Fermi National Accelerator Laboratory

Batavia, IL 60510

SPECIFICATIONS FOR
Endcap Muon Cathode Strip Chamber Panels
5' x 12' 5020-SA-368003
4' x 12' 5520-SA-368004

*** DRAFT 5A***

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(Typo corrections of version 5)

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Revision	Date	Description	Approval(s)
0		Initial Engineering Release ER #	See Above

1.0 General:

This specification covers the requirements for Endcap Muon Cathode Strip Chamber Panels which consists of two sheets of approximately 1/16” thick copper coated FR-4 panels separated by and bonded to approximately 1/2” thick polycarbonate 3mm cell core by a Fermilab approved epoxy adhesive in accordance with the details specified below. Any deviations from these specifications or changes made to the materials or manufacturing processes, must be approved by Fermilab prior to being implemented or used.

Unless otherwise specified below the panel design, materials, and manufacturing processes used shall be the same as those used to produce the panels sent to Fermilab per Purchase Order #102760, dated July 28, 1997.

2.0 FR4 Material:

Supplied in accordance with Fermilab Engineering Specification 5020-SA-368001 (5’ x 12’) and 5020-SA-368002 (4’ x 12’).

The vendor will visually inspect the copper surface of each panel skin for defects as described below prior to bonding and will cover the copper surfaces of acceptable skins with a PVC film.

3.0 Cell Core Material:

To consist of non-conductive white unfilled polycarbonate honeycomb 3mm (1/8”) dia. cell core material having a density of 4.5 lbs/ft^3 +/-10% precision cut to a uniform thickness varying no more than +/- 0.005” so as to meet the finished bonded panel requirements as specified below. The vendor has denoted the formulation for the cores already supplied and will duplicate it on future orders giving it the designation PCFNAL 1/8-4.5.

The splicing of two strips of core material is acceptable to meet the overall panel width requirements. The splicing of material is to take place before material is cut to meet panel thickness requirements by gluing large pieces together with a Fermilab approved epoxy adhesive. Localized gaps or spaces in the bonded seams of the spliced pieces no greater than ¼” wide are permitted. The splice seam is to be located 2.0” +/- ½” to either side of the center of the panel.

Minimum compressive strength to be 150 psi
Minimum plate shear strength to be 50 psi

4.0 Epoxy Bonding Material:

Plascore designation P88 complying with MIL-A-25463 Type I, Group II.

The mechanical properties of the epoxy adhesive in the finished, cured panel must be such as to be able to withstand the performance specifications as outlined below.

5.0 Scrim:

Non-woven polyester fiber sheet having approx. weight of 1 oz. per sq. yd.

6.0 Finished Bonded Panel Requirements:

Panel skins as received from Fermilab and/or GE having dents, scratches, scrapes, voids, or other imperfections that would cause the finished panel to be out of compliance with the specifications contained herein, shall be brought to the attention of Fermilab for disposition prior to part processing:

Dents: No more than two per panel surface and each not exceeding 1/4" in diameter or 0.005" deep.

Scratches: No more than two per panel surface and none penetrating through the copper clading to the FR4 surface.

Skins from GE have an antioxidant coating on the copper surface but otherwise will have no protective film attached.

The cell core material must be completely bonded to the back surfaces of the sanded FR4 material over the entire interfacing surface areas.

The minimum tensile strength of the bonded surfaces to be 150 psi.
Minimum peel strength (per ANSI ASTMD1781) of bonding material of FR4 material to polycarbonate honeycomb material to be 25 lbs. per inch in a

The complete manufactured panel assemblies shall meet the flatness, thickness and parallelism requirements including bend, bow, and twist over the entire finished cut Width (W) and Length (L) dimensions as specified below. The Width and Length dimensions of the finished panels may vary by up to +1/8" and - 1/16" unless otherwise specified and agreed to on the Purchase Order:
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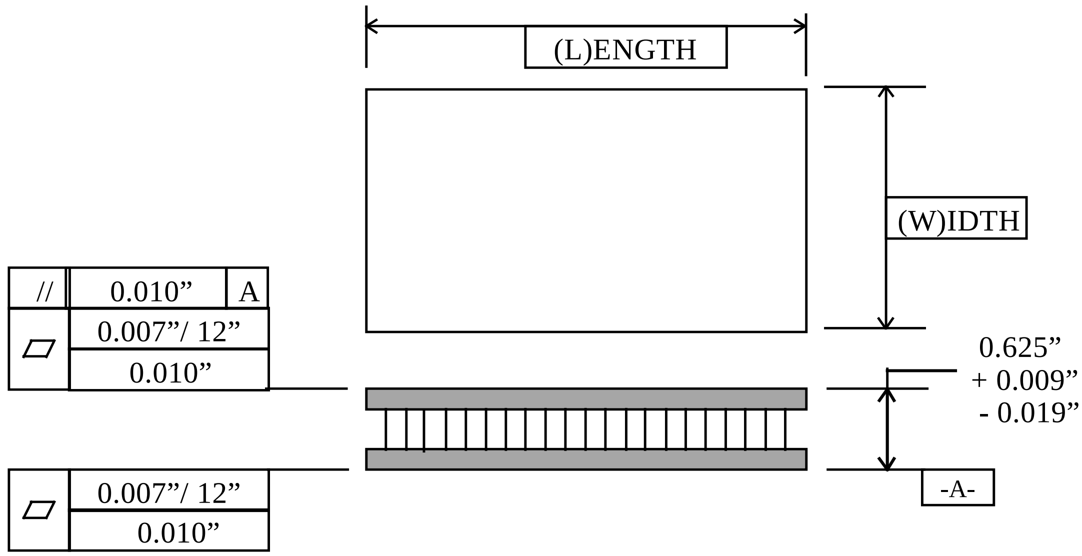
a) Part No. 5020-SA-368003 to be 60" W x 144" L
b) Part No. 5020-SA-368004 to be 48" W x 144" L
c) Other (W)idth and (L)ength as defined on Purchase Order



To ensure adequacy and consistency of the epoxy adhesive bonding process of panel skins to the core material, the finished panel shall not deflect more than as specified below in the center when supported horizontally within 1.00” of each of the four corners and having a downward vertical force as indicated applied to the center of the panel:

Panel Size	**Applied Force**	**Max. Deflection**
5’ X 12’	WWWW #	XXXX”
4’ X 12’	YYYY #	ZZZZ”

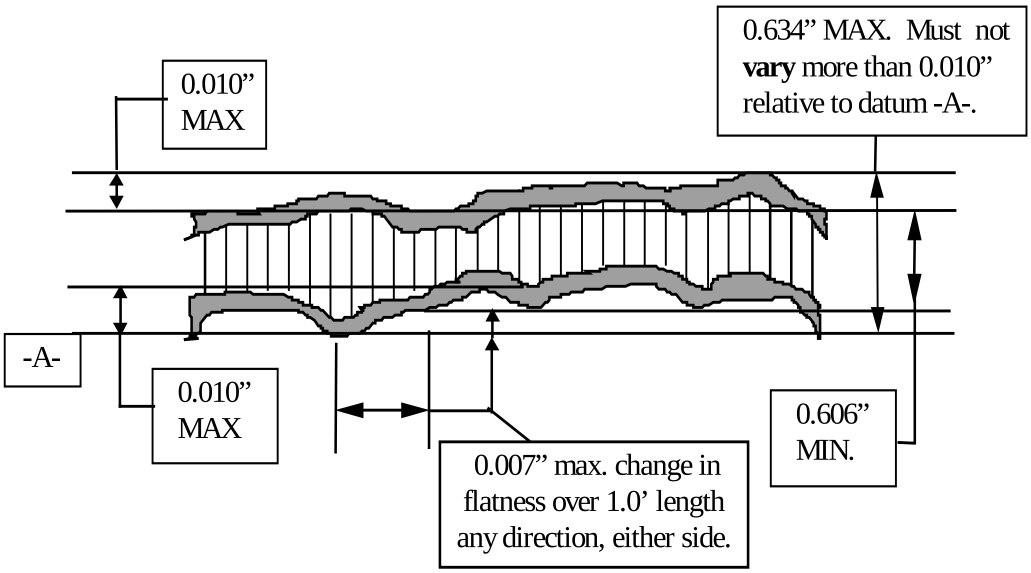
Any inherent bend, bow or twist of a finished panel that might otherwise result in a non-conformance condition to these specifications is acceptable if it is found to conform when either panel side is set on a datum -A- surface and an external force as shown below is applied to the top center of the panel. The weight applied must be spread out such that no residual denting of the panel surface results:

5’ panel -- XXX # max.
4’ panel -- YYY # max.

6.1 **Specification Interpretation:**

With the bottom surface of a panel pressed, pulled or otherwise held flat against datum -A- surface (a surface table or the like) without bow or twist, the side opposite must be flat within 0.010” overall and must not change its flatness by more than 0.007” over any 12” of surface distance in any direction.. The exposed surface must also not vary in height relative to the surface table by more than 0.010” . To facilitate quality assurance, measurements taken to validate this condition may be taken at distances no greater than 1.0’ from the edges of a finished panel.

Panel deflection tests will not be done by the vendor but may be done at Fermilab. The vendor will accept Fermilab results.



Interpretation of Above Specifications

7.0 Panel Manufacturing Process:

The non-copper coated sides of the FR4 material are to be sanded and bonded to the cell core using a wet layup of epoxy adhesive completely saturating the scrim material between cell core and FR4.

8.0 Quality Assurance

Vendor shall use appropriate gauging on core saw so as to maintain required finished panel requirements and specifications both panel to panel and production run to production run.

Vendor shall be able to demonstrate the adequacy of its manufacturing processes, quality assurance procedures, tooling, equipment, and trained personnel to maintain compliance with all aspects of the requirements and specifications herein set forth if requested by Fermilab.

The vendor will inspect the first 5 finished panels produced in each production run (typically 250 panels) for conformance to the above specifications. If all 5 panels are in conformance then only 1 panel per 10 produced in the production run need be inspected.

If any of the first 5 panels in a production run do not conform to these specifications the vendor will stop production and immediately notify Fermilab of the nature of the discrepancy and forward a Discrepancy Report via fax to Fermilab which in addition to describing the nature of the discrepancy also describes the corrective action to be taken by the vendor to correct the problem on future production panels. Upon approval from Fermilab production will be allowed to continue. Fermilab will also respond to the Discrepancy Report by giving final disposition of the non-conforming panel(s).

Subsequent to the initial inspection of the first 5 panels, if a non-conforming panel is detected during routine inspection or is otherwise manufactured improperly due to manufacturing errors or accidents, the vendor will stop production of subsequent panels and notify Fermilab of the discrepancy as above. If the non-conformance is found as a result of the sampling plan, then all panels produced between the previous sample evaluation and the discrepant panel are to be identified and segregated for 100% inspection, with discrepancy reports written for each panel found out of conformance.

Fermilab has the right to accept discrepant panels for their use or may reject them as well as seek compensation from the vendor for the cost of the skin materials if they cannot be reused or reworked into acceptable panels.

Each finished panel is to be identified with a serial number and lot number (marking or labeling to be approved by Fermilab) tracing the panel manufacturing information to the core information. All measurement data taken on any completed panel is to be appropriately recorded relative to the panel serial number in a method agreed to by Fermilab. All recorded data shall be made available to Fermilab at their request.

Fermilab will assist the Vendor to obtain the necessary tooling and inspection equipment needed to perform the appropriate in-process quality assurance measurements.

The vendor shall send to Fermilab, upon its written request, the first or any subsequent completed crate of 32 panels of each production run for its own evaluation. In this case the vendor will include in the crate copies of all measurement and test data for the panels inspected in the crate in accordance with the above specifications.

9.0 Packaging and Shipping

Vendor shall cover finished panel faces with an easily removable film (as described above) and additional foam separator layer between panels to protect their surfaces from damage and package them in sturdy, closed crates which can be handled by forklift without panel damage. As panels are used in the production process at Fermilab and crates are emptied, they will be available for recycling at the vendor’s request.

Crating of panels to be limited to 32 panels per crate and a maximum packaged crate weight of 3,000 lbs. Crates are to be stackable at least 3 high.