

<b>MATERIAL DATA SHEET</b>			<b>MDS D54</b>	<b>Rev. 4</b>
<b>TYPE OF MATERIAL:</b> Ferritic/Austenitic Stainless Steel, Type 25Cr duplex				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Forgings	ASTM A 182	F61 (UNS S32550) F53 (UNS S32750) F55 (UNS S32760)	-	S56
HIP Products	ASTM A 988	UNS S32505		
				Page 1 of 3
<b>1. SCOPE</b>	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. This MDS is intended for forgings with maximum section thickness of 200 mm. For larger thickness special agreements shall be made in each case.			
<b>2. QUALIFICATION</b>	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with NORSOK Standard M-650.			
<b>3. STEEL MAKING</b>	The steel melt shall be refined with AOD or equivalent.			
<b>4. MANUFACTURING PROCESS</b>	The manufacturing of products according to this MDS shall be carried out according to the M-650 qualified manufacturing procedure. The component shall be quenched in water after forging. The Hot Isostatic Pressed (HIP) process is an acceptable alternative to forging. Valves with nominal size NPS 4 and smaller may be machined from solid forgings in compliance with the terminology of ASTM A 788 on the following conditions: - Purchasers' acceptance shall be obtained in each case. - The forging shall be tested and certified according to this MDS. - When bar or block forgings with reference thickness 100 mm or greater is used, tensile and impact specimens shall be taken in both longitudinal and transverse direction. Acceptance criteria shall be the same in both directions. All destructive test specimens shall be taken from the centre of the bar/block. - 100% penetrant testing shall apply to all finished products, ref. Item 13 below.			
<b>5. HEAT TREATMENT</b>	Solution annealing followed by water quenching. Components shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including quenching.			
<b>6. CHEMICAL COMPOSITION</b>	PREN = % Cr + 3.3 % Mo + 16 % N $\geq$ 40.0.			
<b>7. TENSILE TESTING</b>	$R_{p0.2} \geq 550$ MPa; $R_m \geq 750$ MPa; $A \geq 25$ %.			
<b>8. IMPACT TESTING</b>	Charpy V-notch testing according to ASTM A 370 at -46 °C is required for the thickness $\geq 6$ mm (thickness at the weld neck). The minimum absorbed energy shall satisfy 45 J average and 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.			
<b>9. MICROGRAPHIC EXAMINATION</b>	The micrographic examination shall be carried out at the same area as location of specimens for mechanical testing. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 -55 %. The microstructure, as examined at minimum 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.			
<b>10. CORROSION TEST</b>	Corrosion test according to ASTM G 48, Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimen shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM G 48. The whole specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60 °C in a solution of 20 % $\text{HNO}_3$ + 5 % HF. The acceptance criteria are: - No pitting at 20 X magnification. - The weight loss shall be less than 4.0 g/m <sup>2</sup> .			

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				Page 2 of 3
11. EXTENT OF TESTING	One set of impact, tensile, hardness, corrosion testing and microstructure examination shall be carried out for each heat and heat treatment load. The testing shall be carried out on the component with heaviest wall thickness within the load. A test lot shall not exceed 2000 kg for forgings with as forged weight $\leq 50$ kg, and 5000 kg for forgings with as forged weight $> 50$ kg.			
12. TEST SAMPLING	<p>Samples for production testing shall realistically reflect the properties in the actual components. For products forged by the closed die method, the test specimen shall be obtained from a sacrificial product<sup>A)</sup>.</p> <div> </div> <p>For products forged by the open die or by the ring rolling method, the test specimen shall be obtained from a sacrificial forging or from an integral prolongation. For flanges the thickness of the prolongation shall minimum be equal to the hub thickness (<math>T_H</math>) as shown in fig. 1. When prolongations are used test specimens shall be taken in a distance <math>T_B/2</math> or minimum 50mm from the end.</p> <p><b>Test location flanges:</b> The basic test location is mid-thickness of hub (<math>T_H</math>) in a distance <math>T_B/2</math> or minimum 50 mm from weld end, see fig. 1, position 1.</p> <p>If full size test specimens cannot be extracted from position 1 test specimens shall be extracted from flange body position 2.</p> <p><b>Test location other forgings:</b> For forgings having maximum section thickness, <math>T \leq 50</math> mm, the test specimen shall be taken at mid thickness and its mid length shall be at least 50 mm from any</p> <p>Fig. 1 - Location of test specimens for flanges second surface or at equal distance from the second surfaces.</p> <p>For forgings having maximum section thickness, <math>T &gt; 50</math> mm, the test specimens shall be taken at least <math>\frac{1}{4} T</math> from the nearest surface and mid-length of test specimens at least <math>T</math> or 100 mm, whichever is less, from any second surface. For all forgings sketches shall be established showing type, and size of test samples and location for extraction of test specimens.</p> <p>NOTE:</p> <p>A) For closed die forged components and flanges exceeding 80 kg it is recognized that alternative test may be used. Such alternative test sampling shall be qualified and shall comprise comparative testing of sacrificial forgings and the proposed alternative test sample.</p>			
13. NON DESTRUCTIVE TESTING	<p>ASTM A 961 supplementary requirement of S56, penetrant testing, shall apply to 10 % of forgings (from the lot as defined for mechanical testing) above NPS 2. The testing shall be carried out after final machining and pickling. Non-machined surfaces shall be pickled prior to the testing.</p> <p>The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.</p> <p>NDT operators shall be certified in accordance with EN 473 or equivalent.</p>			
14. SURFACE FINISH	Finished products shall be white pickled, including machined surfaces.			
15. REPAIR OF DEFECTS	Weld repair is not acceptable.			
16. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.			

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				Page 3 of 3
<b>17. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 and the system shall have undergone a specific assessment for the relevant materials.</p> <p>The material certificate shall be issued in accordance with EN 10204, Type 3.1, and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Manufacturer of the starting material for the finished product, melting and refining practice.</li> <li>- Heat treatment conditions. (Solution annealing temperature and holding time shall be stated.)</li> </ul>			