

# WELDING PROCEDURE FOR MAKO™ AND BLUE POINTER™ WELD-ON PARTS

SHARK™ GROUND ENGAGING TOOLS

## 1.0. INTRODUCTION

This report details the recommended procedure to be followed when welding Cast Corner and Boss parts of the MAKO™ and BLUE POINTER™ products to a Bucket Lip.

For all welding requirements and parameters, please refer to General Welding Procedure for SHARK™ Ground Engaging Tools (G.E.T) PWP0001.

## 2.0. PREPARATIONS

All joint edges prepared for welding shall exhibit a bright metal finish, free of surface oxide or any other material that may impede weld quality and crack sensitivity

The use of Deoxaluminite coatings to weld joints following grinding to bright metal is not permitted unless it is specifically demonstrated the use of these coatings does not impeded weld quality of Heat Assisted Cold Cracking (HACC) potential.

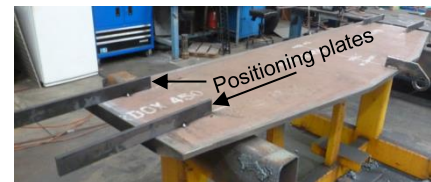


## 3.0. ASSEMBLY AIDS / GUIDE PLATES

Material certification shall be available for all material used as assembly aids and guide plates. The material shall be plain carbon steel not exceeding 350 MPa yield strength.

The use of guide plates / assembly aids is recommended to ensure accurate alignment of weld joints before tack welding. Weld joint geometry shall not exceed the following.

1. Misalignment at weld joints shall not exceed 3.2 mm (1/8").
2. Butt weld root gaps shall not exceed 5 mm (5/32").
3. Butt weld bevel angles supplied on SHARK™ Ground Engaging Tools (G.E.T.) products shall not be altered.
4. Fillet weld root gaps shall not exceed 1.6 mm (1/16"). Where this cannot be complied with, fillet leg length as specified on construction drawings shall be increased by the gap dimension.



Assembly aids and guide plates shall be tack welded under appropriate preheat conditions using welding consumables controlled for production. Upon removal, all tack welds shall be ground flush to the base material surface. Any weld repair needed at these locations shall be performed under the welding conditions in this document. Sandvik Mining and Rock Technology may at their discretion request surface non-destructive testing at these tack weld locations.

#### 4.0. PRE-HEAT/ INTERPASS/ WELDING COOLING

Material	Target Pre-heat temperature °C	Max Inter-pass temperature °C
Sandvik Shark cast corner and boss parts	160-190	230
Lip plate (ASTM A514 Steels)	As per the manufacturer's recommendation	As per the manufacturer's recommendation

Refer to Weld Procedure PWP0001 for more details.

#### 5.0. WELD JOINT TACK WELDING

Tack welds within weld joints shall use welding consumables controlled for production and a minimum localized preheat (refer to Section 4.0). Tack welds within weld joints shall be a minimum 25 mm (1") in length.

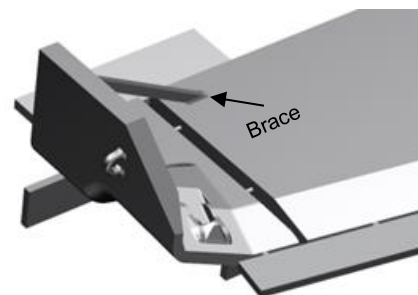
A tack weld that exhibits cracking shall be fully removed and re-welded using appropriate preheat and the length increased to 50 mm (2") minimum.

Tack welds shall NOT remain in completed weld deposits. All tack welds shall be progressively removed during welding the initial weld pass.

#### 6.0. TEMPORARY BRACE PLATES

Material certification shall be available for all material used as temporary bracing. The material shall be plain carbon steel not exceeding 350 MPa yield strength. The brace plates used to maintain joint stability during welding shall be of adequate thickness and dimension to prevent bending during welding activities.

The brace plates shall be located to permit access for welding without restriction. Tack welding of brace plates shall follow the recommendations provided in section 4.0. Tack welds attaching brace plates may require increased length and size to avoid cracking during welding operations.



**NOTE:**

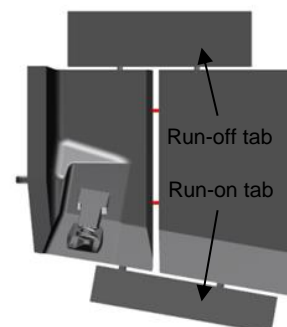
The use of brace plates increases residual stresses at welded joints. This may increase the risk of HACC. The welding Contractor shall consider balanced welding techniques where practicable to reduce the need for heavy brace plates.

The removal of brace plates requires care as damage to SHARK™ G.E.T product surfaces shall be avoided. Any weld repair needed at these locations shall be performed under the welding conditions in this document. Sandvik may at their discretion request surface non-destructive testing at these tack weld locations.

#### 7.0. RUN ON / OFF TABS

Butt welded joints shall incorporate run on/off tabs to avoid stacking of weld stop starts within the final weld joint. Material certification shall be available for all material used as run-on / off tabs. The material shall be plain carbon steel not exceeding 350 MPa yield strength.

The orientation of run on / off tabs shall match the bevel geometry and extend beyond the surface of the weld joint. The length of the run off tabs shall be proportional to the thickness welded to ensure weld starts and weld crater terminations are 100% within the run on / off tab region.



Run on / off tabs shall be removed from final weld deposit extremities prior to allowing welding to cool to ambient conditions. Removal processes may be arc air gouging and / or grinding only. The use of oxygen / fuel cutting equipment to remove run on / off tabs is not permitted. Following removal of run on / off tabs, the weld end shall be ground to the surrounding base material profile.

## 8.0. WELDING

Following visual inspection to assembled joints verifying compliance to this document requirement, welding shall be completed in accordance with SHARK™ G.E.T. Construction drawings using specified consumables, equipment and variables described in this document and only be performed at a temperature range specified in Section 4.0. For further information, please refer to Product Welding Procedure - PWP0001.

## 9.0. BACK-GOUGING

All welds completed from both sides shall be back-gouged and or ground to bright metal before welding commenced. Thermal back-gouging may only be performed using the arc / air process. Oxygen / fuel or plasma gouging methods are not permitted.

All back gouging activities shall be performed under the minimum preheat condition including grind only methods. This is to ensure low crack sensitivity at the root region of back-gouged welds. Visual inspection to the weld region following back-gouging is required to ensure a freedom from visible welding discontinuities.



Following grinding to bright metal and visual inspection acceptance, back gouged welds shall not be allowed to cool to ambient temperatures, and shall be immediately welded until a minimum 30% fill stage at the second side welded is attained or 100% weld completed before cooling to ambient. Refer to Product Welding Procedure- PWP0001, for Sandvik recommended 'Cooling Conditions.'

## 10.0. WELD FINISHING

Completed welds shall be held at the minimum inter-run temperature until run on/off tabs have been removed, weld end profiles established and the welds visually inspected for surface imperfections. Once completed, welds may be cooled to ambient conditions. Refer to Product Welding Procedure- PWP0001, for Sandvik recommended 'Cooling Conditions.'

Following cooling, final weld blending may be performed at weld toes and as necessary to provide required outcomes and ensure correct fitment of SHARK™ G.E.T. products fitted to welded bosses, etc.

Weld deposits shall be free of slag, gross surface imperfections or roughness, and free of spatter to facilitate non-destructive testing operations.



## 11.0. WELD INSPECTION

Visual inspection to complete welds may be assessed following cooling to ambient temperature. It is recommended a repeated visual inspection is performed after 24 hours delay following cooling to ambient temperature.

Fillet welds shall be the leg length specified in our G.E.T drawings and butt weld cap passes above surrounding base material surfaces or ground flush where our G.E.T drawings specify. The surfaces of all welds shall be free of cracks, weld pass termination craters, gross porosity and slag inclusions. The weld toe and base material interface shall not be severely notched and undercuts shall not exceed 0.5 mm (0.02"). Weld toe blending may be necessary to achieve this requirement.

Non-destructive Evaluation (NDE) activities shall not be performed any sooner than 24 hours following welds cooling to ambient conditions. For highly restrained welds in thicker sections or any other welded condition judged a HACC risk, Sandvik may at their discretion a minimum delay of 48 hours for NDE.

NDE may consist of Magnetic Particle Testing (MT) at weld surfaces and Ultrasonic Testing (UT) for butt weld volumetric defects assessment. NDE also consist of weld inspection using Sandvik supplied profile gauges. Sandvik will specify the NDE methodology and extent required as per the construction drawings and additional NDE determined necessary to establish weld integrity and serviceability. Where NDE methods in addition to visual inspection are applied, the acceptance criteria for welds shall satisfy AS/NZS: 1554 Part 4 – SP criteria of AWS D1.1 cyclically loaded connections.

### 12.0. WELD REPAIR

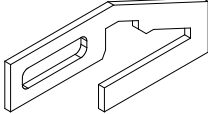

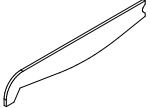
Weld defects requiring weld repair identified by visual inspection or NDE activities shall be brought to the attention of Sandvik Mining and Rock Technology. Welding repair methodologies shall be agreed between the welding Contractor and Sandvik. Weld repair NDE assessment and delay period will be at Sandvik discretion and determined on a case by case basis.

### 13.0. ANNEXURE

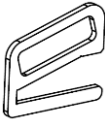

#### 13.1. BOSS SETUP AND LIP PROFILE DRAWINGS

Description	Drawing
50mm Lip-BP2	MD0007
50mm Lip-MAKO™	BU00037748
32mm Lip-BP2	MD0032

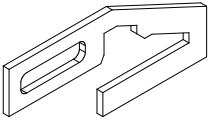
#### 13.2. GAUGES FOR 50mm LIP BLUE POINTER™ SERIES

Description	Serial Number	Image
Boss Setup Gauge	MG0002	
Boss Weld Fillet Gauge	MG0003	
Cast Corner Repair Gauge	MG0011	

#### 13.3. GAUGES FOR 50mm LIP MAKO™

Lip Profile Gauge	SGM50-LP	
Boss Weld Fillet Gauge	SGM50-BW	

#### 13.4. GAUGES FOR 32mm LIP BLUE POINTER™

Boss Setup Gauge	MG0006	
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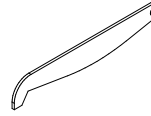
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Boss Weld Fillet Gauge      MG0007



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Cast Corner Repair Gauge      MG0017



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Cast Corner Wear Gauge      MG0016



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### 13.5. BOSS WELD LAYOUT

Description	Document
BLUE POINTER™	WPS: SS-006
MAKO™	WPS: SS-012



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#### 14.0. REVISION NOTES

Rev #	Notes	Prepared By	Checked By	Approved By	Date
0	Initial release.	J. Jose	Weld Consultant	B.Dallard	14.03.2017
1	Format changed to new Sandvik Technical Procedure template	J.Jose	B.Dallard, D.Köhler	R.Schmitz	24.11.2017
2	SHARK™ and MAKO™ trademarks added.	J.Jose	D.Köhler	R.Schmitz	15.03.2017
3	Added Section 4.0, revised references.	R.Lauchlan		M.Javadi	13.09.2023

