

| <b>MATERIAL DATA SHEET</b>   |   |  | <b>MDS D57</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> |
| Bars   | ASTM A 479  | UNS S32550<br>UNS S32750<br>UNS S32760 | -                    | -                  |
| HIP products   | ASTM A 988  | UNS S32505                             |                      |                    |
|  |   |  |                      | Page 1 of 2        |
| <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 based on the mechanical properties of UNS S32760. This MDS is intended for bars with maximum 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.<br>The Hot Isostatic Pressed (HIP) process is an acceptable alternative to forging.  |  |                      |                    |
| <b>5. HEAT TREATMENT</b>   | The bars shall be solution annealed followed by water quenching. The solution annealing temperature shall be as defined in ASTM A 182 for the actual grade/UNS number.<br>Bars shall be placed in such a way as to ensure free circulation of air and water around each bar during the heat treatment process including quenching.  |  |                      |                    |
| <b>6. CHEMICAL COMPOSITION</b>   | PREN (% Cr + 3.3 % Mo + 16 % N) ≥ 40.0.   |  |                      |                    |
| <b>7. TENSILE TESTING</b>  | R <sub>p0.2</sub> ≥ 550 MPa; R <sub>m</sub> ≥ 750 MPa; A ≥ 25 %.  |  |                      |                    |
| <b>8. IMPACT TESTING</b>   | Charpy V-notch testing is required according to ASTM A 370 at - 46 °C. The minimum absorbed energy shall satisfy 45 J average / 35 J single.  |  |                      |                    |
| <b>9. MICROGRAPHIC EXAMINATION</b>   | The micrographic examination shall be carried out at the same area as location of specimens for mechanical testing and near surface. 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 % HNO <sub>3</sub> + 5 % HF.<br>The acceptance criteria are:<br>- No pitting at 20 X magnification.<br>- The weight loss shall be less than 4.0 g/m <sup>2</sup> . |  |                      |                    |
| <b>11. EXTENT OF TESTING</b>   | One set of impact test, tensile test, hardness test, microstructure examination and corrosion test shall be carried out for each heat and heat treatment load.  |  |                      |                    |
| <b>12. TEST SAMPLING</b>   | Samples for production testing shall realistically reflect the properties in the actual components.<br>Test location and orientation shall be:<br>- For bars having maximum section thickness, T ≤ 50 mm, the test specimens shall be taken at mid thickness and its mid length shall be at least 50 mm from any second surface.<br>- For bars having maximum section thickness, T > 50 mm, the test specimen shall be taken at least ¼ T from the nearest surface and at least T or 100 mm, whichever is less, from any second surface.  |  |                      |                    |
| <b>13. SURFACE FINISH</b>  | Finished products shall be white pickled. Machined surfaces do not require pickling.  |  |                      |                    |

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| <b>14. REPAIR OF DEFECTS</b>   | Weld repair is not acceptable.   |  |                      |                    |
| <b>15. MARKING</b>   | The component shall be marked to ensure full traceability to melt and heat treatment lot.  |  |                      |                    |
| <b>16. 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 in accordance with EN 10204 Type 3.1, and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Steel manufacturer,</li> <li>- Steel melting practice and refining method.</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated.)</li> </ul> |  |                      |                    |