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Standard Specification for Reactive and Refractory Metal Clad Plate[1]

This standard is issued under the fixed designation B898; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers plate consisting of a base metal to which is bonded, integrally and continuously, on one or both sides a layer of one of the following: titanium, zirconium, tantalum, niobium, and their alloys. The material generally is intended for pressure vessel use.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard. The values in parentheses and in metric tables are provided for information only.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A265 Specification for Nickel and Nickel-Base Alloy-Clad Steel Plate

A578/A578M Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications

B265 Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate

B393 Specification for Niobium and Niobium Alloy Strip, Sheet, and Plate

B551/B551M Specification for Zirconium and Zirconium Alloy Strip, Sheet, and Plate

B708 Specification for Tantalum and Tantalum Alloy Plate, Sheet, and Strip

2.2 *ASME Code:*[3]

Boiler and Pressure Vessel Code, Section IX Welding Qualifications

Boiler and Pressure Vessel Code, Section VIII Divisions 1, 2, 3

2.3 *Military Standard:*[4]

MIL-J-24445A Joint, Bimetallic Bonded, Aluminum to Steel

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 This material is considered as single-clad or double-clad dependent upon whether one or both sides of the base metal are covered by a cladding metal.

3.1.2 *base metal, n*—the component that comprises the greatest percentage of total thickness.

3.1.3 *cladding metal, or cladding metals, n*—the component, or components, which individually comprise less than the greatest percentage of total thickness.

3.1.4 *cladding operation, n*—the production event, which results in the formation of the bond between the cladding and base metal components, plus all related prebonding and post bonding operations, prior to supply to the purchaser.

3.1.5 *interface, n—of the clad product*, is that region of thickness in which the product transitions from essentially 100 % base metal to 100 % cladding metal. Also known as bond or bond zone.

3.1.6 *interlayer, n*—a metal layer of a type or grade different from the cladding metal and base metal, which is applied between the cladding and base metal.

3.1.7 *integrally and continuously bonded, adv*—a condition in which the cladding metal and base metal are brought together to form a metallurgical bond at essentially the entire interface of the two metals by means other than those processes that do not produce a homogeneous composite plate.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Quantity.

4.1.2 Product dimensions, including thickness of both cladding metal and base metal. It should state whether each thickness value is minimum or nominal. If not stated, thickness values shall be nominal.

[1] This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.01 on Titanium.

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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.

[3] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

[4] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

4.1.3 Cladding metal type and specification (the cladding metal specification) (see Section 6).

4.1.4 Base metal type and specification (the base metal specification) (see Section 6).

4.1.5 Flatness requirements (see 10.3).

4.1.6 Ultrasonic inspection level (see Section 11).

4.1.7 Heat treatment requirements, if any.

4.1.8 Restrictions limiting or disallowing welding, or weld repair, or both, if any (see Section 12).

4.1.9 Any additional codes and standards specified by the purchaser or manufacturer.

4.1.10 Supplementary Requirements, if any.

4.1.11 Additional requirements, if any.

5. Materials and Manufacture

5.1 *Process:*

5.1.1 The base metal shall be manufactured in accordance with all applicable requirements of the base metal specification (see 4.1.4).

5.1.2 The cladding metal shall be manufactured in accordance with all applicable requirements of the cladding metal specification (see 4.1.3).

5.1.3 The cladding metal shall be bonded to the base metal by any cladding operation that will produce a clad product which will conform to the requirements of this specification. Cladding methods may be, but are not limited to, explosion bonding, roll bonding, and weld overlay.

5.1.4 The cladding metal may be fabricated from multiple sheets or plates by edge butt welding prior to the cladding operation.

5.1.5 The cladding thickness may consist of multiple layers of the cladding metal.

5.2 *Heat Treatment*—Unless otherwise specified or agreed between the purchaser and the manufacturer, all heat treatments shall be performed as needed in the cladding operation to assure the following:

5.2.1 The cladding metal conforms to the applicable requirements of the cladding metal specification,

5.2.2 The base metal conforms to the applicable requirements of the base metal specification, and

5.2.3 The clad bond exhibits optimum resistance to disbonding during common fabrication processes.

6. Chemical Composition

6.1 The composite plate may conform to any desired combination of cladding metal and base metal as described in 6.2 and 6.3 and as agreed upon between the purchaser and the manufacturer.

6.2 *Cladding Metal*—The cladding metal shall conform to the requirements as to chemical composition prescribed in the applicable cladding metal specification: B265, B393, B551/B551M, or B708.

6.3 *Base Metal*—The base metal shall be steel or any other product conforming to specifications for metal plate. The base metal shall conform to the requirements as to chemical composition prescribed in the base metal specification.

7. Mechanical Properties

7.1 The base metal shall conform to the mechanical property requirements prescribed in the base metal specification.

7.2 The mechanical properties of the cladding metal may not conform necessarily to the mechanical property requirements prescribed in the cladding metal specification unless otherwise agreed upon between manufacturer and purchaser.

7.3 Mechanical testing of the base metal, in accordance with the base metal specification, may be performed prior to the cladding operation if the cladding operation does not affect the applicable mechanical properties of the base metal.

7.4 Unless simulated post cladding heat treatments are specified by the purchaser, Supplementary Requirement S5, the mechanical test specimens shall be representative of the material in the heat treatment condition of product being shipped from the clad manufacturer.

7.5 *Tensile Strength Requirements*—The tensile properties shall be determined by a tension test on the base metal only in accordance with the testing requirements of the base metal specification. When tension test specimen are taken from the clad plate, the cladding shall be removed before tension tests are made.

7.6 *Bond Shear Strength*—When bond shear strength testing is specified, Supplementary Requirement S1, the bond shear strength of the clad product shall be 20 000 psi (137.9 MPa) minimum when tested in accordance with Fig. 1.

8. Chemical Analysis

8.1 When the cladding operation does not affect the chemical composition of the cladding or base metal, or both, the chemical analysis, in accordance with cladding, or base metal specifications, or both, may be performed prior to the cladding operation. Otherwise, chemical analysis of the applicable component or components shall be performed after the cladding operation in accordance with the cladding metal or base metal specifications, or both.

8.2 When chemical analysis of the finished product is invoked, Supplementary Requirement S4, the frequency of testing, specimen location, and testing methods shall be agreed upon between manufacturer and purchaser.

9. Location and Number of Tests and Retests

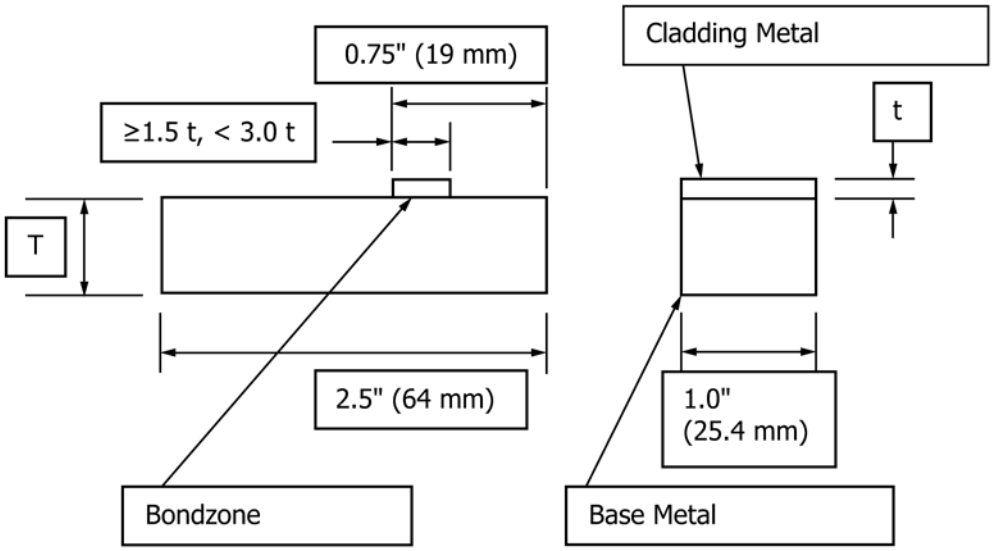
9.1 *Tension, Bend, and Impact Tests (When Required)*—The specimen orientation, location with respect to thickness, and number of tests and retests shall be in accordance with the requirements of the base metal specification. The test specimen location within the plate shall be at the manufacturer's option.

10. Dimensions and Flatness, Permissible Variations

10.1 *Thickness:*

10.1.1 Cladding metal thickness tolerances shall be in accordance with Table 1.

10.1.2 Base metal thickness tolerances shall be in accordance with Table 2.



t = Cladding Metal Thickness—If > 0.125 in. (3.2 mm), machine to 0.125 in. (3.2 mm) max
T = Base Metal Thickness—If base metal thickness >1.0 in. (25.4 mm), it may be machined to 1.0 in. (25.4 mm) nominal.
Remove all cladding from base metal, except for area shown.
All corners are 90°.

FIG. 1 Shear Test Specimen

TABLE 1 Cladding Metal Thickness Tolerance

	When Cladding Metal Thickness is Specified			
	Minimum		Nominal	
Specified Thickness	≤ 0.150 in.	> 0.150 in.	< 0.188 in.	≥ 0.188 in.
Undergage Tolerance	0	0	0.030 in.	0.060 in.
Overgage Tolerance	100 % of min	50 % of min	100 % of nominal	50 % of nominal

TABLE 1M Cladding Metal Thickness Tolerance

	When Cladding Metal Thickness is Specified			
	Minimum		Nominal	
Specified Thickness	≤ 3.8 mm	> 3.8 mm	< 4.8 mm	≥ 4.8 mm
Undergage Tolerance	0	0	0.75 mm	1.5 mm
Overgage Tolerance	100 % of specified minimum	50 % of specified minimum	100 % of specified nominal	50 % of specified nominal

TABLE 2 Base Metal Thickness Tolerance

	When Base Metal Thickness is Specified			
	Minimum		Nominal	
Specified Thickness	< 1.0 in.	≥ 1.0 in.	< 1.0 in.	≥ 1.0 in.
Undergage Tolerance	0	0	0.01 in.	0.01 in.
Overgage Tolerance	0.21 in. over min	0.26 in. over min	0.20 in. over nominal	0.25 in. over nominal

TABLE 2M Base Metal Thickness Tolerance

	When Base Metal Thickness is Specified			
	Minimum		Nominal	
Specified Thickness	< 25.4 mm	≥ 25.4 mm	< 25.4 mm	≥ 25.4 mm
Undergage Tolerance	0	0	0.25 mm	0.25 mm
Overgage Tolerance	5.3 over specified minimum	6.6 over specified minimum	5.1 over specified nominal	6.4 over specified nominal

10.1.3 When the purchaser specifies flatness in accordance with 10.3.1.3 or 10.3.1.4, overgage tolerances in excess of those specified herein may be specified by the manufacturer.

10.1.4 When agreed upon by the producer and the purchaser, overgage tolerances different from those specified herein shall apply.

10.1.5 When an interlayer metal is included in the product and when its thickness exceeds 0.005 in. (0.127 mm) nominal, its composition and nominal thickness shall be reported.

10.2 *Length and Width or Diameter Tolerances:*

10.2.1 Clad plates shall be supplied with edges cut to the dimensions specified by the purchaser. Cutting may be performed by thermal or mechanical means or any other method, which does not deleteriously affect the product quality. Clad plates shall conform to the length and width or diameter tolerances of Table 3 unless otherwise agreed upon between the manufacturer and purchaser.

10.2.2 When specified by the purchaser, clad plate shall be supplied in the as-clad or mill edge, condition. Minimum sound bond size shall be specified, and length and width tolerances of the as-supplied product shall be as agreed upon between

TABLE 3 Length and Width, or Diameter, Tolerance

Total Thickness	Permissible Variation from Specified Length and Widths or Diameter
<2.0 in.	–0, +0.8 in.
≥ 2.0 in., < 4.0 in.	–0, +1.0 in.
≥ 4.0 in., <8.0 in.	–0, +1.5 in.
≥ 8.0 in.	per agreement

TABLE 3M Length and Width, or Diameter, Tolerance

Total Thickness	Permissible Variation from Specified Length and Widths or Diameter
<50 mm	–0, +20 mm
≥ 50, <100	–0, +25 mm
≥ 100, <200	–0, +38 mm
≥ 200 mm	per agreement

purchaser and manufacturer. All edge nonbond areas outside of the specified minimum sound bond area shall be marked clearly on the surface, or the boundary of the required sound bond area shall be marked clearly on the sound bond portion of the surface, or both.

10.3 *Flatness:*

10.3.1 Flatness of the clad plate shall be in accordance with one of the following flatness tolerance requirements. When flatness requirements are not specified by the purchaser, flatness tolerances of 10.3.1.1 shall apply.

10.3.1.1 *Standard Plate Flatness*—Out-of-flatness of the cladding face shall not exceed the requirements of Table 4. This flatness criteria typically is applicable for clad plates intended for subsequent forming, or fabrication, or both.

10.3.1.2 *Special Flatness*—Out-of-flatness of the cladding face shall not exceed 0.100 in. (2.5 mm) over any 36-in. (915-mm) span. This flatness criteria typically is applicable for plates used in the flat condition.

10.3.1.3 *Machined Flatness*—Out-of-flatness of one or both faces, as specified by the purchaser, shall not exceed 0.010 in. (0.25 mm) over any 36-in. (915-mm) span.

10.3.1.4 *Suitable for Machining Flat*—The material shall be supplied in a condition suitable for subsequent machining of specified face or faces while protecting minimum specified thickness. The combination of the flatness of the product and the thickness of the component metals shall permit the cladding metal, or the base metal, or both, as specified by the purchaser, to be machined to the requirements of 10.3.1.3 without reducing thickness below the minimum specified, upon application of proper set-up and machining practice.

10.3.1.5 *Other Flatness*—Other flatness requirements may be agreed upon mutually between the manufacturer and the purchaser.

TABLE 4 Permissible Variations in Flatness of Cladding Metal Surface

Total Thickness (in.)	Maximum Out-of-Flatness Over any 36 in.[A,B,C,D]	Maximum Out-of-Flatness Over any 72 in.[E,A,D]
<0.50	0.38	0.56
≥0.50 <1.0	0.31	0.47
≥1.0 <6.0	0.25	0.38
≥6.0	to be agreed upon	to be agreed upon

[A] Flatness is measured by placing a straight edge of 36-in. length or a straight edge of 72-in. on the plate surface, or both, and then measuring the maximum deviation between the plate surface and the straight edge. Balancing of the straight edge on a high point is an acceptable measurement technique.
[B] For plate dimensions between 36 in. and 72 in., only the 36 in. shall apply.
[C] For plate dimensions less than 36 in., the maximum out of flatness shall be the ratio of (applicable dimension / 36 in.) × (above value for 36-in. measurement).
[D] This flatness criteria shall apply to the total cladding metal surface. Measurements are required only as needed to assure that this requirement is met.
[E] For plate dimensions exceeding 72 in., both the 36-in. and 72-in. measurements shall apply.

TABLE 4M Permissible Variations in Flatness of Cladding Metal Surface

Total Thickness (mm)	Maximum Out-of-Flatness mm Over any 915 mm[A]	Maximum Out-of-Flatness mm Over any 1830 mm[B,C,D,E]
<12.7	9.7	14.2
≥12.7 <25.4	7.9	11.9
≥25.4 <150	6.3	9.7
≥152	to be agreed upon	to be agreed upon

[A] Flatness is measured by placing a straight edge of 915-mm length or a straight edge of 1830 mm on the plate surface, or both, and then measuring the maximum deviation between the plate surface and the straight edge. Balancing of the straight edge on a high point is an acceptable measurement technique.
[B] For plate dimensions exceeding 1830 mm, both the 915 and 1830 measurements shall apply.
[C] For plate dimensions between 915 and 1830, only the 915 shall apply.
[D] For plate dimensions less than 915, the maximum out of flatness shall be the ratio of (applicable dimension / 915)× (above value for 915 measurement)
[E] This flatness criteria shall apply to the total cladding metal surface. Measurements are required only as needed to assure that this requirement is met.

11. Nondestructive Testing

11.1 After the completion of all mechanical and thermal processing components of the cladding operation, clad plates shall be inspected for bond integrity in accordance with the procedures and methods of Specification A578/A578M. Scanning shall be performed with a 1 in. (25 mm) or 1⅛ in. (30 mm) diameter or 1 in. (25 mm) square transducer. Any indication which causes 100 % loss of back reflection accompanied by a reflection from the clad interface shall be recordable. Three Quality Levels shall apply. If the ultrasonic inspection class is not specified, Class C shall apply.

11.1.1 *Class A*—Scanning shall be performed over 100 % of the clad surface. Any single recordable indication exceeding 1 in. (25 mm) in its longest dimension shall be cause for rejection. The minimum sound bond area shall be 99 %.

11.1.2 *Class B*—Scanning shall be performed over 100 % of the clad surface. Any single recordable indication exceeding 3 in. (75 mm) in its longest dimension shall be cause for rejection. The minimum sound bond area shall be 97 %.

11.1.3 *Class C*—Scanning shall be along continuous perpendicular grid lines on nominal 9 in. (225 mm) centers, or at the option of the manufacturer, shall be along continuous parallel paths on nominal 4 in. (100 mm) centers. When an indication is observed during general scanning, the indication shall be evaluated. Any single recordable indication exceeding 9 $in.^2$ (58 cm^2) in area shall be cause for rejection. The minimum sound bond area shall be 95 %.

11.2 If the cladding metal has been applied by welding or fabricated from multiple sheets by welding, when specified in the contract, the exposed surface of the welds are to be 100 % penetrant inspected in accordance with ASME Section VIII, Division 1, Appendix 8, or as agreed between purchaser and manufacturer.

12. Welding

12.1 Any welding, which is part of the delivered product, shall be performed with welders or welding operators that are qualified in accordance with ASME Section IX and a welding procedure specification (WPS) that is in accordance with ASME Section IX.

12.2 All welds in the delivered product shall conform to any applicable requirements of the base and cladding metal specifications and any additional requirements specified in the purchase order.

12.3 Weld Rework: Unless otherwise specified, rework of defects in the cladding and/or base metal may be performed by welding, provided the following requirements are met:

12.3.1 Approval is received from the purchaser in advance of proceeding with rework. When specified in the contract, the

welding procedure specification (WPS) shall be subject to approval by the purchaser prior to rework welding.

12.3.2 The defective area is removed and the area prepared for rework is examined by a magnetic particle method or a liquid penetrant method to ensure all defective area has been removed. Method of examination and acceptance standard shall be as agreed upon between the purchaser and the manufacturer.

12.3.3 Welds to the cladding metal shall be deposited in a suitable manner so as to leave the surface condition similar in corrosion resistance to the adjacent cladding.

12.3.4 The reworked area shall be inspected in accordance with the penetrant inspection requirements of Section 11.2 and the applicable ultrasonic inspection requirements of Section 11.1.

12.3.5 The location and extent of the weld rework together with the examination results are transmitted as a part of the certification.

12.4 References to ASME Design Code shall be replaced with comparable requirements of other national or international standards when agreed upon by the purchaser and the manufacturer (Section 4.1.9).

13. Workmanship, Finish, and Appearance

13.1 The product surfaces shall be free of excess imperfections and extraneous materials as determined by visual examination. Excessive imperfections are those which exceed the standards of the cladding and base metal specifications respectively, or purchaser approved standards. Examples of imperfections are scratches, dents, burrs, seams, blisters, and heavy oxidation. Imperfections, which reduce the cladding, or base metal thickness, or both, below the minimums specified are not permissible unless approved by the purchaser. Examples of extraneous materials are dirt, lubricants, metal chips, abrasive grit, and excess weld metal or spatter.

13.2 The cladding surface shall be blasted, pickled, ground, or polished to remove extraneous material.

13.3 The base metal surface condition shall be in accordance with the requirements of the base metal specification.

13.4 Surface defects may be blended by grinding, providing the metal thickness is not reduced below the specified minimum.

13.5 Surface finish, other than those described herein, may be agreed upon between producer and purchaser.

14. Inspection

14.1 When an inspector is appointed by the purchaser, the manufacturer shall afford the appointed inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests shall be made prior to shipment unless otherwise specified.

15. Rejection

15.1 Material not conforming to this specification or to authorized modifications, as permitted by this specification, shall be subject to rejection. Unless otherwise specified, rejected material may be returned to the manufacturer at the manufacturer's expense unless the purchaser receives, within three weeks of notice of rejection, other instructions for disposition.

16. Certification

16.1 At a minimum the following shall be certified to the purchaser by the manufacturer:

16.1.1 The chemical analysis of the cladding metal and base metal,

16.1.2 The results of mechanical tests of Section 7,

16.1.3 Compliance with the nondestructive tests of Section 11, and

16.1.4 Compliance with the requirements of this specification.

17. Product Marking

17.1 Except at specified in 17.2 and 17.3, the following shall be stamped legibly on each finished clad plate in two places on the base metal face not less than 12 in. (300 mm) from the edges:

17.1.1 Name or brand of the manufacturer,

17.1.2 Manufacturer's test identification number,

17.1.3 This specification number,

17.1.4 Base metal specification number, and

17.1.5 Cladding metal specification number.

17.2 For double-clad material, the information of 17.1 shall be stamped on one cladding metal face, except that when the cladding metal of that face is less than 0.2-in. (5-mm) thick, the marking shall be stenciled legibly instead of stamped.

17.3 When the clad product is less than 72 in. (1830 mm) in its largest lateral dimension, the specified information may be stamped in a single location only.

18. Keywords

18.1 clad metal; clad plate; cladding; niobium; tantalum; titanium; zirconium

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when agreed upon between the purchaser and the manufacturer.

S1. Bond Shear Strength Testing

S1.1 Bond shear strength testing shall be performed on the product when specified by the purchaser.

S1.2 Shear test specimens shall be made in the manner indicated in Fig. 1. Shear testing shall be performed in accordance with Specification A265. The minimum permissible shear strength shall be 20 000 psi (137.9 MPa).

S1.3 One shear test shall be performed for each lot of clad plates, which consist of the same cladding and base metal lots (material from the same heat having the same thickness and same heat treatment), and which are clad under the same bonding conditions. When specified by the purchaser, shear tests shall be performed on each plate as-clad.

S1.4 Unless otherwise specified, the location of the shear test specimen shall be at the manufacturer's option and shall be representative of the product.

S1.5 Retesting shall be permitted only when the test specimen or test method is defective. When retesting is performed, two test specimens shall be obtained from a location as adjacent as possible to the original specimen. The shear strength values of both must exceed the minimum specified value. If the defective test applies to a lot of more than one plate, the retest herein shall be performed on the original plate and a shear test shall be performed on each of the additional plates as-clad.

S2. Ductility Bend Testing

S2.1 Ductility bend tests shall be performed when specified by the purchaser or when applicable, or both, in the base metal specification. Two bend tests of the composite plate shall be made, one with the cladding metal in tension and the other with the cladding metal in compression. On double-clad plates, the bend tests shall be made so that one specimen represents the cladding metal in tension on one side while the other specimen represents the cladding metal in tension on the opposite side. The specimen shall be 1 by 1 in. (25 by 25 mm) × sufficient length to assure a full 180 degree bend. If the cladding metal thickness exceeds 0.5 in. (12.5 mm), it shall be reduced to 0.5 in. (12.5 mm) maximum. Bending radius and acceptance criteria shall be in accordance with the cladding metal specification when the cladding is in tension and the base metal specification when the base metal is in tension.

S3. Side Bend Tests

S3.1 When specified by the purchaser, side bend tests shall be performed. Testing methods and acceptance criteria shall be agreed upon or shall be in accordance with an invoked specification. [5]

S4. Product Analysis

S4.1 Product analysis shall be performed on the cladding, or base metal, or both, when specified by the purchaser. The specimen for analysis shall be taken from one end of each plate, as-clad, after completion of all mechanical and thermal processing component of the cladding operation.

S4.2 Product verification by Positive Metal Identification (PMI) techniques may be used for compliance with S4.1 when mutually agreed upon.

S5. Simulated Heat Treatment of Mechanical Test Coupons

S5.1 The test specimens representing the plate in the as-supplied heat treat condition shall be given additional heat treatments which simulate thermal processing which is to be performed after supply. The temperature range, time, and heating/cooling rates, as applicable, shall be specified by the purchaser. Unless agreed upon, these tests shall replace those representative of the product in the as-supplied condition.

S6. Charpy V-Notch Impact Test of Base Metal

S6.1 Charpy V-Notch tests shall be performed in accordance with the relevant requirements of the base metal specification. Specimen orientation, temperature, and acceptance criteria are to be specified by the purchaser.

S7. Component Metal Ultrasonic Testing

S7.1 Ultrasonic testing shall be performed on the cladding, or base metal, or both, when specified by the purchaser. Testing shall be performed after the completion of all mechanical and thermal processing components of the cladding operation. Testing shall be in accordance with the procedures and methods of Specification A578/A578M. The acceptance level is to be specified by the purchaser.

S8. Bond Tensile Strength Tests

S8.1 When specified by the purchaser, bond tensile strength tests shall be performed. Testing methods [6] and acceptance criteria shall be agreed upon between purchaser and manufacturer.

S9. Base Metal Tensile Strength Test

S9.1 When specified by the purchaser, the tensile strength test of 7.5 shall be performed on specimens taken from the clad plate after completion of all mechanical and thermal processing components of the cladding operation.

[5] For consideration, one type of side bend test is specified in AD Merkblatt Testing Requirements for Clad Metals AD-W8.

[6] For consideration, one example of bond tensile strength testing is the Ram Tensile Strength Test described in MIL-J-24445A.

S10. Requirements When Cladding Metal is Part of Design Strength Requirement

S10.1 The tensile test shall be performed in accordance with the requirements of Specification A265. Specimen design, testing, and acceptance criteria shall be in accordance with the requirements of that specification.

S10.2 Ductility tests of S2 shall be performed.

S10.3 If the cladding metal is fabricated from multiple sheets or plates by welding prior to the cladding operation, or when rework welds are made, or both, welding must be performed by an ASME stamp holder in accordance with ASME code rules and other design code as applicable.

S10.4 References to the ASME Design Code shall be replaced with comparable requirements of other national or international standards when agreed upon by the purchaser and the manufacturer (see 4.1.9).