MATERIAL DATA SHEET MDS D56 Rev. 4

TYPE OF MATERIAL: Ferritic/Austenitic Stainless Steel, Type 25Cr duplex

PRODUCT	***STANDARD***	***GRADE***	***ACCEPT. CLASS***	***SUPPL. REQ.***
Castings	ASTM A 995	5A (UNS J93404) 6A (UNS J93380)	-	S6, S20

1. SCOPE	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.
2. QUALIFICATION	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with NORSOK Standard M-650.
3. MANUFACTURE	The manufacturing of products according to this MDS shall be carried out according to the M-650 qualified manufacturing procedure.
4. STEEL MAKING	The steel melt shall be refined with AOD or equivalent process.
5. HEAT TREATMENT	According to Grade 5A (UNS J93404) or 6A (UNS J93380). Components shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including quenching.
6. CHEMICAL COMPOSITION	PREN = % Cr + 3.3 % Mo + 16 % N ≥ 40.0. S ≤ 0.025 and P ≤ 0.030
7. TENSILE TESTING	$R_{p0.2}$ ≥ 450 MPa; R_m ≥ 700 MPa; A ≥ 18 %.
8. IMPACT TESTING	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.
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical tests and near surfaces. The area shall be minimum 10 x 10 mm. On WPQ's the weld, HAZ and base material shall be examined. 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 200 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.
10. CORROSION TEST	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 % HNO3 + 5 % HF. The acceptance criteria are: - No pitting at 20X magnification. - The weight loss shall be less than 4.0 g/m^2.
11. EXTENT OF TESTING	A full set of mechanical and corrosion tests and microstructure examinations shall be made for each heat and heat treatment charge including any PWHT. A test lot shall not exceed 5 000 kg.
12. TEST SAMPLING	Samples for mechanical testing shall realistically reflect the properties in the actual components. Thickness of the test block shall be equal to the thickness of the actual components. For flanged components the largest flange thickness is the ruling section. Dimensions of test blocks and location of test specimens within the test blocks are shown in figures 1 and 2 for integral and gated test blocks, respectively. The test specimens shall be taken within the cross hatched area and in a distance of T/4 from the ends. When thickness "T" of test block is ≤ 50 mm the longitudinal axis of test specimens shall be located in the centre of test blocks. During any PWHT the test block shall be tack welded onto the casting.

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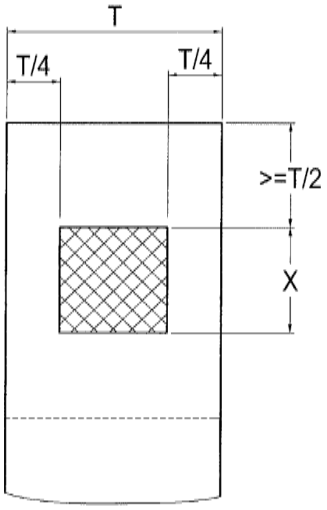

Fig.1 - Integral test block

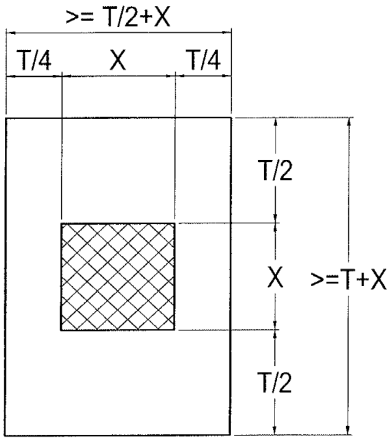

Fig. 2 - Gated test block

13. NON DESTRUCTIVE TESTING

NDT operators shall be certified in accordance with EN 473 or equivalent.

Liquid penetrant testing:

Supplementary requirement S6 shall apply to all surfaces (including internal surfaces) of all castings. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 7.

Radiographic testing (RT):

- Castings shall be tested in accordance with ASME VIII div.1 Appendix 7.
- The number of casting to be tested per lot shall be according to table below.

Extent of RT based on pressure class and nominal size:							
Pressure Class:		*≤ 150*	*300*	*600*	*900*	*1500*	*≥ 2500*
Extent of RT	10%	≥ 10”	≥ 10”	≥ 2”	≥ 2”	≥ 2”	≥ 2”
	100 %	Not applicable	Not applicable	≥ 20”	≥ 16”	≥ 6”	≥ 6”

- Pilot cast of each pattern shall be 100% RT.
- Castings shall be tested in the critical areas as defined by ANSI B16.34, abrupt changes in sections and at the junctions of risers, gates or feeders to the casting.
- When spot examination (10%) is specified, minimum one casting in any order shall be examined. If one test fail two more components shall be tested, and if any of these two fails all items shall be tested.

14. SURFACE FINISH

White pickled shall be carried out after any blasting and shall include finished machined surfaces.

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15. REPAIR OF DEFECTS	ASTM A 703 supplementary requirement S20 shall apply. Post weld heat treatment (PWHT) is required after all weld repairs. For minor weld repairs, as defined by ASTM A 995, the PWHT may be excluded provided the welding procedure qualification shows that all specified properties, as specified in this MDS, can be fulfilled. The repair welding procedure shall be qualified in accordance with ASTM A 488 or ISO 11970 and this MDS. The repair welding procedure qualification shall include the following: - A cast plate of the same grade (UNS number), which shall be welded. - Change of specific make of filler metal (brand names) requires requalification. - Examination of microstructure of base material and weld zone. The ferrite content shall be 35 - 55 % for the base material and 35-65 % for the weld metal. - Charpy V-notch testing as specified above, with two sets (each 3 specimens), with notch located in weld metal and fusion line, respectively. Corrosion test as specified above. The specimen shall include weld zone.
16. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.
17. CERTIFICATION	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. The material certification shall be in accordance with EN 10204 Type 3.1, and shall include the following information: - Steel manufacturer. - Steel melting practice and refining method. - Heat treatment condition. (Solution annealing temperature and holding time shall be stated.)