



February 22, 2008

DEFINITIONS

Advanced Change Notice (ACN) – Documentation of major change(s) to a PCD prior to a PCD revision. NCAMP approval is required.

Prepreg Batch – see applicable NCAMP Material Specifications (NMS).

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During the review process, NCAMP members will provide comments on the draft prepreg PCD and draft NMS prepreg material specification. The material supplier will be asked to revise the PCD based on the comments. Explanations must be provided for those comments that are not incorporated, which will be reviewed in the second step.

The second step occurs after the qualification program has been completed and all the test results are available. Material suppliers and NCAMP staff will work together to establish requirements previously listed as “TBD” and/or revise the other PCD requirements based on the test results. NCAMP members will be invited to review the PCD again. This second review will happen over a period of about 2-3 weeks where NCAMP members who wish to participate must coordinate directly with the material suppliers. The explanations for comments not incorporated in the first step will be provided to all the reviewers. At the end of the review process, NCAMP staff must ensure that all comments have been incorporated into the PCD. Any comment not incorporated in the PCD must be resolved with the individual commenter. Material suppliers may create separate PCDs for individual NCAMP IAB members with unique requirements. NCAMP staff must also make sure that the PCD requirements are in agreement with the corresponding NMS material and detail specification requirements.

3. Facility Audit

A facility audit will be conducted by material users and NCAMP staff. Facility audits typically include:

- a) Review of the supplier’s facility, where the supplier must be able to show that the PCD(s) and applicable material specification(s) are followed, and
- b) Review of the supplier’s quality system

Facility audits should be conducted when the material is initially qualified (usually concurrently with initial PCD review and approval process) and then at least every three years. A facility audit is also required when there are significant changes to the manufacturing facility, as determined by NCAMP through change notification.

4. Content of a PCD

A PCD should describe the raw ingredients and the entire manufacturing process. Specifically, the PCD should include the following information:

4.1 Raw Ingredients and Consumable Materials

- a. Specify all raw ingredients and consumable materials including the procurement specification/document, approved suppliers, and their addresses. Due to the proprietary nature of the PCD, the names of the raw ingredients may be coded.
- b. List the fiber procurement specification and/or tests conducted on the fiber and note the requirements for acceptance or rejection.

- c. Specify the raw ingredient and consumable material quality control tests and requirements.
- d. Specify the raw ingredient and consumable material packaging and marking requirements.
- e. Specify raw ingredient and consumable material storage conditions and corresponding shelf-life. Specify shelf-life revalidation procedures, if applicable.

4.2 Manufacturing Process and Control

- a. Employee training and qualification requirements shall be described in the PCD or a related document. It is advisable that employees be briefed through a meeting by the engineer or manager in charge prior to the manufacturing process to ensure that they are fully aware of the preparation procedures, process parameters, set-points, and the requirements of the PCD. Procedures to check equipment calibration dates and raw ingredient expiration dates should be part of every preparation process.
- b. Describe the general manufacturing process and procedures. Specifically:
 - Provide diagrams to show the equipment and settings, the flow of the manufacturing process, including where in-process monitoring, inspection, and testing takes place.
 - Identify all Controlled Process Equipment by line, model, and serial numbers.
 - Define all Controlled Process Parameters along with their target values and tolerances. For example, provide the target value and tolerance on weight measurements for each manufacturing step.
 - Provide the order and means of combining the subcomponents (portions of the prepreg resin) and give the time-temperature profile with the control tolerances employed.
 - List the tests and control limit requirements on the finished resin system prior to manufacture of the prepreg.
 - Define the time-temperature history of the resin in the filming and fiber impregnation processes and the control tolerances employed. Note that prepreg properties are the result of cumulative time-temperature history from all the process steps. As a result, not all combinations of upper or lower tolerance limits will yield acceptable prepreg properties. For example, a prepreg produced using the upper time and temperature limits of every process step may not yield acceptable tack level. The supplier should be aware of the cumulative time-temperature effects of every step on the prepreg properties. Thermal and rheological testing/analysis tools may be used to simulate process steps and ageing and measure properties such as sub-ambient glass transition temperature and resin cure rheology.
 - Define the prepreg backing release material.
 - Describe acceptance inspection procedures used to evaluate the finished prepreg and state the acceptance/rejection criteria.
 - Describe any foreseeable rework procedures, if applicable.
- c. Freezer storage and out-time condition/time shall be defined.

- d. Other process parameters required to operate the equipment shall include target and tolerance values.
- e. Where applicable, tolerances should be set based on a Type I error probability of 1 percent with one retest as described in section 6 of DOT/FAA/AR-03/19. Where such method of establishing tolerances is inappropriate, the tolerance must be reasonable and able to provide adequate controls.
- f. Where applicable, alarm devices must be present to ensure that operators are alerted when actual process measurements fall outside the permissible tolerance limits.
- g. Actual in-process measurements must be taken at proper intervals and become part of the manufacturing records.
- h.

g.

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Otherwise, the prepreg shall not be certified to the NMS material specification.

6. Revisions and Change Control

The supplier shall maintain a good record of all PCD revisions, associated ACN, and minor

As the meeting facilitator, NCAMP will ensure that the meeting stays focused within the following format:

- a) NCAMP will first provide an introduction of the change notice, explain the activities that have taken place to date, such as the draft test plan and necessary steps needed to take place in order to approve or disapprove the change.
- b) If the existing information (e.g. data) is sufficient to substantiate the change (i.e. no further testing is required), the material supplier will create an ACN and upon reaching consensus, NCAMP will sign the ACN to approve the change on behalf of the members. The supplier has the responsibility to revise relevant section(s) of the PCD in accordance with the approved ACN.
- c) If the existing information is insufficient and a test plan is needed to substantiate the change, the discussion will focus on the test plan content (i.e. what tests are needed, how many specimens are needed, etc.). The material supplier will be responsible for revising the test plan. NCAMP will review the revised test plan to ensure that all agreed-upon action-items have been incorporated. The testing may require conformity by a FAA DAR and be witnessed by a FAA DER. After the testing has been completed, the material supplier will create an ACN and a second meeting will be set up to approve or disapprove the change. In some cases, additional testing will be needed. Upon reaching consensus, NCAMP will sign the ACN to approve or disapprove the change on behalf of the members. The supplier has the responsibility to revise relevant section(s) of the PCD in accordance with the approved ACN.
- d) If the group feels that an expert opinion is needed in the decision making process, NCAMP has a limited budget to hire such an expert. To ensure that the opinion remains impartial, NCAMP will typically remove all references to company names from the documents so that the subject matter expert will provide his/her opinion based purely on a "hypothetical" case. The material supplier may also ask that their NDA with NCAMP be extended to the subject matter expert. Another meeting may be scheduled when the subject matter expert opinion is received, if needed.
- e) If the change is deemed too major (e.g. level 4 changes), the group may decide to disapprove the change during the first meeting.

It is important to note that 100% stakeholder participation is not required to reach a consensus; so all stakeholders should make an effort to participate in the change management activities. Also, the material suppliers have the responsibility to comply with the requirements of DOT/FAA/AR-07/3 and DOT/FAA/AR-06/10 and ensure that material properties published in the original qualification program remain unchanged; other test methods/properties that are unique to a specific user or application may not be the responsibility of the material supplier.

It is desired to reach 100% stakeholder agreement when approving or disapproving changes. However, if 100% agreement cannot be reached due to some unique material application requirements by a minority of user(s), special arrangements between the supplier and user(s) may be made outside of NCAMP. In general, NCAMP's decision is driven by the majority's opinion.

The material supplier has the option to retract the material change request at any time. The major change cannot be implemented until the ACN is signed.

6.2 General PCD Revision

The material supplier will revise the PCD to incorporate all past ACNs and minor changes when there are a significant number of changes which make the document difficult to follow. A new general PCD revision is also warranted when there is a revision to the corresponding material specification. The content of all Major and Minor Changes made to the PCD during the general PCD revision shall be summarized in the revision control block. Whenever possible, major changes should be proposed and approved through ACNs because the process requires involvement of other NCAMP members.

7. Other Requirements

The corresponding material specification will contain additional requirements. Material suppliers shall determine that the PCD is tailored to meet the material specification requirements.

8. References

1. Boeing D6-53356 Requirements for Process Control Documents for Suppliers of Nonmetallic Raw Materials, Rev NEW
2. DOT/FAA/AR-07/3 – Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Unidirectional Prepregs Update
3. DOT/FAA/AR-06/10 - Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Fabric Prepregs
4. DOT/FAA/AR-03/19 – Material Qualification and Equivalency for Polymer Matrix Composite Material Systems: Updated Procedure
5. Draft SAE ARP XXX Composite Material Qualification and Control, SAE AMS P-17, Version 1

9. Revisions

| Revision | Date | Description |
|----------|-----------|---|
| - | 6/7/2006 | Initial Release |
| A | 3/28/2007 | Added section 4.3 and 4.4 |
| B | 2/22/2008 | Added ACN Form (Appendix 1). Revised section 5.1 to agree with existing aerospace standard practice. Replaced DOT/FAA/AR-02/109 with DOT/FAA/AR-07/3 and added DOT/FAA/AR-06/10 as references. Revised section 6.1 ACN process. |

APPENDIX 1: ADVANCED CHANGE NOTICE (ACN)
National Center for Advanced Materials Performance (NCAMP)

To be completed by material supplier:

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|-------------------|---------------|
| ACN NO.: DATE: | REQUESTED BY: |
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