane		
SKYDDSGAS	SHIELDING GAS	SKYDDSGAS TYPE OF SHIELDING					MÄTMETOD METHOD OF MEASUREMENT			Krita, termometer Chalk, thermometer		
		SAMMANSÄTTNING COMPOSITION										
		FLÖDE FLOW RATE			VÄRMEBEHANDLING	POST WELD HEAT TREATM.	VÄRMNING/KYLN. HAST. HEATING/COOLING RATE					
		ROTGAS GAS BACKING					HÅLLTEMPERATUR SOAKING TEMP.					
		FABRIKAT TRADE NAME					HÅLLTID SOAKING TIME					
TEKNIK	TECHNIQUE	STRÅNG, PENDLING STRING, WEAVE BEAD	STRÅNG STRING				VÄRMNINGSMETOD APPLICATION METHOD					
		RENGÖRINGSMETOD CLEANING METHOD	SLIP GRINDING									
		HÄFTNINGSMETOD FIT UP METHOD	SVETS WELDNING		Anmärkning/ remarks							
		ROTSIDANS BEHANDLING ROOT PREPARATION			Avlägsna snö, smuts och rost. Materialet måste vara helt torrt före svetsning. Svetsa ej på kortsida bredd. Motsvets för önskad inträngning: 5 - 10 grader Welder:					Remove snow, dirt and rust. The material must be completely dry before welding. Do not weld cleat on the short side Backhand welding for best deep penetration: 5-10 degree		
		ENKEL/DUBBELELEKTROD SINGLE/MULTIPLE ELECTRODE										
					NORM CODE							

STRÅNG BEAD	METOD PROC.	TILLSATSMATERIAL FILLER MATERIAL										
		StickOut mm	VARUNAMN TRADE NAME	DIAM.	AC DC	POL.	AMPERE MIN	 MAX	VOLT MIN	 MAX	CM/MIN TRAVEL SP.	STRÄCKENERGI 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	KUND CLIENT	MYNDIGHET
	DATUM DATE 2012-06-11	DATUM DATE	DATUM DATE

WELDING INSTRUCTION/SVETSINSTRUKTION

Ölofsfors AB Svetsdatablad WPS Welding Procedure Specification	STANDARD SVETSPROCEDUR WELDING PROCEDURE SPECIFICATION	WPS 111PA02-03

SVETSMETOD WELDING PROCESS			111	FOGUTFORMNING/ GROOVE DES.							SVETSFÖLJD/ WELDING SEQ.		
WPAR No			WPAR111PA02-00										
Inträngningsgodkännande Penetration approval			se svetsprover see welding tests										
GRUNDMATERIAL	BASE MATERIAL	MATERIALTYP MATERIAL TYPE OR GRADE	W03										
		TJOCKLEKSOMRÅDE TH. RANGE QUALIFIED	5 - 50mm										
		KOLEKVIVALENT Cew (IIW) CARBON EQUIVQUENT Cew											
TILLSATSMATERIAL	FILLER MATERIAL	FABRIKAT TRADE NAME	ESAB										
		BENÄMNING DIN / EN CODE	OK 67.45 EN 1600:E 18 8 Mn B 4 2	POS		GILTIGHETSOMRÅDE RANGE OF POSITION QUA.					PA, PB		
		TORKNING AV ELEKTRODER DRYING OF ELEKTRODES	ENL. LEVERANTÖR ACC. SUPPLIER	FÖRVÄRMNING	PREHEAT	FÖRVÄRMNINGS TEMP. PREHEAT TEMP.					Min. 20 °C Min. 68 °F		
		PULVER FLUX				MELLANSTRÅNGSTEMP. INTERPASS TEMP.					150-200° C 302-392° F		
		ROTSTÖD BACKING				VÄRMNINGSMETOD APPL. METHOD					Acetylen/Propan Acetylene/Propane		
SKYDDSGAS	SHIELDING GAS	SKYDDSGAS TYPE OF SHIELDING				MÄTMETOD METHOD OF MEASUREMENT					Krita, termometer Chalk, thermometer		
		SAMMANSÄTTNING COMPOSITION											
		FLÖDE FLOW RATE		VÄRMEBEHANDLING	POST WELD HEAT TREATM.	VÄRMNING/KYLN. HAST. HEATING/COOLING RATE							
		ROTGAS GAS BACKING				HÅLLTEMPERATUR SOAKING TEMP.							
		FABRIKAT TRADE NAME				HÅLLTID SOAKING TIME							
TEKNIK	TECHNIQUE	STRÅNG, PENDLING STRING, WEAVE BEAD	STRÅNG STRING			VÄRMNINGS METOD APPLICATION METHOD							
		RENGÖRINGSMETOD CLEANING METHOD	SLIP GRINDING										
		HÄFTNINGSMETOD FIT UP METHOD	SVETS WELDING	Anmärkning/ remarks									
		ROTSIDANS BEHANDLING ROOT PREPARATION		Avlägsna snö, smuts och rost.							Remove snow, dirt and rust.		
		ENKEL/DUBBELELEKTROD SINGLE/MULTIPLE ELECTRODE		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 inträngning: 5 - 10 grader							Backhand welding for best deep penetration: 5-10 degree		
				NORM CODE									

STRÅNG BEAD	METOD PROC.	TILLSATSMATERIAL FILLER MATERIAL					AMPERE		VOLT		CM/MIN	
		StickOut mm	VARUNAMN TRADENAME	DIAM.	AC DC	POL.	MIN	MAX	MIN	MAX	TRAVELSP.	STRÄCKENERGI HEATINPUT
1 - 4	111		OK 67.45	3,2	DC	(+)	90	100	22	25	11 - 14	1.0

GODKÄNNANDE APPROVALS	ÖLOFSFORS	KUND CLIENT	MYNDIGHET
	DATUM DATE 2012-05-24	DATUM DATE	DATUM DATE

WELDING INSTRUCTION/SVETSINSTRUKTION

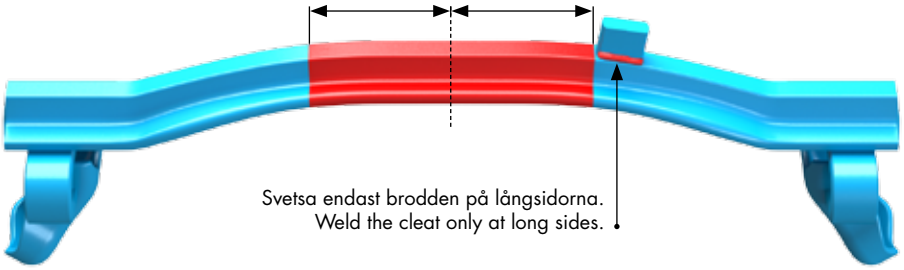
OlofsforsAB Svetsdatablad WPS Welding Procedure Specification			STANDARD SVETSPROCEDUR WELDING PROCEDURE SPECIFICATION								WPS 135PA04-03 REV: 01		
SVETSMETOD WELDING PROCESS			135	FOGUTFORMNING/ GROOVE DES.							SVETSFÖLJD/ WELDING SEQ.		
WPAR No			WPAR135PA04-00										
Inträngningsgodkännade Penetration approval			se svetsprover see welding tests										
GRUNDMATERIAL	BASE MATERIAL	MATERIALTYP MATERIAL TYPE OR GRADE	W03										
		TJOCKLEKSOMRÅDE TH. RANGE QUALIFIED	5 - 50mm										
		KOLEKVIVALENT Ceq (IIW) CARBON EQUIVOLENT Ceq											
TILLSATSMATERIAL	FILLER MATERIAL	FABRIKAT TRADE NAME	ESAB										
		BENÄMNING DIN / EN CODE	AUTOROD 12.50/51 EN 440: G 42 3 M G3Si1	POS		GILTIGHETSOMRÅDE RANGE OF POSITION QUA.					PA, PB		
		TORKNING AV ELEKTRODER DRYING OF ELEKTRODES	ENL. LEVERANTÖR ACC. SUPPLIER	FÖRVÄRMNING	PREHEAT	FÖRVÄRMNINGS TEMP. PREHEAT TEMP.					50° C 122° F		
		PULVER FLUX				MELLANSTRÄNGSTEMP. INTERPASS TEMP.					150-200° C 302-392° F		
		ROTSTÖD BACKING				VÄRMNINGSMETOD APPL. METHOD					Acetylen/ Propan Acetylene/ Propane		
SKYDDSGAS	SHIELDING GAS	SKYDDSGAS TYPE OF SHIELDING	ATAL			MÄTMETOD METHOD OF MEASUREMENT					Krita, termometer Chalk, thermometer		
		SAMMANSÄTTNING COMPOSITION	Ar + 18% CO2										
		FLÖDE FLOW RATE	16 - 22 L/min	VÄRMEBEHANDLING	POST WELD HEAT TREATM.	VÄRMNING/KYLN. HAST. HEATING/COOLING RATE							
		ROTGAS GAS BACKING				HÅLLTEMPERATUR SOAKING TEMP.							
		FABRIKAT TRADE NAME	AirLiquid			HÅLLTID SOAKING TIME							
TEKNIK	TECHNIQUE	STRÄNG, PENDLING STRING, WEAVE BEAD	STRÄNG STRING			VÄRMNINGSMETOD APPLICATION METHOD							
		RENGÖRINGSMETOD CLEANING METHOD	SLIP GRINDING										
		HÄFTNINGSMETOD FIT UP METHOD	SVETS WELDING	Anmärkning/ remarks									
		ROTSIDANS BEHANDLING ROOT PREPARATION		Avlägsna snö, smuts och rost. Materialet måste vara helt torrt före svetsning. Svetsa ej på kortsida bredd.							Remove snow, dirt and rust. The material must be completely dry before welding. Do not weld cleat on the short side		
		ENKEL/DUBBELELEKTROD SINGLE/MULTIPLE ELECTRODE		Welder:									
				NORM CODE									

STRÄNG BEAD	METOD PROC.	TILLSATSMATERIAL FILLER MATERIAL										
		StickOut mm	VARUNAMN TRADENAME	DIAM.	AC DC	POL.	AMPERE MIN	AMPERE MAX	VOLT MIN	VOLT MAX	CM/MIN TRAVELSP.	STRÄCKENERGI 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

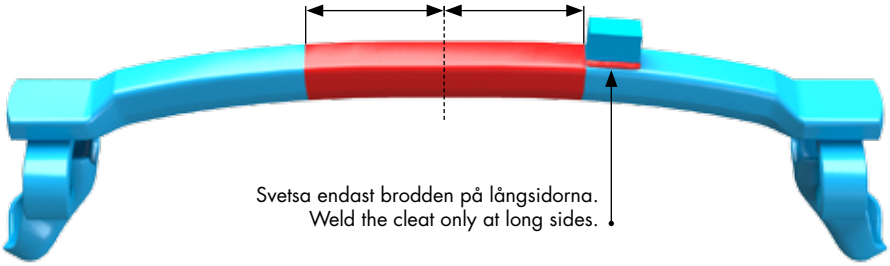
GODKÄNNANDE APPROVALS	OLOFSFORS	KUND CLIENT	MYNDIGHET
	DATUM DATE 2012-05-24	DATUM DATE	DATUM DATE

OBS! I det markerade området får inte broddar svetsas.
Note! Don't weld cleat in the marked area.

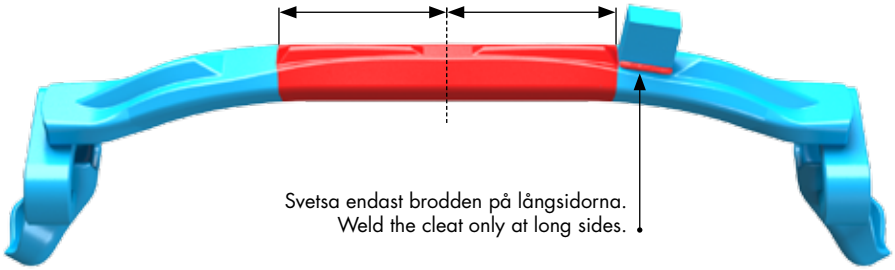
ECO-TRACK
Rekommenderad brodd
Recommended cleat
Art.nr 022-415720
Art.nr 022-483155



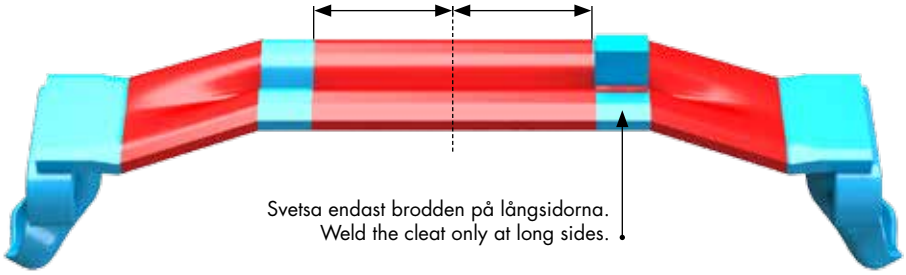
OF/MAX
Rekommenderad brodd
Recommended cleat
Art.nr 022-488200



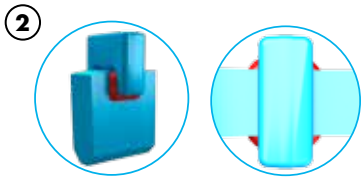
EVO/EVO-M
Rekommenderad brodd
Recommended cleat
Art.nr 022-488205
Småband
Small tracks
Art.nr 022-488200

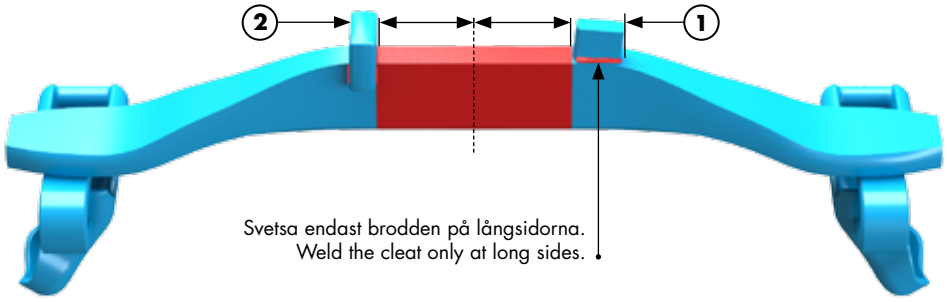


BALTIC/MAGNUM
Rekommenderad brodd
Recommended cleat
Art.nr 022-488205



EX
Rekommenderad brodd, två alternativ
Recommended cleat, two options
Art.nr 022-415720 (1)
Art.nr 022-483156 (2)





KOVAX
Rekommenderad brodd
Recommended cleat
Art.nr 022-488205