

Designation: A488/A488M – $18^{\epsilon 2}$

Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel¹

This standard is issued under the fixed designation A488/A488M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (\$\epsilon\$) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

- 1.1 This practice covers the qualification of procedures, welders, and operators for the fabrication and repair of steel castings by electric arc welding.
- 1.1.1 Qualifications of a procedure and either or both the operator or welder under Section IX of the ASME Boiler and Pressure Vessel Code shall automatically qualify the procedure and either or both the operator or welder under this practice. P-number designations in the ASME grouping of base metals for qualification may be different than the category numbers listed in Table 1. Refer to Appendix X1 for a comparison of ASTM category numbers with the corresponding ASME P-number designations.
- 1.2 Each manufacturer or contractor is responsible for the welding done by his organization and shall conduct the tests required to qualify his welding procedures, welders, and operators.
- 1.3 Each manufacturer or contractor shall maintain a record of welding procedure qualification tests (Fig. 1), welder or operator performance qualification tests (Fig. 2), and welding procedure specification (Fig. 3), which shall be made available to the purchaser's representative on request.
- 1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.4.1 SI Units—Within the text, the SI units are shown in brackets.

1.5 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.6 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

A27/A27M Specification for Steel Castings, Carbon, for General Application

A128/A128M Specification for Steel Castings, Austenitic

Manganese 2-10e1c5e89e14/astm-a488-a488m-18

A148/A148M Specification for Steel Castings, High Strength, for Structural Purposes

A216/A216M Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A217/A217M Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service

A297/A297M Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application

A351/A351M Specification for Castings, Austenitic, for Pressure-Containing Parts

A352/A352M Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service

ε¹ NOTE—Grade designations in Table 1 and Table X1.1 were corrected editorially in January 2020.

 $[\]epsilon^2$ NOTE—Grade designation HG10MNN in Table 1 was corrected editorially in February 2020.

¹ This practice is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



TABLE 1 Categories of Base Materials

1 Carbon steel (carbon less than 0.35 k, lemails strength less than or equal to 70 ksi (485 MPa)) 2 Carbon steel (fensile strength greater than 70 ksi (485 MPa)) 2 Carbon steel (fensile strength greater than 70 ksi (485 MPa)) 2 Carbon-manganese steel (fensile strength greater than 70 ksi (485 MPa)) 2 Carbon-manganese steel (fensile strength strength equal to or greater than 70 ksi (485 MPa)) 3 Carbon-manganese steel (fensile strength greater than 70 ksi (485 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 70 ksi (485 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 70 ksi (485 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 80 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa)) 5 Low-alloy steel (annealed, normalized and tempered than 50 ksi (520 MPa) 4 Carbon-manganese steel (fensile strength equal to or greater than 50 ksi (520 MPa) 5 Low-alloy steel (annealed, normalized and tempered than 50 ksi (520 MPa) 4 Carbon-manganese steel than 50 ksi (520 MPa) 5 Low-alloy steel (quenched and tempered) 6 Low-alloy steel (quenched and tempered) 7 Carbon-manganese steel qu	egory nber	Material Description	ASTM Specification	Grades
A216/A216M WCA, WCB A356/A358M LCB, LCA A356/A358M LCB, LCA A356/A358M LCB, LCA A356/A358M SC 1020, SC 1025, SC 1030, CLASSES 6 A736/A7378M SC 1020, SC 1025, SC 1030, CLASSES 6 A736/A7378M SC 1020, SC 1025, SC 1030, CLASSES 6 B 4 Carbon steel (tensile strength greater than 70 ksi (456 MPa)) Carbon-manganese steel (tensile strength equal to or greater than 70 ksi (820 MPa)) A356/A358M SC 1030, SC 1040, SC 1045, CLASSES 8 B050 3 Carbon and carbon-manganese steel (tensile strength equal to or greater than 90 ksi (820 MPa)) A356/A358M SC 1030, SC 1040, SC 1045, CLASSES 8 B050 4 Low-alloy steel (annealed, normalized, or normalized and tempered Tensile engish less than 85 ksi [83 MPa)) A356/A358M A356/A358M C23, C24 A356/A358M C24, 15, 6, 8 A356/A358M C24, 15, 6, 15, 6 A356/A358M C24, 15, 6, 8 A356/A358M C24, 15, 6 A356/A358M C24, 15, 6 A356/A358M C24, 15, 6 A356/A358M C24, 15, 6	(.35 %, tensile strength less than		All grades
A356/A356M 1 A736/A373M 1A, 2A A757/A757M A1C A756/A575M A1C Carbon steel (tensile strength greater than 70 ksi [465 MPa]) Carbon and carbon-manganese steel (tensile strength equal to or greater than 70 ksi [620 MPa]) 3 Carbon and carbon-manganese steel (tensile strength equal to or greater than 90 ksi [620 MPa]) 4 Carbon and carbon-manganese steel (tensile strength equal to or greater than 90 ksi [620 MPa]) A356/A356M SC 1030, SC 1040, SC 1045, CLASSES 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	·	. oqual to 70 to. [150 till a])		
A732/A732M				
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Carbon-manganese stell (tensile strength equal to or greater than 70 ksi (455 MPal) but less than 90 ksi (620 MPal) A352/A352M LCC A732/A732M 2Q, 3A A757/A757M A2Q A958/A958M SC 1030, SC 1040, SC 1045, CLASSES 8 80/50 3 Carbon and carbon-manganese stele (tensile strength equal to or greater than 90 ksi (620 MPal) A732/A732M 3Q, 4A, 4Q, 5N 4 Low-alloy stel (annealed, normalized, or normalized and tempered Tensile strength less than 85 ksi [585 MPal) A148/A148M 80-50 4 Low-alloy stel (annealed, normalized, or normalized and tempered Tensile strength less than 85 ksi [585 MPal) A217/A217M WC1, WC4, WC5, WC6, WC9 4 Low-alloy stell (annealed, normalized and tempered Tensile strength equal to or greater than 4757/A757M B2M, 838N, B4N A958/A958M C23, C24 A356/A958M C24, C25 A356/A958M C25, C25 A356/A958M C25 A356/A958/A958M C25 A356/A958M C25 A356/A958M C25 A356/A958M C25 A356/A958/A958M C25 A356/A958/A958/			A148/A148M	80-40
A352/A352M	(5	carbon-manganese steel (tensile trength equal to or greater than 0 ksi [485 MPa]) but less than 90	A216/A216M	WCC
A2C		o. [020 4])	A352/A352M	LCC
A958/A958M SC 1030, SC 1040, SC 1045, CLASSES 8 80/50 3 Carbon and carbon-manganese steel (tensile strength equal to or greater than 90 ksi [620 MPa]) 4 Low-alloy steel (annealed, normalized and tempered Tensile strength less than 95 ksi [585 MPa]) 5 Low-alloy steel (annealed, A386/A358M SC 1045, CLASSES 90/60, 105/85, 115/95 MPa]) 6 Low-alloy steel (annealed, A386/A358M C23, C24 A386/A358M SC 1410, SC 8620, SC 8625, SC CLASSES 66/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, normalized and tempered Tensile strength equal to or greater than 85 ksi [585 MPa]) A356/A356M A487/A487M C5, CLASSES 66/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, A386/A356M A487/A487M D4, To, Za, Zc, 4A, 4C, 6A, 8A, 9A, 9C, 1 13A A732/A732M A732/A732M A732/A732M A732/A732M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A732/A352M LC1, LC2, LC3, LC4, LC9 LC3, LC4, LC9, LC4, LC4, LC9 LC3, LC4, LC4, LC4, LC4, LC4, LC4, LC4, LC4				
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Normalized, or normalized and tempered Tensile strength less than 85 ksi A217/A217M WC1, WC4, WC5, WC6, WC9 A352/A352M A356/A356M 2, 5, 6, 8 A386/A356M A356/A356M A487/A487M A757/A757M A757	`		A958/A958M	SC 1045, CLASSES 90/60, 105/85, 115/95
Tensile strength less than 85 ksi [585 MPa]) A352/A352M A363/A352M A363/A356M C23, C24 A487/A487M A958/A398M C23, C24 A487/A487M A958/A958M SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 65/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, normalized and tempered Tensile strength equal to or greater than 85 ksi [585 MPa]) A356/A356M 9, 10, 12 A487/A487M 11, C, ZA, ZC, 4A, 4C, 6A, 8A, 9A, 9C, 1 13A A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A558/A958M SC 4340, CLASSES 90/60, 105/85 6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210 210-180L, 260-210L A352/A352M LC2-1, LC1, LC2, LC3, LC4, LC9 A487/A487M 18, 1C, ZB, ZC, 4B, 4C, 4D, 4E, 6B, 7A, 8 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 14 A732/A732M 70, 8O, 9O, 10O, 11O, 12O, 13O, 14O, E2O, E2O, E2O, B3O, B4O, C1O, D101, D102, D102, E2O1, E2O2, E2O3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/	r	ormalized, or normalized and	A148/A148M	80-50
A352/A352M A356/A356M A356/A356M A356/A356M A356/A356M A356/A356M A356/A356M A356/A356M C23, C24 A487/A487M B2N, B3N, B4N B2N, B3N, B4N, B2N, B3N, B4N, B2N, B3N, B4N, B2N, B3N, B4N, B2N, B3N, B4N B2N, B3N, B4N, B2N, B3N, B4N, B2N, B3N, B4N, B3N, B4N, B3N, B4N, B3N, B4N, B3N, B4N, B3N, B4N, B4N, B4N, B4N, B4N, B4N, B4N, B4	-	ensile strength less than 85 ksi	A217/A217M	WC1, WC4, WC5, WC6, WC9
A389/A389M A487/A487M A958/A958M C23, C24 114, 124, 16A B2N, B3N, B4N SC 4130, SC 8620, SC 8625, SC CLASSES 65/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, normalized and tempered Tensile strength equal to or greater than 85 ksi [585 MPa]) A356/A356M A487/A487M A958/A958M C3, C24 B2N, B3N, B4N SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 65/35, 70/36, 80/40, 80/50 C130, C24 B2N, B3N, B4N SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 66/35, 70/36, 80/40, 80/50 C130, C24 B2N, B3N, B4N SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 66/35, 70/36, 80/40, 80/50 C130, C24 B2N, B3N, B4N SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 66/35, 70/36, 80/40, 80/50 C130, C14 B2N, B3N, B4N SC 4130, SC 4140, SC 8620, SC 8630, CLASSES 115/95, 130/115, 135/125, SC 8630, CLASSES 115/95,				
A487/A487M A958/A958M				
A757/A757M A958/A958M SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 65/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, normalized, or normalized and tempered Tensile strength equal to or greater than 85 ksi [585 MPa]) A217/A217M C5, C12, C12A, WC11 A356/A356M 9, 10, 12 A366/A356M 9, 10, 12 A3732/A732M 6N, 15A A732/A732M 6N, 15A A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A564/A958M SC 4340, CLASSES 90/60, 105/85 6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210 A352/A352M LC2-1, LC1, LC2, LC3, LC4, LC9 A487/A487M 18, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 14B, 14B, 14B, 13B, 14B, 14B, 14B, 14B, 14B, 14B, 14B, 14				
A958/A958M SC 4130, SC 4140, SC 8620, SC 8625, SC CLASSES 65/35, 70/36, 80/40, 80/50 5 Low-alloy steel (annealed, normalized and m/78 1789 5 - 6874 - 466b - bad 2 - 10 e1 c				
August A			A958/A958M	SC 4130, SC 4140, SC 8620, SC 8625, SC 8630,
tempered Tensile strength equal to or greater than 85 ksi [585 MPa]) A356/A356M A487/A487M A487/A487M A757/A757M A958/A958M A352/A352M A732/A32M A352/A352M A487/A487M A958/A958M A557/A757M A958/A958M A557/A757M A958/A958M A352/A352M A757/A757M A958/A958M A757/A757M A958/A958M A757/A757M A958/A958M A757/A757M A958/A958M A757/A757M BA958/A958M A757/A757M BA958/A958M A757/A757M BA958/A958M A758/A958M A757/A757M BC A140, SC 4130, SC 4340, SC 8620, SC 8630, CLASSES 115/95, 130/115, 135/	j 1	ow-alloy steel (annealed, ASTM A4	A148/A148M	90-60, 105-85
than 85 ksi [585 MPa]) A356/A356M A487/A487M A487/A487M A752/A732M A757/A757M A958/A958M A356/A356M A752/A732M A958/A958M A148/A148M A757/A757M A958/A958M A352/A352M A487/A487M A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q2, D1Q2, E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC 8630, CLASSES 115/95, 130/115, 135/	tarus.ricir.ai/	empered Standards/astin//815/0	895-687d-4e6b	-bad2-10e1c5e89e14/astm-a488-a488m-18e
A487/A487M 1A, 1C, 2A, 2C, 4A, 4C, 6A, 8A, 9A, 9C, 1 13A A732/A732M 6N, 15A A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A958/A958M SC 4340, CLASSES 90/60, 105/85 6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210 210-180L, 260-210, 260-210L A352/A352M A487/A487M 1B, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 14 A732/A732M A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q E2Q1, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC 8630, CLASSES 115/95, 130/115, 135/				
13A A732/A732M A757/A757M A757/A757M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 A958/A958M SC 4340, CLASSES 90/60, 105/85 6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210, 210-180L, 260-210, 260-210L A352/A352M A487/A487M 1B, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8, 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 14B, 14B, 14B, 14B, 14B, 14B, 14B, 14				
A732/A732M A757/A757M A958/A958M Control of the part			A407/A407WI	
A757/A757M A958/A958M D1N1, D1N2, D1N3, E2N1, E2N2, E2N3 SC 4340, CLASSES 90/60, 105/85 6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210, 210-180L, 260-210, 260-210L A352/A352M A487/A487M LC2-1, LC1, LC2, LC3, LC4, LC9 1B, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8, 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 11 A732/A732M A757/A757M A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q, E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC 8630, CLASSES 115/95, 130/115, 135/			A732/A732M	
6 Low-alloy steel (quenched and tempered) A148/A148M 90-60, 105-85, 115-95, 130-115, 135-125, 150-135, 160-145, 165-150, 165-150L, 210 210-180L, 260-210, 260-210L A352/A352M A487/A487M LC2-1, LC1, LC2, LC3, LC4, LC9 A487/A487M 1B, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 1 A732/A732M A732/A732M A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/				D1N1, D1N2, D1N3, E2N1, E2N2, E2N3
tempered) 150-135, 160-145, 165-150, 165-150L, 210 210-180L, 260-210, 260-210L A352/A352M			A958/A958M	SC 4340, CLASSES 90/60, 105/85
A487/A487M 1B, 1Ć, 2B, 2C, 4B, 4Ć, 4D, 4E, 6B, 7A, 8 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 1 A732/A732M A757/A757M 7Q, 8Q, 9Q, 10Q, 11Q, 12Q, 13Q, 14Q B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/		, , , ,	A148/A148M	150-135, 160-145, 165-150, 165-150L, 210-180,
9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 1 A732/A732M A757/A757M A757/A757M A958/A958M A958/A958M PA, 8Q, 9Q, 10Q, 11Q, 12Q, 13Q, 14Q B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q E2Q1, E2Q2, E2Q3 SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/			A352/A352M	LC2-1, LC1, LC2, LC3, LC4, LC9
A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q2 E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/			A487/A487M	1B, 1C, 2B, 2C, 4B, 4C, 4D, 4E, 6B, 7A, 8B, 8C, 9A, 9B, 9C, 9D, 9E, 10B, 11B, 12B, 13B, 14A
A757/A757M B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q2 E2Q1, E2Q2, E2Q3 A958/A958M SC 4140, SC 4130, SC 4340, SC 8620, SC SC 8630, CLASSES 115/95, 130/115, 135/			A732/A732M	7Q, 8Q, 9Q, 10Q, 11Q, 12Q, 13Q, 14Q
SC 8630, CLASSES 115/95, 130/115, 135/				B2Q, B3Q, B4Q, C1Q, D1Q1, D1Q2, D1Q3, E1Q,
150/135, 160/145, 165/150, 210/180			A958/A958M	SC 4140, SC 4130, SC 4340, SC 8620, SC 8625, SC 8630, CLASSES 115/95, 130/115, 135/125, 150/135, 160/145, 165/150, 210/180
7 Ferritic stainless steel A743/A743M CB30†, CC50†	· .	erritic stainless steel	A743/A743M	CB30†, CC50†
8 Martensitic stainless steel A217/A217M CA15†	i I	fartensitic stainless steel	A217/A217M	
A352/A352M CA6NM A356/A356M CA6NM				

TABLE 1 Continued

Category Number	Material Description	ASTM Specification	Grades
		A487/A487M	CA15-A, CA15-B, CA15-C, CA15-D, CA15M-A, CA6NM-A, CA6NM-B
		A743/A743M A757/A757M	CA15†, CA15M†, CA6NM, CA40†, CA6N, CB6 E3N
9	Low-carbon austenitic stainless steel (carbon equal to or less than 0.03 %)	A351/A351M	CF3†, CF3A†, CF3M†, CF3MA†, CF3MN†, CK3MCUN†, CG3M, CN3MN
		A743/A743M	CF3†, CF3M†, CF3MN†, CK3MCUN†, CN3M†, CG3M, CN3MN
		A744/A744M	CF3†, CF3M†, CK3MCUN†, CG3M, CN3MN
10	Unstabilized austenitic stainless steel (carbon greater than 0.03 %)	A351/A351M	CF8†, CF8A†, CF8M†, CF10†, CF10M†, CG8M†, CH8†, CH10†, CH20†, CG6MMN, CF10SMNN, CE20N
		A447/A447M A743/A743M	Type I CF8†, CG12†, CF20†, CF8M†, CF16F†, CF10SMNN, CH20†, CG8M†, CE30†, CG6MMN, CH10, CF16Fa
		A744/A744M	CF8†, CF8M†, CG8M†
11	Stabilized austenitic stainless steel	A297/A297M A351/A351M	HG10MNN† CF8C†, CF10MC†, CK20†, HK30†, HK40†, HT30†, CN7M†, CT15C†
		A447/A447M A743/A743M A744/A744M	Type II CF8C†, CN7M†, CN7MS†, CK20† CF8C†, CN7M†, CN7MS†
12	Duplex (austenitic-ferritic) stainless steel	A872/A872M	J93183, J93550
	Docum	A890/A890M A995/A995M	1A, 1B, 2A, 3A, 4A, 5A, 6A 1B, 2A, 3A, 4A, 5A, 6A
13	Precipitation-hardened austenitic stainless steel	A747/A747M	CB7CU-1, CB7CU-2
://sta <mark>l4dard</mark> s.ite	h.ai Nickel-base alloys dards/astm/781	A488/ A494/A494M e66	CW12MW†, CY40† Class 1, CY40† Class 2, CZ100†, M35-1†, M35-2†, M30C†, N12MV†, N7M†, CW6M†, CW2M†, CW6MC† CX2MW†, CU5MCUC
		A990/A990M	CW2M
15	Steel castings, austenitic manganese	A128/A128M	A, B-1, B-2, B-3, B-4, C, D, E-1, E-2, F

†Editorially corrected.

A356/A356M Specification for Steel Castings, Carbon, Low Alloy, and Stainless Steel, Heavy-Walled for Steam Turbines

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A389/A389M Specification for Steel Castings, Alloy, Specially Heat Treated, for Pressure-Containing Parts, Suitable for High-Temperature Service

A447/A447M Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High-Temperature Service

A487/A487M Specification for Steel Castings Suitable for Pressure Service

A494/A494M Specification for Castings, Nickel and Nickel Alloy

A732/A732M Specification for Castings, Investment, Carbon and Low Alloy Steel for General Application, and Cobalt Alloy for High Strength at Elevated Temperatures

A743/A743M Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

A744/A744M Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service

A747/A747M Specification for Steel Castings, Stainless, Precipitation Hardening

A757/A757M Specification for Steel Castings, Ferritic and



RECOMMENDED FORM FOR MANUFACTURER'S RECORD OF WELDING PROCEDURE QUALIFICATION TESTS

Procedure No Da	ate:	Welding Process:				
Material Specification: _				egory No		
Plate Thickness:	Thickne	ess Range Qualified ——		.9017 1101		
Filler Metal F Group No.						
Flux Designation:	Gas Co	omposition:				
Gas Flow Rate:	Backing	Strip, if any:				
Preheat Temperature Ra	nge:	Single or Multiple Pa	ass:			
Position of Groove:	Filler	Wire Diameter:				
Trade Name:	Type of Ba	cking:				
Forehand or Backhand:	A	mps: Volts _		Inches/min:		
Postheat Temperature _	Ti	me at Temperature				
		TENSIO	N TEST RE	ESULTS		
Specimen No.	Width	Dimensions Thickness	Area	Ultimate Total Load, Ib	Ultimate Unit Stress, psi	Nature of Failure and Location
		GUIDED I	BEND TES	T RESULTS		
Specimen No.		Results		Specimen No.		Results
Welder's Name:	Clo	ock No Stamp	. No			
Who by virtue of these t	ests meets	the welder performance	qualification	on.		
Test Conducted By:		Test No.	·	11-		
per		<u>lien s</u>	Man	<u> aras</u>		
We certify that the state	ements in th	nis record are correct and	that the	test welds were prepare	ed, welded, and te	sted in accordance
with the requirements of	of ASTM Sta	ndard/				
Signed:	-	attus.//Sta			<u> </u>	
		Manufac	cturer or C			
Date:						
		FIG. 1	Report Fo	orm 1		



RECOMMENDED FORM FOR MANUFACTURER'S OR CONTRACTOR'S RECORD OF WELDER OR OPERATOR PERFORMANCE QUALIFICATION TESTS

Welder or Opeator's Name: Stamp I	10		
Clock No Welding Process			
Position:			
In accordance with Procedure No			
Material Specification: to	of category No to cate	egory No	
Filler Metal Specification No.	Group No. F. ————		
Was Backing Strip Used?	•		
· .			
	GUIDED BEND	TEST RESULTS	
Specimen No.	Results	Specimen No.	Results
We cout that the statements in this	a record are correct and that the	test welds were prepared, welded, an	d tooted in accordance with ACTM
	s record are correct and that the	test weids were prepared, weided, an	d tested in accordance with ASTM
Standard			
Signed:			
	Manufacture	or Contractor	
Date:			

FIG. 2 Report Form 2

iTeh Standards (https://standards.iteh.ai) Document Preview

<u> ASTM A488/A488M-18e</u>2

https://standards.iteh.ai/catalog/standards/astm/78137895-687d-4e6b-bad2-10e1c5e89e14/astm-a488-a488m-18e/



REPORT FORM 3

RECOMMENDED FORM FOR WELDING PROCEDURE SPECIFICATION

1. Title	7. Preheat
Welding of ^A steel castings.	7.1 Preheat and interpass temperature shall be maintained in the range
^A Indicate general material description, such as carbon, Cr-Mo, 12 Cr, etc.	from ^A to ^B during ^C .
2. Specification NoRev	A Indicate minimum temperature.
Date	^B Indicate maximum temperature.
3. Scope	^C Indicate if preheat maintenance is during welding or until postweld heat
3.1 Procedure Specification No. covers the welding of A	treatment is performed.
steel castings using the B welding process.	7.2 Preheat for tack welding of backing plates is the same as required
A Indicate general material description in the Title.	for welding.
^B Indicate specific welding process, such as shielded metal arc, etc.	7.3 Minimum temperature before applying heat shall be ^A .
4. Base Material	A Indicate temperature.
4.1 The base material shall conform to the specification for ^A	7.4 Local preheating to the temperatures indicated may be performed
which is found in materials category number ^B	so that the heated area completely surrounds the weld preparation for a
A Insert reference to ASTM designation or indicate chemical analysis and	minimum distance of ^A in any direction.
physical properties.	A Indicate minimum distance for local preheating.
^B Indicate category number from Table 1.	8. Welding Position
4.2 Base material shall be in the ^A heat treated condition before	8.1 Welds shall be made in the ^A position.
welding.	A Indicate position or positions in which the welding will be performed. See
A Indicate heat treatment before welding.	Fig. 4.
5. Filler Metal	9. Electrical Characteristics
5.1 The filler metal shall conform to ANSI/AWS Specification ^A	9.1 The current used shall be ^A . The base material shall be attached
which is found in weld metal analysis group A	to the B welding electrode lead.
A Indicate appropriate American Welding Society specification number and	A Indicate whether direct or alternating current. If direct, state whether
filler metal classification (e.g., A5.1 E7018).	non-pulsed or pulsed. If pulsed, state frequency.
^B Indicate A Number from Table 4.	^B Indicate whether electrode positive (EP) or electrode negative (EN) output
5.2 Flux for submerged arc welding shall conform to the following nominal	terminal of power supply is used.
composition: ^A	Electrode
A Indicate chemical composition or trade designation.	Wire
5.3 Shielding gas for gas shielded arc welding shall conform to the	Diameter ^A Amperage ^A Range ^A Voltage ^A
following nominal composition: A .	anuarus
A Indicate the single gas or proportional parts of mixed gases and flow rates.	
 A Indicate the single gas or proportional parts of mixed gases and flow rates. 6. Preparation of Base Material 	
6. Preparation of Base Material	A Indicate for each diameter of electrode, the amperage, the range of
	A Indicate for each diameter of electrode, the amperage, the range of amperage permitted, and the voltage requirements. For welding processes
Preparation of Base Material 6.1 Metal removal shall be performed by ^A	
6. Preparation of Base Material 6.1 Metal removal shall be performed by And Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal.	amperage permitted, and the voltage requirements. For welding processes
6. Preparation of Base Material 6.1 Metal removal shall be performed by And Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal.	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled
6. Preparation of Base Material 6.1 Metal removal shall be performed by A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: ^A
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle.	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed times
6. Preparation of Base Material 6.1 Metal removal shall be performed by A. Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A. Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration welds shall conform to the following geometry: A. Configuration well and A. Configuration well an	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed times the size of the filler metal used.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds. Backing plates shall be made from A steel and shall fit the back of	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed times the size of the filler metal used. A Indicate the number for controlling the maximum width 1488-4488 metals.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds. Backing plates shall be made from A steel and shall fit the back of	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed times the size of the filler metal used. A Indicate the number for controlling the maximum width. 10.2 Craters shall be properly filled before each interruption of the arc.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds.	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed times the size of the filler metal used. A Indicate the number for controlling the maximum width. 10.2 Craters shall be properly filled before each interruption of the arc. 10.3 Slag or flux shall be removed on any bead before depositing the
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds. Backing plates shall be made from A steel and shall fit the back of the cavity with a minimum gap of B	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed Indicate the number for controlling the maximum width. A Indicate the number for controlling the maximum width. 10.2 Craters shall be properly filled before each interruption of the arc. 10.3 Slag or flux shall be removed on any bead before depositing the next successive bead. 10.4 Interpass inspection shall be performed according to the following: A Indicate the following: A Interpass inspection shall be performed according to the following:
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds. Backing plates shall be made from A steel and shall fit the back of the cavity with a minimum gap of B A Indicate material of backing plate.	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed Indicate the filler metal used. A Indicate the number for controlling the maximum width. 10.2 Craters shall be properly filled before each interruption of the arc. 10.3 Slag or flux shall be removed on any bead before depositing the next successive bead.
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A A Indicate minimum root radius and minimum side wall angle. 6.3 Configuration of the weld preparation for full penetration welds shall conform to the following geometry: A A Indicate minimum side wall angle. 6.4 Backing plates shall be used for welding full penetration welds. Backing plates shall be made from A steel and shall fit the back of the cavity with a minimum gap of B A Indicate material of backing plate. B Indicate dimension of maximum gap. 6.5 Surfaces of the weld preparation shall be cleaned of all oil, grease, dirt, scale, slag, shot blasting grit, or any foreign material which may	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed Indicate the number for controlling the maximum width. A Indicate the number for controlling the maximum width. Craters shall be properly filled before each interruption of the arc. 10.3 Slag or flux shall be removed on any bead before depositing the next successive bead. 10.4 Interpass inspection shall be performed according to the following: A Indicate degree of interpass inspection required. 10.5 Peening shall be performed according to the following:
6. Preparation of Base Material 6.1 Metal removal shall be performed by A A Indicate method of metal removal, such as chipping, grinding, carbon arc cutting, frame cutting, etc. Also indicate whether preheat is required during metal removal. 6.2 Configuration of the weld preparation for partial penetration welds shall conform to the following geometry: A	amperage permitted, and the voltage requirements. For welding processes using wire, indicate wire diameter, wire feed speed, and current requirements. 9.2 Electrodes subject to moisture absorption must be stored and handled to maintain dryness according to the following: A Where applicable, indicate electrode care instructions. 10. Welding Details 10.1 The width of any pass of welding shall not exceed Itimes the size of the filler metal used. A Indicate the number for controlling the maximum width. 10.2 Craters shall be properly filled before each interruption of the arc. 10.3 Slag or flux shall be removed on any bead before depositing the next successive bead. 10.4 Interpass inspection shall be performed according to the following: Indicate degree of interpass inspection required.
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FIG. 3 Report Form 3