PEARL Technician Certification

Candidate Level 3 Handbook

Train. Test. Certify.

This booklet contains:

- Exam education and experience requirements
- Selected study references
- Certification policies
- Sample exam questions

Certification Development Committee

PEARL extends its gratitude to the following individuals who were part of the PEARL Certification Development Committee and gave their approval for this document. Together, these members possess 222 years of expertise in the electrical equipment reconditioning and remanufacturing sector.

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Introduction

The PEARL Association

The **Professional Electrical Apparatus Reconditioning League (PEARL)** is a professional trade association of companies that supply reconditioned, and remanufactured electrical power equipment, apparatus, and components to the 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 conference and exhibition that can be attended by anyone concerned with the safety and reliability of reconditioned, remanufactured, and recycled electrical equipment and apparatus.

Why Get Certified?

For employers, the PEARL Technician Certification offers a means to highlight companies that employ certified technicians, providing these firms with a competitive advantage and heightened recognition in the industry. By certifying your technicians, you can boost staff morale, decrease attrition, pave the way for prospective management roles, minimize accidents and related expenses, lessen warranty claims, and enhance the company's overall profitability.

For technicians, PEARL Technician Certification can enhance your career journey, paving the way for new opportunities within your organization. It can foster a deeper sense of professional satisfaction and garner respect from your colleagues, both in the workplace and throughout the broader electrical reconditioning community.

The PEARL Technician Certification Program is an online self-paced program that ensures your technicians get the safety and technical training they need to excel in their careers. Each level of the training has prerequisite modules that must be completed to help prepare the technician for the exam.

The PEARL Technician Certification Program is only available for PEARL Accredited Companies (PAC). PACs are dealer or service members that have passed a rigorous review by a third-party, are peer approved by industry experts, and comply with the PEARL electrical standards: ANSI/PEARL Electrical Equipment Reconditioning Standard (EERS) and the PEARL Inspect & Test Standard.

Delineation of Certification Levels

The PEARL Technician Certification program was created to offer multi-level technical certification for individuals employed in the reconditioned electrical equipment field. Exams are designed by vocational specialists and span four levels of practice, ranging from the entry-level technician (Level 1) to the supervisory technician (Level 4). Levels 2, 3, and 4 are defined in terms of general experience in the electrical equipment reconditioning business and the complexity of the equipment on which they perform work. The certification design committee developed a general delineation of the levels of certification, which are presented below.

Level 1 Technician

Level 1 technicians are qualified to work safely within a shop environment and around de-energized electrical power equipment. They recognize and possess a fundamental understanding of the PEARL reconditioning standards. These technicians can identify various types of electrical apparatus, shop equipment, warehouse equipment, test and measurement equipment, and cleaning equipment used in the electrical equipment reconditioning process, all under the supervision of a higher-level technician.

Level 2

Level 2 technicians can work independently to inspect, test, and perform reconditioning procedures in compliance with PEARL and other industry standards on a wide range of electrical power equipment. They can also accurately interpret equipment drawings, specifications, and electrical schematics at the component level as they relate to the PEARL reconditioning standards.

Level 3

Level 3 technicians can supervise Level 1 and 2 technicians, conduct, and oversee large equipment reconditioning projects, 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 4

Level 4 technicians can manage multiple individuals and projects, conduct complex metering and protection projects, make recommendations on power system diagnostic testing and corrective actions, 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 1	Level 2	Level 3	Level 4
Technician Title:	Entry Technician	Journey Technician	Lead Technician	Supervisory Technician
Certified Specialist Requirement:	Not Applicable	Level 1 certificate	Level 2 certificate	Under development
Education:	None	Same as Level 1	Same as Level 1	Same as Level 1
Training:	None	20 hours of safety training 40 hours of electrical training	Additional 24 hours of safety training	Under Development
Experience:	None	2 years	5 years	10 years
Technical Essential Duties Category:	Level 1 Duties	Level 2 Duties	Level 3 Duties	Level 4 Duties

The Certification Process

Step One – Complete the Online Technician Application

To become certified, all applicants must complete an online certification application. The application verifies an applicant's work experience and qualifications. PEARL certification mandates that applicants be currently employed by a PEARL Accredited Company (service or dealer). Additionally, applicants must satisfy all education, training, and work experience prerequisites as outlined in the PEARL Technician Profile. All applicants are required to pay in advance for the PEARL Technician Certification process to offset costs associated with application review, training, exam creation, and certification.

Step Two – Application Review

Upon payment and submission of your application, your confirmation email will provide information on how your Primary Training Contact can verify the education/training, work experience, and employment details provided in the application. This information must be verified within 30 days of your application submission. If the application is approved, the applicant will receive an email confirmation and enrollment letter. If the application is rejected, the applicant will be notified via email and may be requested to provide additional information, if warranted. A fee of $50.00 will be charged if the employer does not verify or approve the application within 30 days of application submission.

Step Three – Training

The technician will be required to complete all four modules of the Level 3 training program. The coursework to prepare for Level 3 is designed to help prepare the technician for a lead role. The training will focus on management skills needed to maintain a safe work environment. Counterfeiting concerns are emphasized. PEARL EERS & EEITS standards are directed toward the various electrical equipment encountered. Interactive wiring diagrams and drawings aid in the candidate’s ability to understand how the equipment operates.

Step Four – Exam Scheduling

The acceptance/enrollment email will provide applicants with all the instructions needed to proceed with their exam. Exam candidates are required to present at least one valid government-issued photo identification (such as a state driver’s license, ID, or passport). Only after the exam proctor has positively identified a candidate may the exam commence.

To reschedule your exam, you must submit a written request via email to the proctor no later than one week before your scheduled exam, requesting an alternative time. If you miss your scheduled exam time, you may reschedule your exam upon payment of an additional $150 administrative fee. An exam may be rescheduled only twice before all exam fees are forfeited, and a new application must be submitted.

To reschedule an exam after failing, if you do not pass the exam on your first attempt, you may reschedule it following a 30-day waiting period. A new application and exam fee will be required if you have failed the exam more than twice.

Step Five – Taking the Exam and Preliminary Results

After completing the required coursework, the candidate is eligible to take the exam. Exams will be administered at specific times during the year at centralized locations throughout the US and at the annual PEARL Conference & Exhibition. Exams are administered online

using a proctor. During the exam, the candidate will use their own computer, which must have a functioning microphone and camera. If an agency is used, 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 and a standard calculator which is permitted for the math questions.) 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 time limit is 2 hours.

Exam Grading

After participants have completed all the questions, the exam is automatically scored, tabulated, and the answers are stored in a secure PEARL/Training To Go Learning Management System (LMS). The overall exam score will determine whether you pass or fail. The minimum passing score is 70% of items answered correctly. Each time a certification exam is administered, the questions are altered, resulting in a unique exam. The passing score is established as an overall estimate of minimal acceptable competence in the Exam Content Areas, as determined by subject matter and examination experts. Passing scores are calculated based on an overall performance, not on individual Exam Subject Areas, and are independent of other candidates' scores. No partial credit will be awarded for any items answered incorrectly. Upon completion of the test, applicants are notified immediately online of their pass or fail status.

Step Six – Official Exam Notification

Exam results are displayed on the computer screen upon completion of the exam as well as in the LMS account of the candidate. No results are provided by phone or fax. All results are confidential and are released only to the certificate candidate. The official exam notification will indicate only whether the applicant passed or failed the exam. To maintain exam security, no additional feedback will be provided to candidates regarding specific exam item answers. The candidate will be provided an on-line form to communicate any feedback about the exam.

Step Seven – PEARL Certification

All certificates are completed after passing the exam successfully online and stored in the applicant's transcript profile on the PEARL/Training To Go Learning Management System. The Candidate can download a copy from their LMS profile.

Training & Exam Design and Administration

Exam Design

All training and certification exams are designed to test knowledge and skills required to perform essential duties with minimal acceptable competence. Research for these assessments was conducted under the guidance of the Employee Development Committee and PEARL staff. Each test question is crafted to measure at least one requisite area of knowledge or skill essential for task performance.

Exam Format

All PEARL exams are administered in a test format that utilizes a variety of question types. The formats used in the exams include multiple-choice, multiple-response, matching, hotspot, and ranking. Questions may have one, two, or three correct answers. The exam does not feature essay, true/false, or yes/no questions (refer to the Sample Test Questions in this booklet for examples). These objective formats allow for broader content coverage within a given testing time and enhance the reliability of competency measurement.

Complexity of Test Questions

At Level 3, certificate candidates should possess fundamental job knowledge and the capability to safely execute Essential Duties. The coursework to prepare for Level 3 is designed to help prepare the technician for a lead role. The training will focus on management/supervisory skills needed to maintain a safe work environment. Counterfeiting concerns are emphasized. PEARL EERS & EEITS standards are directed toward the various electrical equipment encountered. Interactive wiring diagrams and drawings aid in the candidate's ability to understand how the equipment operates. The training provides quiz assessments through each part and prepares the candidate for the Level 3 exam.

Exam Content Areas (ECAs)

Exam Content Areas (ECAs) encompass the knowledge or skills necessary for performing the essential duties specific to each Level. Every ECA contains crucial knowledge and skills needed for the essential duties of an electrical equipment reconditioning technician. However, the test designers identified certain content areas as more critical, resulting in unequal weighting across the ECAs on the exam.

Item Appeals

Candidates wishing to appeal a specific exam item must do so after the exam period by completing the Evaluation Form. All candidate feedback will be evaluated, and necessary adjustments to the exam content will be made accordingly. However, candidates providing feedback will not receive any direct response.

Using the Training To Go Online Training

Training To Go is the Training Partner for PEARL. It operates in a Cloud Based Learning Management System (LMS) environment. Courses have been selected to correspond with the specific levels of PEARL certification. Some of the content was prepared especially for the certification program. The candidate will have their own account on the LMS that will show the coursework assigned, certificates for each course, and ultimately the PEARL Level Certificate(s). This system also tracks the amount of time spent on each course.

The web site used is TrainingToGo.net. Email communications are sent from this website as part of the LMS. It is recommended that the candidate make sure that TrainingToGo.net is added to their safe email list.

Upon completion of the required coursework, the candidate should contact Training To Go to schedule a time to take the exam or be added to the convenient geographic location. Once registered the TrainingToGo.net site becomes the interface between the candidate and certification.

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 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.
12. Any duplication of the online training materials is strictly prohibited.

Level 3 PEARL - Certified Technician

Eligibility Criteria for Taking the Exam

The PEARL Level 3 Certification is designed to measure competency at a supervisory level for multiple complex reconditioning tasks. Level 3 technicians are expected to be able to work safely in the shop around energized electrical equipment; develop equipment test plans and analyze test results. Certificate candidates should be familiar with mechanical and electrical duties listed in the Level 3 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 3 technician must have met the following eligibility requirements:

1. Have five (5) years' work experience.
2. Required training to include but not limited to either OSHA 10HR, OSHA 30HR, NFPA 70e training, etc.
3. Be currently employed by a PAC (dealer or service members). PEARL Partner members do not qualify.
4. Passed the Level 1 and 2 exams.
5. Completed the online application.
6. Paid the training and exam fee.
7. PTC Candidate Confirmation Form completed.
8. Completed the Level 3 training.

Continuing Professional Development Policy

Certification renews on an annual basis. Starting in 2025, renewal notices will be included in the annual membership renewal dues. A copy of the renewal notices will be emailed to the PTC for their review eight weeks prior to membership renewal. If payment is not received by PEARL within 90 days, certification will expire. Certificate renewals that are less than one year past due are subject to the renewal fee of $75.

Payment to level up does not substitute for payment of the full renewal fee when due. Certification will be required on a lower-level certification before a higher certification can be awarded. See page 12 for eligibility requirement.

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, certified technicians, and PTCs. 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 for the certification to be conferred. These criteria may be changed by PEARL at any time without prior notification. Individuals who do not resident in or work in the United States, Canada or a U.S. territory 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 certified technicians **must comply with the PEARL Code of Ethics (see page 11)** and always follow ethical practices. For example, acquiring and/or providing specific knowledge of test questions prior to testing, or acquiring or aiding 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 certified technician 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 certified technicians on an annual basis for their use but always remain PEARL property and may be recalled by the association at any time without prior notification.
8. **PEARL training materials, test questions, and examinations** are the property of PEARL. Any copying, sharing, or distribution of the content of the training materials, 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 and the PTC 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 renew on an annual basis** after an individual's initial certification is awarded.

Exam Payments and Fee Details

Payment for the PEARL Technician Certification Program is required with the application and includes the training and exam.

PEARL Level 3 training and exam.	$800
Annual certification renewal. *	$75
Certification reactivation free (if renewal is not paid within one year of due date).	$125

* If the renewal fee is not paid within 2 years, certification is no longer valid, and the technician will have to retest.

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 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 3 Exam Content Areas

Exam Content Areas	Skills to:	References
ANSI/PEARL EERS & PEARL EEITS	• Understand the PEARL Reconditioning Standard • Understand the PEARL Inspection and Test Standard • Understand the Reconditioning sequence/process • 4 Step Evaluation Process of Visual, Operational, Measure/Compare, Testing/Documentation • Remember the SMART acronym Stress, Missing, Alignment, Rust, Temperature • Reporting and Documentation • Order Numbers • PEARL Standard Number Used • Product Identification • Customer Information • Technical Information • Any other information • Technician Name and Date • Before and After photos	ANSI/PEARL EERS PEARL EEITS
Management, Supervisory, Safety	• Maintain a safe working environment • Know LOTO Roles • Use LOTO Tags • Ladder Safety • Management responsibility for Signage • Identify hazards, select signs, Proper wording, and proper signs • Safety Meetings • Protective Clothing and safety equipment • SDS Sheets • Difference between Safety Barriers and Barricades • Know NFPA 70 E Arc Flash Area • Restricted Approach • Limited Approach • Arc Flash Boundary • Know Kirk Key Interlock Schemes • Understand Vacuum Breaker maintenance schedule • Test Safety Pointers - De-energize before test, be cautious around electronic circuits, be aware of remaining charge, Ground the circuit, keep tester connected	NFPA70E OSHA HCS 29 CFR 1910.1200(g) OSHA 1910.355(b)(1) OSHA HCS 29 CFR 1910.1200(g)
Interpret Drawings, Wiring Diagrams, Specifications,	• Understand control diagram • Understand a double ended substation Main - Tie - Main	Allen Bradley Publication GI-2.0 – June

Developing a Bill of Material	• Know stored energy and LV Power Breaker Control Diagrams • Know the symbols on a single line diagram • Understand the steps to interpret specifications - read completely, read again and highlight, write the details, ask questions, review the single line diagram, look for subcomponents such as IEEE relay numbers and use product checklists.	1990 Typical Wiring Diagrams Eaton Typical Electrical Symbols Technical Data TR02800001E
Counterfeiting Concerns	• Unsafe installations • Suspicious Product registration • Things to check - examine carton, date code, factory seals, mislabeling, nameplate/toggle, • Know difference between reconditioned and counterfeit. • PEARL Reconditioning Bulletin • PEARL MythBusters Bulletin • Eaton Counterfeit Electrical Products Brochure	Manufacturer's Publications: https://pearl1.org/2021/11/04/reconditioning-the-ultimate-form-of-recycling/ https://pearl1.org/2021/11/04/busting-myths-about-reconditioned-electrical-equipment/ https://www.eaton.com/content/dam/eaton/products/electrical-circuit-protection/molded-case-circuit-breakers/replacement-circuit-breakers/fight-against-counterfeit-electrical-prods.pdf
Test Equipment	• Know which test equipment to use for each test • When is the DLRO Digital Low Resistance OHMmeter Used in the PEARL Reconditioning Process • Understand Penning Principle and Paschen Law as applied to vacuum breakers • Primary Injection Testing • MAC Testing • Secondary Injection Testing • DC Hi Pot - used to test the dielectric strength of a device • Non destructive testing • DC Test Voltage vs. AC Equipment Rating	NETA Standards ANSI/PEARL EERS Equipment Manufacturer Data

	• Factors used when testing electrical equipment - Voltage, Current, Resistance, and Continuity • Current Transformer Test - Ratio, Polarity, Resistance, and Burden • Know the primary injection connections on a transformer test	
Insulation Theory	• Know safe resistance values from various tests • Electrical characteristics of insulation - resistivity, power factor, dissipation, capacitively, dielectric constant, AC impedance, Dielectric Strength • Mechanical, Electrical, Thermal Stresses on Insulation • Classes of Insulation and Temperature Ratings • Properties of Insulation • High resistance to the flow of electrical current • Ability to withstand electrical stresses • Ability to conduct heat • Insulation properties include resistance to - surface leakage, moisture, chemicals, oil, RFI, and temperature • Dielectric definition • Dielectric Constant and in application • Dielectric Absorption • Dielectric Loss • Dielectric Strength • Dielectric Strength vs. Dielectric Constant • Corona - Ionization current • Causes of Insulation Failure • Electrical, Mechanical, Thermal and Chemical Stresses plus environmental contamination • Short time reading 1 megaohm for each 1000 Volts • DAR - 60 second resistance over 30 second resistance - Gills Reading • Polarization Index (PI) - 10 minute resistance over 1 minute resistance • Step Voltage readings • Test Set Connections for Insulation Resistance Tests	ANSI NETA Manufacturer's Standards
Busway/Bus Plugs	• Busway Plug reconditioning process sequence and steps • Advantages of Busway • Voltage Drop • Cost analysis	ANSI/PEARL EERS
LV Power Breaker/Insulated	• Retrofitting both Series Trip and Solid State Trip Units	ANSI/PEARL EERS

Case Breaker Reconditioning	• Rebuild of Insulated Case Breakers	Trip Unit Manufacturers Data Video Reference in Level 3 Training
Molded Case Breakers	• How to derate molded case breakers • 100 Percent Rated Breakers • Interrupting Capacity • Identify the test equipment needed • Checklist of items to be inspected/evaluated • UL Ratings must carry 100% in open air and trip within certain limits at 200% • NEC Short Circuit requirements	ANSI/PEARL EERS Circuit Breaker Manufacturers Standards and data Video Reference in Level 3 Training UL 489 UL 1077 NEC Article 100 NEC Article 110
MV Control	• Understand the control circuit for a MV Control to power a motor - in some instances the control coil is switched to a DC circuit after start up. Understand the power flow when the start button is depressed • Understand how and why a MV Latched Contactor is used	Eaton Instruction Leaflet IB48041 Allen Bradley Centerline 1500 User Manual
MV Switchgear	• Servicing MV Air Circuit Breakers and MV Vacuum Breakers • Use rail clamps • Examine Operating Mechanism • Review control schematic • Identify installed accessories • Check Insulation Integrity • MV Switchgear Arc Resistant Equipment • Type 1 Arc resistant functionality at front of the equipment only • Type 2 Arc resistant functionality at front, rear, and sides of the equipment • Annex - Type 1C, Type 2B, Type 2C, Type 2BC • Know parts of a Vacuum Interrupter	ANSI/PEARL EERS ANSI/IEEE C37.20.7 and EEMAC G14-1 CSA C22.2 No. 0.22 2011
Motor Control Centers	• MCC Bucket Reconditioning • Inspect • Disassemble • Clean • Repair/Replace	ANSI/PEARL EERS Video in Level 3 Training

	• Paint • Plate/Resurface • Test • Know the differences between control and power wiring diagrams • Know the Wiring Classes, A, B, and C as well as Type 1 and Type II	
Protective Relays	• Protected Equipment Zones • Know Instantaneous Vs. Time Overcurrent Devices 50 and 50/51 • Know the parts of an induction disc relay particularly the ICS Instantaneous Contact Switch and the IIT Indicating Instantaneous Trip • Understand the operation of an induction disc relay and Trip Sequence • Understand the various type of Protective relays - Induction Disc, Solid State, Microprocessor • Know the Device Numbers • Testing Solid State Protective relays • Self Test • Record Settings • Set Fault Dial • Trip Instantaneous • Target Displayed • Return to original Settings • Bench Test • Know the Voltage and Current Connections • Know when to use a Test Switch or Test Plug • Know common causes of Protective relay failures • Know symbols and device numbers as it applies to Feeder and Motor Circuits	Manufacturers Data Video in Level 3 Training ANSI/IEEE Standard Applied Protective Relaying
Transformers	• Know the different types of transformers and characteristics • Understand and be able to determine Voltage Tap Ratings • Be able to calculate KVA • Differences between VA, KVA and MVA • Understand Delta Vs. Wye Connections • Slash Vs. X Voltages • Know Temperature Rise Classes of Liquid and Dry Type Transformers • Understand how Temperature Rise can affect the KVA Rating • Calculate Watts Loss • Effects of Transformer Impedance on short circuit current	General Electric Catalog - Section 14

	• Understand BIL Basic Impulse Level • Harmonics and Harmonic Mitigating Transformers	
LV- MV Fuses	• Formula to derate fuses • Understand NEC application Tables and how to select a fuse rating • Expulsion Fuse Vs. Current Limiting Fuse differences • Operation of an Expulsion Fuse • Operation of a Current Limiting Fuse • Differences between Condenser and Discharge filter on Expulsion fuses • PEARL Standard for LV and MV Fuses Non refill Style • Current limiting Fuse Categories • E Rated Fuses • Fuse Clearing Time I Squared T • Fuse Interrupting rating coordination	ANSI/PEARL EERS UL 248-1 NEC 430.2 NEC 100
Develop a B/M and quote	• Identify defective parts • Estimate Time • Generate B/M • Obtain Pricing • Estimate time to repair • Establish a labor rate • Complete Quote sheet • Make recommendations • Use selection factors • Develop a specification	Individual PEARL Member Company Procedures
Circuit Protection	• Clearing time Breakers 1200 A and above	NEC 240.87
Electrical Theory	• Know and understand differences between motor voltage and control voltage • Know the voltage ratings • Know harmonics and be able to identify the number harmonics from a test.	Eaton NEMA v IEC Wiring Diagrams Cross-Reference MZ081001EN Eaton MCC Wiring Diagrams
Application Concerns	• Group Mounted Motor Protection and Control UL 508 E, F, C, D • Type I and Type II Motor Protection Coordination • Differences with Manual Motor Starter and Manual Motor Protector • Two Step Stored Energy Breaker Mechanism - Separate Opening and Closing Springs. Sequence Charge-Close-Recharge- Open-Close-Open • Difference between standard breaker contacts and Current Limiting reverse loop contacts	UL 508 File Table 76.2 IEC 60947-4-1

	• Differences between overload and short circuit and how they are located on a trip curve • Understand the operation of a thermal magnetic circuit breaker • Understand the application and operation of a Motor Circuit Protector (MCP) • Ability to calculate system short circuit current • Differences between interrupting, withstand and short time ratings • Know differences between equipment and personnel ground fault • Residual and Zero Sequence Ground Fault • Selective Breaker Coordination • Slash Voltage Ratings • Application Fuse Considerations - Location, Phase to Phase Spacing, Phase to Ground Spacing, Indoor, Outdoor, Suppression, Disconnect, Non Disconnect, Fuse Drop out, Refills and indicator	
Electric Control	• Follow the PEARL Reconditioning Standard • Identify Test Equipment needed • Perform Evaluation/Inspection • Test • Reconditioning • Retest • Documentation • Certification • Understand how a holding interlock works on 3 wire controls	ANSI/PEARL EERS NEC 970
Standards	• Servicing ICCB and MCCB using NEMA AB 4-2017 • Guidelines • Inspection Procedure • Preventive Maintenance • Test Procedures • Accessory Device Test Procedures • ICCB Inspection & Test Procedures • Electronic Trip Unit Secondary Injection test procedures • Circuit Breaker standards • Supplemental Protectors • Fuse Standards • IEC Category Ratings	UL489 UL1077 NEMA AB 4-2017 IEC
Arc Reduction Energy	• Arc Flash Area • Arc Flash Rules • Methods for preventing arc flash • Methods for reducing clearing time	NFPA 70E ANSI/IEEE C37.20.7

	• Zone Selective Interlocking • Differential Relaying • Energy reducing maintenance switch with local status indicator • Energy reducing active arc flash mitigation system • Instantaneous trip override that is less than available arcing current	CSA 22-2011 EEMAC G14-1 NEC 240.87
Math Skills	• Calculate fault current • Derate MCCB • Derate Fuses • Calculate Transformer KVA • Derate Transformer KVA based on Temperature Rise • Understand decimals • Understand test readings and how to compare with acceptable readings e.g. DAR test Results 1.0-1.25 Questionable, 1.4 - 1.6 Good, and >1.6 excellent • Convert amps to milliamps	High School Math Textbook
Ethical Practices	• PEARL Code of Ethics • Protections, Representation, Assignments, Honesty, Integrity, Regard for safety, Error Ownership, Avoid Conflicts, Bribery, Continuous education, and Confidentiality	https://pearl1.org/code-of-ethics/

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.

Questions will consist of multiple-choice, single answer, multiple-choice multi-answers, matching, order arrangements, and pictorial images.

Exams are delivered on-line at regional testing locations before a proctor.

1. What equipment can be used for contact resistance test (Choose 3)
   A - Micro ohmmeter
   B - Non contact voltage tester
   C - Miliohmmeter
   D – DLRO

2. Why should you use a DC Hipot Test?
   A - Only when AC is not available
   B - To test the dielectric strength of a device
   C - To find the maximum voltage of a device
   D - To determine the DC voltage of a device

3. Match up the test with the purpose

___Continuity	1.	Contact Integrity
___DLRO	2.	MultiMeter
___DC Hipot	3.	Insulation Integrity

4. Arrange the sequence of operation for a 50/51 Time/Overcurrent Induction Disc Relay
   Target gets reset
   IIT Switch is activated
   Pick up current makes the disc start to spin
   Target Displays Trip Condition
   Current increases beyond instantaneous setting

5. Which method should be used to de-rate a molded case breaker?
   Divide the load current by .80
   Multiply load current times 1.25
   Either divide the load current by .80 or multiply the load current times 1.25
   None of these options

6. _____ or _____ are recommended when using an Expulsion Fuse indoors.
   A - External fan or ductwork
   B - Condenser or Discharge filter
   C - Primary fuse or back up fuse
   D - Enclosure or cover doors

7. Match the following mA ratings:

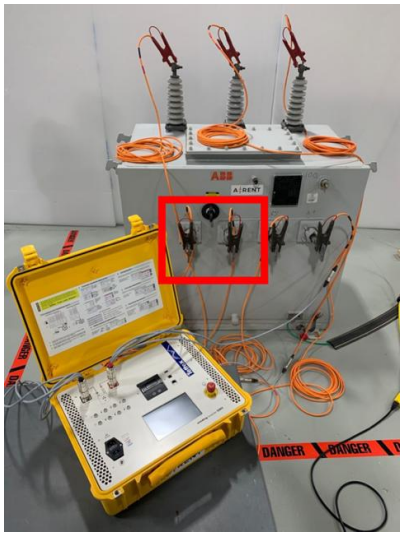
50 mA	1. 0.05 Amp
100 mA	2. 1 Amp
1000 mA	3. 0.1 Amp

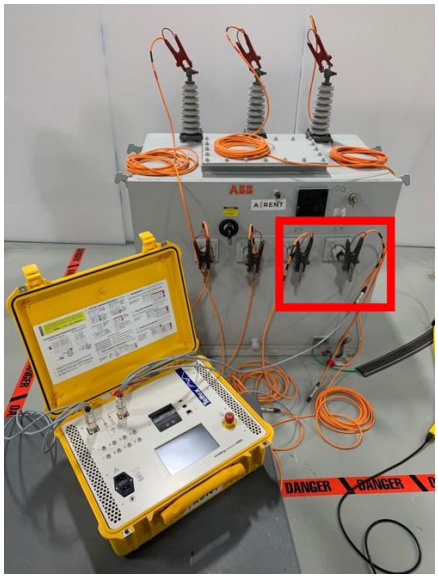
8. Select the test equipment below that is needed to perform a test in accordance with PEARL Standard for Low Voltage Starters (Choose 3)
   AC/DC Voltage Supply
   AC Current Supply with means to perform a timing test
   DC HI Pot
   MultiMeter

9. UL 489 requires a breaker trip at what percentage over current?
   A - 80 Percent
   B - 200 Percent
   C - 150 Percent
   D - 125 Percent

10. Select all that apply when using test equipment (Choose 3)
    A - Equipment tested should always be energized
    B - Caution should be used around electronic equipment
    C - Beware of remaining discharge after testing
    D - Always ground the circuit

11. Select from these images the connections on a transformer test to determine the turns ratio output. (Choose 2)

A. 

B. 

C. 

Answer Key:

1. A, C, D
2. B
3. Continuity - Multimeter
   DLRO - Contact Integrity
   DC Hi Pot - Insulation Integrity
4. Correct Order:
   Pick up current makes the disc start to spin
   Current increases beyond instantaneous setting
   IIT Switch is activated
   Target Displays Trip Condition
   Target gets reset
5. C
6. B

7. 50 mA - 0.05 Amp
   100 mA - 0.1 Amp
   1000 mA - 1 Amp
8. A, B, D
9. B
10. B, C, D
11. A, B