High Current Testing of Molded Case Breakers with the CB 8130 Test Set

EDTECH 503

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SYNTHESIZING THE REFLECTION

This semester's design process has reminded me a lot of the way that I designed my basement pub. The ironic part is that this is the same space in which I'm taking this course. In the beginning, I had a blank space in the bar. The walls were covered by the flimsiest of vinyl paneling and the floor was tiled with something straight out of an elementary school. The only object interrupting the starkness was a bathroom sink cabinet which was used as a source of water.

I began the semester describing the instructional design process as problem solving, and believe me, this space represented a problem, but much like a blank sheet of paper, this space represented opportunity. The process began as any planning process would, with an idea. My wife and I decided that we wanted to use the space for a bar. The decision was based on a needs analysis. We needed a space in which we could entertain friends in our home. This was something that was lacking in our existing structure and we approached the problem in the same manner an Instructional Designer would approach it. I was the designer and she was the client.

We then began the long brainstorming process to determine exactly what type of bar I would design and build. This decision process considered a number of factors. The space had to meet the end goal, in this case provide a space for entertaining. At the same time, we wanted the space to be welcoming to the greatest number of people (students). Initially, she wanted to create a space age bachelor pad type room, complete with glass brick and hand shaped chairs. I rejected this proposal based on the fact that while it would be appealing to our trendy friends, (the smart kids) it would be off putting to our friends who valued comfort over style. Finally, at a Scottish pub in Budapest, we decided to create a pub. This decision was based on the fact that the pub was the best middle of the road choice. It would appeal to the smart kids who would love the stained glass canopy and tin ceiling, while at the same time be unthreatening to the less smart kids who would enjoy the woodwork and the comfortable seating.

I then set to work, and I can honestly say that the planning process took far longer than the actual construction. The initial challenge was that I had no carpentry skills of which to speak. I could use hand and power tools, but I had never undertaken a project of this magnitude. We began the planning process together roughing out the room with painter's tape on the floor. The design of the room began to take shape both on paper and in my mind's eye. Materials for the space were researched and purchased together. Myself and my subject matter expert (ask my wife and she'll tell you she's an expert at every subject) designed and developed our bar both for ourselves and for our friends and neighbors, our students if you will.

The last portion of the room's evolution is the only portion where I deviated from the classical instructional design model in that not only was I the designer and developer, but I was also the person that implemented the instruction. I actually built the bar following the plans I had developed, and much like any good Instructional Designer, I adapted and tweaked my original design along the way.

As for the evaluation phase, the two of us generally evaluate the space four or five times a week. The pub serves, not only our needs, but has become a neighborhood watering hole, where everyone feels at home.

As I think of it, my metaphor describes exactly what I've learned this semester. I was struck how each portion of the project flowed with the previous and subsequent sections. As I stated at the beginning of the course, I'm a technical person who is learning the education process. Obviously ADDIE is a huge portion of our Systematic Approach to Training, but what struck me while developing my project is how little our instructors and industry as a whole know about the process.

As I've mentioned on numerous occasions, as an instructor, I'm surrounded by incredible technically talented people. Unfortunately, with very rare exception these people are not educators. I'm afraid this issue is endemic to our industry. I am currently attending the INPO (Institute of Nuclear Power Operators) online instructor training class. Sadly, and I say sadly because I expect nuclear power to be state of the art, the course falls incredibly short when addressing the ADDIE process. Each section is introduced and concluded as a discrete component, and if my graduate work has taught me anything it's that the process is meant to be circular and seamless in nature.

Thus, having learned at the altar, it now falls to me to go forward and preach the message. I believe in nuclear power. I also believe in the abilities and possibilities of the next generation of nuclear workers. They are generally quick studies and have mastered the technology, which is available to them. The only thing they lack is experience and training.

This new generation deserves the best training possible, and quite frankly, the current offerings of our industry do not make that possible. To be sure, we are an industry which came of age in the late 1960's and 70's and the equipment in the plants reflect that. However, this does not preclude us from moving forward with our training methodology. When Power Point presentation become nothing more than computerized overhead projector slides and reviewing previous presentations and bringing them up to date with new plant information passes as course development, something must be done.

I plan on using what I've learned in this course for the creation and revamping of the course materials that I present. I start in the training department in the beginning of June

and plan on approaching each assignment with the tools that I've learned here. Furthermore, I intend on encouraging my peers to do the same. One of the great things about our industry is that we are constantly being evaluated. As such, quite often we are given access to experts in our field. I plan on introducing these new methods that I've learned to my evaluators. Further, I will challenge them as to why an industry which is considered state of the art has not adopted modern instructional design methods. I am hoping that, when they see the quality of my training materials and more importantly when they see the process that buttresses that material, they will give serious consideration to modernizing their methods and revising their material.

PART 1: TOPIC

PART 1A. STATED LEARNING GOAL:

Upon completion of this lesson, the learner will be able to perform high current testing on a molded case circuit breaker in accordance with C MP 782AE, “Testing of Molded Case Circuit Breakers,” Sections 4.1, 4.2 and 4.6 using the Multi-amp CB 8130, while adhering to all station safety standards and utilizing station Human Performance tools.

PART 1B. DESCRIPTION OF AUDIENCE:

A fully qualified Electrician at Millstone is defined to be a Level 1 Electrician. This means that this individual is qualified to work in the plant independently. Currently, at Millstone, there are a number of electricians who do not fully understand the concepts behind high current testing of circuit breakers. Every electrician should know, at a minimum, how to test molded case circuit breakers. The targeted learners for this unit will be Level 1 qualified Electricians who lack specific circuit breaker testing qualifications.

PART 1C. RATIONALE:

Currently, at Millstone, two different types of test equipment are used to perform high current testing on circuit breakers. The first, the Multi-amp MS-2, is small and portable and is used to test most circuit breakers. Because of its portability, this is the test set which is used during circuit breaker training. The second, the Multi-amp CB 8130, is a larger unit with more capacity and is used to test larger molded case circuit breakers and also the metal clad breakers used in load centers. Because of this, generally speaking, only those individual qualified to perform maintenance on metal clad breakers understand the use of the CB 8130. This leaves a large subset of workers who are qualified to test large molded case circuit breakers, but who are not familiar with the Multi-amp CB 8130. This presentation will eliminate that subset and will result in all electricians who are qualified to test circuit breakers fully proficient in both pieces of high current testing test equipment.

The overall strategy for this instruction is one hundred percent supplantive. Because of the nature of the nuclear power industry, all individual learners must conform to written procedures and guidelines. These documents make up a station standard to which all workers must adhere. In nuclear power, each task must be performed the same way by each person on site to ensure that the intent and

specifications for the maintenance has been met. For the purposes of this presentation, the instructor will present all materials to the learners and then evaluate the learners for their understanding of the material and their ability to perform the task as required per the station procedure.

My instructional strategy will be one for principle learning and will be using an expository approach. While this approach may seem odd for a class covering the procedural testing of a piece of equipment, it is important to remember that the learner is not actually learning the procedure. In nuclear power, the procedure is always present and always available for reference. In fact, during the performance of the maintenance, the technician is required to circle a procedural step, perform the step and then mark off the step after it has been completed. Given these requirements, it is not necessary that the learner memorize, or even learn the procedure. It is more important that the student learn about the breaker and how to apply the procedure to any circuit breaker encountered. Therefore, the students will be taught the concepts behind testing circuit breakers and then apply those concepts when testing the breakers with the CB 8130 test set.

PART 2: ANALYSIS REPORT

PART 2A. DESCRIPTION OF NEED:

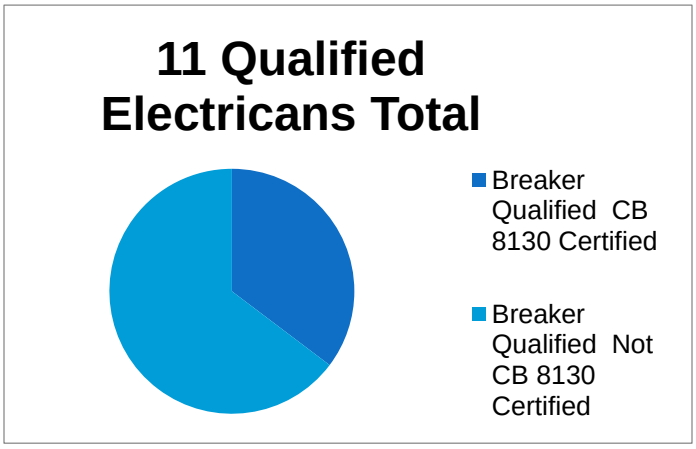
PART 2A.1. NEEDS ANALYSIS SURVEY

I distributed a hard copy needs analysis survey to the Electrical Maintenance Shop at lunch time on Monday. I provided pizza for lunch and explained the purpose of the survey to the workers. The surveys were not anonymous as I have a good rapport with the electricians having once been one. A total of 18 surveys were distributed and then picked up at lunch on Thursday. One survey was drawn at random and the individual received a ten dollar gift card to the local watering hole. Two members of the group did not participate as they were on vacation for the week. All of the workers felt they had sufficient time to complete the survey, and all expressed the desire that some sort of training be developed from the survey. As a side note, this was the first time that the workers had been polled for the purpose of developing training.

PART 2A.2. NEEDS ANALYSIS DATA REPORT

Qualifications:

The chart on the right shows the lack of CB 8130 proficiency. Over fifty percent of breaker qualified electricians are not certified to use the CB 8130 test set. One hundred percent of these individuals are certified to use the MS-2 test set. This means that there are only five individuals in the shop that are certified to test large amperage molded case breakers. This might not be a hardship, but these 5 individuals are also the only individuals qualified to work on metal clad circuit breakers. Therefore a case could arise when the CB 8130 certified individuals might be working on a metal clad breaker and thus would affect shop production.

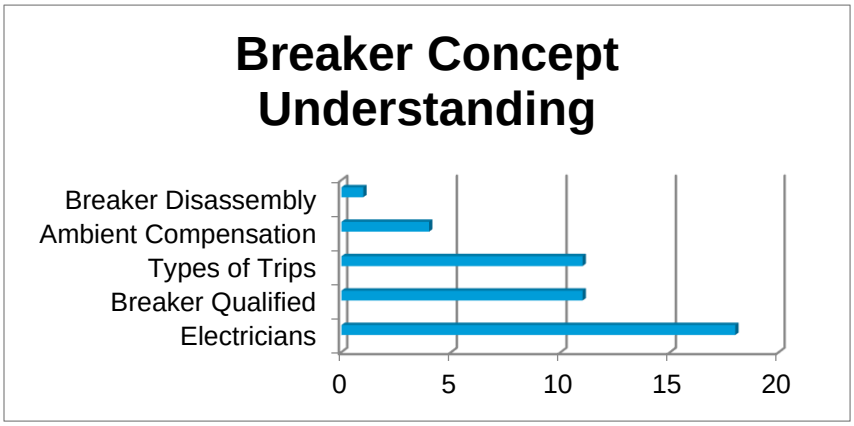


Familiarity:

The survey also revealed that every individual in the shop has at one time or another been the second man on the job during testing with the CB 8130 test set. This makes it a perfect topic for Continuing Training. The worker's have been around the

equipment as it has been operated and thus bring a level of comfort with them to the training, which will facilitate learning. Additionally, by assisting as the second man on the job, all workers will be familiar with the procedure being used, and the expectations to adhere to plant safety standards.

Shop Weakness:



Lastly, the survey results confirmed one of my suspicions. The chart on the right points out a tremendous weakness in the area of under-standing circuit breaker concepts. Out of the 18 electricians who took the survey, (including 11 who are fully qualified to maintain circuit breakers) only four understood the concept of ambient compensation and only one had ever taken this type of breaker apart. These concepts should be fundamental knowledge for all electricians and certainly for all electricians who are breaker qualified.

PART 2B. DESCRIPTION OF LEARNING CONTEXT:

PART 2B.1. LEARNING CONTEXT:

The instruction will take place in the site's breaker overhaul facility. This site is equipped with general hand tools as well as the specific tools required for circuit breaker maintenance. The facility is equipped with a 480 volt feed which is used to power the CB 8130 test set, and a desktop computer for printing and verifying the procedure revision. The course will be presented via a fifty inch flat screen television connected to the computer. The training will take place during regular working hours. Each group being taught will consist of 4 electricians and an electrical supervisor. An effort shall be made to ensure that there are differing experience levels between the workers, although plant maintenance needs may dictate otherwise. The instructor shall be a qualified INPO (Institute of Nuclear Power Operators) instructor with previous qualification on circuit breakers and CB 8130 certification.

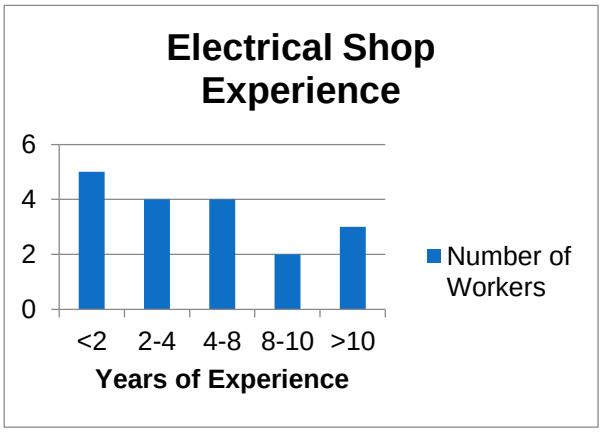
PART 2B.2. TRANSFER CONTEXT:

As the instruction is taking place in the site's breaker overhaul facility, the workers will be learning in the same location in which they will perform their Task Performance Evaluation. This is also the same location in which they will be performing the majority

of their work. During refueling outages, the test set is moved into the radiological controlled area to minimize the time required for transferring breakers.

In each location, the same safety rules apply. In fact, it is most important that the workers practice as they are required to play. Safety and Human Performance Standards must be followed on each job, and it is important that expectations are duplicated in the learning environment. Therefore Personal Protective Equipment shall be worn at all times when working on the breaker. This requirement may be relaxed during the classroom phase of the presentation. These safety rules apply to all personnel who enter the classroom. It is important that any training observer, should they not have the required PPE, be issued this equipment prior to starting their observation.

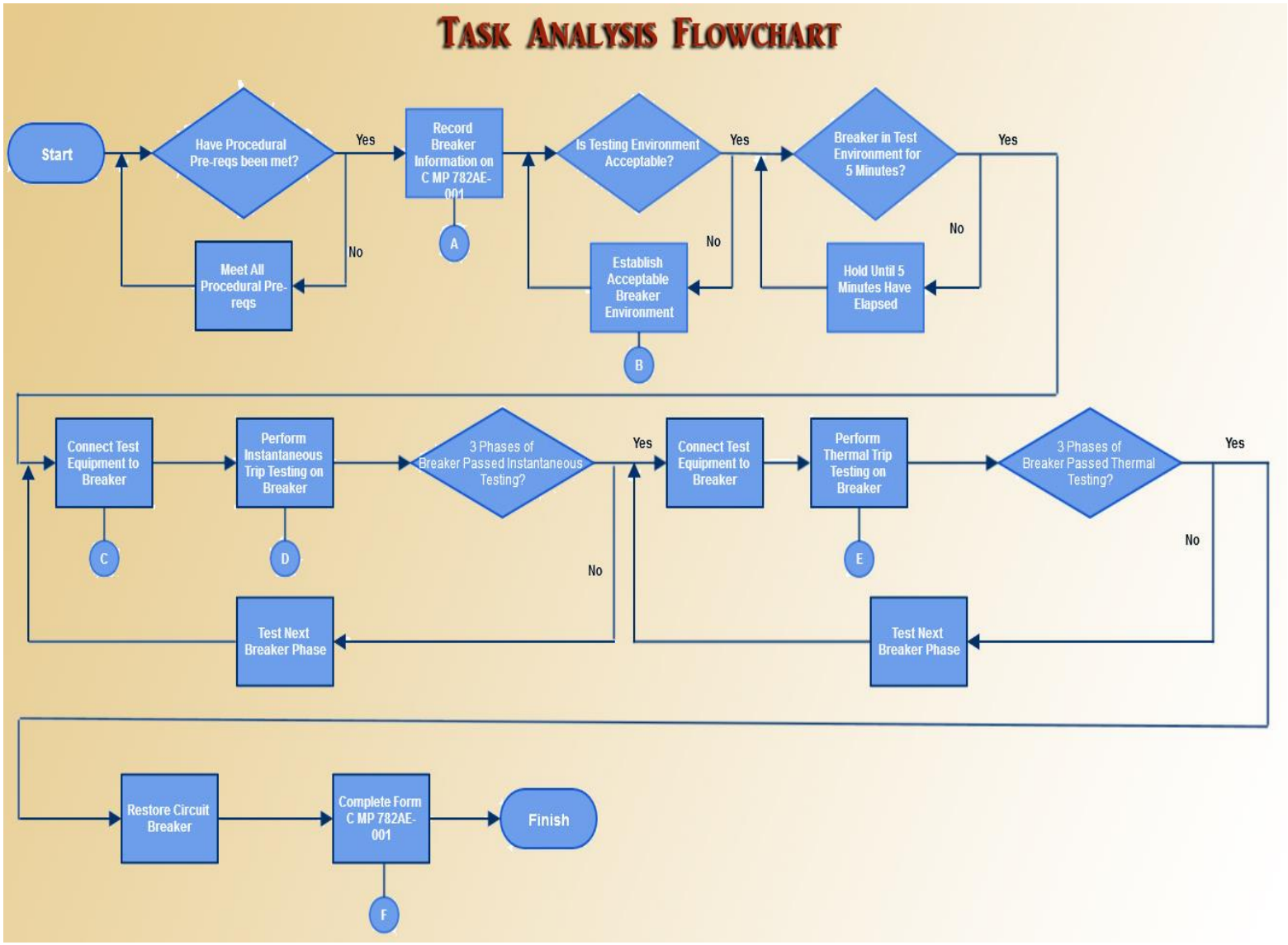
PART 2C. DESCRIPTION OF LEARNERS:

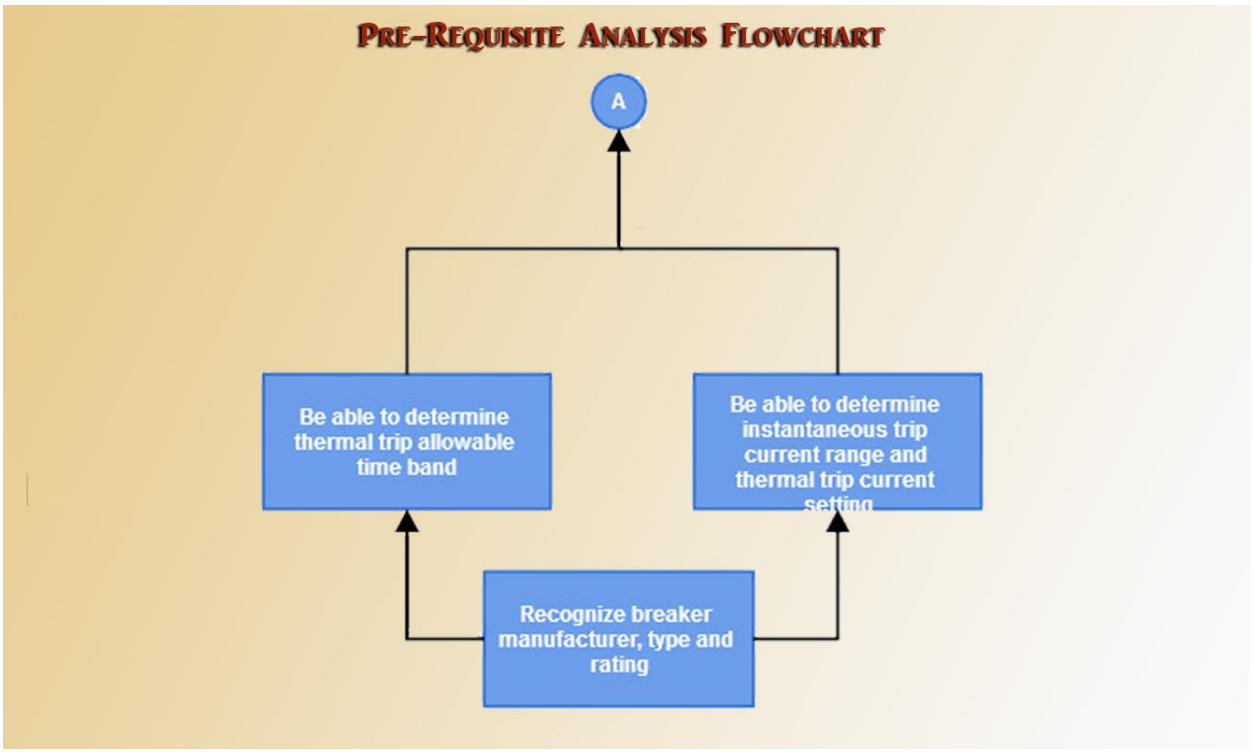


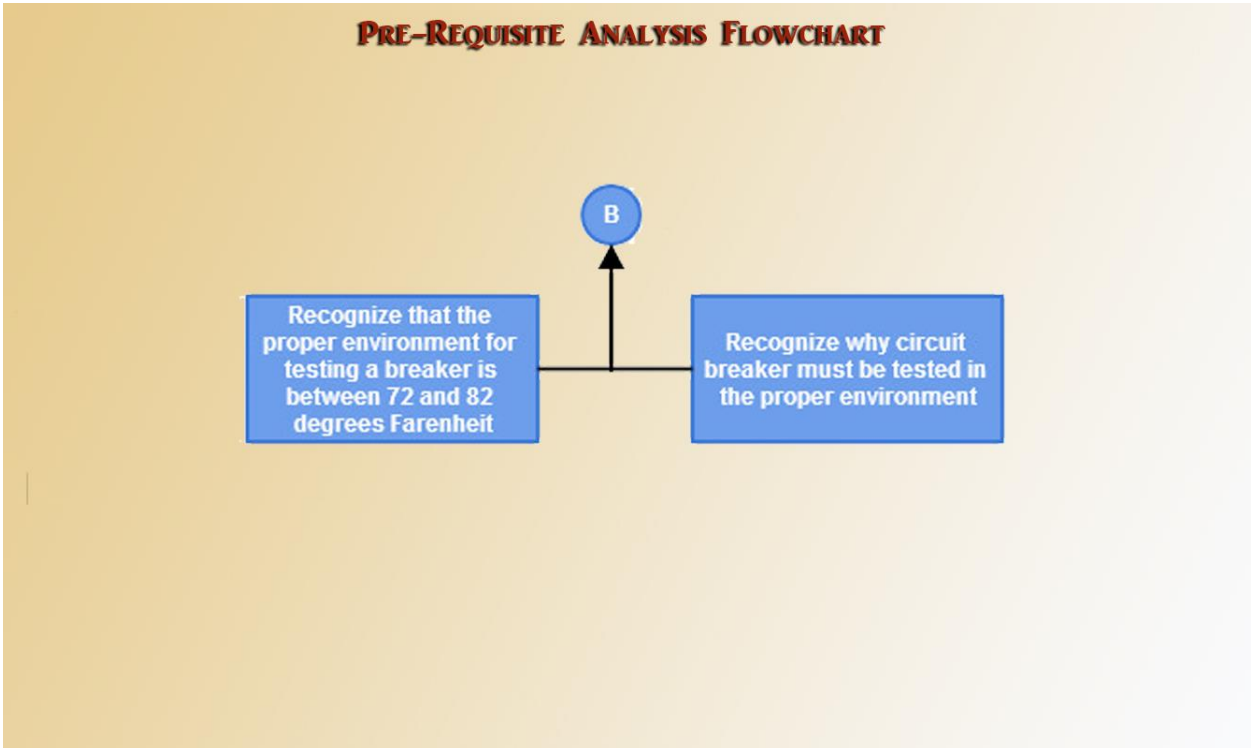
For obvious workplace reasons, no inquiries were made as to the ages of the workers. Instead, the workers were questioned as to their years of experience at Millstone Station. Previous experience in the electrical trade was not counted because, in general, the work of a power plant electrician varies greatly from the work of a licensed electrician. As the graph on the right illustrates, the majority of the electricians have less than eight years experience. The reasons for this are twofold. Approximately eight years ago, the company offered a buyout for site personnel. The result was that a number of experienced electricians left the site to be replaced by new hires. This combined with the aging nuclear workforce and normal turnover have left the shop with minimal experience. The workers with less than two years experience have recently completed a 3 month program which introduced them to nuclear power. As previously mentioned, every effort shall be made to include different experience levels in each session. This diversity ensures that pertinent operating experience is passed on to those members of the shop with less experience.

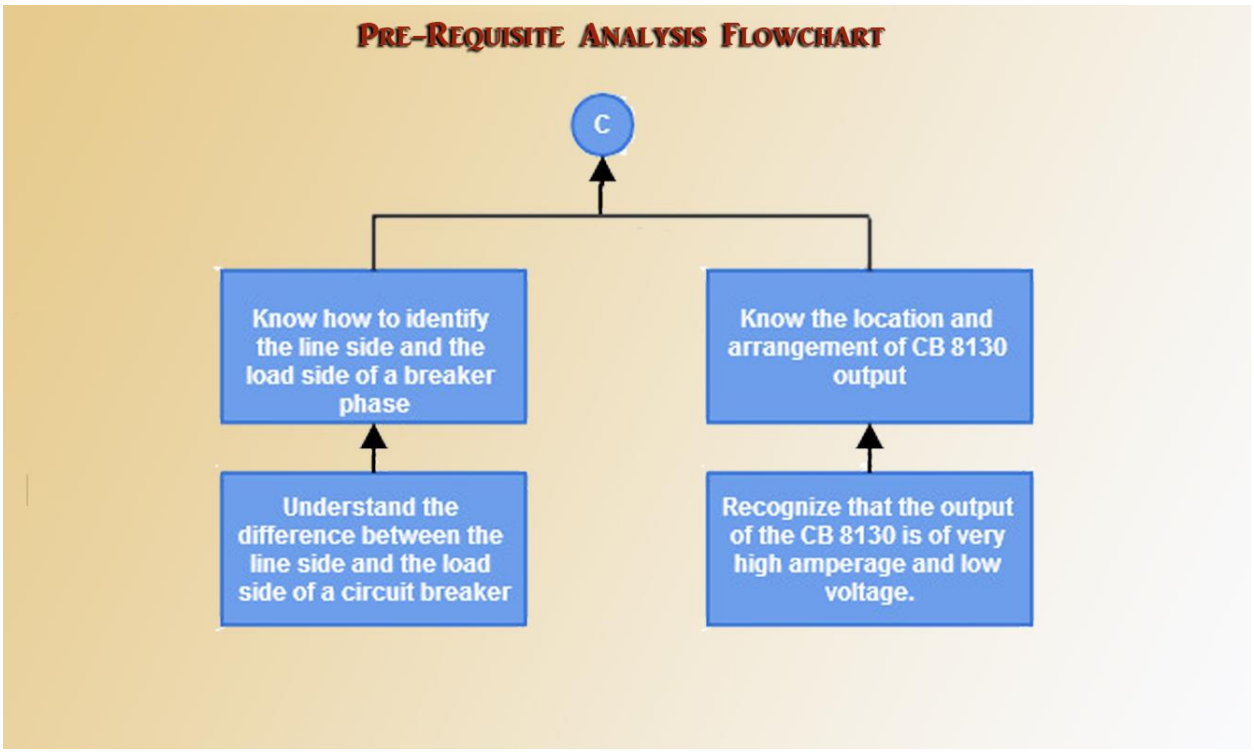
It is important to engage this group with anecdotes. Past personal experiences accomplish two goals. The first is that the instructor will gain the respect of the workers because he has done their job before and done it well. The second is that by relating past experiences, the instructor provides insight in what not to do on the job. The “what not to do” factor is important. As always, the goal of the power station is not to make the same mistake twice.

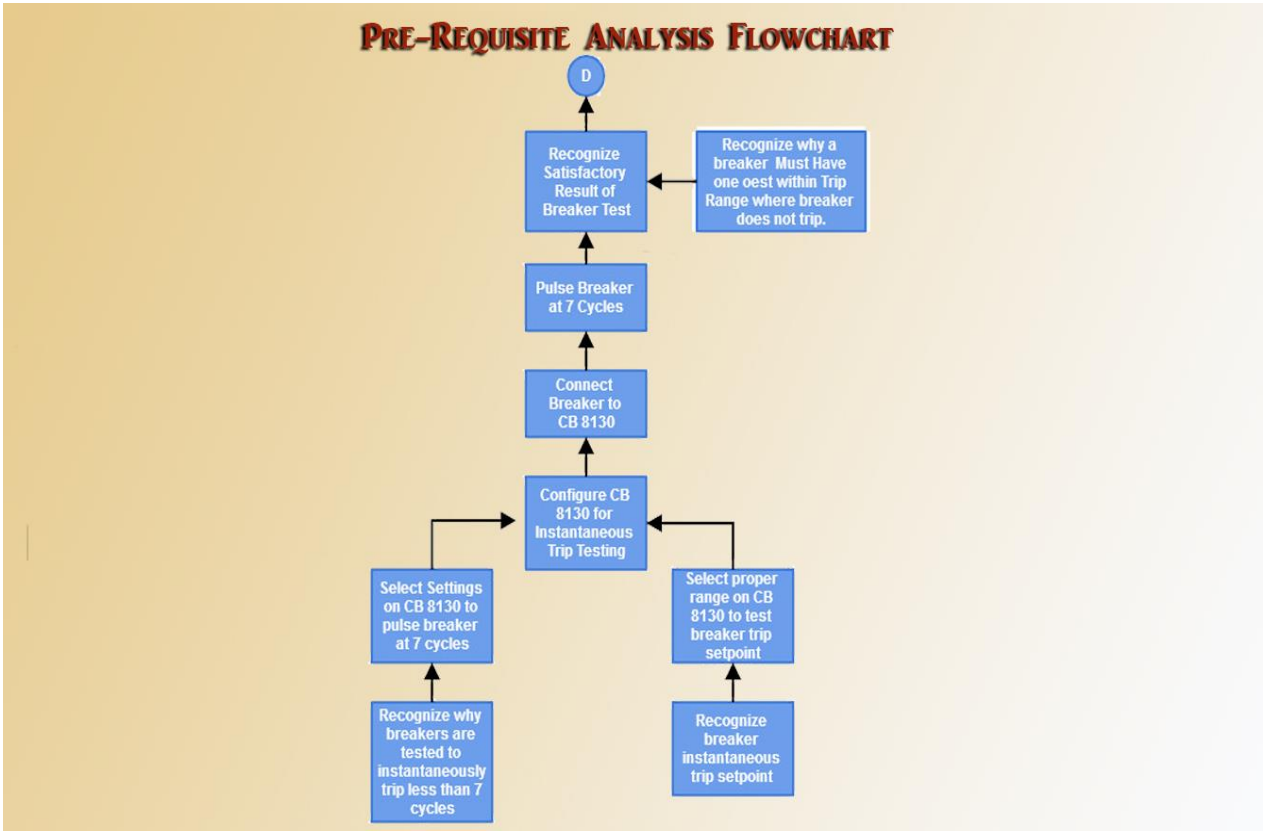
PART 2D. TASK ANALYSIS FLOWCHARTS:

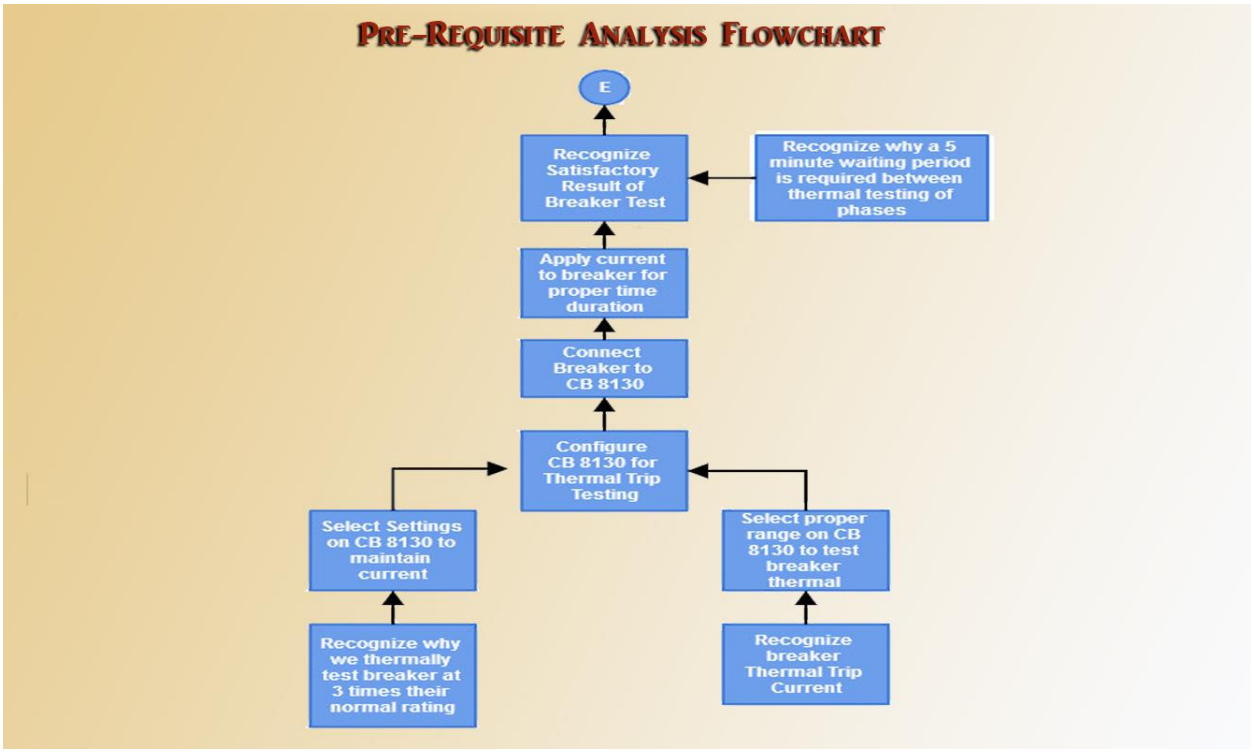


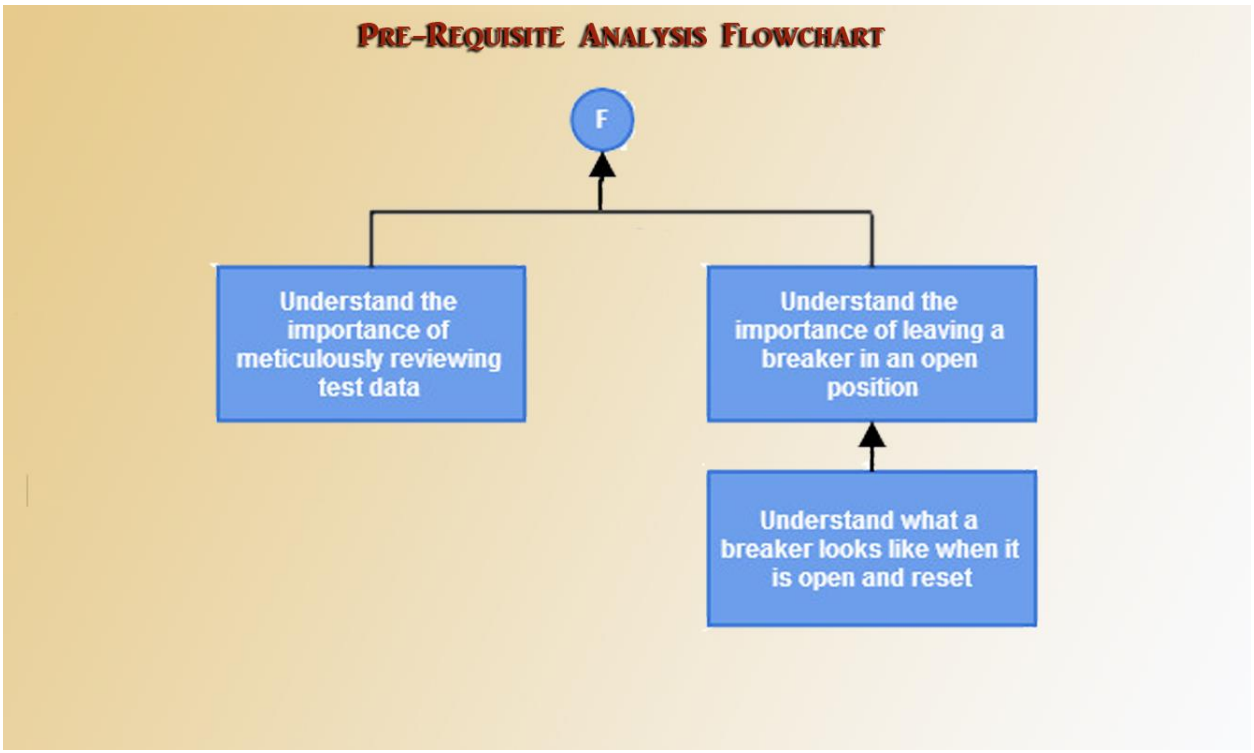

PRE-REQUISITE ANALYSIS FLOWCHART
A
Be able to determine thermal trip allowable time band
Be able to determine instantaneous trip current range and thermal trip current setting
Recognize breaker manufacturer, type and rating


PRE-REQUISITE ANALYSIS FLOWCHART
B
Recognize that the proper environment for testing a breaker is between 72 and 82 degrees Farenheit
Recognize why circuit breaker must be tested in the proper environment


PRE-REQUISITE ANALYSIS FLOWCHART
C
Know how to identify the line side and the load side of a breaker phase
Know the location and arrangement of CB 8130 output
Understand the difference between the line side and the load side of a circuit breaker
Recognize that the output of the CB 8130 is of very high amperage and low voltage.


PRE-REQUISITE ANALYSIS FLOWCHART
D
Recognize Satisfactory Result of Breaker Test
Recognize why a breaker Must Have one oest within Trip Range where breaker does not trip.
Pulse Breaker at 7 Cycles
Connect Breaker to CB 8130
Configure CB 8130 for Instantaneous Trip Testing
Select Settings on CB 8130 to pulse breaker at 7 cycles
Select proper range on CB 8130 to test breaker trip setpoint
Recognize why breakers are tested to instantaneously trip less than 7 cycles
Recognize breaker instantaneous trip setpoint


PRE-REQUISITE ANALYSIS FLOWCHART
E
Recognize Satisfactory Result of Breaker Test
Recognize why a 5 minute waiting period is required between thermal testing of phases
Apply current to breaker for proper time duration
Connect Breaker to CB 8130
Configure CB 8130 for Thermal Trip Testing
Select Settings on CB 8130 to maintain current
Recognize why we thermally test breaker at 3 times their normal rating
Select proper range on CB 8130 to test breaker thermal
Recognize breaker Thermal Trip Current


PRE-REQUISITE ANALYSIS FLOWCHART
F
Understand the importance of meticulously reviewing test data
Understand the importance of leaving a breaker in an open position
Understand what a breaker looks like when it is open and reset

PART 3: PLANNING

PART 3A. LEARNING OBJECTIVES LIST:

Upon completion of the modules, the learner will be able to:

1. State the safety precautions which are required when testing molded case circuit breakers.
2. State the faults that are protected against with both thermal and magnetic circuit breaker trips.
3. Explain why a circuit breakers are ambient compensated.
4. Explain the differences between a thermal and magnetic circuit breaker trips.
5. Determine a molded case breaker's rating.
6. Determine the instantaneous trip point of a molded case circuit breaker in accordance with C MP 782AE.
7. Determine the thermal overload test current of a molded case circuit breaker in accordance with C MP 782AE.
8. Describe and demonstrate connecting the Multi-amp CB 8130 to a molded case circuit breaker for circuit breaker high current testing in accordance with C MP 782AE.
9. Describe and demonstrate the setup of the Multi-amp CB 8130 in accordance with C MP 782AE for both thermal and instantaneous circuit breaker high current testing.
10. Explain the purpose of the 5 minute wait between phases during thermal trip testing.
11. Identify the three states of a molded case circuit breaker.
12. Demonstrate the ability to perform high current testing of molded case circuit breakers.

PART 3B. MATRIX OF OBJECTIVES, BLOOM'S TAXONOMY, AND ASSESSMENT PLAN:

Learning Objectives	Bloom's Taxonomy Classification	Format of Assessment	Description of Test Form	Sample Items *(See Below)*
1	KNOWLEDGE	Written Exam	Short Answer	1
2	KNOWLEDGE	Written Exam	Fill In The Blanks	2
3	COMPREHENSION	Written Exam	Short Answer	3,4
4	COMPREHENSION	Written Exam	Short Answer	5,6
5	APPLICATION	Performance	Task Performance Evaluation	11
6	APPLICATION	Performance	Task Performance Evaluation	11
7	APPLICATION	Performance	Task Performance Evaluation	11
8	COMPREHENSION / APPLICATION	Written Exam / Performance	Short Answer / Task Performance Evaluation	8,11
9	COMPREHENSION / APPLICATION	Written Exam / Performance	Illustration / Task Performance Evaluation	9,11
10	COMPREHENSION	Written Exam	Short Answer	7
11	COMPREHENSION	Written Exam	Matching	10
12	APPLICATION	Performance	Task Performance Evaluation	11

Assessment:

Student assessment will take place in two parts. The first portion will be a ten question test. The second portion will be a formal Task Performance Evaluation. For the written exam, a grade of 80 percent or higher will be considered passing. Anything less than 80 percent correct will be considered a failure. During the Task Performance Evaluation, the only passing result is perfection. The student must follow the procedure to test the breaker observing all applicable station safety and human performance standards.

Written Exam

1. What PPE (Personal Protective Equipment) is required when performing High Current Testing on a molded case circuit breaker?

2. Given the following faults, identify the type of trip, thermal or instantaneous, which provides circuit protection.

a) Motor Overload

b) Short Circuit

c) Circuit Ground

d) Line Undervoltage

3. Why are circuit breakers ambient compensated?

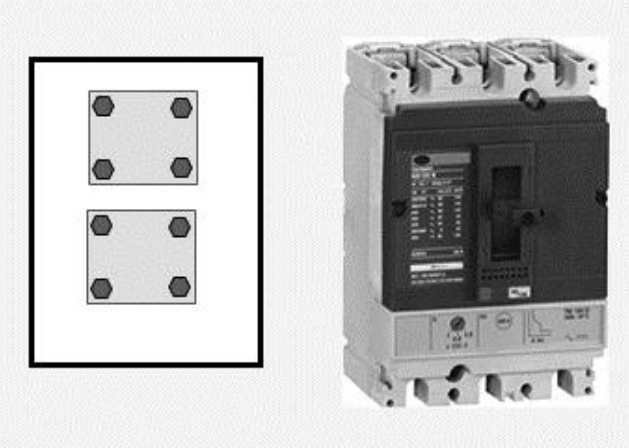
4. How is ambient compensation accounted for during High Current Testing of molded case circuit breakers?

5. Describe how a short circuit causes a circuit breaker to trip.

6. Describe how a motor overload causes a circuit breaker to trip.

7. When performing thermal overload testing, why is there a 5 minute wait between testing each phase?

8. Given the drawing below, connect the circuit breaker to the Multi-amp CB 8130 for testing.



9. Given a 600 Amp molded case circuit breaker to test. Check all appropriate control buttons to select in order to perform thermal overload testing.

Amperage		Duration		Display	
200A	_____	Pulse	_____	Memory	_____
2kA	_____	Maintain	_____	Continuous	_____
20kA	_____			Cycles	_____
200kA	_____			Seconds	_____

10. Identify the condition of the circuit breaker from the image.

_____ _____ _____

Task Performance Evaluation

11. Given a copy of C MP 782AE and a molded case circuit breaker, perform all High Current Testing on that breaker using the Multi-amp CB 8130, while utilizing all safety precautions and applicable Human Performance Tools.

PART 3C. ARCS TABLE:

Project Goal Statement: Upon completion of this lesson, the learner will be able to perform high current testing on a molded case circuit breaker in accordance with C MP 782AE, "Testing of Molded Case Circuit Breakers," Sections 4.1, 4.2 and 4.6 using the Multi-amp CB 8130, while adhering to all station safety standards and utilizing station Human Performance tools.

ATTENTION
A.1 Perceptual Arousal
The Instructor will explain to the students that learning the CB 8130 is the gateway to more qualification. The CB 8130 is the machine used to test all metal clad breakers as well as the larger molded case circuit breakers, and that learning this machine will most certainly lead to eventual metal clad breaker qualification. Explain to the students that more qualification means more money. Additionally, point out to the students that at the end of this course, they will be participating in a TPE for actual certification in the use of the CB 8130.
A.2 Inquiry Arousal
The Instructor will explain to the students that they are actually going to find out how a molded case circuit breaker works. Inform the students that the results of their survey highlighted that only one of their peers had ever seen the inside of a circuit breaker. Additionally, inform the students that they will be learning how the breaker functions so that they understand the testing process and are not just pushing buttons for results. Lastly, point out that they will be learning a technique in the class which will minimize the time they spend testing any breaker and will add to their efficiency as they perform their work.
A.3 Variability
It is important to remember that these are Maintenance Electricians in the classroom. They are, in general, hands on people. If the instructor simply runs through a litany of slides while reading from the lesson plan, they will quickly lose interest and tune out. The instructor should concentrate on getting them out of their seats, on average, every 15 minutes. If a question is raised, remember to show and not tell. Have a molded case circuit breaker front and center in the classroom. Technicians are a "trust but verify" type of learner. They will be skeptical if you merely tell them the answer, but will maintain interest and be incredibly receptive if you show them the answer using the equipment.

RELEVANCE

R.1 Goal Orientation

The primary goal of this training is to produce technicians certified to use the CB 8130 High Current Test set, however, it is important to remember that the instructor is teaching for understanding. The procedure, C MP 782AE, will essentially walk the student through testing a circuit breaker. Whereas the procedure will direct the student as to the arrangement of the equipment and the test sequence to follow, it will not explain the reason for each step. It is vital that each student understands the "why" of what they're doing and are not merely reacting to a set of written instructions. It is important to remember that INPO's SOER 10-2 advocated that nuclear plant workers be part of an "engaged, thinking organization."

R.2 Motive Matching

The Instructor must remember to encourage peer to peer coaching. Always give the students the first opportunity to coach their fellow workers in the areas of safety and human performance. The concept of "play as you practice must be reinforced. Remind the students that they should consider the classroom as an in plant scenario and all safety and human performance rules apply. If a lapse occurs, give the students an opportunity to coach each other. If coaching does not occur, stop the evolution and ask one of the peers what the performer has done wrong. Then inquire why, if they noticed the lapse, they did not provide coaching. It is vital that the worker's aversion to peer to peer coaching be overcome. Reinforce to the students that they are not playing "Gotcha" but are simply protecting their co-workers as they would want to be protected.

R.3 Familiarity

The instructor should reiterate throughout the class that the methodology to testing a breaker is the same, regardless of the test equipment. Let the students know that their survey results revealed that all of them at one time or another had been present when circuit breakers had been tested. When introducing the CB 8130, remember to relate its controls to that of the MS2 test set. Reinforce that all high current testing equipment essentially have the same controls: a control to select the amperage scale, a selector switch to determine whether a constant current or a current pulse will be applied and a rheostat that adjusts the magnitude of current coming from the machine. In order to maintain the attention of those who are already certified to use the MS 2 machine, the instructor should address that while the machines are similar, there are some differences. Also include that the course is going to cover the inner workings of a circuit breaker that the experienced students may not have seen before.

CONFIDENCE

C.1 Learning Requirements

The Instructor should reinforce with the learners that, although the piece of equipment is large and looks imposing, it is no more complicated than the MS 2 test set that most of them regularly use. The instructor should also inform the students that by becoming certified in this equipment, they are adding to the versatility of the shop as a whole. Cite the example that most people qualified to use the CB 8130 are also qualified metal clad breakers which leads to a restriction in shop resources when a metal clad breaker requires maintenance. By adding this certification, they are not only helping themselves, but they are helping their peers as well.

C.2 Success Opportunities

The Instructor should use this theme of becoming a shop asset throughout their presentation. The “Help Others” message should be stressed as a number of the students will be new hires with very few qualifications. Point out that by learning to test breakers, their qualifications will allow many jobs to go in parallel and that they will be directly responsible for more work getting done. Also make sure the students not qualified other specific breakers understand that this is their gateway to further qualifications thereby increasing their usefulness to the shop.

C.3 Personal Control

The instructor should provide an overview of the TPE process prior to breaking the students up into their lab groups. The fact that the students will be fully certified to work on their own following this TPE should be stressed as well as the fact that they will be required to perform their TPE without any help or peer coaching. Reassure them that they will be complying to safety rules because the instructors will be there, but they should know that they pass or fail based on their own work and knowledge and not the assistance of their partners. Additionally point out that during an outage situation, they may very well be the only individual on a team that is certified to use this equipment, and that for this reason, they are required to perform this TPE solo.

SATISFACTION

S.1 Natural Consequences

The instructor should inform the students (and follow up) that they will be reviewing the schedule and making recommendations to Line Supervision as to the availability for the students to follow on and actually perform the work for which they are newly qualified. Also inform them that, as their instructor, you will be performing various job observations to ensure that the training that they have received in this class is germane and adequate. Lastly, inform them that you will be providing feedback to their supervision based on these observations. This will reaffirm that they are well qualified for the tasks which they are performing.

S.2 Positive Consequences

The learner's successes will be reinforced in two ways. The first reinforcement will come when the student successfully passes the TPE and gains certification. More positive reinforcement will come in the form of supervisor praise after they have successfully completed this task on their own. It is vital that the instructor reach out to supervision and provide this feedback. All too often, successful completion of a class is overlooked by the line. It is important that the shop, as a whole, celebrate the successes of the newly trained after they have performed the task for which they were trained.

S.3 Equity

During the aforementioned job observations, it is important that the instructor be supportive of the students. Positive feedback should be provided in front of their peers to reinforce the good things that have been taken away from this training. Any deltas to excellence should be fed back privately and only after positive feedback has been given.

PART 4: INSTRUCTOR GUIDE

Verify All Student Electrical Safety Qualifications prior to starting the class.

Introduction

Miniatures of Slides show on Attachment 2

Gain Attention

Open the class with a review of plant status for the day. Be sure to cite the protected train for each unit and ensure that the class repeats back the protected train. Review any pertinent Condition Reports from the night before.

Review the safety expectations for the room. Call on a single student to conduct a two minute timeout which includes the relative hazards in the room, the mitigation strategies and the exit route in the event of an emergency. Relate a personal anecdote on the value of being prepared. Provide a 5 minute break for the students to get up and get coffee.

Inform Learners of Purpose

Review the Terminal and Enabling Objectives with the student. Be sure to include a slide listing the objectives. It is vital that the instructor face the class while delivering and expanding upon the objectives. This behavior holds true for the entire presentation. Remember that the class is not embedded on the white board, they are in front of you. Nothing will lose a class faster than having an instructor reading the objectives from a board. Be sure to paraphrase the objectives after they are read. Expand upon them to make them personal to the learners.

Arouse Interest and Motivation

Inform the students that not only will they learn how to perform high current testing by injecting thousands of amps into a circuit breaker, but that they will actually be opening a circuit breaker to examine how the internals of the breaker function. Inform them that at the completion of the course, they will each be certified to test circuit breakers using the CB 8130. Inform them that this certification is the gateway to more qualifications in metal clad breakers and that more qualifications equate to more money.

Preview the Learning Activity

Explain the class layout to the students.

The first hour of class will be spent discussing circuit breakers in general. Topics to be covered:

- The various faults that circuit breakers protect against and how the breaker provides protection against these faults.
- How a circuit breaker works including the mechanical parts inside of the breaker.
- How a circuit breaker trips to provide protection for the downstream load.
- How one determines a circuit breaker rating and the condition of a breaker.
- What is ambient compensation and why do we ambient compensate our breakers.

The second hour of class will be spent covering high current testing of a circuit breaker using the CB 8130. Topics to be covered:

- Overview of the CB 8130 Test Set
- Determining Instantaneous Current Trip Range and Thermal Test Current
- Connecting a Circuit Breaker to the CB 8130 Test Set
- Performing an Instantaneous Trip Test of a Molded Case Circuit Breaker
- Performing a Thermal Overload Test of a Molded Case Circuit Breaker.

Lastly the students will be testing circuit breakers in a lab environment.

Upon completion of Lab Time, the students will then be asked a TPE on the testing of circuit breakers.

Body

Recall Relevant Prior Knowledge

Show Slide 1
Begin with a discussion of the purpose of a circuit breaker. Discuss the following facts:

- Circuit Breakers provide a means of quick current interruption in the event of a fault or overload condition.
- Circuit Breakers provide a means of quenching an arc thus interrupting a current path.
- Circuit Breakers provide a *repeatable means energizing a load* after an overload or fault condition occurs.

Present Information and Examples

Show Slide 2

Discuss and expand upon the types of faults that circuit breakers protect against.

Discuss with the students whether each type of fault would be protected by instantaneous or thermal overload protection.

Show Slide 3
Phase to Phase Short

- Discuss what a phase to phase short is
- Symptoms:
    - High rate of current increase.
    - Damage can occur to cables and the load
    - Catastrophic failure mechanism
- Protective Measures
    - Instantaneous Trip of the circuit breaker

Show Slide 4
Undervoltage Condition

- Discuss why an undervoltage condition will result in a trip (Power=Volts x Amps)
- Symptoms:
    - Load Runs Hot.
    - Damage can occur to and the load
    - Can result in stator winding damage due to expansion of rotor
- Protective Measures
    - Thermal Trip of the circuit breaker

Show Slide 5
Motor Ground

- Discuss what a ground is and the different indications of a ground in a grounded and ungrounded system.
- Symptoms:
    - High Rate of current increase
    - Damage can occur to cables or the load depending on where the ground occurs
    - Catastrophic failure mechanism in some cases
- Protective Measures
    - Instantaneous Trip of the circuit breaker

Show Slide 6

Motor Overload

- Discuss some things which could cause a motor to become overloaded.
    - Binding of pump shaft
    - Excessive flow in a fan motor
    - Restrictive flow in a fluid system
- Symptoms:
    - Motor runs hot.
    - Damage could occur to the pump or fan
    - Small amounts of binding may lead to a small overcurrent condition which
    - could trip the breaker over time.
- Protective Measures
    - Thermal Trip of the circuit breaker

Show Slide 7
Thermal Trips

- Discuss what causes a circuit breaker to trip on thermal overload
- Topics
    - What is a bimetallic strip.
    - How does a bimetallic strip cause a circuit breaker to trip
    - Why do we have to wait to reset a breaker after a thermal trip (include 5 minute waiting period when testing circuit breakers)

Show Slide 8

- Testing Mechanism for Thermal Trip Testing
    - Explain a circuit breaker trip curve.
    - Explain why we choose 3X current for thermally testing our breakers.
    - Explain Ambient Compensation

Show Slide 9

Instantaneous Trips

- Discuss what causes a circuit breaker to trip instantaneously
- Topics
    - Discuss how magnetic field induced in a coil is proportional to the current passing through the wire that generates the field.
    - How does magnetic field cause a circuit breaker to trip
    - Why don't we have to wait to reset a breaker after an instantaneous

Show Slide 10

- Testing Mechanism for Instantaneous Trip Testing
    - Explain the two trip minimum for instantaneous testing of circuit breakers.

Gain Attention

Gather the class around the front table. Remove the front cover from a 3 pole molded case circuit breaker. Cycle the breaker from open to close to open. Repeat explaining the internals of the breaker. Show the students how the breaker latches closed and how it is manually opened, opened by an instantaneous trip and opened by a thermal trip. Ask them to predict how the breaker will trip when its trip pushbutton is pushed and why.

10 Minute Break

Employ Learning Strategies

Show Slide 11

Determining Circuit Breaker Rating
Place 5 circuit breakers on a table. Have the students determine the following for each breaker and explain their answers

- Breaker Manufacturer
- Breaker Catalog Number
- Number of Poles
- Breaker Voltage Rating
- Breaker Current Rating.
- Condition of the breaker (Open, Closed, Tripped)

Because of the diversified experience level in the class, this is something that the students should be able to do collectively. Ensure that the less experienced take part in the exercise by asking them to justify their peer's responses.

Show Slide 12

Given the appropriate appendix from C MP 782AE, have the students determine the following from the procedure.

- Instantaneous Trip Range
- Thermal Test Current

Be sure that the students can justify their answers. Follow up with questions such as, "How would the currents differ if this were a two pole breaker?"

CB 8130 Setup Training

Show the slide of the CB 8130 controls, step through the slideshow highlighting each one of the controls. Do not forget to point out that the control wheel is bidirectional for current increase. Following this review, ask the students how they would set up the CB 8130 for Instantaneous Testing, For Thermal Testing. Be sure to cover that the breaker's internal resistance will change during thermal testing making it necessary to adjust the current level manually during the test.

Ask the students how they would connect the breaker to the CB 8130. Discuss the use of welding leads to connect the breaker.

Guide Practice

Give Safety Brief and Task Preview for using the CB 8130. Include notifying peers when energizing the CB 8130.

Divide the class into three groups of two. Base these groups on experience. Each pair should include an experienced individual and a less experienced individual.

The **first group** will complete the data sheet in accordance with the procedure and connect the breaker to the CB 8130. Bring the breaker in from outside the test environment to ensure the students remember the 5 minute waiting period in accordance with the procedure.

The **second group** will perform the instantaneous trip test for each phase. Things to look for in this exercise:

- Improper Place Keeping
- Leaving the breaker open at the end of a trip test resulting in the inability to test the next phase (very common mistake, let them make it so that they learn for themselves. Let them find the answer)
- Lack of notifying the class that the CB 8130 will be energized.
- Not performing the mandatory two tests within the trip range.

The **third group** will be responsible for performing the thermal current trip testing. Things to look for in this exercise:

- Attempting to reset the breaker too soon.
- Leaving the breaker open at the end of the test resulting in the inability to test the next phase.
- Lack of notifying the class that the CB 8130 will be energized.
- Failure to adjust the current level during the test to maintain a constant test current.
- Incorrect settings on the CB 8130 resulting in the inability to monitor current while test is in progress.

Provide Feedback

First provide opportunities for peer to peer coaching. Ask each group what the other groups did wrong, right. Ask each group to evaluate their performance. Provide feedback for each group.
Repeat this exercise with each group doing a complete test of one phase of a breaker. Provide feedback as appropriate.

Conclusion

Provide Review

Provide a brief review of material that was covered. Ensure the material presented covers the objectives in broad scope and the inquiries made to the students cover the specifics. The second portion of the review should be a question and answer format where the instructor asks questions and the students provide answers. Be sure to include questions on the setup of the CB.8130. The last portion of the review should allow the students to ask any questions they have so that points can be clarified, expanded upon. *Also cover industry OE as it relates to human performance standards and live electrical equipment.*

Enhance Transfer

Have the students play the *Nuclear Squares game* on the Nuclear Training.net website.

Remotivate and Close

Inform the students that they will now take a ten question exam. The instructor should ensure that the students know that there is nothing tricky on the exam, that it is very straight forward. Also inform the students that following the successful completion of the exam, they will receive a date and time for their Task Performance Evaluation.

Assess Learning / Provide Feedback and Remediation

Administer the exam in Section 3B.

Review any missed questions with the individual student, making sure to understand why they answered the question the way they did.

Any student scoring less than 80% will require documented remediation and supervisory notification.

PART 5: LEARNER CONTENT

PART 5A. LEARNING MATERIALS:

The student handout can be found in Attachment 3. This attachment follows along with the Power Point presentation and allows the student to take whatever notes they need based on the information provided. There are no borders on the slides by design as students may wish to annotate the drawings and borders can sometimes become a hindrance when sketching is involved.

The students will also be provided with a current copy of C MP 782AE. For proprietary reasons I have not included this in the materials. Dominion Corporate is loathe to share any materials publically that they have developed with their resources. The reasons for including the procedure and data sheets are obvious, these are the materials which the students will be provided with during their OJT/TPE.

PART 5B. SUMMATIVE ASSESSMENT MATERIALS:

The review following the class and prior to the test will be in the form of an online game called Nuclear Squares. This can be found on my website at the following URL: http://www.nucleartraining.net/widgets/games/tic_tac/tic_tac_home.htm. Currently, the game is in its generic form, but I intend on revamping the illustrations and the question prior to the presentation of the class. Nuclear Training.net is a website that I maintain for the benefit of the nuclear training profession so there are no copyright infringements.

The other form of assessment will be a written test of 10 questions. This test can be found in Section 3B of this package. The pass/fail standard is 80%.

Lastly, there will be an OJT/TPE administered to the student for final certification. Again the proprietary nature of the formal document precludes me from attaching it here. As a summary, the document requires the student to test a circuit breaker using all human performance tools and standards which we use at the plant. *Additionally based on my conversations with my SME special attention will be paid to the circling and slashing of procedural steps.*

PART 5C. TECHNOLOGY TOOL JUSTIFICATION:

Added to project post SME interview

Initially, I had not intended on including technology in this lesson. There was no special need for technological tools other than a computer on which to present the Power Point presentation. However, based on my conversation with my SME, I have decided that the next time this course is offered, it will be done with a virtual breaker test app. This app will allow students to test breakers arranged by the instructor to pass or fail various criteria. Given the age of our plants, there are cases in which plant circuit breakers fail testing. However, breakers are fickle pieces of equipment and there is no guarantee that a breaker will fail how you want it to fail when you want it to fail. Therefore the use of a simulation allows repeatable results while at the same time keeping the students on their toes when testing. The simulation will be developed for an Android tablet and will be available for students to download on their own devices so that they can practice testing breakers whenever they wish.

PART 6: FORMATIVE EVALUATION PLAN

PART 6A. EXPERT REVIEW:

Patrick Tolley is my subject matter expert. I've known Pat for the last 10 years during his time at Millstone Power Station. Pat has been an electrician, an electrical supervisor and is now a Senior Nuclear Instructor here at Millstone. He also had the best of all possible people train him to be an electrician at Millstone, specifically me. Since then he has moved on and is intimately involved with teaching electricians on site. Pat is a "hands on" person with a great deal of technical knowledge.

I made Sections 1 through 4 available to him on April 23, 2014. I gave him Section 5 and the related study materials four days later on Sunday, April 27th. We met on May 2nd at a local watering hole. After the feedback provided, I revised my questions to eliminate yes/no answers. These are the questions I asked him.

1. Given the lesson, cite four examples where the material is factually accurate.

2. What recent Operating Experience and Lessons Learned are germane to the material presented and has any of that information changed our approach to testing circuit breakers?

3. Given the material, how long would it take you to present the course?

4. Which of our standards are incorporated into this lesson plan? Cite specific examples.

5. What assumptions can be made about the knowledge level of those who will be taking this course?

6. What knowledge would you require in order to allow the student to pass your Task Performance Evaluation?

PART 6B. ONE TO ONE EVALUATION:

The individual I chose for my One to One Evaluation was Dave Campagna. I chose Dave specifically for two reasons. The first reason is that Dave has been part of the shop for a little over a year and has been in training for over half of his time here. Dave is an individual with very little power plant experience. The second, and more important in my mind, reason I chose Dave is that his son Andrew also works in the Electrical Maintenance Shop. Andrew has been in the shop for six years and so it is a case of the son being more knowledgeable than the father. If anyone is going to feel uncomfortable about not understanding the material, it will be a father who knows less than his son.

I met with Dave on Saturday May 4th during the last 3 hours of his 6pm to 6am shift. We met in the Circuit Breaker Overhaul Facility where I will be presenting the class. Not having the large monitor that will be used when formally presenting the class, I used the facility's computer. I spent the first two hours presenting the class to Dave and the last asking for feedback. These were the questions I asked.

1. What terms in the lesson did you not understand?

2. How do you feel about working around energized gear in the classroom?

3. What do you think the knowledge level should be in order for an individual to be qualified to test circuit breakers?

4. Regarding the information and the terms you were familiar with, where did you learn the terminology from?

PART 6C. SMALL GROUP EVALUATION (HYPOTHETICAL):

For my small group evaluation, I would choose a team of one senior individual (greater than 10 years experience) from the shop and one individual with two to four years experience. The reason for choosing a pair rather than a slightly larger group is that the students will be paired up during their "lab" portion of the course. I chose these two ranges of experience because I don't want the senior people to tune out of the class. I want to be able to introduce information to keep them focused. I chose the 2-4 year experience level for the other position on the small group because this will be an individual who will have worked extensively with breakers, but would still not be considered a senior individual. In fact, this individual would often be the second pair of hands on a job. These are the questions I would ask.

1. What information presented in this class was new to you?

2. Do you think it would be better to perform the lab portion of the lesson in pairs as you've just done now or individually with an additional instructor as a safety man.

3. Which of the Human Performance Tools are you most likely to forget when going into the field?

4. What level of knowledge do you feel is necessary in order from someone to be the lead in performing high current testing of circuit breakers?

PART 6D. FIELD TRIAL (HYPOTHETICAL):

As this is a hypothetical, I would ideally choose a group of varied experience. As can been seen by my learner's survey, the demographics are divided into 5 categories of varying levels of experience. The reason I would do this is to get a final overall evaluation of the material presented. By this time, I would have incorporated all the comments of the three previous reviews and would be ready to make the product ready for public consumption. The survey questions asked of this group are for the purpose of fine tuning the message to make it the best it can possibly be. These are the questions I would ask.

1. What material presented did you find the most interesting?

2. What material presented did you find the least interesting?

3. Do you feel you would have done better in the class if you had a greater level of knowledge, experience?

4. How will this class help you in the performance of your daily duties in the plant?

5. In your opinion, what would be the single most important thing to learn from this class?

PART 7: FORMATIVE EVALUATION REPORT

PART 7A. EVALUATION SURVEY:

Rather than a survey, I decided to interview my SME to gather his thoughts on the material. The notes from that interview are included in Attachment 2. I chose an interview instead of a survey because it allowed me to reflect back and ensure that I was gaining a clear understanding of his points and it allowed me the opportunity to ask follow on questions should the need arise. The natures of my questions were such that they couldn't be addressed adequately by a "Yes/No/Maybe" scenario. The other reason I chose an interview over a survey was that Pat treats interviews much more seriously than he does filling in a form. He has a deep understanding of both the process and the technical content and that understanding simply cannot be captured with a standard form.

PART 7B. EXPERT INTERVIEW RESULTS:

Accuracy

Pat agreed that the material presented by the lecture portion of the class was factually accurate. He thought the idea of opening up the breaker and looking inside for what makes it work was an excellent idea. He appreciated that all fault scenarios involved with a breaker tripping were covered. He commented specifically on the covering of the undervoltage scenario as this is not something that is usually considered when a breaker trips. He did caution about two things. The first is that he specifically wants the instructor to differentiate between the initial 5 minute wait and the subsequent 5 minute periods between thermally testing phases. The first 5 minutes is for ambient compensation, the second 5 minutes is to prevent pre-heating of subsequent phases during testing. He also recommended not using the phrase "resetting and restoring" as this is a function of the Operations Department and not Electrical Maintenance.

Operating Experience

Pat state that no new Operating Experience had come out from INPO regarding the testing of circuit breakers, but he considered applicable Human Performance Operating Experiences germane to the class. He expressed some reservations that students would not actually be pulling circuit breakers from panels prior to testing them, but understood that certain sacrifices had to be made in order to perform testing in an environment equipped with a Multiamp CB8130 test set. We agreed that pulling breakers enclosed in

metal clad starter “buckets” would be adequately covered in the MCC Starter class. He also brought up the point that our newly arrived starters had specific cable length requirements for testing. While I agreed that this was an important topic, I again considered this part of the starter class which is offered.

Duration

Pat estimated the lecture portion of the class would take approximately an hour. He felt, however, that the lab portion of the program would take longer than the allotted hour, especially after spending time reviewing the first hour with an online activity. We decided to hold the first class at the end of the day with an hour of extra time built in. This hour will either be used to continue the lab exercise or as an hour of self-study. Additionally, we decided to limit the review activities to a single game of “Nuclear Squares.”

Standards

Pat was happy that most of our standards were included within the lesson. He highlighted that circling and slashing of procedures while in a lab environment is something that INPO is particularly sensitive about. He did raise one delta in that it is impossible to conduct a jobsite review as the students aren’t actually at the job site to perform a two minute time out. I pointed out to him that this is the case with most classroom scenarios and that it would be up to the instructor to highlight those things that would be seen as job hazards in the actual field.

Student Knowledge Level

Pat raised the issue that most, if not all of the required knowledge, would have been presented to the trainees during their introductory training course. He specifically cited the need for understanding Ohm’s Law and basic electricity, the need to understand math fundamentals such as calculating percentages and the necessity of being comfortable with hand tools and other equipment. Additionally, he brought up that all of the students would have to be verified as Electrical Safety Qualified before commencing the course as there would be live voltages present in the class room.

Required Knowledge Level

I specifically raised this issue with Pat because in addition to being fully qualified as a nuclear instructor, he is qualified to administer the site’s OJT/TPE program. Therefore, it is feasible that Pat will actually be performing an evaluation on the students of this class. He spoke of the need for the student to actually understand how the breaker works and be familiar with the interactions that take place within the breaker casing. He also highlighted that, as with all OJT/TPE scenarios, evaluators are looking for perfection in applying the site’s Human Performance Standards. In this case, not only must the student know the specific electrical safety rules, they must know the general safety and human

performance standards and abide by them. Lastly, he pointed out that the student must be quite familiar with the CB 8130 test unit. He observed that the procedures for testing a circuit breaker are generically written such that the worker will be able use any of our high current test equipment to test a breaker. Therefore, lacking specific guidance, this is one area in which the student will have to maintain a working knowledge of the equipment without the proverbial cheat sheet known as the procedure.

Overall Impressions

Overall, Pat thinks the course will be well received and fulfills the needs of the Electrical Maintenance Shop. While he wishes that students were able to go out into the plant to remove an actual breaker, he understands the impossibility of this scenario.

Pat also expressed misgivings that students weren't being given a failed circuit breaker and asked to identify that. As circuit breaker manufacturers won't sell a specifically faulty circuit breaker, we agreed that the best way to accomplish the goal is to allow students to test the breakers virtually. In line with that, I agreed to begin working on an android app which would allow an instructor to insert faults into the virtual breaker such that it doesn't pass. I gave myself a "due by date" of 12/31/14.

PART 7C. COMMENTS ON CHANGE:

Based on my discussions with Pat, I've made a few changes to the presentation. I eliminated the phrase "resetting and restoring" from the Slide 1 description in Section 4. I also added specific instructions to review industry OE as it relates to human performance standards when working on energized equipment. We agreed to hold the class within a possible 3 hour block of time and lastly, I added a reminder to the instructor to verify all student Electrical Safety Qualifications prior to starting the class. Changes in the Instructor Guide Section are in red italics.

PART 8: AECT STANDARDS GRID

Professional Standards Addressed (AECT)

The following standards, developed by the Association for Educational Communications and Technology (AECT), and used in the accreditation process established by the National Council for Accreditation of Teacher Education (NCATE), are addressed to some degree in this course. The numbers of the standards correspond to the numbers next to the course tasks show on the list of assignments. Not all standards are addressed explicitly through student work.

		Assignments meeting standard in whole or part
Standard 1: DESIGN		
1.1 Instructional Systems Design (ISD)	X	ID Project
1.1.1 Analyzing	X	ID Project
1.1.2 Designing	X	ID Project
1.1.3 Developing	X	ID Project
1.1.4 Implementing	X	ID Project
1.1.5 Evaluating	X	Selected Discussion Forums; ID Project
1.2 Message Design		
1.3 Instructional Strategies	X	ID Project
1.4 Learner Characteristics	X	ID Project
Standard 2: DEVELOPMENT		
2.0 (includes 2.0.1 to 2.0.8)	X	ID Project
2.1 Print Technologies	X	Reading Quiz; ID Projects
2.2 Audiovisual Technologies		
2.3 Computer-Based Technologies	X	(all assignments)
2.4 Integrated Technologies		
Standard 3: UTILIZATION		
3.0 (includes 3.0.1 & 3.0.2)		
3.1 Media Utilization	X	(all assignments)
3.2 Diffusion of Innovations		
3.3 Implementation and Institutionalization	X	ID Project
3.4 Policies and Regulations		
Standard 4: MANAGEMENT		
4.0 (includes 4.0.1 & 4.0.3)		
4.1 Project Management		
4.2 Resource Management		
4.3 Delivery System Management		
4.4 Information Management		
Standard 5: EVALUATION		
5.1 Problem Analysis	X	
5.2 Criterion-Referenced Measurement	X	ID Project
5.3 Formative and Summative Evaluation	X	ID Project
5.4 Long-Range Planning		

COURSE GOALS & OBJECTIVES

The overall goal for the course is for each student to consider and use the systematic process of instructional design to create an instructional product. To achieve this goal, students will engage in activities that promote reflective practice, emphasize realistic contexts, and employ a number of communications technologies. Following the course, students will be able to:

1. Discuss the historical development of the practice of instructional design with regard to factors that led to its development and the rationale for its use

2. Describe at least two reasons why instructional design models are useful

3. Identify at least six instructional design models and classify them according to their use

4. Compare and contrast the major elements of three theories of learning as they relate to instructional design

5. Define "instructional design."

6. Define the word "systematic" as it relates to instructional design

7. Define "learning" and synthesize its definition with the practice of instructional design

8. Relate the design of instruction to the term "educational (or "instructional") technology"

9. Describe the major components of the instructional design process and the functions of models in the design process

10. Provide a succinct summary of various learning contexts (declarative knowledge, conceptual, declarative, principle, problem-solving, cognitive, attitudinal, and psychomotor)

11. Build an instructional design product that integrates major aspects of the systematic process and make this available on the web.

    a. Describe the rationale for and processes associated with needs, learner, context, goal, and task analyses

        i. Create and conduct various aspects of a front-end analysis

ii. Identify methods and materials for communicating subject matter that are contextually relevant

b. Describe the rationale for and processes associated with creating design documents (objectives, motivation, etc.)

i. Construct clear instructional goals and objectives

ii. Develop a motivational design for a specific instructional task

iii. Develop assessments that accurately measure performance objectives

c. Select and implement instructional strategies for selected learning tasks

i. Select appropriate media tools that support instructional design decisions

d. Describe the rationale and processes associated with the formative evaluation of instructional products

i. Create a plan for formative evaluation

12. Identify and use technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.

13. Apply state and national content standards to the development of instructional products

14. Meet selected professional standards developed by the Association for Educational Communications and Technology

15. Use various technological tools for instructional and professional communication

AECT STANDARDS (Applicable to EDTECH 503)

1.0 Design

1.1 Instructional Systems Design

1.1.a Utilize and implement design principles which specify optimal conditions for learning.

1.1.b Identify a variety of instructional systems design models and apply at least one model.

1.1.1 Analyzing

1.1.1.a Write appropriate objectives for specific content and outcome levels.

1.1.1.b Analyze instructional tasks, content, and context.

1.1.2 Designing

1.1.2.a Create a plan for a topic of a content area (e.g., a thematic unit, a text chapter, an interdisciplinary unit) to demonstrate application of the principles of macro-level design.

1.1.2.b Create instructional plans (micro-level design) that address the needs of all learners, including appropriate accommodations for learners with special needs.

1.1.2.d Incorporate contemporary instructional technology processes in the development of interactive lessons that promote student learning.

1.1.3 Developing

1.1.3.a Produce instructional materials which require the use of multiple media (e.g., computers, video, projection).

1.1.3.b Demonstrate personal skill development with at least one: computer authoring application, video tool, or electronic communication application.

1.1.4 Implementing

1.1.4.a Use instructional plans and materials which they have produced in contextualized instructional settings (e.g., practica, field experiences, training) that address the needs of all learners, including appropriate accommodations for learners with special needs.

1.1.5 Evaluating

1.1.5.a Utilize a variety of assessment measures to determine the adequacy of learning and instruction.

1.1.5.b Demonstrate the use of formative and summative evaluation within practice and contextualized field experiences.

1.1.5.c Demonstrate congruency among goals/objectives, instructional strategies, and assessment measures.

1.3 Instructional Strategies

1.3.a Select instructional strategies appropriate for a variety of learner characteristics and learning situations.

1.3.b Identify at least one instructional model and demonstrate appropriate contextualized application within practice and field experiences.

1.3.c Analyze their selection of instructional strategies and/or models as influenced by the learning situation, nature of the specific content, and type of learner objective.

1.3.d Select motivational strategies appropriate for the target learners, task, and learning situation.

1.4 Learner Characteristics

1.4.a Identify a broad range of observed and hypothetical learner characteristics for their particular area(s) of preparation.

1.4.b Describe and/or document specific learner characteristics which influence the selection of instructional strategies.

1.4.c Describe and/or document specific learner characteristics which influence the implementation of instructional strategies.

2.0 Development

2.0.1 Select appropriate media to produce effective learning environments using technology resources.

2.0.2 Use appropriate analog and digital productivity tools to develop instructional and professional products.

2.0.3 Apply instructional design principles to select appropriate technological tools for the development of instructional and professional products.

2.0.4 Apply appropriate learning and psychological theories to the selection of appropriate technological tools and to the development of instructional and professional products.

2.0.5 Apply appropriate evaluation strategies and techniques for assessing effectiveness of instructional and professional products.

2.0.6 Use the results of evaluation methods and techniques to revise and update instructional and professional products.

2.0.7 Contribute to a professional portfolio by developing and selecting a variety of productions for inclusion in the portfolio.

2.1 Print Technologies

2.1.3 Use presentation application software to produce presentations and supplementary materials for instructional and professional purposes.

2.1.4 Produce instructional and professional products using various aspects of integrated application programs.

2.3 Computer-Based Technologies

2.3.2 Design, produce, and use digital information with computer-based technologies.

3.0 Utilization

3.1 Media Utilization

3.1.1 Identify key factors in selecting and using technologies appropriate for learning situations specified in the instructional design process.

3.1.2 Use educational communications and instructional technology (SMETS) resources in a variety of learning contexts.

3.3 Implementation and Institutionalization

3.3.1 Use appropriate instructional materials and strategies in various learning contexts.

3.3.2 Identify and apply techniques for integrating SMETS innovations in various learning contexts.

3.3.3 Identify strategies to maintain use after initial adoption.

4.0 Management

(none specifically addressed in 503)

5.0 Evaluation

5.1 Problem Analysis

5.1.1 Identify and apply problem analysis skills in appropriate school media and educational technology (SMET) contexts (e.g., conduct needs assessments, identify and define problems, identify constraints, identify resources, define learner characteristics, define goals and objectives in instructional systems design, media development and utilization, program management, and evaluation).

5.2 Criterion-referenced Measurement

5.2.1 Develop and apply criterion-referenced measures in a variety of SMET contexts.

5.3 Formative and Summative Evaluation

5.3.1 Develop and apply formative and summative evaluation strategies in a variety of SMET contexts.

SMET = School Media & Educational Technologies

ATTACHMENT 1

Survey Questions and Results

1. How many years have you worked at Millstone Power Station?
    a. Less than two years.
    b. Two to Four years.
    c. Four to Eight years.
    d. Eight to Ten years.
    e. Greater than Ten years.
2. Are you qualified to perform MCC Starter testing?
    a. Yes
    b. No
3. Are you qualified to perform High Current Testing on Molded Case Circuit Breakers?
    a. Yes
    b. No
4. Are you qualified to perform maintenance on ABB Metal Clad Circuit Breakers?
    a. Yes
    b. No
5. Are you qualified to perform maintenance on GE Metal Clad Circuit Breakers?
    a. Yes
    b. No
6. Have you tested molded case circuit breakers using the Multi-amp MS2 (Suitcase) Test Set?
    a. Yes
    b. No
7. Have you tested molded case circuit breakers using the Multi-amp CB-8130 (Mule) Test Set?
    a. Yes
    b. No
8. Do you understand the different types of circuit breaker trips?
    a. Yes
    b. No
9. Do you understand the concept of ambient compensation for circuit breakers?
    a. Yes
    b. No
10. Have you ever disassembled a molded case circuit breaker?
    a. Yes
    b. No
11. Have you ever been the second man when someone was performing High Current Testing using the CB 8130 test set?
    a. Yes
    b. No

Survey Data Table

	Question 1					Question 2		Question 3		Question 4		Question 5	
	<2	2-4	4-8	8-10	>10	Yes	No	Yes	No	Yes	No	Yes	No
Adkins			x				X		X		X		X
Barnett					X	X		X		X			X
A. Campagna			X			X		X			X		X
Falcone			X			X		X			X	X	
Kollar		X					X	X			X		X
Laurion		X					X	X			X	X	
Mandeville		X				X		X			X		X
Moreau					X	X		X		X		X	
Morse		X				X		X			X		X
Rickey				X		X		X			X		X
Roberts				X			X		X		X		X
Seckla			X			X		X			X	X	
Surprenant					X	X		X		X			X
Flynn	X						X		X		X		X
Rizzi	X						X		X		X		X
D. Campagna	X						X		X		X		X
Domina	X						X		X		X		X
Startz	X						X		X		X		X

	Question 6		Question 7		Question 8		Question 9		Question 10		Question 11	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Adkins		X		X		X		X		X	X	
Barnett	X		X		X			X		X	X	
A. Campagna	X			X	X			X		X	X	
Falcone	X		X		X			X		X	X	
Kollar	X			X	X			X		X	X	
Laurion	X		X		X			X		X	X	
Mandeville	X			X	X			X		X	X	
Moreau	X		X		X		X			X	X	
Morse	X			X	X		X			X	X	
Rickey	X			X	X			X		X	X	
Roberts		X		X		X		X		X	X	
Seckla	X		X		X		X			X	X	
Surprenant	X		X		X		X		X		X	
Flynn		X		X		X		X		X	X	
Rizzi		X		X		X		X		X	X	
Campagna		X		X		X		X		X	X	
Domina		X		X		X		X		X	X	
Startz		X		X		X		X		X	X	

ATTACHMENT 2

SME Interview

SME Interview

1. Given the lesson, cite four examples where the material is factually accurate.	- LIKED THE FACT THAT ALL FAULT SCENARIOS WERE COVERED INCLUDING UNDERVOLTAGE & THAT SYMPTOMS WERE COVERED - DIDN'T LIKE "RESETTING/RESTORING" NOT ALLOWED BY PROCEDURE DON'T TEACH - LIKED ALL FACTORS COVERED IN BREAKER RATING WONDERED ABOUT METHODS TO SYNTHESIZE BRKR RATING (FILL IN MISSING DATA - (NOT COVERED / EXPERIENCE) LIKED IDEA OF OPENNING UP BRKR AND LOOKING INSIDE - WATCH OUT DON'T CONFUSE INITIAL 5 MIN WAIT WITH 5 MIN WAIT BETWEEN PHASES AMBIENT COMP VS. COOL DOWN
2. What recent Operating Experience and Lessons Learned are germane to the material presented and has any of that information changed our approach to testing circuit breakers?	NO NEW OE HAS COME OUT MIGHT WANT TO DISCUSS SPECIFIC CABLE LENGTH WHEN TESTING NEW BUCKETS - DECIDED NOT GERMANE BUT IT SHOULD BE TAUGHT IN THE NEXT BUCKET CLASS. BETTER IDEA TO DISCUSS HV OE ELECTRICAL SAFETY (ARC FLASH) SITUATIONAL AWARENESS (CLASS ROOM NOT LIKE PLANT & STUDENTS WON'T BE PULLING 'BUCKET) HV OE → OK PULLING BUCKET SHOULD BE LEFT FOR BUCKET CLASS

SME Interview (cont)

3. Given the material, how long would it take you to present the course?

1 HOUR CLASS TIME GOOD

LAB MAY TAKE MORE THAN AN HOUR.

BETTER IDEA - FIRST CLASS LEAVE HOUR OF FLUFF AT END OF DAY IN CASE GOES LONG

EXTRA HOUR CAN BE LAB ∃(CONT) OR SELF STUDY

4. Which of our standards are incorporated into this lesson plan? Cite specific examples.

TASK PREVIEW
STAR
STOP WHEN UNSURE
PROCEDURE USE & ADHERENCE
PEER CHECKING
CLEAR COMMUNICATION

JOBSITE REVIEW IMPOSSIBLE TO SIMULATE. BECAUSE ~~LAB~~ ISN SHOP ISN'T LIKE THE PLANT

CIRCLE / SLASH IS KEY
INPO IS REALLY PINGING ON THIS. ESPECIALLY IN TRAINING

SME Interview (cont)

. What assumptions can be made about the knowledge level of those who will be taking this course?

MUST HAVE BASIC ACAD KNOWLEDGE ie OHMS LAW (ALL ARE)

MUST BE QUALIFIED ELEC SAFETY (ALL ARE)

MUST HAVE BASIC HAND TOOL KNOWLEDGE (ALL DO)

BASIC MATH SKILLS (PERCENTAGES)

. What knowledge would you require in order to allow the student to pass your ask erformance Evaluation?

MUST UNDERSTAND THE BREAKER & THE CB 8130

CAN'T BE OVERLY DEPENDENT ON PROCEDURE

MUST UNDERSTAND CONCEPTS OF THERMAL/MAG FAULT TRIPS

MUST BE IN THE HABIT OF CIRCLE → SLASHING

MUST KNOW SAFETY RULES ELECTRICAL & OTHERWISE

SME Interview (cont)

Additional Comments

SCENARIO DOES NOT ALLOW FOR FAILING A BREAKER DURING TESTING - AS BREAKER BEING TESTED IS NEW, FAILURE UNLIKELY

TAKE AWAY FOR ME – DEVELOP VIRTUAL HI CURRENT TESTING APP - CREATE BOTH GOOD & BAD BREAKERS (FIN BY 12/31/14)

ATTACHMENT 3

Student Handout

Objectives

Upon completion of this class, you will be able to:

1. State the safety precautions which are required when testing molded case circuit breakers.
2. State the faults that are protected against with both thermal and magnetic circuit breaker trips.
3. Explain why a circuit breakers are ambient compensated.
4. Explain the differences between a thermal and magnetic circuit breaker trips.

Objectives (continued)

5. Determine a molded case breaker's rating.
6. Determine the instantaneous trip point of a molded case circuit breaker in accordance with C MP 782AE.
7. Determine the thermal overload test current of a molded case circuit breaker in accordance with C MP 782AE.
8. Describe and demonstrate connecting the Multi-amp CB 8130 to a molded case circuit breaker for circuit breaker high current testing in accordance with C MP 782AE.
9. Describe and demonstrate the setup of the Multi-amp CB 8130 in accordance with C MP 782AE for both thermal and instantaneous circuit breaker high current testing.

Objectives (continued)

10. Explain the purpose of the 5 minute wait between phases during thermal trip testing.
11. Identify the three states of a molded case circuit breaker.
12. Demonstrate the ability to perform high current testing of molded case circuit breakers.

Breaker Testing

= $$$$$

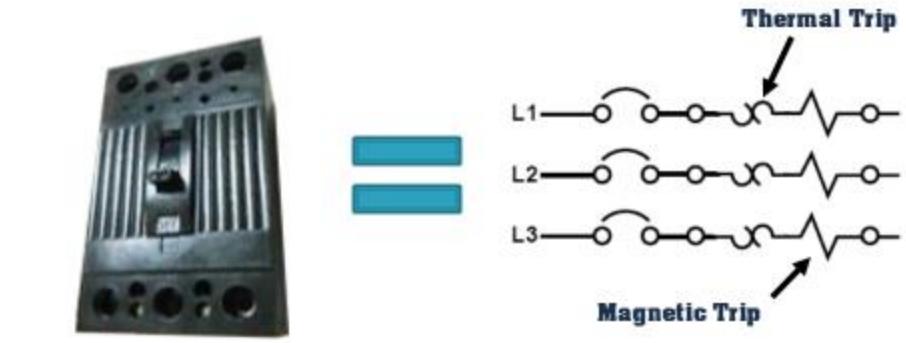
Class Preview

13:00 – 13:50 – Lecture

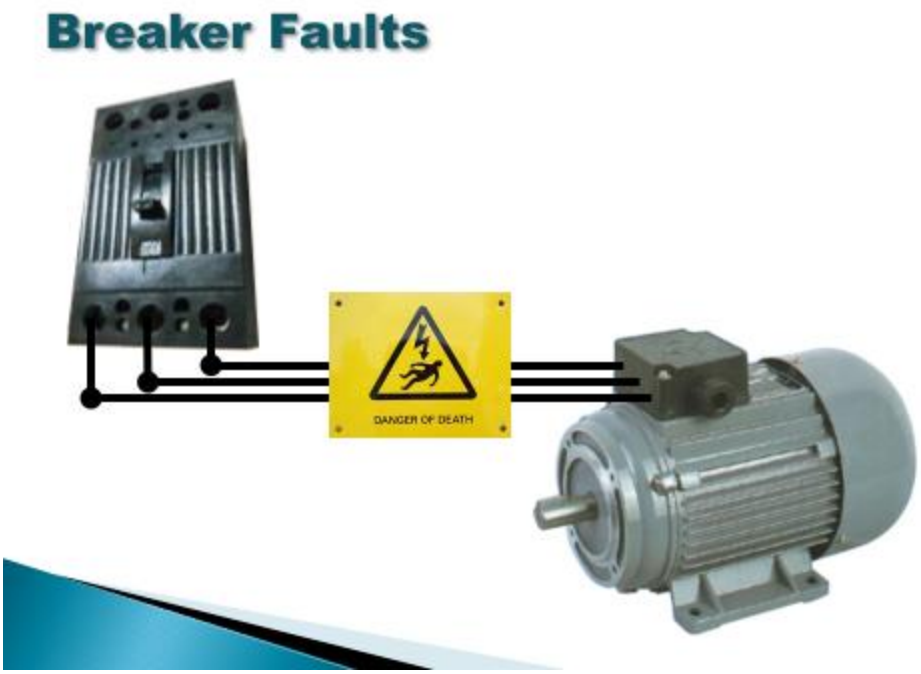
14:00 – 14:50 – Lab

15:00 – 16:00 – Review and Test

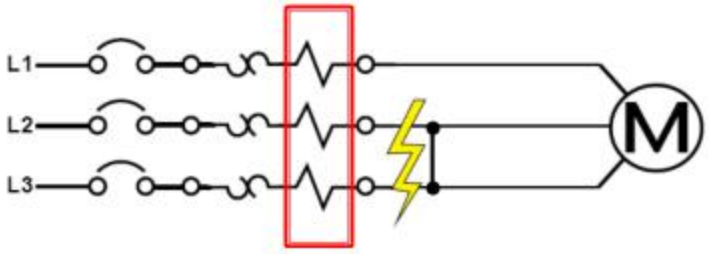
Circuit Breakers



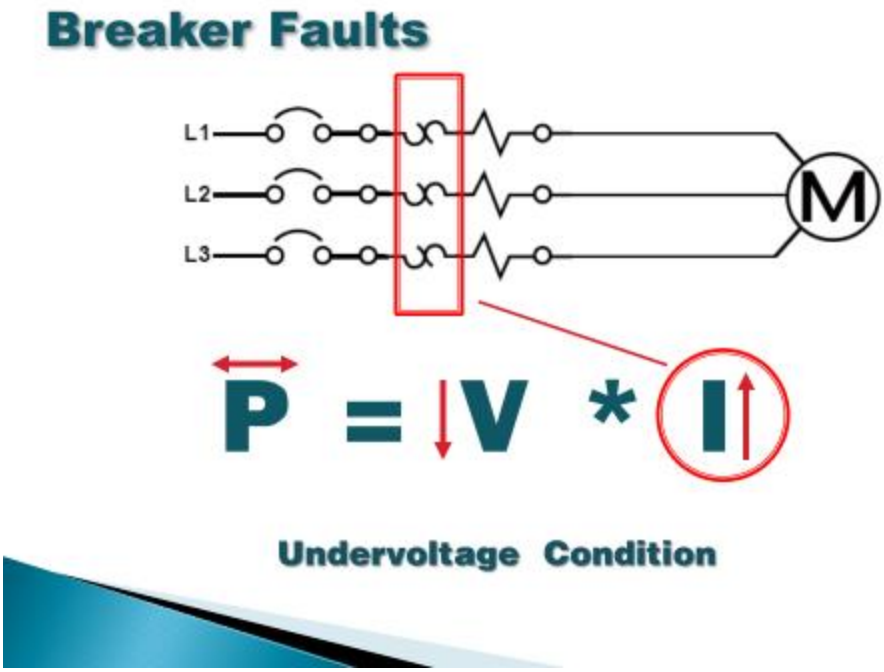
Thermal Magnetic Circuit Breaker


Breaker Faults
DANGER OF DEATH

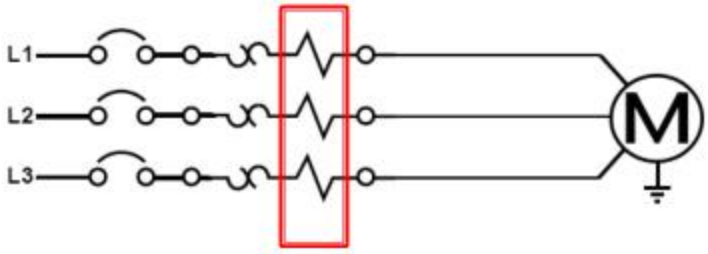
Breaker Faults



Phase to Phase Short Circuit

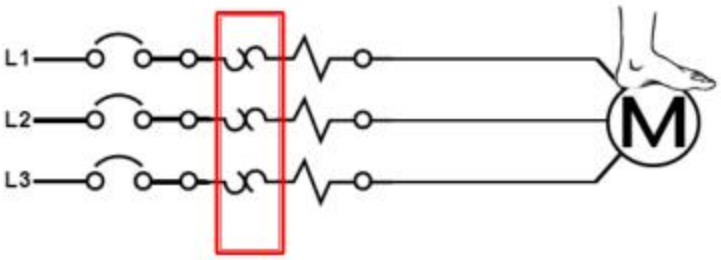

Breaker Faults
L1
L2
L3
M
P = V * I
Undervoltage Condition

Breaker Faults



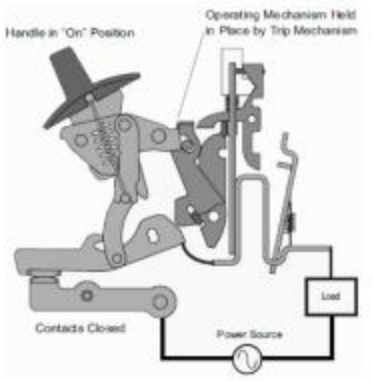
Motor Ground

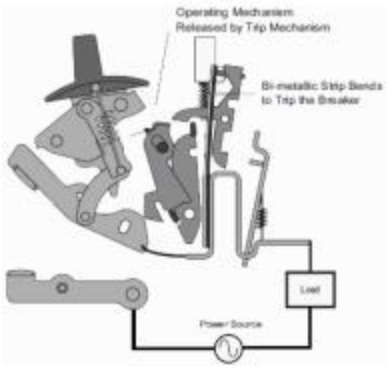
Breaker Faults



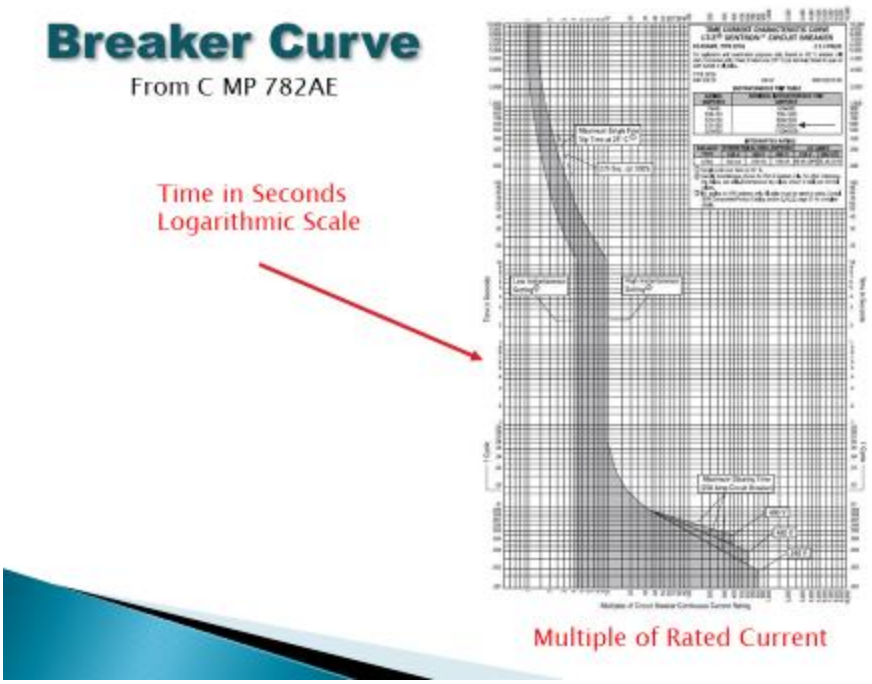
Motor Overload

Thermal Trips

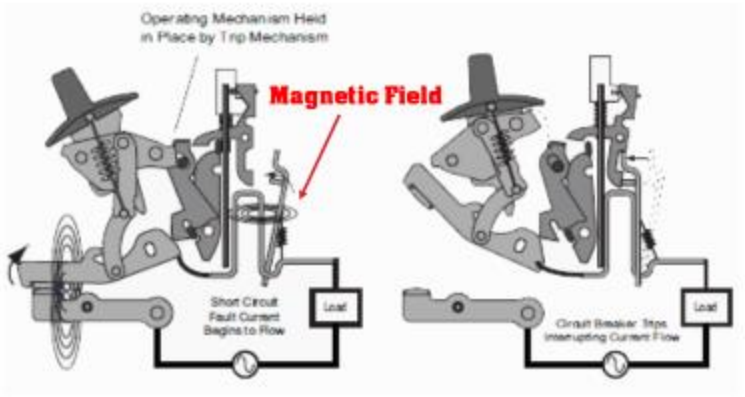




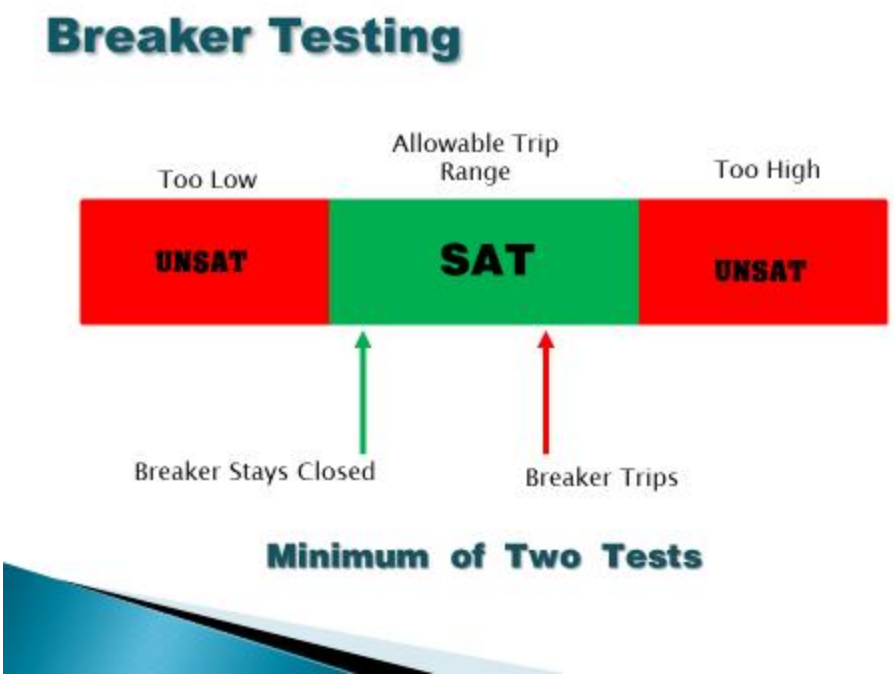
Reference (Csanya, March 2011): [Circuit Breaker Illustration]. Retrieved April 25, 2014 from http://electrical-engineering-portal.com


Breaker Curve
From C MP 782AE
Time in Seconds
Logarithmic Scale
Multiple of Rated Current

Instantaneous Trips



Reference: (Cuenya, March 2011). [Circuit Breaker Illustration]. Retrieved April 25, 2014 from http://electrical-engineering-portal.com


Breaker Testing
Allowable Trip Range
Too Low
Too High
UNSAT
SAT
UNSAT
Breaker Stays Closed
Breaker Trips
Minimum of Two Tests

Dominion

Any Questions

Jim Doran x4515