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Program Document CRBOK

PD 6103

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BODY OF KNOWLEDGE:

ROLE DESCRIPTION: Person that wants to get in to the field of Composite Repairs (auto, marine, aero, etc.) and wants to know the basics of how materials are handled and how repairs are performed.

SPECIAL PROCESS: Composite Repair
SCOPE/METHOD: General Composite Repair
LEVEL: Technician

All eQualified examinations are created using the applicable eQualified Body of Knowledge (BoK), which defines the baseline knowledge and experience required to be considered competent to perform the specified job role in aerospace special process manufacturing.

All eQualified BoKs are created by subject matter experts through an exhaustive job analysis process as detailed in the eQualified Program Document (PD) 6100: Industry Managed Special Process Bodies of Knowledge. All eQualified BoKs are updated periodically according to the requirements of the current eQualified PD6100 document to ensure they are consistent with current industry practice.

1. INTRODUCTION

This document has been created by the eQualified Composite Repair Body of Knowledge Review Board (CR BoKRB) according to the requirements of eQualified Program Document PD6100 Industry Managed Special Process Bodies of Knowledge.

This document constitutes the eQualified Body of Knowledge (BoK) for Composite Repair, General Composite Repair, Technician. It defines the baseline knowledge and experience required to be considered competent to perform this role.

Unless otherwise stated, the CR BoKRB has followed guidelines as detailed in the current version of International Aerospace Quality Group (IAQG) Guidance PCAP 001 (Competence Management Guideline) to develop this BoK.

The information in this BoK will provide guidance for the following:

- Training providers who wish to develop training courses intended to support eQualified examination candidate preparation
- Composite Repair Examination Review Board (CR-ERB) for the development of eQualified examinations
- Candidates taking eQualified examinations who wish to prepare in advance

2. REFERENCES

eQualified documents:

PD6000	Governance & Administration of eQualified Program
PD6100	Industry Managed Special Process Bodies of Knowledge
PD6200	Industry Managed Special Process Examinations System
PD6102	Industry Managed Guidance for Approval of Third Party Training Providers
PD6103	Appendices

International Aerospace Quality Group (IAQG) documents:

IAQG Guidance PCAP 001 Competence Management Guideline

Industry Documents:

TITLE 14	Code of Federal Regulations, Part 147 Aviation Maintenance Technician Schools
EASA AMC 20-29	Composite Aircraft Structure
FAA AC 20-107	Composite Aircraft Structure
FAA AC 65-33	Development of Training/Qualification Programs for Composite Maintenance Technicians
FAA AC 43-214	Repairs and Alterations to Composite and Bonded Aircraft Structure
SAE ARP 6262	Basic Composite Repair Qualification Certificate
SAE AIR 5719	Teaching Points for an Awareness Class on 'Critical Issues in Composite Maintenance and Repair
SAE AIR 4844	Composites and Metal Bonding Glossary

NOTE: The user should verify that they are using the current version of these documents.

3. DEFINITIONS

For additional definitions, please refer to either the PD6000 or the eQualified Dictionary.

BODY OF KNOWLEDGE (BoK): Baseline knowledge and experience required to be considered competent for a target position.

CERTIFICATION CATEGORIES: A class or division of a group based on job function or education, training and experience. There are four categories for composite repair technicians: General Composite Repair Technician, Bonded Technician 2, Metal Bond, and Bolted. Please refer to the current version of PD6000 for equivalent definitions for other special process technologies.

GENERAL EXAMINATION: The General Examination is designed to ascertain the candidate's general knowledge required for a particular job, role or activity. All of the questions will be derived from the corresponding BoK.

EXPERIENCE: The accumulation of knowledge or skill that results from direct participation in events or activities over a period of time.

KNOWLEDGE: Information / understanding acquired over a period of time. Information acquired through study and retained over that period of time (education, training, experience etc.) The combination of data and information, to which is added expert opinion, skills and experience, to result in a valuable asset which can be used to aid decision making and problem solving.

METHOD: A well-defined division of a SPECIAL PROCESS widely recognised by industry. A specific area of a special process for example anodizing within Chemical Processing.

NON-SPECIAL PROCESS RELATED REQUIREMENTS: Miscellaneous requirements such as Health and Safety, Environmental, etc.

PRACTICAL EXAMINATION: The Practical Examination shall consist of a demonstration of proficiency in performing tasks that are typical of those to be accomplished in the performance of the candidate's duties. The examination content is derived from the corresponding BoK.

PERSONAL ATTRIBUTES: A quality or characteristic expected and required for a particular job, role or activity.

REPAIR: The rebuilding of a rejected assembly to restore its intended form, fit and function (as defined in AIR4844).

SKILL: Ability to perform a particular task. The quality of being able to do something that is acquired or developed through training or experience.

SPECIFIC EXAMINATION: The Specific Examination shall cover requirements and use of the specifications, codes, equipment, operating procedures and test techniques the candidate may use in the performance of his/her duties with the employer. Examination content will be derived from the corresponding BoK where applicable.

TECHNICIAN: One whose occupation requires training in a specific technical process.

WEIGHTING: The "weighting" of each line item, using a scale of 1, 3, 7, 10, (1 being least important; 10 being most important) indicates the relative importance of that aspect of the BoK and will determine the likelihood and frequency of a question on that topic appearing in the examination.

4. GUIDANCE TO EXAMINATION CANDIDATES

All eQualified examination candidates are recommended to read all documents referenced in section 2 of this document.

As stated in eQualified PD6200, every eQualified exam question shall relate directly to and be derived from the information as detailed in the current version of the BoK.

Re-assessment to this Body of Knowledge is required every 3 years (ARP 6262) unless otherwise specified; not to exceed 5 years.

Candidates are therefore advised to ensure familiarity with all aspects of the BoK as detailed in Table 1. This can be done through:

- Self-study
- Completion of internal training
- Completion of external training (a list of eQualified approved providers can be found at www.eQualified.com)

Records of all qualified personnel shall be maintained and include:

- Date of Qualification
- Results of Written Exam

5. CERTIFICATION CATEGORIES

Categories				
Composite Repair Specific Criteria	GENERAL COMPOSITE REPAIR TECHNICIAN	BONDED REPAIR TECHNICIAN 2	METAL BOND REPAIR TECHNICIAN	BOLTED REPAIR TECHNICIAN
	<p>Basic understanding of the composite bonded repair special processes, methods and tools.</p> <p>Capable of recognizing hidden damage that is uncovered during the repair which may increase the original scope of the repair.</p> <p>Have the skills and knowledge to perform basic repairs to composite parts. Able to follow work instructions and verbal guidelines.</p> <p>Please see AIR 4938 Part 1 for more detail about General Composite Repair Technician.</p>	<p>Meets the requirements of General Composite Repair Technician.</p> <p>Able to perform composite bonded repairs to aircraft structures in compliance with the manufacturers' repair documentation or other acceptable or approved repair data.</p> <p>Please see AIR 4938 Part 2 for more detail about Bonded Repair Technician 2.</p>	<p>Able to perform metal bonded repairs to metal bond structures in compliance with the manufacturers' repair documentation or other acceptable repair data.</p> <p>Please see AIR 4938 Part 3 for more detail about Metal Bond Repair Technician.</p>	<p>Meets the requirements of General Composite Repair Technician.</p> <p>Able to perform bolted repairs to composite structures in compliance with the manufacturers' repair documentation or other acceptable repair data.</p> <p>Please see AIR 4938 Part 4 for more detail about Bolted Repair Technician.</p>

TABLE 1

The guidelines for table 1 boxes are as noted:

- Box 1 – Knowledge – The basic knowledge of the special processes, methods and tools.
- Box 2 – Skills – The expertise required to perform a particular special process task.
- Box 3 – Personal Attributes – Are statements that will enable judgment of the person’s personal attributes.
- Box 4 – Experience – Are the minimum experience requirements expected to demonstrate their competence.
- Box 5 – Non-Special Process Related Requirements – Defined within these roles are other general or pre-requisites needed.

SPECIAL PROCESS: Composite Repair
ROLE DESCRIPTION: Person that wants to get in to the field of Composite Repairs (auto, marine, aero, etc.) and wants to know the basics of how materials are handled, how repairs are performed.
SCOPE/METHOD: General Composite Repair
LEVEL: Technician

Row #	COMPETENCE	Category (e.g. OP, PL, OW, T1)	Weight (1,3,7,10)	Exam Type Gen/Specific/Practical	Reference Guidelines
1	KNOWLEDGE: The basic knowledge of the special processes, methods and tools				
2	IDENTIFY AND / OR DESCRIBE THE FOLLOWING:				
3	Basic composite materials technology and their application (Introduction to Composites) Knowledge of general principles of Composite Repair	T1	3	Gen	AIR 4938 Section 5
4	The concept of Human Factors, and what factors are likely causes of accidents and incidents	T1	1	Gen	AIR 4938 Section 5
5	The Critical issues in composite maintenance, repair and overhaul.	T1	3	Gen	AIR 4938 Section 5
6	Reinforcement fibers	T1	3	Gen	AIR 4938 Section 5
7	Pre-impregnated materials: Manufacturing levels, matrix material, and re-certification and disposal procedures.	T1	3	Gen	AIR 4938 Section 5
8	The properties of adhesives and their usage, surface preparation levels, bond line control levels and their common failure modes.	T1	7	Gen	AIR 4938 Section 5
9	Material Handling and Storage	T1	1	Gen	AIR 4938 Section 5
10	The importance of Vacuum bagging	T1	7	Gen	AIR 4938 Section 5
11	The different types of Heating Devices utilized in composite repair	T1	3	Gen	AIR 4938 Section 5
12	The OEM manuals used for manufacture and repair of composite structures.	T1	1	Gen	AIR 4938 Section 5
13	The Machining of composites	T1	3	Gen	AIR 4938 Section 5
14	The basic terms related to composite repairs	T1	3	Gen	AIR 4844
15	Aircraft Applications – Composite components in aircraft application	T1	1	Gen	See Addendum 2
16	Weave Styles, Ply Orientation, Lay-up Techniques, Installation of Core, Bagging & Debagging of Assemblies, Cutting & Applying fabrics and adhesives	T1	7	Gen	See Addendum 2
17	Accept/Reject Criteria	T1	3	Gen	See Addendum 2
18	Repair instructions, as well as industry standards (see Addendum 1 and 2 of this document)	T1	3	Gen	See Addendum 2
19	What tools are required for specific task	T1	3	Gen	See Addendum 2
20	The fundamentals of Matrix systems: Thermoplastic and Thermosetting matrix materials, roles and limitations of matrix materials, mix ratios, cure cycle, and matrix cross-linking terminologies	T1	3	Gen	
21	The fundamentals of Structural Design (e.g. sandwich structures and solid laminate structures, including Monolithic).	T1	3	Gen	AIR 4938 ARP 6262
22	The fundamentals of additional repair considerations such as protective coating or lightning strike materials.	T1	3	Gen	AIR 4938

23	The different fundamental Repair techniques such as Prepreg repairs, Wet Lay-up repairs and bolted repairs.	T1	7	Gen	
24	Simple Inspection Techniques such as Non-Destructive Inspection (NDI) techniques and their limitations selected during manufacture and repair	T1	3	Gen	
25	Machining, potting, splicing, septum & stabilization, resin mixing, core processing / machining, trimming / drilling	T1	7	Gen	See Addendum 2
1	SKILLS: The expertise required to perform a particular special process task.				
2	DESCRIBE:				
3	Mixing wet resins at the proper mix ratios	T1	3	Gen	
4	Scarfig / Taper Sanding	T1	3	Gen	
5	Thermocouple placement	T1	3	Gen	
6	Use of heat blankets	T1	3	Gen	
7	Hot bonder programming and operation	T1	1	Gen	
8	Drilling of composites	T1	7	Gen	
9	Paint removal	T1	3	Gen	
10	Properly identify and perform installation of Core	T1	3	Gen	See Addendum 2
11	Properly perform Bagging and Debagging of Assemblies	T1	7	Gen	See Addendum 2
12	Properly perform material cutting, applying fabrics and adhesives	T1	7	Gen	See Addendum 2
13	Properly perform Lay-up Techniques	T1	7	Gen	See Addendum 2
14	Properly perform the Cure (oven, autoclave, etc.)	T1	7	Gen	See Addendum 2
15	Must be able to interpret drawing/specification requirements	T1	3	Gen	See Addendum 2
16	Must be able to understand and interpret shop traveler/work instructions	T1	3	Gen	See Addendum 2
17					
18	READ AND UNDERSTAND WRITTEN INSTRUCTIONS:				
19	Ability to understand specification requirements and customer flow-down requirements	T1	1	Gen	See Addendum 2
20	Apply technical knowledge in a skillful way in solving problems	T1	3	Gen	See Addendum 2
21	Familiar with the scope and limitation of the repair	T1	7	Gen	See Addendum 2
1	PERSONAL ATTRIBUTES: Are statements that will enable judgment of the person's personal attributes				
2	Must be able to work independently with minimum supervision	T1		Gen	
3	Have a high degree of integrity	T1		Gen	
4	Be attentive to details	T1		Gen	
1	EXPERIENCE: Are the minimum experience requirements expected to demonstrate their competence				
2	EDUCATION:				
3	Basic technical mathematics	T1		Gen	AIR 4938 Section 3
4	General shop and hand tool usage	T1		Gen	AIR 4938 Section 3
5	Use of precision measurement tools	T1		Gen	AIR 4938 Section 3
6	Read basic technical drawings	T1		Gen	
7					
8	TRAINING / HANDS-ON EXPERIENCE:				
9	Understand criteria required in AIR 4938 (latest revision)	T1		Gen	AIR 4938
1	NON-SPECIAL PROCESS RELATED REQUIREMENTS: Defined within these roles are other general or pre-requisites needed				
2	Identify and describe Material Safety Data Sheets (MSDS) and Personal Protective Equipment (PPE) Requirements	T1	3	Gen	AIR 4938, Section 3 & 6
3	Safety & Environmental requirements: Knowledge and Understanding of safety and handling of hazardous materials, chemicals, etc. Regulatory Requirements	T1	3	Gen	Environmental laws & regulations
4	Identify and describe Storage requirements of time and temperature sensitive materials	T1	3	Gen	

5	Must be able to wear approved breathing apparatus	T1	3	Gen	
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ADDENDUM 1

LIST OF INTERNATIONAL STANDARDS FOR COMPOSITE REPAIR

DOCUMENT TITLE	DOCUMENT NUMBER
Title 14 Code of Federal Regulations	Part 147
Repairs and Alterations to Composite and Bonded Aircraft Structure	FAA AC 43-214
Development of Training / Qualification Programs for Composite Maintenance Technicians	FAA AC 65-33
Composite Aircraft Structure	FAA AC 20-107
Composite Aircraft Structure	EASA AMC 20-29

ADDENDUM 2

ATA/IATA/SAE COMMERCIAL AIRCRAFT COMPOSITE REPAIR COMMITTEE (CACRC) REFERENCE DOCUMENTS

DOCUMENT TITLE	DOCUMENT NUMBER
Composites of Metal Bond Glossary	AIR 4844
Composite and Bonded Structure Technician/Specialist: Training Document	AIR 4938
Repair Tooling	AIR 5431
Maintenance Life Cycle Cost Model	AIR 5416
Composite and Bonded Structure Engineers: Training Document	AIR 5278
Composite and Bonded Structure Inspector: Training Document	AIR 5279
Teaching Points for an Awareness Class on "Critical Issues in Composite Maintenance and Repair"	AIR 5719
Paste Adhesive for Core Restoration - Part 1 - General Requirements	AMS 2950/1
Technical Specification: Carbon Fiber Fabric and Epoxy Resin Wet Lay-up Repair Material Part 0 – Introduction	AMS 2980
Technical Specification: Carbon Fiber Fabric and Epoxy Resin Wet Lay-Up Repair Material Part 1 - General Requirements	AMS 2980/1
Technical Specification: Carbon Fiber Fabric and Epoxy Resin Wet Lay-Up Repair Material Part 2 - Qualification Program	AMS 2980/2
Technical Specification: Carbon Fiber Fabric and Epoxy Resin Wet Lay-Up Repair Material Purchasing Specification - Fabric	AMS 2980/3
Technical Specification: Carbon Fiber Fabric and Epoxy Resin Wet Lay-Up Repair Material Purchasing Specification - Resin	AMS 2980/4
Carbon Fiber Fabric and Epoxy Resin Wet Lay-Up Repair Material Part 5 - Material Specification: Carbon Fiber Fabrics, Plain Weave, 193 g/m2, and Epoxy	AMS 2980/5
Carbon Fiber Fabric Repair Prepreg, 125°C (250°F) Vacuum Curing Part 0 - Introduction	AMS 3970
Carbon Fiber Fabric Repair Prepreg, 125°C (250°F) Vacuum Curing Part 1 - General Requirements	AMS 3970/1
Carbon Fiber Fabric Repair Prepreg, 125°C (250°F) Vacuum Curing Part 2 - Qualification Program for Fiber, Fabric, Resin and Film Adhesive	AMS 3970/2
Carbon Fiber Fabric Repair Prepreg, 125°C (250°F) Vacuum Curing Part 3 - Purchasing Specification for Epoxy Prepreg	AMS 3970/3
Carbon Fiber Fabric Repair Prepreg, 125°C (250°F) Vacuum Curing Part 4 - Purchasing Specification for Film Adhesive	AMS 3970/4
Carbon Fiber Fabric Repair Prepreg, 120 °C (250 °F) Vacuum Curing, Part 5 - Purchasing Specification for Companion Non-Structural Glass Fiber Fabric Prepreg	AMS 3970/5
Carbon Fiber Fabric Repair Prepreg, 120 °C (250 °F) Vacuum Curing, Part 6 - Material Specification: Carbon Fiber Fabric Reinforced Epoxy Prepreg for Repair, Plain Weave Fabric, 193 g/m2, Adhesive Film for Repair and Non-Structural Glass Fiber Fabric Reinforced Epoxy Prepreg, 105 g/m2	AMS 3970/6
Masking and Cleaning of Epoxy and Polyester Matrix Thermosetting Composite Materials	ARP 4916
Drying of Thermosetting Composite Materials	ARP 4977
Core Restoration of Thermosetting Composite Components	ARP 4991
Composite Repair Ndt/Ndi Handbook	ARP 5089

Vacuum Bagging of Thermosetting Composite Repairs	ARP 5143
Heat Application for Thermosetting Resin Curing	ARP 5144
Mixing Resins, Adhesives and Potting Compounds	ARP 5256
Impregnation of Dry Fabric and Ply Lay-Up	ARP 5319
Solid Composite Laminate NDI Reference Standards	ARP 5605
Composite Honeycomb NDI Reference Standards	ARP 5606
Basic Composite Repair Technician Certification Standard	ARP 6262