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Program Document CRBOK

PD 6103

CRBoK-001/T-1 REV. A

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BODY OF KNOWLEDGE:

ROLE DESCRIPTION: Technician
SPECIAL PROCESS: Composite Repair
METHOD: Bonded Repair

All PRI QualificationSM program examinations are created using the applicable PRI QualificationSM program 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 BoKs are created by subject matter experts who participate in the PRI QualificationSM Body of Knowledge Review Boards. All BoKs are updated periodically according to the latest revision of PRI QualificationSM program documentation (PD6100: Industry Managed Special Process Bodies of Knowledge) to ensure consistency with current industry practice.

1. INTRODUCTION

This document has been created by the PRI QualificationSM program Composite Repair Body of Knowledge Review Board (CR- BoKRB) according to the requirements of PD6100.

This document constitutes the PRI QualificationSM program 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 revision 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 PRI QualificationSM program examination candidate preparation
- Composite Repair Examination Review Board (CR-ERB) for the development of PRI QualificationSM program examinations
- Candidates taking PRI QualificationSM program examinations who wish to prepare in advance
- Person that wants to enter 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.

2. REFERENCES

PRI QualificationSM program documents:

PD6000	Governance & Administration of PRI Qualification SM 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

3. DEFINITIONS

Definitions described within are specific to the Special Process BoK. For program-specific definitions, please refer to either the PD 6000 or the PRI QualificationSM 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, Aerospace Composite Bonded Repair Technician, 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.

LEVEL: A class or division of a group based on education, training and experience. There are 3 levels: Operator/Technician, Planner and Owner. Please refer to the current revision of PD 6000 for definitions of these levels.

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.

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

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.

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.

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 PRI QualificationSM program examination candidates are recommended to read all documents referenced in section 2 of this document.

As stated in PRI QualificationSM program document PD6200, every exam question shall relate directly to and be derived from the information as detailed in the current revision of the BoK.

Re-assessment of candidates 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 Approved Training Providers can be found at <https://p-r-i.org/>)

Records of all qualified personnel shall be maintained and include:

- Date of Qualification
- Results of Written Exam
- Results of Practical Exam (if applicable)
- Summary of Experience (Owner level only)

5. LEVELS

Descriptors	Level		
	Operator (OP) / Technician (T)	Planner (PL)	Owner (OW)
	<i>For descriptions, please refer to current version of PD6000</i>	<i>For descriptions, please refer to current version of PD6000</i>	<i>For descriptions, please refer to current version of PD6000</i>

<p>Composite Repair Specific Criteria</p>	<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><i>Level N/A for Composite Repair</i></p>	<p><i>Level N/A for Composite Repair</i></p>
<p>Technical Knowledge</p>	<p>Basic knowledge of the special process, its main processes, methods and tools.</p>	<p><i>Level N/A for Composite Repair</i></p>	<p><i>Level N/A for Composite Repair</i></p>
<p>Experience</p>	<p>Sufficient experience to deal with recurrent activity.</p>	<p><i>Level N/A for Composite Repair</i></p>	<p><i>Level N/A for Composite Repair</i></p>
<p>Personal Attributes</p>	<p>Takes into consideration behavioral characteristics such as but not limited to: team working, communication, direction and purpose, innovation and problem solving, mutual trust and respect, confidentiality and trustworthiness.</p>		
<p>Skills</p>	<p>Describe the activities necessary to perform each level of job function to comply with the Body of Knowledge.</p>		
<p>Non-Special Process Related Requirements</p>	<p>Health & Safety, Environmental, Quality System Requirements.</p>		

6. TABLE 1

ROLE DESCRIPTION: Technician

SPECIAL PROCESS: Composite Repair

METHOD: Bonded Repair

REFERENCE GUIDELINES: Addendum 1 is a list of the International Standards and Reference Documents applicable to Composites and Composite Repair

Row #	COMPETENCE	Weight (1,3,7,10)	Exam Type Written / Practical	Reference Guidelines
	KNOWLEDGE: The basic knowledge of the special processes, methods and tools			
1	IDENTIFY AND / OR DESCRIBE THE FOLLOWING:			
2	Basic composite materials technology and their application (Introduction to Composites)	3	Written	AIR 4938 Section 5
3	The concept of human factors, and what factors are likely causes of accidents and incidents	1	Written	AIR 4938 Section 5
4	The critical issues in composite maintenance, repair and overhaul	3	Written	AIR 4938 Section 5
5	Reinforcement fibers, Aramid, Carbon, Fiberglass and Ceramic etc.	3	Written	AIR 4938 Section 5
6	Pre-impregnated materials: manufacturing levels, matrix material, and re-certification and disposal procedures	3	Written	AIR 4938 Section 5
7	1. The types of adhesive, paste/film/foam, properties and their usage 2. Adhesive bonding considerations: surface preparation levels, bond line thickness control 3. Common failure modes	7	Written	AIR 4938 Section 5
8	Material handling and storage, out time records, temperatures, kitting and packaging	3	Written	AIR 4938 Section 5
9	The importance of vacuum bagging, bagging & debagging procedures of components	7	Written	AIR 4938 Section 5
10	1. The different types of heating and control devices utilized in composite repair, heat lamp, heat gun, heat blanket, hot bonder, oven and autoclave 2. Thermocouple types & placement	7	Written	AIR 4938 Section 5
11	The OEM manuals used for manufacture and repair of composite structures.	1	Written	AIR 4938 Section 5
12	The machining of composites, cutting, trimming, drilling, countersinking and deburring	7	Written	AIR 4938 Section 5
13	The basic terms and principles related to composite repairs	3	Written	AIR 4844
14	Aircraft applications – composite components in aircraft application	1	Written	ARP5089
15	Weave styles, ply orientation, lay-up techniques, cutting & applying fabrics and adhesives	7	Written	See Addendum 2
16	Accept/Reject criteria for components, materials and repair completion	3	Written	ARP5089 section 6
17	Repair instructions, as well as industry standards	3	Written	See Addendum 1 and 2
19	The fundamentals of matrix systems: thermoplastic and thermosetting matrix materials, roles and limitations of matrix materials, mix ratios, fillers, mixing, cure cycle, and matrix cross-linking terminologies	3	Written	
20	The fundamentals of structural design (e.g. sandwich structures and solid laminate structures, including Monolithic)	3	Written	AIR 4938
21	The fundamentals of additional repair considerations such as protective coating or lightning strike materials	3	Written	AIR 4938
22	The different fundamental repair techniques such as bonded, co-cured, prepreg repairs, wet Lay-up	7	Written	
23	Simple inspection techniques such as Non-Destructive Inspection (NDI)	3	Written	ARP5089

	techniques and their limitations selected during manufacture and repair			
24	Machining/scarf sanding/skin and core removal, potting, splicing, septum & stabilization, core processing	7	Written	See Addendum 2
	SKILLS: The expertise required to perform a particular special process task.			
25	DESCRIBE:			
26	Filling and mixing wet resins at the proper mix ratios	7	Written	
27	Scarfig / taper sanding, core & skin removal	7	Written	
28	Thermocouple placement	3	Written	
29	Use of heat blankets	3	Written	
30	Hot bonder programming and operation	7	Written	
31	Drilling of composites	7	Written	
32	Paint removal	3	Written	
33	Properly identify and perform cutting & installation of core	7	Written	See Addendum 2
34	Properly perform bagging and debagging of assemblies	7	Written	See Addendum 2
35	Properly perform material cutting, applying fabrics and adhesives	7	Written	See Addendum 2
36	Properly perform lay-up techniques	7	Written	See Addendum 2
37	Properly perform the cure (oven, autoclave, etc.)	3	Written	See Addendum 2
38	Must be able to interpret drawing/specification requirements	3	Written	See Addendum 2
39	Must be able to understand and interpret shop traveler/work instructions	3	Written	See Addendum 2
40	READ AND UNDERSTAND WRITTEN INSTRUCTIONS:			
41	Ability to understand specification requirements and customer flow-down requirements	1	Written	See Addendum 2
42	Apply technical knowledge in a skillful way in solving problems	3	Written	See Addendum 2
43	Awareness with the scope and limitation of the repair	7	Written	See Addendum 2
	PERSONAL ATTRIBUTES: Are statements that will enable judgment of the person's personal attributes			
44	Must be able to work in a team or independently with minimum supervision		N/A	
45	Have a high degree of integrity		N/A	
46	Be attentive to details		N/A	
	EXPERIENCE: Are the minimum experience requirements expected to demonstrate their competence			
47	EDUCATION:			
48	Basic technical mathematics		N/A	AIR 4938 Section 3
49	General shop and hand tool usage		N/A	AIR 4938 Section 3
50	Use of precision measurement tools		N/A	AIR 4938 Section 3
51	Read basic technical drawings		N/A	
52	TRAINING / HANDS-ON EXPERIENCE:			
53	Understand criteria required in AIR 4938		N/A	AIR 4938
	NON-SPECIAL PROCESS RELATED REQUIREMENTS: Defined within these roles are other general or pre-requisites needed			
54	Identify and describe Material Safety Data Sheets (SDS) and Personal Protective Equipment (PPE) Requirements		Written	AIR 4938, Section 3 & 6
55	Safety & Environmental requirements: knowledge and understanding of safety and handling of hazardous materials, chemicals, etc. regulatory requirements		Written	Environmental laws & regulations
56	Identify and describe storage requirements of time and temperature sensitive materials		Written	
57	Must be able to wear approved breathing apparatus		Written	

7. DOCUMENT REVISION HISTORY

REVISION DATE	SUMMARY
5 February 2016	Name of Title changed
26 August 2016	Editorial changes made to update BoK with new template revisions
25 September 2018	Document was reviewed, and document was edited to ensure it was up to date
4 December 2019	Editorial revision to update program name from eQualified to PRI Qualification SM .

ADDENDUM 1

LIST OF INTERNATIONAL STANDARDS FOR COMPOSITE REPAIR

DOCUMENT TITLE	DOCUMENT NUMBER
Composite Aircraft Structure	EASA AMC 20-29
Composite Aircraft Structure	FAA AC 20-107
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
Title 14 Code of Federal Regulations	Part 147

ADDENDUM 2

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

DOCUMENT TITLE	DOCUMENT NUMBER
Composites of Metal Bond Glossary	AIR 4844
Composite and Bonded Structure Technician/Specialist: Training Document	AIR 4938
Composite and Bonded Structure Engineers: Training Document	AIR 5278
Composite and Bonded Structure Inspector: Training Document	AIR 5279
Maintenance Life Cycle Cost Model	AIR 5416
Repair Tooling	AIR 5431
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	ARP4916
Drying of Thermosetting Composite Materials	ARP4977
Core Restoration of Thermosetting Composite Components	ARP4991
Composite Repair NDT/NDI Handbook P	AR 5089

Vacuum Bagging of Thermosetting Composite Repairs	ARP5143
Heat Application for Thermosetting Resin Curing	ARP5144
Mixing Resins, Adhesives and Potting Compounds	ARP5256
Impregnation of Dry Fabric and Ply Lay-Up	ARP5319
Solid Composite Laminate NDI Reference Standards	ARP5605
Composite Honeycomb NDI Reference Standards	ARP5606
Basic Composite Repair Technician Certification Standard	ARP6262

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