

AEROSPACE INFORMATION REPORT

SAE AIR5431

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Repair Tooling

RATIONALE

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

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1. SCOPE:

This SAE Aerospace Information Report (AIR) offers information about the use of support tooling for composite repair processes, as well as descriptions of some of the different tooling materials used and their applications. If the repair document requires the use of tooling, refer to this AIR for additional information.

1.1 Purpose:

The purpose of this AIR is to provide a general information and guidance in selecting materials and provide an example of a manufacturing technique for tooling used in the repair of thermosetting composite components.

2. REFERENCES:

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

ARP4916 Masking and Cleaning of Epoxy and Polyester Matrix Thermosetting Composite Materials

ARP5143 Vacuum Bagging of Thermosetting Composite Repairs

ARP5144 Heat Application for Thermosetting Resin Curing

ARP5319 Impregnation of Dry Fabric and Ply Lay Up

2.2 OEM Manuals

2.3 Other References:

Composites – Volume 1 – Engineered Materials Handbook – ASM International – METALS PARK , OHIO 44073

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3. GENERAL:

As the use of the composite material has increased over the past years, the size and the number of the components has also increased, as has the geometrical contour complexity. Also the wider use of complex composite components has increased the need for repair tooling.

The need for performance of larger repairs and the geometric complexity necessary leads to the situation that these repairs cannot be performed without any aid of tooling in order to support the total shape of the component and/or to restore and retain the geometric contour in the repair area. In particular, large area repairs done without tooling, often led to scrapping the component due to distortion.

The tooling/mold must be manufactured to sustain the specific curing cycle load without deformation, leakage or other damage.

To achieve an effective and economical repair it is essential that the most appropriate tooling material and process is used.

The factors influencing the material and process must be investigated; especially the material's thermal characteristics.

To choose the most appropriate tooling material, tooling manufacturing technique and repair tool type, the following options and factors must be considered:

- a. The geometric contour, the complexity of the repair part, and the required dimensional tolerances (including spring back).
- b. Coefficient of Thermal Expansion (CTE) - An important factor is the coefficient of thermal expansion of the component material and the repair tool material. Selecting an inappropriate factor can result in subsequent distortion of the component.
- c. Schedule - The time available to complete the repair.
- d. Required Tool Life
- e. Cure Temperature, Pressure and Repair Size
- f. Dimensional stability and resistance to creep at the cure temperature, especially if the tool will be used many times.