

# Welding Procedure Qualification Record (WPQR)



## Recognized third party body

Manufacturer's WPQR 2-141-51-10-60-BW		Comm No. 216-26393
Manufacturer's pWPS No. EN 129		
Manufacturer Twinweld Sweden AB		
Address Folkets husvägen 52, 840 10 LJUNGAVERK, Sweden		
Direction SS-EN ISO 15614-5:2004, Norsok M 601 Rev 5, SS-EN 13445		AFS 2016:1 PED
Date of welding 2011-11-28		

## Cover range

Welding process 141				<input checked="" type="checkbox"/> Manual	<input type="checkbox"/> Partly mechanized	<input type="checkbox"/> Fully mechanized	<input type="checkbox"/> Automatic
Joint type BW, ss nb, ss mb, bs ng, bs gg and FW					Single run - Multi run Multi run		
Mode of metal transfer							
Parent material ASTM B348-05 Gr 2 see chapter 8.3.1.2 in SS-EN ISO 15614-5:2004							
Parent material thickness, mm BW: 3,0-20,0 FW: 3,0-20,0							
Weld metal thickness, mm							
Outside pipe diameter, mm ≥30		Type of welding current and polarity Root run: DC-. Filler: DC- & DC- puls			Throat thickness, mm 7,5-15,0		
Filler material				Designation AWS A5.16 ERTi-2			
Designation of shielding gas - flux SS-EN ISO 14175:11							
Welding positions All, vertical down excluded.							
Post-heating				Post-weld heat treatment			
Preheat temperature, °C		Interpass temperature, °C 150			Heat input, KJ/mm See record of weld test.		
Other information The designation of the manufacturer's WPQR 11-129, has been renamed to 2-141-51-10-60-BW. Manufacturer's name and address has been changed.							

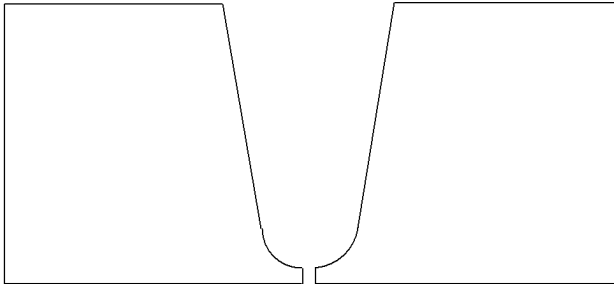
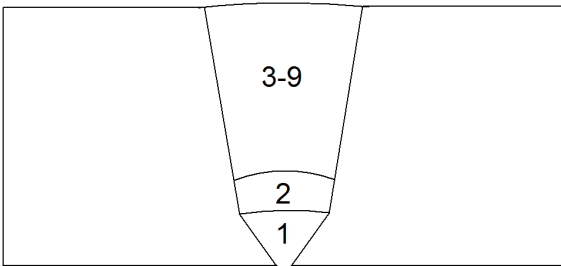
Certified that test welds prepared, welded and tested satisfactorily in accordance with the requirements of the code/testing standard indicated above.

Date of issue 2016-12-02	Recognized third party body FORCE Technology Sweden AB
Location Borlänge	Name and signature Åke Moen

# Record of weld test



1183  
ISO/IEC 17020 (A)

Location <b>Ljungaverk</b>	Comm No. <b>216-26393</b>	
Manufacturer's pWPS No. <b>EN 129</b>	Method for preparation and cleaning <b>Machining, brushing</b>	
WPQR No. <b>2-141-51-10-60-BW</b>		
Manufacturer <b>Twinweld Sweden AB</b>	Parent material spec. <b>ASTM B348-05 Gr 2</b>	
Welder's name <b>Arne Näckstrand</b>		
Welding method <b>141</b>	Parent material thickness A, mm <b>10</b>	Parent material thickness B, mm <b>10</b>
Joint type <b>BW, ss nb</b>	Outside pipe diameter, mm <b>60</b>	
Mode of metal transfer	Welding position <b>H-L045</b>	
<b>Joint design</b>	<b>Welding sequences</b>	
		
Preheat temperature, °C <b>20</b>	Interpass temperature, °C <b>150</b>	
Tungsten electrode: Type, size, mm <b>WTh 20 Ø 3,2</b>	Tungsten electrode: Grinding angle °	
Gas nozzle, mm	Torch angle °	
Weaving (maximum width of run)	Oscillation: Amplitude, frequency, weld time	
Pulse welding details <b>Run 8-9 Puls 50% 1,5 Sek</b>	Plasma welding details	
Post-weld heat treatment method	Post-heating	
Time, temperature	Heating rate	Cooling rate
Back gouging - backing, details	Special baking or drying	
Auxiliary Heat input is calculated with thermal efficiency $k=0,6$ , according to EN 1011-1.		

Manufacturer <b>Twinweld Sweden AB</b>	Weld controller <b>FORCE Technology Sweden AB</b>	Recognized third party body <b>FORCE Technology Sweden AB</b>
Name, date, signature <b>2016-12-20 Pontus Björk</b>	Name, date, signature <b>2016-12-02 Andreas Holfve</b>	Name, date, signature <b>2016-12-02 Åke Moen</b>

# Record of weld test



1183  
ISO/IEC 17020 (A)

Location Ljungaverk	Manufacturer's pWPS No. EN 129
Comm No. 216-26393	WPQR No. 2-141-51-10-60-BW

### Welding details consumable

Run	Method	Filler material	Diameter	Designation	Shielding gas/flux	Backshielding gas
1	141	BAOJI Titanium	1,6	AWS A5.16 ERTi-2	SS-EN ISO 14175:I1	SS-EN ISO 14175:I1
2	141	BAOJI Titanium	2,4	AWS A5.16 ERTi-2	SS-EN ISO 14175:I1	SS-EN ISO 14175:I1
3-9	141	BAOJI Titanium	3	AWS A5.16 ERTi-2	SS-EN ISO 14175:I1	SS-EN ISO 14175:I1

### Welding details individual runs

Run	Method	Type of Current Polarity	Distance contact tube/work piece (mm)	Current (A)	Wire feed speed (m/min)	Voltage (V)	Travel speed (mm/min)	Heat input (KJ/mm)	Shielding Gas flow (l/min)	Backshielding Gas flow (l/min)
1	141	DC-	-	111		12	120	0,4	10	12
2	141	DC-	-	132		12	167	0,3	10	12
3	141	DC-	-	162		12	134	0,5	10	12
4	141	DC-	-	162		12	134	0,5	10	12
5	141	DC-	-	162		12	134	0,5	10	12
6	141	DC-	-	162		12	134	0,5	10	12
7	141	DC-	-	162		12	134	0,5	10	12
8	141	DC- puls	-	123		13	123	0,5	10	12
9	141	DC- puls	-	123		13	123	0,5	10	12

Manufacturer Twinweld Sweden AB	Weld controller FORCE Technology Sweden AB	Recognized third party body FORCE Technology Sweden AB
Name, date, signature 2016-12-20 Pontus Björk	Name, date, signature 2016-12-02 Andreas Holfve	Name, date, signature 2016-12-02 Åke Moen

Tillverkarens WPQR nr: Manufacturer's WPQR No:	11-129	Granskande organ: Examining body:	Inspecta Sweden AB
Tillverkare: Manufacturer:	Permascand AB		
Adress: Address:	Box 42 840 10 Ljungaverk		
Produkt-/Provingsstandard: Code/testing standard:	EN ISO 15614-5:2004 Norsok M-601, rev.5	Directice	97/23 EC
Datum för svetsning: Date of welding:	2011-11-28	Referens nr: Reference No:	S-0505

#### Giltighetsområde/Range of qualification

Svetsmetod: Welding process:	141		
Förbandstyp och svetstyp: Type of joint and weld:	BW, FW, BC $\geq$ 60°		
Grupp(er) och undergrupp(er) för grundmaterial: Parent material group(s) and subgroup(s):	51-51		
Grundmaterialets tjocklek (mm): Parent material thickness (mm):	3,0-20,0		
Svetsgodstjocklek (mm): Weld metal thickness (mm):	3,0-20,0		
a-mått (mm): Throat thickness (mm):	No restriction		
Enkelsträng/Flersträng: Single run/multi run:	Multi run		
Ytterdiameter rör (mm): Outside pipe diameter (mm):	$\geq$ 30,0		
Beteckning tillsatsmaterial: Filler material designation:	AWS A.516 ERTi-2		
Fabrikat tillsatsmaterial: Filler material make:	All		
Beteckning skyddsgas/pulver: Designation of shielding gas/flux:	EN 14175 II Argon	Beteckning rotskyddsgas: Designation of backing gas:	EN 14175 II Argon
Diameter tillsatsmaterial (mm): Filler material size (mm):	No restriction	Typ av ström och polaritet: Type of welding current and polarity:	DC-
Svetslägen: Welding positions:	PA,PB,PC,PD,PE,PF,H-L045	Värmetillförsel (kJ/mm): Heat input (kJ/mm):	See welding details
Förhöjd arbetstemperatur (°C): Preheat temperature (°C):	$\geq$ 20	Sätt för droppövergång: Mode of metal transfer:	--
Väteutdrivning: Post-heating:	--	Mellansträngstemperatur (°C): Interpass temperature (°C):	$\leq$ 150
Värmebehandling efter svetsning: Post-weld heat-treatment:	--		

#### Annan upplysning/Other information

\*+/-15% according to Norsok M-601

x Detta dokument är utfärdat av Inspecta Sweden AB som anmält organ (nr 0409) för AFS 1999:4 (PED)  
This document is issued by Inspecta Sweden AB Notified body (No. 0409) for AFS 1999:4 (PED).

Härmed intygas att provsvetsar bereddes, svetsades och provades med tillfredsställande resultat enligt fordringarna i ovan angiven produktstandard/provingsstandard.

Certified that test welds prepared, welded and tested satisfactorily in accordance with the requirements of the code/testing standard indicated above.

Plats: Location:	Utskriftsdatum: Date of issue:
Sundsvall	2011-12-07

Namn och namnteckning:  
Name and signature:

Kurt Engström /

**Inspecta**

Tillverkare: Permascand AB  
Manufacturer:

Plats: Ljungaverk  
Location:

Svetsarens namn: Arne Näckstrand  
Welder's name:

Tillverkarens pWPS nr: EN 129  
Manufacturer's pWPS No:

Tillverkarens WPQR nr: 11-129  
Manufacturer's WPQR No:

Sätt för droppövergång: --  
Mode of metal transfer:

Förbandstyp och svetstyp: BW  
Type of joint and weld:

Granskande organ: Inspecta Sweden AB  
Examining body:

Sätt för fogberedning och rengöring: Brusch / Wash  
Method of preparation and cleaning:

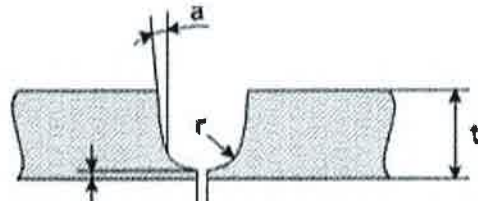

Specifikation för grundmaterialet: Gr2 (51.1)  
Parent material specification:  
Heat no: F00257G21

Materialjocklek (mm): 10  
Material thickness (mm):

Ytterdiameter (mm): 60  
Outside diameter (mm):

Svetsläge: H-L045  
Welding position:

### Fogberedning (skiss)/Weld preparation details (sketch)

<p>Fogutformning: Joint design:</p> 	<p>Svetsföljder: Welding sequences:</p> 
---	--

Svetsdata/ Welding details  Svetsdata redovisas/fortsätter på bilaga/ Welding details is displayed/continues on separate enclosure

Sträng Run	Svetsmetod Welding process	Tillsatsmaterial- diameter Size of filler material (mm)	Ström Current (A)	Spänning Voltage (V)	Strömtyp/ Polaritet Type of current/polarity	Trådmatnings- hastighet Wire feed speed (m/min)	Framförings- hastighet Travel speed (mm/min)	Värmetillförsel Heat input (kJ/mm)	Droppövergång (metod 13X) Metal transfer (method 13X)
1	141	1,6	111	12	DC-		120	*0,4	
2	141	2,4	132	12	DC-		167	*0,3	
3-7	141	3,0	162	12	DC-		134	*0,52	
8-9	141	3,0	123	13	DC-		123	*0,47	

Tillsatsmaterial, beteckning & fabrikat: AWS A5.16 ERTi-1 / BAOJI TITANIUM INDUSTRI Titanium wire. Heat no: 20030907  
Filler material designation and make:

Termisk verkningsgrad: 0,6  
Thermal efficiency:

Särskild värmning eller torkning:  
Any special baking or drying:

Skyddsgas/pulver: toppsidan: EN 14175 I1 Argon  
Gas/Flux: shielding:

rotsidan: EN 14175 I1 Argon  
backing:

Gasflöde (l/min): toppsidan: 10  
Gas flow Rate (l/min): shielding:

rotsidan: 12  
backing:

Wolframelektrod typ/dimension (mm): WTh 20 3,2 mm  
Tungsten electrode Type/size (mm):

Rotmejsling/rotstöd, detaljer:  
Details of back gouging/backing:

Värmebehandling efter svetsning: Ja/Yes  Nej/No X  
Post-weld heat treatment:

Tid, temperatur, metod:  
Time, temperature, method:

Uppvärmnings- och  
svalningshastigheter:  
Heating and cooling rates:

Annat information:  
Other information:

Tillverkare: Namn, datum och namnteckning:  
Manufacturer: Name, date and signature:

Granskande organ: Namn, datum och namnteckning:  
Examining body: Name, date and signature:

  
Inspecta Kurt Engström 2011-12-08,

## PROVNINGSRESULTAT Test results

Tillverkarens WPQR nr: 11-129  
Manufacturer's WPQR No:

Granskande organ:  
Examining body:

Inspecta Sweden AB

Visuell kontroll: Approved  
Visual:

Referens nr: S-0505  
Reference No:

Penetrant: Approved  
Penetrant:

Radiografisk provning: Approved  
Radiography:

Magnetpulverprovning: --  
Magnetic particle:

Ultraljudprovning: --  
Ultrasonic:

Dragprovning Temperatur: +20  
Tensile tests EN ISO 6892-1 Temperature:

Typ/nr Type/No	R (N/mm <sup>2</sup> )	Rm (N/mm <sup>2</sup> )	A (%)	Z (%)	Brottställe Fracture location	Anmärkning Remarks
Fordran Requirement		min 345				
1 C111588		517			Weld metal	Approved
2 C111588		556			Weld metal	Approved

Bockprovning Dorrdiameter: 40  
Bend tests ISO 5173 Former diameter:

Typ/nr Type/No	Bockningsvinkel (°) Bend angle (°)	Förlängning (%) Elongation (%)	Resultat Results	Makroudersökning: Macroscopic examination:
TFBB	180		Approved	Approved Mikroudersökning: Microscopic examination: --
TRBB	180		Approved	
TFBB	180		Approved	
TRBB	180		Approved	

Slagprovning Typ: Storlek: 7,5x10 Fordran [Joule]: 23  
Impact test ISO 9016 Type: Size: Requirement:

Anvisningens läge/riktning Notch location/direction	Temp. [°C]	Värden [Joule] / Values [Joule]			Medelvärde [Joule] Average value [Joule]	Anmärkning Remarks
		1	2	3		
1 VWT 0/1	+20	90	72	76	79	Approved
2 VHT 1/1	+20	64	56	70	63	Approved

Hårdhetsprovning (typ/provkraft): HV 10  
Hardness test (type/load): EN ISO 9015-1

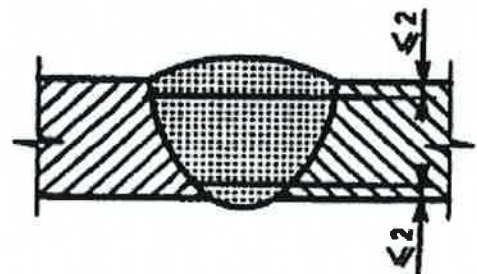
Mätpunkternas lägen (skiss):  
Location of measurements (sketch):

Fordran:  
Requirement:

Grundmaterial: 190-215  
Parent metal:

Värmepåverkad zon: 186-208  
HAZ:

Svetsgods: 173-210  
Weld metal:



Andra provningar:  
Other tests:

Anmärkningar:  
Remarks:

Laboratorierapport referensnr: C111588  
Laboratory report reference No.:

Proven utförda enligt fordringar i: EN ISO 15614-5:2004 Norsok M-601, rev.5 Directive 97 / 23 EC  
Tests carried out in acc with requirements of:

Provningsresultaten var:  Godkända  
Test results were:  Acceptable

Ej godkända  
Not acceptable

Proven utförda i närvaro av: Namn och namnteckning:  
Tests carried out in the presence of: Name and signature:

Granskande organ: Namn, datum och namnteckning:  
Examining body: Name, date and signature:

Inspectas provningslaboratorium Andrés Högberg

*Kurt Engström* Inspecta  
Inspecta Kurt Engström 2011-12-07,



Uppdragsgivare-Client: Permascand AB Box 42 840 10 Ljungaverk		Tekniska krav-Technical requirements: EN ISO 15614-5:2004 Directive 97/23EC Norsok M-601, rev.5	
Er referens-Your reference: Jimmy Wahlsten		Vår referens-Our reference: Andreas Högberg	
Produktspecifikation-Object: Fyra stumsvetsade rör, Ø60 x 10mm Four butt welded pipes, Ø60 x 10mm		Grundmaterial-Parent metal: Titan grade 2	Smälta-Heat#: F00257G21
Svetsprocedurn-WPS No (preliminär-preliminary): EN 129	Utgåva-Issue: -	Svetsare-Welder: Arne Näckstrand	
Svetsmetod-Welding method: 141	Svetsläge-Welding position: H-L045	Tillsatsmaterial-Filler metal: ERTi-2	
Värmebehandlad-Heat treated: Nej/No		Svetsövervakare-Weld inspector: Kurt Engström, Inspecta Sweden AB	
Inkom-Arrived: 2011-11-28		Märkning-Marking: pWPS#	
Innehåll-Contents:			
Dragprovning-Tensile test:		sida-page 2	
Bockprovning-Bend test:		sida-page 2	
Slagprovning-Impact test:		+20°C	sida-page 3
Hårdhetsprovning-Hardness test:		sida-page 3	
Makro-mikroundersökning-Macro-micro examination:		bilaga-appendix 1	
Radiografiskprovning-Radiographic examination:		bilaga-appendix 2	
Penetrantprovning-Dye penetrant examination:		bilaga-appendix 3	
Övriga uppgifter-Other informations: -			
Provningsresultat-Test results:			
<input checked="" type="checkbox"/> Godkänd-Acceptable		<input type="checkbox"/> Underkänd-Not acceptable	
Handläggare-Handled by:  Andreas Högberg/	Inspecta	Kontrollerad av-Controlled by:  Dan Mattsson/	Inspecta
<b>Inspecta Sweden AB</b>			
Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.			
Provningsresultaten i denna rapport gäller enbart för det provade objektet.- The test results in this report apply only to the tested object.			
Den rapporterade osäkerheten är baserad på en standardosäkerhet multiplicerad med en täckningsfaktor k=2, vilket ger en konfidensnivå på ungefär 95%. Mätosäkerhetsberäkningarna är utförda i enlighet med EA-4/16:2003. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation was carried out in accordance with EA-4/16:2003.			
Postadress & Besöksadress Postal address & Visiting address	Neongatan 4 B SE-431 53 Mölndal, Sweden	Telefon Telephone	+46 (0)8 5011 3400
		Fax	+46 (0)8 5011 3401

### DRAGPROVNING-TENSILE TEST

Provning enligt-Test according to: <b>EN ISO 6892-1</b>				Provstav enligt-Specimen according to: <b>EN ISO 4136</b>				Datum-Date: <b>2011-12-06</b>					
Pos # Item #	Prov nr. Test No.	T °C	b / D mm	a mm	S <sub>0</sub> mm <sup>2</sup>	R <sub>eL</sub> N/mm <sup>2</sup>	R <sub>eH</sub> N/mm <sup>2</sup>	R <sub>p0,2</sub> N/mm <sup>2</sup>	R <sub>p1,0</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %	Z %	Anm. Remarks
1	2	3	4	5	6	7		8		9	10	11	12
Krav Requirements					min max					345			
1	C111588	+20	12,3	9,94				402	444	517			
2	C111588	+20	12,3	9,92				397	451	556			
Mätosäkerhet-Uncertainty								±2,7	±2,7	±2,7			

Anmärkningar-Remarks:  
**Brott i svetsgods-Fracture in weld metal**

Förklaringar-Explanations:  
 3. Provnings temperatur-Test temperature  
 4. Provstavens bredd/diameter-Specimen width/diameter  
 5. Provstavens tjocklek-Specimen thickness  
 6. Ursprunglig tvärsnittsarea-Original cross-sectional area  
 7. Undre/Övre sträckgräns-Lower/Upper yield  
 8. Förlängningsgräns-Proof stress  
 9. Brottgräns-Tensile strength  
 10. Brottförlängning-Elongation after fracture  
 11. Brottkontraktion-Reduction of area after fracture

### BOCKPROVNING-BEND TEST

Provning enligt-Test according to: <b>EN ISO 5173</b>				Provstav enligt-Specimen according to: <b>EN ISO 5173</b>				Datum-Date: <b>2011-12-06</b>			
Pos nr. Item No.	Prov nr. Test No.	Typ av prov Type of test	Bredd Width mm	Tjocklek Thickness mm	Dorndiam. Former diam. mm	Avstånd mellan stödrullar Distance between rollers mm	Vinkel Angle °	Förlängning Elongation %	Anm. Remarks		
13	14	15	16	17	18	19	20	21	22		
1	C111588	TFBB	39,8	10,1	40	70	180				
2	C111588	TRBB	40,0	10,2	40	70	180				
3	C111588	TFBB	39,8	10,0	40	70	180				
4	C111588	TRBB	40,3	10,0	40	70	180				
Krav-Requirement					4xa	7xa	180				

Anmärkningar-Remarks:  
-

Förklaringar-Explanations:  
15. Toppsidan dragbelastad-Face side in tension (TFBB), Rotsidan dragbelastad-Root side in tension (TRBB), Sidan dragbelastad-Side in tension (SBB)



### SLAGPROVNING-IMPACT TEST

Provning enligt-Test according to: <b>EN ISO 148 (KV300J)</b>			Provstav enligt-Specimen according to: <b>EN ISO 148, EN ISO 9016</b>				Datum-Date: <b>2011-12-07</b>			
Pos nr. Item No.	Prov nr. Test No	Beteckning Denomination	Typ Type	Temp. °C	Slagenergi Impact energy J			Mv J	Krav Requirements J	Anmärkningar Remarks
23	24	25	26	27	28			29	30	31
1	C111588	VWT 0/1	7,5x10	+20	90	72	76	79	23	Svets-weld HAZ
2	C111588	VHT 1/1	7,5x10	+20	64	56	70	63	23	
Mätosäkerhet-Uncertainty of measurements				0-40J	4,7J	41-68J	6,2J	69-100J	8J	100-300J 17,6J

Anmärkningar-Remarks:

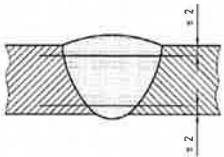
-

Förklaringar-Explanations:

25. Beteckning enligt EN ISO 9016-Denomination according to EN ISO 9016  
26. Provstavstyp-Specimen type (ex. 5x10 mm el. 10x10 mm)

27. Provningstemperatur-Test temperature  
30. Medelvärde-Mean values

### HÅRDHETSPROVNING-HARDNESS TEST

Provning enligt-Test according to: <b>EN ISO 9015-1</b>		Provbelastning-Test load: <b>98,07 N</b>			Mätvärden i-Measurement values in: <b>HV10</b>		Datum-Date: <b>2011-12-06</b>		
Prov nr. Test No.	Position	Grundmaterial- Parent metal	HAZ	Svets-Weld	HAZ	Grundmaterial- Parent metal	Fig.		
C111588  ↓	Topp-Face 1	185	203	210	198	204			
		206	208	204	202	212			
		212	204	195	192	215			
	Rot-Root								
		Topp-Face 2	190	192	173	195			195
			193	186	175	191			203
		200	188	182	205	210			
Krav-Requirement		Max	*	Mätosäkerhet-Uncertainty of measurements ±2.6%					

Anmärkningar-Remarks:

\* Weld metal and HAZ shall not exceed the base material by more than 50 HV10.

### MACRO-AND MICRO EXAMINATION

Test according to: <b>EN 1321</b>	Specimen according to: <b>EN 1321</b>	Requirement: <b>EN ISO 15 614-5 Norsok M-601</b>	Date: <b>2011-12-05</b>
--------------------------------------	--	---	----------------------------

Performance:

**Macro Examination**

During the macro-examination acceptance limits according to EN ISO 15 614-5 and Norsok M-601 were applied.

The examination was performed in a lowpower binocular microscope before and after etching of a grinded and polished cross section of the welded joint.

The etching was made by immersing the cross section in a water solution of HCl + HF.

**Micro Examination**

The micro-section was examined in a metallurgical microscope by magnifications between 50 and 500 times. Limits according to EN ISO 15 614-5 and Norsok M-601 were applied.

Etching as above.

Result(s):

**Macro Examination**

No defects above the acceptance limits were found. The welded joint shows a sound penetration.

The macro-section was **approved**, fig.1.

**Micro Examination**

No micro cracks or other defects were found.

The micro-section was **approved**, fig. 2 and 3.

Handläggare-Handled by:   Arne Gudmundson/	Kontrollerad av-Controlled by:   Andreas Högberg/	<b>Inspecta</b>
--	--	-----------------

### MACRO- AND MICRO EXAMINATION

Figure(s):

C111588



Fig.1. Macrograph of etched cross section of the welded joint.  
Magnification: 4 X.

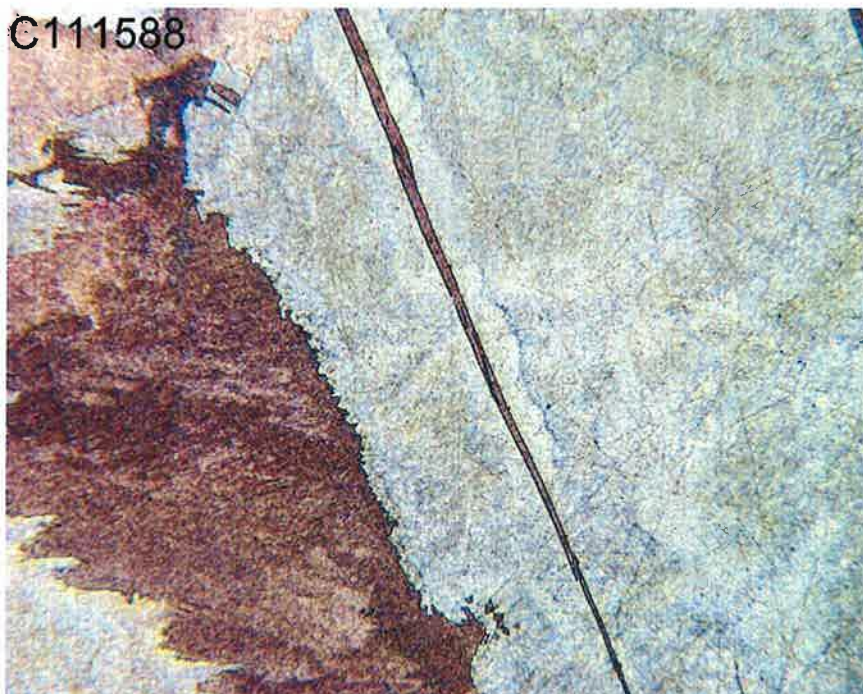


Fig. 2. Weld metal.

Magnification: 100 X.

### MACRO-AND MICRO EXAMINATION

Figure(s):



Fig. 3. Weld metal, fusion line and the heat affected zone.  
Magnification: 100 X.



## EXAMINATION REPORT RADIOGRAPHIC

Customer  
Permascand AB  
Box 42  
840 10 Ljungaverk

Our comm No  
32054906

HOGAND/01/12/2011 07:47

Customer reference  
Jimmy Wahlsten

Order No  
-

### Test object

Manufacturer Permascand AB		Test site Inspecta Materiallaboratorium, Mölndal	
Object Fyra stumsvetsade rör-Four butt welded pipes		Drawing No -	
Base material ASTM B348-05 Gr.2	Filler metal ERTi-2	Manufacturing No -	Heat treated <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Welding process GTAW	Joint -	Item No -	Registration No -

### Extent of examination

<input checked="" type="checkbox"/> 100% <input type="checkbox"/> 10% <input type="checkbox"/> Spot check <input type="checkbox"/> According to	Supplementary data WPS: EN 129 Svetsläge-welding position: 6G (Code and client accept EN 473)
--	--

### Test data

Test according to Standard ASME Section V 2001 Procedure, rev NDT-RT-02 rev.1	Acceptance	Standard, level ASME IX, QW-191.1.2 Procedure, rev -
Gamma source, GBq -	X-ray equipment No Tube 1789 Control unit No 1791	Voltage kV 100 FFD mm 600 Exp time mA min 4,2 Test arr G
Focus, mm 5.0 kV-rating 300	Type of film AGFA D5 Screens Pb 0.027	
Sketch <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Developing <input checked="" type="checkbox"/> Automatic <input type="checkbox"/> Manual	IQI location <input checked="" type="checkbox"/> Sourceside <input type="checkbox"/> Filmside IQI type ASME 1A
Viewing box No 1793	Inspection plan -	

### Examination result

Joint/Film No	Acc to req		Remarks	Repair position	IQI	Density	Exp data	Material size mm	Welder
	Yes	No							
C111588-1 b/c/d	X		-	-	0.40	2,6-3,0	I	Ø60,3x10	Arne Näckstrand
C111588-2 b/c/d	X		-	-	"	"	I	"	"
C111588-3 b/c/d	X		-	-	"	"	I	"	"
C111588-4 b/c/d	X		-	-	"	"	I	"	"

No additional testing has been done.  This testing has been complemented with:

### Inspecta Sweden AB

Date 2011-11-30	Performed by Andreas Högborg	Certified according to EN 473/Nordtest
Date 2011-12-01	Signature 	Level RT2

## EXAMINATION REPORT RADIOGRAPHIC

Customer  
Permascand AB  
Box 42  
840 10 Ljungaverk

Our comm No  
32054906

HOGAND/01/12/2011 07:59

Customer reference  
Jimmy Wahlsten

Order No  
-

### Test object

Manufacturer Permascand AB		Test site Inspecta Materiallaboratorium, Mölndal	
Object Fyra stumsvetsade rör-Four butt welded pipes		Drawing No -	
Base material Titan grade 2	Filler metal ERTi-2	Manufacturing No -	Heat treated <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Welding process 141	Joint -	Item No -	Registration No -

### Extent of examination

<input checked="" type="checkbox"/> 100% <input type="checkbox"/> 10% <input type="checkbox"/> Spot check <input type="checkbox"/> According to	Supplementary data Procedurprovning: EN ISO 15614-5:2004 WPS: EN 129 Svetsläge-Welding position: H-L045
--	--

### Test data

Test according to	Standard EN 1435 B Procedure, rev NDT-RT-01, rev.1	Acceptance	Standard, level EN 12517, level 1 Procedure, rev NDT-RT-03, rev.0
Gamma source, GBq	X-ray equipment No Tube 1789 Control unit No 1791	Exp data	Voltage kV 100
Focus, mm	kV-rating 300		FFD mm 600
Sketch <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Type of film AGFA D4	Screens Pb 0.02	IQI location <input checked="" type="checkbox"/> Sourceside <input type="checkbox"/> Filmiside
Viewing box No 1793	Developing <input checked="" type="checkbox"/> Automatic <input type="checkbox"/> Manual		Exp time mA min 4,2
	Inspection plan -	Test arr	Fig.12

### Examination result

Joint/Film No	Acc to req		Remarks	Repair position	IQI	Density	Exp data	Material size mm	Welder
	Yes	No							
C111588-1 b/c/d	X		-	-	w14	2.6-3,0	I	Ø60,3x10	Arne Näckstrand
C111588-2 b/c/d	X		-	-	"	"	I	"	"
C111588-3 b/c/d	X		-	-	"	"	I	"	"
C111588-4 b/c/d	X		-	-	"	"	I	"	"

No additional testing has been done.  This testing has been complemented with: PT

### Inspecta Sweden AB

Date 2011-11-30	Performed by Andreas Högberg	Certified according to EN 473/Nordtest
Date 2011-12-01	Signature 	Level RT2



## EXAMINATION REPORT LIQUID PENETRANT

Customer  
Permascand AB  
Box 42  
840 10 Ljungaverk

Our comm No  
32054906

HOGAND/01/12/2011 08:04

Customer reference  
Jimmy Wahlsten

Order No  
-

### Test object

Manufacturer Permascand AB		Test site Inspecta Materiallaboratorium, Mölndal	
Object Fyra stumsvetsade rör-Four butt welded pipes		Drawing No -	
Base material Titan grade 2	Filler metal ERTi-2	Manufacturing No -	Heat treated <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Welding process 141	Joint -	Item No -	Registration No -

### Extent of examination

<input checked="" type="checkbox"/> 100% of outer surface.	Supplementary data EN ISO 15614-5:2004 WPS: EN 129 Welding position: H-L045
<input type="checkbox"/> 10%	
<input type="checkbox"/> Spot check	
<input type="checkbox"/> According to	

### Test data

Test according to Standard EN 571-1 Procedure, rev NDT-PT-01 rev.1	Acceptance	Standard, level EN 1289 Level 2X Procedure, rev NDT-PT-01 rev.1			
Surface condition As welded	Method <input checked="" type="checkbox"/> Colour contrast penetrant <input type="checkbox"/> Fluorescent penetrant				
Pre-examination	Cleaning Solvent wetted cloth	Cleaner C10	Charge No 1870	Penetrant RP20	Charge No 379
	Drying method Air	Remover C10	Charge No 1870	Developer D30	Charge No 688
	Drying time 5 min	Penetrant used are removed with <input type="checkbox"/> Water <input type="checkbox"/> Solvent <input checked="" type="checkbox"/> Water + solvent			
Application of penetrant	Application method Spray	Removing	Drying method Air		
	Penetration time 20 min		Drying time 5 min		
	Temperature, °C ~20	Developing	Time 0-30 min	Method Spray	Temperature, °C ~20

### Examination result

According to requirements	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
---------------------------	---	-----------------------------

### Remarks

C111588 Svetsare-Welder: Arne Näckstrand No indications.
--

No additional testing has been done.  This testing has been complemented with: Radiografic examination

### Inspecta Sweden AB

Date 2011-11-30	Performed by Andréas Högberg	Certified according to EN 473/Nordtest
Date 2011-12-01	Signature 	Level PT2

Uppdragsgivare/Client  
Permascand AB  
Box 42  
840 10 Ljungverk

Rapport nummer/Report no  
C141837  
Tekniska krav/Technical requirements  
Kundens/Clients  
(CAHE-WP-MSPDS-10-000-290310 Rev. D0; 2-Feb-12 (pkt/prt 10.4))

Er referens/Your reference  
Jimmy Wahlsten

Vår referens/Our reference  
Sixten Andersson  
Andersson Sixten/15/12/2014 20:54

Produktspecifikation/Object Ett stumsvetsat rör, 60,3 x 10mm One butt welded pipe, 60,3 x 10mm		Grundmaterial/Parent metal ASTM B348 grade 2	Smälta/Heat -
Svetsprocedurnr/WPS No (prel) WPQR#: 11-129	Utgåva/Issue -	Svetsare/Welder -	
Svetsmetod/Welding process 141	Svetsläge/Welding position H-L045	Tillsatsmaterial/Filler metal AWS 5.16-04 ERTi- 1 (Heat#: H19376)	
Värmebehandlad/Heat treated Nej/No		Svetsövervakare/Weld inspector -	
Inkom/Arrived 2014-12-08		Märkning/Marking WPQR#	
Innehåll/Contents  Svetsgodsanalys/Weld deposit analysis: Sida/Page 2			
Övriga uppgifter/Other information  Kompletterande provning till tidigare utförd kvalificering- Additional test to previously performed qualification.			

### Mätutrustning/Measuring equipment

Skjutmått/Caliper, Utrustnings ID/Equipment ID: <input type="checkbox"/> 1797 <input type="checkbox"/> 5327	Mikrometer/Micrometer, Utrustnings ID/Equipment ID: <input type="checkbox"/> 1799 <input type="checkbox"/> 5178
Mikrometer, sfärisk/Micrometer, spherical, Utrustnings ID/Equipment ID: <input type="checkbox"/> 1800 <input type="checkbox"/> 5179	Mätarstativ/Upright gage, Utrustnings ID/Equipment ID: <input type="checkbox"/> 1801 <input type="checkbox"/> 5330

### Provningresultat/Test results

<input type="checkbox"/> Godkänd/Acceptable	<input type="checkbox"/> Underkänd/Not Acceptable	Provningresultaten i denna rapport gäller enbart för det provade objektet. The test results in this report apply only to the tested object.
---	---	--

Inspecta Sweden AB – Neqngatan 4B 431 53 MÖLNDAL Tel +46 8 5011 3400 www.inspecta.com

Övervakad av/Supervised by  Andreas Reichenberg	Underskrift/Signature  Handläggare/Handled by Sixten Andersson	Utfört datum/Date 2014-12-15
--	--	---------------------------------

Den rapporterade osäkerheten är baserad på en standardosäkerhet multiplicerad med en täckningsfaktor k=2, vilket ger en konfidensnivå på ungefär 95%. Mätosäkerhetsberäkningarna är utförda i enlighet med EA-4/16:2003.  
The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation was carried out in accordance with EA-4/16:2003.



Stang



# S-Tech Corporation

No.168,Jiafang St.,Sinying City,  
Tainan Country 730,Taiwan  
TEL: +886-6-652-5522  
FAX: +886-6-652-4560

## INSPECTION CERTIFICATE

Messrs: PERMASCAND AB  
 Date: 01/31/2008  
 Order No: 2007000623      Grade: Ti-Gr.2  
 FILE NO: 2008000069-Z      Size: 60.0 mm  
 HEAT-Lot No: F00257G21      Weight: 533.OKG 1175.06LB  
 Condition: HR-HeatTreatment-Straightened-Peeled-Polished  
 P.O.NO.: 8301925  
 Size Tol.: 0 / -0.19 mm  
 P'cs: 14

Chemical Composition (wt%)

	C	O	N	H	Fe
Min.					
Max.	0.08	0.25	0.03	0.015	0.30
Result	0.02	0.18	0.01	0.001	0.11

Tensile Test

Unit	Elongation(A) %	Tensile Strength(Rm) Mpa	Yield Strength(Rp) Mpa	Reduction of Area(Z) %
Min.	20	345	275	30
Max.				
Result	25	611	421	42

Specification:  
ASTM B348-05 Gr.2

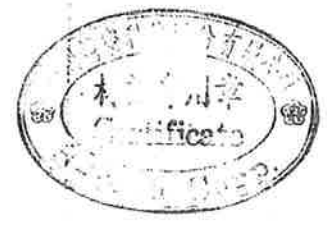
- Remark:
- \*Chemical Composition Other Each : < 0.1%
  - \*Chemical Composition Other Total : < 0.4%
  - \*H(After Peeled):0.00064%
  - \*Heat Treatment: 680±15°C x 1HR MIN Air Cooling
  - \*Certificate ACC. To EN 10204/3.1
  - \*UT Accepted(AMS 2631B GR.1 CLASS A)
  - \*Ti(Composition%): Balance

019822



**PERMASCAND AB**  
**APPROVED**

Date: 080411      Sign: *Heo*



For and behalf of  
**S-TECH CORP**  
 QA Dept.  
*Jesse*  
 Authorized Signature(s)

It is hereby certified that the above results are true and correct in every details.

Till 506 material

11-129

# BAOJI TITANIUM INDUSTRY CO.,LTD

## MATERIAL CERTIFICATION

017690

NO: C200485041-1

DATE: Mar. 1, 2004

EN10204 3.1B

Commodity : TITANIUM WIRE		Finish : ANNEALED	
Specification : AWS A 5.16-90, ERTi-2			
Size [mm]	Quantity [pc]	Net Weight [kg]	Heat No.
DIA. 4.0×1000	50	498.7	20030907
DIA. 1.6×1000	21	201	20030907
DIA. 2.0×1000	26	256	20030907
DIA. 2.4×1000	36	355	20030907
DIA. 3.0×1000	77	771	20030907

### Chemical Composition (wt. %)

Requirement	Fe	C	N	O	H	Residual element		Ti
						Each	Total	
	≤0.20	≤0.03	≤0.020	≤0.10	≤0.008	≤0.05	≤0.20	Remainder
DIA. 4.0	0.05	0.02	0.011	0.06	0.001	<0.05	<0.20	Remainder
DIA. 1.6	0.05	0.01	0.009	0.06	0.003	<0.05	<0.20	Remainder
DIA. 2.0	0.05	0.01	<0.008	0.06	0.001	<0.05	<0.20	Remainder
DIA. 2.4	0.05	0.01	0.011	0.05	0.001	<0.05	<0.20	Remainder
DIA. 3.0	0.05	0.01	0.011	0.05	0.002	<0.05	<0.20	Remainder

Visual Inspection

Dimensional Inspection

ACCEPTABLE

ACCEPTABLE

We hereby certify that the material described above has been tested and complies with the terms of the order confirmation. Inspection and dimensional control without complaints.

Note:

1. C, N, H, O ----- product analysis.

PERMASCAND AB  
c/o TITAN SERVICE CENTER  
APPROVED

Date: 17/5.2004 Sign: *[Signature]*



VICE-MANAGER OF QUALITY DEPARTMENT  
BAOJI TITANIUM INDUSTRY CO.,LTD

Uppdragsgivare-Client: Permascand AB Box 42 840 10 Ljungaverk		Tekniska krav-Technical requirements: ASME IX, Edition 2010, 2011a Addenda	
Er referens-Your reference: Jimmy Wahlsten		Vår referens-Our reference: Andreas Högberg	
Produktspecifikation-Object: Fyra stumsvetsade rör, Ø60 x 10mm Four butt welded pipes, Ø60 x 10mm		Grundmaterial-Parent metal: ASTM B348-05 Gr.2	Smälta-Heat#: F00257G21
Svetsprocedurn-WPS No (preliminär-preliminary): EN 129	Utgåva-Issue: -	Svetsare-Welder: Arne Näckstrand	
Svetsmetod-Welding method: GTAW	Svetsläge-Welding position: 6G	Tillsatsmaterial-Filler metal: ERTi-2	
Värmebehandlad-Heat treated: Nej/No		Svetsövervakare-Weld inspector: Kurt Engström, Inspecta Sweden AB	
Inkom-Arrived: 2011-11-28		Märkning-Marking: pWPS#	
Innehåll-Contents:			
Dragprovning-Tensile test:		sida-page 2	
Bockprovning-Bend test:		sida-page 2	
Radiografiskprovning-Radiographic examination:		bilaga-appendix 1	
Övriga uppgifter-Other informations: -			
Provningsresultat-Test results: <input checked="" type="checkbox"/> <b>Godkänd-Acceptable</b> <input type="checkbox"/> <b>Underkänd-Not acceptable</b>			
Handläggare-Handled by: Andreas Högberg		Kontrollerad av-Controlled by: Dan Mattsson	
<b>Inspecta Sweden AB</b>			
<p>Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.</p> <p>Provningsresultaten i denna rapport gäller enbart för det provade objektet.- The test results in this report apply only to the tested object.</p> <p>Den rapporterade osäkerheten är baserad på en standardosäkerhet multiplicerad med en täckningsfaktor k=2, vilket ger en konfidensnivå på ungefär 95%. Mätosäkerhetsberäkningarna är utförda i enlighet med EA-4/16:2003. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation was carried out in accordance with EA-4/16:2003.</p>			
Postadress & Besöksadress Postal address & Visiting address	Telefon Telephone	Fax	
Neongatan 4 B SE-431 53 Mölndal, Sweden	+46 (0)8 5011 3400	+46 (0)8 5011 3401	



### DRAGPROVNING-TENSILE TEST

Proving enligt-Test according to: <b>ASME IX, pkt-prt QW-152</b>				Provstav enligt-Specimen according to: <b>ASME IX, pkt-prt QW-462.1(c)</b>				Datum-Date: <b>2011-12-06</b>			
---	--	--	--	---	--	--	--	----------------------------------	--	--	--

Pos # Item #	Prov nr. Test No.	T °C	b / D mm	a mm	S <sub>0</sub> mm <sup>2</sup>	ReL N/mm <sup>2</sup>	ReH N/mm <sup>2</sup>	R <sub>p0,2</sub> N/mm <sup>2</sup>	R <sub>p1,0</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %	Z %	Anm. Remarks
1	2	3	4	5	6	7		8		9	10	11	12
Krav Requirements					min	max				345			
1	C111588A	+20	12,3	9,94				402	444	517			
2	C111588A	+20	12,3	9,92				397	451	556			
Mätosäkerhet-Uncertainty								±2,7	±2,7	±2,7			

Anmärkingar-Remarks:  
**Brott i svetsgods-Fracture in weld metal**

Förklaringar-Explanations:  
 3. Provingstemperatur-Test temperature  
 4. Provstavens bredd/diameter-Specimen width/diameter  
 5. Provstavens tjocklek-Specimen thickness  
 6. Ursprunglig tvärsnittsarea-Original cross-sectional area  
 7. Undre/Övre sträckgräns-Lower/Upper yield  
 8. Förlängningsgräns-Proof stress  
 9. Brottgräns-Tensile strength  
 10. Brottörlängning-Elongation after fracture  
 11. Brottkontraktion-Reduction of area after fracture

### BOCKPROVNING-BEND TEST

Proving enligt-Test according to: <b>ASME IX, Pkt-prt QW-466.1 &amp; 466.2</b>				Provstav enligt-Specimen according to: <b>ASME IX, pkt-prt QW-462.3(a)</b>				Datum-Date: <b>2011-12-06</b>			
---	--	--	--	---	--	--	--	----------------------------------	--	--	--

Pos nr. Item No.	Prov nr. Test No.	Typ av prov Type of test	Bredd Width mm	Tjocklek Thickness mm	Dorndiam. Former diam. mm	Avstånd mellan stödrullar Distance between rollers mm	Vinkel Angle °	Förlängning Elongation %	Anm. Remarks
13	14	15	16	17	18	19	20	21	22
1	C111588A	Facebend	9,7	10,2	40	64	180		
2	C111588A	Rootbend	9,8	10,1	40	64	180		
3	C111588A	Facebend	9,9	10,0	40	64	180		
4	C111588A	Rootbend	9,8	10,2	40	64	180		
Krav-Requirement					4xa	6xa+3,2	180		

Anmärkingar-Remarks:  
-

Förklaringar-Explanations:  
15. Toppsidan dragbelastad-Face side in tension (TFBB), Rotsidan dragbelastad-Root side in tension (TRBB), Sidan dragbelastad-Side in tension (SBB)