PEARL Technician Certification Program

Candidate Handbook

PEARL Electrical Equipment Reconditioning Technician Level ll

This booklet contains:

- The subject matter for the PEARL Technician Certification Exam
- Exam education and experience requirements
- Selected study references
- Certification policies
- Sample exam questions

Certification Development Committee

PEARL thanks the following persons who served as members of the PEARL Certification Development Committee and approved this document. Collectively, this group of individuals has **222** years of experience in the electrical equipment reconditioning and remanufacturing industry.

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PEARL Technician Certification Candidate Handbook

Introduction

The PEARL Association

The Professional Electrical Apparatus Recyclers League (PEARL) is a professional trade association of companies that supply reconditioned, and remanufactured electrical power equipment, apparatus, and components to industry. The mission of PEARL is to create a marketable distinction in quality, safety, and integrity for PEARL members in the eyes of their customers. PEARL's members must meet strict technical, safety, and operational requirements; and be committed to the safe reconditioning and remanufacturing of electrical apparatus and equipment that has previously been in service. PEARL sponsors an annual Electrical Safety, Reliability, and Sustainability Conference & Exhibition, which can be attended by anyone concerned with the safety and reliability of reconditioned, remanufactured, and recycled electrical equipment and apparatus.

Why Get Certified?

For the employer, PEARL Technical Certification provides a way to distinguish companies with certified technicians on staff, giving these companies a marketable edge and elevated status within the industry. Certifying your technicians will improve employee morale and reduce turnover, provide a feeder path for future management positions, reduce accidents and associated costs, reduce warranty claims, and improve the company's bottom line.

For the technician, PEARL Technical Certification can extend your career path, opening up new opportunities within your organization; give you a greater sense of professional fulfillment and gain you the respect of your peers – both at work and in the electrical reconditioning community at large.

An important part of this program depends on PEARL, its corporate membership and their employees to educate the customer base on the safety and financial benefits of using companies with PEARL-certified technicians (e.g. improved reliability, reduced downtime losses, and increased employee safety). To this end, PEARL will launch a public relations (PR) campaign and include PEARL Technician Certification logos and badges in advertisements to increase public awareness. Companies with certified technicians also will have the right to post PEARL Technician Certification badges on their websites as well as PR and marketing materials. Thus, technician certification is a critical step toward helping PEARL members provide the industry with a marketable distinction in quality, safety, and integrity of reconditioned and remanufactured electrical equipment.

Delineation of Certification Levels

The PEARL Technician Certification program was created to offer multilevel technical certification for individuals employed in the reconditioned electrical equipment field. Exams are designed by vocational specialists through four levels of practice, ranging from the entry level technician (Level I) to the supervisory technician (Level IV). Levels II, III, and IV are defined in terms of general experience in the electrical equipment reconditioning business and the complexity of the equipment they perform work on. The certification design committee developed a general delineation of the levels of certification that are presented below.

Level I
Level I technicians can work safely in a shop environment and around de-energized electrical power equipment, recognize and have basic understanding of the PEARL reconditioning standards; and are able to identify various types of electrical apparatus, shop equipment, warehouse equipment, test and measurement equipment, and cleaning equipment used in the electrical equipment reconditioning process under the supervision of a higher-level technician. [1]

Level II
Level II technicians can work independently; and inspect, test, and perform reconditioning procedures, following PEARL and other industry standards, on a wide range of electrical power equipment, and accurately interpret equipment drawings, specifications, and electrical schematics, at the component level, as it relates to the PEARL reconditioning standards.

Level III
Level III technicians can supervise Level I and II technicians; conduct and oversee large equipment reconditioning projects; are able to work safely in the field around energized electrical equipment; develop equipment test plans and analyze test results; plan and lead jobs; evaluate shop safety plans; and provide training to others.

Level IV
Level IV technicians can manage multiple individuals and projects; conduct complex metering and protection projects; make recommendations on power system diagnostic testing and corrective action; and evaluate electrical equipment modifications and upgrades for adherence to PEARL and industry standards.

PEARL Technician Profile

This certification program is intended for technicians who are engaged in inspection, reconditioning, and/or remanufacturing, testing, periodic maintenance of electrical power equipment and evaluation of such equipment for acceptance for service, continued serviceability, or required maintenance.

	Level I	Level II	Level III	Level IV
Technician Title	Entry Technician	Journey Technician	Lead/Advance Technician	Supervisory Technician
Certified Specialist	Not Applicable	Level I Certificate	Under Development	Under Development

[1] Applicable after PEARL's Technician Certification program has progressed to Level 2 or beyond to Levels 3 and 4.

Education and Training			
High School/GED	Safety - 20 hrs. Electrical - 40 hrs.	Safety - 24 hrs. additional Electrical - 40 hrs. additional	Safety - 24 hrs. additional Electrical - 40 hrs. additional
None (unless unable to meet Education Requirement)	Two Years	Five Years	Ten Years
Technician Essential Duties Categories			
Level I Duties	Level II Duties	Level III Duties	Level IV Duties

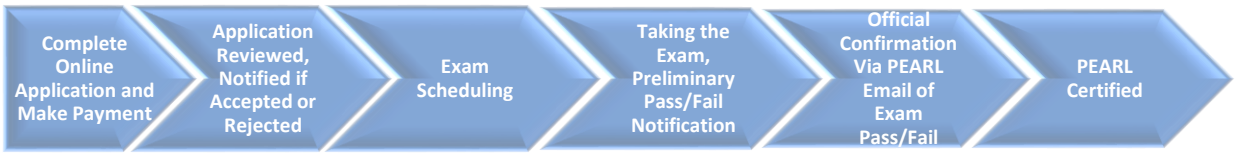
The Certification Process

Step One – Complete the Online Technician Application

To become certified, ***all applicants*** must complete an online certification application. The application confirms an applicant's work and experience qualifications. PEARL certification requires that all applicants must be currently employed by a full PEARL member company or a PEARL Service Organization. Applicants also must meet all the education, training, and work experience requirements as set forth in the PEARL Technician Profile. *All applicants are required to pay in advance for the PEARL Technician Certification exam to offset the costs of application review, exam creation, and delivery.* If an applicant's application is denied by PEARL, PEARL will issue a full refund, less a $75 administrative fee, within 4 weeks following the application review date.

Step Two – Application Review

Upon payment and submission of your application, your confirmation email will provide you with information on how your supervisor may verify the education/training, work experience, and employment information given on the application. This information must be verified within 30 days of your application submission. If the application is approved, then the applicant will receive an email acceptance and enrollment letter. If the application is rejected, the applicant will be notified by email and may be asked to supply more information if warranted. A fee of $50.00 will be charged if the employer does not verify/approve the application within 30 days of application submission.



PEARL Certification Process

Step Three – Exam Scheduling

Once an applicant has received an acceptance letter through email they may schedule their exam. All exams are delivered online using a Web browser and are proctored at an authorized managed test center. The acceptance/enrollment email will provide the applicant all the instructions needed to take their exam. Exam candidates are required to show at least one valid government-issued photo identification (state

driver's license or ID, or passport). Only after positive identification has been made by the exam proctor may a candidate begin the exam.

To *reschedule your exam,* you must submit a written request by email to the proctor agency no later than one week before your scheduled exam requesting another time. If you miss your scheduled exam time, then you may reschedule your exam after paying an additional $50 administrative fee. An exam may only be rescheduled two times before all exam fees are forfeited and a new application must be resubmitted.

To cancel your exam, you must submit a signed written request (a letter stating you wish to cancel your application) to PEARL. The written request must be received before you schedule an exam time. Full refunds, less a $75 administrative fee, will be made within four weeks after the scheduled date.

To re-schedule an exam after failing. If you fail to pass the exam during your first sitting you may reschedule after a 30 day waiting period. A new application and exam fee is required before rescheduling your next exam.

Step Four – Taking the Exam and Preliminary Results

PEARL exams are administered online, using a third party, online proctor. During the exam, the candidate will use their own computer, which must have a functioning microphone and camera. The proctoring agency will lock down the users' browser and maintain video contact throughout the exam to insure a secure exam environment. No reference materials, cell phone, cameras or computers (other than the computer being used for examination) are allowed during the exam. Candidates are not allowed to use any notes during the exam. Candidates who violate exam rules will be disqualified from that exam. All violations of exam security will be investigated by PEARL and appropriate action will be taken.

EXAM GRADING

After participants have completed all the questions, the exam automatically scores, tabulates, and stores the answers in a secure PEARL database. The overall exam score will determine if you pass or fail the exam. The minimum passing score is 70% of items answered correctly. Each time a certification exam is given, the questions are changed, resulting in a different exam. The passing score is developed as an overall estimate of minimal acceptable competence in the Exam Content Areas by subject matter and examination experts. Passing scores are determined by an overall passing score, not by performance on individual Exam Subject Areas, and are independent of other candidates' scores. Partial credit *will not* be awarded for any exam item answered incorrectly. After completing the test, applicants are notified immediately if they have passed or failed the exam.

Step Five – Official Exam Notification

Exam results are displayed on the computer screen upon completion of the exam as well as emailed to the candidate. No results are given by phone, fax, or email. All results are confidential and are only released to the certificate candidate. The official exam notification will only indicate if the applicant passed or failed the exam. For exam security, no additional feedback will be provided to candidates about specific exam item answers.

Step Six – PEARL Certification

All certificates are emailed with the exam notification email, as well as stored in the applicants transcript profile on the PEARL online management system.

All certifications expire three years after an individual's initial certification is awarded and every third year after renewal. Certification renewal will be based on the certificant's activities during that three-year period. Requirements and fees may be found in PEARL's Continuing Professional Development Policy.

Exam Design and Administration

Exam Design

All certification exams are designed to test knowledge and skills required to perform *essential duties* with minimal acceptable competence. All research was conducted under the guidance of the Technical Certification Program Committee and PEARL staff. All test questions are designed to measure at least one area of knowledge or skill that is required to perform an essential task.

Exam Format

All PEARL exams are given in a test format utilizing a variety of exam question types. The following are question formats used in the exam: multiple choice, multiple response, matching, hotspot, and ranking formats. Questions may have one, two or three correct answers. The exam does not utilize essay, true/false, or yes/no questions (see Sample Test Questions in this booklet for an example). These objective formats allow for a greater coverage in content for a given amount of testing time and improve competency measurement reliability.

Complexity of Test Questions

At Level lI, certificate candidates are expected to have basic knowledge of the job and the ability to safely perform the Essential Duties. Examinees will have to answer questions that test knowledge, comprehension, and application of the subject matter. The complexity of the questions will range from basic recall of previously learned material and the ability to understand the meaning of the subject matter to being able to apply knowledge to new situations.

Exam Content Areas (ECAs)

Exam Content Areas (ECAs) contain a Knowledge or Skill that is required to perform the Essential Duties for that specific Level. All of the Exam Content Areas contain important Knowledge and Skills required when performing the Essential Duties of an electrical equipment reconditioning technician. However, the test designers felt that some content areas were of higher importance, thus, not all of the content areas are equally weighted on the exam.

Item Appeals

Candidates who wish to appeal a specific exam item must do so during the exam by completing the Candidate Feedback Review Screen during the exam period. Candidate feedback will be evaluated, and appropriate adjustments will be made to the exam content. Candidates submitting feedback will not be contacted.

Hierarchical Levels

At the entry level is PEARL technician Level I. This entry level certification is designed to measure competence as a general reconditioning and remanufacturing technician worker. A Level l technician is expected to be able to assist either low-voltage electrical specialists performing fundamental duties. Certificate candidates should be familiar with the basic mechanical and electrical principles and duties listed in the Level l PEARL Technician section of this handbook.

The PEARL Level ll technician is a Skilled/Journey level certification designed to measure competence at a Skilled or Journey level for more complex reconditioning tasks. Level ll technicians are expected to be able to work independently on either low-voltage electrical equipment performing comprehensive duties. Certificate candidates should be familiar with the basic mechanical and electrical principles and duties listed in the Level ll PEARL Technician section of this handbook.

Certification at Level III is designed for lead or advanced personnel involved with supervisory and training responsibilities. Candidates must demonstrate high competency in low-voltage electrical and Medium-Voltage Electrical equipment. Certificate-holders at this level are expected to demonstrate a wide range of knowledge and skills and be able to perform the essential duties within multiple areas of low-voltage electrical and Medium-Voltage Electrical equipment. **(This level is currently under development.)**

Level IV certification is designed for managerial-level personnel involved with equipment reconditioning and remanufacturing at either the low-voltage electrical areas. Certified individuals at this level are expected to demonstrate competency as managers of PEARL member operations. Qualified candidates should be able to demonstrate the managerial functions as outlined in the *Level IV* low-voltage electrical sections of this handbook as well as the ability to understand and make managerial level decisions on low-voltage electrical equipment and technology issues. **(This level is currently under development.)**

Code of Ethics

The purpose of the Code of Ethics is to ensure industry confidence in the integrity and service of PEARL member companies while performing their duties. Additionally, it is intended to reflect the standards and behavior that PEARL certificate-holders and applicants expect of each other as they perform their work meeting strict technical, safety, and operational requirements that reaffirm the value of holding a PEARL technical certificate. PEARL-certified technicians recognize the services they render have a significant impact on the clients and industry they serve. As they perform their duties, PEARL technical certificate-holders and applicants are expected to meet the following standards of professional conduct and ethics:

1. To protect themselves, their coworkers, property, and the environment by performing the Essential Duties of the PEARL-certified vocation safely and effectively, and complying with all applicable federal, state, and local regulations.
2. To represent themselves truthfully and honestly when performing their duties and throughout the entire certification process.
3. Undertake only those assignments for which they are competent by way of their education, training, and experience.
4. To adhere to all examination rules and make no attempt to complete the exam dishonestly or to assist any other person in doing so.
5. To refrain from activities that may jeopardize the integrity of the PEARL Technical Certification program.
6. Have due regard for the physical environment and for public safety, health, and well being. If their judgment is overruled under circumstances where the safety, health, property, or welfare of the public may be endangered, they shall notify their employer, client, and such other authority as may be appropriate. An employee shall initially express those concerns to the employer.

7. Admit and accept their own errors when proven wrong and never distort nor alter the facts in an attempt to justify their decisions.
8. Avoid conflicts of interest whenever possible. When unavoidable, they shall disclose to their employer or client, in writing, any action that might create the appearance of a conflict of interest.
9. Avoid receiving and granting bribery in all its forms.
10. Strive to maintain their proficiency by updating their technical knowledge and skills within the industry.
11. Not reveal facts, data, or information obtained in connection with services rendered without prior consent of the client or employer except as authorized by law.

Applicant Ethics Representation and Agreements

PEARL certification is a professional certification designed to distinguish those technicians that have the knowledge, skills and experience required to perform the reconditioning work of our industry from those who do not. It also recognizes those companies within the industry that strive to create an environment and provide services that create a marketable distinction in quality, safety, and integrity for PEARL members in the eyes of their customers. Within the application a series of 5 Representation and Agreement questions are asked of the applicant to help determine if the applicant is within the ethical standards desired by PEARL. If the applicant does not answer or answers no to any of these questions, they will be disqualified from certification or must provide PEARL with a letter of explanation concerning the representation in question.

Level II PEARL-Certified Technician

Eligibility Criteria for Taking the Exam

The PEARL Level ll Certification is designed to measure competency at a Skilled or Journey level for more complex reconditioning tasks. Level ll technicians are expected to be able to work independently on either low-voltage electrical equipment performing comprehensive duties. Certificate candidates should be familiar with the basic mechanical and electrical principles and duties listed in the Level ll PEARL Technician section of this handbook.

Each certification level has individual eligibility requirements, including required education and training, work history requirements, and the ability to perform specific essential duties. To receive technical certification from PEARL, a Level II technician must have met the following eligibility requirements:

1. Have (2) years' work experience in the electrical reconditioning industry **and** a high school diploma or equivalent GED, **or** (5) years' work experience in the electrical reconditioning industry without a high school diploma or equivalent GED
2. Received (20) hours of safety training and (40) hours of electrical training – NOTE: training may be administered on the job by a supervisor or designated personnel
3. Be currently employed by a PEARL full-member company, service organization, or associate member. Candidates who do not meet this employment requirement may have this requirement waived if they have sponsorship from a PEARL member organization
4. Completed the online application
5. Paid the appropriate application fee
6. Passed the Level I exam
7. Passed the Level II exam

Continuing Professional Development Policy

All certifications expire three years after an individual's initial certification is awarded and every third year after renewal. Certification renewal will be based on the certificate-holder's activities during that three-year period. Renewal notices are mailed to certificate holders two months before the due date. Renewal applications will be sent to the last postal or email address provided by the certificant. It is the responsibility of the certificate-holder to ensure that his or her certificate remains valid. . If the application with payment is not received by PEARL prior to the expiration date, the certificate will expire. Certificate renewals that are less than one year past due are subject to the renewal fee of $75 plus an additional reinstatement to Active Status fee of $125. If reinstatement has not occurred one year after the expiration date, retesting will be required to regain certification.

Payment of new testing and/or application fees does not substitute for payment of the full renewal fee when due. However, obtaining a higher level PEARL certification "resets" the established three-year certification period. A certificant will be required to have Active Status on a lower level certification before a higher certification can be awarded.

Conditions of Application for Technicians

1. **PEARL has established policies, procedures, and fees** that govern certification decisions, the uses of certification, and interactions with applicants and certificants. These policies, procedures, and fees may be changed by PEARL at any time without prior notification. Each person who signs any PEARL application accepts and agrees to follow these policies and procedures in all dealings with PEARL.
2. **Each PEARL certification may have multiple criteria** that must be met by a candidate in order for the certification to be conferred. These criteria may be changed by PEARL at any time without prior notification. Individuals who are not resident in, or working in, the United States, Canada. or U.S. territories may not be eligible for certification. These individuals must contact PEARL before applying and may be required to follow additional procedures, with additional fees, to demonstrate they meet the criteria.
3. All applicants and certificants **must comply with the PEARL Code of Ethics** and follow generally accepted ethical practices at all times. For example, acquiring and/or providing specific knowledge of test questions prior to testing, or acquiring or providing assistance during an examination; intentionally providing information to PEARL that is incomplete or inaccurate; or knowingly providing technical services in an unsafe, inaccurate, or unprofessional manner may be cause for denial, suspension, or revocation of certification.
4. PEARL reserves the right to **deny, suspend, or revoke any certification** (pending or awarded) should the association determine that an applicant or certificant has misrepresented information, violated a PEARL policy or procedure, or violated the PEARL Code of Ethics.
5. Maintenance of **current accurate contact information** is the responsibility of the applicant. PEARL requires accurate contact information to communicate to the applicant important information related to testing, certification, and renewal.
6. **The PEARL name, logo, and certification mark** are the property of PEARL and may not be used without the expressed written permission of PEARL.
7. **PEARL approval letters, wallet cards, and certificates** are issued to certificants for their use but remain PEARL property at all times and may be recalled by the association at any time without prior notification.
8. **PEARL test questions and examinations** are the property of PEARL. Any copying, sharing, or distribution of the content of those test questions and/or examinations will be cause for denial, suspension, or revocation of certification.
9. Each person who completes a PEARL application grants PEARL the **right to contact individuals** named in the application to confirm the accuracy of information provided by the applicant.
10. **PEARL certification must be used, represented, and displayed** in accordance with PEARL policies.
11. Each person who is certified by PEARL grants PEARL the **right to provide that information** to others in response to bona fide inquiries. Test scores will be given to the test-taker only, unless the test-taker submits a release form authorizing PEARL to give the scores to another specified individual.
12. **All certifications expire** three years after an individual's initial certification is awarded and every third year after renewal. Certification renewal will be based on the certificant's activities during that three-year period.

13. To **cancel your application** you must submit a signed written request (a letter or email stating you wish to cancel your application) to PEARL. PEARL will reimburse a full refund, less a $75 administration fee, within four (4) weeks after the scheduled date.
14. **Certification payment** is required with an individual's application. If a certificant's application is denied by PEARL, PEARL will reimburse a full refund, less a $75 administration fee, within four (4) weeks after the scheduled date.

Exam Payments and Fee Details

Certification payment is required with an individual's application. If an individual's application is cancelled prior to acceptance or denied by PEARL, the application administrative fee of $75 will still be charged.

PEARL Level II Certification Exam	$ 325.00
Application Administrative Fee (Charged if application is denied or cancelled by applicant)	$ 75.00
Certification Renewal (good for 3 years)	$ 75.00
Certification Reactivation Fee (if within 1 year of due date)	$ 125.00

- **Application Administrative Fee**: $50.00 (Charged if applicant's supervisor fails to submit approval of employee's application within 30 days of application submission)
- **Application Administrative Fee**: $50.00 (Charged if applicant fails to schedule AND complete within 90 days of supervisor approval)

Preparing For Your Test

This section addresses a few possible methods for preparing for the PEARL certification exam. Since the applicants and sponsoring PEARL member companies are the most familiar with the applicant's abilities, they are responsible for determining the best method for preparing for the certification exam. Following the suggestions in this section does not guarantee an applicant will pass the certification exam.

Determining Applicant's Preparedness

An individual's preparedness for the certification test depends on a number of things, including amount of practical experience in the vocation and years of education. If you are unsure how prepared you are for the exam, you should review the Exam Content Areas for the associated PEARL Technician Certification level. If the applicant is not familiar with the required subjects for that level, he/she should consider reviewing some of the material listed in the Selected References section of this booklet.

Using the Selected References

After reviewing the Exam Content Areas, the applicant may want to review some of the Selected References. The references in this list were selected to supplement the applicant's knowledge in relevant

Exam Content Areas. Experienced candidates only may have to brush-up on a few topics while those with less practical experience may have to study extensively.

Using the Exam Content Areas as a Guide to Your Study

The Exam Content Areas are a basic outline of the exam subject matter. You can use the Exam Content Areas as your study guide by referring to them in the primary selected study references. For example, if the applicant is unfamiliar with area #4 (Understands Arc Flash and is familiar with NFPA 70E guidelines), he/she may review that material in NFPA 70E, Article 130.3, or OSHA 29 CFR 1910.303 (listed in the Selected References section of this booklet). Many of the selected study references can be found on the Internet at no cost. Other sources not listed also may be helpful in reviewing these subjects. The best preparation for the exam is practical industry experience in an electrical equipment reconditioning and repair facility. No single book is adequate to prepare individuals with the varied experiences they can receive working in an electrical equipment reconditioning and repair facility.

Level II Exam Content Areas

Exam Content Areas	Skills to:	References:
Able to perform maintenance on large fixed mounted shop equipment	• How to use saw blade fencing properly • Able to correctly install saw blade • Able to safety make blade tension and tracking adjustments • How to safely unjam a machine • Able to safety block machine store energy for cleaning and maintenance	29 CFR 1910 147, 212, 132, 243, 213
Perform safety inspections and maintenance on electrical testing equipment	• Recognize and safely operate common shop test equipment • Perform electrical test equipment safety inspection • Perform test area inspections setup checks • Insure proper equipment grounding for protection against potential back feeds from energized sources • Able to use mechanical safety tools and blocks to secure and capture the store energy while making equipment adjustments and performing maintenance	29 CFR 1910 1450, 332, ASTM FM 3810, ASTM D2865M-06, NFPA 70E Article 110.6
Identify the safety design features of electrical power distribution equipment	• Install and remove a stationary or drawout circuit breaker into or from a switchgear enclosure • Manually and electrically operate a circuit breaker and its accessories	ANSI, NFPA 70B and 70E 130.3, 29 CFR 1910-147

	• Manually discharge the closing springs of a circuit breaker • Manually reset devices such as undervoltage, bell alarms and lockouts, electric lockouts, open fuse lockout and key operated lockouts to override circuit breaker trip free state • Recognize and insure correct mounting of "rejection hardware" on drawout equipment • Read and interpret circuit breaker interchangeability and rejection hardware charts	
Understands Arc Flash and is familiar with NFPA 70E guidelines	• Using safety signs, tags and barricades when testing and performing maintenance • How to read and interpret an Approach Boundaries Table	NFPA 70E 130.3, 29 CFR 1910.303
Perform torqueing using a torque wrench	• Able to determine a bolts grade • Able to tightened breaker terminals to the required torque requirements of manufacturers • Able to accurately read a torque wrench • Able to safely torque plastic fasteners	ASTM
Understands metal corrosion and prevention concepts	• Accurately identify common metals used in electrical equipment (Structural and current carrying) • Identify corrosion and effects on test values (DLRO) and Megger Values • Identify Corrosion types by photo • Identify corrosion prevention compounds	ASTM
Understands metric system unit prefixes	• Able to convert microseconds to milliseconds • Able to convert the unit prefix into an analog value or power	ASTM R0017
Understands low voltage electrical power equipment interrupting ratings	• Able to recognize differences between interrupting withstand and short time delay ratings and how that changes with frame size, trip units and interrupter types. • Able to interpret nameplate ratings and table/chart data • Able to interpret proper insulation rating	OEM Manufacturing Installation and Maintenance Manuals, ANSI C37, UL1066, UL 489

Perform low voltage circuit breaker insertion and removal from de-energized electrical compartment	• Able to verify that the circuit breaker has been tripped and is in the open position • Able to identify closed door racking circuit breaker from open door racking design • Able to inspect the racking cams of the breaker to insure they are correctly positioned • Able to verify that a circuit breaker is the correct type for that compartment • Able to use a circuit breaker racking handle • Able to use a circuit breaker lifting device, spreader bar and overhead lifting hoist	NFPA 70B and 70E
Operate various circuit breaker mechanism types	• Able to manually and electrically charge a circuit breaker closing spring • Able to release the mechanism spring and close a circuit breaker • Able to identify a close button, relay or remote switch to electrically close and trip a circuit breaker	
Able to interpret and apply the PEARL Reconditioning Standard on covered electrical equipment	• Able to select the proper test equipment for each type of electrical equipment covered in the PEARL standard • Able to perform an as found equipment inspection and properly record your observations • Able to perform a fuse evaluation in accordance with the PEARL reconditioning standard 3100 • Able to identify the appropriate reference materials needed for the product • Able to perform a comparison of actual test results with the manufacturer's recommendations or appropriate PEARL standard	PEARL Reconditioning Standards, NETA Standards, NEMA Standards
Perform PEARL electrical equipment reconditioning inspection	• Able to identify damaged or missing parts • Able to inspection and evaluation of pole units for cracks and erosion	PEARL Reconditioning Standards, OEM Instruction and Maintenance Manuals

	• Able to examine and evaluate contacts surfaces, contact structures and pole units • Able to find the correct equipment standard and properly record inspection observations	
Perform cleaning of circuit breaker mechanism and contacts	• Able to disconnect operating mechanism from the crossbar • Able to disconnect and remove secondary disconnects and wiring bundles • Able to remove contact springs • Able to remove and install moving and stationary contacts • Able to perform contact dressing	PEARL Reconditioning Standards, OEM Maintenance Manuals
Perform lubrication of an operating mechanism	• Recognize worn or insufficient lubrication on equipment • How to clean and remove old grease and properly re-lubricate • Able to identify suspect lubrication during inspection	PEARL Reconditioning Standards, OEM Maintenance Manuals
Classifications of electrical distribution equipment based on voltage	• How to determine the voltage rating of a piece of electrical distribution equipment • Can recognize a low voltage circuit breaker from a medium circuit voltage breaker • Able to recognize pitting, cracks and overheating deterioration of a circuit breaker insulation system	
Perform inspection of the current carrying components of a circuit breaker	• Able to recognize signs of overheating • Able to recognize the signs of binding on pivot points and hinged components • Able to recognize failing soldered joints • Can recognize the effects that corrosive environments have on current carrying components	
Perform inspection of an arc chute and arc barriers	• Recognize arc chute damage and/or loose and missing parts • Recognize excessive arc chute deterioration and carbon buildup • Able to safely handle asbestos materials	Pearl Reconditioning Standards, OEM Maintenance Manuals

Perform an inspection of an operating mechanism	• Able to recognize signs of corrosion and rust in an operating mechanism • Able to recognize the signs of binding in an operating mechanism • Able to recognize the signs of lubrication problems in an operating mechanism • Able to identify broken and missing components • Able to release the stored energy of an operating mechanism	Pearl Reconditioning Standards, OEM Maintenance Manuals
Perform an inspection of an auxiliary switch	• Recognize the terms and meaning of 1A 1B, 2A 2B, etc. • Able to interpret field installation instructions to mount the accessory • Able to install wire leads, avoid kinks and shorting, when replacing switch cover • Able to test accessory for proper operation • Able to verify contact arrangement with a meter • Able to perform maintenance on the switch without disturbing intended contact arrangement	PEARL Reconditioning Standards, OEM Maintenance Manuals
Perform an inspection of door interlocks of a circuit breaker	• Able to interpret field installation instructions to mount field mountable key interlocks • Able to manually operate device to verify it operates as intended • Able to manually defeat for testing purposes • Able to maintain interlocks without disturbing intended purpose • Able to adjust to manufacturers specifications • Able to remove contaminants where present and lubricate as needed	Pearl Reconditioning Standards, OEM Maintenance Manuals
Effective Use of Manufacturers Drawings and Wiring Diagrams	• Able to identify key components within a one line/single line diagram • Able to identify, locate and use appropriate drawing information • Able to use drawings to determine primary & secondary connection wiring locations	OEM Operation and Maintenance Manuals, OEM Elementary Diagrams, OEM Wiring Diagrams, OEM Schematics

Understands low voltage disconnect types and features	• Able to recognize differences between interrupting withstand and short time delay ratings and how that changes with fuse size • Able to choose appropriate fuse for application and use cross references to select equals/alternates • Able to recognize common disconnect accessories and understands their functions and proper operations; including shunt trips, under voltage relays, bell alarms blown fuse indicators and auxiliary switches as they relate to disconnects	OEM Maintenance Manuals, NEMA & IEC Standards
Understands low voltage circuit breaker types and features	• Able to recognize differences between interrupting withstand and short time delay ratings and how that changes with frame size, trip units and interrupter types • Able to recognize various types of equipment mounting methods into cells and enclosures; including draw-out, fixed, front and rear connections, primary and secondary connections • Able to recognize common circuit breaker accessories and understands their functions and proper operations; including shunt trips, undervoltage relays, bell alarms and auxiliary switches	OEM Maintenance Manuals
Perform a change out of a thermal magnetic interchangeable trip unit in a molded case circuit breaker	• Tighten connections to the recommend torque limits • Lubricate an operating mechanism properly	OEM Maintenance Manuals
Perform closing and opening adjustments on a circuit breaker	• Able to perform operational and mechanical checks on spring discharge, charging and closing functions, trip-free functions, anti-pump and magnetic release functions • Able to perform trip latch adjustments	PEARL Reconditioning Standards, OEM Maintenance Manuals

Understands and able to recognize low voltage switchgear enclosure types and features	• Able to recognize various features of switchgear enclosures	OEM Enclosure Application Guide, NEMA Standards
Able to recognize and understand various transformers types	• Able to recognize and understands the various differences of Dry type transformer, Control Power Transformer, Current Power Transformer, Potential Transformer, Voltage Transformer, Encapsulated Transformer, Ventilated Dry Type, k factor, drive isolation, autotransformers / Oil Filled: Pole, Pad Mount & Substation Type	ANSI C57, NEMA TR-1, IEEE C57
Perform assembly and wiring of a motor control center bucket	• Able to proper tighten copper and aluminum connections with a torque wrench • Able to reset pushbuttons and indicator lights • Able to properly route and secure internal starter wiring • Able to install door mounted devices such as hand-off-auto selector switch, start-stop- • Able to install control power transformers and auxiliary relays • Able to install door mounted metering	PEARL Reconditioning Standards, OEM Operation and Maintenance Manuals, NEMA ICS 18 (2007)
Recognize motor starter and contactor product features and applications	• Ability to inspect contacts or wear indicators	OEM Application Guide, NEMA ICS 18 (2001), UL 845
Understands low voltage bus duct types and features	• Able to recognize differences between voltage, ampacity, system configuration 3P3W vs 3P4W and NEMA enclosure applications • Able to recognize various types of equipment mounting methods and connections and torque requirements • Able to recognize common bus duct accessories and understands their functions and proper operations; including system design, bus duct plug types, neutral configurations and grounding requirements	OEM Maintenance Manuals, OEM Application Guides, ANSI/IEEE C37.23

Understands how to properly size bus plugs with proper protective elements and features	• Able to recognize differences between interrupting withstand and short time delay ratings and how that changes with fuse size on fusible plugs • Able to choose appropriate fuse for application and use cross references to select equals/alternates • Circuit Breaker: Able to recognize differences between interrupting withstand and short time delay ratings on circuit breakers and how that changes with frame size, trip units and interrupter types • Able to recognize various types of circuit breakers mounted into bus plug enclosures.	OEM Maintenance Manuals, OEM Application Guides
Understands the purpose, operation and device designations of a medium voltage protection relay	• Able to identify OEM manuals for specific type of relays • Interpret ANSI codes for specific type of relays • Recognize electromechanical from solid-state relays • Read and recognize protective relays on an electrical drawing	OEM Application Manuals, NFPA 70E 130.3, ANSI C37.2
Able to recognizes and understands the functions and primary components of a medium voltage disconnect and load interrupter switch	• Able to recognize different components of a disconnect switch and load interrupter switch • Able to determine is a switch is manually, electrically or solenoid operated • Able to identify load-break equipment from isolation or off-load disconnectors • Able to identify switch components such as arc chutes, fuse clips, flicker blades and arc blades	OEM Maintenance Manual, ANSI C37.20.7
Understands relevant information medium voltage switch fuses	• Able to perform a fuse inspection • Able to select proper fuse hardware and install a fuse • Able to test a fuse	PEARL Reconditioning Standards, ANSI C37.47
Able to recognize and understands medium	• Able to recognize various NEMA enclosure types	OEM Application Manual, IEEE and ANSI Design Standards, ANSI C37.20.2

voltage switchgear by various applications	• Able to recognize oil, air, vacuum and SF6 insulating mediums on medium voltage equipment • Able to recognize draw-out elements from fixed elements • Able to recognize metal-enclosed switchgear from metal-clad • Recognize live-front from dead-front switchgear • Recognize arc-resistant switchgear	
Understands the dangers and can recognize the indicators for counterfeit electrical distribution products in the industry	• Able to identify a counterfeit circuit breaker •	ANSI Z535.6-2011
Read and interpret gauges	• How to "zero out" a caliper display • Able to measure internal and external distances • Able to measure the depth of a hole • Perform dimensional measurements with digital instruments such as, height and depth gauges, calipers and micrometers	OEM Calibration Requirements, National Institute of Standards and Technology (NIST), ANSI/NCSL Z540-1, 10 CFR 50
Able to select the proper test equipment for a testing task and determine its suitability and proper calibration	• Able to determine is test equipment is in good mechanical and electrical condition. • Able to determine test equipment suitability for the task • Able to determine test equipment calibration date • Able to determine accuracy of calibration standard	PEARL Calibration Standard 1010, National Institute of Standards and Technology (NIST)
Able to use standard shop testing equipment to perform PEARL reconditioning test	• Make electrical connections from standard shop test equipment • How to check and measure for grounding conductors or potential feedbacks from energized sources • Able to use a digital multi-meter, insulation resistance tester, digital low resistance ohmmeter and millivoltmeter • Able to use a voltage supple to perform minimum rated voltage test on various circuit breaker accessories	PEARL Reconditioning Standards, PEARL Calibration Standard 1010

	• Able to perform trip indicator test on blown fuse indicator • Able to perform and interpret a circuit breaker insulation resistance test	
Perform testing of Transformers	• Able to perform oil sampling/PCB sampling • Able to determine liquid levels • Able to inspect bushings • Able to run fans • Able to perform Turns Ratio testing • Able to use an Insulation Resistance Test Set (Megger) • Able to use HIPOT • Able to use Power Factor Test Set • Able to inspect and test core ground • Able to complete PEARL transformer test report	PEARL Reconditioning Standards, ANSI, NETA, IEEE
Understands the functions and operation of the components of a circuit breaker tripping system	• Able to check for proper operation and replace if necessary circuit breaker current sensors • Able to check for proper operation and replace if necessary a circuit breaker trip actuator • Able to set-up all the programmer protective functions and current sensors tap settings for the given tripping characteristics of a circuit breaker	OEM Application Manual, ANSI/IEEE C37.17-2002
	•	
Able to perform a circuit breaker primary injection test and interpret test results	• Able to read and interpret circuit breaker trip unit curves • Able to perform a long-time, short-time and instantaneous pick-up and overcurrent trip test	PEARL Reconditioning Standards, PEARL Calibrations Standard 1010, ANSI/NETA ATS
Accurately read and record equipment nameplate data and interpret test results and accurately record test results onto appropriate test data sheets	• Interpret test equipment results	PEARL Test Reports
Exam Content Areas (ECAs):	• **Skills to:**	**References:**
Able to read and interpret elementary	• Identify the wiring point necessary to test an electrical device	IEEE Electrical Symbols, OEM Application Guide

wiring diagrams and control schematics	• Identify the control and power circuit of an electrical device • Identify standard elementary diagram nomenclature • Electrically operate a circuit breaker and contactor including auxiliary devices	
Able to operate a computer and use and record data into computer generated test forms	• Able to navigate directories • Install software and drivers • Perform data and software backups • Transfer and backup digital photos • Able to search the internet	
Able to troubleshoot a circuit breaker overheating problem	• Able to recognize when contacts need cleaning or replacement • Able to identify a compromised frame due to overheating • Able to inspect a circuit breaker for insulation compromise • Able to inspect a circuit breaker for overheated trip unit compromise • Able to recognize discoloration as an indicator of heat • Able to perform circuit breaker contact adjustments • Able to clean and replace circuit breaker contacts as needed • Able to check bolts and nuts at terminal connections for proper torque • Able to check breaker for proper load and trip settings	OEM Maintenance Manual, OEM Application Manual
Able to perform basic troubleshooting a circuit breaker for failure to trip and false tripping problems	• Able to perform re-adjustment or replacement of the circuit breaker tripping device • Able to inspect the plug terminals and check the fit of the rating plug in the trip unit of the circuit breaker • Able to check polarity, connection and continuity of current sensors • Able to tighten or replace the trip unit harness • Able to check and re-adjust latch clearances	OEM Maintenance Manual, OEM Application Manual

Able to troubleshoot a breaker or contactor for failure to close and latch problems	• Able to perform re-align and adjust to various interlocks • Able to inspect and perform latch adjustment • Able to replace a return spring • Able to clean and re-lubricate latch bearings and surfaces	OEM Maintenance Manual, OEM Application Manual
Able to troubleshoot incorrect or replace defective control wiring	• Able to terminate, route and tie a bundle of control wire clean and neatly • Able to perform a point to point check on control circuit	
Able to determine by visual equipment inspection nameplate accuracy of manufacturers low voltage frame ratings	• Able to configure and verify a circuit breaker based on catalogue information • Able to determine equipment frame ratings by visual inspection of current carrying components • Able to determine CT size through visual inspection • Able to determine trip unit rating and size through visual inspection • Able to determine trip unit type through visual inspection	OEM Maintenance Manual, OEM Application Manual
Able to recognize water-damaged electrical equipment	• Understands the cleaning, drying, re-lubrication and testing requirements for water damaged electrical distribution equipment • Able to recognize evidence of corrosive water damage such as salt water, sewage, chemical and oil residues in electrical equipment	PEARL Reconditioning Standards, NEMA Guidelines for Handling Water-damaged Electrical Equipment, NETA Maintenance Testing Standards
Able to recognize fire and heat damage electrical equipment	• Understands the cleaning, drying, re-lubrication and testing requirements for fire and heat damaged electrical distribution equipment. • Able to determine visually and through testing, if damage from heat has occurred to equipment • Able to determine visually and through testing, if equipment has smoke damage or heat damage or both	PEARL Reconditioning Standards, NEMA Guidelines for Evaluating Fire and Heat Damaged Equipment, NETA Maintenance Testing Standards

Sample Test Questions

The following sample test questions are provided to help candidates become familiar with the question format. The following questions reflect only a sample of the subject matter covered on the test. An answer key is given at the end of this section.

Level II

1. **After a conductor or circuit part has been deenergized and Lockout-Tagout (LOTO) applied and verified, which of the following is the best way to release stored energy?**
    a. Short the conductor to an adjacent phaseCO2 (carbon dioxide) extinguisher
    b. Wait for 10-minutes and touch it
    c. Ground the conductor or circuit part
    d. Wait for 10-minutes then recheck it with an appropriate voltage indicator

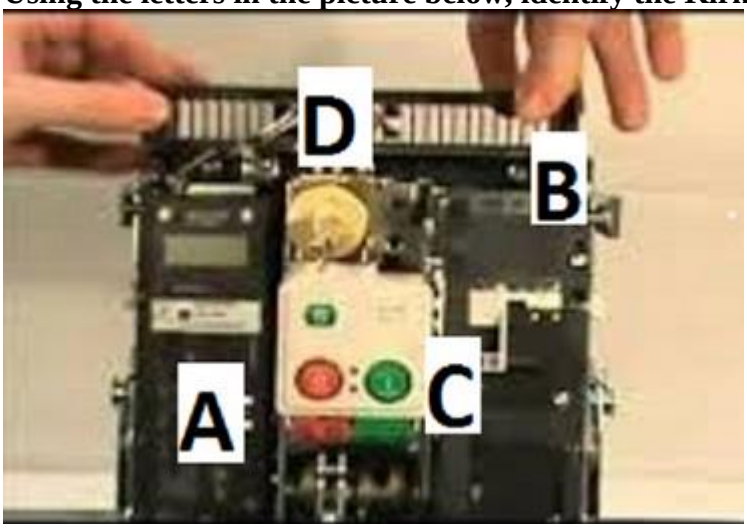
2. **Machine Guards are designed to protect machine operators and workers in the immediate vicinity. Select the appropriate items below that apply to machine guarding of shop power tools. (Choose 3)**
    a. Guards should be properly adjusted to accommodate work
    b. Guards should be removed prior to works
    c. Guards should be inspected prior to starting work
    d. Machine should be locked out / tagged out if guards are not serviceable

3. **According to the PEARL Reconditioning Standard, shop test equipment must be calibrated every:**
    a. 3 Months
    b. 18 Months
    c. 12 Months
    d. 6 Months

4. **Humidity is one of the main causes of poor:**
    a. Digital Low Ohm Resistance (DLRO) readings
    b. Insulation resistance readings
    c. Breaker timing
    d. Longtime pickup tests

5. **According to the PEARL reconditioning standards, which of the following three steps should be performed on a low voltage insulated case circuit breaker operating mechanism? (Choose 3)**
    a. Disassemble the operating mechanism as needed
    b. Clean mechanism
    c. Manually operate circuit breaker mechanism a minimum of three (3) times while checking for proper operation
    d. Apply proper lubrication

6. **Using the letters in the picture below, identify the Kirk key interlock:**



   a. A
   b. B
   c. C
   d. D

7. **Please select the statement about primary injection testing that is correct.**
   a. Can be performed on either electronic or thermal magnetic circuit breakers
   b. Only tests the trip unit
   c. Can only be performed on electronic circuit breakers
   d. Can only be performed on thermal magnetic circuit breakers

8. **Convert 1.265 seconds to milliseconds**
   a. 1265
   b. 126500
   c. 12650
   d. 1265000

9. **Which of the following completes this sentence correctly: A category III clamp-on meter means that the meter:**
   a. Measures voltage at a maximum of 5000V
   b. Is able to measure circuits at a building low-voltage distribution level
   c. Is double insulated equipped
   d. Conforms to North American Safety Standards

10. **From the list below, select the device that is designed to trip the circuit breaker when control power is lost.**
    a. Shunt trip
    b. Undervoltage release
    c. 4A 4B auxiliary
    d. Bell alarm

Sample Test Answers:

1. C
2. A,C,D
3. C
4. B
5. A,B,D
6. D
7. A
8. A
9. B
10. B