## 1.0 INTRODUCTION

The purpose of the Engineering Material Control Manual (EMCM) is to cover all Engineering and specific Quality aspects of control with regards to procurement, supplier monitoring/control on receipt, storage, usage and approval for the materials defined in the Section 2 that follows.

The EMCM is updated as required. Changes will be made by Change Notices released on Bombardier Aerospace Materials and Processes Engineering (BAMPE) intranet and the Bombardier.com engineering portal website. Approved Change Notices will be incorporated in the subsequent revision of the EMCM.

## 2.0 SCOPE

The EMCM covers two (2) types of materials:

- Those which are incorporated in the aircraft by design through engineering drawings or Bombardier Aerospace Process Specifications (BAPS):
  - Specification controlled materials.
  - Commercial materials that require additional Procurement or Monitoring controls.
- Processing materials that are specification controlled or that require Procurement or Monitoring controls when specified in BAPS.

Inappropriate and specifically excluded from the EMCM are the following types of materials:

- Commercial materials and part numbers, called on Engineering Drawings and identified by manufacturer and manufacturer's part number.
- Process materials and shop aid items listed in the "Miscellaneous Materials" section of BAPS.

Materials in Table 10i are solely for interior completion use.

## 3.0 SPECIFICATION/MATERIAL

(Related to columns 1 through 5 of Tables 1 through 12.)

All materials in active use are referred to in Tables 1 through 12.

Active materials are grouped by specification issuing agency or material group in the case of commercial materials, and are listed in numeric or alpha numeric sequence in NUMBER (column 1), of Tables 1 through 12. Explanation of the abbreviations is shown in Table 13. This listing forms the index against which other conditions and requirements are shown.

Materials are subdivided by Specification and Material:

- The SPECIFICATION heading is subdivided into NUMBER (column 1), TITLE (column 2), and TYPE CLASS GRADE (column 3).
- The MATERIAL heading is subdivided into PRODUCT NAME (column 4), and MIX RATIO / SHOP LIFE (column 5).

All specifications are to the latest release unless otherwise stated in this document.

Where manufacturer's part numbers are shown in the PRODUCT NAME (column 4), it does not relieve the APPROVED MANUFACTURERS (column 6) of the obligation to supply material in conformance with and certified to the material specification.

## 3.1 Mix Ratio

(Related to column 5 of Tables 1 through 12.)

For materials consisting of two (2) or more components, the component parts are identified together with their required MIX RATIOS. The mix ratios listed are by volume, unless otherwise specified. Term used for materials such as coatings, putty, sealants, filler, liquid shim, and paste adhesives.

**3.2 Pot Life**

(Related to column 5 of Tables 1 through 12.)

The POT LIFE is the maximum period of time after mixing with a reaction initiating agent, that a multi-component thermosetting material remains suitable for its intended processing. Term used for materials such as coatings, putty, sealants, filler, liquid shim, and paste adhesives.

**3.3 Handling Life (also known as Shop Life)**

(Related to column 5 of Tables 1 through 12.)

The HANDLING LIFE is the maximum **handling time** over which the material retains its **handleability**. Term for materials such as prepregs, film adhesive materials, surfacing films, and foaming adhesives (see Figure 1).

**Handling time**

The handling time is the accumulated time out of refrigerated storage conditions, starting when the material is removed from refrigeration, pausing when returned to refrigeration, and ending when the material is laid-up on the curing tool. Refrigerated conditions are in accordance with BAERD GEN-014. Exposure conditions for out of refrigeration are in a controlled environment facility per BAERD GEN-013. If the material is in the original sealed bag and packaging, only the temperature requirement of BAERD GEN-013 applies.

**Handleability**

Property of a prepreg, adhesive film, foaming adhesive, or surfacing film to be manipulated effectively, with the appropriate tack level and drapability, which results in a part meeting all applicable specification requirements and/or suitable for its intended function.

## 3.4 Out-Life

(Related to column 5 of Tables 1 through 12.)

The OUT-LIFE of a material is the maximum permissible **Out-Time**. Term for materials such as prepregs, film adhesive materials, surfacing films, and foaming adhesives (see Figure 1).

**Out-Time**

The **Out-Time** of a material is the sum of its **Handling Time** and **Staging Time**.

**Staging Time**

The Staging Time is the time that the material is on the tool prior cure. Exposure conditions are in a controlled environment facility per BAERD GEN-013. If the material is sealed within a vacuum bag and subject to minimum vacuum requirements in accordance with the processing specification, then only the temperature requirement of BAERD GEN-013 applies.

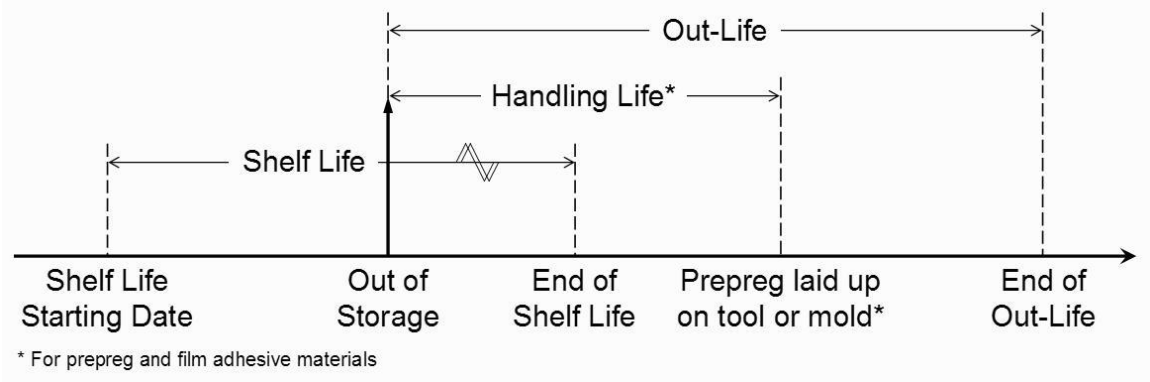


**Figure 1: Graphical definition of the Shelf Life, Handling Life and Out-Life**

## 4.0 PROCUREMENT

(Related to columns 6 through 7 of Tables 1 through 12.)

Procured materials must be manufactured only by APPROVED MANUFACTURERS shown in column 6 of Tables 1 through 12. Explanations of the approved manufacturer codes are shown in Table 14(a). When using the online version of the EMCM, the explanation of the code also appears through the usage of the hyperlinks.

Approved part numbers for forgings, castings and superplastic formed parts are shown in Table 14(b).

Materials may be procured through sales offices, agents, suppliers or distributors provided that APPROVED MANUFACTURERS (column 6) is respected.

Procured materials must meet the purchase conditions shown in column 7 of Tables 1 through 12. The PURCHASE CONDITIONS (column 7) are related to documentation, shipping conditions and special requirements. Explanations of the purchase condition codes are shown in Table 15. When using the online version of the EMCM, the explanation of the code also appears through the usage of the hyperlinks.

Materials consisting of two (2) or more components must be purchased and maintained at all times (testing, storage, shelf-life extended, etc.) in the form of a kit consisting of each component in the proportions indicated in the MIX RATIO SHOP LIFE (column 5) of Tables 1 through 12.

The APPROVED MANUFACTURERS (column 6) will perform mandatory lot/batch testing in accordance with the material specification (column 1, 2 & 3).

## 5.0 MONITORING

(Related to columns 8 and 9 of Tables 1 through 12.)

- Monitoring of APPROVED MANUFACTURERS (column 6) must be performed by Bombardier and its subcontractors through mandatory MONITORING TESTS (column 9) on materials at a defined FREQUENCY (column 8).
- Surveillance of APPROVED MANUFACTURERS will be maintained by Bombardier Quality Assurance Organization.

The test requirements for monitoring of approved manufacturers are shown in column 9 of Tables 1 through 12. Test procedures and acceptance criteria must be those shown in applicable material specification unless otherwise specified. Explanation of test procedure codes is shown in Table 17 or when using the online version of the EMCM, appears through the usage of the hyperlinks.

Bombardier laboratories or laboratories accredited by BAERD GEN-018 must be used to perform MONITORING TESTS (Column 9) and issue laboratory reports showing test results. Trained and certified Quality personnel may perform visual and functional tests (e.g. pressure test, tack).

The FREQUENCY of the monitoring testing is shown in column 8 of Tables 1 through 12 and is based on the reception of a product at Bombardier or at its subcontractor. Test frequency may be reduced in accordance with an approved sampling plan. Materials to which a sampling plan can be applied are identified in the FREQUENCY (column 8). Bombardier and its subcontractors who wish to reduce the test frequency may do so by submitting a sampling plan to Bombardier Quality Assurance Organization for discretionary approval. Bombardier and its subcontractors can only reduce testing once they have received a written confirmation by Bombardier Quality Assurance Organization that their sampling plan has been approved.

Explanations of the FREQUENCY codes are shown in Table 16. When using the online version of the EMCM, the explanation of the code also appears through the usage of the hyperlinks.

## 6.0 USAGE

(Related to columns 10 through 13 of Tables 1 through 12.)

### 6.1 Storage

(Related to column 10 of Tables 1 through 12.)

Explanation of STORAGE CONDITION codes is shown in Table 18 or when using the online version of the EMCM, appears through the usage of the hyperlinks.

Materials must be stored in a manner that will not cause damage to them, or if enclosed, will not cause damage to container or contents. Material identification must be readily visible at all times. Storage must also meet the requirements included in

BAERD GEN-014 whenever this document is referenced in an applicable process specification. Refrigerators must meet the requirements of BAERD GEN-007.

**6.2 Shelf Life**

(Related to column 11 of Tables 1 through 12.)

Explanation of shelf life codes is shown in Table 19 or when using the online version of the EMCM, appears through the usage of the hyperlinks.

The SHELF LIFE (column 11) is the amount of time a perishable material can be stored under specified environmental conditions and continue to meet all applicable specification requirements. For prepreg, adhesive film, foaming adhesive or surfacing film, see Figure 1.

The SHELF LIFE starts at Date of Shipment from the APPROVED MANUFACTURER (Column 6) unless otherwise specified.

For perishable materials, upon receipt, each container must be clearly labeled with the shelf life expiry date.

Perishable materials consisting of two or more components must have the SHELF LIFE specified for all their components and must be maintained at all times in the form of the original procured kit.

Materials which have exceeded their specified SHELF LIFE may have their shelf-life extended in accordance to 6.3.

When the SHELF LIFE is defined as “per manufacturer’s instructions” (Code 8C Table 19), the APPROVED MANUFACTURER must indicate on the container the maximum SHELF LIFE and the required storage environmental conditions such as temperature. When the SHELF LIFE is “per manufacturer’s instructions”, the start date is at the APPROVED MANUFACTURER’s discretion.

The SHELF LIFE of a raw material that has been transformed into a part, or used in an assembly, does not transfer to the part or assembly.

## 6.3 Shelf Life Extension and Limitations

(Related to columns 12 and 13 of Tables 1 through 12.)

Explanations of shelf life extension test codes and limitation codes are shown in Tables 20 and 21 respectively or when using the online version of the EMCM, appear through the usage of the hyperlinks.

Bombardier laboratories or laboratories accredited per BAERD GEN-018 will perform SHELF LIFE EXTENSION TESTS (column 12) and issue laboratory reports showing the test results. Trained and certified Quality personnel may perform visual and functional tests (e.g. pressure, tack).

Extension may be granted when all test results meet applicable requirements.

Extended shelf life expiry dates must be calculated from the last expiry date. To extend a material SHELF LIFE (column 11), no material preparation, specimen fabrication, or testing, must begin before the material has reached 90% of its SHELF LIFE. When additional extensions are permitted per Column 13 of Tables 1 through 12, no material preparation, specimen fabrication, or testing, must begin before the material has reached 90% of the extension period.

For shelf life extended material, each container must be relabeled with the new extended expiry date.

Records must be maintained to ensure integrity of perishable materials stored in-house and at outside storage facilities.

## 7.0 APPROVAL

(Related to columns 14 through 16 of Tables 1 through 12.)

Once a material (refer to Section 2 for the definition of material) is chosen for design purposes by Bombardier Engineering, BAMPE must approve the manufacturing process to ensure that materials produced will consistently meet the conditions of the controlling material specifications.

The contact between Bombardier and all potential manufacturers is Bombardier Sourcing/Procurement. Contact may be made either by a manufacturer approaching Bombardier or alternatively by Bombardier actively seeking out suitable manufacturers.

Bombardier Sourcing/Procurement must obtain clearance of the potential manufacturing site from BAMPE and Bombardier Quality Assurance Organization before starting the approval process.

Once cleared, the potential manufacturing site must develop a qualification test plan showing how requirements of the controlled material specification and approval CHARACTERISTICS (column 15) for Tables 1 through 12 will be met. It must be submitted to BAMPE for agreement, through Bombardier Sourcing/Procurement and/or Bombardier Quality Assurance Organization.

The type of approval process depends on the Category assigned by BAMPE for each material to be approved. The Category is shown against each material in column 14 of Tables 1 through 12 and approval requirement are defined in Sections 7.1 through 7.7 that follow.

- Approval of materials consist of performing the test applicable to that material, as indicated in CHARACTERISTICS (column 15) of Tables 1 through 12 or as defined in the qualification test plan. Explanations of the approval characteristics codes are shown in Table 22. When using the online version of the EMCM, the explanation of the code also appears through the usage of the hyperlinks.
- Acceptance of manufacturers consists of the approval of the manufacturing site by Bombardier Quality Assurance Organization, the addition of the manufacturing site by the Bombardier Quality Assurance organization in the Approved Supplier List for the Aeronautic Sector and, for Categories 1 and 5, a site audit by BAMPE.

An acceptable evaluation of the material and the manufacturer will result in material approval by BAMPE. It will be signified by the addition of the APPROVED MANUFACTURER into column 6 of Tables 1 through 12 for the appropriate SPECIFICATION (column 1 through 3 of Tables 1 through 12). The APPROVED MANUFACTURERS (column 6) of Tables 1 through 12 listed in EMCM refers to the final location where the material is made and certified to the controlling material specification.

Once added to the EMCM, the APPROVED MANUFACTURER (column 6) of Tables 1 through 12 is approved to supply material, subject to all applicable limitations stated.

Production material may not be supplied to Bombardier or its subcontractors by any source until all conditions of the approval procedure have been met and agreed to by BAMPE.

Once approved, the conditions involved in approval, including formulation and properties when BAMPE has approved a Process Control Document, must not be changed without agreement by BAMPE. Failure to comply may result in withdrawal of approval.

The approval process does not apply to materials where procurement conditions (column 6 of Tables 1 through 12) are defined as:

- Any manufacturer listed in Bombardier Approved Suppliers Listing
- Any Canadian or U.S. manufacturer listed in Bombardier Approved Suppliers Listing
- Any manufacturer listed on latest Qualified Product List (QPL) of same specification number and listed in Bombardier Approved Suppliers Listing
- Any manufacturer certified to ISO 9001 or AS9100
- Any manufacturer listed on latest Qualified Product List (QPL) of same specification and certified to ISO 9001 or AS9100

No further BAMPE approval procedure is necessary in these circumstances unless judged otherwise. The manufacturer must however be approved by the Bombardier Quality organization and be listed in the Approved Supplier List for the Aeronautic Sector.

Suppliers and distributors who simply stock or store materials are not subject to the approval process. They must, however, display the controls needed to ensure traceability of materials and documentation to assure authenticity, and to ensure that their storage conditions are such that product deterioration will not occur. Suppliers and distributors may only provide materials to Bombardier and its subcontractors from APPROVED MANUFACTURERS (column 6) listed in Tables 1 through 12.

### 7.1 Category 0

Category 0: Not applicable, approval not controlled by Bombardier (e.g. de Havilland Programs)

Category 0 signifies that the approval for this material per EMCM requirements is not applicable.

**7.2 Category 1**

Category 1: Aircraft Materials: Primary Structures

Approval for Category 1 materials must consist of the following:

- Approval of the manufacturing source by a site audit by a BAMPE representative. The representative must perform all reviews considered necessary to fully evaluate the capabilities of the source.
- A series of tests specified in column 15 of Tables 1 through 12, for the material under review, five specimens per test characteristic on three distinctly separate material samples, or as modified by BAMPE, by a source acceptable to Bombardier. It does not exclude the manufacturer's facilities, however witness of the tests by a BAMPE representative, may be required. Any test source unfamiliar to Bombardier may require approval. In addition, Bombardier may perform any additional or confirmatory tests considered necessary.
- Manufacturer's specific data covering the characteristics specified in column 15 of Tables 1 through 12 for the material under review, covering consecutive lots over a period of one year or fifty consecutive sets of data, whichever is the greater, or as modified by BAMPE.
- General manufacturer's data of the material under review.

Raw metallic material manufacturers must conform to all of the requirements of BAERD GEN-025.

**7.3 Categories 2, 3 and 7**

Category 2: Aircraft Materials: Non Primary Structures

Category 3: Aircraft Materials: Non Primary (Chemical)

Category 7: Process Materials: Directly affect part quality

Approval for Category 2, 3, and 7 materials must consist of the following:

- Manufacturer's specific data concerning the characteristics specified in column 15 of Tables 1 through 12 for the material under review, covering five consecutive lots.

- A series of tests, on a single product sample, five specimens per test characteristic, specified in column 15 of Tables 1 through 12 for the material under review, or as modified by BAMPE. The tests may be performed by an independent source, or the manufacturer, or Bombardier, as defined by BAMPE.

Raw metallic material manufacturers must conform to all of the requirements of BAERD GEN-025.

**7.4 Category 4**

Category 4: Aircraft Materials: Electrical

Approval for Category 4 materials must consist of the following:

- A sample of the material under review plus the data sheet, supplied to BAMPE for evaluation.
- Tests as required by Engineering Drawing and related documents.

**7.5 Category 5**

Category 5: Aircraft Materials: Castings & Forgings

Approval for Category 5 materials must consist of the following:

- Approval of the manufacturing source by a site audit by a BAMPE representative. The representative must perform all reviews considered necessary to fully evaluate the capabilities of the source, including heat treat and non-destructive evaluation.
- Tests as required by Engineering Drawing and related documents.

**7.6 Category 8**

Category 8: Process Materials: Not likely to affect part quality

Approval for Category 8 materials must consist of the following:

- General manufacturer’s data of the material under review.

**7.7 Category 6 and 9**

Category 6: Aircraft Materials: Controlled by QPL – No tests for approval

Category 9: Process Materials: Controlled by QPL or designated unrestricted open bid – no tests for approval

There are no approval requirements for Category 6 and 9 Materials.

**7.8 GROUP**

This column (column 16) is for internal BAMPE use only.

**8.0 INACTIVE MATERIALS**

(Related to Tables 23 through 31.)

Inactive materials and current replacement materials, when applicable, are shown in Tables 23 through 31.

In general, inactive materials will not remain listed in Tables 1 through 12. Tables 23 through 31 permit only substitution of materials in the material column with materials in replacement column and not vice versa.

Inactive materials shown on Engineering Drawings or in materials specifications and processes specifications may continue to be used to depletion or as long as supplies are available. In these cases all conditions applicable to the replacement material shown in Tables 1 through 12 must apply to the inactive material.