



PetroSA SPM Pipeline Repair FEED Study

Bracelet Anode Data Sheet

CONSUB Doc. No:C-0022-MTL-DAT-005

tkIS Doc. No: LOEO-00224-PIP-CONS-0025



<input checked="" type="checkbox"/>	A PROCEED	PetroSA
<input type="checkbox"/>	B PROCEED CHANGE AS NOTED AND RESUBMIT	
<input type="checkbox"/>	C DO NOT PROCEED CHANGE AS NOTED AND RESUBMIT	
<input type="checkbox"/>	D INFORMATION ONLY	
AUTHORISATION TO PROCEED DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY UNDER THE CONTRACT		
Confirmed by Date		

Handwritten signatures

C	06/04/2020	Issued for Client Approval	ASH	SC	RC
REV	DATE	REVISION	BY	CHECKED	APPROVED

Bracelet Anode Data Sheet

ITEM	CODE/ STANDARD	
Pipeline Bracelet Anode Al-Zn-Ind Alloy Requirements	DNV-RP-F103, NACE SP0492 (2016) Metallurgical & Inspection Requirements for Offshore Pipeline Bracelet Anodes, and ISO 15589-2, Cathodic Protection of Pipeline Transportation Systems, Part 2: Offshore Pipelines.	
General		
Pipeline System Designation	14" OD – used for diesel export and condensate import	12" OD – used for petrol export and reformat / condensate import
Total required mass	Refer to MTO - C-0022-PLE-MTO-001	Refer to MTO - C-0022-PLE-MTO-001
Bracelet Anode Design Code/Standard	DNV-RP-F103/ ISO 15589-2	
Installation Location	<p>The bracelets shall be located in the middle of each pipe length or at one third of the pipe length according to the requirements specified on the relevant Drawings.</p> <p>Contractor may also provide a position that is unconcreted and without reinforcing rods at one end of the line pipe on which the bracelets are to be installed.</p> <p>Where anodes are located in middle of the linepipe, the CWC applicator shall execute a groove in the concrete such that the meshed reinforcing steel rods shall not under any circumstances come into contact with the core of the anodes.</p> <p>This groove shall be, as long as the overall length of the bracelet, plus 5 cm minimum on each side.</p>	
Bracelet Reference Drawing	TBC	
Design Data		
Design Life	25 yrs	
Design Water Depth	23 m	
Seawater Design Temperature	Min 9° C – Max 11° C	
Pipeline Operating Temperature	Max 10° C (Table 6-4 C-0022-PMT-BOD-001)	Max 10° C (Table 6-4 C-0022-PMT-BOD-001)
Pipeline Burial Status	Buried	Buried
Mean Resistivity	TBC e.g. 0.3 (Seawater) or 1.0 (In Seawater Sediments) $\Omega \cdot m$	

Mean Current Density for Bare Steel	0.05 (Seawater) A/m ²	
Pipe Dimensions		
Pipe Outside Diameter (OD)	14" - 355.6 mm	12" - 323.85 mm
Pipe Material	L290Q or X42Q Class PSL 2 as per C-0022-MTL-DAT-001	
'Anti-Corrosion Coating Type	A.E (Asphalt Enamel, or "Bitumen")	
Anti-Corrosion Coating Thickness	As per CDS - C-0022-MTL-DAT-006	As per CDS - C-0022-MTL-DAT-006
Concrete Weight Coating Thickness	As per CWCDS - C-0022-MTL-DAT-007	As per CWCDS - C-0022-MTL-DAT-007
Anode Data		
Anode Type	Two halves Bolted Bracelet, using 4-point bolting system	
Anode Material	Aluminium-Zinc-Indium	
Chemical Composition	Zn 2.5 – 5.75% In 0.016 – 0.04% Fe 0.090% Max. Si 0.120% Max Cu 0.003% Max. Cd 0.002% Max. Other: 0.02% (each) Aluminium: Remainder	
Density	2750 kg/m ³	
Closed Circuit Potential (vs Ag/AgCl Seawater)	-1.05 (Seawater) or -1.0 (In Seawater Sediments) volts minimum (negative)	
Electrochemical capacity	2000 (Seawater) or 1500 (In Seawater Sediments) Ampere Hours/kg minimum	
Anode Design Utilisation	0.8	
Anode Geometry and Weight		
Anode Geometry	Cylinder	Cylinder
Anode Inner Diameter	367.6 mm	335.9 mm
Anode Outside Diameter	417.6 mm	385.9 mm

Anode Bracelet Thickness	50 mm	50 mm
Anode Bracelet Tapered Thickness	-	-
Anode Outer Length	400 mm	400mm
Anode Inner Length (including tapers)	400 mm	400 mm
Anode Half Shell Gap	80 mm	80 mm
Anode Net Weight per Half Shell (excluding insert)	34.3 kg	31.5 kg
Anode Net Weight per Full Bracelet (excluding insert)	68.5 kg	63.0 kg
Anode Dimensional Tolerances		
Anode Length	TBC e.g. $\pm 3.0\%$ or ± 25 mm, whichever the smaller	
Anode Thickness	TBC e.g. -0 min and +3 max	
Anode Internal Diameter	TBC e.g. -0 min and +5 max	
Anode Net Weight	TBC e.g. -2 min and +3 max	
Anode Steel Core		
Anode Steel Core Design	weldable structural steel grade, blasted to Sa 2.5 prior to positioning	
Flat Bar Core Material	Steel,	
Maximum Carbon Equivalent (IIW)	max 0.42	
Leads		
'Quantity of Continuity Leads per Bracelet	TBC e.g. 4	
Size of Continuity Leads	TBC e.g. 10 (No. 8 AWG) mm ²	
Minimum Length of Continuity Leads	TBC e.g. 1 m	
Anode Testing		
'Chemical Composition Testing	2 samples per heat to be analysed. If casting heat < 500 kg, then 1 sample. Anodes from heats which fail to meet the required chemical composition shall be rejected.	
Electrochemical QC Tests	Above 3 tests to be carried out in natural or artificial seawater (to ASTM D1141) in accordance with ISO 15589-2 Annex E	

Corrosion Pattern	Indication against uneven consumption, intergranular attack, passivity
Surface irregularities (casting)	<p>Shrinkage depressions, < 10% of anode thickness</p> <p>Topping up area, maximum shrinkage ≤ 10 mm from straight edge across topping-up face, and ≤ 0.5% of gross anode volume. Any additional topping up materials or casting surface irregularities to be fully bonded to anode material.</p> <p>Cold shuts < 10 mm depth and/or extend over < 150 mm</p>
Cracks	<p>All anodes to be inspected for cracks</p> <p>Cracks penetrating to steel core : Not permitted</p> <p>Cracks > 100 mm length, not permitted</p> <p>See ISO 15589-2 for remainder of criteria</p>
Anode Mass	<p>0% underweight lot not permitted</p> <p>97% of net weight permitted for individual anode.</p>
<p>Notes:</p> <ol style="list-style-type: none"> 1. All details are preliminary and shall be confirmed during detailed design. 2. The above are minimum requirements. Alternative equivalent requirements may be used subject to Client approval. 	

REVISION RECORD

Rev	Date	Description of Revision
01	25/02/2020	Issued for Internal Review
02	11/03/2020	Issued for Client Review
A03	23/03/2020	Issued for Client review/ Updated as per client comments: NACE SP0492 year and title updated. Maximum Temperature modified to be read "Maximum Operating Temperature". Issued for Client Approval
B	31/03/2020	Front sheet updated as issued for Client approval Pipeline max temp changed to 30 from 10 Issued for Client Approval
C	06/04/2020	Maximum operating Temperature is changed to 10 degree C as per Table 6-4 in Design Basis also confirmed by the client via an email. Issued for the Client approval.