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Superseding AMS5850C

Steel, Corrosion and Heat-Resistant, Honeycomb Core
Resistance Welded, Square Cell

RATIONALE

This document has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE

1.1 Form

This specification covers a honeycomb core fabricated from a corrosion and heat-resistant steel.

1.2 Application

This product has been used typically as a low-density material in brazed structures, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 5520 Steel Sheet, Strip, Foil, and Plate, Corrosion and Moderate Heat Resistant, 15Cr - 7.1Ni - 2.5Mo - 1.1Al, Solution Heat Treated, Precipitation Hardenable

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be as specified on the drawing or purchase order.

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3.2 Configuration

Core shall have cells square in shape. Nominal configuration shall be as shown in Figure 1.

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 classified according to cell size, foil thickness, material, and cut edge finish (See Table 1) 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 (μm). Perforation of the cell shall be shown by (P), and non-perforation by (N).

Example: Core with 3/16 inch (4.8 mm) cell size, 0.0015 inch (38 μm) 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 inch (0.76 mm) in diameter. All core under 0.75 inch (19 mm) in thickness shall have not less than one hole in each cell wall; core 0.75 inch (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 principle 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 Figure 2, and then dividing the dimension obtained by 10.

3.2.5 Cell Pitch

The cell pitch (See Figure 2) of a block of core shall conform to the dimensions given in Table 2. 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 Figure 5 and Figure 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 inch (305 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 Figure 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 damage or sub-standard areas in the core material are repaired, repairs shall be made by a method shown in Figure 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 inch (305 mm) square shall be less than 2% of the total number of nodes or walls in the 12 inch (305 mm) square if the cells are 1/4 inch (6.4 mm) and smaller; 4% if cells are larger than 1/4 inch (6.4 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 2 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 2 for the applicable core type. It shall be measured by pulling in tension a chain of 9 to 15 nodes. Not less than three rows of weld shall be used (See Figure 3). Loading shall be applied at a rate of 15 to 30 pounds force (66.7 to 133.4 N) per minute 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 3.

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 Figure 1 where,

T = Thickness, depth, or height dimension 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 1 as applicable. The thickness shall not vary by more than 0.003 inch (0.08 mm) in any 2 inches (51 mm).

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 degrees by more than the values listed in Table 2. 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 Table 1. 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 1.

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the core conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Density (3.3.1), node weld strength (3.3.2), and node weld quality (3.4.1) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests

All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of a core to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

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 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 inch (25 mm), and 72 inches (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 equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample core. Production core made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports

The vendor of core shall furnish with each shipment a report showing the results of tests for 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, lot or block numbers, AMS 5850D, product designation, size, quantity, foil lot numbers, and foil thickness of each foil lot.

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. 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 legibly identified, with not less than the following information applied to a durable tag or label, using characters which will not be obliterated by normal handling:

AMS 5850D
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 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.

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 A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.
- 8.2 Terms used in AMS are clarified in ARP1917.
- 8.3 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.
- 8.4 Purchase documents should specify not less than the following:

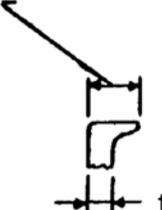
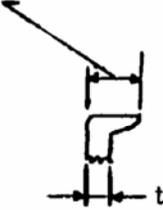
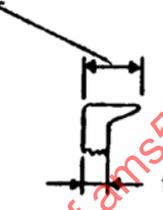
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Cell size and density of core desired

Size of core slices or blocks desired

Quantity of core desired.

TABLE 1 - 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 inch (±0.08 mm) | ±0.005 inch (±0.13 mm) | ±0.016 inch (±0.41 mm) | ±1/16 inch (±1.6 mm) |
| Ribbon Mismatch Maximum Depth (3.5.2.7) | 0.003 inch (0.08 mm) | 0.005 inch (0.13 mm) | 0.016 inch (0.41 mm) | 1/16 inch (1.6 mm) |
| Surface Condition or Burr (3.2.6) | Maximum Layover: 0.003 inch (0.08 mm) + t  | Maximum Layover: 0.003 inch (0.08 mm) + t  | Maximum Layover: 0.003 inch (0.08 mm) + t  | Maximum 1/6 inch (4.2 mm) deep rough cut surface condition |

Note: t = foil thickness

TABLE 2A - CORE CHARACTERISTICS, INCH/POUND UNITS

| Core Type | Nominal Density pounds/cubic foot (See Note 1) | Node Pull pounds/inch (L) | Longitudinal Pitch Inch | Traverse 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 |

TABLE 2A - CORE CHARACTERISTICS, INCH/POUND UNITS (CONTINUED)

| Core Type | Nominal Density pounds/cubic foot (See Note 1) | Node Pull pounds/inch (L) | Longitudinal Pitch Inch | Traverse Pitch Inch | Out-of-Square inch per inch |
|-----------|--|------------------------------|-------------------------------|---------------------------|--------------------------------|
| 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 7750 kg/m³ and shall be adjusted proportionately for alloys of other nominal densities.

TABLE 2B - CORE CHARACTERISTICS, SI UNITS

| Core Type | Nominal Density kg/m ³ (See Note 1) | Node Pull N/m (L) | Longitudinal Pitch Millimeters | Traverse Pitch Millimeters | Out-of-Square mm per mm |
|-----------|--|----------------------|--------------------------------------|----------------------------------|----------------------------|
| 1.6- 25 | 266 | 7,880 | | 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/m³ and shall be adjusted proportionately for alloys of other nominal densities.

TABLE 3 - NODE WELD CONDITIONS

| General Class of Condition | Condition | Description | Limitation |
|--|-------------------------|--|---|
| Heat- Produced Holes | Weld Porosity | Small hole up to and including 0.005 inch (0.13 mm) diameter | Max 18 per node per inch (25 mm) of "T" |
| | Pin Hole | Holes over 0.005 to 0.015 inch (0.13 to 0.38 mm) inclusive, in diameter | Max 4 per node per inch (25 mm) of "T" |
| | Small Burn-through | Holes over 0.015 to 0.030 inch (0.38 to 0.76 mm) inclusive, in diameter | Max one per node per inch (25 mm) of "T" |
| | Large Burn-through | Holes over 0.030 inch (0.76 mm) in 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 inch (0.13 mm) deep, max 0.015 inch (0.38 mm) wide. Not extending into wall | Max 10% of nodes on each surface |
| | Large Edge Notch | Burned notch at edge of node, over 0.005 to 0.015 inch (0.13 to 0.38 mm) inclusive deep; Over 0.015 to 0.030 inch (0.38 to 0.76 mm), inclusive, wide not extending into wall | Max 1% of nodes on each surface |
| | Edge Burn-out | Burned notch at edge of node, over 0.015 inch (0.38 mm) deep, or over 0.030 inch (0.76 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" |

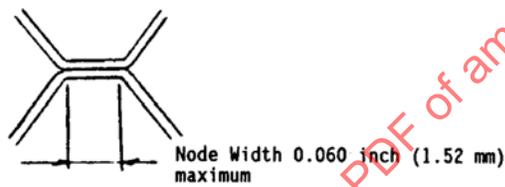
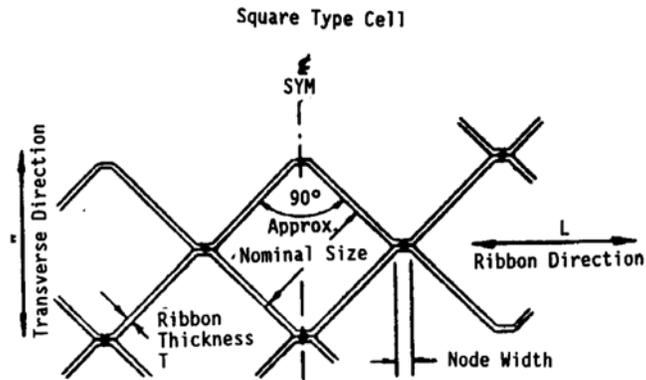
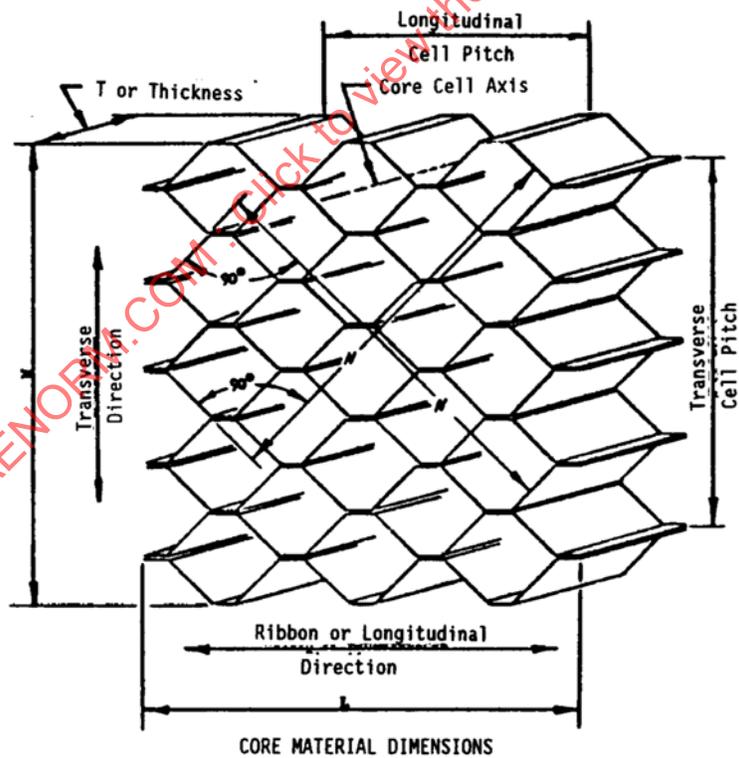


FIGURE 1



(Average cell size equals 1/10 dimension across 10 cells
= $N/10$)

Note: This core cell configuration is for clarification of dimensions only.

FIGURE 2

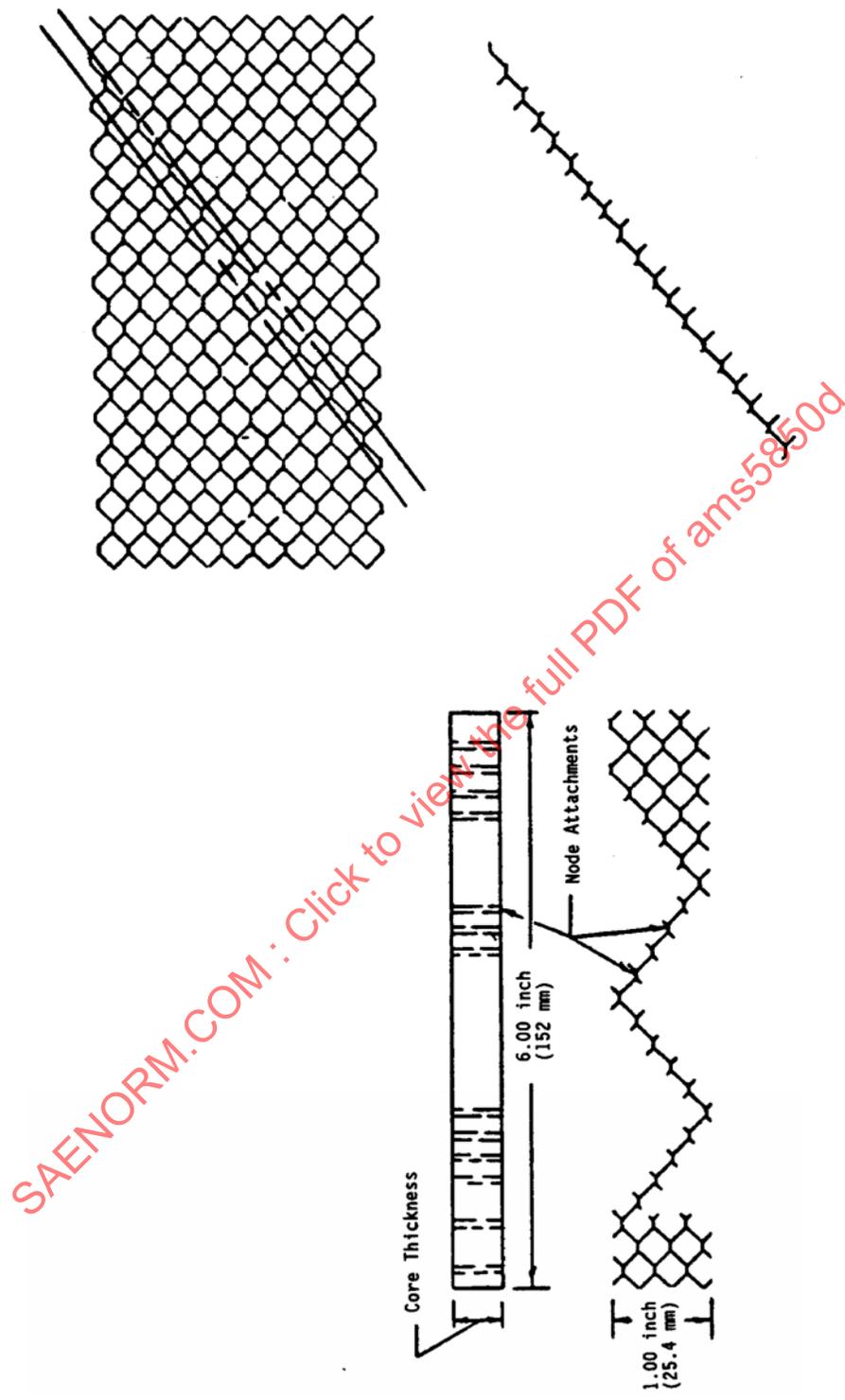


FIGURE 3 - NODE WELD SHEAR TEST METHOD