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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 5850B

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Superseding AMS 5850A

HONEYCOMB CORE, CORROSION AND HEAT RESISTANT STEEL
Resistance Welded, Square Cell

1. SCOPE:

1.1 Form: This specification covers resistance-welded, square cell, honeycomb core fabricated from a corrosion and heat resistant steel.

1.2 Application: Primarily for use as a low-density material in brazed structures.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 5520 - Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 15Cr - 7.1Ni - 2.5Mo - 1.1Al

2.2 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.2.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be as specified on the drawing or purchase order.

3.2 Configuration: Core shall have cells square in shape. Nominal configuration shall be as shown in Fig. 1.

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3.2.1 Node-to-Node Attachment: Node-to-node attachment between foil ribbons shall be accomplished by resistance welding.

3.2.2 Classification: Core shall be as classified according to cell size, foil thickness, material, and cut edge finish (See Table I) in accordance with the following identification system:

3.2.2.1 The identification code shall be divided into three parts: the first describes the cell size and foil thickness; the second, the foil alloy; and the third, the cut edge finish.

3.2.2.1.1 Cell size shall be shown in sixteenths of an inch (mm), foil thickness in ten-thousandths of an inch (m). Perforation of the cell shall be shown by (P), and non-perforation by (N).

Example: Core with 3/16 in. (4.8 mm) cell size, 0.0015 in. (38 m) thick foil, perforated, made of AMS 5520 with a core surface Finish 1 shall be identified as follows:

3-15-P, AMS 5520; Finish 1 in inch/pound units

4.8-38-P, AMS 5520; Finish 1 in SI units

3.2.3 Perforations: When perforated core is specified, each cell wall shall be perforated by means of punched or pierced holes. These holes shall be not larger than 0.030 in. (0.75 mm) in diameter. All core less than 0.75 in. (19 mm) in thickness shall have not less than one hole in each cell wall; core 0.75 in. (19 mm) and over in thickness shall have not less than two holes in each cell wall per inch (25 mm) of thickness.

3.2.4 Cell Dimensions: Cell size shall be the perpendicular distance between any two of the principal cell walls located opposite and parallel to each other. An average cell size shall be determined by measuring perpendicularly across the principal walls of any 10 adjacent cells, as shown in Fig. 2, and then dividing the dimension obtained by 10.

3.2.5 Cell Pitch: The cell pitch (See Fig. 2) of a block of core shall conform to the dimensions given in Table II. The longitudinal pitch shall be measured parallel to the "L" dimension; the transverse pitch, perpendicular to the "L" dimension.

3.2.6 Splices: Splices may be made by any of the approved methods shown in Figs. 5 and 6. Splices may be made parallel to and transverse to the longitudinal dimension of the core piece. There shall be not more than one intersection of transverse and longitudinal splices in any 12 in. (300 mm) square of core. Core containing splices shall comply with all requirements for density, dimensional accuracy, node weld strength, and other strength requirements. Where drawings require splices between core sections of dissimilar types, such splices shall be made in accordance with applicable drawings.

3.2.7 Extension of "W" Dimension: The addition of blocks of core by the method shown in Fig. 4 shall not be considered a splice. Blocks joined in this manner shall be subject only to those requirements for a conventionally-made, production node weld.

3.2.8 Repairs and Inserts: When localized damaged or sub-standard areas in the core material are repaired, repairs shall be made by a method shown in Fig. 7. Finished core containing such repairs shall comply with all requirements for core without repairs except as noted in 3.5.2.1. The number of spliced or repaired nodes or cell walls in any area which may be covered by a 12 in. (300 mm) square shall be less than 2% of the total number of nodes or walls in the 12 in. (300 mm) square if the cells are 1/4 in. (6.25 mm) and smaller; 4% if cells are larger than 1/4 in. (6.25 mm).

3.3 Properties: Core shall conform to the following requirements:

3.3.1 Density: The density of core blocks shall be as specified in Table II and shall not vary more than 8% from the nominal density specified.

3.3.2 Node Weld Strength: Shall be not less than the value given for node pull in Table II for the applicable core type. It shall be measured by pulling in tension a chain of 9 to 15 nodes. Not less than 3 rows of weld shall be used (See Fig. 3). Loading shall be applied at a rate of 15 to 30 lb (66.7 - 133.4 N) per min. to failure.

3.4 Quality: The core, as received by purchaser, shall be uniform in quality and free from broken cell walls, foil tears, and other imperfections detrimental to usage of the core.

3.4.1 Node Welds: Shall conform to the requirements of Table III.

3.4.2 Cleanliness: Core shall be free from oil contaminants not readily removable by normal cleaning procedures.

3.5 Sizes and Tolerances:

3.5.1 Sizes: Core shall be supplied in the size ordered, with core dimensions as shown in Fig. 1 where,

T = Thickness, depth, or height dimention measured parallel to the core axis.

W = Transverse dimension measured perpendicular to the "L" dimension.

L= Longitudinal or ribbon dimension measured along the direction of a ribbon.

3.5.2 Tolerances:

3.5.2.1 Cell Sizes: The average shall be within 6% of the nominal cell size. No single cell shall vary from the nominal cell size by more than 12% except that spliced cells may be up to 30% smaller than nominal size. Pitch, as measured over a length of 20 cells, shall not vary by more than 8% from nominal.

3.5.2.2 Perpendicularity of Cell Walls: The angle between the cell walls and the face surfaces shall not vary from perpendicular by more than three degrees.

3.5.2.3 Foil Thickness: Foil thickness shall be within 10% of the specified thickness.

3.5.2.4 Core Thickness: Shall be in accordance with Table I as applicable. The thickness shall not vary by more than 0.003 in. (0.08 mm) in any 2 in. (50 mm) distance.

3.5.2.5 L and W Dimensions: Shall be not less than the nominal dimensions specified for the rough core block.

3.5.2.6 Out of Square: The angle between the "L" and the "W" axis of the core shall not deviate from 90 deg by more than the values listed in Table II. The core shall be in the relaxed condition when measurements are made.

3.5.2.7 Foil Mismatch: Adjacent cell wall edges shall not vary by more than the ribbon mismatch for the particular class ordered as shown in Tabel I. The mismatch tolerance shall not be in addition to the thickness tolerance.

3.5.2.8 Ribbon Burr: The maximum layover shall not exceed the value given in Table I.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of core shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the core conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Test to determine conformance to requirements for density (3.3.1), node weld strength (3.3.2), and node weld quality (3.4.1) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of core to a purchaser, when a change in material, processing, or both requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows; a lot shall be all slices cut from a single block or belt:

4.3.1 For Acceptance Tests: Each block or belt or 2% of the slices from each lot.

4.3.1.1 Node Weld Quality: Each node weld need not be examined, but only those in selected areas. The number and size of the selected areas shall be at the discretion of the inspector.

4.3.1.2 Foil Samples: A piece of the foil used to make the block or belt of core shall be submitted to the purchaser with each shipment of core. When more than one lot of foil is used to make the core in a shipment, a sample from each lot shall accompany the core. This sample shall be of the same width as the core, but not necessarily wider than 1 in. (25 mm), and 72 in. (1.8 m) long. This sample may be used to determine heat treat response, mechanical properties, and composition of the core material.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample core shall be approved by purchaser before core for production use is supplied, unless such approval be waived by purchaser. Results of tests on production core shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production core which are essentially the same as those used on the approved sample core. If necessary to make any change in ingredients, in type of equipemnt for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material, processing, or both and, when requested, sample core. Production core made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor of core shall furnish with each shipment a report showing the results of tests for chemical composition of each foil lot and the results of tests for density and node weld strength on each lot. This report shall include the purchase order number, AMS 5850B, product designation, size, quantity, lot or block number, foil lot number, and foil thickness of each foil lot.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 5850B, contractor or other direct supplier of core, supplier's material designation, part number, and quantity. When core for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of core to determine conformance to the requirements of this specification and shall include in the report either a statement that the core conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the core may be based on the results of testing three additional specimens, cut from the same block, for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the core represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each piece of core and each interior and exterior container shall be identified with not less than the following information applied to a durable tag or label, using characters of such size as to be legible and which will not be obliterated by normal handling:

AMS 5850B
CORE CLASSIFICATION _____
THICKNESS, TRANSVERSE, AND LONGITUDINAL DIMENSIONS _____
COMMERCIAL ALLOY AND CONDITION OR TEMPER _____
FOIL LOT NUMBER _____
MANUFACTURER'S NAME OR TRADEMARK _____
PART NUMBER _____
CONTRACT OR PURCHASE ORDER NUMBER _____

5.2 Packaging:

5.2.1 Core shall be packaged and shipped in outer containers in such a manner as to ensure that the core, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any other normal hazard.

5.2.2 Containers of core shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the core to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.2.3 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 and 5.2.2 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Core not conforming to this specification or to modifications authorized by purchaser will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Dimensions and properties in inch/pound units are primary; dimensions and properties in SI units are shown as the approximate equivalents of the primary units and are presented only for information.

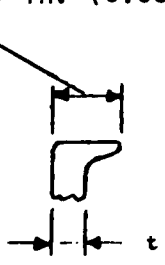
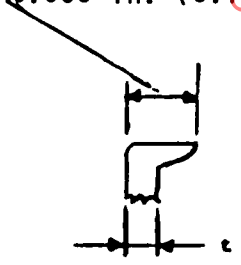
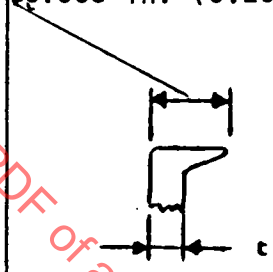
8.3 For direct U.S. Military procurement, purchase documents should specify not less than the following:

Title, number, and date of this specification
Cell size and density of core desired
Size of core slices or blocks desired
Quantity of cored desired
Applicable level of packaging (See 5.2.3)

8.4 Core meeting the requirements of this specification has been classified under Federal Supply Classification (FSC) 9520.

TABLE I

STANDARD CLASSES OF WELDED HONEYCOMB FINISHES

	Finish 1 Finished for Brazing	Finish 2 Finished for Organic Bonding	Finish 3 Semi-Finished for Machining	Finish 4 Rough Cut
Thickness Tolerance (3.5.2.4)	± 0.003 in. (0.08 mm)	± 0.005 in. (0.12 mm)	± 0.016 in. (0.40 mm)	± 1/16 in. (1.6 mm)
Ribbon Mismatch Max depth (3.5.2.7)	0.003 in. (0.08 mm)	0.005 in. (0.12 mm)	0.016 in. (0.40 mm)	1/16 in. (1.6 mm)
Surface Condition or Burr (3.2.6)	Max Layover: 0.003 in. (0.08 mm) + t 	Max Layover: 0.005 in. (0.12 mm) + t 	Max Layover: 0.008 in. (0.20 mm) + t 	Max 1/6 in. (4.2 mm) deep rough cut surface condition

Note: t = foil thickness

TABLE II

CORE CHARACTERISTICS

Core Type	Nominal Density lb per cu ft (See Note 1)	Node Pull lb per in. (L)	Longitudinal Pitch inch	Transverse Pitch inch	Out-of-Square inch per inch
1-10	16.6	45	0.105	0.073	
1-15	24.9	67			
1-20	33.2	90			
1-50	83.0	190	0.105	0.073	
2-10	8.3	45	0.2068	0.1468	
2-15	12.5	67			
2-20	16.6	90			
2-30	25.0	135			
2-40	33.2	160			
2-50	41.5	190			
2-60	50.0	210			
2-100	83.0	250	0.2068	0.1468	
3-10	5.6	45	0.295	0.240	0.042
3-15	8.3	67			0.029
3-20	11.2	90			0.021
3-25	13.8	112			0.021
3-30	16.5	135			0.014
3-40	22.0	160			
3-50	27.5	190			
3-60	33.0	210			
3-100	56.0	250	0.295	0.240	
4-10	4.3	45	0.390	0.320	0.055
4-15	6.2	67			0.039
4-20	8.3	90			0.029
4-25	10.4	112			0.029
4-30	12.5	135			0.019
4-40	16.6	160			0.014
4-50	21.0	190			
4-60	25.2	210			
4-100	42.0	250	0.390	0.320	
6-10	2.8	45	0.585	0.480	0.085
6-15	4.2	67			0.055
6-20	5.6	90			0.042
6-30	8.4	135	0.585	0.480	0.029
8-30	6.2	135	0.780	0.640	
10-30	5.0	135			
10-35	5.8	157			
10-40	6.6	160			
12-40	5.5	160			
12-50	6.9	190			

Note 1. Figures shown apply to alloys with nominal density of 0.28 lb per cu in. and shall be adjusted proportionately for alloys of other nominal densities.

TABLE II (SI)

Core Type	Nominal Density kg/m^3 (See Note 1)	Node Pull N/m (L)	Longitudinal Pitch mm	Transverse Pitch mm	Out-of Square mm per mm
1.6-25	266	7,880	2.67	1.85	
1.6-38	399	11,730			
1.6-51	532	15,670			
1.6-127	1330	33,270	2.67	1.85	
3.2-25	133	7,880	5.253	3.729	
3.2-38	200	11,730			
3.2-51	266	15,760			
3.2-76	400	23,640			
3.2-102	532	28,020			
3.2-127	665	33,270			
3.2-152	801	36,780			
3.2-254	1330	43,780	5.253	3.729	
4.8-25	90	7,880	7.49	6.10	0.042
4.8-38	133	11,730			0.029
4.8-51	179	15,760			0.021
4.8-64	221	19,610			0.021
4.8-76	264	23,640			0.014
4.8-102	352	28,020			
4.8-127	441	33,270			
4.8-152	529	36,780			
4.8-254	897	43,780	7.49	6.10	
6.4-25	69	7,880	9.91	8.13	0.055
6.4-38	99	11,730			0.039
6.4-51	133	15,760			0.029
6.4-64	167	19,610			0.029
6.4-76	200	23,640			0.019
6.4-102	266	28,020			0.014
6.4-127	336	33,270			
6.4-152	404	36,780			
6.4-254	673	43,780	9.91	8.13	
9.5-25	45	7,880	14.86	12.19	0.085
9.5-38	67	11,730			0.055
9.5-51	90	15,760			0.042
9.5-76	135	23,640	14.86	12.19	0.029
12.7-76	99	23,640	19.81	16.26	
15.9-76	80	23,640			
15.9-89	93	27,500			
15.9-102	106	28,020			
19.1-102	88	28,020			
19.1-127	111	33,270			

Note 1. Figures shown apply to alloys with nominal density of 7750 kg/m^3 and shall be adjusted proportionately for alloys of other nominal densities.

TABLE III

NODE WELD CONDITIONS

General Class of Condition	Condition	Description	Limitation
Heat-Produced Holes	Weld Porosity	Small hole up to and including 0.005 in. (0.12 mm) diameter	Max 18 per node per inch (25 mm) of "T"
	Pin Hole	Holes from 0.005 (0.12 mm) to and including 0.015 in. (0.38 mm) diameter	Max 4 per node per inch (25 mm) of "T"
	Small Burn-through	Holes from 0.015 (0.38 mm) to and including 0.030 in. (0.75 mm) diameter	Max 1 per node per inch (25 mm) of "T"
	Large Burn-through	Holes greater than 0.030 in. (0.75 mm) diameter	Not Permissible
	All Heat-produced Holes	Overall limit, any diameter	Max 20 per node per inch (25 mm) of "T"
Heat-Produced edge burn-outs (Not applicable on Finish 3 and Finish 4).	Small Edge Notch	Burned notch at edge of node,, max 0.005 in. (0.12 mm) deep, max 0.015 in. (0.38 mm) wide. Not extending into wall	Max 10% of nodes on each surface
	Large Edge Notch	Burned notch at edge of node, from 0.005 in. (0.12 mm) to 0.15 in. (0.38 mm) deep; from 0.015 in. (0.38 mm) to 0.030 in. (0.75 mm) wide; not extending into wall	Max 1% of nodes on each surface
	Edge Burn-out	Burned notch at edge of node, more than 0.015 in. (0.38 mm) deep, or more than 0.030 in. (0.75 mm) wide, or extending into wall	Not Permissible
Electrode Sticking or "pickup" defects	Blister	Raised projection, unbroken metal, narrower than node flat with or without small copper spot from electrode	Max of 2 per node per inch (25 mm) of "T"
	Pickup	Blister, unbroken, causing cell wall deformation with or without small copper spot from electrode	Max of 4 per 1000 nodes per inch (25 mm) of "T"

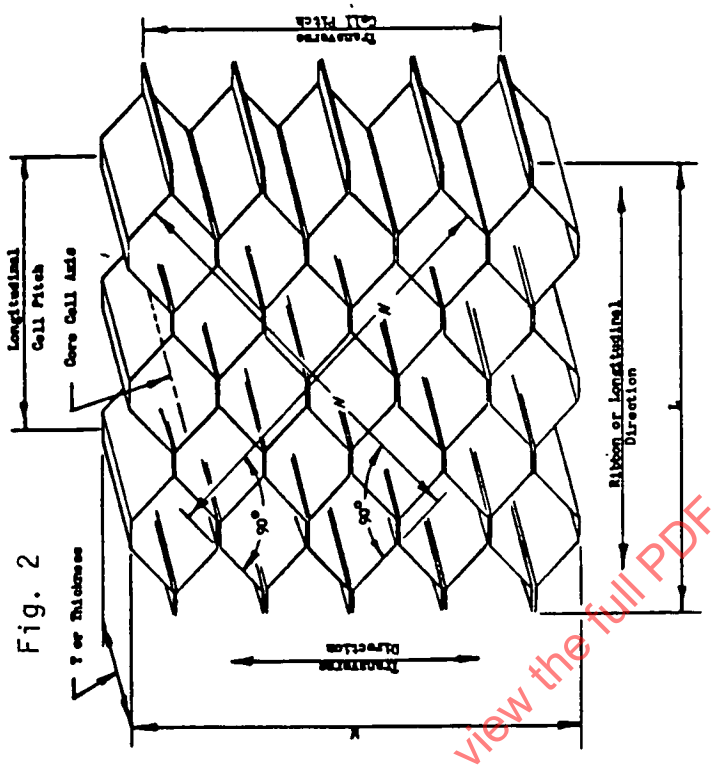


Fig. 2

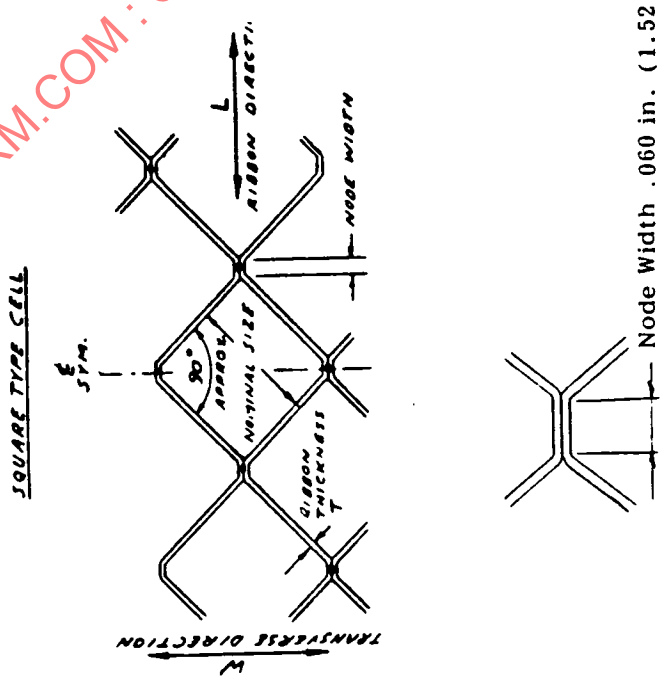


Fig. 1