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Program Document CPBOK

PD 6103

CPBok-011/PL-2 REV. A

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BODY OF KNOWLEDGE:

ROLE DESCRIPTION: PLANNER

SPECIAL PROCESS: Chemical Processing

METHOD: Corrosion Protection/Engineering Plating (Chromium, Nickel, Rhodium, Tin); Sacrificial Plating (Cadmium, Zinc); Plating for Electronics (Copper, Tin-Lead); Precious Metals Plating (Gold, Palladium, Platinum, Silver).

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 Chemical Process Body of Knowledge Review Board (CP-BoKRB) according to the requirements of PD6100.

This document constitutes the PRI QualificationSM program BoK for Chemical Process: Corrosion Protection/Engineering Plating (Chromium, Nickel, Rhodium, Tin); Sacrificial Plating (Cadmium, Zinc); Plating for Electronics (Copper, Tin-Lead); Precious Metals Plating (Gold, Palladium, Platinum, Silver) (Chemical Process, for the Planner Level. It defines the baseline knowledge and experience required to be considered competent to perform this role.

Unless otherwise stated, the CP-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
- Chemical Process Examination Review Board (CP-ERB) for the development of PRI QualificationSM program examinations
- Candidates taking PRI QualificationSM program examinations who wish to prepare in advance

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

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.

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 version of PD 6000 for definitions.

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.

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 version of the BoK.

Re-assessment to this BoK is required every 5 years, unless otherwise specified.

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

Level			
Descriptors	Operator (OP) / Technician (T) <i>For current descriptors, please refer to current version of PD6000</i>	Planner (PL) <i>For current descriptors, please refer to current version of PD6000</i>	Owner (OW) <i>For current descriptors, please refer to current version of PD6000</i>
Special Process Specific Criteria	No additional criteria for the Plating process.	No additional criteria for the Plating process.	No additional criteria for the Plating process.
Technical Knowledge	Basic knowledge of the special process, its main processes, methods and tools.	Good level of knowledge in all aspects of the special process, all its processes, methods and tools. Ability to coach others on contents and methods in the context of their workplace.	High or extensive knowledge in all aspects of the special process, all its processes, methods and tools to assess and validate improvements. Able to contribute to set externally recognized standards. Ability to define contents and methods for using knowledge effectively in influencing and developing international processes. Ability to influence the process with ones knowledge.
Experience	Sufficient experience to deal with recurrent activity.	Has enough experience to deal with unforeseen issues.	Wide proven experience of the subject. Is recognized specialist within the Plating process.
Personal Attributes	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.		
Skills	Describes the activities necessary to perform each level of job function to comply with the Body of Knowledge		
Non-Special Process Related Requirements	Health & Safety, Environmental, Quality System Requirements.		

6. TABLE 1

ROLE DESCRIPTION: Planner

SPECIAL PROCESS: Chemical Processing

SCOPE / METHOD: Corrosion Protection/Engineering Plating (Chromium, Nickel, Rhodium, Tin); Sacrificial Plating (Cadmium, Zinc); Plating for Electronics (Copper, Tin-Lead); Precious Metals Plating (Gold, Palladium, Platinum, Silver)

REFERENCE GUIDELINES: *Addendum 1 is a list of the International Standards and Reference Documents applicable to Plating processes.*

Row #	COMPETENCE	Weight (1,3,7,10)	Exam Type: Written (W) Practical (P)	Reference Guidelines
	KNOWLEDGE: The basic knowledge of the special processes, methods and tools			
	GENERAL KNOWLEDGE:			
1.	Understand how to determine if there has been damage to the part surface.	10	W	AC 7108
2.	Full and complete understanding of Internal Work instructions	10	W	AC 7108
3.	Know how to access customer specifications and requirements (i.e. where to find them).	10	W	AC 7108
4.	Understand how to interpret customer specification and requirements in the context of performing the Plating process.	7	W	AC 7004; AS 9100; AC 7108/9; AC 7108/10
5.	Understand Industry Standards (see Addendum 1 of this document)	7	W	Addendum 1
6.	Knowledge and understanding of the Accept/Reject Criteria	7	W	AC 7108
7.	Knowledge of the Surface Preparation procedures	10	W	AC 7108/3; AC 7108/9; AC 7108/10; ASTM-B322; ISO 27831
8.	Basic understanding of the control and calibration requirements for equipment.	7	W	AC 7004; AS 9100
9.	Know how to perform the Water Break Free Cleanliness Verification	7	W	AC 7108
10.	Knowledge and understanding of mathematics, including decimal and fractions	10	W	General Industry
11.	Know how to use precision measuring instruments and equipment	7	W	General Industry
12.	Know and understand Job Documentation including Fixed and Frozen Process requirements.	10	W	AC 7004; AS 9100; AC 7108
13.	Know and understand proper chemistry, both usage and application.	10	W	AC 7108
14.	Know and understand General Cleaning, Mechanical Cleaning and Chemical Cleaning prior to Plating.	10	W	AC 7108/9; AC 7108/10; ASTM B322; ISO 27831
15.	Know and understand how to correct or adjust the amps per square foot(ASFs)for the Plating process.	7	W	AC 7108/9; AC 7108/10
16.	Know and understand Laboratory Procedures.	7	W	AC 7108/4
17.	Know and understand analytical requirements and limits.	7	W	AC 7108
18.	Know and understand how to review and take action on analytical data & limits.	7	W	AC 7108
19.	Understand the need for pre-process checks (such as calibration status and solution temperatures.	7	W	AC 7108
20.	Understand the mechanics and importance of Racking, Part Set-Up and Masking.	7	W	AC 7108
21.	Thoroughly understand the Plating process.	10	W	AC 7108/9; AC 7108/10
22.	Knowledge and ability to write and review internal procedures and practices.	10	W	AC 7004; AS 9100
23.	Know how to recognize unsafe and/or inappropriate work practices.	7	W	AC 7108; ; ISO 14001; OHSAS 18001
24.	Know and understand the effects and aspects of the Plating process on different alloys and materials (including chemicals, masking materials, tanks, work environment, etc.)	10	W	AC 7108/9; AC 7108/10
25.	Understand how to deal with incorrect or inappropriate Plating.	10	W	AC 7108/9; AC 7108/10
26.	Knowledge and understanding about the selection of appropriate equipment for use in the Plating process.	7	W	AC 7108/9; AC 7108/10
27.	Understanding of the significance of pH and grades of water purity and their measurement.	7	W	AC 7108
28.	General knowledge and understand of all the Plating processes and methods.	10	W	AC 7108/9; AC 7108/10
	CORROSION PROTECTION/ENGINEERING PLATING (CHROMIUM, NICKEL, RHODIUM, TIN)			
29.	Be aware of substrate requirements for this type of plating.	7	W	AMS-QQ-C-320; MIL-C-23422; MIL-STD-1501;
30.	Know cleaning steps and restrictions for this type of plating.	7	W	AMS 2406; AMS 2460;;
31.	Understand "Accept & Reject" Criteria and testing for this type of plating.	7	W	MIL-STD-14538; AMS-QQ-N-290; AMS 2403;
32.	Know uses, features and applications for this type of plating.	10	W	AMS 2417; SAE-AMS-C-26074; MIL-P-27418; MIL-P-18317; MIL-R-46085;
33.	Understand the limitations for this type of plating.	10	W	AMS 2408; ASTM B545;
34.	Understand the environmental, worker safety and health concerns associated with this type of plating.	7	W	

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	SACRIFICIAL PLATING (CADMIUM, ZINC)			
35.	Be aware of substrate requirements for this type of plating.	7	W	SAE-AMS-QQ-P-416; AMS 2400; SAE-AMS-QQ-Z-325; ASTM B633; AMS 2417
36.	Know cleaning steps and restrictions for this type of plating.	7	W	
37.	Understand "Accept & Reject" Criteria and testing for this type of plating.	7	W	
38.	Know uses, features and applications for this type of plating.	10	W	
39.	Understand the limitations for this type of plating.	10	W	
40.	Understand the environmental, worker safety and health concerns associated with this type of plating.	7	W	
	PLATING FOR ELECTRONICS (COPPER, TIN-LEAD)			
41.	Be aware of substrate requirements for this type of plating.	7	W	MIL-C-14550;AMS 2418; MIL-P-81728; SAE-AMS-P-81728
42.	Know cleaning steps and restrictions for this type of plating.	7	W	
43.	Understand "Accept & Reject" Criteria and testing for this type of plating.	7	W	
44.	Know uses, features and applications for this type of plating.	10	W	
45.	Understand the limitations for this type of plating.	10	W	
46.	Understand the environmental, worker safety and health concerns associated with this type of plating.	7	W	
	PRECIOUS METALS PLATING (GOLD, PALLADIUM, PLATINUM, SILVER)			
47.	Be aware of substrate requirements for this type of plating.	7	W	MIL-G45204; MIL-P-45209; ASTM B679; SAE-AMS-QQ-S-365; ASTM B700; AMS 2410; AMS 2411; AMS 2412;
48.	Know cleaning steps and restrictions for this type of plating.	7	W	
49.	Understand "Accept & Reject" Criteria and testing for this type of plating.	7	W	
50.	Know uses, features and applications for this type of plating.	10	W	
51.	Understand the limitations for this type of plating.	10	W	
52.	Understand the environmental, worker safety and health concerns associated with this type of plating.	7	W	
	SKILLS:			
	Defined within these rolls describes the range of skills. The skills required to perform a particular special process task			
	READ AND UNDERSTAND WRITTEN INSTRUCTIONS:			
53.	Ability to understand specification requirements and customer flow-down requirements	10	P	AC 7004; AS 9100; AC 7108
54.	Apply plating techniques appropriately	3	P	AC 7108/9; AC 7108/10
55.	Verify and validate the plating results.	3	P	AC 7108/9; AC 7108/10
56.	Properly report nonconformances	10	P	AC 7004; AS 9100; AC 7108
57.	Apply technical knowledge in a skillful way when solving problems	10	P	AC 7004; AS 9100; AC 7108
58.	Be familiar with the scope and limitations of plating.	10	P	AC 7108/9; AC 7108/10
59.	Use of appropriate equipment for the plating process.	7	P	AC 7108/9; AC 7108/10
60.	Ability to follow instructions	10	P	AC 7004; AS 9100; AC 7108
61.	Ability to write Work Instructions and Procedures	10	P	AC 7004; AS 9100; AC 7108
62.	Interpretation of an acceptable plating process	10	P	AC 7108/9; AC 7108/10
63.	Must be able to read drawings and specifications	10	P	AC 7004; AS 9100; AC 7108
64.	Must be able to interpret specification requirements	10	P	AC 7004; AS 9100; AC 7108
65.	Must be able to understand and interpret shop travelers	7	P	AC 7004; AS 9100; AC 7108
	PERSONAL ATTRIBUTES:			
	Are statements that will enable judgment of the person's personal attributes			
66.	Be able to work independently with a minimum of supervision	10	N/A	General Industry
67.	Must have a high degree of integrity	10	N/A	General Industry
68.	Be attentive to details	10	N/A	General Industry
69.	Be flexible	7	N/A	General Industry
70.	Tolerate stress	7	N/A	General Industry
71.	Exhibit conflict resolution	7	N/A	General Industry
72.	Decision making ability	10	N/A	General Industry

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73.	Team Worker	10	N/A	General Industry
74.	Ethical Behavior	10	N/A	General Industry
75.	Exhibit Leadership	7	N/A	General Industry
EXPERIENCE:				
Are the minimum experience requirement expected to demonstrate their competence.				
76.	EDUCATION:			
77.	High School Diploma or GED or Secondary Education	10	N/A	General Industry
78.	Apprenticeship	3	N/A	General Industry
79.	Industry Training or Courses	3	N/A	General Industry
80.	TRAINING / HANDS-ON-EXPERIENCE:	10	N/A	General Industry
81.	Complete on the job training: Minimum number of hours-			
82.	OPERATOR – 160 Hours			
83.	PLANNER – 160 Hours	10	GEN	General Industry
84.	OWNER – 640 Hours			
NON-SPECIAL PROCESS RELATED REQUIREMENTS:				
Defined within these rolls are other general or pre-requisite needed				
85.	General understand of Quality Systems AS/EN/JISQ 9100 , or AC7004, or equivalent	10	W	AS 9100 AC7004
86.	SAFETY & ENVIRONMENTAL REQUIREMENTS:			
87.	Knowledge and understanding of safety and handling of hazardous material, chemicals, etc. including safe storage, interpretation of Health & Safety Data Sheets and Regulatory Requirements	10	W	AC 7108; ISO 14001; OHSAS 18001
88.	Understand Safety Data Sheets (SDS) and Personal Protective Equipment Requirements: When and how to use appropriate personal protective equipment (goggles, gloves, rubber boots, aprons, etc.)	10	W	AC 7108; ISO 14001; OHSAS 18001
89.	Understand which personal protective equipment to use, when and why	10	W	AC 7108; ISO 14001; OHSAS 18001
90.	Understand the safe storage, shelf life and mixing of chemicals	10	W	AC 7108; ISO 14001; OHSAS 18001
91.	Ability to recognize symbols associated with chemicals and their usage	10	W	AC 7108; ISO 14001; OHSAS 18001

7. DOCUMENT REVISION HISTORY

REVISION DATE	SUMMARY
16 May 2018	Updated to new template
18 January 2019	Reviewed by eQualified Content Developer to ensure content is up to date.
4 December 2019	Editorial revision to update program name from eQualified to PRI Qualification SM .

ADDENDUM 1

LIST OF INTERNATIONAL STANDARDS & REFERENCE DOCUMENTS FOR PLATING PROCESSES

SPECIAL PROCESS	DOCUMENT TITLE	DOCUMENT NUMBER
Quality	Audit Criteria for Aerospace Management System	AC 7004
Chemical Process	Audit Criteria for Chemical Processing	AC 7108
Chemical Process	Audit Criteria for Surface Preparation Prior to Metal Bond	AC 7108/3
Chemical Process	Audit Criteria for Solution Analysis & Testing in Support of Chemical Processing	AC7108/4
Chemical Process	Audit Criteria for Electroplating and Electroforming	AC 7108/9
Chemical Process	Audit Criteria for Electroless Plating	AC 7108/10
Cadmium Plating	Cadmium Plating	AMS 2400
Nickel Plating	Plating, Nickel, General Purpose	AMS 2403
Chromium Plating	Plating, Chromium, Hard Deposit	AMS 2406
Tin Plating	Plating, Tin	AMS 2408
Silver Plating	Plating, Silver, Nickel Strike, High Bake	AMS 2410
Silver Plating	Plating, Silver, for High Temperature Applications	AMS 2411
Silver Plating	Plating, Silver, Copper Strike, Low Bake	AMS 2412
Zinc Nickel Plating	Plating, Zinc-Nickel Alloy	AMS 2417
Copper Plating	Plating, Copper	AMS 2418
Gold Plating	Plating, Gold	AMS 2422
Chromium Plating	Plating, Chromium	AMS 2460
Quality	Quality Management System-Requirements for Aviation, Space and Defense Organisation	AS 9100
Chemical Process	Standard Guide for Cleaning Metals Prior to Electroplating	ASTM B322
Tin Plating	Standard Specification for Electrodeposited Coatings of Tin	ASTM B545
Zinc Plating	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel	ASTM B633
Palladium Plating	Standard Specification for Electrodeposited Coatings of Palladium for Engineering Use	ASTM B679
Silver Plating	Standard Specification for Electrodeposited Coatings of Silver for Engineering Use	ASTM B700
Safety	Occupational Health and Safety Management	BS OHSAS 18001

Environment	Environment Management System	ISO 14001
Chemical Process	Metallic and other inorganic coatings -- Cleaning and preparation of metal surfaces	ISO 27831
Copper Plating	Military Specification: Copper Plating (Electrodeposited)	MIL-C-14550
Chromium Plating	Chromium Plating, Electrodeposited	MIL-C-23422
Gold Plating	Military Specification Gold Plating Electrodeposited	MIL-G-45204
Nickel Plating	Plating, Black Nickel (Electrodeposited) On Brass, Bronze, Or Steel	MIL-P-18317
Sulfamate Nickel	Military Specification: Plating, Soft-Nickel Electrodeposited Sulfamate Bath	MIL-P-27418
Palladium Plating	Military Specification: Palladium Plating (Electrodeposited)	MIL-P-45209
Tin-Lead Plating	Military Specification: Electrodeposited or Hot Dipped, For Ferrous & Non-Ferrous Metals	MIL-P-81728
Rhodium Plating	Military Specification: Rhodium Plating (Electrodeposited)	MIL-R-46085
Chromium Plating	Chromium Plating, Black (Electrodeposited)	MIL-STD-14538
Chromium Plating	Chromium Plating, Low Embrittlement, Electrodeposition	MIL-STD-1501
Brush Plating	Military Standard: Selective (Brush Plating) Electro-Deposition	MIL-STD-865
Tin Plating	Military Specification: Electrodeposited or Hot Dipped, For Ferrous & Non-Ferrous Metals	MIL-T-10727
Chromium Plating	Chromium Plating (Electrodeposited)	SAE AMS-QQ-C-320
Cadmium Plating	Plating Cadmium (Electrodeposited)	SAE AMS-QQ-P-416
Electroless Nickel Plating	Military Specification: Coatings – Electroless Nickel	SAE-AMS-C-26074
Nickel Plating	Electroless Nickel Coatings	SAE-AMS-C-26074
Tin-Lead Plating	Plating, Tin-Lead (Electrodeposited)	SAE-AMS-P-81728
Nickel Plating	Federal Specification: Nickel Plating (Electrodeposited)	SAE-AMS-QQ-N-290
Silver Plating	Federal Specification: Silver Plating, Electrodeposited)	SAE-AMS-QQ-S-365
Zinc Plating	Federal Specification: Zinc Coating, Electrodeposited	SAE-AMS-QQ-Z-325

ADDENDUM 2

ADDITIONAL SAFETY & ENVIRONMENTAL REQUIREMENTS

REACH REGULATION INFORMATION

Several metal finishing processes (painting, anodize, chromate conversion, passivate, electroplating) may have REACH regulated substances that are either used as process chemicals or are contained within the finished product after a process is completed. Chemical suppliers are obliged to provide a legislatively compliant safety data sheet.

Below are topics of concern that a chemical processing owner should be aware of and have adequate understanding if products are produced within or shipped to the European Union.

- REACH (Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals)
- Affects raw materials/substances that go into products either produced within or shipped to the European Union.
- Under EU REACH regulation, substances that are one of the following can be regarded as substance of very high concern (SVHC):
 - carcinogenic, mutagenic or toxic to reproduction (CMRs);
 - persistent, bio-accumulative and toxic (PBTs);
 - very persistent and bio-accumulative (vPvBs);
 - seriously and / or irreversibly damaging the environment or human health, as substances damaging the hormone system;
- The SVHC candidate list is a moving target that will continue to grow with 168 substances as of January 2016. This list is reviewed nominally twice a year by ECHA.
- Some typically used SVHC's contained in or used but not limited to during chemical processing are;
 - Cadmium
 - Strontium Chromate
 - Chromium trioxide
 - Sodium dichromate
- SVHC content is allowable up to 0.1% of an article produced within or shipped to the EU.
- Additionally, SVHC's may at some time be added to the Authorization List known as Annex 14 or XIV which contains a sunset date for each SVHC in this list.
- Owner needs to be aware of sunset dates for SVHC's contained in the Authorization list. Once an SVHC from the Authorization List reaches the sunset date, it can no longer be used in the EU without specific authorization from ECHA (European Chemicals Agency).
- Manufacturing sites either located within or if shipping product to the EU must comply with all aspects of REACH. Chemical suppliers in the EU must provide safety data sheets that reflect any conditions of an authorization.
- Further information/current SVHC and Authorization list with sunset dates can be obtained by accessing (<http://www.echa.europa.eu/web/guest/candidate-list-table>)